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SECTION 1. EXECUTIVE DIGEST

1.1 EXECUTIVE SUMMARY

This document represents the results of a type approval certification test of an Emergency Position Indicating Radio Beacon (EPIRB), Model PRO Find EPIRB 406, manufactured by Seimac, Limited. The EPIRB produces serialized protocol short message format. The tests were conducted at the Electronic Proving Ground's Environmental Test Facility (ETF) and Antenna Test Facility (ATF) at Fort Huachuca, Arizona. The test period was from 2 to 16 October, 2000.

Before beginning Cospas-Sarsat testing, the EPIRB was subjected to all environmental tests required for U.S. Coast Guard certification. After starting Cospas-Sarsat and during spurious emissions testing at low temperature, the EPIRB failed phase modulation. Subsequently to this failure, the manufacturer modified the EPIRB by exchanging resistors. He then agreed with us that it was prudent to start Cospas-Sarsat testing from the beginning. An explanation of the failure, as supplied by the manufacturer, is provided in Appendix D.

The manufacturer of the EPIRB had also requested to test two batteries for the 48-hour (required for U.S. Coast Guard certification) Operating Lifetime, ETERN and SAFT. EPIRB, SN 029, was used to test the ETERN battery according to specifications and passed the requirements. However, after subsequently attempting to test the SAFT battery with the same unit, the transmit power output of that unit dropped to 28 decibel with reference to 1 milliwatt (dBm).

Consequently, the SAFT battery was subjected to the 48-hour Operating Lifetime test with EPIRB, SN 017 without incident.

Electrical and Functional Tests at Constant Temperature

The following electrical and functional tests were conducted at ambient temperature [+25° Celsius (C)], maximum temperature (+55° C), and minimum temperature (-40° C) conditions:

a. Transmitter power output.

b. Message format and structure.

c. Modulation.

d. Transmitted frequency.

e. Spurious output.

f. Voltage standing wave ratio (VSWR) check.

g. Self-test mode.

Test Results at Ambient Temperature (+25° C)

The unit under test (UUT) passed all ambient temperature tests.

Test Results at Minimum Temperature (-40° C)

The UUT passed all minimum temperature tests.

Test Results at Maximum Temperature (+55° C)

The UUT passed all maximum temperature tests.

Thermal Shock Test

The following electrical and functional tests were conducted during the thermal shock test:

a. Transmitted frequency

b. Transmitted power output

c. Message format and structure

Test Results

The UUT passed all thermal shock tests.

Frequency Stability Test with Temperature Gradient

The following electrical and functional tests were conducted during the frequency stability test with temperature gradient:

a. Transmitted frequency

b. Transmitted power output

c. Message format and structure

Test Results

The UUT passed all frequency stability test requirements with temperature gradient.

Operating Lifetime at Minimum Temperature

Test Results

The UUT passed the operating lifetime test.

Self-Test Mode

Test Results

The UUT passed the requirements for the EPIRB self-test mode.

Antenna Characteristics

Test Results

The calibration signal level was -60.50 dBm. The calibration ERP level was -6.90 dBm.

The received signal levels (in dBm) for vertical and horizontal polarization of the probe antenna are tabulated in Appendix B, Table B-1 and Table B-2.

EPIRB ERP measurement.

Range Calibration Factor. The range calibration factor (in dB) was calculated to be

-6.90 - (-60.50) = 53.60 dB.

Total ERP calculation. The total EPIRB ERP was determined by combining the vertical and horizontal polarization received signal levels using the following equation:

Total ERP (in dBm) =

$$10\, log_{10} \left[\, 10^{P_v(\text{in dBm})/10} + 10^{P_h(\text{in dBm})/10} \,\right] + \text{Range Calibration Factor}$$

This equation converted the vertical and horizontal received signal power levels (Pv and Ph, in dBm) into milliwatts, added the two components together, and then converted the total power in milliwatts to a power level in dBm. The range calibration factor (in dB) was added to this value to yield total ERP (in dBm). These values were calculated and tabulated for every 30 degrees of azimuth from 0 to 330 degrees, and for every 10 degrees of elevation from 10 to 50 degrees (see Appendix B, Table B-3).

Antenna range instrumentation accuracy. The measurement accuracy of the arc test range is $\pm$2.45 dB. This root-sum-squared value (rss) is determined from the following range instrumentation accuracies:

$\pm$0.02 dB	Hewlett-Packard 438A Power Meter
$\pm$0.13 dB	Hewlett-Packard 8481A Power Sensor
$\pm$1.00 dB	Hewlett-Packard 8562A Spectrum Analyzer
$\pm$2.00 dB	Antenna gain standard calibration accuracy
$\pm$1.00 dB	Allowance for environmental variations

$$\text{rss accuracy} = \pm\sqrt{(0.02)^2 + (0.13)^2 + (1.00)^2 + (2.00)^2 + (1.00)^2} = \pm\ 2.45\ \text{dB}$$

The percentage of ERP values ranging from 1.6 to 20 watts (32.0 to 43.0 dBm), allowing for antenna range instrumentation accuracy, was 100%. See Appendix B, Table B-3.

The EPIRB antenna is considered to be vertically polarized.

Satellite Qualitative Tests

Not applicable.

Navigation System

Not applicable.

CONCLUSION

The UUT passed certification requirements for type approval.

SUPPORTING TEST DATA

1. Electrical and Functional Tests at Constant Temperature

    a. Ambient Temperature (See Annex I of Appendix A, page A-I-1.)

    b. Maximum Temperature: +55° C (See Annex I of Appendix A, page A-I-17.)

    c. Minimum Temperature: -40° C (See Annex I of Appendix A, page A-I-28.)

2. Thermal Shock Test (See Annex II of Appendix A.)

3. Frequency Stability Test with Temperature Gradient (See Annex III of Appendix A.)

4. Operating Lifetime at Minimum Temperature (See Annex IV of Appendix A.)

5. Self-Test Mode (See Annex V of Appendix A.)

6. Antenna Characteristics (See Appendix B.)

1.2 REFERENCE DOCUMENTS

- Cospas-Sarsat Document C/S T.001, Specification for Cospas-Sarsat 406 MHz Distress Beacon, Issue 3, Revision 3, October 1999.

- Cospas-Sarsat Document C/S T.007, Cospas-Sarsat 406 MHz Distress Beacon Type Approval standard, Issue 3, Revision 6, October 1999.

- EPG Document, Cospas-Sarsat 406 MHz Distress Beacon Type Approval Certification Revised Test Procedures, June 2000.

1.3 PURPOSE

The purpose of this document is to present detailed test procedures to implement type approval test methods delineated in C/S T.007.

1.4 SCOPE

The detailed test procedures for the following tests are presented in Section 3:

a. Electrical and Functional Tests at Constant Temperature

b. Thermal Shock Test

c. Frequency Stability Test with Temperature Gradient

d. Operating Lifetime at Minimum Temperature

e. Self-Test Mode

f. Antenna Characteristics

g. Satellite Qualitative Tests

h. Navigation System

A summary of 406.028-MHz EPIRB test results is provided in Appendix C.

A distribution list is provided in Appendix E.

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SECTION 2. TESTS REQUIRED

2.1 ELECTRICAL AND FUNCTIONAL TESTS AT CONSTANT TEMPERATURE

The following electrical and functional tests were conducted at ambient temperature, maximum temperature, and minimum temperature conditions. The UUT, while turned off, was allowed to stabilize for 2 hours at the test temperature and was then turned on and allowed a 15-minute warm-up period before conducting the following tests:

a. Transmitter power output

b. Message format and structure

c. Modulation

d. Transmitted Frequency

e. Spurious output

f. VSWR check

g. Self-test mode

2.2 THERMAL SHOCK TEST

The UUT, while turned off, was allowed to stabilize within a chamber for 2 hours at -40° C. The chamber was then ramped at its maximum rate of change of ≥25° C per minute to a final temperature of -10° C. The UUT was then turned on and allowed to operate for 15 minutes before the following electrical and functional tests were conducted:

a. Transmitted frequency

b. Transmitted power output

c. Message format and structure

2.3 FREQUENCY STABILITY TEST WITH TEMPERATURE GRADIENT

A temperature chamber was programmed to execute the temperature gradient profile defined by Figure 2-1. The UUT was placed in the chamber, and the following electrical and functional tests were conducted continuously throughout the temperature gradient test:

a. Transmitted frequency

b. Transmitted power output

c. Message format and structure

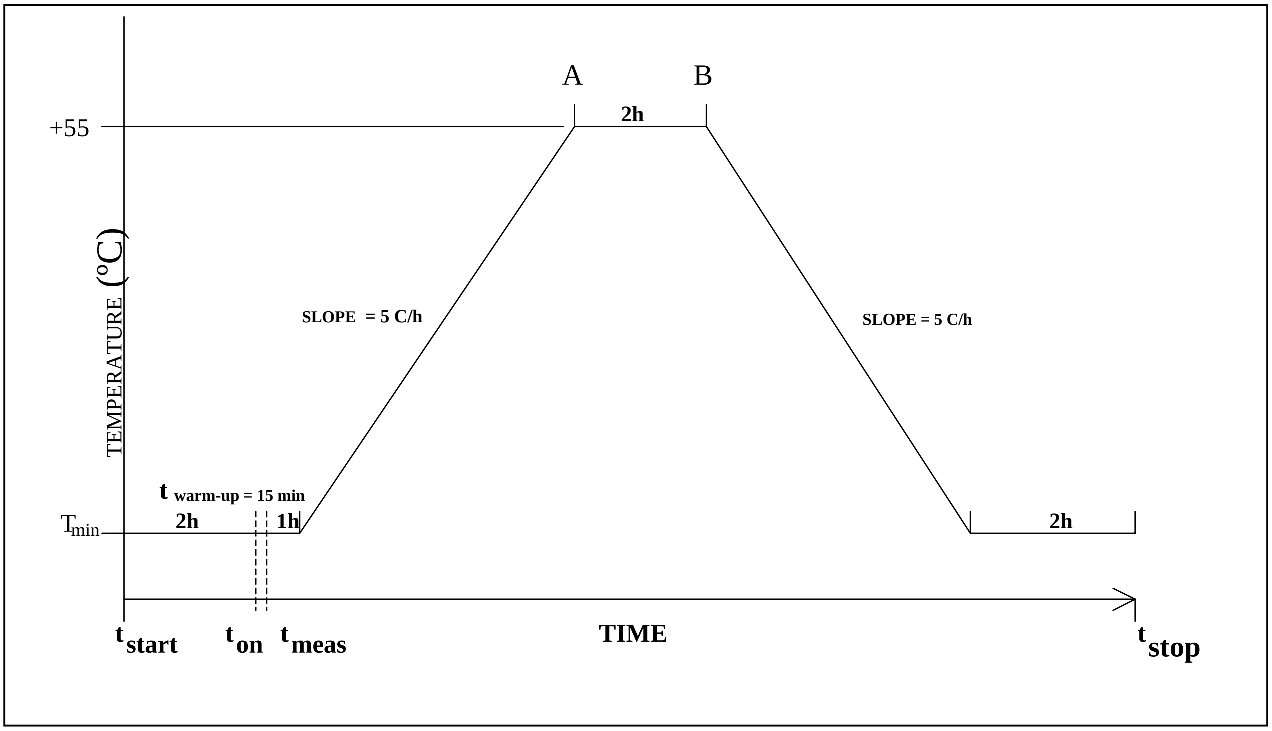

Figure 2-1. Temperature Gradient.

2.4 OPERATING LIFETIME AT MINIMUM TEMPERATURE

The operational lifetime test is intended to establish, with reasonable confidence, that the UUT will function at its minimum operating temperature for its rated life using a battery that has reached its expiration date. The life test was performed with a fresh battery pack.

The UUT was operated at its minimum operating temperature for its rated life. During this period, the following parameters were measured on each transmission:

- Transmitted frequency
- Transmitter power output
- Message format and structure

The 18-sample analysis window of the stability calculations is advanced in time through the period such that each succeeding data set includes the latest frequency sample and drops the earliest one.

2.5 SELF-TEST MODE

The duration of the radio frequency (RF) energy burst of the UUT was measured, the frame synchronization pattern was checked, and the message was checked for the correct default code. The format flag bit was reported.

2.6 ANTENNA CHARACTERISTICS

The beacon antenna test was performed as described in Section 3.4, at the ambient temperature of the test facility, and a correction factor was applied to the data to calculate the radiated power at -40° C at the end of the operating lifetime in computing the values of $ERP_{MAX\ EOL}$ and $ERP_{MIN\ EOL}$. This test was performed using the standard antenna-configured UUT.

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SECTION 3. TYPE APPROVAL CERTIFICATION TEST PROCEDURES FOR COSPAS-SARSAT BEACONS

The following are the detailed electrical and functional test procedures for the tests required.

3.1 MESSAGE FORMAT AND STRUCTURE

The following parameters were measured in accordance with the procedure prescribed in this section:

3.1.1 Repetition Period

3.1.2 Continuous wave (CW) Preamble (Duration of the Unmodulated Carrier)

3.1.3 Total Transmission Time

3.1.4 Bit Rate and Stability

3.1.5 Message Coding

3.1.1 Repetition Period

3.1.1.1 Scope.

a. References:

(1) C/S T.001, paragraph 2.2.1.

(2) C/S T.001 Annex B, paragraph B.3.1.1.

b. The objective was to measure the randomized repetition period T_r of the beacon transmissions.

c. *Repetition Period,* $T_{r,}$ is the period between two successive beacon transmissions.

3.1.1.2 Facilities and Instrumentation.

- Environmental Test Facility

  - Cospas-Sarsat Measurement System (see Figure 3-1).
  - IBM Compatible Computer System
  - HP-1631D Logic Analyzer
  - HP-423B Crystal Detector w/50-ohm Termination
  - 20-decibel (dB) Attenuator
  - 3-dB Attenuator
  - HP-11667A Power Splitter

3.1.1.3 Test Conditions.

a. Normal ambient or any other specified environmental condition.

b. Performed these measurements on the unmodulated portion of the carrier.

c. Nominal operating voltage.

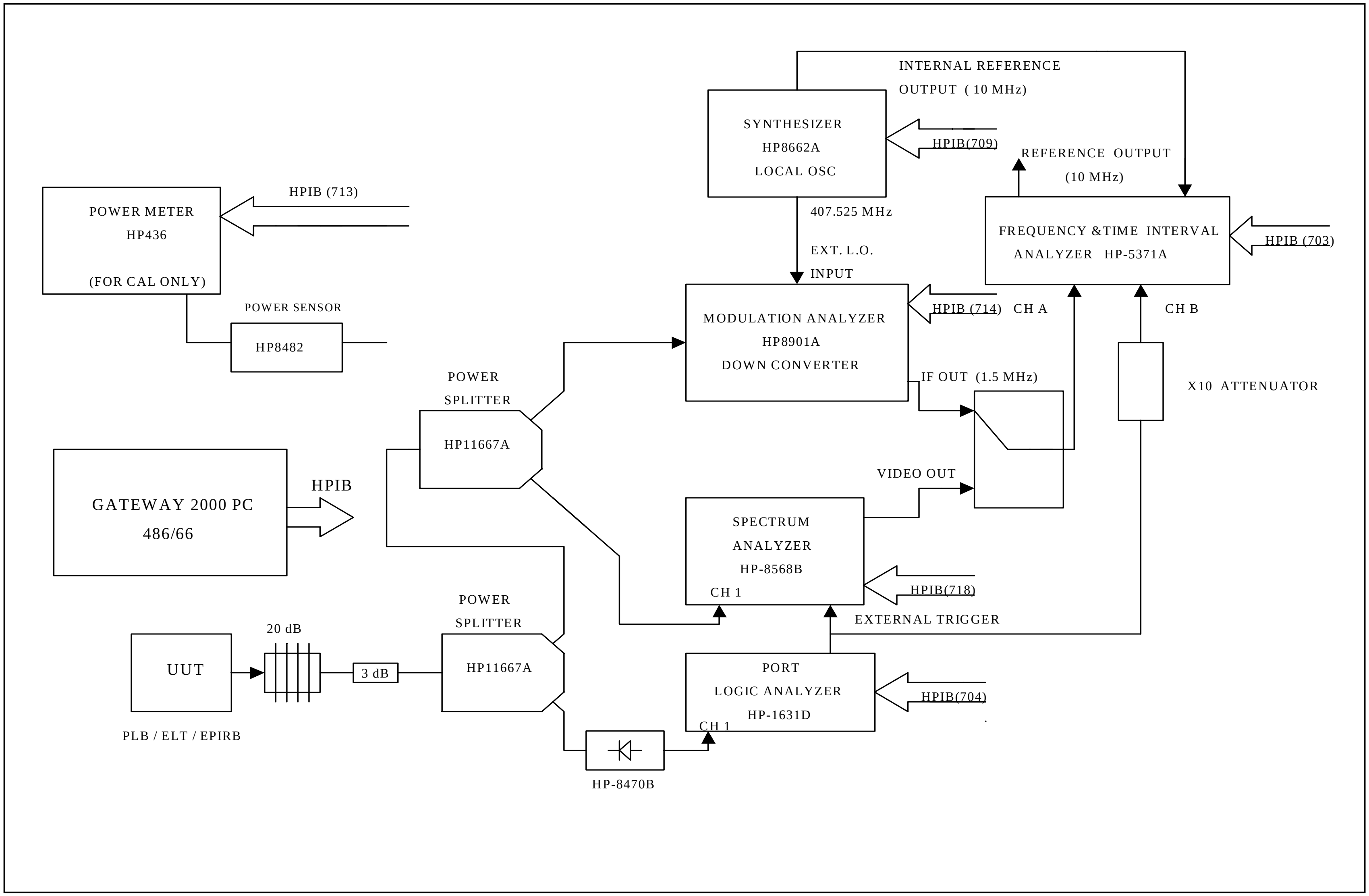


Figure 3-1. Cospas-Sarsat measurement system.

3.1.1.4 Test Procedure.

a. The power of the beacon radio output was derived from the crystal detector output applied to the analog input of the HP-1631D Logic Analyzer.

b. The HP-1631D was programmed to capture the rising edge of the burst waveform. Each voltage data point was converted into a power data point using the crystal detector power transfer equation and the attenuator/ power splitter attenuation value. The peak envelope voltage (100% power point) was then calculated by averaging 100 power data points, 6 milli-seconds (ms) after the trigger (-0.3 volt falling edge). The time between the 10% and 90% power points was found by counting the number of samples between these two points. Each sample was 10 microseconds (Φs). At the end of the rise time measurement, the Logic Analyzer was then programmed to trigger at the 10% power point level.

c. Captured and recorded the time interval measurements for 18 successive transmissions.

d. Calculated the mean repetition period and the standard deviation.

e. Recorded any repetition period that fell outside of specified limits.

3.1.1.5 Data Reduction and Presentation.

Presented the recorded data in tabular form and annotated those readings which exceeded the specified limits.

3.1.2 CW Preamble (Duration of the Unmodulated Carrier)

3.1.2.1 Scope.

a. References:

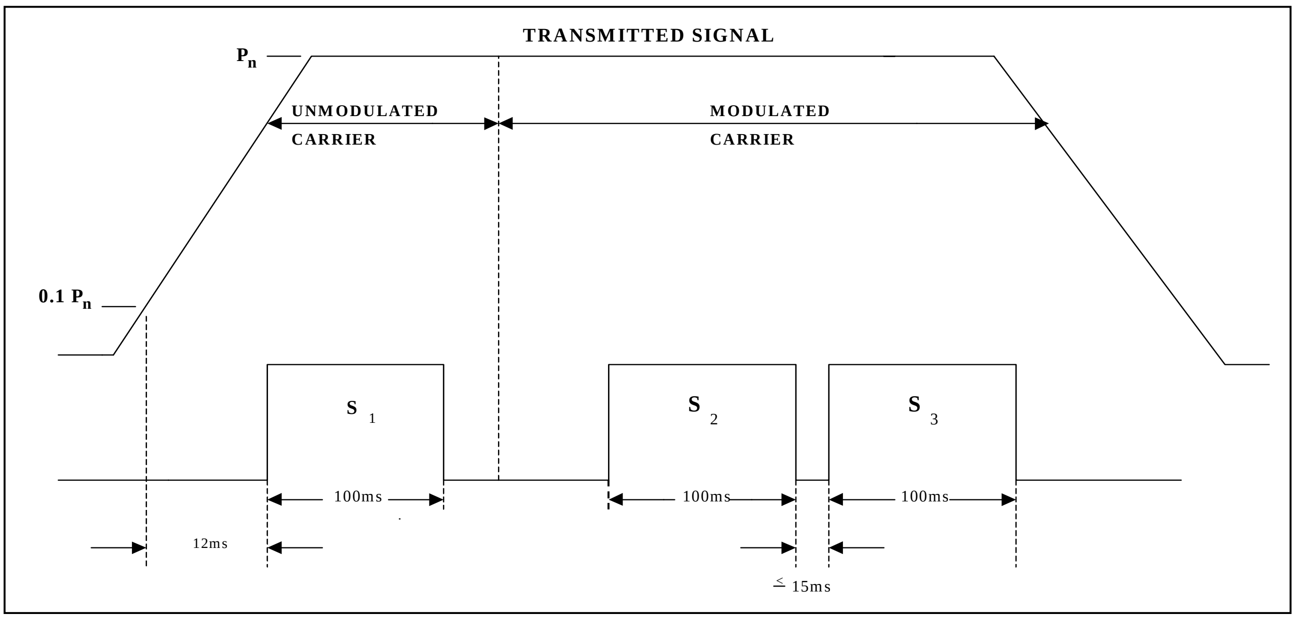
(1) C/S T.001, paragraph 2.2.2.

(2) C/S T.001, paragraph 2.2.3.

(3) C/S T.001 Annex B, paragraph B3.1.2.

b. The objective was to measure the unmodulated carrier duration between the beginning of a transmission and the beginning of the data modulation.

c. *Unmodulated carrier duration,* T_1, is the period between the beginning of transmission and the beginning of data modulation (see Figure 3-2).



The S_1 pulse starts 12 ms after the beginning of the unmodulated carrier.
The S_2 pulse starts at the beginning of bit 23.
The S_3 pulse starts not later than 15 ms after the end of S_2.

Figure 3-2. Definition of measurement intervals.

3.1.2.2 Facilities and Instrumentation.

- Environmental Test Facility

  - Cospas-Sarsat Measurement System (see Figure 3-1).
  - IBM Compatible Computer System
  - HP-1631D Logic Analyzer
  - HP-5371A Frequency and Time Interval Analyzer
  - HP-423B Crystal Detector w/50-ohm Termination
  - 20-dB Attenuator
  - 3-dB Attenuator
  - HP-1667A Power Splitter (2 each)

3.1.2.3 Test Conditions.

a. Normal ambient or any other specified environmental condition.

b. Performed these measurements on the unmodulated portion of the carrier.

c. Nominal operating voltage.

3.1.2.4 Test Procedure.

a. While the total transmission time was measured by the Logic Analyzer, the CW preamble was measured using the Frequency and Time Interval Analyzer. The Frequency and Time Interval Analyzer was programmed to acquire event versus time data after being triggered by Channel B signal (Logic Analyzer trigger out at 10% of P_n). The first phase transition of the modulated portion of the waveform was detected, and the time interval from that point to the trigger point on the rising edge of the waveform was measured.

b. Repeated the above measurements for 18 successive transmissions.

3.1.2.5 Data Reduction and Presentation.

Presented the recorded data in tabular form and annotated those readings which exceeded the specified limits.

3.1.3 Total Transmission Time

3.1.3.1 Scope.

a. References:

(1) C/S T.001, paragraph 2.2.2.

(2) C/S T.001, paragraph 2.2.3.

(3) C/S T.001 Annex B, paragraph B.3.1.2.

b. The objective was to measure the unmodulated carrier duration between the beginning of a transmission and the beginning of the data modulation and to measure the total transmission time of the transmitted waveform.

c. *Unmodulated carrier duration,* $T_{1,}$ is the period between the beginning of transmission and the beginning of data modulation (see Figure 3-2, definition of measurement intervals).

d. *Total transmission time* is the period between the 10% power point on the rising edge of the waveform to 10% power point of the falling edge of the waveform.

3.1.3.2 Facilities and Instrumentation.

- Environmental Test Facility

  - Cospas-Sarsat Measurement System (see Figure 3-1).
  - IBM Compatible Computer System
  - HP-1631D Logic Analyzer
  - HP-423B Crystal Detector w/50-ohm Termination
  - 20-dB Attenuator
  - 3-dB Attenuator
  - HP-11667A Power Splitter

3.1.3.3 Test Conditions.

a. Normal ambient or any other specified environmental condition.

b. Performed these measurements on the unmodulated portion of the carrier.

c. Nominal operating voltage.

3.1.3.4 Test Procedure.

a. The power of the beacon radio output was derived from the crystal detector output applied to the analog input of the HP-1631D Logic Analyzer.

b. The HP-1631D was programmed to capture the rising edge of the burst waveform. Each voltage data point was converted into a power data point using the crystal detector power transfer equation and the attenuator/ power splitter attenuation value. The peak envelope voltage (100% power points) was then calculated by averaging 100 power data points, 6 ms after the trigger (-0.3-volt falling edge). The time between 10% power point levels of the rising and falling edges was measured.

c. Captured and recorded the total transmission times for 18 successive transmissions.

d. Recorded any total transmission time that fell outside of specified limits.

3.1.3.5 Data Reduction and Presentation.

Presented the recorded data in tabular form and annotated those readings which exceeded the specified limits.

3.1.4 Bit Rate and Stability

3.1.4.1 Scope.

a. Reference: C/S T.001, paragraph 2.2.1.

b. b. The objective was to measure the bit rate and stability of the baseband digital data.

c. *Bit Rate,* f_b, in bits per second (bps) is measured over at least the first 50 bits of one transmission.

d. *Stability* is the variation in bit rate measured over 18 transmissions.

3.1.4.2 Facilities and Instrumentation.

- Environmental Test Facility
  - Cospas-Sarsat Measurement System (see Figure 3-1).
  - IBM Compatible Computer System
  - HP-1631D Logic Analyzer
  - HP-8901 Modulation Analyzer/Down Converter
  - HP-5371A Frequency and Time Interval Analyzer
  - HP-8662A Frequency Synthesizer
  - HP-11667A Power Splitter (2 each)
  - 20-dB Attenuator
  - 10-dB Attenuator
  - 3-dB Attenuator

3.1.4.3 Test Conditions.

a. Normal ambient or any other specified environmental condition.

b. Performed these measurements on the modulated portion of the carrier.

c. Nominal operating voltage.

3.1.4.4 Test Procedure.

a. The bit rate, f_b, in bps was derived by measuring the period T_n encompassed by the first 50 bits of the modulated waveform. The bit rate is then $f_b = 50/T_n$.

b. The trigger marking the 0.1 P_n of the start of the burst waveform was generated by the Logic Analyzer. The phase information marking the start of the modulated waveform was obtained from the event versus time data acquired by the Frequency and Time Interval Analyzer. The event versus time data were acquired after a holdoff delay of 159 ms from the Logic Analyzer trigger event. Frequency and interval measurements started slightly before the start of the first bit. The sampling interval was 31.7 μs. A total acquisition time of 130 ms was used to encompass the first 50 bits of the modulated portion of the burst waveform.

c. The above measurement was repeated 18 times.

3.1.4.5 Data Reduction and Presentation.

a. Calculated the bit rate for each of the 18 measurements. The bit rate was equal to the measured time interval encompassing 50 bits divided by 50.

b. Presented the bit rate data in tabular form.

c. Presented the maximum and minimum bit rates and determined whether the values satisfy the requirement that:

$$396 \text{ bps} < f_b < 404 \text{ bps}$$

3.1.5 Message Coding

3.1.5.1 Scope.

a. References:

(1) C/S T.001, paragraph 3.

(2) C/S T.001 Annex A.

b. The objective was to check the content of the digital message for validity and compliance with the format for each data field, bit by bit.

3.1.5.2 Facilities and Instrumentation.

- Environmental Test Facility

  - Cospas-Sarsat Measurement System (see Figure 3-1).
  - IBM Compatible Computer System
  - HP-1631D Logic Analyzer
  - HP5371A Frequency and Time Interval Analyzer
  - HP-423B Crystal Detector w/50 Ohm termination
  - 20-dB Attenuator
  - 3-dB Attenuator
  - HP-1667A Power Splitter (2 each)

3.1.5.3 Test Conditions.

a. Normal ambient or any other specified environmental condition.

b. Performed these measurements on the modulated portion of the carrier.

c. Nominal operating voltage.

3.1.5.4 Test Procedure.

a. The modulated portion of the transmitted signal was demodulated.

b. The message data contained in bit positions 25-85 were decoded using the BCH error-correcting code in positions 86-106 (short message format). The message data in bit positions 25-85 and 107-132 (long message format) were decoded using the BCH error-correcting codes in bit positions 86-106 and 133-144, respectively.

3.1.5.5 Data Reduction and Presentation.

a. Processed the bit sequence captured by the measurement system.

b. Presented the decoded message by field and checked the result for validity and compliance with the format for each field.

c. Verified that the decoded message was in agreement with that provided by the manufacturer.

3.2 MODULATOR AND 406-MHz TRANSMITTER

The following parameters were measured in accordance with the procedures prescribed in this section:

- 3.2.1 Transmitted Frequency
- 3.2.2 Transmitter Power Output
  - 3.2.2.1 Transmitter Power Output Level
  - 3.2.2.2 Transmitter Power Output Rise Time
  - 3.2.2.3 Spurious Output
- 3.2.3 Data Encoding and Modulation

3.2.1 Transmitted Frequency

3.2.1.1 Scope.

a. Reference: C/S T.001, paragraph 2.3.1.

b. The objective was to measure the deviation of the transmitter's RF from the selected frequency versus operating time after switch-on, under specified conditions of power supply and temperature.

c. This test procedure applies to 406-MHz beacon transmitters.

d. Frequency accuracy is the maximum allowable relative difference between the measured frequency and the selected frequency during the measurement period.

3.2.1.2 Facilities and Instrumentation.

- Environmental Test Facility

  - Cospas-Sarsat Measurement System (see Figure 3-1).
  - IBM Compatible Computer System
  - HP-1631D Logic Analyzer
  - HP-8901A Modulation Analyzer/Down Converter
  - HP-5371A Frequency and Time Interval Analyzer
  - HP-8662A Frequency Synthesizer
  - HP11667A Power Splitter (2 each)
  - 20-dB Attenuator
  - 10-dB Attenuator
  - 3-dB Attenuator

3.2.1.3 Test Conditions.

a. Normal ambient conditions or any other specified environmental condition.

b. Performed these measurements in the designated measurement intervals S_1, S_2, and S_3.

c. Nominal operating voltage.

3.2.1.4 Test Procedure.

a. Before starting this test, the UUT was stabilized at the laboratory ambient temperature in a non-operating condition. The UUT was then allowed to operate for 15 minutes before measurements were started.

b. The measurement system was triggered by the transmitter burst. Measurement commenced 12 ms after the start of the carrier relative to 0.1 P_n. Three sampling periods were defined where frequency measurements were made (see Figure 3-2, definition of measurement intervals).

c. Turned the beacon transmitter on and measured the frequency of the transmitter during the three 100-ms sampling intervals of the carrier.

d. Repeated the above measurement 18 times.

3.2.1.5 Data Reduction and Presentation.

a. The mean transmission frequency f_0, was determined from 18 successive measurements of $f_i^{(1)}$ as follows:

$$f_0 = f^{(1)} = \frac{1}{n}\sum_{i=1}^{n} f_i^{(1)}$$

where n=18

b. The short-term frequency stability was derived from measurements of $f_i^{(2)}$ and $f_i^{(3)}$ made during the intervals S2 and S3 during 18 successive transmissions, as follows:

$$\sigma_{100ms} = \left\{ \frac{1}{2n} \sum_{i=1}^{n} \left(\frac{f_i^{(2)} - f_i^{(3)}}{f_i^{(2)}} \right)^2 \right\}^{1/2}$$

where n=18

c. The medium-term frequency stability was derived from measurements of $f_i^{(2)}$ made over 18 successive transmissions at instants t_i (refer to Figure 3-3.).

$$A = \frac{n\sum_{i=1}^{n} t_i f_i - \sum_{i=1}^{n} t_i \sum_{i=1}^{n} f_i}{n\sum_{i=1}^{n} t_i^2 - \left(\sum_{i=1}^{n} t_i\right)^2}$$

where n=18

d. The ordinate at the origin of the least-squares straight line was given by:

$$B = \frac{\sum_{i=1}^{n} f_i \sum_{i=1}^{n} t_i^2 - \sum_{i=1}^{n} t_i \sum_{i=1}^{n} t_i f_i}{n \sum_{i=1}^{n} t_i^2 - \left(\sum_{i=1}^{n} t_i \right)^2}$$

where n=18

e. The residual frequency variation was given by:

$$\sigma = \left\{ \frac{1}{n} \sum_{i=1}^{n} (f_i - A t_i - B)^2 \right\}^{1/2}$$

where n=18

f. Plotted the transmitter frequency error (E) as a function of the operating time.

g. Plotted the transmitter frequency error (E) as a function of temperature (for data collected during temperature tests).

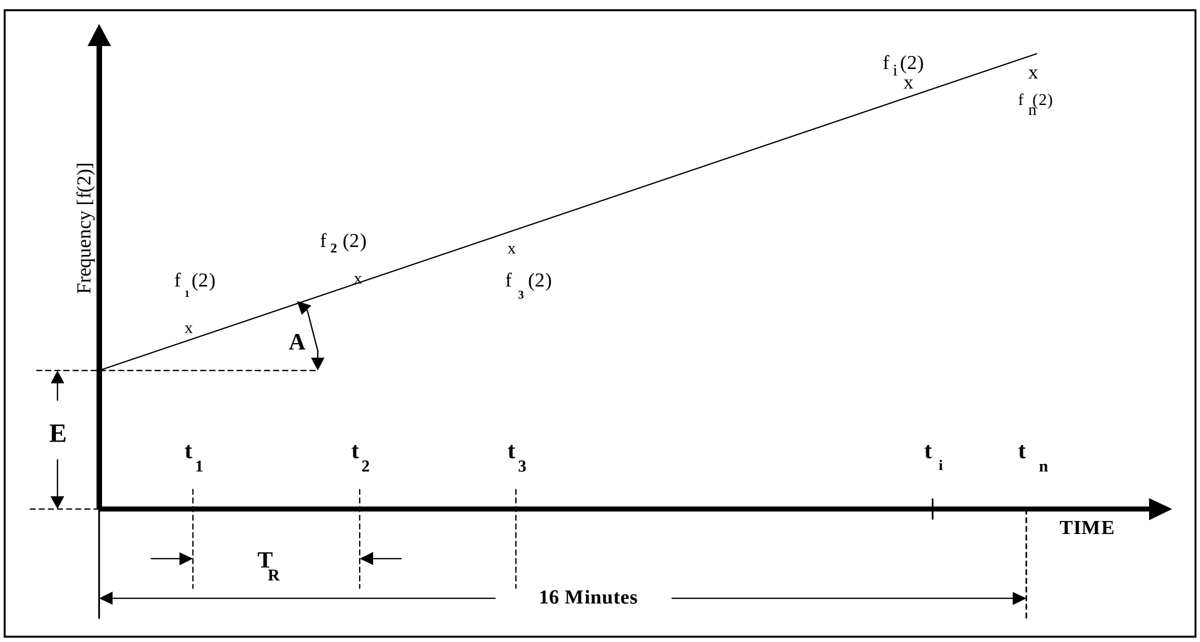


Figure 3-3. Medium-term frequency stability measurement.

3.2.2 Transmitter Power Output

3.2.2.1 Transmitter Power Output Level

3.2.2.1.1 Scope.

a. Reference: C/S T.001, paragraph 2.3.2.

b. The objective was to measure the transmitter RF output power.

c. RF output power is the power that the beacon transmitter delivers to the antenna or to a load with the same VSWR as the antenna at the operational frequency. This power is defined for the unmodulated carrier-on condition.

3.2.2.1.2 Facilities and Instrumentation.

- Environmental Test Facility

  - Cospas-Sarsat Measurement System (see Figure 3-1).
  - IBM Compatible Computer System
  - HP-1631D Logic Analyzer
  - HP-423B Crystal Detector w/50 Ohm Termination
  - HP-11667A Power Splitter
  - 20-dB Attenuator
  - 3-dB Attenuator

3.2.2.1.3 Test Conditions.

a. Normal ambient or any other specified environmental condition.

b. Performed these measurements on the unmodulated portion of the waveform.

3.2.2.1.4 Test Procedure for RF Power Output.

a. The RF output of the transmitter was applied to the HP-423B crystal detector. The output of the detector was applied to the analog input of the HP-1631D analog input. The HP-1631D was programmed to capture the burst envelope. The trigger threshold setting used with the HP-1631D in conjunction with the burst envelope rise time tests ensures power is less than -10 dBm 1 ms before burst.

b. Ensured that the battery in the UUT was at full capacity.

c. Keyed the transmitter and measured the RF power (P_1), in watts, into the dummy load at the transmission frequency. The Logic Analyzer captured the waveform to measure the transmitted power.

d. Measured the RF power (P_1) during the 100-ms period following a 12-ms offset measured from the 10% power point of the transmitted signal envelope rise time.

3.2.2.1.5 Data Reduction and Presentation.

a. Recorded the measured transmitter power and noted any anomalies such as irregularity in amplitude during the 100-ms unmodulated carrier portion of the carrier.

b. Peak envelope voltage was obtained by averaging 800 voltage data points during 400 ms of the burst. (See Figure 3-4.) The peak envelope voltage was then converted into transmitter output power by using the crystal detector polynomial power transfer equation and the attenuators/power splitter attenuation value. The polynomials and the attenuation value were stored on disk files during the calibration subprogram.

c. Presented the measured power output in tabular form.

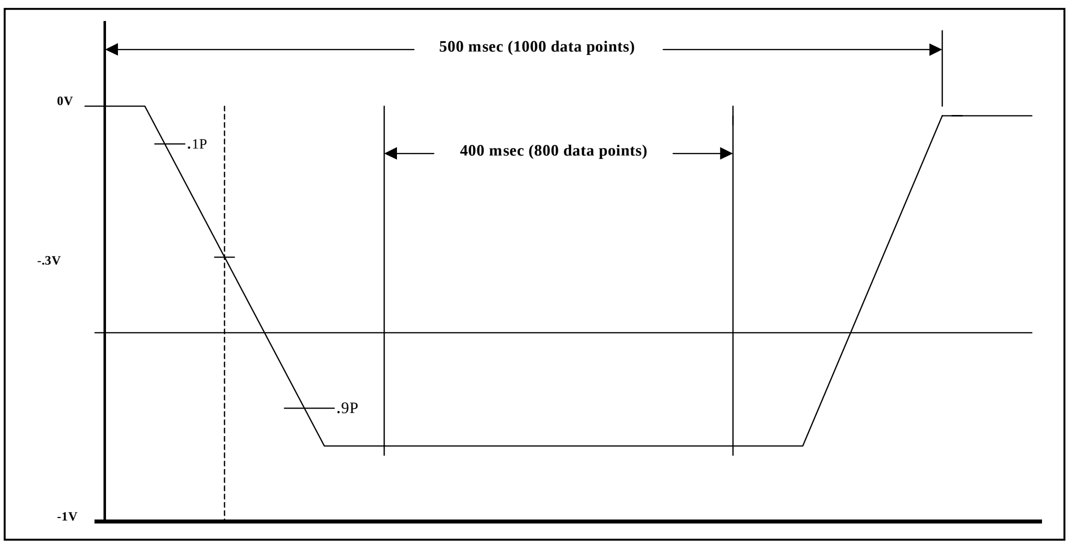


Figure 3-4. Burst envelope data acquisition.

3.2.2.2 Transmitter Power Output Rise Time

3.2.2.2.1 Scope.

a. Reference: C/S T.001 paragraph 2.3.2

b. The objective was to measure the power output rise time.

c. Rise Time is the time required for power to increase from 10% to 90% of its steady-state value (see Figure 3-2, definition of measurement intervals).

3.2.2.2.2 Facilities and Instrumentation.

- Environmental Test Facility
  - COSPAS-SARSAT Measurement System (see Figure 3-1.)
  - IBM Compatible Computer System
  - HP-1631D Logic Analyzer
  - HP-423B Crystal Detector w/50 Ohm Termination
  - 3 dB Attenuator
  - 20 dB Attenuator
  - HP-1667A Power Splitter (2 each)

3.2.2.2.3 Test Conditions.

a. Normal ambient or any other specified environmental condition.

b. Performed these measurements on the unmodulated portion of the carrier.

c. Nominal operating voltage.

3.2.2.2.4 Test Procedure.

a. The HP-1631D was programmed to capture the rising edge of the burst waveform. Each voltage data point was converted into a power data point using the crystal detector power transfer equation and the attenuator/power splitter attenuation value. The time between the 10% and 90% power points was found by counting the number of samples between these two points. Each sample was 10 (Φs).

b. Repeated the above measurements for 18 successive transmissions.