ANALYSIS - Annex vs Doc 8071 vs Order 8200.1

Facility **ASR** **Parameter** **Accuracy**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref

Annex Ref 3.1.1.10 **8071 Reference** 2.27 - 2.29 - 2.33 **8200 Reference** 14.14d,j, k, n

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.1.10 [SURVEILLANCE] Accuracy [Subparameters, 1 & 3 Azimuth and Range] 3.1.1.10.1 The range and azimuth accuracy of the ground interrogator shall be monitored at sufficientl frequent intervals to ensure system integrity. Note. Interrogators that are associated with and operated in conjunction with primary radar may use the primary radar as the monitoring device; alternatively, an electronic range and azimuth accuracy monitor would be required. 3.1.1.10.2 Recommendation. In addition to range and azimuth monitoring, provision should be made monitor continuously the other critical parameters o the ground interrogator for any degradation of performance exceeding the allowable system tolerances and to provide an indication of any such occurrence.	2.27, 2.29, 2.33 [SURVEILLANCE] Accuracy [Subparameters 1, 2 & 3 Azimuth, Elevation and Range] Surveillance approaches 2.29 All terminal Primary Surveillance Radar (PSR) approaches must be checked for accuracy and coverage by a flight inspection aircraft during commissioning inspections ‘or any time a new approach procedure is developed. The flight inspector shall confer with engineering personnel that the approach is conducted on a surveillance radar scope. Conducting a terminal PSR approacl on a precision approach radar (PAR) scope is not acceptable for flight inspection purposes. Termina PSR approaches are not authorized using Secondary Surveillance Radar (SSR) only; and th SSR should be offset for this check. Approach to a runway 2.30 The approach course shall coincide with the runway centre line extended and shall meet accuracy and coverage tolerances. Approach to an aircraft 2.3 1 The approach course shall be aligned to the missed approach point (MAPt) as determined by procedures and engineering personnel. Helicopte only final approach courses may be established tc a MAPt no further than 780 m (2 600 ft) from the centre of the lauding area for a point-in-space approach to a MAPt from which flight to the landing area must be accomplished by visual reference to a prescribed route along the surface. In each instance, approach guidance shall be provided to the prescribed MAPt. Approach procedure 2.32 Fly an 18.5 km (10 NM) terminal PSR final approach as directed by the controller. Fly at the	14.14j,k [SURVEILLANCE] Accuracy Subparameter 1 - Azimuth] d. Orientation (1) Purpose. To verify the radar azimuth corresponds with a known azimuth position and may be conducted with a flight inspection aircraft or ground check. (2) Approved Procedures (a) Fly inbound or outbound radially over a well-defined ground checkpoint or position the aircraft using AFIS. The altitude and distance of the checkpoint should be well inside the radar coverage limits. (b) A radar PE, maintenance beacon, or MTI reflector of known location may be used to determine alignment of the radar azimuth in lieu o a flight inspection aircraft. (3) Evaluation. Compare the azimuth observed by the controller with the magnetic azimuth of the checkpoint. [Subparameters 1, 2 & 3 - Azimuth, Elevation an Range] j. Fix/ Map Accuracy (1) Purpose. To verify all airways, routes, fixes, and runway centerlines on the video map display. Replacement map overlays, video maps, or digita generated maps do not require a flight inspection if Facilities Maintenance personnel can determine, using targets-of opportunity, that the new map is accurate. (2) Approved Procedure. The flight inspector mus fly the minimum altitude where satisfactory radar coverage exists using NAVAID guidance, ground	[SURVEILLANCE] Accuracy [Subparameters 1 & 3 Azimuth and Range] 8200, Doc9071 and Ann10 provides for the use c permanent terrain or man made structures and/o ATCRBS remote monitors (Parrots) for accuracy checks. [Subparameters 1, 2 & 3, Azimuth, Elevation and Range] Doc8071 dictates that 8200 tolerances be met bu are not explicitly defined. Recommendation: Filing a difference letter should not be required. [Subparameters 1,2 & 3 Azimuth, Elevation and Range] 8200 meets or exceeds Doc 8071 on all defined parameters. Recommendation: These documents do not require accuracy checks for multiple display facilities. With the advent of terminal and enrout facilities sharing/utilizing both short range and long range surveillance radars these checks should be considered.

lowest prescribed altitudes until reaching the final approach segment. Between the final approach fix (FAP) and the MAPt fly 30 m (100 ft) below any stepdown fix altitudes, recommended altitudes and/or the minimum descent altitude (MDA). During the approach, the flight inspector shall evaluate the approach procedure, note the aircraft position relative to the runway centre line extended/airport, and determine at the MAPt whether a lauding can be successfully performed without excessive maneuvering.

Evaluation

2.33 Terminal PSR approach radars shall meet flight inspection tolerances or be cancelled; however, cancellation of a terminal PSR approach radar does not constitute a restriction on the radar facility. When the use of MTI is required for a terminal PSR approach, the flight inspection report should be so annotated. A requirement to use MTI does not constitute a facility restriction, however, terminal PSR approaches which require the use of MTI are not authorized when the MTI feature is inoperative.

[Subparameters 1 & 3 Azimuth and Range]

Fixed target identification

2.27 The purpose of this test is to identify prominent primary broadband targets used for range and azimuth accuracy checks when solar and radar analysis programmes are not available. Identify the permanent echo (PE) by one of the following methods:

a) co-operating aircraft; and

b) flight inspection or rental aircraft.

2.28 Approved procedures: select identifiable features from comparison of the ground clutter reports and geographic maps (islands, mountain peaks, towers, etc.); and direct the pilot to the PE return. If the pilot can identify and describe the ground target, and the target is a permanent feature, record the PE in the inspection report.

checkpoints, or AFIS to identify the airway, route, or fix. The procedure is the same whether using a flight inspection aircraft or targets-of-opportunity; Facilities Maintenance personnel compare reported aircraft position relative to the airway, route, or fix with the video map presentation. Similarly, verify runway centerline to video map alignment by observing landing and departing aircraft.

(3) Evaluation. Compute the distance between the airway, route or fix, and the aircraft position, and apply the appropriate tolerance.

(4) Radar Overlays. Flight inspection of radar map overlays used as a backup for a video map need not be accomplished, provided the overlay contain data which is identical to
a video map display which has been satisfactorily inspected. Any data on an overlay that differs from the video map display must be inspected before use. This applies to new or replacement map overlays.

K. Surveillance Approaches

(1) Purpose. All ASR approaches must be checked for accuracy and coverage by a flight inspection aircraft during commissioning inspections or any time a new approach procedure is developed. ASR approaches must be checked on a periodic basis. Surveillance approaches must be evaluated using surveillance type radar scopes. Conducting an ASR approach on a PAR display is not acceptable for flight inspection purposes. ASR approaches are not authorized using ATCRBS only, and the ATCRBS display should be offset.

(a) Approach to a Runway. The approach course must coincide with the runway centerline extended and must meet accuracy and coverage tolerances.

(b) Approach to an Airport. The approach course must be aligned to the MAP as determined by procedures and Facilities Maintenance personnel. Helicopter-only final approach courses may be established to a MAP no farther than 2,600 ft from the center of the landing area.

(2) Approved Procedure. The controller must provide vectors for a 10-mile ASR final approach. The flight inspector must fly at MVA until reaching the final approach segment. Prior to the final

segment, compare published minimum descent altitude (MDA) with MDA provided by the air traffic controller. The final approach segment must be flown flying headings as provided by the air traffic controller. Descend to the minimum descent altitude and verify recommended altitudes on final. The flight inspector must evaluate the approach procedure, evaluate the aircraft position relative to the runway centerline extended/ airport, and determine if a landing can be made without excessive maneuvering.

(3) Evaluation. ASR approaches must meet flight inspection tolerances or be canceled by appropriate NOTAM action. The cancellation of an ASR approach does not constitute a restriction on the radar facility. When MTI is required for an ASR approach, information must be documented on the flight inspection report. The use of MTI does not constitute a facility restriction; however, ASR approaches which require MTI are NOT authorized when this feature is inoperative.

N. ATCRBS Modes and Codes

(1) Purpose: To verify the proper decoding of ATCRBS reply pulses. Facilities Maintenance personnel must ensure that all modes and codes are verified by equipment
test procedures before requesting flight inspection. Codes 7500, 7600, and 7700 should not be used due to the possibility of alarming other facilities.

[Subparameter 2 - Elevation]

(2) Approved Procedure. Facilities Maintenance personnel must monitor the flight inspection aircraft transponder replies or targets-of-opportunity throughout the vertical coverage, airway, route, and terminal checks to verify correct altitude readout. During these tests, Facilities Maintenance personnel should request the flight inspection aircraft use different modes or codes to sample various modes and code trains. When targets-of-opportunity are used, ensure that the sample contains all modes interrogated and a sufficiently large sample of codes to ensure correct decoding of beacon replies.

(3) Evaluation. Facilities Maintenance personnel must ensure the displayed transponder reading agrees with the aircraft transponder setting.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
[SURVEILLANCE] Accuracy No tolerances provided.	[SURVEILLANCE] Accuracy Flight Inspection Tolerances are copied here from 8200 as Doc8071 dictates that these tolerances must be met. Accuracy [Subparameters 1, 2 & 3 Azimuth, Elevation and Range] Note 1: 3% exceeds 500 ft at aircraft to antenna distance greater than 16,667 ft (3.28 nm). Note 2: 3% exceeds 1,000 ft (ATCRBS) at aircrat to antenna distance greater than 33,333 ft (6.57 nm). Fix/map -- Within 3% of aircraft to antenna distance or 500' (1,000' for ATCRBS), whichever is greater. Approaches: Straight-in -- Within 500' of runway edge at MAP. Circling -- Within a radius of the MAP which is 3% of the aircraft to the antenna distance or 500', whichever is greater. [Subparameter 2 - Elevation] Altitude Readout -- ± 125' of altitude displayed in the cockpit relative to 29.92 in Hg. [Subparameter 1 - Azimuth] Orientation Maximum azimuth difference between actual and indicated for broadband and narrowband radar systems -- ± 2 deg	[SURVEILLANCE] Accuracy Accuracy [Subparameters 1, 2 & 3 Azimuth, Elevation and Range] Note 1: 3% exceeds 500 ft at aircraft to antenna distance greater than 16,667 ft (3.28 nm). Note 2: 3% exceeds 1,000 ft (ATCRBS) at aircrat to antenna distance greater than 33,333 ft (6.57 nm). Fix/map -- Within 3% of aircraft to antenna distance or 500' (1,000' for ATCRBS), whichever is greater. Approaches: Straight-in -- Within 500' of runway edge at MAP. Circling -- Within a radius of the MAP which is 3% of the aircraft to the antenna distance or 500', whichever is greater. [Subparameter 2 - Elevation] Altitude Readout -- ± 125' of altitude displayed in the cockpit relative to 29.92 in Hg. [Subparameter 1 - Azimuth] Orientation Maximum azimuth difference between actual and indicated for broadband and narrowband radar systems -- ± 2 deg

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
Requirement to monitor ATCRBs with a remote monitor for range and azimuth accuracy. This is a requirement to have and use remote	8071 combines accuracy and coverage in simultaneous checks.	8200 combines accuracy and coverage in simultaneous checks. 8200 is explicit in the verification of altitudes and

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
monitoring such as MTI reflectors or "parrots" and as such is a design or specification requirement.		aircraft identification codes.	
	Measurement Uncertainty		

Annex10_ID	8071_ID	8200_ID	Results_ID
375	569	325	543

Facility **ASR** **Parameter** **Communications**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** 2.34 **8200 Reference** 14.14q, Chapter 8

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	2.34 The purpose of the optional check is to evaluate the VHF/UHF communications capability within the radar coverage area. All required check can normally be completed by using participating aircraft. If additional requirements are identified by engineering personnel, conduct the inspection concurrent with the radar inspection.	The purpose of this check is to evaluate VHF/ UHF communications capability within the radar coverage area. When flight inspection aircraft are not equipped for UHF communications, the inspection can be completed using VHF only. UHF coverage may be confirmed by the appropriate air traffic facility via targets of opportunity. The flight inspector must check communications in accordance with Chapter 8, concurrent with the radar inspection.	[SURVEILLANCE] Communications 8200 meets or exceeds Doc 8071 requirements. Requirements are to conduct inspection/evaluation concurrent with radar evaluation. No tolerance's are provided. Annex1 does not address this requirement. Recommendation: A letter of difference is not required.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		[SURVEILLANCE] Communications See Paragraph 8.14: a. Maximum Recommended Coverage. Communications frequencies are engineered for distinct volumes of airspace, which are guaranteed to be free from a preset level of interference from an undesired source. Each specific function has its own frequency protected service volume. Some are cylinders, and others a odd multi-point geometric shapes. These odd shapes are normally required for en route ATC services. Following is a table of maximum altitude and radius dimensions recommended for each type of service. Under no circumstances will a service volume be approved at an altitude and distance greater than the radio line of sight (RLOS distance (reference Figure A3-1). B. Local Requirements. Communications service volume requirements are established by the controlling Air Traffic facility based on local operational requirements. When a flight inspection is requested, these local requirements must be validated and adjusted, if necessary, for satisfactory operation. Communications must be clear and readable.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		C. Restrictions. USAF air traffic control facilities will not be restricted due to unusable radios unless the ability to provide required service is severely limited; the loss of 50 or more of published frequencies or loss of VHF/ UHF emergency capability is considered a severe limitation. Document inoperative or unusable radio and frequencies on the flight inspection report. Th inoperative or unusable radio or frequency can be returned to service after a satisfactory operational check is conducted by local aircraft at a distance maximum intended use and altitude of MVA/ MEA D. Light Gun Requirements (1) Ground. Ensure adequate coverage for operational control of ground traffic. (2) Air. Three miles in all quadrants at the lowest traffic pattern altitude.	
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
SURVEILLANCE [Communications] No reference is made for radio communications.	SURVEILLANCE [Communications] No reference is made for coverage tolerance.	SURVEILLANCE [Communications] Requiremen to conduct concurrent with radar evaluation/inspection.	
	Measurement Uncertainty		

Annex10_ID	8071_ID	8200_ID	Results_ID
376	570	326	544

Facility **ASR** **Parameter** **Coverage**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref

Annex Ref 3.1.1.8.2, 2.1.2, 3.1.1.4,3.3 **8071 Reference** 2.12 - 2.26 **8200 Reference** 14.14e,g, h, l,o,p

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
[Subparameter 3 - Range] 3.1.1.8.2 RADIATED POWER Recommendation. In order to minimize system interference the effective radiated power of interrogators should be reduced to the lowest value consistent with the operationally required range of each individual interrogator site. 3.1.1.8.3 Recommendation. When Mode C information is to be used from aircraft flying below transition levels, the altimeter pressure reference datum should be taken into account. Note. Use of Mode C below transition levels is in accordance with the philosophy that Mode C can usefully be employed in all environments. [Subparameters 1, 2, & 3 Azimuth, Elevation and Range] 2.1.2 INTERROGATION MODES (ground-to-air) 2.1.2.1 Interrogation for air traffic services shall be performed on the modes described in 3.1.1.4.3 or 3.1.2. The uses of each mode shall be as follows: 1) Mode A - to elicit transponder replies for identity and surveillance. 2) Mode C - to elicit transponder replies for automatic pressure-altitude transmission and surveillance. 3) Intermode - a) Mode A/C/S all-call: to elicit replies for surveillance of Mode A/C transponders and for the acquisition of Mode S transponders. B) Mode A/C-only all-call: to elicit replies for surveillance of Mode A/C transponders. Mode S transponders do not reply.	[Subparameter 2 & 3 - Elevation and Range] Vertical Coverage 2.12 The purpose of this test is to determine and document the primary and secondary radar syster vertical coverage. A) All radars. Evaluate the inner and outer fringes on all primary and secondary radars using a flight inspection aircraft with a. calibrated transponder; b) Radars without radar analysis tools. Evaluate primary and secondary radar coverage within the fringe envelope using a flight inspection aircraft or rental aircraft; C) Radars with radar analysis tools. Evaluate primary and secondary radar coverage within the fringe envelope using radar analysis tools, targets of opportunity, co-operating aircraft, or flight inspection aircraft. Radar analysis data recordings and analysis of the vertical coverage test are used as continuing database for a permanent record, and as a legal document certifying facility performance Vertical coverage radial 2.13 A significant portion of the inspection is conducted on a reference bearing from the radar site. Conduct the commissioning inspection, and all subsequent inspections concerning facility performance on the same bearing for valid comparison. The radial should be free of clutter, dense traffic and populated areas, and influences created by line-of-site. Commissioning procedure 2.14 Determine the outer fringe by evaluating tail-on targets and the inner fringe by nose-on targets Aircraft reflective surface and transponder antenn characteristics vary between inbound and outbound flight; consequently, some difference in	[Subparameter 2 - Elevation] g. Vertical Coverage (1) Purpose. To determine and document the coverage in the vertical plane of the primary and ATCRBS antenna patterns. Evaluate the inner an outer fringes on all primary and secondary radars. (2) Vertical Coverage Azimuth. Choose an azimut from the radar antenna or coincident VOR/ TACAN radial from the radar antenna which is fre of clutter, dense traffic, heavy population areas, and interference created by line-of-site obstructions. Conduct the commissioning inspection and all subsequent inspections concerning facility performance, on the same azimuth for comparison purposes. For inspection at altitudes above flight inspection aircraft service ceiling, Air Traffic Technical Operations/ Air Traffi has the option of using targets of opportunity/ RDAS. (3) Configuration: Facilities Maintenance personn must determine the lowest usable radar configuration. Suggested configurations are as follows: Antenna Polarization -- Circular Diplex Systems -- Simplex mode Integrators/Enhancers -- OFF Magnetron/Amplitron Systems -- Amplitron (See Note) Video Processor (military mobile radar) -- OFF ASR-9 Display Video -- Uncorrelated ARSR-3: Target Threshold -- 91 MTI: I & Q -- "I" NOTE: At the request of engineering, conduct an additional vertical coverage check for the ARSR 1 & 2 with the amplitron OFF. It is not necessary to	[SURVEILLANCE] Coverage [Subparameters 1, 2 & 4 Azimuth, Elevation & airway/route coverage] While not explicitly measured, Doc8071 and 820 implicitly ensure that the ATCRBS pulse width and interval parameters as defined in Ann10 are within tolerance (coverage would not meet requirements if out of tolerance conditions existed). 8200 meets or exceeds Doc 8071. Recommendation: A letter of difference should not be required. [Subparameter 3 & 5 Range and Optimization] 8071 broadband target strength is more narrowly defined than 8200. Some 8200 references are to a specific radar (i.e ARSR-3). Recommendation: A letter of difference should not be required.

4) Mode S -

a) Mode S-only all-call: to elicit replies for acquisitio of Mode S transponders.

B) Broadcast: to transmit information to all Mode S transponders. No replies are elicited.

C) Selective: for surveillance of, and communicatio with, individual Mode S transponders. For each interrogation, a reply is elicited only from the transponder uniquely addressed by the interrogatio

Note 1.- Mode A/C transponders are suppressed by Mode S interrogations and do not reply.

Note 2.- There are 25 possible interrogation (uplink formats and 25 possible Mode S reply (downlink) formats. For format assignment see 3.1.2.3.2, Figures 3-7 and 3-8.

2.1.2.1.1 Recommendation. Administrations should coordinate with appropriate national and internation authorities those implementation aspects of the SS system which will permit its optimum use.

Note. In order to permit the efficient operation of ground equipment designed to eliminate interferenc from unwanted aircraft transponder replies to adjacent interrogators (defruiting equipment), State may need to develop coordinated plans for the assignment of pulse recurrence frequencies (PRF) to SSR interrogators.

2.1.2.1.2 The assignment of interrogator identifier (I codes, where necessary in areas of overlapping coverage, across international boundaries of flight information regions, shall be the subject of regional air navigation agreements.

2.1.2.1.3 The assignment of surveillance identifier (SI) codes, where necessary in areas of overlappin coverage, shall be the subject of regional air navigation agreements.

Note. The SI lockout facility cannot be used unless all Mode S transponders within coverage range are equipped for this purpose.

2.1.2.2 Mode A and Mode C interrogations shall be provided.

Note. This requirement may be satisfied by

coverage can be expected. Using map checkpoints, a navigation system radial, or radar vectors to remain on vertical coverage radial, the flight inspector
should complete the coverage check. Fly all patte altitudes described herein as height above the radar antenna.

Note.- In order to produce a meaningful database the flight inspector must compute and fly true altitudes (corrected for pressure and temperature)

Commissioning profile - terminal PSR/SSR radars without radar analysis
2.15 Refer to Figure A-2 and proceed as follows:

a) determine the inner fringe at 300 m (1 000 ft). Then fly outbound at 300 m (1 000 ft) and establish the outer fringe;

b) climb to 600 m (2 000 ft) and establish the oute fringe. Then proceed inbound at 600 m (2 000 ft) and establish the inner fringe;

c) climb to 900 m (3 000 ft) and establish the oute fringe;

d) climb to 1 500 m (5 000 ft) and establish the outer fringe;

e) repeat the outer fringe check at 1 500 m (5 000 ft) (or lower if necessary) as required in order to complete the over-all quality test and to evaluate radar auxiliary functions (linear polarization, PIN diode, integrators, etc., for primary and GTUSTC for secondary). Most auxiliary functions produce a decrease in receiver sensitivity which is indicated by a decrease in cut-off range. Conduct the test b marking the outer fringe with the function on, then off, while noting the difference in range. Then proceed inbound at 1 500 m (5 000 ft) and establish the inner fringe;

f) climb to 2 100 m (7 000 ft) and establish the outer fringe;

g) climb to 3 000 m (10 000 ft) and establish the outer fringe. Then proceed inbound at 3 000 m (10 000 ft) to establish the inner fringe; I

h) if the required operational altitude is greater tha 3 000 m (IO 000 ft), check the outer fringe in 1 50 m (5 000 ft) increments up to the operational

conduct the entire vertical coverage; only a spot check of altitudes and ranges, as specified by the engineer.

(4) Approved Procedures. Targets-of-opportunity may be used to check the vertical coverage, provided that sufficient targets are present to verif the coverage volume.
When using targets-of-opportunity, multiple target returns are required to ensure accuracy. Verify questionable accuracy with flight inspection aircraft. When using a flight inspection aircraft, determine the outer fringe coverage by evaluating tail-on targets and the inner fringe coverage by nose-on targets. When special requests are made by Facilities Maintenance personnel to evaluate target returns at the outer fringe with nose-on targets, clearly differentiate between nose-on and tail-on results on the flight inspection report. Aircraft reflective surfaces and transponder antenna radiation characteristics vary between inbound and outbound flight; consequently, differences in coverage can be expected. The flig inspector must obtain the vertical coverage azimuth and maximum required altitude from the facilities maintenance personnel. Use map checkpoints, a NAVAID radial, AFIS, or radar vectors to remain on the vertical coverage azimut Fly all pattern altitudes as height above the radar antenna.

NOTE: For inspections of USAF mobile facilities where the operational requirements do not dictate flying the profile to the outer fringe, or the complet coverage check is not requested, the coverage wi be requested to operational range requirements plus at least 10%. A statement should be made in the Remarks Section that coverage was made to operational requirements plus 10%, and the vertical coverage plot is not to the limits of radar coverage. The facility will be restricted.

(a) Commissioning Vertical Coverage Profile, ASR ATCRBS.

Refer to the Checklist in Paragraph 14.13 and to Figure 14-1 and proceed as follows:

1 Determine the inner fringe at 1,000 ft. Then fly outbound at 1,000 ft and establish the outer fringe

2 Climb to 2,000 ft and establish the outer fringe. Then proceed inbound at 2,000 ft and establish th

intermode interrogations which elicit Mode A and Mode C replies from Mode A/C transponders.

2.1.2.3 Recommendation. In areas where improved aircraft identification is necessary to enhance the effectiveness of the ATC system, SSR ground facilities having Mode S features should include aircraft identification capability.

Note. Aircraft identification reporting through the Mode S data link provides unambiguous identification of aircraft suitably equipped.

3.1.1.4.1 The interrogation shall consist of two transmitted pulses designated P1 and P3. A control pulse P2 shall be transmitted following the first interrogation pulse P1.

3.1.1.4.2 Interrogation Modes A and C shall be as defined in 3.1.1.4.3.

3.1.1.4.3 The interval between P1 and P3 shall determine the mode of interrogation and shall be as follows:

Mode A 8 ±0.2 microseconds

Mode C 21 ±0.2 microseconds

3.1.1.4.4 The interval between P1 and P2 shall be 2.0 plus or minus 0.15 microseconds.

3.1.1.4.5 The duration of pulses P1, P2 and P3 shall be 0.8 plus or minus 0.1 microsecond.

3.1.1.4.6 The rise time of pulses P1, P2 and P3 shall be between 0.05 and 0.1 microsecond.

Note 1. The definitions are contained in Figure 3-1 "Definitions of secondary surveillance radar waveform shapes,
intervals and the reference point for sensitivity and power".

Note 2. The intent of the lower limit of rise time (0.0 microsecond) is to reduce sideband radiation. Equipment
will meet this requirement if the sideband radiation no greater than that which, theoretically, would be produced by
a trapezoidal wave having the stated rise time.

altitude; e.g. if 5 100 m (17 000 ft), check the outer fringe at 4 500 m (15 000 ft) and 5 100 m (17 000 ft), then proceed inbound at the operational altitude and establish the inner fringes. If adequate radar coverage is not maintained during the inbound run, conduct flights through the coverage pattern to establish the maximum usable altitude;

i) check the inner fringe at the altitudes used to establish the outer fringe back down to 3 000 m (10 000 ft) level: and

j) unless specifically requested, do not inspect vertical coverage above the operational altitude, if the required operational altitude is lower than 3 000 m (10 000 ft).

Commissioning profile - en-route PSR/SSR without radar analysis tools

2.16

Refer to Figure A-3 and proceed as follows:

a) complete steps a) through g) of the terminal PSWSSR commissioning profile procedures;

b) climb to 4 500 m (15 000 ft) and establish the outer fringe;

c) climb to 6 000 m (20 000 ft) and establish the outer fringe. Then proceed inbound at 6 000 m (20 000 ft) and establish the inner fringe;

d) climb to 7 500 m (25 000 ft) and establish the outer fringe;

e) climb to 9 000 m (30 000 ft) and establish the outer fringe;

f) repeat the outer fringe as required to complete the over-all quality and auxiliary tests;

g) then proceed inbound at 9 000 m (30 000 ft) and establish the inner fringe; and

h) if operational or engineering requirements are greater than 9 000 m (30 000 ft), or if this level conflicts with air traffic, climb to a mutually agreeable altitude (to a maximum of 12 000 m (40 000 ft)) and establish the outer and inner fringes.

Commissioning profile - terminal en-route

inner fringe.

3 Climb to 3,000 ft and establish the outer fringe.

4 Climb to 5,000 ft and establish the outer fringe.

5 Repeat the outer fringe check at 5,000 ft (or lower if necessary) to evaluate radar auxiliary functions such as linear polarization, pin diode, integrators, etc., on the primary and GTC/ STC or the secondary radar. Linear polarization normally increases the usable distance, so this check should be performed at an altitude where the change can be observed. Most auxiliary functions produce a decrease in receiver sensitivity, thereby decreasing the usable distance. Conduct these tests by establishing the outer fringe with the function on, and then off, and noting the difference in usable distance.

6 Return the equipment to its original inspection configuration and proceed inbound at 5,000 ft and establish the inner fringe.

7 Climb to 7,000 ft and establish the outer fringe.

8 Climb to 10,000 ft and establish the outer fringe. Then proceed inbound at 10,000 ft and establish the inner fringe.

9 If the maximum required altitude is greater than 10,000 ft, check the outer fringe in 5,000 foot increments up to the maximum required altitude; e.g., if 17,000 ft, check the outer fringe at 15,000 and 17,000 ft, then proceed inbound at the maximum required altitude and establish the inner fringe. If satisfactory radar coverage is not maintained during this inbound run, conduct additional flights through the vertical coverage pattern and establish the maximum usable altitude.

10 Check the inner fringe at the altitudes used to establish the outer fringe stepping down in altitude to the 10,000-foot level.

NOTE: If the maximum required altitude is 10,000 ft or lower, do not inspect vertical coverage above this altitude unless requested.

(b) Commissioning Vertical Coverage Profile, ARSR/ ATCRBS

1 Complete steps (1) through (8) of the ASR

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
3.1.1.4.7 The decay time of pulses P1, P2 and P3 shall be between 0.05 and 0.2 microsecond. Note. The intent of the lower limit of decay time (0.0 microsecond) is to reduce sideband radiation. Equipment will meet this requirement if the sideband radiation is no greater than that which, theoretically, would be produced by a trapezoidal wave having the stated decay time. [Subparameter 1 - Azimuth] 3.1.1.9 INTERROGATOR RADIATED FIELD PATTERN Recommendation. The beam width of the directiona interrogator antenna radiating P3 should not be wid than is operationally required. The side- and back-lobe radiation of the directional antenna should be a least 24 Db below the peak of the main-lobe radiatio	PSR/SSR, radars with radar analysis tools 2.17 Refer to Figure A-4 and proceed as follows: a) Fringe envelope check. The flight inspector sha fly outbound from the site at 300 m (1 000 ft) above the antenna to the outer fringe, up to the outer fringe to the required altitude, across the top inbound to the inner fringe, then down the inner fringe to the 300 m (1 000 ft) inner fringe. Probe and score the primary and secondary fringes at 300,600,900,1 500,2 100,3 000,4 500,6 000, 7 500 and 9 000 m (as required) (1, 2, 3, 5, 7, 10, 15, 20, 25 and 30 (as required) thousand ft). Establish the ascending {outer) fringes by turning inbound and climbing to the next higher level, flyir inbound at the higher level until solid primary and secondary reports are received, then turning outbound to establish the primary and secondary reports at that level. Evaluate the inner fringes in the same manner, with the directions reversed. Conduct the over-all quality and auxiliary functions test at 1 500 m (5 000 ft) or 9 000 m (30 000 ft) as per the previous procedures. B) Coverage within the fringe envelope. Engineering personnel shall use radar analysis tools and targets of opportunity to determine the coverage inside the fringe envelope, and identify the location and extent of holes and other lobing related anomalies Coverage can be determined with analysis of plots on series of recording. Limit the tracks to a 20 degree wedge, centered on the vertical coverage azimuth and filtered for the altitudes of concern. The SSR delay should be active during the recordings to provide a better separation of primar and secondary tracks for independent analysis. Lobing will be evident as primary and secondary tracks, exhibiting decreasing run lengths as they enter a 'hole', disappear in the null, then reappear with progressively higher run lengths as they clear the fringe on the opposite side. Include the printout plots in the facility permanent database. Note.- "SSR delay" refers to the technique of delaying the SSR signal beyond the merge window of the plot combiner. En-route/terminal PSR antenna change	commissioning requirements in Paragraph 14.14g(4)(a). 2 Climb to 20,000 ft and establish the outer fringe Then proceed inbound at 20,000 ft and establish the inner fringe. 3 Climb to 30,000 ft and establish the outer fringe 4 Repeat the outer fringe as required to conduct auxiliary functions tests. 5 Then proceed inbound at 30,000 ft and establish the inner fringe. 6 If operational or engineering requirements are greater than 30,000 ft, or 30,000 ft conflicts with air traffic, climb to a mutually agreeable altitude and establish the outer and inner fringes. © Commissioning Inspection - Military BRITE/ DBRITE Display. Inspect an ASR which has the sole function of providing a video source for a BRITE/ DBRITE display to operational requirements or 4,000 ft/ 10 miles, whichever is greater. 1 Determine the inner and outer fringes at every 1,000-foot level up to 4,000 ft or the operational altitude. 2 No comparative equipment auxiliary function configuration checks are required. 3 Target definition will be from the BRITE display. 4 There are no periodic inspection requirements. (d) Primary Radar Antenna Change. When the primary ASR or ARSR antenna is changed, fly the vertical coverage profile depicted in Figure 14-3 or 14-4, as applicable. 1 After determining the outer fringe at 5,000 ft, repeat the outer fringe check, as required, to evaluate auxiliary functions as requested by facilities maintenance personnel. Conduct the remainder of the coverage check in the original configuration. 2 Checks of additional facility equipment configurations and altitudes will be at the option o	

2.18 When the en-route/terminal PSR antenna is changed, fly the profile depicted in Figures A-5a and Al-5b, as applicable.

A) Repeat the outer fringe checks as necessary ir order to complete an over-all quality and auxiliary functions test as requested by engineering personnel. Conduct the remainder of the coverag check
in the original configuration; and

b) checks of additional facility equipment configurations and additional altitudes may be conducted at the option of engineering personnel.

SSR Antenna Change

2.19 For the same type of antenna, all requirements may be completed using targets of opportunity. Comparison analysis is performed on the historic solar data, SSR parameters and performance measurements (targets of opportunity) to ensure that the same performance (commissioned) can be expected with new antennas. When the antenna is replaced with a different type, or targets of
opportunity are not available, checklist requirements shall be completed using a flight inspection aircraft.

A) Terminal SSR. Fly the profile for a primary antenna change as illustrated in Figure A-5a.

B) En-route SSR. Fly the profile for a primary antenna change as illustrated in Figure A-5b.

Evaluation

2.20 Engineering personnel shall record target strength as defined in Table A-2 (Tolerance/limit), on each scan, aircraft position every five miles, ar aircraft altitude for each fringe check and level rur Where available, engineering personnel shall document results of the vertical coverage check using radar analytical/diagnostic programmes for inclusion in their facility report and permanent records.

[Subparameter 2 - Horizontal]

Horizontal Screening

2.21 The purpose of this test is to verify the

Facilities Maintenance personnel.

(e) ATCRBS Antenna Change. When replacing the antenna with the same type, all inspection requirements may be completed using targets-of-opportunity. When the antenna is replaced with a different type, checklist requirements must be completed using a flight inspection aircraft as required by the Checklist.

1 Terminal Radar. The profile for a primary radar antenna change is indicated in Figure 14-3.

2 En Route Radar. The profile for a primary radar antenna change is indicated in Figure 14-4.

(5) Evaluation. Facilities Maintenance personnel must record target strength as defined in Paragraph 14.16 on each scan, aircraft position every five miles, and aircraft altitude
for each fringe check and level run. Facilities Maintenance personnel must document results of the vertical coverage check using analysis/ diagnostic programs (RDAS tools), when available for inclusion in the facility report.

[Subparameter 2 - Azimuth]

H. Horizontal Screening

(1) Purpose. To verify the indicated coverage on the horizontal screening charts. This test is optional depending upon operational requirements and ground evaluation tools
available. After reviewing the results of the vertica coverage check and other data, engineering personnel will determine if the horizontal coverage check is required.

(2) Approved Procedure. Fly an orbit at an altitude and distance which corresponds to the lowest screening angle at which coverage is expected. D not use an orbit radius of less than ten miles. AFIS, DME, or vectors provided by the controller may be used to maintain the orbit. MTI, if used, should be gated to a range inside the orbit radius, except where
ground clutter obscures the targets unless MTI is used. If MTI is gated outside of the orbit, the radiu of the orbit must be constantly changed to avoid target cancellation due to tangential blind speed. For example, vary the distance on a 12-mile orbit between 10 and 14 miles, flying oblique straight

indicated coverage on the horizontal screening charts. The test is optional depending upon local requirements, and may be accomplished by one c more of the following methods:

a) using either flight inspection or rental aircraft, fl an orbit at an altitude and distance which corresponds to the lowest screening angle at which coverage is expected. Do not use an orbit radius of
less than 18.5 km (10 NM). DME or headings provided by the controller may be used to maintai the orbit. Select "Normal" on the aircraft transponder. MTI, if used, should be gated to a range inside the orbit radius, except those locations where ground clutter will obscure the target unless MTI is used. If MT1 must be gated outside the orbit, the radius of the orbit should be constantly changed to avoid target cancellation du to tangential blind speed. For example, vary the pattern on a 22.2 km (12 NM) orbit between 18.5 km (10 NM) and 25.9 km (14 NM) so as to averag a 22.2 km (12 NM) orbit. Engineering personnel shall record target strength on each scan and target azimuth/distance position each 10 degrees and

b) horizontal screening can also be determined by running the radar analysis programmes on pre recorded data. Limit the data input on successive runs to azimuth sectors with a constant screening angle for each run. Compute the screening angle for any given run (azimuth sector) from the lowest coverage returns at a given range. Then, coverag at any given range beyond the screen can be predicted and a comparison drawn between value on the horizontal screening chart of actual coverage. Limit tests to elevation angles near the expected horizon.

[Subparameter 4 - airway/route coverage]

Airway/route coverage

2.22 The purpose of this check is to document coverage along all routes and airways required by air traffic, and may be accomplished by one or a combination of the following methods:

a) flight inspection or rental aircraft; and

b) radar analysis/targets of opportunity.

courses between the 10-mile and 14-mile orbits, s as to average a 12-mile orbital distance.

(3) Evaluation. Facilities Maintenance personnel must record target strength, azimuth and distance every scan. They must determine if the coverage supports operational
requirements.

[Subparameter 4 - Route/Airways]

i. Airway/ Route Coverage

(1) Purpose: To document coverage along routes and airways, required by AT. Facilities Maintenance personnel must determine the exten of these evaluations which determine the overall radar facility coverage. Areas of intense clutter, poor target returns, or other potential problems identified in the inspection plan may be further evaluated to determine
actual facility coverage. This check must be accomplished using targets-of-opportunity with the final commissioning check done with a flight inspection aircraft.

(2) Approved Procedures

(a) Facilities Maintenance personnel must configure the primary radar in "circular polarization". The altitudes at which satisfactory radar coverage exists will be determined by flying the minimum altitude (not lower than MOCA) on airway centerline. The terminal arrival and departure routes and other areas of interest identified in the inspection plan will be flown at MOCA. Maintain course guidance by reference to AFIS, ground checkpoints, NAVAID signals, or radar vectors. Coverage verification using linear polarization may be checked at the discretion of tl test engineer or, if a joint use site, by the DOD agency.

(b) Targets-of-Opportunity. Targets may consist o one or an assortment of aircraft returns on a particular airway, route or terminal radial. Targets used must be mode-C equipped so altitude information can be obtained. Scoring may be accomplished by either RDAS tools or manually. RDAS may be used to evaluate the track information of a selected (beacon code) target.

2.23 Approved procedures: select "normal" on the flight inspection/rental aircraft transponder. Configure the primary radar in circular polarizatior Fly the minimum coverage altitude not lower than the minimum obstruction clearance altitude (MOCA), on airway centre line. Maintain course guidance by reference to ground checkpoints, navigation system signals, or radar vectors. Fly terminal
arrival/departure routes and other areas of interes identified in the flight inspection, via radar vectors at the MGCA.

2.24 Radar analysis programmes and targets of opportunity: targets may consist of one co-operating aircraft or an assortment of aircraft reports on a particular airway. Targets included ir the output data must be Mode C- or Equipped for essential altitude information. Scoring may be accomplished either with radar analysis programmes or manually. Document the fix positional coverage by filtering a data run with the start/stop azimuth and high/low altitude that effectively "boxes" in the fix. Good coverage withir the box constitutes adequate coverage at the position fix.

Way-point/map accuracy

2.25 The purpose of this test is to verify the accuracy of all airways, routes, fixes, and centre lines displayed on the video map. This test may b accomplished by either of the following methods:

a) flight inspection or rental aircraft; and

b) targets of opportunity.

2.26 Approved procedures: since the object of the test is to compare the displayed video map featur against indicated target reports, radar configuratic (MTI, antenna polarization, transponder settings, etc.) does not affect the test results. The procedure is the same whether using a flight inspection aircraft or targets of opportunity; compare reported aircraft position on or over an airway, route or fix, with video map presentation. Similarly, verify runway centre line-to-video map alignment by observing landing and departing aircraft. However, when using targets of opportunity, numerous target reports are required to verify the accuracy of any particular airway, route, or fix. Verify accuracy with a flight inspectio

(3) Evaluation. Facilities Maintenance personnel must determine if the facility coverage meets operational requirements.

[Subparameter 5 - Optimization]

O. ATCRBS Power Optimization

(1) Purpose: To reduce over-interrogation, over-suppression, fruit, and false targets caused by reflections. Optimum ATCRBS power must be the minimum ATCRBS power to meet operational requirements.

(2) Approved Procedures. The aircraft must be positioned to fly an arc in the vicinity of the vertica coverage radial or mutually agreed to reference radial at maximum distance. The aircraft altitude must be 10,000 ft for ASR(s) and 30,000 ft for ARSR(s), or as close to these altitudes as operational conditions allow. The beacon transmitter power must be adjusted to the minimum value that produces a usable beacon reply or target. During this check, ensure that the aircraft transponder antenna is not shielded by aircraft. An ATCRBS power optimization must be performed with a flight inspection aircraft following an increase in antenna tilt. Vertical coverage as flown by a flight inspection aircraft or targets-of-opportunity must be checked using the power leve established in this paragraph. The beacon must b commissioned at this power level, plus 1 dB.

(3) Evaluation. Facilities Maintenance personnel must observe ATCRBS performance during the ATCRBS power optimization for a usable beacon reply.

NOTE: Although this test may be accomplished during the vertical coverage check, any changes made in beacon power, as a result of this test, wil invalidate any portion of the flight inspection checked previously.

P. ATCRBS GTC/ STC Evaluation

(1) Purpose: To evaluate the ATCRBS GTC/ STC setting. It must be adjusted prior to the flight inspection and confirmed during the vertical and airway/ route coverage checks.
GTC/ STC reduces the interrogator receiver gain,

	aircraft. Replacement map overlays, video maps, or digitally generated maps do not require flight inspection if engineering personnel are satisfied through evaluation of targets of opportunity or by comparison to an existing map, that the new map is accurate.	as the range to the station reduces, thereby reducing ring-around and false targets. (2) Approved Procedures (a) Facilities Maintenance personnel must observe the flight inspection aircraft target for ring-around, during the vertical coverage and airway/ route coverage checks. Ring-around is an indication that GTC/ STC is improperly adjusted. (b) If false targets and/or ring-around persists, conduct a special target scoring check conducted solely for setting GTC/ STC. This test requires a flight inspection aircraft configured in accordance with the checklist in Paragraph 14.13. Position the aircraft on the vertical coverage radial or mutually agreed to reference radial, either inbound or outbound, at 10,000 ft AGL for ASR(s) and at 30,000 ft AGL for ARSR(s), or as close to these altitudes as operational conditions allow. Facilities Maintenance personnel must examine the receive beacon signal during the entire radial (fringe to fringe). Correct GTC/ STC setting is indicated by a fairly constant signal level over the entire radial. © STC may be established during ground checks and evaluated with targets-of-opportunity by using RDAS tools or other software tools. (3) Evaluation. Facilities Maintenance personnel must observe the display for minimum false ATCRB(s) targets or ring-around. E. Tilt Verification (1) Purpose. To verify the primary and secondary radar antenna tilt settings are optimum and the mechanical antenna tilt indicators are accurate. (2) Approved Procedure. Facilities Maintenance personnel must direct the aircraft through the heaviest ground clutter within operational areas so the predetermined angle can be evaluated and adjustments made if required. If radar coverage is acceptable and the radar range is satisfactory, complete the remaining portions of the flight inspection. If parameters are not acceptable, it will be necessary to reestablish the antenna tilt angle. In this case, re-accomplish any previously completed flight inspection procedures using the new antenna tilt angle.	

(3) Evaluation. The tilt selection process consider the interaction of various radar parameters and th final radar system performance. The optimum tilt angle is a compromise
between coverage (with/ without MTI) over clutter and range coverage.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Mode 3 8.0 +/- 0.2 microseconds Mode C 21.0 +/- 0.2 microseconds P1 to P2 interval 2.0 +/- 0.15 microseconds P1, P2 and P3 duration 0.8 +/- 0.1 microseconds	[Parameter - Coverage] Target strengths on Video Map (Vol. 3 Table A-2) (1) Broadband 2-usable -- Target shows each scan, remains on the scope for at least l/3 of the scan. L-unusable -- Weak target, barely visible, possible miss. O-unusable -- No visible target. (2) Narrowband l-usable -- Visible target, satisfactory for ATC purposes. 2-unusable -- No visible target.	[Subparameter 2 - Elevation] Vertical - from inner to outer fringe -- Meets operational requirements at all altitudes. [Subparameter 2 - Horizontal] Horizontal -- No tolerance. [Subparameter 3 - Routes/Airways] Approaches, airways, arrival and departure routes and fixes route/procedure -- A usable target return must be maintained alon the entire route or throughout the procedure. [Subparameter 3 - Optimization] ATCRBS power - minimum to meet operational requirements Broadband/Reconstituted 3 usable -- Target leaves trail or persists from sca to-scan without trail. 2 usable -- Target shows each scan, remains on the display for at least 1/3 of the scan. 1 unusable -- Weak target, barely visible, possible miss. 0 unusable -- No visible target. Narrowband 1 usable -- Visible target, satisfactory for ATC purposes.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		0 unusable -- No visible target, unsatisfactory for ATC. Target which is not missed/ unusable on three or more consecutive scans.	

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
Radiated power, antenna pattern and ground to air modes are implicit in coverage requirements. This is a requirement to have and use remote monitoring such as MTI reflectors or "parrots" and as such is a design or specification requirement.	Accuracy checks are inherent in the coverage checks.	Accuracy checks are inherent in the coverage checks.

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
377	571	327	545

Facility ASR **Parameter** General

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref 2.1.1 **SARPS Ref** **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
2.1.1 When SSR is installed and maintained in operation as an aid to air traffic services, it shall conform with the provisions of 3.1 unless otherwise specified in this 2.1. Note. As referred to in this Annex, Mode A/C transponders are those which conform to the characteristics prescribed in 3.1.1. Mode S transponders are those which conform to the characteristics prescribed in 3.1.2. The functional capabilities of Mode A/C transponders are an integral part of those of Mode S transponders.			[GENERAL] Recommendation: Annex10 Note; This transponder requirement may require flight check validation. Example: "Terra" transponders were placed into service and did not "properly" respon to ground based interrogations. A letter of difference would not be required. Recommendation: All documents do not reflect the capabilities of some of the newer radar facilities such as the ARSR-4's design for primar elevation determination. The documents should be updated to reflect all equipment now in servic

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
This is a design or ground maintenance issue. Flight check does not address this.	Does not reflect newer equipment capabilities suc as the ARSR-4 primary height determination.	Does not reflect newer equipment capabilities suc as the ARSR-4 primary height determination. Recommendation: Annex10 Note; This transponder requirement may require flight check validation. Example: "Terra" transponders were placed into service and did not "properly" respond to ground based interrogations. A letter of deference would not be required.

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
378	572	328	546

Facility ASR **Parameter** Interrogation Frequency

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 3.1.1.1 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.1.1.1 INTERROGATION FREQUENCY 3.1.1.1.1 The carrier frequency of the interrogation and control transmissions shall be 1 030 MHz. 3.1.1.1.2 The frequency tolerance shall be plus or minus 0.2 MHz. 3.1.1.1.3 The carrier frequencies of the control transmission and of each of the interrogation pulse transmissions shall not differ from each other by more than 0.2 MHz.			[INTERROGATION FREQUENCY] This is a design and specification requirement and is only checked by ground maintenance.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
This is a design or ground maintenance issue. Flight check does not address this.	There is no flight check requirement for interrogation frequency.	There is no flight check requirement for interrogation frequency.

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
379	573	329	547

Facility ASR **Parameter** Interrogation Rep Freq

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref 3.1.1.8

SARPS Ref

8071 Reference

8200 Reference

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.1.8.1 Interrogation repetition frequency. The maximum interrogation repetition frequency shall be 450 interrogations per second. 3.1.1.8.1.1 Recommendation. To minimize unnecessary transponder triggering and the resultin high density of mutual interference, all interrogators should use the lowest practicable interrogator repetition frequency that is consistent with the display characteristics, interrogator antenna beam width and antenna rotation speed employed.			[INTERROGATION REPETITION FREQUENCY] This a design and specification requirement and is not explicitly checked during flight check.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Maximum of 450 interrogations/sec		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
This is a design or ground maintenance issue. Flight check does not address this.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
380			548

Facility **ASR** **Parameter** **Polarization**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 3.1.1.3 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.1.3 POLARIZATION Polarization of the interrogation, control and reply transmissions shall be predominantly vertical.			This is a design or ground maintenance issue. Flight check does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
This is a design or ground maintenance issue. Flight check does not address this.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
381			549

Facility ASR **Parameter** Sidelobe Suppression

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref 2.1.2.4

SARPS Ref

8071 Reference

8200 Reference

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
2.1.2.4 SIDE-LOBE SUPPRESSION CONTROL INTERROGATION 2.1.2.4.1 Side-lobe suppression shall be provided in accordance with the provisions of 3.1.1.4 and 3.1.1.5 on all Mode A, Mode C and intermode interrogations. 2.1.2.4.2 Side-lobe suppression shall be provided in accordance with the provisions of 3.1.2.1.5.2.1 on a Mode S only all-call interrogations.			[SIDELOBE SUPPRESSION] This is a design or ground maintenance issue. Flight check does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
This is a design or ground maintenance issue. Flight check does not address this.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
382			550

Facility ASR **Parameter** Spurious Emissions & Responses

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref 3.1.1.11

SARPS Ref

8071 Reference

8200 Reference

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.1.11 SPURIOUS EMISSIONS AND SPURIOUS RESPONSES 3.1.1.11.1 SPURIOUS RADIATION Recommendation. CW radiation should not exceed 76 dB below 1 W for the interrogator and 70 dB below 1 W for the transponder. 3.1.1.11.2 SPURIOUS RESPONSES Recommendation. The response of both airborne and ground equipment to signals not within the receiver pass band should be at least 60 dB below normal sensitivity.			[SPURIOUS EMISSIONS AND RESPONSES] This is a design or ground maintenance issue. Flight check does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
This is a design or ground maintenance issue. Flight check does not address this.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
383			551

Facility **ASR** **Parameter** **Standby Equipment**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** 2.35 **8200 Reference** 14.14r, 4.33b

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	2.35 The purpose of this check is to evaluate the performance of standby equipment, and may be accomplished during pre-inspection testing using targets of opportunity. Some radars have been engineered to meet reliability requirements throug the use of redundant parallel units. Structure the pre-inspection testing of these systems so as to thoroughly test all such redundant units. A standb antenna (duplicate) may be installed at selected locations to provide for continued radar service in the event of antenna failure. The commissioning requirements for a standby antenna may be completed using the antenna checklist.	14.14r. Standby Equipment. The purpose of this check is to evaluate the performance of standby equipment, and may be accomplished during pre-inspection testing using targets-of opportunity. If standby equipment is available but not working, th flight inspector must be notified (see Paragraph 4.33b). Some radar installations are engineered tc meet reliability requirements by the use of redundant parallel units, instead of standby transmitters. Conduct flight inspection of these facilities while the system is operating in parallel. A separate check of each channel is not required. Some replacement radar units are collocated in the building with the primary radar and share the sam waveguide and antenna during installation and checkout. In this case, the standby transmitter cannot be placed in operation without an extende facility shutdown. The pre-inspection testing of these systems must thoroughly test all redundant and standby units to ensure they meet or exceed tolerances established on the flight inspected channel. A standby antenna (duplicate) may be installed at selected locations to provide continue radar service, in the event of antenna failure. The commissioning requirements for a standby antenna will be completed using the antenna change checklist. 4.33b. Standby Equipment. It is necessary to kno which system or transmitter is operating so the performance of each can be determined. (1) When one unit of a dual equipped facility is found out-of-tolerance, it must be identified and removed from service. The unit can be identified a transmitter number 1 or 2, channel A or B, serial number, etc. (2) Some inspections may only require the checking of one equipment. The details for each type of facility are included in the appropriate facility checklists.	[STANDBY EQUIPMENT] Meets Doc 8071 requirements. Annex 10 does not address this issue. Recommendation: A letter of difference is not b required.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
ICAO Annex Tol	**Doc 8071 Tolerance**	**8200 Tolerance**	
		Meet same tolerances as main (dual channel) equipment. See Paragraph 4.33b.	
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
	Measurement Uncertainty		

Annex10_ID	8071_ID	8200_ID	Results_ID
	574	330	552

Facility **ASR** **Parameter** **Standby Power**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** 2.36 **8200 Reference** 14.14s , 4.33c

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	2.36 The purpose of this test is to evaluate radar performance on standby power (engine generator or uninterruptible power supply) and shall be conducted during pre-inspection testing. Results. are satisfactory when the engine generator monitc equipment detects a power failure without manual intervention. Conduct this test with a simulated power failure by manually switching out the incoming commercial power.	14.14s. The purpose of this check is to evaluate radar performance on standby (engine generator) power and must be conducted during pre-inspection testing. Results are satisfactory when the engine generator monitor equipment detects a power failure, starts the engine, and switches to the engine power without manual intervention. Conduct this test with a simulated power failure by manually switching out the incoming commercial power. 4.33c. Standby Power (1) The flight inspector must check the facility on standby power during a commissioning flight inspection if standby power is installed. If a standby power system is installed after the commissioning flight inspection, the flight inspectc must check the facility on standby power during the next regularly scheduled periodic inspection. The flight inspector must make comparative measurements to ensure that facility performance is not derogated on the standby power system and that all tolerance parameters for the specific inspection are met. Standby power checks are not required on facilitie powered by batteries that are constantly charged by another power source. (2) It is not necessary to recheck a facility when the standby power source is changed.	[STANDBY POWER] 8200 meets Doc 8071 requirements/intent. Annex 10 does not address this issue, Recommendation: A letter of difference is not required.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		See Paragraph 4.33c.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
Annex10_ID	8071_ID	8200_ID	Results_ID
	575	331	553

Facility **ASR** **Parameter** **Transmission Characteristics**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 3.1.1.5 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.1.5.1 The radiated amplitude of P2 at the antenna of the transponder shall be: a) equal to or greater than the radiated amplitude of P1 from the side-lobe transmissions of the antenna radiating P1; and b) at a level lower than 9 dB below the radiated amplitude of P1, within the desired arc of interrogation. 3.1.1.5.2 Within the desired beam width of the directional interrogation (main lobe), the radiated amplitude of P3 shall be within 1 dB of the radiated amplitude of P1.			[TRANSMISSION CHARACTERISTICS] This is a design qualification or ground maintenance issue. Flight check does not address this. Recommendation: A letter of difference is not required.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
This is a design qualification or ground maintenance issue. Flight check does not address this.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
384			554

Facility DF **Parameter** Bearing Accuracy

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 8.22b2, b6

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		(2) Bearing Accuracy (a) DF coverage will not substantially exceed line-of-sight. Coverage is dependent on power output, antenna height, terrain, and the effects of signal reflection. The bearing accuracy check is conducted to determine the ability of the DF facilit to furnish accurate bearings throughout the servic area during commissioning, and forms the reference for other inspections. This is accomplished by comparing DF bearings from the facility with bearings measured from AFIS, theodolite, or ground checkpoints. (b) If communications become unsatisfactory, or i bearing errors exceed tolerance, climb above the altitude being flown until adequate communicatior are established again and/or bearing errors are satisfactory. (c) If communications and bearing accuracy remain satisfactory on the next measurement, descend to the appropriate selected altitude or to the minimum altitude which will provide satisfacto bearings and communications, whichever is higher, and continue to the next checkpoint. This procedure will provide the lowest altitudes throughout the coverage area of the DF facility at which acceptable bearing information and communication can be expected. (6) Analysis of Bearing Accuracy. After completing the bearing accuracy check, station adjustment may be necessary to balance station error and keep all bearings within toleranc Whenever orbital bearing errors are beyond ± 6° on any type of flight inspection, verify the errors radially. If, due to the availability of ground checkpoints, the exact azimuth found suspect in the orbit cannot be verified, radially fly another inbound/ outbound radial in the same 90° quadrant. When an out-of-tolerance condition cannot be corrected, the controller must be advised of the area(s) not to be used. The	ICAO has not published any SARPS or Flight Testing recommendations for DF equipment.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		condition(s) will be noted on the flight inspection report and the facility assigned a "restricted" classification. A NOTAM will not be issued.	
ICAO Annex Tol	**Doc 8071 Tolerance**	**8200 Tolerance**	
		8.24a. Bearing Accuracy VHF/ DF, UHF/ DF: Each DF bearing must be within 10 deg of the actual bearing. VHF/ DF (doppler): Each DF bearing must be within 6 deg of the actual bearing	
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
	Measurement Uncertainty		

Annex10_ID	8071_ID	8200_ID	Results_ID
		332	555

Facility DF **Parameter** Communications

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 8.22b(9)

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		(9) Communications and Coverage. Voice communication is the means for getting DF information to a pilot. Quality of communications greatly affects the capability of the DF to provide quality service. Bearings must be obtained on as many of the published frequencies as practical during the checkpoint orbit. For a commissioning inspection, all frequencies proposed for use will b checked. This may be accomplished on the orbit o during radial flight at the extremes of coverage. Fo periodic inspections, voice communications will be checked on all frequencies if less than four are used for DF bearings. If more than four are available, at least four frequencies will be checked The VHF emergency frequency, if available, must be evaluated during all flight inspections. Where coverage is required at greater distances for special purposes, it can be determined by either orbital or radial flight at the greater distance and altitude.	ICAO has not published any SARPS or Flight Testing recommendations for DF equipment.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		8.24c. Communications. Communications on all required frequencies must be clear and readable throughout the coverage area.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
		333	556

Facility DF **Parameter** Controller Performance

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 8.22b(11)

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		(11) Operator Performance. The flight inspector must determine that the overall system is safe an reliable. The operator should be able to direct the aircraft over the facility, report station passage, ar provide pertinent information relative to the use of DF service. If an emergency approach procedure has been established (DF approaches are not SIAP(s)), the operator should be able to direct the aircraft to a position from which a safe landing ca be made.	ICAO has not published any SARPS or Flight Testing recommendations for DF equipment.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		8.24e. Controller Performance. Controllers must be capable of directing an aircra to the station, reporting station passage, providing guidance for an emergency approach, and vectoring aircraft to avoid terrain and obstacles.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
		The Procedure paragraph title, "Operator Performance" differs from the parameter name "Controller Performance" in the list of Tolerances in 8.24e. Recommend one be changed.

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
		334	557

Facility DF **Parameter** Coverage

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 8.22b(8) and (9)

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		8. Commissioning Inspection (a) An orbit procedure, as outlined in this section, must be used to evaluate bearing accuracy for the commissioning flight inspection. Orbit radius must be the minimum of: 1 40 miles for Doppler DF facilities; 2 30 miles for older equipment; 3 operational requirements The altitude must be 1,500 ft above site elevation the minimum altitude providing 1,000 ft of obstacl clearance (2,000 ft obstacle clearance in designated mountainous areas), or the minimum altitude which will provide radio line-of-sight, whichever is the higher. (b) AFIS or theodolite bearings may be taken at frequent intervals as close together as 10°. A minimum of four bearings must be taken for each quadrant, regardless of which orbit method is use (9) Communications and Coverage. Voice communication is the means for getting DF information to a pilot. Quality of communications greatly affects the capability of the DF to provide quality service. Bearings must be obtained on as many of the published frequencies as practical during the checkpoint orbit. For a commissioning inspection, all frequencies proposed for use will b checked. This may be accomplished on the orbit o during radial flight at the extremes of coverage. Fo periodic inspections, voice communications will be checked on all frequencies if less than four are used for DF bearings. If more than four are available, at least four frequencies will be checke The VHF emergency frequency, if available, must be evaluated during all flight inspections. Where coverage is required at greater distances for special purposes, it can be determined by either orbital or radial flight at the greater distance and altitude.	ICAO has not published any SARPS or Flight Testing recommendations for DF equipment.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		8.24b. Coverage VHF/ DF UHF/ DF: 30 miles VHF/ DF (doppler): 40 miles

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
		The coverage requirement, in radial miles, is not specifically addressed in the Communications and Coverage Procedures paragraph 8.22b(9). Instead, it is found indirectly in the "Commissioning Inspection" text for BEARING ACCURACY in paragraph 8.22b(8).

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
		335	558

Facility DF **Parameter** Emergency Approaches

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 8.22b(13)

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		(13) DF Approaches (a) The emergency DF approach must be checke at the time of commissioning. Airway Facilities personnel or DF facility operators may request a check of the approach during any inspection if, in their opinion, verification of the procedure, obstructions, or equipment performance is desire (b) Conduct the approach in accordance with the DF operator's instructions and evaluate the obstacle clearance and flyability per Chapter 6. The flight inspector must note the position of the aircraft relative to the airport and determine whether it will permit a safe landing.	ICAO has not published any SARPS or Flight Testing recommendations for DF equipment.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		8.24g. Emergency Approaches. Where a DF approach procedure is established, the system must provide the capability of directing the aircraft to a position from which a safe landing can be made.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
		336	559

Facility DF **Parameter** Standby Equipment

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 8.23

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		8.23 STANDBY EQUIPMENT. Where installed, standby equipment will meet the same operational tolerances during commissionin as the primary equipment. Periodic inspection of standby equipment is not required unless requested by Airway Facilities, Engineering, or the DF operator.	ICAO has not published any SARPS or Flight Testing recommendations for DF equipment.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		Same as Main equipment.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
		This "tolerance" does not appear in the tolerances paragraph 8.24. To be consistent with other chapters, Standby Equipment should be added to paragraph 8.24.

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
		337	560

Facility DF **Parameter** Standby Power

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 8.22b(12)

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		(12) Standby Power (a) Standby power, if installed, must be checked on the commissioning inspection to ensure that n derogation of communication or bearing accuracy occurs when using the alternate power source. Ar orbit on each source will be performed and the bearing accuracy and overall station error compared. If standby power is installed at a later date, the facility will be inspected on standby pow at the first periodic inspection scheduled after the installation of the standby power system. Inspections after a change in the standby power source are at the discretion of the Airway Facilitie Engineering Division. (b) Periodic inspections normally will not require the use of standby power systems. Airway Facilities personnel may request a check on standby power if they suspect that the alternate power source causes a deterioration in the performance of the DF facility.	ICAO has not published any SARPS or Flight Testing recommendations for DF equipment.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		8.24f. Standby Power. The DF facility will meet all tolerances in this chapter when operating on an alternate power source.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
		The premise of this check is that using a standby power source could introduce bearing errors. (While this was possible using earlier equipments it is quite unusual with modern equipment.) This text requires that a standby power source, newly-installed after commissioning, be flight checked during the next scheduled inspection. Since the current periodicity is 540 days (1.5 years), any bearing errors introduced by using the

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		standby power source could exist for many month It appears illogical to be concerned about bearing errors, yet allow them to potentially exist for up to 18 months. Consider making the flight testing immediate for older equipment types, or prohibiting the use of th standby power system until a flight inspection occurs.	
	Measurement Uncertainty		

Annex10_ID	8071_ID	8200_ID	Results_ID
		338	561

Facility **DF** **Parameter** **Station Passage**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 8.22b(10)

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		(10) Station Passage. Fly inbound to the DF antenna from a position at least 5 miles out and a altitude of 1,500 ft above the antenna. Obtain sufficient steers from the DF operator to overfly th antenna and note the distance from the aircraft to the DF antenna when the operator reports station passage. This check may be performed in conjunction with the DF approach procedure (Paragraph 8.22b(13) at the discretion of the pilot and DF operator.	ICAO has not published any SARPS or Flight Testing recommendations for DF equipment.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		8.24d. Station Passage. Station passage must be recognized within 1 1/2 miles at 1,500 ft AGL.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
		339	562

Facility DME **Parameter** Accuracy

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref 3.5.4.5

Annex Ref 3.5.4.5, 3.5.3.1.3 **8071 Reference** 3.3.9 **8200 Reference** 11.31

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.5.4.5 Accuracy 3.5.4.5.1 DME/N. The transponder shall not contribute more than plus or minus 1 microsecond (150 m (500 ft)) to the overall system error. 3.5.4.5.2 DME/N. A transponder associated with a landing aid shall not contribute more than plus or minus 0.5 microsecond (75 m (250 ft)) to the overal system error. 3.5.4.5.3 DME/P FA mode 3.5.4.5.3.1 Accuracy standard 1. The transponder shall not contribute more than plus or minus 10 m (plus or minus 33 ft) PFE and plus or minus 8 m (plus or minus 26 ft) CMN to the overall system erro 3.5.4.5.3.2 Accuracy standard 2. The transponder shall not contribute more than plus or minus 5 m (plus or minus 16 ft) PFE and plus or minus 5 m (plus or minus 16 ft) CMN to the overall system erro 3.5.4.5.4 DME/P IA mode. The transponder shall not contribute more than plus or minus 15 m (plus o minus 50 ft) PFE and plus or minus 10 m (plus or minus 33 ft) CMN to the overall system error. 3.5.4.5.5 Recommendation. When a DME is associated with an MLS angle facility, the above accuracy should include the error introduced by the first pulse detection due to the pulse spacing tolerances. ---------- 3.5.3.1.3.1 System accuracy. The accuracy standards specified herein shall be met on a 95 per cent probability basis. Note. The total system limits include errors from all causes such as those from airborne equipment, ground equipment, propagation and random pulse interference effects.	Accuracy 3.3.9 The accuracy of the system can be evaluate by comparing the measured DME distance with a three-dimensional reference. It is good practice to make the calculations in three-dimensional space to avoid errors based on differences between slan range and the range on the ground. The accuracy can be checked on both orbital and radial flights. The DME transponder's contribution to the total error budget is principally the main delay. The mo accurate calibration of this parameter is by ground measurement.	DISTANCE ACCURACY. Check the accuracy of the DME distance information during inspection o radials, orbits, approach procedures, and DME fixes. The exact mileage indication displayed on the distance indicators must be noted on the recordings. Comparison of the scaled distance on the chart (converted to slant range) to the distanc indicated by the DME distance indicator at the various points may be made for accuracy determination. a. It is not necessary to compute the slant range for distances measured at altitudes below a vertic angle of 5° because the relative difference betwee slant and chart range is negligible (less than ½ to 1 percent). b. For ease of computation, a 5° angle is equivale to approximately 1,000 ft above the antenna at 2 miles and 5,000' above the antenna at 10 miles. Above a 5° angle, a DME slant range mileage mu be converted to chart distance. c. If the ground facility is emitting false reply pulses, erroneous distance information may be present. This condition usually occurs within 25 miles of the antenna. Whenever actual false lock-ons are experienced, the offending facility must be removed from service until this condition is remedied.	8200 matches the Annex 10 tolerance of 0.2 NM for TOTAL system error. Embedded in the Annex 10 requirement is an assumption that the airborne interrogator contributes less than 315m (0.17 NM) error. Recommendation: AVN should confirm by measurement or analysis that the airborne equipment used for DME flight inspections meets this assumption.

3.5.3.1.3.2 DME/N accuracy. Recommendation. At distances of from zero to 370 km (200 NM) from the transponder, dependent upon the particular service application, the total system error, excluding readin error, should be not greater than plus or minus 460 m (0.25 NM) plus 1.25 per cent of distance measured.

3.5.3.1.3.3 The total system error shall not exceed plus or minus 370 m (0.2 NM).

Note 1. This system accuracy is predicated upon th achievement of an airborne interrogator error contribution of not more than plus or minus 315 m (0.17 NM).

Note 2. In mixed DME/N and DME/P operations it is intended that the achieved accuracy be at least tha in 3.5.3.1.3.2.

3.5.3.1.3.4 DME/P accuracy

Note 1. In the following, two accuracy standards, 1 and 2, are stated for the DME/P to accommodate a variety of applications.

Note 2. Guidance on accuracy standards is given ir Attachment C, 7.3.2.

3.5.3.1.3.4.1 Error components. The path following error (PFE) shall be comprised of those frequency components of the DME/P error at the output of the interrogator which lie below 1.5 rad/s. The control motion noise (CMN) shall be comprised of those frequency components of the DME/P error at the output of the interrogator which lie between 0.5 rad/ and 10 rad/s.

Note. Specified error limits at a point are to be applied over a flight path that includes that point. Information on the interpretation of DME/P errors and the measurement of those errors over an interv appropriate for flight inspection is provided in Attachment C, 7.3.6.1.

3.5.3.1.3.4.2 Errors on the extended runway centre line shall not exceed the values given in Table B at the end of this chapter.

3.5.3.1.3.4.3 In the approach sector, away from the extended runway centre line, the allowable PFE for both standard 1 and standard 2 shall be permitted t increase linearly with angle up to plus or minus 40

degrees MLS azimuth angle where the permitted error is 1.5 times that on the extended runway centr line at the same distance. The allowable CMN shall not
increase with angle. There shall be no degradation either PFE or CMN with elevation angle.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
transponder alone: DME/N: <= 150m (500'), 75m (250') if used for landings DME/P/FA: <= 10m (33') PFE, <= 8m (26') CMN DME/P/IA: <=15m (50') PFE, <=10m (33') CMN Total System Error: <= 370m (0.2 NM)	<= 150m <= 75m for DME associated with landing aids	0.20 nm (1215')

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
Duplicated text 3.5.3.1.3.1 from SYSTEM CHARACTERISTICS parameter, to match parameter names in Doc 8071 and Order 8200.1. 3.5.3.1.3.1 gives TOTAL system error, including interrogator and transponder. A 95% confidence is applied to the TOTAL system error.	8071 tolerances are for DME/N facilities. "95% rule" is not addressed. DME/P facilities are not addressed.	"95% rule" is not addressed. Tolerance is equal t Annex 10 for TOTAL system error.

Measurement Uncertainty
20m

Annex10_ID	8071_ID	8200_ID	Results_ID
385	576	340	563

Facility **DME** **Parameter** **Coverage**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref 3.5.3.1.2

Annex Ref 3.5.3.1.2 **8071 Reference** 3.3.5 - 3.3.8 **8200 Reference** 11.24, 11.33

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.5.3.1.2 Coverage 3.5.3.1.2.1 When associated with a VOR, DME/N coverage shall be at least that of the VOR to the extent practicable. 3.5.3.1.2.2 When associated with either an ILS or a MLS, DME/N coverage shall be at least that of the respective ILS or of the MLS azimuth angle guidanc coverage sectors. 3.5.3.1.2.3 DME/P coverage shall be at least that provided by the MLS azimuth angle guidance coverage sectors. Note. This is not intended to specify the operational range and coverage to which the system may be used; spacing of facilities already installed may limi the range in certain areas.	Coverage 3.3.5 The coverage is measured by recording the automatic gain control (AGC) level of the airborne DME receiver. When combined with the reference system, a horizontal and vertical pattern can be plotted. A high assurance of continuous coverage should be established for all flight procedures based on the use of DME. Horizontal coverage 3.3.6 The aircraft is flown in a circular track with a radius depending on the service volume of the associated facility around the ground station antenna at an altitude corresponding to an angle c elevation of approximately 0.5" above the antenna site, or 300 m (1 O00 ft) above intervening terrain whichever is higher. If there is no associated facility, the orbit may be made at any radius great than 18.5 km (10 NM). Since this flight is performed close to the radio horizon, it is possible to evaluate variations in field strength by recording the AGC voltage. Flight inspection of the coverage at maximum radius and minimum altitude, as prescribed by the operational requirements for the selected transponder, is usually necessary only o commissioning checks, when major modifications are made in the ground equipment, or if large structures are built i the vicinity of the antenna. The signal strength at the aircraft is generally adequate to maintain the interrogator in the tracking mode. Thus, the equipment itself can be used by the pilot for the desired orbit track guidance. Note.- Checking of the associated VOR can be performed on the same flight. For a terminal class VOR, an orbit of 46.3 km (25 NM) can be flown. Vertical coverage 3.3.7 The following flight inspection may be made to evaluate the lobing pattern of a DME transponder. The flight test aircraft is used to	11.24 DME COVERAGE must be recorded or annotated and evaluated to the same coverage requirements as the service (ILS/ VOR/ NDB, etc. it supports. 11.33 DME coverage must be recorded or annotated and evaluated to the same coverage requirements as the service (ILS/ VOR/ NDB, etc. it supports. DME fixes located outside the FISSV must be evaluated for coverag ± 4 nm or 4.5° (whichever is greater) at 5 nm greater than the fix distance. Coverage is validate on one transponder only. 11.20c En Route Radials (1) FISSV. Radials flown to determine the facility's ability to support the FISSV must be flown at a minimum altitude of 1,000 ft (2,000 ft in designate mountainous terrain) above the site elevation, or the highest terrain or obstruction, to a distance of 40 miles for "L"and "H" class facilities, or 25 miles for "T" class facilities. The 40-mile or 25-mile distances are considered the standard flight inspection coverage distances. (2) All radials supporting instrument flight procedures must be checked for signal quality an accuracy. Fly Airways, Off-Airway Routes, or rout segments throughout the length of the intended use, at or below the minimum requested altitudes. If these radials have procedural requirements beyond the Flight Inspection Standard Service Volume (FISSV) distance, they must be inspected to the additional distances at the minimum requested altitudes. (3) Changeover Points. The minimum en route altitude (MEA) for an airway change-over point (COP) must be the altitude where usable signals exist from the supporting stations. There is no requirement to check coverage beyond the COP. (4) Evaluate azimuth alignment, course sensitivity or modulations, polarization, roughness and	Annex 10 does not define coverage in terms of measurements. Doc 8071 contains a tolerance of -89 dBW/m^2, which is a value not found in the SARPS. 8200.1 defines coverage in terms of stable lock-on, which is in turn depending on the receiver/antenna combination used on the flight inspection aircraft. Although the level of lock-on is undefined, this criterion in 8200.1 meets the mission, since Annex 10 contains no explicit tolerance. See also SIGNAL STRENGTH parameter.

perform a horizontal flight at approximately 1 500 m (5 O00 ft) on a bearing found suitable. The fligh inspector records the FW-level or the AGC from the airborne receiver. Airspace procedures based on the use of DME are evaluated at the minimum flight altitude. The flight inspector verifies that the distance information is properly available in the aircraft at ATC reporting points, along air routes.

3.3.8 It is possible to check that the interrogator transponder system is operating properly at every point of the airspace under consideration by recording the AGC voltage. The measurements made in flight provide data for plotting a graph showing the range in relation to the altitude. This graph makes it possible to:

a) form a clear picture of the different lobes of the radiation pattern and thus evaluate the characteristics of the antenna and its environment

b) show the cone as seen from directly overhead; and

c) foresee any limitations of the transponder coverage and their operational implications.

scalloping, bends, identification, voice features, sensing, and signal strength while flying the desired azimuth.

11.20d Intersection Radials/ DME Fixes

(1) Intersections are used to identify azimuth positions in space. These intersections can be used for navigational fixes, reporting points, DME fixes, COP(s), etc. Establish a minimum reception altitude (MRA) for each intersection that does not meet the minimum en route IFR altitude (MEA). The MRA is the lowest altitude where reliable signals can be received within the procedural design area.

(2) Fixes located within the FISSV. When fixes are located within the FISSV, coverage throughout the fix displacement area can be predicted (fix displacement evaluation is not required). Inspect these fixes for azimuth alignment, course sensitivity or modulations, identification, roughness and scalloping, and signal strength along the radial track used to define the fix at the proposed procedural use altitude.

NOTE: Flight inspection of ESV is described in Chapter 22 of this order.

11.20e Terminal Radials/ Fixes (Approach, Missed Approach)

(1) Evaluate all the radial segments that comprise the STAR, SID/ DP, or SIAP on commissioning and frequency change inspections. All final segments must be flown in the direction of intended use. Ensure the procedure is compatible with human factors (see Paragraph 6.15c) and the navigational guidance is satisfactory. On commissioning and frequency change inspections the radials must be evaluated to include the holding patterns, procedure turns, approach and missed approach, or departure routings. During periodic, antenna change, and facility rotation inspections evaluate only the final approach segment of the SIAP(s). Evaluate other terminal radials on a surveillance basis.

(2) All evaluations must be conducted at the procedural altitudes except the final approach segment. This segment is evaluated from the FAF (or final descent point) descending to 100 ft below the lowest MDA to the MAP. During site,

commissioning, reconfiguration, antenna change, frequency change, and changes to the applicable SIAP, evaluate VOR radials 5° on each side of the final approach radial. Evaluate the offset VOR radials on one transmitter at the same altitudes as the final approach radial segment.

(3) When terminal fixes are located within the facility's FISSV or below the FISSV but within the standard service volume, coverage, throughout the fix displacement area, can be predicted (fix displacement evaluation is not required).

(4) During a periodic evaluation, verify that the crossing radial identifying the fix supports the procedure. Verification may be by recording trace or analysis of the cockpit instrumentation. There is no requirement to evaluate the fix displacement area.

(5) [This paragraph deals with TACAN, and is omitted here.]

(6) Commissioning Inspections. On commissioning inspections, missed approach, and SID/ DP radials for facilities located within the airfield, boundary must be evaluated from overhead the station outbound to the limits depicted for the procedure. If no termination point is depicted, the radial must be checked to where it joins the en route structure or the expected coverage limit of the facility category, i.e., 25 miles for a "T" class and 40 miles for "L" or "H" class facilities.

(7) Evaluate the radials for signal quality and accuracy. The final approach course must deliver the aircraft to the desired aiming point. Evaluate azimuth alignment, course sensitivity or modulations, polarization (when within 5 to 20 nm of the station), roughness and scalloping, bends, identification, and signal strength when flying the radials. Evaluate the 5° offset radials for course sensitivity or modulations, roughness and scalloping, spectrum analysis, identification, and signal strength.

(8) [This paragraph deals with MAGVAR changes, and is omitted here.]

11.20g. Expanded Service Volumes

(ESV(s)) are required only when procedural use is predicated on a NAVAID's performance outside of

the SSV, as illustrated in Appendix 3, Figures A3-5A - F. Evaluate ESV(s) on one transmitter only. When required, an ESV may be revalidated by orbital flight at the ESV distance and lowest approved altitude. Lateral limits of the area shoulc encompass allowable radial misalignment or applicable fix displacement area. There is no neec to inspect the upper limits of an ESV unless interference is reported or suspected.

In most applications, the VOR is the primary facili supporting procedural use (i.e., airways, fixes, intersections). When evaluating facilities supporting procedural uses, record all component signals. If any NAVAID component (i.e., VOR, TAC, or DME) does not meet flight inspection parameter tolerances, document the results as follows.

(1) Within the applicable 25 or 40 nm flight inspection service volume, complete the appropriate flight inspection report form(s) and restrict the NAVAID accordingly.

(2) Beyond the applicable flight inspection service volume but within the SSV, complete the appropriate flight inspection report form(s) and document flight inspection results on the procedures package forms. No facility restriction is required.

(3) Beyond the applicable SSV, complete the appropriate flight inspection form(s), ESV forms, noting the component(s) which will not support the ESV, and document the results on the procedures package forms. No facility restriction is required. For flight inspections beyond the applicable 25 or 40 nm distance, complete only the fields of the flight inspection report forms for the NAVAID components identified for procedural use.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Nominally, at least that of the associated navaid	Signal strength such that field density >= -89 dBW/m^2 at limits of operational requirements	Solid stable DME lock-on is present throughout al areas of intended use. Unlocks: Approach Radials: No condition of distance unloc is permitted within the final segment if required

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		procedurally. The only exception would be normal passage through the station cone. En route criteri should be applied to all other segments. En route Radials: No more than one condition of distance unlock not to exceed 0.5 nm in a 5 nm segment.	
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
This parameter duplicates text 3.5.3.1.2 from SYSTEM CHARACTERISTICS parameter, to match parameter names in Doc 8071 and Order 8200.1 Annex 10 does not explicitly define coverage in numerical terms.	The Doc 8071 field density value of -89 dBW/m^2 is not found in Annex 10.	Paragraphs 11.20c, d, e, and g are not referenced in the Tolerances section of Order 8200.1.	
	Measurement Uncertainty		
	1 dB repeatability		

Annex10_ID	8071_ID	8200_ID	Results_ID
386	577	341	564

Facility DME **Parameter** Decoding

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref 3.5.4.3

SARPS Ref

8071 Reference

8200 Reference

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.5.4.3 Decoding 3.5.4.3.1 The transponder shall include a decoding circuit such that the transponder can be triggered only by pairs of received pulses having pulse duration and pulse spacings appropriate to interrogator signals as described in 3.5.5.1.3 and 3.5.5.1.4. 3.5.4.3.2 The decoding circuit performance shall no be affected by signals arriving before, between, or after, the constituent pulses of a pair of the correct spacing. 3.5.4.3.3 DME/N Decoder rejection. An interrogation pulse pair with a spacing of plus or minus 2 microseconds, or more, from the nominal value and with any signal level up to the value specified in 3.5.4.2.3.3 shall be rejected such that the transmission rate does not exceed the value obtained when interrogations are absent. 3.5.4.3.4 DME/P Decoder rejection. An interrogatic pulse pair with a spacing of plus or minus 2 microseconds, or more, from the nominal value anc with any signal level up to the value specified in 3.5.4.2.3.4 shall be rejected such that the transmission rate does not exceed the value obtained when interrogations are absent.			This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
Annex10_ID	8071_ID	8200_ID	Results_ID
387			565

Facility DME **Parameter** Definitions

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref 3.5.1 **SARPS Ref** **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
Control motion noise (CMN). That portion of the guidance signal error which causes control surface, wheel and column motion and could affect aircraft attitude angle during coupled flight, but does not cause aircraft displacement from the desired course and/or glide path. (See 3.11.) DME dead time. A period immediately following the decoding of a valid interrogation during which a received interrogation will not cause a reply to be generated. Note. Dead time is intended to prevent the transponder from replying to echoes resulting from multipath effects. DME/N. Distance measuring equipment, primarily serving operational needs of en-route or TMA navigation, where the "N" stands for narrow spectrum characteristics. DME/P. The distance measuring element of the MLS, where the "P" stands for precise distance measurement. The spectrum characteristics are those of DME/N. Equivalent isotropically radiated power (e.i.r.p.). The product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna (absolute or isotropic gain). Final approach (FA) mode. The condition of DME/P operation which supports flight operations in the final approach and runway regions. Initial approach (IA) mode. The condition of DME/P operation which supports those flight operations outside the final approach region and which is interoperable with DME/N. Key down time. The time during which a dot or dash of a Morse character is being transmitted. MLS approach reference datum. A point on the minimum glide path at a specified height above the			This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

threshold. (See 3.11.)

MLS datum point. The point on the runway centre line closest to the phase centre of the approach elevation antenna. (See 3.11.)

Mode W, X, Y, Z. A method of coding the DME transmissions by time spacing pulses of a pulse pair, so that each frequency can be used more than once.

Partial rise time. The time as measured between the 5 and 30 per cent amplitude points on the leading edge of the pulse envelope, i.e. between points h and i on Figures 3-1 and 3-2.

Path following error (PFE). That portion of the guidance signal error which could cause aircraft displacement from the desired course and/or glide path. (See 3.11.)

Pulse amplitude. The maximum voltage of the pulse envelope, i.e. A in Figure 3-1.

Pulse decay time. The time as measured between the 90 and 10 per cent amplitude points on the trailing edge of the pulse envelope, i.e. between points e and g on Figure 3-1.

Pulse code. The method of differentiating between W, X, Y and Z modes and between FA and IA modes.

Pulse duration. The time interval between the 50 per cent amplitude point on leading and trailing edges of the pulse envelope, i.e. between points b and f on Figure 3-1.

Pulse rise time. The time as measured between the 10 and 90 per cent amplitude points on the leading edge of the pulse envelope, i.e. between points a and c on Figure 3-1.

Reply efficiency. The ratio of replies transmitted by the transponder to the total of received valid interrogations.

Search. The condition which exists when the DME interrogator is attempting to acquire and lock onto the response to its own interrogations from the selected transponder.

System efficiency. The ratio of valid replies

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

processed by the interrogator to the total of its own interrogations.

Track. The condition which exists when the DME interrogator has locked onto replies in response to i own interrogations, and is continuously providing a distance measurement.

Transmission rate. The average number of pulse pairs transmitted from the transponder per second.

Virtual origin. The point at which the straight line through the 30 per cent and 5 per cent amplitude points on the pulse leading edge intersects the 0 pe cent amplitude axis (see Figure 3-2).

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
388			566

Facility DME **Parameter** Efficiency

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 3.5.4.6 **8071 Reference** 3.3.14 **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.5.4.6 Efficiency 3.5.4.6.1 The transponder reply efficiency shall be a least 70 per cent for DME/N and DME/P (IA mode) and 80 per cent for DME/P (FA mode) at all values of transponder loading up to the loading corresponding to 3.5.3.5 and at the minimum sensitivity level specified in 3.5.4.2.3.1 and 3.5.4.2.3.5. Note. When considering the transponder reply efficiency value, account is to be taken of the DME dead time and of the loading introduced by the monitoring function. 3.5.4.6.2 Transponder dead time. The transponder shall be rendered inoperative for a period normally not to exceed 60 microseconds after a valid interrogation decode has occurred. In extreme case when the geographical site of the transponder is such as to produce undesirable reflection problems the dead time may be increased but only by the minimum amount necessary to allow the suppression of echoes for DME/N and DME/P IA mode. 3.5.4.6.2.1 In DME/P the IA mode dead time shall not blank the FA mode channel and vice versa.	Reply efficiency 3.3.14 Throughout the flight inspection, the reply efficiency should be monitored and recorded. This provides data on the service provided by the ground transponder to the aircraft within the service area. It can be used to indicate problem areas due to multipath and interference.		This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	Note areas where this changes significantly	

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

N/A

Annex10_ID	8071_ID	8200_ID	Results_ID
389	578		567

Facility DME **Parameter** General

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref 3.5.2 **SARPS Ref** **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.5.2.1 The DME system shall provide for continuous and accurate indication in the cockpit of the slant range distance of an equipped aircraft fror an equipped ground reference point. 3.5.2.2 The system shall comprise two basic components, one fitted in the aircraft, the other installed on the ground. The aircraft component shall be referred to as the interrogator and the ground component as the transponder. 3.5.2.3 In operation, interrogators shall interrogate transponders which shall, in turn, transmit to the interrogator replies synchronized with the interrogations, thus providing means for accurate measurement of distance. 3.5.2.4 DME/P shall have two operating modes, IA and FA. Xxxxxxxxxxxxxxxxxxx two figures xxxxxxxxxxxxxxxxxxxx 3.5.2.5 When a DME function is combined with either an ILS, MLS or VOR for the purpose of constituting a single facility, they shall be considere to be associated in a manner complying with Chapter 2, 2.2.2, only when: a) operated on a standard frequency pairing in accordance with 3.5.3.3.5; b) collocated within the limits prescribed for associated facilities in 3.5.2.6; and c) complying with the identification provisions of 3.5.3.6.4. Note. A single DME facility may be paired with both an ILS and MLS. 3.5.2.6 Collocation limits for a DME facility associated with an ILS, MLS or VOR facility 3.5.2.6.1 Associated VOR and DME facilities shall			This is a design qualfication and/or ground maintenance issue. Flight testing does not address this.

be collocated in accordance with the following:

a) coaxial collocation: the VOR and DME antennas are located on the same vertical axis; or

b) offset collocation:

1) for those facilities used in terminal areas for approach purposes or other procedures where the highest position fixing accuracy of system capability is required, the separation of the VOR and DME antennas does not exceed 30 m (100 ft) except that at Doppler VOR facilities, where DME service is provided by a separate facility, the antennas may be separated by more than 30 m (100 ft), but not in excess of 80 m (260 ft);

2) for purposes other than those indicated in 1), the separation of the VOR and DME antennas does not exceed 600 m (2 000 ft).

3.5.2.6.2 Association of DME with ILS

Note. Attachment C, 2.11 gives guidance on the association of DME with ILS.

3.5.2.6.3 Association of DME with MLS

3.5.2.6.3.1 Recommendation. If a DME/P is used to provide ranging information, it should be sited as close as possible to the MLS azimuth facility.

Note. Attachment G, 5 and Attachment C, 7.1.6 give guidance on siting of DME with MLS. This guidance sets forth, in particular, appropriate steps to be taken to prevent different zero range indication if DME/P associated with MLS and DME/N associated with ILS serve the same runway.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
Annex10_ID	8071_ID	8200_ID	Results_ID
390			568

Facility DME **Parameter** Identification

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref 3.5.3.6

Annex Ref 3.5.3.6 **8071 Reference** 3.3.13 **8200 Reference** 11.32

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.5.3.6 Transponder identification 3.5.3.6.1 All transponders shall transmit an identification signal in one of the following forms as required by 3.5.3.6.5: a) an "independent" identification consisting of coded (International Morse Code) identity pulses which can be used with all transponders; b) an "associated" signal which can be used for transponders specifically associated with a VHF navigation or an MLS angle guidance facility which itself transmits an identification signal. Note. An MLS angle guidance facility provides its identification as a digital word transmitted on the data channel into the approach and back azimuth coverage regions as specified in 3.11.4.6.2.1. 3.5.3.6.2 Both systems of identification shall use signals, which shall consist of the transmission for an appropriate period of a series of paired pulses transmitted at a repetition rate of 1 350 pulse pairs per second, and shall temporarily replace all reply pulses that would normally occur at that time excep as in 3.5.3.6.2.2. These pulses shall have similar characteristics to the other pulses of the reply signals. 3.5.3.6.2.1 DME/N. Reply pulses shall be transmitted between key down times. 3.5.3.6.2.2 DME/N. Recommendation. If it is desire to preserve a constant duty cycle, an equalizing pai of pulses, having the same characteristics as the identification pulse pairs, should be transmitted 100 microseconds plus or minus 10 microseconds after each identity pair. 3.5.3.6.2.3 DME/P. Reply pulses shall be transmitted between key down times. 3.5.3.6.2.4 For the DME/P transponder, reply pulse pairs to valid FA mode interrogations shall also be	Identification 3.3.13 The identification signal should be checkec for correctness and clarity, with the aircraft in orbital or radial flight. A DME associated with an ILS localizer or VOR should be checked for correc synchronization of the two identification signals.	11.32 The identification must be checked for correctness and clarity, with the aircraft either in orbital or radial flight. A DME associated with an associated facility will be checked for correct synchronization of the two identification signals. 11.21 ANALYSIS a. Identification (ID). This check is made to ensur the identification is correct and is usable throughout the operational service volume. (1) Specifications. Evaluate the identification during all checks. The facility must be restricted if the identification is not usable in all areas of required coverage. (2) Identification Sequence (a) VOR(s), VOR/ DME(s), and VORTAC(s) with VOR voice identification using dual voice code reproducers at dual location or single voice code reproducer at single VOR location uses the following sequence: Identification on VOR in code. Identification on VOR by voice. Identification on VOR in code. Identification on TACAN/ DME at the normal time for voice identification on the VOR. (b) VOR(s), VOR/ DME(s), and VORTAC(s) with VOR voice identification using single voice code reproducer with dual VOR equipment: The identification sequence is the same as in Paragraph (a) above; however, synchronization w not exist between the TACAN and VOR identification. Voice identification may be heard with the keyed ident, and the flight inspector must determine from an operational standpoint if the identification is clear and that the course is not adversely affected. (c) VOR(s), VOR/ DME(s), and VORTAC(s)	Most of the text in Annex 10 addresses design qualfication and/or ground maintenance issues. Flight testing does not address these specifics. Both Doc 8071 and 8200.1 instead address operational suitability of the detected identificatio signal.

transmitted during key down times and have priority over identification pulse pairs.

3.5.3.6.2.5 The DME/P transponder shall not emplo the equalizing pair of pulses of 3.5.3.6.2.2.

3.5.3.6.3 The characteristics of the independent identification signal shall be as follows:

a) the identity signal shall consist of the transmissic of the beacon code in the form of dots and dashes (International Morse Code) of identity pulses at leas once every 40 seconds, at a rate of at least 6 words per minute; and

b) the identification code characteristic and letter ra for the DME transponder shall conform to the following to ensure that the maximum total key dow time does not exceed 5 seconds per identification code group. The dots shall be a time duration of 0.1 second to 0.160 second. The dashes shall be typically 3 times the duration of the dots. The duration between dots and/or dashes shall be equa to that of one dot plus or minus 10 per cent. The time duration between letters or numerals shall not be less than three dots. The total period for transmission of an identification code group shall no exceed 10 seconds.

Note. The tone identification signal is transmitted at a repetition rate of 1 350 pps. This frequency may b used directly in the airborne equipment as an aural output for the pilot, or other frequencies may be generated at the option of the interrogator designer (see 3.5.3.6.2).

3.5.3.6.4 The characteristics of the "associated" signal shall be as follows:

a) when associated with a VHF or an MLS angle facility, the identification shall be transmitted in the form of dots and dashes (International Morse Code as in 3.5.3.6.3 and shall be synchronized with the VHF facility identification code;

b) each 40-second interval shall be divided into fou or more equal periods, with the transponder identification transmitted during one period only anc the associated VHF and MLS angle facility identification, where these are provided, transmittec during the remaining periods;

c) for a DME transponder associated with an MLS,

without VOR voice identification uses the followin sequence:

Identification on VOR in code.
Blank
Identification on VOR in code.
Identification on TACAN/ DME at the normal time for code
identification on the VOR.

(3) Identification is a series of coded dots and dashes and/or voice identification transmissions that amplitude modulate the VOR RF carrier frequency. The ID enables a user to identify the VOR station.

(4) Evaluate the ID signals for correctness, clarity and to ensure there is no adverse effect on the azimuth course structure. When it is difficult to determine what effect the ID has on the azimuth course structure because of roughness and scalloping, evaluate the same azimuth radial with the ID off and compare the results. When simultaneous voice and Morse coded ID are installed, the modulation levels are adjusted so both audio levels sound the same. These levels a approximately 30 and 8 percent, respectively. When a voice broadcast feature is installed (ATIS AWOS, etc.), the voice ID feature is suppressed during voice transmissions, but the Morse coded ID should still be heard. The Morse coded ID signals must be identifiable throughout the entire unrestricted VOR coverage area, including ESV(s). When the identification is unacceptable, take appropriate NOTAM action an notify Facilities Maintenance.

(5) For facilities with standby transmitters and separate standby ID equipment, use the Morse coded ID to identify each transmitter. The number one transmitter has equal spacing between all characters of the coded identification. The spacin between the second and third characters of the number two transmitter is increased by one dot.

the identification shall be the last three letters of the MLS angle facility identification specified in 3.11.4.6.2.1.

3.5.3.6.5 Identification implementation

3.5.3.6.5.1 The "independent" identification code shall be employed wherever a transponder is not specifically associated with a VHF navigational facility or an MLS facility.

3.5.3.6.5.2 Wherever a transponder is specifically associated with a VHF navigational facility or an ML facility, identification shall be provided by the "associated" code.

3.5.3.6.5.3 When voice communications are being radiated on an associated VHF navigational facility, an "associated" signal from the transponder shall n be suppressed.

ICAO Annex Tol

Properly synchronized, 1350 pulse pair/second re rate

Doc 8071 Tolerance

Correct, clear, properly synchronized

8200 Tolerance

Morse code and voice identification must be correct, clear, and identifiable. The audio levels of code and voice must sound similar. The course structure must not be affected by the identificatior

ICAO Annex Remarks

This is duplicated text 3.5.3.6 from SYSTEM CHARACTERISTICS parameter, to match parameter names in Doc 8071 and Order 8200.1

Doc 8071 Remarks

8200 Remarks

Paragraph 11.21 is not referenced in the Tolerances section of Order 8200.1.

Measurement Uncertainty

N/A

Annex10_ID	8071_ID	8200_ID	Results_ID
391	579	342	569

Facility DME **Parameter** Int Tx Frequency

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 3.5.5.1.1 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.5.5.1.1 Frequency of operation. The interrogator shall transmit on the interrogation frequency appropriate to the assigned DME channel (see 3.5.3.3.3).			This is a design qualfication and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
392			570

Facility DME **Parameter** Interrogator

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 3.5.5 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
[Note: Annex 10 defines many characteristics of th airborne DME interrogator, to ensure that it: a) does not jeopardize the effective operation of the DME system, e.g. by increasing transponder loadin abnormally; and b) is capable of giving accurate distance readings. [NOTE for database users: Because this section o Annex 10 deals with airborne equipment and is not subject to DME flight inspection, DME ground maintenance, or DME design qualification activities the text is not included here.]			This is a design qualfication and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
393			571

Facility DME **Parameter** Monitoring and Control

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref 3.5.4.7 **SARPS Ref** **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.5.4.7 Monitoring and control 3.5.4.7.1 Means shall be provided at each transponder site for the automatic monitoring and control of the transponder in use. 3.5.4.7.2 DME/N monitoring action 3.5.4.7.2.1 In the event that any of the conditions specified in 3.5.4.7.2.2 occur, the monitor shall cause the following action to take place: a) a suitable indication shall be given at a control point; b) the operating transponder shall be automatically switched off; and c) the standby transponder, if provided, shall be automatically placed in operation. 3.5.4.7.2.2 The monitor shall cause the actions specified in 3.5.4.7.2.1 if: a) the transponder delay differs from the assigned value by 1 microsecond (150 m (500 ft)) or more; b) in the case of a DME/N associated with a landing aid, the transponder delay differs from the assigned value by 0.5 microsecond (75 m (250 ft)) or more. 3.5.4.7.2.3 Recommendation. The monitor should cause the actions specified in 3.5.4.7.2.1 if the spacing between the first and second pulse of the transponder pulse pair differs from the nominal valu specified in the table following 3.5.4.4.1 by 1 microsecond or more. 3.5.4.7.2.4 Recommendation. The monitor should also cause a suitable indication to be given at a control point if any of the following conditions arise: a) a fall of 3 dB or more in transponder transmitted power output;			This is a design qualfication and/or ground maintenance issue. Flight testing does not address this.

b) a fall of 6 dB or more in the minimum transponde receiver sensitivity (provided that this is not due to the action of the receiver automatic gain reduction circuits);

c) the spacing between the first and second pulse c the transponder reply pulse pair differs from the normal value specified in 3.5.4.1.4 by 1 microsecon or more;

d) variation of the transponder receiver and transmitter frequencies beyond the control range of the reference circuits (if the operating frequencies are not directly crystal controlled).

3.5.4.7.2.5 Means shall be provided so that any of the conditions and malfunctioning enumerated in 3.5.4.7.2.2,

3.5.4.7.2.3 and 3.5.4.7.2.4 which are monitored car persist for a certain period before the monitor takes action. This period shall be as low as practicable, b shall not exceed 10 seconds, consistent with the need for avoiding interruption, due to transient effects, of the service provided by the transponder.

3.5.4.7.2.6 The transponder shall not be triggered more than 120 times per second for either monitoring or automatic frequency control purposes or both.

3.5.4.7.3 DME/P monitoring action

3.5.4.7.3.1 The monitor system shall cause the transponder radiation to cease and provide a warnir at a control point if any of the following conditions persist for longer than the period specified:

a) there is a change in transponder PFE that exceeds the limits specified in either 3.5.4.5.3 or 3.5.4.5.4 for more than one second. If the FA mode limit is exceeded, but the IA mode limit is maintaine the IA mode may remain operative;

b) there is a reduction in the effective radiated powe to less than that necessary to satisfy the requirements specified in 3.5.4.1.5.3 for a period of more than one second;

c) there is a reduction of 3 dB or more in the transponder sensitivity necessary to satisfy the requirements specified in 3.5.4.2.3 for a period of

more than five seconds in FA mode and ten second in IA mode (provided that this is not due to the actio of the receiver automatic sensitivity reduction circuits);

d) the spacing between the first and second pulse o the transponder reply pulse pair differs from the value specified in the table in 3.5.4.4.1 by 0.25 microsecond or more for a period of more than one second.

3.5.4.7.3.2 Recommendation. The monitor should cause a suitable indication to be given at a control point if there is an increase above 0.3 microsecond or a decrease below 0.2 microseconds of the reply pulse partial rise time which persists for more than one second.

3.5.4.7.3.3 The period during which erroneous guidance information is radiated shall not exceed th periods specified in 3.5.4.7.3.1. Attempts to clear a fault by resetting the primary ground equipment or b switching to standby ground equipment, if fitted, shall be completed within this time. If the fault is no cleared within the time allowed, the radiation shall cease. After shutdown, no attempt shall be made to restore service until a period of 20 seconds has elapsed.

3.5.4.7.3.4 The transponder shall not be triggered for monitoring purposes more than 120 times per second in the IA mode and 150 times per second in the FA mode.

3.5.4.7.3.5 DME/N and DME/P monitor failure. Failure of any part of the monitor itself shall automatically produce the same results as the malfunctioning of the element being monitored.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
Annex10_ID	8071_ID	8200_ID	Results_ID
394			572

Facility **DME** **Parameter** **Noise**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 3.5.4.2.5 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.5.4.2.5 Noise. When the receiver is interrogated a the power densities specified in 3.5.4.2.3.1 to produce a transmission rate equal to 90 per cent of the maximum, the noise generated pulse pairs shal not exceed 5 per cent of the maximum transmissior rate.			This is a design qualfication and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
395			573

Facility **DME** **Parameter** **Receiver Checkpoints**

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for all

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 11.20h

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		Receiver Checkpoints are established to allow pilots to check the accuracy of their receivers. Inability of a facility to support receiver checkpoint must not result in facility restrictions. (1) Ground Receiver Checkpoints will be established on the airport ramp or taxiways at points selected for easy access by aircraft, but where there will be no obstruction of other airport traffic. They normally will not be established at distances less than one-half mile from the facility, nor should they be established o non-paved areas. All azimuth bearings must be stable and within prescribed azimuth tolerance. Evaluate azimuth alignment, course sensitivity or modulations, roughness and scalloping, identification, and signal strength. If a stable signa and alignment cannot be obtained at a location, select another site or establish an airborne receiv checkpoint. Ensure that surface markings and signage are correct. Observed slight variances in airport surface markings and signage should not affect their acceptability unless, in the judgment o the flight inspector, they could affect the usability of the checkpoint. (2) Airborne Receiver Checkpoints must be designated over prominent ground checkpoints. It is preferred that such checkpoints be near an airport so they are easily accessible to users and must be at least 1,000 ft AGL. The checkpoint should not be established at a distance less than miles or more than 30 miles from the facility. However, consideration should be given to selecting an area and altitude that will not interfer with normal traffic patterns. The electronic radial overlying the geographic checkpoint, rounded off the nearest whole degree, will be the azimuth published as the receiver checkpoint.	Order 8200.1 discusses the operational use of receiver checkpoints, and the necessary assessment of them by flight inspection personn Neither ICAO document addresses checkpoints specifically.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
ICAO Annex Tol	**Doc 8071 Tolerance**	**8200 Tolerance**	
		Distance must be within 0.2 nm of the measured distance.	
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
	Measurement Uncertainty		

Annex10_ID	8071_ID	8200_ID	Results_ID
		343	574

Facility DME **Parameter** Rx Bandwidth

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 3.5.4.2.6 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.5.4.2.6.1 The minimum permissible bandwidth of the receiver shall be such that the transponder sensitivity level shall not deteriorate by more than 3 dB when the total receiver drift is added to an incoming interrogation frequency drift of plus or minus 100 kHz. 3.5.4.2.6.2 DME/N. The receiver bandwidth shall be sufficient to allow compliance with 3.5.3.1.3 when the input signals are those specified in 3.5.5.1.3. 3.5.4.2.6.3 DME/P IA mode. The receiver bandwidth shall be sufficient to allow compliance with 3.5.3.1.3 when the input signals are those specified in 3.5.5.1.3. The 12 dB bandwidth shall no exceed 2 MHz and the 60 dB bandwidth shall not exceed 10 MHz. 3.5.4.2.6.4 DME/P FA mode. The receiver bandwidth shall be sufficient to allow compliance with 3.5.3.1.3 when the input signals are those specified in 3.5.5.1.3. The 12 dB bandwidth shall no exceed 6 MHz and the 60 dB bandwidth shall not exceed 20 MHz. 3.5.4.2.6.5 Signals greater than 900 kHz removed from the desired channel nominal frequency and having power densities up to the values specified in 3.5.4.2.3.3 for DME/N and 3.5.4.2.3.4 for DME/P shall not trigger the transponder. Signals arriving a the intermediate frequency shall be suppressed at least 80 dB. All other spurious response or signals within the 960 MHz to 1 215 MHz band and image frequencies shall be suppressed at least 75 dB.			This is a design qualfication and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
396			575

Facility **DME** **Parameter** **Rx CW and Echo Suppression**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 3.5.4.2.9 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.5.4.2.9 CW and echo suppression Recommendation. CW and echo suppression should be adequate for the sites at which the transponders will be used. Note. In this connection, echoes mean undesired signals caused by multipath transmission (reflections, etc.).			This is a design qualfication and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
397			576

Facility DME **Parameter** Rx Frequency

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 3.5.4.2.1 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.5.4.2.1 Frequency of operation. The receiver centre frequency shall be the interrogation frequenc appropriate to the assigned DME operating channe (see 3.5.3.3.3).			This is a design qualfication and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
398			577

Facility DME **Parameter** Rx Frequency Stability

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 3.5.4.2.2 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.5.4.2.2 Frequency stability. The centre frequency of the receiver shall not vary more than plus or mini 0.002 per cent from the assigned frequency.			This is a design qualfication and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
399			578

Facility DME **Parameter** Rx Interference Protection

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 3.5.4.2.10 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.5.4.2.10 Protection against interference Recommendation. Protection against interference outside the DME frequency band should be adequate for the sites at which the transponders wil be used.			This is a design qualfication and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
400			579

Facility DME **Parameter** Rx Load Limiting

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref 3.5.4.2.4 **SARPS Ref** **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.5.4.2.4 Load limiting 3.5.4.2.4.1 DME/N. Recommendation. When transponder loading exceeds 90 per cent of the maximum transmission rate, the receiver sensitivity should be automatically reduced in order to limit the transponder replies, so as to ensure that the maximum permissible transmission rate is not exceeded. (The available range of sensitivity reduction should be at least 50 dB.) 3.5.4.2.4.2 DME/P. To prevent transponder overloading the transponder shall automatically limi its replies, so as to ensure that the maximum transmission rate is not exceeded. If the receiver sensitivity reduction is implemented to meet this requirement, it shall be applied to the IA mode only and shall not affect the FA mode. 3.5.4.2.5 Noise. When the receiver is interrogated a the power densities specified in 3.5.4.2.3.1 to produce a transmission rate equal to 90 per cent of the maximum, the noise generated pulse pairs shal not exceed 5 per cent of the maximum transmissior rate.			This is a design qualfication and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
401			580

Facility DME **Parameter** Rx Recovery Time

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref 3.5.4.2.7

SARPS Ref

8071 Reference

8200 Reference

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.5.4.2.7 Recovery time. Within 8 microseconds of the reception of a signal between 0 dB and 60 dB above minimum sensitivity level, the minimum sensitivity level of the transponder to a desired sign shall be within 3 dB of the value obtained in the absence of signals. This requirement shall be met with echo suppression circuits, if any, rendered inoperative. The 8 microseconds are to be measured between the half voltage points on the leading edges of the two signals, both of which conform in shape, with the specifications in 3.5.5.1.			This is a design qualfication and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
402			581

Facility **DME** **Parameter** **Rx Spurious Radiation**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 3.5.4.2.8 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.5.4.2.8 Spurious radiations. Radiation from any part of the receiver or allied circuits shall meet the requirements stated in 3.5.4.1.6.			This is a design qualfication and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
403			582

Facility DME **Parameter** Rx Transponder Sensitivity

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref 3.5.4.2.3 **SARPS Ref** **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.5.4.2.3 Transponder sensitivity 3.5.4.2.3.1 In the absence of all interrogation pulse pairs, with the exception of those necessary to perform the sensitivity measurement, interrogation pulse pairs with the correct spacing and nominal frequency shall trigger the transponder if the peak power density at the transponder antenna is at leas a) minus 103 dBW/m2 for DME/N; b) minus 86 dBW/m2 for DME/P IA mode; c) minus 75 dBW/m2 for DME/P FA mode. 3.5.4.2.3.2 The minimum power densities specified in 3.5.4.2.3.1 shall cause the transponder to reply with an efficiency of at least: a) 70 per cent for DME/N; b) 70 per cent for DME/P IA mode; c) 80 per cent for DME/P FA mode. 3.5.4.2.3.3 DME/N dynamic range. The performanc of the transponder shall be maintained when the power density of the interrogation signal at the transponder antenna has any value between the minimum specified in 3.5.4.2.3.1 up to a maximum of minus 22 dBW/m2 when installed with ILS or MLS and minus 35 dBW/m2 when installed for othe applications. 3.5.4.2.3.4 DME/P dynamic range. The performanc of the transponder shall be maintained when the power density of the interrogation signal at the transponder antenna has any value between the minimum specified in 3.5.4.2.3.1 up to a maximum of minus 22 dBW/m2. 3.5.4.2.3.5 The transponder sensitivity level shall nc vary by more than 1 dB for transponder loadings between 0 and 90 per cent of its maximum transmission rate.			This is a design qualfication and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
3.5.4.2.3.6 DME/N. When the spacing of an interrogator pulse pair varies from the nominal valu by up to plus or minus 1 microsecond, the receiver sensitivity shall not be reduced by more than 1 dB. 3.5.4.2.3.7 DME/P. When the spacing of an interrogator pulse pair varies from the nominal valu by up to plus or minus 1 microsecond, the receiver sensitivity shall not be reduced by more than 1 dB.			

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
404			583

Facility DME **Parameter** Signal Strength

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 11.23

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		During all flight inspection evaluations, the receive signal must be equal to or greater than the specified tolerance.	Annex 10 has no requirements for measurable signal strengths. Doc 8071 contains an independently defined power density level of -89 dBW/m^2. This parameter in Order 8200.1 does not really have a tolerance. See also COVERAGE parameter.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		The expected minimum signal strength is -80 dbm However, a lesser signal must not be the sole determination for restricting or removing a facility from service if a solid stable DME lock-on is present.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
		The text in the tolerance table doesn't really defin a tolerance in that the minimum signal strength is "expected." As a practical matter, the absence of unlocks, as also discussed in the COVERAGE parameter, serves as an indicator that signal strength is sufficient (for the airborne interrogator used for the test).

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
		344	584

Facility DME **Parameter** Standby Equipment

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref

Annex Ref **8071 Reference** 3.3.16 **8200 Reference** 11.20i

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	Standby equipment 3.3.15 The standby DME transponder should be spotchecked to ensure that it meets the same tolerances as the primary equipment. This should be done at the most critical points during the facility check in order to obtain the comparison. These points are normally at the maximum orbit o radial distances. There should be no appreciable difference in the characteristics of the transponde (spectrum of pulses, energy radiated, etc.) between the primary and standby equipment.	Standby Transmitters. Both transmitters must be evaluated for each required checklist item, except the coverage orbit and ESV(s), which are required on one transmitter only. Alignment evaluations may be made by changing transmitters during an evaluation and comparing the azimuth course shift. Transmitter changes must not be made inside the final approach fix; however, transmitter changes made before the final approach fix are satisfactory for evaluation purposes. If comparison results are questionable, fly the approach segment on each transmitter.	Annex 10 does not address standby equipment. However, both Doc 8071 and 8200.1 address it ir essentially identical terms.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	Same as primary transmitter	[none]

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

N/A

Annex10_ID	8071_ID	8200_ID	Results_ID
	580	345	585

Facility **DME** **Parameter** **Standby Power**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref

Annex Ref **8071 Reference** 3.3.17 **8200 Reference** 11.20j

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	Standby power 3.3.17 The standby power check can normally be performed satisfactorily on the ground. During commissioning and periodic inspections, this provision may be checked by observing operation and noting any appreciable differences in radiated signal characteristics that result from a changeove to standby power. The transponder characteristics (spectrum of pulses, energy radiated, etc.) should not be degraded when switched to standby power	Standby Power (reference Paragraph 4.33c) (1) The following checklist items will be inspected while operating on standby power (one transmitte only need be checked): (a) Course alignment (one radial) (b) Course structure (c) Identification (d) Distance accuracy (2) The inspections are to be performed when flying a portion of a radial with the station operatin on normal power and then repeating the check over the same ground track with the station operating on standby power.	Annex 10 does not address standby power functionality. However, both Doc 8071 and 8200.1 address it in essentially identical terms.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	Should not affect transponder parameters	[none stated in Tolerances table]

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

N/A

Annex10_ID	8071_ID	8200_ID	Results_ID
	581	346	586

Facility DME **Parameter** System Characteristics

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref 3.5.3 **SARPS Ref** **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.5.3.1 Performance 3.5.3.1.1 Range. The system shall provide a means of measurement of slant range distance from an aircraft to a selected transponder to the limit of coverage prescribed by the operational requirement for the selected transponder. 3.5.3.1.2 Coverage 3.5.3.1.2.1 When associated with a VOR, DME/N coverage shall be at least that of the VOR to the extent practicable. 3.5.3.1.2.2 When associated with either an ILS or a MLS, DME/N coverage shall be at least that of the respective ILS or of the MLS azimuth angle guidance coverage sectors. 3.5.3.1.2.3 DME/P coverage shall be at least that provided by the MLS azimuth angle guidance coverage sectors. Note. This is not intended to specify the operational range and coverage to which the system may be used; spacing of facilities already installed may limit the range in certain areas. 3.5.3.1.3 Accuracy 3.5.3.1.3.1 System accuracy. The accuracy standards specified herein shall be met on a 95 per cent probability basis. Note. The total system limits include errors from all causes such as those from airborne equipment, ground equipment, propagation and random pulse interference effects. 3.5.3.1.3.2 DME/N accuracy. Recommendation. At distances of from zero to 370 km (200 NM) from the transponder, dependent upon the particular service application, the total system error, excluding reading error, should be not greater than plus or minus 460 m (0.25 NM) plus 1.25 per cent of distance			This is a design qualfication and/or ground maintenance issue. Flight testing does not address this.

measured.

3.5.3.1.3.3 The total system error shall not exceed plus or minus 370 m (0.2 NM).

Note 1. This system accuracy is predicated upon th achievement of an airborne interrogator error contribution of not more than plus or minus 315 m (0.17 NM).

Note 2. In mixed DME/N and DME/P operations it is intended that the achieved accuracy be at least tha in 3.5.3.1.3.2.

3.5.3.1.3.4 DME/P accuracy

Note 1. In the following, two accuracy standards, 1 and 2, are stated for the DME/P to accommodate a variety of applications.

Note 2. Guidance on accuracy standards is given ir Attachment C, 7.3.2.

3.5.3.1.3.4.1 Error components. The path following error (PFE) shall be comprised of those frequency components of the DME/P error at the output of the interrogator which lie below 1.5 rad/s. The control motion noise (CMN) shall be comprised of those frequency components of the DME/P error at the output of the interrogator which lie between 0.5 rad/ and 10 rad/s.

Note. Specified error limits at a point are to be applied over a flight path that includes that point. Information on the interpretation of DME/P errors and the measurement of those errors over an interv appropriate for flight inspection is provided in Attachment C, 7.3.6.1.

3.5.3.1.3.4.2 Errors on the extended runway centre line shall not exceed the values given in Table B at the end of this chapter.

3.5.3.1.3.4.3 In the approach sector, away from the extended runway centre line, the allowable PFE for both standard 1 and standard 2 shall be permitted t increase linearly with angle up to plus or minus 40 degrees MLS azimuth angle where the permitted error is 1.5 times that on the extended runway centr line at the same distance. The allowable CMN shall not
increase with angle. There shall be no degradation either PFE or CMN with elevation angle.

3.5.3.3 Channelling

3.5.3.3.1 DME operating channels shall be formed by pairing interrogation and reply frequencies and b pulse coding on the paired frequencies.

3.5.3.3.2 Pulse coding. DME/P channels shall have two different interrogation pulse codes as shown in the table in 3.5.4.4.1. One shall be used in the initia approach (IA) mode; the other shall be used in the final approach (FA) mode.

3.5.3.3.3 DME operating channels shall be chosen from Table A (located at the end of this chapter), of 352 channels in which the channel numbers, frequencies, and pulse codes are assigned.

3.5.3.3.4 Area channel assignment

3.5.3.3.4.1 In a particular area, the number of DME operating channels to be used shall be decided regionally.

Note. Standards and Recommended Practices on the utilization of the DME frequency band 960-1 21 MHz are found in Volume V, Chapter 4.

3.5.3.3.4.2 The specific DME operating channels to be assigned in such a particular area shall also be decided regionally, taking into consideration the requirements for co-channel and adjacent channel protection.

3.5.3.3.4.3 Recommendation. Coordination of regional DME channel assignments should be effected through ICAO.

Note. The above paragraphs permit the use of DME airborne interrogators having less than the total number of operating channels where so desired.

3.5.3.3.5 Channel pairing. When a DME transponder is intended to operate in association with a single VHF navigation facility in the 108 MHz to 117.95 MHz frequency band and/or an MLS angl facility in the 5 031.0 MHz to 5 090.7 MHz frequenc band, the DME operating channel shall be paired with the VHF channel and/or MLS angle frequency as given in Table A.

Note. There may be instances when a DME will be paired with both the ILS frequency and an MLS

channel (see Volume V, Chapter 4, 4.3).

3.5.3.4 Interrogation pulse repetition frequency

Note. If the interrogator operates on more than one channel in one second, the following specifications apply to the sum of interrogations on all channels.

3.5.3.4.1 DME/N. The interrogator average pulse repetition frequency (PRF) shall not exceed 30 pairs of pulses per second, based on the assumption that at least 95 per cent of the time is occupied for tracking.

3.5.3.4.2 DME/N. If it is desired to decrease the time of search, the PRF may be increased during search but shall not exceed 150 pairs of pulses per second.

3.5.3.4.3 DME/N. Recommendation. After 15 000 pairs of pulses have been transmitted without acquiring indication of distance, the PRF should not exceed 60 pairs of pulses per second thereafter, until a change in operating channel is made or successful search is completed.

3.5.3.4.4 DME/N. When, after a time period of 30 seconds, tracking has not been established, the pulse pair repetition frequency shall not exceed 30 pulse pairs per second thereafter.

3.5.3.4.5 DME/P. The interrogator pulse repetition frequency shall not exceed the following number of pulse pairs per second:

a) search 40

b) aircraft on the ground 5

c) initial approach mode track 16

d) final approach mode track 40

Note 1. A pulse repetition frequency (PRF) of 5 pulse pairs per second for aircraft on the ground may be exceeded if the aircraft requires accurate range information.

Note 2. It is intended that all PRF changes be achieved by automatic means.

3.5.3.5 Aircraft handling capacity of the system

3.5.3.5.1 The aircraft handling capacity of

transponders in an area shall be adequate for the peak traffic of the area or 100 aircraft, whichever is the lesser.

3.5.3.5.2 Recommendation. Where the peak traffic in an area exceeds 100 aircraft, the transponder should be capable of handling that peak traffic.

Note. Guidance material on aircraft handling capacity will be found in Attachment C, 7.1.5.

3.5.3.6 Transponder identification

3.5.3.6.1 All transponders shall transmit an identification signal in one of the following forms as required by 3.5.3.6.5:

a) an "independent" identification consisting of coded (International Morse Code) identity pulses which can be used with all transponders;

b) an "associated" signal which can be used for transponders specifically associated with a VHF navigation or an MLS angle guidance facility which itself transmits an identification signal.

Note. An MLS angle guidance facility provides its identification as a digital word transmitted on the data channel into the approach and back azimuth coverage regions as specified in 3.11.4.6.2.1.

3.5.3.6.2 Both systems of identification shall use signals, which shall consist of the transmission for an appropriate period of a series of paired pulses transmitted at a repetition rate of 1 350 pulse pairs per second, and shall temporarily replace all reply pulses that would normally occur at that time excep as in 3.5.3.6.2.2. These pulses shall have similar characteristics to the other pulses of the reply signals.

3.5.3.6.2.1 DME/N. Reply pulses shall be transmitted between key down times.

3.5.3.6.2.2 DME/N. Recommendation. If it is desire to preserve a constant duty cycle, an equalizing pai of pulses, having the same characteristics as the identification pulse pairs, should be transmitted 100 microseconds plus or minus 10 microseconds after each identity pair.

3.5.3.6.2.3 DME/P. Reply pulses shall be transmitted between key down times.

3.5.3.6.2.4 For the DME/P transponder, reply pulse pairs to valid FA mode interrogations shall also be transmitted during key down times and have priority over identification pulse pairs.

3.5.3.6.2.5 The DME/P transponder shall not emplo the equalizing pair of pulses of 3.5.3.6.2.2.

3.5.3.6.3 The characteristics of the independent identification signal shall be as follows:

a) the identity signal shall consist of the transmissio of the beacon code in the form of dots and dashes (International Morse Code) of identity pulses at leas once every 40 seconds, at a rate of at least 6 words per minute; and

b) the identification code characteristic and letter ra for the DME transponder shall conform to the following to ensure that the maximum total key dow time does not exceed 5 seconds per identification code group. The dots shall be a time duration of 0.1 second to 0.160 second. The dashes shall be typically 3 times the duration of the dots. The duration between dots and/or dashes shall be equa to that of one dot plus or minus 10 per cent. The time duration between letters or numerals shall not be less than three dots. The total period for transmission of an identification code group shall n exceed 10 seconds.

Note. The tone identification signal is transmitted at a repetition rate of 1 350 pps. This frequency may b used directly in the airborne equipment as an aural output for the pilot, or other frequencies may be generated at the option of the interrogator designer (see 3.5.3.6.2).

3.5.3.6.4 The characteristics of the "associated" signal shall be as follows:

a) when associated with a VHF or an MLS angle facility, the identification shall be transmitted in the form of dots and dashes (International Morse Code as in 3.5.3.6.3 and shall be synchronized with the VHF facility identification code;

b) each 40-second interval shall be divided into fou or more equal periods, with the transponder identification transmitted during one period only anc the associated VHF and MLS angle facility identification, where these are provided, transmitted

during the remaining periods;

c) for a DME transponder associated with an MLS, the identification shall be the last three letters of the MLS angle facility identification specified in 3.11.4.6.2.1.

3.5.3.6.5 Identification implementation

3.5.3.6.5.1 The "independent" identification code shall be employed wherever a transponder is not specifically associated with a VHF navigational facility or an MLS facility.

3.5.3.6.5.2 Wherever a transponder is specifically associated with a VHF navigational facility or an MLS facility, identification shall be provided by the "associated" code.

3.5.3.6.5.3 When voice communications are being radiated on an associated VHF navigational facility, an "associated" signal from the transponder shall not be suppressed.

3.5.3.7 DME/P mode transition

3.5.3.7.1 The DME/P interrogator for standard 1 accuracy shall change from IA mode track to FA mode track at 13 km (7 NM) from the transponder when approaching the transponder, or any other situation when within 13 km (7 NM).

3.5.3.7.2 For standard 1 accuracy, the transition from IA mode to FA mode track operation may be initiated within 14.8 m (8 NM) from the transponder. Outside 14.8 km (8 NM), the interrogator shall not interrogate in the FA mode.

Note. Paragraph 3.5.3.7.1 does not apply if the transponder is a DME/N or if the DME/P transponder FA mode is inoperative.

3.5.3.8 System efficiency. The DME/P system accuracy of 3.5.3.1.3.4 shall be achieved with a system efficiency of 50 per cent or more.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
	Measurement Uncertainty		

Annex10_ID	8071_ID	8200_ID	Results_ID
405			587

Facility DME **Parameter** Time Delay

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 3.5.4.4 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.5.4.4 Time delay 3.5.4.4.1 When a DME is associated only with a VHF facility, the time delay shall be the interval from the half voltage point on the leading edge of the second constituent pulse of the interrogation pair and the half voltage point on the leading edge of the second constituent pulse of the reply transmission. This delay shall be consistent with the following table, when it is desired that aircraft interrogators are to indicate distance from the transponder site. Pulse pair spacing (µs) Time delay (µs) Channel suffix Operating mode Interrogation Reply 1st pulse timing 2nd pulse timing X DME/N 12 12 50 50 DME/P IA M 12 12 50 – DME/P FA M 18 12 56 – Y DME/N 36 30 56 50 DME/P IA M 36 30 56 – DME/P FA M 42 30 62 – W DME/N – – – – DME/P IA M 24 24 50 – DME/P FA M 30 24 56 – Z DME/N – – – – DME/P IA M 21 15 56 – DME/P FA M 27 15 62 – Note 1. W and X are multiplexed on the same frequency. Note 2. Z and Y are multiplexed on the same frequency. 3.5.4.4.2 When a DME is associated with an MLS angle facility, the time delay shall be the interval from the half voltage point on the leading edge of the first constituent pulse of the interrogation pair and the half voltage point on the leading edge of the first			This is a design qualfication and/or ground maintenance issue. Flight testing does not address this.

constituent pulse of the reply transmission. This delay shall be 50 microseconds for mode X channe and 56 microseconds for mode Y channels, when it is desired that aircraft interrogators are to indicate distance from the transponder site.

3.5.4.4.2.1 For DME/P transponders, no time delay adjustment shall be permitted.

3.5.4.4.3 Recommendation. For the DME/N the transponder time delay should be capable of being set to an appropriate value between the nominal value of the time delay minus 15 microseconds and the nominal value of the time delay, to permit aircra interrogators to indicate zero distance at a specific point remote from the transponder site.

Note. Modes not allowing for the full 15 microseconds range of adjustment in transponder time delay may only be adjustable to the limits give by the transponder circuit delay and recovery time.

3.5.4.4.3.1 DME/N. The time delay shall be the interval from the half voltage point on the leading edge of the first constituent pulse of the interrogatic pair and the half voltage point on the leading edge c the first constituent pulse of the reply transmission.

3.5.4.4.3.2 DME/P IA mode. The time delay shall b the interval from the half voltage point on the leadin edge of the first constituent pulse of the interrogatic pulse pair to the half voltage point on the leading edge of the first constituent pulse of the reply pulse pair.

3.5.4.4.3.3 DME/P FA mode. The time delay shall be the interval from the virtual origin of the first constituent pulse of the interrogation pulse pair to the virtual origin of the first constituent pulse of the reply pulse pair. The time of arrival measurement points shall be within the partial rise time of the first constituent pulse of the pulse pair in each case.

3.5.4.4.4 DME/N. Recommendation. Transponders should be sited as near to the point at which zero indication is required as is practicable.

Note 1. It is desirable that the radius of the sphere a the surface of which zero indication is given be kep as small as possible in order to keep the zone of ambiguity to a minimum.

Note 2. Guidance material on siting DME with MLS

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

is provided in 7.1.6 of Attachment C and 5 of Attachment G. This guidance material sets forth, in particular, appropriate steps to be taken to prevent different zero range indication if DME/P associated with MLS and DME/N associated with ILS serve the same runway.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
406			588

Facility DME **Parameter** Tx Frequency

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 3.5.4.1.1 8071 Reference 8200 Reference

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.5.4.1.1 Frequency of operation. The transponder shall transmit on the reply frequency appropriate to the assigned DME channel (see 3.5.3.3.3).			This is a design qualfication and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
407			589

Facility DME **Parameter** Tx Frequency Stability

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 3.5.4.1.2 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.5.4.1.2 Frequency stability. The radio frequency o operation shall not vary more than plus or minus 0.002 per cent from the assigned frequency.			This is a design qualfication and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
408			590

Facility DME **Parameter** Tx Peak Power Output

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 3.5.4.1.5 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.5.4.1.5 Peak power output 3.5.4.1.5.1 DME/N. Recommendation. The peak effective radiated power should not be less than tha required to ensure a peak pulse power density of approximately minus 83 dBW/m2 at the maximum specified service range and level. 3.5.4.1.5.2 DME/N. The peak equivalent isotropical radiated power shall not be less than that required t ensure a peak pulse power density of minus 89 dBW/m2 under all operational weather conditions a any point within coverage specified in 3.5.3.1.2. Note. Although the Standard in 3.5.4.1.5.2 implies an improved interrogator receiver sensitivity, it is intended that the power density specified in 3.5.4.1.5.1 be available at the maximum specified service range and level. 3.5.4.1.5.3 DME/P. The peak equivalent isotropical radiated power shall not be less than that required t ensure the following peak pulse power densities under all operational weather conditions: a) minus 89 dBW/m2 at any point within the coverage specified in 3.5.3.1.2 at ranges greater than 13 km (7 NM) from the transponder antenna; b) minus 75 dBW/m2 at any point within the coverage specified in 3.5.3.1.2 at ranges less than 13 km (7 NM) from the transponder antenna; c) minus 70 dBW/m2 at the MLS approach reference datum; d) minus 79 dBW/m2 at 2.5 m (8 ft) above the runway surface, at the MLS datum point, or at the farthest point on the runway centre line which is in line of sight of the DME transponder antenna. Note. Guidance material relating to the ERP may be found in Attachment C, 7.2.1 and 7.3.8. 3.5.4.1.5.4 The peak power of the constituent pulse			This is a design qualfication and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

of any pair of pulses shall not differ by more than 1 dB.

3.5.4.1.5.5 Recommendation. The reply capability o the transmitter should be such that the transponder should be capable of continuous operation at a transmission rate of 2 700 plus or minus 90 pulse pairs per second (if 100 aircraft are to be served).

Note. Guidance on the relationship between numbe of aircraft and transmission rate is given in Attachment C, 7.1.5.

3.5.4.1.5.6 The transmitter shall operate at a transmission rate, including randomly distributed pulse pairs and distance reply pulse pairs, of not less than 700 pulse pairs per second except during identity. The minimum transmission rate shall be as close as practicable to 700 pulse pairs per second. For DME/P, in no case shall it exceed 1 200 pulse pairs per second.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
409			591

Facility DME **Parameter** Tx Pulse Shape and Spectrum

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref 3.5.4.1.3 **SARPS Ref** **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.5.4.1.3 Pulse shape and spectrum. The following shall apply to all radiated pulses: a) Pulse rise time. 1) DME/N. Pulse rise time shall not exceed 3 microseconds. 2) DME/P. Pulse rise time shall not exceed 1.6 microseconds. For the FA mode, the pulse shall have a partial rise time of 0.25 plus or minus 0.05 microsecond. With respect to the FA mode and accuracy standard 1, the slope of the pulse in the partial rise time shall not vary by more than plus or minus 20 per cent. For accuracy standard 2, the slope shall not vary by more than plus or minus 10 per cent. 3) DME/P. Recommendation. Pulse rise time shoul not exceed 1.2 microseconds. b) Pulse duration shall be 3.5 microseconds plus or minus 0.5 microsecond. c) Pulse decay time shall nominally be 2.5 microseconds but shall not exceed 3.5 microseconds. d) The instantaneous amplitude of the pulse shall not, at any instant between the point of the leading edge which is 95 per cent of maximum amplitude and the point of the trailing edge which is 95 per ce of the maximum amplitude, fall below a value which is 95 per cent of the maximum voltage amplitude of the pulse. e) For DME/N and DME/P: the spectrum of the pulse modulated signal shall be such that during th pulse the effective radiated power contained in a 0. MHz band centred on frequencies 0.8 MHz above and 0.8 MHz below the nominal channel frequency in each case shall not exceed 200 mW, and the effective radiated power contained in a 0.5 MHz band centred on frequencies 2 MHz above and 2 MHz below the nominal channel frequency in each			This is a design qualfication and/or ground maintenance issue. Flight testing does not address this.

case shall not exceed 2 mW. The effective radiated power contained within any 0.5 MHz band shall decrease monotonically as the band centre frequency moves away from the nominal channel frequency.

Note. Guidance material relating to the pulse spectrum measurement is provided in Attachment C Section 7.1.11.

f) To ensure proper operation of the thresholding techniques, the instantaneous magnitude of any pulse turn-on transients which occur in time prior to the virtual origin shall be less than one per cent of the pulse peak amplitude. Initiation of the turn-on process shall not commence sooner than 1 microsecond prior to the virtual origin.

Note 1. The time "during the pulse" encompasses the total interval from the beginning of pulse transmission to its end. For practical reasons, this interval may be measured between the 5 per cent points on the leading and trailing edges of the pulse envelope.

Note 2. The power contained in the frequency band specified in 3.5.4.1.3 e) and f) is the average power during the pulse. Average power in a given frequency band is the energy contained in this frequency band divided by the time of pulse transmission according to Note 1.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
410			592

Facility DME **Parameter** Tx Pulse Spacing

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref 3.5.4.1.4

Annex Ref 3.5.4.1.4 **8071 Reference** 3.3.11 **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.5.4.1.4 Pulse spacing 3.5.4.1.4.1 The spacing of the constituent pulses of transmitted pulse pairs shall be as given in the table in 3.5.4.4.1. 3.5.4.1.4.2 DME/N. The tolerance on the pulse spacing shall be plus or minus 0.25 microsecond. 3.5.4.1.4.3 DME/N. Recommendation. The tolerance on the DME/N pulse spacing should be plus or minus 0.10 microsecond. 3.5.4.1.4.4 DME/P. The tolerance on the pulse spacing shall be plus or minus 0.10 microsecond. 3.5.4.1.4.5 The pulse spacings shall be measured between the half voltage points on the leading edge of the pulses.	Pulse spacing 3.3.1 1 The same technique applies for the measurement of the pulse space [sic: spacing] as for the pulse shape. [Pulse Shape:] 3.3. I0 It is not easy to measure the pulse shape of the DME transponder signal in orbital or radial flight due to multipath effects. The amplitude of the RF signal will vary along the flight path. The preferred method is to store a waveform of the pulse pair on a digital oscilloscope and use the timing functions of the instrument to average the calculated parameters over a series of sample		This is a design qualfication and/or ground maintenance issue. Flight testing does not address this. In-Flight assessment of pulse spacing, as defined in Doc 8071, is unnecessary and generally problematic due to multipath.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Defined spacing +/- 0.1 us (recc), 0.25 us max	X channel: 12 +/- 0.25 us Y channel: 30 +/- 0.25 us	

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
	Doc 8071 tolerances match Annex 10.	

Measurement Uncertainty

0.05 us

Annex10_ID	8071_ID	8200_ID	Results_ID
411	583		593

Facility DME **Parameter** Tx Spurious Radiation

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 3.5.4.1.6 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.5.4.1.6 Spurious radiation. During intervals between transmission of individual pulses, the spurious power received and measured in a receive having the same characteristics as a transponder receiver, but tuned to any DME interrogation or repl frequency, shall be more than 50 dB below the peal pulse power received and measured in the same receiver tuned to the reply frequency in use during the transmission c the required pulses. This provision refers to all spurious transmissions, including modulator and electrical interference. ‡3.5.4.1.6.1 DME/N. The spurious power level specified in 3.5.4.1.6 shall be more than 80 dB below the peak pulse power level. 3.5.4.1.6.2 DME/P. The spurious power level specified in 3.5.4.1.6 shall be more than 80 dB below the peak pulse power level. 3.5.4.1.6.3 Out-of-band spurious radiation. At all frequencies from 10 to 1 800 MHz, but excluding th band of frequencies from 960 to 1 215 MHz, the spurious output of the DME transponder transmitter shall not exceed minus 40 dBm in any one kHz of receiver bandwidth. 3.5.4.1.6.4 The equivalent isotropically radiated power of any CW harmonic of the carrier frequency on any DME operating channel shall not exceed minus 10 dBm.			This is a design qualfication and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

Annex10_ID	8071_ID	8200_ID	Results_ID
412			594

Facility **DME** **Parameter** **Unlocks**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** 3.3.15 **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	Unlocks 3.3.15 Areas where persistent unlocks occur should be investigated by further flight inspection to determine whether engineering action or promulgation is necessary.		Annex 10 does not address unlocks. Order 8200.1 indirectly address unlocks in its coverage discussion (see COVERAGE parameter).

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	Note where unlocking occurs	

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

N/A

Annex10_ID	8071_ID	8200_ID	Results_ID
	584		595

Facility **ESV** **Parameter** **DME**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 22.11

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		e. Distance Measuring Equipment (DME). Chapte 7 [sic], Section 5 provides instructions and performance criteria for certifying standard distance measuring equipment (DME). The flight inspection validation of an ESV for DME can be performed separately but is normally checked in conjunction with the more detailed check of the associated ILS, MLS, VOR, or TACAN facility. When conducting a flight inspection for ESV of DME, independent of an associated facility, check the following: Accuracy Identification Coverage	

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		To adequately support a proposed ESV of airspace, facility performance must meet all operational tolerances as described in Chapter 7 [sic] (appropriate section) and conform to the process described in Paragraph 22.12 above. Facilities which do not meet tolerances beyond th FISSV must not be restricted; however, procedura use must be denied.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
		Tolerance text in paragraph 22.13 refers inappropriately to Chapter 7 (Lighting Systems). The same is true for paragraph 22.11e.

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
		347	596

Facility **ESV** **Parameter** **General**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref none

Annex Ref none **8071 Reference** none **8200 Reference** 22.10

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		INTRODUCTION. This chapter provides information concerning flight inspection's role with an Expanded Service Volume (ESV) and the ESV process. Service Volume (SV) is defined as that volume of airspace surrounding a NAVAID within which a signal of usable strength exists and where that signal is not operationally limited by co-channel interference. NOTE: For VOR/ TACAN/ DME and ILS, the following definitions are used: a. Standard Service Volume (SSV) - That volume of airspace defined by the national standard. b. Flight Inspection Standard Service Volume (FISSV) is defined in the appropriate chapter for the specific facility type. c. Expanded Service Volume (ESV) - An ESV is a volume of airspace, outside of a facility's Standard Service Volume (SSV), that is approved for operational use by Spectrum Engineering, and where a facility meets the applicable flight inspection requirements. An ESV is validated by flight inspection when requested by the FAA's Air Traffic Service or procedure specialist and approved by frequency management of the Airway Facilities Division. d. Operational Service Volume (OSV) - The airspace available for operational use. It includes the following: (1) The SSV excluding any portion of the SSV which has been restricted. (2) The ESV	

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		none

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
ICAO Annexes do not deal with flight inspection requirements for Extended Service Volumes. They do define spectrum management principles for co-channel frequency assignments, which indirectly affect ESVs.	ICAO Manuals on flight inspection do not deal with requirements for Extended Service Volumes. They do address spectrum management principles for co-channel frequency assignments, which indirectly affect ESVs.	

Measurement Uncertainty

N/A

Annex10_ID	8071_ID	8200_ID	Results_ID
413	585	348	597

Facility ESV **Parameter** ILS

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 22.11b

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		b. Instrument Landing System (ILS). When an operational requirement exists to use either or bot the localizer and glide slope to altitudes and/or distances beyond the normal service volume, the facilities must be inspected to the expanded altitudes and/or distances (in accordance with the respective RF alarm referenc checks) to determine that facility performance for the required parameters meets tolerances. Place particular emphasis on signal strength, interference, clearances, and structure. If a localizer or glide slope cannot support ESV requirements, the ESV must be denied. The facili must not be classified as restricted solely becaus it fails to support the ESV. Check ESV(s) during a commissioning inspection, when new procedures are developed or changed so as to require localiz or glide slope use beyond the normal service volume, or on appropriate special inspections (e.g user complaints). (1) Localizer. The two most common ESV(s) are those to support transitions and those to support localizer interception at greater than normal distances. In either case, the validated minimum altitude in the ESV area may b higher than the lower standard altitude of 1,500 ft above the antenna or 500 ft above terrain, whichever is higher, within the SSV. These minimum altitudes, as well as the maximum authorized, must be specifically documented on the flight inspection report and the Facility Data Sheet. Approved Procedure. This procedure applies to th front course (and the back course if it is used for an approach or missed approach). This check must be conducted with the facility operating at reduced power. Check for interference, signal strength, clearances, flag alarm, identification, an structure as follows: (a) Fly an arc across the localizer at the ESV distance and the highest ESV altitude, throughout Sector 1.	

(b) Repeat the arc, except fly at the lowest ESV altitude.

(c) Proceed inbound at the lowest ESV altitude to the SSV limits (18/25 nm) from the antenna). This run may also be used for localizer Zone 1 structur analysis.

NOTE: If the ESV includes one procedural altitude, only one ESV arc is required, and the ES will be approved at that one altitude.

(2) Glide Slope. To validate an ESV, calculate the altitude at 0.45 times the commissioned angle at the ESV distance. Use that altitude to fly the checks listed below, starting
no closer than the ESV distance. The ESV checks replace the standard 10-mile checks. If the facility is unsatisfactory, perform the ESV check at a higher altitude that provides 150 µA fly-up indications and coverage requirements. Approve the ESV at the requested altitude and distance if these requirements can be met at any altitude between 0.45 times the commissioned angle and the requested ESV altitude.

(a) Approved Procedure. The glidepath transmitte must be placed in reduced power setting for this check (both primary and clearance transmitters fo capture effect and endfire glide slopes). This check must be made on the localizer on-course and 8° each side of a point on localizer centerline abeam the glide slope origination point. While maintaining the altitude at 0.45 times the commissioned angle at the ESV distance, fly inbound to the interception of the lower sector of the glidepath (i.e., the point nearest the glidepath which 150 µA occurs).. Fly through the glidepath sector and check clearances above the path.

NOTE: Endfire. The endfire glide slope antenna array is orientated toward the runway. The normal fly-up/ fly-down signal ends at approximately 5° or the antenna side of the runway; therefore, you will have only 150 Hz clearance signal at 8° on the antenna side of the runway. The provisions of Paragraph 15.51d will apply to this situation.

(b) Glide slope structure must be analyzed while flying inbound on the glidepath and localizer cours from the ESV distance to 10 miles from the glide slope antenna. This evaluation may be conducted

in normal or RF reduced power setting.

(3) Reporting Fixes, Transition Areas, SID(s)/ DP(s), STAR(s), and Profile Descents. Refer to Figure 22-3. The localizers, SDF, or LDA may be used to support fixes or departure, en route, and arrival procedures. Transitions may be published through airspace which are beyond the localizer, SDF, or LDA service volume. Under these circumstances, navigation is accomplished using some other facility such as VOR or NDB. If the fix is not contained within the localizer and/or glide slope SSV (see definition in Appendix 1), an ESV must be established to support the procedure.

(a) Required Coverage

1 LOC (A) B1 to B2

2 VOR (B) A1 to B2 (R±4.5°). Does not need to be checked if within the VOR/ NDB FISSV.

3 VOR (B) A3 to B4.

(b) Transitions. When a transition (or missed approach routing) is designed to traverse localizer course Sector 3 or airspace which is outside the commissioned service volume, and the transition termination point is not identified with a facility other than the localizer course, check clearance and coverage throughout the entire transition airspace at the minimum authorized altitudes. This will normally be an approach segment from a facility or fix to intercept a localizer final approach. An ESV must be established for areas outside the ILS SSV. Termination points not requiring clearance validation are: DME fixes on transition radial, waypoint, compass locator, lead radials, fixes made up from other than the localizer, and "radar required" fixes. Examples of a transition requiring clearances would be a radial to the localizer only or a radial to a marker beacon on the localizer course.

EVALUATE COVERAGE:

LOC (A) B to A2
VOR (B) B to A2

(c) Standard Instrument Departure (SID(s))/ Departure Procedure (DP(s)).

Check on-course structure throughout the area of

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		intended use. Check clearance in Sector 1 at the termination point at the minimum authorized altitude. (d) Standard Terminal Arrival Route (STAR(s)) and Profile Descents. Fly these procedures as proposed or as publishec Check facility performance when checking STAR(s) and profile descents in accordance with Paragraphs (a) and (b) above, with fixes. Fig 22-3	

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		To adequately support a proposed ESV of airspace, facility performance must meet all operational tolerances as described in Chapter 7 [sic] (appropriate section) and conform to the process described in Paragraph 22.12 above. Facilities which do not meet tolerances beyond th FISSV must not be restricted; however, procedura use must be denied.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
		Tolerance text in paragraph 22.13 refers inappropriately to Chapter 7 (Lighting Systems).

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
		349	598

Facility **ESV** **Parameter** **MLS**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 22.11c

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		c. Microwave Landing System (MLS). An ESV outside of an MLS, or MMLS facility's Standard Service Volume (SSV), that is approved for operational use by Spectrum Engineering, and where a facility meets the applicable flight inspection requirements. An ESV will be validated by flight inspection only when requested by the FAA's Air Traffic Service or procedure specialist and approved by frequency management of the Airway Facilities Division.	Effectively, there is no Order 8200 coverage of MLS ESVs. Reference could be made to the ILS section of the ESV Chapter, if similar policies and procedures are considered appropriate.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		To adequately support a proposed ESV of airspace, facility performance must meet all operational tolerances as described in Chapter 7 [sic] (appropriate section) and conform to the process described in Paragraph 22.12 above. Facilities which do not meet tolerances beyond the FISSV must not be restricted; however, procedural use must be denied.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
		First sentence is incomplete, and appears to be phrased as a definition. There is no detailed procedural text. Perhaps it should read much as for ILS, or refer to that text if appropriate. Tolerance text in paragraph 22.13 refers inappropriately to Chapter 7 (Lighting Systems).

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
		350	599

Facility ESV **Parameter** NDB

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 22.11d

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		d. Nondirectional Beacon (NDB): (1) Evaluate obstructions or hazards for impact or intended procedures and advise the procedure specialist. Evaluate the signal for excessive needl oscillation, weak or garbled ident, and interference as per Paragraph 22.11. Coverage at distances greater than the orbit radius will be certified for specific routes or transitions. The flight inspector must fly intended routes or transitions at the minimum altitudes and maximum distances as depicted in the flight procedure document. For satisfactory performance, the facility must meet th tolerances in Chapter 12, Section 1. If the facility does not support the procedure, the flight inspecto must determine the minimum altitudes and maximum distances that meet all the tolerances i Chapter 12, Section 1 and forward this informatio to the procedure specialist. (2) Expanded Service Volume (ESV) on commissioned facilities will be established at normal power. At facilities where dual transmitters are installed, evaluate ESV(s) on one transmitter only. (3) Tolerances. NDB(s) that meet tolerances throughout the area of intended use are classified as UNRESTRICTED. Facilities that do not suppor routes or transitions outside of coverage as listed in Chapter 12, Section 1 will not be restricted, but use of the facility for that purpose will be denied.	

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		To adequately support a proposed ESV of airspace, facility performance must meet all operational tolerances as described in Chapter 7 [sic] (appropriate section) and conform to the process described in Paragraph 22.12 above. Facilities which do not meet tolerances beyond th FISSV must not be restricted; however, procedura

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		use must be denied.	
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
		This is the only one of the 6 facility types covered in this Chapter that has its own tolerances subparagraph (22.11d(3)). Tolerance text in paragraph 22.13 refers inappropriately to Chapter 7 (Lighting Systems).	
	Measurement Uncertainty		

Annex10_ID	8071_ID	8200_ID	Results_ID
		351	600

Facility **ESV** **Parameter** **Process**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 22.12

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		22.12 EXPANDED SERVICE VOLUME PROCESS a. FMO-Approved Limits. When a proponent requests an ESV, the FMO ensures the calculate signal level from the desired (D) facility is sufficier and signal levels from any undesired (U) transmissions are low enough to provide a satisfactory D/ U ratio throughout the area of use. Usually, these values are predicted to be satisfactory at the requested altitude, azimuth, an distance limits. Flight inspections are required to verify satisfactory signal strength and quality (structure, modulation, etc.). In the event that the signal does not meet flight inspection tolerances a the requested and FMO approved limit, the ESV must be restricted to the limit of satisfactory coverage. (1) In some cases, the FMO calculations predict satisfactory signal level and/or frequency protectic to some point less than requested. This is indicated on FAA Form 6050-4, Expanded Service Volume Request, by a Part II entry of "Restricted" and definition of the FMO-approved limit. This lim may be due to factors used in the FMO modeling process and not detectable through flight inspection. For example, at the requested distanc the D/ U ratio is unsatisfactory, but flight check only sees a clean signal, meeting flight inspection tolerances. We could then erroneously approve a ESV where there is insufficient frequency protection. In this example, the flight inspection should not extend beyond the Part II Restricted distance or lowest altitude. (2) Occasionally, frequency protection is not a problem, but desirable signal strength is calculate to be marginal. The FMO would note in a Part II remark that they approve of an ESV to a given point less than requested, and defer the final approval contingent on a successful flight check a the requested limit. In this case, the flight inspection should be to the requested distance an at the lowest requested altitude.	

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		(3) It must be understood that flight inspection does not approve any part of an ESV beyond that which is approved by the FMO. b. Clarity of Flight Inspection Results. Some flight inspection comments in Part III of FAA Form 6050-4 have been misleading. As can be seen from Issue 1, the final flight inspection approval can only be equal to or more restrictive than the FMO approved limit. If the FMO approves exactly what was originally requested and the signal strength and quality meet flight inspection tolerances to the requested distance and lowest altitude, the flight inspector should check the APPROVED block in Part III. In the Remarks section, define the limits of the ESV by facility component, azimuth/ bearing, distance, and Minimum Reception Altitude (MRA) and Maximum Authorized Altitude (MAA). Any other situation requires a Part III entry of RESTRICTED and a definition of the ESV limits. Facility components, such as VOR and TACAN, which result in different coverage limits, should be defined individually. c. Expanded Service Volume (ESV) Facilities. When a facility no longer supports an ESV, the facility is not restricted, but a NOTAM must be issued for the instrument flight procedures predicated on that ESV. Coordinate and publish the newly established ESV and instrument flight procedures.	

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		none

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
		352	601

Facility ESV **Parameter** Rho-Theta

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 22.11a

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		a. Rho-Theta. ESV(s) are required only when procedural use is predicated on a NAVAID's performance outside of the SSV, as illustrated in Appendix 3, Figures A3-5A – F. Evaluate ESV(s) on one transmitter only. When required, an ESV may be revalidated by orbital flight at the ESV distance and lowest approved altitude. Lateral limits of the area should encompass allowable radial misalignment or applicable fix displacement area. There is no nee to inspect the upper limits of an ESV unless interference is reported or suspected. In most applications, the VOR is the primary facility supporting procedural use (i.e., airways, fixes, intersections). When evaluating facilities supporting procedural uses, record all component signals. If any NAVAID component (i.e., VOR, TAC, or DME) does not meet flight inspection parameter tolerances, document the results as follows. (1) Within the applicable 25 or 40 nm flight inspection service volume, complete the appropriate flight inspection report form(s) and restrict the NAVAID accordingly. (2) Beyond the applicable flight inspection service volume but within the SSV, complete the appropriate flight inspection report form(s) and document flight inspection results on the procedures package forms. No facility restriction is required. (3) Beyond the applicable SSV, complete the appropriate flight inspection form(s), ESV forms, noting the component(s) which will not support the ESV, and document the results on the procedures package forms. No facility restriction is required. For flight inspections beyond the applicable 25 or 40 nm distance, complete only the fields of the flight inspection report forms for the NAVAID components identified for procedural use. (4) En Route Radial Fixes Located Beyond the FISSV	

(a) If the fix is located beyond the FISSV of any facility that supports the fix, the appropriate fix displacement coverage evaluation must be accomplished for that
facility. When establishing a fix that is located beyond the FISSV, the station(s) are evaluated on the furthest side from the facility of the fix to ensure that usable signals exist. Evaluations must include course sensitivity or modulations, identification, roughness and scalloping, alignment and signal strength.

Fig 22-1

The radials of the primary facility are evaluated at 4 nm or ± 4.5° either side of the primary radial, whichever is greater. The crossing radial is evaluated at ± 3.6°.

NOTE: The primary facility provides primary course guidance to the intersection. If either facility can be the primary, then evaluate both at ± 4 nm or ± 4.5°. If the crossing facility is an NDB, the primary facility is evaluated ± 5° of
the NDB on-course bearing. In Figure 22-1, if Station B were an NDB providing the crossing radial, A1 and B2 would each be 5° from the NDB crossing bearing, and Station B would be evaluated from A1 to B2.

(b) Coverage Evaluation. The radials of the primary facility are evaluated at ± 4 nm or ± 4.5°, whichever is greater. At a distance of 50.8 nm, 4 nm equals 4.5° off course. When a fix is beyond 40 nm but within 50.8 nm of the primary facility, the degrees off course that equals 4 nm must be calculated. In Figure 22-2, XXX is the primary facility, and the fix is located 41 nm from the facility. A determination of the degrees off course that equals 4 nm at 41 nm can be made using the chart in Appendix 3, Figure A3-7. For this example, the offset radials equal ± 5.6° at 41 nm. When the radials of the primary facility are beyond 50.8 nm, the offset radials will be ± 4.5°. An alternative method may be used for the coverage evaluation. Beyond 40 nm but within 50.8 nm, you may fly an arc about the facility at a distance equal to the fix distance plus 4 nm or 4.5°, whichever is greater (3.6° for crossing radials). Using the chart in Appendix 3, Figure A3-7, determine the degrees off course equal to 4 nm at the fix distance to determine the appropriate start and stop point of the arc. For the

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		example in Figure 22-2, we will assume both facilities may be primary. Therefore, Facility XXX arc would be flown at 45.17 nm (41 nm plus 4.17 nm which is the distance that equates to 4.5° at 5 nm) from ± 5.6°. The arc about Facility YYY woul be flown at 57 nm (53 nm plus 4 nm which is the greater of 4.5° or 4 nm at 41 nm). For radials beyond 50.8 nm, the arc will remain ± 4.5°, but th distance that must be added to the fix distance ar will increase as the distance outbound increases (see Appendix 3, Figure A3-7). (c) Stand-Alone DME Fixes must be evaluated for coverage ± 4 nm or 4.50 (whichever is greater) at nm greater than the fix distance. Fig 22-2	
ICAO Annex Tol	**Doc 8071 Tolerance**	**8200 Tolerance**	
		To adequately support a proposed ESV of airspace, facility performance must meet all operational tolerances as described in Chapter 7 [sic] (appropriate section) and conform to the process described in Paragraph 22.12 above. Facilities which do not meet tolerances beyond th FISSV must not be restricted; however, procedura use must be denied.	
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
		Tolerance text in paragraph 22.13 refers inappropriately to Chapter 7 (Lighting Systems).	
	Measurement Uncertainty		

Annex10_ID	8071_ID	8200_ID	Results_ID
		353	602

Facility ESV **Parameter** RNAV using DME/DME

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 22.11f

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		f. Area Navigation (RNAV) - Procedural Routes Predicated on DME/DME Position Estimation. Thi paragraph addresses ESV guidance for inspectio of RNAV procedures requiring a DME/ DME infrastructure. Expanded Service Volume (ESV) requirements: Where the DME infrastructure assessment tool (RNAV-PRO) indicates insufficient DME coverage using standard service volume, the RNAV-PRO can identify proposed ESV(s) for DME facilities that should ensure an acceptable navigational solution. When ESV documentation is provided in the procedure package, the expected coverage on the ESV form will be compared to the ESV data collected during the flight inspection. The actual facility ESV coverage is presented on the "DME/ DME Leg Summary Report" printed by AFIS at the end of each route inspected. (AFIS Technician User Manual, TI 4040.55, DME/ DME Mode Operations, explains AFIS operation and display). The Leg Summary Report is the actual facility coverage and should be reported on the ESV request form if it is different from the expected coverage on the ESV form. The ESV request form with noted differences is returned to the FICO after the procedure inspection is completed. During the inspection, if a Critical, or ESV designated, DME appears not to be transmitting, verify with Air Traffic or a local Flight Service Station that the facility is in service. If a DME designated Critical is off the air, the inspection must be terminated and resumed after the facility is returned to service. When there are three or les DME(s) and one of the three is out of service, the check should be rescheduled.	

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
ICAO Annex Tol	**Doc 8071 Tolerance**	**8200 Tolerance**	
		To adequately support a proposed ESV of airspace, facility performance must meet all operational tolerances as described in Chapter 7 [sic] (appropriate section) and conform to the process described in Paragraph 22.12 above. Facilities which do not meet tolerances beyond th FISSV must not be restricted; however, procedura use must be denied.	
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
		Tolerance text in paragraph 22.13 refers inappropriately to Chapter 7 (Lighting Systems).	
	Measurement Uncertainty		

Annex10_ID	8071_ID	8200_ID	Results_ID
		354	603

Facility **FM** **Parameter** **Coverage**

8200/Annex (sub)parameter Compare Results

8200 doesn't meet A10 for any

SARPS Ref 3.6.1.2.5, 3.6.1.2.6

Annex Ref 3.6.1.2.5 **8071 Reference** 6.3.4 - 6.3.7 **8200 Reference** 15.40c, f

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.6.1.2.5 Coverage and radiation pattern Note. The coverage and radiation pattern of marker beacons will ordinarily be established by Contractin States on the basis of operational requirements, taking into account recommendations of regional meetings. The most desirable radiation pattern would be one that: a) in the case of fan marker beacons, results in lam operation only when the aircraft is within a rectangular parallelepiped, symmetrical about the vertical line through the marker beacon and with the major and minor axes adjusted in accordance with the flight path served; b) in the case of a Z marker beacon, results in lamp operation only when the aircraft is within a cylinder, the axis of which is the vertical line through the marker beacons. In practice, the production of such patterns is impracticable and a compromise radiation pattern is necessary. In Attachment C, antenna systems currently in use and which have proved generally satisfactory are described for guidance. Such designs and any new designs providing a closer approximation to the most desirable radiation patter outlined above will normally meet operational requirements. 3.6.1.2.6 Determination of coverage. The limits of coverage of marker beacons shall be determined o the basis of the field strength specified in 3.1.7.3.2. [inserted below following this text from 3.6] 3.6.1.2.7 Radiation pattern. Recommendation. The radiation pattern of a marker beacon normally shou be such that the polar axis is vertical, and the field strength in the pattern is symmetrical about the pola axis in the plane or planes containing the flight path for which the marker beacon is intended.	There is no international standard for coverage of an enroute marker. It is determined by individual states' operational requirements. Coverage is measured by flying over the marker beacon at operationally used altitudes and measuring the tot time or distance during which a visual indication is obtained from a calibrated marker receiver and antenna, or during which a predetermined signal level is obtained. At commissioning, the coverage should be measured at a number of altitudes, whi for routine checks it will usually be sufficient to make the check at a single altitude. Since the routine checks of the marker beacon will normally be carried out in conjunction with the associated navigational aid, it will be convenient to check bot at the same altitude. At commissioning, it is preferable to determine the coverage by making a continuous recording of signal strength, since this allows a more detailed assessment of the ground beacon performance. For routine checks, measurement of light activation time or distance over which the visual indication is received will usually be sufficient. Measuring Procedure 6.3.5 The procedure used for coverage measurements is to fly over the beacon, noting th true airspeed of the aircraft and the total time or distance over which the visual indication or predetermined signal level is obtained. A 180-degree turn is then made and the measurement repeated while flying over the beacon at the same airspeed in the opposite direction. These two flights are required in order to average out the win speed and other effects, such as receiver lag, tilt, or asymmetry in aircraft antenna pattern, etc. The time during which visual indication is obtained (light time) can be measured directly by a stopwatch. If a continuous recording of signal lev is being made, a knowledge of the chart speed wi enable the time for which the predetermined value of signal level is exceeded to be scaled directly from the chart. The coverage may be converted into time at a reference airspeed or distance as	f. Holding Fixes. Marker beacons which will be used as a fix for holding or any other instrument flight procedural use, at altitudes above those noted in Paragraph 15.40c must be checked for major and minor axis coverage at the highest proposed altitude. If performance is not satisfactory and cannot be corrected by facility adjustment, the operational altitudes will have to b revised or procedural use denied. c. Coverage. This check is conducted to assure that the facility will provide a radiation pattern that supports operational requirements without interfering with other facilities or instrument flight procedures. All of the commissioning coverage requirements must be completed with any adjacent marker beacons removed from service to preclude a misrepresentative coverage analysis caused by signal intermixing. The aircraft marker beacon sensitivity must be set at the low position for all checks. [subparameter 1 - Minor Axis Width] (1) Minor Axis. This check is performed to measure the actual width and quality of the radiation pattern along the procedural course where it will be used. Approved Procedure. Fly through the marker beacon signal while inbound on the electronic course providing approach guidance. Maintain the published minimum altitude to check marker beacons that support nonprecision approaches. For markers that support precision instrument flight procedures, the preferred method is to fly down the glidepath. An alternate procedure is to maintain the altitude at which the glide slope intersects the marker location. If the facility supports both precision and nonprecision procedures and the difference between the respective intercept altitudes exceeds 100 ft, conduct the initial check at both altitudes. Thereafter, either altitude may be used.	Unlike other Nav facilities, the MKR output power (signal strength) is adjusted to achieve a specifie coverage area (width). The Annex 10 measurand of Field strength of the ILS Fan Marker antenna pattern is not directly measured in 8200.1. Rather, the distance through the pattern for which the received signal exceeds the light illumination level is used as an end-end measurement. This method of measurement assumes that receiver sensitivity is sufficient regardless of marker field strength. Given any modern receiver, this assumption is sufficient. It is an unproven assumption is that the 8200 edge definition (1700uV) is considered equivalen to the Annex 10 edge definition (1.5mV/m). Sinc the units of signal LEVEL (1700 uV) in 8200 appear to be received voltage level at the receive input terminals across a 50 ohm load, it is not possible to determine whether the Annex 10 field strength or power density requirements are met, without knowledge of the airborne flight inspectio antenna's Gain Factor or Capture Area. Editorially, the 1700 uV criterion appears sufficient in daily use, given the myriad combinations of user receivers, feedlines, and antennas producing satisfactory marker indications. Although it isn't possible at present to say that 8200 fully meets Annex 10 because of the units differences, this should not warrant filing an ICAC difference. FAA does not specify a minimum for the peak field strength as is specified in Annex 10 (>/= 3.(mV/m). Recommendation: Add an 8200.1 check of the minimum received level, based on experience wi existing facilities.

Note. Difficulty in siting certain marker beacons mai make it necessary to accept a polar axis that is not vertical.

****

[following text from ILS marker section of SARPS is referenced in 3.6.1.2.6 of SARPS for enroute markers]

3.1.7.3.2 The field strength at the limits of coverage specified in 3.1.7.3.1 shall be 1.5 millivolts per metr (minus 82 dBW/m2). In addition, the field strength within the coverage area shall rise to at least 3.0 millivolts per metre (minus 76 dBW/m2).

Note 1. In the design of the ground antenna, it is advisable to ensure that an adequate rate of chang of field strength is provided at the edges of coverag It is also advisable to ensure that aircraft within the localizer course sector will receive visual indication.

Note 2. Satisfactory operation of a typical airborne marker installation will be obtained if the sensitivity so adjusted that visual indication will be obtained when the field strength is 1.5 millivolts per metre (minus 82 dBW/m2).

follows:

If V1 is the true airspeed and T1, T2 are the coverage times obtained on the two flights in opposite directions, then the coverage time, T, at reference airspeed of V2 and Coverage Distance, D, will be:

T = [2 (T1xT2) / (T1 + T2)] x [V1/V]
D = [2(T1xT2) / (T1 + T2)] x V1

[see remark for both equations]

6.3.6 Alternatively, coverage distance may be measured directly, by flying over the beacon as described above; and noting the locations on the ground directly beneath the aircraft which coincide with the beginning and end of coverage. These points defining the coverage area are then plotted on a map of the locality and the coverage distanc read off. If the flight check aircraft is fitted with a Doppler or inertial navigation system, it can of course be used to measure the coverage area. A DME, suitably located, could also be used.

6.3.7 At commissioning, a check should be mad that the center of the coverage area is in the correct position. This will usually be over the marker beacon but in some cases, due to siting difficulties, the polar axis of the marker beacon radiation pattern may have to be other than vertical. Reference should then be made to the operational procedures to determine the correct location of the center of coverage, with respect to some recognizable point on the ground. The center of coverage can be checked during the coverage flights described above, by marking the continuous recording when the aircraft is directly over the marker beacon (or other defined point). The average of the two recordings, taken with respect to the mark on the recording, will show whether the coverage pattern is centered over the beacon (or other defined point). The separate recordings taken in each direction will seldom be symmetrical about this reference mark on the recording due to such effects as asymmetry of ground beacon radiation pattern, tilt in aircraft antenna pattern, receiver lags, etc.

NOTE: Outer Marker Coverage will be considered satisfactory when the width is between 1,350 and 4,000 ft; 2,000 ft is the optimum width.

[Subparameter 2] - Major Axis Width

(2) Major Axis. This measurement is conducted to verify that the marker beacon provides adequate coverage by measuring the width of the minor axi at the extremities of
a predefined off-course sector. There is no requirement to flight inspect major axis coverage for inner markers. It is not necessary to obtain the limits of actual coverage unless requested as an engineering assist.

Approved Procedure. Fly though the marker beacon signal while positioned on the course or microamp displacement which defines the require coverage limits (see Figure 15-3). Maintain the altitudes required for the minor axis measurement

(a) Coverage Limits. The required coverage limits are predicated upon the type facility providing course guidance.

(b) Unidirectional facilities (e.g., LOC/ LDA/ SDF). Coverage must be provided 75 µA each side of th localizer on-course signal, with the facility in Normal.

(c) Omnidirectional facilities (e.g., VOR, NDB). Coverage must be provided 5° each side of the or course signal.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
3.6.1.2.6 states use field strength levels defined in 3.1.7.3.2: Edge 1.5mV/m (-82 dBW/sqm) Peak >/= 3.0 mV/m (-76 dBW/sqm)	Proper indication given to aircraft of the particular location on the airway. The coverage pattern should be centered over the beacon (or other defined point). Commissioning: Nominal (as determined by operational requirements), +/- 25% Periodic: Nominal (as determined by operational requirements), +/- 50%	[subparameter 1 - Minor Axis Width] With a constant signal at or above 1,700 microvol (µV), the following widths must be provided: Fan Marker 1000-3000' All Others - Width must not be less than 1,350 ft or more than 4,000 ft [Subparameter 2] - Major Axis Width Any duration not to exceed the respective minor axis tolerance. As measured along the minor axis at the extremities of the pre-defined off-course sector.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
Completely editorial or Recommendation in nature except for field strength reference in 3.6.1.2.6.	The quantity V1/V should be V1/V2 ********** Original composition of 8071 text had D = T x V2 **********	Provide a radiation pattern that supports operational requirements without interfering with other facilities or procedures. All commissioning coverage requirements must be completed with any adjacent marker beacons removed from service to preclude a misrepresentative coverage analysis caused by signal intermixing. The aircra marker beacon must be set at the low position for all checks. (1) Minor Axis. Measure the actual width and quality of the radiation pattern along the procedur course where it will be used. (2) Major Axis. Verify adequate coverage by measuring the width of the minor axis at the extremities of a pre-defined off course sector.

Measurement Uncertainty

1 second or 10 uV

Annex10_ID	8071_ID	8200_ID	Results_ID
414	586	355	604

Facility **FM** **Parameter** **Electromagnetic Spectrum**

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for all

SARPS Ref (none)

Annex Ref (none) **8071 Reference** (none) **8200 Reference** (none)

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
(none)	(none)	Radio Frequency: Not addressed, considered ground inspection.	

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
(none)	(none)	RF Frequency - n/a to flight inspection Interference must not cause an out-of-tolerance condition.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
		Ground inspection of frequency, tolerance equals the annex 10 tolerance (+/-.005%) however it is based on assigned frequency (75MHz +/-4K if offset operation). Interference tolerance not addressed in source te

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
415	587	356	605

Facility **FM** **Parameter** **Frequency**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 3.6.1.1 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.6.1.1 Frequencies. The emissions of an en-route VHF marker beacon shall have a radio frequency of 75 MHz plus or minus 0.005 per cent.	(none)	(none)	This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
75 MHz +/- 0.0005%		RF Frequency - n/a to flight inspection

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
		Ground inspection of frequency, tolerance equals the annex 10 tolerance (+/-.005%) however it is based on assigned frequency (75MHz +/-4K if offset operation).

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
416	588	357	606

Facility **FM** **Parameter** **Identification**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref 3.6.1.2.4

Annex Ref 3.6.1.2.4 **8071 Reference** 6.3.3 **8200 Reference** 15.40b

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.6.1.2.4 Identification. If a coded identification is required at a radio marker beacon, the modulating tone shall be keyed so as to transmit dots or dashe or both in an appropriate sequence. The mode of keying shall be such as to provide a dot-and-dash duration together with spacing intervals corresponding to transmission at a rate equivalent t approximately six to ten words per minute. The carrier shall not be interrupted during identification.	If identification coding is used on the marker beacon, it should be checked during a flight over the beacon. The identification is assessed from both the aural and visual indication and is satisfactory when the coded characters are correct, clear and properly spaced. The frequenc of the modulating tone can be checked by observing that the visual indication is obtained on the correct (white) lamp of a three-lamp system.	b. Identification and Modulation Tone. The purpos of this check is to ensure that the correct modulation tone and keying code are transmitted without interference throughout the area of required coverage. Keying rate is checked by Facility Maintenance personnel. Approved Procedure. Record and evaluate the keying code while flying in the radiation pattern at the proposed or published altitude(s). [Following text appears and is addressed in MODULATION Parameter] Check that the audio modulation tone is correct b noting that the proper light comes on for the type marker being inspected, e.g., the OM illuminates the blue lamp.	

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
If required, appropriate sequence of dots and dashes	Clearly audible, proper keying, correct coding and frequency	Distinct, correct, constant throughout the coverag area; and clearly distinguishable from any other markers.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
		Audible/visible check without a quantitative tolerance. No AF check of keying rate beyond equipment design acceptance.

Measurement Uncertainty

(none)

Annex10_ID	8071_ID	8200_ID	Results_ID
417	589	358	607

Facility **FM** **Parameter** **Modulation**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 3.6.1.2 **8071 Reference** **8200 Reference** 15.40b

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
[Subparameter 1 - Modulation Depth and Distortion 3.6.1.2.1 Radio marker beacons shall radiate an uninterrupted carrier modulated to a depth of not less than 95 per cent or more than 100 per cent. Th total harmonic content of the modulation shall not exceed 15 per cent. [Subparameter 2 - Modulation Frequency] 3.6.1.2.2 The frequency of the modulating tone sha be 3 000 Hz plus or minus 75 Hz.		b. Identification and Modulation Tone. The purpos of this check is to ensure that the correct modulation tone and keying code are transmitted without interference throughout the area of required coverage. Keying rate is checked by Facility Maintenance personnel. Approved Procedure. Record and evaluate the keying code while flying in the radiation pattern at the proposed or published altitude(s). Check that the audio modulation tone is correct by noting tha the proper light comes on for the type marker beir inspected, e.g., the OM illuminates the blue lamp.	This is a design qualification and/or ground maintenance issue. Flight testing does not address this, except to confirm that gross errors have not been made in selecting the modulating frequency by installation or maintenance personnel.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
[Subparameter 1 - Modulation Depth and Distortion] -- 95-100%, <=15% THD [Subparameter 2 - Modulation Frequency] -- 3000 Hz +/- 75 Hz		FM - White Light (3,000 Hz)

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
		FAA ground inspection tolerances (6750.49A): Frequency +/- 1.0% (tighter) Harmonic Distortion - Not addressed Depth of Modulation - 95% +/-4% (equal)

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
418		359	608

Facility **FM** **Parameter** **Monitoring**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 3.6.1.3 **8071 Reference** **8200 Reference** none

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.6.1.3 Monitoring. Recommendation.— For each marker beacon, suitable monitoring equipment should be provided which will show at an appropriate location: a) a decrease in radiated carrier power below 50 pe cent of normal; b) a decrease of modulation depth below 70 per ce c) a failure of keying.	(none)	No monitor consideration by flight inspection.	AF Maintenance tolerances for enroute markers are found in Order 6770.2B. Monitoring tolerances in 6770.2B protect the ICAO recommendation for decrease in output power, failure of keying. The Monitoring tolerances in 6770.2B do not address reduction of modulation depth below 70 %.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
If provided, beacon shall shutdown at 50% power, 70% modulation depth, and continuous or no keyir	none	none

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
Monitoring and automatic shutdown of enroute fan markers is not required by Annex 10.	not addressed	No flight inspection requirement

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
419	590	360	609

Facility **FM** **Parameter** **Polarization**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 3.6.1.2.3 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.6.1.2.3 The radiation shall be horizontally polarize	(none)	(none)	This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
420	591	361	610

Facility **FM** **Parameter** **Standby Equipment**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref (none)

Annex Ref (none) **8071 Reference** 6.3.8 **8200 Reference** 15.40g

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
(none)	At commissioning, the standby equipment is checked in the same manner as the main equipment. For routine checks, it is usually not necessary to check both main and standby equipments, provided that the checks are carried out on each equipment alternately. If any change in the performance of the marker beacon is considered likely when it is connected to its sourc of standby power, then all the flight checks shoulc be repeated with the marker beacon on stand by power.	g. Standby Equipment. See Chapter 4, Section 3. This equipment must b checked in the same manner as the main equipment. h. Standby Power. Refer to Chapter 4, Section 3. the check is required, complete periodic checklist requirements on one set of equipment while operating on standby power.	The US has very few enroute fan markers remaining, and very likely none of them has dual equipment. There is no ICAO requirement to check the standby equipment.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
(none)	Same checks and tolerances as main equipment	Same as for main equipment

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

(none)

Annex10_ID	8071_ID	8200_ID	Results_ID
421	592	362	611

Facility GBAS **Parameter** Coverage

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref 3.7.3.5.3 **SARPS Ref** **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.7.3.5.3 Coverage 3.7.3.5.3.1 Category I precision approach and approach with vertical guidance. The GBAS coverage to support each Category I precision approach or approach with vertical guidance shall b as follows, except where topographical features dictate and operational requirements permit: a) laterally, beginning at 140 m (450 ft) each side of the landing threshold point/fictitious threshold point (LTP/FTP) and projecting out ±35 degrees either side of the final approach path to 28 km (15 NM) an ±10 degrees either side of the final approach path t 37 km (20 NM); and b) vertically, within the lateral region, up to the greater of 7 degrees or 1.75 promulgated glide path angle (GPA) above the horizontal with an origin at the glide path interception point (GPIP) and 0.45 GPA above the horizontal or to such lower angle, down to 0.30 GPA, as required, to safeguard the promulgated glide path intercept procedure. This coverage applies between 30 m (100 ft) and 3 000 (10 000 ft) height above threshold (HAT). Note. LTP/FTP and GPIP are defined in Appendix B, 3.6.4.5.1. 3.7.3.5.3.1.1 Recommendation. For Category I precision approach, the data broadcast as specifiec in 3.7.3.5.4 should extend down to 3.7 m (12 ft) above the runway surface. 3.7.3.5.3.1.2 Recommendation. The data broadcas should be omnidirectional when required to support the intended applications. Note. Guidance material concerning coverage for Category I precision approach and APV is provided in Attachment D, 7.3. 3.7.3.5.3.2 GBAS positioning service. The GBAS positioning service area shall be that area where th data broadcast can be received and the positioning			No tolerances are given in the Annex 10 text for this parameter - the coverage text defines a service volume, without any measurable quantitie

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
service meets the requirements of 3.7.2.4 and supports the corresponding approved operations. Note. Guidance material concerning the positioning service coverage is provided in Attachment D, 7.3.			

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
none - text defines coverage volume only		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
This text defines a coverage volume, without specifying the characteristics of the GBAS signal (e.g., microvolts/meter) within that coverage volum Para 3.7.3.5.3.2, which defines a coverage area fo Positioning Service use, is not relevant to flight inspection operations for approach and landing.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
422			612

Facility GBAS **Parameter** Data Broadcast Characteristics

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref 3.7.3.5.4 **SARPS Ref** **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.7.3.5.4 Data broadcast characteristics Note. RF characteristics are specified in Appendix B, 3.6.2. [The contents of B3.6.2 deal solely with characteristics tested during Design Qualification (e.g., Pulse shaping filter frequency response) or ground testing (e.g., RF carrier frequency stability).] 3.7.3.5.4.1 Carrier frequency. The data broadcast radio frequencies used shall be selected from the radio frequencies in the band 108 to 117.975 MHz. The lowest assignable frequency shall be 108.025 MHz and the highest assignable frequency shall be 117.950 MHz. The separation between assignable frequencies (channel spacing) shall be 25 kHz. Note 1. Guidance material on VOR/GBAS frequenc assignments and geographical separation criteria is given in Attachment D, 7.2.1. Note 2. ILS/GBAS geographical separation criteria and geographical separation criteria for GBAS and VHF communication services operating in the 118 - 137 MHz band are under development. Until these criteria are defined and included in SARPs, it is intended that frequencies in the band 112.050 - 117.900 MHz will be used. 3.7.3.5.4.2 Access technique. A time division multiple access (TDMA) technique shall be used with a fixed frame structure. The data broadcast shall be assigned one to eight slots. Note. Two slots is the nominal assignment. Some GBAS facilities that use multiple VHF data broadcast (VDB) transmit antennas to improve VDB coverage may require assignment of more than two time slots. Guidance on the use of multiple antenna is given in Attachment D, 7.12.4; some GBAS broadcast stations in a GRAS may use one time slo 3.7.3.5.4.3 Modulation. GBAS data shall be transmitted as 3-bit symbols, modulating the data	[See parameter VDB COVERAGE for relevant Doc 8071 Text for comparison with paragraph 3.7.3.5.4.4 in Annex 10.]		Except for the signal strength values in paragrapl 3.7.3.5.4.4, these functions are system design characteristics, and are tested during design qualification or ground testing activities.

broadcast carrier by D8PSK, at a rate of 10 500 symbols per second.

[The following paragraph 3.7.3.5.4.4 is duplicated and assessed under Parameter VDB COVERAGE.]

3.7.3.5.4.4 Data broadcast RF field strength and polarization

Note. GBAS can provide a VHF data broadcast with either horizontal (GBAS/H) or elliptical (GBAS/E) polarization that employs both horizontal polarizatio (HPOL) and vertical polarization (VPOL) components. Aircraft using a VPOL component will not be able to conduct operations with GBAS/H equipment. Relevant guidance material is provided Attachment D, 7.1.

3.7.3.5.4.4.1 GBAS/H

3.7.3.5.4.4.1.1 A horizontally polarized signal shall be broadcast.

3.7.3.5.4.4.1.2 The effective radiated power (ERP) shall provide for a horizontally polarized signal with minimum field strength of 215 microvolts per metre 99 dBW/m2) and a maximum field strength of 0.350 volts per metre (-35 dBW/m2) within the GBAS coverage volume. The field strength shall be measured as an average over the period of the synchronization and ambiguity resolution field of the burst. The RF phase offset between the HPOL and any VPOL components shall be such that the minimum signal power defined in Appendix B, 3.6.8.2.2.3 is achieved for HPOL users throughout the coverage volume.

3.7.3.5.4.4.2 GBAS/E

3.7.3.5.4.4.2.1 Recommendation. An elliptically polarized signal should be broadcast whenever practical.

3.7.3.5.4.4.2.2 When an elliptically polarized signal is broadcast, the horizontally polarized component shall meet the requirements in 3.7.3.5.4.4.1.2, and the effective radiated power (ERP) shall provide for vertically polarized signal with a minimum field strength of 136 microvolts per metre (-103 dBW/m2 and a maximum field strength of 0.221 volts per metre (-39 dBW/m2) within the GBAS coverage

volume. The field strength shall be measured as an average over the period of the synchronization and ambiguity resolution field of the burst. The RF phas offset between the HPOL and VPOL components, shall be such that the minimum signal power define in Appendix B, 3.6.8.2.2.3 is achieved for HPOL an VPOL users throughout the coverage volume.

Note. The minimum and maximum field strengths ir 3.7.3.5.4.4.1.2 and 3.7.3.5.4.4.2.2 are consistent with a minimum receiver sensitivity of -87 dBm and minimum distance of 200 m (660 ft) from the transmitter antenna for a coverage range of 43 km (23 NM).

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3.7.3.5.4.5 Power transmitted in adjacent channels. The amount of power during transmission under all operating conditions when measured over a 25 kHz bandwidth centred on the ith adjacent channel shall not exceed the values shown in Table 3.7.3.5-1 (located at the end of section 3.7).

3.7.3.5.4.6 Unwanted emissions. Unwanted emissions, including spurious and out-of-band emissions, shall be compliant with the levels shown in Table 3.7.3.5-2 (located at the end of section 3.7 The total power in any VDB harmonic or discrete signal shall not be greater than -53 dBm.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Horizontally Polarized Field Strength: -99 to -35 dBW/m2 Vertically Polarized Field Strength, if provided: -10 to -39 dBW/m2		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
Except for paragraph 3.7.3.5.4.4, Data Broadcast RF Field Strength and Polarization, these parameters are system design characteristics, and are tested during design qualification or ground testing activities.		

Measurement Uncertainty

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
Annex10_ID	8071_ID	8200_ID	Results_ID
423	593		613

Facility GBAS **Parameter** Data Content

8200/Annex (sub)parameter Compare Results

8200 doesn't meet A10 for any

SARPS Ref B3.6.4

Annex Ref **8071 Reference** 4.3.15 - 4.3.16 **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	[This text is referenced in 8071 Volume 2 to paragraph 4.3.8, which is an error.] Data content (operational) 4.3.15 VDB broadcast data affecting operational use of the GBAS station should be confirmed to b correct during flight testing. The list of parameters shown in Table II-4-5 should be checked. While flying within the service volume of the VDB broadcast under test, confirm that the broadcast information matches the intended values obtainec from the ground maintenance personnel. 4.3.16 In addition to confirming data content, an end-to-end test of GBAS approach selection should be accomplished by using the assigned channel number as published on the approach plate. This confirms that the reference path data selector (RPDS) data field and the VDB frequency match the channel number. Alternatively, the approach t be inspected may be selected by the VDB frequency and the appropriate RPDS. If a GBAS positioning service is provided, the reference station data selector (RSDS) value should be confirmed by substituting the RSDS value for the RPDS value in the approach selection process. Table II-4-5. Data broadcast parameters to be checked during flight testing Parameters to be confirmed — Values or special coding Type 2 Message (GBAS related data) ---------- --- GAD (GBAS Accuracy Designator) letter — A, B, or C GCID — 1 or 7 Reference Station Data Selector (RSDS) — Site-specific		ICAO Doc 8071 is a guidance manual, and as a result its contents to not require compliance. For GBAS, FAA Order 8200.1 does not yet contain any flight testing content. For the purposes of this comparison database, the 8071 "requirements" will be considered as if they were Annex 10 requirements. As a result, this parameter is considered non-compliant. When 8200.1 content for GBAS is published, it is likely this parameter will match or exceed Annex 10 requirements.

Maximum use distance (Dmax, if broadcast)	Maximum procedural use distance (km) (Special coding '0' when no limitations)
Magnetic Variation	Site-specific

Type 4 Message (FAS data)

Operation Type	0 for straight-in approach
Airport Identification	3 or 4 alphanumeric characters
Runway Number	Site-specific
Runway Letter	Site-specific, (R, C, L, or no letter)
Approach Performance Designator	Site-specific (1 for Categor I)
Route Indicator	Site-specific
Reference Path Data Selector (RPDS)	Site-specific
Reference Path Identifier (RPI)	Site-specific
FASVAL alert limit, deviations	Value determines vertical ('1111 1111' if vertical not to be used)
FASLAL status	Value determines approac ('1111 1111' if approach not to be used)

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	Exact Match	

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
	Measurement Uncertainty N/A		

Annex10_ID	8071_ID	8200_ID	Results_ID
	594		614

Facility **GBAS** **Parameter** **FAS Data**

8200/Annex (sub)parameter Compare Results

8200 doesn't meet A10 for any

SARPS Ref B3.6.4.5

Annex Ref **8071 Reference** 4.3.4 **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	[This text is referenced in 8071 Volume 2 to paragraph 4.3.3, which is an error.] Way-point and procedure design correlation 4.3.4 The FAS data received from the ground station should be checked for consistency against the original procedure design.		ICAO Doc 8071 is a guidance manual, and as a result its contents to not require compliance. For GBAS, FAA Order 8200.1 does not yet contain any flight testing content. For the purposes of this comparison database, the 8071 "requirements" will be considered as if they were Annex 10 requirements. As a result, this parameter is considered non-compliant. When 8200.1 content for GBAS is published, it is likely this parameter will match or exceed Annex 10 requirements.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	Consistent with FAS Design	

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
	This is an on-ground "test". It is a confirmation that the FAS data matches the original approach design intent.	

Measurement Uncertainty

N/A

Annex10_ID	8071_ID	8200_ID	Results_ID
	595		615

Facility GBAS **Parameter** Functions

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref 3.7.3.5.2 **SARPS Ref** **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.7.3.5.2 Functions. GBAS shall perform the following functions: a) provide locally relevant pseudo-range corrections b) provide GBAS-related data; c) provide final approach segment data when supporting precision approach; d) provide predicted ranging source availability data and e) provide integrity monitoring for GNSS ranging sources. Note. Additional GBAS SARPs will be developed to provide ground-based ranging function.			These functions are system design characteristics, and are tested during design qualification or ground testing activities.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
none		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
none		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
424			616

Facility GBAS **Parameter** Message Block Header

8200/Annex (sub)parameter Compare Results

8200 doesn't meet A10 for any

SARPS Ref B3.6.3.4.1

Annex Ref **8071 Reference** 4.3.14 **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	[This text is referenced in 8071 Volume 2 to paragraph 4.3.7, which is an error.] Message block header (GBAS identification only) 4.3.14 While flying within the service volume of th VDB broadcast, confirm proper GBAS identification.		ICAO Doc 8071 is a guidance manual, and as a result its contents to not require compliance. For GBAS, FAA Order 8200.1 does not yet contain any flight testing content. For the purposes of this comparison database, the 8071 "requirements" will be considered as if they were Annex 10 requirements. As a result, this parameter is considered non-compliant. When 8200.1 content for GBAS is published, it is likely this parameter will match or exceed Annex 10 requirements.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	Exact Match	

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
	This 8071 requirement applies only the GBAS Identification portion of the message block header	

Measurement Uncertainty

N/A

Annex10_ID	8071_ID	8200_ID	Results_ID
	596		617

Facility GBAS **Parameter** Navigation Information

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 3.7.3.5.5 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.7.3.5.5 Navigation information. The navigation da transmitted by GBAS shall include the following information: a) pseudo-range corrections, reference time and integrity data; b) GBAS-related data; c) final approach segment data when supporting precision approach; and d) predicted ranging source availability data. Note. Structure and contents of data are specified i Appendix B, 3.6.3.			These functions are system design characteristics, and are tested during design qualification or ground testing activities.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
none		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
These parameters are system design characteristics, and are tested during design qualification or ground testing activities.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
425			618

Facility GBAS **Parameter** Performance

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref 3.7.3.5.1 **SARPS Ref** **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.7.3.5.1 Performance. GBAS combined with one o more of the other GNSS elements and a fault-free GNSS receiver shall meet the requirements for system accuracy, continuity, availability and integrit for the intended operation as stated in 3.7.2.4. Note. GBAS is intended to support all types of approach, landing, departure and surface operation and may support en-route and terminal operations. GRAS is intended to support en-route, terminal, no precision approach, departure, and approach with vertical guidance. The following SARPs are developed to support Category I precision approach approach with vertical guidance, and a GBAS positioning service. In order to achieve interoperability and enable efficient spectrum utilization, it is intended that the data broadcast is t same for all operations.			These functions are system design characteristics, and are tested during design qualification or ground testing activities.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
none		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
none		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
426			619

Facility GBAS **Parameter** Position Domain Accuracy

8200/Annex (sub)parameter Compare Results

8200 doesn't meet A10 for any

SARPS Ref none

Annex Ref **8071 Reference** 4.3.17 - 4.3.18 **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	[This text is referenced in 8071 Volume 2 to paragraph 4.3.9, which is an error.] Position accuracy (optional) 4.3.17 Although position accuracy is checked during ground testing, it can optionally be performed during flight testing if a suitable positio fixing system is available. This functional test is intended to confirm that the GBAS contribution to the position domain accuracy is satisfactory, but i not intended to provide a statistical confidence level of the position measurement. If the deviation output signals of the receiver are used for this assessment, the position fixing system must provide accurate range information in order to convert the measured deviations to linear errors f application of tolerances. 4.3.18 Fly the final approach segment from at lea 18.5 km (10 NM) to ensure that the carrier smoothing filter has converged prior to making a point measurement close to the decision height o threshold. The measured lateral and vertical error should meet the tolerance in Table II-4-4.		ICAO Doc 8071 is a guidance manual, and as a result its contents to not require compliance. For GBAS, FAA Order 8200.1 does not yet contain any flight testing content. For the purposes of this comparison database, the 8071 "requirements" will be considered as if they were Annex 10 requirements. As a result, this parameter is considered non-compliant. When 8200.1 content for GBAS is published, it is likely this parameter will match or exceed Annex 10 requirements.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	4m vertical 16m lateral	

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
	This test in the position domain for accuracy is considered optional in Doc 8071. It is intended as an end-end check of the GBAS signal, for use when a truth system is available in the test aircraf	

Measurement Uncertainty

1m

Annex10_ID	8071_ID	8200_ID	Results_ID
	597		620

Facility GBAS **Parameter** Procedure Validation

8200/Annex (sub)parameter Compare Results

8200 doesn't meet A10 for any

SARPS Ref none

Annex Ref **8071 Reference** 5.3 **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	All Segments (Details are found Facility Type 'Flight Procedures') Objective 5.3.1 The objective of the flight inspection and flight validation evaluation of instrument flight procedures is to assure that the navigation source supports the procedure, ensures obstacle clearance, and checks the flyability of the design. The following activities should be accomplished: a) Verify the obstacle that serves as the basis for computing the minimum altitude in each segment of the IAP. b) Evaluate aircraft manoeuvring areas for safe operations for each category of aircraft for which the procedure is intended. c) Review the instrument procedure for complexity of design, and evaluate the intensity of the cockpi workload to determine if any unique requirements adversely impact safe operating practices. Check for correctness of information, propriety and ease of interpretation. d) If appropriate, verify that all required runway markings, lighting and communications are in place and operative. 5.3.2 The flight validation of an instrument flight procedure and verification of the obstacle data ma be conducted during the associated navigation aic inspection if visual meteorological conditions (VMC) prevail throughout each segment. Verification of obstacle clearance 5.3.3 Original flight procedures. A ground or in-flight obstacle verification should be conducted fo each route segment during the development of original flight procedures. 5.3.4 Identification of new obstacles. When new		ICAO Doc 8071 is a guidance manual, and as a result its contents to not require compliance. For GBAS, FAA Order 8200.1 does not yet contain any flight testing content. For the purposes of this comparison database, the 8071 "requirements" will be considered as if they were Annex 10 requirements. As a result, this parameter is considered non-compliant. When 8200.1 content for GBAS is published, it is likely this parameter will match or exceed Annex 10 requirements.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
	obstacles are discovered during flight validation activities, the fight validator should identify the location and height of the new obstruction(s) and provide the information to the procedure specialis Procedure commissioning should be denied until the procedure specialist's analysis has been completed and the flight procedure adjusted as appropriate. 5.3.5 Determination of obstacle heights. If in-flight height determination of obstacles or terrain is required, accurate altimeter settings and altitude references are necessary to obtain the most accurate results possible. The method of obstacle height determination should be documented on th flight validation report.		

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	N/A	

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
	The procedural aspects of GBAS flight inspection are essentially duplicative of flight inspecting all Procedures. See Facility Type 'Flight Procedures for a more comprehensive assessment.	

Measurement Uncertainty

Subjective

Annex10_ID	8071_ID	8200_ID	Results_ID
	598		621

Facility GBAS **Parameter** Resistance to Interference

8200/Annex (sub)parameter Compare Results

8200 doesn't meet A10 for any

SARPS Ref B3.7

Annex Ref **8071 Reference** 4.3.6 **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	[This text is referenced in 8071 Volume 2 to paragraph 4.3.5, which is an error.] Resistance to interference (ranging signal) 4.3.6 GBAS receiver standards require that receivers not provide hazardously misleading information in the presence of radio frequency interference. Excessive ranging signal interferenc will therefore affect continuity and availability, rather than integrity. The loss of GBAS correction signals and/or the loss of guidance have proven t be good indicators of probable GNSS and/or GBAS interference. If interference is suspected, further investigation should be conducted. Some States may require a precommissioning survey of the interference environment. The suspected area should be probed and spectrum analysis accomplished to define its geographical extent. GNSS and GBAS parameters such as carrier-to-noise density (C/No), horizontal and vertical protection levels, satellites tracked, and DOP should be documente to aid further investigation. If interference is confirmed, the appropriate action should be taken e.g. approach procedure may be removed from operational status, pending corrective action, and appropriate authorities should be notified. For mo details, refer to Chapter 1, Attachment 3.		ICAO Doc 8071 is a guidance manual, and as a result its contents to not require compliance. For GBAS, FAA Order 8200.1 does not yet contain any flight testing content. For the purposes of this comparison database, the 8071 "requirements" will be considered as if they were Annex 10 requirements. As a result, this parameter is considered non-compliant. When 8200.1 content for GBAS is published, it is likely this parameter will match or exceed Annex 10 requirements.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	<interference mask definitions	

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

+/- 3 dB

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
Annex10_ID	8071_ID	8200_ID	Results_ID
	599		622

Facility GBAS **Parameter** VDB Coverage

8200/Annex (sub)parameter Compare Results

8200 doesn't meet A10 for any

SARPS Ref 3.7.3.5.4.4

Annex Ref **8071 Reference** 4.3.7 - 4.3.13 **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
[The following text is duplicated from parameter DATA BROADCAST CHARACTERISTICS, for purposes of comparing directly with VDB COVERAGE as defined in Doc 8071.] 3.7.3.5.4.4 Data broadcast RF field strength and polarization Note. GBAS can provide a VHF data broadcast with either horizontal (GBAS/H) or elliptical (GBAS/E) polarization that employs both horizontal polarizatio (HPOL) and vertical polarization (VPOL) components. Aircraft using a VPOL component will not be able to conduct operations with GBAS/H equipment. Relevant guidance material is provided Attachment D, 7.1. 3.7.3.5.4.4.1 GBAS/H 3.7.3.5.4.4.1.1 A horizontally polarized signal shall be broadcast. 3.7.3.5.4.4.1.2 The effective radiated power (ERP) shall provide for a horizontally polarized signal with minimum field strength of 215 microvolts per metre 99 dBW/m2) and a maximum field strength of 0.350 volts per metre (-35 dBW/m2) within the GBAS coverage volume. The field strength shall be measured as an average over the period of the synchronization and ambiguity resolution field of the burst. The RF phase offset between the HPOL and any VPOL components shall be such that the minimum signal power defined in Appendix B, 3.6.8.2.2.3 is achieved for HPOL users throughout the coverage volume. 3.7.3.5.4.4.2 GBAS/E 3.7.3.5.4.4.2.1 Recommendation. An elliptically polarized signal should be broadcast whenever practical. 3.7.3.5.4.4.2.2 When an elliptically polarized signal is broadcast, the horizontally polarized component shall meet the requirements in 3.7.3.5.4.4.1.2, and	[This text is referenced in 8071 Volume 2 to paragraph 4.3.6, which is an error.] Coverage 4.3.7 The broadcast power of an installed VDB is constrained by many factors, only one of which is the desired field strength in the defined coverage region. Other constraints include adjacent and cochannel interference to neighbouring systems and the VDB receiver sensitivity. Within the minimum required GBAS coverage volume of eac final approach segment served, the minimum and maximum VDB field strength requirements must be met. Where an operational requirement exists use GBAS to altitudes and/or distances beyond th nominal coverage volume, the field strength requirement should be inspected to the expanded altitudes and/or distances. 4.3.8 The field strength should be measured as a average over the period of the synchronization an ambiguity resolution bits in the training sequence portion of the message. As a recommended method, an on-board calibrated VDB receiver may be used to confirm adequate field strength within the coverage volume. This receiver should provid accurate power measurement within the full dynamic range necessary to confirm the minimum and maximum field strength on each received burst. Using this method allows checking the coverage in parallel with other checks (e.g. flyability, message content). 4.3.9 As an alternate method during commissioning, the VDB transmitter can be place in CW mode and a spectrum analyser or power meter used. The power transmitted in CW mode should be the same as that measured as an average over the period of the synchronization and ambiguity resolution bits in the training sequence portion of the message. 4.3.10 If GBAS positioning service is used, the		ICAO Doc 8071 is a guidance manual, and as a result its contents to not require compliance. For GBAS, FAA Order 8200.1 does not yet contain any flight testing content. For the purposes of this comparison database, the 8071 "requirements" will be considered as if they were Annex 10 requirements. As a result, this parameter is considered non-compliant. When 8200.1 content for GBAS is published, it is likely this parameter will match or exceed Annex 10 requirements.

the effective radiated power (ERP) shall provide for vertically polarized signal with a minimum field strength of 136 microvolts per metre (-103 dBW/m2 and a maximum field strength of 0.221 volts per metre (-39 dBW/m2) within the GBAS coverage volume. The field strength shall be measured as an average over the period of the synchronization and ambiguity resolution field of the burst. The RF phas offset between the HPOL and VPOL components, shall be such that the minimum signal power define in Appendix B, 3.6.8.2.2.3 is achieved for HPOL an VPOL users throughout the coverage volume.

Note. The minimum and maximum field strengths in 3.7.3.5.4.4.1.2 and 3.7.3.5.4.4.2.2 are consistent with a minimum receiver sensitivity of -87 dBm and minimum distance of 200 m (660 ft) from the transmitter antenna for a coverage range of 43 km (23 NM).

field strength requirements should be confirmed b flying the procedures. Note.— For safety reasons the height of the aircraft above obstacles should b taken into account (Doc 8071, Volume I, Chapter 1, 1.16.9).

Arcs

4.3.11 Arcs should be flown to assess the lower limit of the GBAS coverage within the required lateral region. Fly an arc ±10 degrees across the extended Final Approach Segment course at 37 k (20 NM) from the FTP/LTP. Fly an arc ±35 degrees across the extended Final Approach Segment at 28 km (15 NM). The arc can be flown in either direction. A ±35 degree arc at 20 NM ma be flown in lieu of the ±10 degree 37 km (20 NM) and ±35 degree 28 km (15 NM) arcs. Arcs for parallel or multiple runways may be combined to minimize flight inspection time. Confirm minimum field strength requirements are met at the lowest vertical coverage limit. If the field strength is unsatisfactory, altitudes may be raised incrementally to an altitude that coincides with the lower limit of the coverage volume.

Flight at constant height

4.3.12 The minimum field strength level may be found not only at the edge of coverage, but within the coverage area because of fading effects. Adequate flight checks should be performed to verify that the required minimum field strength is met within the whole coverage volume. An acceptable means to assess the fading effects is to fly at a constant height along the extended runway centreline. Fly at the upper height of the required coverage volume (e.g. 7 degrees minimum, 3 000 m (10 000 ft) HAT) from the oute limit of coverage to less than 24 km (13 NM) (for 7 degrees), and at an altitude of 2 000 ft beginning a 39 km (21 NM) (corresponding to the lowest vertical coverage limit of 0.9 degrees) to within 4.6 km (2.5 NM) for each runway end served. Confirm minimum field strength requirements are met on both level runs.

Final approach path

4.3.13 The minimum and maximum field strength requirements should be confirmed along all FAS served by the ground subsystem. Proceed inboun along the final approach course following the

procedure. Intercept the glidepath and fly to an altitude of 30 m (100 ft). When the coverage is required to be extended down to 3.7 m (12 ft) above runway surface, the maximum and minimu field strengths should be confirmed to the touchdown point. If the signal level is unsatisfactory prior to glidepath interception, altitudes may be raised incrementally to coincide with the lower limit of the coverage volume.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
GBAS/H: >-99 dBW/m2 to -35 dBW/m2 GBAS/E Horizontal: >-99 dBW/m2 to -35 dBW/m2 GBAS/E Vertical: >-103 dBW/m2 to -39 dBW/m2	GBAS/H: >-99 dBW/m2 to -35 dBW/m2 GBAS/E Horizontal: >-99 dBW/m2 to -35 dBW/m GBAS/E Vertical: >-103 dBW/m2 to -39 dBW/m2	

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
	Matches Annex 10	

Measurement Uncertainty

+/- 3 dB

Annex10_ID	8071_ID	8200_ID	Results_ID
427	600		623

Facility GS **Parameter** Alignment

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for some, doesn't for others

SARPS Ref 3.1.5.1.2.2

Annex Ref 3.1.5.1.2.2 **8071 Reference** 4.2.3.4.1 **8200 Reference** 15.30f

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
[subparameter 1 - Angle] 3.1.5.1.2.2 The glide path angle shall be adjusted and maintained within: a) 0.075 θ from θ for Facility Performance Categories I and II ILS glide paths; b) 0.04 θ from θ for Facility Performance Category III ILS glide paths. Note 1. Guidance material on adjustment and maintenance of glide path angles is given in 2.4 of Attachment C. [subparameter 2 - Tilt] 3.1.5.3.1 The glide path equipment shall provide signals sufficient to allow satisfactory operation of a typical aircraft installation in sectors of 8 degrees in azimuth on each side of the centre line of the ILS glide path, to a distance of at least 18.5 km (10 NM) up to 1.75 θ and down to 0.45 θ above the horizontal or to such lower angle, down to 0.30 θ, as required to safeguard the promulgated glide path intercept procedure.	[subparameter 1 - Angle] Angle: Cat I: Within 7.5% of nominal angle Cat II: Within 7.5% of nominal angle Cat III: Within 4% of nominal angle	[subparameter 1 - Angle] Angle: C: Within ± 0.05° of the commissioned angle. (Sit Survey, USAF test van: ± 0.1° of the commissioned angle) P: Within + 10.0% to -7.5% of the commissioned angle. Angle Alignment: CAT I - Not applicable CAT II and III (Also CAT I authorized use below CAT I minima) Zone 3: ± 37.5 µA about the commissioned angle at Point B; expanding linearly to ± 48.75 µA about the commissioned angle at Point C; expanding linearly to ± 75 µA about the commissioned angle at ILS reference datum. [subparameter 2 - Tilt] Tilt: Within + 10.0% to -7.5% of the commissioned angle. Clearance Above Path, Modulation (no criteria?) Clearance Below Path - 180µA Transmitter Differential: C: ± 0.10° P: ± 0.20°	NOTE: Only the setting or ADJUST tolerance is addressed under this parameter of Alignment. See MONITOR parameter for the maintenance limits discussion and comparison. [subparameter 1 - Angle] Angle -- 8200 easily exceeds Annex 10 [subparameter 2 - Tilt] There is no angle accuracy requirement in the Til text of Annex 10 (see Annex 10 Remarks). NOTE: In the 8200 GS Tolerances table, for Tilt, the words "Clearance Above Path, Modulation" appear, with no apparent tolerances. This parameter is marked "Matches for some, doesn't for others" solely due to this apparent missing tolerance. Once this is corrected or deemed acceptable, this parameter should be changed to "…matches Annex 10 for All."

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
CAT I,II: Within 7.5% of design path angle CAT III: Within 4% of design path angle	[same as Annex 10] CAT I,II: Within 7.5% of angle CAT III: Within 4% of angle	For a 3.00 deg GS, the 8200 commissioning tolerance of 0.05 deg is within 1.7%, and the periodic tolerance of 0.1 deg is within 3.3%. For a 2.5 deg (minimum angle) GS, the tolerance are 2% and 4% respectively.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		For a 5.0 deg GS, the tolerances are 1% and 2% respectively. The 8200 tolerances for Angle Alignment, tilt, and transmitter differential do not specifically appear in Annex 10.	
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
This Annex 10 text contains both setting (adjust) and monitor (maintain) limits. See also the MONITOR and COVERAGE parameters. Indirectly, a path angle requirement, out to 8 degrees in azimuth either side of the centerline, is found in the Annex 10 text re: coverage, in paragraph 3.1.5.3.1 However, the meaning of "satisfactory operation of a typical aircraft installation" is not defined. This must NOT mean "satisfactory approach guidance", since obstacle protection of a quality equal to centerline angle tolerances is not provided at such wide azimuth angles. Thus, "satisfactory operation of a typical aircraft installation" is deduced to mean that warning flag alarms do not occur out to 8 degrees either side -- i.e., signal strength COVERAGE is required to 8 degrees.		The 8200 Tilt tolerance of +10% exceeds the stated +7.5% tolerance in Annex 10. However, it applied in 8200 off the runway centerline.	
	Measurement Uncertainty Cat I: 0.75%		

Annex10_ID	8071_ID	8200_ID	Results_ID
428	601	363	624

Facility GS **Parameter** Clearance

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for some, doesn't for others

SARPS Ref 3.1.5.6.5, 3.1.5.3.1

Annex Ref 3.1.5.6.5 **8071 Reference** 4.3.3.4.4 **8200 Reference** 15.30f, 15.30g

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
[subparameter 1 - Clearances below path] 3.1.5.6.5 The DDM below the ILS glide path shall increase smoothly for decreasing angle until a value of 0.22 DDM is reached. This value shall be achieved at an angle not less than 0.30 θ above the horizontal. However, if it is achieved at an angle above 0.45 θ, the DDM value shall not be less than 0.22 at least down to 0.45 θ or to such lower angle, down to 0.30 θ, as required to safeguard the promulgated glide path intercept procedure. Note. The limits of glide path equipment adjustment are pictorially represented in Figure C-11 of Attachment C. [This text also appears under parameter DISPLACEMENT SENSITIVITY.] [subparameter 2 - Clearances above path] 3.1.5.3.1 The glide path equipment shall provide signals sufficient to allow satisfactory operation of a typical aircraft installation in sectors of 8 degrees in azimuth on each side of the centre line of the ILS glide path, to a distance of at least 18.5 km (10 NM) up to 1.75 θ and down to 0.45 θ above the horizontal or to such lower angle, down to 0.30 θ, as required to safeguard the promulgated glide path intercept procedure. [This text also appears under COVERAGE parameter.]	[subparameter 1 - Clearances below path] Below Path: Not less than 190 μA at an angle above the horizontal of not less than 0.3 θ . If 190 μA is realized at an angle greater than 0.45 θ , a minimum of 190 μA must be maintained at least down to 0.45 θ . [subparameter 2 - Clearances above path] Above Path: Must attain at least 150 μA and not fall below 150 μA until 1.75 θ is reached.	[subparameter 1 - Clearances below path] 15.30f: 190 μA of fly-up signal occurs at an angle which is at least 30% of the commissioned angle. Exception: If this tolerance cannot be met, apply clearance procedures and tolerances. 15.30g: Below Path: Adequate obstacle clearance at no less than 180 μA of fly-up signal in normal (150 μA in any monitor limit condition). [subparameter 2 - Clearances above path] 15.30g: Above Path: 150 μA of fly-down signal occurs at some point prior to the first false path.	[subparameter 1 - Clearances below path] 8200 matches Annex 10 in the basic requirement to provide at least 190 uA by an angle as low as 0.3 θ . Annex 10 also defines how to handle meeting the 190 uA at angles above 0.45θ , by saying that DDM may not drop below 190 uA before that angle, and must remain above 190 uA down to 0 θ if required by the procedure. However, 8200 does not specifically address this and it is possible for 190 uA to occur above 0.45θ , then DDM could drop below 190 uA at an angle between 0.30θ and 0.45 θ without violating 8200 tolerances. [See also OBSTRUCTION CLEARANCE parameter.] [subparameter 2 - Clearances above path] [Use Doc 8071 definition of coverage above path 8200's requirement for 150 uA prior to the first false path could have 150 uA occurring at 1.9 θ . This would exceed the Annex 10/Doc 8071 requirement of exceeding 150 uA by 1.75 θ . Recommendation: Consider modifying Order 8200.1 to address the two above anomalies. These issues do not warrant filing a difference with ICAO.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
[subparameter 1 - Clearances below path] Below: increase to 0.22 DDM at >=0.3 θ . If reached at >0.45 θ , >0.22 DDM down to 0.45 θ or lower if required for procedure..	[subparameter 1 - Clearances below path] 190 μA by 0.3 θ . If above 0.45 θ , no less than 190 down to 0.45 θ	[subparameter 1 - Clearances below path] 190 μA by 0.3 θ .with an exception allowed, but not defined in the tolerances.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
[subparameter 2 - Clearances above path] Above: No warning flag up to 1.75 θ .	[subparameter 2 - Clearances above path] >=150 until up to 1.75 θ .	[subparameter 2 - Clearances above path] 150 uA occurs prior to first false path	
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
Indirectly, a Clearance requirement is found in the Annex 10 3.1.5.3.1 text re: Coverage, since "satisfactory operation of a typical aircraft installation" performance is required up to 1.75 θ .to support intercept. However, the meaning of "satisfactory operation of a typical aircraft installation" is not defined. It is deduced to mean that warning flag alarms do not occur up to that upper angle limit -- i.e., signal strength COVERAGE is required to 1.75 θ .		[subparameter 2 - Clearances above path] First false path in not explicitly defined. It could b where DDM = 0 with normal sensing, and no warning flag occurs. This angle would then be 9 degrees for a 3 degree GS. If it means merely a warning flag occurs, it would be 6 degrees.	
	Measurement Uncertainty ± 6 μA For a nominal 190 μA input.		

Annex10_ID	8071_ID	8200_ID	Results_ID
429	602	364	625

Facility GS **Parameter** Continuity of Service

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 3.1.5.8 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.5.8.3 The probability of not losing the radiated guidance signal shall be greater than 1 - 2 × 10-6 in any period of 15 seconds for Facility Performance Categories II and III glide paths (equivalent to 2 000 hours mean time between outages). 3.1.5.8.4 Recommendation. The probability of not losing the radiated guidance signal should exceed 1 - 4 × 10-6 in any period of 15 seconds for Facility Performance Category I glide paths (equivalent to 1 000 hours mean time between outages). Note. Guidance material on integrity and continuity service is given in 2.8 of Attachment C.			This is a design qualification and/or ground maintenance issue. Flight testing does not address this. The ground maintenance program will be addressing Continuity of Service more rigorously due to the imminent (as of 03/07) publication of the following order: 6750.xx, Instrument Landing System Continuity c Service Requirements and Procedures

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
430			626

Facility GS **Parameter** Coverage

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for some, doesn't for others

SARPS Ref

Annex Ref 3.1.5.3 **8071 Reference** 4.3.3.4.8 **8200 Reference** 15.30n

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
[subparameter 1 - Coverage Volume] 3.1.5.3.1 The glide path equipment shall provide signals sufficient to allow satisfactory operation of a typical aircraft installation in sectors of 8 degrees in azimuth on each side of the centre line of the ILS glide path, to a distance of at least 18.5 km (10 NM) up to 1.75 θ and down to 0.45 θ above the horizontal or to such lower angle, down to 0.30 θ, as required to safeguard the promulgated glide path intercept procedure. [subparameter 2 - Signal Strength] 3.1.5.3.2 In order to provide the coverage for glide path performance specified in 3.1.5.3.1, the minimum field strength within this coverage sector shall be 400 microvolts per metre (minus 95 dBW/m2). For Facility Performance Category I glide paths, this field strength shall be provided down to a height of 30 m (100 ft) above the horizontal plane containing the threshold. For Facility Performance Categories II and III glide paths, this field strength shall be provided down to a height of 15 m (50 ft) above the horizontal plane containing the threshold. Note 1. The requirements in the foregoing paragraphs are based on the assumption that the aircraft is heading directly toward the facility. Note 2. Guidance material on significant airborne receiver parameters is given in 2.2.5 of Attachment C. Note 3. Material concerning reduction in coverage outside 8 degrees on each side of the centre line of the ILS glide path appears in 2.4 of Attachment C.	[subparameter 1 - Coverage Volume] Flag Current: Satisfactory receiver operation in sector 8° azimuth either side of the localizer centerline for at least 10 NM up to 1.75theta and down to 0.45theta above the horizontal, or to a lower angle, down to 0.3theta as required to safeguard the glidepath intercept procedure. [subparameter 2 - Signal Strength] Field Strength: > 400 uV/meter (-95 dBW/m2) (Refer to Annex 10 for specific signal strength requirements.)	At or greater than: Signal Level: 15 µV Flag Alarm: No Flag or indication of invalid signal Fly-up/ Fly-down Signal: 150 µA Clearance and Structure in tolerance. Interference must not cause an out-of-tolerance condition.	[subparameter 1 - Coverage Volume] Given the physical limits of the coverage volume of the Annex 10 reference are met, 8200 meets this requirement. [subparameter 2 - Signal Strength] Since the units of signal LEVEL in 8200 appear to be received voltage level at the receiver input terminals across a 50 ohm load, it is not possible to determine whether the Annex 10 field strength or power density requirements are met, without knowledge of the airborne flight inspection antenna's Gain Factor or Capture Area. Editorially, the 15 uV criterion appears sufficient i daily use, given the myriad combinations of user receivers, feedlines, and antennas producing satisfactory landing guidance. Although it isn't possible at present to say that 8200 fully meets Annex 10 because of the units differences, this should not warrant filing an ICAO difference.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
[subparameter 1 - Coverage Volume]	[subparameter 1 - Coverage Volume]	Simultaneously: >= 15 uV, no flag, at least 150 uA DDM, structure

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
"Satisfactory operation" at +/- 8 degrees az, to >= 10 NM, up to 1.75 θ and down to 0.45 θ or lowe if required. [subparameter 2 - Signal Strength] >= 400 uV/m (-95 dBW/m2) for CAT I: down to 100' above threshold plane CAT II/III: down to 50' above threshold plane	"Satisfactory operation" at +/- 8 degrees az, to >= 10 NM, up to 1.75 θ and down to 0.45 θ or lowe if required. [subparameter 2 - Signal Strength] >= 400 uV/m (-95 dBW/m2) for CAT I: down to 100' above threshold plane CAT II/III: down to 50' above threshold plane	good, no interference.	
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
[subparameter 2 - Signal Strength] Units are for E field and power density.	Doc 8071 tolerances are same as in Annex 10.	[subparameter 1 - Coverage Volume] The coverage volume is the same as for Annex 1 8200 chooses to use receiver input power (15 uV lack of flag alarm, at least 150 uA, etc., as the criterion for "satisfactory operation" of a typical aircraft installation. This appears more than sufficient. [subparameter 2 - Signal Strength] The 8200 signal LEVEL requirement of 15 uV appears to be uV at the receiver terminals across 50 ohms. If so, this is neither Field Strength or Power Density, both of which are used in Annex 1 to specify the criterion for meeting the coverage volume.	
	Measurement Uncertainty		

Annex10_ID	8071_ID	8200_ID	Results_ID
431	603	365	627

Facility GS **Parameter** Displacement Sensitivity

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for all

SARPS Ref 3.1.5.6

Annex Ref 3.1.5.6 **8071 Reference** 4.3.3.4.2 **8200 Reference** 15.30f

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
[subparameter 1 - nominal D.S.] 3.1.5.6.1 For Facility Performance Category I ILS glide paths, the nominal angular displacement sensitivity shall correspond to a DDM of 0.0875 at angular displacements above and below the glide path between 0.07 θ and 0.14 θ. Note. The above is not intended to preclude glide path systems which inherently have asymmetrical upper and lower sectors. 3.1.5.6.2 Recommendation. For Facility Performance Category I ILS glide paths, the nominal angular displacement sensitivity should correspond to a DDM of 0.0875 at an angular displacement below the glide path of 0.12 θ with a tolerance of plus or minus 0.02 θ. The upper and lower sectors should be as symmetrical as practicable within the limits specified in 3.1.5.6.1. 3.1.5.6.3 For Facility Performance Category II ILS glide paths, the angular displacement sensitivity sha be as symmetrical as practicable. The nominal angular displacement sensitivity shall correspond to a DDM of 0.0875 at an angular displacement of: a) 0.12 θ below path with a tolerance of plus or minus 0.02 θ; b) 0.12 θ above path with a tolerance of plus 0.02 θ and minus 0.05 θ 3.1.5.6.4 For Facility Performance Category III ILS glide paths, the nominal angular displacement sensitivity shall correspond to a DDM of 0.0875 at angular displacements above and below the glide path of 0.12 θ with a tolerance of plus or minus 0.02 θ. 3.1.5.6.5 The DDM below the ILS glide path shall increase smoothly for decreasing angle until a value of 0.22 DDM is reached. This value shall be achieved at an angle not less than 0.30 θ above the horizontal. However, if it is achieved at an angle	Refer to Annex 10, paragraph 3.1.5.6	C: 0.7° ± 0.05° (Site Survey, USAF test van: 0.7° ± 0.1°) P: 0.7° ± 0.2°	[subparameter 1 - nominal D.S.] ICAO defines the nominal DS as a function of path angle, while in the US the DS is set to a fixe value of 0.7 degrees, regardless of path angle. The US fixed value of DS meets the ICAO nominal value requirements ("between 0.07 θ. ar 0.14 θ.") for path angles between 5 and 2.5 degrees respectively. This range includes the standard GP angle range in the U.S. -- MEETS See also SYMMETRY parameter. See also CLEARANCE parameter. [subparameter 2 - D.S. adjust/maintain limits] NOTE: Only the setting or ADJUST tolerance is addressed under this parameter of DS. See MONITOR parameter for the maintenance limits discussion and comparison. The US commissioning setting tolerance of 7.15% is about half of the tightest ICAO ADJUST AND MAINTAIN tolerance. MEETS

above 0.45 θ, the DDM value shall not be less than 0.22 at least down to 0.45 θ or to such lower angle, down to 0.30 θ, as required to safeguard the promulgated glide path intercept procedure.
Note. The limits of glide path equipment adjustmen are pictorially represented in Figure C-11 of Attachment C. [See also parameters CLEARANCE and OBSTRUCTION CLEARANCE.]

[subparameter 2 - D.S. adjust/maintain limits]

3.1.5.6.6 For Facility Performance Category I ILS glide paths, the angular displacement sensitivity sh be adjusted and maintained within plus or minus 25 per cent of the nominal value selected.

3.1.5.6.7 For Facility Performance Category II ILS glide paths, the angular displacement sensitivity sh be adjusted and maintained within plus or minus 20 per cent of the nominal value selected.

3.1.5.6.8 For Facility Performance Category III ILS glide paths, the angular displacement sensitivit shall be adjusted and maintained within plus or minus 15 per cent of the nominal value selected.

Note. Guidance material on ILS glide path adjustment and maintenance values is given in Attachment C, 2.1.5.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
CAT I: Nominal DS +/- 25% CAT II: Nominal DS +/- 20% CAT III: Nominal DS +/- 15% These include setting and monitor tolerances -- se MONITOR parameter.	Same as Annex 10 (by reference)	C: 0.7° ± 0.05° (7.14% of US nominal value) P: 0.7° ± 0.2° (28.6% of US nominal value))

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
3.1.5.6.1 through 3.1.5.6.5 define design goals for the nominal value of this parameter, against which the adjust and maintain limits are applied. The actual tolerances for deployed equipment are foun in 3.1.5.6.6 through 3.1.5.6.8 The tolerances include setting tolerances ("adjust" and (effectively) monitor ("maintain") tolerances.		

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
	Measurement Uncertainty Cat I: 2.5%		
Annex10_ID	**8071_ID**	**8200_ID**	**Results_ID**
432	604	366	628

Facility GS **Parameter** Frequency Pairing

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 3.1.6 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.6 Localizer and glide path frequency pairing 3.1.6.1 The pairing of the runway localizer and glide path transmitter frequencies of an instrument landin system shall be taken from the following list in accordance with the provisions of Volume V, Chapter 4, 4.2: Localizer Glide path (MHz) (MHz) 108.1 334.7 108.15 334.55 108.3 334.1 108.35 333.95 108.5 329.9 108.55 329.75 108.7 330.5 108.75 330.35 108.9 329.3 108.95 329.15 109.1 331.4 109.15 331.25 109.3 332.0 109.35 331.85 109.5 332.6 109.55 332.45 109.7 333.2 109.75 333.05 109.9 333.8 109.95 333.65 110.1 334.4 110.15 334.25 110.3 335.0 110.35 334.85 110.5 329.6 110.55 329.45 110.7 330.2 110.75 330.05 110.9 330.8 110.95 330.65 111.1 331.7 111.15 331.55 111.3 332.3 111.35 332.15 111.5 332.9			This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

111.55	332.75
111.7	333.5
111.75	333.35
111.9	331.1
111.95	330.95

3.1.6.1.1 In those regions where the requirements for runway localizer and glide path transmitter frequencies of an instrument landing system do not justify more than 20 pairs, they shall be selected sequentially, as required, from the following list:

Sequence number	Localizer (MHz)	Glide path (MHz)
1	110.3	335.0
2	109.9	333.8
3	109.5	332.6
4	110.1	334.4
5	109.7	333.2
6	109.3	332.0
7	109.1	331.4
8	110.9	330.8
9	110.7	330.2
10	110.5	329.6
11	108.1	334.7
12	108.3	334.1
13	108.5	329.9
14	108.7	330.5
15	108.9	329.3
16	111.1	331.7
17	111.3	332.3
18	111.5	332.9
19	111.7	333.5
20	111.9	331.1

ICAO Annex Tol

Doc 8071 Tolerance

8200 Tolerance

ICAO Annex Remarks

Doc 8071 Remarks

8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
433			629

Facility GS **Parameter** Integrity

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref 3.1.5.8

SARPS Ref

8071 Reference

8200 Reference

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.5.8.1 The probability of not radiating false guidance signals shall not be less than 1 - 0.5 × 10-9 in any one landing for Facility Performance Categories II and III glide paths. 3.1.5.8.2 Recommendation. The probability of not radiating false guidance signals should not be less than 1 - 1.0 × 10-7 in any one landing for Facility Performance Category I glide paths.			This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
434			630

Facility GS **Parameter** Modulation

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for some & meets others

SARPS Ref

Annex Ref 3.1.5.5 **8071 Reference** 4.3.3.4.6.1 **8200 Reference** 15.30b

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
[subparameter 1 - depth of modulation] 3.1.5.5.1 The nominal depth of modulation of the radio frequency carrier due to each of the 90 Hz an 150 Hz tones shall be 40 per cent along the ILS glide path. The depth of modulation shall not deviat outside the limits of 37.5 per cent to 42.5 per cent. [subparameter 2 - modulation frequency] 3.1.5.5.2 The following tolerances shall be applie to the frequencies of the modulating tones: a) the modulating tones shall be 90 Hz and 150 Hz within 2.5 per cent for Facility Performance Categor I ILS; b) the modulating tones shall be 90 Hz and 150 Hz within 1.5 per cent for Facility Performance Categor II ILS; c) the modulating tones shall be 90 Hz and 150 Hz within 1 per cent for Facility Performance Category III ILS; [inserted from below to group with relevant text] 3.1.5.5.2.1 Recommendation. For Facility Performance Category I ILS, the modulating tones should be 90 Hz and 150 Hz within plus or minus 1.5 per cent where practicable. [subparameter 3 - spurious content] d) the total harmonic content of the 90 Hz tone shal not exceed 10 per cent: additionally, for Facility Performance Category III equipment, the second harmonic of the 90 Hz tone shall not exceed 5 per cent; e) the total harmonic content of the 150 Hz tone sh not exceed 10 per cent. 3.1.5.5.2.2 For Facility Performance Category III	Modulation Balance 0.002 DDM Modulation Depth 37.5% to 42.5% for each tone. Recommended means of measurement is by ground check	Level: C: 78 - 82% P: 75 - 85% Equality: as required) Zero µA ± 5µA	[subparameter 1 - depth of modulation] Mod Bal: 8200 is tighter for commissioning, and equals for periodics Mod Equality: 8200 is looser than Doc 8071 for both commissioning and periodics. [subparameter 2 - modulation frequency] This is a design qualification and/or ground maintenance issue. Flight testing does not address this. [subparameter 3 - spurious content] This is a design qualification and/or ground maintenance issue. Flight testing does not address this, except to the extent that any variations from spurious content visible during flight measurements will have structure tolerance applied to them. [subparameter 4 - modulation phase] This is a design qualification and/or ground maintenance issue. Flight testing does not address this. [subparameter 5 - undesired FM/PM] This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

glide path equipment, the depth of amplitude modulation of the radio frequency carrier at the power supply frequency or harmonics, or at other noise frequencies, shall not exceed 1 per cent.

[inserted from later paragraph to group with relevan text]
3.1.5.2.3 For Facility Performance Category III ILS glide path equipment, signals emanating from the transmitter shall contain no components which result in apparent glide path fluctuations of more than 0.02 DDM peak to peak in the frequency band 0.01 Hz to 10 Hz.

[subparameter 4 - modulation phase]

3.1.5.5.3 The modulation shall be phase-locked s that within the ILS half glide path sector, the demodulated 90 Hz and 150 Hz wave forms pass through zero in the same direction within:

a) for Facility Performance Categories I and II ILS glide paths: 20 degrees;

b) for Facility Performance Category III ILS glide paths: 10 degrees,

of phase relative to the 150 Hz component, every half cycle of the combined 90 Hz and 150 Hz wave form.

Note 1. The definition of phase relationship in this manner is not intended to imply a requirement for measurement of phase within the ILS half glide patl sector.

Note 2. Guidance material relating to such measure is given at Figure C-6 of Attachment C.

3.1.5.5.3.1 With two-frequency glide path systems, 3.1.5.5.3 shall apply to each carrier. In addition, the 90 Hz modulating tone of one carrier shall be phase-locked to the 90 Hz modulating tone of the other carrier so that the demodulated wave forms pass through zero in the same direction withi

a) for Categories I and II ILS glide paths: 20 degrees;
b) for Category III ILS glide paths: 10 degrees,

of phase relative to 90 Hz. Similarly, the 150 Hz tones of the two carriers shall be phase-locked so that the demodulated wave forms pass through zer

in the same direction, within:

1) for Categories I and II ILS glide paths: 20 degrees;

2) for Category III ILS glide paths: 10 degrees,

of phase relative to 150 Hz.

3.1.5.5.3.2 Alternative two-frequency glide path systems that employ audio phasing different from the normal in-phase condition described in 3.1.5.5.3.1 shall be permitted. In these alternative systems, the 90 Hz to 90 Hz phasing and the 150 Hz to 150 Hz phasing shall be adjusted to their nominal values to within limits equivalent to those stated in 3.1.5.5.3.1.

Note. This is to ensure correct airborne receiver operation within the glide path sector where the two carrier signal strengths are approximately equal.

[subparameter 5 - undesired FM/PM]

3.1.5.5.4 Recommendation. Undesired frequency and phase modulation on ILS glide path radio frequency carriers that can affect the displayed DDM values in glide path receivers should be minimized the extent practical.

Note. Relevant guidance material is given in 2.15 of Attachment C.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
[subparameter 1 - depth of modulation] 37.5-42.5% (75-85% SDM) [subparameter 2 - modulation frequency] CAT I: 90 & 150 Hz +/- 2.5% CAT II: 90 & 150 Hz +/- 1.5% CAT III: 90 & 150 Hz +/- 1.0% R CAT I: 1.5% (from 3.1.5.5.2.1) [subparameter 3 - spurious content] THD 90 & 150 Hz <=10% CAT III: 90 Hz 2nd harmonic <=5% R CAT III: spurious <=1%	none - recommended by ground personnel	

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
[subparameter 4 - modulation phase] CAT I, II: locked within 20 deg (150) CAT III: locked within 10 deg (150) CEGS: applies to both carriers CEGS CAT I,II: 90-90 Hz within 20 deg (90) CEGS CAT III: 90-90 Hz within 10 deg (90) CEGS CAT I,II: 150-150 within 20 deg (150) CEGS CAT III: 150-150 within 10 deg (150) If design uses alternative phase locking, apply above tolerances to nominally-intended value [subparameter 5 - undesired modulation] minimize as much as possible (table in Guidance Material)			

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
[subparameter 4 - modulation phase] modulation phase is a definition, not a requiremen to measure within the half sector [subparameter 5 - undesired FM/PM] Residual FM and/or PM modulation can change th DDM value on path. Attachment C discusses this, and provides recommended limits.		

Measurement Uncertainty

Mod Balance 0.001 DDM

Annex10_ID	8071_ID	8200_ID	Results_ID
435	605	367	631

Facility GS **Parameter** Monitor

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for some, doesn't for others

SARPS Ref 3.1.5.7

Annex Ref 3.1.5.7 **8071 Reference** 4.3.3.4.9 **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.5.7 Monitoring [subparameter 1 - Monitor Action] 3.1.5.7.1 The automatic monitor system shall provide a warning to the designated control points and cause radiation to cease within the periods specified in 3.1.5.7.3.1 if any of the following conditions persist: [subparameter 2 - Angle/Alignment Limit] a) shift of the mean ILS glide path angle equivalent to more than minus 0.075 θ to plus 0.10 θ from θ; [subparameter 3 - Power Reduction Limit] b) in the case of ILS glide paths in which the basic functions are provided by the use of a single-frequency system, a reduction of power output to less than 50 per cent of normal, provided the glide path continues to meet the requirements of 3.1.5.3, 3.1.5.4 and 3.1.5.5; c) in the case of ILS glide paths in which the basic functions are provided by the use of two-frequency systems, a reduction of power output for either carrier to less than 80 per cent of normal, except th a greater reduction to between 80 per cent and 50 per cent of normal may be permitted, provided the glide path continues to meet the requirements of 3.1.5.3, 3.1.5.4 and 3.1.5.5; Note. It is important to recognize that a frequency change resulting in a loss of the frequency difference specified in 3.1.5.2.1 may produce a hazardous condition. This problem is of greater operational significance for Categories II and III installations. As necessary, this problem can be dealt with through special monitoring provisions or highly reliable circuitry. [subparameter 4 - Displacement Sensitivity Limit]	Recommended means of measurement is by ground check, provided that correlation has been established between ground and air measuremen [subparameter 2 - Angle/Alignment Limit] Angle: Monitor must alarm for a change in angle c 7.5% of the promulgated angle [subparameter 4 - Displacement Sensitivity Limit] Displacement Sensitivity: Cat I: Monitor must alarm for a change in the angl between the glidepath and the line below the glidepath at which 75 µA is obtained, by more tha 0.037 θ . Cat II: Monitor must alarm for a change in displacement sensitivity by more than 25% Cat III: Monitor must alarm for a change in displacement sensitivity by more than 25% [subparameter 3 - Power Reduction Limit] Power: Monitor must alarm either for a power reduction of 3 dB, or when the coverage falls belo the requirement for the facility, whichever is the smaller change. For two-frequency glidepaths, the monitor must alarm for a change of ± 1 dB in either carrier, unless tests have proved that use of the wider limits above will not cause unacceptable signal degradation.	[following text is from "MONITOR REFERENCE VALUES" parameter in 8200] [subparameter 2 - Angle/Alignment Limit] Angle: Within + 10.0% to -7.5% of the commissioned angle [subparameter 4 - Displacement Sensitivity Limit] Width: 0.9° maximum. 0.5° minimum. [subparameter 3 - Power Reduction Limit] RF Power (Reference 15.30n) - Not less than: Signal Level - 15 µV Fly-up/ Fly-down Signal: 150 µA Flag Alarm: No Flag or indication of invalid signal	[subparameter 1 - Monitor Action] This is a design qualification and/or ground maintenance issue. Flight testing does not address this. ---------- [subparameter 2 - Angle/Alignment Limit] The requirement that an alarm occur at the flown values is a ground maintenance issue. Flight testing does not address this. The alarm limits match Annex 10. ---------- [subparameter 3 - Power Reduction Limit] The requirement that an alarm occur at the flown values and at or before specific dB change limits is a ground maintenance issue. Flight testing does not address this. The 8200 tolerances do not specifically ensure that the structure tolerances of Annex 10 para 3.1.5.4 are met at the power reduction alarm limi This subparameter does not meet Annex 10. ---------- [subparameter 4 - Displacement Sensitivity Limit The requirement that an alarm occur at the flown values is a ground maintenance issue. Flight testing does not address this Annex 10 signal-in-space limits displacement sensitivity are in terms of percentages of path angle, while 8200 limits are in terms of absolute path width (actually, path half-width). Example calculation for θ = 3.00 degrees: Annex specifies the nominal position of the 75uA line below path angle at 0.12 θ , or at 2.64 degrees. The tightest requirement for monitor

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
d) for Facility Performance Category I ILS glide paths, a change of the angle between the glide path and the line below the glide path (150 Hz predominating) at which a DDM of 0.0875 is realized by more than plus or minus 0.0375 θ; e) for Facility Performance Categories II and III ILS glide paths, a change of displacement sensitivity to value differing by more than 25 per cent from the nominal value; f) lowering of the line beneath the ILS glide path at which a DDM of 0.0875 is realized to less than 0.7475 θ from horizontal; g) a reduction of DDM to less than 0.175 within the specified coverage below the glide path sector. Note 1. The value of 0.7475 θ from horizontal is intended to ensure adequate obstacle clearance. This value was derived from other parameters of the glide path and monitor specification. Since the measuring accuracy to four significant figures is not intended, the value of 0.75 θ may be used as a monitor limit for this purpose. Guidance on obstacle clearance criteria is given in the PANS-OPS (Doc 8168). Note 2. Subparagraphs f) and g) are not intended to establish a requirement for a separate monitor to protect against deviation of the lower limits of the half-sector below 0.7475 θ from horizontal. Note 3. At glide path facilities where the selected nominal angular displacement sensitivity corresponds to an angle below the ILS glide path which is close to or at the maximum limits specified in 3.1.5.6, it may be necessary to adjust the monitor operating limits to protect against sector deviations below 0.7475 θ from horizontal. Note 4. Guidance material relating to the condition described in g) appears in Attachment C, 2.4.13. 3.1.5.7.2 Recommendation. Monitoring of the ILS glide path characteristics to smaller tolerances should be arranged in those cases where operation penalties would otherwise exist. [subparameter 5 - Monitor Shutdown Times] 3.1.5.7.3 The total period of radiation, including period(s) of zero radiation, outside the performance			action is the CAT II/III change limit of 25%, which corresponds to 0.09 θ and 0.15 θ -below the path angle -- angles of 2.73 and 2.55 respectively. The corresponding widths would be 0.72 (nominal), 0.54 (narrow), and 0.90 (wide). In this case, the 8200 limits would not protect the ICAO 0.54 width value, since 8200 would allow widths as narrow as 0.50 degrees. This subparameter does not meet Annex 10. ---------- [subparameter 5 - Monitor Shutdown Times] This is a design qualification and/or ground maintenance issue. Flight testing does not address this. ---------- [subparameter 6 - Remote Shutdown Annunciation] This is a design qualification and/or ground maintenance issue. Flight testing does not address this. Recommendation 1: Consider modifying 8200.1 to require in-tolerance structure performance for frequency glide paths at the power reduction limit Recommendation 2: Modify 8200.1 to address the possibility of exceeding Annex 10 requirements for displacement sensitivity. Given the large experience base for U.S. glide paths, these two issues do not warrant filing a difference with ICAO.

limits specified in 3.1.5.7.1 a), b), c), d), e) and f) shall be as short as practicable, consistent with the need for avoiding interruptions of the navigation service provided by the ILS glide path.

3.1.5.7.3.1 The total period referred to under 3.1.5.7.3 shall not exceed under any circumstances

6 seconds for Category I ILS glide paths;

2 seconds for Categories II and III ILS glide paths.

Note 1. The total time periods specified are never-to-be-exceeded limits and are intended to protect aircraft in the final stages of approach against prolonged or repeated periods of ILS glide path guidance outside the monitor limits. For this reason they include not only the initial period of outside tolerance operation but also the total of any or all periods of outside tolerance radiation, including periods of zero radiation, which might occur during action to restore service, for example, in the course of consecutive monitor functioning and consequent changeovers to glide path equipments or elements thereof.

Note 2. From an operational point of view, the intention is that no guidance outside the monitor limits be radiated after the time periods given, and that no further attempts be made to restore service until a period in the order of 20 seconds has elapse

3.1.5.7.3.2 Recommendation. Where practicable, the total period specified under 3.1.5.7.3.1 for Categories II and III ILS glide paths should not exceed 1 second.

[subparameter 6 - Remote Shutdown Annunciation]

3.1.5.7.4 Design and operation of the monitor system shall be consistent with the requirement tha radiation shall cease and a warning shall be provide at the designated remote control points in the event of failure of the monitor system itself.

Note. Guidance material on the design and operatio of monitor systems is given in 2.1.8 of Attachment C

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
[subparameter 2 - Angle/Alignment Limit] +10%, -7.5% of θ [subparameter 3 - Power Reduction Limit] 1fGS: @ limit of >=50%, alarm must occur, and must meet 3.1.5.3, 3.1.5.4, and 3.1.5.5 (Coverage Structure, Modulation) 2fGS: @ limit of >= 80%, alarm must occur and must meet 3.1.5.3, 3.1.5.4, and 3.1.5.5 (Coverage Structure, Modulation). Reduction to 50% allowed same requirements met. [subparameter 4 - Displacement Sensitivity Limit] CAT I: alarms if 75uA angle below path changes by more then 0.0375 θ . CAT II/III: alarms if more than 25% width change All CAT: alarms if 75 uA occurs at lower than 0.7475 θ (0.75 may be used) and alarms if 150 uA not provided within coverage are below path angle (for obstacle clearance). (A separate monitor from the width monitor is not intended for these two "All CAT" requirements.)	[subparameter 2 - Angle/Alignment Limit] Alarms for change of 7.5% of angle. [subparameter 3 - Power Reduction Limit] 1fGS: Alarms at -3dB, or if coverage fails at smaller reductions. 2fGS: Alarms at +/-1 dB, unless tests show wider limits work. [subparameter 4 - Displacement Sensitivity Limit] CAT I: Alarm for 75 uA angle lower than 0.037θ CAT II/III: Alarm for DS change more than 25%	[subparameter 2 - Angle/Alignment Limit] Matches Annex 10 [subparameter 3 - Power Reduction Limit] At alarm point: >=15 uV, >=150 uA, and no warning flag [subparameter 4 - Displacement Sensitivity Limit] <28.6% change in width

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
[subparameter 4 - Displacement Sensitivity Limit] A value of 0.75 may be used in place of the 0.7475 value. A separate monitor from the width monitor i not intended for these two "All CAT" requirements.		[subparameter 3 - Power Reduction Limit] The tolerance does not specifically protect the Structure requirement (paragraph 3.1.5.4) of Annex 10 [subparameter 4 - Displacement Sensitivity Limit] Because ICAO lists tolerances as a function of path angle, while the US uses fixed path width values for limits, the two are not directly comparable.

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
436	606	368	632

Facility GS **Parameter** Monitor Reference Values

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 15.30m

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		Angle: Within + 10.0% to -7.5% of the commissioned angle Width: 0.9° maximum. 0.5° minimum. RF Power (Reference 15.30n) - Not less than: Signal Level - 15 µV Fly-up/ Fly-down Signal: 150 µA Flag Alarm: No Flag or indication of invalid signal	This parameter name appears solely as the label used in 8200. The ICAO requirements for this parameters are listed under the MONITOR parameter.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
		369	633

Facility GS **Parameter** Obstruction Clearance

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref N/A

Annex Ref **8071 Reference** 4.3.3.4.7 **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.5.6.5 The DDM below the ILS glide path shall increase smoothly for decreasing angle until a value of 0.22 DDM is reached. This value shall be achieved at an angle not less than 0.30 θ above the horizontal. However, if it is achieved at an angle above 0.45 θ, the DDM value shall not be less than 0.22 at least down to 0.45 θ or to such lower angle, down to 0.30 θ, as required to safeguard the promulgated glide path intercept procedure. Note. The limits of glide path equipment adjustment are pictorially represented in Figure C-11 of Attachment C. [This text also appears under parameter DISPLACEMENT SENSITIVITY.]	Safe clearance @ * 180 uA (Normal), or * 150 uA (wide alarm)		This Annex 10 requirement is covered under Clearances in 8200. It is listed here because Doc 8071 used this parameter name for the reference text. See CLEARANCE PARAMETER.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Subjective Assessment

Annex10_ID	8071_ID	8200_ID	Results_ID
437	607		634

Facility GS **Parameter** Phasing

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref N/A

Annex Ref **8071 Reference** 4.3.3.4.10 **8200 Reference** 15.30d

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
[none]	No fixed tolerance. To be optimized for the site and equipment. Optional, at the request of the ground technician.	(also airborne phase verification) - No Tolerance	Phasing is a parameter used in the tune-up of a GS. There are no Annex 10 tolerances for this parameter.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
none	none	none

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

N/A

Annex10_ID	8071_ID	8200_ID	Results_ID
438	608	370	635

Facility GS **Parameter** Polarization

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 3.1.5.2 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.5.2.2 The emission from the glide path equipment shall be horizontally polarized.			This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
This is a design statement - no tolerances are give	none	none

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
439	609	371	636

Facility GS **Parameter** Radio Frequency

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 3.1.5.2 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.5.2 Radio frequency 3.1.5.2.1 The glide path equipment shall operate in the band 328.6 MHz to 335.4 MHz. Where a single radio frequency carrier is used, the frequency tolerance shall not exceed 0.005 per cent. Where two carrier glide path systems are used, the frequency tolerance shall not exceed 0.002 per cen and the nominal band occupied by the carriers shal be symmetrical about the assigned frequency. With all tolerances applied, the frequency separation between the carriers shall not be less than 4 kHz nc more than 32 kHz.			This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
440			637

Facility GS **Parameter** Reference Datum Height

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for some & meets others

SARPS Ref 3.1.5.1.2.2

Annex Ref 3.1.5.1 **8071 Reference** 4.2.3.4.1 **8200 Reference** 15.51h

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
[3.1.5.1.2.2] Note 2. Guidance material on ILS glide path curvature, alignment and siting, relevant to the selection of the height of the ILS reference datum is given in 2.4 of Attachment C and Figure C-5. 3.1.5.1.4 The height of the ILS reference datum fo Facility Performance Categories II and III ILS shall be 15 m (50 ft). A tolerance of plus 3 m (10 ft) is permitted. 3.1.5.1.5 Recommendation. The height of the ILS reference datum for Facility Performance Category ILS should be 15 m (50 ft). A tolerance of plus 3 m (10 ft) is permitted. Note 1. In arriving at the above height values for the ILS reference datum, a maximum vertical distance 5.8 m (19 ft) between the path of the aircraft glide path antenna and the path of the lowest part of the wheels at the threshold was assumed. For aircraft exceeding this criterion, appropriate steps may hav to be taken either to maintain adequate clearance a threshold or to adjust the permitted operating minim Note 2. Appropriate guidance material is given in 2. of Attachment C. 3.1.5.1.6 Recommendation. The height of the ILS reference datum for Facility Performance Category ILS used on short precision approach runway codes 1 and 2 should be 12 m (40 ft). A tolerance of plus 6 m (20 ft) is permitted.	Height of Reference Datum: Cat I: 15 m (50 ft.) + 3 m (10 ft.) (rec. Only) Cat II: 15 m (50 ft.) + 3 m (10 ft.) Cat III: 15 m (50 ft.) + 3 m (10 ft.) This requirement only arises during commissionin and categorization checks. The method of calculating the height of the extended glidepath at the threshold is described in paragraph 4.4.4, Analysis. For Cat I approaches on short code 1 and 2 runways, refer to paragraph 3.1.5.1.6 of Annex 10.	CAT I: Maximum 60 ft CAT II and III: 50 to 60 ft. (Also CAT I authorized use below CAT I minima)	While the numerical tolerances for RDH match well with ICAO documents, the application differs substantially. ICAO is considering adding clarity to its documents to define RDH as a design goal, and recommend in-flight assessment of the achieved value as "valuable". Numerous papers on measurement and use of this [design goal] parameter and its achieved physical correlated parameter exist, primarily in the international flight inspection community. They should be considered prior to making any changes in this parameter.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
CAT II/III: RDH = 50', up to 60' permitted. CAT I (Recc): 50', up to 60' permitted (40', up to 60' permitted, on short runways)	Same as Annex 10	Same as Annex 10 (actually tighter for CAT I, given that the tolerances for CAT I in Annex 10 ar only a recommendation)

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
Historically, this parameter has been the subject of substantial debate in the ICAO community,	As noted under Annex 10 remarks, Doc 8071 is likely to be changed to say that determination of	

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
especially since Doc 8071 was republished in approximately 2000. Recently adopted (late 2005) papers at the ICAO Conventional Navigation and Testing SubGroup meetings have defined RDH as a design goal for the procedure. As a result, Doc 8071 is planned to be modified to say that measurement of the RDH "may be useful" [or similar wording]. Many countries do not attempt to measure RDH with an aircraft.	whether the design goal was met at a particular G installation will be labeled "may be useful." Until the changes proposed ~2005 at ICAO meetings are formally published, it is difficult to state that there is an ICAO requirement to measure RDH, since Doc8071 is advisory, and the Annex 10 doe not define a measurement.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
441	610	372	638

Facility GS **Parameter** Structure

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for all

SARPS Ref 3.1.5.4

Annex Ref 3.1.5.4 **8071 Reference** 4.3.3.4.5 **8200 Reference** 15.30j

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
[subparameter 1 - Structure (only subparameter in Annex 10 for this parameter)] 3.1.5.4 ILS glide path structure 3.1.5.4.1 For Facility Performance Category I ILS glide paths, bends in the glide path shall not have amplitudes which exceed the following: Zone Amplitude (DDM) (95% probability) Outer limit of coverage to ILS Point "C" 0.035 3.1.5.4.2 For Facility Performance Categories II and III ILS glide paths, bends in the glide path shal not have amplitudes which exceed the following: Zone Amplitude (DDM) (95% probability) Outer limit of coverage to ILS Point "A" 0.035 ILS Point "A" to ILS Point "B" 0.035 at ILS Point "A" decreasing at a linear rate to 0.023 at ILS Point "B" ILS Point "B" to the ILS reference datum 0.023 Note 1. The amplitudes referred to in 3.1.5.4.1 and 3.1.5.4.2 are the DDMs due to bends as realized on the mean ILS glide path correctly adjusted. Note 2. In regions of the approach where ILS glide path curvature is significant, bend amplitudes are calculated from the mean curved path, and not the downward extended straight line. Note 3. Guidance material relevant to the ILS glide path course structure is given in 2.1.5 of Attachmen C.	[subparameter 1 - Structure (only subparameter ir Annex 10 for this parameter)] Cat I: From coverage limit to Point C: 30 µA. Cat II and III: From coverage limit to Point A:30 µA From Point to Point B: Linear decrease from 30 µA to 20 µA. From Point B to Reference Datum: 20 µA. Tolerances are referenced to the mean course path between points A and B, and relative to the mean curved path below point B.	[subparameter 1 - Structure (only subparameter ir Annex 10 for this parameter)] With AFIS or Tracking Device: Category 1: Zone 1 - 30 µA from graphical average path. Zone 2 - 30 µA from actual path angle. Zone 3 - 30 µA from graphical average path Category II and III (Also CAT I authorized use below CAT I minima): Zone 1 - 30 µA from graphical average path. Zone 2 - From actual path angle 30 µA at Point A then a linear decrease to 20 µA at Point B. Zone 3 - 20 µA from the graphical average path Without AFIS or tracking device (P only): Category 1: Zone 1 - 30 µA from the graphical average path. Zone 2 - 30 µA from the graphical average path. Zone 3 - 30 µA from the graphical average path. Exception: (Reference 15.50a) - An aggregate out of-tolerance condition for 354 ft may be acceptabl in a 7,089-foot segment. [subparameter 2 - Reversals] Change/Reversal (Reference 15.50b) - 25 µA per 1,000 ft in a 1,500-foot segment.	[subparameter 1 - Structure (only subparameter i Annex 10 for this parameter)] In general, 8200 matches Annex 10, except that Zone 2 with AFIS or Tracking Device, 8200 is actually more demanding, since the tolerances a applied with respect to the actual path angle, whi Annex 10 allows application of tolerances agains the "mean curved path" anywhere "curvature is significant". If the ICAO debate on the frequency content of GS structure settles to say, "apply these tolerances to characteristics slow enough that they can be flown" or similar language, then 820 should be amended to not apply tolerances to what is commonly referred to in the U.S. as "roughness". This will require defining rigorously the filtering characteristics of the receiver and AFIS combination. [subparameter 2 - Reversals] This tolerance in 8200 does not appear in the ICAO documents. Historically, it appeared in the US because some early model autopilots had difficulties with some GS structure characteristics that otherwise met ICAO tolerances, but caused unlocks. A. Editorially, it is highly likely that all these early models have been aged out of the fleet, and ther may be no real requirement for a Reversal tolerance. B. Editorially, because of the user-specific nature of this Reversal tolerance (causing the establishment of the tolerance), it moves 8200 beyond an activity of "assuring the signal-in-spac meets tolerances" using the highest quality test equipment, and begins to concern 8200 with individual user installation characteristics. Generally in the international community, the fligl testing function is to use the best equipment and deal with the signal in space, rather than how

specific installations react to signal-in-space characteristics. Rather, that function is left to the aircraft certification function in most countries.

ICAO Annex Tol

CAT I: Zone 2, 30 uA max
CAT II/III: Zone 1, 30 uA max
CAT II/III: Zone 2, 30 uA at Pt A decreasing linearly to 20 uA at Pt B
CAT II/III: Zone 3, 20 uA

Doc 8071 Tolerance

Same as Annex 10

8200 Tolerance

[subparameter 1 - Structure (only subparameter in Annex 10 for this parameter)]

Same as Annex 10 or more demanding.

[subparameter 2 - Reversals]

This tolerance does not appear in Annex 10 or Doc 8071.

ICAO Annex Remarks

Note that text refers specifically to "bends". There is recent debate in ICAO circles whether these tolerances should be applied to signal aberrations which are too fast for the aircraft to follow.

Doc 8071 Remarks

8200 Remarks

The exception statement in the 8200 tolerances implements the Annex 10 95% probability statement, by allowing out-of-tolerance results 5% of the distance, or 5% of the time (using a constant speed assumption).

Measurement Uncertainty

Cat I: 3 µA

Annex10_ID	8071_ID	8200_ID	Results_ID
442	611	373	639

Facility GS **Parameter** Structure Below Path

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 15.30f

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		190 µA of fly-up signal occurs at an angle which is at least 30% of the commissioned angle. Exception: If this tolerance cannot be met, apply clearance procedures and tolerances.	Consider deleting this parameter - covered under CLEARANCE parameter, to match placement of 190 uA angle in ICAO documents. This parameter is listed here because 8200 uses this parameter name for the same requirements as Annex 10 defines for the CLEARANCE parameter.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
		374	640

Facility GS **Parameter** Symmetry

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for all

SARPS Ref

Annex Ref 3.1.5.6 **8071 Reference** **8200 Reference** 15.30f

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
[3.1.5.6.1] Note. The above is not intended to preclude glide path systems which inherently have asymmetrical upper and lower sectors. 3.1.5.6.2 Recommendation. For Facility Performance Category I ILS glide paths, the nominal angular displacement sensitivity should correspond to a DDM of 0.0875 at an angular displacement below the glide path of 0.12 θ with a tolerance of plus or minus 0.02 θ. The upper and lower sectors should be as symmetrical as practicable within the limits specified in 3.1.5.6.1. 3.1.5.6.3 For Facility Performance Category II ILS glide paths, the angular displacement sensitivity sh be as symmetrical as practicable. The nominal angular displacement sensitivity shall correspond to a DDM of 0.0875 at an angular displacement of: a) 0.12 θ below path with a tolerance of plus or minus 0.02 θ; b) 0.12 θ above path with a tolerance of plus 0.02 θ and minus 0.05 θ 3.1.5.6.4 For Facility Performance Category III ILS glide paths, the nominal angular displacement sensitivity shall correspond to a DDM of 0.0875 at angular displacements above and below the glide path of 0.12 θ with a tolerance of plus or minus 0.02 θ.		The following criteria are applied with the facility i a normal configuration: CAT I 67-33%. Broad sector either above or belo path. CAT II 58-42%. Broad sector either above or belo path. 67-33% If broad sector below path only (Also CAT I authorized use below CAT I minima) Cat III 58-42%. Broad sector either above or belo path.	Translate Annex 10 tolerance on percentages of path angle for the75 uA angle to symmetries using 8200 definition: (The resulting symmetry percentage is the same regardless of the path angle. Example for 2.5 de path angle:) CAT II limits are 75 uA @ 0.25-0.35 deg below path, and 0.175 - 0.35 deg above path. Worst-case symmetries are then calculated for 75 uA angles of 2.25/2.85, and 2.15/2.675. The resulting Annex 10 symmetry limits are between 58.3% (broad sector above) and 33.3% (broad sector below). CAT III limits are 75 uA @ 0.25 - 0.35 deg above and below. Worst-case symmetries then calculated for 75 uA angles of 2.25/2.85, or 2.15/2.75. The resulting Annex 10 symmetry limits are between 58.3% and 41.7%. 8200 tolerances are slightly tighter. LNS NOTE to DWM: xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx Annex 10 CAT II limits are asymmetrical, and appear to allow broad sector BELOW PATH, rather than ABOVE PATH. 8200 is faithful to ICAO in this regard. Correct? Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
CAT I: [Recc only] Symmetrical as possible: CAT II: 75 uA @ 0.1 - 0.14 θ below path 75 uA @ 0.07 - 0.14 θ above path CAT III: 75 uA @ 0.1 - 0.14 θ above & below path		

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
	Measurement Uncertainty		
Annex10_ID	**8071_ID**	**8200_ID**	**Results_ID**
443		375	641

Facility GS **Parameter** System Description

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 3.1.5.1 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.5.1 General 3.1.5.1.1 The radiation from the UHF glide path antenna system shall produce a composite field pattern which is amplitude modulated by a 90 Hz and a 150 Hz tone. The pattern shall be arranged to provide a straight line descent path in the vertical plane containing the centre line of the runway, with the 150 Hz tone predominating below the path and the 90 Hz tone predominating above the path to at least an angle equal to 1.75 θ. 3.1.5.1.2 Recommendation. The UHF glide path equipment should be capable of adjustment to produce a radiated glide path from 2 to 4 degrees with respect to the horizontal. 3.1.5.1.2.1 Recommendation. The ILS glide path angle should be 3 degrees. ILS glide path angles in excess of 3 degrees should not be used except where alternative means of satisfying obstruction clearance requirements are impracticable. 3.1.5.1.2.2 The glide path angle shall be adjusted and maintained within: a) 0.075 θ from θ for Facility Performance Categories I and II ILS glide paths; b) 0.04 θ from θ for Facility Performance Category III LS glide paths. Note 1. Guidance material on adjustment and maintenance of glide path angles is given in 2.4 of Attachment C. Note 2. Guidance material on ILS glide path curvature, alignment and siting, relevant to the selection of the height of the ILS reference datum is given in 2.4 of Attachment C and Figure C-5. 3.1.5.1.3 The downward extended straight portion of the ILS glide path shall pass through the ILS reference datum at a height ensuring safe guidance over obstructions and also safe and efficient use of			This text addresses design qualification and/or Flight Procedures issues. Flight testing does not address this.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

the runway served.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
444			642

Facility LIGHTS **Parameter** Apch Lights Application

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 5.3.4.1 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
Application 5.3.4.1 Application A. Non-instrument runway Recommendation. Where physically practicable, a simple approach lighting system as specified in 5.3.4.2 to 5.3.4.9 should be provided to serve a non-instrument runway where the code number is 3 or 4 and intended for use at night, except when the runway is used only in conditions of good visibility, and sufficient guidance is provided by other visual aids. Note. A simple approach lighting system can also provide visual guidance by day. B. Non-precision approach runway Where physically practicable, a simple approach lighting system as specified in 5.3.4.2 to 5.3.4.9 shall be provided to serve a non-precision approach runway, except when the runway is used only in conditions of good visibility or sufficient guidance is provided by other visual aids. Note. It is advisable to give consideration to the installation of a precision approach category I lighting system or to the addition of a runway lead-in lighting system. C. Precision approach runway category I Where physically practicable, a precision approach category I lighting system as specified in 5.3.4.10 to 5.3.4.21 shall be provided to serve a precision approach runway category I. D. Precision approach runway categories II and III A precision approach category II and III lighting system as specified in 5.3.4.22 to 5.3.4.39 shall be provided to serve a precision approach runway category II or III.			This Annex 10 text defines how/when various lighting systems should be used. There are no flight inspection requirements for this.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
ICAO Annex Tol	**Doc 8071 Tolerance**	**8200 Tolerance**	
none			
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
Describes intended applications of various approach lighting systems			
	Measurement Uncertainty		

Annex10_ID	8071_ID	8200_ID	Results_ID
445			643

Facility LIGHTS **Parameter** CAT I Apch Lights

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 5.3.4.10 - 5.3.4.21 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
5.3.4.10 A precision approach category I lighting system shall consist of a row of lights on the extended centre line of the runway extending, wherever possible, over a distance of 900 m from th runway threshold with a row of lights forming a crossbar 30 m in length at a distance of 300 m from the runway threshold. Note. The installation of an approach lighting syster of less than 900 m in length may result in operation limitations on the use of the runway. See Attachme A, Section 11. 5.3.4.11 The lights forming the crossbar shall be as nearly as practicable in a horizontal straight line at right angles to, and bisected by, the line of the cent line lights. The lights of the crossbar shall be space so as to produce a linear effect, except that gaps may be left on each side of the centre line. These gaps shall be kept to a minimum to meet local requirements and each shall not exceed 6 m. Note 1. Spacings for the crossbar lights between 1 m and 4 m are in use. Gaps on each side of the centre line may improve directional guidance when approaches are made with a lateral error, and facilitate the movement of rescue and fire fighting vehicles. Note 2. See Attachment A, Section 11 for guidance on installation tolerances. 5.3.4.12 The lights forming the centre line shall be placed at longitudinal intervals of 30 m with the innermost light located 30 m from the threshold. 5.3.4.13 The system shall lie as nearly as practicable in the horizontal plane passing through the threshold, provided that: a) no object other than an ILS or MLS azimuth antenna shall protrude through the plane of the approach lights within a distance of 60 m from the centre line of the system; and b) no light other than a light located within the central part of a crossbar or a centre line barrette (not their extremities) shall be screened from an			This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

approaching aircraft. Any ILS or MLS azimuth antenna protruding through the plane of the lights shall be treated as an obstacle and marked and lighted accordingly.

5.3.4.14 The centre line and crossbar lights of a precision approach category I lighting system shall be fixed lights showing variable white. Each centre line light position shall consist of either:

a) a single light source in the innermost 300 m of th centre line, two light sources in the central 300 m o the centre line and three light sources in the outer 300 m of the centre line to provide distance information; or

b) a barrette.

5.3.4.15 Where the serviceability level of the approach lights specified as a maintenance objectiv in 10.4.10 can be demonstrated, each centre line light position may consist of either:

a) a single light source; or

b) a barrette.

5.3.4.16 The barrettes shall be at least 4 m in lengt When barrettes are composed of lights approximating to point sources, the lights shall be uniformly spaced at intervals of not more than 1.5 n

5.3.4.17 Recommendation. If the centre line consis of barrettes as described in 5.3.4.14 b) or 5.3.4.15 b), each barrette should be supplemented by a capacitor discharge light, except where such lightin is considered unnecessary taking into account the characteristics of the system and the nature of the meteorological conditions.

5.3.4.18 Each capacitor discharge light as describe in 5.3.4.17 shall be flashed twice a second in sequence, beginning with the outermost light and progressing toward the threshold to the innermost light of the system. The design of the electrical circuit shall be such that these lights can be operated independently of the other lights of the approach lighting system.

5.3.4.19 If the centre line consists of lights as described in 5.3.4.14 a) or 5.3.4.15 a), additional crossbars of lights to the crossbar provided at 300 r from the threshold shall be provided at 150 m, 450

m, 600 m and 750 m from the threshold. The lights forming each crossbar shall be as nearly as practicable in a horizontal straight line at right angle to, and bisected by, the line of the centre line lights. The lights shall be spaced so as to produce a linear effect, except that gaps may be left on each side of the centre line. These gaps shall be kept to a minimum to meet local requirements and each shal not exceed 6 m.

Note. See Attachment A, Section 11 for detailed configuration.

5.3.4.20 Where the additional crossbars described in 5.3.4.19 are incorporated in the system, the oute ends of the crossbars shall lie on two straight lines that either are parallel to the line of the centre line lights or converge to meet the runway centre line 30 m from threshold.

5.3.4.21 The lights shall be in accordance with the specifications of Appendix 2, Figure A2-1.

Note. The flight path envelopes used in the design o these lights are given in Attachment A, Figure A-4.

ICAO Annex Tol

Numerous physical tolerances are listed in a desig goal fashion. None is directly subject to flight inspection.

Doc 8071 Tolerance

8200 Tolerance

ICAO Annex Remarks

Text defines in detail the physical location and characteristics of a precision approach CAT I lighting system.

Doc 8071 Remarks

8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
446			644

Facility LIGHTS **Parameter** CAT II/III Apch Lights

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 5.3.4.22 - 5.3.4.39 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
5.3.4.22 The approach lighting system shall consist of a row of lights on the extended centre line of the runway, extending, wherever possible, over a distance of 900 m from the runway threshold. In addition, the system shall have two side rows of lights, extending 270 m from the threshold, and two crossbars, one at 150 m and one at 300 m from the threshold, all as shown in Figure 5-13. Where the serviceability level of the approach lights specified a maintenance objectives in 10.4.7 can be demonstrated, the system may have two side rows lights, extending 240 m from the threshold, and two crossbars, one at 150 m and one at 300 m from the threshold, all as shown in Figure 5-14. Note. The length of 900 m is based on providing guidance for operations under category I, II and III conditions. Reduced lengths may support category and III operations but may impose limitations on category I operations. See Attachment A, Section 1 5.3.4.23 The lights forming the centre line shall be placed at longitudinal intervals of 30 m with the innermost lights located 30 m from the threshold. 5.3.4.24 The lights forming the side rows shall be placed on each side of the centre line, at a longitudinal spacing equal to that of the centre line lights and with the first light located 30 m from the threshold. Where the serviceability level of the approach lights specified as maintenance objective in 10.4.7 can be demonstrated, lights forming the side rows may be placed on each side of the centre line, at a longitudinal spacing of 60 m with the first light located 60 m from the threshold. The lateral spacing (or gauge) between the innermost lights of the side rows shall be not less than 18 m nor more than 22.5 m, and preferably 18 m, but in any event shall be equal to that of the touchdown zone lights. 5.3.4.25 The crossbar provided at 150 m from the threshold shall fill in the gaps between the centre lir and side row lights. 5.3.4.26 The crossbar provided at 300 m from the			This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

threshold shall extend on both sides of the centre line lights to a distance of 15 m from the centre line

5.3.4.27 If the centre line beyond a distance of 300 m from the threshold consists of lights as describec in 5.3.4.31 b) or 5.3.4.32 b), additional crossbars of lights shall be provided at 450 m, 600 m and 750 m from the threshold.

5.3.4.28 Where the additional crossbars described in 5.3.4.27 are incorporated in the system, the oute ends of these crossbars shall lie on two straight line that either are parallel to the centre line or converge to meet the runway centre line 300 m from the threshold.

5.3.4.29 The system shall lie as nearly as practicable in the horizontal plane passing through the threshold, provided that:

a) no object other than an ILS or MLS azimuth antenna shall protrude through the plane of the approach lights within a distance of 60 m from the centre line of the system; and

b) no light other than a light located within the centr part of a crossbar or a centre line barrette (not their extremities) shall be screened from an approaching aircraft. Any ILS or MLS azimuth antenna protrudin through the plane of the lights shall be treated as a obstacle and marked and lighted accordingly.

5.3.4.30 The centre line of a precision approach category II and III lighting system for the first 300 m from the threshold shall consist of barrettes showin variable white, except that, where the threshold is displaced 300 m or more, the centre line may consi of single light sources showing variable white. Where the serviceability level of the approach lights specified as maintenance objectives in 10.4.7 can b demonstrated, the centre line of a precision approach category II and III lighting system for the first 300 m from the threshold may consist of either

a) barrettes, where the centre line beyond 300 m from the threshold consists of barrettes as describe in 5.3.4.32 a); or

b) alternate single light sources and barrettes, wher the centre line beyond 300 m from the threshold consists of single light sources as described in 5.3.4.32 b), with the innermost single light source located 30 m and the innermost barrette located 60

m from the threshold; or

c) single light sources where the threshold is displaced 300 m or more;

all of which shall show variable white.

5.3.4.31 Beyond 300 m from the threshold each centre line light position shall consist of either:

a) a barrette as used on the inner 300 m; or

b) two light sources in the central 300 m of the centre line and three light sources in the outer 300 of the centre line;

all of which shall show variable white.

5.3.4.32 Where the serviceability level of the approach lights specified as maintenance objective in 10.4.7 can be demonstrated, beyond 300 m from the threshold each centre line light position may consist of either:

a) a barrette; or

b) a single light source;

all of which shall show variable white.

5.3.4.33 The barrettes shall be at least 4 m in lengt When barrettes are composed of lights approximating to point sources, the lights shall be uniformly spaced at intervals of not more than 1.5 m

5.3.4.34 Recommendation. If the centre line beyon 300 m from the threshold consists of barrettes as described in 5.3.4.31 a) or 5.3.4.32 a), each barrett beyond 300 m should be supplemented by a capacitor discharge light, except where such lightin is considered unnecessary taking into account the characteristics of the system and the nature of the meteorological conditions.

5.3.4.35 Each capacitor discharge light shall be flashed twice a second in sequence, beginning with the outermost light and progressing toward the threshold to the innermost light of the system. The design of the electrical circuit shall be such that these lights can be operated independently of the other lights of the approach lighting system.

5.3.4.36 The side row shall consist of barrettes

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

showing red. The length of a side row barrette and the spacing of its lights shall be equal to those of th touchdown zone light barrettes.

5.3.4.37 The lights forming the crossbars shall be fixed lights showing variable white. The lights shall be uniformly spaced at intervals of not more than 2 m.

5.3.4.38 The intensity of the red lights shall be compatible with the intensity of the white lights.

5.3.4.39 The lights shall be in accordance with the specifications of Appendix 2, Figures A2-1 and A2-2

Note. The flight path envelopes used in the design o these lights are given in Attachment A, Figure A-4.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Numerous physical tolerances are listed in a desig goal fashion. None is directly subject to flight inspection.		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
Text defines in detail the physical location and characteristics of a precision approach CAT II/III lighting system.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
447			645

Facility LIGHTS **Parameter** Centerline Lights

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref 5.3.12 **SARPS Ref** **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
Application 5.3.12.1 Runway centre line lights shall be provided on a precision approach runway category II or III. 5.3.12.2 Recommendation. Runway centre line ligh should be provided on a precision approach runway category I, particularly when the runway is used by aircraft with high landing speeds or where the width between the runway edge lights is greater than 50 r 5.3.12.3 Runway centre line lights shall be provided on a runway intended to be used for take-off with ar operating minimum below an RVR of the order of 400 m. 5.3.12.4 Recommendation. Runway centre line ligh should be provided on a runway intended to be use for take-off with an operating minimum of an RVR o the order of 400 m or higher when used by aeroplanes with a very high take-off speed, particularly where the width between the runway edge lights is greater than 50 m. Location 5.3.12.5 Runway centre line lights shall be located along the centre line of the runway, except that the lights may be uniformly offset to the same side of th runway centre line by not more than 60 cm where it is not practicable to locate them along the centre line. The lights shall be located from the threshold t the end at longitudinal spacing of approximately 15 m. Where the serviceability level of the runway centre line lights specified as maintenance objectives in 10.4.7 or 10.4.11, as appropriate, can be demonstrated and the runway is intended for use in runway visual range conditions of 350 m or greater, the longitudinal spacing may be approximately 30 m. Note. Existing centre line lighting where lights are spaced at 7.5 m need not be replaced. 5.3.12.6 Recommendation. Centre line guidance fo			This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

take-off from the beginning of a runway to a displaced threshold should be provided by:

a) an approach lighting system if its characteristics and intensity settings afford the guidance required during take-off and it does not dazzle the pilot of an aircraft taking off; or

b) runway centre line lights; or

c) barrettes of at least 3 m length and spaced at uniform intervals of 30 m, as shown in Figure 5-22, designed so that their photometric characteristics and intensity setting afford the guidance required during take-off without dazzling the pilot of an aircra taking off.

Where necessary, provision should be made to extinguish those centre line lights specified in b) or reset the intensity of the approach lighting system o barrettes when the runway is
being used for landing. In no case should only the single source runway centre line lights show from the beginning of the runway to a displaced threshol when the runway is being
used for landing.

Characteristics

5.3.12.7 Runway centre line lights shall be fixed lights showing variable white from the threshold to the point 900 m from the runway end; alternate red and variable white from 900 m to 300 m from the runway end; and red from 300 m to the runway end except that for runways less than 1 800 m in length the alternate red and variable white lights shall extend from the mid-point of the runway usable for landing to 300 m from the runway end.

Note. Care is required in the design of the electrical system to ensure that failure of part of the electrical system will not result in a false indication of the runway distance remaining.

5.3.12.8 Runway centre line lights shall be in accordance with the specifications of Appendix 2, Figure A2-6 or A2-7.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

ICAO Annex Tol

Numerous physical tolerances are listed in a desig goal fashion. None is directly subject to flight inspection.

Doc 8071 Tolerance

8200 Tolerance

ICAO Annex Remarks

Text defines in detail the physical location and characteristics of runway centerline lights.

Doc 8071 Remarks

8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
448			646

Facility **LIGHTS** **Parameter** **General**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref none

Annex Ref **8071 Reference** none **8200 Reference**

ICAO Annex Text

Doc 8071 Source Text

8200 Source Text

Comparison Remarks

ICAO Annex Tol

Doc 8071 Tolerance

none

8200 Tolerance

ICAO Annex Remarks

Doc 8071 Remarks

ICAO Doc 8071 does not address lighting system

8200 Remarks

Measurement Uncertainty

N/A

Annex10_ID	8071_ID	8200_ID	Results_ID
	612		647

Facility **LIGHTS** **Parameter** **Inoperative Lights**

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for all

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 7.24a(3-4), 7.24b(1)

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		a. Approach Lighting Systems, Runway Edge Lights, Touchdown Zone, and Runway Centerline Lights will meet the following tolerances. It is not intended that these facilities be classified in accordance with Chapter 5, Section 1 unless a hazard to safety exists. (3) Inoperative Lights. For a commissioning inspection, all lights of each system must be operative, and proper filters must be in place. During routine inspection if inoperative, obscured, or misaligned lights are detected, the number and location must be noted in as much detail as practicable and this information reported to the operating or maintenance authority for corrective action. (4) Touchdown Zone and Centerline Lighting Systems. These systems are integral parts of the Category II ILS and will conform to specified criteria. When reduced minimums have been authorized on the basis of these systems being available and operative, compliance with the belo criteria is required for the application of reduced minimums. Whenever the system fails to meet th following requirements, out-of-tolerance condition exist and the system automatically reverts to application of Category I minima. (a) No more than 10% of the lights of the Centerline Lighting System may be inoperative. (b) No more than 10% of the lights on either side of the Touchdown Zone Lighting System may be inoperative. (c) No more than four consecutive lights of the Centerline Lighting system may be inoperative. (d) More than one bar (three-light fixture) of the touchdown zone system may be inoperative; however, two adjacent bars on the same side of the system may not be inoperative. A bar is considered inoperative when all of its lights are ou	Paragraph 7.24b(1) should have its own paragraph, titled INOPERATIVE LIGHTS, to parallel presentation in 7.24a(3).

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		[following text duplicated from LIGHT INTENSITY parameter] b(1) Light Intensity. The lights must be oriented so that the light intensity is substantially uniform on the runway centerline extended. The character of appearance of the light must be aviation white or xenon ARC. No color is permitted, and BOTH LIGHTS MUST BE OPERATIVE [emphasis added]. The flashing rate can be measured best by observation from the ground; however, the flight inspector should observe this feature for grossly rapid or slow flashing rate.	

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		Apch, Edge, TDZ, CL Lights: Commissioning: All lights operating TDZ, CL Lights with reduced minima: CL: <=10% inoperative, <=4 consecutive lights inoperative TDZ: <=10% on either side inoperative, <2 adjacent bars (all lamps per bar out) on same side inoperative REIL: Both lights operative

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
		Paragraph 7.24b(1) should have its own paragraph, titled INOPERATIVE LIGHTS, to parallel presentation in 7.24a(3).

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
		376	648

Facility **LIGHTS** **Parameter** **Lamp Alignment**

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for all

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 7.24a(2)

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		a. Approach Lighting Systems, Runway Edge Lights, Touchdown Zone, and Runway Centerline Lights will meet the following tolerances. It is not intended that these facilities be classified in accordance with Chapter 5, Section 1 unless a hazard to safety exists. (2) Lamp Alignment. All lamps must be aimed in both vertical and horizontal axes to provide the proper guidance along an electronic glide path of approximately 3.0°. b. Runway End Identifier Lights (REIL) will meet the following tolerances. It is not intended that the facility be classified in accordance with Chapter 5 Section 1 unless a hazard to safety exists. (2) Lamp Alignment. The system must be aligned or shielded so as to be unobjectionable to a pilot o final approach within 1,500 ft of the runway threshold on an approach path of 2.5o or higher. I the REIL lights produce an unacceptable glare within 1,500 ft of the runway threshold, the flight inspector must request that the aiming of the lamps be adjusted.	

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		Apch, Edge, TDZ, CL Lights: proper guidance @ ~3.0 degrees REIL: Unobjectionable glare to pilot @ <=1500' o threshold, at 2.5 degrees vertical or higher

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
		Subjective assessment of alignment/glare.

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
		377	649

Facility LIGHTS **Parameter** Lead-In Lights

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref 5.3.7 **SARPS Ref** **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
Application 5.3.7.1 Recommendation. A runway lead-in lighting system should be provided where it is desired to provide visual guidance along a specific approach path, for reasons such as avoiding hazardous terrain or for purposes of noise abatement. Note. Guidance on providing lead-in lighting system is given in the Aerodrome Design Manual, Part 4. 5.3.7.2 Recommendation. A runway lead-in lighting system should consist of groups of lights positioned so as to define the desired approach path and so that one group may be sighted from the preceding group. The interval between adjacent groups should not exceed approximately 1 600 m. Note. Runway lead-in lighting systems may be curved, straight or a combination thereof. 5.3.7.3 Recommendation. A runway lead-in lighting system should extend from a point as determined by the appropriate authority, up to a point where the approach lighting system, if provided, or the runway or the runway lighting system is in view. Characteristics 5.3.7.4 Recommendation. Each group of lights of a runway lead-in lighting system should consist of at least three flashing lights in a linear or cluster configuration. The system may be augmented by steady burning lights where such lights would assist in identifying the system. 5.3.7.5 Recommendation. The flashing lights should be white, and the steady burning lights gaseous discharge lights. 5.3.7.6 Recommendation. Where practicable, the flashing lights in each group should flash in sequence towards the runway.			This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
<1600m between groups of lights		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
This text defines design characteristics of lead-in lights, none of which is subject to flight inspection.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
449			650

Facility LIGHTS **Parameter** Light Intensity

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for all

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 7.24a(1), b(1)

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		a. Approach Lighting Systems, Runway Edge Lights, Touchdown Zone, and Runway Centerline Lights will meet the following tolerances. It is not intended that these facilities be classified in accordance with Chapter 5, Section 1 unless a hazard to safety exists. (1) Light Intensity. The system must be capable o operating on all light intensity settings; the relative intensity of all lights must be uniform on each individual setting. Light intensity should be checked by pilot control function and controller operation. b. Runway End Identifier Lights (REIL) will meet the following tolerances. It is not intended that the facility be classified in accordance with Chapter 5 Section 1 unless a hazard to safety exists. [following text duplicated in INOPERATIVE LIGHTS parameter] (1) Light Intensity. The lights must be oriented so that the light intensity is substantially uniform on the runway centerline extended. The character of appearance of the light must be aviation white or xenon ARC. No color is permitted, and both lights must be operative. The flashing rate can be measured best by observation from the ground; however, the flight inspector should observe this feature for grossly rapid or slow flashing rate.	7.24b(1) text, labeled light intensity, contains a tolerance on inoperative lights - this should be moved to a new subparagraph titled INOPERATIVE LIGHTS, to parallel 7.24a.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		Apch, Edge, TDZ, CL Lights: capable of all intensity settings; relative intensity of all lamps uniform per setting; pilot & controller operation REIL: substantially uniform on extended centerline; no color; reasonable rate

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
		7.24b(1) text, labeled light intensity, contains a tolerance on inoperative lights - this should be moved to a new subparagraph titled INOPERATIVE LIGHTS, to parallel 7.24a. Subjective assessment	
	Measurement Uncertainty		
Annex10_ID	**8071_ID**	**8200_ID**	**Results_ID**
		378	651

Facility LIGHTS **Parameter** Runway Edge Lights

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref 5.3.9 **SARPS Ref** **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
Application 5.3.9.1 Runway edge lights shall be provided for a runway intended for use at night or for a precision approach runway intended for use by day or night. 5.3.9.2 Recommendation. Runway edge lights should be provided on a runway intended for take-o with an operating minimum below an RVR of the order of 800 m by day. Location 5.3.9.3 Runway edge lights shall be placed along th full length of the runway and shall be in two parallel rows equidistant from the centre line. 5.3.9.4 Runway edge lights shall be placed along th edges of the area declared for use as the runway o outside the edges of the area at a distance of not more than 3 m. 5.3.9.5 Recommendation. Where the width of the area which could be declared as runway exceeds 6 m, the distance between the rows of lights should b determined taking into account the nature of the operations, the light distribution characteristics of the runway edge lights and other visual aids serving the runway. 5.3.9.6 The lights shall be uniformly spaced in rows at intervals of not more than 60 m for an instrument runway, and at intervals of not more than 100 m for non-instrument runway. The lights on opposite side of the runway axis shall be on lines at right angles t that axis. At intersections of runways, lights may be spaced irregularly or omitted, provided that adequat guidance remains available to the pilot. Characteristics 5.3.9.7 Runway edge lights shall be fixed lights showing variable white, except that: a) in the case of a displaced threshold, the lights			This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

between the beginning of the runway and the displaced threshold shall show red in the approach direction; and

b) a section of the lights 600 m or one-third of the runway length, whichever is the less, at the remote end of the runway from the end at which the take-of run is started, may show yellow.

5.3.9.8 The runway edge lights shall show at all angles in azimuth necessary to provide guidance to pilot landing or taking off in either direction. When the runway edge lights are
intended to provide circling guidance, they shall show at all angles in azimuth (see 5.3.6.1).

5.3.9.9 In all angles of azimuth required in 5.3.9.8, runway edge lights shall show at angles up to 15° above the horizontal with an intensity adequate for the conditions of visibility and ambient light in which use of the runway for take-off or landing is intended. In any case, the intensity shall be at least 50 cd except that at an aerodrome without extraneous lighting the intensity of the lights may be reduced to not less than 25 cd to avoid dazzling the pilot.

5.3.9.10 Runway edge lights on a precision approach runway shall be in accordance with the specifications of Appendix 2, Figure A2-9 or A2-10.

ICAO Annex Tol

Numerous physical tolerances are listed in a desig goal fashion. Of these, none is directly subject to flight inspection.

If providing circling guidance, lights must show at all azimuth angles.

Lights must show up to 15 degrees above horizont

Doc 8071 Tolerance

8200 Tolerance

ICAO Annex Remarks

Text defines in detail the physical location and characteristics of runway edge lights.

Doc 8071 Remarks

8200 Remarks

Measurement Uncertainty

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
Annex10_ID	8071_ID	8200_ID	Results_ID
450			652

Facility LIGHTS **Parameter** Runway End Lights

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 5.3.11 **8071 Reference** **8200 Reference** 7.22d

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
Application 5.3.11.1 Runway end lights shall be provided for a runway equipped with runway edge lights. Note. When the threshold is at the runway extremity fittings serving as threshold lights may be used as runway end lights. Location 5.3.11.2 Runway end lights shall be placed on a line at right angles to the runway axis as near to the end of the runway as possible and, in any case, not more than 3 m outside the end. 5.3.11.3 Recommendation. Runway end lighting should consist of at least six lights. The lights should be either: a) equally spaced between the rows of runway edge lights, or b) symmetrically disposed about the runway centre line in two groups with the lights uniformly spaced in each group and with a gap between the groups of not more than half the distance between the rows of runway edge lights. For a precision approach runway category III, the spacing between runway end lights, except between the two innermost lights a gap is used, should not exceed 6 m. Characteristics 5.3.11.4 Runway end lights shall be fixed unidirectional lights showing red in the direction of the runway. The intensity and beam spread of the lights shall be adequate for the conditions of visibility and ambient light in which use of the runway is intended. 5.3.11.5 Runway end lights on a precision approach runway shall be in accordance with the specifications of Appendix 2, Figure A2-8.		d. Runway End Identifier Lights. The REIL lights will be checked for synchronization of the two lights and approximate flashing rate of 120 flashes per minute for unidirectional REIL systems, or approximately 60 flashes per minute for omni-directional REIL systems. The aiming of the REIL system will be evaluated during a visual approach commencing from a distance of two miles from the runway threshold on the runway centerline extended. A descent will be made at a vertical angle not lower than 2.5° (530 ft @ 2 miles) to the runway threshold. The facility will be observed for blinding characteristics and overall effectiveness of the REIL system.	This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Numerous physical tolerances are listed in a desig goal fashion. None is directly subject to flight inspection.		(derived tolerances): Synchronized Flash rate: ~120 flashes per minute for unidirectional, ~60 for omni

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
Text defines in detail the physical location and characteristics of runway end lights.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
451		379	653

Facility LIGHTS **Parameter** Simple Apch Lights

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 5.3.4.2 - 5.3.4.9 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
5.3.4.2 A simple approach lighting system shall consist of a row of lights on the extended centre line of the runway extending, whenever possible, over a distance of not less than 420 m from the threshold with a row of lights forming a crossbar 18 m or 30 m in length at a distance of 300 m from the threshold. 5.3.4.3 The lights forming the crossbar shall be as nearly as practicable in a horizontal straight line at right angles to, and bisected by, the line of the centre line lights. The lights of the crossbar shall be spaced so as to produce a linear effect, except that, when a crossbar of 30 m is used, gaps may be left on each side of the centre line. These gaps shall be kept to a minimum to meet local requirements and each shall not exceed 6 m. Note 1. Spacings for the crossbar lights between 1 m and 4 m are in use. Gaps on each side of the centre line may improve directional guidance when approaches are made with a lateral error, and facilitate the movement of rescue and fire fighting vehicles. Note 2. See Attachment A, Section 11 for guidance on installation tolerances. 5.3.4.4 The lights forming the centre line shall be placed at longitudinal intervals of 60 m, except that, when it is desired to improve the guidance, an interval of 30 m may be used. The innermost light shall be located either 60 m or 30 m from the threshold, depending on the longitudinal interval selected for the centre line lights. 5.3.4.5 Recommendation. If it is not physically possible to provide a centre line extending for a distance of 420 m from the threshold, it should be extended to 300 m so as to include the crossbar. If this is not possible, the centre line lights should be extended as far as practicable, and each centre line light should then consist of a barrette at least 3 m in length. Subject to the approach system having a crossbar at 300 m from the threshold, an additional crossbar may be provided at 150 m from the			This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

threshold.

5.3.4.6 The system shall lie as nearly as practicable in the horizontal plane passing through the threshold, provided that:

a) no object other than an ILS or MLS azimuth antenna shall protrude through the plane of the approach lights within a distance of 60 m from the centre line of the system; and

b) no light other than a light located within the centr part of a crossbar or a centre line barrette (not their extremities) shall be screened from an approaching aircraft. Any ILS or MLS azimuth antenna protrudin through the plane of the lights shall be treated as ar obstacle and marked and lighted accordingly.

5.3.4.7 The lights of a simple approach lighting system shall be fixed lights and the colour of the lights shall be such as to ensure that the system is readily distinguishable from other aeronautical ground lights, and from extraneous lighting if present. Each centre line light shall consist of either

a) a single source; or

b) a barrette at least 3 m in length.

Note 1. When the barrette as in b) is composed of lights approximating to point sources, a spacing of 1.5 m between adjacent lights in the barrette has been found satisfactory.

Note 2. It may be advisable to use barrettes 4 m in length if it is anticipated that the simple approach lighting system will be developed into a precision approach lighting system.

Note 3. At locations where identification of the simp approach lighting system is difficult at night due to surrounding lights, sequence flashing lights installe in the outer portion of the system may resolve this problem.

5.3.4.8 Recommendation. Where provided for a noninstrument runway, the lights should show at all angles in azimuth necessary to a pilot on base leg and final approach. The intensity of the lights shoul be adequate for all conditions of visibility and ambient light for which the system has been provided.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

5.3.4.9 Recommendation. Where provided for a nonprecision approach runway, the lights should show at all angles in azimuth necessary to the pilot of an aircraft which on final approach does not deviate by an abnormal amount from the path defined by the non-visual aid. The lights should be designed to provide guidance during both day and night in
the most adverse conditions of visibility and ambier light for which it is intended that the system should remain usable.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Numerous physical tolerances are listed in a desig goal fashion. None is directly subject to flight inspection.		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
Text defines in detail the physical location and characteristics of a simple approach lighting syster		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
452			654

Facility LIGHTS **Parameter** TDZ Lights

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 5.3.13 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
Application 5.3.13.1 Touchdown zone lights shall be provided in the touchdown zone of a precision approach runway category II or III. Location 5.3.13.2 Touchdown zone lights shall extend from the threshold for a longitudinal distance of 900 m, except that, on runways less than 1 800 m in length the system shall be shortened so that it does not extend beyond the midpoint of the runway. The pattern shall be formed by pairs of barrettes symmetrically located about the runway centre line. The lateral spacing between the innermost lights of a pair of barrettes shall be equal to the lateral spacing selected for the touchdown zone marking. The longitudinal spacing between pairs of barrettes shall be either 30 m or 60 m. Note. To allow for operations at lower visibility minima, it may be advisable to use a 30 m longitudinal spacing between barrettes. Characteristics 5.3.13.3 A barrette shall be composed of at least three lights with a spacing between the lights of not more than 1.5 m. 5.3.13.4 Recommendation. A barrette should be not less than 3 m nor more than 4.5 m in length. 5.3.13.5 Touchdown zone lights shall be fixed unidirectional lights showing variable white. 5.3.13.6 Touchdown zone lights shall be in accordance with the specifications of Appendix 2, Figure A2-5.			This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
ICAO Annex Tol	**Doc 8071 Tolerance**	**8200 Tolerance**	
Numerous physical tolerances are listed in a desig goal fashion. None is directly subject to flight inspection.			
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
Text defines in detail the physical location and characteristics of runway touchdown zone lights.			
	Measurement Uncertainty		

Annex10_ID	8071_ID	8200_ID	Results_ID
453			655

Facility LIGHTS **Parameter** Threshold ID Lights

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 5.3.8 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
Application 5.3.8.1 Recommendation. Runway threshold identification lights should be installed: a) at the threshold of a non-precision approach runway when additional threshold conspicuity is necessary or where it is not practicable to provide other approach lighting aids; and b) where a runway threshold is permanently displaced from the runway extremity or temporarily displaced from the normal position and additional threshold conspicuity is necessary. Location 5.3.8.2 Runway threshold identification lights shall be located symmetrically about the runway centre line, in line with the threshold and approximately 10 m outside each line of runway edge lights. Characteristics 5.3.8.3 Recommendation. Runway threshold identification lights should be flashing white lights with a flash frequency between 60 and 120 per minute. 5.3.8.4 The lights shall be visible only in the directic of approach to the runway.			

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Flash frequency 60-120/minute		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
Text describes ID lights in general terms. Functionality is identical to REIL.		

Measurement Uncertainty

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
Annex10_ID	8071_ID	8200_ID	Results_ID
454			656

Facility LIGHTS **Parameter** Threshold Lights

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 5.3.10 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
Application of runway threshold lights 5.3.10.1 Runway threshold lights shall be provided for a runway equipped with runway edge lights except on a noninstrument or non-precision approach runway where the threshold is displaced and wing bar lights are provided. Location of runway threshold lights 5.3.10.2 When a threshold is at the extremity of a runway, the threshold lights shall be placed in a row at right angles to the runway axis as near to the extremity of the runway as possible and, in any cas not more than 3 m outside the extremity. 5.3.10.3 When a threshold is displaced from the extremity of a runway, threshold lights shall be placed in a row at right angles to the runway axis at the displaced threshold. 5.3.10.4 Threshold lighting shall consist of: a) on a non-instrument or non-precision approach runway, at least six lights; b) on a precision approach runway category I, at least the number of lights that would be required if the lights were uniformly spaced at intervals of 3 m between the rows of runway edge lights; and c) on a precision approach runway category II or III, lights uniformly spaced between the rows of runway edge lights at intervals of not more than 3 m. 5.3.10.5 Recommendation. The lights prescribed in 5.3.10.4 a) and b) should be either: a) equally spaced between the rows of runway edge lights, or b) symmetrically disposed about the runway centre line in two groups, with the lights uniformly spaced i each group and with a gap between the groups equ to the gauge of the touchdown zone marking or			This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

lighting, where such is provided, or otherwise not more than half the distance between the rows of runway edge lights.

Application of wing bar lights

5.3.10.6 Recommendation. Wing bar lights should be provided on a precision approach runway when additional conspicuity is considered desirable.

5.3.10.7 Wing bar lights shall be provided on a noninstrument or non-precision approach runway where the threshold is displaced and runway threshold lights are required, but are not provided.

Location of wing bar lights

5.3.10.8 Wing bar lights shall be symmetrically disposed about the runway centre line at the threshold in two groups, i.e. wing bars. Each wing bar shall be formed by at least five lights extending at least 10 m outward from, and at right angles to, the line of the runway edge lights, with th innermost light of each wing bar in the line of the runway edge lights.

Characteristics of runway threshold and wing bar lights

5.3.10.9 Runway threshold and wing bar lights shal be fixed unidirectional lights showing green in the direction of approach to the runway. The intensity and beam spread of the lights shall be adequate for the conditions of visibility and ambient light in which use of the runway is intended.

5.3.10.10 Runway threshold lights on a precision approach runway shall be in accordance with the specifications of Appendix 2, Figure A2-3.

5.3.10.11 Threshold wing bar lights on a precision approach runway shall be in accordance with the specifications of Appendix 2, Figure A2-4.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Numerous physical tolerances are listed in a desig goal fashion. None is directly subject to flight inspection.		

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
Text defines in detail the physical location and characteristics of runway threshold lights.			
	Measurement Uncertainty		

Annex10_ID	8071_ID	8200_ID	Results_ID
455			657

Facility LOC **Parameter** Alignment

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for some & meets others

SARPS Ref 3.1.3.6

Annex Ref 3.1.3.6 **8071 Reference** 4.3.3.2.7 **8200 Reference** 15.20g(1)

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.3.6.1 The mean course line shall be adjusted and maintained within limits equivalent to the following displacements from the runway centre line at the ILS reference datum: a) for Facility Performance Category I localizers: plu or minus 10.5 m (35 ft), or the linear equivalent of 0.015 DDM, whichever is less; b) for Facility Performance Category II localizers: plus or minus 7.5 m (25 ft); c) for Facility Performance Category III localizers: plus or minus 3 m (10 ft). 3.1.3.6.2 Recommendation. For Facility Performance Category II localizers, the mean cours line should be adjusted and maintained within limits equivalent to plus or minus 4.5 m (15 ft) displacement from runway centre line at the ILS reference datum. Note 1. It is intended that Facility Performance Categories II and III installations be adjusted and maintained so that the limits specified in 3.1.3.6.1 and 3.1.3.6.2 are reached on very rare occasions. I is further intended that design and operation of the total ILS ground system be of sufficient integrity to accomplish this aim. Note 2. It is intended that new Category II installations are to meet the requirements of 3.1.3.6.2. Note 3. Guidance material on measurement of localizer course alignment is given in 2.1.4 of Attachment C.	4.3.3.2.7 Course Alignment Accuracy. The measurement and analysis of localizer course alignment should take into account the course line bends. The alignment of the mean course line needs to be established in the following critical region before the appropriate decision height: Category I -- in the vicinity of ILS Point B. Category II -- ILS Point B to ILS reference datum. Category III -- ILS Point C to ILS Point D. 4.3.3.2.7.1 A normal ILS approach should be flown, using the glidepath where available. The aircraft's position should be recorded using the tracking or position fixing system. By relating the aircraft average position to the average measured DDM, the alignment of the localizer may be determined. 4.3.3.2.7.2 Where there are course line bends in the area being evaluated, they should be analyzed so that the average localizer alignment may be calculated. Back Course: 4.3.3.3 Localizer Back Course 4.3.3.3.1 The back course formed by some types of localizers can serve a very useful purpose as a approach aid, provided that it meets specified requirements and that an associated aid is available to provide a final approach fix. Although glide path is not to be used in conjunction with the back course, landing weather minima commensurate with those of other non precision aids can be approved. The display in the aircraft cockpit will present a reverse sensing indication to the pilot; however, pilots are well aware of this and it is not considered significant. 4.3.3.3.2 Under no circumstances should localize equipment be adjusted to enhance performance c the back course, if the adjustment would adversel affect the desired characteristics of the front course.	Paraphrased: [Relevant portions duplicated in STRUCTURE parameter.] 15.20g. Course Alignment and Structure. These checks measure the quality and alignment of the on-course signal. The alignment and structure checks are usually performed simultaneously; therefore, use the same procedures to check alignment and structure. Approved Procedure. This procedure applies to th front course (and the back course) if it is used for an approach or missed approach). (1) General. Evaluate the course along the designed procedural azimuth from the furthest point required by the type of inspection being conducted throughout the remaining zones. Maintain the published or proposed procedural altitudes through each approach segment until intercepting the glidepath and then descend on th glidepath to Point C or runway threshold. NOTE: For FAA and U.S. Non-Federal civil facilities, the alignment must meet Maintenance Reference "Initial" tolerances IAW Order VN200 8240.52, Chapter 15, any time alignment is adjusted, or at the end c a Periodic with Monitors inspection. (a) For a localizer-only approach, the published or proposed procedural altitudes must be maintained in each segment, except the final segment must b flown as follows: Upon reaching the FAF inbound, descend at a rate of approximately 400 ft per mile (930 ft per minute at 140 knots; 800 ft per minute at 120 knots) to an altitude of 100 ft below the lowest published MDA and maintain this altitude t Point C, which is the MAP. NOTE: See Appendix 1 definition of Point C for localizer only approaches. (b) For ILS approaches which support localizer-	8200 contains tolerances for Offset LOC, Offset SDF, and LDA facilities. These are not specifically addressed in Annex 10 or Doc 8071, with rare exception. 8200 matches the basic alignment tolerances for all CATegories. 8200 exceeds Annex 10 in defining alignment tolerances for SDF, LDA, and Offset facilities.

4.3.3.3.3 Where the localizer back course is to be used for approaches to landing, it should be evaluated for commissioning and at periodic intervals thereafter. Procedures used for checking the front course will normally be used for the back course, the principal difference being the application of certain different tolerances which are given in Table 4-4. At a minimum, alignment, sector width, structure, and modulation depth should be inspected.

only minima, the procedure specified in (a) above must be used in addition to the run on normal glidepath during the following inspections: Site, Commissioning, and Specials for antenna system change, user complaint or site modifications, and on a periodic inspection any time there is a significant deterioration of localizer structure.

(c) For localizers which are aligned along the runway centerline, the aircraft may be positioned along the runway centerline by visual cues or theodolite. When RTT or AFIS equipment is used the localizer on-course signal must be flown.

(d) Theodolite, RTT, or AFIS must be the method of evaluation for facilities which are not aligned along the runway centerline.

(e) For LDA(s) oriented toward a non-descript point-in-space where adequate visual checkpoints are not available and AFIS runway updates are impractical, the alignment on commissioning-type inspections must be determined using Differential GPS AFIS (truth system), pseudo runway development or theodolite. Pseudo runway development based on surveyed airport checkpoints (runway ends, taxiways, etc.) must be approved in advance by Flight Inspection Policy. Establish an equality of modulation reference for subsequent alignment and monitor comparison. During subsequent periodic inspections, facilities not requiring localizer alignment may be determined to be either Satisfactory (S) or Unsatisfactory (U), in lieu of course alignment values (refer to Paragraph 6.14d). If the actual alignment is required (i.e., SOIA, PRM), the use of Differential GPS AFIS "truth system", theodolite, or pseudo runway development is required.

(2) Roll-Out Procedures. The procedures below are required for all Category II/III localizers. They are also required for all Category I localizers installed at Part 139 airports with runway lengths of 5,000 ft or greater. Offset localizers, localizers installed without glide slopes, SDF(s), LDA(s), and facilities currently with a classification of I/ A, B, or C, need not be checked. Rollout checks and the 5 ft ILS-3 comparison checks are required on both transmitters.

(a) Site, Commissioning, Reconfiguration and Categorization Inspections of centerline oriented facilities. Use the procedures in Paragraph

15.20g(1) until reaching Point C. Cross Point C at 100 ft, runway threshold at approximately 50 ft, and continue on the extended glidepath angle to the touchdown point. Continue the landing roll and determine the actual course alignment for ILS Zones 4 and 5.

Measure the course structure from the actual alignment. If the actual alignment for Zones 4 and 5 cannot be determined using this method, taxi the aircraft along the runway centerline from abeam the glide slope to Point E. Record the raw crosspointer information and mark, abeam the glide slope, Point D and Point E. Manually calculate the actual course alignment and structure for each of the required zones.

This is also a comparison check intended to authorize the 50 ft run as a periodic check of Zone 4 and 5 structure. A comparison of structure results found on Rollout and on the 50 ft ILS-3 run is needed to determine if the expedient method of checking Zones 4 and 5 structure on the 50 ft run is valid for periodic checks. Satisfactory comparability must be defined as 3 µA or less difference between the results in each zone with both Rollout and 50 ft results being in-tolerance for that zone. Maximum structure in either zone does not have to occur at the same point on the runs to be comparable. Apply the 95% rule as specified in Paragraph 15.51a to results outside normal tolerance.

The Zone 4 and Zone 5 structure analysis determined during Rollout procedures is the definitive pass/ fail criteria, taking precedence over the results of the 50 ft ILS-3 maneuver.

Document the Rollout and ILS-3 50 ft structure comparability results IAW Order 8240.36, Appendix 8. Submit Form VN 200 8240-20, NAVAID Restriction/ Checkpoint Transmittal to the Aviation System Standards Flight Inspection Central Operations (FICO) Technical Services Sub-Team (TSS) to effect ILS Classification changes to the National Flight Data Center (NFDC).

When the Rollout check is found satisfactory on a Category I ILS and the comparability check is unsatisfactory, the TSS must contact the National Flight Procedures Office Procedures Specialist and the regional All-Weather Operations

representative to determine if any users are authorized IFR use below Category I minima. The TSS will make the final determination as to the requirement for future Zone 4 and 5 rollouts on th facility, and transmit the appropriate ILS classification to NFDC.

Refer to the Rollout flow chart and associated Rollout code legend for the Zones 4 and 5 structure comparison process.

(b) Periodic or Special Inspections which require Structure Analysis. Except for those facilities that have been identified as "Rollout Required", use th procedures in Paragraph 15.20g(1) until reaching Point C. Cross Point C at 100 ft, runway threshold at 50 ft, and then conduct a low approach at 50 to 100 ft, on runway centerline, throughout the required zones. If the aircraft cannot be maintaine on centerline for evaluation of
Zones 4 and 5 due to wind conditions, the evaluation may be conducted by taxiing the aircra down centerline throughout Zones 4 and 5.

On a facility previously checked satisfactory for Zone 4 and Zone 5 Rollout / ILS-3 50 ft run structure comparability, if Zone 4 or Zone 5 structure appears to have deteriorated since the previous inspection, or if out-of-tolerance structure is found, verify the results of this check by flying the rollout procedure listed in 15.20g(2) above. If that structure has deteriorated to below Category III standards for facilities with published classification of I, II, III/ T, D, or E (as applicable), initiate NOTAM action and send VN 200 Form 8240-20, NAVAID Facility Restriction/ Checkpoint Transmittal, to Aviation System Standards FICO TSS.

When periodic ILS-3 50 ft runs indicate improved Zone 4 and Zone 5 structure on localizers previously documented as "Rollout required" (due to unsatisfactory Zone 4 and Zone 5 Rollout / ILS 50 ft run comparability) identify the improvement t the Aviation System Standards FICO TSS. The TSS must review the facility historical results to determine if the improvement is based on season changes or long-term structure improvements, prior to any publication or NOTAM action.

As indicated in the chart below, periodic rollout checks are only required on localizers that have failed the comparability check, Zone 4 and Zone 5

Rollout is satisfactory, and a documented requirement exists where users are authorized IFI use below Category I minima.

CATEGORY CODE INSPECTION
I/ II/ III S Z4 & Z5 inspect via 50 ft run and report airborne results in Field 8
I/ II NR, U4, or Q4 Z4 & Z5 no inspection or reported results
I/ II Q5 or U5 Z4 inspect via 50 ft run; no Z5 inspection or reported results
I/ II/ III R4 or R5 Z4 & Z5 inspect via Rollout and report Rollout results in Field 8; report results of the 50 ft run in Remarks.

(3) Zones to be inspected for structure. All ILS localizers sited on the extended runway centerline must be inspected and analyzed through Zones 1 2, 3, 4, and 5 (runways less than 5,000 ft long do not have Zone 5) on all inspections requiring alignment or structure validation. These localizers must be classified according to the furthest point a which the structure conforms to Category III tolerance.

Specific reporting instructions are contained in Order 8240.36. This classification is for autoland authorization. Other facilities must be inspected and analyzed in Zones 1, 2, and 3. See Appendix and Figure 15-1 for zone identification.

Type Approach/ Facility Zones Required for Unrestricted Service (1)
Category III Zones 1, 2, 3, 4, 5
Category II ILS Zones 1, 2, 3, and 4 (see Paragraph 5.12j(9)
Category I ILS Zones 1, 2, 3
Other types of facilities or approaches Zones 1, 2 3

NOTE 1: During site, commissioning, reconfiguration, categorization, antenna, and/or frequency change inspection - check all of Zone 1 All other inspections (i.e., periodic, periodic with monitors, etc.) evaluate structure from GSI or the FAF (whichever is further) through all other required zones. For After Accident Inspections, see Paragraph 4.14g.

NOTE 2: Category II localizers failing to meet structure tolerance in Zone 4 will not be shown as restricted on the flight inspection report; however, NOTAM will be issued. See Chapter 5, Section 1.

(4) Alignment Areas. Determine the course alignment in the following areas:

Front Course From To
CAT I, II, III One mile from runway threshold Runway threshold
ILS Zone 4 Runway threshold Point D
ILS Zone 5 Point D Point E
Offset Localizers One mile from runway threshold Runway threshold or abeam runway threshold
LDAs and SDFs One mile from Point C Point C
Back Course
All Types of Facilities Two miles from the antenna One mile from the antenna
NOTE: When a restriction occurs in an area wher alignment is normally analyzed, measure alignme through manual or AFIS analyzation of the averag course signal in the following areas:
From To
One mile from the start of the restriction The start of the restriction.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Equivalent to the following displacements at the IL reference datum: CAT I: ± 10.5 m (35 ft.) or the linear equivalent c 0.015 DDM, whichever is less CAT II: ± 7.5 m (25 ft.) CAT II Recommendation: ± 4.5 m (15 ft.) CAT III: ± 3 m (10 ft.)	Equivalent to the following displacements at the ILS reference datum: Cat I: ± 10.5 m (35 ft.) Cat II: ± 7.5 m (25 ft.) [± 4.5 m (15 ft.) for thos Cat II localizers which are adjusted and maintained within ± 4.5 m] Cat III: ± 3 m (10 ft.) Back Course: Within 60 m of the extended center line at 1 NM	C: Within ± 3 µA of the designed procedural azimuth. P: For ILS(s), localizer-only on centerline and SDF(s) on centerline. From the designed procedural azimuth: CAT I ± 15 µA. CAT II ± 11 µA. CAT III ± 9 µA. Offset Loc(s), Offset SDF(s), & LDA(s) ± 20 µA Independently monitored Back Course(s) ± 20 µA. Facilities subordinate to Front Course Designed procedural azimuth +/-65 µA. At the conclusion of a monitor inspection or when alignment is adjusted, FAA and non-Federal civil localizers must be ≤ 3µA, LDA(s), offset localizers must be ≤ 8µA, and independently monitored back courses must be ≤ 10µA.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		Back Course: Independently Monitored Back Course: C: Within ± 3 µA of the designed procedural azimuth. P: For ILS(s), localizer-only on centerline and SDF(s) on centerline. From the designed procedural azimuth: CAT I ± 15 µA. CAT II ± 11 µA. CAT III ± 9 µA. Offset Localizers, Offset SDF(s), and LDA(s) ± 20 µA Back Course ± 20 µA. At the conclusion of a monitor inspection or when alignment is adjusted, FAA and non-Federal civil localizers must be ≤ 3 µA, LDA(s), offset localizers must be ≤ 8 µA, and independently monitored back courses must be ≤ 10 µA. Facilities subordinate to front course: Designed procedural azimuth ± 65 µA.	
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
Back Course alignment not addressed	Contains back course alignment tolerance. Tolerances match Annex 10. **Measurement Uncertainty** Cat I: ± 2 m		

Annex10_ID	8071_ID	8200_ID	Results_ID
456	613	380	658

Facility LOC **Parameter** Continuity of Service

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref 3.1.3.12 **SARPS Ref** **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.3.12 Integrity and continuity of service requirements 3.1.3.12.3 The probability of not losing the radiated guidance signal shall be greater than: a) 1 - 2 × 10-6 in any period of 15 seconds for Facility Performance Category II localizers or localizers intended to be used for Category III A operations (equivalent to 2 000 hours mean time between outages); and b) 1- 2 × 10-6 in any period of 30 seconds for Facility Performance Category III localizers intende to be used for the full range of Category III operations (equivalent to 4 000 hours mean time between outages). 3.1.3.12.4 Recommendation. The probability of not losing the radiated guidance signal should exceed 1 - 4 × 10-6 in any period of 15 seconds for Facility Performance Category I localizers (equivalent to 1 000 hours mean time between outages). Note. Guidance material on integrity and continuity service is given in Attachment C, 2.8.			This is a design qualification and/or ground maintenance issue. Flight testing does not address this. The ground maintenance program will be addressing Continuity of Service more rigorously due to the imminent (as of 03/07) publication of the following order: 6750.xx, Instrument Landing System Continuity c Service Requirements and Procedures

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
457			659

Facility LOC **Parameter** Course Structure

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for some & meets others

SARPS Ref 3.1.3.4

Annex Ref 3.1.3.4 **8071 Reference** 4.3.29 - 4.3.33 **8200 Reference** 15.20g

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.3.4.1 For Facility Performance Category I localizers, bends in the course line shall not have amplitudes which exceed the following: Zone / Amplitude (DDM) (95% probability) Outer limit of coverage to ILS Point"A" / 0.031 ILS Point "A" to ILS Point "B" / 0.031 at ILS Point "A" decreasing at a linear rate to 0.015 at ILS Point "B" ILS Point "B" to ILS Point "C" / 0.015 3.1.3.4.2 For Facility Performance Categories II and III localizers, bends in the course line shall not have amplitudes which exceed the following: Zone / Amplitude (DDM) (95% probability) Outer limit of coverage to ILS Point"A" / 0.031 ILS Point "A" to ILS Point "B" / 0.031 at ILS Point "A" decreasing at a linear rate to 0.005 at ILS Point "B" ILS Point "B" to the ILS reference datum / 0.005 and, for Category III only: ILS reference datum to ILS Point "D" / 0.005 ILS Point "D" to ILS Point "E" / 0.005 at ILS Point "D" increasing at a linear rate to 0.010 at ILS Point "E" Note 1. The amplitudes referred to in 3.1.3.4.1 and 3.1.3.4.2 are the DDMs due to bends as realized on the mean course line, when correctly adjusted. Note 2. Guidance material relevant to the localizer course structure is given in 2.1.4, 2.1.6 and 2.1.7 of Attachment C.	Re: SARPS Reference: See Annex 10, Attach C, Note to Paragraph 2.1.3 4.3.29 Course Structure. This is an accurate measurement of course bends and may be accomplished concurrently with the alignment and displacement sensitivity checks. Recordings of approaches made during the course alignment check and during the course sensitivity checks can be used for the calculation of course bends. The center, or mean, of the total amplitude of bends represents the course line for bend evaluation purposes, and the tolerance for bends is applied to that as a reference. If the evaluation is made on airborne data, low pass filtering of the position-corrected crosspointer signal is necessary to eliminate high-frequency structure components of no practical consequence. The total time constant of the receiver and recorder DDM circuits for the measurements should be referenced to an aircraft speed of 105 knots, for which the constant is approximately 0.5 seconds (refer to Attachment C to Annex 10, paragraph 2.1.7, for specific filter guidance). From the recording of airborne measurements, the alignment for each zone for application of structure tolerances may be determined as the average course position between runway threshold and Point D, and separately between Point D and Point E. To analyze the post-filtering low frequency spectral components, the guidance found in Attachment C to Annex 10, paragraphs 2.1.4 and 2.1.6, should be used, with the structure tolerances referenced to the average course position in each zone. 4.3.30 For evaluation of course centerline structure, a normal approach should be flown, using the glidepath where available. For Category II and III localizers, the aircraft should cross threshold at approximately the normal design height of the glidepath, and continue downward to the normal touchdown point. Continue a touchdown roll until at least Point E. Optionally, the touchdown roll may be conducted from	Paraphrased: [Portions relevant to STRUCTURE excerpted and duplicated here from ALIGNMENT parameter.] 15.20g. Course Alignment and Structure. These checks measure the quality and alignment of the on-course signal. The alignment and structure checks are usually performed simultaneously; therefore, use the same procedures to check alignment and structure. . . . (b) For ILS approaches which support localizer-only minima, the procedure specified in (a) above must be used in addition to the run on normal glidepath during the following inspections: Site, Commissioning, and Specials for antenna system change, user complaint or site modifications, and on a periodic inspection any time there is a significant deterioration of localizer structure. . . . Measure the course structure from the actual alignment. If the actual alignment for Zones 4 and 5 cannot be determined using this method, taxi the aircraft along the runway centerline from abeam the glide slope to Point E. Record the raw crosspointer information and mark, abeam the glide slope, Point D and Point E. Manually calculate the actual course alignment and structure for each of the required zones. This is also a comparison check intended to authorize the 50 ft run as a periodic check of Zone 4 and 5 structure. A comparison of structure results found on Rollout and on the 50 ft ILS-3 run is needed to determine if the expedient method of checking Zones 4 and 5 structure on the 50 ft run is valid for periodic checks. Satisfactory comparability must be defined as 3 µA or less difference between the results in each zone with both Rollout and 50 ft results being in-tolerance for	The basic Zones 1-5 tolerances in Annex 10, Doc 8071, and 8200 match. 8200 is more prescriptive in defining structure tolerances for SDF facilities and for back courses The exception in 15.50a implements the ICAO 95% probability allowance.

touchdown to Point D, at which point a takeoff ma be executed, with altitude not exceeding 50' until Point E is reached. These procedures must be used to evaluate the localizer guidance in the user's environment. Accurate tracking or position fixing must be provided from ILS point A to the following points:

For Category I -- ILS reference datum.
For Category II -- ILS reference datum.
For Category III -- ILS point E

4.3.31 For Category III bend evaluation between the ILS reference datum and ILS point E, ground measurements using a suitably equipped vehicle may be substituted for flight inspection measurements, as described in paragraph 4.2.8 and 4.2.9.

4.3.32 If the localizer's back course is used for takeoff guidance, bend measurements along the runway should be made for any category of ILS.

4.3.33 Guidance material concerning course structure is provided in 2.1.4 to 2.1.7 of Attachment C to Annex 10, Volume 1.

Note: Course structure should be measured only while the course sector is in its normal operating width.

that zone. Maximum structure in either zone does not have to occur at the same point on the runs to be comparable. Apply the 95% rule as specified in Paragraph 15.51a to results outside normal tolerance.

The Zone 4 and Zone 5 structure analysis determined during Rollout procedures is the definitive pass/ fail criteria, taking precedence ove the results of the 50 ft ILS-3 maneuver.

Document the Rollout and ILS-3 50 ft structure comparability results IAW Order 8240.36, Appendix 8. Submit Form VN 200 8240-20, NAVAID Restriction/ Checkpoint Transmittal to th Aviation System Standards Flight Inspection Central Operations (FICO) Technical Services Sub-Team (TSS) to effect ILS Classification changes to the National Flight Data Center (NFDC).

. . .

Refer to the Rollout flow chart and associated Rollout code legend for the Zones 4 and 5 structure comparison process.

(b) Periodic or Special Inspections which require Structure Analysis. Except for those facilities that have been identified as "Rollout Required", use th procedures in Paragraph 15.20g(1) until reaching Point C. Cross Point C at 100 ft, runway threshold at 50 ft, and then conduct a low approach at 50 to 100 ft, on runway centerline, throughout the required zones. If the aircraft cannot be maintaine on centerline for evaluation of
Zones 4 and 5 due to wind conditions, the evaluation may be conducted by taxiing the aircra down centerline throughout Zones 4 and 5.

On a facility previously checked satisfactory for Zone 4 and Zone 5 Rollout / ILS-3 50 ft run structure comparability, if Zone 4 or Zone 5 structure appears to have deteriorated since the previous inspection, or if out-of-tolerance structure is found, verify the results of this check by flying the rollout procedure listed in 15.20g(2) above. If that structure has deteriorated to below Category III standards for facilities with published classification of I, II, III/ T, D, or E (as applicable), initiate NOTAM action and send VN 200 Form 8240-20, NAVAID Facility Restriction/ Checkpoint Transmittal, to Aviation System Standards FICO

TSS.

When periodic ILS-3 50 ft runs indicate improved Zone 4 and Zone 5 structure on localizers previously documented as "Rollout required" (due to unsatisfactory Zone 4 and Zone 5 Rollout / ILS-50 ft run comparability) identify the improvement t the Aviation System Standards FICO TSS. The TSS must review the facility historical results to determine if the improvement is based on season changes or long-term structure improvements, prior to any publication or NOTAM action.

. . .

(3) Zones to be inspected for structure. All ILS localizers sited on the extended runway centerline must be inspected and analyzed through Zones 1 2, 3, 4, and 5 (runways less than 5,000 ft long do not have Zone 5) on all inspections requiring alignment or structure validation. These localizers must be classified according to the furthest point a which the structure conforms to Category III tolerance.

. . .

NOTE 1: During site, commissioning, reconfiguration, categorization, antenna, and/or frequency change inspection - check all of Zone 1 All other inspections (i.e., periodic, periodic with monitors, etc.) evaluate structure from GSI or the FAF (whichever is further) through all other required zones. For After Accident Inspections, see Paragraph 4.14g.

NOTE 2: Category II localizers failing to meet structure tolerance in Zone 4 will not be shown as restricted on the flight inspection report; however, NOTAM will be issued. See Chapter 5, Section 1.

(4) Alignment Areas. Determine the course alignment in the following areas:

Front Course From To
CAT I, II, III One mile from runway threshold
Runway threshold

ILS Zone 4 Runway threshold Point D

ILS Zone 5 Point D Point E

Offset Localizers One mile from runway threshold

Runway threshold or abeam runway threshold

LDAs and SDFs One mile from Point C Point C

Back Course

All Types of Facilities Two miles from the antenna One mile from the antenna

NOTE: When a restriction occurs in an area wher alignment is normally analyzed, measure alignme through manual or AFIS analyzation of the averag course signal in the following areas:

From To

One mile from the start of the restriction The start of the restriction.

ICAO Annex Tol

Outer limit of coverage to Point A:
0.031DDM all Categories

Point A to Point B:

CAT I: Linear decrease, 0.031 to 0.015
CAT II: Linear decrease, 0.031 to 0.005 DDM
CAT III: Linear decrease, 0.031 to 0.005 DDM

Inside Point B:
CAT I: 0.015 DDM to Point C
CAT II: 0.005 DDM to reference datum
CAT III: 0.005 DDM to Point D, then linear increas to 0.010 DDM at Point E

Doc 8071 Tolerance

Outer limit of coverage to Point A:
30 µA all Categories

Point A to Point B:
Cat I: Linear decrease to 15 µA
Cat II: Linear decrease to 5 µA
Cat III: Linear decrease to 5 µA

Beyond Point B:
Cat I: 15 µA to Point C
Cat II: 5 µA to Reference Datum
Cat III: 5 µA to Point D, then linear increase to 10 µA at Point E

NOTE: Course Structure along the runway may be measured by flight inspection and ground vehicle. Refer to paragraph 4.4.4 for guidance on structure analysis.

Back Course:
Limit of coverage to final approach fix: 40 µA

Final approach fix to 1 NM from threshold: ± 40 µ

Decreasing at a linear rate to ± 20 µA

8200 Tolerance

Front Course:
Zone 1 -- From the graphical average course:
CAT I,II,III: ± 30 µA to Point A
SDF: ± 40 µA to Point A

Zone 2 -- From the actual course alignment:
CAT I: ± 30 µA at Point A;
linear decrease to ± 15 µA at Point B.
CAT II,III: ± 30 µA at Point A;
linear decrease to ± 5µA at Point B,
SDF: ± 40 µA at Point A; l
linear decrease to ± 20µA at Point B.

Zone 3 -- From the actual course alignment:
CAT I: ± 15 µA at Point B;;
± 15µA at Point C.
SDF: ± 20 µA at Point C.

Zones 3&4 - From the actual course alignment:
CAT II,III: ± 5 µA at Point B;
± 5 µA to Point D.

Zone 5 -- From the actual course alignment.
CAT III: ± 5 µA at Point D; l
linear increase to ± 10 µA at Point E.

15.50a: Exception: An aggregate out-of-tolerance condition for 354 ft may be acceptable in a 7,089-foot segment.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		Back Course: Zone 1-- From the graphical average course: ± 40 µA to Point A. Zone 2 -- From actual course alignment: ± 40 µA at Point A; linear decrease to ± 20 µA at Point B. Zone 3 -- From actual course alignment ± 20 µA at Point B; ± 20 µA at Point C. 15.50a: Exception: An aggregate out-of-toleranc condition for 354 ft may be acceptable in a 7,089-foot segment.	

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
	See Annex 10, Attach C, Note to Paragraph 2.1.3 See Annex 10, Attachment C, paragraph 2.1.5 Matches Annex 10	NOTE: For localizer only approaches (ILS facilities), including RF alarm, and when alignment is determined as S/ U, structure may be measured from graphical average course

Measurement Uncertainty

Fm A to B, 3 decreasing to 1 uA

Annex10_ID	8071_ID	8200_ID	Results_ID
458	614	381	660

Facility LOC **Parameter** Coverage

8200/Annex (sub)parameter Compare Results

8200 doesn't meet A10 for any

SARPS Ref 3.1.3.3

Annex Ref 3.1.3.3 **8071 Reference** 4.3.3.2.9 **8200 Reference** 15.20j, 15.20l

ICAO Annex Text

[subparameter 1 - Service Volume)

3.1.3.3.1 The localizer shall provide signals sufficient to allow satisfactory operation of a typical aircraft installation within the localizer and glide patl coverage sectors. The localizer coverage sector shall extend from the centre of the localizer antenna system to distances of:

46.3 km (25 NM) within plus or minus 10 degrees from the front course line;

31.5 km (17 NM) between 10 degrees and 35 degrees from the front course line;

18.5 km (10 NM) outside of plus or minus 35 degrees if coverage is provided;

except that, where topographical features dictate or operational requirements permit, the limits may be reduced to 33.3 km (18 NM) within the plus or minu 10-degree sector and 18.5 km (10 NM) within the remainder of the coverage when alternative navigational facilities provide satisfactory coverage within the intermediate approach area. The localize signals shall be receivable at the distances specifie at and above a height of 600 m (2 000 ft) above the elevation of the threshold, or 300 m (1 000 ft) above the elevation of the highest point within the intermediate and final approach areas, whichever is the higher. Such signals shall be receivable, to the distances specified, up to a surface extending outward from the localizer antenna and inclined at 7 degrees above the horizontal.

Note. Guidance material on localizer coverage is given in 2.1.11 of Attachment C.

[subparameter 2 - Field Strength)

3.1.3.3.2 In all parts of the coverage volume specified in 3.1.3.3.1, other than as specified in 3.1.3.3.2.1, 3.1.3.3.2.2 and 3.1.3.3.2.3, the field strength shall be not less than 40 microvolts per metre (minus 114 dBW/m2).

Doc 8071 Source Text

4.3.3.2.9 Coverage. This check is conducted to determine that the facility provides the correct information to the user throughout the area of operational use. Coverage has been determined some extent by various other checks; however, additional procedures are necessary to complete the check of coverage at distances of 10, 17 and 25 NM from the antenna.

4.3.3.2.9.1 Flights at appropriate heights are required for routine and commissioning inspection to ensure the following coverage requirements are satisfied. Adequate coverage for modern aircraft systems may be defined by a signal level of 5 microvolts (from a calibrated antenna installation) at the receiver input together with 240 microamperes of flag current. If the ground installation is required to support aircraft fitted with receivers having a sensitivity poorer than 5 microvolts, a higher signal input (up to 15 microvolts) should be used when assessing coverage for these aircraft. The localizer coverag sector extends from the localizer antenna to distances of:

25 NM within ± 10 from the front course line;
17 NM between 10 and 35 from the front course line;
10 NM outside of ± 35 if coverage is provided.

Where topographical features dictate or operation requirements permit, the limits may be reduced to 18 NM within the 10 degree sector and 10 NM within the remainder of the coverage when alternative navigational facilities provide satisfactory coverage within the intermediate approach area. The localizer signals should be receivable at the distances specified at and above a height of 600 meters (2000 feet) above the elevation of the threshold or 300 meters (1000 feet) above the elevation of the highest point withi the intermediate and final approach areas, whichever is the higher.

4.3.3.2.9.2 At periodic inspections, it is necessary

8200 Source Text

Paraphrased:

15.20j. RF Power Monitor Reference. This inspection is conducted to determine that the localizer meets specified tolerances throughout th service volume while operating at reduced power.

Approved Procedure. This procedure applies to th front course (and the back course if it is used for an approach or missed approach). This check must be conducted with the facility operating at reduced power. Check for interference, signal strength, clearances, flag alarm, identification, an structure as follows.

Steps:

(1) Fly an arc across the localizer course at 18 miles* from the antenna at 4,500 ft above antenna elevation throughout Sector 1.

(2) Fly an arc across the localizer course at 18 miles* from the antenna at 2,000 ft above the threshold elevation or 1,000 ft above intervening terrain, whichever is higher.
If 1,000 ft above intervening terrain is higher than 4,500 ft above antenna elevation, the localizer mu be restricted. Determine a distance where terrain clearance is within the SSV for a localizer restriction distance. The facility must have an ESV for use outside the SSV.

(3) Proceed on course, inbound from 18 miles*, until reaching 7° above the horizontal (measured from the localizer antenna) at 2,000 ft above threshold elevation, or 1,000 ft above intervening terrain, whichever is higher.

(4) Fly an arc throughout Sectors 1 and 2 (and 3 if procedurally required) across the localizer cours 1,500 ft above the antenna or 500 ft above intervening terrain, whichever is higher, at 10 miles** from the antenna. Altitude is intended to b single altitude. If unable to maintain minimum terrain clearance within the SSV, restrict the facilit

Comparison Remarks

[subparameter 1 - Service Volume)

The Standard Service Volume (SSV) definition differs between Annex 10 and Order 8200.1:

8200 SSV 18 NM within ± 10°
10 NM between 10° and 35°
Annex 10 25 NM within ± 10°
17 NM between 10° and 35°

8200 applies the 25/17 NM limit for "ICAO Service Volumes".

Annex 10 has provisions for 18/10 NM limits when "topographical features or operational requirements permit."

Given the extensive US experience with Localizers, filing a difference with ICAO is not necessary, since clearly operational requirements permit reducing the SSV to 18/10 NM.

[subparameter 2 - Field Strength)

The Annex 10 measurand of Field strength is not directly measured in 8200.1. Rather, the receive signal strength at the receiver's input terminals is measured. This method of measurement assumes that receiver sensitivity is sufficient regardless of localizer field strength. Given any modern receiver, this assumption is sufficient.

It is an unproven assumption is that the 8200 lim of-coverage definition (5uV) is equivalent to the Annex 10 definition (-114 dBW/m^2). Since the units of signal LEVEL in 8200 appear to be received voltage level at the receiver input terminals across a 50 ohm load, it is not possible to determine whether the Annex 10 field strength or power density requirements are met, without knowledge of the airborne flight inspection antenna's Gain Factor or Capture Area.

Editorially, the 5 uV criterion appears sufficient in daily use, given the myriad combinations of user

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
Note. This minimum field strength is required to permit satisfactory operational usage of ILS localize facilities. 3.1.3.3.2.1 For Facility Performance Category I localizers, the minimum field strength on the ILS glide path and within the localizer course sector fror a distance of 18.5 km (10 NM) to a height of 60 m (200 ft) above the horizontal plane containing the threshold shall be not less than 90 microvolts per metre (minus 107 dBW/m2). 3.1.3.3.2.2 For Facility Performance Category II localizers, the minimum field strength on the ILS glide path and within the localizer course sector sha be not less than 100 microvolts per metre (minus 106 dBW/m2) at a distance of 18.5 km (10 NM) increasing to not less than 200 microvolts per metre (minus 100 dBW/m2) at a height of 15 m (50 ft) above the horizontal plane containing the threshold. 3.1.3.3.2.3 For Facility Performance Category III localizers, the minimum field strength on the ILS glide path and within the localizer course sector sha be not less than 100 microvolts per metre (minus 106 dBW/m2) at a distance of 18.5 km (10 NM), increasing to not less than 200 microvolts per metre (minus 100 dBW/m2) at 6 m (20 ft) above the horizontal plane containing the threshold. From this point to a further point 4 m (12 ft) above the runway centre line, and 300 m (1 000 ft) from the threshold in the direction of the localizer, and thereafter at a height of 4 m (12 ft) along the length of the runway the direction of the localizer, the field strength shall be not less than 100 microvolts per metre (minus 106 BW/m2). Note. The field strengths given in 3.1.3.3.2.2 and 3.1.3.3.2.3 are necessary to provide the signal-to-noise ratio required for improved integrity. 3.1.3.3.3 Recommendation. Above 7 degrees, the signals should be reduced to as low a value as practicable. Note 1. The requirements in 3.1.3.3.1, 3.1.3.3.2.1, 3.1.3.3.2.2 and 3.1.3.3.2.3 are based on the assumption that the aircraft is heading directly toward the facility. Note 2. Guidance material on significant airborne receiver parameters is given in 2.2.2 and 2.2.4 of	to check coverage only at 17 NM 35 degrees eithe side of the course unless use is made of the localizer outside of this area.	accordingly. NOTE: See Chapter 22 for additional ESV requirements. If the ESV altitude is within the SSV distance, special consideration will be applied to localizer support. * 25 miles from the antenna for ICAO Service Volumes. ** 17 miles from the antenna for ICAO Service Volumes. 15.20l. Coverage must be evaluated concurrently with each required check during all inspections.	receivers, feedlines, and antennas producing satisfactory localizer indications. Although it isn't possible at present to say that 8200 fully meets Annex 10 because of the units differences, this should not warrant filing an ICAO difference. Order 8200.1 does not address the Annex 10 increased field strength requirements of paragraphs 3.1.3.3.2.1 , 3.1.3.3.2.2, and 3.1.3.3.2.3, when on glide path and within the localizer course. However, again due to the extensive US experience and satisfactory localize performance, no filing of an ICAO difference is required.

Attachment C.

3.1.3.3.4 [Referred to power ratio] When coverag is achieved by a localizer using two radio frequency carriers, one carrier providing a radiation field patte in the front course sector and the other providing a radiation field pattern outside that sector, the ratio c the two carrier signal strengths in space within the front course sector to the coverage limits specified 3.1.3.3.1 shall not be less than 10 dB.

Note. Guidance material on localizers achieving coverage with two radio frequency carriers is given the Note to 3.1.3.11.2 and in 2.7 of Attachment C.

3.1.3.3.5 [Referred to power ratio] Recommendation. For Facility Performance Category III localizers, the ratio of the two carrier signal strengths in space within the front course sector should not be less than 16 dB.

ICAO Annex Tol

Refer to 3.1.3.3.1 for full details.

Field Strength: > 40 uV/meter (-114 dBW/m2)
From the localizer antenna to distances of:
25 NM within ± 10° from the course line.
17 NM between 10° and 35° from the course line.
10 NM beyond ± 35° if coverage is provided.

Additionally;
On the ILS glide path and within the localizer cours sector from a distance of:
CAT I >= 90 µV/m 10 NM to a height of 200'
CAT II >= 100 µV/m at 10 NM increasing to;
>= 200 µV/m at 50' above threshold
CAT III >= 100 µV/m at 10 NM increasing to;
>= 200 µV/m at 20' above threshold
then >= 100 µV/m to 12' above runway at 1,000' down runway and thereafter at 12'.

Doc 8071 Tolerance

Usable Distance:
From the localizer antenna to distances of:
25 NM within ± 10° from the course line.
17 NM between 10° and 35° from the course line.
10 NM beyond ± 35° if coverage is provided.

(See detailed procedure for exceptions)

Field Strength: > 40 uV/meter (-114 dBW/m2)

8200 Tolerance

At or greater than:
Signal Strength - 5 µV
Flag Alarm - No Flag or indication of invalid signal
Clearance and Structure - in tolerance
Interference - must not cause an out-of-tolerance condition.

ICAO Annex Remarks

Specifies increased field strength when on glide path and within the localizer course sector, with increasing requirements dependent on performanc category.

Doc 8071 Remarks

Usable Distance: See Annex 10, Attach C, Figures C7 and C8

8200 Remarks

Address linearity without quantitative tolerances.

8200 SSV limits:
18 NM within ± 10° from the course line.
10 NM between 10° and 35° from the course line
10 NM beyond ± 35° if coverage is provided.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		Raised to 25/17 NM for "ICAO Service Volumes" Coverage is tested in RF power alarm condition.	
	Measurement Uncertainty		

Annex10_ID	8071_ID	8200_ID	Results_ID
459	615	382	661

Facility LOC **Parameter** Displacement Sensitivity

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for some & meets others

SARPS Ref 3.1.3.7

Annex Ref 3.1.3.7 **8071 Reference** 4.3.3.2.4 **8200 Reference** 15.20f,15.51c(2)(c)

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.3.7.1 The nominal displacement sensitivity withi the half course sector at the ILS reference datum shall be 0.00145 DDM/m (0.00044 DDM/ft) except that for Category I localizers, where the specified nominal displacement sensitivity cannot be met, the displacement sensitivity shall be adjusted as near a possible to that value. For Facility Performance Category I localizers on runway codes 1 and 2, the nominal displacement sensitivity shall be achieved at the ILS Point "B". The maximum course sector angle shall not exceed 6 degrees. Note. Runway codes 1 and 2 are defined in Annex 14. 3.1.3.7.2 The lateral displacement sensitivity shall b adjusted and maintained within the limits of plus or minus: a) 17 per cent of the nominal value for Facility Performance Categories I and II; b) 10 per cent of the nominal value for Facility Performance Category III. 3.1.3.7.3 Recommendation. For Facility Performance Category II ILS, displacement sensitivity should be adjusted and maintained withir the limits of plus or minus 10 per cent where practicable. Note 1. The figures given in 3.1.3.7.1, 3.1.3.7.2 and 3.1.3.7.3 are based upon a nominal sector width of 210 m (700 ft) at the appropriate point, i.e. ILS Poir "B" on runway codes 1 and 2, and the ILS reference datum on other runways. Note 2. Guidance material on the alignment and displacement sensitivity of localizers using two radi frequency carriers is given in 2.7 of Attachment C. Note 3. Guidance material on measurement of localizer displacement sensitivity is given in 2.9 of Attachment C. 3.1.3.7.4 [This paragraph also appears in paramete	Paraphrased: 4.3.3.2.4.1 Two methods - approaches on edges or orbits. For commissioning the approach metho is recommended. Correlation between ground an air should not exceed 10%. On initial, set to nominal value [tailored]. 4.3.3.2.4.2 Approach Method offset at 75 (or 150) µA. 4.3.3.2.4.3 The orbital method of displacement sensitivity measurement is typically used during periodic inspections. 4.3.3.2.4.3.1 This procedure should be carried ou at commissioning for correlation. 4.3.3.2.4.3.2 The full sector from 150 to 150 µA should be flown so that linearity can be assessed by examining the recordings.	Paraphrased: 15.20f. Course Sector Width and Symmetry. The purpose of this check is to establish and maintain a course sector width and ratio between half-course sectors that will provide the desired displacement sensitivity required at the procedura missed approach point (MAP) or threshold and be within the limitations of the procedural protected area. Approved Procedure. This procedure applies to th front course (and back course if it is used for an approach or missed approach). Measure the course sector width and symmetry. On periodic checks, higher altitudes may be used, provided a course width comparability check (within ± 0.2°) in the normal configuration is made at the lower standard altitude. (1) Basic Method. A crossing, perpendicular to the on-course. Measure the course sector width and calculate the symmetry. (2) Theodolite or Tracking Device Method. (3) Width Requirements. Localizers, offset localizers, and LDA(s) must be tailored to a cours sector width not greater than 6° and a linear sectc width of 700 ft at the following points: (a) Point C for LDA and SDF (b) Point B for runways less than 4,000 ft long and for runways which do not conform to precisior instrument design standards. (c) Point T for facilities supporting all other applications. The tailoring requirement may be waived for facilities supporting other than CAT II or III. If the course sector width on a facility which supports a precision approach will not provide for at least 40(ft linear width at the runway threshold, the course	8200 meets Annex 10/8071 on displacement sensitivity (width) 8200 addresses symmetry with a tolerance.

OFF COURSE CLEARANCE] The increase of DDM shall be substantially linear with respect to angular displacement from the front course line (where DDM is zero) up to an angle on either side o the front course line where the DDM is 0.180. From that angle to plus or minus 10 degrees, the DDM shall not be less than 0.180. From plus or minus 10 degrees to plus or minus 35 degrees, the DDM sha not be less than 0.155. Where coverage is required outside of the plus or minus 35 degrees sector, the DDM in the area of the coverage, except in the bac course sector, shall not be less than 0.155.

Note 1. The linearity of change of DDM with respec to angular displacement is particularly important in the neighbourhood of the course line.

Note 2. The above DDM in the 10-35 degree sector is to be considered a minimum requirement for the use of ILS as a landing aid. Wherever practicable, a higher DDM, e.g. 0.180, is advantageous to assist high speed aircraft to execute large angle intercepts at operationally desirable distances provided that limits on modulation percentage given in 3.1.3.5.3.6 are met.

Note 3. Wherever practicable, the localizer capture level of automatic flight control systems is to be set at or below 0.175 DDM in order to prevent false localizer captures.

must be restricted as unusable inside the point where the linear width is 400 ft. The commissione course width of an SDF must be no greater than 12.0°. If the course width is adjustable, it must be tailored.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Sensitivity at reference datum 0.00044 DDM/ft (705') CAT I,II +/- 17.% CAT III +/-10% Recommendation - CAT II +/-10%	Cat I: Within 17% of the nominal value Cat II: Within 17% of the nominal value Cat III: Within 10% of the nominal value Back Course Width: Not less than 3°	Maximum - 6.0° (SDF-12.0°). CAT II & III tailored to 700 ft. Precision approach - 400 ft minimum course width at the threshold. Front Course: C: ± 0.1° of the commissioned width. P: Within 17% of the commissioned width. P: Tx Differential - The difference in the normal widths must not be greater than 0.5° or 10% of th commissioned width, whichever is least. Symmetry (Front course only) - 45-55% with the facility in Normal Back Course Width: C: Between 3.0° and 6.0°

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		P: Between 2.49° and 7.02° in normal or monitor alarm condition. C and P: SDFs - Within 10% of the front course sector width.	
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
	Recommended means of measurement is by ground check, provided that correlation has been established between ground and air measuremen [tolerance note].	8200 does not offer an approach procedure to analyze width, only orbital.	
	Measurement Uncertainty		
	± 3 µA		

Annex10_ID	8071_ID	8200_ID	Results_ID
460	616	383	662

Facility LOC **Parameter** Frequency Pairing

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref 3.1.6 **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.6 Localizer and glide path frequency pairing 3.1.6.1 The pairing of the runway localizer and glide path transmitter frequencies of an instrument landin system shall be taken from the following list in accordance with the provisions of Volume V, Chapter 4, 4.2: Localizer Glide path (MHz) (MHz) 108.1 334.7 108.15 334.55 108.3 334.1 108.35 333.95 108.5 329.9 108.55 329.75 108.7 330.5 108.75 330.35 108.9 329.3 108.95 329.15 109.1 331.4 109.15 331.25 109.3 332.0 109.35 331.85 109.5 332.6 109.55 332.45 109.7 333.2 109.75 333.05 109.9 333.8 109.95 333.65 110.1 334.4 110.15 334.25 110.3 335.0 110.35 334.85 110.5 329.6 110.55 329.45 110.7 330.2 110.75 330.05 110.9 330.8 110.95 330.65 111.1 331.7 111.15 331.55 111.3 332.3 111.35 332.15 111.5 332.9			This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

111.55	332.75
111.7	333.5
111.75	333.35
111.9	331.1
111.95	330.95

3.1.6.1.1 In those regions where the requirements for runway localizer and glide path transmitter frequencies of an instrument landing system do not justify more than 20 pairs, they shall be selected sequentially, as required, from the following list:

Sequence number	Localizer (MHz)	Glide path (MHz)
1	110.3	335.0
2	109.9	333.8
3	109.5	332.6
4	110.1	334.4
5	109.7	333.2
6	109.3	332.0
7	109.1	331.4
8	110.9	330.8
9	110.7	330.2
10	110.5	329.6
11	108.1	334.7
12	108.3	334.1
13	108.5	329.9
14	108.7	330.5
15	108.9	329.3
16	111.1	331.7
17	111.3	332.3
18	111.5	332.9
19	111.7	333.5
20	111.9	331.1

3.1.6.2 Where existing ILS localizers meeting national requirements are operating on frequencies ending in even tenths of a megahertz, they shall be reassigned frequencies, conforming with 3.1.6.1 or 3.1.6.1.1 as soon as practicable and may continue operating on their present assignments only until th reassignment can be effected.

3.1.6.3 Existing ILS localizers in the international service operating on frequencies ending in odd tenths of a megahertz shall not be assigned new frequencies ending in odd tenths plus one twentieth of a megahertz except where, by regional agreeme general use may be made of any of the channels listed in 3.1.6.1 (see Volume V, Chapter 4, 4.2).

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
ICAO Annex Tol	**Doc 8071 Tolerance**	**8200 Tolerance**	
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
	Measurement Uncertainty		

Annex10_ID	8071_ID	8200_ID	Results_ID
461			663

Facility LOC **Parameter** High Angle Clearance

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref n/a

Annex Ref ---- **8071 Reference** 4.3.3.2.6 **8200 Reference** 15.20k(3)

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
Not addressed	Paraphrased: 4.3.3.2.6 High Angle Clearance. The combinatior of ground environment and antenna height can cause nulls, or false courses, which may not be apparent at all normal instrument approach altitudes. High altitude clearance should therefore be investigated on: a) Initial commissioning; b) Change in location of antenna; c) Change in height of antenna; or d) Installation of a different type antenna.	Paraphrased: 15.20k(3) High Angle Clearance. This check determines that the transmitted signals provide proper off-course indications at the upper limit of the service volume and must be conducted during a site evaluation, commissionin inspection, or when a change in location, height, c type of antenna is made. This check applies to th front course (and the back course if it is used for an approach or missed approach). This check is only required on one transmitter. (a) Fly a 10-mile arc through Sectors 1 and 2 (and 3, if procedurally required), at 4,500 ft above the antenna. (b) If clearances are out-of-tolerance, additional checks will be made at decreasing altitudes to determine the higher altitude at which the facility may be used.	8200 and 8071 tolerances match.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	>=150 uA in normal	>=150 uA in normal

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
		Procedure is specified

Measurement Uncertainty

± 5 µA

Annex10_ID	8071_ID	8200_ID	Results_ID
462	617	384	664

Facility LOC **Parameter** Identification

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref 3.1.3.9

Annex Ref 3.1.3.9 **8071 Reference** 4.3.3.2.1 **8200 Reference** 15.20o

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.3.9.1 The localizer shall provide for the simultaneous transmission of an identification signa specific to the runway and approach direction, on th same radio frequency carrier or carriers as used for the localizer function. The transmission of the identification signal shall not interfere in any way wi the basic localizer function. 3.1.3.9.2 The identification signal shall be produced by Class A2A modulation of the radio frequency carrier or carriers using a modulation tone of 1 020 Hz within plus or minus 50 Hz. The depth of modulation shall be between the limits of 5 and 15 per cent except that, where a radiotelephone communication channel is provided, the depth of modulation shall be adjusted so that the ratio of pea modulation depth due to radiotelephone communications to that due to the identification signal modulation is approximately 9:1 (see 3.1.3.8.3.2). The emissions carrying the identification signal shall be horizontally polarized. Where two carriers are modulated with identificatior signals, the relative phase of the modulations shall be such as to avoid the occurrence of nulls within the coverage of the localizer. 3.1.3.9.3 The identification signal shall employ the International Morse Code and consist of two or thre letters. It may be preceded by the International Morse Code signal of the letter "I", followed by a short pause where it is necessary to distinguish the ILS facility from other navigational facilities in the immediate area. 3.1.3.9.4 The identification signal shall be transmitted by dots and dashes at a speed corresponding to approximately seven words per minute, and shall be repeated at approximately equ intervals, not less than six times per minute, at all times during which the localizer is available for operational use. When the transmissions of the localizer are not available for operational use, as, fo example, after removal of navigation components, o during maintenance or test transmissions, the identification signal shall be suppressed. The dots	4.3.3.2.1 Identification. The coded identification that is transmitted from the facility should be monitored during the various checks over all of the coverage area. The identification is satisfactory if the coded characters are correct, clear and properly spaced. The transmission of the identification signal should not interfere in any way with the basic localizer function. Monitoring the identification also serves the purpose of detecting frequency interference which is primarily manifested by heterodyne, or noise which affects the identification.	15.20o Identification and Voice. This check is made to ensure identification and voice (if installe is received throughout the coverage area of the localizer. SDF(s) have a three-letter coded identifier. Localizers and LDA(s) have a three-letter coded identifier preceded by the code letter I. Approved Procedure. This procedure is applicable to the front course (and the back course if it is procedurally used). Record the identification during all checks. Check voice transmissions when on-course and at the maximum distance at which course structure is being evaluated. A localizer must be restricted if identification cannot be received in all areas of required coverage. A localizer must not be restricted solely because the voice/ ATIS cannot be received. In this event, advise the procedures specialist and/or Air Traffic Operations personnel. [Repeated for Voice]	Measurement of tolerances to meet annex10 criteria is a design qualification and/or ground maintenance issue. Flight testing does not address this. 8200 and 8071 criteria are equal as a qualitative assessment of clarity and correctness.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

shall have a duration of 0.1 second to 0.160 second. The dash duration shall be typically three times the duration of a dot. The interval between dots and/or dashes shall be equal to that of one dot plus or minus 10 per cent. The interval between letters shall not be less than the duration of three dots.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
tone frequency 1020 Hz +/-50hz depth of modulation 5 to 15 % dot/dash timing - refer to 3.1.3.9.2	Proper keying, clearly audible to the limit of the range.	Clear, correct. The identification must have no effect on the course.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Subjective Assessment

Annex10_ID	8071_ID	8200_ID	Results_ID
463	618	385	665

Facility LOC **Parameter** Integrity

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref 3.1.3.12

SARPS Ref

8071 Reference

8200 Reference

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.3.12 Integrity and continuity of service requirements 3.1.3.12.1 The probability of not radiating false guidance signals shall not be less than 1 - 0.5 × 10-9 in any one landing for Facility Performance Categories II and III localizers. 3.1.3.12.2 Recommendation. The probability of not radiating false guidance signals should not be less than 1-1.0 × 10-7 in any one landing for Facility Performance Category I localizers.	none	none	This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
464	619	386	666

Facility LOC **Parameter** Interlock

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref 3.1.2.7 **SARPS Ref** **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.2.7 At those locations where two separate ILS facilities serve opposite ends of a single runway, an interlock shall ensure that only the localizer serving the approach direction in use shall radiate, except where the localizer in operational use is Facility Performance Category I ILS and no operationally harmful interference results. 3.1.2.7.1 Recommendation. At those locations where two separate ILS facilities serve opposite ends of a single runway and where a Facility Performance Category I ILS is to be used for auto-coupled approaches and landings in visual conditions an interlock should ensure that only the localizer serving the approach direction in use radiates, providing the other localizer is not required for simultaneous operational use. Note. If both localizers radiate there is a possibility of interference to the localizer signals in the threshold region. Additional guidance material is contained in 2.1.9 and 2.13 of Attachment C. 3.1.2.7.2 At locations where ILS facilities serving opposite ends of the same runway or different runways at the same airport use the same paired frequencies, an interlock shall ensure that only one facility shall radiate at a time. When switching from one ILS facility to another, radiation from both shall be suppressed for not less than 20 seconds. Note. Additional guidance material on the operation of localizers on the same frequency channel is contained in 2.1.9 of Attachment C and Volume V, Chapter 4.			This is a design qualification and/or ground installation/maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
465			667

Facility LOC **Parameter** Linearity

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for all

SARPS Ref 3.1.3.7.4

Annex Ref 3.1.3.7.4 **8071 Reference** n/a **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.3.7.4 [This text also appears in parameter DISPLACEMENT SENSITIVITY.] The increase of DDM shall be substantially linear with respect to angular displacement from the front course line (where DDM is zero) up to an angle on either side o the front course line where the DDM is 0.180. From that angle to plus or minus 10 degrees, the DDM shall not be less than 0.180. From plus or minus 10 degrees to plus or minus 35 degrees, the DDM sha not be less than 0.155. Where coverage is required outside of the plus or minus 35 degrees sector, the DDM in the area of the coverage, except in the bac course sector, shall not be less than 0.155. Note 1. The linearity of change of DDM with respec to angular displacement is particularly important in the neighbourhood of the course line.	4.3.3.2.4.3.2 The full sector from 150 to 150 µA should be flown so that linearity can be assessed by examining the recordings.	15.51c(2)(c) Momentary deviations of the localize cross pointer in Sector 1 can be averaged without further evaluation, provided the cross pointer deviation does not present a noticeable effect on flyability or create a possible false course. Questionable reversals of trend or excessive irregular flattening of the course ("steps") require an evaluation of the effect on the procedure. Whe this condition occurs, evaluate for noticeable effects on flyability and possible false course indications. The procedure must be removed if reversals of trend have noticeable effects on flyabililty or flyable false course indications occur.	8200 tighter regarding linearity in that it includes quantitative reversal tolerance.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	> 180 µA (Linear increase from 0 to > 180 µA)	Reversals <= 10µA

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
		Puts a quantitative tolerance on reversals (drawn from text).

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
466	620	387	668

Facility LOC **Parameter** Modulation

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for some, doesn't for others

SARPS Ref n/a

Annex Ref 3.1.3.5 **8071 Reference** 4.3.3.2.3 **8200 Reference** 15.20b/c

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
[Sub 1 - depth of modulation] 3.1.3.5.1 The nominal depth of modulation of the radio frequency carrier due to each of the 90 Hz an 150 Hz tones shall be 20 per cent along the course line. 3.1.3.5.2 The depth of modulation of the radio frequency carrier due to each of the 90 Hz and 150 Hz tones shall be within the limits of 18 and 22 per cent. [inserted from below to group with relevant text] 3.1.3.5.3.6 Recommendation. The sum of the modulation depths of the radio frequency carrier du to the 90 Hz and 150 Hz tones should not exceed 6 per cent or be less than 30 per cent within the required coverage. 3.1.3.5.3.6.1 For equipment first installed after 1 January 2000, the sum of the modulation depths of the radio frequency carrier due to the 90 Hz and 15 Hz tones shall not exceed 60 per cent or be less than 30 per cent within the required coverage. Note 1. If the sum of the modulation depths is greater than 60 per cent for Facility Performance Category I localizers, the nominal displacement sensitivity may be adjusted as provided for in 3.1.3.7.1 to achieve the above modulation limit. Note 2. For two-frequency systems, the standard fo maximum sum of modulation depths does not apply at or near azimuths where the course and clearanc carrier signal levels are equal in amplitude (i.e. at azimuths where both transmitting systems have a significant contribution to the total modulation depth Note 3. The standard for minimum sum of modulation depths is based on the malfunctioning alarm level being set as high as 30 per cent as stated in 2.3.3 of Attachment C. [inserted from below to group with relevant text] 3.1.3.5.3.7 When utilizing a localizer for	[Sub 1 - depth of modulation] 4.3.3.2.3.1 Modulation Balance. Although the modulation balance is most easily measured on th ground, it may be measured from the air while radiating the carrier signal only. Position the aircraft close to the runway centerline and note th crosspointer indication. 4.3.3.2.3.2 Modulation Depth. The percentage of modulation should be determined only while flying inbound on course at a point where the receiver signal strength corresponds to the value at which the receiver modulation depth calibration was made; therefore, this requirement should be fulfilled concurrently with the alignment check. If the receiver modulation depth indications are influenced significantly by RF level, measure the modulation depth near Point A. (An adequate preliminary check of modulation can be made whi the aircraft is crossing the course during the displacement sensitivity check.) Modulation percentage is determined by the use of calibratior data furnished with the individual receiver.	Paraphrased: [Sub 1 - depth of modulation] 15.20b. Modulation Level. This check measures the modulation of the radiated signal. Approved Procedure - Front Course. Measure modulation while inbound on the localizer, betwee 10 miles and 3 miles from the localizer antenna, and on glidepath (at procedural altitude for localiz only facilities). Approved Procedure - Back Course. Measure modulation by using the front course flight procedures described above. On single frequency localizers, adjustments to front course modulation will also affect the back course; therefore, adjustments are not required on the back course. NOTE: Modulation must be measured during the NORMAL configuration clearance checks require by Paragraph 15.20k in order to analyze what some receivers see excessive modulation as low clearances. Out-of-tolerance modulation must be basis for restrictions on facilities installed or reconfigured with new type antennas after Januar 1, 2000. 15.20c. Modulation Equality. This check is performed to obtain a crosspointer value, which w be used as a reference for phasing.	[Sub 1 - depth of modulation] 8200 tolerances in SDM do not fully protect the Annex 10/8071 stated 90/150 individual tone tolerances. For example, 90 Mod could be 17, and 150 Mod 19 - the sum would be in tolerance at 36%, while the 90 Mod would be below the 18 ICAO tolerance. If Modulation Equality is assumed to be reasonable or very close to zero a maintained on the ground, the 8200 tolerance is essentially identical to the ICAO tolerance. (Modulation Equality is a ground maintenance issue. Flight testing is not required to address this.) Recommendation: Consider modifying 8200.1 to protect a minimum per-tone modulation level of 18%. This issue does not warrant filing a difference with ICAO. 8200 equals Annex 10 relative to off-course line tolerance limits (<=60%/>=30%) [Sub 2 - modulation frequency] This is a design qualification and/or ground maintenance issue. Flight testing does not address this. [Sub 3 - spurious content] This is a design qualification and/or ground maintenance issue. Flight testing does not address this, except to the extent that any variations from spurious content visible during flight measurements will have structure tolerance applied to them. [Sub 4 - modulation phase] This is a design qualification and/or ground maintenance issue. Flight testing does not address this. [Sub 5 - undesired FM/PM]

radiotelephone communications, the sum of the modulation depths of the radio frequency carrier du to the 90 Hz and 150 Hz tones shall not exceed 65 per cent within 10 degrees of the course line and shall not exceed 78 per cent at any other point around the localizer.

[Sub 2 - modulation frequency]

3.1.3.5.3 The following tolerances shall be applie to the frequencies of the modulating tones:

a) the modulating tones shall be 90 Hz and 150 Hz within plus or minus 2.5 per cent;

b) the modulating tones shall be 90 Hz and 150 Hz within plus or minus 1.5 per cent for Facility Performance Category II installations;

c) the modulating tones shall be 90 Hz and 150 Hz within plus or minus 1 per cent for Facility Performance Category III installations;

[inserted from below to group with relevant text]
3.1.3.5.3.1 Recommendation. For Facility Performance Category I ILS, the modulating tones should be 90 Hz and 150 Hz within plus or minus 1.5 per cent where practicable.

[Sub 3 - spurious content]

d) the total harmonic content of the 90 Hz tone shal not exceed 10 per cent; additionally, for Facility Performance Category III localizers, the second harmonic of the 90 Hz tone shall not exceed 5 per cent;

e) the total harmonic content of the 150 Hz tone sha not exceed 10 per cent.

3.1.3.5.3.2 For Facility Performance Category III localizers, the depth of amplitude modulation of the radio frequency carrier at the power supply frequency or its harmonics, or by other unwanted components, shall not exceed 0.5 per cent. Harmonics of the supply, or other unwanted noise components that may intermodulate with the 90 Hz and 150 Hz navigation tones or their harmonics to produce fluctuations in the course line, shall not exceed 0.05 per cent modulation depth of the radio frequency carrier.

[Sub 4 - modulation phase]

This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

[Sub 6 - Back Course Modulation]

Although not explicitly addressed in Annex 10 or 8200, Doc 8071 does recommend an 18-22% tolerance. This is covered by the 8200 tolerance on SDM (with the same limitations mentioned in Subparameter 1).

3.1.3.5.3.3 The modulation tones shall be phase-locked so that within the half course sector, the demodulated 90 Hz and 150 Hz wave forms pass through zero in the same direction within:

a) for Facility Performance Categories I and II localizers: 20 degrees; and

b) for Facility Performance Category III localizers: 1 degrees,

of phase relative to the 150 Hz component, every half cycle of the combined 90 Hz and 150 Hz wave form.

Note 1. The definition of phase relationship in this manner is not intended to imply a requirement to measure the phase within the half course sector.

Note 2. Guidance material relative to such measurement is given at Figure C-6 of Attachment

3.1.3.5.3.4 With two-frequency localizer systems, 3.1.3.5.3.3 shall apply to each carrier. In addition, the 90 Hz modulating tone of one carrier shall be phase-locked to the 90 Hz modulating tone of the other carrier so that the demodulated wave forms pass through zero in the same direction within:

a) for Categories I and II localizers: 20 degrees; and

b) for Category III localizers: 10 degrees,

of phase relative to 90 Hz. Similarly, the 150 Hz tones of the two carriers shall be phase-locked so that the demodulated wave forms pass through zero in the same direction within:

1) for Categories I and II localizers: 20 degrees; and

2) for Category III localizers: 10 degrees,

of phase relative to 150 Hz.

3.1.3.5.3.5 Alternative two-frequency localizer systems that employ audio phasing different from the normal in-phase conditions described in 3.1.3.5.3.4 shall be permitted. In this alternative system, the 90 Hz to 90 Hz phasing and the 150 Hz to 150 Hz phasing shall be adjusted to their nominal values to within limits equivalent to those stated in 3.1.3.5.3.4.

Note. This is to ensure correct airborne receiver operation in the region away from the course line where the two carrier signal strengths are approximately equal.

[Sub 5 - undesired FM/PM]

3.1.3.5.4 Recommendation. Undesired frequency and phase modulation on ILS localizer radio frequency carriers that can affect the displayed DDM values in localizer receivers should be minimized to the extent practical.

Note. Relevant guidance material is given in 2.15 of Attachment C.

ICAO Annex Tol

[Sub 1 - depth of modulation]

Each Tone 18-22%
SDM 90 Hz + 150 Hz within the required coverage area: <= 60% & >=30%

[Sub 2 - modulation frequency]

90 & 150 Hz: Within +/- 2.5%
CAT II: Within +/- 1.5%
CAT III: Within +/- 1.0%

[Sub 3 - spurious content]

THD 90 & 150 Hz <=10%
CAT III: 90 Hz 2nd harmonic <=5%

[Sub 4 - modulation phase]

CAT I, II: locked within 20 deg (150)
CAT III: locked within 10 deg (150)
CEGS: applies to both carriers
CEGS CAT I,II: 90-90 Hz within 20 deg (90)
CEGS CAT III: 90-90 Hz within 10 deg (90)
CEGS CAT I,II: 150-150 within 20 deg (150)
CEGS CAT III: 150-150 within 10 deg (150)
If design uses alternative phase locking, apply above tolerances to nominally-intended value

[Sub 5 - undesired modulation]

Doc 8071 Tolerance

Balance: 0.002 DDM
Depth 18% to 22%

Note - Recommended means of measurement is by ground check.

[Sub 1 - depth of modulation]

8200 tolerances in SDM do not fully protect the Annex 10/8071 stated 90/150 individual tone tolerances. For example, 90 Mod could be 17, an 150 Mod 19 - the sum would be in tolerance at 36%, while the 90 Mod would be below the 18% ICAO tolerance. If Modulation Equality is assume to be reasonable or very close to zero as maintained on the ground, the 8200 tolerance is essentially identical to the ICAO tolerance. (Modulation Equality is a ground maintenance issue. Flight testing is not required to address this.)

8200 equals Annex 10 relative to off-course line tolerance limits (<=60%/>=30%)

[Sub 2 - modulation frequency]

This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

[Sub 3 - spurious content]

8200 Tolerance

[Sub 1 - depth of modulation]

36 - 44% [carrier] as measured IAW Paragraph 15.20b
30% - 60% throughout the service volume of all localizers installed or reconfigured with new type antennas after 01/01/2000. For existing systems, note in the flight inspection report areas where modulation exceeds 60%.

For two-frequency systems, the standard for maximum modulation percentage does not apply or near azimuth where the course and clearance signal levels are equal in amplitude (i.e at azimuths where both transmitting systems have a significant contribution to the total modulation percentage).

Waveguide Clearance XMTR: 36 - 44% as measured IAW Paragraph 15.20b

[Sub 6 - Back Course Modulation]

(None)

minimize as much as possible (table in Guidance Material)

[Sub 1 - depth of modulation]

8200 tolerances in SDM do not fully protect the Annex 10/8071 stated 90/150 individual tone tolerances. For example, 90 Mod could be 17, and 150 Mod 19 - the sum would be in tolerance at 36%, while the 90 Mod would be below the 18% ICAO tolerance. If Modulation Equality is assumed to be reasonable or very close to zero as maintained on the ground, the 8200 tolerance is essentially identical to the ICAO tolerance. (Modulation Equality is a ground maintenance issue. Flight testing is not required to address this.)

8200 equals Annex 10 relative to off-course line tolerance limits (<=60%/>=30%)

[Sub 2 - modulation frequency]

This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

[Sub 3 - spurious content]

This is a design qualification and/or ground maintenance issue. Flight testing does not address this, except to the extent that any variations from spurious content visible during flight measurements will have structure tolerances applied to them.

[Sub 4 - modulation phase]

This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

[Sub 5 - undesired FM/PM]

This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

[Sub 6 - Back Course Modulation]

None

This is a design qualification and/or ground maintenance issue. Flight testing does not address this, except to the extent that any variations from spurious content visible during flight measurements will have structure tolerances applied to them.

[Sub 4 - modulation phase]

This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

[Sub 5 - undesired FM/PM]

This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

[Sub 6 - Back Course Modulation]

Modulation Depth: 18% to 22% approximately 5 NM from the localizer.

ICAO Annex Remarks

Modulation equality is not addressed other than an implied limits of 0.040 DDM based on limits of the

Doc 8071 Remarks

Recommended means of measurement is stated as ground check.

8200 Remarks

Carrier tolerances are on SDM as compared to Annex 10 specs for each tone. This allows

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
separate 90 and 150 tones.	Modulation Balance tolerance of 0.002 DDM is unreasonable as stated. FAA ground tolerance is 0.020 DDM when establishing a reference with a +/-0.002 DDM tolerance around the established reference DDM. Back Course: Recommended means of measurement is by ground check. **Measurement Uncertainty** Balance 0.001 DDM	conditions where Annex 10 tolerances are not met. Example: one tone at 17.5% and the other 19% would meet the 8200 tolerances with an SDM of 36.5%, however the individual tone at 17.5% does not meet the Annex 10 minimum of 18%. FAA places ground requirements on equality (0.020 DDM or +/-2%).	

Annex10_ID	8071_ID	8200_ID	Results_ID
467	621	388	669

Facility LOC **Parameter** Monitor

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for some, doesn't for others

SARPS Ref 3.1.3.11

Annex Ref 3.1.3.11 **8071 Reference** 4.3.3.2.11 **8200 Reference** 15.20i

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
[Subparameter 1 - Monitor Action] 3.1.3.11.1 The automatic monitor system shall provide a warning to the designated control points and cause one of the following to occur, within the period specified in 3.1.3.11.3.1, if any of the conditions stated in 3.1.3.11.2 persist: a) radiation to cease; b) removal of the navigation and identification components from the carrier; c) reversion to a lower category in the case of Facil Performance Categories II and III localizers where the reversion requirement exists. Note. It is intended that the alternative of reversion offered in 3.1.3.11.1 may be used only if: 1) the safety of the reversion procedure has been substantiated; and 2) the means of providing information to the pilot on the change of category has adequate integrity. 3.1.3.11.2 The conditions requiring initiation of monitor action shall be the following: [Subparameter 2 - Alignment Limit] a) for Facility Performance Category I localizers, a shift of the mean course line from the runway centre line equivalent to more than 10.5 m (35 ft), or the linear equivalent to 0.015 DDM, whichever is less, a the ILS reference datum; b) for Facility Performance Category II localizers, a shift of the mean course line from the runway centre line equivalent to more than 7.5 m (25 ft) at the ILS reference datum; c) for Facility Performance Category III localizers, a shift of the mean course line from the runway centre line equivalent to more than 6 m (20 ft) at the ILS	4.3.3.2.11 Localizer Monitors. Localizer course alignment and displacement sensitivity monitors may be checked by ground or flight inspection. A suggested method of flight inspection is given below: [Subparameter 2 - Alignment Limit] Paraphrased: a) Alignment Monitor. Position aircraft on runway threshold centerline, adjust DDM to alarm, note displacement in both directions. [Subparameter 4 - Displacement Sensitivity Limit Paraphrased: b) Displacement Sensitivity Monitor. Adjust to broad and narrow, orbital flight if good correlation to approach method. Note: Clearance checks (comm. and after mod) in broad alarm with reduced from normal tolerances (175µA and 150µA) to 160µA and 135µA respectively. [Subparameter 3 - Power Reduction Limit] c) Power Monitor (commissioning only). The field strength of the localizer signal should be measure on course at the greatest distance at which it is expected to be used, but not less than 18 NM, while operating with 50 percent of normal power. the field strength is less than 5 microvolts, the power will be increased to provide at least 5 microvolts and the monitor limit adjusted to alarm at this level. (Note: Fifteen microvolts may be required – see paragraph 4.3.3.2.9.1.)	Paraphrased: [Subparameter 1 - Monitor Action] 15.20i. Monitor References. The inspector must ensure that the facility is set at the monitor reference prior to each check. Monitor references must be checked IAW Paragraph 15.12a(3) when prescribed by the checklist and when applicable o special inspections. [Subparameter 4 - Displacement Sensitivity Limit Approved Procedure - Width Reference. Use the flight procedure and methods described in Paragraph 15.20(f). [Subparameter 2 - Alignment Limit] Approved Procedure - Alignment Reference. This check is performed to assure that the monitors wi detect a specific shift of the localizer course, and must only be accomplished upon special request from the FAA region or appropriate military authority. It is not necessary to verify ground alignment monitor checks in the air or to verify airborne alignment monitor checks on the ground. [Subparameter 3 - Power Reduction Limit] [Power reduction is tested as part of all Coverage tests, refer to 15.20j]	The following subparameters are design qualification and/or ground maintenance issues. Flight testing does not address them. Subparameter 1 - Monitor Action Subparameter 5 - Monitor Shutdown Times Subparameter 6 - Remote Shutdown Annunciation [Subparameter 2 - Alignment Limit] 8200 and 8071 - Both recommend accomplishment by ground maintenance [Subparameter 3 - Power Reduction Limit] 8200 alarm checks are part of full coverage checks (refer Coverage). 8071 alarm check is accomplished only on course, with no check prescribed to test the 2 frequency system clearance tolerance. [Subparameter 4 - Displacement Sensitivity Limi 8200 is looser than Annex 10/8071, allowing clearances to drop to 135 µA. for two frequency systems. Annex 10 and Doc 8071 only allow the reduced clearance limit (135µA.) on single frequency systems (this is inferred from the lack of any mention). Annex 10 para 3.1.3.11.2.1 recommends a minimimum Clearances level of 0.155 DDM, or 150 uA. Recommendation: Consider requiring 150 uA minimum for 2-frequency localizers, and for 1-frequency localizers if Flight Inspection experience shows this is not problematic. (Modern antenna arrays should have no difficulty providing a minimum of 150 uA.) This issue does not warrant filing a difference with ICAO.

reference datum;

[Subparameter 3 - Power Reduction Limit]

d) in the case of localizers in which the basic functions are provided by the use of a single-frequency system, a reduction of power output to less than 50 per cent of normal, provided the localizer continues to meet the requirements of 3.1.3.3, 3.1.3.4 and 3.1.3.5;

e) in the case of localizers in which the basic functions are provided by the use of a two-frequenc system, a reduction of power output for either carrie to less than 80 per cent of normal, except that a greater reduction to between 80 percent and 50 per cent of normal may be permitted, provided the localizer continues to meet the requirements of 3.1.3.3, 3.1.3.4 and 3.1.3.5;

Note. It is important to recognize that a frequency change resulting in a loss of the frequency difference specified in 3.1.3.2.1 may produce a hazardous condition. This problem is of greater operational significance for Categories II and III installations. As necessary, this problem can be dealt with through special monitoring provisions or highly reliable circuitry.

Note [relocated from f)]. In selecting the power reduction figure to be employed in monitoring referred to in 3.1.3.11.2 e, particular attention is directed to vertical and horizontal lobe structure (vertical lobing due to different antenna heights) of the combined radiation systems when two carriers are employed. Large changes in the power ratio between carriers may result in low clearance areas and false courses in the off-course areas to the limits of the vertical coverage requirements specifie in 3.1.3.3.1.

[Subparameter 4 - Displacement Sensitivity Limit]

f) change of displacement sensitivity to a value differing by more than 17 per cent from the nominal value for the localizer facility.

3.1.3.11.2.1 Recommendation. In the case of localizers in which the basic functions are provided by the use of a two-frequency system, the condition requiring initiation of monitor action should include the case when the DDM in the required coverage

beyond plus or minus 10 degrees from the front course line, except in the back course sector, decreases below 0.155.

[Subparameter 5 - Monitor Shutdown Times]

3.1.3.11.3 The total period of radiation, including period(s) of zero radiation, outside the performance limits specified in a), b), c), d), e) and f) of 3.1.3.11. shall be as short as practicable, consistent with the need for avoiding interruptions of the navigation service provided by the localizer.

3.1.3.11.3.1 The total period referred to under 3.1.3.11.3 shall not exceed under any circumstance
10 seconds for Category I localizers;
5 seconds for Category II localizers;
2 seconds for Category III localizers.

Note 1. The total time periods specified are never-t be-exceeded limits and are intended to protect aircraft in the final stages of approach against prolonged or repeated periods of localizer guidance outside the monitor limits. For this reason, they include not only the initial period of outside toleranc operation but also the total of any or all periods of outside tolerance radiation including period(s) of ze radiation, which might occur during action to restore service, for example, in the course of consecutive monitor functioning and consequent changeover(s) to localizer equipment or elements thereof.

Note 2. From an operational point of view, the intention is that no guidance outside the monitor limits be radiated after the time periods given, and that no further attempts be made to restore service until a period in the order of 20 seconds has elapse

3.1.3.11.3.2 Recommendation. Where practicable, the total period under 3.1.3.11.3.1 should be reduced so as not to exceed two seconds for Category II localizers and one second for Category III localizers.

[Subparameter 6 - Remote Shutdown Annunciation

3.1.3.11.4 Design and operation of the monitor system shall be consistent with the requirement tha navigation guidance and identification will be removed and a warning provided at the designated remote control points in the event of failure of the monitor system itself.

Note. Guidance material on the design and operatic of monitor systems is given in Attachment C, 2.1.8.

3.1.3.11.5 Any erroneous navigation signals on the carrier occurring during removal of navigation and identification components in accordance with 3.1.3.11.1 b) shall be suppressed within the total periods allowed in 3.1.3.11.3.1.

Note. To prevent hazardous fluctuations in the radiated signal, localizers employing mechanical modulation equipment may require suppression of navigation components during modulator rundown.

ICAO Annex Tol

[Subparameter 2 - Alignment Limit]

At the ILS reference datum;
CAT I: Lesser of 35' or 0.015 DDM
CAT II: 25' [0.011 DDM]
CAT III: 20' [0.0088 DDM]

[Subparameter 3 - Power Reduction Limit]

1fLOC: @ limit of >=50%, alarm must occur, and must meet 3.1.3.3, 3.1.3.4, and 3.1.3.5 (Coverage Structure, Modulation)

2fGS: @ limit of >= 80%, alarm must occur and must meet 3.1.3.3, 3.1.3.4, and 3.1.3.5 (Coverage Structure, Modulation). Reduction to 50% allowed same requirements met.

[Subparameter 4 - Displacement Sensitivity Limit]

Nominal value [width] +/-17%
Recommendation:
2 Freq. beyond 10 degrees >= 0.155ddm

Doc 8071 Tolerance

[Subparameter 2 - Alignment Limit]

Monitor must alarm for a shift in the main course line from the runway centerline equivalent to or more than the following distances at the ILS reference datum.
Cat I: 10.5 m (35 ft.)
Cat II: 7.5 m (25 ft.)
Cat III: 6.0 m (20 ft)

[Subparameter 4 - Displacement Sensitivity Limit

Monitor must alarm for a change in displacement sensitivity to a value differing from the nominal value by more than:
Cat I: 17%
Cat II: 17%
Cat III: 17%

Off Course Clearance: Required only for certain types of localizer. Monitor must alarm when the c course clearance cross-pointer deflection falls below 150 µA [two freq system] anywhere in the c course coverage area.

[Subparameter 3 - Power Reduction Limit]

Monitor must alarm either for a power reduction o 3 dB, or when the coverage falls below the requirement for the facility, whichever is the smaller change. For two-frequency localizers, the monitor must alarm for a change of ± 1 dB in eithe carrier, unless tests have proved that use of the wider limits above will not cause unacceptable

8200 Tolerance

[Subparameter 2 - Alignment Limit]

Front Course Alignment:
The course alignment monitor must alarm when the actual course alignment signal shifts from the designed procedural azimuth by no greater than:

Facilities aligned along the runway:
CAT I ILS and SDF(s) ± 15 µA
CAT II ± 11 µA
CAT III ± 9 µA.

Offset Localizers, Offset SDFs, and LDAs:
± 20 µA from the designed procedural azimuth when using actual course alignment references, i.e., AFIS, theodolite, etc.

Localizers, SDF's, and LDA's where alignment is determined to be satisfactory by visual observations:
±20 µA from established equality of modulation reference.

[Subparameter 4 - Displacement Sensitivity Limit

Front Course Width: Not more than ± 17% of the commissioned width.

Independently Monitored Back Course: Not more than ± 17% of the commissioned width.

Back Course [Subordinate]: 2.49 - 7.02°

Facility in any alarm configuration:

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
	signal degradation (> 150 µA in clearance sector)	Clearances [limits] are reduced 15 µA [to 135 µA] from the clearance required in normal. [Subparameter 3 - Power Reduction Limit] Commissioning only: RF Power: Signal Strength >=5 µV Flag Alarm - No Flag or indication of invalid signal Clearance and Structure - in tolerance.	
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
Calculated tolerance [DDM] based on 0.00044 DDM/ft (3.1.3.7.1).	Recommended means of measurement is by ground check, provided that correlation has been established between ground and air measuremen [Subparameter 4 - Displacement Sensitivity Limit Off course clearance: Tolerance applicable to 2 frequency systems. Source text specs commissioning limit of 135 µA presumably for single frequency systems. [Subparameter 3 - Power Reduction Limit] Alarm limits checked only on course at the greate distance expected to be used, but not less than 18NM. Does not check clearance power tolerance for 2 frequency systems. **Measurement Uncertainty** A: 2 m	Dual frequency checklists places both transmitter into alarm.	

Annex10_ID	8071_ID	8200_ID	Results_ID
468	622	389	670

Facility LOC **Parameter** Off Course Clearance

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref 3.1.3.7.4

Annex Ref 3.1.3.7.4 **8071 Reference** 4.3.3.2.5 **8200 Reference** 15.20k

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.3.7.4 [considered also in displacement sensitivity] The increase of DDM shall be substantially linear with respect to angular displacement from the front course line (where DDM is zero) up to an angle on either side of the front course line where the DDM is 0.180. From that ang to plus or minus 10 degrees, the DDM shall not be less than 0.180. From plus or minus 10 degrees to plus or minus 35 degrees, the DDM shall not be les than 0.155. Where coverage is required outside of the plus or minus 35 degrees sector, the DDM in th area of the coverage, except in the back course sector, shall not be less than 0.155. Note 1. The linearity of change of DDM with respec to angular displacement is particularly important in the neighbourhood of the course line. Note 2. The above DDM in the 10-35 degree sector is to be considered a minimum requirement for the use of ILS as a landing aid. Wherever practicable, a higher DDM, e.g. 0.180, is advantageous to assist high speed aircraft to execute large angle intercepts at operationally desirable distances provided that limits on modulation percentage given in 3.1.3.5.3.6 are met. Note 3. Wherever practicable, the localizer capture level of automatic flight control systems is to be set at or below 0.175 DDM in order to prevent false localizer captures.	4.3.3.2.5 Off-course Clearance. The localizer clearance is checked to determine that the transmitted signals will provide the user with the proper off course indication and that there are no false courses. Conduct an orbital flight with a radius of 5 to 8 NM from the facility and approximately 460 meters (1500 feet) above the antenna. Where terrain is a factor, the height will be adjusted to provide line of sight between the aircraft and the antenna. 4.3.3.2.5.1 Clearance need be checked only to the angular limits of coverage provided on either side of the front course (typically * 35 degrees), unless the back course is used for approaches. In such cases, clearances will also be checked to the angular coverage limits of the back course. An annual 360-degree orbit is recommended to checl for possible false courses in the out-of-coverage area. These false courses may be due to antenna pattern characteristics or environmental conditions and may be valuable in establishing the historical behavior of the facility.	Paraphrased: 15.20k. Clearance. Clearances are measured to ensure that the facility provides adequate off-course indications throughout the service volume (or ESV, whichever is greater). Approved Procedure. This check applies to the front course (and the back course if it is used for an approach or missed approach). The clearance orbit will be conducted at a radius between 6 to 10 miles from the antenna at the lower standard altitude of 1,500 ft above the antenna or 500 ft above intervening terrain, whichever is higher. On periodic checks, clearances may be checked to a distance of 14 nm from the localizer antenna. Verify any unusual/ out-of-tolerance indications at distance of 10 nm or less. If the condition repeats or if unable to verify due to weather or ATC restrictions, take appropriate NOTAM/ restriction action. (1) Clearance Comparability. In some cases it may be necessary to perform clearance measurements at altitudes higher than the lower standard altitude. After commissioning, higher altitudes may be used, provided a comparability check is made (usually at commissioning) documenting clearances at the lower standard altitude. (2) Inspections (a) Commissioning. Check clearances in both the normal and the monitor limit configurations described in the appropriate checklist. (b) Monitor Reference Evaluations. Check clearances in the monitor limit configurations described in the appropriate checklist. It is not necessary to check clearances in the normal configuration if the clearances found during the monitor checks are equal to or greater than the tolerances required for normal. (3) High Angle Clearance. [transferred to High Angle Clearance] This check determines that the transmitted signals provide proper off-course indications at the upper limit of the service volume…	8200 equals Annex 10/8071

ICAO Annex Tol

From centerline to 10°: Substantially linear increase up to 0.180 DDM, then >= 180 DDM to 10°.
10° to 35° >=0.155 DDM
beyond 35° >=0.155 DDM except back course

Doc 8071 Tolerance

On either side of course line, linear increase to 17 µA, then maintenance of 175 µA to 10°. Between 10° and 35°, minimum 150 µA. Where coverage required outside of ± 35°, minimum of 150 µA except in back course sector.

8200 Tolerance

Front and Back Course: As measured from the procedural designed azimuth:

Facility in Normal configuration:
Sector Minimum Clearance
1 Linear increase to 175 µA then maintain 175 µA to 10°.
2 150 µA (see note).
3 150 µA (see note).

Facility in any alarm configuration:
Clearances are reduced 15 µA from the clearance required in normal.

NOTE: Exceptions are authorized in Sectors 2 an 3.

ICAO Annex Remarks

DDM conversions:
0.155 DDM = 150µA
0.180 DDM = 174.2µA

Doc 8071 Remarks

8200 Remarks

Measurement Uncertainty

± 5 µA

Annex10_ID	8071_ID	8200_ID	Results_ID
469	623	390	671

Facility **LOC** **Parameter** **Phasing**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref n/a

Annex Ref **8071 Reference** 4.3.3.2.12 **8200 Reference** 15.20e

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	4.3.3.2.12 Phasing. The following phasing procedure applies to null reference localizer systems. Alternative phasing procedures in accordance with manufacturer recommendations should be followed for other types of localizers. T the extent possible, methods involving ground tes procedures should be used, and airborne measurements made only upon request from ground maintenance personnel. If additional confirmation is desirable by means of a flight check, the following is an example of a suitable procedure. Note: Adjustments made during the phasing procedure may affect many of the radiated parameters. For this reason, it is advisable to confirm the localizer phasing as early as possible during the commissioning tests. a) Measure the displacement sensitivity of the localizer if it is not already determined. b) Feed the localizer antenna with carrier equally modulated by 90 Hz and 150 Hz and load the sideband output with a dummy load. Note the cross pointer deflection as X(90) or X(150) microamperes. c) The aircraft should be flown at a suitable off course angle (depending on the type of localizer antenna used) during the phasing adjustment and should not be closer than 3 NM from the antenna. d) Insert a 90* line in series with the sideband input to the antenna and feed the antenna with sideband energy. e) Adjust the phaser until the deviation indicator reading is the same as in (ii) above. f) Remove the 90* line, used in step (d) above. 4.3.3.2.12.1 This completes the process of phasing the carrier with the composite sidebands. As an additional check, displacement sensitivity	Paraphrased: 15.20e. Phasing. The purpose of this check is to determine that the phase relationship between the sideband and carrier energy is optimum. The facility will normally be phased using ground procedures. No specific requirement exists for airborne phasing.	This is a design qualification and/or ground maintenance issue. Flight testing does not address this, except when requested by ground maintenance personnel.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
	should be rechecked, and compared with that obtained in step (a). The value obtained after the phasing adjustment should never be greater than the value obtained before the phasing adjustment		

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	<=10 µA of the modulation balance value.	No tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
	Optional, at the request of the ground technician, unless good correlation between airborne and ground phasing techniques has not been established.	No airborne phasing requirement

Measurement Uncertainty

+/-1 µA

Annex10_ID	8071_ID	8200_ID	Results_ID
	624	391	672

Facility LOC **Parameter** Polarization

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref 3.1.3.2.2

Annex Ref 3.1.3.2 **8071 Reference** 4.3.3.2.10 **8200 Reference** 15.20n

ICAO Annex Text

3.1.3.2.2 The emission from the localizer shall be horizontally polarized. The vertically polarized component of the radiation on the course line shall not exceed that which corresponds to a DDM error of 0.016 when an aircraft is positioned on the cours line and is in a roll attitude of 20 degrees from the horizontal.

3.1.3.2.2.1 For Facility Performance Category II localizers, the vertically polarized component of the radiation on the course line shall not exceed that which corresponds to a DDM error of 0.008 when a aircraft is positioned on the course line and is in a roll attitude of 20 degrees from the horizontal.

3.1.3.2.2.2 For Facility Performance Category III localizers, the vertically polarized component of the radiation within a sector bounded by 0.02 DDM either side of the course line shall not exceed that which corresponds to a DDM error of 0.005 when a aircraft is in a roll attitude of 20 degrees from the horizontal.

3.1.3.2.3 For Facility Performance Category III localizers, signals emanating from the transmitter shall contain no components which result in an apparent course line fluctuation of more than 0.005 DDM peak to peak in the frequency band 0.01 Hz t 10 Hz.

Doc 8071 Source Text

4.3.3.2.10 Polarization. This check is conducted to determine the effects of undesired vertically polarized signal components. While maintaining the desired track (on extended centerline), bank the aircraft around its longitudinal axis 20 degrees each way from level flight. The aircraft's position should be monitored using an accurate tracking o position fixing system. Analyze the crosspointer recording to determine if there are any course deviations caused by the change in aircraft (antenna) orientation. The effects of vertically polarized signal components are acceptable, whe they are within specified tolerances. If this check is accomplished in the area of the outer marker, the possibility of errors due to position changes w be lessened. The amount of polarization effect measured also depends on polarization characteristics of the aircraft antenna, hence the vertical polarization effect of the aircraft antenna should be as low as possible.

8200 Source Text

15.20n Polarization Effect. The purpose of this check is to determine the effects that vertical polarization may have on the course structure.

Approved Procedure. This check applies to the front course (and the back course if it is procedurally used), and may be accomplished concurrently with the course structure check. Thi check is only required on one transmitter.

Fly inbound on-course within the unrestricted coverage prior to the FAF and roll the aircraft to a 20 degree bank left and right. Actuate the event mark at the maximum banked attitude.

Comparison Remarks

Tolerance match dependent on rounding off annex10 tolerances to nearest microamp, otherwise both 8071 and 8200 would be looser than annex10 for Cat II and III.

ICAO Annex Tol

Polarization error not greater than:
CAT I ± 0.016 DDM [15.5 µA]
CAT II ± 0.008 DDM [7.7 µA]
CAT III ± 0.005 DDM [4.8 µA]

Doc 8071 Tolerance

For a roll attitude of 20° from the horizontal:
Cat I: 15 µA on the course line
Cat II: 8 µA on the course line
Cat III: 5 µA within a sector bounded by 20 µA either side of the course line.

8200 Tolerance

Polarization error not greater than:
CAT I ± 15 µA
CAT II ± 8 µA
CAT III ± 5 µA

ICAO Annex Remarks

Doc 8071 Remarks

8200 Remarks

Cat II and III meet annex10 when rounded ICAO/8071 limits converted to microamps and rounded off to the nearest.

Measurement Uncertainty

+/- 1 µA

Annex10_ID	8071_ID	8200_ID	Results_ID
470	625	392	673

Facility LOC **Parameter** Power Ratio

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref

Annex Ref 3.1.3.3.4/3.1.3.3.5 **8071 Reference** **8200 Reference** 15.20d

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.3.3.4 When coverage is achieved by a localize using two radio frequency carriers, one carrier providing a radiation field pattern in the front course sector and the other providing a radiation field pattern outside that sector, the ratio of the two carri signal strengths in space within the front course sector to the coverage limits specified at 3.1.3.3.1 shall not be less than 10 dB. Note. Guidance material on localizers achieving coverage with two radio frequency carriers is given the Note to 3.1.3.11.2 and in 2.7 of Attachment C. 3.1.3.3.5 Recommendation. For Facility Performance Category III localizers, the ratio of the two carrier signal strengths in space within the front course sector should not be less than 16 dB.	Not addressed	Paraphrased: 15.20d. Power Ratio Check. The purpose of this check is to measure the ratio of power between the course and clearance transmitters of dual frequency localizers.	Tolerances are the same. 8200 does not address Annex 10 Cat III recommendation of 16 dB.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Course to Clearance ratio >=10 dB Recommendation Cat III >= 16 dB	None	The course transmitter power level must be at lea 10 dB greater than the clearance transmitter.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
		Does not address Annex 10 Cat III recommendation of 16 dB. Current generation equipment operates nominally at the 16dB recommendation.

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
471	626	393	674

Facility LOC **Parameter** Radio Frequency

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref 3.1.3.2

SARPS Ref

8071 Reference

8200 Reference

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.3.2 Radio frequency 3.1.3.2.1 The localizer shall operate in the band 108 MHz to 111.975 MHz. Where a single radio frequency carrier is used, the frequency tolerance shall not exceed plus or minus 0.005 per cent. Where two radio frequency carriers are used, the frequency tolerance shall not exceed 0.002 per cen and the nominal band occupied by the carriers shal be symmetrical about the assigned frequency. With all tolerances applied, the frequency separation between the carriers shall not be less than 5 kHz no more than 14 kHz.	none	none	This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
472	627	394	675

Facility LOC **Parameter** Receiver Interference Immunity

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref 3.1.4 **SARPS Ref** **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.4 Interference immunity performance for ILS localizer receiving systems 3.1.4.1 After 1 January 1998, the ILS localizer receiving system shall provide adequate immunity t interference from two-signal, third-order intermodulation products caused by VHF FM broadcast signals having levels in accordance with the following: 2N1 + N2 + 72 ≤ 0 for VHF FM sound broadcasting signals in the rang 107.7 - 108.0 MHz and 2N1 + N2 + 3(24 - 20 log (Δ f/0.4)) <= 0 for VHF FM sound broadcasting signals below 107. MHz, where the frequencies of the two VHF FM sound broadcasting signals produce, within the receiver, a two-signal, third-order intermodulation product on the desired ILS localizer frequency. N1 and N2 are the levels (dBm) of the two VHF FM sound broadcasting signals at the ILS localizer receiver input. Neither level shall exceed the desensitization criteria set forth in 3.1.4.2. Δf = 108.1 — f1, where f1 is the frequency of N1, the VHF FM sound broadcasting signal closer to 108.1 MHz. 3.1.4.2 After 1 January 1998, the ILS localizer receiving system shall not be desensitized in the presence of VHF FM broadcast signals having leve in accordance with the following table: Frequency (MHz) — Maximum level of unwanted signal at receiver input (dBm) 88-102 — +15 104 — +10 106 — +5 107.9 — -10	none	none	This is a design qualification and airworthiness issue. Flight testing does not address this.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

Note 1. The relationship is linear between adjacent points designated by the above frequencies.

Note 2. Guidance material on immunity criteria to b used for the performance quoted in 3.1.4.1 and 3.1.4.2 is contained in Attachment C, 2.2.9.

3.1.4.3 After 1 January 1995, all new installations o airborne ILS localizer receiving systems shall meet the provisions of 3.1.4.1 and 3.1.4.2.

3.1.4.4 Recommendation. Airborne ILS localizer receiving systems meeting the immunity performance standards of 3.1.4.1 and 3.1.4.2 shoul be placed into operation at the earliest possible dat

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
473	628	395	676

Facility LOC **Parameter** Remote Indications

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref 3.1.2.1.1

SARPS Ref

8071 Reference

8200 Reference

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.2.1.1 Facility Performance Categories I, II and I ILS shall provide indications at designated remote control points of the operational status of all ILS ground system components. Note 1. It is intended that the air traffic services unit involved in the control of aircraft on the final approach be one of the designated control points receiving, without delay, information on the operational status of the ILS as derived from the monitors. Note 2. It is intended that the air traffic system is likely to call for additional provisions which may be found essential for the attainment of full operational Category III capability, e.g. to provide additional lateral and longitudinal guidance during the landing roll-out, and taxiing, and to ensure enhancement of the integrity and reliability of the system.	none	none	This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
474	629	396	677

Facility LOC **Parameter** Siting

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref 3.1.3.10

SARPS Ref

8071 Reference

8200 Reference

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.3.10 Siting 3.1.3.10.1 The localizer antenna system shall be located on the extension on the centre line of the runway at the stop end, and the equipment shall be adjusted so that the course lines will be in a vertical plane containing the centre line of the runway served. The antenna system shall have the minimu height necessary to satisfy the coverage requirements laid down in 3.1.3.3, and the distance from the stop end of the runway shall be consistent with safe obstruction clearance practices.	none	none	This is a design qualification and/or ground installation/maintenance issue. Flight testing doe not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
475	630	397	678

Facility LOC **Parameter** Symmetry

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for all

SARPS Ref ----

Annex Ref ---- **8071 Reference** ---- **8200 Reference** 15.20f

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
none	none	Paraphrased: [This text also appears in DISPLACEMENT SENSITIVITY parameter.] 15.20f. Course Sector Width and Symmetry. The purpose of this check is to establish and maintain a course sector width and ratio between half-course sectors that will provide the desired displacement sensitivity required at the procedura missed approach point (MAP) or threshold and be within the limitations of the procedural protected area. Approved Procedure. This procedure applies to th front course (and back course if it is used for an approach or missed approach). Measure the course sector width and symmetry. On periodic checks, higher altitudes may be used, provided a course width comparability check (within ± 0.2°) in the normal configuration is made at the lower standard altitude. (1) Basic Method. A crossing, perpendicular to the on-course. Measure the course sector width and calculate the symmetry.	

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		Front course only - 45-55% with the facility in Normal

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
476	631	398	679

Facility LOC **Parameter** System Description

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref 3.1 **SARPS Ref** **8071 Reference** **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.2.1 The ILS shall comprise the following basic components: a) VHF localizer equipment, associated monitor system, remote control and indicator equipment; b) UHF glide path equipment, associated monitor system, remote control and indicator equipment; c) VHF marker beacons, or distance measuring equipment (DME) in accordance with section 3.5, together with associated monitor system and remote control and indicator equipment. Note. Guidance material relative to the use of DME as an alternative to the marker beacon component the ILS is contained in Attachment C, 2.11. 3.1.2.2 The ILS shall be constructed and adjusted so that, at a specified distance from the threshold, similar instrumental indications in the aircraft represent similar displacements from the course lin or ILS glide path as appropriate, irrespective of the particular ground installation in use. 3.1.2.3 The localizer and glide path components specified in 3.1.2.1 a) and b) which form part of a Facility Performance Category I ILS shall comply a least with the Standards in 3.1.3 and 3.1.5 respectively, excepting those in which application to Facility Performance Category II ILS is prescribed. 3.1.2.4 The localizer and glide path components specified in 3.1.2.1 a) and b) which form part of a Facility Performance Category II ILS shall comply with the Standards applicable to these components in a Facility Performance Category I ILS, as supplemented or amended by the Standards in 3.1. and 3.1.5 in which application to Facility Performance Category II ILS is prescribed. 3.1.2.5 The localizer and glide path components an other ancillary equipment specified in 3.1.2.1.1, which form part of a Facility Performance Category			This Annex 10 text provides a top-level system description. Flight testing does not address this.

III ILS, shall otherwise comply with the Standards applicable to these components in Facility Performance Categories I and II ILS, except as supplemented by the Standards in 3.1.3 and 3.1.5 i which application to Facility Performance Category III ILS is prescribed.

3.1.2.6 To ensure an adequate level of safety, the ILS shall be so designed and maintained that the probability of operation within the performance requirements specified is of a high value, consisten with the category of operational performance concerned.

Note. The specifications for Facility Performance Categories II and III ILS are intended to achieve th highest degree of system integrity, reliability and stability of operation under the most adverse environmental conditions to be encountered. Guidance material to achieve this objective in Categories II and III operations is given in 2.8 of Attachment C.

3.1.3 VHF localizer and associated monitor

Introduction. The specifications in this section cove ILS localizers providing either positive guidance information over 360 degrees of azimuth, or providing such guidance only within a specified portion of the front coverage (see 3.1.3.7.4). Where ILS localizers providing positive guidance informatic in a limited sector are installed, information from some suitably located navigation aid, together with appropriate procedures, will generally be required to ensure that any misleading guidance information outside the sector is not operationally significant.

3.1.3.1 General

3.1.3.1.1 The radiation from the localizer antenna system shall produce a composite field pattern whic is amplitude modulated by a 90 Hz and a 150 Hz tone. The radiation field pattern shall produce a course sector with one tone predominating on one side of the course and with the other tone predominating on the opposite side.

3.1.3.1.2 When an observer faces the localizer from the approach end of a runway, the depth of modulation of the radio frequency carrier due to the 150 Hz tone shall predominate on the observer's right hand and that due to the 90 Hz tone shall predominate on the observer's left hand.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
3.1.3.1.3 All horizontal angles employed in specifying the localizer field patterns shall originate from the centre of the localizer antenna system which provides the signals used in the front course sector.			

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
477			680

Facility LOC **Parameter** Voice

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for some, doesn't for others

SARPS Ref 3.1.3.8

Annex Ref 3.1.3.8 **8071 Reference** 4.3.3.2.2 **8200 Reference** 15.20o

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.3.8.1 Facility Performance Categories I and II localizers may provide a ground-to-air radiotelephor communication channel to be operated simultaneously with the navigation and identificatior signals, provided that such operation shall not interfere in any way with the bas localizer function. 3.1.3.8.2 Category III localizers shall not provide such a channel, except where extreme care has been taken in the design and operation of the facility to ensure that there is no possibility of interference with the navigational guidance. 3.1.3.8.3 If the channel is provided, it shall conform with the following Standards: 3.1.3.8.3.1 The channel shall be on the same radio frequency carrier or carriers as used for the localize function, and the radiation shall be horizontally polarized. Where two carriers are modulated with speech, the relative phases of the modulations on the two carriers shall be such as to avoid the occurrence of nulls within the coverage of the localizer. 3.1.3.8.3.2 The peak modulation depth of the carrie or carriers due to the radiotelephone communications shall not exceed 50 per cent but shall be adjusted so that: a) the ratio of peak modulation depth due to the radiotelephone communications to that due to the identification signal is approximately 9:1; b) the sum of modulation components due to use o the radiotelephone channel, navigation signals and identification signals shall not exceed 95 per cent. 3.1.3.8.3.3 The audio frequency characteristics of the radiotelephone channel shall be flat to within 3 dB relative to the level at 1 000 Hz over the range 300 Hz to 3 000 Hz.	4.3.3.2.2 Voice Feature. Where the facility has the capability of ground-to-air voice transmission on the localizer frequency it will be checked over a of the coverage area in generally the same way as the identification. It should be checked to ensure that it adequately serves its purpose as a ground-to-air communication channel and does not adversely affect the course.	15.20o Identification and Voice. This check is made to ensure identification and voice (if installe is received throughout the coverage area of the localizer. SDF(s) have a three-letter coded identifier. Localizers and LDA(s) have a three-letter coded identifier preceded by the code letter I. Approved Procedure. This procedure is applicable to the front course (and the back course if it is procedurally used). Record the identification during all checks. Check voice transmissions when on-course and at the maximum distance at which course structure is being evaluated. A localizer must be restricted if identification cannot be received in all areas of required coverage. A localizer must not be restricted solely because the voice/ ATIS cannot be received. In this event, advise the procedures specialist and/or Air Traffic Operations personnel. [Repeated for Identification]	Measurement of tolerances to meet annex10 criteria is a design qualification and/or ground maintenance issue. Flight testing does not address this with the exception that voice not cause interference. 8200 and 8071 criteria equally require a qualitative assessment of clarity and correctness 8200 places a 5μA allowable limit on the disturbance, whereas 8071and Annex10 say "no interference" and "shall not interfere in any way" respectively. Recommendation: Modify Order 8200.1 to change the 5uA value to "no interference" or similar. If this is done, no filing of a difference with ICAO is required.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Shall not interfere Voice modulation <=50% Sum of all modulation components <=95% Audio frequency characteristics: flat to within 3 dB relative to the level at 1 000 Hz over the range 300 Hz to 3 000 Hz.	Clear audio level similar to identification, no effect on course line. No interference. No nulls	Clear, correct. Audio level of the voice equal to the identification level. Voice modulation must no cause more than 5µA of course disturbance.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
		Defines max limit of 5µA interference

Measurement Uncertainty

Subjective Assessment

Annex10_ID	8071_ID	8200_ID	Results_ID
478	632	399	681

Facility **MKR** **Parameter** **Coverage**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for some, doesn't for others

SARPS Ref 3.1.7.3

Annex Ref **8071 Reference** 4.3.3.5.2 **8200 Reference** 15.40c

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.7.3 Coverage [subparameter 1 - Minor Axis Width] 3.1.7.3.1 The marker beacon system shall be adjusted to provide coverage over the following distances, measured on the ILS glide path and localizer course line: a) inner marker (where installed): 150 m plus or minus 50 m (500 ft plus or minus 160 ft); b) middle marker: 300 m plus or minus 100 m (1 00 ft plus or minus 325 ft); c) outer marker: 600 m plus or minus 200 m (2 000 ft plus or minus 650 ft). [subparameter 2 - Field Strength -- This subparameter is not addressed here -- see FIELD STRENGTH parameter.] 3.1.7.3.2 The field strength at the limits of coverage specified in 3.1.7.3.1 shall be 1.5 millivolts per metr (minus 82 dBW/m2). In addition, the field strength within the coverage area shall rise to at least 3.0 millivolts per metre (minus 76 dBW/m2). Note 1. In the design of the ground antenna, it is advisable to ensure that an adequate rate of chang of field strength is provided at the edges of coverag It is also advisable to ensure that aircraft within the localizer course sector will receive visual indication. Note 2. Satisfactory operation of a typical airborne marker installation will be obtained if the sensitivity so adjusted that visual indication will be obtained when the field strength is 1.5 millivolts per metre (minus 82 dBW/m2).	[Paraphrased] [subparameter 1 - Minor Axis Width] Coverage is determined by measuring the total distance during which a visual indication is obtained from a calibrated marker or a predetermined RF carrier signal level. The coverage should be determined by making a continuous recording of RF signal. The visual indication distance should be noted for compariso with subsequent routine checks. An RF level recording check should be made that the center of the coverage area is in the correct position. There should be a well-defined separation between each marker. A check should also be is made on the glide path but displaced ± 75 *A from the localizer center (major axis).	[Paraphrased] [subparameter 1 - Minor Axis Width] Provide a radiation pattern that supports operational requirements without interfering with other facilities or procedures. All commissioning coverage requirements must be completed with any adjacent marker beacons removed from service to preclude a misrepresentative coverage analysis caused by signal intermixing. The aircrat marker beacon must be set at the low position for all checks. (1) Minor Axis. Measure the actual width and quality of the radiation pattern along the procedur course where it will be used. (2) Major Axis. Verify adequate coverage by measuring the width of the minor axis at the extremities of a pre-defined off course sector (typically 75uA).	As coverage is adjusted by power level, width of prescribed signal level is the measured coverage Assuming an equal definition of the coverage limits (refer to the FIELD STRENGTH parameter [subparameter 1 - Minor Axis Width] The OM upper limit in Order 8200.1 is looser thar the ICAO documents, at 4000. The ICAO limits are 2650'. Given the very large number of markers and the vast flight inspection experience in the US with the markers and numerous receiver types, the 4000' minor axis upper limit appears procedurally acceptable. On this basis, filing a difference with ICAO should not be necessary. ---------- Major Axis: 8200 specifies major axis criteria, while Annex 10 and Doc 8071 do not address it.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
[subparameter 1 - Minor Axis Width] OM 2000 ± 650' MM 1000 ± 325' IM 500 ± 160'	[subparameter 1 - Minor Axis Width] Proper A/C indication & indication should be centered OM 2000 ± 650' MM 1000 ± 325' IM 500 ± 160' Should be a well-defined separation between markers. Measurements should use the Low sensitivity setting on receiver.	[subparameter 1 - Minor Axis Width] OM 1350-4000' MM 675-1325' IM 340-650' Fan Marker 1000-3000' OM Major 700-4000', Those markers installed to serve dual runways must not exceed 4,000 ft within the normal localizer width sector of 150 uA, either side of the procedural centerline. MM Major 350-1325' IM Major n/a All Others - Any duration not to exceed the respective minor axis tolerance.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
	"Should" for everything except coverage distance.	Applies major axis tolerance OM upper tolerance beyond annex 10 limit

Measurement Uncertainty
± 40m

Annex10_ID	8071_ID	8200_ID	Results_ID
479	633	400	682

Facility **MKR** **Parameter** **Electromagnetic Spectrum**

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for all

SARPS Ref

Annex Ref **8071 Reference** 4.2.3.4.1 **8200 Reference** 15.40a

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.7.2 Radio frequency 3.1.7.2.1 The marker beacons shall operate at 75 MHz with a frequency tolerance of plus or minus 0.005 per cent and shall utilize horizontal polarizatic	Carrier Frequency. The carrier frequency should be checked using an accurate frequency standarc to ensure that it is within tolerance. Reference should be made to the instructions supplied with the frequency standard which will give the detailec procedures for its use.	Radio Frequency: Not addressed, considered ground inspection.	This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
n/a to flight inspection	n/a to flight inspection	RF Frequency - n/a to flight inspection Interference must not cause an out-of-tolerance condition.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
RF frequency is ground inspected. Tolerance doe not consider offset operation (75MHz +/-4KHz). Horizontal polarization set by transmitting antenna design.	Ground inspection of frequency	Ground inspection of frequency, tolerance equals the annex 10 tolerance (+/-.005%) however it is based on assigned frequency (75MHz +/-4K if offset operation). Interference tolerance not addressed in source te

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
480	634	401	683

Facility **MKR** **Parameter** **Field Strength**

8200/Annex (sub)parameter Compare Results

8200 doesn't meet A10 for any

SARPS Ref

Annex Ref **8071 Reference** 4.3.3.5.2.3 **8200 Reference** 15.60c

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
[Subparameter 2 of 3.1.7.3 Coverage text -- Field Strength] [See COVERAGE parameter for subparameter 1 of Coverage text -- Minor Axis Width] 3.1.7.3.2 The field strength at the limits of coverage specified in 3.1.7.3.1 shall be 1.5 millivolts per metr (minus 82 dBW/m2). In addition, the field strength within the coverage area shall rise to at least 3.0 millivolts per metre (minus 76 dBW/m2). Note 1. In the design of the ground antenna, it is advisable to ensure that an adequate rate of chang of field strength is provided at the edges of coverag It is also advisable to ensure that aircraft within the localizer course sector will receive visual indication. Note 2. Satisfactory operation of a typical airborne marker installation will be obtained if the sensitivity so adjusted that visual indication will be obtained when the field strength is 1.5 millivolts per metre (minus 82 dBW/m2).	The signal strength recording should be examinec to ensure that there are no sidelobes of sufficient signal strength to cause false indications and that there are no areas of weak signal strength within the main lobe.	Widths are noted under the Coverage parameter based on edge level of 1,700uV.	Unlike other Nav facilities, the MKR output power (signal strength) is adjusted to achieve a specifie coverage area (width). The Annex 10 measurand of Field strength of the ILS Fan Marker antenna pattern is not directly measured in 8200.1. Rather, the distance through the pattern for which the received signal exceeds the light illumination level is used as an end-end measurement. This method of measurement assumes that receiver sensitivity is sufficient regardless of marker field strength. Given any modern receiver, this assumption is sufficient. It is an unproven assumption is that the 8200 edge definition (1700uV) is considered equivalen to the Annex 10 edge definition (1.5mV/m). Sinc the units of signal LEVEL (1700 uV) in 8200 appear to be received voltage level at the receive input terminals across a 50 ohm load, it is not possible to determine whether the Annex 10 field strength or power density requirements are met, without knowledge of the airborne flight inspectio antenna's Gain Factor or Capture Area. Editorially, the 1700 uV criterion appears sufficient in daily use, given the myriad combinations of user receivers, feedlines, and antennas producing satisfactory marker indications. A. Although it isn't possible at present to say tha 8200 fully meets Annex 10 because of the units differences, this should not warrant filing an ICAC difference. B. FAA does not specify a minimum value for th peak field strength as is specified in Annex 10 (>/= 3.0 mV/m). Again, given the large number of markers and receivers and the vast experience in the US without this minimum specification, the markers are clearly operationally acceptable. Or this basis, it should not be necessary to file an ICAO difference.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Edge 1.5mV/m (-82 dBW/sqm) Peak >/= 3.0 mV/m (-76 dBW/sqm)	Considerations addressed as coverage.	With a constant signal at or above 1,700 microvol (uV), the following widths (refer to the Coverage parameter) must be provided:

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
Units are those of E Field (Field Strength) and power density. Contains a minimum peak level requirement Note 1 addresses nonmandatory checks of the major axis.	Doc 8071 tolerances do not address field strength	Does not address a minimum for the peak field strength within the coverage area.

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
481	635	402	684

Facility **MKR** **Parameter** **General**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref **SARPS Ref** **8071 Reference** none **8200 Reference** none

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.7.1 General a) There shall be two marker beacons in each installation except as provided in 3.1.7.6.6. A third marker beacon may be added whenever, in the opinion of the Competent Authority, an additional beacon is required because of operational procedures at a particular site. b) The marker beacons shall conform to the requirements prescribed in 3.1.7. When the installation comprises only two marker beacons, the requirements applicable to the middle marker and to the outer marker shall be complied with. c) The marker beacons shall produce radiation patterns to indicate predetermined distance from the threshold along the ILS glide path. 3.1.7.1.1 When a marker beacon is used in conjunction with the back course of a localizer, it shall conform with the marker beacon characteristics specified in 3.1.7. 3.1.7.1.2 Identification signals of marker beacons used in conjunction with the back course of a localizer shall be clearly distinguishable from the inner, middle and outer marker beacon identifications, as prescribed in 3.1.7.5.1.	Not addressed for use on a localizer backcourse.	Not addressed for use on a backcourse.	This Annex 10 text is prescriptive in nature for marker beacon design considerations. The text requires that all applications of the ILS-associate marker comply with the detailed technical requirements. This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
n/a	None	None

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
		Likely considered and addressed as a fan marker 8200.1B (previous version) included back course markers as a variation of a fan marker. 8200 does not specify the use of a marker beacon on a localizer backcourse.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
	Measurement Uncertainty		
Annex10_ID	8071_ID	8200_ID	Results_ID
482	636	403	685

Facility **MKR** **Parameter** **Identification**

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for all

SARPS Ref 3.1.7.4

Annex Ref **8071 Reference** 4.3.3.5.1 **8200 Reference** 15.40b

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.7.5 Identification [subparameter 1 - Keying] 3.1.7.5.1 The carrier energy shall not be interrupted The audio frequency modulation shall be keyed as follows: a) inner marker (when installed): 6 dots per second continuously; b) middle marker: a continuous series of alternate dots and dashes, the dashes keyed at the rate of 2 dashes per second, and the dots at the rate of 6 do per second; c) outer marker: 2 dashes per second continuously. [subparameter 2 - Keying Rate Variation] These keying rates shall be maintained to within plu or minus 15 per cent.	Keying. The keying is checked during an ILS approach over the beacons. The keying is assessed from both the aural and visual indicatior and is satisfactory when the coded characters are correct, clear and properly spaced. The frequenc of the modulating tone can be checked by observing that visual indication is obtained on the correct lamp of a three lamp system, i.e. Outer marker (OM) - blue, Middle marker (MM) - orange and Inner marker (IM) - white.	Purpose is of this check is to ensure that the correct modulation tone and keying code are transmitted without interference throughout the area of required coverage. Keying rate is checke by Facility Maintenance personnel. Record and evaluate the keying code while flying the radiation pattern at the proposed or published altitude(s).	[subparameter 1 - Keying] Both Doc 8071 and 8200 specify an audible qualitative check on the correct keying (combination of dots and dashes).. [subparameter 2 - Keying Rate Variation] Keying rates: Neither 8200 nor 8071 applies a measured check against the Annex 10 +/-15% tolerance, This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
[subparameter 1 - Keying] IM: 6 dots/s MM: 2 dashes/s 6 dots/s OM: 2 dashes/s [subparameter 2 - Keying Rate Variation] Keying Rate +/- 15% of specified	Proper keying, clearly audible OM: 400 Hz, 2 dashes per second continuously MM: 1300 Hz, alternate dots and dashes continuously. The sequence being repeated once per second. IM: 3000 Hz, 6 dots per second continuously Proper light indication confirms frequency.	Distinct, correct, constant throughout the coverag area; and clearly distinguishable from any other markers.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
Not specified for flight inspection	Audible check without a quantitative tolerance.	Audible check without a quantitative tolerance. No AF check of keying rate beyond equipment design acceptance.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
	Measurement Uncertainty		
Annex10_ID	8071_ID	8200_ID	Results_ID
483	637	404	686

Facility **MKR** **Parameter** **Modulation**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** 4.3.3.5.1 **8200 Reference** 15.40b

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.7.4 Modulation [subparameter 1 - Modulation Frequency] 3.1.7.4.1 The modulation frequencies shall be as follows: a) inner marker (when installed): 3 000 Hz; b) middle marker: 1 300 Hz; c) outer marker: 400 Hz. [subparameter 2 - Mod Frequency Tolerance and Distortion] The frequency tolerance of the above frequencies shall be plus or minus 2.5 per cent, and the total harmonic content of each of the frequencies shall not exceed 15 per cent. [subparameter 3 - Modulation Depth] 3.1.7.4.2 The depth of modulation of the markers shall be 95 per cent plus or minus 4 per cent.	n/a to flight testing	Check that the audio modulation tone is correct b noting that the proper light comes on for the type marker being inspected.	This is a design qualification and/or ground maintenance issue. Flight testing does not address this. Harmonic Distortion: FAA does not prescribe a check (either by flight or ground testing) on the Annex 10 tolerance on Harmonic Distortion. This tolerance is covered by design qualification testir Modulation Frequency: FAA is tighter than the Annex 10 tolerance (ground inspection by both FAA and ICAO). 8200 - Checks for proper Light Illumination

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Frequency +/- 2.5% Harmonic Distortion <=15% Depth of Modulation 95% + 4%	n/a	The modulation must illuminate the following light OM - Blue Light (400 Hz) MM - Amber Light (1,300 Hz) IM - White Light (3,000 Hz) FM - White Light (3,000 Hz)

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
n/a to flight inspection	All modulation parameters are covered by ground test requirements (Table I-4-6)	FAA ground inspection tolerances (6750.49A): Frequency +/- 1.0% (tighter) Harmonic Distortion - Not addressed Depth of Modulation - 95% +/-4% (equal)

Measurement Uncertainty

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
Annex10_ID	8071_ID	8200_ID	Results_ID
484	638	405	687

Facility **MKR** **Parameter** **Monitoring**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref 3.1.7.7

Annex Ref **8071 Reference** 4.3.3.5.3 **8200 Reference** none

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.1.7.7 Monitoring 3.1.7.7.1 Suitable equipment shall provide signals for the operation of an automatic monitor. The monitor shall transmit a warning to a control point if either of the following conditions arise: a) failure of the modulation or keying; b) reduction of power output to less than 50 per cer of normal. 3.1.7.7.2 Recommendation. For each marker beacon, suitable monitoring equipment should be provided which will indicate at the appropriate location a decrease of the modulation depth below 50 per cent.	4.3.3.5.3.1 At commissioning, the coverage shoul be measured with the marker beacon operating at 50 percent of normal power and with the modulation depth reduced to 50 percent. An operationally usable indication should still be obtained, if not, the power should be increased to provide an indication and the monitor adjusted to alarm at this level. 4.3.3.5.3.2 Alternatively, the coverage under monitor alarm conditions can be determined by analyzing the field strength recording as detailed i paragraph 4.3.3.5.2.	No monitor consideration by flight inspection.	This is a design qualification and/or ground maintenance issue. Flight testing does not address this. Neither 8200 or Annex 10 requires flight inspection, however 8071 does specify flight inspection action. FAA ground requirements do not meet annex 10 requirements specific to remote monitor indications.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
n/a	An operationally usable indication should be obtained for a reduction in power output of 50%, c a higher power at which the equipment will be monitored. Alternatively, this can be checked by analyzing the field strength recording	none

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
No flight inspection requirement. Ground requirement is a monitor that provides a remote indication with failure of modulation or keying or when power output drops to less than 50%. Automatic shutdown is not a stated requirement. Recc only	Adds criteria beyond annex 10 requirements whic tests the acceptability of the 50% power tolerance and provides resolution when not met..	No flight inspection requirement FAA criteria for monitoring (6750.49A): Automatic shutdown when the annex 10 monitor requirements are not met. Remote indication is typically not installed, especially for CAT I installations.

Measurement Uncertainty

± 1 dB

Annex10_ID	8071_ID	8200_ID	Results_ID
485	639	406	688

Facility **MKR** **Parameter** **Separation**

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for all

SARPS Ref none

Annex Ref **8071 Reference** **8200 Reference** n/a

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
none	none	15.40d. Proximity Check. Supplements basic coverage checks to assure operational compatibility between a marker beacon sited in close proximity to another marker beacon(s). (1) Signal Intermix. Determine if there is unacceptable signal derogation caused by the simultaneous operation of two or more marker beacons in close proximity. (2) Procedure Overlap. Assure that there are no false marker beacon indications present along an instrument approach course. Per procedure, signal intrusion must no exceed 1700uV at the extremity of the approach course (150uA or 5 degree, as appropriate) nearest the potentially misleading marker beacon at the minimum procedural altitude .	8200 specifies procedural checks to address possible interference between marker facilities.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
none	none	A separation between the 1,700 uV points of succeeding marker patterns which provide a fix or the same approach course, e.g., MM to IM, must be at least 709 ft.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
486	640	407	689

Facility **MKR** **Parameter** **Siting**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref 8071 Reference	8200 Reference	
ICAO Annex Text	**Doc 8071 Source Text**	**8200 Source Text**	**Comparison Remarks**
3.1.7.6 Siting 3.1.7.6.1 The inner marker, when installed, shall be located so as to indicate in low visibility conditions the imminence of arrival at the runway threshold. 3.1.7.6.1.1 Recommendation. If the radiation patter is vertical, the inner marker, when installed, should be located between 75 m (250 ft) and 450 m (1 500 ft) from the threshold and at not more than 30 m (100 ft) from the extended centre line of the runway Note 1. It is intended that the inner marker pattern should intercept the downward extended straight portion of the nominal ILS glide path at the lowest decision height applicable in Category II operations Note 2. Care must be exercised in siting the inner marker to avoid interference between the inner and middle markers. Details regarding the siting of inne markers are contained in Attachment C, 2.10. 3.1.7.6.1.2 Recommendation. If the radiation patter is other than vertical, the equipment should be located so as to produce a field within the course sector and ILS glide path sector that is substantially similar to that produced by an antenna radiating a vertical pattern and located as prescribed in 3.1.7.6.1.1. 3.1.7.6.2 The middle marker shall be located so as to indicate the imminence, in low visibility condition of visual approach guidance. 3.1.7.6.2.1 Recommendation. If the radiation patter is vertical, the middle marker should be located 1 050 m (3 500 ft) plus or minus 150 m (500 ft), from the landing threshold at the approach end of the runway and at not more than 75 m (250 ft) from the extended centre line of the runway. Note. See Attachment C, 2.10, regarding the siting of inner and middle marker beacons. 3.1.7.6.2.2 Recommendation. If the radiation patter			This is a design qualification and/or ground installation/maintenance issue. Flight testing doe not address this.

is other than vertical, the equipment should be located so as to produce a field within the course sector and ILS glide path sector that is substantially similar to that produced by an antenna radiating a vertical pattern and located as prescribed in 3.1.7.6.2.1.

3.1.7.6.3 The outer marker shall be located so as to provide height, distance and equipment functioning checks to aircraft on intermediate and final approac

3.1.7.6.3.1 Recommendation. The outer marker should be located 7.2 km (3.9 NM) from the threshold except that, where for topographical or operational reasons this distance is not practicable, the outer marker may be located between 6.5 and 11.1 km (3.5 and 6 NM) from the threshold.

3.1.7.6.4 Recommendation. If the radiation pattern vertical, the outer marker should be not more than 7 m (250 ft) from the extended centre line of the runway. If the radiation pattern is other than vertical the equipment should be located so as to produce a field within the course sector and ILS glide path sector that is substantially similar to that produced by an antenna radiating a vertical pattern.

3.1.7.6.5 The positions of marker beacons, or when applicable, the equivalent distance(s) indicated by the DME when used as an alternative to part or all of the marker beacon component of the ILS, shall be published in accordance with the provisions of Annex 15.

3.1.7.6.5.1 When so used, the DME shall provide distance information operationally equivalent to that furnished by marker beacon(s).

3.1.7.6.5.2 When used as an alternative for the middle marker, the DME shall be frequency paired with the ILS localizer and sited so as to minimize the error in distance information.

3.1.7.6.5.3 The DME in 3.1.7.6.5 shall conform to the specification in 3.5.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
487			690

Facility **MKR** **Parameter** **Standby Equipment**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref n/a

Annex Ref **8071 Reference** 4.3.3.5.4 **8200 Reference** 15.40g

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
Not specified	At commissioning, the standby equipment is checked in the same manner as the main equipment. It will usually not be necessary to check both main and standby equipments at each routine check, if equipment operation has been scheduled so that the routine checks are carried out on each equipment alternately.	This equipment (standby) must be checked in the same manner as the main equipment. 15.12h(8) Checklist - At commissioning only.	Periodicity of standby equipment check: Annex 10 - Not addressed 8071 - alternate periodics 8200 - only at commissioning

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
none	Same checks and tolerances as main equipment.	Same as main equipment

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
none	Requires check of standby equipment alternating with main equipment at successive periodic check	FAA no longer has or maintains standby marker equipment in the inventory. When applicable (foreign/non-FAA systems) the same checks of both main and standby are required at commissioning only.

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
488	641	408	691

Facility MLS **Parameter** Angle Guidance

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref / 8071 Reference	8200 Reference

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.11.4.5 Angle guidance parameters. Angle guidance information shall be encoded by the amount of time separation between the centres of the received TO and FRO scanning beam main lobes. The coding shall be interpreted in the airborn equipment as a linear function of time as follows: θ = (T0 - t) V/2 where: θ = Azimuth or elevation guidance angle in degree t = Time separation in microseconds between TO and FRO beam centres T0 = Time separation in microseconds between TO and FRO beam centres corresponding to zero degrees V = Scan velocity scaling constant in degrees per microsecond. 3.11.4.5.1 The values of the angle guidance parameters shall be as shown in the following table [Detailed table omitted for convenience - no flight inspection parameters] Note 1. Between the end of the TO scan and the beginning of the FRO scan there is a pause time of no radiation of appropriate duration. Additional information is provided in Attachment G, 2.2.1. Note 2. The maximum scan angles shown recogniz that the scan angle must exceed the proportional guidance sector limit by at least one half of the widt of the detected scanning beam envelope (in equivalent angle) to allow successful decoding. 3.11.4.5.2 The tolerances on the ground equipment scanning beam velocity and the time separation between TO and FRO pulses corresponding to zero degrees shall be sufficient to satisfy the accuracy requirements specified in 3.11.4.9.			This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

3.11.4.5.3 The TO and FRO scan transmissions shall be symmetrically disposed about the mid-scan point listed in each of Tables A-2 through A-5 of Appendix A. The mid-scan point and the centre of the time interval between the TO and FRO scan transmissions shall coincide with a tolerance of plus or minus 10 microseconds.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
N/A		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
This text provides design characteristics which are not subject to flight inspection.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
489			692

Facility MLS **Parameter** Angle Guidance Functions

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref 8071 Reference	8200 Reference	
ICAO Annex Text	**Doc 8071 Source Text**	**8200 Source Text**	**Comparison Remarks**
3.11.4.6 Azimuth guidance functions [Subparameter 1 - Basic Signals] 3.11.4.6.1 Each transmission of a guidance angle shall consist of a clockwise TO scan followed by a counterclockwise FRO scan as viewed from above the antenna. For approach azimuth functions, increasing angle values shall be in the direction of the TO scan. For the back azimuth functions, increasing angle values shall be in the direction of the FRO scan. Note. A diagram illustrating the scanning conventions is provided in Attachment G, 2.3.1. 3.11.4.6.2 Sector signals. The transmission forma of any azimuth function shall include time slots for airborne antenna selection, out-of-coverage indication, and test pulses as specified in Appendix A, Tables A-2 and A-3. The internal timing accuracy of the sector signals shall conform to the internal timing accuracy of the DPSK transitions specified in 3.11.4.3.4. ---------- [Paragraph 3.11.4.6.2.1 below and its subparagraphs are duplicated elsewhere in the DATA FUNCTIONS parameter, to match draft MLS Doc 8071 parameter names.] 3.11.4.6.2.1 Ground equipment identification. The MLS providing services for a particular runway shall be identified by a four-character alphabetic designator starting with the letter M. This designato less the first letter shall be transmitted as a digital word as listed in Appendix A, Table A-7. Note. It is not required that MLS ground equipment will transmit identification outside the angle guidanc coverage sectors. If MLS channel identification is operationally required outside angle guidance coverage sectors, it may be derived from associate omnidirectional DME. (See 3.11.5.5.2 and Attachment G, 8.2.)			[Subparameter 1 - Basic Signals] This is a design qualification and/or ground maintenance issue. Flight testing does not address this. (Portions are covered under other parameter names.) [Subparameter 2 - Clearance Guidance] This is a design qualification and/or ground maintenance issue. Flight testing does not address this. (Portions are covered under other parameter names.)

3.11.4.6.2.1.1 The signal shall be transmitted on the data channel into the approach and back azimu coverage regions.

3.11.4.6.2.1.2 The code bit in the time slot previously allocated for the alternate (Morse code) ground equipment identification following the azimuth preamble shall be fixed in the "ZERO" stat

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3.11.4.6.2.2 Airborne antenna selection signal. A signal for airborne antenna selection shall be transmitted as a "zero" DPSK signal lasting for a si bit period. The signal shall be available throughout the coverage sector in which approach or back azimuth guidance is provided.

Note. The signal provides an opportunity for the selection of the most appropriate antenna in a multiple antenna airborne installation.

[Para 3.11.4.6.2.3 and its subparagraphs below duplicated elsewhere under the SIGNAL LEVEL RATIOS parameter, to match draft MLS Doc 8071 parameter name.]

3.11.4.6.2.3 Azimuth out-of-coverage indication pulses. Where out-of-coverage indication pulses ar used, they shall be:

a) greater than any guidance signal in the out-of-coverage sector;

b) at least 5 dB less than the fly-left (fly-right) clearance level within the fly-left (fly-right) clearance sector; and

c) at least 5 dB less than the scanning beam level within the proportional coverage region.

The duration of each pulse measured at the half amplitude point shall be at least 100 microseconds, and the rise and fall times shall be less than 10 microseconds.

3.11.4.6.2.3.1 If desired, it shall be permissible to sequentially transmit two pulses in each out-of-coverage indication time slot. Where the pulse pairs are used, the duration of each pulse shall be at leas 50 microseconds and the rise and fall times shall be less than 10 microseconds.

3.11.4.6.2.3.2 The transmissions of out-of-coverage indication pulses radiated from antennas with overlapping coverage patterns shall be separated by at least 10 microseconds.

3.11.4.6.2.4 Ground radiated test signals

Note. Time has been reserved in the azimuth angle guidance signal formats for the future use of a ground radiated test signal.

[Subparameter 2 - Clearance Guidance]

[Following subparameter text duplicated in CLEARANCE GUIDANCE parameter for matching draft MLS Doc 8071 parameter names.]

3.11.4.6.2.5 Clearance guidance. Where the proportional guidance sector provided is less than the minimum coverage specified in 3.11.5.2.2.1.1 a and 3.11.5.2.2.2 a), clearance guidance shall be provided to supplement the coverage sector by the transmission of fly-left/fly-right clearance pulses in the formats for the approach azimuth, high rate approach azimuth and back azimuth functions. Alternatively, it shall be permissible to provide clearance guidance by permitting the scanning bea to scan beyond the designated proportional guidanc sector to provide fly-left or fly-right clearance information as appropriate when the decoded angle exceeds the designated limits of proportional guidance coverage.

3.11.4.6.2.5.1 Clearance guidance information shall be provided by transmitting pairs of pulses within the angle scan time slots. One pair shall consist of one pulse adjacent to the start time of the scanning beam TO scan and one pulse adjacent to the stop time of the FRO scan. A second pair shall consist of one pulse adjacent to the stop time of the scanning beam TO scan, and one pulse adjacent to the start time of the FRO scan. The fly-right clearance pulses shall represent positive angles an the fly-left clearance pulses shall represent negative angles. The duration of each clearance pulse shall be 50 microseconds with a tolerance of plus or minus 5 microseconds. The transmitter switching time between the clearance pulses and the scannin beam transmissions shall not exceed 10 microseconds. The rise time at the edge of each clearance pulse not adjacent to the scanning beam

shall be less than 10 microseconds.

3.11.4.6.2.5.2 The signal-in-space characteristics of the clearance guidance pulses shall be as follows

a) within the fly-right clearance guidance sector, the fly-right clearance guidance signal shall exceed the scanning beam side lobes and all other guidance and out-of-coverage indication signals by at least 5 dB;

b) within the fly-left clearance guidance sector, the fly-left clearance guidance signal shall exceed the scanning beam side lobes and all other guidance and out-of-coverage indication signals by at least 5 dB;

c) within the proportional guidance sector, the clearance guidance signals shall be at least 5 dB below the scanning beam main lobe.

3.11.4.6.2.5.3 The power density of the clearance signal shall be as required in 3.11.4.10.1.

Note 1. Attachment G, 2.3.4 contains guidance information on the following:

a) clearance and scanning beam timing arrangements;

b) pulse envelopes in the transition regions between clearance and scanning beam signals;

c) clearance (fly-right/fly-left) convention changes.

Note 2. The proportional coverage limits are transmitted in basic data as specified in 3.11.4.8.2.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
N/A		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
This text, except for those portions duplicated under other parameter names, provides design characteristics which are not subject to flight inspection.		

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
	Measurement Uncertainty		
Annex10_ID	8071_ID	8200_ID	Results_ID
490			693

Facility MLS **Parameter** Channeling

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref / 8071 Reference	8200 Reference	ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
			3.11.4.1 Channelling 3.11.4.1.1 Channel arrangement. The MLS angle and data functions shall operate on any one of the 200 channels assigned on the frequencies from 5 031.0 MHz to 5 090.7 MHz as shown in Table A. 3.11.4.1.1.1 Channel assignments in addition to those specified in 3.11.4.1.1 shall be made within the 5 030.4 to 5 150.0 MHz sub-band as necessary to satisfy future air navigation requirements. 3.11.4.1.2 Channel pairing with DME. The channe pairing of the angle and data channel with the channel of the ranging function shall be in accordance with Table A. 3.11.4.1.3 Frequency tolerance. The operating radio frequency of the ground equipment shall not vary more than plus or minus 10 kHz from the assigned frequency. The frequency stability shall be such that there is no more than a plus or minus 50 Hz deviation from the nominal frequency when measured over a one-second interval. 3.11.4.1.4 Radio frequency signal spectrum 3.11.4.1.4.1 The transmitted signal shall be such that, during the transmission time, the mean power density above a height of 600 m (2 000 ft) shall not exceed –94.5 dBW/m2 for angle guidance or data signals, as measured in a 150 kHz bandwidth centred 840 kHz or more from the nominal frequenc 3.11.4.1.4.2 The transmitted signal shall be such that, during the transmission time, the mean power density beyond a distance of 4 800 m (2.6 NM) fron any antennas and for a height below 600 m (2 000 ft) shall not exceed -94.5 dBW/m² for angle guidance or data signals, as measured in a 150 kH bandwidth centred 840 kHz or more from the nominal frequency. Note 1. Requirements in 3.11.4.1.4.2 are applicable when the operational coverage of another MLS			This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

ground station has overlap with the radio-horizon of the considered ground station.

Note 2. Guidance material on MLS frequency planning is provided in Attachment G, 9.3.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
N/A		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
This text provides design characteristics which are not subject to flight inspection.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
491			694

Facility **MLS** **Parameter** **Clearance Guidance**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref 3.11.4.6

Annex Ref **8071 Reference** 6.3 **8200 Reference** 16.20b(1), (4)c

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
[Following text duplicated from ANGLE GUIDANCE FUNCTIONS parameter to match draft MLS Doc 8071 parameter name.] 3.11.4.6.2.5 Clearance guidance. Where the proportional guidance sector provided is less than the minimum coverage specified in 3.11.5.2.2.1.1 a and 3.11.5.2.2.2 a), clearance guidance shall be provided to supplement the coverage sector by the transmission of fly-left/fly-right clearance pulses in the formats for the approach azimuth, high rate approach azimuth and back azimuth functions. Alternatively, it shall be permissible to provide clearance guidance by permitting the scanning bea to scan beyond the designated proportional guidanc sector to provide fly-left or fly-right clearance information as appropriate when the decoded angle exceeds the designated limits of proportional guidance coverage. 3.11.4.6.2.5.1 Clearance guidance information shall be provided by transmitting pairs of pulses within the angle scan time slots. One pair shall consist of one pulse adjacent to the start time of the scanning beam TO scan and one pulse adjacent to the stop time of the FRO scan. A second pair shall consist of one pulse adjacent to the stop time of the scanning beam TO scan, and one pulse adjacent to the start time of the FRO scan. The fly-right clearance pulses shall represent positive angles an the fly-left clearance pulses shall represent negative angles. The duration of each clearance pulse shall be 50 microseconds with a tolerance of plus or minus 5 microseconds. The transmitter switching time between the clearance pulses and the scannin beam transmissions shall not exceed 10 microseconds. The rise time at the edge of each clearance pulse not adjacent to the scanning beam shall be less than 10 microseconds. 3.11.4.6.2.5.2 The signal-in-space characteristics of the clearance guidance pulses shall be as follows a) within the fly-right clearance guidance sector, the fly-right clearance guidance signal shall exceed the	6.3 Clearance Guidance Indications - 6.-3.1 General 6.3.1.1 The flight inspection should determine if correct fly-right or fly- left clearance is present within the clearance sectors. Since the processin and display of clearance guidance is very receiver dependent, the operation of the receiver must be well understood. 6.3.1.2 Since precision operations are not conducted in the clearance sectors, they do not require extensive testing. 6.3.1.3 Two types of clearance information may b provided by an azimuth station with a proportional guidance volume less than 2 40°; either pulse typ clearance or overscan clearance. The procedures noted below are applicable to both types of clearance signals. 6.3.1.4 Where pulsed clearance techniques are used, signal level ratio measurements must also b carried out. 6.3.2 Equipment Neither Special receiver features nor an accurate position reference are necessary to meet this requirement. 6.3.3 Maneuvers Clearance guidance is most easily checked while flying an arc through the clearance sectors. By continuing the arc into the proportional guidance sector, transitions from clearance to proportional guidance may also be checked. 6.3.4 Procedures 6.3.3.1 [sic, should be 6.3.4.1] The full scale deflection of the angle guidance crosspointer display with the receiver set to the maximum selectable azimuth angle indicates that the clearance guidance is correctly oriented and provides sufficient fly-right or fly-left information.	[The text below is duplicated from parameter OPERATIONAL COVERAGE, for comparison purposes.] (1) Lateral Coverage. Coverage arcs are used to define and certify the lateral and distance limits of AZ, EL, and DME coverage. Evaluate proportiona guidance and clearance coverage. (a) Service Volume Arc. A commissioning inspection maneuver to define and certify the operational range, lateral, and vertical limits of the MLS service volume. Perform the inspection with the facility operating at the lowest computed powe required to establish adequate signal coverage fo the intended service volume. 1 Positioning. Start the arc at the maximum usabl distance and 5° outside the edge of the service volume limit. Maintain an altitude equal to the minimum glide path (MGP). If signal coverage of all MLS components cannot be maintained at the MGP, the MLS must be restricted. There is no requirement to certify the lower, 0.9°, or higher, 20,000 ft, limits of lateral coverage unless procedurally or operationally required. The Option Service Volume Arc should be flown at a distance of 14 nm. 2 Inspection a There must be no less than 10° proportional guidance either side of the procedural on course. b While traversing the azimuth proportional guidance sectors, record azimuth and elevation deviation. Deviation crosspointer fluctuations greater than 0.5° that exceed 2° of arc, and all MLS receiver unlocks, must be validated by radial flight, using the procedures outlined in Paragraph 16.20b(2) (Vertical Coverage). (b) Reference Arc: A commissioning and periodic arc throughout the proportional guidance area to	For this parameter, (unpublished) Doc 8071 will be considered the requirement. Order 8200.1 matches the intent of Doc 8071, although no specific tolerances are listed.

scanning beam side lobes and all other guidance and out-of-coverage indication signals by at least 5 dB;

b) within the fly-left clearance guidance sector, the fly-left clearance guidance signal shall exceed the scanning beam side lobes and all other guidance and out-of-coverage indication signals by at least 5 dB;

c) within the proportional guidance sector, the clearance guidance signals shall be at least 5 dB below the scanning beam main lobe.

3.11.4.6.2.5.3 The power density of the clearance signal shall be as required in 3.11.4.10.1.

Note 1. Attachment G, 2.3.4 contains guidance information on the following:

a) clearance and scanning beam timing arrangements;

b) pulse envelopes in the transition regions between clearance and scanning beam signals;

c) clearance (fly-right/fly-left) convention changes.

Note 2. The proportional coverage limits are transmitted in basic data as specified in 3.11.4.8.2.

6.3.3.2 [sic, should be 6.3.4.2] In the case of overscan clearance, an alternative to this is the recording of the angular output of the receiver. Th results should be assessed to ensure that the angles are greater than the limit of the proportiona guidance sector plus one half of the course width for the function.

assure azimuth and elevation signal coverage at the lower edge of elevation deflection sensitivity.

1 Positioning. At a distance of between 5 and 10 nm from the ARD, start the arc 5° outside the edg of the service volume. Vertical altitude must be computed to equal the MGP x 0.75 at the distance flown. The distance and altitude at which the arc i flown on commissioning will be recorded on the Facility Data Sheet. This must be the reference fo periodic evaluations.

2 Altitudes. The approximate (including earth curvature) arc altitudes above site elevation are computed below for selected angles and distance Maintaining a centered elevation crosspointer at the correct distance will give a more precise altitude and is the preferred method of flying the arcs. See Table 16-1 for reference arc altitudes.

[Table 16-1 omitted for simplicity]

3 Inspection

a There must be no less than 10° proportional guidance either side of the procedural on course.

b While traversing the proportional guidance sectors, record azimuth and elevation deviation. Deviation crosspointer fluctuations greater than 0.5° that exceed 2° of arc, and all MLS receiver unlocks, must be validated by radial flight using th procedures outlined in Paragraph 16.20b(2) (Vertical Coverage).

[The paragraph below is duplicated from the MONITOR AND CONTROL parameter for comparison purposes.]

(c) Below Path Coverage Evaluation. Perform this check during a commissioning flight inspection when in low angle alarm. Three runs are required, one on procedural centerline, and at 2° either side of centerline. With the MGP selected for evaluation, fly at an angle equal to [(MGP° x 0.75) 0.25°]. Ensure a full-scale fly up indication is maintained on the elevation signal and AZ guidance and obstacle clearance can be maintained from the FAF to the MAP.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	(none)	none

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
	This (draft) MLS volume of Doc 8071 was never published by ICAO. It was prepared prior to any significant operational fielding of MLS equipment, and as a result some of its apparent flight inspection requirements may no longer be appropriate.	No tolerances are listed for clearance indications.

Measurement Uncertainty

(none)

Annex10_ID	8071_ID	8200_ID	Results_ID
492	642	409	695

Facility MLS **Parameter** Coverage

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref / 8071 Reference	8200 Reference	ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
			[Az Ground Equipment] 3.11.5.2.2 Coverage [Subparameter 1 - Az Coverage Design Requirements] Note. Diagrams illustrating the coverage requirements specified herein are contained in Attachment G, Figures G-5A, G5-B and G-6. 3.11.5.2.2.1 Approach azimuth. The approach azimuth ground equipment shall provide guidance information in at least the following volumes of spac 3.11.5.2.2.1.1 Approach region. a) Laterally, within a sector of 80 degrees (normally plus and minus 40 degrees about the antenna boresight) which originates at the approach azimuth antenna phase centre. b) Longitudinally, from the approach azimuth antenna to 41.7 km (22.5 NM). c) Vertically, between: 1) a lower conical surface originating at the approac azimuth antenna phase centre and inclined upward to reach, at the longitudinal coverage limit, a height of 600 m (2 000 ft) above the horizontal plane which contains the antenna phase centre; and 2) an upper conical surface originating at the approach azimuth antenna phase centre inclined at 15 degrees above the horizontal to a height of 6 00 m (20 000 ft). Note 1. Where intervening obstacles penetrate the lower surface, it is intended that guidance need not be provided at less than line-of-sight heights. Note 2. Where it is determined that misleading guidance information exists outside the promulgate coverage sector and appropriate operational			[Subparameter 1 - Az Coverage Design Requirements] This is a design qualification and/or ground maintenance issue. Flight testing does not address this. [Subparameter 2 - Az Operational Coverage Requirements This subparameter is addressed under the OPERATIONAL COVERAGE parameter. [Subparameter 3 - El Coverage Design Requirements] This is a design qualification and/or ground maintenance issue. Flight testing does not address this. [Subparameter 4 - El Operational Coverage Requirements] This subparameter is addressed under the OPERATIONAL COVERAGE parameter.

procedures cannot provide an acceptable solution, techniques to minimize the effects are available. These techniques include adjustment of the proportional guidance sector or use of out-of-coverage indication signals. Guidance material on the use of these techniques is contained in Attachment G, 8.

Note 3. Where the proportional guidance sector provided is less than the minimum lateral coverage specified in 3.11.5.2.2.1.1 a), clearance guidance signals specified in 3.11.4.6.2.5 are required.

3.11.5.2.2.1.2 Runway region.

a) Horizontally within a sector 45 m (150 ft) each side of the runway centre line beginning at the stop end and extending parallel with the runway centre line in the direction of the approach to join the minimum operational coverage region as described in 3.11.5.2.2.1.3.

b) Vertically between:

1)a horizontal surface which is 2.5 m (8 ft) above th farthest point of the runway centre line which is in line of sight of the azimuth antenna; and

2) a conical surface originating at the azimuth ground equipment antenna inclined at 20 degrees above the horizontal up to a height of 600 m (2 000 ft).

Note 1. Information on the determination of the poir referred to in b) 1) is given in Attachment G, 2.3.6.

Note 2. It is intended that guidance below the line o sight may be allowed as long as the signal quality can satisfy the accuracy requirements in 3.11.4.9.4

3.11.5.2.2.1.2.1 Recommendation. The lower leve of the coverage in the runway region should be 2.5 (8 ft) above the runway centre line.

3.11.5.2.2.1.2.2 Where required to support automatic landing, roll-out or take-off, the lower leve of coverage in the runway region shall not exceed 2.5 m (8 ft) above the runway centre line.

Note. The lower coverage limit of 2.5 m (8 ft) is intended to serve all runways. Information on the possibility of relaxing the power density requiremen in 3.11.4.10.2 at 2.5 m (8 ft) is provided at

Attachment G, 2.3.6.

[Subparameter 2 - Az Operational Coverage Requirements - not addressed under this paramete name, but duplicated in OPERATIONAL COVERAGE parameter to match draft MLS Doc 8071 parameter names.]]

3.11.5.2.2.1.3 Minimum operational coverage region.

a) Laterally, within a sector of plus and minus 10 degrees about the runway centre line which originates at the MLS datum point.

b) Longitudinally, from the runway threshold in the direction of the approach to the longitudinal coverag limit specified in 3.11.5.2.2.1.1 b).

c) Vertically, between:

1) a lower plane which contains the line 2.5 m (8 ft) above the runway threshold and is inclined upward reach the height of the surface specified in 3.11.5.2.2.1.1 c) 1) at the longitudinal coverage limi and

2) the upper surface specified in 3.11.5.2.2.1.1 c) 2

3.11.5.2.2.1.4 Recommendation. The approach azimuth ground equipment should provide guidance vertically to 30 degrees above the horizontal.

3.11.5.2.2.1.5 The minimum proportional guidanc sector shall be as follows:

Approach azimuth antenna to proportional threshold distance (AAT)	Minimum coverage
AAT < 500 m	±8°
500 m < AAT < 3 100 m	±6°
3 100 m < AAT	±4°

3.11.5.2.2.2 Back azimuth. The back azimuth ground equipment shall provide information in at least the following volume of space:

a) Horizontally, within a sector plus or minus 20 degrees about the runway centre line originating at the back azimuth ground equipment antenna and

extending in the direction of the missed approach a least 18.5 km (10 NM) from the runway stop end.

b) Vertically, in the runway region between:

1) a horizontal surface 2.5 m (8 ft) above the farthe point of runway centre line that is in line-of-sight of the back azimuth antenna; and

2) a conical surface originating at the back azimuth ground equipment antenna inclined at 20 degrees above the horizontal up to a height of 600 m (2 000 ft).

c) Vertically, in the back azimuth region between:

1) a conical surface originating 2.5 m (8 ft) above th runway stop end, inclined at 0.9 degree above the horizontal; and

2) a conical surface originating at the back azimuth ground equipment antenna, inclined at 15 degrees above the horizontal up to a height of 3 000 m (10 000 ft).

Note 1. Information on the determination of the poir referred to in b) 1) is given in Attachment G, 2.3.6.

Note 2. When physical characteristics of the runwa or obstacles prevent the achievement of the Standards in b) and c), it is intended that guidance need not be provided at less than line-of-sight heights.

3.11.5.2.2.2.1 Recommendation. The back azimuth facility should provide guidance informatior to 30 degrees above the horizontal.

3.11.5.2.2.2.2 The minimum proportional guidanc sector shall be plus or minus 10 degrees about the runway centre line.

Note. Application information is provided in Attachment G, 7.5.

[EI Ground Equipment]

3.11.5.3.2 Coverage

[Subparameter 3 - EI Coverage Design Requirements]

Note. Diagrams illustrating the coverage requirements specified herein are contained in Attachment G, Figure G-10A.

3.11.5.3.2.1 Approach elevation. The approach elevation ground equipment shall provide proportional guidance information in at least the following volume of space.

3.11.5.3.2.1.1 Approach region.

a) Laterally, within a sector originating at the elevation antenna phase centre which has an angular extent at least equal to the proportional guidance sector provided by the approach azimuth ground equipment at the longitudinal coverage limit

b) Longitudinally, from the elevation antenna in the direction of the approach to 37 km (20 NM) from threshold.

c) Vertically, between:

1) a lower conical surface originating at the elevatio antenna phase centre and inclined upward to reach at the longitudinal coverage limit, a height of 600 m (2 000 ft) above the horizontal plane which contains the antenna phase centre; and

2) an upper conical surface originating at the elevation antenna phase centre and inclined 7.5 degrees above the horizontal up to a height of 6 00 m (20 000 ft).

Note. When the physical characteristics of the approach region prevent the achievement of the Standards under a), b) and c) 1), it is intended that guidance need not be provided below the line of sight.

3.11.5.3.2.1.1.1 Recommendation. The approach elevation ground equipment should provide proportional guidance to angles greater than 7.5 degrees above the horizontal when necessary to meet operational requirements.

[Subparameter 4 - EI Operational Coverage Requirements, not addressed under this parameter name, but duplicated in OPERATIONAL COVERAGE parameter to match draft MLS Doc 8071 parameter names.]

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

3.11.5.3.2.1.2 Minimum operational coverage region.

a) Laterally, within a sector originating at the MLS datum point, of plus and minus 10 degrees about th runway centre line;

b) Longitudinally, 75 m (250 ft) from the MLS datum point in the direction of threshold, to the far coverag limit specified in 3.11.5.3.2.1.1 b);

c) Vertically, between the upper surface specified in 3.11.5.3.2.1.1 c) 2), and the higher of:

1) a surface which is the locus of points 2.5 m (8 ft) above the runway; or

2) a plane originating at the MLS datum point and inclined upward to reach, at the longitudinal coverage limit, the height of the surface specified in 3.11.5.3.2.1.1 c) 1).

Note. Information related to the horizontal radiation pattern of the approach elevation is provided in Attachment G, 3.3.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
N/A		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
This text provides a mixture of design characteristics which are not subject to flight inspection, and operational coverage requirements The latter are covered under the OPERATIONAL COVERAGE parameter.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
493			696

Facility MLS **Parameter** Data Coverage & Monitoring

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref / 8071 Reference	8200 Reference

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.11.5.4 Data coverage and monitoring Note 1. Guidance material relating to data applications is provided in Attachment G, 2.7. Note 2. The essential data are basic data and essential auxiliary data transmitted in auxiliary data words A1, A2, A3 and A4. 3.11.5.4.1 Basic data 3.11.5.4.1.1 The basic data words 1, 2, 3, 4 and 6 shall be transmitted throughout the approach azimuth coverage sector. Note. The composition of the basic data words is given in Appendix A, Table A-7. 3.11.5.4.1.2 Where the back azimuth function is provided, basic data words 4, 5 and 6 shall be transmitted throughout the approach azimuth and back azimuth coverage sectors. 3.11.5.4.2 Auxiliary data 3.11.5.4.2.1 Auxiliary data words A1, A2 and A3 shall be transmitted throughout the approach azimuth coverage sector. 3.11.5.4.2.2 Where the back azimuth function is provided, auxiliary data words A3 and A4 shall be transmitted throughout the approach azimuth and back azimuth coverage sectors. Note. Auxiliary data words B42 and B43 are transmitted in place of A1 and A4, respectively, to support applications which require azimuth antenna rotation beyond the alignment range available in A1 and A4. 3.11.5.4.2.3 When provided, auxiliary data B words shall be transmitted throughout the approach azimuth sector, except that the words comprising th back azimuth procedure database shall be transmitted throughout the back azimuth sector.			This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

3.11.5.4.2.4 Recommendation. If the back azimut function is provided, the appropriate auxiliary data E words should be transmitted.

Note. The composition of the auxiliary data words is given in Appendix A, Tables A-10, A-12 and A-15.

3.11.5.4.3 Monitor and control

3.11.5.4.3.1 The monitor system shall provide a warning to the designated control point if the radiate power is less than that necessary to satisfy the DPSK requirement specified in 3.11.4.10.1.

3.11.5.4.3.2 If a detected error in the basic data radiated into the approach azimuth coverage occurs in at least two consecutive samples, radiation of these data, approach azimuth and elevation functions shall cease.

3.11.5.4.3.3 If a detected error in the basic data radiated into the back azimuth coverage occurs in a least two consecutive samples, radiation of these data and the back azimuth function shall cease.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
N/A		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
This text provides design characteristics which are not subject to flight inspection.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
494			697

Facility MLS **Parameter** Data Functions

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for some & meets others

SARPS Ref 3.11.4.6.2.1, 3.11.4.8

Annex Ref **8071 Reference** 6.10 **8200 Reference** 16.20b(6), 16.22f

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
[Paragraph 3.11.4.6.2.1 below and its subparagraphs are duplicated here from the AZIMUTH GUIDANCE FUNCTIONS parameter, to match draft MLS Doc 8071 parameter names.] [subparameter 1 - Identification] 3.11.4.6.2.1 Ground equipment identification. The MLS providing services for a particular runway shal be identified by a four-character alphabetic designator starting with the letter M. This designato less the first letter shall be transmitted as a digital word as listed in Appendix A, Table A-7. Note. It is not required that MLS ground equipment will transmit identification outside the angle guidanc coverage sectors. If MLS channel identification is operationally required outside angle guidance coverage sectors, it may be derived from associate omnidirectional DME. (See 3.11.5.5.2 and Attachment G, 8.2.) 3.11.4.6.2.1.1 The signal shall be transmitted on the data channel into the approach and back azimu coverage regions. 3.11.4.6.2.1.2 The code bit in the time slot previously allocated for the alternate (Morse code) ground equipment identification following the azimuth preamble shall be fixed in the "ZERO" state ---------- [subparameter 2 - Data Words] 3.11.4.8 Data functions. Provision shall be made the MLS signal format for the transmission of basic data and auxiliary data. Note. Ground equipment data coverage and monitoring requirements are specified in 3.11.5.4. 3.11.4.8.1 Data transmission. Data shall be transmitted as specified in 3.11.4.4.3.1.	[This parameter name is listed in the draft MLS Doc 8071 as "Identification and Data"; it is changed here to match the SARPS reference title for convenience.] ---------- [subparameter 1 - Identification] [subparameter 2 - Data Words] ---------- 6.10 Identification and Facility Data 6.10.1 General Testing of the facility identification and data words is accomplished through ground check procedures. This check may be included in flight inspection to satisfy legal concerns. 6.10.2 Equipment 6.10.2.1 To verify the Morse Code Identification th audio and/ or the digital data display of the MLS receiver is used. The receiver Morse Code generation process should be considered. 6.10.2.2 To verify the correctness of the transmitted data words a device that decodes the basic data words output from the receiver is required. 6.10.2 Maneuvers This test can be performed during any of the flight maneuvers within the coverage volume. 6.10.3 Procedures No special procedures are required.	[subparameter 1 - Identification] 16.20b(6) Identification. The purpose of the identification check is to ensure correct identification is received throughout the coverage area. Validate the identification by listening to the Morse code or recording Basic Data Word 6. ---------- [subparameter 2 - Data Words] 16.20b(8) Data Words. The receiver uses transmitted data words containing facility siting an approach information to process AZ and EL angle information, identify the station, and determine crosspointer sensitivity. Basic data words are used for all approaches. Auxiliary data words are used for RNAV or Computed Centerline Approaches. Some stations may not transmit all auxiliary data words. The AFIS, loaded with the correct facility data, is the standard for compariso with transmitted data words. See Table 16-2 for a breakdown of individual data words. If using non-AFIS equipment, the data words supplied by the Facility Data Sheet are the standard. On commissioning, data word discrepancies must be resolved with Facilities Maintenance before placin the facility in service; any intentionally missing dat words must be documented on the Facility Data Sheet. Table 16-2, MLS DATA WORD TRANSLATOR -- [tutorial, not included here for simplicity]	For this parameter, (unpublished) Doc 8071 will be considered the requirement. [subparameter 1 - Identification] Matches in intent, no specific tolerances in 8071 [subparameter 2 - Data Words] Matches in intent, no specific tolerances in 8071

3.11.4.8.2 Basic data structure and timing. Basic data shall be encoded as 32-bit words consisting of a function preamble (12 bits) specified in 3.11.4.4, and data content as specified in Appendix A, Table A-7. The timing of the basic data words shall be as specified in Appendix A, Table A-6. The content, maximum interval between transmission of the sam word and organization of the words shall be as specified in Appendix A, Table A-7. Data containing digital information shall be transmitted with the leas significant bit first. The smallest binary number shal represent the lower absolute range limit with increments in binary steps to the upper absolute range limit specified in Appendix A, Table A-7.

3.11.4.8.2.1 Basic data contents. The data items specified in Appendix A, Table A-7 shall be defined as follows:

a) Approach azimuth antenna to threshold distance shall represent the minimum distance between the approach azimuth antenna phase centre to the vertical plane perpendicular to the centre line which contains the runway threshold.

b) Approach azimuth proportional coverage limit shall represent the limit of the sector in which proportional approach azimuth guidance is transmitted.

c) Clearance signal type shall indicate the method c providing the azimuth clearance signal.

d) Minimum glide path shall represent the lowest angle of descent along the zero-degree azimuth as defined in 3.11.1.

e) Back azimuth status shall represent the operational status of the back azimuth equipment.

f) DME status shall represent the operational status of the DME equipment.

g) Approach azimuth status shall represent the operational status of the approach azimuth equipment.

h) Approach elevation status shall represent the operational status of the approach elevation equipment.

i) Beamwidth shall represent, for a particular function, the antenna beamwidth as defined in

3.11.1.

j) DME distance shall represent the minimum distance between the DME antenna phase centre and the vertical plane perpendicular to the runway centre line which contains the MLS datum point.

k) Approach azimuth magnetic orientation shall represent the angle measured in the horizontal plar clockwise from Magnetic North to the zero-degree approach azimuth, originating from the approach azimuth antenna. The vertex of the measured angle shall be the approach azimuth antenna phase centr

l) Back azimuth magnetic orientation shall represen the angle measured in the horizontal plane clockwis from Magnetic North to the zero-degree back azimuth, originating from the back azimuth antenna The vertex of the measured angle shall be the back azimuth antenna phase centre.

m) Back azimuth proportional coverage limit shall represent the limit of the sector in which proportiona back azimuth guidance is transmitted.

n) MLS ground equipment identification shall represent the last three characters of the system identification specified in 3.11.4.6.2.1. The characters shall be encoded in accordance with International Alphabet No. 5 (IA-5) using bits b1 through b6.

Note 1. International Alphabet No. 5 (IA-5) is define in Annex 10, Volume III.

Note 2. Bit b7 of this code may be reconstructed in the airborne receiver by taking the complement of b b6.

3.11.4.8.3 Auxiliary data organization and timing. Auxiliary data shall be organized into 76-bit words consisting of the function preamble (12 bits) as specified in 3.11.4.4, the address (8 bits) as specified in Appendix A, Table A9, and data conten and parity (56 bits) as specified in Appendix A, Tables A-10, A-11, A-12, A-13 and A-15. Three function identification codes are reserved to indicate transmission of auxiliary data A, auxiliary data B an auxiliary data C. The timing of the auxiliary data function shall be as specified in Appendix A, Table 8. Two auxiliary data word formats shall be provided one for digital data and one for alphanumeric character data. Data containing digital information

shall be transmitted with the least significant bit first. Alpha characters in data words B1 through B39 shall be encoded in accordance with International Alphabet No. 5 (IA5) using bits b1 to b5 with b1 transmitted first. Alphanumeric data characters in other data words shall be encoded in accordance with IA-5 using seven information bits, plus one even parity bit added to each character. Alphanumeric data shall be transmitted in the order in which they are to be read. The serial transmission of a character shall be with the lower order bit transmitted first and the parity bit transmitted last.

Note 1. International Alphabet No. 5 (IA5) is defined in Annex 10, Volume III.

Note 2. Auxiliary data A contents are specified in 3.11.4.8.3.1. Auxiliary data B contents are specified in 3.11.4.8.3.2. Auxiliary data C contents are reserved for national use.

3.11.4.8.3.1 Auxiliary data A content. The data items contained in auxiliary data words A1 through A4 as specified in Appendix A, Table A-10 shall be defined as follows:

a) Approach azimuth antenna offset shall represent the minimum distance between the approach azimuth antenna phase centre and a vertical plane containing the runway centre line.

b) Approach azimuth antenna to MLS datum point distance shall represent the minimum distance between the approach azimuth antenna phase centre and the vertical plane perpendicular to the runway centre line which contains the MLS datum point.

c) Approach azimuth alignment with runway centre line shall represent the minimum angle between the zero-degree approach azimuth and the runway centre line.

D) Approach azimuth antenna coordinate system shall represent the coordinate system (planar or conical) of the angle data transmitted by the approach azimuth antenna.

Note. Although the above Standard has been developed to provide for alternate coordinate systems, the planar coordinate system is not implemented and it is not intended for future implementation.

e) Approach azimuth antenna height shall represen the vertical location of the antenna phase centre wi respect to the MLS datum point.

f) Approach elevation antenna offset shall represen the minimum distance between the elevation anten phase centre and a vertical plane containing the runway centre line.

g) MLS datum point to threshold distance shall represent the distance measured along the runway centre line from the MLS datum point to the runway threshold.

h) Approach elevation antenna height shall represe the vertical location of the elevation antenna phase centre with respect to the MLS datum point.

i) MLS datum point elevation shall represent the datum point elevation relative to mean sea level (m

j) Runway threshold height shall represent the vertical location of the intersection of the runway threshold and centre line with respect to the MLS datum point.

k) DME offset shall represent the minimum distance between the DME antenna phase centre and a vertical plane containing the runway centre line.

l) DME to MLS datum point distance shall represen the minimum distance between the DME antenna phase centre and the vertical plane perpendicular to the runway centre line which contains the MLS datum point.

m) DME antenna height shall represent the vertical location of the antenna phase centre with respect to the MLS datum point.

n) Runway stop-end distance shall represent the distance along centre line between the runway stop end and the MLS datum point.

o) Back azimuth antenna offset shall represent the minimum distance between the back azimuth antenna phase centre and a vertical plane containin the runway centre line.

p) Back azimuth to MLS datum point distance shall represent the minimum distance between the back azimuth antenna and the vertical plane perpendicul

to the runway centre line which contains the MLS datum point.

Q Back azimuth alignment with runway centre line shall represent the minimum angle between the zer degree back azimuth and the runway centre line.

r) Back azimuth antenna coordinate system shall represent the coordinate system (planar or conical) of the angle data transmitted by the back azimuth antenna.

Note. Although the above Standard has been developed to provide for alternate coordinate systems, the planar coordinate system is not implemented and it is not intended for future implementation.

s) Back azimuth antenna height shall represent the vertical location of the antenna phase centre with respect to the MLS datum point.

Note. It is intended that no additional auxiliary data words be defined.

3.11.4.8.3.2 Auxiliary data B content. Auxiliary da B words shall be defined as specified in Appendix A Tables A-11 and A-13.

3.11.4.8.3.2.1 Microwave landing system/area navigation (MLS/RNAV) procedure data. Where required, auxiliary data words B1 through B39 shall be used to transmit data to support MLS/RNAV procedures. It shall be permissible to divide this procedure data into two separate databases: one fo transmission in the approach azimuth sector, the other for transmission in the back azimuth sector. Data for each procedure shall be transmitted in the database for the coverage sector in which the procedure commences. Missed approach procedur data shall be included in the database containing th associated approach procedure.

3.11.4.8.3.2.2 Procedure database structure. Where used, each procedure database shall be constructed as follows:

a) a map/CRC word shall identify the size of the database, the number of procedures defined, and the cyclic redundancy check (CRC) code for validation of the database;

b) procedure descriptor words shall identify all

named approach and departure procedures within the database; and

c) way-point data words shall define the location an sequence of way-points for the procedures.

Note. The structure and coding of auxiliary B words B1 through B39 are defined in Appendix A, Tables A 14 through A-17. Guidance material concerning the coding of MLS/RNAV procedures is given in Attachment G.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
N/A	(none)	f. Data Words. The AFIS is the reference for the correctness of the received data words (data shee for non-AFIS). Due to calculation rounding and feet/ meter conversion, some apparent errors occur. When the received data words do not matc the AFIS expected values, the differences must b resolved with Facilities Maintenance. The followin data words, if transmitted, have acceptable tolerances; all other values must match.

(1) Basic Data Words

Word	Description	Tolerance
Basic 1	AZ to threshold distance	± 1 Meter
Basic 3	DME distance	± 1 Meter

(2) Auxiliary Data Words

Word	Description	Tolerance
AUX 1		
	Az to Offset	± 1 Meter
	Az to MDPT	± 1 Meter
	Az Ant Height	± 1 Meter
AUX 2		
	El Ant Offset	± 1 Meter
	MDPT Distance	± 1 Meter
	El Ant Height	± 0.1 Meter
	MDPT Height	± 1 Meter
	Threshold Height	± 0.1 Meter
AUX 3		
	DME Offset	± 1 Meter

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		DME to MDPT Distance ± 1 Meter DME Ant Height ± 1 Meter Rwy Stop End Distance ± 1 Meter	
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
This text provides design characteristics and data element definitions, some of which may be subject to flight inspection.	This (draft) MLS volume of Doc 8071 was never published by ICAO. It was prepared prior to any significant operational fielding of MLS equipment, and as a result some of its apparent flight inspection requirements may no longer be appropriate.	none in Tolerances, Paragraph 16.22.	
	Measurement Uncertainty (none)		
Annex10_ID	**8071_ID**	**8200_ID**	**Results_ID**
495	643	410	698

Facility MLS **Parameter** Distance Measuring Equipment

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref / 8071 Reference	8200 Reference

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.11.5.5 Distance measuring equipment 3.11.5.5.1 DME information shall be provided at least throughout the coverage volume in which approach and back azimuth guidance is available. 3.11.5.5.2 Recommendation. DME information should be provided throughout 360° azimuth if operationally required. Note. Siting of DME ground equipment is depender on runway length, runway profile and local terrain. Guidance on siting of DME ground equipment is given in Attachment C, 7.1.6 and Attachment G, 5.			This is an installation requirement and a general definition of DME coverage volume. Flight testin does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
N/A		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
This text provides design characteristics which are not subject to flight inspection.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
496			699

Facility MLS **Parameter** Elevation Guidance Functions

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref / 8071 Reference	8200 Reference

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.11.4.7 Elevation guidance functions 3.11.4.7.1 Scanning conventions. For the approach elevation function, increasing elevation guidance angles shall be in the upward direction. Zero elevation angle shall coincide with a horizontal plane through the respective antenna phase centre. Each guidance angle transmission shall consist of a TO scan followed by a FRO scan. The TO scan shall be in the direction of increasing angle values. ---------- [Paragraph 3.11.4.7.2 below duplicated elsewhere under SIGNAL LEVEL RATIOS parameter, to match draft MLS Doc 8071 parameter names.] 3.11.4.7.2 Sector signal. Provision for transmission of one out-of-coverage indication pulse shall be made in the format for the approach elevation function. Where an out-of-coverage indication pulse is used, it shall be: (1) greater than any guidance signal in the out-of-coverage indication sector and (2) at least 5 dB less than the guidance signals within the guidance sector. The elevation out-of-coverage indication timing shall be as shown in Appendix A, Table A-4. The duration of each pulse measured at the half amplitude points shall be at least 100 microseconds, and the rise and fall times shall be less than 10 microseconds. ---------- 3.11.4.7.2.1 If desired, it shall be permissible to sequentially transmit two pulses in each obstacle clearance indication time slot. Where pulse pairs are used, the duration of each pulse shall be at least 50 microseconds, and the rise and fall times shall be less than 10 microseconds.			This is a design qualification and/or ground maintenance issue. Flight testing does not address this. (Portions are covered under other parameter names.)

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
OCI: > guidance sector in OCI sector, >= 5 dB less than guidance signals in guidance sector		

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
This text provides a mixture of design characteristics which are not subject to flight inspection, and power ratios which may be flight tested..			
	Measurement Uncertainty		

Annex10_ID	8071_ID	8200_ID	Results_ID
497			700

Facility **MLS** **Parameter** **False Courses**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref (none)

Annex Ref **8071 Reference** 6.6 **8200 Reference** 16.20b(5)

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	6.6 False Courses 6.6.1 General 6.6.1.1 The purpose of. this test is to determine if any flyable false guidance exists. If guidance is found, additional testing to determine its operational impact on the published procedure wil be required. 6.6.1.2 It should be noted that since MLS receiver use signal history to validate guidance signals, some flight paths through an area of potential fals guidance may not result in the display of an erroneous guidance signal. 6.6.2 Equipment An MLS receiver with the same modifications, as used for the angular measurements is recommended. An accurate position reference is not required. 6.6.3 Maneuvers. A complete orbit around the airport is recommended. The radius and height of the orbit should be based on the locations of predicted multipath. 6.6.4 Procedures 6.6.4.1 When within the proportional coverage sector, potential false courses will be indicated by the presence of a significant number of frame flag 6.6.4.2 The presence of valid data words outside the coverage volume can be an indication that the potential for false guidance exists. However, this condition alone does not indicate that there will be false courses, as the antenna patterns of the DPSK antennas will be different from those of the scanning beam antennas. 6.6.4.3 When areas are discovered which have these characteristics a further investigation is necessary.	(5) Out-of-Coverage Indication (OCI). The purpos of the OCI check is to ensure that no false angle decoding occurs outside of proportional guidance coverage areas. This check is accomplished at maintenance request if there are procedural requirements beyond the service volume. Fly an orbit radius of 6 to 10 mile about the azimuth facility for this check. The aircraft will be flown at an altitude as close to the MGP that line of site with the MLS facilities will allow. During the orbit, note the position of any decoded angles lasting longer than 4 seconds or 1.5° of arc, whichever is greater. Return to the are after completing the orbit and manually program the decoded angle into the receiver. If the angle can be locked onto and flown as a radial, even though an OCI signal is present, the problem mus be corrected, or the facility restricted. MMLS does not have OCI capability.	For this parameter, (unpublished) Doc 8071 will be considered the requirement. Order 8200.1 matches the intent of Doc 8071, although no specific tolerances are listed.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	(none)	none in 16.22, Tolerances

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
	This (draft) MLS volume of Doc 8071 was never published by ICAO. It was prepared prior to any significant operational fielding of MLS equipment, and as a result some of its apparent flight inspection requirements may no longer be appropriate.	An explicit tolerance is not found in Chapter 16, other than an implication in the procedural text in 16.20b(5).

Measurement Uncertainty

(none)

Annex10_ID	8071_ID	8200_ID	Results_ID
	644	411	701

Facility MLS **Parameter** Ground Equipment Accuracy

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref 8071 Reference	8200 Reference	ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
			[Az Ground Equipment] 3.11.5.2.5 Ground equipment accuracy 3.11.5.2.5.1 The ground equipment contribution to the mean course error shall not exceed an error equivalent to plus or minus 3 m (10 ft) at the MLS approach reference datum. 3.11.5.2.5.2 Recommendation. The ground equipment contribution to the CMN at the reference datum should not exceed 1 m (3.3 ft) or 0.03 degree whichever is less, on a 95 per cent probability basis Note 1. This is the equipment error, and does not include any propagation effects. Note 2. Guidance on the measurement of this parameter can be found in Attachment G, 2.5.2. ---------- [El Ground Equipment] 3.11.5.3.5 Ground equipment accuracy 3.11.5.3.5.1 The ground equipment contribution to the mean glide path error component of the PFE shall not exceed an error equivalent to plus or minus 0.3 m (1 ft) at the approach reference datum. 3.11.5.3.5.2 Recommendation. The ground equipment contribution to the CMN at the reference datum should not exceed 0.15 m (0.5 ft) on a 95 per cent probability basis. Note 1. This is the equipment error, and does not include any propagation effects. Note 2. Guidance on the measurement of this parameter can be found in Attachment G, 2.5.2.			This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
ICAO Annex Tol	**Doc 8071 Tolerance**	**8200 Tolerance**	
Az Mean course error: <= 3m (10') at ARD El Mean course error: <= 0.3m (1') at ARD			
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
This text provides design and ground equipment characteristics which do not include propagation effects, and are not subject to flight inspection. Ground testing activities cover these requirements			
	Measurement Uncertainty		

Annex10_ID	8071_ID	8200_ID	Results_ID
498			702

Facility MLS **Parameter** Integrity and Cont. of Service

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref 8071 Reference	8200 Reference	ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
			[Az Ground Equipment] 3.11.5.2.4 Integrity and continuity of service requirements for MLS azimuth 3.11.5.2.4.1 The probability of not radiating false guidance signals shall not be less than 1 - 0.5 × 10-9 in any one landing for an MLS azimuth intended to be used for Categories II and III operations. 3.11.5.2.4.2 Recommendation. The probability of not radiating false guidance signals should not be less than 1 - 1.0 × 10-7 in any one landing for an MLS azimuth intended to be used for Category I operations. 3.11.5.2.4.3 The probability of not losing the radiated guidance signal shall be greater than: a) 1 - 2 × 10-6 in any period of 15 seconds for an MLS azimuth intended to be used for Category II or Category IIIA operations (equivalent to 2 000 hours mean time between outages); and b) 1 - 2 × 10-6 in any period of 30 seconds for an MLS azimuth intended to be used for the full range of Category III operations (equivalent to 4 000 hours mean time between outages). 3.11.5.2.4.4 Recommendation. The probability of not losing the radiated guidance signal should exceed 1 - 4 × 10-6 in any period of 15 seconds for an MLS azimuth intended to be used for Category I operations (equivalent to 1 000 hours mean time between outages). Note. Guidance material on integrity and continuity service is given in Attachment G, 11. ---------- [El Ground Equipment] 3.11.5.3.4 Integrity and continuity of service			This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

requirements for MLS approach elevation

3.11.5.3.4.1 The probability of not radiating false guidance signals shall not be less than 1 - 0.5 × 10-9 in any one landing for an MLS approach elevation intended to be used for Categories II and III operations.

3.11.5.3.4.2 Recommendation. The probability of not radiating false guidance signals should not be less than 1 - 1.0 × 10-7 in any one landing on MLS approach elevation intended to be used for Categor I operations.

3.11.5.3.4.3 The probability of not losing the radiated guidance signal shall be greater than 1 - 2 10-6 in any period of 15 seconds for an MLS approach elevation intended to be used for Categories II and III operations (equivalent to 2 000 hours mean time between outages).

3.11.5.3.4.4 Recommendation. The probability of not losing the radiated guidance signal should exceed 1 - 4 × 10-6 in any period of 15 seconds for an MLS approach elevation intended to be used for Category I operations (equivalent to 1 000 hours mean time between outages).

Note. Guidance material on integrity and continuity service is given in Attachment G, 11.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
N/A		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
This text provides design and maintenance characteristics which are not subject to flight inspection.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
499			703

Facility MLS **Parameter** Monitor and Control

8200/Annex (sub)parameter Compare Results: N/A (no A10 requirement, etc.)

SARPS Ref 3.11.5.2.3, 3.11.5.3.3

Annex Ref **8071 Reference** 6.9 **8200 Reference** 16.20b(4)

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
[Az Ground Equipment] 3.11.5.2.3 Monitor and control [Subparameter 1 - Az Monitoring] 3.11.5.2.3.1 The approach azimuth and back azimuth monitor systems shall cause the radiation c their respective functions to cease and a warning shall be provided at the designated control points if any of the following conditions persist for longer tha the periods specified: a) there is a change in the ground equipment contribution to the mean course error such that the PFE at the approach reference datum or in the direction of any azimuth radial exceeds the limits specified in 3.11.4.9.4 and 3.11.4.9.5 and (for simplified MLS configuration) in 3.11.3.4 for a perio of more than one second or (for simplified MLS configuration) for a period of more than six seconds b) there is a reduction in the radiated power to less than that necessary to satisfy the requirements specified in 3.11.4.10.1 and 3.11.4.6.2.5.2 for a period of more than one second; c) there is an error in the preamble DPSK transmissions which occurs more than once in any one-second period; d) there is an error in the TDM synchronization of a particular azimuth function such that the requiremer specified in 3.11.4.3.2 is not satisfied, and this condition persists for more than one second. Note. Guidance material is provided in Attachment G, 6. [Subparameter 2 - Az Control] 3.11.5.2.3.2 Design and operation of the monitor system shall cause radiation to cease and a warnin shall be provided at the designated control points in the event of failure of the monitor system itself.	[Draft Doc 8071 lists "none" for SARPS Reference; However, some parts of SARPS appear relevant.] [Detailed SARPS References: 3.11.5.1, and 3.11.5.2.3 for Az and 3.11.5.3.3 for El] 6.9 Monitor Verification 6.9.1 General The establishment and testing of monitor alarm limits may be performed through ground testing techniques. This check may be performed during flight inspections to satisfy legal concerns. 6.9.2 Equipment The equipment required is identical to that used for angle accuracy and powe measurements. 6.9.3 Maneuvers 6.9.3.1 Angle alarm limits may be checked while flying the published approach procedure. 6.9.3.2 Power density limits may be checked whil flying an arc through the coverage area at a distance of 20 NM and at the altitude of the lower limit of coverage. 6.9.3 Procedures 6.9.3.1 The angle alarm limit may be checked by shifting the transmitter alignment to its alarm limit measuring PFE on the published approach and determining if it remains in tolerance. 6.9.3.2 The power level limit may be checked by placing the transmitter at the low power level limit and verifying that power density requirements are satisfied as described in 6.4.	(4) Monitor References (a) Purpose: To provide Facilities Maintenance personnel reference readings to be used in the validation of facility monitoring parameters. Facilit discrepancies must be assigned if the alignment shift results in out-of-tolerance PFE at any distance on the approach. (b) Inspection 1 Azimuth monitor references must be establishe after the facility is optimized to a MCE within ± 0.02° of the designed procedural azimuth. After th MCE is established, have maintenance personnel shift the system to one side, record the reference, shift the same amount to the other side, record th reference, then restore to normal. Azimuth monitc can also be established on the ground when parked within proportional guidance, maintaining line-of-sight at the maximum practical distance from the antenna. When azimuth monitors are checked on the ground, algebraically add the azimuth shift to the reported maximum PFE on th approach. 2 Elevation monitor references are established airborne and require the MGP to be established within ± 0.02° of the commissioned angle prior to accomplishment. Request an elevation angle change of no greater than 0.10° high, record the reference, have the elevation angle changed to nc greater than 0.10° low, record the reference, then restore to normal. 3 If the elevation lower scan angle limit is increased to improve PFE, recheck normal EL pa structure. ---------- [The paragraph below is duplicated in parameter "CLEARANCE GUIDANCE" for comparison purposes.]	For this parameter, (unpublished) Doc 8071 will be considered the requirement. Text in Doc 8071 makes clear this can normally be done by ground maintenance actions, and flight testing may be needed solely for legal purposes.

3.11.5.2.3.3 The period during which erroneous guidance information is radiated, including period(s of zero radiation, shall not exceed the periods specified in 3.11.5.2.3.1. Attempts to clear a fault b resetting the primary ground equipment or by switching to standby ground equipment shall be completed within this time. If the fault is not cleared within the time allowed, the radiation shall cease. After shutdown, no attempt shall be made to restore service until a period of 20 seconds has elapsed.

[EI Ground Equipment]

3.11.5.3.3 Monitor and control

[Subparameter 3 - EI Monitoring]

3.11.5.3.3.1 The approach elevation monitor system shall cause the radiation of its respective functions to cease and a warning shall be provided at the designated control point if any of the following conditions persist for longer than the periods specified:

a) there is a change in the ground equipment contribution to the mean glide path error componen such that the PFE at the approach reference datum or on any glide path consistent with published approach procedures exceeds the limits specified in 3.11.4.9.6 and (for simplified MLS configuration) in 3.11.3.4 for a period of more than one second or (fo simplified MLS configuration) for a period of more than six seconds;

b) there is a reduction in the radiated power to less than that necessary to satisfy the requirements specified in 3.11.4.10.1 for a period of more than one second;

c) there is an error in the preamble DPSK transmissions which occurs more than once in any one-second period;

d) there is an error in the TDM synchronization of a particular elevation function such that the requirement specified in 3.11.4.3.2 is not satisfied and this condition persists for more than one secon

Note. Guidance material is provided in Attachment G, 6.

(c) Below Path Coverage Evaluation. Perform this check during a commissioning flight inspection when in low angle alarm. Three runs are required, one on procedural centerline, and at 2° either side of centerline. With the MGP selected for evaluation, fly at an angle equal to [(MGP° x 0.75) 0.25°]. Ensure a full-scale fly up indication is maintained on the elevation signal and AZ guidance and obstacle clearance can be maintained from the FAF to the MAP.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

[Subparameter 4 - EI Control]

3.11.5.3.3.2 Design and operation of the monitor system shall cause radiation to cease and a warnin shall be provided at the designated control points in the event of failure of the monitor system itself.

3.11.5.3.3.3 The period during which erroneous guidance information is radiated, including period(s of zero radiation, shall not exceed the periods specified in 3.11.5.3.3.1. Attempts to clear a fault b resetting the primary ground equipment or by switching to standby ground equipment shall be completed within this time. If the fault is not cleared within the time allowed, radiation shall cease. After shutdown, no attempt shall be made to restore service until a period of 20 seconds has elapsed.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	(none)	See Remarks re: 16.20b(4)(c). No tolerances are applied in this text - the checks are for ground maintenance personnel only.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
	This (draft) MLS volume of Doc 8071 was never published by ICAO. It was prepared prior to any significant operational fielding of MLS equipment, and as a result some of its apparent flight inspection requirements may no longer be appropriate. This document indirectly states that this paramete is not subject to flight testing.	Subparagraph (c) isn't really a Monitor check, but rather a below-path coverage check conducted with the facility adjusted to a low angle alarm condition. Consider creating a new parameter fo the tolerances tables, and relocating this subparagraph out of the monitor section..

Measurement Uncertainty

(none)

Annex10_ID	8071_ID	8200_ID	Results_ID
500	645	412	704

Facility **MLS** **Parameter** **Operational Coverage**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref 3.11.5.2, 3.11.5.3

Annex Ref **8071 Reference** 6.8 **8200 Reference** 16.20b1, b2

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
[Subparameter 1 - Az Operational Coverage Requirements - duplicated here from Subparameter 2 of COVERAGE parameter to match draft MLS Doc 8071 parameter name.] 3.11.5.2.2.1.3 Minimum operational coverage region. a) Laterally, within a sector of plus and minus 10 degrees about the runway centre line which originates at the MLS datum point. b) Longitudinally, from the runway threshold in the direction of the approach to the longitudinal coverag limit specified in 3.11.5.2.2.1.1 b). c) Vertically, between: 1) a lower plane which contains the line 2.5 m (8 ft) above the runway threshold and is inclined upward reach the height of the surface specified in 3.11.5.2.2.1.1 c) 1) at the longitudinal coverage limi and 2) the upper surface specified in 3.11.5.2.2.1.1 c) 2 3.11.5.2.2.1.4 Recommendation. The approach azimuth ground equipment should provide guidance vertically to 30 degrees above the horizontal. 3.11.5.2.2.1.5 The minimum proportional guidanc sector shall be as follows: Approach azimuth antenna to proportional threshold distance (AAT) — Minimum coverage AAT < 500 m — ±8° 500 m < AAT < 3 100 m — ±6° 3 100 m < AAT — ±4° 3.11.5.2.2.2 Back azimuth. The back azimuth ground equipment shall provide information in at least the following volume of space:	[Draft Doc 8071 lists "none" for SARPS Reference; However, some parts of SARPS appear relevant.] [Detailed SARPS References: 3.11.5.2.2.1.3 through 3.11.5.2.2.2.2 for Az, and 3.11.5.3.2.1.2 for El] 6.8 Operationally Significant Areas of Coverage 6.8.1 General 6.8.1.1 This test determines if the guidance signals in areas close to obstacles support safe operations. 6.8.1.2 Lateral obstacle clearance distances and elevation guidance below the MGP are considere as areas of this type. These flight tests are conducted to satisfy legal concerns. 6.8.1.3 It is recommended that the transmitter's worst case condition be simulated during these tests (e.g., Clearance levels reduced to the minimum allowed by the equipment monitor). 6.8.2 Equipment The equipment required is identical to that used for the measurement of angl accuracy and signal ratios. 6.8.3 Maneuvers As the requirements will differ between sites, the maneuvers must take into account the operational objectives. For example, testing of the azimuth obstacle clearance can be accomplished with an inbound radial at the edges of the operationally useful areas. Testing of the lo elevation angles can be accomplished by flying sufficiently below the MGP to determine that full fl up guidance is provided in that area. 6.8.4 Procedures 6.8.4.1 When verifying clearance from an obstacl an operational evaluation of the signal can be ma by measuring the receiver crosspointer deviations	[Paragraph 16.20b1 below is duplicated in parameter CLEARANCE GUIDANCE for comparison purposes.] (1) Lateral Coverage. Coverage arcs are used to define and certify the lateral and distance limits of AZ, EL, and DME coverage. Evaluate proportiona guidance and clearance coverage. (a) Service Volume Arc. A commissioning inspection maneuver to define and certify the operational range, lateral, and vertical limits of the MLS service volume. Perform the inspection with the facility operating at the lowest computed powe required to establish adequate signal coverage fo the intended service volume. 1 Positioning. Start the arc at the maximum usabl distance and 5° outside the edge of the service volume limit. Maintain an altitude equal to the minimum glide path (MGP). If signal coverage of all MLS components cannot be maintained at the MGP, the MLS must be restricted. There is no requirement to certify the lower, 0.9°, or higher, 20,000 ft, limits of lateral coverage unless procedurally or operationally required. The Option Service Volume Arc should be flown at a distance of 14 nm. 2 Inspection a There must be no less than 10° proportional guidance either side of the procedural on course. b While traversing the azimuth proportional guidance sectors, record azimuth and elevation deviation. Deviation crosspointer fluctuations greater than 0.5° that exceed 2° of arc, and all MLS receiver unlocks, must be validated by radial flight, using the procedures outlined in Paragraph 16.20b(2) (Vertical Coverage). (b) Reference Arc: A commissioning and periodic arc throughout the proportional guidance area to	For this parameter, (unpublished) Doc 8071 will be considered the requirement. Direct comparisons between the "requirements" i the three documents are difficult, due to differences in phrasing and presentation. However, analysis indicates that the general intention is met. In addition, where specific tolerances appear in ICAO documents, such as a minimum of 10 degrees proportional guidance either side of the approach course, the match is good. However, in a literal sense, 8200.1 does not fully address all the coverage specifications in the SARPS. Those specifications are an inconvenient mix of design goals, and operationally practical requirements. ICAO Doc 8071 [unpublished] took the practical approach and addresses "operationally significar areas of coverage." Because this is the ICAO recommended testing method, this parameter is considered to "match" ICAO "requirements."

a) Horizontally, within a sector plus or minus 20 degrees about the runway centre line originating at the back azimuth ground equipment antenna and extending in the direction of the missed approach a least 18.5 km (10 NM) from the runway stop end.

b) Vertically, in the runway region between:

1) a horizontal surface 2.5 m (8 ft) above the farthe point of runway centre line that is in line-of-sight of the back azimuth antenna; and

2) a conical surface originating at the back azimuth ground equipment antenna inclined at 20 degrees above the horizontal up to a height of 600 m (2 000 ft).

c) Vertically, in the back azimuth region between:

1) a conical surface originating 2.5 m (8 ft) above th runway stop end, inclined at 0.9 degree above the horizontal; and

2) a conical surface originating at the back azimuth ground equipment antenna, inclined at 15 degrees above the horizontal up to a height of 3 000 m (10 000 ft).

Note 1. Information on the determination of the poir referred to in b) 1) is given in Attachment G, 2.3.6.

Note 2. When physical characteristics of the runwa or obstacles prevent the achievement of the Standards in b) and c), it is intended that guidance need not be provided at less than line-of-sight heights.

3.11.5.2.2.2.1 Recommendation. The back azimuth facility should provide guidance informatior to 30 degrees above the horizontal.

3.11.5.2.2.2.2 The minimum proportional guidanc sector shall be plus or minus 10 degrees about the runway centre line.

Note. Application information is provided in Attachment G, 7.5.

[Subparameter 2 - EI Operational Coverage Requirements, duplicated here from Subparameter

or by recording the MLS angle output.

6.8.4.2 When assessing the crosspointer deviations, it should be noted that the results are influenced by receiver processing as well as by th characteristics of the signal in space.

assure azimuth and elevation signal coverage at the lower edge of elevation deflection sensitivity.

1 Positioning. At a distance of between 5 and 10 nm from the ARD, start the arc 5° outside the edg of the service volume. Vertical altitude must be computed to equal the MGP x 0.75 at the distance flown. The distance and altitude at which the arc i flown on commissioning will be recorded on the Facility Data Sheet. This must be the reference fo periodic evaluations.

2 Altitudes. The approximate (including earth curvature) arc altitudes above site elevation are computed below for selected angles and distance Maintaining a centered elevation crosspointer at the correct distance will give a more precise altitude and is the preferred method of flying the arcs. See Table 16-1 for reference arc altitudes.

[Table 16-1 omitted for simplicity]

3 Inspection

a There must be no less than 10° proportional guidance either side of the procedural on course.

b While traversing the proportional guidance sectors, record azimuth and elevation deviation. Deviation crosspointer fluctuations greater than 0.5° that exceed 2° of arc, and all MLS receiver unlocks, must be validated by radial flight using th procedures outlined in Paragraph 16.20b(2) (Vertical Coverage).

---

(2) Vertical Coverage

(a) Purpose

1 A commissioning maneuver to evaluate vertical coverage of the azimuth and elevation on the procedural azimuth and at + 10° each side.

2 Validate elevation and azimuth deviation crosspointer fluctuations noted on arcs.

(b) Positioning. Accomplish this check by performing a level run at an altitude equal to MGP x 0.75 as calculated at the FAF distance, starting at the standard service volume. While flying inbound, determine the angle at which a consister

of COVERAGE parameter to match draft MLS Doc 8071 parameter name.]

3.11.5.3.2.1.2 Minimum operational coverage region.

a) Laterally, within a sector originating at the MLS datum point, of plus and minus 10 degrees about th runway centre line;

b) Longitudinally, 75 m (250 ft) from the MLS datum point in the direction of threshold, to the far coverag limit specified in 3.11.5.3.2.1.1 b);

c) Vertically, between the upper surface specified in 3.11.5.3.2.1.1 c) 2), and the higher of:

1) a surface which is the locus of points 2.5 m (8 ft) above the runway; or

2) a plane originating at the MLS datum point and inclined upward to reach, at the longitudinal coverage limit, the height of the surface specified in 3.11.5.3.2.1.1 c) 1).

Note. Information related to the horizontal radiation pattern of the approach elevation is provided in Attachment G, 3.3.

satisfactory signal is achieved. If this angle is higher than 0.9°, the facility must be restricted. If the angle found is
greater than MGP x 0.75, the facility is unusable.

(c) Inspection. Record deviation, PFN, and CMN. Observe the azimuth and elevation crosspointers for excessive signal aberrations which may indica multipath or signal shadowing. Observe the elevation crosspointer for a smooth linear transitio terminating between 15 and 20°.

1 When fluctuations exceed ± 0.5° within ± 10° of the procedural on course, fly the approach offset 5° on the affected side(s) of the procedural on course and apply PFN and CMN tolerances. If the 5° offset approach is satisfactory, the approach may be placed in service.

2 Validation of deviations noted on arcs must be discussed with maintenance personnel for corrective action. If not correctable, the area in question must be restricted.

3 Increases in the minimum EL lower scan limit may present an erroneous crosspointer indication at elevation angles below the scan limit. The elevation coverage should be restricted below the adjusted lower scan limit.

4 Increases in the minimum EL lower scan limit made after determination of normal path structure requires a recheck of the EL approach guidance inside the FAF.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	(none)	none in 16.22, Tolerances -- see remarks

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
Text is a mix of design requirements, and operational/practical requirements.	This (draft) MLS volume of Doc 8071 was never published by ICAO. It was prepared prior to any significant operational fielding of MLS equipment, and as a result some of its apparent flight inspection requirements may no longer be appropriate.	Effectively, the tolerances for coverage are found in the procedural text. For azimuth coverage, for example, in 16.20b1(a)(2), Inspection, we find "no less than 10" degrees proportional guidance eithe side, and "crosspointer fluctuations greater than 0.5" degrees over 2 degrees of arc must be validated by radial flight. These two tolerances, and others in this procedural text, should be place in the Tolerances paragraph, 16.22.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		For vertical coverage, in 16.20b2(c), the implicit tolerances are "smooth linear transition between and 20" degrees, and "When fluctuations exceed 0.5° within ± 10° of the procedural on course, fly the approach offset 5° on the affected side(s) of the procedural on course and apply PFN and CMI tolerances. If the 5° offset approach is satisfactory the approach may be placed in service."	
	Measurement Uncertainty		
	(none)		

Annex10_ID	8071_ID	8200_ID	Results_ID
501	646	413	705

Facility **MLS** **Parameter** **Polarization**

8200/Annex (sub)parameter Compare Results

8200 doesn't meet A10 for any

SARPS Ref 3.11.4.2

Annex Ref **8071 Reference** 6.7 **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.11.4.2 Polarization. The radio frequency transmissions from all ground equipment shall be nominally vertically polarized. The effect of any horizontally polarized component shall not cause th guidance information to change by more than 40 pe cent of the PFE allowed at that location with the airborne antenna rotated 30 degrees from the vertic position or cause the PFE limit to be exceeded.	6.7 Polarization 6.7.1 General The influence of airport environmen on MLS signal polarization is not well understood. At this time it is not known whether this is a flight inspection requirement. 6.7.2 Equipment The measurement of polarizatior errors requires at least the equipment necessary for the measurement of the angle accuracy an the published approach. If an additional antenna, physically mounted at 30' to the normal (vertical) antenna is available, the aircraft maneuvers are simplified. 6.7.3 Maneuvers 6.7.3.1 This test can be accomplished while flying an approach toward the transmitter under test. 6.7.3.2 When no additional antenna is available tr receiving antenna should be rotated 30° off the vertical. This can be accomplished by banking the aircraft to 30° during an approach. 6.7.3 Procedures The system PFE should be measured with any change from the errors found during a normal approach noted. When the additional antenna is available, the test is performed by switching to this antenna.		For this parameter, (unpublished) Doc 8071 will be considered the requirement. Order 8200.1 does not address polarization in the MLS Chapter. Recommendation: Add a polarization check in 8200.1. If this is done, there is no need to file a difference with ICAO.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Guidance change due to HP < 0.4 of allowed PFE, and PFE limit not exceeded, for 30 degree crosspolarization	(none)	

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
	This (draft) MLS volume of Doc 8071 was not published by ICAO. It was prepared prior to any significant operational fielding of MLS equipment,	

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
	and as a result some of its apparent flight inspection requirements may no longer be appropriate. **Measurement Uncertainty** (none)		

Annex10_ID	8071_ID	8200_ID	Results_ID
502	647		706

Facility **MLS** **Parameter** **Power Density**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for some, doesn't for others

Annex Ref **SARPS Ref** 3.11.4.10 **8071 Reference** 6.4 **8200 Reference** 16.20b(1)(a)(2)

ICAO Annex Text

3.11.4.10 Power density

3.11.4.10.1 The power density for DPSK, clearance and angle guidance signals shall be at least the values shown in the following table under operational weather conditions at any point within coverage except as specified in 3.11.4.10.2.

Clearance signals Function	DPSK signals (dBW/m2)	Angle signals (dBW/m2) 1° (antenna beamwidth)	2°	3°
Approach az Guidance	-89.5	-85.7	-79.7	-76.2
High rate approach azimuth guidance	-89.5	-88.0	-84.5	-81.0
Backaz approach azimuth guidance	-89.5	-88.0	-82.7	-79.2
Approach el approach azimuth guidance	-89.5	-88.0	-84.5	N/A

N/A = not applicable

Note. The table above specifies the minimum powe densities for clearance signals and scanning beam signals. The relative values of the two signals are specified in 3.11.4.6.2.5.2.

3.11.4.10.2 The power density of the approach azimuth angle guidance signals shall be greater tha that specified in 3.11.4.10.1 by at least:

a) 15 dB at the approach reference datum;

b) 5 dB for one degree or 9 dB for 2 degree or large beamwidth antennas at 2.5 m (8 ft) above the runway surface, at the MLS datum point, or at the farthest point of the runway centre line which is in

Doc 8071 Source Text

Power Density

6.4.1 General

6.4.1.1 The measurement of power density is part of determining the system coverage. An estimate of the line-of-sight power density may be provided by the ground inspection.

6.4.1.2 An aircraft measurement is necessary to perform power density measurements in regions c the coverage volume which have not line-of-sight with the transmitters.

6.4.2 Equipment

6.4.2.1 In order to assess the received signal leve equipment that provides an indication of the absolute RE [Ed: Receive Equipment] level of the signal at the receiver input is required. Usually the AGC information is sufficient to perform this measurement.

6.4.2.2 If absolute power density is to be measure by a flight inspection aircraft, calibration of the receiving antenna and RE cables is necessary. These calibrations are costly.

6.4.3 Maneuvers

6.4.3.1 For typical airports, arcs are flown at the limits of the coverage volume. i.e. a distance of 2(NM and an elevation angle of 0.9". In addition to the arc, a level inbound approach may be flown. The level is determined by the interception level o the minimum glide path.

6.4.3.2 For atypical airports and mountainous regions the maneuvers are adapted to the particular situation.

6.4.3 Procedures To calibrate systems, the signal level measurements may be referenced to the ground LOS power density. The aircraft is positioned so that LOS exists and the difference i

8200 Source Text

2 Inspection

a There must be no less than 10° proportional guidance either side of the procedural on course.

b While traversing the azimuth proportional guidance sectors, record azimuth and elevation deviation. Deviation crosspointer fluctuations greater than 0.5° that exceed 2° of arc, and all MLS receiver unlocks, must be validated by radial flight, using the procedures outlined in Paragraph 16.20b(2) (Vertical Coverage).

Comparison Remarks

For this parameter, (unpublished) Doc 8071 will be considered the requirement. Although Annex 10 specifies power density, Doc 8071 measures received signal level (at the receiver input terminals), and remarks that calibrating the receiver and antenna system for actual power density measurements is costly..

Only a single, somewhat obtuse reference to "receiver unlocks" in the section on coverage arc addresses signal level in 8200.1 in any way. No tolerances are provided.

Even the reference to "receiver unlocks" is missing for Elevation stations.

Recommendation: Add 8200.1 measurements and tolerances for received signal level. It may b necessary to document a variety of existing systems to arrive at an acceptable signal level fo the tolerance. If this is added to 8200.1, there is no need to file a difference with ICAO.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
line of sight of the azimuth antenna. Note 1. Near the runway surface the approach azimuth equipment will normally provide power densities higher than those specified for angle signals in 3.11.4.10.1 to support auto-land operations. Attachment G provides guidance as regards antenna beamwidth and power budget considerations. Note 2. The specifications for coverage in 3.11.5.2. and 3.11.5.3.2 make provision for difficult ground equipment siting conditions in which it may not be feasible to provide the power density specified in 3.11.4.10.2.	power density between the reading aircraft and th figure calculated from the ground measurement is taken to be the antenna factor for the aircraft. This factor should be used when assessing the results of the power density flight inspection results.		

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
not stated here in a simplified version -- too compl to abbreviate, and directly dependent on antenna beamwidth.	(none)	No tolerance for power density, signal strength, o other measure of signal if found in Tolerances, paragraph 16.22.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
Normally, measurement of power density is considered a design qualification type of test, rathe than a repetitive, operational test.	This (draft) MLS volume of Doc 8071 was never published by ICAO. It was prepared prior to any significant operational fielding of MLS equipment, and as a result some of its apparent flight inspection requirements may no longer be appropriate. Text states that measuring power density is essential where line-of-sight does not exist within the service volume, but then allows simpler AGC measurements in place of the costly power densit measurements.	The only mention in Chapter 16 of 8200.1 of MLS power/signal level, regardless of the specific units is found in 16.20b(1)(a)(2), and only indirectly there -- "receiver unlocks".

Measurement Uncertainty

(none)

Annex10_ID	8071_ID	8200_ID	Results_ID
503	648	414	707

Facility MLS **Parameter** Preamble

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref 8071 Reference	8200 Reference	
ICAO Annex Text	**Doc 8071 Source Text**	**8200 Source Text**	**Comparison Remarks**
3.11.4.4 Preamble 3.11.4.4.1 A preamble signal shall be transmitted throughout the applicable coverage sector to identif the particular function to follow. The preamble shall consist of a radio frequency carrier acquisition period, a receiver reference time code, and a function identification code. The timing of the preamble transmissions shall be as specified in Appendix A, Table A-1. 3.11.4.4.2 Carrier acquisition. The preamble transmission shall begin with a period of unmodulated radio frequency carrier as specified in Appendix A, Table A-1. 3.11.4.4.3 Modulation and coding 3.11.4.4.3.1 Differential phase shift keying (DPSK). The preamble codes and the basic and auxiliary data signals specified in 3.11.4.8 shall be transmitted by DPSK of the radio frequency carrier. A "zero" shall be represented by a 0 degrees plus o minus 10 degrees phase shift and a "one" shall be represented by a 180 degrees plus or minus 10 degrees phase shift. The modulation rate shall be 1 625 bauds. The internal timing accuracy of the DPSK transition shall be as specified in 3.11.4.3.4. There shall be no amplitude modulation applied during the phase transition. The transition time shal not exceed 10 microseconds, and the phase shall advance or retard monotonically throughout the transition region. 3.11.4.4.3.2 Receiver reference time. All preambles shall contain the receiver reference time code, 11101 (bits I1 to I5). The time of the last phase transition midpoint in the code shall be the receiver reference time. The receiver reference time code shall be validated by decoding a valid function identification immediately following the receiver reference time code. 3.11.4.4.3.3 Function identification. A code for function identification shall follow the receiver			This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

reference time code. This code shall consist of the five information bits (I6 to I10) allowing identificatior of 31 different functions, plus two parity bits (I11 an I12) as shown in the following table:

[Detailed table omitted for convenience - no flight inspection parameters]

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
N/A		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
This text provides design characteristics which are not subject to flight inspection.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
504			708

Facility MLS **Parameter** Scanning Beam Characteristics

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref / 8071 Reference	8200 Reference	ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
			[Az Ground Equipment] 3.11.5.2.1 Scanning beam characteristics. Azimuth ground equipment antennas shall produce fan-shaped beam which is narrow in the horizontal plane, broad in the vertical plane and which is scanned horizontally between the limits of the proportional guidance sector. 3.11.5.2.1.1 Coordinate system. Azimuth guidanc information shall be radiated in either conical or planar coordinates. 3.11.5.2.1.2 Antenna beamwidth. The antenna beamwidth shall not exceed 4 degrees. Note. It is intended that the detected scanning bear envelope, throughout the coverage should not exceed 250 microseconds (equivalent to a beamwidth of 5 degrees) in order to ensure proper angle decoding by the airborne equipment. 3.11.5.2.1.3 Scanning beam shape. The minus 1(dB points on the beam envelope shall be displaced from the beam centre by at least 0.76 beamwidth, but not more than 0.96 beamwidth. Note. The beam shape described applies on boresight in a multipath free environment using a suitable filter. Information on beam shape and side lobes is provided in Attachment G, 3.1 and 3.2. ---------- [El Ground Equipment] 3.11.5.3.1 Scanning beam characteristics. The elevation ground equipment antenna shall produce fan-shaped beam that is narrow in the vertical plane broad in the horizontal plane and which is scanned vertically between the limits of the proportional guidance sector. 3.11.5.3.1.1 Coordinate system. Approach elevation guidance information shall be radiated in			This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

conical coordinates.

3.11.5.3.1.2 Antenna beamwidth. The antenna beamwidth shall not exceed 2.5 degrees.

3.11.5.3.1.3 Scanning beam shape. The minus 10 dB points on the beam envelope shall be displayed from the centre line by at least 0.76 beamwidth but not more than 0.96 beamwidth.

Note. The beam shape described applies on boresight in a multipath-free environment using a suitable filter. Information on beam shape and side lobes is provided in Attachment G, 3.1 and 3.2.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
N/A		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
This text provides design characteristics which are not subject to flight inspection.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
505			709

Facility MLS **Parameter** Signal Level Ratios

8200/Annex (sub)parameter Compare Results

8200 doesn't meet A10 for any

SARPS Ref 3.11.4.6.2, 3.11.4.7.2

Annex Ref **8071 Reference** 6.5 **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
[Para 3.11.4.6.2.3 below duplicated from ANGLE GUIDANCE FUNCTIONS parameter, to match draf MLS Doc 8071 parameter names.] ---------- 3.11.4.6.2.3 Azimuth out-of-coverage indication pulses. Where out-of-coverage indication pulses ar used, they shall be: a) greater than any guidance signal in the out-of-coverage sector; b) at least 5 dB less than the fly-left (fly-right) clearance level within the fly-left (fly-right) clearance sector; and c) at least 5 dB less than the scanning beam level within the proportional coverage region. The duration of each pulse measured at the half amplitude point shall be at least 100 microseconds, and the rise and fall times shall be less than 10 microseconds. 3.11.4.6.2.3.1 If desired, it shall be permissible to sequentially transmit two pulses in each out-of-coverage indication time slot. Where the pulse pairs are used, the duration of each pulse shall be at leas 50 microseconds and the rise and fall times shall be less than 10 microseconds. 3.11.4.6.2.3.2 The transmissions of out-of-coverage indication pulses radiated from antennas with overlapping coverage patterns shall be separated by at least 10 microseconds. ---------- [Paragraph 3.11.4.7.2 below duplicated from ELEVATION GUIDANCE FUNCTIONS parameter, to match draft MLS Doc 8071 parameter names.] 3.11.4.7.2 Sector signal. Provision for transmission of one out-of-coverage indication puls	6.5 Signal Level Ratios 6.5.1 General This test is to determine if the relative RF levels of the scanning beam, OCI and clearance signals meet Annex 10 requirements in the appropriate sectors. 6.5.2 Equipment 6.5.2.1 The signal ratios of components within an angle guidance function may be visually observed using a receiver with its log video output monitore by an oscilloscope. 6.5.2.2 An alternative is a receiver which provides the relative signal levels in a digital form. This ma require additional equipment to decode and displa the information. 6.5.3 Maneuvers 6.5.3.1 For azimuth relative signal levels. this test can be performed by flying an arc which -passes through all coverage areas, including areas into which OCI signals are transmitted. 6.5.3.2 For elevation OCI, this test can be performed with a crossover that passes through the elevation angles proportional guidance sector and continues into the area into which the OCI signal is transmitted. 6.5.4 Procedures 6.5.4.1 The areas where transitions between proportional and clearance guidance or between guidance and OCI occurs should be evaluated. 6.5.4.2 For systems which do not provide digital processing facilities the following procedure is used. The log video output of the receivers may b viewed on an oscilloscope and the relative amplitudes of the signals are determined. An example of a recording is given in Figure 6.5.1.		For this parameter, (unpublished) Doc 8071 will be considered the requirement. Only a single, somewhat obtuse reference to "receiver unlocks" in the section on coverage arc addresses signal level in 8200.1 in any way. Signal ratios are simply not addressed. No tolerances are provided. Even the reference to "receiver unlocks" is missing for Elevation stations. Recommendation: Add 8200.1 measurements and tolerances for received power ratios. If this is added to 8200.1, there is no need to file a difference with ICAO.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
shall be made in the format for the approach elevation function. Where an out-of-coverage indication pulse is used, it shall be: (1) greater than any guidance signal in the out-of-coverage indicatio sector and (2) at least 5 dB less than the guidance signals within the guidance sector. The elevation ou of-coverage indication timing shall be as shown in Appendix A, Table A-4. The duration of each pulse measured at the half amplitude points shall be at least 100 microseconds, and the rise and fall times shall be less than 10 microseconds.	6.5.4.3 When processing capabilities are availabl the digital information of the receiver is used. Examples of digitally processed relative signal measurements are given in Figure 6.5.2.		

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	(none)	

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
	This (draft) MLS volume of Doc 8071 was never published by ICAO. It was prepared prior to any significant operational fielding of MLS equipment, and as a result some of its apparent flight inspection requirements may no longer be appropriate.	

Measurement Uncertainty

(none)

Annex10_ID	8071_ID	8200_ID	Results_ID
506	649		710

Facility MLS **Parameter** Siting

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref 8071 Reference	8200 Reference	
ICAO Annex Text	**Doc 8071 Source Text**	**8200 Source Text**	**Comparison Remarks**
[Az Ground Equipment] 3.11.5.2.6 Siting Note 1. It is not intended to restrict the installation o MLS when it is not possible to site the azimuth ground equipment on the extension of the runway centre line. Note 2. Guidance material on critical and sensitive areas for azimuth antennas is provided in Attachment G, 4.2. 3.11.5.2.6.1 Normally, the approach azimuth ground equipment antenna shall be located on the extension of the runway centre line beyond the stop end and shall be adjusted so that the vertical plane containing the zero degree course line will contain the MLS approach reference datum. Siting of the antenna shall be consistent with safe obstacle clearance SARPs in Annex 14. 3.11.5.2.6.2 The back azimuth ground equipment antenna shall normally be located on the extension the runway centre line at the threshold end, and the antenna shall be adjusted so that the vertical plane containing the zero degree course line will contain the back azimuth reference datum. ---------- [El Ground Equipment] 3.11.5.3.6 Siting Note. Guidance material on critical areas for elevation antennas is provided in Attachment G, 4.2 3.11.5.3.6.1 The approach elevation ground equipment antenna shall be located beside the runway. Siting of the antennas shall be consistent with obstacle clearance Standards and Recommended Practices in Annex 14.			This text is an installation requirement or installation guidance. Flight testing does not address this.

3.11.5.3.6.2 The approach elevation ground equipment antenna shall be sited so that the asymptote of the minimum glide path crosses the threshold at the MLS approach reference datum.

3.11.5.3.6.2.1 Recommendation. The minimum glide path angle is normally 3 degrees and should not exceed 3 degrees except where alternative means of satisfying obstacle clearance requiremen are impractical.

Note. It is intended that the choice of a minimum glide path angle higher than 3 degrees be determined by operational rather than technical factors.

3.11.5.3.6.2.2 Recommendation. The approach elevation ground equipment antenna should be site so that the height of the point which corresponds to the decoded guidance signal of the minimum glide path above the threshold does not exceed 18 m (60 ft).

Note. The offset of the elevation antenna from the runway centre line will cause the minimum glide pat elevation guidance to be above the approach reference datum.

3.11.5.3.6.3 Recommendation. When ILS and MLS simultaneously serve the same runway, the IL reference datum and the MLS approach reference datum should coincide within a tolerance of 1 m (3 ft).

Note 1. It is intended that this recommendation would apply only if the ILS reference datum satisfie the height specifications in 3.1.5.1.4 and 3.1.5.1.5.

Note 2. Information related to collocated MLS/ILS siting is provided in Attachment G, 4.1.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
N/A		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
This text provides design characteristics which are not subject to flight inspection.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
507			711

Facility **MLS** **Parameter** **Standby Equipment**

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for all

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 16.22c

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		[no Procedures included]	Standby Equipment is not addressed in the ICAO documents.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		Standby Equipment must meet the same tolerances as the primary equipment.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
		none

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
		415	712

Facility MLS **Parameter** Synchronization and Monitoring

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref / 8071 Reference	8200 Reference

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.11.5.1 Synchronization and monitoring. The synchronization of the time-division-multiplexed angle guidance and data transmissions which are listed in 3.11.4.3.3 shall be monitored. Note. Specific monitoring requirements for various MLS functions are specified in 3.11.5.2.3 and 3.11.5.3.3. 3.11.5.1.1 Residual radiation of MLS functions. The residual radiation of an MLS function at times when another function is radiating shall be at least 70 dB below the level provided when transmitting. Note. The acceptable level of residual radiation for particular function is that level which has no advers effect on the reception of any other function and is dependent upon equipment siting and aircraft position.			This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
N/A		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
This paragraph is poorly titled and worded. It requires that the sync of angle guidance and data transmissions, listed elsewhere, shall be monitored. However, the actual monitoring requirements are in another paragraph. The following subparagraph deals with a totally differen issue unrelated to the 3.11.5.1 paragraph title -- residual radiation. This text provides design characteristics which are not subject to flight inspection.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
508			713

Facility **MLS** **Parameter** **System Accuracy**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for some, doesn't for others

SARPS Ref 3.11.4.9

Annex Ref **8071 Reference** 6.2 **8200 Reference** 16.20b, 16.22

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.11.4.9 System accuracy. The accuracy standards specified herein shall be met on a 95 per cent probability basis unless otherwise stated. Note 1. The overall error limits include errors from a causes such as those from airborne equipment, ground equipment, and propagation effects. Note 2. It is intended that the error limits are to be applied over a flight path interval that includes the approach reference datum or back azimuth reference datum. Information on the interpretation c MLS errors and the measurement of these errors over an interval appropriate for flight inspection is provided in Attachment G, 2.5.2. Note 3. To determine the allowable errors for degradation allowances at points other than the appropriate reference datum, the accuracy specifie at the reference datum should first be converted from its linear value into its equivalent angular value with an origin at the antenna. ---------- [Subparameter 1 - MLS ARD] ---------- 3.11.4.9.1 MLS approach reference datum. The height of the MLS approach reference datum shall be 15 m (50 ft). A tolerance of plus 3 m (10 ft) shall be permitted. Note 1. The operational objective of defining the height of the MLS approach reference datum is to ensure safe guidance over obstructions and also safe and efficient use of the runway served. The heights noted in 3.11.4.9.1 assume Code 3 or Code 4 runways as defined by Annex 14. Note 2. At the same time, the reference datum is to provide a convenient point at which the accuracy ar other parameters of the function may be specified. Note 3. In arriving at the above height values for the MLS approach reference datum, a maximum vertica	---------- [Subparameter 1 - MLS ARD] - not addressed ---------- ---------- [Subparameter 2 - MLS Back Az RD] - not addressed ---------- ---------- [Subparameter 3 - PFE/CMN/Rx Filter Characteristics] - not addressed ---------- NOTE: The text below in paragraph 6.2 applies equally to the three following subparameters: ---------- [Subparameter 4 - Az Accuracy] ---------- ---------- [Subparameter 5 - Back Az Accuracy] ---------- ---------- [Subparameter 6 - El Accuracy] ---------- 6.2 Angle Accuracy 6.2.1 General 6.2.1.1 The flight inspection evaluation of angle and distance accuracy requires the determination of PFE, PFN, and CMN. 6.2.1.2 PFE, PFN and CMN have a close relationship to each other. Depending on the velocity and the flight track of an aircraft, PFE can turn into CMN or vice versa. This allows the prediction of probable areas of high PFE where increases in measured CMN are observed. An increase in the CMN may also be used as an indication of a possible false guidance signal area	16.20b(3) MLS Approaches (a) Purpose. The approach should be the first maneuver flown during a commissioning, reconfiguration, or restoration flight inspection, so that the azimuth and elevation course and coverage may be optimized to the desired procedural alignment. This maneuver is performe to verify that the azimuth and elevation facilities w satisfactorily support the proposed or published approach and categories of intended use. (b) Positioning. Approaches must be evaluated or the designed procedural azimuth and the minimur glidepath, unless otherwise indicated. For the purpose of evaluating structure, optimizing azimut and elevation alignments, and conducting periodic inspections, start the approach at a distance not closer than the published FAF, GSI, or 6 miles from runway threshold, whichever is greater. For commissioning, fly the approach on the MGP from the desired service volume limits at normal power and while the facility is at minimum RF power. (c) MLS Approaches Which Support Azimuth Only Minima. The final approach segment of azimuth only minima must be checked during site evaluation, commissioning, and special inspection for azimuth antenna change and anytime there is significant deterioration of azimuth structure. Upo reaching the FAF inbound, descend at a rate of approximately 400 ft per mile (930 ft per minute a 140 knots; 800 ft per minute at 120 knots) to an altitude of 100 ft below the lowest published MDA and maintain this altitude to the MAP. (d) Inspection 1 Azimuth facilities sited along runway centerline with Decision Altitudes of 200 ft or less must be evaluated through Zones 1, 2, and 3 (also Zones and 5 if autoland or CAT II/ III operations are authorized) on all inspections requiring alignment and structure measurements; elevation guidance on these facilities must be evaluated to the ARD.	---------- [Subparameter 1 - MLS ARD] - not addressed - this is a design qualification type specification. [Subparameter 2 - MLS Back Az RD] - not addressed - this is a design qualification type specification. [Subparameter 3 - PFE/CMN/Rx Filter Characteristics] - not addressed - this is a design qualification type specification. ---------- [Subparameter 4 - Az Accuracy] ---------- PFN NTE value should be 0.15, rather than 0.25 degrees. (2 places) At the ARD, Annex 10 allows defines CMN to be not greater than +/- 10.5 feet or 0.1 degree, whichever is less. 8200.1 states "10.5' NTE 0.1 degree" - this phrasing could allow a CMN value of 0.08 degrees (since the degradations are calculated in terms of angular limits), even thoug it might exceed 10.5'. Recommendations: 1. Delete tables for paragraph e(1)(b) and e(1)(c in 8200.1. 2. Revise table in paragraph e(1)(a) for errors noted above, and make a thorough scrub of each cell in the table against Annex 10 text. A variety smaller errors appear to exist, e.g., ICAO makes no CMN distinction between autoland and non-autoland, or by Categories. If these changes are made, there is no need to fi a difference with ICAO. ---------- [Subparameter 5 - Back Az Accuracy] ---------- No specific tolerances are given for Back Az

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
distance of 5.8 m (19 ft) between the path of the aircraft MLS antenna selected for final approach an the path of the lowest part of the wheels at the threshold was assumed. For aircraft exceeding this criterion, appropriate steps may have to be taken either to maintain adequate clearance at threshold o to adjust the permitted operating minima. ---------- [Subparameter 2 - MLS Back Az RD] ---------- 3.11.4.9.2 MLS back azimuth reference datum. The height of the MLS back azimuth reference datum shall be 15 m (50 ft). A tolerance of plus 3 m (10 ft) shall be permitted. Note. The objective of defining the MLS back azimuth reference datum is to provide a convenient point at which the accuracy and other parameters o the function may be specified. ---------- [Subparameter 3 - PFE/CMN/Rx Filter Characteristics] ---------- 3.11.4.9.3 The PFE shall be comprised of those frequency components of the guidance signal error at the output of the airborne receiver which lie below 0.5 rad/s for azimuth guidance information or below 1.5 rad/s for elevation guidance information. The control motion noise shall be comprised of those frequency components of the guidance signal error at the output of the airborne receiver which lie abov 0.3 rad/s for azimuth guidance or above 0.5 rad/s fo elevation guidance information. The output filter corner frequency of the receiver used for this measurement is 10 rad/s. ---------- [Subparameter 4 - Az Accuracy] ---------- 3.11.4.9.4 Approach azimuth guidance functions. At the approach reference datum, the approach azimuth function shall provide performance as follows: a) the PFE shall not be greater than plus or minus 6 m (20 ft); b) the PFN shall not be greater than plus or minus	6.2.2 Equipment 6.2.2.1 Normally flight inspections are performed with a receiver that reflects the characteristics of a standard MLS receiver. This is to take into accour the contribution of the airborne receiver to the tota MLS error budget. 6.2.2.2 To ensure that the receiver error contribution to the system error does not exceed recommended Annex 10 tolerances (3.11.6.1.1.2) the flight inspection receivers should be calibratec 6.2.2.3 Modifications to a commercial receiver, such as the availability of flag information regardir each angle guidance function transmission (frame flags) and of angle guidance signal component level difference information may benefit the flight inspection. Details of the recommended modification are given in Chapter 7. 6.2.2.4 For the measurements of the guidance signals a position reference system is required. The required accuracy of this position reference depends on the kind of measurements that are performed. For PFE, PFN and CMN measurements referenced to an absolute position an accurate reference system is required. To assess PFN and CMN only, an absolute position reference is not required. 6.2.2.5 The receiver angular output data is referenced to the positioning information, to obtair the raw error data. To determine the PFE, PFN, CMN of this raw data some processing is necessary. This may be done by visually inspecting recordings of raw error data. To process PFE, PFN and CMN as defined in the guidance material of Annex 10 the raw error data has to be filtered. As the error data is present in samples, the easiest way to perform this filtering i to implement digital filters. A description of these filters is given in chapter 7. 6.2.2 Maneuvers 6.2.2.1 Within the Region of the Published Approaches 6.2.2.1.1 Flight inspection must be conducted on all published approaches. At commissioning, "off angle" checks should be conducted at angles corresponding to the course width or path width fc	All other facilities must be evaluated to 100 ft belc Decision Altitude (DA). NOTE: During site, commissioning, reconfiguration, categorization, antenna, and/or frequency change inspection -- check all of Zone 1. All other inspections (i.e., periodic, periodic wit monitors, etc.) evaluate structure from published FAF, GSI, or 6 nm (whichever is further) through all other required zones. 2 Approved RTT and/or AFIS methods must be used for the approach evaluation. The facility erro budget will provide all tolerances to be used durin commissioning and periodic flight inspection. Mea course error (MCE) must be established prior to application of PFE tolerances. Exclude data in areas that are restricted due to facility performanc 3 For azimuth facilities sited along runway centerline IAW Figure 16-3, with a Decision Altitude at or below 200 ft, the azimuth MCE must be determined and reported as found in the 1.0 nr segment ending at the ARD. For other facilities, use the 1.0 nm segment, ending at 100 ft below DA. For elevation facilities, determine the glide angle in Zone 2 as defined in Figures 16-3, 4, and 5. 4 Visual Autoland or Category II or III Operations Authorized. On commissioning inspections, cross Point C at 100 ft, runway threshold at approximately 50 ft, and continue on the extendec glidepath angle to the touchdown point. Continue the landing roll and determine the actual course alignment for Zones 4 and 5. Measure the course structure from the actual alignment. If the actual alignment for Zones 4 and 5 cannot be determine using this method, taxi the aircraft along the runway centerline from abeam the elevation site t Point E. Record the raw crosspointer information and mark, abeam the elevation site, Point D and Point E. Manually calculate the actual course alignment and structure for each of the required zones. ---------- 16.20b(7) DME. The DME must be evaluated as a DME/ N throughout all areas of coverage. MLS DME is specified by ICAO to transmit the three-letter ID, dropping the preceeding M. Evaluate DME accuracy IAW	facilities, nor is it clear which of the 4 tables of tolerances should be used. While the basic Annex 10 tolerances are the same as for front Az measurements made at the ARD, the degradatio text in Annex 10 differs, especially for CMN, from that for front Az CMN. This difference does not appear in 8200.1. Recommendation: Modify 8200.1 to make clear the tolerances for Back Az facilities, or delete any mention of Back Az if none exists in the flight inspection area. ---------- [Subparameter 6 - El Accuracy] ---------- [NOTE: The following commentary assumes tha Recommendation 1 for Subparameter 4 above) is adopted.] There are no units for the PFE, PFN, and CMN tolerances. (probably degrees) If the tolerances are in degrees, they may still allow Annex 10 tolerances to be exceeded, depending on the ARD/El station locations. (Should be revised to same format as for Az facilities.) Recommendations: 1. Add units to tolerances. 2. Revise table in paragraph e(1)(d) for errors noted above, and make a thorough scrub of each cell in the table against Annex 10 text. A variety smaller errors appear to exist, e.g., ICAO makes no CMN distinction between autoland and non-autoland, or by Categories. If these changes and Recommendation 1 of Subparameter 4 are made, there is no need to fil a difference with ICAO.

3.5 m (11.5 ft);

c) the CMN shall not be greater than plus or minus 3.2 m (10.5 ft) or 0.1 degree, whichever is less.

3.11.4.9.4.1 Recommendation. At the approach reference datum, the PFE should not be greater tha plus or minus 4 m (13.5 ft).

3.11.4.9.4.2 The linear accuracy specified at the reference datum shall be maintained throughout the runway coverage region specified in 3.11.5.2.2.1.2 except where degradation is allowed as specified in 3.11.4.9.4.3.

3.11.4.9.4.3 Degradation allowance. The approac azimuth angular PFE, PFN and CMN shall be allowed to degrade linearly to the limits of coverage as follows:

a) With distance. The PFE limit and PFN limit, expressed in angular terms at 37 km (20 NM) from the runway threshold along the extended runway centre line, shall be 2 times the value specified at th approach reference datum. The CMN limit shall be 0.1 degree at 37 km (20 NM) from the approach reference datum along the extended runway centre line at the minimum glide path angle.

b) With azimuth angle. The PFE limit and PFN limit expressed in angular terms at plus or minus 40 degrees azimuth angle, shall be 1.5 times the value on the extended runway centre line at the same distance from the approach reference datum. The CMN limit, expressed in angular terms at plus or minus 40 degrees azimuth angle is 1.3 times the value on the extended runway centre line at the sar distance from the approach reference datum.

c) With elevation angle. The PFE limit and PFN lim shall not degrade up to an elevation angle of 9 degrees. The PFE limit and PFN limit, expressed in angular terms at an elevation angle of 15 degrees from the approach azimuth antenna phase centre, shall be 2 times the value permitted below 9 degree at the same distance from the approach reference datum and the same azimuth angle. The CMN limit shall not degrade with elevation angle.

d) Maximum CMN. The CMN limits shall not exceed 0.2 degree in any region of coverage.

3.11.4.9.4.3.1 Recommendation. The CMN shoul

that facility. It is not necessary to continue the "off angle" checks to threshold. The point at which the "off angle" check should be terminated is dependent on operational considerations.

6.2.2.1.2 The off-angle checks may be discontinued when experience shows that the characteristics of the signals on the published approach are representative of the signals at the edges of the course width or path width.

6.2.2.2 Outside the Published Approach Region and Within the Azimuth and Elevation Guidance Sectors

6.2.2.2.1 An arc through the azimuth guidance sector and a level or climbing crossover through the elevation guidance sector should be flown to identify possible anomalies.

6.2 .2 .2 .2 The arc and crossover should be carried out at distances and altitudes which minimize the effect of angular slew rate on the MLS receiver by limiting the angular velocity of the aircraft (see chapter 7 for additional information). Examples of these maneuvers are given in Figure 6.2.1 and 6.2.2.

6.2 .2 .2 .3 No maneuvers other than the arcs anc crossovers are considered essential. When multipath or shadowing is predicted in areas beyond the-region of the approach other maneuvers may be necessary. These should be consistent with the operational use of the facility.

6.2.3 Procedures

6.2.3.1 Within the region of the published approach, emphasis is given to the angular accuracy measurements (i.e. after alignment of a ground station a flight inspection verifies that the PFE values do not exceed the requirements). Special attention is given to parts of the approach where high CMN is measured, these parts may suffer from severe out-of-beam multipath or shadowing.

6.2.3.2 Outside the published approach region, ar alternative flight inspection procedure can be usec which does not rely on an absolute position reference system. In this procedure, only the fluctuating components of the flight record produced at the output of. the PFE and CMN filter

Chapter 11. Currently commissioned facilities transmitting 4-letter on DME (e.g., M-XXX) function must be left in service.

16.22d. Alignment must be reported as the average flight inspection angle. Facilities found with an alignment that exceeds 60% of the allowable PFE must generate a maintenance alert IAW Paragraph 15.51e.

not exceed 0.1 degree in any region of coverage.

3.11.4.9.4.4 Maximum angular PFE and PFN. In any region within coverage, the angular error limits shall be as follows:

a) the PFE shall not exceed plus or minus 0.25 degree; and

b) the PFN shall not exceed plus or minus 0.15 degree.

[Subparameter 5 - Back Az Accuracy]

3.11.4.9.5 Back azimuth guidance function. At the back azimuth reference datum, the back azimuth function shall provide performance as follows:

a) the PFE shall not be greater than plus or minus 6 m (20 ft);

b) the PFN component shall not be greater than plu or minus 3.5 m (11.5 ft);

c) the CMN shall not be greater than plus or minus 3.2 m (10.5 ft) or 0.1 degree, whichever is less.

3.11.4.9.5.1 Degradation allowance. The back azimuth angular PFE, PFN and CMN shall be allowed to degrade linearly to the limits of coverage as follows:

a) With distance. The PFE limit and PFN limit, expressed in angular terms at the limit of coverage along the extended runway centre line, shall be 2 times the value specified at the back azimuth reference datum. The CMN limit, expressed in angular terms at 18.5 km (10 NM) from the runway stop end along the extended runway centre line, sh be 1.3 times the value specified at the back azimuth reference datum.

b) With azimuth angle. The PFE limit and PFN limit expressed in angular terms at plus or minus 20 degrees azimuth angle, shall be 1.5 times the value on the extended runway centre line at the same distance from the back azimuth reference datum. The CMN limit, expressed in angular terms at plus o minus 20 degrees azimuth angle, shall be 1.3 times the value on the extended runway centre line at the same distance from the back azimuth reference

are measured and compared with the appropriate standard. Areas with significant angle errors will identify regions where guidance anomalies exist. This procedure may be used to overcome the difficulties of accurate position referencing during orbital and crossover flights.

6.2.3.3 For both regions, a significant number of frame flags indicates that the acquisition time of the guidance signals will be poor, even though the angle accuracy measurements may be within the Annex 10 standards. Typical receivers are satisfie with 55% valid frames, but to ensure a good quali of guidance a value of 72% valid frames is recommended. When regions are discovered with relatively few valid frames further investigation is necessary. This investigation is supported by the site modelling.

datum.

c) With elevation angle. The PFE limit and PFN lim shall not degrade up to an elevation angle of 9 degrees. The PFE limit and PFN limit, expressed in angular terms at an elevation angle of 15 degrees from the back azimuth antenna phase centre, shall be 2 times the value permitted below 9 degrees at the same distance from the back azimuth reference datum and the same azimuth angle. The CMN limit shall not degrade with elevation angle.

d) Maximum CMN. The CMN limits shall not exceed 0.2 degree in any region of coverage.

3.11.4.9.5.2 Maximum angular PFE and PFN. In any region within coverage, the angular error limits shall be as follows:

a) the PFE shall not exceed plus or minus 0.50 degree; and

b) the PFN shall not exceed plus or minus 0.30 degree.

[Subparameter 6 - El Accuracy]

3.11.4.9.6 Elevation guidance function. For equipment sited to provide a minimum glide path of nominally 3 degrees or lower, the approach elevatio function shall provide performance at the approach reference datum as follows:

a) the PFE shall not be greater than plus or minus 0.6 m (2 ft);

b) the PFN shall not be greater than plus or minus 0.4 m (1.3 ft);

c) the CMN shall not be greater than plus or minus 0.3 m (1 ft).

3.11.4.9.6.1 Degradation allowance. The approac elevation angular PFE, PFN and CMN shall be allowed to degrade linearly to the limits of coverage as follows:

a) With distance. The PFE limit and PFN limit, expressed in angular terms at 37 km (20 NM) from the runway threshold on the minimum glide path, shall be 0.2 degree. The CMN limit shall be 0.1

degree at 37 km (20 NM) from the approach reference datum along the extended runway centre line at the minimum glide path angle.

b) With azimuth angle. The PFE limit and PFN limit expressed in angular terms at plus or minus 40 degrees azimuth angle, shall be 1.3 times the value on the extended runway centre line at the same distance from the approach reference datum. The CMN limit, expressed in angular terms at plus or minus 40 degrees azimuth angle, shall be 1.3 times the value on the extended runway centre line at the same distance from the approach reference datum.

c) With elevation angle. For elevation angles above the minimum glide path or 3 degrees, whichever is less and up to the maximum of the proportional guidance coverage and at the locus of points direct above the approach reference datum the PFE limit, PFN limit and the CMN limit expressed in angular terms shall be allowed to degrade linearly such that at an elevation angle of 15 degrees the limits are 2 times the value specified at the reference datum. In no case shall the CMN directly above the reference datum exceed plus or minus 0.07 degree. For other regions of coverage within the angular sector from an elevation angle equivalent to the minimum glide path up to the maximum angle of proportional coverage, the degradations with distance and azimuth angle specified in a) and b) shall apply.

d) The PFE, PFN and CMN limits shall not degrade with elevation angle in the region between the minimum glide path and 60 per cent of the minimum glide path. For elevation angles below 60 per cent of the minimum glide path and down to the limit of coverage specified in 3.11.5.3.2.1.2, and at the locu of points directly below the approach reference datum the PFE limit, the PFN limit and the CMN lim expressed in angular terms, shall be allowed to increase linearly to 6 times the value at the approac reference datum. For other regions of coverage within the angular sector from an elevation angle equivalent to 60 per cent of the minimum glide path angle value, and down to the limit of coverage, the degradation with distance and azimuth angle specified in a) and b) shall apply. In no case shall the PFE be allowed to exceed 0.8 degree, or the CMN be allowed to exceed 0.4 degree.

e) Maximum CMN. For elevation angles above 60 per cent of the minimum glide path, the CMN limits shall not exceed 0.2 degree in any region of

coverage.

3.11.4.9.6.2 Maximum angular PFE and PFN. In any region within coverage, the angular error limits for elevation angles above 60 per cent of the minimum glide path shall be as follows:

a) the PFE shall not exceed plus or minus 0.25 degree; and

b) the PFN shall not exceed plus or minus 0.15 degree.

3.11.4.9.6.3 Recommendation. The limit expressed in angular terms on the linear degradatic of the PFE limit, the PFN limit and the CMN limit at angles below 60 per cent of the minimum glide path and down to the limit of coverage should be 3 times the value permitted at the approach reference datur

Note. For other regions of coverage within the angular sector from an elevation angle equivalent to 60 per cent of the minimum glide path and down to the limit of coverage, the degradation with distance and azimuth angle specified in 3.11.4.9.6.1 a) and b applies.

3.11.4.9.6.4 Recommendation. Maximum CMN. For elevation angles above 60 per cent of the minimum glide path, the CMN limits should not exceed 0.1 degree in any region of coverage.

3.11.4.9.6.5 Recommendation. The PFE should not exceed 0.35 degree, and the CMN should not exceed 0.2 degree.

3.11.4.9.6.6 Approach elevation equipment sited provide a minimum glide path higher than 3 degree shall provide angular accuracies not less than those specified for equipment sited for a 3-degree minimum glide path within the coverage volume.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
[Subparameter 4 - Az Accuracy] PFE <= +/- 20 ft + degradation, NTE+/- 0.25 deg PFN <= +/- 11.5 ft + degradation, NTE +/- 0.15 deg CMN lesser of +/- 10.5 ft or 0.1 deg, + Degradation NTE 0.2 deg	(none)	[Subparameter 4 - Az Accuracy] PFE 20' + degradation, NTE 0.25 deg PFN 11.5' + degradation, NTE 0.25 deg CMN (autoland) 10'5 NTE 0.1 deg within 10 deg from C/L

The Degradation factors include their own limits.

[Subparameter 5 - Back Az Accuracy]

PFE <= 20' + degradation, NTE 0.5 deg
PFN <= 11.5' + degradation, NTE 0.3 deg
CMN lesser of 10.5' or 0.1 deg, + degradation, NTE 0.2 deg
The Degradation factors include their own limits.

[Subparameter 6 - El Accuracy]

PFE <= 2' + degradation, NTE +/- 0.25 deg above 60% of min GP Angle
PFN <= 1.3' + degradation, NTE +/- 0.15 deg above 60% of min GP Angle
CMN <= 1' + degradation, NTE 0.2 deg
The Degradation factors include their own limits.

CMN (CAT I) 0.1 deg within 10 deg of C/L, 0.2 deg beyond 10 deg of C/L

[Subparameter 5 - Back Az Accuracy]
Not clearly defined

[Subparameter 6 - El Accuracy]

PFE 0.133 + degradation
PFN 0.087 + degradation
CMN (autoland) 0.05, max 0.1 deg within 10 deg of C/L, max 0.2 deg beyond 10 deg of C/L
CMN (CAT I) 0.10, max 0.1 deg within 10 deg of C/L, max 0.2 deg beyond 10 deg of C/L

ICAO Annex Remarks

Doc 8071 Remarks

This (draft) MLS volume of Doc 8071 was never published by ICAO. It was prepared prior to any significant operational fielding of MLS equipment, and as a result some of its apparent flight inspection requirements may no longer be appropriate.

8200 Remarks

The tolerances in the Tolerances paragraph 16.22 are essentially all addressing accuracy only. Compared to Annex 10, the presentation is incredibly complex, with tens to potentially many tens of detailed steps and specific tolerances.

The example degradation example in Table 16-3 has a column head titled "14b step", which appears to be undefined. (probably should read "16.22b step")

The Annex 10 degradation factors vary according to parameter name (e.g., PFE and PFN degrade the same, while CMN degrades differently. However, the degradation instructions in 16.22 do not make this distinction.

The 8200 tolerances are listed in different tables for (1) centerline Az, (2) Offset Az, Az collocated with El, and Heliport Az, (3) Az and El not Aligned as a Precision Approach Aid to a Runway, and (4 El. It is not clear which table is to be used for Bac Az facilities. Annex 10 makes no distinction for these differences, listing only Az, Back Az, and E tolerances.

A number of differences between the ICAO tolerances and the 8200 tolerance tables exist; in the general case, the 8200 tables are not sufficiently specific, and in a few cases the tables appear to be in error or to allow greater tolerances than Annex 10.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
	Measurement Uncertainty Abs Mean Error 0.03 deg		
Annex10_ID	**8071_ID**	**8200_ID**	**Results_ID**
509	650	416	714

Facility MLS **Parameter** TDM Organization

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref / 8071 Reference	8200 Reference

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.11.4.3 Time-division-multiplex (TDM) organization 3.11.4.3.1 Both angle information and data shall b transmitted by TDM on a single radio frequency channel. 3.11.4.3.2 Synchronization. The transmissions from the various angle and data ground equipment serving a particular runway shall be time synchronized to assure interference-free operations on the common radio frequency channel of operatic 3.11.4.3.3 Function rates. Each function transmitted shall be repeated at the rates shown in the following table: Function -- Average rate (Hz) measured over any 1 second period Approach azimuth guidance -- 13 ± 0.5 High rate approach azimuth guidance -- 39 ± 1.5 Back azimuth guidance -- 6.5 ± 0.25 Approach elevation guidance -- 39 ± 1.5 Flare elevation guidance -- 39 ± 1.5 Basic data -- see Appendix A, Table A-7 Auxiliary data -- see Appendix A, Tables A-10 and A 12 3.11.4.3.3.1 Recommendation. When the proportional guidance sector is not greater than plus or minus 40 degrees and a need for flare elevation other growth functions at that facility is not anticipated, the high rate approach azimuth functior should be used. Note. Application information is contained in Attachment G, 2.3.3. 3.11.4.3.4 Function timing. Timing standards for each angle and data function shall be as specified i Appendix A, Tables A-1 through A-6 and A-8. The ground equipment internal timing accuracy of each listed event including jitter shall be the specified nominal value plus or minus 2 microseconds. The			This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

timing jitter shall be less than 1 microsecond root mean square (RMS).

Note 1. The timing of each listed event indicates the beginning of the event time slot and the end of the previous event time slot. The characteristics and timing of the actual transmissions are as specified i the applicable paragraphs.

Note 2. Information on the measurement of the timing accuracy is contained in Attachment G, 2.2.2

3.11.4.3.5 Function sequence. The time interval between repetitive transmissions of any one functio shall be varied in a manner which provides protectic from synchronous interference.

Note 1. Each function transmission is an independent entity which can occur in any position i the TDM sequence (with the exception that back azimuth must be preceded by basic data word 2).

Note 2. Some sequences which have demonstratec protection from synchronous interference are illustrated in Attachment G, 2.1.4.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
(N/A)		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
This text provides design characteristics which are not subject to flight inspection.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
510			715

Facility NDB **Parameter** Airway Coverage

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref 3.4.2

Annex Ref **8071 Reference** 5.3.10 **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	The facility coverage along the airways is obtaine by flying the route at minimum altitude and checking for excessive ADF needle oscillation, identification quality and interference. Although a airways are checked at commissioning, it is usual not necessary to check all airways during routine tests. However, an airway in each quadrant shou be checked annually. Note [from Table 5-3]: External and aircraft noise sources as well as terrain features routinely affect NDB cross-pointer accuracy. Although tolerances are shown for airways, approaches, and holding patterns, it is not necessary to restrict or remove from service an NDB solely because it provides momentary out-of-tolerance needle oscillations th are brief, relative to the intended procedural use. As long as bearing errors greater than the listed tolerances are generally oscillatory in nature rathe than one-sided, and have durations less then 4 seconds for approaches and 8 seconds for airway and holding patterns, the NDB may be considerec acceptable. (These time periods apply to each occurrence of oscillatory out-of-tolerance needle activity.)		Airway coverage (e.g., sufficient signal strength, needle accuracy, etc.) is not specifically covered in either Annex 10 or 8200. Existing 8200 text under the HOLDING & APPROACH PROCEDURE parameter could be applied to Airways with only minor or no modifications. (Airways are mentioned only as a subordinate check preliminary to flying procedures and holding patterns. Recommendation: make specific mention of airways in 8200. Note: This omission is not relevant to filing an ICAO difference, because Annex 10 does not identify airway coverage explicitly.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	ADF needle oscillations not to exceed +/- 10 degrees to the limit of coverage specified for the airway. See Note re: exceeding these tolerances (in Source Text)	

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

2 degrees

Annex10_ID	8071_ID	8200_ID	Results_ID
	651		716

Facility NDB **Parameter** Coverage

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for some, doesn't for others

Annex Ref **SARPS Ref** 3.4.2 **8071 Reference** 5.3.7 **8200 Reference** 12.20c, e

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
[Subparameter 1 - Field Strength] 3.4.2.1 Recommendation. The minimum value of field strength in the rated coverage of an NDB should be 70 microvolts per metre. Note 1. Guidance on the field strengths required particularly in the latitudes between 30°N and 30°S is given in 6.1 of Attachment C, and the relevant ITU provisions are given in Chapter VIII, Article 35, Section IV, Part B of the Radio Regulations. Note 2. The selection of locations and times at whic the field strength is measured is important in order avoid abnormal results for the locality concerned; locations on air routes in the area around the beacc are operationally most significant. [Subparameter 2 - Coverage Classification] 3.4.2.2 All notifications or promulgations of NDBs shall be based upon the average radius of the ratec coverage. Note 1. In classifying radio beacons in areas where substantial variations in rated coverage may occur diurnally and seasonally, such variations should be taken into account. Note 2. Beacons having an average radius of rated coverage of between 46.3 and 278 km (25 and 150 NM) may be designated by the nearest multiple of 46.3 km (25 NM) to the average radius of rated coverage, and beacons of rated coverage over 278 km (150 NM) to the nearest multiple of 92.7 km (50 NM). 3.4.2.3 Recommendation. Where the rated coverag of an NDB is materially different in various operationally significant sectors, its classification should be expressed in terms of the average radius of rated coverage and the angular limits of each sector as follows: Radius of coverage of sector/angular limits of secto	5.3.5 An NDB's coverage is determined by field strength measurements (rated coverage) or by a quality assessment (effective coverage) of factors such as signal strength, voice and identification, and crosspointer activity. The use of either or bot methods depends upon operational and engineering requirements. 5.3.6 Co-channel Interference. In areas where th density of NDB facilities is high and interference amongst them is likely, a night-time check should be made to verify that the design field strength is obtained at the rated coverage limit. If not, the transmitter power output should be adjusted accordingly. This will optimize the power to minimize interference between NDBs. 5.3.7 Rated Coverage. Normally a complete orbi of radius equal to the rated coverage and at a suitable minimum altitude should be flown around the NDB. If problem areas are found, or if the terrain is considered sufficiently homogenous that a complete orbit is unnecessary, the coverage ca be probed via radial flight or measured in representative sectors by measuring the field strength along suitable airways, also at minimum altitude. Adjustments to the NDB antenna current may be required to obtain satisfactory results. 5.3.8 Field Strength Measurements. Field strength measurements are read from a meter or recorded along with DME distance or ground reference points. These reference points can the be plotted on a map together with the measured field strength in order to arrive at the rated coverage. The measurements should be made during daylight hours and in good weather conditions. If this is not possible, the measurement conditions should be described in detail in the report. 5.3.9 Effective Coverage. Effective coverage is obtained from an assessment of the quality of the guidance signals provided by the NDB. The areas where the quality is measured will be largely	12.13c. Coverage Orbit. Standard service volume coverage is evaluated by flying orbits at the lowes coverage altitude. Facility Maintenance determine the reduced power output of the facility during coverage checks. At facilities where dual transmitters are installed, facility coverage for maximum useable distance may be evaluated by alternating transmitters. Switch transmitters at least every 30 degrees. (1) Maneuvering. Fly an orbit about the facility at the maximum distance specified by the facility classification. The orbit altitude must be 1,500 ft above facility site elevation, or the minimum altitu which will provide 1,000 (2,000 ft in designated mountainous areas) above intervening terrain or obstacles, whichever is higher as determined by map study. Coverage orbits are usually completec counterclockwise, as the ADF navigation needle parks to the right if the signal has an unlock (this i true for mechanical instruments; however, the needle may disappear on electronic displays). Sectors found out of tolerance must be evaluated using orbits at reduced distances or increased altitudes in an attempt to determine facility restrictions. Monitor the facility identification durin coverage checks, as the loss of the identifier usually corresponds with the loss of the NDB signal. (2) Analysis. Evaluate the signal for out of tolerance needle oscillations, weak or garbled identification, and interference throughout the coverage area. If the facility performance does no meet tolerances to the SSV, the facility will have the status of restricted or unusable, and NOTAM action is required. If there is a suspicion the beacon carrier frequency is out of tune (off frequency), have ground maintenance check the transmitted frequency, or evaluate with the onboard spectrum analyzer. (3) Other Considerations. NDB restrictions must be sectored as bearings from the facility. See Chapter 5 for examples of NDB restrictions.	[Subparameter 1 - Field Strength] Although Annex 10 defines a specific field strength level, Doc 8071 allow for subjective assessments. [Subparameter 2 - Coverage Classification] 8200 does not mention diurnal or seasonal variations. However, flight inspections of NDBs are almost always conducted during daylight hours This potential difference between Annex 1 coverage classification statements and actual practice is minor, and does not warrant filing an ICAO difference.

expressed as magnetic bearing clockwise from the beacon.

Where it is desirable to classify an NDB in such a manner, the number of sectors should be kept to a minimum and preferably should not exceed two.

Note. The average radius of a given sector of the rated coverage is equal to the radius of the corresponding circle sector of the same area.
Example:
150/210° - - 30°
100/30° -- 210°.

determined by the operational usage to be made of the beacon and by a consideration of the factors affecting effective coverage described in paragraphs 5.1.4 to 5.1.10. In most cases, it will be sufficient to fly the air routes served by the NDB together with a small radius orbit around the beacon. However, where the effective coverage is required in all sectors, and circumstances do not permit the coverage to be inferred from selected radials, an orbit commensurate with the required radius of coverage should be flown. Any unusual areas within the required coverage area where the quality of the signal may be affected, e.g. by mountains, should be flown. The flights should be conducted at minimum route or sector altitude and note made of excessive ADF needle oscillation, weak identification or interference, together with DME distance or ground reference points. These reference points can later be plotted on a map to obtain the effective coverage and the location of areas of poor quality. If suitable equipment is available, the ADF bearing from which the aircraft heading has been subtracted can be recorded. Where interference occurs from another facility, the interfering station should be identified.

Note [from Table 5-3]: External and aircraft noise sources as well as terrain features routinely affect NDB cross-pointer accuracy. Although tolerances are shown for airways, approaches, and holding patterns, it is not necessary to restrict or remove from service an NDB solely because it provides momentary out-of-tolerance needle oscillations that are brief, relative to the intended procedural use. As long as bearing errors greater than the listed tolerances are generally oscillatory in nature rather than one-sided, and have durations less then 4 seconds for approaches and 8 seconds for airway and holding patterns, the NDB may be considered acceptable. (These time periods apply to each occurrence of oscillatory out-of-tolerance needle activity.)

Recommendation: The number of sectors should be kept to a minimum, and preferably should not exceed two.

12.13e. ESV. For ESV(s), refer to Chapter 22. Coverage at greater than the orbital distance for specific fixes, airways, routes or transitions, may be evaluated on one transmitter.
Establish at normal power.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
[Subparameter 1 - Field Strength] >= 70 uV/m [Subparameter 2 - Coverage Classification] Use average radius, consider diurnal and seasona	[Measure signal strength or bearing] Signal Strength: The minimum signal strength as required for the particular geographical area .	c. Usable Distance: (1) The minimum usable distance must be: CLASS COVERAGE Compass Locator 15 nm MH Facility 25 nm

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
variations	Bearing: ADF needle oscillations not to exceed +/ 10 degrees throughout the specified coverage area. See Note re: exceeding these tolerances (ir Source Text)	H Facility 50 nm HH Facility 75 nm (2) Maximum bearing deviation: 20° (± 10°). e. Bearing Tolerance Deviation. Short duration ou of-tolerance needle activity (including repetitive events) will be allowed when either: (1) The duration does not exceed four seconds or an approach (flown at a nominal 130 knot ground speed), or (2) The duration does not exceed eight seconds fo en route and holding pattern use; but only if the out-of-tolerance activity cannot be construed as a station passage, and th activity is not generally one-sided when repetitive.	
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
[Subparameter 1 - Field Strength] - This is not a hard requirement ("should be"). Note 2 provides fo expected field strength variation with local ground conditions [Subparameter 2 - Coverage Classification] - Giver the field strength measurements in Subparameter 1, classification is not a flight testing issue, but rather the result of the testing.	Coverage can be determined by field strength measurements or by a subjective assessment, normally during daylight hours. Nighttime checks recommended if density of NDB's is high, due to skywave propagation effects. Needle accuracy tolerance of 2 degrees is applied to airways, except that it is not necessary to restri or remove from service an NDB solely because it provides momentary out-of-tolerance needle oscillations that are brief, relative to the intended procedural use. Definitions of brief and out-of-tolerance are provided in a Note to Table 5-3. **Measurement Uncertainty** 3 dB	No field strength measurements are defined or available. Loss of identification is considered loss of coverage - i.e., signal strength and identificatio must both be present, subjectively, to achieve coverage at a given location.	

Annex10_ID	8071_ID	8200_ID	Results_ID
511	652	417	717

Facility NDB **Parameter** Definitions

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref 8071 Reference	8200 Reference

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.4.1 Definitions Note. In Attachment C, guidance is given on the meaning and application of rated coverage and effective coverage and on coverage of NDBs. Average radius of rated coverage. The radius of a circle having the same area as the rated coverage. Effective coverage. The area surrounding an NDB within which bearings can be obtained with an accuracy sufficient for the nature of the operation concerned. Locator. An LF/MF NDB used as an aid to final approach. Note. A locator usually has an average radius of rated coverage of between 18.5 and 46.3 km (10 ar 25 NM). Rated coverage. The area surrounding an NDB within which the strength of the vertical field of the ground wave exceeds the minimum value specified for the geographical area in which the radio beacon is situated. Note. The above definition is intended to establish a method of rating radio beacons on the normal coverage to be expected in the absence of sky wav transmission and/or anomalous propagation from th radio beacon concerned or interference from other LF/MF facilities, but taking into account the atmospheric noise in the geographical area concerned.			Definitions are not subject to flight testing.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
[none]		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
	Measurement Uncertainty		
Annex10_ID	**8071_ID**	**8200_ID**	**Results_ID**
512			718

Facility NDB **Parameter** Emissions

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref / 8071 Reference	8200 Reference

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
Note. The following specifications are not intended preclude employment of modulations or types of modulations that may be utilized in NDBs in addition to those specified for identification, including simultaneous identification and voice modulation, provided that these additional modulations do not materially affect the operational performance of the NDBs in conjunction with currently used airborne direction finders, and provided their use does not cause harmful interference to other NDB services. [Subparameter 1 - Emission Type] 3.4.6.1 Except as provided in 3.4.6.1.1, all NDBs shall radiate an uninterrupted carrier and be identified by on/off keying of an amplitude modulating tone (NON/A2A) 3.4.6.1.1 NDBs other than those wholly or partly serving as holding, approach and landing aids, or those having an average radius of rated coverage of less than 92.7 km (50 NM), may be identified by on/off keying of th unmodulated carrier (NON/A1A) if they are in areas of high beacon density and/or where the required rated coverage is not practicable of achievement because of: a) radio interference from radio stations; b) high atmospheric noise; c) local conditions. Note. In selecting the types of emission, the possibility of confusion, arising from an aircraft tuning from a NON/A2A facility to a NON/A1A facility without changing the radio compass from "MCW" to "CW" operation, will need to be kept in mind.			[Subparameter 1 - Emission Type] This is a design qualification and/or ground maintenance issue. Flight testing does not address this. [Subparameter 2 - Modulation Depth and Purpos This is a design qualification and/or ground maintenance issue. Flight testing does not address this. [Subparameter 3 - Modulation Characteristics] This is a design qualification and/or ground maintenance issue. Flight testing does not address this. [Subparameter 4 - Emissions Purity] This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

[Subparameter 2 - Modulation Depth and Purpose]

3.4.6.2 For each NDB identified by on/off keying of an audio modulating tone, the depth of modulation shall be
maintained as near to 95 per cent as practicable.

3.4.6.3 For each NDB identified by on/off keying of an audio modulating tone, the characteristics of emission during
identification shall be such as to ensure satisfactory identification at the limit of its rated coverage.

Note 1. The foregoing requirement necessitates as high a percentage modulation as practicable, together with
maintenance of an adequate radiated carrier power during identification.

Note 2. With a direction-finder pass band of plus or minus 3 kHz about the carrier, a signal to noise rati of 6 dB at
the limit of rated coverage will, in general, meet the foregoing requirement.

Note 3. Some considerations with respect to modulation depth are contained in Attachment C, 6

[Subparameter 3 - Modulation Characteristics]

3.4.6.4 Recommendation. The carrier power of an NDB with NON/A2A emissions should not fall when the identity
signal is being radiated except that, in the case of a NDB having an average radius of rated coverage exceeding 92.7 km
(50 NM), a fall of not more than 1.5 dB may be accepted.

3.4.6.5 Unwanted audio frequency modulations sha total less than 5 per cent of the amplitude of the carrier.

Note. Reliable performance of airborne automatic direction-finding equipment (ADF) may be seriously prejudiced if the
beacon emission contains modulation by an audio frequency equal or close to the loop switching frequency or its second harmonic.
The loop switching frequencies in currently used equipment lie between 30 Hz and 120 Hz.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

[Subparameter 4 - Emissions Purity]

3.4.6.6 The bandwidth of emissions and the level of spurious emissions shall be kept at the lowest value that the state of technique and the nature of the service permit.

Note. Article S3 of the ITU Radio Regulations contains the general provisions with respect to technical characteristics
of equipment and emissions. The Radio Regulation contain specific provisions relating to necessary bandwidth, frequency
tolerance, spurious emissions and classification of emissions (see Appendices APS1, APS2 and APS3).

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
[Subparameter 2 - Modulation Depth and Purpose] 95% nominal [Subparameter 3 - Modulation Characteristics] Carrier Level Variation <= 1.5 dB Unwanted Modulation < 5%		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
[Subparameter 1 - Emission Type] - Most NDBs are expected to radiate a continuous carrier, with tone keying; some types may use a keyed carrier, without any tone modulation. [Subparameter 2 - Modulation Depth and Purpose] Modulation percentage translates directly to effective coverage area. ICAO defines 6 dB S/N ratio to be sufficient for successful identification decoding by the pilot.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
513			719

Facility NDB **Parameter** Holding & Approach Procedure

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref [3.4.2, indirectly]

Annex Ref **8071 Reference** 5.3.11 **8200 Reference** 12.20d, e

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	Where a holding pattern or approach procedure is based on an NDB, this procedure should be flown to check for flyability from a pilot's viewpoint. A check is made for excessive needle oscillation, erroneous reversals giving a false impression of station passage, or any other unusual condition. Note [from Table 5-3: External and aircraft noise sources as well as terrain features routinely affect NDB cross-pointer accuracy. Although tolerances are shown for airways, approaches, and holding patterns, it is not necessary to restrict or remove from service an NDB solely because it provides momentary out-of-tolerance needle oscillations th are brief, relative to the intended procedural use. As long as bearing errors greater than the listed tolerances are generally oscillatory in nature rathe than one-sided, and have durations less then 4 seconds for approaches and 8 seconds for airway and holding patterns, the NDB may be considerec acceptable. (These time periods apply to each occurrence of oscillatory out-of-tolerance needle activity.)	12.13d. Instrument Flight Procedures (1) Maneuvering: (a) Commissioning or Evaluating Amended Procedures. Fly each new procedural segment th uses a facility bearing at the minimum procedural altitude. Fly final approach segments in the direction of intended use. After the procedure turn or FAF, descend to 100 feet below the minimum descent altitude for the segment. In addition, descend to 100 feet below all step-down fix altitudes inside the FAF. Evaluate holding pattern airways, routes and transitions along the entire procedure at the minimum procedural altitude(s). (b) Periodic Inspections. Required coverage evaluations during periodic inspections are limited to surveillance checks of any airways, routes or transitions to the extent the aircraft is maneuvere to position for other required checks, as well as al SIAP final approach segments. For SIAP(s) with a FAF, cross the FAF at the minimum published altitude and descend to at least 100 feet below the minimum descent altitude for that segment. For SIAP(s) without a FAF, fly the final segment from the procedure turn distance at the minimum published procedure turn completion altitude and descend to at least 100 feet below the minimum descent altitude for that segment. In addition, descend to 100 feet below all step-down fix altitudes inside the FAF. (3) [sic, should be 2] Analysis. Evaluate the signa for out of tolerance needle oscillations, weak or garbled identification, and interference. Recommendation: Where two locators are used a supplements to an ILS, the frequency separation between the carriers of the two should be not less than 15 kHz to ensure correct operation of the radio compass, and preferably not more than 25 kHz in order to permi a quick tuning shift in cases where an aircraft has only one radio compass.	NOTE: See AIRWAY COVERAGE parameter for recommendation to modify 8200 to more fully comply with ICAO intent. ICAO 8071 and FAA 8200 text re: momentary ou of-tolerance deviations of the bearing indicator ar identical - ICAO actually adopted the 8200 provisions, which had been composed earlier. Tolerances are identical.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	Adequate flyability, needle oscillations not to exceed +/- 5 degrees, with no erroneous reversals giving false impression of station passage. See Note re: exceeding these tolerances (in Source Text)	d. NDB Approach. Bearing indicator deviation in the final approach segment and holding pattern must not exceed: 10° (± 5°) e. Bearing Tolerance Deviation. Short duration ou of-tolerance needle activity (including repetitive events) will be allowed when either: (1) The duration does not exceed four seconds or an approach (flown at a nominal 130 knot ground speed), or (2) The duration does not exceed eight seconds fo en route and holding pattern use; but only if the out-of-tolerance activity cannot be construed as a station passage, and th activity is not generally one-sided when repetitive.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
		8200 description is much more specific than ICAO 8071. The recommendation text under the Analysis paragraph actually addresses a spectrum management issue, and is not directly relevant to flight testing, except perhaps for a flight inspector' assessment of tuning difficulties..

Measurement Uncertainty

2 degrees

Annex10_ID	8071_ID	8200_ID	Results_ID
	653	418	720

Facility NDB **Parameter** Identification

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref 3.4.5.1

Annex Ref **8071 Reference** 5.3.3 **8200 Reference** 12.20a

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
[Subparameter 1 - Identification Type/Rate] 3.4.5.1 Each NDB shall be individually identified by two- or three-letter International Morse Code group transmitted at a rate corresponding to approximatel 7 words per minute. 3.4.5.2 The complete identification shall be transmitted at least once every 30 seconds, except where the beacon identification is effected by on/off keying of the carrier. In this latter case, the identification shall be at approximately 1-minute intervals, except that a shorter interval may be usec at particular NDB stations where this is found to be operationally desirable. 3.4.5.2.1 Recommendation. Except for those cases where the beacon identification is effected by on/off keying of the carrier, the identification signal should be transmitted at least three times each 30 seconds spaced equally within that time period. 3.4.5.3 For NDBs with an average radius of rated coverage of 92.7 km (50 NM) or less that are primarily approach and holding aids in the vicinity o an aerodrome, the identification shall be transmitted at least three times each 30 seconds, spaced equally within that time period. [Subparameter 2 - Identification Frequency] 3.4.5.4 The frequency of the modulating tone used for identification shall be 1 020 Hz plus or minus 50 Hz or 400 Hz plus or minus 25 Hz. Note. Determination of the figure to be used would be made regionally, in the light of the consideration contained in Attachment C, 6.5.	The coded identification on the NDB signal shoulc be monitored during the flight inspection to the lim of coverage (in some cases, the range to which th identification can be received may determine the effective coverage of the NDB). The identification is satisfactory if the coded characters are correct, clear, and properly spaced. Monitoring of the identification during the flight also aids in identifying an interfering station.	12.13a. Identification. The facility identification is evaluated throughout the area of intended use, including any route, airway or transition that may extend beyond the normal service volume. The evaluation should be accomplished during all required checks. (1) Maneuvering. No specific maneuver instructions. (2) Analysis. The facility identification is out of tolerance when it is incorrect or not identifiable. The coded characters should be correct, clear, an properly spaced. (3) Other Considerations. On aircraft so equipped utilize the 'Ident' feature on the ADF audio panel.	[Subparameter 1 - Identification Type/Rate] Except for Morse Code speed, these characteristics are design qualification and/or ground maintenance issues. The requirements c Annex 10 3.4.5.1 are met by the subjective activities defined in 8200. [Subparameter 2 - Identification Frequency] This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
[Subparameter 1 - Identification Type/Rate] -	Clearly audible, proper keying, correct coding to	a. Morse Code Identification. All facilities must

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
Keying Rate ~ 7 wpm Keying Sequence: >= 2/min for tone modulation, >= 6 preferred >= 1/min for on/off carrier modulation [Subparameter 2 - Identification Frequency] 1020 Hz +/- 50 Hz or 400 Hz +/- 25 Hz	the limit of coverage	have a Morse code identifier that is correct, clear, and identifiable throughout the area of intended use, including any route, airway or transition that may extend beyond the normal service volume. If the Morse identifier is augmented with voice identification, the voice identification must adhere to the same tolerance as the associated Morse identifier.	
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
	Measurement Uncertainty		
	(none)		

Annex10_ID	8071_ID	8200_ID	Results_ID
514	654	419	721

Facility NDB **Parameter** Monitoring

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref 8071 Reference	8200 Reference	
ICAO Annex Text	**Doc 8071 Source Text**	**8200 Source Text**	**Comparison Remarks**
3.4.8.1 For each NDB, suitable means shall be provided to enable detection of any of the following conditions at an appropriate location: [Subparameter 1 - Power Monitor] a) a decrease in radiated carrier power of more than 50 per cent below that required for the rated coverage; [Subparameter 2 - Identification Monitor] b) failure to transmit the identification signal; [Subparameter 3 - Failsafe Monitor] c) malfunctioning or failure of the means of monitoring itself. [Subparameter 4 - Power Supply Monitor] 3.4.8.2 Recommendation. When an NDB is operated from a power source having a frequency which is close to airborne ADF equipment switching frequencies, and where the design of the NDB is such that the power supply frequency is likely to appear as a modulation product on the emission, the means of monitoring should be capable of detecting such power supply modulation on the carrier in excess of 5 per cent. [Subparameter 5 - Monitoring Continuity] 3.4.8.3 During the hours of service of a locator, the means of monitoring shall provide for a continuous check on the functioning of the locator as prescribed in 3.4.8.1 a), b) and c). 3.4.8.4 Recommendation. During the hours of service of an NDB other than a locator, the means of monitoring should provide for a continuous check of the functioning of the NDB as prescribed in 3.4.8.1 a), b) and c).			This is a design qualification and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

Note. Guidance material on the testing of NDBs is contained in 6.6 of Attachment C.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Alarm when: -3dB Power Loss of ID Keying Failure of Monitor function		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
[Subparameter 4 - Power Supply Monitor] - Modern NDB equipment types do not have a power supply hum issue. [Subparameter 5 - Monitoring Continuity] - Monitoring is expected to be continuous when NDB is in service.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
515			722

Facility NDB **Parameter** Radiated Power Limitations

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref 8071 Reference	8200 Reference

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.4.3 Limitations in radiated power The power radiated from an NDB shall not exceed t more than 2 dB that necessary to achieve its agree rated coverage, except that this power may be increased if coordinated regionally or if no harmful interference to other facilities will result.			This is a spectrum management, design qualification, and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Power <= +2 dB from rated coverage power unless no interference		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
This parameter is a spectrum management issue. Transmitters very rarely fail in a manner that increases the output power.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
516			723

Facility NDB **Parameter** Radio Frequencies

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref / 8071 Reference	8200 Reference	ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
			[Subparameter 1 - Channel Frequency] 3.4.4.1 The radio frequencies assigned to NDBs shall be selected from those available in that portio of the spectrum between 190 kHz and 1 750 kHz. 3.4.4.3 Recommendation. Where two locators are used as supplements to an ILS, the frequency separation between the carriers of the two should b not less than 15 kHz to ensure correct operation of the radio compass, and preferably not more than 25 kHz in order to permit a quick tuning shift in cases where an aircraft has only one radio compass. [Subparameter 2 - Frequency Stability] 3.4.4.2 The frequency tolerance applicable to NDBs shall be 0.01 per cent except that, for NDBs of antenna power above 200 W using frequencies of 1 606.5 kHz and above, the tolerance shall be 0.005 per cent. [Subparameter 3 - Interlock] 3.4.4.4 Where locators associated with ILS facilities serving opposite ends of a single runway are assigned a common frequency, provision shall be made to ensure that the facility not in operational us cannot radiate. Note. Additional guidance on the operation of locato beacons on common frequency channels is contained in Volume V, Chapter 3, 3.2.2.			[Subparameter 1 - Channel Frequency] This is a spectrum management issue. Flight testing does not address this. NOTE: The Recommendation in Annex 10 3.4.4.3 re: frequency separation is addressed in 8200, under the HOLDING & APPROACH PROCEDURE parameter. [Subparameter 2 - Frequency Stability] This is a design qualification, and/or ground maintenance issue. Flight testing does not address this. [Subparameter 3 - Interlock] This is a ground installation and maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
[Subparameter 2 - Frequency Stability] +/- 0.01% (100 ppm), or +/- 0.005 % (50 ppm) for >200 watts and >= 1606.5 kHz		

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
[Subparameter 1 - Channel Frequency] and [Subparameter 3 - Interlock] -- These are spectrum management and facility installation issues not subject to flight testing.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
517			724

Facility NDB **Parameter** Siting

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref 8071 Reference	8200 Reference

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.4.7.1 Recommendation - Where locators are used as a supplement to the ILS, they should be located at the sites of the outer and middle marker beacons. Where only one locator is used as a supplement to the ILS, preference should be given to location at the site of the outer marker beacon. Where locators are employed as an aid to final approach in the absence of an ILS, equivalent locations to those applying when an ILS is installed should be selected, taking into account the relevant obstacle clearance provisions of the PANS-OPS (Doc 8168). 3.4.7.2 Recommendation. Where locators are installed at both the middle and outer marker positions, they should be located, where practicable, on the same side of the extended centre line of the runway in order to provide a track between the locators which will be more nearly parallel to the centre line of the runway.			This is a ground installation issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
518			725

Facility NDB **Parameter** Standby Equipment

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** 5.3.13 **8200 Reference** 12.20g

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	The checks to be carried out on standby equipment (if installed) will depend on whether it is identical to the main equipment. If the main and standby equipments are interchangeable, the full commissioning checks are carried out on one equipment, and only the identification, voice, and brief quality check on the other. Subsequent equipment operation can be scheduled so that routine checks are carried out on each equipment alternately. If the standby equipment is of lower power than the main, both equipments are checke during commissioning. This need not increase flight times if coordination between ground and air can be arranged to change the equipment when requested. Thus, on a flight outbound on an airway from the NDB, the lower power equipment is first checked, and when its coverage has been exceeded, the higher power equipment is brought on and the flight proceeds to the coverage limit of this equipment. If any change in the performance of the NDB is considered likely when connected to its source of standby power, then all the flight checks should be repeated with the NDB on standby power. Normally, facilities whose standby power source consists of float-charged batteries without switching equipment do not require this check.	12.13g. Standby Equipment. If dual transmitters are installed, evaluate all required parameters for each transmitter during a commissioning inspection. When practical, for periodic inspections of dual transmitter facilities, conduct the inspection using the transmitter not checked during the previous periodic inspection. (1) Maneuvering. No specific maneuver instructions. (2) Analysis. Evaluate the same as primary equipment. (3) Other Considerations. See Chapter 5 for standby equipment NOTAM. 12.13h. Standby Power. If standby power is installed and of such a type that Paragraph 4.33 requires it be checked, have the facility power source switched to the standby source and repeat all the flight inspection checks (one transmitter only). (1) Maneuvering. No specific maneuver instructions. (2) Analysis. Evaluate the signal for out of tolerance needle oscillations, weak or garbled identification, and interference within the coverage area. (3) Other considerations. Standby power checks are not required for facilities powered by batteries that are constantly charged by another power source. The Facility Data Sheet should indicate the source of standby powe	8200 matches Doc 8071 in intent and effect.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	Same tolerances as main equipment	g. Standby Equipment. If installed, standby equipment must perform to all

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		tolerances in this chapter.	

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
	[intuitive]	[intuitive]

Measurement Uncertainty

(none)

Annex10_ID	8071_ID	8200_ID	Results_ID
	655	420	726

Facility **NDB** **Parameter** **Station Passage**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** 5.3.12 **8200 Reference** 12.20f

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	This check confirms that a correct indication is given when passing over a station. The aircraft should be flown over the NDB, preferably from two radials 90 degrees apart, to ensure that an ADF reversal is obtained with an acceptably limited needle oscillation.	12.13f. Station Passage. Needle reversal should occur when the aircraft passes directly over, or in very close proximity to the facility. (1) Maneuvering. Overfly the antenna at the minimum procedural altitude. (2) Analysis. Station passage is out of tolerance if any indication of false station passage occurs, or station passage does not occur over the station. Momentary needle hunting while near or over the station does not in itself constitute false station passage.	8200 matches Doc 8071 in intent and effect.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	Absence of any tendency for false station passage or excessive ADF needle oscillation	f. Station Passage. Station passage indications must be unambiguous. Momentary needle hunting while over the station will not be construed as false passage.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
	[intuitive]	[intuitive]

Measurement Uncertainty

(none)

Annex10_ID	8071_ID	8200_ID	Results_ID
	656	421	727

Facility NDB **Parameter** Voice

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** 5.3.4 **8200 Reference** 12.20b

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	When a facility provides voice transmissions such as weather broadcasts, the voice quality is checked. A voice transmission should be requested, if not available continuously, and a check made for quality, modulation and freedom from interference. If the voice transmission cannc be received at the maximum range from the beacon, the maximum range for satisfactory reception should be noted.	12.13b. Voice. The voice feature (if installed) is evaluated within the standard service volume. The evaluation may be accomplished while other required checks are being performed. (1) Maneuvering. No specific maneuver instructions. (2) Analysis. The voice feature is out of tolerance it renders the facility identification not decipherabl (except live voice). The voice transmission should be evaluated for quality, modulation and freedom from interference. Record the maximum usable voice range on commissioning for future reference The voice feature should be clear and recognizab for a minimum of two-thirds the standard service volume range. Notify maintenance anytime the voice reception distance is less than the required range. Facility restrictions are not determined by the voice feature. The voice feature should be removed from service if it adversely affects the facility identification. (3) Other Considerations. On aircraft so equipped utilize the "Voice" function on the ADF audio panel.	8200's requirements are more demanding (e.g., voice good for at least 2/3 of usable distance), bu reasonable.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	Clearly audible and free from interference to the limit of coverage	b. Voice Transmission. Broadcast information should be clear and recognizable for a minimum c two-thirds of the NDB's usable distance.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

(none)

Annex10_ID	8071_ID	8200_ID	Results_ID
	657	422	728

Facility **PAR** **Parameter** **PAR Accuracy**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for some, doesn't for others

SARPS Ref 3.2.3.3

Annex Ref **8071 Reference** 7.3.5, 7.3.6 **8200 Reference** 14.24a, c,d, h

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.2.3.3 [PAR] Accuracy [Subparameter 1 - Azimuth Accuracy] 3.2.3.3.1 Azimuth accuracy. Azimuth information shall be displayed in such a manner that left-right deviation from the on-course line shall be easily observable. The maximum permissible error with respect to the deviation from the on-course line sha be either 0.6 per cent of the distance from the PAR antenna plus 10 per cent of the deviation from the c course line or 9 m (30 ft), whichever is greater. The equipment shall be so sited that the error at the touchdown shall not exceed 9 m (30 ft). The equipment shall be so aligned and adjusted that the displayed error at the touchdown shall be a minimu and shall not exceed 0.3 per cent of the distance from the PAR antenna or 4.5 m (15 ft), whichever is greater. It shall be possible to resolve the positions of two aircraft which are at 1.2 degrees in azimuth c one another. [Subparameter 2 - Elevation Accuracy] 3.2.3.3.2 Elevation accuracy. Elevation information shall be displayed in such a manner that up-down deviation from the descent path for which the equipment is set shall be easily observable. The maximum permissible error with respect to the deviation from the on-course line shall be 0.4 per cent of the distance from the PAR antenna plus 10 per cent of the actual linear displacement from the chosen descent path or 6 m (20 ft), whichever is greater. The equipment shall be so sited that the error at the touchdown shall not exceed 6 m (20 ft). The equipment shall be so aligned and adjusted tha the displayed error at the touchdown shall be a minimum and shall not exceed 0.2 per cent of the distance from the PAR antenna or 3 m (10 ft), whichever is greater. It shall be possible to resolve the positions of two aircraft that are at 0.6 degree in elevation of one another. [Subparameter 3 - Distance Accuracy]	[Subparameter 1 - Azimuth Accuracy] 7.3.5 The procedures are as follows: a) Locate the theodolite on the extended centerlir of the runway a safe distance off the approach end, carefully level and zero it accurately along th centerline. b) Locate the radio unit near the theodolite to allo easy operation by the theodolite operator. c) Incline the theodolite at the glide angle. d) The controller at the console should now vecto the aircraft at an appropriate altitude so that the aircraft will be positioned for a straight in approacl if possible, at least 10 NM from touchdown. e) The controller begins the talk down so that the aircraft can establish the correct rate of descent and azimuth heading. f) When the aircraft becomes visible to the theodolite operator, the operator begins tracking the nose of the aircraft and reading out the positic of the aircraft every half-mile during the approach. The controller alerts the theodolite operator as each half-mile is crossed. g) The aircraft deviations are read from the theodolite to an accuracy of 0.01degree, if possible. For example, if the aircraft is on course, the operator will report 0.00 degree, if the aircraft to the right of center line the operator reports 0.02 degree and, if the aircraft is to the left, he reports 0.98degree. h) During the run, the pilot attempts to retain a suitable rate of descent so that the aircraft will remain within the field of vision of the theodolite. He will also alter course in accordance with the indications from the theodolite so that the aircraft will remain as nearly as possible on course.	a. Course Alignment and Coverage (Azimuth). An of the following methods may be used: (1) AFIS Method. This is the preferred method. Use the procedures in the appropriate AFIS equipment handbook. (2) Visual Method. To check for course alignment proceed in-bound at pattern/ intercept altitude fror approximately 10 to 12 miles from the runway and when on-course and path, descend at a normal glidepath angle wi the final controller furnishing information to enable the flight inspector to fly on the centerline azimuth This information is to be given as "left," "right," or "on-course." Range should be given at least every mile. The flight inspector will determine, by visual reference to the runway, if the centerline is straight and if it coincides with the runway centerline extended. (3) Theodolite Method. At some locations, it may be necessary to use a theodolite to supplement th pilot's observations, especially when the runway is extremely wide or poorly defined by surrounding terrain. Proceed in-bound at pattern/ intercept altitude from 10 to 12 miles from the field. Have the final controller furnish information as to the aircraft's position relative to runway centerline. The theodolite operator will continuously track the aircraft and inform the pilot of the aircraft position relative to runway centerline. (4) Course alignment is most critical at touchdowr Ensure the alignment is satisfactory at runway threshold using AFIS, visual means, or theodolite Along-track azimuth Alignment at distances greater than threshold must be determined when AFIS measurement techniques are used. Apply th along-track tolerance to the average of all on-course calls. Discuss any singular along-track errors with Air Traffic and/or PAR maintenance personnel for resolution.	[Subparameter 1 - Azimuth Accuracy] 8200 does not reflect allowable aircraft deviation in percentage as a function of distance. Rather, adopts a tolerance of 30 feet or 0.6% of distance whichever is greater. This is a conservative approach. 8200 does not address the requirement to be abl to resolve two aircraft which are at 1.2 degrees o each other. However, this is a function of the antenna beamwidth, and is a design qualification issue, rather than a flight testing issue. ---------- [Subparameter 2 - Elevation Accuracy] 8200 does not reflect aircraft deviation in percentage as either a function of distance or a specific linear error (20 feet). Rather, it adopts a single and simple tolerance of 0.1 or 0.2 degrees for the glide path angle. ICAO's tolerances are stated as a function of distance/deviation, OR 20 whichever is greater. This means that for an aircraft beyond ~5800' in distance, it is possible t exceed the 20' ICAO tolerance when using the 0. degree (non-commissioning) tolerance. Howeve at that distance, the ICAO tolerance of 0.4% is larger. Thus this is a conservative approach. 8200 does not reflect the resolution of two aircraf which are within 0.6 degrees of each other. 8200 utilizes matching of glide slope angle in lieu of absolute elevation accuracy (and tolerances). However, this ability to resolve two targets is a function of antenna beamwidth, and is a design qualification issue, rather than a flight testing issue. ---------- [Subparameter 3 - Distance Accuracy] Range/Distance: 8200 at first appears to be mor demanding than Annex 10 as distance increases

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
3.2.3.3.3 Distance accuracy. The error in indication of the distance from the touchdown shall not excee 30 m (100 ft) plus 3 per cent of the distance from the touchdown. It shall be possible to resolve the positions of two aircraft which are at 120 m (400 ft) of one another on the same azimuth.	i) The approach is broken off when the aircraft is over the end of the runway and control reverts to the controller to position the aircraft for the next approach. j) During the approach, the controller and the theodolite operator record on a suitable form the aircraft position with respect to the runway centerline every half-mile from the distance of 18. km (10 NM). This information is used later to calculate the PAR errors. [Subparameter 2 - Elevation Accuracy] 7.3.6 The procedures are as follows: a) Locate the theodolite on the side of the runway towards the approach end such that the optical plane of the instrument will pass through the touchdown point when inclined at the glide path angle. Since the instrument is higher than the touchdown point, it should be positioned in the direction of the approach end of the runway and the appropriate number of meters (feet) from the touchdown point. For a glide angle of 2.5 degrees the theodolite would be moved 7 meters (23 ft) for every 0.3 meters (1 foot) difference in height. b) Locate the radio near the theodolite to allow easy operation by the theodolite operator. c) Carefully level the theodolite, align it parallel to the runway centerline, and incline it at the desired glide angle. d) The controller at the console should now vecto the aircraft at an appropriate altitude so that the aircraft will be positioned for a normal approach, if possible, at least 18.5 km (10 NM) from touchdown. e) The controller begins the talk down so that the aircraft can establish the correct rate of descent and glide path heading. f) When the aircraft becomes visible to the theodolite operator, he begins tracking the nose o the aircraft and reading out the position of the aircraft every half-mile during the approach. The controller alerts the theodolite operator as each ha mile is crossed. g) The aircraft deviations are read from the	B. Azimuth Only Procedures. Some facilities have AZ ONLY or PAR w/o GS procedures published for use during outages of the elevation portion. Procedurally, the obstacle clearance area of the PAR is used and non-precision Required Obstacle Clearance (ROC) applied. An AZ ONLY approach may therefore have a lower MDA than an ASR approach to the same runway because the ASR obstacle clearanc area is larger and may contain higher obstacles. For a PAR with w/o GS procedure, the procedural altitudes must be maintained in all but the final segment. For the final segment, upon reaching th FAF inbound, descend at a rate of approximately 400 ft per mile to an altitude of 100 ft below the lowest MDA and maintain this altitude to the threshold. Ensure radar coverage and obstacle clearance. Alignment should be measured at threshold; this requirement may be satisfied durin the normal PAR approach. C. Course Deviation Accuracy. While flying inbound on runway centerline extended, deviation to the right or left of centerline should be made wi attention directed as to how far the aircraft must move off centerline befor the controller notices movement. The controller needs only to state - slightly left (or right) of centerline. D. Range Accuracy. Check the accuracy of the range information, both video and fixed, by comparison with the AFIS or DME. Checkpoints such as the outer marker or VOR are excellent; however, any well surveyed checkpoint satisfactory, provided its distance from the field can be established. All ranges are measured in nautical miles from touchdown. In areas where there are no ground checkpoints or good electron means of accurately measuring distance from the field, such as DME, this check may be omitted. Normally, two checkpoints, one at 5 to 10 miles and one at 1/2 mile, are sufficient for checking range accuracy. Range accuracy checks of azimuth and elevation radar normally will be made simultaneously. (See Paragraph 14.24e, Note.) h. Glidepath Alignment. During the glidepath alignment check, it is necessary to determine the glidepath angle and the straightness of the glidepath centerline. Some new military PAR(s) have the capability to provide controller selected multiple glidepaths. For these radars, all	from threshold (2% vs. 3%). However, Annex 10 is in units of distance to touchdown, while 8200 uses units of true range. Depending on the PAR antenna location, 8200 can allow range accuracies worse than ICAO's tolerance. Recommendation - Clarify or restate distance accuracy tolerances to protect the Annex 10 requirement. If this is done, filing a difference with ICAO will not be necessary. 8200 does not reflect the resolution of two aircraf which are with 120m (440 ft) of each other. However, this is a function of the antenna beamwidth, and is a design qualification issue, rather than a flight testing issue. ---------- [Subparameters 1-3 Azimuth, Elevation and Range] Annex10 does not reflect Doc 8071 notes (recommendations) that tighter tolerances are easily obtained and should be considered. Recommendation: Although these tighter tolerances are possible this should not warrant filing an ICAO difference.

theodolite to an accuracy of 0.01degree, if possible. For example, for a glide angle of 2.5 degrees the operator will report 2.50 degrees whe the aircraft is on path, 2.52 degrees when the aircraft is above path and 2.48 degrees when the aircraft is below path.

h) During the run, the pilot is required to remain ir line with the extended runway centerline so that tr aircraft will remain within the field of vision of the theodolite. He will also alter his rate of descent in accordance with the indications from the theodolit so that the aircraft will remain as close as possible on glide path.

i) The approach is broken off when the aircraft is over the end of the runway and control reverts to the controller to position the aircraft for the next approach.

j) During the approach, the controller and the theodolite operator record on a suitable form the aircraft position with respect to the runway centerline every half-mile, if possible, from 18.5 kı (10 NM). This information is used later to calculate the PAR errors.

published angles must be inspected prior to use; for periodic inspections, only the lowest angle mu be evaluated.

(1) AFIS Methods. PAR glide slope angle will be determined by AFIS, unless theodolite method or Chapter 24 is applied.

(2) Theodolite Method. Position the theodolite according to instructions in Paragraph 14.21d. Communications on a common frequency are essential for the theodolite operator, final controller, and flight inspector. Afte communications have been established at all thre locations, the aircraft should proceed in-bound from a point approximately 12 miles from touchdown and at the pattern altitude until the fina controller advises that the aircraft is on the glidepath. A descent is then commenced, maintaining the aircraft as nearly on the centerline or glidepath as possible by using the information furnished by the controller. The pilot should CHG maintain as constant an attitude as possible throughout the approach. Information should be given in terms of "above," "below," or "on glidepath." The theodolite operator will track the aircraft from the start of the in-bound run, maintaining the horizontal cross-hair exactly on th aircraft as it descends on the glidepath. As the aircraft proceeds in-bound, the theodolite operato should listen carefully to the glidepath information issued by the controller and have an assistant record the angle each time the controller calls the aircraft "on glidepath." Do not record calls taken inside of decision height. These angle readings should then be averaged to determine the actual glidepath angle.

(3) Precision Range Mark Method. Determination of angle using altimetry is only authorized when inspecting under the provisions of Chapter 24. When it is impractical to check the glidepath alignment using the above methods, it is permissible to use the radar to determine the distance of the aircraft from the touchdown point. Obviously, any range errors present in the PAR w cause a corresponding error when measuring the glide slope angle. When making this check, calculate the altitude for the published/ desired glidepath angle at the 6-, 5-, 4-, 3-, 2-, and 1-mile range marks.

Instruct the PAR controller to give precise "on

path" calls and the precise point at which the rada return crosses the range marks. By comparing the actual aircraft altitude at the exact point on glidepath with the calculated altitude, it can be determined that the glidepath is at the published/desired angle. Although there is a smal amount of altimeter lag when proceeding down th glidepath using this method, it is negligible and ca be disregarded. The straightness of the glidepath can be ascertained concurrently with the alignmer check.

An alternative method is to fly a descending run o the glidepath and note the difference in altitude between range marks. It is necessary that the controller provide range information each time a path call is given. The glidepath angle can then be determined as indicated in the formula in Appendi 2, Paragraph A2.17b, using on-path calls at the measurement points.

i. Application of Angle Tolerances. Prior to the commissioning inspection of PAR(s), operational personnel must determine the "desired" angle to which the PAR is to be commissioned. This angle is determined by obstacle clearance criteria and operational use requirements. The obstacle clearance criteria allows for operational deviation (periodic angle tolerance) of 0.2 ° from the commissioned angle. It is imperative that the reported commissioned angle be the angle for which obstacle clearance and operational criteria has been applied. The desired angle, the computed angle, and the commissioned angle are actually the same.

The allowable periodic deviation of 0.2 ° is applied to the desired/ computed angle and not the angle found during commissioning inspections. Because the periodic tolerance of 0.2 ° is applied to the commissioned angle, operations/ maintenance personnel must determine the acceptability of a facility which will require the application of an imbalanced periodic tolerance. An example of this situation is as follows: Desired/ commissioned angle = 3.00 °, angle found during commissioning = 2.90 °, allowable deviation = 3.00 ± .2 ° or 2.8 to 3.2 °.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Azimuth: 0.6% of distance from PAR antenna + 10% of aircraft deviation, or 9 meters (30 ft), whichever is greater. Elevation: 0.4% of distance from PAR antenna + 10% of aircraft deviation, or 6 meters (20 ft), whichever is greater. Distance: 30 meters (100 ft) + 3% of distance to touchdown	Azimuth: 0.6% of distance from PAR antenna + 10% of aircraft deviation, or 9 meters (30 ft), whichever is greater. Note: In practice, it has been found that the following tolerances, although more stringent, are easily applied and attained: Azimuth: 0.6 % of distance to PAR antenna Elevation: 0.4% of distance from PAR antenna + 10% of aircraft deviation, or 6 meters (20 ft), whichever is greater. Note: In practice, it has been found that the following tolerances, although more stringent, are easily applied and attained: Elevation: 0.4 % of distance to PAR antenna Distance: 30 meters (100 ft) + 3% of distance to touchdown	Azimuth Course Alignment (at Threshold) - 30 ft referenced to runway centerline Azimuth Course Alignment (along track) - The greater of 30 ft or 0.6% of the aircraft to PAR antenna distance, referenced to runway centerline Course Deviation Accuracy - Target presentation must be coincident with aircraft position Glide Path Alignment (Angle) - 0.1 degree of published angle (Commissioning). 0.2 degrees of published angle (Periodic) Range Accuracy - +/- 2% of true range

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
[Subparameters 1-3 Azimuth, Elevation and Range Annex10 tolerance does not reflect Doc 8071 note that tighter tolerances are acceptable	[Subparameters 1-3 Azimuth, Elevation and Rang This document does not make a formal recommendation to adhere to more stringent tolerances.	[Subparameters 1-3 Azimuth, Elevation and Range] Commissioning/routine resolution: Does not provide for a check of resolution of two aircraft. Does not reflect an allowable deviation in percentage as a function of distance. [Subparameter 4 - Course deviation accuracy] Course deviation accuracy: Does not reflect aircraft deviation in percentage as a function of distance. The following paragraph is from Annex10. The maximum permissible error with respect to th deviation from the on-course line shall be either 0 per cent of the distance from the PAR antenna plus 10 per cent of the deviation from the on-course line or 9 m (30 ft), whichever is greater.

Measurement Uncertainty

Az & El & Distance: 3m (10 ft)

Annex10_ID	8071_ID	8200_ID	Results_ID
519	658	423	729

Facility **PAR** **Parameter** **PAR Coverage**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for some, doesn't for others

Annex Ref **SARPS Ref** 3.2.3.1 **8071 Reference** 7.3.7 **8200 Reference** 14.24e, f, g

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.2.3.1 [PAR] Coverage [Subparameters 1, 2, and 3 - Azimuth, Elevation an Distance] 3.2.3.1.1 The PAR shall be capable of detecting an indicating the position of an aircraft of 15 m2 echoing area or larger, which is within a space bounded by a 20-degree azimuth sector and a 7-degree elevation sector, to a distance of at least 16 km (9 NM) from its respective antenna. Note. For guidance in determining the significance the echoing areas of aircraft, the following table is included: private flyer (single-engined): 5 to 10 m2; small twin-engined aircraft: from 15 m2; medium twin-engined aircraft: from 25 m2; four-engined aircraft: from 50 to 100 m2.	7.3.7 The coverage of the PAR facility can easily be confirmed during the azimuth and glide path flight tests. Coverage checks require solid returns from an aircraft with a reflection area of 15 m^2 (165 ft^2) and should be obtained from a distance of 16.7 km (9 NM) and an altitude of 300 meters (1000 ft) above intervening terrain. For aircraft having different surface reflection areas, the coverage requirements should be modified accordingly.	e. Usable Distance. The check for usable distance or maximum range, may be made while proceedin in-bound from the limit of the radar coverage during the course alignment check by having the controller give the mileage when the aircraft is firs displayed. The new radars have ranges of 15 to 2 miles, but because of small aircraft size, less coverage can be expected. Azimuth and elevatio coverage can be checked simultaneously. Coverage of those PAR(s) which have coverage capabilities beyond 10 nm should be checked at the minimum vectoring altitude to the coverage capabilities of the radar. Coverage should be checked using alternately normal and MTI radar. Periodic coverage checks need to be made only i the area of operational use. NOTE: Mileage information given by the radar operator should be the mileage from the touchdown point to the target aircraft. In case erroneous mileage information is given, the flight inspector should inquire if the range information obtained from the scope has been corrected to compensate for the distance from the antenna to the RPI (touch-down point). f. Coverage (Lateral). The lateral coverage of the PAR may be determined by flying perpendicular t the course. Lateral position of the aircraft must be determined by AFIS, theodolite, or large scale ma Altitude and distance will be determined by engineering/maintenance personnel. The controlle will indicate when he/ she obtains and loses radar contact. g. Moving Target Indicator (MTI)/ Moving Target Detector (MTD). Blind speeds for PAR systems are usually quite high due to the high pulse repetition frequency (PRF) required for good targe definition. It may be quite difficult to perform an MTI/ MTD check with certain types of small aircra due to speed limitations. This check can be omitted if the speed range required is impossible attain. The check can be performed at a later date when a faster aircraft is available. An airspeed	[Parameter: PAR Coverage] 8200 is not as precise in identifying coverage of different types of aircraft. Recommendation: Annex10 uses this for guidance and as such should not warrant filing a ICAO difference. [Subparameter 1 - Coverage Azimuth] 8200 azimuth tolerance is tighter than Annex10 (+/-10 degrees vs. +/-20 degrees). Recommendation: Since procedural centerline could be different than actual center line this tighter tolerance should not warrant filing an ICA difference. [Subparameter 2 - Coverage Elevation] 8200 elevation tolerance is provided in units of range rather than in degrees as for Annex 10. Clarification is needed to ensure that the Annex 10 tolerances are met. If this clarification is provided, there is no need to file a difference wit ICAO. [Subparameter 3 - Coverage Distance] 8200 distance tolerance is less demanding numerically than Annex10 (minimum of 7.5 NM vs. 9NM). However, Annex10 references the range measurement to the antenna locations, whereas 8200 refers to touchdown. Depending on the location of the PAR antenna, this difference may be small or large. Recommendation: Clarification is needed to protect the Annex 10 tolerance. If this clarificatio is provided, there is no need to file a difference with ICAO. [Subparameter 4 - Coverage - MTI/MTD blind speeds]

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		notch of as much as ± 20 knots may exist around the computed blind speed. (1) During the commissioning inspection, the MTI/ MTD feature will be checked to determine if there are any blind speeds at which it is impossible to maintain continuous radar contact. On subsequen inspections, MTI/ MTD needs to be checked only when requested by maintenance or operations. Maintenance personnel will provide the precomputed blind speed for the radar. Determine the airspeed which will give the required ground speed. Fly in-bound from approximately 10 miles (ensure that MTI is gated beyond 10 miles) while varying the air speed slightly above and below the previously computed airspeed. Note the speed range within which a reduction of target brilliance occurs. Close coordination between the controlle and the flight inspector is necessary to determine the speed at which MTI/ MTD causes the greates effect. (2) When MTI/ MTD is required on the final approach, this information must be noted on the flight inspection report. The requirements for MTI do not constitute a facility restriction. Both azimut and elevation MTI/ MTD normally will be checked at the same time. (3) On radars with computer generated displays, the normal mode of operation is to use the synthetically generated symbols for approaches. The normal radar (scan) mode must be checked t determine its usability for approaches. If unusable for approaches, determine the inner limit of usability so that the feature can be used for contr and traffic information outside of that point. Document the results of the scan-mode inspectio in the Remarks section. If the scan mode is not usable for approaches, it will not cause a facility restriction but must be documented on the Facility Data Sheet.	Annex10 does not differentiate between normal and MTI/MTD operation. Since blind speeds are a function of design (PRF), this does not warrant filing an ICAO difference.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Distance: >= 16.7 km (9 NM) Azimuth: +/- 20 deg of centerline Elevation: 7 deg	Distance: >= 16.7 km (9 NM) Azimuth: +/- 20 deg of centerline Elevation: 7 deg	Usable Distance AZ and EL -- Minimum of 7.5 NM from touchdown Lateral Coverage -- +/- 10 degrees from procedur centerline

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		MTI/MDT: Must not cause loss of usable target a other than blind speed	
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
[Parameter - Coverage] Coverage does not differentiate between normal and MTI/MTD operation and consequently does nc reflect checks for blind speed(s). [Subparameter 3 - Coverage Distance] Coverage for distance is referenced from its antenna.	The following portion of paragraph 3.2.3.11is included here for completeness but is covered in Annex10 [PAR COVERAGE] Note. For guidance in determining the significance of the echoing areas of aircraft, the following table is included: private flyer (single-engined): 5 to 10 m2; small twin-engined aircraft: from 15 m2; medium twin-engined aircraft: from 25 m2; four-engined aircraft: from 50 to 100 m2.	[Subparameters 2 & 3 - Coverage Elevation and Distance]] Coverage for distance and elevation are reference from touchdown. Elevation is given in distance rather than degrees. The following portion of paragraph 3.2.3.11is included here for completeness but is covered in Annex10 [PAR COVERAGE] Note. For guidance in determining the significance of the echoing areas of aircraft, the following table is included: private flyer (single-engined): 5 to 10 m2; small twin-engined aircraft: from 15 m2; medium twin-engined aircraft: from 25 m2; four-engined aircraft: from 50 to 100 m2.	
	Measurement Uncertainty Distance: 0.19km (0.1 NM)		

Annex10_ID	8071_ID	8200_ID	Results_ID
520	659	424	730

Facility **PAR** **Parameter** **PAR Siting**

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for some & meets others

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 14.24j, k

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.2.3.2 [PAR] Siting 3.2.3.2.1 The PAR shall be sited and adjusted so that it gives complete coverage of a sector with its apex at a point 150 m (500 ft) from the touchdown i the direction of the stop end of the runway and extending plus or minus 5 degrees about the runwa centre line in azimuth and from minus 1 degree to plus 6 degrees in elevation. Note 1. Paragraph 3.2.3.2.1 can be met by siting th equipment with a set-back from the touchdown, in the direction of the stop end of the runway, of 915 n (3 000 ft) or more, for an offset of 120 m (400 ft) from the runway centre line, or of 1 200 m (4 000 ft) or more, for an offset of 185 m (600 ft) when the equipment is aligned to scan plus or minus 10 degrees about the centre line of the runway. Alternatively, if the equipment is aligned to scan 15 degrees to one side and 5 degrees to the other side of the centre line of the runway, then the minimum set-back can be reduced to 685 m (2 250 ft) and 915 m (3 000 ft) for offsets of 120 m (400 ft) and 185 m (600 ft) respectively. Note 2. Diagrams illustrating the siting of PAR are given in Attachment C (Figures C-14 to C-17 inclusive).		j. PAR Coincidence with Other Guidance. Coincidence of the azimuths and glidepaths of the PAR and ILS/ MLS/ VGSI is essential to preclude pilot confusion from different indications of the ILS MLS/ VGSI and PAR. Coincidence may be checked using the AFIS, theodolite, precision range mark procedure, or a microamp comparisor with the ILS/ ILS/ VGSI. If any doubt exists as to glide angle coincidence, the theodolite or AFIS must be used. Perform a PAR approach as directed by the final controller and monitor the approach using the ILS/ MLS/ VGSI. Coincidence probably will not be maintained from Point "B" to touchdown due to the characteristics of the ILS glide slope inside Point "B." Areas of non-coincidence of the azimuths and glidepaths shoul be noted. [Subparameter 1 - Obstacle clearance] k. Lower Safe Limit Alignment. The lower safe lim must be checked as follows: (1) Fly in-bound 5 to 7 miles from the runway on the lower safe limit line and maintain "on-path" at the controller's direction. Maintain "on path" position to the runway, or until it becomes obvious that a pull-up is necessary to avoid obstacles. By flying the lower safe limit line, the aircraft should clear all obstacles prior to passing the runway threshold. (2) Scopes which do not have the lower safe limit line portrayed must be checked in the same manner as above. The controller will supply information to the flight inspector so that he can fl the lower safe limit altitudes (below which a misse approach would be necessary), and be clear of obstacles prior to passing the runway threshold. The lower safe limit angle is normally 0.5 ° less than the glidepath angle. During the commissioning flight checks, the lower safe limit angle must be established in the same manner as the glide slope angle (see Paragraph 14.24h). Verification of the angle on subsequent checks is	[Subparameter 1 -Obstacle clearance] 8200's lower safe limit alignment is clearer in intent than Annex10. Recommendation: This clearer text does not warrant filing a difference with ICAO

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		not necessary unless requested by maintenance; all that is required is that satisfactory obstacle clearance is provided while flying the lower safe limit line/ altitude as described above.	

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Sector Coverage: Apex 150m (500ft) from touchdown. Azimuth: +/- 5 degree about runway centerline Elevation: -1degree to +6 degree Azimuth error: The equipment will be sited such that the error at touchdown shall not exceed 9m (30ft)		PAR/ILS/MLS/VGSI Comparison of "as-found" PAR angle with published ILS/MLS/VGSI Angle -- 0.2 degrees Lower Safe Limit Alignment (Angle) -- Clearance from all obstacles from GSI to runway Threshold

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
Alternatives are provided for equipment with wider scan capabilities. These alternatives provide minimum set back of PAR with respect to touchdown for scans of 5 to 15 degrees. Azimuth error siting tolerance is also given in paragraph 3.2.3.3.1 [PAR Accuracy]	There are no discussions regarding siting.	[Subparameter 1 - Obstacle clearance] Lower safe limit alignment angle is normally 0.5 degrees less than GS angle

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
521	660	425	731

Facility **PAR** **Parameter** **SRE Accuracy**

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for all

Annex Ref	SARPS Ref 8071 Reference	8200 Reference	
ICAO Annex Text	**Doc 8071 Source Text**	**8200 Source Text**	**Comparison Remarks**
3.2.4.3 [SRE] Accuracy [Subparameter 1 - Azimuth Accuracy] 3.2.4.3.1 Azimuth accuracy. The indication of position in azimuth shall be within plus or minus 2 degrees of the true position. It shall be possible to resolve the positions of two aircraft which are at 4 degrees of azimuth of one another. [Subparameter 2 - Distance Accuracy] 3.2.4.3.2 Distance accuracy. The error in distance indication shall not exceed 5 per cent of true distance or 150 m (500 ft), whichever is the greater. It shall be possible to resolve the positions of two aircraft that are separated by a distance of 1 per ce of the true distance from the point of observation or 230 m (750 ft), whichever is the greater. 3.2.4.3.2.1 Recommendation. The error in distance indication should not exceed 3 per cent of the true distance or 150 m (500 ft), whichever is the greater. [Subparameter 3 - Update Rate] 3.2.4.4 The equipment shall be capable of completely renewing the information concerning the distance and azimuth of any aircraft within the coverage of the equipment at least once every 4 seconds. 3.2.4.5 Recommendation. Efforts should be made t reduce, as far as possible, the disturbance caused by ground echoes or echoes from clouds and precipitation.		All references to accuracy are contained in tables that relate both to PAR and SRE.	[Parameter - [SRE] Accuracy] 8200 does not specifically address SRE accurac separately from PAR accuracy. A single table of tolerances is used for both. [Subparameter 1 - Azimuth Accuracy] Since the tolerances applied to the SRE function are those applied to the PAR function, this is a conservative approach compared to the ICAO tolerance of 2 degrees. The resolution of the SRE is a function of the antenna design beamwidth. This is a design qualification issue, rather than a flight testing issue. [Subparameter 2 - Distance Accuracy] The 8200 tolerance of 2% of true range is substantially tighter than the ICAO tolerance of 5%. The resolution of the SRE is a function of the antenna design beamwidth. This is a design qualification issue, rather than a flight testing issue. [Subparameter 3 - Update Rate] This is a function of equipment design, and is subject to Design Qualification Testing, rather than Flight Testing.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Azimuth: +/- 2 degrees of true position Azimuth Resolution: 2 aircraft at 4 degrees of each		Azimuth Course Alignment (at Threshold) - 30 ft referenced to runway centerline

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
other Distance: 5% of true distance or 150m (500 ft) whichever is greater Distance resolution: 2 aircraft separated by a distance of 1% of true distance or 230m (750 ft) whichever is greater		Azimuth Course Alignment (along track) - The greater of 30 ft or 0.6% of the aircraft to PAR antenna distance, referenced to runway centerline Course Deviation Accuracy - Target presentation must be coincident with aircraft position Glide Path Alignment (Angle) - 0.1 degree of published angle (Commissioning). 0.2 degrees of published angle (Periodic) Range Accuracy - +/- 2% of true range	
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
[Parameter [SRE] Accuracy] Recommendations are made to tighten tolerances both coverage and distance accuracy to reflect actual equipment capabilities.	There is no discussion on SRE accuracy.	[Parameter [SRE] Accuracy] 8200 combines SRE accuracy in tables specific to PAR/SRE types.	
	Measurement Uncertainty		

Annex10_ID	8071_ID	8200_ID	Results_ID
522	661	426	732

Facility **PAR** **Parameter** **SRE Coverage**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

Annex Ref	SARPS Ref 8071 Reference	8200 Reference	Comparison Remarks
ICAO Annex Text	**Doc 8071 Source Text**	**8200 Source Text**	
3.2.4.2 [SRE] Coverage 3.2.4.2.1 The SRE shall be capable of detecting aircraft of 15 m2 echoing area and larger, which are in line of sight of the antenna within a volume described as follows: The rotation through 360 degrees about the antenna of a vertical plane surface bounded by a line at an angle of 1.5 degrees above the horizontal plane of the antenna, extending from the antenna to 37 km (20 NM); by a vertical line at 37 km (20 NM) from the intersection with the 1.5-degree line up to 2 400 m (8 000 ft) above the level of the antenna; by a horizontal line at 2 400 m (8 000 ft) from 37 km (20 NM) back towards the antenna to the intersection with a line from the antenna at 20 degrees above the horizontal plane of the antenna, and by a 20-degree line from the intersection with the 2 400 m (8 000 ft) line to the antenna. 3.2.4.2.2 Recommendation. Efforts should be made in development to increase the coverage on an aircraft of 15 m2 echoing area to at least the volume obtained by amending 3.2.4.2.1 with the following substitutions: --for 1.5 degrees, read 0.5 degree; -- for 37 km (20 NM), read 46.3 km (25 NM); -- for 2 400 m (8 000 ft), read 3 000 m (10 000 ft); -- for 20 degrees, read 30 degrees. Note. A diagram illustrating the vertical coverage of SRE is given in Attachment C (Figure C-18).		All references to coverage are contained in tables that are specific to equipment type for both PAR and SRE.	[Parameter - [SRE] Coverage] 8200 combines SRE coverage in tables specific to PAR/SRE types. The tolerances are generally in line with Annex10 for detection of aircraft within the antenna pattern. Recommendation: 8200 procedures are adequate and does not warrant filing a difference with ICAO

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Detection: aircraft 15m2 within the antenna pattern		Usable Distance AZ and EL -- Minimum of 7.5 NM from touchdown

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		Lateral Coverage -- +/- 10 degrees from procedur centerline MTI/MDT: Must not cause loss of usable target a other than blind speed	
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
	There is no discussion on SRE coverage.	[Parameter [SRE] Coverage] 8200 combines SRE coverage in tables specific t PAR/SRE types. These tolerances are generally in line with Annex10 for detection of aircraft within the antenna pattern.	
	Measurement Uncertainty		

Annex10_ID	8071_ID	8200_ID	Results_ID
523	662	427	733

Facility **PAR** **Parameter** **Standby Equipment**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 14.24n

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		n. Standby Equipment. Checklists in Paragraph 4.33 specify the minimum checks for the standby equipment, if installed. For periodic inspections, review the previous report and attempt to perform the primary equipment checks on the equipment used as standby on the previous inspection. The standby equipment will be checked to ensure that is functioning in a manner equal to the primary equipment.	Annex10 does not reference standby equipment, whereas 8200 requires checks for standby equipment specific to each particular type of equipment. Does not warrant filing a difference with ICAO.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		Equal to the primary equipment

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
No reference to checks on standby equipment.	There is no discussion on Standby Equipment	All references for specific checks on standby equipment are contained in tables for each particular type of PAR/SRE.

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
524	663	428	734

Facility PAR **Parameter** System General

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for some, doesn't for others

Annex Ref	SARPS Ref 8071 Reference	8200 Reference	Comparison Remarks
ICAO Annex Text	**Doc 8071 Source Text**	**8200 Source Text**	
3.2 Specification for precision approach radar syste Note. Slant distances are used throughout this specification. [Subparameter 1 - Design Characteristics] 3.2.1 The precision approach radar system shall comprise the following elements: 3.2.1.1 The precision approach radar element (PAR 3.2.1.2 The surveillance radar element (SRE). 3.2.2 When the PAR only is used, the installation shall be identified by the term PAR or precision approach radar and not by the term "precision approach radar system". Note. Provisions for the recording and retention of radar data are contained in Annex 11, Chapter 6. 3.2.3.4 Information shall be made available to perm the position of the controlled aircraft to be established with respect to other aircraft and obstructions. Indications shall also permit appreciation of ground speed and rate of departure from or approach to the desired flight path. [Subparameter 2 - Information renewal] 3.2.3.5 Information shall be completely renewed at least once every second			[Subparameter 1 - Design Characteristics] This requirement is a design specification, and is not subject to flight testing. [Subparameter 2 - Information renewal] Annex10 requires information to be renewed at least once every second. This will not be possibl for 4 second SRE (ASR) equipment. Recommendation: This requirement would only pertain to new equipment, a design parameter, and thus does not warrant filing a difference with ICAO.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
[Subparameter 2 - Information renewal]	[Subparameter 2 - Information renewal]	[Subparameter 2 - Information renewal]

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
Information shall be completely renewed at least once every second pertains to the update rate of th equipment which is dependant on the antenna scan. This update will vary for the different types o PAR's and SRE's.	There are no discussions on information renewals	There are no references in 8200 for this subparameter .	

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
525	664	429	735

Facility **PROC** **Parameter** **Air/Ground Communications**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref none

Annex Ref **8071 Reference** V2, 5.3.14 **8200 Reference** 6.14

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	5.3.14 Air-ground communications with the appropriate controlling facility should be evaluatec for satisfactory performance at the minimum initia approach fix altitude and at the missed approach altitude. In those cases where air traffic control operations require continuous communications throughout the approach, flight inspection should evaluate availability of that coverage.	i. Air/ Ground Communications. Air/ ground communications with ATC must be satisfactory at the initial approach fix (IAF) minimum altitude and at the missed approach altitude and holding fix. Satisfactory communications coverage over the entire airway or route segment at minimum en route IFR altitudes must be available with an ATC facility. Where ATC operations require continuity i communication coverage and ATC requests verification, flight inspection must evaluate that coverage in accordance with appropriate chapters of this order.	substantially identical text

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	none	none

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

N/A

Annex10_ID	8071_ID	8200_ID	Results_ID
	665	430	736

Facility **PROC** **Parameter** **Charted Visual Approaches**

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for all

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 6.14

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		f. Charted Visual Approaches. A commissioning check of charted visual procedures is required. Determine flyability and ensure that depicted landmarks are visible in both day and night visual conditions. Flyability is determined by difficulty of aircraft placement, cockpit workload, landmark identification, location and visibility, and VFR obstacle clearance. A night evaluation must be completed prior to authorizing night use.	This topic is not addressed in Doc 8071.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		The procedure must be safe, practical, flyable, an easily interpreted with minimal additional cockpit workload. Supporting facilities/ systems must meet tolerances of the appropriate chapters of thi manual and not contribute to operational confusio

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
		431	737

Facility **PROC** **Parameter** **Circling Area**

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for some & meets others

SARPS Ref none

Annex Ref **8071 Reference** V2, 5.3.9 **8200 Reference** 6.14d

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	5.3.9 The flight validator should verify that the depicted circling manoeuvring areas are safe for each category of aircraft and that the controlling obstacle is correctly identified.	[following text duplicated from INSTRUMENT APPROACH PROCEDURE parameter] (3) Circling. The flight inspector must verify that proposed circling maneuvers are safe and sound for the category of aircraft proposed. Circling maneuvers involving adverse obstructions/ terrain must be evaluated for day/ night operations and restricted if necessary.	8200 contains additional requirements, for day-night operations.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

N/A

Annex10_ID	8071_ID	8200_ID	Results_ID
	666	432	738

Facility **PROC** **Parameter** **Data Package**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref none

Annex Ref **8071 Reference** V2, 5.2.3 **8200 Reference** 6.11

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	5.2.3 Each IAP flight inspection or validation package should include the following data: a) A plan view of the final approach obstacle evaluation template, drawn on air navigation chart of sufficient scale to safely accommodate use for navigation, elevated terrain analysis, obstacles an obstructions evaluation. b) Completed documents that identify associated terrain, obstacles and obstructions as applicable t the procedure. The controlling terrain/obstacle should be identified and highlighted on the appropriate chart. c) Minimum altitudes determined to be applicable from map studies and database information for each segment of the procedure. d) A narrative description of the instrument approach procedure. e) Plan and profile pictorial views of the instrumen approach procedure. f) Documented data as applicable for each fix, intersection, and/or holding pattern. g) Air-ground communications, as applicable to each segment of the procedure. h) Airport marking and any special local operating procedures such as noise abatement, non-standard traffic patterns, lighting activation, etc. i) Output from the navaid coverage analysis that was conducted by/for the procedure designer together with any supporting data and design assumptions.	b. Procedural data must include the following as a minimum: (1) Charts of sufficient detail to safely navigate an identify considerable terrain, obstacles, and obstructions; (2) Controlling terrain/ obstructions identification for each segment; (3) Minimum (and maximum where applicable) altitudes determined to be usable from map study and data base information for each segment of th procedure; (4) Plan and profile views for SIAP(s); (5) Data for each fix, intersection, waypoint, and holding pattern; (6) Airport marking and any special local operational procedure (e.g., noise abatement, nor standard traffic patterns, lighting activation). (7) Training, operational, or equipment procedure specific requirements. c. The procedure package must contain the minimum data to conduct a flight inspection. FAA 8260-XX forms should be used as a baseline for required information. Procedure packages with inadequate information will be returned to FICO, which will return it to the developing organization. The FICO/ flight inspector must identify deficiencies on a comment sheet to accompany the returned procedure package.	Substantially identical text

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
ICAO Annex Tol	**Doc 8071 Tolerance**	**8200 Tolerance**	
none		none	
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
	Measurement Uncertainty		
	N/A		

Annex10_ID	8071_ID	8200_ID	Results_ID
	667	433	739

Facility **PROC** **Parameter** **Enroute/Terminal Routes**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref none

Annex Ref **8071 Reference** V2, 5.3.6, 5.3.10 **8200 Reference** 6.14

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	5.3.6 Evaluate each en-route or terminal segment during commissioning flight validation to ensure that the proposed minimum obstacle clearance altitude (MOCA) is adequate. These segments should be flown at the proposed minimum en-rout altitude (MEA) using the applicable NAVAID for guidance. For instrument departure procedures, the segment(s) should be evaluated according to an established NAVAID, fix or point where en-route obstacle clearance has been established. For a terminal arrival route, each segment should be evaluated from where the route departs established obstacle clearance to the point where the route intercepts an established approach procedure. Periodic validations of en-route and terminal route segments are not required. 5.3.10 Controlling obstacles in terminal segments should be confirmed visually by in-flight or ground observation. If unable to confirm that the controllir obstacle, as identified by the procedure specialist is the highest obstruction in the segment, the fligh validator should list the location, type, and approximate elevation of the obstacles to be provided to the procedure specialist for technical evaluation. Conduct obstacle evaluations in VMC only. The flight validator should be responsible for ensuring that instrument flight procedures are operationally safe in all areas of design, criteria application and flyability.	a. Standard Instrument Departure (SID)/ Departur Procedure (DP) procedures must be evaluated inflight to an established NAVAID, fix, or waypoint where en route obstacle clearance has been established. Evaluate the SID DP, using the minimum climb gradients and altitudes specified. b. Airways, Routes, and Terminal Route Segments. Evaluate each airway, route, or termin segment during commissioning flight inspection to ensure that the proposed minimum obstacle clearance altitude (MOCA) is adequate. Route segments must be flown at the proposed MEA (true altitude), using the applicable navigation system(s) for guidance and to or from a point where course or obstacle clearance has been established. ---------- [the following paragraph is duplicated for analysis in the MEA & COP parameter; it is not analyzed here.] The MEA and changeover points must be predicated on MOCA, minimum reception altitude (MRA), airspace, and communication requirements. If more than one of the above altitudes is procedurally required, the highest altitude determined through flight inspection will become the minimum en route altitude. ---------- c. Standard Terminal Arrival Route (STAR) procedures must be evaluated to where the route intercepts a portion of an established SIAP or poi from which a normal descent and landing can be accomplished.	substantially identical text

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	Distance and bearing accuracies should be in	The procedure must be safe, practical, flyable, an

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
	accordance with the specific chapters of this document, depending on the type of navigation source upon which the instrument procedure has been developed. The navigation aid and the procedure should consistently deliver the aircraft t a point within the depicted fix displacement area, as applicable.	easily interpreted with minimal additional cockpit workload. Supporting facilities/ systems must meet tolerances of the appropriate chapters of thi manual and not contribute to operational confusio	
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
	Measurement Uncertainty		
	N/A		

Annex10_ID	8071_ID	8200_ID	Results_ID
	668	434	740

Facility **PROC** **Parameter** **Final Approach Segment**

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for some & meets others

SARPS Ref none

Annex Ref **8071 Reference** V2, 5.3.7 **8200 Reference** 6.14d

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	5.3.7 The final approach course should deliver the aircraft to the desired point. The point varies with the type of system providing procedural guidance and should be determined by the procedure specialist. After flight validation verifies the established point, it should not be changed withou the concurrence of the procedure specialist. Wher the system does not deliver the aircraft to the poir and if the system cannot be adjusted to regain the desired alignment, the procedure should be redesigned.	[The following text is copied from the INSTRUMENT APPROACH PROCEDURE parameter, to facilitate direct comparison with Doc 8071 text.] (1) Final Approach Segment. The final approach course must deliver the aircraft to the desired aiming point. The aiming point varies with the type of system providing procedural guidance and will be determined by the procedure developer. After flight inspection verifies the aiming point, the course will not be changed without the concurrence of the procedure developer. When th system no longer delivers the aircraft to the established aiming point and the system cannot b adjusted to regain the desired alignment, consideration should be given to amending the procedure. The final approach segment must be flown to an altitude 100 ft below the proposed minimum descent altitude. Approaches with vertical guidance must be evaluated to the proposed decision or missed approach altitude.	8200 text contains additional requirements.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	Distance and bearing accuracies should be in accordance with the specific chapters of this document, depending on the type of navigation source upon which the instrument procedure has been developed. The navigation aid and the procedure should consistently deliver the aircraft t a point within the depicted fix displacement area, as applicable.	

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

N/A

Annex10_ID	8071_ID	8200_ID	Results_ID
	669	435	741

Facility PROC **Parameter** Fixes/Holding Patterns

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref none

Annex Ref **8071 Reference** V2 5.3.13 **8200 Reference** 6.14

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	5.3.13 Controlling obstacles should be verified to ensure the adequacy of minimum holding altitude (MHA).	h. Holding Patterns. Controlling obstacles must be verified to ensure the adequacy of minimum holding altitude (MHA). System performance will be evaluated to ensure conformance with appropriate tolerance chapters of this manual. If system performance and obstacle clearance data are on file, flight inspection of the procedure is not required.	Substantially identical requirements text.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	Distance and bearing accuracies should be in accordance with the specific chapters of this document, depending on the type of navigation source upon which the instrument procedure has been developed. The navigation aid and the procedure should consistently deliver the aircraft t a point within the depicted fix displacement area, as applicable.	The procedure must be safe, practical, flyable, an easily interpreted with minimal additional cockpit workload. Supporting facilities/ systems must meet tolerances of the appropriate chapters of thi manual and not contribute to operational confusio

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

N/A

Annex10_ID	8071_ID	8200_ID	Results_ID
	670	436	742

Facility **PROC** **Parameter** **General**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref none

Annex Ref **8071 Reference** V2, 5.1.1.-5.1.3 **8200 Reference** 6.10

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	5.1.1 Instrument flight procedures depict standard routings, manoeuvring areas, flight altitudes and approach minima for instrument flight rules (IFR) flight activities. These procedures include airways offairway routes, jet routes, instrument approach procedures (IAPs), instrument departure procedures, terminal arrival routes and procedure predicated upon the use of Area Navigation (RNAV) systems. 5.1.2 Flight inspection of instrument flight procedures, as detailed in the other chapters of this document should assure that the appropriate radio navigation aids adequately support the procedure. Flight validation involves the verificatio of all obstacle and navigational data, verification c the required infrastructure and the assessment of the charting and the flyability of the procedure. When the State can verify, by ground validation, the accuracy and completeness of all obstacle and navigation data considered in the procedure design, and any othe factors normally considered in the flight validation then the flight validation requirement may be dispensed with. 5.1.3 Instrument flight procedures should be a par of the flight validation process for initial certificatio and a part of the periodic quality assurance programme as established by the individual State	Instrument flight procedures specify standard routings, maneuvering areas, flight altitudes, and visibility minimums for instrument flight rules (IFR These procedures include airways, jet routes, off-airway routes, Standard Instrument Approach Procedures (SIAP(s)), Standard Instrument Departure Procedures/ Departure Procedures (SID(s))/ DP(s)), and Standard Terminal Arrival Routes (STAR(s)). All new and revised procedure are subject to flight inspection. References in this chapter are for clarification purposes only and do not supersede instructions or flight inspection criteria for facilities or systems contained elsewhere in this order.	ICAO's PANS-OPS document contains extensive procedural design criteria, similar to the U.S. TERPS manual. However, in general, neither contains parameters which must be flight inspected. Rather, subjective judgments on fundamental characteristics of the procedures (e.g., workload, flyability, obstacle clearance) are expected to be validated by the flight inspection activity. Extensive guidance on these activities ar contained in ICAO Manual Doc 8071, Volumes 1 and 2.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
N/A	none	none

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
ICAO's PANS-OPS document contains extensive procedural design criteria, similar to the U.S. TERPS manual. However, in general, neither contains parameters which must be flight inspected. Rather, subjective judgments on fundamental characteristics of the procedures (e.g		

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
workload, flyability, obstacle clearance) are expected to be validated by the flight inspection activity. Extensive guidance on these activities are contained in ICAO Manual Doc 8071, Volumes 1 and 2.			

Measurement Uncertainty

N/A

Annex10_ID	8071_ID	8200_ID	Results_ID
526	671	437	743

Facility **PROC** **Parameter** **Human Factors**

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for all

SARPS Ref none

Annex Ref **8071 Reference** V2, 5.4.2-5.4.4 **8200 Reference** 6.14, 6.15c

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	5.4.2 The criteria used to develop instrument fligh procedures include factors associated with minimizing cockpit workload and human limitation The flight validator should consider whether or not an instrument approach procedure is operationally safe and flyable for a minimally qualified solo pilot flying an aircraft with basic IFR instrumentation in instrument meteorological conditions, using standard navigation charting. The flight validator should apply the principles of Human Factors when certifying an original or amended procedure by considering the following characteristics. 5.4.3 Complexity. The procedure should be as simple as possible to avoid imposing an excessive workload. 5.4.4 Presentation. The flight validator should confirm that the procedure presentation conforms to requirements.	6.14 DETAILED PROCEDURES. The flight inspector must evaluate all facets of the procedur to ensure compliance with safe operating practices. The evaluation must include the clarity and readability of the depiction. Workloads imposed on the aircrew to select or program the procedure must be reasonable and straightforward. Objective and professional judgment from aircrews trained in flight inspection is expected. 6.15c. Human Factors are concerned with optimizing the relationship between flight crews and their activities by systematic application of human sciences integrated within the framework of systems engineering. In the context of flight inspection, it is a question of whether a flight procedure is operationally safe, practical, an flyable for a minimally qualified sole pilot flying an aircraft with basic IFR instrumentation in instrument meteorological conditions using standard navigation charting. The criteria used to develop instrument flight procedures represent many factors such as positioning requirements, protected airspace, system and avionics capabilities, etc. Sensory, perceptual, and cognitive restrictions historically have been incorporated in the criteria only to a limited extent (e.g., length of approach segments, descent gradients, turn angles). These are products of subjective judgments in procedure development and cartographic standards. It is incumbent upon the flight inspector to apply the principles of human factors and professional judgment when certifying an original or amended procedure. The following factors must be evaluate (1) Practical. The procedure should be practical. Segment lengths for approach and missed approach segments should be appropriate for the category of aircraft using the procedure. Procedures must not require excessive aircraft maneuvering to remain on lateral and vertical patl	8200 contains substantially more detailed text about human factors and their evaluation.

(2) Complexity. The procedure should be as simp as possible. It should not impose an excessive workload on a sole pilot flying a minimally equippe aircraft.

(3) Interpretability

(a) The final approach course should be clearly identifiable, with the primary guidance system or NAVAID unmistakable;

(b) The procedure should clearly indicate which runway the approach serves and indicate which runway(s) circling maneuvers apply to;

(c) Fix naming must be readable and clearly understood. Fixes/waypoints with similar sounding identifiers should not be used in the same procedure.

(d) Areas not to be used for maneuvering must be clearly defined.

(e) Significant terrain features must be displayed on approach charts.

(f) Operations into a "black hole" effect should be noted.

(4) Human Memory Considerations. Pilots must b able to extract information quickly and accurately during an instrument approach. Multiple tasks complicate the memory process and tend to produce prioritization during stressful phases of flight. Workload reduction can be accomplished through methodical chart layout that encourages the pilot to periodically refer to the depicted procedure rather than trying to memorize complex maneuvers.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
none		The procedure must be safe, practical, flyable, an easily interpreted with minimal additional cockpit workload. Supporting facilities/ systems must meet tolerances of the appropriate chapters of thi manual and not contribute to operational confusio

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

N/A

Annex10_ID	8071_ID	8200_ID	Results_ID
	672	438	744

Facility **PROC** **Parameter** **Instrument Approach Procedure**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref none

Annex Ref **8071 Reference** V2, 5.3.11 **8200 Reference** 6.14

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	5.3.11 An IAP intended for publication should be evaluated in flight. The final approach template should be evaluated to identify/verify the controllir obstruction. The final approach segment should b flown at an altitude 30 m (100 ft) below the proposed minimum descent altitude. Approaches with precision vertical guidance should be evaluated according to the proposed decision or missed approach altitude. Discrepancies or inaccurate data should be provided to the procedure specialist for action prior to commissioning the procedure.	d. Standard Instrument Approach Procedures (SIAP). All SIAP(s) intended for publication must be in-flight evaluated. Misalignment or inaccurate data indications will be forwarded to the procedure developer for further review prior to commissionin the procedure. ---------- [The following paragraph is duplicated under the FINAL APPROACH SEGMENT parameter for direct comparison with Doc 8071 text.] (1) Final Approach Segment. The final approach course must deliver the aircraft to the desired aiming point. The aiming point varies with the type of system providing procedural guidance and will be determined by the procedure developer. After flight inspection verifies the aiming point, the course will not be changed without the concurrence of the procedure developer. When th system no longer delivers the aircraft to the established aiming point and the system cannot b adjusted to regain the desired alignment, consideration should be given to amending the procedure. The final approach segment must be flown to an altitude 100 ft below the proposed minimum descent altitude. Approaches with vertical guidance must be evaluated to the proposed decision or missed approach altitude. ---------- [The following paragraph is duplicated under the MISSED APPROACH parameter for direct comparison with Doc 8071 text.] (2) Missed Approach. Flight inspection of the missed approach segment will assure that the procedure is safe and operationally sound for the category aircraft intended. When conducting periodic obstacle verification inspections, fly the missed approach procedure to a point where the flight inspector can identify any obstacles that could be a potential hazard. ---------- [The following paragraph is duplicated under the	When combined with Doc 8071's text on Missed approach segment, final approach segment, circling areas, and markings and lighting, this 8200 text is substantially identical to Doc 8071.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		CIRCLING AREA parameter for direct comparisor with Doc 8071 text.] (3) Circling. The flight inspector must verify that proposed circling maneuvers are safe and sound for the category of aircraft proposed. Circling maneuvers involving adverse obstructions/ terrain must be evaluated for day/ night operations and restricted if necessary. ---------- [The following text is duplicated in the MARKINGS AND LIGHTING parameter for direct comparison with Doc 8071 text.] (4) Visual Segment. Some procedures have extensive visual segments between the missed approach point and landing area. Evaluate these segments for operational suitability and safety. Recommend procedural adjustments when buildings or obstructions obscure access to the landing area. Procedures proposed for night use must be evaluated at night prior to commissioning	

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	Distance and bearing accuracies should be in accordance with the specific chapters of this document, depending on the type of navigation source upon which the instrument procedure has been developed. The navigation aid and the procedure should consistently deliver the aircraft t a point within the depicted fix displacement area, as applicable.	The procedure must be safe, practical, flyable, an easily interpreted with minimal additional cockpit workload. Supporting facilities/ systems must meet tolerances of the appropriate chapters of thi manual and not contribute to operational confusio

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

N/A

Annex10_ID	8071_ID	8200_ID	Results_ID
	673	439	745

Facility **PROC** **Parameter** **Markings and Lighting**

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for some & meets others

SARPS Ref none

Annex Ref **8071 Reference** V2, 5.3.23-5.3.24 **8200 Reference** 6.14d(4),j; 6.15b

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	5.3.23 New flight procedures. For new instrument approach procedures at airports with no prior IFR service, a night flight validation should be conducted to determine the adequacy of airport lighting systems prior to authorizing night minima. 5.3.24 Approach/landing light system validation. Airport light systems should be evaluated during the hours of darkness. The evaluation should determine that the light system displays the corre lighting patterns, that it operates in accordance with operational design/capabilities and that local area lighting patterns do not distract, confuse or incorrectly identify the runway environment.	---------- [The following paragraph, 614d(4), is copied from the INSTRUMENT APPROACH PROCEDURE parameter, for direct comparison with Doc 8071 text.] d(4) Visual Segment. Some procedures have extensive visual segments between the missed approach point and landing area. Evaluate these segments for operational suitability and safety. Recommend procedural adjustments when buildings or obstructions obscure access to the landing area. Procedures proposed for night use must be evaluated at night prior to commissioning ---------- j. Runway Markings, Lighting, and Communicatior The flight inspector must evaluate the suitability o the airport to support the procedure. Unsatisfactor or confusing airport markings, non-standard or confusing lighting aids, or lack of communication at critical flight phases may be grounds for denyin the procedure. In all cases, the procedure developer will be apprised of the conditions discovered during the flight inspection. b. Night Evaluations (1) Procedures developed for airports with no prio IFR service and procedures to newly constructed runways, and procedures to runways lengthened or shortened require a night flight inspection to determine the adequacy of airport lighting system prior to authorizing night minimums. (2) Inspect initial installation of approach light systems during the hours of darkness. Evaluate the light system for: (a) Correct light pattern as charted. (b) Operation in the manner proposed (e.g., photocell, radio control); (c) Local lighting patterns in the area surrounding	8200 contains substantially more descriptive text than Doc 8071.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		the airport do not distract, confuse, or incorrectly identify the runway environment. (3) Addition or reconfiguration of lights to an existing system already approved for IFR service. (a) An approach lighting system requires a night evaluation. (b) A runway lighting system may be evaluated da or night (excluding REIL).	

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
none		none

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

N/A

Annex10_ID	8071_ID	8200_ID	Results_ID
	674	440	746

Facility **PROC** **Parameter** **Maximum Authorized Altitudes**

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for all

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 6.14

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		g. Maximum Authorized Altitudes (MAA). MAA(s) are limitations based on airspace restrictions, system performance characteristics, or interference predictions. If the MAA(s) are based on an interference problem, the source of the interference must be identified and corrective action initiated where possible.	This topic is not addressed in Doc 8071.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		The procedure must be safe, practical, flyable, an easily interpreted with minimal additional cockpit workload. Supporting facilities/ systems must meet tolerances of the appropriate chapters of thi manual and not contribute to operational confusio

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
		441	747

Facility **PROC** **Parameter** **MEA and COP**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref none

Annex Ref **8071 Reference** V2, 5.3.12 **8200 Reference** 6.14b

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	5.3.12 MEAs are computed and published in accordance with policies and procedures in effect within each State. MEAs and COPs should be predicated on minimum obstruction clearance altitude (MOCA), minimum reception altitude (MRA), airspace, or communication requirements. If more than one of these altitudes are procedural applicable, the highest altitude determined throug a flight validation should become the minimum operational altitude.	[The following paragraph is duplicated from the ENROUTE/TERMINAL ROUTE parameter.] The MEA and changeover points must be predicated on MOCA, minimum reception altitude (MRA), airspace, and communication requirements. If more than one of the above altitudes is procedurally required, the highest altitude determined through flight inspection will become the minimum en route altitude.	nearly identical text

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

N/A

Annex10_ID	8071_ID	8200_ID	Results_ID
	675	442	748

Facility **PROC** **Parameter** **Missed Approach**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref none

Annex Ref **8071 Reference** V2, 5.3.8 **8200 Reference** 6.14d

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	5.3.8 The flight validator should assure that the designed procedural altitudes provide the appropriate required or minimum obstacle clearance (ROC/MOC) and determine that the procedure is safe and operationally sound for the categories of aircraft for which use is intended.	[The following text is copied from the INSTRUMENT APPROACH PROCEDURE parameter, for direct comparison with Doc 8071 text.] (2) Missed Approach. Flight inspection of the missed approach segment will assure that the procedure is safe and operationally sound for the category aircraft intended. When conducting periodic obstacle verification inspections, fly the missed approach procedure to a point where the flight inspector can identify any obstacles that could be a potential hazard.	

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	Distance and bearing accuracies should be in accordance with the specific chapters of this document, depending on the type of navigation source upon which the instrument procedure has been developed. The navigation aid and the procedure should consistently deliver the aircraft t a point within the depicted fix displacement area, as applicable.	The procedure must be safe, practical, flyable, an easily interpreted with minimal additional cockpit workload. Supporting facilities/ systems must meet tolerances of the appropriate chapters of thi manual and not contribute to operational confusio

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

N/A

Annex10_ID	8071_ID	8200_ID	Results_ID
	676	443	749

Facility **PROC** **Parameter** **Objective**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref none

Annex Ref **8071 Reference** V2, 5.3.1-5.3.2 **8200 Reference** 6.12

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	5.3.1 The objective of the flight inspection and flight validation evaluation of instrument flight procedures is to assure that the navigation source supports the procedure, ensures obstacle clearance, and checks the flyability of the design. The following activities should be accomplished: a) Verify the obstacle that serves as the basis for computing the minimum altitude in each segment of the IAP. b) Evaluate aircraft manoeuvring areas for safe operations for each category of aircraft for which the procedure is intended. c) Review the instrument procedure for complexity of design, and evaluate the intensity of the cockpi workload to determine if any unique requirements adversely impact safe operating practices. Check for correctness of information, propriety and ease of interpretation. d) If appropriate, verify that all required runway markings, lighting and communications are in place and operative. 5.3.2 The flight validation of an instrument flight procedure and verification of the obstacle data ma be conducted during the associated navigation aic inspection if visual meteorological conditions (VMC) prevail throughout each segment.	a. The objective of evaluating instrument flight procedures is to ensure safety, flyability, human factors, and workload. The following items are included in this evaluation: (1) Procedure design meets the required obstacle clearance per applicable FAA 8260.XX orders or approved criteria. (2) The applicable navigation system(s) (NAVAID Satellite, RADAR, etc) supports the procedure. (3) Procedure design must be simple. Chart complexity should be kept to a minimum for huma memory considerations. (4) Navigation charts must properly portray the procedure and be easily interpreted. (5) Aircraft maneuvering must be consistent with safe operating practices for the category of aircrat intending to use the procedure. (6) Cockpit workload is acceptable. (7) Runway marking and lighting meet requirements. (8) Communications are adequate. (9) RADAR coverage is available, where required.	Similar objectives; not assessed for "compliance'

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	none	none

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

N/A

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
Annex10_ID	8071_ID	8200_ID	Results_ID
	677	444	750

Facility **PROC** **Parameter** **Obstacle Clearance**

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for some & meets others

SARPS Ref none

Annex Ref **8071 Reference** V2, 5.3.3-5.3.5 **8200 Reference** 6.12

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	5.3.3 Original flight procedures. A ground or in-flight obstacle verification should be conducted fo each route segment during the development of original flight procedures. 5.3.4 Identification of new obstacles. When new obstacles are discovered during flight validation activities, the fight validator should identify the location and height of the new obstruction(s) and provide the information to the procedure specialis Procedure commissioning should be denied until the procedure specialist's analysis has been completed and the flight procedure adjusted as appropriate. 5.3.5 Determination of obstacle heights. If in-flight height determination of obstacles or terrain is required, accurate altimeter settings and altitude references are necessary to obtain the most accurate results possible. The method of obstacle height determination should be documented on th flight validation report.	b. Verification of Required Obstacle Clearance (1) Controlling obstacles in each segment must be confirmed by in-flight or ground observation durin the commissioning of flight procedures. If unable to confirm that the declared controlling obstacle is the highest obstacle in the segment, list the location, type, and approximate elevation of the obstacles the flight inspector desires the procedu developer to consider. The flight inspector will place special emphasis on discovered obstacles that may not be listed in the FAA database. If the controlling obstacle is listed as terrain/ trees or Adverse Assumption Obstacle (AAO), it is not necessary to verify which tree is controlling, only that no higher man-made obstacle is present in th protected airspace. If the flight inspector observes that the controlling obstacle has been eliminated dismantled, the flight inspector must forward that information to the procedure developer. (2) Identification of New Obstacles. In most instances, accurate information concerning the location, description, and heights of tall towers an other considerable obstacles is available from the FAA database and/ or other government sources. When new potentially controlling obstructions not identified in the procedure package are discovered, the procedure commissioning will be denied until the procedure developer can analyze the impact of the obstacle on the overall procedure. (a) Obstacle locations must be noted in latitude/ longitude, or radial/bearing and distance from a known facility. If these methods are not available, an accurate description on the flight inspection map may be used. (b) Obstacle heights measured in-flight will not be used unless the actual height of the obstruction cannot be determined by other means. If in-flight height determination is required, accurate altimete settings and altitude references must be used to obtain precise results. The flight inspection report	8200 text is substantially more descriptive.

will reflect the documentation for the method of height determination.

(3) The controlling obstacle for initial approach segments of some RNAV procedures may also be the controlling obstacle for a large segment of the Terminal Arrival Area (TAA). The obstacle will not always be within the primary or secondary zones of the approach segment. Verify that there are no obstacles in the approach segments that are higher than the identified controlling obstacle. There is no requirement to verify that the identified controlling obstacle is the highest obstacle in the entire TAA segment, but, while transiting the segment, observe the area for obstacles that may exceed the height of the controlling obstacle.

(4) The flight inspector retains the responsibility to ensure that the procedure is operationally safe. During obstacle verification inspections (other than commissioning inspections), it is not necessary to visually identify the controlling obstacle but rather to visually verify the integrity of the required obstacle clearance surface for the final and missed approach
segments.

(5) Obstacle verification for a multiple of approaches to a runway may be completed during a single inspection to meet periodic requirements (i.e., KOKC ILS RWY 35R, ILS RWY 35R (CAT II), RNAV RWY 35R, NDB RWY 35R). Consideration must be given to the required obstacle clearance area for each approach and missed approach surface.

ICAO Annex Tol

none

Doc 8071 Tolerance

8200 Tolerance

The procedure must be safe, practical, flyable, and easily interpreted with minimal additional cockpit workload. Supporting facilities/ systems must meet tolerances of the appropriate chapters of this manual and not contribute to operational confusion.

ICAO Annex Remarks

Doc 8071 Remarks

8200 Remarks

Measurement Uncertainty

N/A

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
Annex10_ID	8071_ID	8200_ID	Results_ID
	678	445	751

Facility **PROC** **Parameter** **Procedures Office/Specialist**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref none

Annex Ref **8071 Reference** V2, 5.2.1 - 5.2.2 **8200 Reference** 6.11

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	5.2.1 The instrument flight procedure designer is normally responsible, in coordination with the appropriate engineering authority, for providing all data applicable to conducting a flight inspection or a flight validation to the appropriate operations activity. This includes output from the navaid infrastructure coverage analysis together with any supporting data and design assumptions. The procedure owner should also identify any alternate routes published on the chart as 'at ATC discretion'. Such routes should be reviewed to determine if it is necessary for them to be included in the flight inspection or the flight validation. When appropriate, the procedure specialists should be prepared to provide briefings to the flight crews in those cases where flight procedures have unique application or special features. 5.2.2 The instrument flight procedures specialist should participate in the initial certification flight to assist in its evaluation and obtain direct knowledge of issues related to the procedures design from the flight validation pilot and/or validator.	a. The office initiating the procedure must forward all data necessary for conducting the flight inspection to the Flight Inspection Central Office (FICO) who, in turn, will forward the information to the flight inspector responsible for the inspection. If there are special factors relative to the procedure, the FICO will set up a briefing by the procedures developer, or designee, for the flight inspector.	Conceptually similar text; not assessed for "compliance".

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	none	none

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

N/A

Annex10_ID	8071_ID	8200_ID	Results_ID
	679	446	752

Facility **PROC** **Parameter** **Radar Coverage**

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for all

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 6.14

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		k. RADAR Coverage. RADAR coverage must be verified for any procedure which requires RADAR	This topic is not addressed in Doc 8071.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		none

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
		447	753

Facility **PROC** **Parameter** **Safety and Flyability**

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for some & meets others

SARPS Ref none

Annex Ref **8071 Reference** V2, 5.3.22, 5.4.1 **8200 Reference** 6.12b(4), 6.14e

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	5.3.22 The validation pilot should review and evaluate each segment of the procedure for conformance with safe operational practices as applicable to the following areas: a) Procedure safety: The procedure should be evaluated to ensure compliance with safe operatir practices, simplicity of the depiction, and a reasonable level of flight crew workload associate with programming and flying the required manoeuvres. 5.4.1 The flight validation should determine that tr procedure is flyable and safe. When a new procedure is found to be unsatisfactory, the flight validator should coordinate with the instrument flight procedure specialist to resolve identified problem areas and determine the necessary changes. When a published procedure is found unsatisfactory, the flight validator should initiate action to advertise the deficiency through a NOTAM publication and advise the procedure specialist.	(4) The flight inspector retains the responsibility tc ensure that the procedure is operationally safe. During obstacle verification inspections (other tha commissioning inspections), it is not necessary tc visually identify the controlling obstacle but rather to visually verify the integrity of the required obstacle clearance surface for the final and misse approach segments. e. Flyability. For procedures with a note stating "Applicable to Turbojet Aircraft Only", an appropriately equipped turbojet flight inspection aircraft must be used for flyability evaluation. For complex procedures, additional flyability may be required in a proponent's simulat or aircraft. Flyability must be evaluated with the aircraft coupled to the autopilot and may require additional evaluation by hand flying. Vertical Flyability. Calculating Deceleration Segment Length Example: (may be applied to STAR or Initial/ Intermediate Approach Segments) An RNAV STAR begins at waypoint ALPHA at 17,000 MSL and 310 kts and requires the aircraft to descent to and cross waypoint BRAVO at 9,000 MSL and 240 kts. The minimum leg length between ALPHA and BRAVO is computed as follows: (17,000 - 9,000)/ 318 = Minimum leg length using a 3° descent gradient, 8,000/ 318 = 25.157 nm Plus (310 kts - 240 kts)/ 10 = Deceleration segment 70/ 10 = 7 nm 25.157 + 7 = 32.157 nm (round to 32.2 nm)	8200 contains additional information on Vertical Flyability

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		NOTE: Applicable TERPS criteria may allow for shorter deceleration segment.	

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
none		The procedure must be safe, practical, flyable, an easily interpreted with minimal additional cockpit workload. Supporting facilities/ systems must meet tolerances of the appropriate chapters of thi manual and not contribute to operational confusio

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

N/A

Annex10_ID	8071_ID	8200_ID	Results_ID
	680	448	754

Facility RFI **Parameter** Effects

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref none

Annex Ref **8071 Reference** V1&2, Ch1, Atch3-1 an **8200 Reference** 23.10a

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	[From Volume 1, re: Ground-based Navaids Testing] 1. INTERFERENCE EFFECTS Interference to a navigation aid can manifest itself in many ways. A VOR receiver may appear to operate normally but indicate a solid bearing to an adjacent cochannel facility. A localizer deviation signal may become erratic while FM broadcast is heard on the receiver audio output. The glide path signal may be lost momentarily as an aircraft passes over an industrial facility. A GNSS receiver used for position fixing may lose track of satellites due to interference. Interference may be caused by not providing adequate separation between facilities on the same frequency. Ground-based non-aeronautical services such as FM broadcast stations may be the cause. Interference may originate on board the aircraft due to a poor avionics installation or from carry-on equipment. There are many possible sources and the probability of interference occurring is increasing as the frequency spectrum becomes more congested. ---------- [From Volume 2, re: GNSS Testing] 2. INTERFERENCE Potential for interference 2.1 The potential for interference exists to various extents in all radio navigation bands. As with any navigation system, the users of GNSS signals must be protected from harmful interference that results in the degradation of achieved navigation performance. 2.2 Current satellite navigation systems provide weak received signal power -- meaning that an interference signal can cause loss of service at a lower receiver power level than with current	a. Airborne investigation of RFI is usually the last resort and should not be used until all reasonable ground methods are tried. In general, if an interfering signal can be received on the ground, it can be located through ground investigation. In few instances, usually in remote areas, it may be impractical to use any ground methods. If the source of interference is not near ground receiver, it may only affect the airborne reception and must be located through use of an aircraft. Although the aircraft has pinpointed some RFI sources, it is generally sufficient to narrow the location down to an area small enough to cover with ground equipment.	

terrestrial navigation systems. Potential for interference exists wherever the GNSS signal is authorized for use. GNSS is, however, more resistant to misleading navigation errors from interference signals than current terrestrial radio navigation systems.

Spectrum allocations

2.3 Both current core satellite constellations, GPS and GLONASS, operate using the radio frequency (RF) spectrum allocated by the International Telecommunication Union (ITU). States authorizing GPS- or GLONASS-based operations have an obligation to ensure that their national frequency allocations and assignments in the 1559 -1610 MHz band do not cause interference t GPS or GLONASS aviation users. Similarly, services operating in the adjacent bands should not generate harmful interference to GPS or GLONASS.

2.4 GPS and GLONASS operate using spectrum allocated to the aeronautical radio navigation service (ARNS) and radio navigation satellite service (RNSS). GPS, GLONASS and SBAS operate in segments of the 1559-1610 MHz frequency band. GBAS operates in the 108-117.975 MHz band allocated to ARNS.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	none	none

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
	General description of interference effects for ground-based navaids and GNSS, plus a description of frequency bands for GNSS.	Use ground techniques first, then an aircraft only necessary.

Measurement Uncertainty

N/A

Annex10_ID	8071_ID	8200_ID	Results_ID
	681	449	755

Facility **RFI** **Parameter** **General**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref none

Annex Ref **8071 Reference** V1 & 2, Ch1-1.13; V2, **8200 Reference** 23.10

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	[From Volume 1, re: Ground-based Navaids Testing] 1.13.1 Electromagnetic interference to a navigatio aid is a rare occurrence, but the possibility of it happening should not be excluded. All reports of suspected interference should be investigated. During a flight inspection, interference might affec the signals from the navigation aid being inspecte or it might affect the signals used for some types of position fixing, such as GNSS. 1.13.2 Attachment 3 to this chapter gives guidanc on this subject, including types of interference, possible sources, methods of detection, and steps which can be taken to eliminate or mitigate the effects. ---------- [From Volume 2, re: GNSS Testing] 1.13 ELECTROMAGNETIC INTERFERENCE 1.13.1 Attachment 3 to this chapter provides guidance on this subject specifically for GNSS, including types of interference, possible sources, methods of detection and mitigations which can b used to eliminate or reduce the interference effects. 1.13.2 Additional guidance is available in RTCA document DO-235A, Assessment of Radio Frequency Interference Relevant to the GNSS. 6. SUMMARY 6.1 Due to the fact that GNSS signals are of a low power when received by a user receiver, interference from unintentional or intentional sources can present a risk to the safe use of GNSS, noticeably for approach and landing operations. However, there are many steps that can be taken to mitigate the influence of interference — technically,	23.10 INTRODUCTION. The radio frequency spectrum, particularly in the VHF communication and navigation bands, is the subject of increasing interference from many sources. This chapter describes the role of flight inspection and present techniques of flight inspection in the location of Radio Frequency Interference (RFI) to Communications, Navigation, and Surveillance (CNS) systems, including satellite Global Positioning System (GPS).	

institutionally and operationally.

6.2 From a technical perspective, judicious siting of the aircraft GNSS antenna well away from satellite communications antennas and other high effective radiated power systems will provide mitigation
from on-board interference sources. At the same time, consideration should be given to siting the antenna to optimize airframe shielding from groun based interference. Adaptive antennas, notch filters and INS coupling all provide increasing levels of protection from interference effectively negating the threat altogether.

6.3 Flight inspection of GNSS approaches for interference combined with the use of groundbased monitoring and the provision of time status information to ATC will act to protect the users of GNSS.
At an institutional level, both ANS providers and States must take all necessary steps to protect users of radio navigation satellite services by ensuring proper enforcement of the GNSS spectrum protection and strict application of the ITU Radio Regulations.

6.4 The key issue for States to recognize is that o all the techniques available to mitigate interferenc only those appropriate to the airfield and operatior being undertaken need to be put in place.
There is no need to unnecessarily burden the users or the service providers where no risk exists

ICAO Annex Tol

none

ICAO Annex Remarks

Annex 10 does not address spectrum interference in a definitional or specific way, except that genera references may occur in Chapters related to specific Navaids. In general, ICAO text re: spectrum interference is found in Doc 8071, on Testing methods.

Doc 8071 Tolerance

none

Doc 8071 Remarks

Interference is a topic applying to all navaids undergoing flight inspection. As a result, parameter names are not technical in nature, but rather refer to descriptions, techniques, methods, analysis, etc.

Ground-based and GNSS Interference discussions in ICAO Doc 8071 are in Volumes 1 and 2 respectively, each with an interference Attachment (3) to Chapter 1. Volume 3,

8200 Tolerance

none

8200 Remarks

Interference is a topic applying to all navaids undergoing flight inspection. As a result, parameter names are not technical in nature, but rather refer to descriptions, techniques, methods, analysis, etc.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
	Surveillance Systems, does not specifically address spectrum interference. **Measurement Uncertainty** N/A		

Annex10_ID	8071_ID	8200_ID	Results_ID
527	682	450	756

Facility **RFI** **Parameter** **General Methods**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for some, doesn't for others

SARPS Ref none

Annex Ref **8071 Reference** V1&2, Ch1, Atch3-3, 3- **8200 Reference** 23.12

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	[From Volume 1, re: Ground-based Navaids Testing] 3. GENERAL METHODS FOR DETECTING AND RESOLVING INTERFERENCE PROBLEMS 3.1 There are many possible approaches to detecting and resolving interference problems. They all should be considered as tools to be applied when required. EMC event-reporting system 3.2 An interference problem is often first observed by users of the navigation aid. Therefore, pilot and ATC reports are the first step in identifying the nature and approximate locations of where it occurs. The reporting system should be used to establish a point-of-contact between the users wh observed the interference and the agency charged with resolving such occurrences. Ground monitoring 3.3 The increasing pollution of the electromagneti environment at or near airports is a major concern to many States. It can be a particular problem nea major airports with a large number of aeronautical systems. The local electromagnetic environment tends to be more congested by the many ground-based non-aeronautical interference sources. Ground-based monitoring systems to detect interference events are being developed. 3.4 The protection of the integrity of the signal-in-space against degradation, which can arise from extraneous radio interference falling within the ILS frequency band, must be considered. This is particularly important where the ILS is used for Category II and III approach and landing operations. It is necessary, therefore, to periodically confirm that the radio environment at each Category II/III runway does not constitute a hazard.	23.12 FLIGHT INSPECTION PROCEDURES. Use the equipment and techniques of Paragraph 23.14 for missions dispatched to search for RFI. Flight inspectors should remain alert to any suspected interference throughout normal flight activities. Any possible interference received mus be investigated as thoroughly as possible within the constraints of equipment capabilities and mission limits. a. If interference is suspected within the Standard or Expanded Service Volume of a facility undergoing flight inspection, attempt to get the facility shut down and verify the presence and characteristics of the interfering signal. If time and circumstances permit, try to identify the source. If it is not readily found, report the findings to the Regional FMO for ground analysis before further airborne attempts. b. If interference is to a facility or frequency used for normal flight operations, use the applicable techniques from Paragraph 23.14 to analyze the problem. Documenting the signal characteristics a multiple locations along the route of flight will significantly aid the Regional FMO in determining the next step in the process.	Order 8200.1 doesn't specifically address GNSS interference, except by general references. Annex 10 does not specifically address RFI. For the purposes of this comparison database, the 8071 "requirements" will be considered as if they were Annex 10 requirements. As a result, this parameter is considered non-compliant. When 8200.1 content for GNSS RFI is re-assessed, and if it is deemed sufficient as-is, the Compare Results for this parameter should be changed to "8200 Matches Annex 10 for all".

Technical confirmation of the interference

3.5 Ground and/or airborne test equipment deployment to obtain technical measurements wil depend on how and where the interference manifests itself.

3.6 Most flight inspection aircraft can readily recor the effects of the interference on receiver AGC, crosspointer, flag and audio signals, as well as determine the aircraft position and altitude when interference is observed. Confirmation of the interference characteristics and location by the flight inspection service is a second step toward solving the problem. More detailed information ca be obtained about the relative signal levels and th frequencies being received at the aircraft antenna if the flight inspection aircraft is equipped with a spectrum analyser or field strength metre. Recording of
the audio channel of the affected receiver, spectrum analyser or field strength meter is usefu in identifying the interference source through its unique demodulated audio characteristics. A simple test such as inserting a suitable RF filter ahead of the receiver can often assist in identifyin whether an interference source is in-band or out-c band.

3.7 Confirmation of a suspected interference source can be achieved by switching the suspected source on and off several times and noting the resulting effects on the affected receive

3.8 It should be noted that there will be cases where the ground test equipment or the flight inspection aircraft may not be able to detect/confirm reported interference problems because:

a) the receiver systems used in the air or on the ground (i.e. receiver, antenna, and cable system) may have significantly different performance characteristics from those receiver systems reported to have experienced interference;

b) interference is intermittent and may not be occurring during the investigative flight test; or

c) it may be difficult to find a ground observation point which corresponds to the interference conditions seen in the air.

[From Volume 2, re: GNSS Testing]

4.1 Protection of the aeronautical radio navigation safety services spectrum is of paramount importance. International regulations state that the aeronautical radio navigation service is afforded special protection. ITU Radio Regulation Article 4.10 states: "Members recognize that the safety aspects of radio navigation and other safety services require special measures to ensure their freedom from harmful interference; it is necessary therefore to take this factor into account in the assignment and use of frequencies." Each State wishing to implement GNSS in support of air traffi services should ensure that regulations are in place to protect the aeronautical radio navigation spectrum allocated satellite navigation. Interferen detection, flight inspection and ground monitoring

4.2 Reliance on GNSS will require States to re-examine their respective capabilities to detect, localize and identify interference sources in order to minimize potential service disruptions in their flight information regions. This examination may result in planning efforts to investigate a need for airborne and ground-based systems for detecting and localizing potential sources of RF interference (RFI) to the GNSS signals.

4.3 In order to quickly identify and mitigate GNSS interference, a suite of systems may be required. Current technology provides RFI direction finding (DF) and localization capabilities in four main platforms of interest - aircraft, land fixed (e.g. airport), land mobile (surface vehicle), and handheld. Cooperative efforts between the responsible regulatory organizations within a State utilizing such a suite of systems will provide the capability to locate and initiate measures to terminate sources of interference.

4.4 The extent of development a particular State may desire to implement should be predicated on the extent of operational services provided by GNSS and required availability for those services.

4.5 Interference is of primary concern for approac and landing operations. States and air navigation services (ANS) providers have an obligation to validate the interference environment as part of th flight inspection of the approach operation. This

can be carried out by a spectrum analysis of the frequency ranges used by core satellite constellations and their respective augmentation signals. In this way it is possible to identify any unintentional interference that has the potential to disrupt approach operations.

4.6 GNSS receivers for approach operations, developed in accordance with guidance material i the SARPs, are required to achieve a minimum level of performance in the presence of both continuous wave (CW) and pulsed interference. To assess the potential impact of received signals a comparison of the received spectrum with the interference masks specified in the SARPs is recommended. If no incursion of the CW interference is detected, the environment can be regarded as satisfactory. Since the interference masks are only valid for the most harmful CW interference, further (post-processing) analysis of the spectrum is necessary if broadband or pulsed signals exceed the interference mask.

4.7 To achieve the required measurement sensitivity, a suitable preamplifier and a resolutior bandwidth of 10 kHz or less are required. It is desirable to analyse the frequency ranges of GPS (1575±20 MHz) and GLONASS (1598-20 MHz to 1604.25+20 MHz). It is recommended to use a digital signal processing (DSP) receiver rather tha a spectrum analyser since only DSP-receivers allow a satisfactory sweep rate.

4.8 If the primary aim is just to detect interference a GPS or GPS/GLONASS antenna with an appropriate preamplifier can be used. If a location of the interference source is to be determined, a directionfinding antenna or a multi-channel DSP receiver with direction-finding capability should be used.

4.9 The complexity of the interference monitoring equipment depends on the extent of operational services provided by GNSS and the required availability for those services. At airports with very high traffic that rely on GNSS as the navigation means for approach, it may be desirable to deplo a permanent interference monitoring station. In th way a timely notification to ATC of the threat of interference can be performed.

4.10 Even with a flight inspection there is no full guarantee that all interference sources have been

identified. For example, some sources may be intermittent transmitters or may come from mobile transmitters. Therefore it is recommended that aircraft be equipped with interference sensors (GNSS receivers with interference detection capability producing automatic reports). In this wa the ATC operator can collect and analyse reports to obtain information on the spatial distribution of interference events.

4.11 In addition to the analysis of the spectrum, a GNSS receiver should be used to determine the impact of interference to the GNSS data.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	none	none

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
	Ground-based navaids: High-level description of how to deal with interference - ie, learn of it, checl it out on the round, use airborne methods if necessary GNSS: More detailed description of importance, techniques, and equipment.	Introduction to procedures - generalized.

Measurement Uncertainty

N/A

Annex10_ID	8071_ID	8200_ID	Results_ID
	683	451	757

Facility RFI **Parameter** Sources and Types

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for some, doesn't for others

SARPS Ref none

Annex Ref **8071 Reference** V1&2, Ch1, Atch3-2, 3- **8200 Reference** 23.10b

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	[From Volume 1, re: Ground-based Navaids Testing] 2. INTERFERENCE SOURCES Note.- The following sources account for most of the problems affecting radio navigation or radio communications receivers. Ground-based aeronautical sources 2.1 Aeronautical facilities are engineered, installe and maintained to avoid causing interference to users of other aeronautical facilities. The service volumes of aeronautical facilities are protected from Co-channel and adjacent channel interference by using frequency coordination procedures based on minimum and maximum fiel strengths and protection criteria promulgated primarily in Annex 10. In-band interference is usually caused by malfunctioning transmitters, frequency coordination problems and receiver operation outside the protected service volume of the aeronautical facility. The use of signal generators on operational aeronautical frequencie during avionics testing can cause interference problems. Ground-based non-aeronautical sources 2.2 These sources include broadcast transmitters and emitters such as industrial, scientific and medical (ISM) equipment and power lines. RF emitters are normally licensed and must comply with ITU Radio Regulations and domestic regulations. Malfunctioning transmitters and unintentional emitters are the cause of many interference problems. FM broadcast transmitters 2.3 The FM broadcast services operating in the 8 107.9 MHz band can be a major source of interference in the adjacent VHF band 108-137 MHz, affecting ILS, VOR and VHF	b. Types of Interferers. Interference to CNS systems may take several forms, from broadband noise to narrow-band signals. Interference may b constant or intermittent, either predictable or random. Most interference is unintentional, although there have been instances of intentional disruption of air traffic services by individuals or groups for various purposes. Knowing the characteristics of the various types of interference is a key factor in locating their source. (1) Unintentional interference to CNS systems is usually the result of defective equipment or intermodulation of two or more frequencies. Most cases requiring airborne investigation are due to spurious emissions from defective electric or electronic devices. Many frequencies generated b malfunctioning equipment are not stable and may drift, impacting several victim frequencies. (2) Intentional interference is usually directed at VHF communications frequencies. Some intentional interference has been disguised as unintentional, but the majority of involve voice or music transmitted from a normal VHF transceiver Some rare cases involve Phantom Controllers attempting to misdirect aircraft. As intentional interference to CNS systems is a criminal activity, investigative methods and results should be treated as confidential information to avoid compromising any prosecution of the offenders.	Order 8200.1 doesn't specifically address GNSS interference, except by general references. Annex 10 does not specifically address RFI. For the purposes of this comparison database, the 8071 "requirements" will be considered as if they were Annex 10 requirements. As a result, this parameter is considered non-compliant. When 8200.1 content for GNSS RFI is re-assessed, and if it is deemed sufficient as-is, the Compare Results for this parameter should be changed to "8200 Matches Annex 10 for all".

communications receivers. Two general types of interference can occur. The first is caused by FM broadcast emissions that fall inside the aeronautical band, such as intermodulation products generated when multiple FM transmitters feed one antenna or out-of-band emissions from stations operating at the upper edge of the FM band. The second type is generated within the navigation receiver in response to FM broadcast emissions that fall outside the aeronautical band. These are usually intermodulation or receiver desensitization effects caused by high-level signa outside the aeronautical band.

2.4 Annex I O, Volume I, Chapter 3,3.1.4 and 3.3.8, and associated guidance material in Attachment C, contains FM immunity performanc criteria for ILS and VOR receivers. Additional ITU-R material is provided in Appendices 1 and 2 to this manual. The ICAO Handbook for Evaluation c Electromagnetic Compatibility Between ILS and FM Broadcasting Stations Using Flight Test * provides guidance on conducting flight tests of thi kind of interference.

TV broadcast transmitters

2.5 Harmonics, intermodulation products and spurious emissions of TV video and audio carriers may cause interference to DME, VHF communications, VOR and ILS receivers, and GNSS.

Land mobile transmitters

2.6 In-band interference can be caused by spurious emissions from a single transmitter or by radiated intermodulation products created at a Co sited facility. VHF communications frequencies ar often affected because a fixed mobile service ban lies immediately above 137 MHz. The mobile satellite service (MSS) operating in the band adjacent to the GNSS band or the fixed service (FS) operating in the GNSS band in some States can cause interference to GNSS receivers.

Cable television distribution systems

2.7 These CATV systems distribute TV broadcasting signals on ILS and VHF communications frequencies. Most CATV system use coaxial cables, which can leak RF signals anc cause in-band interference.

Industrial, scientific and medical (ISM) systems

2.8 Specific radio frequency bands (e.g. centred a 13.56, 27.12 and 40.98 MHz) are allocated for the operation of ISM equipment. In-band interference to VHF communications, VOR and ILS localizer receivers may be caused by the radiation of harmonics of the ISM frequencies from malfunctioning or inadequately shielded ISM equipment. The interfering signal sweeps repetitively through a portion of the VHF aeronautical band affecting several aeronautical frequencies. The most common ISM interference sources are industrial equipment such as plastic welders.

Power line distribution systems

2.9 Power line carrier (PLC) systems inject signals into power lines for monitoring and control purposes. ADF receivers can experience in-band interference because some PLC systems operate within the NDB band and PLC signals can radiate from power lines,

2.10 Corona noise and gap discharges from malfunctioning electrical equipment such as high-voltage busbars, switchgear, and insulators, can generate broadband impulsive-type noise, which can interfere with ILS localizer, VOR and VHF communications receivers in over-flying, low-altitude aircraft.

Other ground-based non-aeronautical sources

2.11 Low/medium/high frequency (LF/MF/HF) transmitters can cause Co-channel and adjacent channel interference to ADF and HF communications receivers. High-power military radar may generate harmonic and spurious emission levels high enough to cause in-band and out-of-band interference to on-board pulse-type systems such as GNSS receivers. Radiated emissions from most information technology equipment (ITE) are regulated domestically. Malfunctioning ITE can cause in-band interference. Radiation of ITE clock frequency signals and their harmonics can interfere with VHF communications, ILS localizer, VOR and other receivers.

Airborne equipment sources

2.12 On-board aeronautical transmitters may cause inband interference to aircraft receivers through harmonics of the intentional emissions or harmonics of local oscillator frequencies being conducted between units. Potential problems associated with portable electronic device installations on-board aircraft should normally be identified and resolved during airworthiness testin

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[From Volume 2, re: GNSS Testing]

3. SOURCES OF INTERFERENCE

In-band sources

3.1 A potential source of in-band harmful interference is that of fixed-service operation in certain States. There are primary or secondary allocations to the fixed-service for point-to-point microwave links in certain States in the frequency band used by GPS and GLONASS.

3.2 It is expected that States authorizing GNSS operations endeavour to ensure that existing and future frequency assignments in the 1559-1610 MHz band with the potential to interfere with the GNSS operations be moved to other frequency bands.

Out-of-band sources

3.3 Potential sources of interference from service operating in bands outside the 1559- 1610 MHz band include harmonics and spurious emissions c aeronautical VHF transmitters, VHF and ultra-high frequency (UHF) television (TV) broadcast stations, and other high-power sources. Out-of-band noise, discrete spurious products and intermodulation products (IMP) from radio service operating near the 1559-1610 MHz band can also cause interference problems.

3.4 Studies have shown that commercial VHF transmissions do not pose an operationally significant threat to GNSS users. However, furthe consideration should be given to this threat for specific VHF transmit antennas located in the vicinity of a runway and approach area.

3.5 Television stations do pose a threat to GNSS.

Given current limitations on out-of-band emissions from TV transmitters, it is feasible for a transmitte operating within specifications to radiate significar power into the GPS L1 band. TV systems such as High Definition TV may be capable of causing significant interference to GNSS receivers. Therefore, there is a need for mitigation strategies to prevent operational impacts to GNSS aviation users operating in the airport vicinity. As the spurious emission characteristics of TV transmitters change over time (due to maintenance, weather conditions, etc.), there will be a need for an ongoing interference mitigation strategy on the behalf of the affected air navigatio services provider.

On-board sources

3.6 The potential for harmful interference to GPS and GLONASS on an aircraft depends on the individual aircraft, its size, and what transmitting equipment is installed. The GNSS antenna locatic should take into account the possibility of on-boar interference - mainly emanating from satellite communication equipment.

3.7 On large aircraft sufficient isolation between a transmitting antenna and a GNSS receiving antenna can usually be obtained to mitigate an interference problem. Transmitters of particular interest are the satellite communications equipment and VHF transmitters. The possible generation of intermodulation products on the aircraft from one transmitter with multiple carriers or multiple transmitters is controlled by a combination of transmitter filtering and frequency management. Some on-board interference could be due to harmonics generated by weathered join and connections. It is recommended that air operators and State regulatory authorities take action to control such occurrences.

3.8 Avionics must be installed in accordance with industry standards to ensure that the equipment operates properly. These standards require testin for interference with and by other on-board systems.

3.9 The combination of appropriately shielded GNSS antenna cabling, separation of antennas and cables, and transmitter filters can solve most interference problems on board small aircraft. Transmit equipment should be filtered within its

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
	own box or as close to the transmit-antenna port a possible. Additionally, some personal electronic devices are capable of generating sufficient in-band energy to interfere with avionics when used on board an aircraft. Malicious interference 3.10 Intentional malicious interference (jamming) GNSS is also a possibility as it is to all radio navigation systems. Such unauthorized interference is illegal and should be dealt with by the appropriate State authorities. 3.11 Spoofing of GNSS receivers can be made extremely difficult with proper design of the RAIM fault detection, and RAIM fault detection and exclusion (FDE) algorithms resident in aviation receiver equipment. 3.12 For States that determine that the risk of intentional interference is unacceptable in specific areas, safety and efficiency can be maintained by adopting an effective mitigation strategy through a combination of on-board mitigation techniques, procedural methods and terrestrial navigation aids		

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	none	none

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
	Thorough description of likely sources, both for ground-based and GNSS-based navigation.	Generalized description of types of interference.

Measurement Uncertainty

N/A

Annex10_ID	8071_ID	8200_ID	Results_ID
	684	452	758

Facility RFI **Parameter** Troubleshooting Methods

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref none

Annex Ref **8071 Reference** V1&2, Ch1, Atch3-3.9-1 **8200 Reference** 23.14

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	[From Volume 1, re: Ground-based Navaids Testing] Specialized electromagnetic interference (EMI) troubleshooting methods 3.9 Specialized equipment and computer simulation will likely be required if a source of interference cannot be readily identified. Many States have invested considerable time and effort on hardware and software techniques to resolve EM1 problems. These techniques include: a) databases of potential interference sources; b) EMC analysis software; c) interference simulators; d) special ground or airborne data acquisition systems; e) interference direction-finding systems; and f) antenna calibration techniques. Interference investigation 3.10 It may be helpful, in resolving the more difficult interference problems, to form an investigative team consisting of personnel representing (as required) flight inspection services, the State spectrum regulatory agency, aeronautical spectrum management and aeronautical facility engineering/maintenance. Thi team could seek input from the affected users an the owner/operator of the potential interference source, develop and implement test plans, analys results and make recommendations for resolving interference problems. ---------- [From Volume 2, re: GNSS Testing]	a. Airborne Equipment (1) DF Equipment. The DF receiver system produces a strobe indication giving a Line of Bearing (LOB) from the aircraft to the transmissio source. Following the strobe will bring the aircraft to the signal source. Usually, the aircraft is too hig on the initial pass over the signal source for its identification. A descending 270° turn to pass ove the signal from a different direction may aid in its location. (2) Spectrum Analyzer. Many interfering signals are not on the affected frequency but are within th victim receiver's bandwidth. Tuning the DF receiver to the affected frequency with its bandwidth set too narrow will degrade its effectiveness. Use the spectrum analyzer to find the center frequency and effective bandwidth of any signals that appear close enough to the victim frequency to be the likely interferer. (3) Flight inspection receivers can be tuned slightl above or below the affected facility frequency to find a peak in signal strength through the flight inspection equipment. This may help find the center frequency of the interference source. (4) Audio Recording. Flight inspection aircraft should be equipped with audio recorders capable of recording from the various communications or navigational radios as selected by the crew. Record the interference whenever practical to assist FMO personnel in characterizing the signal (5) Autonomous GPS recording capability is available in some flight inspection aircraft. It continually monitors the GPS signal for any anomalies and stores up to 24 "events" of unsatisfactory GPS data. The airborne technician should monitor this capability and report any new "Events" to the FICO. b. Search patterns are usually based either on	

5. MITIGATION TECHNIQUES

Regulatory techniques

5.1 There is always the possibility of interference, and aircraft CNS systems should be designed witl this potential in mind. Aircraft certification and installation procedures should require demonstration of protection against on-board harmful interference.

5.2 The most effective place to deal with interference is at its source. Assuming that regulatory authorities have implemented suitable frequency management procedures, appropriate measures can be mandated to limit out-of-band emissions.

5.3 The combined use of satellite constellations o additional signals on multiple frequencies in the same receiver provides a more robust design against interference, particularly unintentional interference. However, careful design must be employed, as a common wide-band RF front-end to a combined receiver has the potential to increase the level of interference rather than decrease it.

5.4 Control of the harmonic content will be necessary where TV transmitters cause interference. There are known TV transmitters wit harmonics that are over 100 dB less than the carrier. This is 40 dB greater than that required by regulation. If the States' regulations are in conformance with what can be achieved and is typical in some States, then interference protectio from TV transmissions could be assured. Depending upon the adequacy of existin standards and practice, the cost of additional filter for TV broadcast stations to protect GNSS operations may be reasonable.

5.5 It is important to evaluate airspace where aircraft are authorized to fly in order to identify potential sources of interference. If interference does exist, then consideration should be given to filtering the source transmitter, avoiding the sourc where operationally feasible, or moving the transmitter to another frequency band.

INS coupling

5.6 Protection can be obtained from the effects of

signal strength or a homing receiver. The signal strength methods are less accurate but may be accomplished with more basic equipment.

(1) Hot/ Cold. This method requires the aircraft to go closer or further from the interferer while the signal strength or best signal to noise ratio (SNR) is noted. If the aircraft travels in a straight line, the peak of the signal should be when the transmitter is directly off the aircraft wing. Another track flown 90° from the first will provide another peak. Sequentially flying a "box pattern" of decreasing size will locate the interference.

(2) The second method, particularly useful for finding GPS interference, requires antennas both on the top and bottom of the aircraft feeding separate sensors. With the bottom antenna fed to a receiver or spectrum analyzer and the top to a GPS receiver, the aircraft is banked to both sides. As the GPS interference will be from the ground, banking the aircraft away from the interferer exposes the bottom sensor antenna to more of th interfering signal, decreasing the SNR. It also shades the top antenna from the ground interference and increases the SNR on that receiver. No significant change while banking either left or right indicates the interference is in front or behind the aircraft. Changes in direction can eventually narrow the search area.

(3) Triangulation. A radiation source can be locate by using the DF Receiver to get LOB from two or more locations. Using a geodetic calculator program with an "Intersection" function, the coordinates of the receiver(s) and the lines of bearing (True) are input, and the result is the coordinates of the intersection. It is important to use the correct aircraft heading reference (true or magnetic) to correlate with the DF receiver direction reference. The more samples taken with the receiver locations separated by several miles increase the accuracy of the intersection coordinates.

23.15 ANALYSIS

a. Intermittent Interference. Some interference occurs intermittently in either a random or predictable time pattern. Locating these type signals is sometimes very difficult and may take several attempts, with each attempt gathering one or more receiver coordinates and lines of bearing.

interference through the coupling of GNSS receivers with inertial navigation systems (INS). The characteristics of both systems are complementary. INS is immune to external interference and offers excellent short-term position stability but suffers from a bias error that increases with the time from its last position update. GNSS on the other hand has excellent long-term position stability but can suffer from short-term signal outages including those caused by transient interference. INS coupling should, however, be considered as an extra margin for unforeseen interference events.

Adaptive antennas and adaptive notch filters

5.7 Both adaptive antenna and notch filter technologies have been applied to GNSS to help overcome the problems of interference. These technologies were originally developed to protect military users from hostile jamming of the GNSS signals and are now found in civil applications. Both techniques require additional airborne equipment, but once installed can provide significant protection from unintentional interference.

Airframe masking and antenna locations

5.8 Airframe shielding of the top-mounted GNSS antenna from ground-based transmitters can offer additional mitigation against interference. The radiation pattern of the antenna and the antenna's position on the aircraft are important in rejecting ground-based interference.

FM broadcast compatibility issues for GBAS

5.9 Receivers for the instrument landing system (ILS) have been shown to be susceptible to interference from two- and three-signal 3rd order and 5th order intermodulation products from commercial radio broadcast stations operating in the band adjacent to the bottom of the 108-117.975 MHz Aeronautical Radio Navigation Service (ARNS) band where ILS localizers operate. VHF FM broadcasters have been allowed frequency assignments below 108 MHz, assuming interference immunity performance of ILS receivers specified in Annex 10, Volume I, 3.1.4.

5.10 States currently require coordination between FM broadcasters and ILS localizer installations to

Each piece of information gathered should be filed together with all data reevaluated as new information is obtained. Assuming the interference source is not physically moving, time has no impact on the data quality. Interfering signals may also move in frequency, i.e., sweep through the victim band. In this case, the bandwidth on the Spectrum Analyzer should be increased. They may also change in modulation, i.e., change in appearance on the spectrum analyzer when the bandwidth is narrow.

b. Analyze the interfering signal as much as possible, using the equipment and techniques in Table 23-1, to provide as much information as possible to the Regional FMO.

Table 23-1

System	Record Audio	Detune Receiver	Spectrum Analyzer	Oscilloscope
VHF/ UHF Comm	X	X	X	X
NDB/ ADF	X	X	X	X
VOR/ ILS	X	X	X	X
TACAN/ DME		X	X	X
MLS		X	X	X
GPS			X	X
VHF DATALINK		X	X	X

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
	protect users from the possibility of harmful unintentional interference arising from intermodulation products. The same form of protection is required for GBAS, whose receivers employ the same interference immunity standards (Annex 10, Volume I, Appendix B, 3.6.8.2.2.8.3).		

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	none	none

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
	Ground-based navaids: Brief description of equipment and tactics GNSS: Mitigation Techniques	Techniques and recommended equipment

Measurement Uncertainty

N/A

Annex10_ID	8071_ID	8200_ID	Results_ID
	685	453	759

Facility **RNAV** **Parameter** **DME-DME Errors**

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for all

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** Ch 11, Sec 6

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		13.33 ANALYSIS. AFIS will determine and verify that the DME infrastructure will support a DME/ DME RNAV position solution in accordance with FAA Advisory Circular AC 90-100 (U.S. TERMINAL AND EN ROUTE AREA NAVIGATION (RNAV) OPERATIONS) performance criteria. Two DME/ DME infrastructure navigation performance levels are evaluated by AFIS. The two levels are for procedures requiring: -- FMS with a DME/ DME sensor and -- FMS with a DME/ DME sensor and IRU a. "RNAV 2" ("Type A") RNAV SID(s)/ STAR(s)/ Routes require system performance currently met by GPS or DME/ DME RNAV systems. "RNAV 2" procedures require the aircraft's track keeping accuracy remain bounded by ± 2 nm for 95% of the total flight time. The "RNAV 2" procedure may require an IRU to mitigate marginal DME/ DME infrastructure. b. "RNAV 1" ("Type B") RNAV SID(s)/ STAR(s)/ Routes require system performance currently met by GPS or DME/ DME/ IRU RNAV systems. "RNAV 1" procedures may require the aircraft's track keeping accuracy remain bounded by ± 1 nm for 95% of the total flight time. Results of the DME/ DME infrastructure are reported on the AFIS "Leg Summary Page". "RNAV 2" procedures (DME/ DME RNAV) are reported as a Position Estimation Error (PEE) value. "RNAV 2" procedures requiring DME/ DME/ IRU, and "RNAV 1" procedures are reported as a Total System Error (TSE) value. Procedures not meeting DME infrastructure PEE/ TSE tolerance must be returned to the procedure developer for modification. NOTE: "RNAV 2" procedures are equivalent to RNP 2.0, and "RNAV 1" procedures are equivalent to RNP 1.0 for analysis.	Order 8200.1 exceeds the requirements of Doc 8071, since 8071 does not present any guidance or tolerances explicit to DME-DME based navigation. However, the tolerances in 8200.1 fo this parameter are intuitive.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		c. Approach. (Reserved)	

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		Single DME Accuracy <= 0.2 NM NOTE. DME facilities with range errors greater than 0.20 nm do not invalidate the DME/ DME procedure, unless it is a 'critical' DME facility as identified in RNAV Pro. PEE for DME/ DME RNAV Procedures: <RNP Limit TSE DME/ DME/ IRU RNAV Procedures: <RNP limit

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
		454	760

Facility **RNAV** **Parameter** **Flyability**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref none

Annex Ref **8071 Reference** V2, 2.3.5, 5.3.20 **8200 Reference** 13.12, 13.13

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	Evaluation 2.3.5 Evaluation should confirm the continuous presence of guidance information, the absence of RAIM alerts and, for NPAs, the location of the GNSS-indicated missed approach point (MAPt) (see Table II-2-3). ---------- [The following paragraph 5.3.20 is duplicated under parameter PROCEDURE DESIGN VALIDATION.] 5.3.20 Procedure validation. The instrument flight procedure should be evaluated for conformance with the procedure design and navaid signal reception. The following issues should also be addressed: a) Reception of navaid signals required for the procedure may be interrupted during aircraft banking or masked by terrain. When this is encountered, the instrument flight procedure may require modification. In some locations, modification may not mitigate this situation and th instrument flight procedure should be denied. Procedures that support azimuth-only approaches should be evaluated through the MAPt. Procedure with vertical guidance should be evaluated to the decision altitude. b) Aircraft manoeuvring must be consistent with safe operating practices for the category of aircrat intending to use the procedure. c) Cockpit workload must be acceptable. d) Navigation charts must properly portray the procedure and must be easily interpreted. e) Obstacles that control the minimum altitude for each segment should be verified visually by in-flight or ground observation. f) Way-point accuracy. The way-points depicted o	13.12 FLIGHT INSPECTION PROCEDURES. The RNAV procedure must be inspected IAW Chapter 6 and appropriate sections of this chapte The flight inspection of RNAV procedures will evaluate safety, flyability, human factors, and workload. Any anomalies found durin inspection must be resolved before the procedure is approved. Use appropriate FAA Order(s) or approved guidance (e.g., 8260.44, Civil Utilization of RNAV Departure Procedures; 8260.48, Area Navigation (RNAV) Approach Construction Criteria; 8260.54, The United States Standard for Area Navigation (RNAV); and 8260.51, US Standard for RNP Instrument Approach Procedur Construction) for required obstruction clearance criteria. 13.13 FLIGHT INSPECTION ANALYSIS. Flight inspection of RNAV procedures determines if the procedure is flyable and safe. ARINC 424 coded data will be used to compare coded path versus actual path to verify all data prior to release to the public and other database suppliers. If a new procedure is unsatisfactory, the flight inspector must coordinate with the procedures designer, ATC, and/ or the proponent of the procedure, as applicable, to determine the necessary changes. When existing procedures are found unsatisfactory, notify the procedures designer immediately for Notice to Airman (NOTAM) action The inspector must evaluate the following items: a. Waypoint spacing is sufficient to allow the aircraft to stabilize on each leg segment without jumping over waypoints/ legs. Leg length must be sufficient to allow for aircraft deceleration or altitude change, if required.	Although difficult to compare directly, the text in these two documents that can be reasonably attributed to the parameter FLYABILITY is essentially identical in intent. Consider establishing some simplified criteria for ROC.

the procedure should be verified as properly labeled and correct.

g) Bearing accuracy. Where applicable, the bearing, as depicted on the instrument approach procedure, should be evaluated for accuracy.

h) Distance accuracy. Distances should be verifie for accuracy using a validated, automated flight inspection system, where applicable, or by using ground reference positions when conducting manual flight validation operations.

i) Flyability. The verification of the flyability of an RNAV procedure can include independent assessments by procedure designers and other experts using specialist software, full flight simulators or even trial flights conducted by flight validation or flight inspection aircraft. Where a flight validation is required to address flyability aspects, the procedure designer should identify which procedures, or parts of a procedure, should be reviewed by the flight validator from a flyability perspective.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	Flyable	none (subjective evaluation)

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
		The last half of paragraph 13.12 references the flight inspector to four example documents for ROC criteria. This seems fairly impractical from an operational standpoint, given the volume of information in those documents.

Measurement Uncertainty

Subjective

Annex10_ID	8071_ID	8200_ID	Results_ID
	686	455	761

Facility **RNAV** **Parameter** **General**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref none

Annex Ref **8071 Reference** none **8200 Reference** none

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
none	Doc 8071 Volume 2 does not individually address the various types of RNAV, e.g., GNSS-based, DME-DME based, etc. It covers RNAV under headings of ABAS (Chapter 2, Aircraft-Based Augmentation Systems), which presumes GNSS only as the sensor input, and PROCEDURES (Chapter 5). For the purposes of this comparison database, Facility type PROCedures is taken to mean traditional (pre-GNSS) procedures based o ground navaids, while Facility type RNAV applies to area navigation based on GNSS, FMS using DME-DME, and FMS implementing RNP.	Chapter 13 (RNAV) in Order 8200.1is organized i four sections: 1. RNAV [essentially, RNAV with GNSS sensor input] 2. RNP RNAV 3. DME-DME Supported RNAV [essentially, RNAV without GNSS sensor input] 4. WAAS RNAV Each of these sections relies on Chapter 6 for flight inspection of Procedures as a general topic. Further, Sections 2 and 3 refer to activities and practices defined in Section 1. The content of Section 2 is entirely tutorial in nature, except for guidance on where to position the aircraft for obstacle evaluation for RNP procedures. The contents of Section 3 largely comprise tutoria and aircraft positioning information, plus a brief Analysis/tutorial section and three tolerances. For this database, Sections 1-3 are combined intc a single RNAV Facility type. Section 4 is treated under Facility type SBAS.	This parameter is used to discuss how the sever documents organize and present RNAV related criteria.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
none	none	none

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
Annex 10 does not address RNAV Procedures. See ICAO Document 8071.	Doc 8071 Volume 2 does not individually address the various types of RNAV, e.g., GNSS-based, DME-DME based, etc. It covers RNAV under headings of ABAS (Chapter 2, Aircraft-Based Augmentation Systems), which presumes GNSS only as the sensor input, and PROCEDURES (Chapter 5). For the purposes of this comparison database, Facility type PROCedures is taken to mean traditional (pre-GNSS) procedures based o	

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
	ground navaids, while Facility type RNAV applies to area navigation based on GNSS, FMS using DME-DME, and FMS implementing RNP. **Measurement Uncertainty** N/A		

Annex10_ID	8071_ID	8200_ID	Results_ID
528	687	456	762

Facility **RNAV** **Parameter** **Guidance Indications**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref none

Annex Ref **8071 Reference** V2, 2.3.5 **8200 Reference** 13.11, 13.12

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	Evaluation 2.3.5 Evaluation should confirm the continuous presence of guidance information, the absence of RAIM alerts and, for NPAs, the location of the GNSS-indicated missed approach point (MAPt) (see Table II-2-3).	[The following paragraph is copied from the PROCEDURE DESIGN VALIDATION parameter for comparison purposes.] e. Navigation System Status. Determine the statu of the required navigation system(s) (e.g., DME, GPS, LAAS, and WAAS) before every flight inspection and after an inspection that detects anomalies. NOTAM(s) and GPS Service Interruptions (interference testing) location and schedule should be considered. ---------- 13.12 FLIGHT INSPECTION PROCEDURES. The RNAV procedure must be inspected IAW Chapter 6 and appropriate sections of this chapter. The flight inspection of RNAV procedures will evaluate safety, flyability, human factors, and workload. Any anomalies found durin inspection must be resolved before the procedure is approved.	Although difficult to compare directly, the text in these two documents that can be reasonably attributed to the parameter GUIDANCE INDICATIONS is essentially identical in intent.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	Continuous [guidance indications]	GPS Integrity: RAIM

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

none

Annex10_ID	8071_ID	8200_ID	Results_ID
	688	457	763

Facility **RNAV** **Parameter** **Interference**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref 3.7.4

Annex Ref **8071 Reference** V2, 2.3.4 **8200 Reference** 13.13

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	2.3.4 For NPA approaches, the presence of a RAIM alert and/or the loss of guidance have proven to be good indicators of probable GNSS interference affecting availability rather than accuracy or integrity. Although relying on these indicators does not actually confirm that the spectrum environment meets the resistance-to-interference standards in Annex 10, Volume I, Chapter 3, 3.7.4, it is considered sufficient for the procedures covered by this chapter. Furthermore, the presence of interfering signals for NPA approaches may not require a procedural restriction unless GNSS receiver performance is affected. However, if interference is suspected, further investigation should be conducted. The suspected area should be probed to define its geographical extent, GNSS parameters such as signal/noise ratios and DOP should be documented, the approach procedure should be removed from operational status, and appropriate authorities should be notified.	d. Interference. The RF spectrum from 1,155 to 1,250 MHz and 1,555 to 1,595 MHz should be observed when GPS parameters indicate possible RF interference. Interfering signals are not restrictive, unless they affect the receiver/ sensor performance. The SNR values being recorded ma indicate RF interference problems. The normal GPS signal strength is -130 to -123 dBm. Use the SNR values, along with the spectrum analyzer, to investigate the RF interference, the location of its occurrence, and possible sources. Particular attention must be given to harmonics on or within 20 MHz of GPS L1 (1,575.42 MHz), L5 (1,176.45 MHz), and those on or within 10 MHz of GPS L2 (1,227.6 MHz). During an RNAV procedure, document all spectrum anomalies. Paper records and electronic collection of data are required. NOTE: Report interference to the FICO, who will i turn forward the report to the ATCSCC/ Spectrum Assignment and Engineering Office at Herndon, Virginia.	The text in Order 8200 is more explicit, but with the same general content as Document 8071.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	No RAIM alerts; Continuous guidance	NONE

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

none

Annex10_ID	8071_ID	8200_ID	Results_ID
	689	458	764

Facility **RNAV** **Parameter** **MAPt Indicated Location**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref none

Annex Ref **8071 Reference** V2, 2.3.5, 5.3.21 **8200 Reference** 13.12, 13.12c(5)

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	Evaluation 2.3.5 Evaluation should confirm the continuous presence of guidance information, the absence of RAIM alerts and, for NPAs, the location of the GNSS-indicated missed approach point (MAPt) (see Table II-2-3). 5.3.21 The position of the missed approach point (MAPt) must be confirmed with respect to the physical environment. This verification may be achieved either visually or electronically, and descent below the published minima may be necessary. A truth system may be used when visual verification is not practical, such as for over water or some non-threshold MAPts. Consideration must be given to the types of aircra that will be using the procedure and the runway environment.	13.12 FLIGHT INSPECTION PROCEDURES. The RNAV procedure must be inspected IAW Chapter 6 and appropriate sections of this chapter. The flight inspection of RNAV procedures will evaluate safety, flyability, human factors, and workload. Any anomalies found durin inspection must be resolved before the procedure is approved. (5) Missed Approach. During commissioning inspection, fly the missed approach segment(s) a depicted in the procedure.	Taken together with the general requirements in 8200.1's Procedures chapter 11, the requirements in these two documents are the same.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	Visual Verification	

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
	Volume 2, Chapter 2 of Doc 8071 is titled ABAS, which is written specifically for RNAV based solel on GNSS. The actual parameter name in Doc 8071 is "MAPt GNSS-indicated location." This has been generalized here, to also cover RNP RNAV and DME-DME RNAV.	

Measurement Uncertainty

Subjective

Annex10_ID	8071_ID	8200_ID	Results_ID
	690	459	765

Facility **RNAV** **Parameter** **Procedure Design Validation**

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for all

SARPS Ref none

Annex Ref **8071 Reference** V2, 5.3.15-5.3.20 **8200 Reference** 13.11, 13.13b

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	5.3.15 Procedures based upon RNAV (GNSS or DME/DME) should be evaluated by flight validatio for conformance to safe and sound operational practices. 5.3.16 The entire procedure should be flown, including, for approach procedures, Initial, Intermediate, Final Approach and Missed Approach segments. Alternate or additional segments should be checked on commissioning t the point where the routing intersects a portion of the procedure already checked. The intent is that each segment of the procedure should be flown a least once; common segments do not need to be repeated. 5.3.17 Survey requirements. RNAV instrument flight procedures are predicated on airport and runway survey coordinates. Airport survey accuracies must conform to the required standard referenced in Chapter 1, Section 1.4, to support aircraft database use. 5.3.18 Navigation data requirements. RNAV instrument flight procedures describe a prescribed ground track which is defined by way-point location, way-point type, path terminator and, where appropriate, speed constraint, altitude constraint and course. The flight validation aircraft must fly the proposed RNAV procedure following the ground track defined by the procedure designer. One way in which this can be achieved by using an RNAV system and an ARINC 424 compatible navigation database containing the procedures to be checked. Standard RNAV(GNSS) approaches may be defined by manual entry of all the waypoints. In all other cases, manual entry of way-point coordinates is n an acceptable means of defining the path to be flown. The RNAV system and the database may be part of the flight inspection system or the aircraft navigation system. The flight validation should be carried out before the procedures are released for public use. This generally means before the procedures are published in the AIP.	13.11 PREFLIGHT REQUIREMENTS a. Aircraft. The aircraft avionics configuration mus be appropriate to support the procedure to be flig inspected. Flight Inspection of RNAV Standard Instrument Departure (SID(s)), airways, and Standard Terminal Arrival Route (STAR(s)) may be accomplished with any flight inspection aircraft capable of the procedure's ARINC 424 path and terminators. RNAV approach charts provide separate minima for Lateral Navigation (LNAV), Lateral and Vertical Navigation (LNAV/ VNAV), and LPV. Inspection of an RNAV procedure with vertical guidance requires an appropriately equipped flight inspection aircraft. Flight inspectio of an LNAV approach procedure (without vertical navigation) may be accomplished with any flight inspection aircraft capable of the procedure's ARINC 424 path and terminators. b. Navigation Database. Verify a current navigatio database is installed. Use waypoint data from the FMS/ GPS navigation database when available. The National Flight Database (NFD) is government source ARINC 42 navigation data. When NFD navigation data is available, it must be used for the flight inspection. c. Pilot-Defined Procedure. RNAV procedures (databases) are designed (coded) using ARINC 424 path and terminators. Path and terminator combinations can result in different ground tracks; hence, requiring utmost complianc with the "official government source documentation". Entering the RNAV procedure simply as a route does not adequately represent the ARINC 424 leg types used to define the procedure or provide for the intended ground trac on which obstacle clearance and other requirements are based. A difference in the ARINC 424 coded data from the source documentation can result in very different FMS/ GPS performance and aircraft ground and vertica track.	Originally, ICAO Doc 8071, Volume 2, was drafted around the preliminary content of Order 8200.1 for GNSS-based procedures. 8200.1 contained, and still contains, explicit tolerances for the procedure validation, prior to any airborne flight testing or evaluation of the procedures. During a re-write of Volume 2, ICAO inserted a new Chapter 5 covering GNSS-based procedures, and deleted the table of procedure design tolerances, replacing it with generic language such as, " Where applicable, the bearing, as depicted on the instrument approach procedure, should be evaluated for accuracy." In this sense, 8200 is more demanding than the ICAO document.

This may require the use of a special test databas produced by the appropriate navigation data provider and packed for the RNAV system in use on the flight validation aircraft. If this involves the use of navigation databases produced by the commercial datahouses, the procedure owner must take account of the likely lead times.

5.3.19 Maps and charts for flight validations. The pilot or crew member responsible for the flight validation should have appropriate topographical maps and procedure charts of the area to the runway to be tested, showing the runway, and identifying prominent landmarks and way-point locations of the procedure. The available set of documentation for flight validation should include all relevant data such as procedure design, segment lengths, bearings, and descent and climl angles. For more details, refer to Volume I of Doc 8071.

[The following paragraph 5.3.20 is duplicated under parameter FLYABILITY.]

5.3.20 Procedure validation. The instrument flight procedure should be evaluated for conformance with the procedure design and navaid signal reception. The following issues should also be addressed:

a) Reception of navaid signals required for the procedure may be interrupted during aircraft banking or masked by terrain. When this is encountered, the instrument flight procedure may require modification. In some locations, modification may not mitigate this situation and th instrument flight procedure should be denied. Procedures that support azimuth-only approaches should be evaluated through the MAPt. Procedure with vertical guidance should be evaluated to the decision altitude.

b) Aircraft manoeuvring must be consistent with safe operating practices for the category of aircrat intending to use the procedure.

c) Cockpit workload must be acceptable.

d) Navigation charts must properly portray the procedure and must be easily interpreted.

e) Obstacles that control the minimum altitude for

(1) Waypoint resolution is critical. For approach procedures with vertical guidance and minimums, enter latitude/ longitude to a minimum of thousandths (1/ 1,000) of a minute.

(2) For vertically guided approaches, enter waypoint altitudes as depicted. The end-of-approach (EOA) waypoint altitude at the threshold should be the actual runway threshold MSL altitude, plus the proposed TCH. For offset approach procedures, the end-of-approach (EOA) altitude is found by calculating the altitude at whic the glide path angle (GPA) passes through the EOA waypoint.

d. Evaluation of Procedure Data. Prior to the procedure being flown, leg segment data accurac must be evaluated by comparison of the procedur waypoint data (FAA Form 8260 or equivalent) to the flight plan waypoint data. Use the official source documentation to obtain the ARINC 424 coding. Verify true course to next waypoint, distances, and the Flight Path Angle (FPA) indicated on the FMS or GPS accurately reflects the procedure design. When evaluating RNAV CF legs, including holding legs (HM, HF, HA), compare aircraft navigation performance wit the instrument procedure design. Do not apply an tolerance to course-to-fix values. Confirmation of proper ARINC coding will be accomplished with either an appropriately equipped aircraft, or by a desktop evaluation of the current navigation database. Out-of-tolerance values must be resolved with the procedure designer.

[The following paragraph (e) is duplicated under the GUIDANCE INDICATIONS parameter.]

e. Navigation System Status. Determine the statu of the required navigation system(s) (e.g., DME, GPS, LAAS, and WAAS) before every flight inspection and after an inspection that detects anomalies. NOTAM(s) and GPS Service Interruptions (interference testing) location and schedule should be considered.

13.13b. Procedural Design. The procedure must be evaluated to verify the geodetic coordinates (waypoints) and vertical path angles meet the requirements of Paragraph 13.14.

each segment should be verified visually by in-flight or ground observation.

f) Way-point accuracy. The way-points depicted o the procedure should be verified as properly labeled and correct.

g) Bearing accuracy. Where applicable, the bearing, as depicted on the instrument approach procedure, should be evaluated for accuracy.

h) Distance accuracy. Distances should be verifie for accuracy using a validated, automated flight inspection system, where applicable, or by using ground reference positions when conducting manual flight validation operations.

i) Flyability. The verification of the flyability of an RNAV procedure can include independent assessments by procedure designers and other experts using specialist software, full flight simulators or even trial flights conducted by flight validation or flight inspection aircraft. Where a flight validation is required to address flyability aspects, the procedure designer should identify which procedures, or parts of a procedure, should be reviewed by the flight validator from a flyability perspective.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	V2, 5.5: Distance and bearing accuracies should be in accordance with the specific chapters of this document [Vol 2, Doc 8071], depending on the type of navigation source upon which the instrument procedure has been developed. The navigation aid and the procedure should consistently deliver the aircraft to a point within th depicted fix displacement area, as applicable.	Route/DP/SID/STAR, Initial/Intermediate Approac Segment, Final Approach Segment, Missed Approach Segment: True Course/Distance to next WP: ± 1 degree, ± 0.1 NM ---------- Vertical Path (VNAV): ± 0.1 degree ---------- GPS Integrity: RAIM

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
	The first edition of Volume 2 Doc 8071 contained table of accuracies for ABAS, within which the procedure validation must fall; it did not contain a separate chapter for GNSS-based procedures. In the 2nd edition, the validation accuracy table was removed, and a new chapter on Procedures inserted, containing the general language now	

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
	found in 5.3.20, without the explicit tolerances nov found in Order 8200.1..		
	Measurement Uncertainty N/A		
Annex10_ID	**8071_ID**	**8200_ID**	**Results_ID**
	691	460	766

Facility **SBAS** **Parameter** **FAS Data**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref B3.6.4.5

Annex Ref **8071 Reference** 3.3.3 **8200 Reference** 13.41b 13.43a 13.44

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	Pre-departure checks 3.3.3 Each FAS data block has an associated cyclic redundancy check (CRC) code which ensures that the data is not corrupted during the data transfer. The CRC must be generated by the procedure designer and not changed before being entered into the receiver. The receiver must also confirm the validity of the FAS data block using th CRC prior to flight testing. The FAS data should be checked for consistency against the original design.	13.41b. LPV FAS Data Block Verification. The LPV FAS data (data specified on FAA Form 8260 10) is developed and coded into binary files by the procedure developer. The FAS data files are save into a network file for flight inspection access. Download the FAS data blocks files required for the scheduled itinerary onto removable disk media Prior to mission departure, confirm AFIS access t the removable disk media. Access each individual FAS data file and confirm the CRC Remainder matches the FAA Form 8260-10 data. This ensures no errors occurred during data transfer (data file integrity). Any corruption must b resolved prior to conducting 13.43a. CRC Remainder. The FAS data block integrity must be confirmed by a perfect match of the CRC remainder documented on FAA Form 8260-10 and the CRC remainder as computed by AFIS.	This an ICAO-recommended on-ground "flight test" of the FAS data block for SBAS procedures There is no Annex 10 tolerance to be checked.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	Consistent with FAS design	13.44 Perfect Match (no CRC error)

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
	This is an on-ground "test".	

Measurement Uncertainty

N/A

Annex10_ID	8071_ID	8200_ID	Results_ID
	692	461	767

Facility **SBAS** **Parameter** **Flyability**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref None

Annex Ref **8071 Reference** 5.3.20 **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	5.3.20 Procedure validation. The instrument flight procedure should be evaluated for conformance with the procedure design and navaid signal reception. The following issues should also be addressed: [5.3.20a covered under parameter GUIDANCE INDICATIONS.] b) Aircraft manoeuvring must be consistent with safe operating practices for the category of aircraf intending to use the procedure. c) Cockpit workload must be acceptable. d) Navigation charts must properly portray the procedure and must be easily interpreted. e) Obstacles that control the minimum altitude for each segment should be verified visually by in-flight or ground observation. [5.3.20f, g, and h covered under parameter GUIDANCE INDICATIONS.] i) Flyability. The verification of the flyability of an RNAV procedure can include independent assessments by procedure designers and other experts using specialist software, full flight simulators or even trial flights conducted by flight validation or flight inspection aircraft. Where a flight validation is required to address flyability aspects, the procedure designer should identify which procedures, or parts of a procedure, should be reviewed by the flight validator from a flyability perspective.		There is no Annex 10 tolerance to be checked. See facility type "Flight Procedures" for a more thorough discussion.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	Flyable	

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
	Measurement Uncertainty Subjective		
Annex10_ID	**8071_ID** 693	**8200_ID**	**Results_ID** 768

Facility SBAS **Parameter** Functions

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref 8071 Reference	8200 Reference	
ICAO Annex Text	**Doc 8071 Source Text**	**8200 Source Text**	**Comparison Remarks**
3.7.3.4.2 Functions. SBAS shall perform one or more of the following functions: a) ranging: provide an additional pseudo-range signal with an accuracy indicator from an SBAS satellite (3.7.3.4.2.1 and Appendix B, 3.5.7.2); b) GNSS satellite status: determine and transmit th GNSS satellite health status (Appendix B, 3.5.7.3); c) basic differential correction: provide GNSS satellite ephemeris and clock corrections (fast and long-term) to be applied to the pseudo-range measurements from satellites (Appendix B, 3.5.7.4) and d) precise differential correction: determine and transmit the ionospheric corrections (Appendix B, 3.5.7.5). Note. If all the functions are provided, SBAS in combination with core satellite constellation(s) can support departure, en-route, terminal and approach operations including Category I precision approach. The level of performance that can be achieved depends upon the infrastructure incorporated into SBAS and the ionospheric conditions in the geographic area of interest.			These functions are system design characteristics, and are tested during design qualification or ground testing activities.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
none		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
none		

Measurement Uncertainty

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
Annex10_ID	8071_ID	8200_ID	Results_ID
529			769

Facility **SBAS** **Parameter** **Guidance Indications**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref None

Annex Ref **8071 Reference** 5.3.20 **8200 Reference** 13.43b

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	5.3.20 Procedure validation. The instrument flight procedure should be evaluated for conformance with the procedure design and navaid signal reception. The following issues should also be addressed: a) Reception of navaid signals required for the procedure may be interrupted during aircraft banking or masked by terrain. When this is encountered, the instrument flight procedure may require modification. In some locations, modification may not mitigate this situation and th instrument flight procedure should be denied. Procedures that support azimuth-only approaches should be evaluated through the MAPt. Procedure with vertical guidance should be evaluated to the decision altitude. [5.3.20b, c, d and e covered under parameter GUIDANCE INDICATIONS.] f) Way-point accuracy. The way-points depicted o the procedure should be verified as properly labeled and correct. g) Bearing accuracy. Where applicable, the bearing, as depicted on the instrument approach procedure, should be evaluated for accuracy. h) Distance accuracy. Distances should be verifie for accuracy using a validated, automated flight inspection system, where applicable, or by using ground reference positions when conducting manual flight validation operations. [5.3.20i covered under parameter GUIDANCE INDICATIONS.]	b. WAAS Signal. To the extent possible, monitor WAAS signal while en route and during approach for anomalies. Print AFIS WAAS IO pages when anomalies are observed. Activate the AFIS data logger during approach inspections when WAAS anomalies are observed, and anytim GPS/ WAAS data may need additional evaluation ---------- [The following two paragraphs are duplicated under parameter INTERFERENCE for comparisol to Doc 8071.] If GPS interference is suspected, annotate on the flight inspection report any visual observation of radio, cellular or other facilities, which may be a possible source for emitting RFI. NOTE: Report interference to the FICO, who will i turn forward the report to the ATCSCC/ Spectrum Assignment and Engineering Office at Herndon, Virginia. ---------- c. Parameters. There are no flight inspection tolerances applied to the parameters. However, the values listed below (Table 13-1) provide a baseline for analysis of any WAAS signal anomalies or interference. The parameters in Table 13-1 must be documented throughout the Intermediate and Final Approach Segments and whenever anomalies are found during any phase of the flight inspection. Table 13-1 Parameter Expected Value HPL (1) ≤ 40 meters VPL (1) ≤ 50 meters HDOP 1.0 - 1.5 VDOP 1.0 - 1.5 WAAS Healthy Satellites 4 GPS & 1 GEO minimum Satellites Tracked 4 GPS & 1 GEO minimum Satellites in View 4 GPS & 1 GEO minimum	There is no Annex 10 tolerance to be checked. See facility type "Flight Procedures" for a more thorough discussion.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		Geostationary Satellite SNR (2) ≥ 30 dB/ Hz WAAS Sensor Status "SBAS" Footnotes: (1) Extreme solar storm activity may affect HPL/ VPL values and other WAAS signal parameters. (2) SNR is not received from a WAAS GEO if it is not sending ranging messages.	

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	Continuous	none

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

None

Annex10_ID	8071_ID	8200_ID	Results_ID
	694	462	770

Facility **SBAS** **Parameter** **Interference**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

Annex Ref **SARPS Ref** B3.7 **8071 Reference** 3.3.5 **8200 Reference** 13.42c, 13.43b, 23

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	3.3.5 SBAS receiver standards require that receivers not provide hazardously misleading information in the presence of radio frequency interference. Excessive interference will therefore affect continuity and availability, rather than integrity. The loss of SBAS correction signals and/or the loss of guidance have proven to be goc indicators of probable GNSS and/or SBAS interference. If interference is suspected, further investigation should be conducted. Some States may require a pre-commissioning survey of the interference environment. The suspected area should be probed and spectrum analysis accomplished to define its geographical extent. GNSS and SBAS parameters such as carrier-to-noise density (C/NO), horizontal and vertical protection levels, satellites tracked and DOP should be documente to aid further investigation. If interference is confirmed, the approach procedure should be removed from operational status, pending corrective action, and appropriate authorities notified. For more details, refer to Chapter 1, Attachment 3.	13.42c(3) WAAS Interference. If interference is suspected, record additional data from the two following runs. Evaluation of the final approach segment for interference is accomplished by flying along the left and right edges of primary FAS obstruction trapezoid. (Create a route using 90° offset waypoints 0.3 nm from the PFAF and 0.1 nm from the Missed Approach Waypoint (MAWP), respectively, with a vertical angle at least 1° less than the procedure GPA (full scale fly-up). This will provide lateral/ vertical guidance slightly outside the "W" obstacle clearance surface.) Assure that a full fly-up indication is provided below the approach GPA on FAS centerline and along edges of the primary FAS obstruction trapezoid. ---------- [The following two paragraphs are copied from parameter GUIDANCE INDICATIONS for direct comparison with Doc 8071 text.] If GPS interference is suspected, annotate on the flight inspection report any visual observation of radio, cellular or other facilities, which may be a possible source for emitting RFI. NOTE: Report interference to the FICO, who will i turn forward the report to the ATCSCC/ Spectrum Assignment and Engineering Office at Herndon, Virginia. ---------- 23.10 INTRODUCTION. The radio frequency spectrum, particularly in the VHF communication and navigation bands, is the subject of increasing interference from many sources. This chapter describes the role of flight inspection and presents techniques of flight inspection in the location of Radio Frequency Interference (RFI) to Communications, Navigation, and Surveillance (CNS) systems, including satellite Global Positioning System (GPS). 23.14a(5) Autonomous GPS recording capability i	ICAO's Annex 10 does not contain any implied flight inspection requirements for SBAS interference. ICAO's Doc 8071 discusses interference in general terms in Volume 1, Chapter 1, and again in Volume 2, Chapter 1 in more GNSS-specific terms.

available in some flight inspection aircraft. It continually monitors the GPS signal for any anomalies and stores up to 24 "events" of unsatisfactory GPS data. The airborne technician should monitor this capability and report any new "Events" to the FICO.

23.14b(2) The second method, particularly useful for finding GPS interference, requires antennas both on the top and bottom of the aircraft feeding separate sensors. With the bottom antenna fed to a receiver or spectrum analyzer and the top to a GPS receiver, the aircraft is banked to both sides. As the GPS interference will be from the ground, banking the aircraft away from the interferer exposes the bottom sensor antenna to more of the interfering signal, decreasing the SNR. It also shades the top antenna from the ground interference and increases the SNR on that receiver. No significant change while banking either left or right indicates the interference is in front or behind the aircraft. Changes in direction can eventually narrow the search area.

23.15b. Analyze the interfering signal as much as possible, using the equipment and techniques in Table 23-1, to provide as much information as possible to the Regional
FMO. [Table 23-1 specifies use of a spectrum analyzer for GPS interference.]

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	No alerts and continuous guidance	23.16 TOLERANCES. Tolerances applicable to specific facilities are contained in their individual chapters of this order.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
	This is the only SBAS parameter unique to the facility type - all other parameters are either desig characteristics, or are common to instrument fligh procedures based on any type of navaid.	The "8200 Source" field of this record contains all paragraphs that specifically mention GPS in the interference context. There are no references in Chapter 23 of 8200.1 to SBAS.

Measurement Uncertainty

None

Annex10_ID	8071_ID	8200_ID	Results_ID
	695	463	771

Facility **SBAS** **Parameter** **LNAV/VNAV**

8200/Annex (sub)parameter Compare Results

8200 doesn't meet A10 for any

Annex Ref	SARPS Ref / 8071 Reference	8200 Reference	13.44

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
			Table 13-3 is not referenced anywhere in Order 8200.1, Chapter 13. There is no text in Chapter 13 of Order 8200.1 that addresses LNAV/VNAV (other than in the Introductory description), and no text that refers the flight inspector to the tolerances in Table 13-3 As a result, although Order 8200.1 goes beyond the content of ICAO Doc 8071 for LNAV/VNAV, this parameter is marked as "8200 doesn't meet A10 for any [subparameters]", as a reminder to address this anomaly.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		Table 13-3. AFIS Announced Data (WAAS Supported LNAV/ VNAV without FAS Data) Final Approach Segment (FAS) Parameter Tolerance WAAS Horizontal Protection Level (HPL) ≤ 556 m WAAS Vertical Protection Level (VPL) ≤ 50m SNR-W ≥ 30 dB/ Hz

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
	696	464	772

Facility **SBAS** **Parameter** **LPV**

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for all

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 13.41c, 13.42, 13.44

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		13.41c. WAAS Status. Determine WAAS status before every flight inspection and after an inspection that detects anomalies. WAAS/ GPS NOTAM(s) and GPS Service Interruptions (interference testing) location and schedule should be considered. Severe solar storm activity may adversely affect WAAS availability for approach. 13.42 FLIGHT INSPECTION PROCEDURES. The RNAV WAAS/ LPV procedure must be inspected IAW Chapter 6, Flight Inspection of Instrument Flight Procedures, and this chapter. FAA Orders 8260.54, The United States Standard for Area Navigation (RNAV); and 8260.48, Area Navigation (RNAV) Approach Construction Criteria, contain required obstruction clearance criteria. b. Detailed Procedures (1) For RNAV WAAS/ LPV, do not deselect any navigation sensors. (2) Paper recordings and electronic collection of data are required. During an RNAV WAAS/ LPV approach, document WAAS data starting from the intermediate waypoint inbound to the Landing Threshold Point (LTP)/ Fictitious Threshold Point (FTP). A flight inspection 'low approach' is required to provide back corrections for data analysis. Also document WAAS data on below-glide-path runs. c. Aircraft Positioning (1) Commissioning (a) The FAS positioning must be on course, on path. Evaluate the Glide Path Angle (GPA) course guidance, WAAS positioning, and delivery alignment throughout the final approach segment. (b) Confirm WAAS full scale fly-up in the FAS by conducting a below glide-path run on course centerline with a vertical angle at least one degree less than the procedure GPA.	ICAO Doc 8071, Volume 2, does not specifically address LPV tolerances in the SBAS chapter. Table 13-2 (Tolerances for LPV approaches) is not referenced anywhere in 8200.1.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		(2) Periodic. The final approach segment positioning must be on course, on path. Evaluate the GPA, course guidance, WAAS positioning, and delivery alignment throughout the final approach segment.	

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		Table 13-2: WAAS Horiz Protection Level (HPL) ≤ 40 m WAAS Vertical Protection Level (VPL) ≤ 35 meters (200 - 249' approach minima) ≤ 50 meters (≥250' approach minima) Signal-to-Noise Ratio (SNR-W) ≥30 dB/ Hz Course Alignment ± 0.1° of true course Glide Path Alignment ± 0.09° Threshold Crossing Height + 12 ft -10 ft

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
		465	773

Facility **SBAS** **Parameter** **MAPt or DA**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref None

Annex Ref **8071 Reference** 5.3.21 **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	5.3.21 The position of the missed approach point (MAPt) must be confirmed with respect to the physical environment. This verification may be achieved either visually or electronically, and descent below the published minima may be necessary. A truth system may be used when visual verification is not practical, such as for over water or some non-threshold MAPts. Consideration must be given to the types of aircra that will be using the procedure and the runway environment.		There is no Annex 10 tolerance to be checked. See facility type "Flight Procedures" for a more thorough discussion.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	Visual verification of Displacement	

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Subjective

Annex10_ID	8071_ID	8200_ID	Results_ID
	697		774

Facility SBAS **Parameter** Navigation Information

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref 8071 Reference	8200 Reference

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.7.3.4.6 Navigation information. The navigation da transmitted by the satellites shall include the necessary information to determine: a) SBAS satellite time of transmission; b) SBAS satellite position; c) corrected satellite time for all satellites; d) corrected satellite position for all satellites; e) ionospheric propagation delay effects; f) user position integrity; g) time transfer to UTC; and h) service level status. Note. Structure and contents of data are specified i Appendix B, 3.5.3 and 3.5.4, respectively.			These parameters are system design characteristics, and are tested during design qualification or ground testing activities.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
none		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
These parameters are system design characteristics, and are tested during design qualification or ground testing activities.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
530			775

Facility **SBAS** **Parameter** **Performance**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref 8071 Reference	8200 Reference	
ICAO Annex Text	**Doc 8071 Source Text**	**8200 Source Text**	**Comparison Remarks**
3.7.3.4.1 Performance. SBAS combined with one o more of the other GNSS elements and a fault-free receiver shall meet the requirements for system accuracy, integrity, continuity and availability for the intended operation as stated in 3.7.2.4. Note. SBAS complements the core satellite constellation(s) by increasing accuracy, integrity, continuity and availability of navigation provided within a service area, typically including multiple aerodromes.			This is a system definition, with no flight inspection requirement.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
none		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
none		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
531			776

Facility SBAS **Parameter** Procedure Design Validation

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

SARPS Ref none

Annex Ref **8071 Reference** 5.3 **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	All Segments (Details are found Facility Type 'Flight Procedures') Objective 5.3.1 The objective of the flight inspection and flight validation evaluation of instrument flight procedures is to assure that the navigation source supports the procedure, ensures obstacle clearance, and checks the flyability of the design. The following activities should be accomplished: a) Verify the obstacle that serves as the basis for computing the minimum altitude in each segment of the IAP. b) Evaluate aircraft manoeuvring areas for safe operations for each category of aircraft for which the procedure is intended. c) Review the instrument procedure for complexity of design, and evaluate the intensity of the cockpi workload to determine if any unique requirements adversely impact safe operating practices. Check for correctness of information, propriety and ease of interpretation. d) If appropriate, verify that all required runway markings, lighting and communications are in place and operative. 5.3.2 The flight validation of an instrument flight procedure and verification of the obstacle data ma be conducted during the associated navigation aic inspection if visual meteorological conditions (VMC) prevail throughout each segment. Verification of obstacle clearance 5.3.3 Original flight procedures. A ground or in-flight obstacle verification should be conducted fo each route segment during the development of original flight procedures. 5.3.4 Identification of new obstacles. When new		There is no Annex 10 tolerance to be checked. See facility type "Flight Procedures" for a more thorough discussion of the in-flight validation.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
	obstacles are discovered during flight validation activities, the fight validator should identify the location and height of the new obstruction(s) and provide the information to the procedure specialis Procedure commissioning should be denied until the procedure specialist's analysis has been completed and the flight procedure adjusted as appropriate. 5.3.5 Determination of obstacle heights. If in-flight height determination of obstacles or terrain is required, accurate altimeter settings and altitude references are necessary to obtain the most accurate results possible. The method of obstacle height determination should be documented on th flight validation report.		

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	none	

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
	The procedural aspects of SBAS flight inspection are essentially duplicative of flight inspecting all Procedures. See Facility Type 'Flight Procedures for a more comprehensive assessment.	

Measurement Uncertainty

N/A

Annex10_ID	8071_ID	8200_ID	Results_ID
	698	466	777

Facility SBAS **Parameter** Ranging

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref 8071 Reference	8200 Reference

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.7.3.4.2.1 Ranging 3.7.3.4.2.1.1 Excluding atmospheric effects, the range error for the ranging signal from SBAS satellites shall not exceed 25 m (82 ft) (95 per cent) 3.7.3.4.2.1.2 The probability that the range error exceeds 150 m (490 ft) in any hour shall not exceed 10-5 [1x10e-5]. 3.7.3.4.2.1.3 The probability of unscheduled outage of the ranging function from an SBAS satellite in an hour shall not exceed 10-3. [1x10e-3] 3.7.3.4.2.1.4 The range rate error shall not exceed 2 m (6.6 ft) per second. 3.7.3.4.2.1.5 The range acceleration error shall not exceed 0.019 m (0.06 ft) per second-squared.			These paragraphs define SBAS characteristics in the Range domain (per SBAS satellite), rather than the Position domain, which is normally used for flight inspection. These parameters are system design characteristics, and are tested during design qualification or ground testing activities.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Range error <=25m, excl atmospheric effects Probability exceeding 150m <= 1x10e-5 Probability of unscheduled outages of SBAS satellite in any hour <= 1x10e-3 Range rate <= 2m/s Range Acceleration <= 0.019m/s/s		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
These paragraphs define SBAS characteristics in the Range domain (per SBAS satellite), rather than the Position domain, which is normally used for flight inspection.		

Measurement Uncertainty

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
Annex10_ID	8071_ID	8200_ID	Results_ID
532			778

Facility SBAS **Parameter** RF Characteristics

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref 8071 Reference	8200 Reference	
ICAO Annex Text	**Doc 8071 Source Text**	**8200 Source Text**	**Comparison Remarks**
3.7.3.4.4 RF characteristics Note. Detailed RF characteristics are specified in Appendix B, 3.5.2. 3.7.3.4.4.1 Carrier frequency. The carrier frequency shall be 1 575.42 MHz. Note. After 2005, when the upper GLONASS frequencies are vacated, another type of SBAS may be introduced using some of these frequencies. 3.7.3.4.4.2 Signal spectrum. At least 95 per cent of the broadcast power shall be contained within a ±12 MHz band centred on the L1 frequency. The bandwidth of the signal transmitted by an SBAS satellite shall be at least 2.2 MHz. 3.7.3.4.4.3 Signal power level. Each SBAS satellite shall broadcast navigation signals with sufficient power such that, at all unobstructed locations near the ground from which the satellite is observed at an elevation angle of 5 degrees or higher, the level of the received RF signal at the output of a 3 dBi linearly polarized antenna is within the range of -161 dBW to -153 dBW for all antenna orientations orthogonal to the direction of propagation. 3.7.3.4.4.4 Polarization. The broadcast signal shall be right-hand circularly polarized. 3.7.3.4.4.5 Modulation. The transmitted sequence shall be the Modulo-2 addition of the navigation message at a rate of 500 symbols per second and the 1 023 bit pseudo-random noise code. It shall then be BPSK-modulated onto the carrier at a rate of 1.023 megachips per second.			These parameters are system design characteristics, and are tested during design qualification or ground testing activities.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Bandwidth >= 2.2 MHz. Spectrum - >=95% broadcast power within +/- 12 MHz of L1 Frequency Received power level at mask angle >=5 degrees 161 dBW to -153 dBW Polarization: Right-hand, circular Modulation: Nav message added to 1023 bit PRN code, modulo-2, then BPSK modulated on carrier a 1.023 megachips/sec		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
These parameters are system design characteristics, and are tested during design qualification or ground testing activities.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
533			779

Facility SBAS **Parameter** SBAS Network Time

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref / 8071 Reference	8200 Reference

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.7.3.4.5 SBAS network time (SNT). The difference between SNT and GPS time shall not exceed 50 nanoseconds.			This parameter is a system design characteristic and is tested during design qualification or groun testing activities.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Within 50 ns of GPS time		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
This parameter is a system design characteristic, and is tested during design qualification or ground testing activities.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
534			780

Facility **SBAS** **Parameter** **Service Area**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref 8071 Reference	8200 Reference

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.7.3.4.3 Service area. The SBAS service area sha be a defined area within an SBAS coverage area where SBAS meets the requirements of 3.7.2.4 anc supports the corresponding approved operations. Note 1. The coverage area is that area within which the SBAS broadcast can be received (e.g. the geostationary satellite footprints). Note 2. SBAS coverage and service areas are discussed in Attachment D, 6.2.			This is a definition, with no flight inspection requirements [until a flight procedure is defined].

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
none		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
Definitional		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
535			781

Facility VGSI **Parameter** Airfield/System Contrast

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for all

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 7.12b(5)

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		(5) System Identification/ Contrast (a) General. VGSI(s) must provide a glidepath which is easily identifiable and readily distinguishable from other visual aids and aeronautical lights within the runway threshold an touchdown zone area. (b) Positioning. This evaluation is conducted during the other flight inspection maneuvers. (c) Evaluation. During the flight inspection maneuvers, observe if any surrounding lights or aircraft on taxiways interfere with the identification or use of the installed system. If there is any question of misidentification or interference, this inspection parameter should be checked at night. a specific problem can be identified during the da there is no requirement to confirm it at night.	This parameter is not addressed in ICAO Annex 10. ICAO has not published Doc 8071 coverage for VGSI systems.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		7.14e. Airfield/ System Contrast. The system mus provide a glidepath signal which is easily identifiable and readily distinguishable from other visual aids and aeronautical lights within the installed environment. Misidentifying or failure to readily acquire the VGSI system will require an unusable status designation.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
		There is no corresponding ICAO Annex 10 requirement, other than indirectly via its intensity design requirements.

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
		467	782

Facility **VGSI** **Parameter** **Angular Coverage**

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for all

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 7.12b(3)

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
ICAO Annex 10 indirectly defines angular coverage in Figures A2-22 and A2-23. These figures provide light intensity contours for each type of light unit, bu the widest contour defined extends to angular limits of 5 to 8 degrees either side of bore sight. Further, these light intensity contours are design characteristics, rather than operationally tested parameters. (See SYSTEM CHARACTERISTICS parameter.) ICAO Annex 10 defines an obstacle protection surface out to 10 degrees either side of system centerline. (See OBSTACLE PROTECTION SURFACE parameter.)		(3) Angular Coverage (a) General. VGSI(s) will provide coverage/ obstacle clearance 10° either side of the runway centerline extended, measured from abeam the first light bar/ box. Fly a perpendicular crossing to determine the horizontal angular coverage of the VGSI(s) during commissioning inspections. In addition, this check is used to verify a restriction i coverage if a blanking device is used to limit coverage of a system due to obstructions or other hazardous situations. If an offset ILS/ MLS is installed on the same runway as a VGSI (the VGS will be aligned to the runway), the angular relationships must be carefully analyzed to determine the coverage suitability. (b) Positioning. Check the angular coverage by crossing the extended runway centerline at a 90° angle at a sufficient distance to enable the flight inspector to observe any shielding effect on the system. Conduct the maneuver at an altitude whic provides an onpath indication. (c) Evaluation. Observe the point where the VGSI system becomes usable or unusable. The usable area is the angular coverage. For a system installed on only one side to be considered usable all lights must be visible. For dual side installation coverage from either side is required.	The 8200.1 tolerance requiring at least 10 degrees of coverage either side exceeds that of Annex 10, since Annex 10 does not directly defin a minimum angular coverage. It is possible that this 8200.1 tolerance of >= 10 degrees either side is actually relating to the definition of the obstacle protection surface, and being misapplied to the operationally achieved angular coverage. ICAO has not published Doc 8071 coverage for VGSI systems.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		7.14c. Angular Coverage. The VGSI(s) must provide guidance relative to the approach angle over a horizontal angle of not less than 10° either side of the runway centerline extended. When coverage or obstacle clearance is less than 10° either side of runway centerline, restrict the facility issue a NOTAM, and ensure publication in the Airport/ Facility Directory.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks	
	Measurement Uncertainty		

Annex10_ID	8071_ID	8200_ID	Results_ID
536		468	783

Facility VGSI **Parameter** Application

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref 8071 Reference	8200 Reference	
ICAO Annex Text	**Doc 8071 Source Text**	**8200 Source Text**	**Comparison Remarks**
5.3.5.1 A visual approach slope indicator system shall be provided to serve the approach to a runway whether or not the runway is served by other visual approach aids or by nonvisual aids, where one or more of the following conditions exist: a) the runway is used by turbojet or other aeroplane with similar approach guidance requirements; b) the pilot of any type of aeroplane may have difficulty in judging the approach due to: 1) inadequate visual guidance such as is experienced during an approach over water or featureless terrain by day or in the absence of sufficient extraneous lights in the approach area by night, or 2) misleading information such as is produced by deceptive surrounding terrain or runway slopes; c) the presence of objects in the approach area ma involve serious hazard if an aeroplane descends below the normal approach path, particularly if there are no non-visual or other visual aids to give warnin of such objects; d) physical conditions at either end of the runway present a serious hazard in the event of an aeroplane undershooting or overrunning the runway and e) terrain or prevalent meteorological conditions are such that the aeroplane may be subjected to unusu turbulence during approach. Note. Guidance on the priority of installation of visu approach slope indicator systems is contained in Attachment A, Section 12. 5.3.5.2 The standard visual approach slope indicato systems shall consist of the following: a) T-VASIS and AT-VASIS conforming to the specifications contained in 5.3.5.6 to 5.3.5.22			There are no flight inspection requirements in the application description for VGSI systems. ICAO has not published Doc 8071 coverage for VGSI systems.

inclusive;

b) PAPI and APAPI systems conforming to the specifications contained in 5.3.5.23 to 5.3.5.40 inclusive; as shown in Figure 5-15.

5.3.5.3 PAPI, T-VASIS or AT-VASIS shall be provided where the code number is 3 or 4 when one or more of the conditions specified in 5.3.5.1 exist.

5.3.5.4 PAPI or APAPI shall be provided where the code number is 1 or 2 when one or more of the conditions specified in 5.3.5.1 exist.

5.3.5.5 Recommendation. Where a runway threshold is temporarily displaced from the normal position and one or more of the conditions specified in 5.3.5.1 exist, a PAPI should be provided except that where the code number is 1 or 2 an APAPI may be provided.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
(none)		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
This text defines when VGSIs should be installed, and the standard types of VGSIs.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
537			784

Facility VGSI **Parameter** Light Intensity

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 7.12b(1)

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		(1) Light Intensity (a) General. Depending on the type of VGSI(s) an system design, the light intensity can be either manually or automatically controlled for daylight o darkness operations Some systems have three settings which allow for daylight, twilight, and dark operations. Maintenance can select one or two options for night operations to accommodate loca site conditions for some systems. (b) Positioning. For facilities that are manually controlled, fly inbound while the controller change the intensity settings to all operating ranges. Systems that use the automatic intensity settings should be checked the same as the manually controlled systems, if a method of changing the intensity is available. Intensity should be observe throughout the flight inspection. (c) Evaluation. Ensure all lamps are operating an are at the same relative intensity for each setting. possible, the flight inspection should not be made during bright sunlight as it will reduce the effectiveness of the VGSI(s). The normal intensity setting for daylight operation is 100 percent, for twilight periods 30 percent, and for hours of darkness 10 percent.	Recommendation: If intended, embed the apparent requirement that all light units be operating into the paragraph 7.14a tolerance. ICAO has not published Doc 8071 coverage for VGSI systems.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		7.14a. Light intensity. All lights must operate at th same relative intensity at each setting.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
		There is no corresponding ICAO Annex 10 requirement, other than indirectly via its intensity design requirements (in the SYSTEMS CHARACTERISTICS parameter). The tolerance in 8200.1 para 7.14a does not specifically address the apparent requirement in

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		7.12b(1)c that all lights be operating (i.e., can a system be successfully flight inspected with one c some burned-out lamps?	
	Measurement Uncertainty		

Annex10_ID	8071_ID	8200_ID	Results_ID
		469	785

Facility **VGSI** **Parameter** **Obstacle Clearance**

8200/Annex (sub)parameter Compare Results

8200 doesn't meet A10 for any

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 7.12b(4)

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
(Following paragraphs duplicated from the SYSTEM SETTINGS parameter) (TVASI Systems) 5.3.5.22 The azimuth spread of the light beam shall be suitably restricted where an object located outsid the obstacle protection surface of the system, but within the lateral limits of its light beam, is found to extend above the plane of the obstacle protection surface and an aeronautical study indicates that the object could adversely affect the safety of operations. The extent of the restriction shall be such that the object remains outside the confines o the light beam. (PAPI Systems) 5.3.5.39 The azimuth spread of the light beam shall be suitably restricted where an object located outsid the obstacle protection surface of the PAPI or APAPI system, but within the lateral limits of its ligh beam, is found to extend above the plane of the obstacle protection surface and an aeronautical study indicates that the object could adversely affec the safety of operations. The extent of the restrictio shall be such that the object remains outside the confines of the light beam. Note. See 5.3.5.41 to 5.3.5.45 concerning the related obstacle protection surface.		(4) Obstruction Clearance (a) General. The visual glidepath should be at lea 1° above all obstacles in the final approach area. The VGSI(s) must provide clearance above all obstacles within the commissioned operational service volume. Figures 7-D/ G/ H/ J diagram the aiming of light boxes and installation obstruction clearance requirements for the different type VGS systems. Flight inspection does not verify obstruction clearance as determined by site survey. It does verify that specific VGSI below pat indications clear all obstacles within the COMMISSIONED OPERATIONAL SERVICE VOLUME. The below-path approach is conducted during commissioning inspections and anytime there is a questionable obstruction to determine satisfactory guidance and obstruction clearances. (b) Positioning. Position the aircraft outside of the normal glide slope intercept distance below the glidepath. While proceeding inbound, a definite below path indication must be visible on the VGSI(s) while maintaining clearance above all obstacles in the approach path. (c) Evaluation. Make approaches on runway centerline extended and along each side of the approach area from the point where the VGSI's angle intercepts 1,000 ft AGL or procedural altitude, whichever is higher. If the lateral coverag extremities can be checked for obstacle clearance while flying the runway centerline track, a single inbound run may be used. A definite climb indication must be evidenced by the system while maintaining clearance above all obstacles. If necessary, use a theodolite to verify a critical obstacle. The followin climb indications must be visible while maintaining clearance above all obstacles: 1 VASI. A definite RED/ RED light must be visible on both upwind and downwind bars while maintaining clearance above all obstacles.	8200.1 requires angular coverage to AT LEAST 10 degrees either side, which either intentionally or accidentally matches the definition of an obstacle protection surface. However, the Annex 10 requirements in 5.3.5.22 and 5.3.5.39 are to physically restrict the light beams whenever an object OUTSIDE the 10 degree limit of the defined surface is within the lateral limit of the light beams. 8200.1 does not directly address objects outside the 20-degree wide surface but yet within the ligh beam azimuthal coverage. Further, the referenced Figures 7-D/G/H/J are merely side views of the vertical structure of the VGSI systems, and do not define lateral characteristics Finally, the definition of "commissioned operational service volume" is not clear or define Recommendation: Modify 8200.1 to ensure that these lighting systems are baffled when the angular azimuthal coverage exceed +/- 10 degrees, and there are objects in that area above the obstacle protection surface. Also, provide a definition for commissioned operational service volume. If these changes are made, there is no need to file a difference with ICAO.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		2 PAPI. A definite RED must be visible on all light boxes while maintaining clearance above all obstacles. 3 PVASI/ HAPI. A definite flashing RED must be visible on the light unit while maintaining clearanc above all obstacles. 4 T-VASI. A definite RED must be observed on al 4 horizontal and all 3 vertical lights while maintaining clearance above all obstacles.	

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		7.14d. Obstacle Clearance. A definite fly-up indication must be visible while maintaining clearance above all obstacles within the approach area.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
		The apparent tolerances in 712b(4)c(1) through (4 are more definitive than those in 7.14d.

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
538		470	786

Facility VGSI **Parameter** Obstacle Protection Surface

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref 8071 Reference	8200 Reference	
ICAO Annex Text	**Doc 8071 Source Text**	**8200 Source Text**	**Comparison Remarks**
Note. The following specifications apply to T-VASIS AT-VASIS, PAPI and APAPI. 5.3.5.41 An obstacle protection surface shall be established when it is intended to provide a visual approach slope indicator system. 5.3.5.42 The characteristics of the obstacle protection surface, i.e. origin, divergence, length an slope shall correspond to those specified in the relevant column of Table 5-3 and in Figure 5-20. [Table 5-3 and Figure 5-20 not included here.] 5.3.5.43 New objects or extensions of existing objects shall not be permitted above an obstacle protection surface except when, in the opinion of th appropriate authority, the new object or extension would be shielded by an existing immovable object. Note. Circumstances in which the shielding principl may reasonably be applied are described in the Airport Services Manual, Part 6. 5.3.5.44 Existing objects above an obstacle protection surface shall be removed except when, i the opinion of the appropriate authority, the object i shielded by an existing immovable object, or after aeronautical study it is determined that the object would not adversely affect the safety of operations aeroplanes. 5.3.5.45 Where an aeronautical study indicates tha an existing object extending above an obstacle protection surface could adversely affect the safety of operations of aeroplanes one or more of the following measures shall be taken: a) suitably raise the approach slope of the system; b) reduce the azimuth spread of the system so that the object is outside the confines of the beam; c) displace the axis of the system and its associate obstacle protection surface by no more than 5°;			This Annex 10 text deals entirely with establishin a surface, clearing it, and reacting to changes in the violation status of the surface. There are no flight inspection requirements defined. ICAO has not published Doc 8071 coverage for VGSI systems.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

d) suitably displace the threshold; and

e) where d) is found to be impracticable, suitably displace the system upwind of the threshold to provide an increase in threshold crossing height equal to the height of the object penetration.

Note. Guidance on this issue is contained in the Aerodrome Design Manual, Part 4.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Surface characteristics per Table 5-3 and Figure 5 20;		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
This text deals both with the initial establishment o the surface, and how to deal with changes in the operational environment. It does not define any obstacle clearance requirements from a flight inspection perspective.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
539			787

Facility VGSI **Parameter** PAPI Systems Description

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref 8071 Reference	8200 Reference

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
5.3.5.23 The PAPI system shall consist of a wing bar of 4 sharp transition multi-lamp (or paired single lamp) units equally spaced. The system shall be located on the left side of the runway unless it is physically impracticable to do so. Note. Where a runway is used by aircraft requiring visual roll guidance which is not provided by other external means, then a second wing bar may be provided on the opposite side of the runway. 5.3.5.24 The APAPI system shall consist of a wing bar of 2 sharp transition multi-lamp (or paired single lamp) units. The system shall be located on the left side of the runway unless it is physically impracticable to do so. Note. Where a runway is used by aircraft requiring visual roll guidance which is not provided by other external means, then a second wing bar may be provided on the opposite side of the runway. 5.3.5.25 The wing bar of a PAPI shall be constructed and arranged in such a manner that a pilot making an approach will: a) when on or close to the approach slope, see the two units nearest the runway as red and the two units farthest from the runway as white; b) when above the approach slope, see the one unit nearest the runway as red and the three units farthest from the runway as white; and when further above the approach slope, see all the units as white and c) when below the approach slope, see the three units nearest the runway as red and the unit farthest from the runway as white; and when further below the approach slope, see all the units as red. 5.3.5.26 The wing bar of an APAPI shall be constructed and arranged in such a manner that a pilot making an approach will:			There are no flight inspection requirements in the system description for PAPI systems. ICAO has not published Doc 8071 coverage for VGSI systems.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

a) when on or close to the approach slope, see the unit nearer the runway as red and the unit farther from the runway as white;

b) when above the approach slope, see both the units as white; and

c) when below the approach slope, see both the units as red.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
(none)		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
This text is descriptive only, and does not contain any testable parameters suitable for flight testing.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
540			788

Facility VGSI **Parameter** System Characteristics

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref / 8071 Reference	8200 Reference	ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
			[TVASI Systems] 5.3.5.10 The systems shall be suitable for both day and night operations. 5.3.5.11 The light distribution of the beam of each light unit shall be of fan shape showing over a wide arc in azimuth in the approach direction. The wing bar light units shall produce a beam of white light from 1°54′ vertical angle up to 6° vertical angle and beam of red light from 0° to 1°54′ vertical angle. Th fly-down light units shall produce a white beam extending from an elevation of 6° down to approximately the approach slope, where it shall have a sharp cut-off. The fly-up light units shall produce a white beam from approximately the approach slope down to 1°54′ vertical angle and a red beam below a 1°54′ vertical angle. The angle of the top of the red beam in the wing bar units and fly up units may be increased to comply with 5.3.5.21. 5.3.5.12 The light intensity distribution of the fly-down, wing bar and fly-up light units shall be as shown in Appendix 2, Figure A2-22. 5.3.5.13 The colour transition from red to white in th vertical plane shall be such as to appear to an observer, at a distance of not less than 300 m, to occur over a vertical angle of not more than 15′. 5.3.5.14 At full intensity the red light shall have a Y coordinate not exceeding 0.320. 5.3.5.15 A suitable intensity control shall be provide to allow adjustments to meet the prevailing conditions and to avoid dazzling the pilot during approach and landing. 5.3.5.16 The light units forming the wing bars, or the light units forming a fly-down or a fly-up matched pair, shall be mounted so as to appear to the pilot c an approaching aeroplane to be substantially in a horizontal line. The light units shall be mounted as low as possible and shall be frangible.			This text defines design characteristics of VGSI systems. These attributes are appropriate only f design qualification testing and/or ground maintenance practices. Flight testing does not address these characteristics. ICAO has not published Doc 8071 coverage for VGSI systems.

5.3.5.17 The light units shall be so designed that deposits of condensation, dirt, etc., on optically transmitting or reflecting surfaces shall interfere to the least possible extent with the light signals and shall in no way affect the elevation of the beams or the contrast between the red and white signals. The construction of the light units shall be such as to minimize the probability of the slots being wholly or partially blocked by snow or ice where these conditions are likely to be encountered.

[PAPI Systems]

5.3.5.28 The system shall be suitable for both day and night operations.

5.3.5.29 The colour transition from red to white in th vertical plane shall be such as to appear to an observer, at a distance of not less than 300 m, to occur within a vertical angle of not more than 3′.

5.3.5.30 At full intensity the red light shall have a Y coordinate not exceeding 0.320.

5.3.5.31 The light intensity distribution of the light units shall be as shown in Appendix 2, Figure A2-23

Note. See the Aerodrome Design Manual, Part 4 fo additional guidance on the characteristics of light units.

5.3.5.32 Suitable intensity control shall be provided so as to allow adjustment to meet the prevailing conditions and to avoid dazzling the pilot during approach and landing.

5.3.5.33 Each light unit shall be capable of adjustment in elevation so that the lower limit of the white part of the beam may be fixed at any desired angle of elevation between 1°30′ and at least 4°30′ above the horizontal.

5.3.5.34 The light units shall be so designed that deposits of condensation, snow, ice, dirt, etc., on optically transmitting or reflecting surfaces shall interfere to the least possible extent with the light signals and shall not affect the contrast between the red and white signals and the elevation of the transition sector.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
[TVASI] Wing bar white: 1 deg 54 min up to 6 deg vertical Wing bar red: 0 deg to 1 deg 54 min vertical Fly down white: 6 deg to approx approach slope vertical Fly up white: approx approach slope down to 1 deg 54 min vertical Fly up red: below 1 deg, 54 min vertical Intensity per Appendix 2, Figure A2-22 Red-white transition within 15 minutes of vertical angle [PAPI] Red/White transition @ >300m within <= 3 minutes vertical; Light intensity per Appendix 2, Figure A2-23;		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
TVASI text includes azimuthal extent, intensity, and installation requirements. PAPI text includes a mixture of design goal and operational setting parameters.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
541			789

Facility VGSI **Parameter** System Settings

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref / 8071 Reference	8200 Reference

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
[5.3.5.18 - 5.3.5.22 TVASI System Settings] [following two paragraphs duplicated in the VISUAL GLIDE PATH ANGLE parameter] 5.3.5.18 The approach slope shall be appropriate fo use by the aeroplanes using the approach. 5.3.5.19 When the runway on which a T-VASIS is provided is equipped with an ILS and/or MLS, the siting and elevations of the light units shall be such that the visual approach slope conforms as closely as possible with the glide path of the ILS and/or the minimum glide path of the MLS, as appropriate. 5.3.5.20 The elevation of the beams of the wing bar light units on both sides of the runway shall be the same. The elevation of the top of the beam of the fl up light unit nearest to each wing bar, and that of th bottom of the beam of the flydown light unit nearest to each wing bar, shall be equal and shall correspond to the approach slope. The cut-off angle of the top of the beams of successive fly-up light units shall decrease by 5″ of arc in angle of elevatio at each successive unit away from the wing bar. Th cut-in angle of the bottom of the beam of the fly-down light units shall increase by 7′ of arc at each successive unit away from the wing bar (see Figure 5-17). 5.3.5.21 The elevation setting of the top of the red light beams of the wing bar and fly-up light units shall be such that, during an approach, the pilot of an aeroplane to whom the wing bar and three fly-up light units are visible would clear all objects in the approach area by a safe margin if any such light dic not appear red. [following paragraph duplicated in the OBSTACLE CLEARANCE parameter.] 5.3.5.22 The azimuth spread of the light beam shall be suitably restricted where an object located outsic the obstacle protection surface of the system, but within the lateral limits of its light beam, is found to			Most of the text in Annex 10 for this parameter is not subject to flight testing. Rather, it is a mixture of adjustments, siting, and installation requirements. The portions on coincidence with electronic aids and azimuthal coverage are duplicated in the VISUAL GLIDE PATH ANGLE and ANGULAR COVERAGE parameters respectively. ICAO has not published Doc 8071 coverage for VGSI systems.

extend above the plane of the obstacle protection surface and an aeronautical study indicates that the object could adversely affect the safety of operations. The extent of the restriction shall be such that the object remains outside the confines of the light beam.

[5.3.5.35 - 5.3.5.40 PAPI System Settings]

[following two paragraphs duplicated in the VISUAL GLIDE PATH ANGLE parameter]

5.3.5.35 The approach slope as defined in Figure 5-19 shall be appropriate for use by the aeroplanes using the approach.

5.3.5.36 When the runway is equipped with an ILS and/or MLS, the siting and the angle of elevation of the light units shall be such that the visual approach slope conforms as closely as possible with the glide path of the ILS and/or the minimum glide path of the MLS, as appropriate.

5.3.5.37 The angle of elevation settings of the light units in a PAPI wing bar shall be such that, during an approach, the pilot of an aeroplane observing a signal of one white and three reds will clear all objects in the approach area by a safe margin.

5.3.5.38 The angle of elevation settings of the light units in an APAPI wing bar shall be such that, during an approach, the pilot of an aeroplane observing the lowest onslope signal, i.e. one white and one red, will clear all objects in the approach area by a safe margin.

[following paragraph duplicated in the OBSTACLE CLEARANCE parameter.]

5.3.5.39 The azimuth spread of the light beam shall be suitably restricted where an object located outside the obstacle protection surface of the PAPI or APAPI system, but within the lateral limits of its light beam, is found to extend above the plane of the obstacle protection surface and an aeronautical study indicates that the object could adversely affect the safety of operations. The extent of the restriction shall be such that the object remains outside the confines of the light beam.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

Note. See 5.3.5.41 to 5.3.5.45 concerning the related obstacle protection surface.

5.3.5.40 Where wing bars are installed on each side of the runway to provide roll guidance, correspondin units shall be set at the same angle so that the signals of each wing bar change symmetrically at th same time.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Runway with ILS and/or MLS: visual approach slope conforms ACAP with glide path or minimum glide path of MLS;		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
This text includes a mixture of adjustments (e.g., approach slope), siting requirements (e.g., elevatic of wing bar light unit beams, clearance of objects), and light unit modifications (e.g., restriction of azimuth coverage via baffling). Except for the paragraphs noted, none of these paragraphs represents flight testing requirements.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
542			790

Facility VGSI **Parameter** System Siting

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref 8071 Reference	8200 Reference	ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
			[TVASI Siting] 5.3.5.9 The light units shall be located as shown in Figure 5-16, subject to the installation tolerances given therein. Note. The siting of T-VASIS will provide, for a 3° slope and a nominal eye height over the threshold c 15 m (see 5.3.5.6 and 5.3.5.19), a pilot's eye height over threshold of 13 m to 17 m when only the wing bar lights are visible. If increased eye height at the threshold is required (to provide adequate wheel clearance), then the approaches may be flown with one or more fly-down lights visible. The pilot's eye height over the threshold is then of the following order: Wing bar lights and one fly-down light visible 17 m to 22 m Wing bar lights and two fly-down lights visible 22 m to 28 m Wing bar lights and three fly-down lights visible 28 m to 54 m [Figure 5-16. Siting of light units for T-VASIS not included here] ---------- [PAPI Siting] 5.3.5.27 The light units shall be located as in the basic configuration illustrated in Figure 5-18, subjec to the installation tolerances given therein. The unit forming a wing bar shall be mounted so as to appea to the pilot of an approaching aeroplane to be substantially in a horizontal line. The light units shal be mounted as low as possible and shall be frangib [Figure 5-18. Siting of PAPI and APAPI not included here]			This Annex 10 text defines siting requirements fo the location of the light units, to produce the design value for eye height above threshold. It is not subject to flight testing. ICAO has not published Doc 8071 coverage for VGSI systems.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
ICAO Annex Tol	**Doc 8071 Tolerance**	**8200 Tolerance**	
[TVASI] Installed per Figure 5-18; low as possible; frangible [PAPI] Nominal Eye Height over Threshold - 13-17m			
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
	Measurement Uncertainty		

Annex10_ID	8071_ID	8200_ID	Results_ID
543			791

Facility VGSI **Parameter** TVASI Systems Description

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref / 8071 Reference	8200 Reference

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
5.3.5.6 The T-VASIS shall consist of twenty light units symmetrically disposed about the runway centre line in the form of two wing bars of four light units each, with bisecting longitudinal lines of six lights, as shown in Figure 5-16. 5.3.5.7 The AT-VASIS shall consist of ten light units arranged on one side of the runway in the form of a single wing bar of four light units with a bisecting longitudinal line of six lights. 5.3.5.8 The light units shall be constructed and arranged in such a manner that the pilot of an aeroplane during an approach will: a) when above the approach slope, see the wing bar(s) white, and one, two or three fly-down lights, the more flydown lights being visible the higher the pilot is above the approach slope; b) when on the approach slope, see the wing bar(s) white; and c) when below the approach slope, see the wing bar(s) and one, two or three fly-up lights white, the more fly-up lights being visible the lower the pilot is below the approach slope; and when well below the approach slope, see the wing bar(s) and the three fly-up lights red. When on or above the approach slope, no light shall be visible from the fly-up light units; when on or below the approach slope, no light shall be visible from the fly-down light units. [Figure 5-15. Visual approach slope indicator systems not included here]			There are no flight inspection requirements in the system description for TVASI systems. ICAO has not published Doc 8071 coverage for VGSI systems.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
(none)		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
This text is descriptive only, and does not contain		

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
any testable parameters suitable for flight testing			
	Measurement Uncertainty		

Annex10_ID	8071_ID	8200_ID	Results_ID
544			792

Facility VGSI **Parameter** Visual Glide Path Angle

8200/Annex (sub)parameter Compare Results

8200 tighter than Annex 10 for all

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 7.12, 7.12(b)2, (b)7

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
[Duplicated from the SYSTEM SETTINGS parameter.] [Subparameter 1 - Path Angle] (TVASI Systems) 5.3.5.18 The approach slope shall be appropriate fo use by the aeroplanes using the approach. [PAPI Systems] 5.3.5.35 The approach slope as defined in Figure 5 19 shall be appropriate for use by the aeroplanes using the approach. ---------- [Subparameter 2 - Coincidence with Electronic Aids (TVASI Systems) 5.3.5.19 When the runway on which a T-VASIS is provided is equipped with an ILS and/or MLS, the siting and elevations of the light units shall be such that the visual approach slope conforms as closely as possible with the glide path of the ILS and/or the minimum glide path of the MLS, as appropriate. (PAPI Systems) 5.3.5.36 When the runway is equipped with an ILS and/or MLS, the siting and the angle of elevation of the light units shall be such that the visual approach slope conforms as closely as possible with the glide path of the ILS and/or the minimum glide path of the MLS, as appropriate.		[Subparameter 1 - Path Angle] [excerpt from header text in 7.12] If the flight inspection effective glidepath angle is found out of tolerance IAW Paragraph 7.14b, the VGSI vertical alignment angles may be adjusted beyond Order 6850.5, Maintenance of Lighted Navigational Aids, tolerances to satisfy flight inspection results. These reference settings will b the basis for all future VGSI vertical alignments. [paragraph 7.12(b)2] (2) Glidepath Angle (a) General. VGSI(s) provide vertical guidance for a VFR approach or for the visual portion of an instrument approach. The angle established by th VGSI(s) is referred to as the visual glidepath angl The signal formats used to establish the visual glidepath angle can vary from a single light source two or three light sources in a longitudinal array, and four or more light sources in a lateral and/or longitudinal array. Setting the required visual angl is a function of ground installation personnel. (See Figures 7-D and G.) (b) Positioning 1 Level Run Method. This method can be used with AFIS or ground checkpoint distances at locations where ground checkpoint distances are known. Position the aircraft inbound on the runwa centerline in the below path sector at the procedural intercept altitude or 1,000 ft AGL, whichever is higher. Proceed inbound while maintaining constant airspeed and altitude. 2 On-Path Method. Position the aircraft inbound o the runway centerline in the below path sector at the procedural intercept altitude or 1,000 ft AGL, whichever is higher. Upon reaching the glidepath indications, begin a descent and keep the aircraft	ICAO has not published Doc 8071 coverage for VGSI systems. [Subparameter 1 - Path Angle] 8200.1 exceeds ICAO requirements with the 0.2 degree angle limit. [Subparameter 2 - Coincidence with Electronic Aids] 8200 exceeds ICAO Annex 10 requirement

in the center of the on-glidepath indication.

3 Theodolite Positioning. Position the theodolite beside the runway so the imaginary glidepath, originating from a point abeam the runway reference point (RRP), will pass through the theodolite eyepiece. The RRP is the point on the runway where the visual glidepath intercepts the surface.

(c) Evaluation

1 The Level Run Method may be used to determi the path angle of all VGSI types. Average the results of at least two runs for commissioning-type inspections. Keeping a constant altitude and airspeed, the flight inspector marks the appropriat indications for the VGSI type. These are typically the below-path, the first on-path, the last on-path, and the first above-path indications, or the RED to WHITE changes of the individual PAPI boxes. Se the appropriate AFIS handbook for specific operational procedure. If a theodolite is used, the operator tracks the aircraft during the level run. The pilot calls when passing the desired indications, and the theodolite operator notes the angles. The center of the on-path indications is used as the glide path angle. For PAPI, the glide angle is the average of the angles measured whe the two boxes (Boxes 2 and 3 on 4-box systems) change from RED to WHITE.

2 On-Path Method. The on-path method, using AFIS or theodolite, may be used to determine the path angle of all VGSI types. See the appropriate AFIS handbook for specific operational procedure If theodolite is used, the operator tracks the pilot's window and notes the angles when the pilot repor the desired indication.

a VASI, PVASI, T-VASI, TRCV, and HAPI should be measured at the center of the on-path indicatio as defined in Paragraphs 7-10a, 7-10c, 7-10d, an 7-10f.

b PAPI Evaluation. Determine the angle of individual light boxes by measuring the angle the light box changes color from WHITE to RED and from RED to WHITE. Fly the color changes of a single box and measure the angle at which it changes colors. The light box angle is the average of not less than three light color changes in each direction. The PAPI angle is the average between

the angle of light boxes 2 and 3 of a 4-box system or light boxes 1 and 2 of a 2-box system as shown in Figure 7-H. For an accurate angle, you must average equal WHITE/ RED and RED/ WHITE calls; otherwise, the average is skewed in the direction of the larger number of calls. This is caused by the time delay in recognizing the color change, calling or marking the change, and recording the angle. There is no requirement to measure the angle of boxes 1 and 4 of a 4-box system unless, in the judgment of the flight inspector, the light boxes are out of symmetry with the overall system. If the symmetry is unacceptable, the angle of light boxes 1 and 4 should be measured so ground maintenance can make adjustments.

[Subparameter 2 - Coincidence with Electronic Aids]

[paragraph 7.12(b)7]

(7) Coincidence (ILS/ MLS/ PAR/ LAAS/ WAAS).

(a) General. When VGSI(s) and electronic glide path information serve the same runway, the visual approach path will coincide with the one produced electronically. VGSI installations are engineered to provide close RRP coincidence with the RPI (ILS, MLS, PAR) or the GPI (LAAS, WAAS), using the same commissioned angle for both systems. Siting conditions affecting the electronic aid's achieved RPI may result in achieved RPI/RRP coincidence values beyond installation specifications, but satisfactory for use. Noncoincidence of angles and/or intercept points may be allowed, providing they are published as such. Approved waivers to electronic glide slopes must apply to VGSI systems.

1 Height Group 4. Some PAPI and PVASI are installed to serve aircraft in Height Group 4 (FAA Order 6850.2, Visual Guidance Lighting Systems). The RRP of these systems is engineered to be 300 - 350 ft down the runway from the electronic RPI. PAPI or PVASI sited to support height group 4 must be identified in Airport/ Facility Directories or similar publications.

2 Barometric Vertical Navigation (VNAV) Instrument Procedures Development will cause VNAV path angles to be published on non-precision approaches. Whenever possible, the

VGSI should be coincident with the VNAV path angle.

(b) Positioning. For systems installed to support aircraft in Height Groups 1, 2, and 3, fly the electronic glide slope from approximately 2 nm to threshold. For PAPI/ PVASI installed for Height Group 4, independently fly both the electronic and visual glide slopes. While flying the visual glide slope, monitor or record the ILS/ MLS glide slope for expected ILS/ MLS displacement at the 6,000 and 1,000 ft points.

(c) Evaluation. Compare the electronic and visual glide slopes in the area between 6,000 ft and 1,00 ft prior to threshold for coincidence of runway poir of-intercept. For commissioning, both angles should be optimized if possible. For PAPI/ PVASI sited for Height Group 4 aircraft, compare the achieved runway intersection points of both systems.

ICAO Annex Tol

Doc 8071 Tolerance

8200 Tolerance

7.14b. Visual Glidepath Angle

(1) The visual glidepath is normally 3.0°, unless a different angle is necessary for obstacle clearance or special operations. The angle must be publishe in the Airport/ Facility Directory or similar publication.

(2) The effective glidepath angle must be within 0.20° of the established or desired angle.

(3) The visual and electronic glide slopes must coincide in the area between 6,000 ft and 1,000 ft prior to threshold such that there are no conflicting indications that may result in pilot confusion. For PAPI/ PVASI sited to support aircraft in Height Group 4, coincidence must be considered satisfactory if the visual glide slope intersects the runway 300 to 350 ft past the point where the electronic glide slope intersects th runway.

ICAO Annex Remarks

Doc 8071 Remarks

8200 Remarks

The meaning of "effective glide path angle" in 7.14b(2) is apparently not defined.

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
545		471	793

Facility VHF-UH **Parameter** Ground Receiving Function

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref 8071 Reference	8200 Reference	
ICAO Annex Text	**Doc 8071 Source Text**	**8200 Source Text**	**Comparison Remarks**
2.2.2 Receiving function 2.2.2.1 Frequency stability. Where 8.33 kHz channe spacing is introduced in accordance with Volume V the radio frequency of operation shall not vary more than plus or minus 0.0001 per cent from the assigned frequency. 2.2.2.2 Sensitivity. After due allowance has been made for feeder loss and antenna polar diagram variation, the sensitivity of the receiving function sh be such as to provide on a high percentage of occasions an audio output signal with a wanted/unwanted ratio of 15 dB, with a 50 per cent amplitude modulated (A3E) radio signal having a field strength of 20 microvolts per metre (minus 120 dT3w/m2) or more. 2.2.2.3 Effective acceptance bandwidth. When tuned to a channel having a width of 25 kHz, 50 kH or 100 kHz, the receiving system shall provide an adequate and intelligible audio output when the signal specified at 2.2.2.2 above has a carrier frequency within plus or minus 0.005 per cent of the assigned frequency. When tuned to a channel having a width of 8.33 kHz, the receiving system shall provide an adequate and intelligible audio output when the signal specified at 2.2.2.2 above has a carrier frequency within plus or minus 0.0005 per cent of the assigned frequency. Further information on the effective acceptance bandwidth contained in Attachment A to Part II. Note.- The effective acceptance bandwidth includes Doppler shift. 2.2.2.4 Adjacent channel rejection. The receiving system shall ensure an effective rejection of 60 dB or more at the next assignable channel. Note.- The next assignable frequency will normally be plus or minus 50 kHz. Where this channel spacing will not suffice, the next assignable frequency will be plus or minus 25 kHz, or plus or minus 8.33 kHz, implemented in accordance			This ICAO Annex 10 text defines design qualification and/or ground maintenance parameters. No flight testable parameters are included. ICAO has not published any Flight Testing recommendations (Doc 8071 format) for VHF-UHF Communications equipment.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

with the provisions of Volume V. It is recognized that in certain areas of the world receivers designed for 25 kHz, 50 kHz or 100 kHz channel spacing may continue to be used.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
(none)		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
This text deals entirely with ground receiver characteristics. It contains no flight-testable parameters.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
546			794

Facility VHF-UH **Parameter** Ground Transmitting Function

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref 8071 Reference	8200 Reference	
ICAO Annex Text	**Doc 8071 Source Text**	**8200 Source Text**	**Comparison Remarks**
2.2.1 Transmitting function 2.2.1.1 Frequency stability. The radio frequency of operation shall not vary more than plus or minus 0.005 per cent from the assigned frequency. Where 25 kHz channel spacing is introduced in accordanc with Volume V, the radio frequency of operation sha not vary more than plus or minus 0.002 per cent from the assigned frequency. Where 8.33 H z channel spacing is introduced in accordance with Volume V, the radio frequency of operation shall no vary more than plus or minus 0.0001 per cent from the assigned frequency. Note.- The above tolerances will not be suitable for offset carrier systems. 2.2.1.1.1 Offset carrier systems in 25 kHz, 50 kHz and 100 Hz channel spaced environments. The stability of individual carriers of an offset carrier system shall be such as to prevent first-order heterodyne frequencies of less than 4 kHz and, additionally, the maximum frequency excursion of th outer carrier frequencies from the assigned carrier frequency shall not exceed 8 kHz. Offset carrier systems shall not be used on 8.33 kHz spaced channels. Note.- Examples of the required stability of the individual carriers of offset carrier systems may be found at Attachment A to Part 11. Recommendation.- On a high percentage of occasions, the effective radiated power should be such as to provide a field strength of a least 75 microvolts per metre (minus 109 dl3w/m2) within th defined operational coverage of the facility, on the basis of free space propagation. 2.2.1.3 Modulation. A peak modulation factor of at least 0.85 shall be achievable. 2.2.1.4 Recommendation.- Means should be provided to maintain the average modulation factor the highest practicable value without overmodulatio			This ICAO Annex 10 text defines design qualification and/or ground maintenance parameters. No flight testable parameters are included. ICAO has not published any Flight Testing recommendations (Doc 8071 format) for VHF-UHF equipment.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Freq. Stability: +/- 0.005% for 50 kHz spacings; +/- 0.002% for 25 kHz spacings; +/- 0.0001% for 8.333 kHz spacings		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
Except for frequency stability, this text deals entire with design goals and design qualification type tes and parameters. There is no flight testing parameter included.		

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
547			795

Facility VHF-UH **Parameter** Light Gun

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 8.12b(5)

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
(none)		(5) Light Gun Signals must be checked for adequate coverage on the ground and in flight.	ICAO has not published any Flight Testing recommendations (Doc 8071 format) for VHF-UHF equipment.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		8.14d. Light Gun Requirements (1) Ground. Ensure adequate coverage for operational control of ground traffic. (2) Air. Three miles in all quadrants at the lowest traffic pattern altitude.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
548		472	796

Facility **VHF-UH** **Parameter** **Local Requirements**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 8,.12b(2), (3)

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
(none)		(2) During requested commissioning inspections, coverage must be determined by the air traffic service requirements established locally. (3) Flight profiles may vary according to the local requirements and could include an orbit or a detailed sector evaluation. Communications for fixes, hand-off positions, changeover points, or controlled airspace must be checked.	ICAO has not published any Flight Testing recommendations (Doc 8071 format) for VHF-UHF equipment.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		8-14b. Local Requirements. Communications service volume requirements are established by the controlling Air Traffic facility based on local operational requirements. When a flight inspectio is requested, these local requirements must be validated and adjusted, if necessary, for satisfactory operation. Communications must be clear and readable.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
		Only the last sentence in the Tolerance field is a true tolerance.

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
549		473	797

Facility VHF-UH **Parameter** Maximum Recommended Coverage

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 8.12b(1) - (4)

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
(none)		(1) Coverage. When coverage cannot be predicte by facility engineering, a flight inspection will be requested. Evaluate facilities where the minimum en route altitude (MEA) is determined by communications coverage. (2) During requested commissioning inspections, coverage must be determined by the air traffic service requirements established locally. (3) Flight profiles may vary according to the local requirements and could include an orbit or a detailed sector evaluation. Communications for fixes, hand-off positions, changeover points, or controlled airspace must be checked. (4) Additional frequencies assigned to the same service requirement will not require a complete inspection, but should be evaluated on a surveillance basis. c. Terminal Communications (TCOM) includes tower, ground control, clearance delivery, departure, arrival, and light gun communications. Commissioning inspections, when requested, must be conducted at the extremities o the airport to determine if there are blind spots and adequate coverage. Departure and arrival frequencies must be checked to verify service throughout the established sector volume. d. En route Communications (ECOM) includes VHF and UHF air/ ground frequencies and BUEC channels. When requested, these frequencies must be evaluated throughout the established sector service volume. e. Automatic Terminal Information Service (ATIS) broadcast on a NAVAID facility must be commissioned and reported with that NAVAID (see Chapter 11, Section 1). When commissioning is requested, ATIS broadcast on a discrete communications frequenc must be checked in accordance with local requirements Departure ATIS must be verified at the airport	ICAO has not published any Flight Testing recommendations (Doc 8071 format) for VHF-UHF equipment.

extremities.
f. Automated Weather Observing System (AWOS)/Automated Surface Aviation Observing System (ASOS). These systems provide local weather observations and may be broadcast on a NAVAID or a discrete VHF communications frequency. Transmission on a NAVAID must be verified in accordance with Chapter 11 or 12. Local altimeter settings from these systems can result in lower minimums for standard instrument approach procedures. Whenever this occurs, ensure that the associated procedure has been flight inspected to the new minimum prior to publication. When AWOS/ ASOS is used as the primary airport altimeter source, flight inspection must verify reception at a before the initial approach fix (IAF).

g. Transcribed Weather Broadcast (TWEB). This system broadcasts route-oriented data with specially prepared National Weather Service forecasts, inflight advisories, and winds aloft plus pre-selected current information, such as routine or special weather reports (METAR/ SPECI), NOTAM(s), and special notices. The data is broadcast continuously over selected L/ MF and H NDB(s) and/or VOR(s).

Service	Maximum Dimensions Altitude	Distance
ECOM		
Low Altitude	Surface to 23,000	6
Intermediate Altitude	11,000 to 25,000	6
High Altitude	24,000 to 35,000	15
Ultra-High Altitude	35,000 and above	15
TCOM		
Ground Control	100	
Clearance Delivery	100	5
PAR (Military)	5,000	1
Helicopter	5,000	30
Local Control	25,000	3
Approach Control	25,000	6
Departure Control	25,000	6
ATIS		
Arrival	25,000	6
Departure	100	5
AWOS/ ASOS	10,000	25

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

NAVAID	Chapter 11 or 12
Discrete Comm	At or before the IAF
TWEB	Chapter 11 or 12

ICAO Annex Tol

Doc 8071 Tolerance

8200 Tolerance

8.14a. Maximum Recommended Coverage. Communications frequencies are engineered for distinct volumes of airspace, which are guaranteed to be free from a preset level of interference from an undesired source. Each specific function has its own frequency protected service volume. Some are cylinders, and others a odd multi-point geometric shapes. These odd shapes are normally required for en route ATC services. Following is a table of maximum altitude and radius dimensions recommended for each type of service. Under no circumstances will a service volume be approved at an altitude and distance greater than the radio line of sight (RLOS distance (reference Figure A3-1).

[Table included in "8200 Source" Field.
[Figure A3-1 not included here.]=

ICAO Annex Remarks

Doc 8071 Remarks

8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
550		474	798

Facility VHF-UH **Parameter** Restrictions

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 8.13

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
(none)		8.13 ANALYSIS. Unsatisfactory conditions must be brought to the attention of the appropriate air traffic control and facilities maintenance personne	ICAO has not published any Flight Testing recommendations (Doc 8071 format) for VHF-UHF equipment.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
		8.14c. Restrictions. USAF air traffic control facilities will not be restricted due to unusable radios unless the ability to provide required servic is severely limited; the loss of 50% or more of published frequencies or loss of VHF/ UHF emergency capability is considered a severe limitation. Document inoperative or unusable radic and frequencies on the flight inspection report. Th inoperative or unusable radio or frequency can be returned to service after a satisfactory operational check is conducted by local aircraft at a distance maximum intended use and altitude of MVA/ MEA

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
		This "parameter" is not really a flight inspection requirement or tolerance, but rather tutorial or guidance material in nature.

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
551		475	799

Facility VHF-UH **Parameter** System Characteristics

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref 8071 Reference	8200 Reference	
ICAO Annex Text	**Doc 8071 Source Text**	**8200 Source Text**	**Comparison Remarks**
2.1 AIR-GROUND VHF COMMUNICATION SYSTEM CHARACTERISTICS Note.- In the following text the channel spacing for 8.33 kHz channel assignments is defined as 25 kHz divided by 3 which is 8.3333 ... kHz. 2.1.1 The characteristics of the air-ground VHF communication system used in the International Aeronautical Mobile Service shall be in conformity with the following specifications: 2.1.1.1 Radiotelephone emissions shall be double sideband (DSB) amplitude modulated (AM) carriers. The designation of emission is A3E, as specified in the ITU Radio Regulations. 2.1.1.2 Spurious emissions shall be kept at the lowest value which the state of technique and the nature of the service permit. Note.- Appendix S3 to the ITU Radio Regulations specifies the levels c$ spurious emissions to which transmitters must conform. 2.1.1.3 The radio frequencies used shall be selecte from the radio frequencies in the band 117.975 - 13 MHz. The separation between assignable frequencies (channel spacing) and frequency tolerances applicable to elements of the system shall be as specified in Volume V. Note.- The band 117.975 - 132 MHz was allocated to the Aeronautical Mobile (R) Service in the ITU Radio Regulations (1947). By subsequent revisions at 1TU World Administrative Radio Conferences the bands 13.2 - 136 MHz and 136 - 137 MHz were added under conditions which differ for ITU Regions, or .for specified countries or combinations of countries (see RRs S5.203, S5.203A and S5.203B for additional allocations in the band 136 - 137 MHz, and S5.201 for the band 132 - 136 MHz). 2.1.1.4 The design polarization of emissions shall b			This ICAO Annex 10 text defines the air-ground communications system in general terms. No flight testable parameters are included. ICAO has not published any Flight Testing recommendations (Doc 8071 format) for VHF-UHF equipment.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

vertical.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
(none)		

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
552			800

Facility **VOR** **Parameter** **Complementary Facilities**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref (none)

Annex Ref **8071 Reference** 2.3.31 **8200 Reference**

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	2.3.31 Facilities associated with the VOR that complement operational use (such as, marker beacons, DME, lighting aids that support the visibility minima of an approach procedure, communications, etc.) should be inspected concurrently with the VOR and in accordance with applicable procedures.		

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	As required	

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

(none)

Annex10_ID	8071_ID	8200_ID	Results_ID
	699		801

Facility **VOR** **Parameter** **Coverage**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for some, doesn't for others

SARPS Ref 3.3.4

Annex Ref **8071 Reference** 2.3.15, 2.3.16 **8200 Reference** 11.23

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.3.4.1 The VOR shall provide signals such as to permit satisfactory operation of a typical aircraft installation at the levels and distances required for operational reasons, and up to an elevation angle o 40 degrees. 3.3.4.2 Recommendation. The field strength or power density in space of VOR signals required to permit satisfactory operation of a typical aircraft installation at the minimum service level at the maximum specified service radius should be 90 microvolts per metre or minus 107 dBW/m2. Note. Typical effective radiated powers (ERPs) to achieve specified ranges are contained in 3.1 of Attachment C.	2.3.15 Coverage of the VOR is the useable area within the operational service volume and is determined during the various checks of the VOR Additional flight checks are required to determine the distance from the facility at which satisfactory coverage is obtained at the specified altitudes. 2.3.16 The coverage of a VOR can be affected b factors other than signal strength. Where out-of-tolerance roughness, scalloping, bends, alignmen and/or interference render the facility unusable in certain areas, a restriction will result which should be handled in the same manner as restricted coverage due to lack of signal strength.	11.23 SIGNAL STRENGTH. During all flight inspection evaluations, the received signal must b equal to or greater than the specified tolerance.	Since the units of signal LEVEL in 8200 appear t be received voltage level at the receiver input terminals across a 50 ohm load, it is not possible to determine whether the Annex 10 field strength or power density requirements are met, without knowledge of the airborne flight inspection antenna's Gain Factor or Capture Area. Editorially, the 5 uV criterion appears sufficient in daily use, given the myriad combinations of user receivers, feedlines, and antennas producing satisfactory landing guidance. Although it isn't possible at present to say that 8200 fully meets Annex 10 because of the units differences, this should not warrant filing an ICAC difference.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	90 uV/m	Received RF signal strength must equal or excee 5 uV or -93 dBm.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
		Conversion of uV/m to uV at 50 ohm needed.

Measurement Uncertainty

3 dB

Annex10_ID	8071_ID	8200_ID	Results_ID
553	700	476	802

Facility VOR **Parameter** General

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref / 8071 Reference	8200 Reference	
ICAO Annex Text	**Doc 8071 Source Text**	**8200 Source Text**	**Comparison Remarks**
3.3.1.1 The VOR shall be constructed and adjusted so that similar instrumental indications in aircraft represent equal clockwise angular deviations (bearings), degree for degree from magnetic North as measured from the location of the VOR. 3.3.1.2 The VOR shall radiate a radio frequency carrier with which are associated two separate 30 H modulations. One of these modulations shall be such that its phase is independent of the azimuth o the point of observation (reference phase). The oth modulation (variable phase) shall be such that its phase at the point of observation differs from that o the reference phase by an angle equal to the bearin of the point of observation with respect to the VOR. 3.3.1.3 The reference and variable phase modulations shall be in phase along the reference meridian through the station. Note. The reference and variable phase modulation are in phase when the maximum value of the sum c the radio frequency carrier and the sideband energy due to the variable phase modulation occurs at the same time as the highest instantaneous frequency the reference phase modulation.	(none)	(none)	This is a general description of the VOR, and the characteristics are a design qualification and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	(none)	(none)

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
554	701	477	803

Facility VOR **Parameter** Interference Immunity

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref 8071 Reference	8200 Reference

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.3.8 Interference immunity performance for VOR receiving systems 3.3.8.1 After 1 January 1998, the VOR receiving system shall provide adequate immunity to interference from two signal, third-order intermodulation products caused by VHF FM broadcast signals having levels in accordance with the following: $2N1 + N2 + 72 \leq 0$ for VHF FM sound broadcasting signals in the rang 107.7 – 108.0 MHz and $2\ N1 + N2 + 3\ (\ 24 -\ 20 \log \Delta 0F/0.4\ ) \leq 0$ for VHF FM sound broadcasting signals below 107. MHz, where the frequencies of the two VHF FM sound broadcasting signals produce, within the receiver, a two-signal, third-order intermodulation product on th desired VOR frequency. N1 and N2 are the levels (dBm) of the two VHF FM sound broadcasting signals at the VOR receiver input. Neither level shall exceed the desensitization criteria set forth in 3.3.8.2. $\Delta f = 108.1$ —-f1, where f1 is the frequency of N1, the VHF FM sound broadcasting signal closer to 108.1 MHz. 3.3.8.2 After 1 January 1998, the VOR receiving system shall not be desensitized in the presence of VHF FM broadcast signals having levels in accordance with the following table: Frequency (MHz) — Maximum level of unwanted signal at receiver input (dBm) 88-102 — +15 104 — +10	(none)	(none)	This is a design qualification issue for receiver manufacturers. Flight testing does not address this.

106	+ 5
107.9	-10

Note 1. The relationship is linear between adjacent points designated by the above frequencies.

Note 2. Guidance material on immunity criteria to b used for the performance quoted in 3.3.8.1 and 3.3.8.2 is contained in Attachment C, 3.6.5.

3.3.8.3. After 1 January 1995, all new installations c airborne VOR receiving systems shall meet the provisions of 3.3.8.1 and 3.3.8.2.

3.3.8.4 Recommendation. Airborne VOR receiving systems meeting the immunity performance standards of 3.3.8.1 and 3.3.8.2 should be placed into operation at the earliest possible date.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	(none)	(none)

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
555	702	478	804

Facility VOR **Parameter** Modulation - Nav Signals

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for some, doesn't for others

SARPS Ref 3.3.5

Annex Ref **8071 Reference** 2.3.17 **8200 Reference** 11.21d

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
[Subparameter 1 - Signal Description] 3.3.5.1 The radio frequency carrier as observed at any point in space shall be amplitude modulated by two signals as follows: a) a subcarrier of 9 960 Hz of constant amplitude, frequency modulated at 30 Hz and having a deviatio ratio of 16 plus or minus 1 (i.e. 15 to 17): 1) for the conventional VOR, the 30 Hz component of this FM subcarrier is fixed without respect to azimuth and is termed the "reference phase"; 2) for the Doppler VOR, the phase of the 30 Hz component varies with azimuth and is termed the "variable phase"; b) a 30 Hz amplitude modulation component: 1) for the conventional VOR, this component results from a rotating field pattern, the phase of which varies with azimuth, and is termed the "variable phase"; 2) for the Doppler VOR, this component, of constar phase with relation to azimuth and constant amplitude, is radiated omnidirectionally and is terme the "reference phase". ---------- [Subparameter 2 - Modulation Depth and Deviation] 3.3.5.2 The depth of modulation of the radio frequency carrier due to the subcarrier of 9 960 Hz shall be within the limits of 28 per cent and 32 per cent. 3.3.5.3 The depth of modulation of the radio frequency carrier due to the 30 Hz or 9 960 Hz signals, as observed at any angle of elevation up to degrees, shall be within the limits of 28 to 32 per cent.	2.3.17 Modulation. The modulation of the 30 Hz reference, 30 Hz variable and 9960 Hz subcarrier shall be measured during the flight inspection. Note that the roles of the FM and AM signals are reversed between the CVOR and the DVOR.	d. Modulation Levels (1) The three individual modulation levels associated with the VOR are: 30 Hz AM, the 30 Hz FM (or deviation ratio of the 9960 Hz subcarrier), and the 9960 Hz AM modulation of the VOR RF carrier. (a) 30 Hz AM is optimized at 30% and is termed the "variable phase" on conventional VOR(s). (b) 30 Hz FM (a deviation ratio of 16 is equivalent to 30% modulation value) is termed the "reference phase" on a conventional VOR. On Doppler VOR(s), it is termed the "variable phase". (c) 9960 Hz AM is optimized at 30%. The 9960 Hz amplitude modulation of the VOR RF carrier may cause receiver flag warnings when out of tolerance. (2) Analysis. Adjustments of modulation values may be made on any radial within 10 to 25 miles of the facility). Modulation values must meet operational tolerances throughout the unrestricted service volume of a VOR. Determine the average modulation values or the graphical average of the recorded modulation values (when available) when fluctuations are encountered.	[Subparameter 1 - Signal Description] This is the definition of the design of the VOR system signal, and is not flight tested. [Subparameter 2 - Modulation Depth and Deviation] 8200 is wider than Doc 8071 and Annex 10. Although airborne adjustment is allowed, ground maintenance adjustments are preferred. 8200 allows 20-55% and application of 95% rule of modulation depth. ICAO is in the process of adopting this range of modulations, but it is not y published in Annex 10. The US submitted a paper offering its experience with several hundre DVORs since 1991 as validation for the propose and accepted proposal. However, recent estimates from the CN&TSG Secretary suggest i may be 2009 until formal adoption occurs. . Recommendation: No difference letter be filed du to pending adoption. [Subparameter 3 - Modulation Frequencies] Set by equipment design and ground adjustment [Subparameter 4 - Undesired Modulations] Not measured under 8200. Recommendation: No letter required, not measured under Doc 8071 or AVN

[Subparameter 3 - Modulation Frequencies]

3.3.5.4 The variable and reference phase modulatic frequencies shall be 30 Hz within plus or minus 1 per cent.

3.3.5.5 The subcarrier modulation mid-frequency shall be 9 960 Hz within plus or minus 1 per cent.

[Subparameter 4 - Undesired Modulations]

3.3.5.6

a) For the conventional VOR, the percentage of amplitude modulation of the 9 960 Hz subcarrier shall not exceed 5 per cent.

b) For the Doppler VOR, the percentage of amplitude modulation of the 9 960 Hz subcarrier shall not exceed 40 per cent when measured at a point at least 300 m (1 000 ft) from the VOR.

3.3.5.7 Where 50 kHz VOR channel spacing is implemented, the sideband level of the harmonics c the 9 960 Hz component in the radiated signal shall not exceed the following levels referred to the level the 9 960 Hz sideband:

Subcarrier	Level
9 960 Hz	0 dB reference
2nd harmonic	-30 dB
3rd harmonic	-50 dB
4th harmonic and above	-60 dB

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
[Subparameter 2 - Modulation Depth and Deviatior 28-32% 9960 Hz: 28-32% 30 Hz and 9960 Hz, up to 5 degrees, 28-32%		25 - 35% (optimum 30%) Deviation Ratio 14.8 - 17.2 (optimum 16.0) 20 to 35% on transmitters with voice modulation 20 to 55% on transmitters without voice modulatic

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		NOTE: Modulation exceeding these limits is acceptable, using the following criteria: .05 nm in any 1.0 nm segment from FAF to the MAP. 0.25 nm in any 5 nm segment from sea level up to 10,000 ft MSL. 0.5 nm in any 10 nm segment from 10,001 to 20,000 ft MSL. 1.0 nm in any 20 nm segment above 20,000 ft MSL.	
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
30 Hz and 9960 Hz modulation 28-32% 9960 deviation 15-17 [Subparameter 4 - Undesired Modulation] Appears to be system design criterion.	Do not have tolerance for residual AM modulation on 9960 Hz. [Subparameter 4 - Undesired Modulation] Not measured.	8200 allows 20-55% and application of 95% rule of modulation depth for 9960Hz. ICAO is in the process of adopting this rule but it is not yet published in A10.	
	Measurement Uncertainty		
	1%		

Annex10_ID	8071_ID	8200_ID	Results_ID
556	703	479	805

Facility **VOR** **Parameter** **Monitoring**

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for all

Annex Ref **SARPS Ref** 3.3.7.1 **8071 Reference** 2.3.22 - 2.3.25 **8200 Reference** 11.20b

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.3.7 Monitoring 3.3.7.1 Suitable equipment located in the radiation field shall provide signals for the operation of an automatic monitor. The monitor shall transmit a warning to a control point, and either remove the identification and navigation components from the carrier or cause radiation to cease if any one or a combination of the following deviations from established conditions arises: a) a change in excess of 1 degree at the monitor sit of the bearing information transmitted by the VOR; b) a reduction of 15 per cent in the modulation components of the radio frequency signals voltage level at the monitor of either the subcarrier, or 30 H amplitude modulation signals, or both. 3.3.7.2 Failure of the monitor itself shall transmit a warning to a control point and either: a) remove the identification and navigation components from the carrier; or b) cause radiation to cease. Note. Guidance material on VOR appears in Sectio 3 of Attachment C.	2.3.22 The requirements for checking the monito are as follows: a) during commissioning inspections; b) during subsequent inspections, if the alignment at the reference checkpoint has changed more than one degree from the alignment last established and the monitor has not alarmed. 2.3.23 The check is made over the reference checkpoint at the same altitude as that used to establish the reference checkpoint. Position the aircraft inbound or outbound and activate the ever mark exactly over the checkpoint while the following course conditions exist: a) With the course in the normal operating condition. b) With the course shifted to the alarm point. c) With the course shifted to the alarm point to the opposite direction from (b) above. d) With the course returned to the normal operating condition. 2.3.24 The course alignment should be compare in each of these conditions, by reference to the recordings to determine the amplitude of shift to the alarm point and to verify the return to normal. 2.3.25 Check both transmitters in the same manner when dual monitors are installed. Both w be checked on a systematic basis. Follow the procedure for single monitor check above, except in steps b) and c) the course will be shifted in eac direction until both monitors alarm. Determine the amplitude of course-shift required to alarm both monitors.	b. Monitor Reference Evaluation (1) The monitor reference evaluation determines the minimum amount of azimuth course shift required to activate the ground facility monitor alarm system. (2) Monitor reference may be established either in the air or on the ground. Once established, the check must become the reference for all subsequent checks. The procedure for establishing a monitor reference is as follows: (a) With the course in the normal operating condition. (b) With the course shifted to the monitor reference point. (c) With the course shifted to the monitor reference point in the opposite direction from Step (b) above. (d) With the course returned to the normal operating condition. NOTE: Step (d). There is no requirement that the course return to the measurement in Step (a). Monitor shifts of more than 1° will be brought to th attention of appropriate engineering personnel to determine if environmental or equipment related. In each of these conditions, the course alignment will be compared by reference to recorded data to determine the mount of shift to the alarm point an to verify that it has returned to a normal condition. (3) Facilities that have dual parallel monitors require a monitor evaluation on one transmitter only. Facilities that have two individual monitors require evaluations on each transmitter.	A10 defines design requirements for monitoring alarms. 8071 and 8200 cover testing of alarm limits. 8200 matches 8071 and Annex 10 for bearing. Checking of modulation alarm limits is a ground maintenance activity.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
ICAO Annex Tol	**Doc 8071 Tolerance**	**8200 Tolerance**	
Alarm for: >1 degree bearing reduction b y 15% of modulations Failure of monitor to be able to monitor	Bearing Monitor: +/- 1 deg	The transmitter azimuth monitor reference must not exceed ± 1.0°.	
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
		8200 matches A10	
	Measurement Uncertainty		
	0.3 deg		

Annex10_ID	8071_ID	8200_ID	Results_ID
557	704	480	806

Facility VOR **Parameter** Orbital Alignment

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref

Annex Ref **8071 Reference** **8200 Reference** 11.20f

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
		f. Orbit Evaluations. Orbit evaluations are used to determine azimuth error distribution and signal quality. Orbit data are used as reference information. Establish reference alignment during commissioning, antenna change frequency change, facility rotation, if no orbital reference exists, or if the ARR and alignment orbi dates on the AVNIS Data Sheet do not match. Evaluate for deviation from the reference during a subsequent orbital evaluations. When optimizing alignment, the mean orbital alignment should be within ± 0.5°, and the system differential between collocated VOR and TACAN should not exceed 1 For dual transmitter systems, use the primary transmitter as the reference. Inform maintenance when alignment references are established/ re-established. Notification may be accomplished through Flight Inspection Central Operations if maintenance is not on site and/or abnormal delay occur. (1) Alignment Orbit (a) The alignment orbit is used to determine the accuracy and optimum error distribution of the azimuth. The evaluation is conducted for 360° of azimuth. An orbit radius of 5 nm and beyond may be used when using GPS hybrid or equivalent for updating and 10 nm and beyond when using distance measuring equipment updating. When using theodolite, the orbit radius must be the maximum visual range for the theodolite operator. The orbit may be flown clockwise (CW) or counterclockwise (CCW), but once established, it must be flown in the same direction, at the same distance and altitude, on each subsequent inspection. Compute a tapeline altitude to fly the orbit at a standard angle of 4 to 6° from the site. The objective of the check is to help Facilities Maintenance personnel determine environmental problems close in to the facility. The ratio between distance and altitude becomes critical when looking for low angle reflections or shadowing. Altitudes and distance may be modified when conditions prevent	A10 and 8071 do not provide orbit evaluation guidance

establishing them at the recommended 4 to 6° (ai traffic requirements, engineering or maintenance support, and site conditions). Indicate deviations from the standard on the flight inspection report and Facility Data Sheet.

(b) If alignment cannot be determined orbitally, it may be measured by flying one radial in each quadrant. A partial orbit, augmented with radial alignment, is preferred over alignment determined solely by radial means. Notify the Flight Inspectio Policy Team if the use of radial flight is accomplished in lieu of orbital alignment.

(c) One orbit may be flown on dual transmitter facilities during any inspection, except commissioning, by requesting transmitter change If sufficient transmitter changes cannot be accommodated (at least one in every 40o), fly an orbit on each transmitter.

(d) During the orbit, evaluate azimuth alignment, course sensitivity or modulations, sensing and rotation, roughness and scalloping, identification, and signal strength (a minimum of 1 evaluation every 20°). Out-of-tolerance conditions found during an orbital inspection must be confirmed by radial evaluation before restricting a facility or issuing a NOTAM. The radial evaluations normally have priority.

(e) Course error distribution must be determined prior to rotation (if required) to achieve optimum station balance. It is not necessary to refly the orb after this facility rotation, provided the direction an magnitude of the adjustment can be confirmed radially. Apply the confirmed azimuth shift to the alignment orbit for final error spread determinatio and plotting. Complete the remaining facility rotation checklist items after the rotation.

(f) Course Alignment. On periodics, if a change in mean course alignment of more than 1° is found, contact Facilities Maintenance. Facilities Maintenance will conduct an evaluation to determine if the change in the facility was caused by a maintenance problem or caused by an environmental change.

(2) Coverage

(a) This check is conducted to determine the facility's ability to support the Flight Inspection

Standard Service Volume (FISSV). The FISSV must be established as follows: On "T" class facilities, the FISSV is 25 nm and 1,000 ft above facility antenna elevation, or the minimum altitude which will provide 1,000 ft (2,000 ft in designated mountainous areas)
above intervening terrain as determined by map study. On "L" and "H" class facilities, the distance extends to 40 nm, and the altitudes are the same as for the "T" class. Establish facility restrictions and performance status based on the FISSV. One complete orbit (one transmitter only) must be flow at either:

1 The applicable FISSV

2 Altitudes high enough to receive in-tolerance signals. If these altitudes are higher than the altitudes in paragraph (1) above, facility restrictior and NOTAM action are required.

(b) During the orbit, evaluate azimuth alignment, course sensitivity or modulations, sensing and rotation, roughness and scalloping, identification, and signal strength (a minimum of 1 evaluation every 20°).

(c) Out-of-tolerance conditions discovered during orbital inspections must be confirmed by a radial inspection before restricting a facility or issuing a NOTAM. An orbit segment used to establish a restriction may be defined laterally by orbital means. Radials flown through the most severe ou of-tolerance area may be used to define the distance and altitude limits of the entire segment. The radial inspection results normally have priorit over orbital inspection data. In areas of multiple restricted segments, it may be appropriate to grou those segments into larger, easier to understand restrictions. The advantages of this possible overrestriction in some areas must be weighed against user requirements. Fly an arc at the FISS of the facility at the restricted altitude to encompass the restricted area to determine usabl signal coverage.

(d) Procedures flown below or outside the FISSV, which are found unsatisfactory, must be denied, but a facility restriction is not required.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
ICAO Annex Tol	**Doc 8071 Tolerance**	**8200 Tolerance**	
		Notify maintenance if found to exceed ± 1° from the reference.	
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
Does not mention orbits.	Does not mention orbits.	Covers orbits, not mentioned in A10 or 8071.	
	Measurement Uncertainty		

Annex10_ID	8071_ID	8200_ID	Results_ID
558	705	481	807

Facility VOR **Parameter** Polarizat'n, Pattern Accuracy

8200/Annex (sub)parameter Compare Results

8200 matches Annex 10 for some, doesn't for others

Annex Ref **SARPS Ref** 3.3.3.1, 3.3.3 **8071 Reference** 2.3.5, 2.3.9 to 2.3.14 **8200 Reference** 11.20a, 21e, 22

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
[Subparameter 1 - Polarization] 3.3.3.1 The emission from the VOR shall be horizontally polarized. The vertically polarized component of the radiation shall be as small as possible. Note. It is not possible at present to state quantitatively the maximum permissible magnitude the vertically polarized component of the radiation from the VOR. (Information is provided in the Manu on Testing of Radio Navigation Aids (Doc 8071) as to flight checks that can be carried out to determine the effects of vertical polarization on the bearing accuracy. [Subparameter 2 - Bearing Accuracy] 3.3.3.2 The accuracy of the bearing information conveyed by the horizontally polarized radiation fro the VOR at a distance of approximately four wavelengths for all elevation angles between 0 and 40 degrees, measured from the centre of the VOR antenna system, shall be within plus or minus 2 degrees.	[Subparameter 1 - Polarization] Polarization Effect. The polarization effect results from vertically polarised RF energy being radiated from the antenna system. The presence of undesired "vertical polarization" should be checke by the "attitude effect" and may be further investigated by either the "360 deg turn method" c the "heading effect" method. Attitude effect method 2.3.6 The Vertical polarization effect should be checked when flying directly to, or from, the facilit at a distance of 18.5 to 37 km (10 to 20 NM). The aircraft should be rolled to a 30 degree bank, first to one side, then to the other, and return to straigh level flight. Track and heading deviations should be kept to a minimum. Course deviation, as measured on the recording, is the indication of vertical polarization effect. 30 degree bank, 360 degree turn method 2.3.7 Vertical polarization may be checked by executing a 30 degree bank, 360 degree turn, 18.5 to 37 km (10 to 20 NM) from the antenna. The turn should begin from an "on-course" (towar the station) position over a measured ground checkpoint. 2.3.8 The recording should be marked at the start of the turn and at each 90 degree of heading change until the turn is completed. The turn should be completed over the starting point and th recording marked. The recording should show a smooth departure from and return to the "on course" position, deviating only by the amount tha the aircraft is displaced from the original starting point when vertical polarization effect is not present. Other excursions of the cross-pointer may be attributable to vertical polarization effect. The effect of the wing shadowing the aircraft antenna should be considered in evaluating the recording.	11.20a Reference Radial Check. A reference radial must be established when establishing an orbital reference and evaluated during subsequen checks. An approach radial is recommended as the reference. When course roughness and scalloping occur during an alignment evaluation, the graphic average of the deviations must be used. This reference will be used for subsequent checks of course alignment and airborne monitor reference evaluation. Determine DME accuracy as described in Paragraph 11.31. (1) Following an antenna change, optimize the orbital alignment, then re-establish the reference. (2) During a periodic evaluation, if the alignment is found more than 1° than previously established, perform an alignment orbit. If the orbit remains satisfactory, find a new radial that better represen the orbital alignment, and re-establish both the reference radial and alignment orbit. Notify Maintenance when the ARR and orbit are re-established. 11.21e. Polarization causes azimuth course variations whenever the aircraft is banked around its longitudinal axis. It is caused by the radiation o a vertically polarized signal from the VOR antenna (horizontal polarization on TACAN) or other reflective surfaces around the site. The indication are similar to course roughness and scalloping, bu normally can be separated by relating the course deviations to the aircraft banking. When roughnes and scalloping cannot be separated from polarization, select another radial. The evaluations should be conducted on another nearby radial in the same azimuth quadrant. (1) Evaluation. Polarization should be evaluated any time a radial is checked and within 5 to 20 miles (inbound or outbound) from the facility. Only one radial is required for TACAN. The preferred method of evaluating for polarization is to bank th aircraft 30° around the longitudinal axis (starting o	[Subparameter 1 - Polarization] 8200 procedure and tolerance matches Annex 1(for polarization. [Subparameter 2 - Bearing Accuracy] 8200 tolerance matches 8071 for Bends and roughness/scalloping 8200 tolerance is wider than A10 for alignment (2.5 degrees vs 2.0 degrees). Recommendation: File letter for difference and acceptability of wider tolerance given the history findings and variances in user fleet receivers.

[Subparameter 2 - Bearing Accuracy]

Alignment.

2.3.9 Alignment can be determined by flying an orbit or by flying a series of radials. The altitude selected for the flight should place the aircraft in the main lobe of the VOR.

2.3.10 The orbit should be flown at a height and range that allows the position reference system to accurately determine the position of the aircraft. This will require low, close in orbits for theodolite-based position systems. Other automated systems will require the orbits to be conducted at greater range to achieve the required accuracy. The orbit should have sufficient overlap to ensure that the measurement covers the complete 360 degrees. The alignment of the VOR is determined by averaging the error throughout the orbit. Judgement may be exercised where the tracking of the orbit is interrupted to determine the effect of the lost information on the average alignment.

2.3.11 Alignment can also be determined by flying a series of radial approaches. These approaches should be conducted at equal angular displacements around the facility. A minimum of eight radials is considered necessary to determine the alignment of the VOR.

Bends

2.3.12 A bend is determined by flying a radial pattern and comparing the indicated course against a position reference system. The error is measured against the correct magnetic azimuth of the radial. Deviations of the course due to bends should not exceed 3.5 degrees from the computed average course alignment and should remain within 3.5 degrees of the correct magnetic azimuth.

Roughness and scalloping error

2.3.13 Scalloping is a cyclic deviation of the course line. The frequency is high enough that deviation is averaged out and will not cause aircraft displacement. Roughness is a ragged irregular series of deviations. Momentary deviations of the course due to roughness, scalloping or combinations thereof should not exceed 3.0° from the average course.

either side) returning to level flight momentarily, bank 30° in the opposite direction and returning to straight and level flight. During the aircraft banking, the tracking and heading changes must be kept to a minimum. The course deviations that occur during the 30°rolls may indicate polarization.

The indications of polarization may be influenced by course roughness and scalloping. A confirmation check is required if out-of-tolerance conditions are discovered using this method.

(2) Confirmation Procedure. Fly over a prominent ground checkpoint, located 5 - 20 miles from the facility. Execute a 30° bank and turn, holding this attitude through 360°. End this maneuver as close to the same ground checkpoint as possible. Mark the recording at the beginning and end and at each 90° change in azimuth heading. If polarization is not present, the course will indicate a smooth departure from and return to the "on-course" position, deviating only by the amount that the aircraft is displaced from the original azimuth.

11.22 a. Roughness, scalloping, and bends are displayed on the recorder charts as deviations of the crosspointer (course deviation indicator) recording trace. Roughness will show a series of ragged irregular deviations; scalloping as a series of smooth rhythmic deviations; and the frequency of each is such that it is not flyable and must be "averaged out" to obtain a course.

b. To measure the amplitude of roughness and scalloping, or the combination, draw two lines on the recording which are tangential to and along each positive and negative peak of the course deviation. The number of degrees or microamperes between these lines will be the total magnitude of course deviations; one-half of this magnitude will be the plus and minus deviations.

c. Draw a third line equidistant from these lines to obtain the average "on course" from which course alignment is measured. Thus, the instantaneous alignment error of the course may be computed from the course recordings at any point where an accurate checkpoint has been marked on the recording. Alignment error will be referred to in degrees to the nearest tenth. Misalignment in a clockwise direction is considered positive. Where the magnetic azimuth of the

Flyability

2.3.14 Flyability is a subjective assessment of the pilot flying the inspection. Assessment of flyability should be performed on operational radials and during procedures based on the VOR.

measured (ground) checkpoint is greater than the electronic radial, the error is positive. (See Figure 11-2.)

d. A bend is similar to scalloping except its frequency is such that an aircraft can be maneuvered throughout a bend to maintain a centered crosspointer. Accordingly, a bend might be described as a brief misalignment of the course. Bends are sometimes difficult to discern, especially in those areas where good ground checkpoints or other means of aircraft positioning are not available. It is, therefore, important to the analysis of a bend to consider aircraft heading and radial alignment deviations. A smooth deviation of the course over a distance of 2 miles would manifest itself as a bend for a flight inspection aircraft at a ground speed of 150 knots. An aircraft of greater speed would not detect such smooth deviations of the course as a bend unless it was over a greater distance. In the analysis of bends, further consideration should be given to the flight levels and speeds of potential users. Since speed altitude, system response, and other factors are important in the analysis of course structure, the flight inspector should carefully evaluate the flyability factor before assigning a final facility classification.

e. Application of Tolerances

(1) The alignment of a radial is the long-term average of the data points derived by eliminating the short-term variations of roughness and scalloping and bends. Bends
and the length of the measurement distance influence the measured alignment. A short measurement segment may sample only an area that is really a bend when compared to a longer measurement segment. Flight inspectors must consider the procedural needs of the radial and measure enough of the radial to define alignment the procedural use area. Thus, a short radial segment used for an approach may be unsatisfactory due to a bend being correctly analyzed as alignment when an identical bend would be correctly analyzed as a bend from the overall alignment of a longer airway radial segment

(2) The displacement of the course by a bend must not exceed 3.5° from either the correct magnetic azimuth or the average "on course" provided by the facility. The

following two examples are offered for clarificatior

(a) A radial having zero alignment error. The maximum bend tolerance of 3.5° is allowable both sides of the "on course", whether the bends occur singly or in a series.

(b) A radial having an alignment error of +2.0°. Further displacement of the course by a bend of +1.5° is allowable: this results in a +3.5° displacement from the correct magnetic azimuth. Displacement of the course of 3.5° from the average 'on course' is allowable; this results in a -1.5° displacement from the correct magnetic azimuth.

(3) In the event of roughness or scalloping, or combination, superimposed on the bend, the average 'on course' must be determined by averaging the total amplitude of such aberrations. This can result in a momentary displacement of the course of 6.5° where ± 3.0° o roughness is superimposed on a bend of 3.5°.

(4) The criteria for roughness and scalloping must not be applied strictly as a plus and a minus facto from the average course. Where it is apparent tha a rapid deviation occurs only on one side of the course rather than in a series, the criteria must be applied as a plus or minus factor.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Azimuth: +/- 2 degrees between horizon and +40 degrees elevation, at 4 wavelengths from the antenna.	Polarization: +/- 2.0 deg Alignment: +/- 2.0 deg Bends: +/- 3.5 deg R/S: +/- 3.0 deg Flyability: Flyable	Polarization: Less than or equal to 2.0° Pattern Accuracy - Radial Alignment and Structur Alignment of all electronic radials must not excee ± 2.5° of correct magnetic azimuth except: Deviations of the course due to bends must not exceed 3.5° from the correct magnetic azimuth ar must not exceed 3.5° from the average electronic radial alignment. Roughness/ Scalloping/ Course Aberrations: Deviations from the course, greater than 3.0° are acceptable, provided the aggregate does not exceed the following:

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
		.05 nm in any 1.0 nm segment from FAF to the MAP. 0.25 nm in any 5 nm segment from sea level up to 10,000 ft MSL. 0.5 nm in any 10 nm segment from 10,001 to 20,000 ft MSL. 1.0 nm in any 20 nm segment above 20,000 ft MSL. Flyability: The effects of any one, or combination of any alignment and/or structure criteria, even though individually in tolerance, must not render the radial unusable or unsafe.	
ICAO Annex Remarks	**Doc 8071 Remarks**	**8200 Remarks**	
Annex 10 accuracy requirements for VOR are very brief, and are defined only at a very close distance from the VOR. If this is interpreted to mean "in an area free of multipath", then one can derive an underlying static accuracy requirement of 2 degrees, and this can be applied to (static) alignment. The Annex 10 text does not address bends, roughness, or scalloping. Due to this brevity, ICAO's Doc 8071 text must be used for more specificity.	The tolerance for alignment, +/- 2 degrees, matches the Annex 10 requirement which is stated only at a distance of 4 wavelengths (~32') from the VOR. But the 8071 measurement text makes clear this alignment tolerance is applied at user-distances. In addition, 8071 provides "guidance" on tolerances for bends and roughness/scalloping	Matches Doc 8071 for bends and R/S, wider than Annex 10 and Doc 8071 for alignment.	
	Measurement Uncertainty Pol: 0.3 deg		

Annex10_ID	8071_ID	8200_ID	Results_ID
559	706	482	808

Facility VOR **Parameter** Radio Frequency

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref	SARPS Ref 8071 Reference	8200 Reference

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.3.2.1 The VOR shall operate in the band 111.975 MHz to 117.975 MHz except that frequencies in the band 108 MHz to 111.975 MHz may be used when, in accordance with the provisions of Volume V, Chapter 4, 4.2.1 and 4.2.3.1, the use of such frequencies is acceptable. The highest assignable frequency shall be 117.950 MHz. The channel separation shall be in increments of 50 kHz referred to the highest assignable frequency. In areas where 100 kHz or 200 kHz channel spacing is in general use, the frequency tolerance of the radio frequency carrier shall be plus or minus 0.005 per cent. 3.3.2.2 The frequency tolerance of the radio frequency carrier of all new installations implemente after 23 May 1974 in areas where 50 kHz channel spacing is in use shall be plus or minus 0.002 per cent. 3.3.2.3 In areas where new VOR installations are implemented and are assigned frequencies spaced at 50 kHz from existing VORs in the same area, priority shall be given to ensuring that the frequency tolerance of the radio frequency carrier of the existing VORs is reduced to plus or minus 0.002 pe cent.			This is a general description of the VOR, and the characteristics are a design qualification and/or ground maintenance issue. Flight testing does not address this.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

Annex10_ID	8071_ID	8200_ID	Results_ID
560			809

Facility **VOR** **Parameter** **Reference Checkpoint**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref (none)

Annex Ref **8071 Reference** 2.3.26 to 2.3.27 **8200 Reference** 11.20h

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	Reference checkpoint 2.3.26 A checkpoint should be selected during th commissioning inspection on or close to the monitor radial (usually 090 or 270 degrees) and located within 18.5 to 37 km (10 to 20 NM) of the antenna. This checkpoint should be used in establishing course alignment and will serve as a reference point for subsequent inspections of alignment, monitors, course sensitivity and modulation measurements. Course alignment an sensitivity will normally be adjusted with reference to this checkpoint. Adjustments made elsewhere will require a recheck of these parameters at this reference checkpoint. 2.3.27 The flight inspector should record a description of the reference checkpoint that includes the azimuth to the nearest tenth of a degree, distance from the facility and the mean se level (MSL) altitude, usually 460 meters (1500 fee above the antenna. This data should be revised any time the reference checkpoint is re-established. The final course alignment error, measured at the reference checkpoint, should be recorded on the facility data sheet for subsequent reference to determine the necessity for a complete monitor check as specified in 2.3.3.9 [sic - Monitor Bearing paragraph)	h. Receiver Checkpoints are established to allow pilots to check the accuracy of their receivers. Inability of a facility to support receiver checkpoint must not result in facility restrictions. (1) Ground Receiver Checkpoints will be established on the airport ramp or taxiways at points selected for easy access by aircraft, but where there will be no obstruction of other airport traffic. They normally will not be established at distances less than one-half mile from the facility, nor should they be established o non-paved areas. All azimuth bearings must be stable and within prescribed azimuth tolerance. Evaluate azimuth alignment, course sensitivity or modulations, roughness and scalloping, identification, and signal strength. If a stable signa and alignment cannot be obtained at a location, select another site or establish an airborne receiv checkpoint. Ensure that surface markings and signage are correct. Observed slight variances in airport surface markings and signage should not affect their acceptability unless, in the judgment o the flight inspector, they could affect the usability of the checkpoint. (2) Airborne Receiver Checkpoints must be designated over prominent ground checkpoints. It is preferred that such checkpoints be near an airport so they are easily accessible to users and must be at least 1,000 ft AGL. The checkpoint should not be established at a distance less than miles or more than 30 miles from the facility. However, consideration should be given to selecting an area and altitude that will not interfere with normal traffic patterns. The electronic radial overlying the geographic checkpoint, rounded off to the nearest whole degree, will be the azimuth published as the receiver checkpoint.	A10 does not address Ground Receiver Checkpoints. The 8200 tolerance for ground checkpoints is tighter (for azimuth) than for flight measurements.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	As required	Airborne Receiver Checkpoints. All parameters must meet tolerances, and the alignment must be within ± 1.5° of the published azimuth. Ground receiver checkpoints must equal or excee 15 µv or -83 dbm. Ground Receiver Checkpoints. All parameters must meet tolerances, and the alignment must be within ± 2.0° of the published azimuth. Inability of the facility to provide a ground or airborne receiver checkpoint according to the tolerances specified above must not cause a restriction to be placed on the facility.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

(none)

Annex10_ID	8071_ID	8200_ID	Results_ID
	707	483	810

Facility **VOR** **Parameter** **Sensing and Rotation**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

Annex Ref

SARPS Ref 3.3.1.3, 3.3.1.1

8071 Reference 2.3.3, 2.3.4

8200 Reference 11.21c

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	Sensing 2.3.3 This check is required at the beginning of the flight inspection and need not be repeated. The bearing of the aircraft from the station must b known. Select an appropriate radial and when the crosspointer is centred, the indicator should indicate "FROM". Rotation 2.3.4 Begin an orbit. The radial bearing as indicated should continually decrease [for a counterclockwise orbit] or increase for a clockwise orbit. Sensing should be checked before rotation. Incorrect sensing might cause the station rotation to appear reversed.	c. Sensing and Rotation (1) The sensing and the following rotation check are required at the beginning of the flight inspection. The position of the aircraft on a radial from the station must be known. Select the azimuth of the radial being flown. When the crosspointer is centered, the" TO - FROM" indicator will properly indicate "FROM" if sensing i correct. For AFIS-equipped aircraft, compare the computer-generated bearing. Sensing should be checked before rotation, as incorrect sensing may in itself cause the station rotation to appear reversed. See Appendix 3. (2) Rotation. Upon completion of the sensing check, conduct a partial orbit. The radial bearings must continually decrease for a counterclockwise orbit or continually increase for a clockwise orbit. This check may be satisfied by visually observing either cockpit or AFIS azimuth indications.	A10 does not address sensing explicitly, but characterizes proper operation in a general description.. 8071 and 8200 agree.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
	Correct	The "To/From" sensing must be "From" when positioned on a selected radial, and the bearings must decrease in a counterclockwise direction around the station.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks

Measurement Uncertainty

(none)

Annex10_ID	8071_ID	8200_ID	Results_ID
	708	484	811

Facility **VOR** **Parameter** **Standby Equipment**

8200/Annex (sub)parameter Compare Results

N/A (no A10 requirement, etc.)

SARPS Ref (none)

Annex Ref **8071 Reference** 2.3.28 - 2.3.30 **8200 Reference** 11.20i, 11.20j, 4.33

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
	Standby Power 2.3.28 Standby power, when installed, should be checked during the commissioning inspection. This is not necessary for some types of standby power installations, e.g., float-charged battery supplies where there is no possibility of performance variation when operating on standby power. Subsequent inspections should not be required unless there is reported evidence of facility deterioration while this source of power is i use. The following items should be evaluated while operating on standby power. a) Course alignment (one radial); b) Course structure, and c) Modulations. 2.3.29. The inspections are to be performed whe flying a portion of a radial with the station operatin on normal power, and then repeating the check at the same altitude and over the same ground track with the station operating on standby power. Standby equipment 2.3.30 Both transmitters should be checked on each required item of Table I-2-3. These checks may be performed using radial flights and a single alignment orbit.	[Subparameter 1 - Standby Transmitters] i. Standby Transmitters. Both transmitters must b evaluated for each required checklist item, except the coverage orbit and ESV(s), which are requirec on one transmitter only. Alignment evaluations ma be made by changing transmitters during an evaluation and comparing the azimuth course shi Transmitter changes must not be made inside the final approach fix; however, transmitter changes made before the final approach fix are satisfactory for evaluation purposes. If comparison results are questionable, fly the approach segment on each transmitter. 4-33b. Standby Equipment. It is necessary to kno which system or transmitter is operating so the performance of each can be determined. (1) When one unit of a dual equipped facility is found out-of-tolerance, it must be identified and removed from service. The unit can be identified a transmitter number 1 or 2, channel A or B, serial number, etc. (2) Some inspections may only require the checking of one equipment. The details for each type of facility are included in the appropriate facility checklists. {Subparameter 2 - Standby Power] j. Standby Power (reference Paragraph 4.33c) (1) The following checklist items will be inspected while operating on standby power (one transmitte only need be checked): (a) Course alignment (one radial) (b) Course structure	No A10 requirement. 8200 matches 8071

(c) Identification

(d) Distance accuracy

(2) The inspections are to be performed when flying a portion of a radial with the station operatin on normal power and then repeating the check over the same ground track with the station operating on standby power.

4-33 c. Standby Power

(1) The flight inspector must check the facility on standby power during a commissioning flight inspection if standby power is installed. If a standby power system is
installed after the commissioning flight inspection, the flight inspector must check the facility on standby power during the next regularly schedule periodic inspection. The flight inspector must mak comparative measurements to ensure that facility performance is not derogated on the standby power system and that all tolerance parameters fo the specific inspection are met. Standby power checks are not required on facilities powered by batteries that are constantly charged by another power source.

(2) It is not necessary to recheck a facility when the standby power source is changed.

ICAO Annex Tol

Doc 8071 Tolerance

Standby Power: Normal operation
Standby Equipment: As required

8200 Tolerance

Standby Equipment: The standby transmitter mu meet all tolerances and the difference in azimuth alignment between transmitters must not exceed 2.0°.

Standby Power: Operation on standby power mu not cause
any parameters to exceed tolerances.

ICAO Annex Remarks

Doc 8071 Remarks

8200 Remarks

Measurement Uncertainty

(none)

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
Annex10_ID	8071_ID	8200_ID	Results_ID
	709	485	812

Facility VOR **Parameter** Voice and Identification

8200/Annex (sub)parameter Compare Results: 8200 matches Annex 10 for some, doesn't for others

SARPS Ref 3.3.6.2, 3.3.6.5

Annex Ref **8071 Reference** 2.3.18 - 2.3.21 **8200 Reference** 11.21a, b

ICAO Annex Text	Doc 8071 Source Text	8200 Source Text	Comparison Remarks
3.3.6 Voice and identification 3.3.6.1 If the VOR provides a simultaneous communication channel ground-to-air, it shall be on the same radio frequency carrier as used for the navigational function. The radiation on this channel shall be horizontally polarized. [Subparameter 1 - Voice modulation depth] 3.3.6.2 The peak modulation depth of the carrier on the communication channel shall not be greater tha 30 per cent. [Subparameter 2 - Voice frequency response] 3.3.6.3 The audio frequency characteristics of the speech channel shall be within 3 dB relative to the level at 1 000 Hz over the range 300 Hz to 3 000 Hz [Subparameter 3 - Morse Identification] 3.3.6.4 The VOR shall provide for the simultaneous transmission of a signal of identification on the sam radio frequency carrier as that used for the navigational function. The identification signal radiation shall be horizontally polarized. 3.3.6.5 The identification signal shall employ the International Morse Code and consist of two or thre letters. It shall be sent at a speed corresponding to approximately 7 words per minute. The signal shall be repeated at least once every 30 seconds and the modulation tone shall be 1 020 Hz within plus or minus 50 Hz. 3.3.6.5.1 Recommendation. The identification signa should be transmitted at least three times each 30 seconds, spaced equally within that time period. Or of these identification signals may take the form of voice identification. Note. Where a VOR and DME are associated in accordance with 3.5.2.5, the identification provision of 3.5.3.6.4 influence the VOR identification.	Voice Channel. 2.3.18 Voice communications on the VOR frequency should be checked for clarity, signal strength, and effect on the course structure in the same manner as described for identification checks. The audio level of voice communications is the same as the level of the voice identification feature. Flight inspection personnel should maintain surveillance of the quality and coverage recorded voice transmissions (Automatic Termina Information Service (ATIS) or other transcribed voice service) and ensure that there is no detrimental effect on the performance of the VOR Comments and deficiencies should be included in the appropriate flight inspection reports. 2.3.19 Speech affect on normal navigation function. Observe the indicated bearing information during a stable approach flight and determine if the bearing information is affected by the voice transmission. Identification. 2.3.20 The identification signal should be inspected for correctness, clarity, and possible detrimental effect on the course structure. This check will be performed while flying on-course an within radio line-of-sight of the station. Observe the course recording to determine if either code o voice identification affects the course structure. If course roughness is suspected, the identical trac should be reflown with the identification turned off Maintenance personnel should be advised immediately if it is determined that the course characteristics are affected by the identification signal. 2.3.21 The audible transmission of simultaneous voice/code identification signals should appear to be equal in volume to the user. The voice identification is not utilised during ground-to-air broadcasts on the VOR frequency, but the coded identification should be audible in the background	[Subparameter 1 - Identification] a. Identification (ID). This check is made to ensur the identification is correct and is usable throughout the operational service volume. (1) Specifications. Evaluate the identification during all checks. The facility must be restricted if the identification is not usable in all areas of required coverage. (2) Identification Sequence (a) VOR(s), VOR/ DME(s), and VORTAC(s) with VOR voice identification using dual voice code reproducers at dual location or single voice code reproducer at single VOR location uses the following sequence: Identification on VOR in code. Identification on VOR by voice. Identification on VOR in code. Identification on TACAN/ DME at the normal time for voice Identification on the VOR. (b) VOR(s), VOR/ DME(s), and VORTAC(s) with VOR voice identification using single voice code reproducer with dual VOR equipment: The identification sequence is the same as in Paragraph (a) above; however, synchronization w not exist between the TACAN and VOR identification. Voice identification may be heard with the keyed ident, and the flight inspector must determine from an operational standpoint if the identification is clear and that the course is not adversely affected. (c) VOR(s), VOR/ DME(s), and VORTAC(s) without VOR voice identification uses the following sequence:	[Subparameter 1 - Voice modulation depth] This is a ground maintenance issue. Flight testing does not address this subparameter. [Subparameter 2 - Voice frequency response] This is a design qualification and/or ground maintenance issue. Flight testing does not address this subparameter. [Subparameter 3 - Morse Identification] This is a design qualification and/or ground maintenance issue. Flight testing does not address this subparameter. [Subparameter 4 - Morse Identification Depth] This is a design qualification and/or ground maintenance issue. Flight testing does not address this subparameter. [Subparameter 5 - Voice modulation effects] The allowable Course change during voice modulation is wider in 8200 (up to 0.5 degree) than in 8071 (up to 0.3 degree). The 8200 tolerance is also wider than Annex 10 ("shall not interfere in any way"). Given the small number of VORs with voice modulation in the US, and an extensive experience base, this does not warrant filing a difference with ICAO. [Subparameter 6 - Received Identification] This is a design qualification and/or avionics certification issue. Flight testing does not addres this subparameter.

[Subparameter 4 - Morse Identification Depth]

3.3.6.6 The depth to which the radio frequency carrier is modulated by the code identification signa shall be close to, but not in excess of 10 per cent except that, where a communication channel is not provided, it shall be permissible to increase the modulation by the code identification signal to a val not exceeding 20 per cent.

3.3.6.6.1 Recommendation. If the VOR provides a simultaneous communication channel ground-to-air the modulation depth of the code identification sign should be 5 plus or minus 1 per cent in order to provide a satisfactory voice quality.

[Subparameter 5 - Voice modulation effects]

3.3.6.7 The transmission of speech shall not interfere in any way with the basic navigational function. When speech is being radiated, the code identification shall not be suppressed.

[Subparameter 6 - Received Identification]

3.3.6.8 The VOR receiving function shall permit positive identification of the wanted signal under the signal conditions encountered within the specified coverage limits, and with the modulation parameter specified at 3.3.6.5, 3.3.6.6 and 3.3.6.7.

Identification on VOR in code.

Blank

Identification on VOR in code.

Identification on TACAN/ DME at the normal time for code

identification on the VOR.

(3) Identification is a series of coded dots and dashes and/or voice identification transmissions that amplitude modulate the VOR RF carrier frequency. The ID enables a user to identify the VOR station.

(4) Evaluate the ID signals for correctness, clarity and to ensure there is no adverse effect on the azimuth course structure. When it is difficult to determine what effect the ID
has on the azimuth course structure because of roughness and scalloping, evaluate the same azimuth radial with the ID off and compare the results. When simultaneous voice and Morse coded ID are installed, the modulation levels are adjusted so both audio levels sound the same. These levels are approximately 30 and 8 percent, respectively. When a voice broadcast feature is installed (ATIS, AWOS, etc.), the voice ID feature is suppressed during voice transmissions, but the Morse coded ID should still be heard. The Morse coded ID signals must be identifiable throughout the entire unrestricted VOR coverage area, including ESV(s). When the identification is unacceptable, take appropriate NOTAM action an notify Facilities Maintenance.

(5) For facilities with standby transmitters and separate standby ID equipment, use the Morse coded ID to identify each transmitter. The number one transmitter has equal spacing between all characters of the coded identification. The spacin between the second and third characters of the number two transmitter is increased by one dot.

[Subparameter 2 - Voice]

b. Voice

(1) The voice broadcast feature, when installed, allows a user to receive radio communications,

weather and altimeter information, air traffic and airport advisories, etc., on the VOR frequency. Voice amplitude modulates the VOR carrier frequency by 30 percent.

(2) Inspect the voice for clarity to ensure there is no adverse effect on the azimuth course. Ensure that all published remote sites can respond on the VOR frequency when
contacted. Maintain a periodic surveillance of the quality and coverage of the voice transmissions throughout the VOR coverage area.

(3) Advisory services that provide voice broadcast features include ATIS, AWOS, ASOS, TWEB, and HIWAS. Some services may not be continuously available. Inspect
only the services available.

(4) When the voice transmissions are unsatisfactory, but the remainder of the VOR operation is satisfactory, NOTAM only the voice feature out of service. When the
voice modulation adversely affects the VOR operations, the voice portion must be disabled and NOTAMed out of service, or the VOR must be NOTAMed out of service.

ICAO Annex Tol	Doc 8071 Tolerance	8200 Tolerance
Zero voice modulation effects on navigation information.	Voice: Clear Identification: Clear Speech Effect on Bearing: No effect Speech Effect on Modulation: No effect	Identification: Morse code and voice identification must be correct, clear and identifiable. The audio levels of code and voice must sound similar. The course structure must not be affected by the identification. Voice: Voice transmissions must be clear and understandable. Simultaneous voice transmissions and code identification must sound similar. The voice identification must be suppressed during voice transmissions. Voice transmissions must not cause more than ± 0.5° of course deviations.

ICAO Annex Remarks	Doc 8071 Remarks	8200 Remarks
Voice tolerance <= 30%	Code identification must be audible during voice. No tolerance on voice modulation %. Speech Effect on bearing and modulation: none	No tolerance on voice modulation %. Voice transmissions must not cause more than ± 0.5° of course deviations.

ICAO Annex Information	ICAO Doc 8071 Information	Order 8200 Information	Document Comparison Information
	Measurement Uncertainty Voice, ID - none		
Annex10_ID	**8071_ID**	**8200_ID**	**Results_ID**
561	710	486	813