

§ 2.1505 Test instrumentation and equipment.

(a) *Receiver (field intensity meter).* A calibrated field intensity meter (FIM) with a frequency range of 30 to 1000 MHz is required for measuring radiated emission levels. This instrument should be capable of making peak measurements with a bandwidth of 100 kHz.

(b) *Spectrum analyzer.* Spectral measurements are to be made with a spectrum analyzer with a minimum resolution bandwidth no greater than 10 Hz. The video filter, if used, should have a bandwidth wide enough so as to not affect peak readings. A linear video output is desirable for performing measurements of modulation characteristics.

(c) *Storage oscilloscope.* Measurements of modulation characteristics are to be made using a calibrated storage oscilloscope. This instrument is to be DC coupled and capable of manually triggered single sweeps.

(d) *Frequency counter.* A frequency counter with an accuracy of at least 5 parts per million is required for measuring the carrier frequency.

(e) *Signal generator.* A calibrated signal generator with an output of at least 75 mW at 121.5 and 243 MHz is required for generating a reference signal for site calibration.

(f) *Antenna.* Radiated emissions are to be measured with calibrated, tuned, half-wave dipole antennas covering the frequency range of 30 to 1000 MHz.

(g) *Temperature chamber.* Tests which call for subjecting the EPIRB to temperature levels other than the ambient temperature are to be performed in a temperature test chamber which can be adjusted to stable temperatures from -20 to +55 °C. This chamber is to be of sufficient size to accommodate the EPIRB under test.

(h) *Vibration table.* A vibration table capable of vibrating the EPIRB with a sinusoidal motion is required. The table must be capable of varying the frequency of vibration either linearly or logarithmically over a range of 4 to 33 Hz with maximum peak amplitudes of up to 2.5 mm.

(i) *Salt fog chamber.* A chamber capable of producing salt fog at a temperature of 35 °C for 48 hours is required.

This chamber is to be of sufficient size to accommodate the EPIRB under test.

(j) *Drop test facility.* A facility which will permit dropping an EPIRB from a height of 20 m into water is required. The water must be deep enough so that the EPIRB will not touch bottom when dropped.

ENVIRONMENTAL AND OPERATIONAL TEST PROCEDURES**§ 2.1507 Test frequencies.**

Testing of an EPIRB for compliance outside a shielded room on a distress frequency is prohibited, since this may interfere with emergency communications. Therefore, all compliance testing outside a shielded room should be conducted on one of the pairs of alternate frequencies specified below:

121.600/243.200 MHz
 121.650/243.300 MHz
 121.700/243.400 MHz
 121.750/243.500 MHz
 121.800/243.600 MHz
 121.850/243.700 MHz
 121.900/243.800 MHz

The above frequencies are to be used for limited testing of EPIRBs for compliance with FCC Rules, subject to the following conditions:

(a) The testing shall not cause harmful interference to authorized communications on these frequencies.

(b) The testing shall be coordinated with the nearest FCC district office.

For simplicity, 121.5 MHz and 243 MHz will be used throughout this test procedure to indicate the alternate test frequency.

§ 2.1509 Environmental and duration tests.

The environmental and operational tests in § 2.1509 (a) through (e) are to be conducted on a single test unit in the order given below. This sequence of tests also includes the electrical tests in §§ 2.1511, 2.1513 and 2.1515 of this part. The test unit is not to be adjusted, nor is the battery to be replaced during these tests, and a log of battery on-time should be maintained. The above tests are to be performed on the same test unit. The tests in § 2.1509 (f) through (i) may be run in any sequence or may be performed on separate test units.

(a) *Vibration test.*

Step (1) Secure the EPIRB to the vibration table. The EPIRB is not to be operated and should not activate while being vibrated.

Step (2) Subject the EPIRB to sinusoidal motion parallel to one of the three major orthogonal axes under the following conditions:

A. Frequency (Hz)	Peak amplitude (mm)
4-10	2.5
10-15	0.8
15-25	0.4
25-33	0.2

B. The frequency is to be changed either linearly or logarithmically with time between 4 Hz and 33 Hz such that a complete cycle (4 Hz to 33 Hz to 4 Hz) takes approximately 5 minutes.

C. The EPIRB is to be vibrated for at least 30 minutes or six complete cycles.

Step (3) Remount the EPIRB, if necessary, and repeat step 2 for each of the other two major orthogonal axes.

Step (4) Upon completion of the test, perform an exterior mechanical inspection and verify operation by turning the unit on and observing the RF power indicator on the unit or monitoring the transmission with a receiver. Record test results.

(b) *Thermal shock tests.* These tests are to be performed on EPIRBs which are required or intended to float.

(1) *Low temperature thermal shock test.*

Step (1) Place the EPIRB in a temperature chamber for at least 3 hours at -20 °C or colder. The EPIRB is not to be operated while being cooled.

Step (2) Immediately place the EPIRB in water that has been maintained at +10 °C or warmer.

Step (3) After 15 minutes, perform an exterior mechanical inspection and verify operation by turning the unit on and observing the RF power indicator on the unit or monitoring the transmission with a receiver. Record test results.

(2) *High temperature thermal shock test.*

Step (1) Place the EPIRB in a temperature chamber for at least 3 hours at +55 degrees C or warmer. The EPIRB is not to be operated while being heated.

Step (2) Immediately float the EPIRB in water that is maintained at +25 degrees C or colder.

Step (3) After 15 minutes, perform an exterior mechanical inspection and verify operation by turning the unit on and observing the RF power indicator on the unit or monitoring the transmission with a receiver. Record test results.

(c) *Salt fog test.*

Step (1) Place the EPIRB in a salt fog chamber for a period of at least 2 hours at a temperature of 35 °C (±2 °C) before exposing it to salt fog. The EPIRB is to be turned off during this test.

Step (2) With the chamber temperature maintained at 35 °C, introduce salt fog at the saturation point for 48 hours. The salt fog is to be prepared from a 5% (±1%) salt (sodium chloride solution. For detailed guidance on the preparation of the solution and the apparatus for generating salt fog, refer to MIL-STD-810D (19 July 1983), method 509.2.

Step (3) Upon completion of the salt fog exposure, the EPIRB is to be airdried at room temperature for 12 hours and operation verified by turning the unit on and observing the RF power indicator on the unit or monitoring the transmission with a receiver. Record observations.

(d) *Drop test.* This test is to be performed on EPIRB which are required or intended to float.

Step (1) Turn the EPIRB on, log the time and drop it three times into water from a height of 20 meters. The water is to be deep enough so that the EPIRB does not touch bottom when dropped. Each drop should be initiated from a different orientation as follows: antenna vertical up; antenna vertical down; antenna horizontal.

Step (2) Upon completion of the drop test, an exterior mechanical inspection is to be performed and operation verified by observing the RF power indicator on the unit or monitoring the transmission with a receiver. Record observations. Turn the test unit off and log the total on-time.

(e) *Forty-eight hour operational test.* This test includes the battery life test and all the electrical tests given in §§ 2.1511, 2.1513 and 2.1515 of this part, at various temperatures. The tests are to be performed on the same EPIRB in the sequence specified herein. Be sure to record the on-time of the unit during each test. No more than 8 hours of total on-time is permitted before commencing step 4. When operating the EPIRB in the environmental chamber, a non-radiating load may be substituted for the antenna provided it is electrically equivalent to the standard antenna and does not reduce the battery current drain.

Step (1) Perform the radiated emissions test in § 2.1511 of this part.

Step (2) Perform the modulation characteristic tests in § 2.1513 of this part.

Step (3) Perform the spectral tests in §2.1515 of this part.

Step (4) With the EPIRB off, place unit in an environmental chamber at a temperature of -20°C for at least 2 hours.

Step (5) With the EPIRB in the chamber, repeat the carrier frequency test in §2.1515(d) of this part. (Leave the EPIRB turned on.)

Step (6) Near the end of 48 hours of total on-time for the EPIRB, repeat the carrier frequency test in §2.1515(d) of this part.

Step (7) At the end of 48 hours of total on-time, remove EPIRB from the chamber and immediately repeat the PERP test for the fundamental emissions in §2.1511(c) of this part. The unit should be maintained at -20°C to the extent possible for this test.

(f) *Float free and activation test.* This test is required only for Class A EPIRBs.

Step (1) The EPIRB is to be installed in the automatic release mechanism and the assembly is to be mounted on a fixture simulating a deck or bulkhead as per manufacturer's installation instructions.

Step (2) Submerge the fixture in water in its normal mounted orientation. The EPIRB must float free before reaching a depth of 4 meters and should automatically activate. Activation is to be verified by observing the RF power indicator on the unit or monitoring the transmission with a receiver. If the EPIRB is equipped with an automatically deployable antenna, the antenna must properly deploy during each immersion. Record observations.

(g) *Stability and buoyancy test.* This test is to be performed on EPIRBs which are required or intended to float. This test is to be conducted in fresh water.

Step (1) With the antenna deployed in its normal operating position, submerge the EPIRB in a horizontal position just below the surface of the water.

Step (2) Release the EPIRB and observe the amount of time required for it to come to an upright position. It must reach its upright position within one second from each position.

The EPIRB must have a reserve buoyancy of at least 5% of its gross weight. It must also float upright in calm water with the base of the antenna a minimum of 5 cm above the water. Record the time required for the test unit to right itself.

(h) *Temperature/frequency test.* The frequency stability shall be measured over an ambient temperature from -20° to $+55^{\circ}\text{C}$ at intervals of not more than 10°C . A period of time sufficient to stabilize all of the components of

the oscillator circuit at each temperature level shall be allowed prior to frequency measurement.

Step (1) Place the EPIRB in the environmental test chamber.

Step (2) Adjust the temperature in the chamber to $+20^{\circ}\text{C}$ and allow sufficient time for the oscillator to stabilize at that temperature.

Step (3) Measure the carrier frequency in accordance with the procedure in §2.1515(d) of this part. Record the carrier frequency in Hertz. The carrier frequency at $+20^{\circ}\text{C}$ is the reference for determining the frequency tolerance.

Step (4) Increase the temperature in the chamber to $+55^{\circ}\text{C}$ and allow sufficient time for the oscillator to stabilize at that temperature. Measure the carrier frequency using the procedure in §2.1515(d) of this part.

Step (5) Reduce the temperature in the chamber in 10°C maximum increments until -20°C is reached. At each new temperature, allow sufficient time for the oscillator to stabilize at that temperature. Measure the temperature and frequency in each case and plot the frequency vs temperature from -20° to $+55^{\circ}\text{C}$.

(i) *Leakage and immersion test.*

Step (1) Completely submerge the EPIRB in water for 48 hours. The EPIRB is to be turned off during this test.

Step (2) Remove the EPIRB from the water and wipe dry.

Step (3) Verify operation by briefly turning the EPIRB on and observing the RF power indicator on the unit or monitoring the transmission with a receiver.

Step (4) Open the EPIRB for examination. There is to be no water inside the unit. Record observations.

§2.1511 Measurements of radiated emissions.

The Commission's Rules require that the peak effective radiated power (PERP) of a Class A, B or S EPIRB not be less than 75 mW under certain specified conditions. The PERP of an EPIRB transmitter is determined by comparing its level to a reference PERP generated by a standard quarter-wave monopole antenna located on a one wavelength minimum diameter metal ground plane. The Rules also require that all spurious and harmonic emissions be attenuated by a specified amount with respect to the reference PERP. In addition, there is a limit on the PERP of radiated emissions with the switch in the test mode. These