Radio Interference Test Procedures
FS/OAS A-30
Revision: Original

September 10, 2018

Standard testing verifies that radios meet specifications for correct frequency, modulation or deviation levels and basic operation. More in-depth testing may be required for aircraft approved for complex missions, initial use under a contract or when interference problems are suspected. In these cases the following tests can be used to verify proper operation.

These tests should be performed outside and at least 20 feet from any nearby buildings. The test set must be at least 20 feet from the aircraft to prevent near-field antenna effects. Further separation may be necessary to ensure direct line of sight. When possible ensure equal distance to each Com antenna.

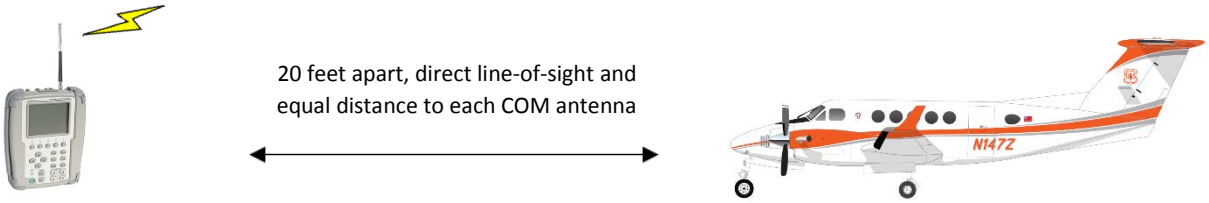
Step 1. Measure Com receiver sensitivity.

Receiver sensitivity determines the distance at which the radio can communicate effectively. This test simulates reception of a signal from 50 nautical miles (industry standard for installed radio verification).

Test setup for measuring sensitivity

1. Position the test set at a distance listed in Table 1. Ensure that the test set has direct line-of-sight and approximately equal distance to each aircraft Com antenna. Record the path loss corresponding to the distance selected.
2. Set frequencies of 122.925 for AM radio tests and 168.3500 for FM radio tests.
3. Using a Nav/Com Test Set with the telescoping antenna fully extended, record the RF level that causes the squelch to open on each radio.
4. Add the RF level to the path loss to establish the receiver sensitivity. The radio must receive a signal of -73 dBm or smaller to demonstrate reception of a signal from 50 NM.
5. Repeat this test for any radios with antennas that were not at the distance in Table 1.

Step 1 Example:



-44 dBm ⟶ 20 ft. Separation (From Table 1) ⟶ Signal strength at the received antenna = -74 dBm

Path loss = 30 dB at 20 feet separation between the IFR 4000 and the aircraft

The squelch opens when the IFR 4000 is set to transmit at -44 dBm

Result:	*IFR 4000*	+	*Path Loss*	=	*Sensitivity*	(must be -73 dBm or smaller)
	-44 dBm	+	(-30 dB)	=	-74 dBm	= PASS

Step 2. Measure sensitivity during simultaneous use of multiple radios.

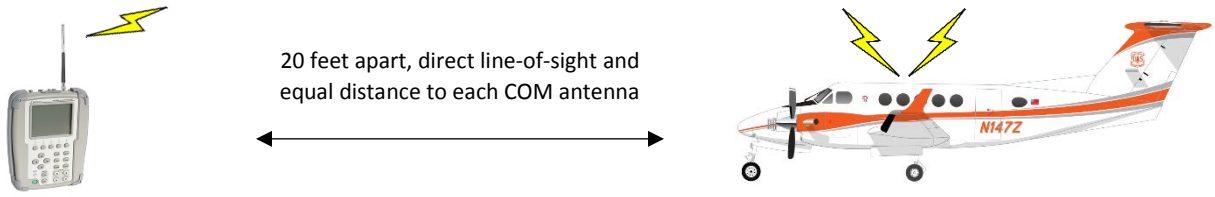
This test verifies that communications can be maintained at a distance of at least 24 nautical miles during simultaneous use of multiple radios. It also verifies that transmit interlock functions are not incorporated. Step 2 is not required for non-fire aircraft, single-engine helicopters that are not approved for passengers, or single-engine airtankers.

This is identical to Step 1 except a second aircraft radio must be transmitting while measuring receiver sensitivity. Table 2 provides equivalent ranges for reference.

<u>Test setup for measuring sensitivity during simultaneous use of multiple radios</u>

1. Set the radio under test to receive a desired signal (such as 122.925 MHz).
2. From the copilot station, transmit on a second radio at a frequency spaced 2 MHz from the desired receiver frequency (such as 124.925 MHz). **Verify these are not active frequencies in the test area.**
3. Monitor the radio under test from the pilot station and record the RF level on the test set that causes the squelch to open.
4. Add the RF level to the path loss to establish the receiver sensitivity. The radio must receive a signal of -66 dBm or smaller to demonstrate reception of a signal from 24 NM.
5. Repeat this test for each combination of AM and FM radios.

Step 2 Example:



-37 dBm ⟶ 20 ft. Separation (From Table 1) ⟶ Signal strength at the received antenna = -67 dBm

The IFR 4000 is generating a signal on 122.925 MHz and Com 1 is tuned to 122.925 MHz

Com 2 is transmitting on 124.925 MHz

Path loss = 30 dB at 20 feet separation between the IFR 4000 and the aircraft

The squelch opens when the IFR 4000 is set to transmit at -37 dBm

Result:	*IFR 4000*	+	*Path Loss*	=	*Sensitivity*	(must be -66 dBm or smaller)
	-37 dBm	+	(-30 dB)	=	-67 dBm	= PASS

Step 3. Check for adjacent channel interference.

This test verifies that transmitters will not open squelch on, or interfere with, other radios on the aircraft which are monitoring different frequencies.

<u>Test setup for checking adjacent channel interference</u>

1. On the pilot's audio panel, enable audio for all Com receivers. Transmissions are conducted from the copilot station to prevent audio muting from masking interference during the test.
2. Tune Com 1 to 122.925, all other AMs to 123.925 and all FMs to 138.0000.
3. Transmit on Com 1 from the copilot station while monitoring all Com receivers from the pilot station for squelch breaks or other noise.
4. Repeat this test multiple times while channeling the radios to different frequencies and spacing throughout the AM and FM band. Interference may vary based on the frequency of the receiver and the spacing from the transmitter. If any interference occurs, record the radios affected and transmit and receive frequencies tuned during the interference.
5. Repeat Steps 3 and 4 for each AM radio on the aircraft.
6. Tune FM 1 to 168.3500, all other FMs to 169.3500 and all AMs to 136.975.

7. Transmit on FM 1 from the copilot station while monitoring all Com receivers from the pilot station for squelch breaks or other noise.
8. Repeat this test multiple times while channeling the radios to different frequencies and spacing throughout the AM and FM band. If any interference occurs, record the radios affected and transmit and receive frequencies tuned during the interference.
9. Repeat Steps 7 and 8 for each FM radio on the aircraft.
10. Ensure the radios can be channeled to within 1 MHz of each other without squelch breaks or interference during transmissions.

Table 1

Free space path loss and maximum test set signal level to pass Step 1 and Step 2.

Test Set to Antenna Separation (feet)	Equivalent Path Loss (dB)	Maximum Signal at Test Set to Pass **Step 1** (dBm)	Maximum Signal at Test Set to Pass **Step 2** (dBm)
20	-30	-43	-36
30	-34	-39	-32
40	-36	-37	-30
50	-38	-35	-28

Note 1: The difference in required signal levels between AM and FM radios is offset by an equivalent change in path loss. This results in the same RF level required at the test set making the values in Table 1 valid for both AM and FM radios.

Table 2

Received signal strength at various distances on 122.925 MHz. Assumes the transmitting aircraft is using the least powerful radio allowed by contract (5 Watts).

Sensitivity (dBm)	Effective Range (NM)
-64.3	20
-65.9	24
-67.8	30
-72.3	50

Table headings link to range calculator
Pt = 5 W
Gt & Gr = 0 dBd (aviation antennas)
Pr = Sensitivity

Note 2: The effective range calculator (https://www.random-science-tools.com/electronics/friis.htm) uses statute miles. This must be converted to nautical miles for the purpose of this test.

Note 3: If using the linked effective range calculator for FM frequencies, the recorded sensitivity must be increased by 3 dB to account for the corresponding increase in path loss (i.e. -66 dBm to -69 dBm). This does not apply to existing tables which take this into account.