

DESIGN QUALIFICATION TEST PLAN
for the
SRB-406, 406MHz EMERGENCY LOCATOR
TRANSMITTER
(FCC)

Next Assembly: P3-03-0041 Series
Where used: Model SRB-406

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REVISIONS

Revision	Date	Change Description	Approval
-	4/21/03	ECO #13762	T. Cohen

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1.0 PURPOSE

The DME SRB-406 Emergency Locator Transmitter is a distress beacon that is intended to be attached to various types of life rafts aboard U.S. registered civil airplanes. The 406.028 MHz Emergency Locator Transmitter also contains a homing beacon that transmits at 121.5 MHz and 243 MHz. Emergency Locator Transmitters that are used aboard U.S. registered civil airplanes must meet the minimum performance standards prescribed by the Federal Aviation Administration and the Federal Communications Commission.

This document identifies the test procedures used to demonstrate that the DME model SRB-406 Type S Emergency Locator Transmitter (ELT) complies with the performance requirements prescribed by the Code of Federal Regulations (CFR) Title 47, Federal Communications Commission (FCC) Part 87, Aviation Services for a survival type ELT.

The SRB-406, part number P3-03-0041-001/-002, is a water activated Survival (class S) ELT that transmits on 406.028, 121.5, and 243 MHz. The SRB-406 consists of the transmitter housing, a replaceable battery pack, and either one or two detachable antenna assemblies consisting of coaxial cable, a rubber antenna mounting boot, and the antenna mast.

2.0 SCOPE

47 CFR Part 87, Aviation Services for a Survival type prescribes the minimum performance standards that a 406.028 MHz ELT must meet in order to be identified with the applicable FCC marking. Other than the spurious emission limits specified in 87.139, The DME 406.028 MHz ELT that is to be so identified must meet the minimum performance standards set forth in RTCA Document No. DO-204 as required by 47CFR 87.199. RTCA/DO-204 requires that the 121.5 MHz / 243 MHz portion of the ELT meet the requirements of RTCA/DO-183. Tests listed in this document are developed from RTCA/DO-183 and RTCA/DO-204.

These tests shall be performed at an outside test laboratory and the DME test laboratory.

3.0 REFERENCE DOCUMENTS

The following documents form a part of the SRB-406 ELT Test Plan to the extent specified herein. When paragraphs within a specification are cited, the citation is understood to include all subparagraphs unless otherwise noted.

<u>GOVT. DOC.</u>	<u>REV</u>	<u>DATE</u>	<u>DESCRIPTION</u>
47CFR87.199		99/10/01	(Code of Federal Regulations, FCC) Special Requirements For 406.025 MHz ELTs
FAA TSO C91a		04/29/85	Emergency Locator Transmitter (ELT) Equipment
FAA TSO C126		92/12/23	Technical Standard Order, 406 MHz Emergency Locator Transmitter (ELT)
RTCA/DO-204		89/09/29	Minimum Operational Performance Standards For 406MHz Emergency Locator Transmitters (ELT)
RTCA/DO-183		83/05/13	Minimum Operational Performance Standards For Emergency Locator Transmitters, Automatic Fixed-ELT (AF), Automatic Portable-ELT (AP), Automatic Deployable-ELT (AD), Survival-ELT (S), Operating on 121.5 and 243.0 MHz
EUROCAE/ED-62		90/05	MOPS for Aircraft Emergency Locator Transmitters (121.5/243 MHz and 406 MHz)
RTCA/DO-160D		97/07/29	Environmental Conditions and Test Procedures For Airborne Equipment
C/S T.001	3	99/10	Specification For COSPAS-SARSAT 406 MHz Distress Beacons
C/S T.007	7	00/10	COSPAS-SARSAT 406 MHz Distress Beacon Type Approval Standard

4.0 TEST EQUIPMENT AND CALIBRATION

In accordance with standard test procedures, all measurements must be performed with equipment and instrumentation that is in a known state of calibration, and with measurement traceable to National Standards. All test equipment will have a calibration sticker affixed to the equipment and will provide as a minimum the calibration date and the calibration due date.

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5.0 RTCA/DO-204 & DO-183 TESTS

After the Production Testing requirements have been verified, the units shall be subjected to the following qualification tests. The UUT shall not inadvertently activate during any test. Before the start of any environmental test, it shall be determined if the battery pack has sufficient life to complete the test. Unless indicated otherwise, the battery pack may be replaced before the start of any environmental test.

5.1 Grouping of Tests

Four groups of tests are specified: A, B, C and D. These groups are intended to represent the environmental situations likely to be experienced by an ELT, and the order in which they will occur. The group of tests is as follows:

Group A

Low Temperature (Activation), High Temperature (Activation), Altitude, Decompression, Overpressure, Vibration, Long Term Frequency Stability.

These tests may be performed on multiple units and in any order.

Group B

Humidity, Spray Proof, Saltwater Immersion, Sand and Dust, Salt Spray, Shocks, Crush, Flame, Post Crash Immersion.

These tests must be performed following the Group A tests on the units in the order shown.

Group C

Low Temperature Life, High Temperature Life, Temperature Variation (Frequency Stability), Thermal Shock.

These tests must be performed following the Group B tests and may be performed on the units in any order.

Group D

Post Test Performance, VSWR, Self-Test, Top/Bottom Antenna Switching.

These tests must be performed following the Group C tests and may be performed on the units in any order.

5.2 Requested Waivers

Waivers are requested for the following tests:

Tests required in DO-204 that are deemed not applicable to the DME CORP. SRB-406 beacon:

- POWER INPUT NORMAL OPS (Ref: DO-204, 2.3.13.1),
 - POWER INPUT ABNORMAL OPS (Ref: DO-204, 2.3.13.2),
 - INDUCED SIGNAL SUSCEPTIBILITY (Ref: DO-204, 2.3.16),
 - EMISSION OF RF ENERGY (Ref: DO-204, 2.3.18),
 - CRASH SAFETY (Ref: DO-204, 2.4.2.4), and
 - IMPACT (Ref: DO-204, 2.3.4.2)
- A. Ref: DO-204 tests 2.3.13.1 and 2.3.13.2 specify testing of input voltages to the beacon. The DME CORP SRB-406 is battery powered and, therefore, these tests do not apply.
 - B. Ref: DO-204 test 2.3.16 specifies testing of the beacon in the “OFF” state to verify that the beacon will not activate due to induced magnetic fields and references DO-160, 19.3.1 CAT A or Z. DO-160D section 19 states the purpose of the test relates to other on-board equipment or systems coupled to the ELT “through its interconnecting wiring.” The DME CORP SRB-406 is battery powered and does not have interconnecting wiring. Therefore, this test does not apply to the DME CORP SRB-406.
 - C. Ref: DO-204 test 2.3.18 states that this test is not applicable to ELT type (S) units. The DME CORP SRB-406 is a type S beacon. (Table 2-2 in DO-204 on page 32 that is used as the reference for the tests that are required is in error.)
 - D. Ref: DO-204 test 2.4.2.4 references DO-204 test 2.2.5. Test 2.2.5 specifies that the test is not applicable to type (S) units. The DME CORP SRB-406 is a type S beacon.
 - E. Ref: DO-204 test 2.3.4.2 specifies tests using an impactor against the ELT on an unyielding surface when the ELT is in the “ON” state. After the test is concluded, the ELT must still be operating. The DME CORP SRB-406 is designed to be packaged in a pouch inside a raft that is installed in the airplane in an enclosed compartment and manually activated when the raft is outside of the airplane in the water. The conditions of this test will never exist for the operating condition of the DME CORP SRB-406 beacon and do not apply.

5.3 Test Procedures and Methods

Unless otherwise specified the temperatures quoted in this document have a tolerance of $\pm 3^{\circ}\text{C}$. When the term "allowed to stabilize" is used, it means that the equipment shall have been exposed to the appropriate temperature for at least 30 minutes or to a time equal to twice the thermal time constant of the ELT oscillator, whichever is the greater.

5.3.1 Group A Tests

NOTE: In the following tests that reference the Eurocae ED-62 test document, these tests were selected due to their more stringent requirements when compared to the respective DO-204 document test procedure.

5.3.1.1 Low Temperature Activation (Ref. Eurocae ED-62, para. 4.4.1.1)

The beacon assembly shall be subjected to the test specified in Eurocae ED-62, para. 4.4.1.1. The beacon shall activate after the arming pin is removed from the beacon and the antenna water sensor is immersed in water at 0°C . After the beacon is de-armed, the beacon self-test function will be tested. The beacon performance testing is deferred until after the completion of the vibration testing.

5.3.1.2 High Temperature Activation (Ref. Eurocae ED-62, para. 4.4.1.2)

The beacon assembly shall be subjected to the test specified in Eurocae ED-62, para. 4.4.1.2. The beacon shall activate after the arming pin is removed from the beacon and the antenna water sensor is immersed in water at 40°C . After the beacon is de-armed, the beacon self-test function will be tested. The beacon performance testing is deferred until after the completion of the vibration testing.

5.3.1.3 Altitude (Ref. Eurocae ED-62, para. 4.4.1.3)

The beacon assembly shall be subjected to the test specified in Eurocae ED-62, para. 4.4.1.3. The beacon shall activate after the arming pin is removed from the beacon and the antenna water sensor is immersed in water at 40°C . After the beacon is de-armed, the beacon self-test function will be tested. The beacon performance testing is deferred until after the completion of the vibration testing.

5.3.1.4 Decompression (Ref. Eurocae ED-62, para. 4.4.2, as modified)

The beacon assembly shall be subjected to the test specified in Eurocae ED-62, para. 4.4.2, as modified. With the beacon at ambient temperature, reduce chamber pressure from ambient to 10 psi and maintain this pressure for a minimum of ten minutes. At the end of ten minutes, decrease chamber pressure to 1 psi within a maximum of 25 seconds and hold the pressure at 1 psi for a minimum of 10 minutes.

Increase chamber pressure to ambient pressure within a maximum of 150 seconds. Activates the ELT by immersing the antennas in water at room temperature, when ambient pressure is reached and verify the ELT is transmitting.

5.3.1.5 Overpressure (Ref. RTCA DO-204, para. 2.3.1.5)

The beacon assembly shall be subjected to the test specified in RTCA DO-204, para. 2.3.1.5. The beacon must not activate during the test event. The beacon shall activate after the arming pin is removed from the beacon and the antenna water sensor is immersed in water at room temperature. After the beacon is de-armed, the beacon self-test function will be tested. The beacon performance testing is deferred until after the completion of the vibration testing.

5.3.1.6 Vibration (Ref. RTCA DO-204, para. 2.3.5)

The beacon assembly shall be subjected to the test specified in RTCA DO-204, para. 2.3.5. The unit will be tested per RTCA DO-160D, paragraph 8.5.1, Figure 8-2, test curve Z, except upper frequency will be 2000 Hz instead of 1400 Hz. The beacon must not activate during the test event. The beacon shall activate after the arming pin is removed from the beacon and the antenna water sensor is immersed in water at room temperature. After the beacon is de-armed, the beacon self-test function will be tested, the operation of controls will be checked, the aliveness test of RTCA DO-204, paragraph 2.3 will be performed and a production acceptance test per Y1-02-1053 will be performed.

5.3.1.7 Long Term Frequency Drift (Ref. RTCA DO-204, para. 2.4.2.1.4)

The beacon assembly shall be subjected to the test specified in RTCA DO-204, para 2.4.2.1.4.

5.3.2 Group B Tests

5.3.2.1 Humidity (Ref: RTCA DO-204, para. 2.3.3)

The beacon assembly shall be subjected to the test specified in RTCA DO-204, para. 2.3.3. The beacon must not activate during the test event. The beacon shall activate after the arming pin is removed from the beacon and the antenna water sensor is immersed in water at room temperature. After the beacon is de-armed, the beacon self-test function will be tested, the operation of controls will be checked and the aliveness and production acceptance test per Y1-02-1053 will be performed.

5.3.2.2 Spray Proof (RTCA DO-204, para. 2.3.8.2)

The beacon assembly shall be subjected to the test specified in RTCA DO-204, para. 2.3.8.2. The beacon must not activate during the test. The beacon shall activate after the arming pin is removed from the beacon and the antenna water sensor is immersed in water at room temperature. After the beacon is de-armed, the beacon self-test function will be tested. The beacon performance testing is deferred until after the completion of the salt-water immersion test.

5.3.2.3 Salt Water Immersion (RTCA DO-204, para. 2.3.9.2)

The beacon assembly shall be subjected to the test specified in RTCA DO-204, para. 2.3.9.2. After completion of the test, the beacon self-test function will be tested, the operation of controls will be checked, the aliveness test of RTCA DO-204, paragraph 2.3 will be performed and a production acceptance test per Y1-02-1053 will be performed.

5.3.2.4 Sand and Dust (RTCA DO-204, para. 2.3.10)

The beacon assembly shall be subjected to the test specified in RTCA DO-204, para. 2.3.10. After completion of the test, the beacon self-test function will be tested, the operation of controls will be checked, the aliveness test of RTCA DO-204, paragraph 2.3 will be performed and a production acceptance test per Y1-02-1053 will be performed.

5.3.2.5 Salt Spray (RTCA DO-204, para. 2.3.12)

The beacon assembly shall be subjected to the test specified in RTCA DO-204, para. 2.3.12. After completion of the test, the beacon self-test function will be tested, the operation of controls will be checked, the aliveness test of RTCA DO-204, paragraph 2.3 will be performed and a production acceptance test per Y1-02-1053 will be performed.

5.3.2.6 Operational Shocks (RTCA DO-204, para. 2.3.4.1)

The beacon assembly shall be subjected to the test specified in RTCA DO-204, para. 2.3.4.1. After completion of the test, the beacon self-test function will be tested, the operation of controls will be checked. The beacon will then be subjected to the crashworthiness test.

5.3.2.7 Crash Shocks (RTCA DO-204, para. 2.3.4.1)

The beacon assembly shall be subjected to the test specified in RTCA DO-204, para. 2.3.4.1. After completion of the test, the beacon self-test function will be tested, the operation of controls will be checked, the aliveness test of RTCA DO-204, paragraph 2.3 will be performed and a production acceptance test per Y1-02-1053 will be performed.

5.3.2.8 Crush Test (RTCA DO-160D, para. 2.3.4.3)

The beacon assembly shall be subjected to the test specified in RTCA DO-204, para. 2.3.4.3. After completion of the test, the beacon self-test function and the operation of controls is checked.

5.3.2.9 Flame Test (RTCA DO-204, para. 2.3.7.1)

(All ELT equipment, including antenna(s) and antenna cabling)

NOTE: With the type of battery provided with the ELT, the possibility of explosion makes this test potentially hazardous. Appropriate precautions should be taken.

The beacon assembly shall be subjected to the test specified in RTCA DO-204, para. 2.3.7.1. The beacon self-test function will be tested after the beacon has returned to ambient temperature.

5.3.2.10 Post-crash Immersion Test (RTCA DO-204, para. 2.3.9.4)

The beacon assembly shall be subjected to the test specified in RTCA DO-204, para. 2.3.9.4. After completion of the test, the beacon self-test function will be tested, the operation of controls will be checked, the aliveness test of RTCA DO-204, paragraph 2.3 will be performed and a production acceptance test per Y1-02-1053 will be performed.

5.3.3 Group C Tests

5.3.3.1 Low Temperature Life (RTCA DO-204, para. 2.3.2.1, 2.3.2.6 and RTCA DO-183, para. 2.3.1.1)

The beacon assembly shall be subjected to the test specified in RTCA DO-204, para. 2.3.2.1, 2.3.2.6 and RTCA DO-183, para. 2.3.1.1.

5.3.3.2 High Temperature Life (RTCA DO-204, para. 2.3.2.2, 2.3.2.6 and RTCA DO-183, para. 2.3.1.2)

The beacon assembly shall be subjected to the test specified in RTCA DO-204, para. 2.3.2.2, 2.3.2.6 and RTCA DO-183, para. 2.3.1.2

5.3.3.3 Temperature Variation/Frequency Stability (RTCA DO-204, para. 2.3.2.3)

The beacon assembly (less antennas) shall be subjected to the test specified in RTCA DO-204, para. 2.3.2.3. The frequency stability derived from the measurements must be within the allowable limits of paragraph 2.2.2.1 and Table 2-1.

5.3.3.4 Thermal Shock Test (RTCA DO-204, para. 2.3.2.4)

The beacon assembly (less antennas) shall be subjected to the test specified in RTCA DO-204, para. 2.3.2.4. The frequency stability, power output and content of the digital message shall be as required by paragraph 2.3.2.4.

5.3.4 Group D Tests

5.3.4.1 Post Test Performance Test
(DME Corporation Y1-02-1053 and Y1-02-1054)

The beacon assembly shall be subjected to the test specified in DME Corporation Y1-02-1053 and Y1-02-1054.

5.3.4.2 Voltage Standing Wave Ration (VSWR) Test (RTCA DO-204, Para. 2.3.2.5)

The beacon assembly shall be subjected to the test specified in RTCA DO-204, Para. 2.3.2.5. The frequency stability, power output and content of the digital message shall be as required by paragraph 2.3.2.5.

5.3.4.3 Self-Test Function (RTCA DO-204, Para. 2.3.2.6)

The beacon assembly shall be subjected to the test specified in RTCA DO-204, Para. 2.3.2.6. The ELT must indicate a successful completion of the self-test.

5.3.4.4 Top/Bottom Antenna Switching

Accomplish the procedure necessary to change the software bit from the existing single antenna code to the dual antenna code. Accomplish the ATP test procedure to confirm the performance test of the dual antenna configuration.

6.0 FCC SPECIFIC TESTING

6.1 Spurious Emission Limitations

The beacon assembly shall be shown to meet or exceed the performance specifications regarding Spurious Emission Limitations listed in FCC 47CFR87.139(h).

6.2 Output Power Characteristics

The beacon assembly shall be tested to show compliance with Output Power Characteristics as defined in FCC 47CFR87.141(i). The beacon assembly shall be

tested in accordance with the Signal Enhancement Test contained in Subpart N, part 2 or FCC 47CFR.

6.3 Long Term Stability of Carrier Frequency

The beacon assembly shall be tested to show compliance with Output Power Characteristics as defined by FCC 47CFR87.133. This testing will take place as part of requirements for FAA certifications in section 6.3 of this document.

7.0 **COSPAS-SARSAT TESTING**

In accordance with FCC 47CFR87.199(c) the DME 406.028 MHz ELT will be certified by a test facility recognized as a COSPAS-SARSAT partner, specifically, Fort Huachuca, Az. Verification of this testing will be supplied with the test report in the form of an attached COSPAS-SARSAT Type Approval Certificate (TAC)