**CHANGE**

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

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

1. PURPOSE. This change updates the periodic maintenance schedule and standards and tolerances for the type FA-10235 very-high-frequency omnidirectional range test (VOT) equipment and provides guidance for those VOT facilities where the antenna monitor loop has been bypassed. This revision implements Configuration Control Decision (CCD) N14469, Update VOT Technical Documentation.

2. DISPOSITION OF TRANSMITTAL. Retain this transmittal.

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# CHAPTER 1. GENERAL INFORMATION AND REQUIREMENTS

**1. OBJECTIVE.**

This handbook provides the necessary guidance, to be used in conjunction with information available in instruction books and other handbooks, for the proper maintenance of very-high-frequency omnidirectional range test (VOT) equipment, type FA-10235.

**2. MAINTENANCE CONCEPT.**

Internal measurements are used to verify operational capabilities and certification parameters and to isolate problems in the replaceable hardware modules. External test equipment is used on a periodic basis to validate the internal measurements. The technician is still responsible for periodic maintenance performance checks and maintenance tasks to ensure the integrity of the system.

**3. CERTIFICATION REQUIREMENTS.**

Refer to Order 6000.15B for general guidance on the certification of systems, subsystems, and equipment. Refer to appendix 1 of this handbook for specific certification requirements of the type FA-10235 VOT system.

**4. AIRCRAFT ACCIDENT.**

The Systems Maintenance Service is responsible for the evaluation and documentation of the technical performance of facilities that may have been involved in an aircraft accident. The technical evaluation is to be conducted in accordance with Order 6000.15B. Facility operational data must be obtained and recorded in the facility maintenance logs and technical performance records. These recorded data are official documents and may be used during an aircraft accident investigation to determine the facility operational status at the time of the accident. Therefore, the entries shall be complete, clear, concise, and accurate. See Order 8020.11A, Aircraft Accident and Incident - Notification, Investigation, and Reporting, for general responsibilities, designation of the accident representative, and other aspects of accident procedures. While Order 8020.11A and any regional or sector supplements prescribe the actual activities to be conducted following an aircraft accident, the following activities shall be accomplished as a minimum to establish the condition of the equipment.

**NOTE:** No equipment adjustments are to be made until the as-found readings are recorded and flight inspection, if required, is accomplished.

**a.** Record the following data on FAA Form 6030-1, Facility Maintenance Log.

(1) Time of arrival at the facility.

(2) Operating condition of the equipment.

**b.** If any out-of-tolerance conditions are noted, do not make any check or adjustment that alters a characteristic of the radiated signal or monitor parameters.

**c.** Record findings on FAA Form 6030-1, Facility Maintenance Log.

**d.** Contact the accident representative relative to any shutdown and flight inspection requirements.

**e.** Certify the operation of the facility on the facility maintenance log in accordance with Order 8020.11A.

**5. STANDBY POWERPLANTS.**

Standby powerplants shall be tested and operated in accordance with Order 6980.11B, Maintenance of Engine Generators. Coordination with air traffic (AT) personnel is required before transferring the facility to standby power.

**6. CONFIGURATION MANAGEMENT.**

All VOT systems are under configuration management control as defined in Order 1800.8F, National Airspace System Configuration Management, and NAS-MD-001, National Airspace System Configuration Management Document. Any changes to the baseline configuration or requests for deviation from National standards shall be processed through the national change proposal (NCP) process.

*** 7. ANTENNA MONITOR LOOP BYPASS.**

At some VOT locations the antenna monitor loop was bypassed at the time of installation. This was done at those airports where the required rf signal level at the VOT reference point could not be achieved with the built-in rf attenuator or by lowering the antenna. The VOT system configuration in this case is as shown in appendix 2.

**8.-19. RESERVED.** *

# CHAPTER 3. STANDARDS AND TOLERANCES

30. GENERAL.

This chapter prescribes the standards and tolerances for the type FA-10235 very-high-frequency omnidirectional range test (VOT) equipment as defined and described in Order 6000.15B. All key performance parameters and/or key inspection elements are identified by an arrow (→) placed to the left of the appropriate item.

## Section 1. TRANSMITTER

| Parameter | Reference Paragraph | Standard | Tolerance/Limit | |
|---|---|---|---|---|
| | | | Initial | Operating |
| → 31. **TRANSMITTER CARRIER OUTPUT.** | | | | |
| a. **Frequency** | 108 | 108 to 118 MHz | Within 0.0005 percent of assigned frequency | Same as initial |
| b. **Power Output to RF Attenuator** | 104 | 2 W (unmodulated) | −0, +10 percent of standard with voice transmission; −0, +25 percent of standard without voice transmission | Same as initial |
| * c. **Voltage Standing-Wave Ratio (VSWR) (3dB Transmission Line Loss)** | 105 | 1.0:1 | ≤1.1:1 | ≤1.2:1 * |
| → 32. **RF ATTENUATOR SETTING** | 192 | At least 15 μV but not more than 20 μV | Determined by flight inspection, but not to exceed standard | Same as initial |
| → 33. **VARIABLE SIGNAL.** | | | | |
| a. **Frequency** | 109 | 30 Hz | Within 0.33 percent of standard (0.1 Hz) | Same as initial |
| b. **Modulation** | 106 | 30 percent (as established by flight inspection) | ±2 percent of standard | Same as initial |

## Section 1. TRANSMITTER - (Continued)

| Parameter | Reference Paragraph | Standard | Tolerance/Limit | |
|---|---|---|---|---|
| | | | Initial | Operating |
| → 34. REFERENCE SIGNAL. | | | | |
| a. Center Frequency | 109 | 9960 Hz | Within 0.03 percent of standard (3.0 Hz) | Same as initial |
| b. Peak Deviation | 109 | 1 V p-p | Within 10 perent of standard (0.1 V) | Within 20 percent of standard (0.2 V) |
| c. Reference Signal | 109 | 30 Hz | Within 0.33 percent of standard (0.1 Hz) | Same as initial |
| d. Modulation | 106 | 30 percent (as established by flight inspection) | ±2 percent of standard | Same as initial |
| e. Calibration Generator Clock Frequency | 109 | 14.6880 MHz | Within 100 Hz of standard | Within 1000 Hz of standard |
| → 35. IDENTIFICATION. | | | | |
| a. Frequency | 109 | 1020 Hz | Within 0.3 percent of standard (3.0 Hz) | Same as initial |
| b. Modulation | 106 | 8 percent | 7 to 9 percent | Same as initial |
| 36. VOICE. | | | | |
| a. Modulation | 106 | 30 percent | 28 to 30 percent | Same as initial |
| b. Automatic Gain Control (AGC) | 107 | Less than 3 dB change for a ±10 dB change in signal | Same as standard | Same as standard |
| 37. FRONT PANEL METER. | | | | |
| a. Driver Current | 104 | 0.06 ampere (A) (rf=2 W) | Within 67 percent of standard (0.04 A) | Same as initial |

## Section 2. MONITOR - (Continued)

| Parameter | Reference Paragraph | Standard | Tolerance/Limit Initial | Tolerance/Limit Operating |
|---|---|---|---|---|
| (3) Reference phase signal | 121 | Variable with 3.0 V predominant | Within 10 percent of standard (0.3 V) | Same as initial |
| (4) Identification signal (continuous) | 121 | Variable with 3.0 V predominant | Within 10 percent of standard (0.3 V) | Same as initial |
| (5) Voltages | 120 | +5.0 V | ±0.1 V | Same as initial |
| | | +15.0 V | ±0.2 V | Same as initial |
| | | -15.0 V | ±0.2 V | Same as initial |
| | | +24.0 V | ±1.0 V | Same as initial |
| (6) Currents | 120, 168 | 1.6 A (+5.0 V) | ±0.3 A | Same as initial |
| | | 0.16 A (+15.0 V) | ±0.03 A | Same as initial |
| | | 0.12 A (-15.0 V) | ±0.03 A | Same as initial |
| | | 0.0 A (+24.0 V) | +0.1 A | Same as initial |
| → **b. Variable Phase Signal Frequency** | 122 | 30 Hz | ±0.3 Hz | Same as initial |
| → **c. Subcarrier (FM).** | | | | |
| (1) Center frequency | 122 | 9960 Hz | ±3 Hz | Same as initial |
| (2) Peak deviation | 122 | 1 V p-p | ±0.1 V | ±0.2 V |
| (3) Reference signal frequency | 122 | 30 Hz | ±0.1 Hz | Same as initial |
| (4) Calibration generator clock frequency | 122 | 14.6880 MHz | ±100 Hz | ±1000 Hz |
| → **d. Phase Alarm Threshold** | 123 | ±1° as established by flight inspection | ±0.1° | Same as initial |
| **e. Shutdown Time Delay** | 125 | ≤10 seconds | ±1 second | Same as initial |

## Section 2. MONITOR - (Continued)

| Parameter | Reference Paragraph | Standard | Tolerance/Limit | |
|---|---|---|---|---|
| | | | Initial | Operating |
| → f. Monitor/RSCU Interface Voltage | 127 | +22 V (RSCU connected); +24 V (RSCU disconnected) | ±1 V | Same as initial |
| → 52. POWER SUPPLY VOLTAGES | 168 | | | |
| a. TP2 | | +28 V dc | ±0.6 V | Same as initial |
| b. TP3 | | +15 V dc | ±0.15 V | Same as initial |
| c. TP4 | | -15 V dc | ±0.15 V | Same as initial |
| d. TP5 | | +5.15 V dc | ±0.15 V | Same as initial |
| e. TP6 | | +24 V dc | ±0.5 V | Same as initial |
| 53.-59. RESERVED. | | | | |

## Section 3. REMOTE STATUS AND CONTROL UNIT (RSCU)

| Parameter | Reference Paragraph | Standard | Tolerance/Limit | |
|---|---|---|---|---|
| | | | Initial | Operating |
| → 60. RSCU VOLTAGE LEVEL. | | | | |
| a. System Normal | 136 | +22 V (RSCU connected); +24 V (RSCU disconnected) | ±1 V | Same as initial |
| b. System Alarm | 136 | +22 V (RSCU connected); +24 V (RSCU disconnected) | ±1 V | Same as initial |
| c. Aural Alarm | 136 | +22 V (RSCU connected); +24 V (RSCU disconnected) | ±1 V | Same as initial |
| 61.-64. RESERVED. | | | | |

## Section 4. ANTENNA

| Parameter | Reference Paragraph | Standard | Tolerance/Limit | |
|---|---|---|---|---|
| | | | Initial | Operating |
| 65. ANTENNA VSWR ..... | 150 | ≤1.2:1 | ≤1.2:1 | Same as initial |
| * 66. MONITOR COUPLING LOSS[1] ..... | 150 | 5.1 dB | ±1 dB | Same as initial * |
| 67.-74. RESERVED. | | | | |

* [1] Not applicable at locations where the monitor loop antenna has been bypassed. See chapter 1, par 7. *

# CHAPTER 4. PERIODIC MAINTENANCE

75. GENERAL.

This chapter establishes all the maintenance activities that are required for the VOT type FA-10235 equipment on a periodic, recurring basis and the schedules for their accomplishment. The chapter is divided into two sections. The first section identifies the performance checks (i.e., tests, measurements, and observations) of normal operating controls and functions, which are necessary to determine whether operation is within established tolerances/ limits. The second section identifies other tasks, which are necessary to prevent deterioration and/or ensure reliable operation. Refer to Order 6000.15B for additional general guidance.

## Section 1. SYSTEM PERFORMANCE CHECKS

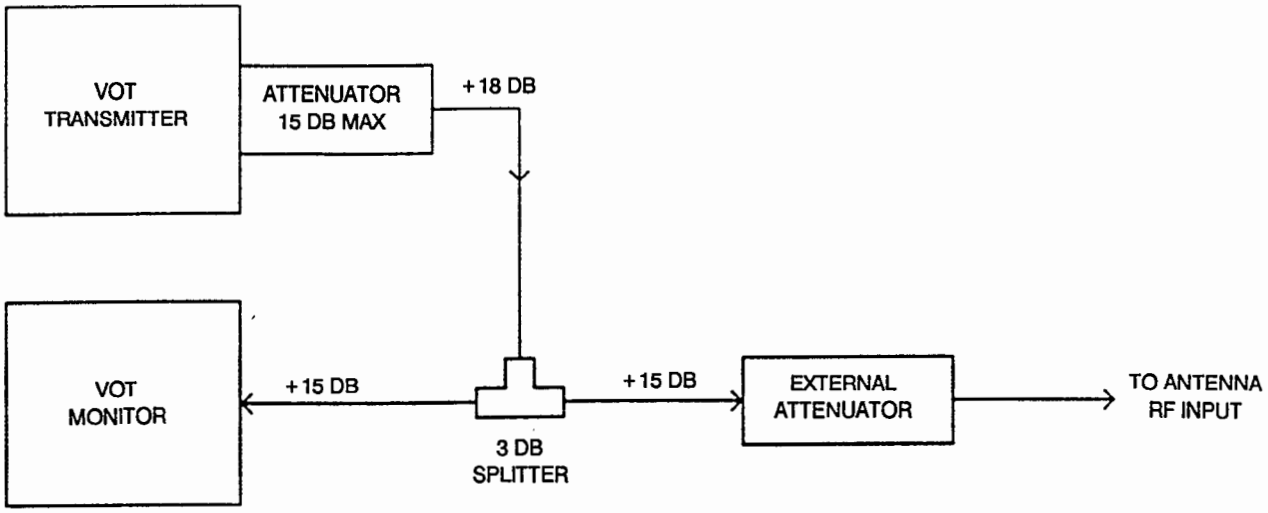
| *Performance Checks* | *Reference Paragraph* | |
|---|---|---|
| | *Standards and Tolerances* | *Maintenance Procedures* |
| 76. QUARTERLY. | | |
| **a. Check the following transmitter parameters:** | | |
| (1) Power supply voltages | 37g | 103 |
| (2) Power supply currents | 37h | 103 |
| (3) Forward power and rf currents | 31b, 37 | 104 |
| (4) Reflected power | — | 105 |
| (5) 30-Hz variable phase modulation | 33b | 106 |
| (6) 9960-Hz subcarrier modulation | 34d | 106 |
| (7) 1020-Hz identification modulation | 35b | 106 |
| **b. Check the following monitor parameters:** | | |
| (1) Power supply voltages | 51a(5) | 120 |
| (2) Power supply currents | 51a(6) | 120 |
| (3) Monitor signal levels | 51a(1), (2), (3), and (4) | 121 |
| (4) Phase alarm threshold | 51d | 123 |
| (5) System shutdown delay | 51e | 125 |
| (6) 400-Hz go/no-go signal | 50 | 126 |
| (7) Alarm LED operation | — | 124 |

## Section 1. SYSTEM PERFORMANCE CHECKS - (Continued)

| *Performance Checks* | *Reference Paragraph* | |
|---|---|---|
| | *Standards and Tolerances* | *Maintenance Procedures* |
| 77. ANNUALLY. | | |
| **a. Measure the following transmitter parameters:** | | |
| (1) Carrier frequency | 31a | 108 |
| (2) 30-Hz variable phase frequency | 33a | 109 |
| (3) 30-Hz reference frequency | 34c | 109 |
| (4) 9960-Hz subcarrier frequency | 34a | 109 |
| (5) 9960-Hz subcarrier deviation | 34b | 109 |
| (6) 1020-Hz identification frequency | 35a | 109 |
| (7) Calibration generator clock frequency | 34e | 109 |
| (8) Voice modulation | 36a | 106 |
| **b. Measure the following monitor parameters:** | | |
| (1) 30-Hz variable phase frequency | 51b | 122 |
| (2) 30-Hz reference frequency | 51c(3) | 122 |
| (3) 9960-Hz subcarrier frequency | 51c(1) | 122 |
| (4) 9960-Hz subcarrier deviation | 51c(2) | 122 |
| (5) Calibration generator clock frequency | 51c(4) | 122 |
| **c. Measure the RSCU voltage levels** | 60 | 136 |
| **d. Measure the following antenna parameters:** | | |
| (1) Voltage standing-wave ratio (vswr) | 65 | 150e(10) |
| * (2) Monitor coupling loss[1] | 66 | 150e(10) * |
| 78.-89. RESERVED. | | |

* [1] Not applicable at locations where the monitor loop antenna has been bypassed. See chapter 1, par 7. *

# APPENDIX 2. MONITOR LOOP BYPASS




1. The transmitter output power is 2 watts, or 33 dB.

2. The VOT attenuator is set to its maximum of 15 dB.

3. The signal available to the antenna is 15 dB. If more than 15 dB is required, the VOT attenuator may be set to less than 15 dB but NOT TO LESS THAN 4 dB AS DAMAGE TO THE MONITOR MAY RESULT (+26 dBm at the monitor).

4. The external attenuator is set so that rf signal strength at the VOT reference point is 15 to 20 microvolts.

5. On the monitor FLM board, R2 is adjusted as necessary.

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