

CHANGE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

6810.3A
CHG 4

10/30/2003

MAINTENANCE OF FA-10235 VERY-HIGH FREQUENCY OMNIDIRECTIONAL RANGE TEST
SUBJ: (VOT) FACILITIES

1. PURPOSE. This change provides page changes to Order 6810.3A, Maintenance of FA-10235 Very-High Frequency Omnidirectional Range Test (VOT) Facilities, to correct the procedure for comparing modulation depths indicated in the VOT transmitter front panel meter with those indicated by external test equipment. This directive implements Configuration Control Decision (CCD) No. N16643, Add Potentiometer to Calibrate Modulation Depth Meter. This CCD is also implemented in SSM-VOT-001.

2. DISTRIBUTION.

a. This directive is distributed to selected offices having the following facilities/equipment: VOT.

b. An electronic version and distribution report of this directive are available on an Intranet site located at <http://aos-ext.amc.faa.gov/> under the "Technical Documentation" heading.

c. To obtain additional hard copies of this publication, contact Printing & Distribution Team, AMI-700B, at (405) 954-6892.

3. DISPOSITION OF TRANSMITTAL. Retain this transmittal.

PAGE CONTROL CHART

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23 through 26	5/11/92	23	5/11/92
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33 and 34	5/11/92	33	5/11/92
		34	10/30/2003



For Richard A. Thoma
Director, Technical Operations Support

TECHNICAL PERFORMANCE RECORD												VOT TYPE FA-10235 COMPARISON CHECKS											
FACILITY				DATES				EQUIPMENT				SUPERVISOR'S SIGNATURE											
FSS				FROM 6/92 TO				VOT Serial # 1				E. Anzo											
LOCATION Will Rogers World Airport OKC, OK				MODULATION DEPTH				FREQ. 111.0 MHz				REMARKS											
DATE	TIME	TRANSMITTER			MONITOR			9960 Hz			30 Hz			1020 Hz			INITIALS						
		TP2 (NI) V P-P	TP3 (NI) V P-P	POWER SUPPLY (W)	TP1 (MFM) V P-P	TP3 (MFM) V P-P	POWER SUPPLY (W)	MOD DP % NORMAL	TP4 (FLM) V P-P	MOD DP % NORMAL	TP6 (FLM) V P-P	MOD DP % NORMAL	TP10 (FLM) V P-P	MOD DP % NORMAL	TP10 (FLM) V P-P	MOD DP % NORMAL							
NOMINAL		7	7	✓	10	10	✓	30	27	1	0.9	30	27	1	0.9	8	6	1	0.35				
6/91/1000		7	6.8	✓	10	10	✓	32	29	1	0.9	31	28	1	0.9	9	7	1	0.35		(Readjusted alarm		
6/92/0900		6.9	6.8	✓	9	9	✓	31	27	1	0.8	29	25	1	0.8	8	5	1	0.55		Sensitivity thresholds		

FAA FORM 6810-4 (5-19) NSN 0052-00-908-0000

Figure 5-4. Example of FAA Form 6810-4 for VOT Type FA-10235 Comparison Checks

- d. **Conditions.** The equipment is operating normally.
- e. **Detailed procedure.**

(1) Set the transmitter front panel meter switch S1 to FWD PWR and record the meter reading on FAA Form 6810-1. Ascertain that the power is within operating tolerance.

(2) Set the transmitter front panel meter switch S1 to the PWR AMPL1 CUR, PWR AMPL2 CUR, DRVR CUR, AMPL CUR, and OSC CUR positions and record the display indication in amperes for each position on FAA Form 6810-1. Ascertain that readings are within operating tolerance.

105. REFLECTED POWER

a. **Object.** This procedure provides a method to determine if there has been a deterioration of the voltage standing-wave ratio (vswr).

b. **Discussion.** Changes in reflected power indicate impedance changes in the antenna system. The REFLD PWR position of the transmitter switch S1, used in this procedure, shall be used for relative reading only since it is accurate to only one decimal point. A reflected power meter reading of 0.1 or greater warrants further investigation and measurement of transmission system vswr per paragraph 150.

c. **Test Equipment Required.** No external test equipment is required.

- d. **Conditions.** The equipment is operating normally.

- e. **Detailed Procedure.**

(1) Set the transmitter meter switch S1 to the REFLD PWR position and record the reflected power on FAA Form 6810-1.

(2) Note the previous reflected power reading from the form and determine if further action is required.

106. MODULATION DEPTHS.

a. **Object.** This procedure provides a method to determine if the modulation depths of the 30-Hz variable, 9960-Hz subcarrier, 1020-Hz identification, and voice signals are within operating tolerance.

b. **Discussion.** Correct modulation levels provide proper amplitude of the recovered demodulated components in the aircraft receiver. It is important that the combined total modulation of all components does not

exceed 90 percent to ensure accuracy of course information and clarity of identification and voice signals.

c. **Test Equipment Required.** Transmission test set (TTS) equivalent to Telecom Model TTS-44.

d. **Conditions.** It is necessary to interrupt transmitter operation to perform this check.

- e. **Detailed Procedure.**

(1) 30-Hz Variable Phase Signal Modulation Depth.

(a) Set the monitor front panel NORMAL/ BYPASS switch S5 to BYPASS.

(b) On the NIV board edge panel, set the SUB-CARR and VO switches S11 and S12 to OFF, the VO and IDENT/VO switch S14 to VO, and the VAR PH switch S13 to ON.

(c) Set the transmitter front panel meter switch S1 to MOD DP %. Record the meter display (30-Hz variable phase signal modulation depth) on FAA Form 6810-3.

* **NOTE:** For out of tolerance condition between the transmitter front panel meter and the external test equipment refer to the 30-Hz calibration procedure in TI 6810.1. *

(d) Return the SUBCARR and VO switches S11 and S12 to ON, VO AND IDENT/VO S14 switch to VO and IDENT, and monitor front panel NORMAL/ BYPASS switch S5 to NORMAL.

(2) 9960-Hz Subcarrier Signal Modulation Depth.

(a) Set the monitor front panel NORMAL/ BYPASS switch S5 to BYPASS.

(b) On the NIV board edge panel, set the VAR PH and VO switches S13 and S12 to OFF, the VO and IDENT/VO switch S14 to VO, and the SUBCARR switch S11 to ON.

(c) Ascertain that the transmitter front panel meter switch S1 is in the MOD DP % position and record the meter display (9960-Hz subcarrier signal modulation depth) on FAA Form 6810-3.

* **NOTE:** For out of tolerance condition between the transmitter front panel meter and the external test equipment refer to the 30-Hz calibration procedure in TI 6810.1. *

(d) Return the VAR PH and VO switches S13 and S12 to ON, the VO and IDENT/VO switch S14 to VO IDENT, and the monitor front panel NORMAL/BYPASS switch S5 to NORMAL.

(3) Identification Signal Modulation Depth.

(a) Set the monitor front panel NORMAL/BYPASS switch S5 to BYPASS.

(b) On the NIV board edge panel, set the SUBCARR, VAR PH, and VO switches S11, S13, and S12 to OFF, the VO and IDENT/VO switch S14 to VO and IDENT, and the IDENT COD OFF/NORM/ON switch S15 to ON.

(c) Ascertain that the transmitter front panel switch S1 is in the MOD DP % position and record the meter display (ident signal modulation depth) on FAA Form 6810-3.

* **NOTE:** For out of tolerance condition between the transmitter front panel meter and the external test equipment refer to the 30-Hz calibration procedure in TI 6810.1. *

(d) Return the SUBCARR, VAR PH, and VO switches S11, S13, and S12 to ON, the IDENT COD OFF/NORM/ON switch to NORM, and the monitor front panel NORMAL/BYPASS switch S5 to NORMAL.

(4) Voice Signal Modulation Depth.

(a) Set the front panel NORMAL/BYPASS switch S5 to BYPASS.

(b) On the NIV board edge panel, set the SUBCARR and VAR PH switches S11 and S13 to OFF, the VO and IDENT/VO switch S14 to VO, the VO switch S12 to ON, and the IDENT COD OFF/NORM/ON switch S15 to OFF.

(c) Modulate the carrier connecting the transmission test set to terminals TB1-3 and TB1-4 on the transmitter rear panel and jumper terminal TB1-5 to TB1-6 (PTT).

(d) Set the output to 600 ohms at -20 dBm and the frequency to 600 Hz. Ascertain that the transmitter front panel switch S11 is in the MOD DP % position, and record the meter display (voice signal modulation depth) on FAA Form 6810-3. Repeat this procedure with the transmission test set output frequency set to 1020 Hz and

then 2400 Hz. There should be no modulation depth indication at 1020 Hz.

(e) Disconnect the test set and jumper and set the SUBCARR and VAR PH switches S11 and S13 to ON, the VO and IDENT/VO switch S14 to VO and IDENT, the monitor front panel NORMAL/BYPASS switch to NORMAL, and the IDENT COD OFF/NORM/ON switch S5 to NORM.

107. AUTOMATIC GAIN CONTROL (AGC).

a. Object. This procedure provides a method to determine if the agc is within operating tolerance.

b. Discussion. The agc prevents overdriving of the transmitter circuits during voice broadcast. Overdriven circuits produce distorted voice output and possible course error in the VOT radiated signal.

c. Test Equipment Required. Transmission test set (TTS) equivalent to Northern Telecom Model TTS-44, audio jack M642/2-2, and an ac voltmeter equivalent to Hewlett Packard Model HP400E.

d. Conditions. It is necessary to interrupt normal transmitter operation to perform this check.

e. Detailed Procedure.

(1) Set monitor NORMAL/BYPASS switch S5 to BYPASS.

(2) Note switch positions on the transmitter NIV board edge panel, then set the SUBCARR switch S11 and VAR PH switch S13 to OFF. Set VO switch S12 to ON, VO and IDENT/VO switch S14 to VO, and IDENT COD OFF/NORM/ON switch S15 to IDENT COD OFF.

(3) Connect the TTS using the audio jack M642/2-2, to the VOICE INPUT jack J2 on the transmitter front panel. The tip and ring contacts of the audio jack are used.

(4) Adjust the TTS frequency to 600 Hz and the output level to -20 dBm at 600 ohms.

(5) Connect the ac voltmeter to test point TP1 on the transmitter NIV board and note the voltmeter indication in dBm.

(6) Increase the TTS output by 10 dB to -10 dBm. Observe the voltmeter indication and ascertain that the

change in the reading from step (5) is within operating tolerance. Record the change in db on FAA Form 6810-3.

(7) Decrease the TTS output by 20 dB to -30 dBm and observe the ac voltmeter reading. It should be 10 dB \pm 1 dB lower than the indication noted in step (5).

(8) Remove the test equipment and return the NIV board switches to the positions noted in step (2).

(9) Set the monitor NORMAL/BYPASS switch S5 to NORMAL and NIV board edge panel switches to their original positions.

108. CARRIER FREQUENCY.

a. Object. This procedure provides a method to determine if the carrier frequency is within operating tolerance.

b. Discussion. The carrier frequency is dependent on the accuracy and stability of the transmitter oscillator crystal. The crystal frequency range is in the 108 to 118 MHz range and is selected for the station assigned frequency.

c. Test Equipment Required. A frequency counter equivalent to Hewlett Packard Model 5328A.

d. Conditions. The equipment is operating normally.

e. Detailed Procedure.

(1) Connect the frequency counter to the transmitter front panel TEST OUT connector.

(2) Adjust the frequency counter for a stable reading and record the frequency on FAA Form 6810-3. Ascertain that the carrier frequency is within operating tolerance.

(3) Remove the counter from the TEST OUT connector.

109. NAVTONE FREQUENCIES.

a. Object. This procedure provides a method to determine if the 30-Hz variable phase, the 9960-Hz subcarrier, and 1020-Hz identification frequencies are

within operating tolerance. It also provides a method to determine if the identification code repetition rate is within operating tolerance.

b. Discussion. After detection in the aircraft receiver, these frequencies are passed through bandpass or low-pass filters. If the frequency of these signals is outside the pass range of the filters, distortion occurs which affects the ability of receiver to produce correct course information and/or undistorted identification.

c. Test Equipment Required. A frequency counter equivalent to Hewlett Packard Model 5328A and a dual-trace oscilloscope equivalent to Hewlett Packard Model 1740A.

d. Conditions. It is necessary to interrupt transmitter operation for the identification frequency and the identification code repetition rate only.

e. Detailed Procedure.

(1) 30-Hz Variable Phase Frequency.

(a) Connect the frequency counter to TP3 on the NIV board edge panel.

(b) Adjust the frequency counter to obtain a stable reading and record the reading on FAA Form 6810-3. Ascertain that the frequency is within operating tolerance.

(c) Disconnect the frequency counter from TP3.

(2) 9960-Hz Subcarrier Center Frequency.

(a) Connect the frequency counter to TP4 on the FLM board edge panel.

(b) Adjust the frequency counter to obtain a stable reading and record the 9960-Hz subcarrier frequency reading on FAA Form 6810-1. Ascertain that frequency is within operating tolerance.

(c) Remove the frequency counter from TP4.

(3) 9960-Hz Deviation. Frequency modulation (fm) deviation is directly proportional to the amplitude of the 30-Hz modulating frequency.

Using the short piece of coaxial cable, insert the thru-line wattmeter between the transmission cable and the antenna.

(11) Turn the transmitter on and measure the antenna input and reflected powers. Record the input power on FAA Form 6810-3.

(12) Turn off the transmitter, remove the thru-line wattmeter, and reconnect the transmission cable to the antenna.

(13) Using the short piece of coaxial cable, connect the power meter to the monitor output of the antenna. Turn the transmitter on and record the antenna monitor output power on FAA Form 6810-3.

(14) Calculate the monitor coupling loss as follows:

$$-dB = 10 \log \frac{P_{in}}{P_{out}}$$

(15) Ascertain that the monitor coupling loss is within operating tolerance and record the value on FAA Form 6810-3.

(16) From the values of antenna input and reflected power from step (11), calculate the antenna vswr using the equation in step (6). Ascertain that the antenna vswr is within operating tolerance per paragraph 65.

(17) Turn the transmitter off and disconnect the short piece of coaxial cable from the antenna monitor output. Connect the monitor cable to the antenna monitor output.

(18) Reset the rf attenuator switches to the positions noted in step (4) and return the VOT to normal operation.

151.-155. RESERVED.

Section 2. OTHER MAINTENANCE TASK PROCEDURES

Subsection 1. TRANSMITTER COMPARISON CHECKS

156. DIGITAL-TO-ANALOG (D/A) CONVERTERS.

a. Object. This procedure provides a method to measure and compare analog outputs for 9960-Hz sub-carrier and 30-Hz variable phase signals to FAA Form 6810-4 references.

b. Discussion. Digital-to-analog convert reference voltages are proportional to the amplitude of the analog outputs. The output amplitudes, which are also a function of modulation depth, can be measured at test points on the NIV board edge panel using an oscilloscope.

c. Test Equipment Required. An oscilloscope equivalent to Hewlett Packard Model 1740A.

d. Conditions. The equipment is operating normally.

e. Detailed Procedure.

(1) Using the oscilloscope, measure and record on FAA Form 6810-4, the 9960-Hz subcarrier signal level at test point TP2 on the MV board edge panel.

(2) Using the oscilloscope, measure and record on FAA Form 6810-4, the 30-Hz variable phase signal level at test point TP3 on the NIV board edge panel.

(3) Compare the 9960-Hz subcarrier signal and 30-Hz variable phase signal indications to the nominal values on FAA Form 6810-4.

157. TRANSMITTER POWER SUPPLY VOLTAGES AND CURRENTS.

a. Object. This procedure provides a method to measure the transmitter power supply voltages and currents and compare the readings with the front panel METER display and to FAA Form 6810-1 references.

b. Discussion. Power supply test points provide for external measurement of the power supply voltages and currents using an external multimeter.

c. Test Equipment Required. A multimeter equivalent to Fluke Model 8020A.

d. Conditions. The equipment is operating normally.

e. Detailed Procedure.

(1) Measure and note the power supply output voltages and currents at the test points shown in table 5-1.

(2) Compare the test point readings with the applicable front panel METER display. Place a check (√) in the transmitter power supply (V) column on FAA Form 6810-4 to indicate this procedure has been accomplished. Ascertain that voltage and current readings are within operating tolerance.

Table 5-1. TRANSMITTER POWER SUPPLY TEST POINTS

<i>Test Point</i>	<i>Function</i>
TP1 (red)	Monitors reference voltage VREF + 7.15 V (nominal)
TP2 (red)	Monitors +28 V voltage
TP3 (red)	Monitors +15 V voltage
TP4 (red)	Monitors -15 V voltage
TP5 (red)	Monitors +5 V voltage
TP6 (red)	Monitors +24 V voltage
TP7 (red)	Monitors +28 V current
TP8 (red)	Monitors +15 V current
TP9 (red)	Monitors -15 V current
TP10 (red)	Monitors +5 V current
TP11 (black)	Ground

158. MODULATION DEPTHS.

a. Object. This procedure provides a method to compare modulation depths indicated on the transmitter front panel meter with those indicated by external test equipment.

b. Discussion. For the 30-Hz variable, 9960-Hz subcarrier and voice signals, a difference in modulation depth readings of ±2 percent between meter and test equipment readings is acceptable. A difference of ±1 percent is acceptable for the identification signal.

* **c. Test Equipment Required.** Wilcox PIR Model 7010, or a thruline wattmeter equivalent to Bird Model 4381. *

d. Conditions. It is necessary to temporarily interrupt transmission operation during connection and disconnection of test equipment.

e. Detailed Procedure.

* (1) Procedure for using the Wilcox PIR.

(a) Connect the 50-dB attenuator (NSN 0000-00-012-1679) to the Wilcox PIR. The attenuator was provided in SSM-VOT-001. *

* (b) Using a short piece of coaxial cable connect the 50-dB attenuator in the Wilcox PIR to the transmitter TEST OUT connector (J1). When using the Wilcox PIR, the channel frequency shall be set to the VOT frequency.

(c) Implement the procedures in paragraph 106. compare the modulation depths displayed on the front panel meter with those displayed on the test equipment.

(2) Procedure using a thruline wattmeter.

(a) Turn the transmitter OFF and disconnect the rf cable from the rf attenuator assembly (1A6).

(b) Install the thruline wattmeter in-line with the coaxial cable between the wattmeter and the attenuator assembly. Ensure the wattmeter plug-in element used is of the correct power range. Depress the % MOD key on the wattmeter keyboard.

(c) Turn the transmitter ON and implement the procedures in paragraph 106. Compare the modulation depths displayed on the front panel meter with those displayed on the wattmeter.

NOTE: For out of tolerance conditions refer to the appropriate paragraph in TI 6810.1. *

159.-165. RESERVED.