

METALLURGICAL, INC.

Testing & Consulting Services

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Report Date: 4/16/99

Test Report For RLB-32/33

Test conducted for:

**ACR Electronics, Inc.
5757 Ravenswood Road
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Test conducted by:

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SUMMARY

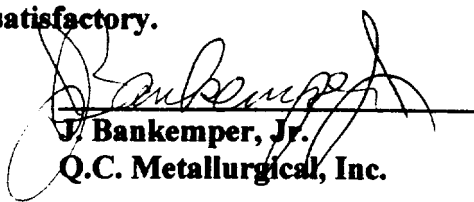
Subject: Environmental and Operational Performance Test For RLB-32/33.

Attached is the complete report covering the test on ACR's Model RLB-33.

Tests performed were:

- 2.0. Initial Aliveness**
- 3.0. Humidity**
- 4.0. Dry Heat Cycle**
- 5.0. Damp Heat Cycle**
- 6.0. Vibration, Non Active**
- 7.0. Vibration, Frequency**
- 8.0. Bump**
- 9.0. Salt Fog**
- 10.0. Drop and Buoyancy, 20m**
- 11.0. Drop, 1m**
- 12.0. Automatic Release Mechanisms and Automatic Activation Test for Category 1 Satellite EPIRB.**
- 13.0. Leakage and Immersion**
- 14.0. Spurious Emissions**
- 15.0. Thermal Shock**
- 17.0. Operation Life**
- 18.0. Strobe Light**
- 19.0. Self-test**
- 20.0. Stability and Buoyancy**
- 21.0. Inadvertent Activation**
- 22.0. Orientation**
- 23.0. 121.5 MHz Auxiliary Radio-Locating Device Transmitter**

All test parameters were found to be satisfactory.



J. Bankemper, Jr.
Q.C. Metallurgical, Inc.

ENVIRONMENTAL AND OPERATIONAL PERFORMANCE TEST PLAN FOR RLB-32 AND RLB-33

1.0 GENERAL TEST CONDITIONS

Except for the automatic release mechanism tests, all tests are applicable to all categories of 406 MHz satellite EPIRBs.

All units submitted for test should be coded with the test protocol and if they are to be used in tests 2 through 11, 13 through 19, 22, and 23 except 23.6, they should also have an watertight, external RF connectors for connection to an external 50 ohm test set. Those units that have an integral antenna should have the antenna disconnected internally and the RF output connected to the external RF connector for connection to an external 50 ohm test set.

No adjustments are permitted to the equipment under test (EUT) throughout the complete test program except for removal and application of primary power as required by the test procedures. A log of battery on-time should be maintained for the EUT. Batteries should not be replaced unless it is probable that the battery on-time will exceed the prescribed operating life time before the test is completed. Batteries should not be replaced during a test.

An aliveness test consisting of a measurement of the carrier frequency, the power output, and the data message is required at various points in the test sequence. An inability to meet the aliveness test specification ($406.025 \text{ MHz} \pm 0.002 \text{ MHz}$ and $5 \text{ W} \pm 2 \text{ dB}$) or failure of any test required by the test procedure should be considered a critical failure, and the test should be terminated. When performing the aliveness test, the carrier frequency measurement may be made on a single burst of the total 406 MHz transmission.

The values of all parameters of EUT conditions/states measured or observed, respectively, during each of the tests prescribed in the procedures of this plan, should be duly recorded and submitted as part of the required test approval data set. The measurement accuracy of each value (or set of values) should also be reported in the test data. A completed Summary of Test Results (Appendix A) should also be submitted.

Except as specified by the test procedures, opening of the unit is not allowed. Where laboratory tests require the use of water, fresh water¹ should be used unless otherwise indicated.

2.0 INITIAL ALIVENESS TEST

The EUT should be stabilized at ambient temperature and a measurement made of the carrier frequency, the power output, and the data message.

3.0 HUMIDITY TEST

The humidity test should be conducted with the electrical components removed from the satellite EPIRB or with the housing opened or modified to expose the internal elements to the humid test environment.

The test chamber atmosphere should be maintained at a relative humidity in excess of 95% and at a temperature of at least 40°C for a period of 8 hours or more. During this time, the EUT should be turned OFF.

At the end of the period, the unit should be removed from the test chamber to ambient room conditions. Within 5 minutes after removal, the unit should be turned ON.

Fifteen minutes after application of power, the aliveness test should be conducted.

4.0 DRY HEAT CYCLE

The EUT should be placed in a chamber of normal room temperature. Then the temperature should be raised to and maintained at $70^{\circ} \pm 3^{\circ}\text{C}$ for a period of 10 hours.

At the end of the 10 hour period, any climatic control devices provided in the equipment may be switched on and the chamber cooled to $55^{\circ} \pm 3^{\circ}\text{C}$. The cooling of the chamber shall be completed within 30 minutes.

The equipment should be switched on 30 minutes after the end 10 hour period and remain on for a period of at least 2 hours in the $55^{\circ} \pm 3^{\circ}\text{C}$ chamber. An aliveness check should be performed during and at the end of the 2 hour period.

¹ Fresh water is defined as having a conductivity of $50\ \mu\text{S} \pm 10\%$.

5.0

DAMP HEAT CYCLE

The EUT should be placed in a chamber of normal room temperature and humidity which, steadily, over a period of 3 ± 0.5 hours, should be heated to $40^\circ \pm 3^\circ\text{C}$ and should during this period be brought to a relative humidity of $93\% \pm 2\%$ so that excessive condensation is avoided. These conditions should be maintained for a period of 10 hours.

At the conclusion of the 10 hours, the satellite EPIRB and any climatic control devices provided in the equipment should be switched on and remain on for a period of at least 2 hours in the $40^\circ \pm 3^\circ\text{C}$ and $93\% \pm 2\%$ relative humidity chamber. An aliveness check should be performed during and at the end of the 2 hour period.

The chamber should be brought to room temperature in not less than 1 hour. The equipment should then be removed from the test chamber and exposed to normal room temperature and humidity for not less than 3 hours, or until moisture has dispersed, whichever is longer, before the next test is carried out.

6.0

VIBRATION TEST, NON ACTIVE

The EUT should be secured to the vibration table through its normal attachments or mounting intended for use in service conditions with vibration isolators, if any, in place. Additional straps or other holding means should not be used for Category I EPIRBs. The EUT should be mounted in the same position (with respect to the direction gravity) for all vibration tests and should be subjected to sinusoidal motion in each of its three orthogonal axes according to the following profile:

- | 1. | Frequency (Hz) | Peak Amplitude (mm) |
|----|----------------|---------------------|
| | 4-10 | 2.5 |
| | 10-15 | 0.8 |
| | 15-25 | 0.4 |
| | 25-33 | 0.2 |
- The frequency should change either linearly or logarithmical with time between 4 Hz and 33 Hz such that a complete cycle (4 Hz – 33 Hz – 4 Hz) will take approximately 5 minutes.
 - The EUT should be vibrated in each orthogonal axes for a period of at least 30 minutes.

4. Upon completion of the vibration test, an exterior mechanical inspection should be performed and the aliveness test should be conducted.
5. The EUT should not activate during the vibration tests.

7.0 VIBRATION TEST, FREQUENCY

Class I and II EPIRBs shall be subjected to the test in accordance with the following test procedure.

- 7.1** Throughout the vibration test, the EPIRB shall be operating under the normal duty cycle.

7.2 Procedure

The EPIRB shall be secured to the vibration table through its normal attachments or the mounting intended for use in service conditions, with vibration isolators, if any, in place. Additional straps or other holding means shall not be used. The EPIRB shall be mounted in the same position (with respect to the direction of gravity) for all vibration tests. Sinusoidal vibratory motion shall be applied to each of the three perpendicular axes of the equipment, i.e., lateral, vertical or longitudinal in any sequence under the following conditions:

<u>(a) Frequency (Hz)</u>	<u>Peak Amplitude (mm)</u>
4-10	2.5
10-15	0.8
15-25	0.4
25-33	0.2

- (b) The frequency shall change either linearly or logarithmically with time between 4 and 33 Hz such that a complete cycle (4-33-4 Hz) will take approximately 5 minutes.
- (c) The EPIRB shall be vibrated in each orthogonal axes for a period of at least 30 minutes.
- (d) Frequency measurements shall be made on a continuous basis throughout the vibration test.

Upon completion of the vibration test, an exterior mechanical inspection shall be performed followed by the transmitter power output test into a 50 ohm dummy load and the frequency accuracy test.

- 7.2.1** The test EPIRB shall also be deemed unacceptable if loose or dislodged components are found.

8.0 BUMP TEST

The EUT should be secured to the testing equipment through its normal attachments or mounting intended for use in service conditions and mounted in the normal operating position(s). Additional straps or other holding means should not be used for Category I EPIRBs. Category 2 EPIRBs should be securely mounted to the testing equipment with the antenna in the vertical axis. The bump test is conducted to give a measure of confidence that the equipment will meet service conditions.

The EUT should be subjected to the bump test according to the following profile:

Peak Acceleration	98 m/s ²
Pulse Duration	16 ms
Waveshape	Half-cycle Sinewave
Test Axis	Vertical
Number of Bumps	4000

Upon completion of the bump test, an exterior mechanical inspection should be performed and an aliveness test conducted.

9.0 SALT FOG TEST

The salt fog test should be conducted on a complete Category 1 satellite EPIRB including the release mechanism and on a Category 2 satellite EPIRBs with its mounting device. The EUT should be turned OFF during the test.

The salt fog should 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, reference should be made to MIL-STD-810D (19 July 1983), method 509.2.

Before exposing the EUT to salt fog, it should be conditioned for a duration of at least 2 hours at a temperature of $35^{\circ}\text{C} \pm 2^{\circ}\text{C}$. After this conditioning and with the ambient temperature maintained at 35°C , salt fog should be added and maintained at the saturation point for 48 hours.

After exposure to salt fog, the EUT should be permitted to dry at room temperature ($20^{\circ}\text{C} \pm 5^{\circ}\text{C}$) for 24 hours before being exposed to another period of 12 hours of salt fog exposure at 35°C . Upon completion of this exposure and after a 12 hour drying period at room temperature, the exterior of the unit should be inspected for corrosion, peeling paint, and other signs of deterioration and the aliveness test conducted.

After the test, salt deposits and water stains may be washed off with clean warm water not exceeding a temperature of 38°C . In particular, the Category 1 satellite EPIRB should not be removed from the release mechanism for cleaning.

10.0 DROP AND BUOYANCY TESTS, 20M

10.1 This test shall be conducted on the EPIRB out of its bracket. The unit shall be turned "ON" for the duration of the test.

10.2 Procedure

The EUT should be dropped three times from a height of at least 20m into water. Each drop should be initiated from a different orientation as follows: Antenna vertical up; antenna vertical down; antenna horizontal.

Upon completion of the drop test, the EPIRB shall float upright. An exterior mechanical inspection shall then be performed, followed by an aliveness check.

10.2.1 The test EPIRB shall also be deemed unacceptable if loose or dislodged components are found.

11.0 DROP TEST, 1M.

11.1 Drop Test on Hard Surface

The EUT should be soaked at minimum stowage temperature for 2 hours. The drop test should then be performed within five minutes after removal from a temperature chamber.

The EUT should be dropped from a height of 1 meter (± 10 mm) above the test surface. The orientation of the EUT when dropped should be the normal floating position.

The test surface should consist of a piece of solid wood with a thickness of at least 150 mm and a mass of 30 kg or more.

At the conclusion of the drop, the EUT should be subjected to an aliveness check.

12.0 AUTOMATIC RELEASE MECHANISMS AND AUTOMATIC ACTIVATION TESTS FOR CATEGORY 1 SATELLITE EPIRB

The automatic release mechanism and the assembly should be mounted on a fixture simulating a deck or a bulkhead as per manufacturer's installation instructions. The fixture should then be submerged in water as specified below. Release shall occur before reaching a depth of 4 meters (measured from the center point of the test object to the surface of the water) and the EPIRB shall be automatically activated. The depth of actual release and the attitude shall be recorded.

The test should then be conducted as specified below with the EUT rotated in each instance prior to immersion.

1. Normal mounted orientation
 - a. EUT (including automatic release mechanism and assembly) conditioned for at least 2 hours at minimum stowage temperature
 - b. EUT (including automatic release mechanism and assembly) conditioned for at least 2 hours at maximum stowage temperature
 - c. EUT (including automatic release mechanism and assembly) conditioned for at least 2 hours at ambient temperature of $18^{\circ}\text{C} \pm 2^{\circ}\text{C}$
2. Rolling 90° starboard

3. Rolling 90° port
4. Pitching 90° bow down
5. Pitching 90° stern down
6. Upside down

If the EUT is equipped with an automatically-deployable antenna, the antenna must properly deploy during each immersion. Activation should be verified by observing operation of the strobe light.

13.0 LEAKAGE AND IMMERSION TESTS

The EUT should be turned OFF during the leakage and immersion tests and the tests performed in the following sequence.

1. The equipment shall be placed in an atmosphere of $+65 \pm 3^{\circ}\text{C}$ for one hour. It shall then immediately be immersed in water at $+20 \pm 3^{\circ}\text{C}$ to a depth of 100 ± 5 mm, measured from the highest point of the equipment to the surface of the water, for a period of 48 hours.
2. The EUT should be immersed under a 10 meter head of water for 5 minutes.
3. At the end of the test period the equipment shall be subjected to a performance check, and then be inspected for damage and visible ingress of water viewed with the unaided eye. There should be no free water inside the compartment containing the electronic components.

14.0 SPURIOUS EMISSIONS TEST

The spurious and harmonic emissions measurements for the 406 MHz and 121.5 MHz signals should be performed with the EUT at the minimum, maximum, and ambient temperatures. The 121.5 MHz spectrum should be of mean (or average) RF power. These emissions should not exceed the limits given in Figures 1 and 2 respectively, when measured in a nominal 100 Hz resolution bandwidth.

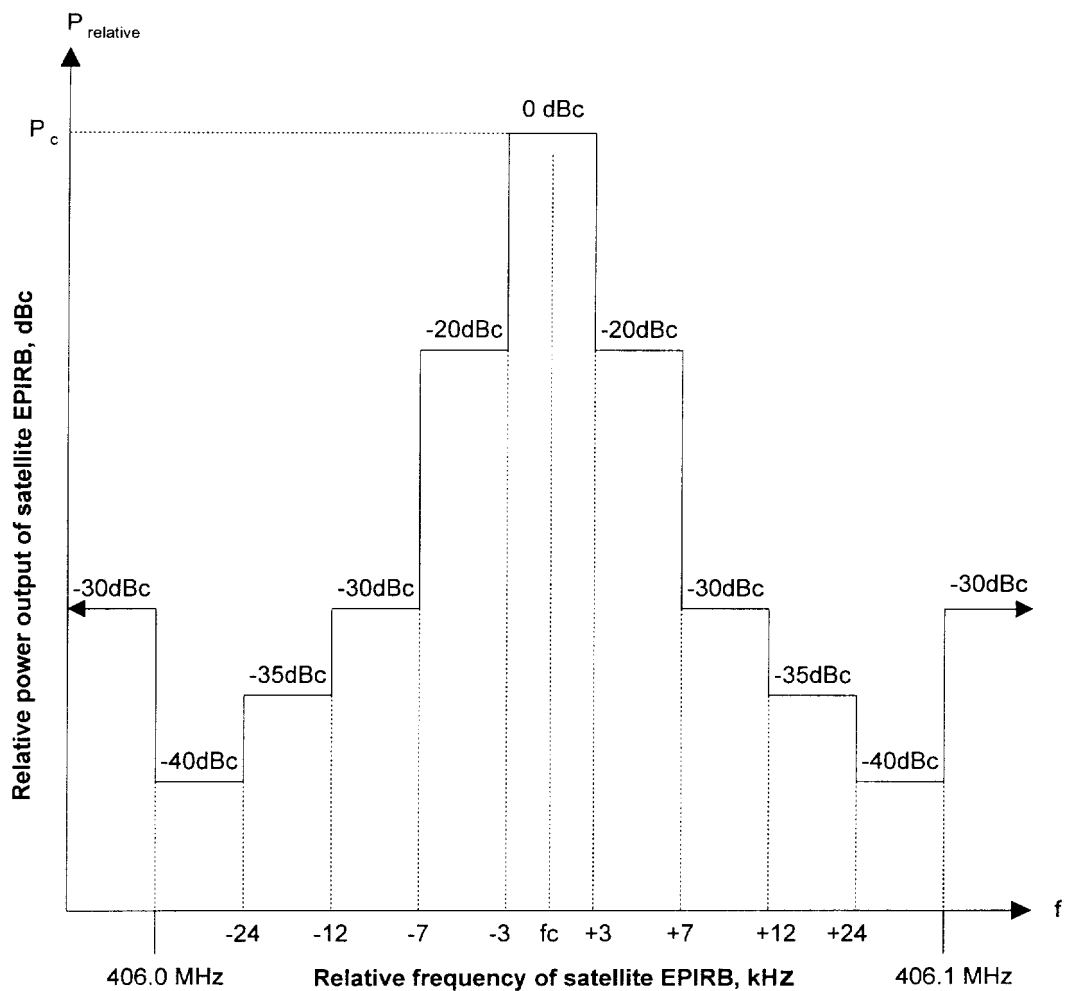
15.0 THERMAL SHOCK TEST

15.1 Low Temperature Thermal Shock Test

The EUT should be in the READY condition and thermally soaked at least 3 hours at the minimum stowage temperature or colder. The EUT should then be totally immersed in fresh water at a temperature of 0° C to +5°C for 5 – 10 seconds, then floated in water that is maintained at that temperature. The EUT should self-activate within 5 minutes.

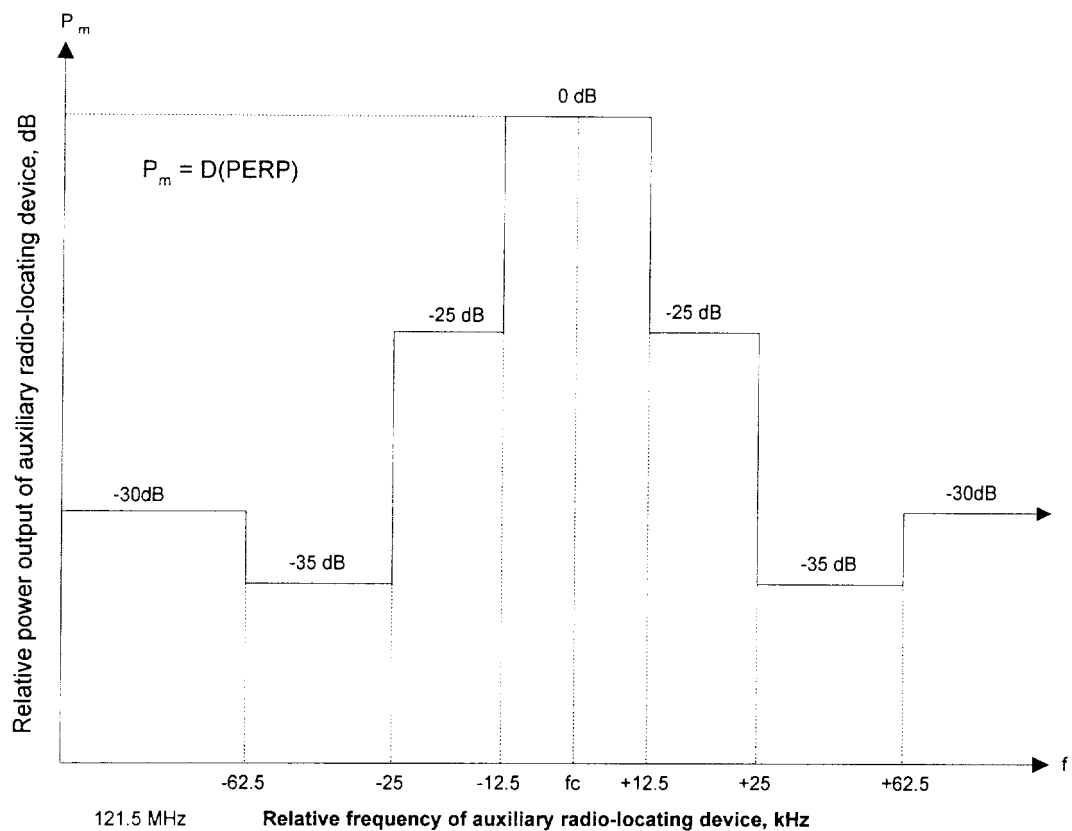
The EUT should be removed from the water, deactivated, made ready for automatic activation, set to the READY position and thermally soaked at least 3 hours at the minimum stowage temperature or colder. The EUT should then be totally immersed in salt water (5% NaCl) at temperature of –2°C to +5°C for 5 – 10 seconds, then float in the water maintained at that temperature. The EUT should self-activate within 5 minutes. After 20 minutes, the following measurements should be conducted (the EUT should remain in the water throughout the test):

1. Aliveness test
2. Short-term frequency stability (≤ 0.002 parts/million in 100 ms)
3. Medium-term frequency stability
 - a. Mean slope
 - b. Residual frequency variation



P_c = Satellite EPIRB unmodulated carrier power output
 f_c = Satellite EPIRB carrier frequency
 dBc = Satellite EPIRB emitted signal power level in dB relative to P_c (measured in a 100 Hz resolution bandwidth)

FIGURE 1
EMISSION MASK FOR 406 MHz SIGNAL



PERP = Peak effective radiated power
 P_m = Mean power
 D = Modulation duty cycle

FIGURE 2
EMISSION MASK FOR 121.5 MHz SIGNAL

15.2 High Temperature Thermal Shock Test

The high temperature shock test should be performed similarly to section A15.1 except that the EUT should be thermally soaked at the maximum stowage temperature (or hotter) and floated in water that is maintained between 25°C and 35°C.

16.0 COSPAS-SARSAT TYPE APPROVAL TESTS

The set of tests required by COSPAS-SARSAT for satellite EPIRB type approval are designed to ensure that the satellite EPIRB will not degrade the performance of the system. These tests must be performed by a COSPAS-SARSAT approved testing facility and follow the requirements of the COSPAS-SARSAT document C/S T.007, COSPAS-SARSAT 406 MHz Distress Beacon Type Approval Standard.

17.0 OPERATIONAL LIFE TEST

The operational life test is intended to establish, with reasonable confidence, that the satellite EPIRB will function for a minimum of 48 hours using a battery pack that has reached its expiration date. To accomplish this, the life test should be performed with a fresh battery pack, and the duration of the test should be extended beyond 48 hours by a factor (F) that is equivalent to the percentage loss in battery capacity due to self-testing (at the satellite EPIRB manufacturer's recommended interval(s) as well as battery pack self-discharging during the useful lifetime of the battery pack. The satellite EPIRB manufacturer should substantiate the method used to determine the test extension factor (F).

Using a fresh battery pack, the EUT should be turned ON (at the ambient temperature) for a period of time equal to the extension interval ($F \times 48$ h). The EUT should then be turned OFF and subjected to a cold soak (at the minimum operating temperature) for a period of at least 2 hours. The EUT should then be turned ON and maintained at the minimum operating temperature throughout the remainder of the test period. The following measurements should be made:

1. Nominal carrier frequency ($406.025 \text{ MHz} \pm 0.002 \text{ MHz}$)
2. Short-term frequency stability (≤ 0.002 part/million in 100 ms)
3. Medium-term frequency stability
 - a. Mean Slope
 - b. Residual frequency variation
4. RF output power ($5 \text{ W} \pm 2 \text{ dB}$)

5. Strobe light flash rate (20 to 30 flashes per minute)
6. Auxiliary radio-locating device peak envelope output power

The measurements should be repeated at no more than 24 hours after turn-ON and thereafter at intervals of not more than 6 hours until a total elapsed ON time of $48 \times (1 + F)$ hours is reached.

18.0 STROBE LIGHT TEST

The strobe light test may be performed separately or in conjunction with the Self Test or any of the COSPAS-SARSAT Type approval tests. This test must be performed at the minimum operating temperature (or colder), at the ambient temperature, and at the maximum operating temperature (or hotter). The EUT should be turned OFF and thermally soaked for at least 3 hours at the required operating temperature.

The EUT should be turned ON and a strobe light flash rate of 20 to 30 times per minute, effective intensity of not less than 0.75 candela and a flash duration between 10^{-6} and 10^{-2} seconds should be verified at the maximum, minimum, and ambient temperatures. If these measurements cannot be made within the climatic chamber, the measurements should be initiated within 1 minute of removing the satellite EPIRB from the climatic chamber.

19.0 SELF TEST

The self test may be performed separately or in conjunction with any other test in section A11. The self test must be performed at the minimum operating temperature (or colder), at the ambient temperature, and at the maximum operating temperature (or hotter).

The EUT should be turned OFF and thermally-soaked for at least 3 hours at the required operating temperature.

The EUT should be turned ON and the aliveness test performed. Upon successful completion of the aliveness test, the EUT should be turned OFF. After a period of at least 5 minutes, the EUT should be placed in the self-test mode in accordance with the manufacturer's operating instructions. The EUT should indicate successful completion of the self test and the following should be verified:

1. The 406 MHz RF output pulse duration does not exceed 0.444 seconds.

2. The frame synchronization pattern is 0 1101 0000.
3. Only one burst of the 406 MHz RF signal is transmitted.

20.0 STABILITY AND BUOYANCY TEST

With the antenna deployed in its normal operating position, the EUT should, when rotated to a horizontal position about any axis, submerged just below the surface, and released, pass through an upright position within 2 seconds.

The satellite EPIRB should float upright in calm fresh water with the base of the antenna a minimum of 40 mm above the waterline.

The reserve buoyancy of the satellite EPIRB should be at least 5% when determined by one of the following procedures:

1. Submerge the complete unit and measure the buoyant force with a scale. Divide the measured buoyant force by the weight of the unit.
2. Determine the location of the waterline on the floating satellite EPIRB. Calculate the volume of the unit above the water and the volume below the water. Divide the volume above the water by the volume below the water.

21.0 INADVERTENT ACTIVATION TEST

The following test is intended to determine that the water activation mechanism will not be activated inadvertently by waves washing over the ship. It is also intended to demonstrate that a mounting bracket intended for stowing the satellite EPIRB in an exposed location on deck will not inadvertently release the unit when subjected to waves. A Category 2 satellite EPIRB is not required to be subjected to this test, unless it is provided with a bracket intended to be mounted in an exposed location on deck.

The unit consisting of the satellite EPIRB and its release mechanism installed in its bracket, if any, should be mounted successively in each method intended for mounting on a ship, as described in the manufacturer's instructions. A stream from a hose should be directed at the EUT for a period of 5 minutes. The nozzle should have a nominal diameter of 63.5 mm and a water delivery rate of approximately 2300 liters of water per minute. The end of the nozzle should be 3.5 m away from the EUT and 1.5 m above the base of the antenna. The satellite

EPIRB should be rotated, or the nozzle should be moved in a horizontal plane during the test, so that water strikes the EUT from all directions over an arc of at least 180°.

The EUT should not release from its bracket, nor should it automatically activate as a result of water from the hose stream.

22.0 ORIENTATION TEST

The purpose of the orientation test is to verify that once the EUT is activated (either automatically or manually), the EUT will remain ON until manually deactivated, regardless of its orientation. The orientation test may be performed separately or in conjunction with any other test. This test may be performed at any temperature within the operating temperature range.

The EUT should be activated and positioned vertically. After 15 minutes, the aliveness test should be performed. The EUT should subsequently be placed in a horizontal position, upside down, and returned to its initial upright position and the aliveness test performed 2 minutes after each orientation.

23.0 121.5 MHz AUXILIARY RADIO-LOCATING DEVICE TRANSMITTER TEST

The following test procedure is considered satisfactory for performing the subject test; however, it is recognized that alternate procedures may be performed. Such alternate procedures may be used if the test provider can show that they provide equivalent information.

Test results are to be presented in graphical form wherever possible. The graphs are also to show the permissible limits.

Unless otherwise specified, all auxiliary radio-locating device transmitter signal characteristics should be measured at ambient temperature. Frequencies of 121.6, 121.65, 121.7, 121.75, 121.85, or 121.9 MHz should be used for testing outside of a screen room to avoid radiation at 121.5 MHz.

The tests may be performed in any sequence and in conjunction with other electrical tests. In all cases, the tests should be conducted after the EUT has been temperature stabilized for at least 1 hour and has been ON for at

least 15 minutes. Unless otherwise specified, the test should be performed with modulation present.

23.1 Carrier Frequency (121.5 MHz)

Frequency stability is a measure of the frequency drifts due to temperature and supply voltage variations, with reference to the frequency measured at 20°C and rated supply voltage.

The carrier frequency shall be measured at the antenna connector and under the conditions specified below. A sufficient stabilization period at each temperature shall be used prior to each frequency measurement:

- (a) at -40 degrees and at 10 degree intervals of temperatures between -20 and +55 degrees C at the manufacturer's rated supply voltage, and
- (b) at +20°C temperature and ±15% supply voltage variations

Minimum Standard: The RF carrier frequency shall not depart by more than $\pm 0.005\%$ (± 50 ppm) from that measured at 20°C and rated supply voltage.

23.2 Output Power (121.5 MHz)

Output power stability is a measure of the output power drifts due to temperature and supply voltage variations, with reference to the power measured at 20°C and rated supply voltage.

The output power shall be measured at the antenna connector and under the conditions specified below. A sufficient stabilization period at each temperature shall be used prior to each frequency measurement:

- (a) at -40 degrees and at 10 degree interval of temperature between -20 and +55 degrees C at the manufacturer's rated supply voltage, and
- (b) at +20°C temperature and ±15% supply voltage variations.

Minimum Standard: The RF output power shall not fall below the minimum 25 milliwatts nor be more than 100 milliwatts.

23.3 Unwanted Emissions

The unwanted emissions may be measured at room temperature and this temperature is to be recorded. The transmitter is to be modulated with the

audio sweep signal. A spectrum analyzer of resistance equal to the impedance specified for the antenna is to be used.

Minimum Standard: The power of unwanted emissions measured by an averaging meter of 300 Hz resolution bandwidth shall be less than the mean transmitter power (TP) by:

- (i) at least 25 dB on any frequency removed from the center of the authorized bandwidth by more than 50% up to and including 100% of the authorized bandwidth;
- (ii) at least 30 dB on any frequency removed from the center of the authorized bandwidth by more than 100% up to and including 250% of the authorized bandwidth.

Outside 250% of the authorized bandwidth, there are no specified limits for unwanted emissions.

The authorized bandwidth is 25 kHz. See Emission mask, Figure 3

23.4 Modulation Characteristics

The transmitter duty cycle, modulation frequency, modulation duty cycle, modulation factor, and sweep repetition rate may all be determined in a manner described below by observing the detected RF signal with a storage oscilloscope. All measurements shall be made at the minimum, ambient and maximum operating temperatures.

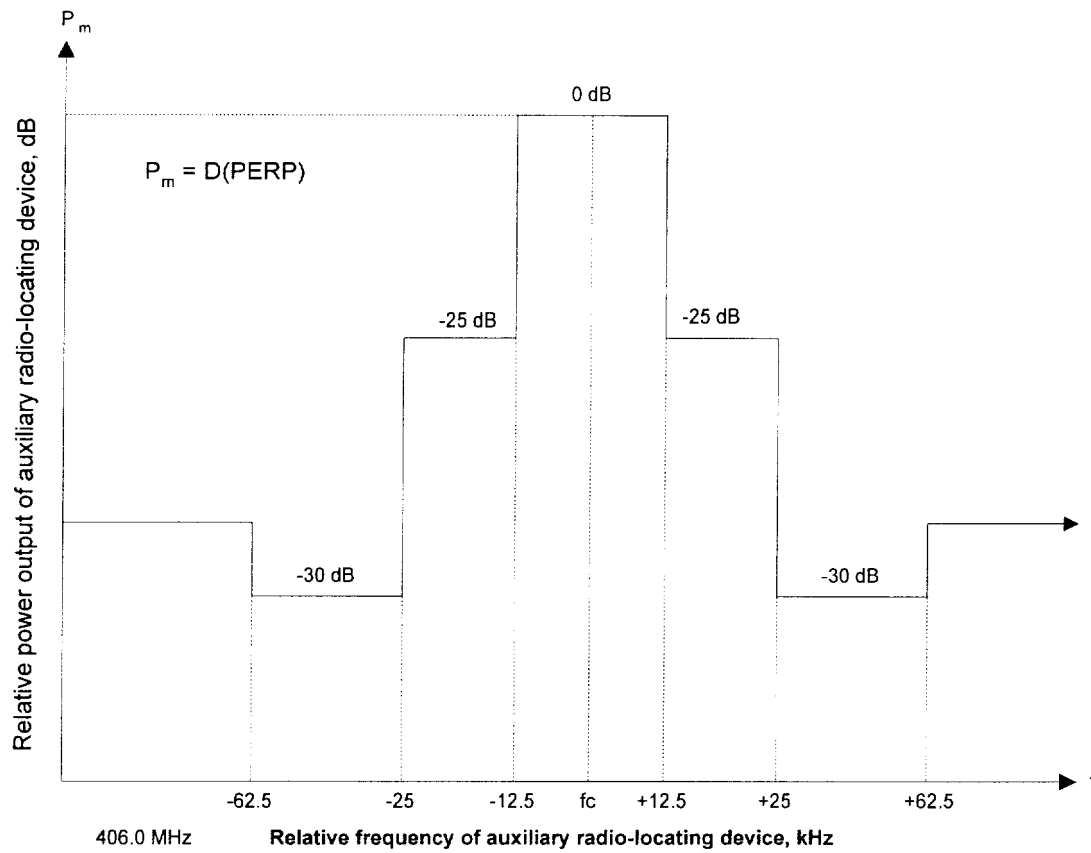
1. **Transmitter Duty Cycle.** Observe the transmitted signal and determine that the carrier is not interrupted (except for up to two seconds during transmission of the 406 MHz pulse).
2. **Modulation Frequency and Sweep Repetition Rate.** Observe the modulation envelope and determine the upper and lower audio-frequency sweep limits and sweep repetition rate. Measure and record direction of audio sweep.
3. **Modulation Duty Cycle.** Modulation duty cycle is the ratio of the positive modulation peak duration to the period of the instantaneous fundamental audio modulation frequency, observed at the half-amplitude points on the modulation envelope using the following formula (see Figure 4A):

$$Duty\ Cycle = \frac{A}{B} \times 100\%$$

The modulation duty cycle should be measured near the start, midpoint, and end of the modulation sweep period.

4. **Modulation Factor.** The modulation factor should be defined with respect to the maximum and minimum amplitudes of the modulation envelope by the following formula (see Figures 4B and 4C):

$$\text{Modulation Factor} = \frac{A - B}{A + B}$$



PERP = Peak effective radiated power
 P_m = Mean power in 300 Hz resolution bandwidth
D = Modulation duty cycle

FIGURE 3
EMISSION MASK FOR 121.5 MHz SIGNAL

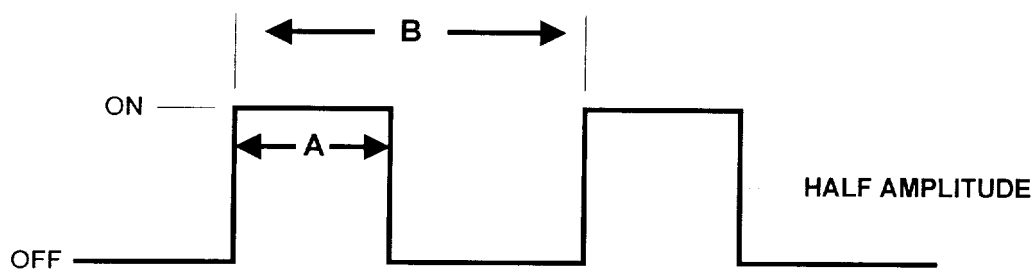


FIGURE 4A
TYPICAL MODULATION WAVEFORM

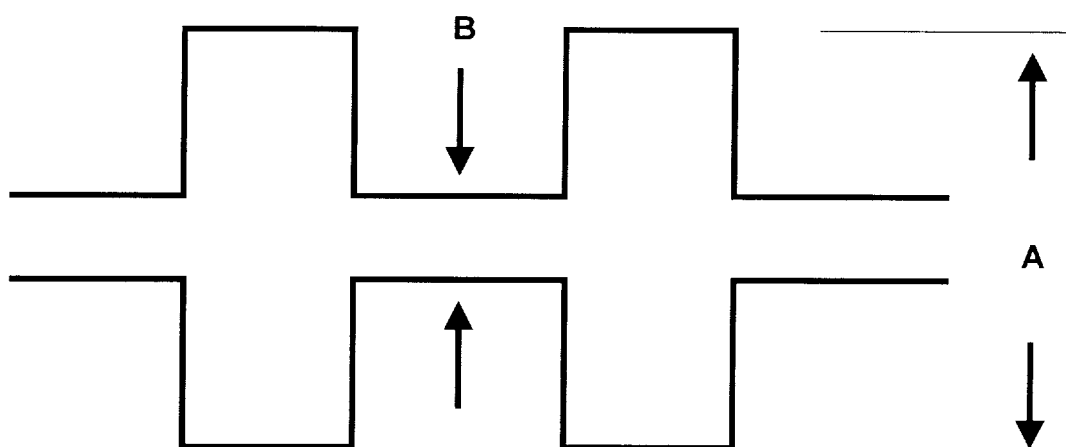


FIGURE 4B
TYPICAL FULL-WAVE MODULATION ENVELOPE

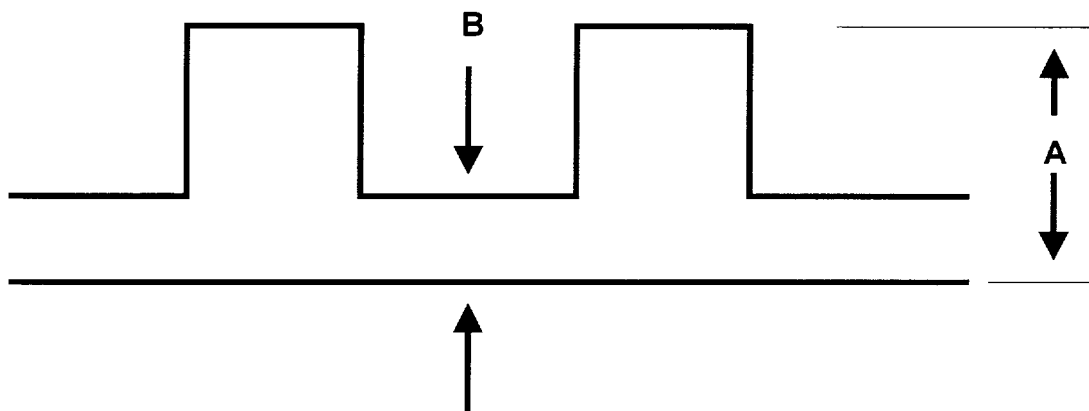


FIGURE 4C
TYPICAL ONE-HALF WAVE MODULATION ENVELOPE

23.5 Spectrum Characteristics

The A3X modulation must have a clearly defined carrier frequency distinct from the modulation side band components. For this, at least 30% of the total power emitted during any transmission shall be contained within ± 30 Hz of the carrier frequency in the case of the 121.5 MHz beacon.

23.5.1 Method of Measurement:

The following method of measurement was submitted to RTCA Special Committee #136 by NASA. It is more precise than the method given in the standards and is for this reason used here.

23.5.1.1 Connect the beacon RF output to the spectrum analyzers' RF signal input. Set the analyzer controls as follows:

Frequency:	Set so carrier is centered on display
Resolution (I.F.) Bandwidth:	100 Hz
Total Span :	20 KHz
Vertical Display:	5 dB/DIV
Total Scan Time:	200 Sec.
Log Reference Control:	Scaled so that carrier is approximately -6 dB from top of display.

In the display, each pair of side bands appears as a rectangular tier. Each tier of equal height to the right and left of the carrier corresponds to the upper and lower side bands of each harmonic of the modulating waveform.

23.5.1.2 Starting at the right side of the carrier, as displayed on the spectrum analyzer, note the amplitude in dBm of each side band tier. Use the maximum amplitude and ignore the slope apparent on each tier. The slope results because the beacon sweep rate is not strictly linear. The apparent slope is a function of the selected I.F. bandwidth and could be eliminated if the bandwidth were increased to 300 Hz, however, the increased value would make it more difficult to distinguish the carrier. Each tier corresponds to odd-order side bands because in this case the modulating wave form was a symmetrical square wave. Repeat the above procedure for the lower set of side bands.

23.5.1.3 Note the amplitude in dBm of the carrier.

23.5.1.4 Convert the carrier and each measured side band to watts.

23.5.1.5 The fractional power level of the carrier relative to the total power is computed by dividing the carrier power in watts by the total side band and

carrier power in watts. Multiplying this fractional answer by 100 gives the answer in percent. Record this value.

- 23.5.1.6** Next is to determine the carrier component bandwidth. Set the spectrum analyzer controls as follows:

Frequency:	Set so carrier is centered on display
Resolution (I.F.) Bandwidth:	30 Hz
Total Span:	1 KHz
Vertical Display:	2 dB/Div
Total Scan time:	30 sec.
Log Reference Control:	Scaled so that carrier is approximately -2 dB from top of display

- 23.5.1.7** Measure the 3 dB bandwidth of the carrier. Record this value.

23.5.1.8 Minimum Standard

The percent power in the carrier shall not be less than 30% and the 3 dB bandwidth of the carrier shall be less than 60 Hz indicating that at least 30% of the power resides within the band $f_c \pm 30$ Hz.

23.6 Peak Equivalent Isotropic Radiated Power

The peak equivalent isotropic radiated power (PEIRP) is the peak envelope power (PEP)² multiplied by the gain of the antenna.

This test is only required to be performed at ambient temperature and should use a EUT whose battery has been ON for a minimum of 44 hours. If the test exceeds four hours, the battery may be replaced with another which has been preconditioned with at least 44 hours of ON time.

The measurement procedure includes a determination of 12 values of PEIRP made by direct measurement of radiated power. Twelve (12) measurements are taken at an azimuth angle increments of $30^\circ \pm 3^\circ$. The 12 azimuth PEIRP measurements should be made at the same elevation angle; the elevation used should be the angle between 5° and 20° for which the EUT exhibits a maximum antenna gain. The starting point for the 12 azimuth measurements should be determined by rotating the EUT through 360° until the minimum signal is received. The median value of PEIRP should be between 25 and 100 mw; the ratio of maximum to minimum of the 11 highest values of PEIRP should not exceed 4 to 1 (6 dB).

² PEP is the RMS power supplied to the antenna by the transmitter measured at the highest crest of the modulation envelope.

23.6.1 Radiated Power Test Conditions

The test site should be on level ground which has uniform electrical characteristics. The site should be clear of metal objects, overhead wires, etc., and as free as possible from undesired signals such as ignition noise or other RF carriers. The distance from the EUT, or the search antenna to reflecting objects should be at least 30m. The EUT should be placed in the center of a ground plane with a radius of 75 cm $\pm$ 5 cm mounted at ground level.

Measurement of the radiated signals should be made at a point 10 m from the EUT. At this point, a wooden pole or insulated tripod with a movable boom should be arranged so that a search antenna can be raised and lowered through an elevation of 1 m to 4 m.

23.6.2 Method of Measurement

The elevation of the search antenna between 1 m and 4 m which produces a maximum gain is determined with the EUT at an arbitrary azimuth. The PEIRP should be measured and the elevation should be noted and should remain fixed for the remainder of the test. The remaining 11 measurements of PEIRP may be obtained by rotating the EUT in increments of $30^\circ \pm 3^\circ$. For each measurement the EUT PEIRP should be computed using the following equation:

$$PEIRP = LOG -1 \frac{P_{REC} - G_{REC} + L_c + L_p}{10}$$

Where:

- P_{rec} = Measured Power level from spectrum analyzer (dBm)
- G_{rec} = Antenna gain of search antenna (dB)
- L_c = Receive system attenuator and cable loss (dB)
- L_p = Free space propagation loss (dB)



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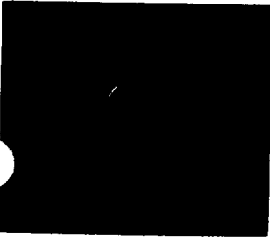
2.0 Initial Aliveness Test

The initial aliveness test was performed on RLB-33, S/N 1.

The unit was checked for:

- (a) Carrier frequency.
- (b) Power Output.
- (c) Data message.

RLB-33, S/N 1 passed the requirements outlined in the Environmental and Operational Performance Test Plan Section 2.0.



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3.0 Humidity Test

RLB-33, S/N 1 was exposed for 8 hours at 40°C/95%+ R.H.

The unit was removed from the test chamber and activated within the five minute time period.

Within the fifteen minutes allowed, the unit was checked for:

- (a) Carrier frequency.
- (b) Power output.
- (c) Data message.

RLB-33, S/N 1 passed the humidity test requirements outlined in the Environmental and Operational Performance Test Plan Section 3.0.

RLB-33 S/W 1

2/11/99

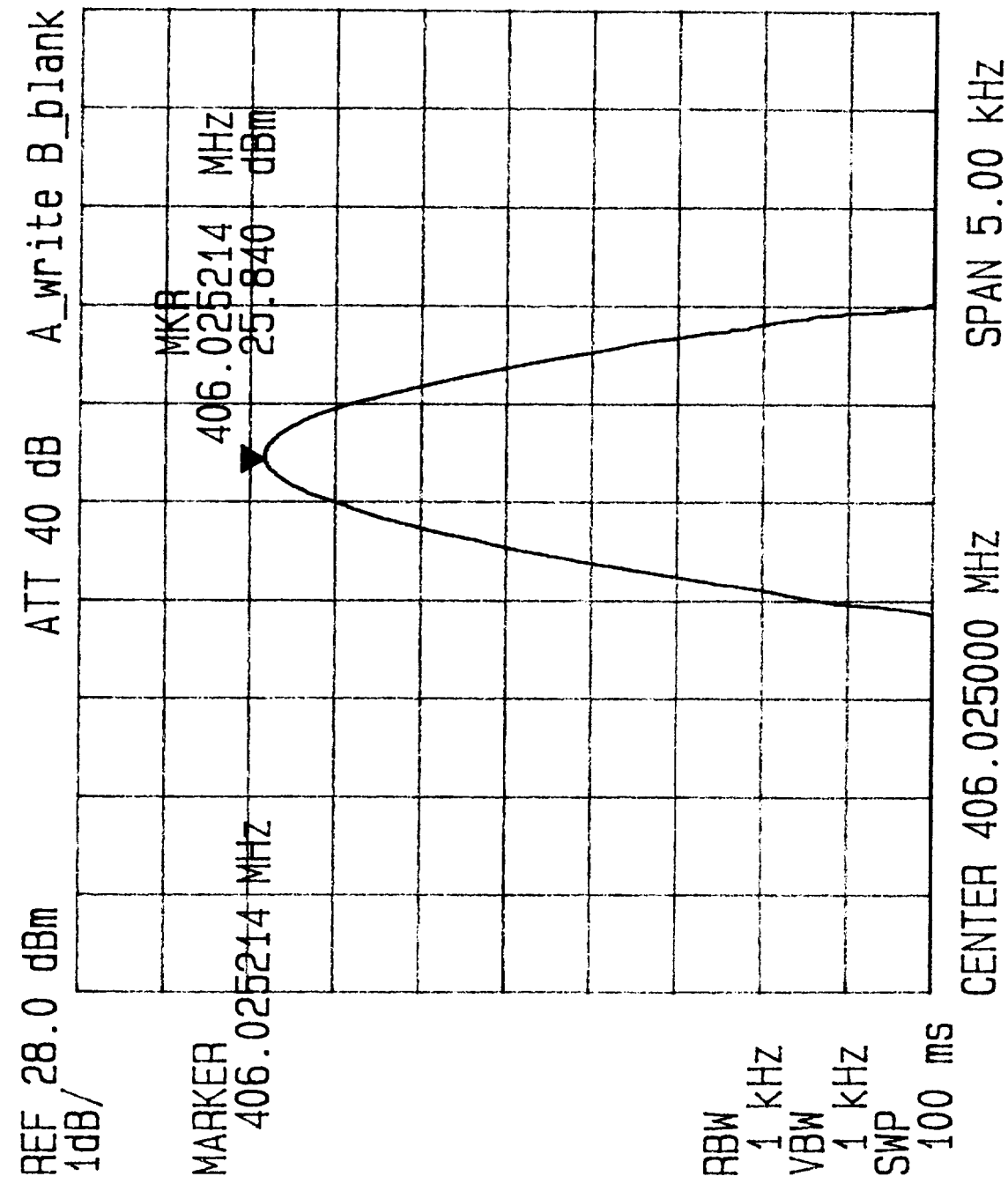
SUMMARY OF TEST RESULTS

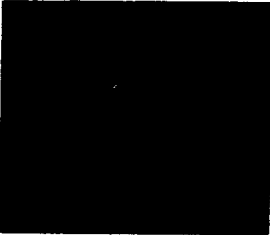
PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min.} (<u> </u> °C)	T _{amb.} (<u>24</u> °C)	T _{max.} (<u>40</u> °C)	
1. N/A						
2. Initial Aliveness Test						
• Carrier Frequency	406.025 ± 0.002	MHz		406.02526		
• Power Output	35 - 39	dBm		38.71		
• Data Message	FFFE2F96E E2EC0017F DFFC0A6D35 B3E0FAA8	✓		✓		
3. Humidity Test						
• Aliveness Test						
- Carrier Frequency	406.025 ± 0.002	MHz			406. 025214	
- Power Output	35 - 39	dBm			38.24	
- Data Message	FFFE2F96E E2EC0017F DFFC0A6D3 583E0FAA8	✓				

0/11/79
10:06 OUT OF
CHAMBER

2LB-33 5/21 3.0 HUNDRED TEST

ATTEN:
12.4dB





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4.0 Dry Heat Cycle

RLB-33, S/N 1 was placed in the chamber at room temperature. The chamber was then raised to 70°C+/-3.

The unit was exposed for 10 hours at 70°C+/-3, then lowered to 55°C+/-3 within 30 minutes. The unit was switched on and held at 55°C+/-3 for > 2 hours.

An aliveness check was performed during the 2 hour cycle and at the end of the 2 hour period.

The unit was checked for:

- (a) Carrier frequency.
- (b) Power output.
- (c) Data message.

RLB-33, S/N 1 passed the requirements of the dry heat cycle as outlined in the Environmental and Operational Performance Test Plan Section 4.0.

SUMMARY OF TEST RESULTS

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min} (°C)	T _{amb.} (°C)	T _{max.} (°C)	
4. Dry Heat Cycle						
- Aliveness Test (during 2 hour period) - Carrier Frequency - Power Output - Data Message - Aliveness Test (at end of 2 hour period) - Carrier Frequency - Power Output - Data Message	406.025 ± 0.002 35 - 39 FFFE2F96E E2EC0017F DFFC0A6D3 583E0FAA8	MHz dBm ✓			406.02518 37.74 ✓	
	406.025 ± 0.002 35 - 39 FFFE2F96E E2EC0017F DFFC0A6D3 583E0FAA8	MHz dBm ✓			406.02518 37.73 ✓	
	DFFC0A6D3 583E0FAA8					

DATE: 02-12-1999 TIME: 16:55:24

ACK V6.0

2DDC5D8002FFBFF
C/S-187-USA-1

PASSED

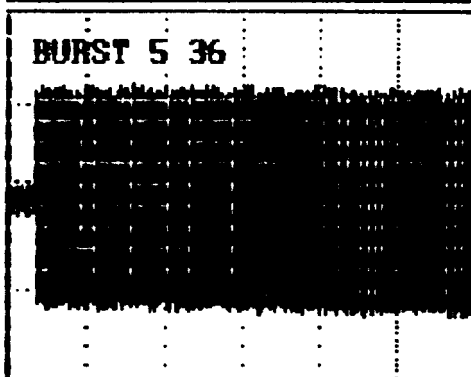
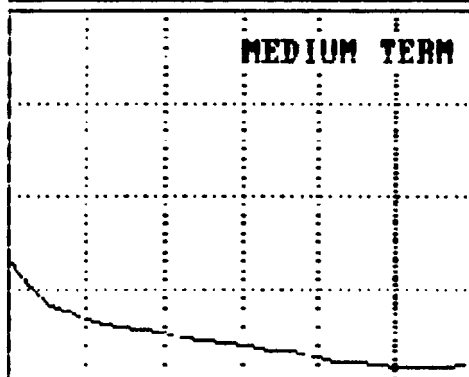
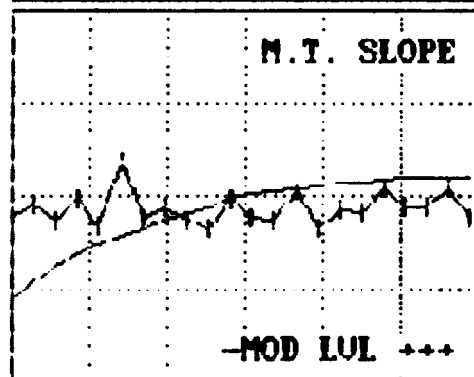
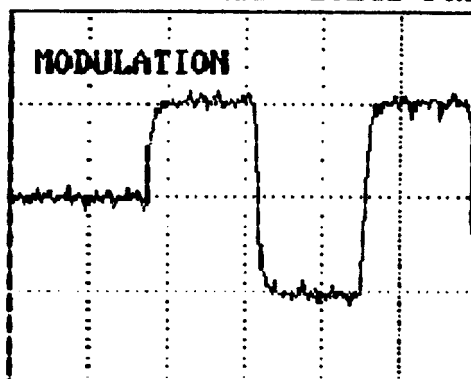
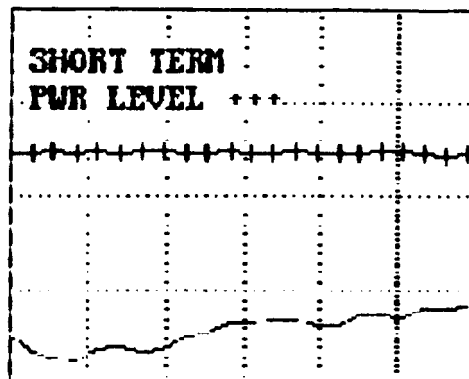
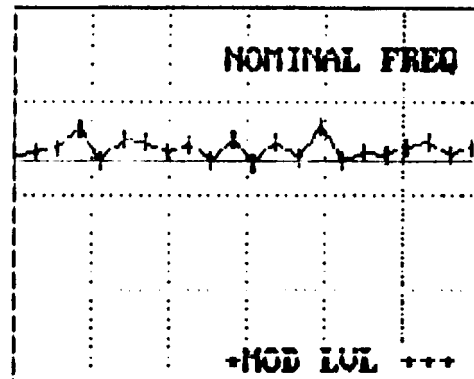
PASSED

186.4 Hz

PASSED

4.182E-18

PEAKS: +1.263 -1.243 rad



PASSED

9.585E-11

PASSED

1.394E-18

PEAKS: +1.344 -1.427 rad

NOMINAL FREQUENCY: 406.02518 MHz PWRK OUTPUT: 5.939 Watts +37.74 dbm PWRK STABILITY: 9.91 % PWRK RISE TIME: 730 µsec PEAK VOLTAGE: +2.802 Volts DRIFT SLOPES: 1) -1.99E-01 rad/sec 2) -1.99E-01 rad/sec 3) -1.99E-01 rad/sec MODULATION LEVELS: +1.136 radians +1.144 -1.115 -1.142 radians +0.015 offset -0.003 radians MODULATION TIMES: RISE 144 µsec FALL 150 µsec SYMMETRY 0.20 % MODULATION BIT RATE: 396.75 Hz BURST TIMES: AVG PERIOD 50.5 sec CARRIER DURATION 160.0 msec MESSAGE DURATION 361.2 msec TOTAL DURATION 521.2 msec PREAMBLE LEAKAGE LEVEL 35.0 dbc LEAKAGE LENGTH 0.1 msec	HEXADECIMAL MESSAGE 2DDC5D8002FFBFF FFFE2F96EE2E0017F0FFD0B6C5B3E0FAAD BIT SYNCHRONIZATION..... UK FRAME SYNCHRONIZATION... UK MESSAGE FORMAT..... LONG PROTOCOL FLAG..... STANDARD COUNTRY..... USA SERIALIZED USER..... TEST MODE C/S CERTIFICATE NO..... 18/ SERIAL NUMBER..... 1 LATITUDE..... N 127.75 LONGITUDE..... E 255.75 ERROR CORRECTION CODE 1. UK EMULATED DATA SOURCE..... Internal 121.5 MHz HUMING..... No SPARES status..... Not UK LATITUDE OFFSET..... + 0 60 LONGITUDE OFFSET..... + 0 60 ERROR CORRECTION CODE 2. UK
--	--

DATE: 02-12-1999 TIME: 18:15:59

ACR V6.0

2DDC5D8002EFBFF
C/S-187-USA-1

PASSED

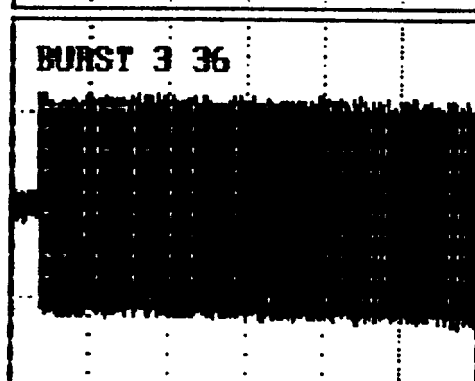
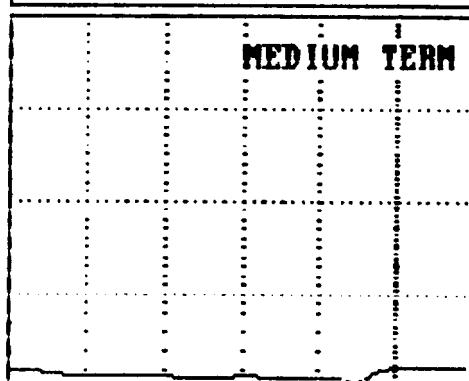
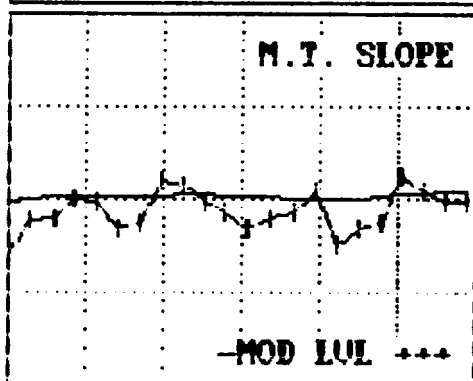
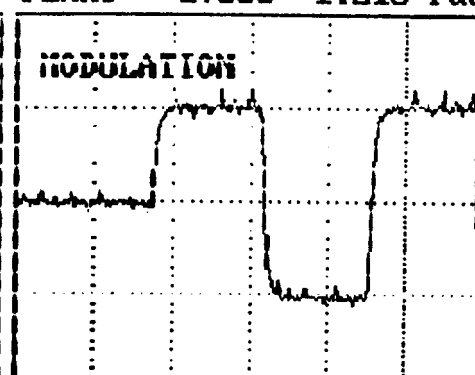
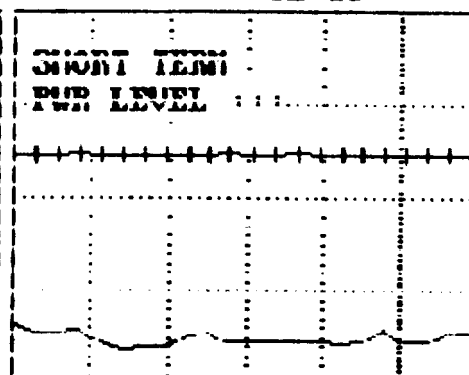
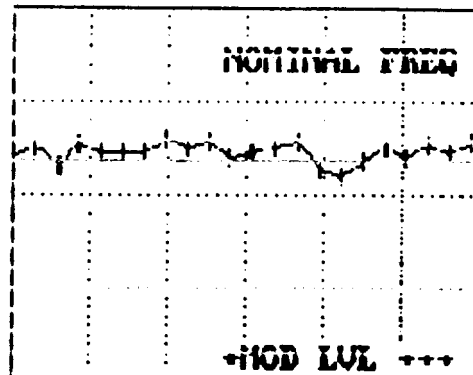
PASSED

187.3 Hz

PASSED

2.715E-10

PEAKS: +1.333 -1.218 rad



PASSED

4.325E-11

PASSED

1.771E-10

PEAKS: +1.333 -1.471 rad

NOMINAL FREQUENCY: 406.02018 MHz POWER OUTPUT: 5.930 Watts +37.73 dBm POWER STABILITY: 8.07 % POWER RISE TIME: 730 µsec PEAK VOLTAGE: +2.77 Volts DRIFT SLOPES: 1) -2.52E-01 rad/sec 2) -2.52E-01 rad/sec 3) -2.52E-01 rad/sec MODULATION LEVELS: +1.129 radians +1.142 -1.114 -1.135 radians +0.014 OFFSET -0.003 radians MODULATION TIMES: RISE 143 µsec FALL 147 µsec SYMMETRY 0.29 % MODULATION BIT RATE: 398.75 Hz BURST TIMES: AVG PERIOD 50.5 sec CARRIER DURATION 160.1 msec MESSAGE DURATION 361.2 msec TOTAL DURATION 521.2 msec PREAMBLE LEAKAGE LEVEL 35.0 dBc LEAKAGE LENGTH 0.1 msec	HEXADECIMAL MESSAGE 2DDC5D8002EFBFF FFFE2F96EE2E0017A7FFC0AB6555E0FAD BIT SYNCHRONIZATION..... UK FRAME SYNCHRONIZATION... UK MESSAGE FORMAT..... LONG PROTOCOL FLAG..... STANDARD COUNTRY..... USA SERIALIZED USER..... TEST MODE C/S CERTIFICATE No..... 187 SERIAL NUMBER..... 1 LATITUDE..... N 127.75 LONGITUDE..... E 255.75 ERROR CORRECTION CODE 1. OK ENCODED DATA SOURCE..... Internal 121.5 MHz HUMING..... No SPARES STATUS..... Not UK LATITUDE OFFSET..... + 0 60 LONGITUDE OFFSET..... + 0 60 ERROR CORRECTION CODE 2. UK
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5.0 Damp Heat Cycle

RLB-33, S/N 1 was placed in the chamber at room temperature. The chamber was raised steadily to $40^{\circ}\text{C} \pm 3 / 93\% \text{ R.H.} \pm 2$ over a period of 3 hours.

The unit was exposed for 10 hours then switched on and exposed for 2 more hours.

An aliveness check was performed during the 2 hour cycle and at the end of the two hour period.

The unit was checked for:

- (a) Carrier frequency.
- (b) Power output.
- (c) Data message.

RLB-33, S/N 1 passed the requirements of the damp heat cycle as outlined in the Environmental and Operational Performance Test Plan Section 5.0.

SUMMARY OF TEST RESULTS

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min.} (<u> </u> °C)	T _{amb.} (<u>40</u> °C)	T _{max.} (<u> </u> °C)	
5. Damp Heat Cycle - Aliveness Test (during 2 hour period) - Carrier Frequency - Power Output - Data Message - Aliveness Test (at end of 2 hour period) - Carrier Frequency - Power Output - Data Message	406.025 ± 0.002 35 - 39 FFFFE2FF96E E2EC0017F DFFC0A6D3 583E0FAA8	MHz dBm ✓		406.02521 37.67 ✓		
	406.025 ± 0.002 35 - 39 FFFFE2FF96E E2EC0D17E DFFC0A6D3 503E0FAA8	MHz dBm ✓		406.02520 37.71 ✓		

DATE: 02-13-1999 TIME: 10:35:13

ACK V6.0

2DDC5D8002FFBFF
C/S-187-USA-1

PASSED

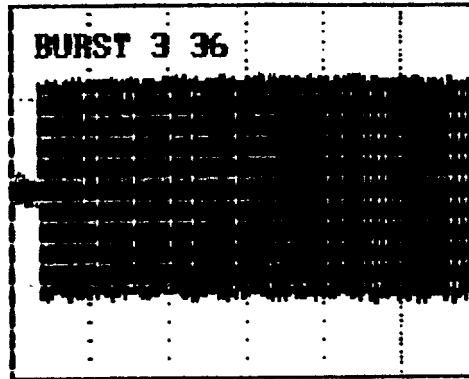
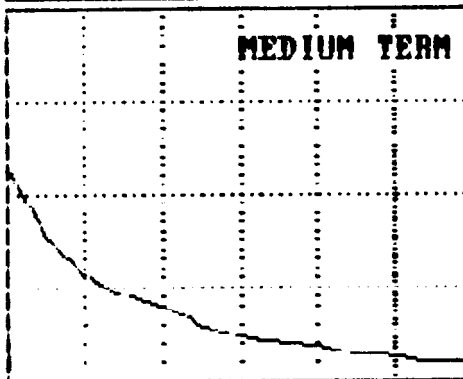
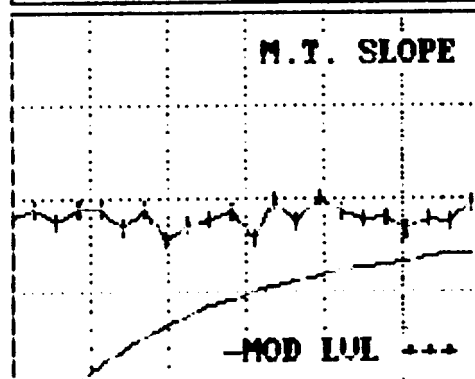
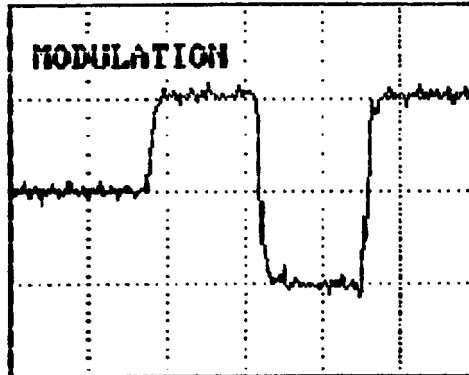
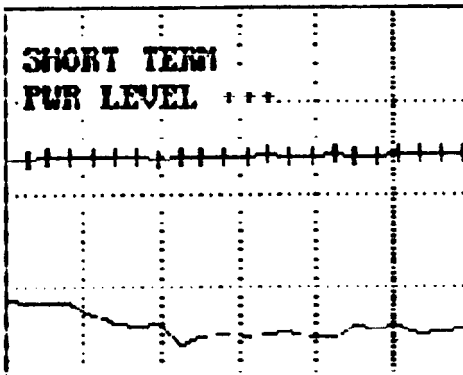
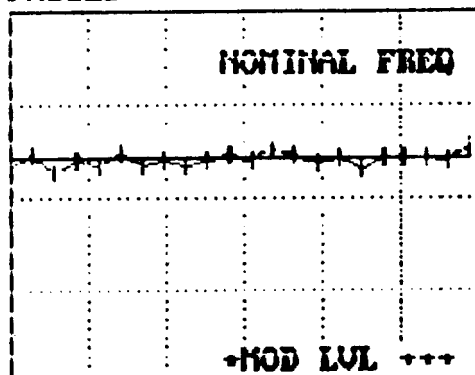
PASSED

212.8 Hz

PASSED

2.868E-10

PEAKS: +1.282 -1.264 rad



PASSED

-3.379E-10

PASSED

1.845E-10

PEAKS: +1.483 -1.332 rad

NOMINAL FREQUENCY: 406.02521 MHz
POWER OUTPUT: 5.845 Watts
+3/-67 dBm
POWER STABILITY: 9.12 %
POWER RISE TIME: 690 µsec
PEAK VOLTAGE: +2.776 Volts
DRIFT SLOPES: 1) +1.47E-01 rad/sec
2) +1.47E-01 rad/sec
3) +1.47E-01 rad/sec
MODULATION LEVELS: +1.129 radians
+1.140 -1.116 -1.134 radians
+0.012 OFFSET -0.002 radians
MODULATION TIMES: RISE 152 µsec
FALL 154 µsec
SYMMETRY 0.30 %
MODULATION BIT RATE: 358.6/ Hz
BURST TIMES: AVG PERIOD 50.6 sec
CARRIER DURATION 160.1 msec
MESSAGE DURATION 361.1 msec
TOTAL DURATION 521.2 msec
PREAMBLE LEAKAGE LEVEL 35.0 dBc
LEAKAGE LENGTH 0.1 msec

HEXADECIMAL MESSAGE

2DDC5D8002FFBFF
FFFE2F96EE2ED0017F1FFC0A6D3583E0FAAB
BIT SYNCHRONIZATION..... OK
FRAME SYNCHRONIZATION... OK
MESSAGE FORMAT..... LONG
PROTOCOL FLAG..... STANDARD
COUNTRY..... USA
SERIALIZED USER..... TEST MODE
C/S CERTIFICATE No..... 187
SERIAL NUMBER..... 1
LATITUDE..... N 127.75
LONGITUDE..... E 200.75
ERROR CORRECTION CODE 1. OK
ENCODED DATA SOURCE..... Internal
121.5 MHz HUMING..... NO
SPARE STATUS..... NOT OK
LATITUDE OFFSET..... + 0 60
LONGITUDE OFFSET..... + 0 60
ERROR CORRECTION CODE 2. OK

DATE: 02-13-1999 TIME: 11:56:38

ACR v6.0

2DDC5D8002FFBFF
C/S-187-USA-1

PASSED

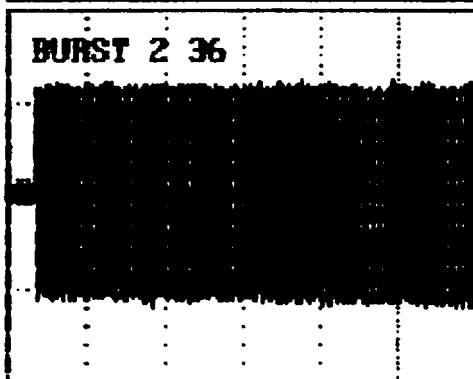
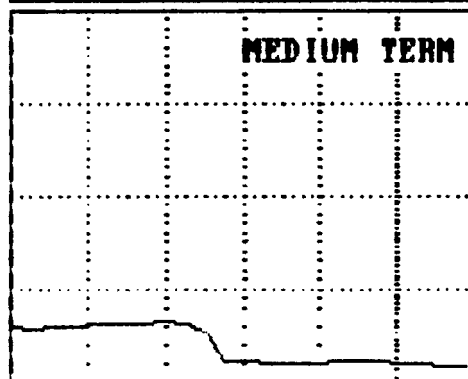
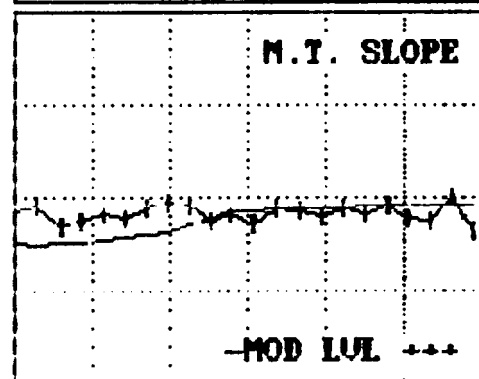
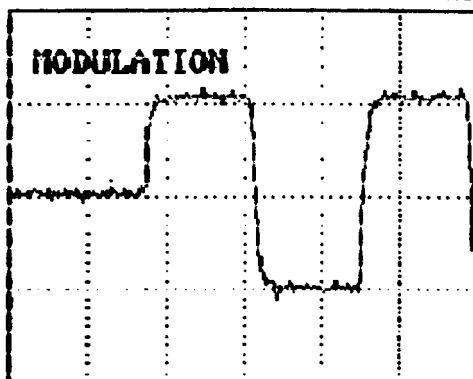
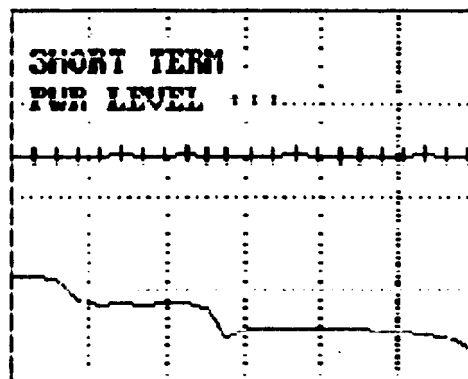
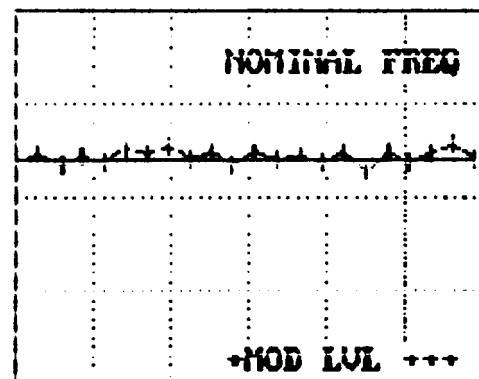
PASSED

206.2 Hz

PASSED

2.782E-18

PEAKS: +1.382 -1.214 rad



PASSED -4.713E-11

PASSED 1.485E-18

PEAKS: +1.387 -1.324 rad

NOMINAL FREQUENCY: 406.02520 MHz
 POWER OUTPUT: 5.899 Watts
 +37.71 dbm
 POWER STABILITY: 8.42 %
 POWER RISE TIME: 500 µsec
 PEAK VOLTAGE: +2.782 Volts
 DRIFF SLOPES: 1) +1.60E-01 rad/sec
 2) +1.60E-01 rad/sec
 3) +1.60E-01 rad/sec
 MODULATION LEVELS: +1.130 radians
 +1.143 -1.115 -1.130 radians
 +0.014 OFFSET -0.002 radians
 MODULATION TIMES: RISE 151 µsec
 FALL 156 µsec
 SYMMETRY 0.07 %
 MODULATION BIT RATE: 358.76 Hz
 BURST TIMES: AVG PERIOD 50.5 sec
 CARRIER DURATION 160.1 msec
 MESSAGE DURATION 361.2 msec
 TOTAL DURATION 521.3 msec
 PREAMBLE LEAKAGE LEVEL 35.0 dbc
 LEAKAGE LENGTH 0.1 msec

HEXADECIMAL MESSAGE

2DDC5D8002FFBFF
 FFFEF96EE2ED0017F1FFC0A6C83E0FAAB
 BIT SYNCHRONIZATION..... OK
 FRAME SYNCHRONIZATION... OK
 MESSAGE FORMAT..... LONG
 PROTOCOL FLAG..... STANDARD
 COUNTRY..... USA
 SERIALIZED USER..... TEST MODE
 C/S CERTIFICATE No..... 187
 SERIAL NUMBER..... 1
 LATITUDE..... N 127.75
 LONGITUDE..... E 255.75
 ERROR CORRECTION CODE 1. OK
 ENCODED DATA SOURCE..... Internal
 121.5 MHz HOMING..... No
 SPARES status..... Not OK
 LATITUDE OFFSET..... + 0 60
 LONGITUDE OFFSET..... + 0 60
 ERROR CORRECTION CODE 2. OK

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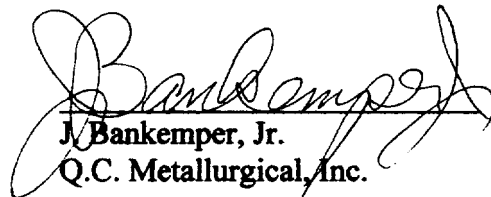
6.0 Vibration Test, Non Active

The vibration test, non active was performed by East-West Technology Corp. on behalf of Q.C. Metallurgical, Inc.

RLB-33, S/N 1 passed the requirements of the vibration test as outlined in the Environment and Operational Performance Test Plan Section 6.0.

See attached report.

Test was witnessed by J. Bankemper, Jr. of Q.C. Metallurgical, Inc.



J. Bankemper, Jr.
Q.C. Metallurgical, Inc.

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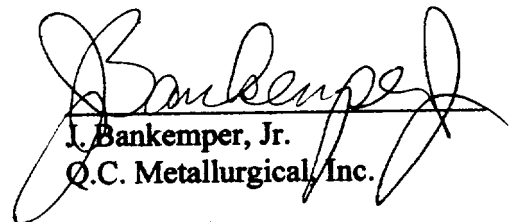
7.0 Vibration Test, Frequency

The vibration test, frequency was performed by East-West Technology Corp. on behalf of Q.C. Metallurgical, Inc.

RLB-33, S/N 1 passed the requirements as outlined in the Environmental and Operational Performance Test Plan Section 7.0.

See attached report.

Testing was witnessed by J. Bankemper, Jr. of Q.C. Metallurgical, Inc.


J. Bankemper, Jr.
Q.C. Metallurgical, Inc.

SUMMARY OF TEST RESULTS

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min.} (<u> </u> °C)	T _{amb.} (<u>25</u> °C)	T _{max.} (<u> </u> °C)	
6. Vibration Test (Non Activate)						
• Exterior Mechanical Inspection	No Damage	✓		✓		
• Did not Activate		✓		✓		
• Aliveness Test						
- Carrier Frequency	406.025 ± 0.002	MHz		406.02521		
- Power Output	35 – 39	dBm		37.75		
- Data Message	FFFF2F96F ELEC0017F	✓		✓		
7. Vibration Test (Frequency)						
• Carrier Frequency (during test)	DFFC0A6D3 583E0FAAB 406.025 ± 0.002	MHz		406.025172 406.025178 406.025171		
• Exterior Mechanical Inspection	No Damage	✓		✓		
• Aliveness Test:						
- Carrier Frequency	406.025 ± 0.002	MHz		406.02521		
- Power Output	35 – 39	dBm		37.75		

DATE: 02-16-1999 TIME: 09107:53

ACR v6.0

2DDC5D8002FFBF
C/S-187-USA-1

PASSED

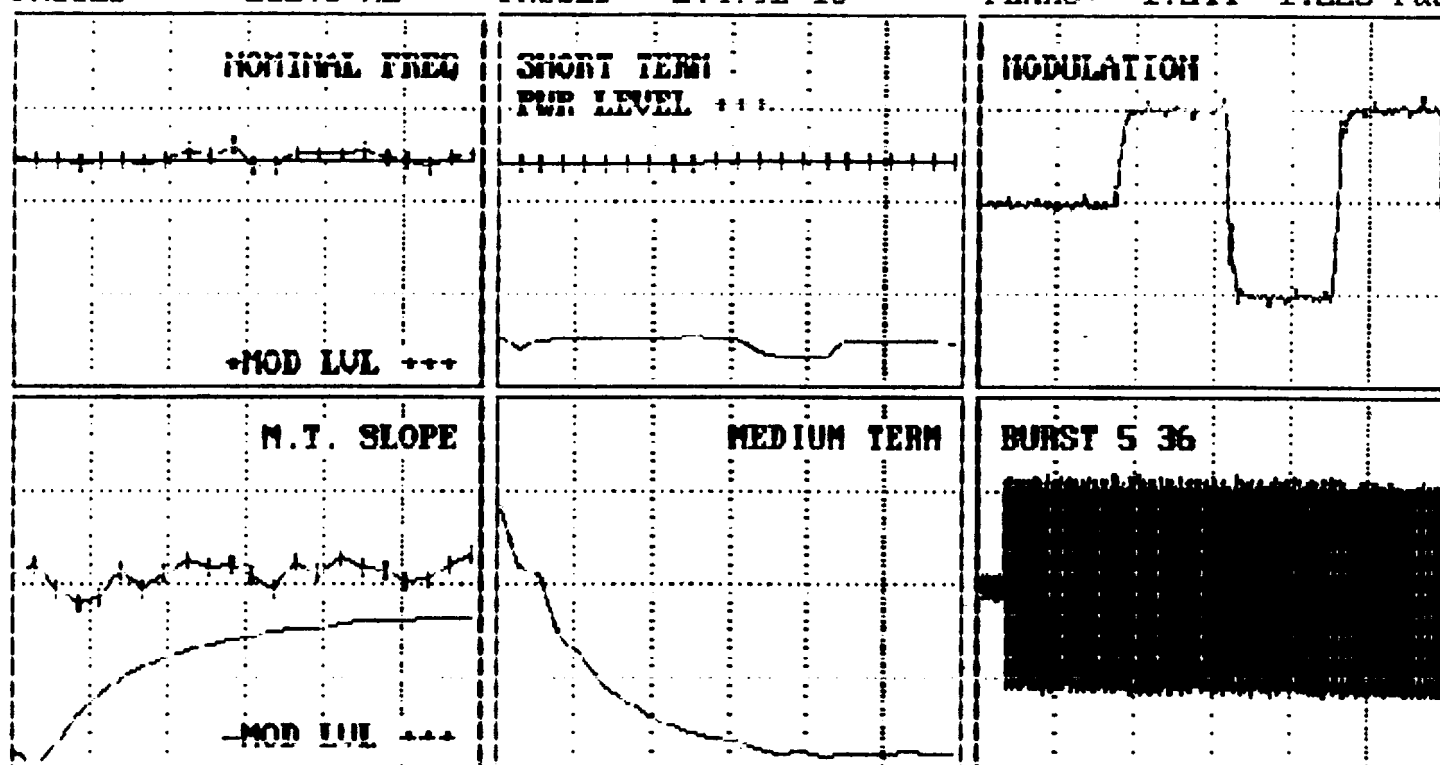
PASSED

212.8 Hz

PASSED

2.479E-18

PEAKS: +1.244 -1.223 rad



PASSED -1.994E-16

PASSED 1.462E-16

PEAKS: +1.299 -1.362 rad

NOMINAL FREQUENCY: 406.02521 MHz
 POWER OUTPUT: 5.963 Watts
 +37.75 dBm
 POWER STABILITY: 9.61 %
 POWER RISE TIME: 740 µsec
 PEAK VOLTAGE: +2.765 Volts
 DRIFF SLOPES: 1) -1.67E-01 rad/sec
 2) -1.67E-01 rad/sec
 3) -1.67E-01 rad/sec
 MODULATION LEVELS: +1.119 radians
 +1.145 -1.095 -1.125 radians
 +0.025 OFFSET -0.003 radians
 MODULATION TIMES: RISE 156 µsec
 FALL 156 µsec
 SYMMETRY 0.52 %
 MODULATION BIT RATE: 398.75 Hz
 BURST TIMES: AVG PERIOD 50.5 sec
 CARRIER DURATION 160.0 msec
 MESSAGE DURATION 361.1 msec
 TOTAL DURATION 521.1 msec
 PREAMBLE LEAKAGE LEVEL 35.0 dBc
 LEAKAGE LENGTH 0.1 msec

HEXADECIMAL MESSAGE

2DDC5D8002FFBF
 FFEEF96EE2ED00177UFF00A6D3583E0FA8
 BIT SYNCHRONIZATION..... OK
 FRAME SYNCHRONIZATION... OK
 MESSAGE FORMAT..... LONG
 PROTOCOL FLAG..... STANDARD
 COUNTRY..... USA
 SERIALIZED USER..... TEST MODE
 C/S CERTIFICATE No..... 187
 SERIAL NUMBER..... 1
 LATITUDE..... N 127.75
 LONGITUDE..... E 255.75
 ERROR CORRECTION CODE 1. OK
 ENCODED DATA SOURCE..... Internal
 121.5 MHz HUMMING..... No
 SPARES STATUS..... Not OK
 LATITUDE OFFSET..... + 0 60
 LONGITUDE OFFSET..... + 0 60
 ERROR CORRECTION CODE 2. OK

EAST-WEST TECHNOLOGY CORP.

15814 Corporate Circle
West Palm Beach, FL. 33422
(561) 776-7339 • Fax (561) 776-7344

VIBRATION, OPERATING AND NON-OPERATING

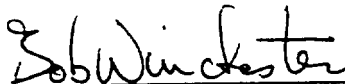
For The

**ACR ELECTRONICS, INC.
BOTTOM CASE SEA SHELTER**

TEST REPORT R1255

PREPARED FOR: **ACR ELECTRONICS, INC.**
5757 Ravenwood Road
Ft. Lauderdale, FL 33312

Prepared By:

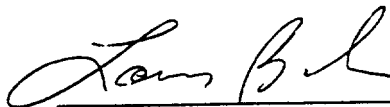


Bob Winchester
EWT Technical Writer

Date:

10 Mar 99

Checked By:



Lou Baker
EWT Operations Manager

Date:

3/10/99

Approved By:



Robert Cowdrey
EWT Quality Manager

Date:

3/10/99

ADMINISTRATIVE DATA

Prepared For:	ACR ELECTRONICS, INC. 5757 Ravenwood Road Ft Lauderdale , FL 33478
Test Performed:	Vibration, Operating and Non-Operating
Test Facility:	East-West Technology Corp. PO Box 220716 West Palm Beach, Fl. 33422

Item Tested:	Bottom Case Sea Shelter
Model Number:	N/A
Serial Number:	N/A

Primary Test Specification:	ACR Electronics Transmittal Dated 11-23-98
Reference Document:	N/A

Purchase Order No.:	57460
Contract Number:	N/A
EWT Job No.:	1255
EWT Test Report No.:	R1255
Test Begin Date:	15 February 98
Test Completion Date:	15 February 98
Test Report Date:	10 March 98
Test Report Revision Level:	N/A
Revision Date:	N/A

TABLE OF CONTENTS

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APPENDICES

A	Vibration Test Data
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[illegible]

1.0 Introduction

1.1 Scope

This document describes procedures, and performance of the Random Vibration with Thermal Cycling Tests.

1.2 Purpose

The purpose of these tests is to demonstrate that the test specimens meet or exceed the design specification requirements, during and/or upon completion of exposure to the stresses outlined herein.

1.3 Summary

All testing was performed in accordance with the requirements outlined in the ACR ELECTRONICS, INC. Transmittal faxed to EWT on 11/23/98.

2.0 Applicable Documents

2.1 ACR ELECTRONICS, INC.

ECD 1226E

Qualification Test Plan
AE2100 Bottom Case Sea Shelter

Fax

ACR Electronics, Inc Transmittal
Dated 11/23/98

2.2 Military

MIL-Q-9858A

Quality Assurance System

MIL-STD-810D

Environmental Test Methods and
Engineering Guidelines

2.3 ANSI

ANSI/NCSL Z540-1-1994

Calibration System Requirements

2.4 Order of Precedence

In cases of conflict between this procedure and the documents and issues referenced, the order of precedence was as follows:

- a) ACR Electronics, Inc. Facsimile
- b) ACR Electronics, Inc. Purchase Order
- c) Military Specifications

3.0 General Information

3.1 Test Equipment

All Test instrumentation is calibrated in accordance with ANSI/NCSL Z540-1-1994 and MIL-Q-9858-A, and are traceable to the National Institute of Standards and Technology (NIST). Table 1 lists the equipment used during the tests performed.

3.2 Test Facilities

The testing described herein was performed at East-West Technology Corp. (EWT) 15814 Corporate Circle, Jupiter FL 33478.

3.3 Test Conditions

Unless specified herein, all tests and measurements are performed at the room ambient conditions existing at the laboratory during testing:

Temperature:	25°C ± 10°C
Barometric Pressure	Prevailing site pressure
Relative Humidity:	Room ambient up to 90%

TABLE 1

TEST EQUIPMENT -VIBRATION TEST

Test Date (s) 2/15/98

Item: Signal Conditioner
Mfr.: Dytron
Model: 4123
S/N: 154
EWT No. 2355
Last Calibration: 11/28/98
Calibration Interval: 1 year

Item: Controller
Mfr.: Data Physics
Model: DP550win
S/N: 3515
EWT No.: 3-4002
Last Calibration: 10/1/98
Calibration Interval: 6 months

Item: Amplifier/Exciter
Mfr.: Ling
Model: PP35/70 VC-2/300B
S/N: 38/155
EWT No.: n/a
Last Calibration: n/r
Calibration Interval: n/r

Item: Accelerometer
Mfr.: Dytran
Model: 3101BG
S/N: 3256
EWT No.: 2349
Last Calibration: 1/20/99
Calibration Interval: 1 year

3.0 General Information (continued)

3.4 Test Tolerances

All test conditions are maintained within the tolerances specified in the detailed test procedure or in accordance with referenced test specifications.

3.5 Test Witnessing / Monitoring

All testing is conducted by a qualified East-West Technology (EWT) Technician under the direction and cognizance of the EWT Operations Manager and Quality Assurance. The ACR ELECTRONICS, INC. representative evaluated the test setup and had access to all phases of the tests.

3.6 Test Recording

3.6.1 Chronological logs of all significant events are maintained by test lab personnel and indicate date, times and descriptions of conditions. These logs are used as reference and are retained at EWT.

3.7 Recommendation

All recorded data and observations made by East-West Technology personnel during the testing described herein are available for your evaluation.

4.0 Test Procedure

4.1 Vibration Test Setup

- 4.1.1 A visual inspection was performed on the Bottom Case Sea Shelter to verify pre-test condition. No anomalies were noted.
- 4.1.2 The customer provided fixture was mounted onto the vibration table adapter plate. The ACR Electronics representative then mounted the Unit Under Test (UUT) to the fixture.
- 4.1.3 The control accelerometer was mounted to the customer's fixture adjacent to a fixture to table interface attachment point.
- 4.1.3 A test cable was attached to the UUT and the monitoring equipment. The UUT was in the non-operating condition.
- 4.1.4 The test specimen was mounted in the upright position through each of the three perpendicular axes of the unit.
- 4.1.5 A list of test equipment utilized for the Vibration test is described in Table 1.

4.2 Vibration Test

- 4.2.1 The UUT was subjected to the sine vibration spectrum at the levels required for the test axis as shown in Table 2.

Table 2
Vibration Levels

FREQUENCY (Hertz)	LEVEL (inches Double Amplitude)
4 – 10	0.1
10 – 15	0.03
15 – 25	0.016
25 – 33	0.08

4.2 Vibration Test (continued)

- 4.2.2 The complete cycle, from 4Hz to 33Hz to 4Hz, was traversed in five minutes.
- 4.2.3 Exposure in each axis was first in the non-operating mode. The UUT was then turned on and monitored for the operational mode.
- 4.2.4 The duration of applied vibration for each axis was thirty minutes in the operational and thirty minutes in the non-operational modes.
- 4.2.5 During the application of vibration in the operational mode the UUT was monitored by the ACR Electronics representative. At the completion of exposure in each axis a visual inspection was completed.

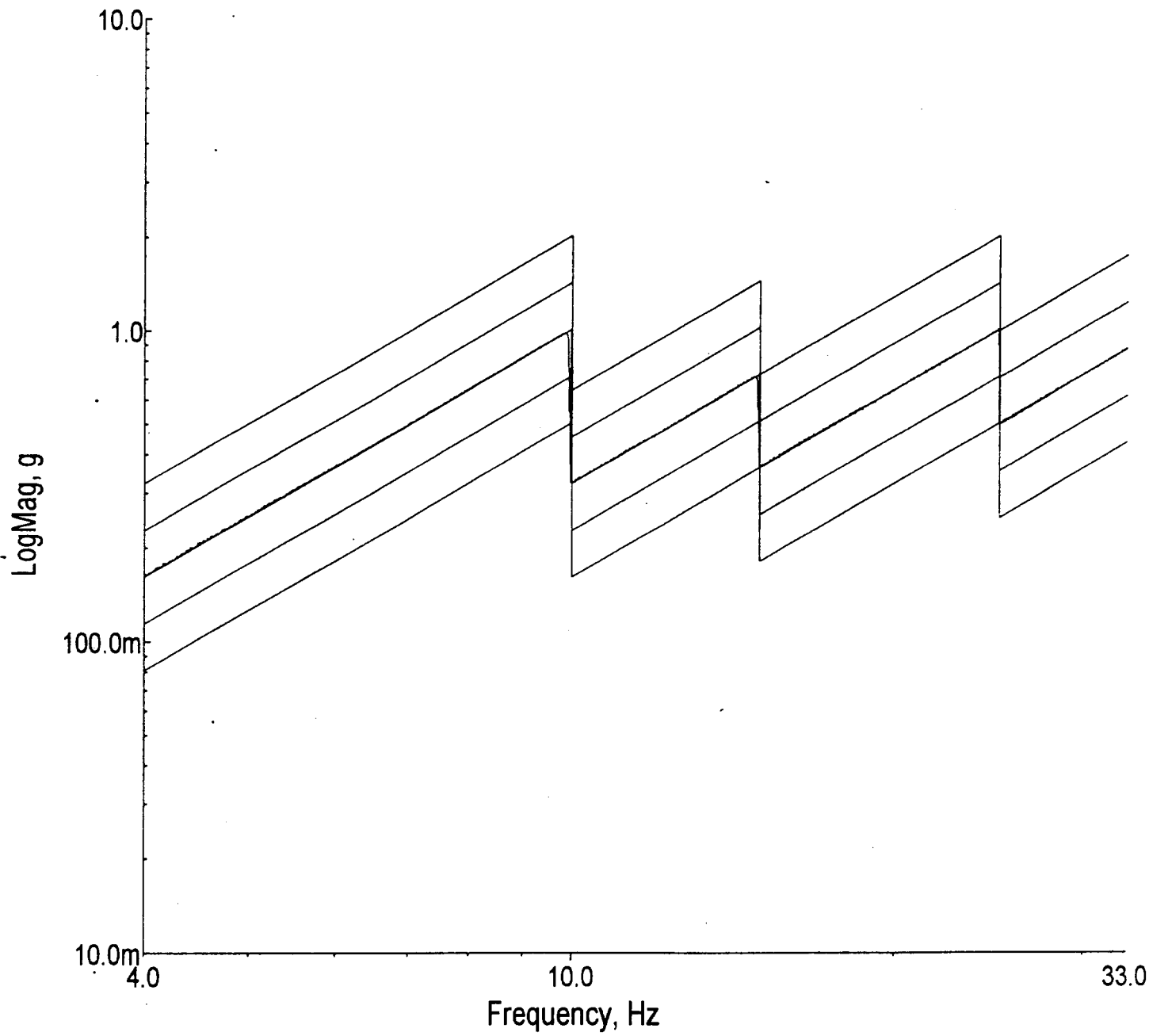
4.3 Vibration Test Results

- 4.3.1 The UUT was exposed to a total of 1 ½ hours of vibration testing in the non-operating mode in each of the three perpendicular axes.
- 4.3.2 The UUT was exposed to a total of 1 ½ hours of vibration testing in the operating mode in each of the three perpendicular axes.
- 4.3.3 A visual inspection was performed at the completion of testing in each axis. No anomalies were noted. Test data is contained in Appendix A.
- 4.3.4 Operational monitoring of the unit was performed by the ACR Electronics representative. All data was retained by ACR Electronics.
- 4.3.5 The UUT was returned to ACR Electronics for further evaluations.

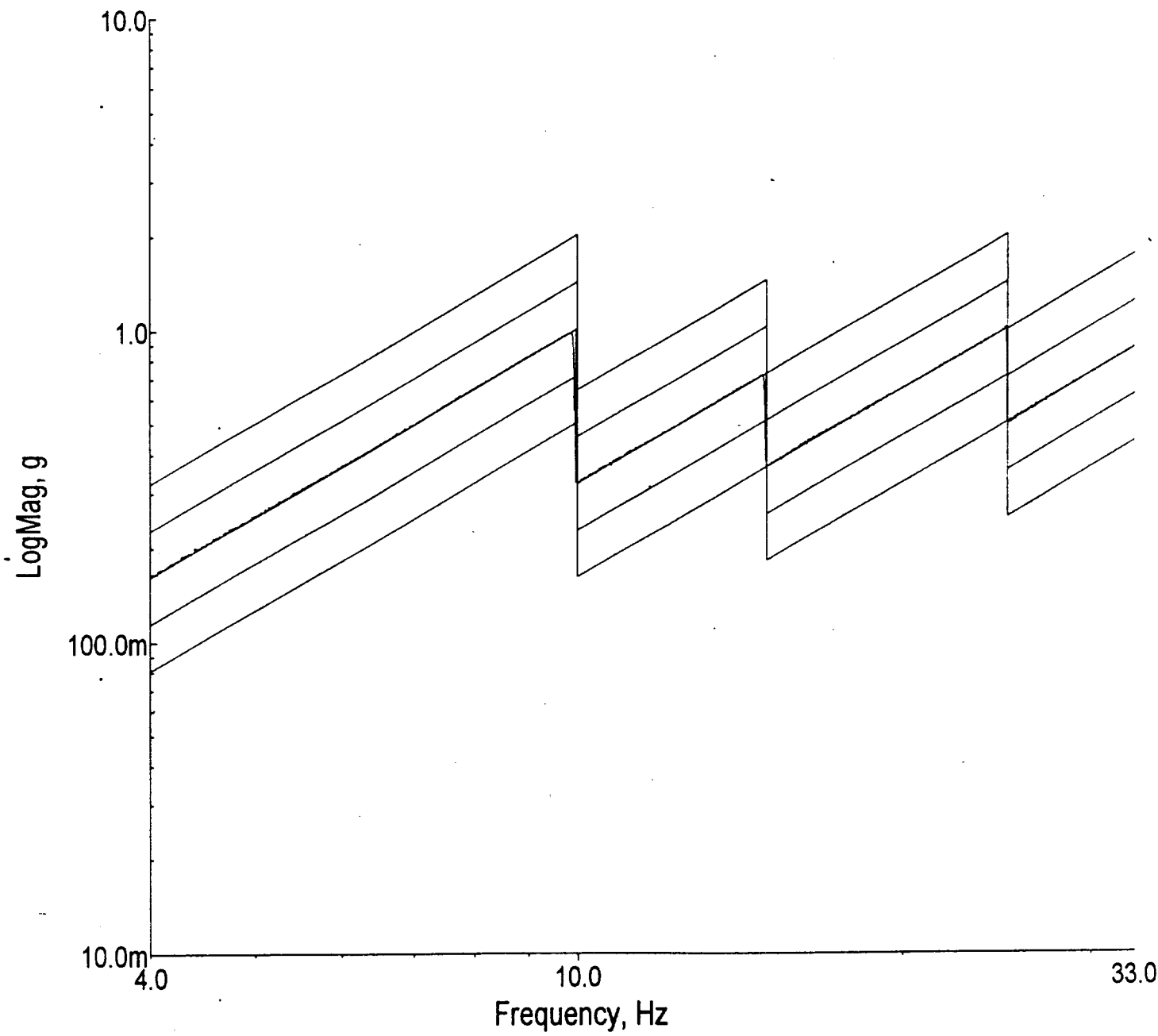
APPENDIX A

TEST DATA

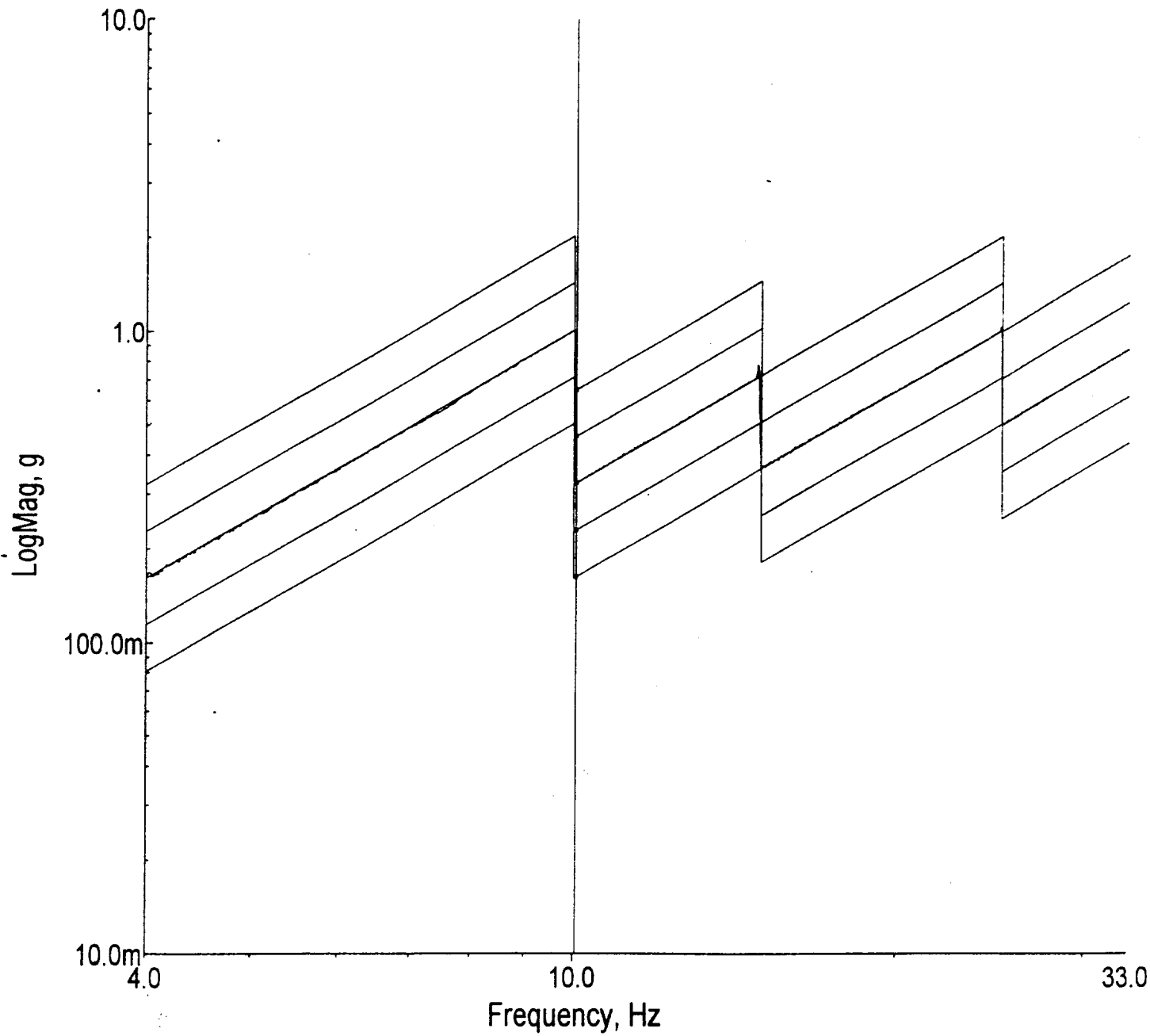
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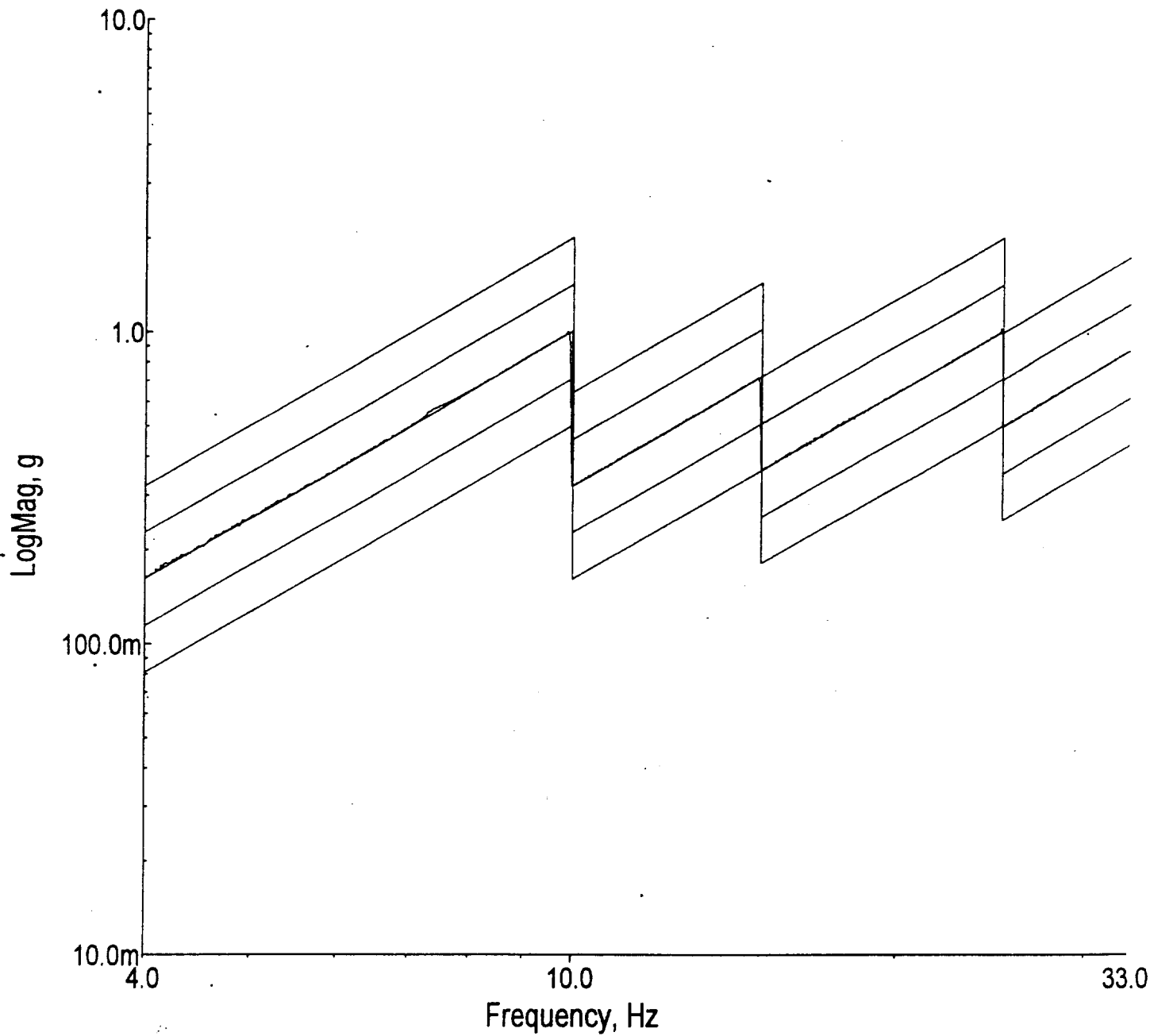
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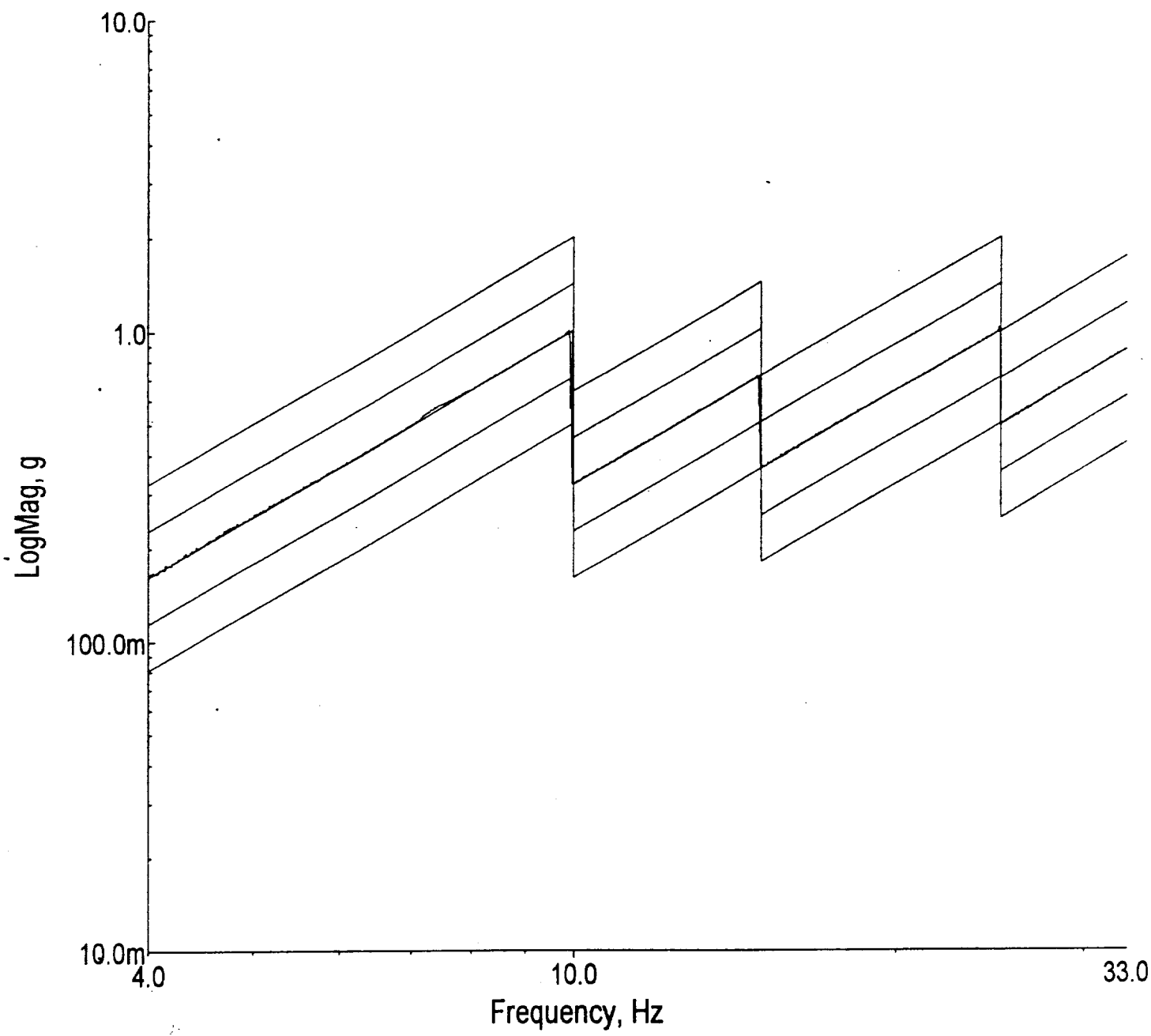
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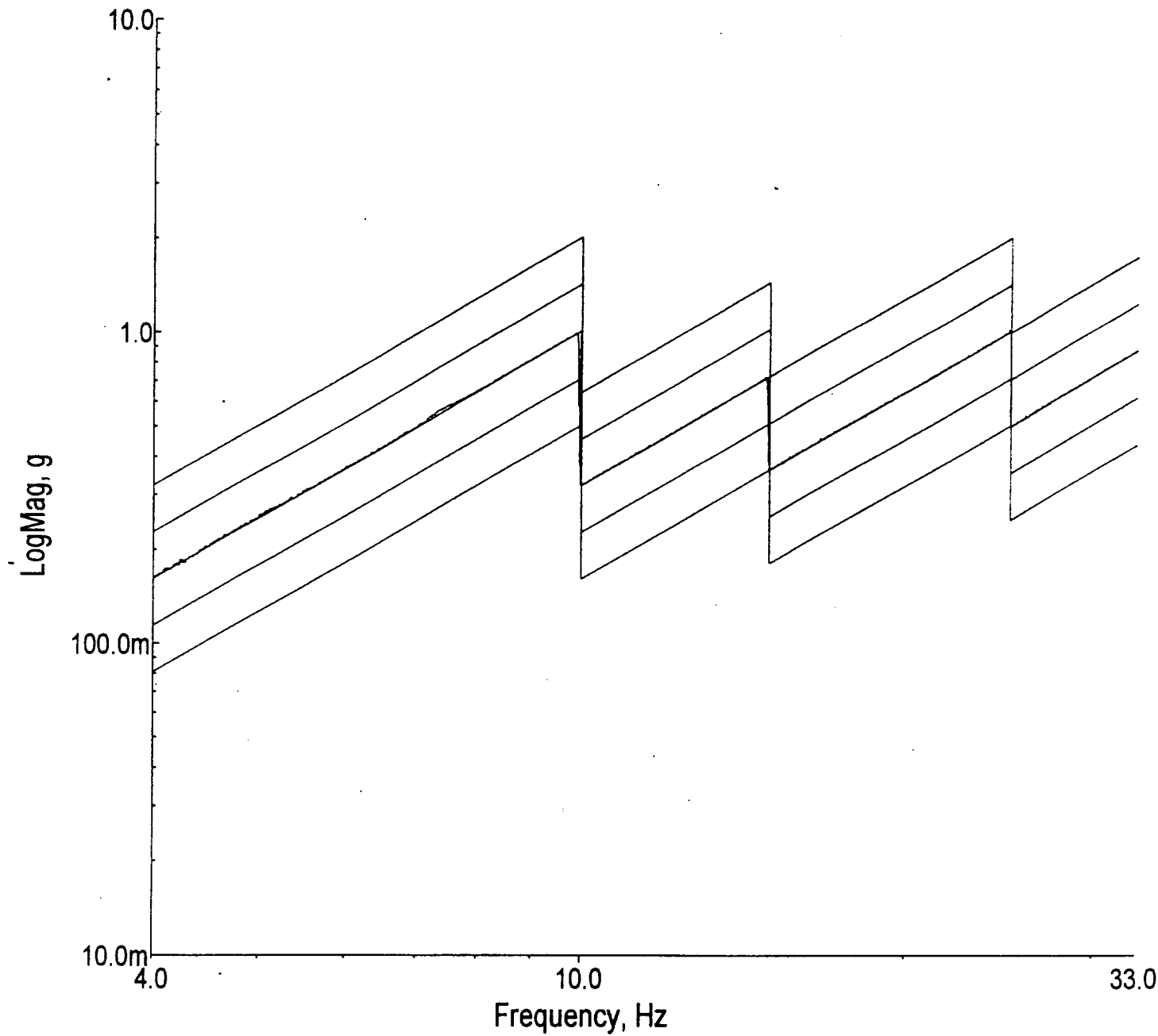
Control



Control



Control





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8.0 Bump Test

The bump test was conducted on RLB-33, S/N 1. Upon completion of the bump test, an exterior mechanical inspection was performed and an aliveness test was conducted.

The unit was checked for:

- (a) Carrier frequency.
- (b) Power output.
- (c) Data message.

RLB-33, S/N 1 passed the requirements outlined in the Environmental and Operational Performance Test Plan Section 8.0.



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9.0 Salt Fog Test

The salt fog test was conducted on RLB-33, S/N 1. Upon removal from the salt fog chamber, an exterior mechanical inspection and an aliveness test were performed.

The unit was checked for:

- (a) Carrier frequency.
- (b) Power output.
- (c) Data message.

RLB-33, S/N 1 passed the requirements outlined in the Environmental and Operational Performance Test Plan Section 9.0.

SUMMARY OF TEST RESULTS

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min} (°C)	T _{amb} (24 °C)	T _{max} (°C)	
8. Bump Test						
• Exterior Mechanical Inspection	No Damage	✓		✓		
• Aliveness Test						
- Carrier Frequency	406.025 ± 0.002	MHz		406.02521		
- Power Output	35 - 39	dBm		37.80		
- Data Message	FFFE2F96E E2EC0017F DFFC0A6D3 583E0FAA8	✓		✓		
9. Salt Fog Test						
• Exterior Mechanical Inspection	No Damage	✓		✓		
• Aliveness Test:						
- Carrier Frequency	406.025 ± 0.002	MHz		406.02521		
- Power Output	35 - 39	dBm		37.09		
- Data Message	FFFE2F96E E2EC0017F	✓		✓		

DFFC0A6D3
583E0FAA8

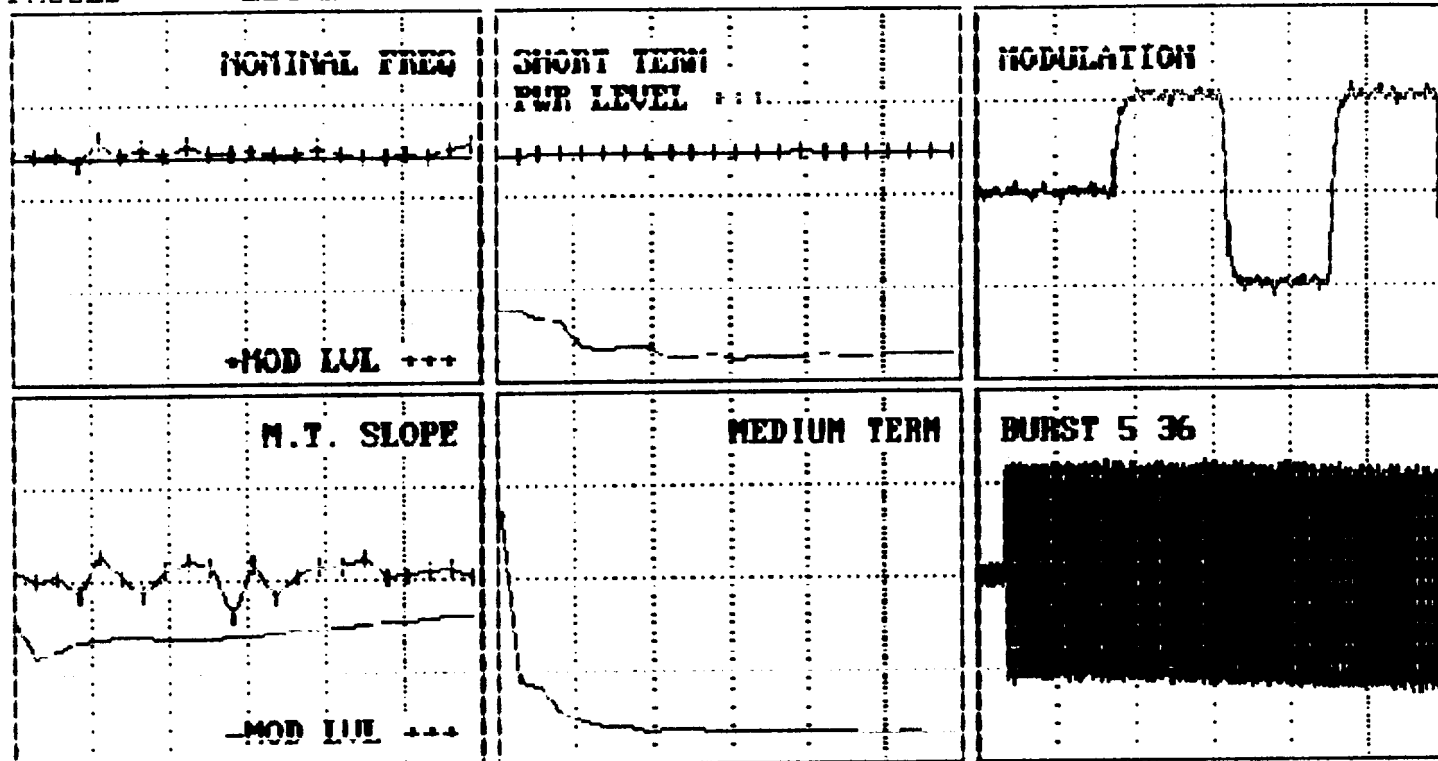
DATE: 02-16-1999 TIME: 11:06:02

ACR V6.0

2DDC5D8002FFBF
C/S-187-USA-1

PASSED

PASSED 214.2 Hz PASSED 1.489E-18 PEAKS: +1.383 -1.224 rad



PASSED -2.233E-18 PASSED 2.493E-18 PEAKS: +1.366 -1.414 rad

NOMINAL FREQUENCY: 406.02521 MHz
 POWER OUTPUT: 6.019 Watts
 +37.80 dBm
 POWER STABILITY: 9.50 %
 PULSE RISE TIME: 710 µsec
 PEAK VOLTAGE: +2.810 Volts
 DRIFT SLOPES: 1) -6.80E-02 rad/sec
 2) -6.80E-02 rad/sec
 3) -6.80E-02 rad/sec
 MODULATION LEVELS: +1.120 radians
 +1.149 -1.100 -1.127 radians
 +0.025 OFFSET -0.003 radians
 MODULATION TIMES: RISE 153 µsec
 FALL 156 µsec
 SYMMETRY 0.71 %
 MODULATION BIT RATE: 398.74 Hz
 BURST TIMES: AVG PERIOD 30.5 sec
 CARRIER DURATION 160.1 msec
 MESSAGE DURATION 361.2 msec
 TOTAL DURATION 521.2 msec
 PREAMBLE LEAKAGE LEVEL 30.0 dBc
 LEAKAGE LENGTH 0.1 msec

HEXADECIMAL MESSAGE

2DDC5D8002FFBF
 FFE2F96EE2ED0017F0FFC0A603583E0FAA8
 BIT SYNCHRONIZATION..... OK
 FRAME SYNCHRONIZATION... OK
 MESSAGE FORMAT..... LONG
 PROTOCOL FLAG..... STANDARD
 COUNTRY..... USA
 SERIALIZED USER..... TEST MOLE
 C/S CERTIFICATE No..... 187
 SERIAL NUMBER..... 1
 LATITUDE..... N 127.75
 LONGITUDE..... E 258.75
 ERROR CORRECTION CODE 1. OK
 ENCODED DATA SOURCE..... Internal
 121.5 MHz HUMMING..... NO
 SPARES STATUS..... Not OK
 LATITUDE OFFSET..... + 0.60
 LONGITUDE OFFSET..... + 0.60
 ERROR CORRECTION CODE 2. OK

DATE: 02-22-1999 TIME: 09:20:00

ACR v6.0

2DDC5D8002EFBFF
C/S-187-USA-1

PASSED

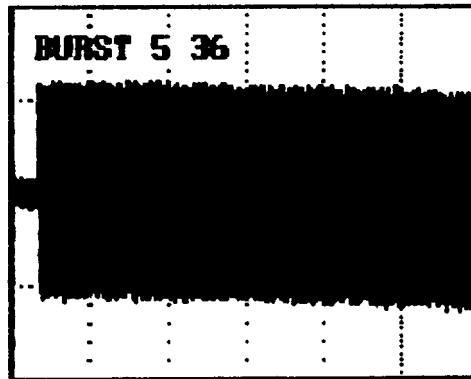
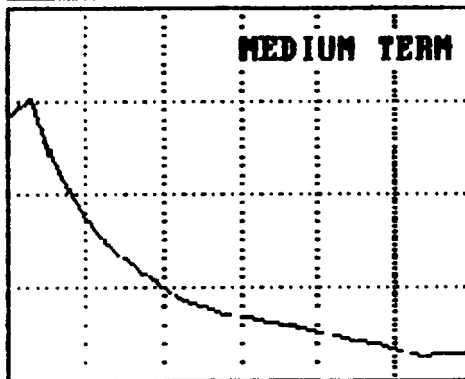
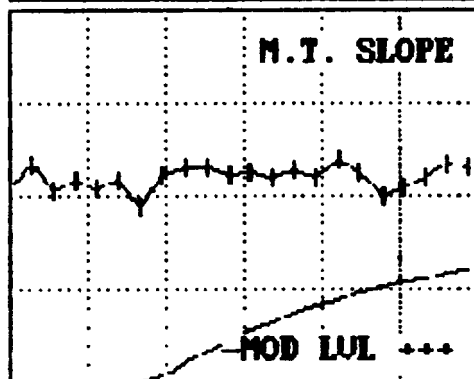
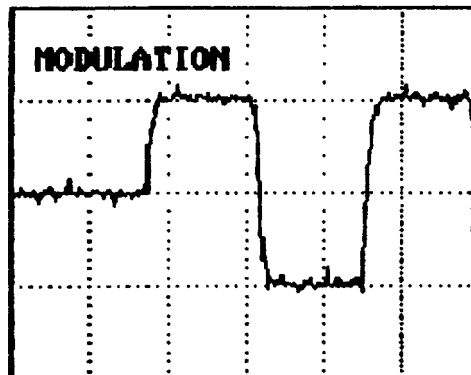
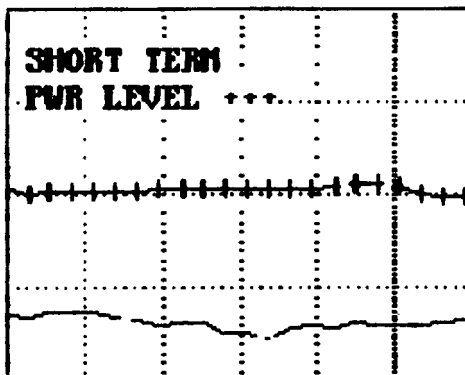
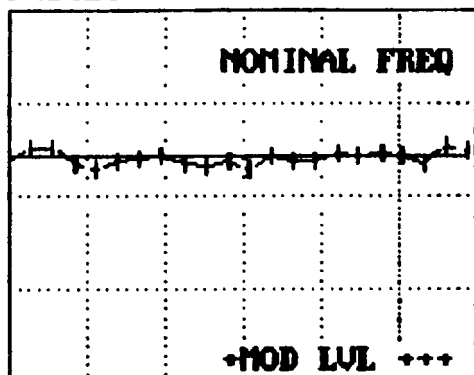
PASSED

216.0 Hz

PASSED

3.244E-10

PEAKS: +1.381 -1.174 rad



PASSED

-4.612E-10

PASSED

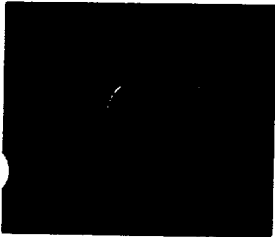
2.334E-10

PEAKS: +1.334 -1.410 rad

NOMINAL FREQUENCY: 406.02521 MHz
POWER OUTPUT: 5.114 Watts
+37.09 dBm
POWER STABILITY: 9.19 %
POWER RISE TIME: 690 µsec
PEAK VOLTAGE: +2.587 Volts
DRIFT SLOPES: 1) -1.34E-01 rad/sec
2) -1.34E-01 rad/sec
3) -1.34E-01 rad/sec
MODULATION LEVELS: +1.111 radians
+1.140 -1.086 -1.117 radians
+0.027 OFFSET -0.003 radians
MODULATION TIMES: RISE 153 µsec
FALL 153 µsec
SYMMETRY 0.68 %
MODULATION BIT RATE: 398.75 Hz
BURST TIMES: AVG PERIOD 50.5 sec
CARRIER DURATION 160.0 msec
MESSAGE DURATION 361.1 msec
TOTAL DURATION 521.2 msec
PREAMBLE LEAKAGE LEVEL 35.0 dBc
LEAKAGE LENGTH 0.1 msec

HEXADECIMAL MESSAGE

2DDC5D8002EFBFF
FFFE2F96EE2ED0017DFD0A6D03583E0FAAB
BIT SYNCHRONIZATION..... OK
FRAME SYNCHRONIZATION... OK
MESSAGE FORMAT..... LONG
PROTOCOL FLAG..... STANDARD
COUNTRY..... USA
SERIALIZED USER..... TEST MODE
C/S CERTIFICATE No..... 187
SERIAL NUMBER..... 1
LATITUDE..... N 127.75
LONGITUDE..... E 255.75
ERROR CORRECTION CODE 1. OK
ENCODED DATA SOURCE..... Internal
121.5 MHz HOMING..... No
SPARES status..... Not OK
LATITUDE OFFSET..... + 0 60
LONGITUDE OFFSET..... + 0 60
ERROR CORRECTION CODE 2. OK



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10.0 Drop and Buoyancy Test, 20m

This test was conducted with RLB-33, S/N 1 out of its' bracket and turned "ON" for the duration of the test.

The unit was dropped three times from a height of > 20m into water. Each drop was initiated from a different orientation.

Drop#1. Antenna vertical up.

Drop#2. Antenna vertical down.

Drop#3. Antenna horizontal.

After each drop the unit returned to an upright float position. Upon completion of the test, an exterior mechanical inspection was performed, followed by an aliveness check.

RLB-33, S/N 1 passed the requirements outlined in the Environmental and Operational Performance Test Plan Section 10.0.



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11.0 Drop Test, 1m

RLB-33, S/N 1 was soaked at minimum stowage temperature for 2 hours. Within 5 minutes after removal from the temperature chamber the unit was tested.

RLB-33 was held in a normal floating position and dropped from a height of 1 meter (+/- 10mm) on to a solid piece of wood. An aliveness test was then performed on the unit.

RLB-33, S/N 1 passed the requirements of the Environmental and Operational Performance Test Plan Section 11.0.

SUMMARY OF TEST RESULTS

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min} * (°C)	T _{amb.} (20 °C)	T _{max.} (°C)	
10. Drop Test In Water						
• Exterior Mechanical Inspection	No Damage	✓		✓		
• Aliveness Test						
- Carrier Frequency	406.025 ± 0.002	MHz		406.02521		
- Power Output	35 - 39	dBm		37.16		
- Data Message	FFFE2F96E E2EC0017F DFFC0A6D3 583E0FA8	✓		✓		
11. Drop Test On Hard Surface						
• Exterior Mechanical Inspection	No Damage	✓		24°C		
• Aliveness Test:						
- Carrier Frequency	406.025 ± 0.002	MHz		406.02522		
- Power Output	35 - 39	dBm		36.00		
- Data Message	FFFE2F96E E2EC0017F	✓		✓		

DFFC0A6D3
583E0FA8

DATE: 02-22-1999 TIME: 12:35:47

ACR v6.0

2DDC5D8002FFBFF
C/S-187-USA-1

PASSED

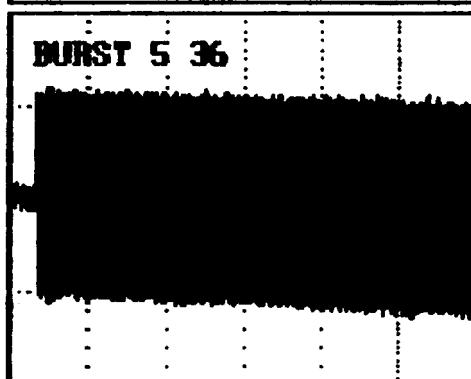
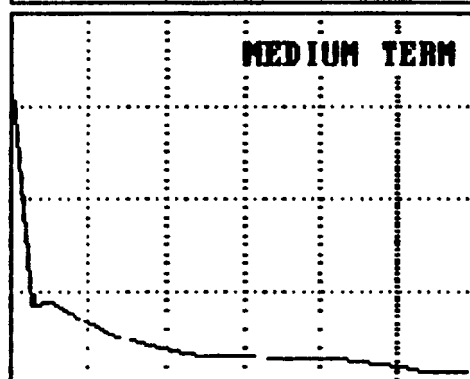
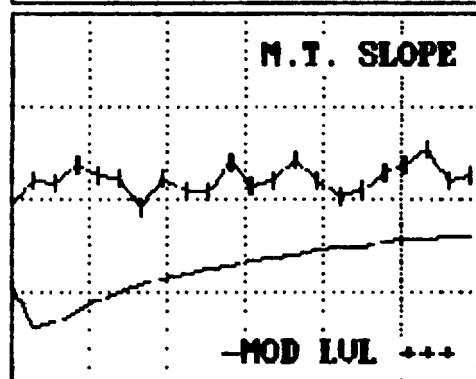
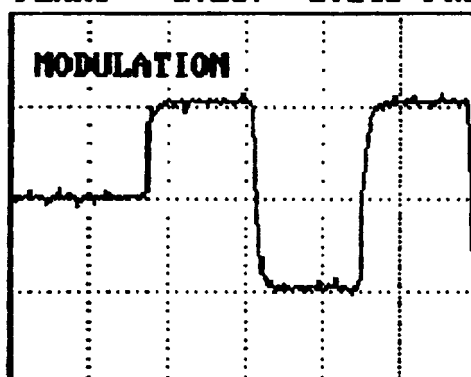
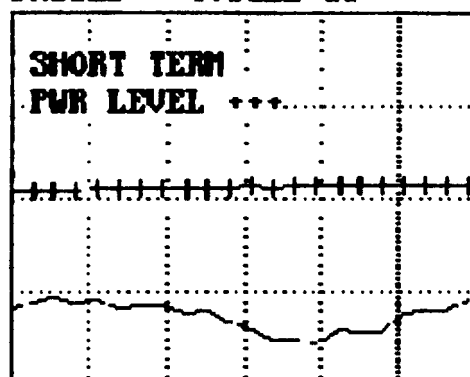
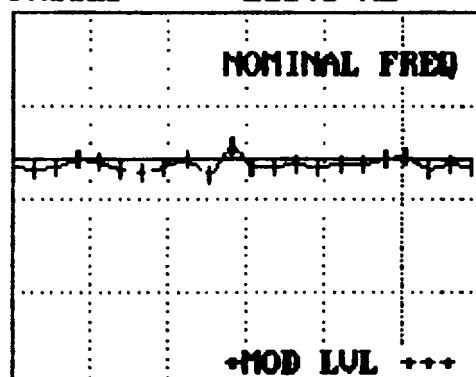
PASSED

215.6 Hz

PASSED

4.512E-10

PEAKS: +1.267 -1.145 rad



PASSED -2.196E-10

PASSED 1.395E-10

PEAKS: +1.325 -1.425 rad

NOMINAL FREQUENCY: 406.02521 MHz
POWER OUTPUT: 5.198 Watts
+37.16 dBm
POWER STABILITY: 7.60 %
POWER RISE TIME: 710 µsec
PEAK VOLTAGE: +2.604 Volts
DRIFT SLOPES: 1) -1.73E-01 rad/sec
2) -1.73E-01 rad/sec
3) -1.73E-01 rad/sec
MODULATION LEVELS: +1.110 radians
+1.135 -1.082 -1.117 radians
+0.026 OFFSET -0.003 radians
MODULATION TIMES: RISE 156 µsec
FALL 156 µsec
SYMMETRY 0.22 %
MODULATION BIT RATE: 398.74 Hz
BURST TIMES: AVG PERIOD 50.5 sec
CARRIER DURATION 160.0 msec
MESSAGE DURATION 361.1 msec
TOTAL DURATION 521.1 msec
PREAMBLE LEAKAGE LEVEL 35.0 dBc
LEAKAGE LENGTH 0.1 msec

HEXADECIMAL MESSAGE

2DDC5D8002FFBFF
FFFE2F96EE2ED0017F7DFF0A6D3583E0FAA8
BIT SYNCHRONIZATION..... OK
FRAME SYNCHRONIZATION... OK
MESSAGE FORMAT..... LONG
PROTOCOL FLAG..... STANDARD
COUNTRY..... USA
SERIALIZED USER..... TEST MODE
C/S CERTIFICATE No..... 187
SERIAL NUMBER..... 1
LATITUDE..... N 127.75
LONGITUDE..... E 255.75
ERROR CORRECTION CODE 1. OK
ENCODED DATA SOURCE..... Internal
121.5 MHz HOMING..... No
SPARES status..... Not OK
LATITUDE OFFSET..... + 0 60
LONGITUDE OFFSET..... + 0 60
ERROR CORRECTION CODE 2. OK

DATE: 02-22-1999 TIME: 16:43:11

ACR v6.0

2DDC5D8002FFBFF
C/S-187-USA-1

PASSED

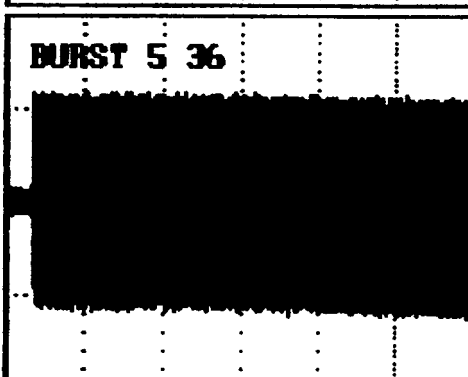
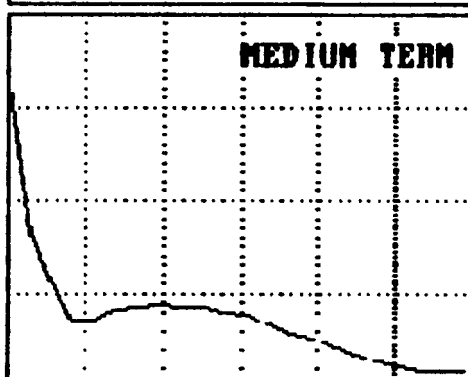
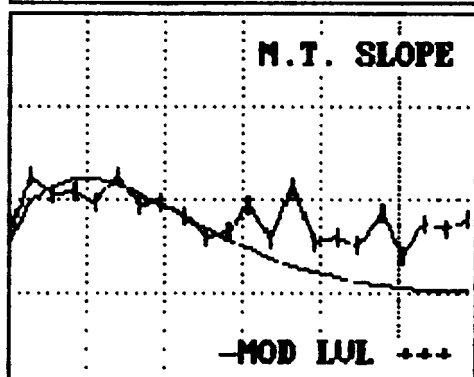
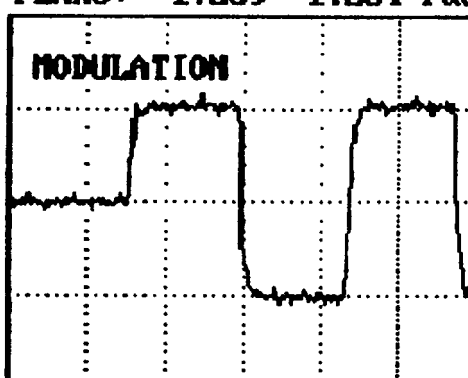
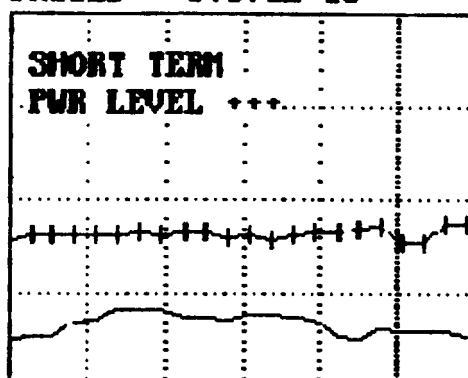
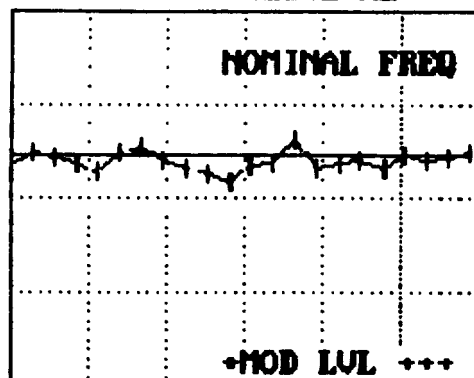
PASSED

228.2 Hz

PASSED

3.871E-10

PEAKS: +1.289 -1.204 rad



PASSED -4.925E-10

PASSED 1.737E-10

PEAKS: +1.384 -1.381 rad

NOMINAL FREQUENCY: 406.02522 MHz
POWER OUTPUT: 3.980 Watts
+36.00 dBm
POWER STABILITY: 9.93 %
POWER RISE TIME: 580 µsec
PEAK VOLTAGE: +2.282 Volts
DRIFT SLOPES: 1) -1.15E-01 rad/sec
2) -1.15E-01 rad/sec
3) -1.15E-01 rad/sec
MODULATION LEVELS: +1.135 radians
+1.139 -1.103 -1.141 radians
+0.018 OFFSET -0.003 radians
MODULATION TIMES: RISE 147 µsec
FALL 148 µsec
SYMMETRY 0.53 %
MODULATION BIT RATE: 398.75 Hz
BURST TIMES: AVG PERIOD 50.5 sec
CARRIER DURATION 160.0 µsec
MESSAGE DURATION 361.2 µsec
TOTAL DURATION 521.1 µsec
PREAMBLE LEAKAGE LEVEL 35.0 dBc
LEAKAGE LENGTH 0.1 µsec

HEXADECIMAL MESSAGE

2DDC5D8002FFBFF
FFFE2F96EE2ED0017FDFFC0A6D3583E0FAA8
BIT SYNCHRONIZATION..... OK
FRAME SYNCHRONIZATION... OK
MESSAGE FORMAT..... LONG
PROTOCOL FLAG..... STANDARD
COUNTRY..... USA
SERIALIZED USER..... TEST MODE
C/S CERTIFICATE No..... 187
SERIAL NUMBER..... 1
LATITUDE..... N 127.75
LONGITUDE..... E 255.75
ERROR CORRECTION CODE 1. OK
ENCODED DATA SOURCE..... Internal
121.5 MHz HOMING..... No
SPARES status..... Not OK
LATITUDE OFFSET..... + 0 60
LONGITUDE OFFSET..... + 0 60
ERROR CORRECTION CODE 2. OK



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12.0 Automatic Release Mechanisms and Automatic Activation Test for Category 1 Satellite EPIRB.

RLB-33, S/N 1 was mounted on a fixture simulating a bulkhead per manufacturer's installation instructions.

The unit was submerged in water at normal mounted orientation.

After:

- (a) > 2 hours at minimum stowage temperature.
- (b) > 2 hours at maximum stowage temperature.
- (c) > 2 hours at ambient temperature.

The unit was then tested at 5 different orientations at ambient temperatures:

- (a) Rolling 90° starboard.
- (b) Rolling 90° port.
- (c) Pitch 90° bow down.
- (d) Pitch 90° stern down.
- (e) Upside down.

At all of the conditions and orientations tested, RLB-33, S/N 1 released and activated properly. The unit passed the requirements outlined in the Environmental and Operational Performance Test Plan Section 12.0.

SUMMARY OF TEST RESULTS

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min.} (-55 °C)	T _{amb.} (18 °C)	T _{max.} (70 °C)	
12. Automatic Release Mechanism Test	Automatic activation and release ≤ 4 meters	Meters		3.50		11' 6"
• Normal mounted orientation - Depth of Release	≤ 4 meters	Meters		3.20		9' 9" + 9"
• Rolling 90° starboard - Depth of Release	≤ 4 meters	Meters		2.97		9' 0" + 9"
• Rolling 90° bow down - Depth of Release	≤ 4 meters	Meters		3.12		10' 3" - 0"
• Rolling 90° stern down - Depth of Release	≤ 4 meters	Meters		3.05		10' 0" - 0"
• Upside down - Depth of Release	≤ 4 meters	Meters		2.82		8' 6" + 9"
• Normal mounted orientation @ min. storage temperature - Depth Release	≤ 4 meters	Meters	3.99			11' 9" + 16"
• Normal mounted orientation @ max. storage temperature - Depth Release	≤ 4 meters	Meters			2.54	7' 0" + 16"



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13.0 Leakage and Immersion Test

RLB-33, S/N 1 was tested in the off position. The unit was conditioned at $65^{\circ}\text{C} \pm 3$ for one hour.

The unit was immediately immersed in water at $20^{\circ}\text{C} \pm 3$ at a depth of $100\text{mm} \pm 5$ for 48 hours.

Upon removal, the unit was immersed 10 meters for 5 minutes. The unit was then checked for water damage inside the compartment and an aliveness test was performed.

RLB-33, S/N 1 passed the requirements outlined in the Environmental and Operational Performance Test Plan Section 13.0.



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14.0 Spurious Emissions Test

RLB-33, S/N 1 was tested for spurious and harmonic emissions at 406 MHz and 121.5 MHz.

These measurements were performed by James Jesse of Atlantic Coast Engineering Systems on behalf of Q.C. Metallurgical, Inc.

RLB-33, S/N 1 passed the requirements outlined in the Environmental and Operational Performance Test Plan Section 14.0.

See attached graphs.

SUMMARY OF TEST RESULTS

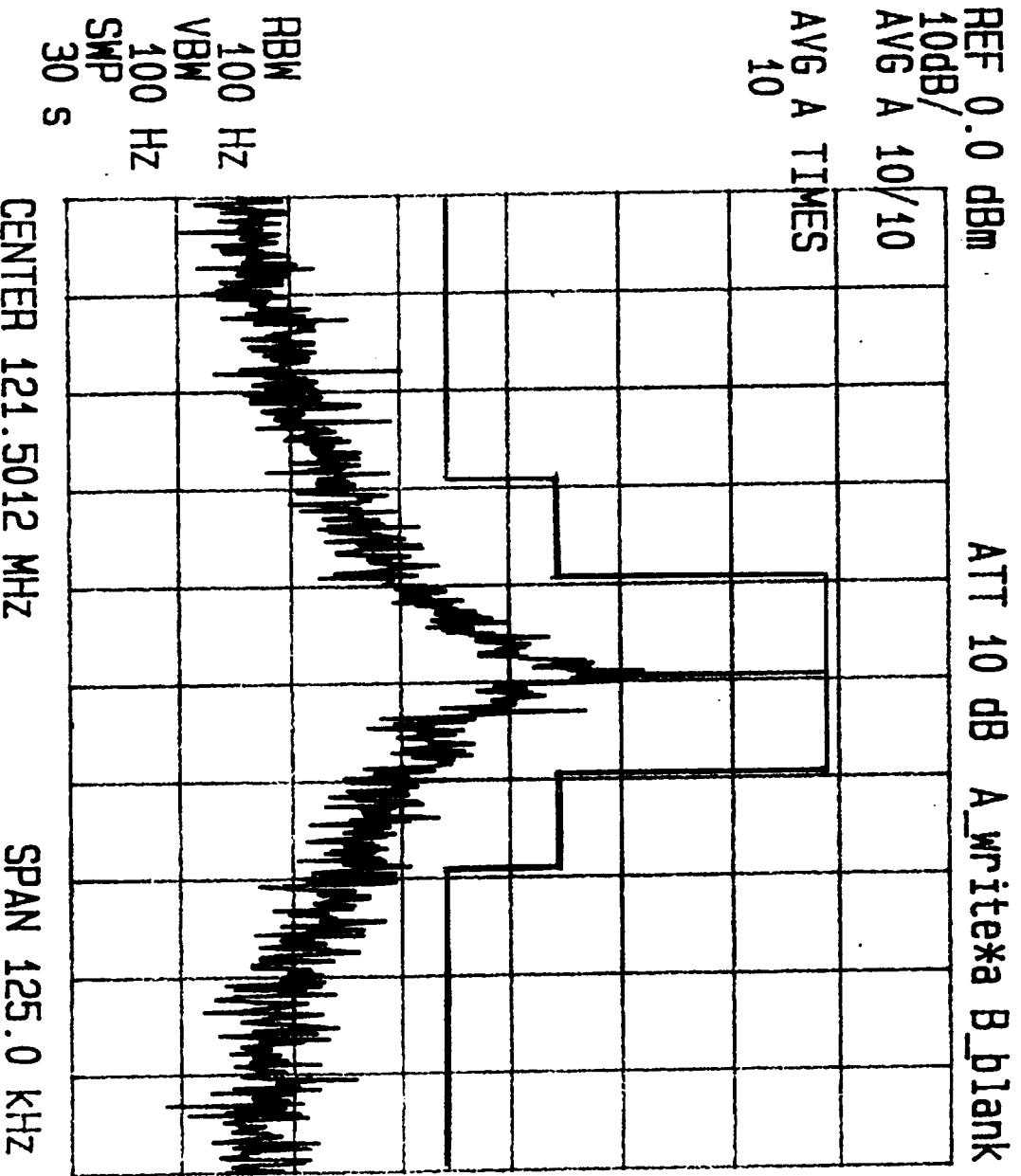
PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min.} (<u> </u> °C)	T _{amb.} (<u>22</u> °C)	T _{max.} (<u> </u> °C)	
13. Leakage And Immersion Test • Aliveness Test - Carrier Frequency - Power Output - Data Message • Interior Inspection	406.025 ± 0.002 35 – 39 <u>FFFFE2F96E</u> <u>E2EC0017F</u> <u>RFEC0A6D3</u> No water 583E0FAA8	MHz dBm ✓ ✓		406.02521 38.15 ✓ ✓		
14. Spurious Emissions Test • 406 MHz • 121.5 MHz	Figure 1 Figure 2	✓ (attach graphs) ✓ (attach graphs)	✓ ✓	✓ ✓	✓ ✓	

RLB-33

S/N 1

TEMP +55 DEG C

02/26/99



RLB-33

S/N 1

TEMP +55 DEG C

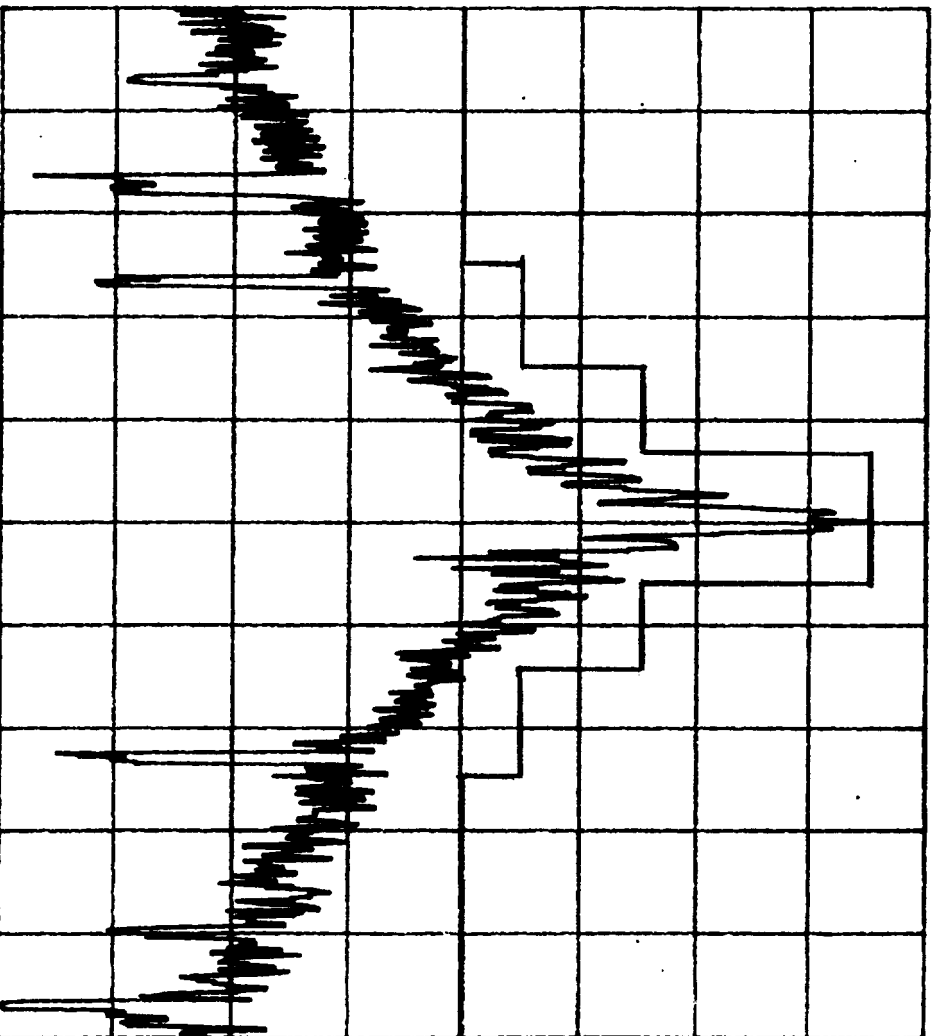
02/26/99

REF 28.0 dBm
10dB/

ATT 40 dB A_writexm B_blank

SWP
10 s

RBW 100 Hz
VBW 100 Hz
SMP 10 s



CENTER 406.02521 MHz

SPAN 48.0 KHz

REF 17.0 dBm
10dB/

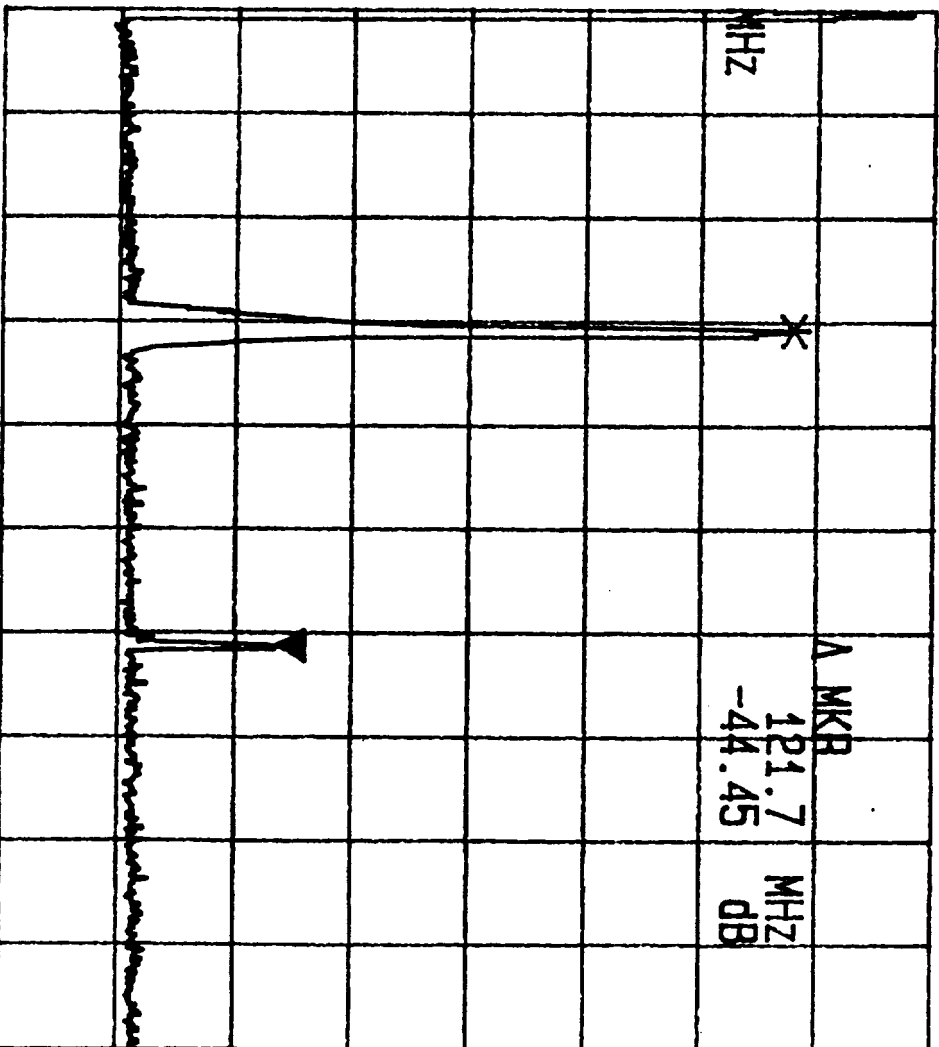
ATT 30 dB

A_view B_blank

A MKR
121.7
MHz

A MKR
121.7
-44.45
MHz
dB

RBW 1 MHz
VBW 1 MHz
SMP 30 ms



CENTER 200.0 MHz

SPAN 400.0 MHz

RLB-33

S/N 1

TEMP +55 DEG C

02/26/99

REF 28.0 dBm
10dB/

ATT 40 dB A_writexm B_blank

A MKR
405.7

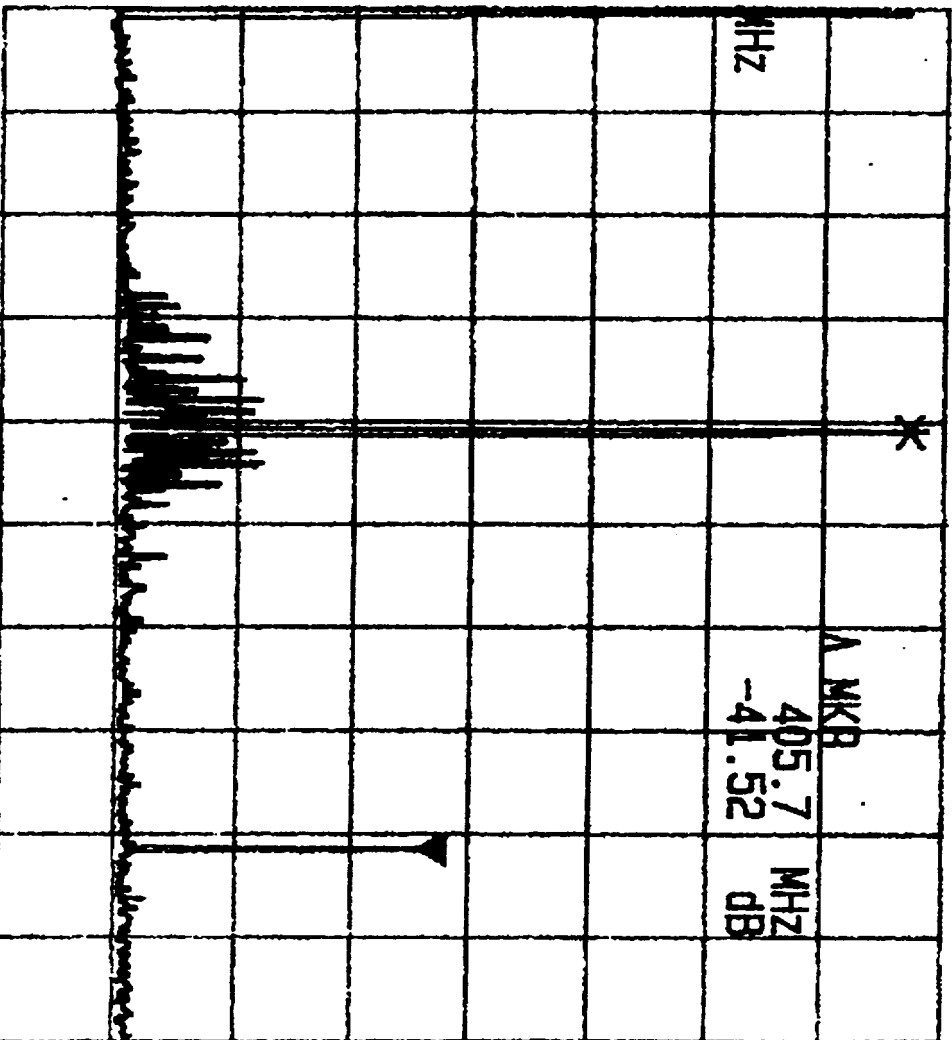
MHZ

A MKR

405.7
-41.52

MHZ
dB

RBW
1 MHz
VBW
1 MHz
SMP
30 ms



CENTER 500.0 MHZ

SPAN 1000 MHZ

RLB-33

S/N 1

TEMP AMBIENT

02/26/99

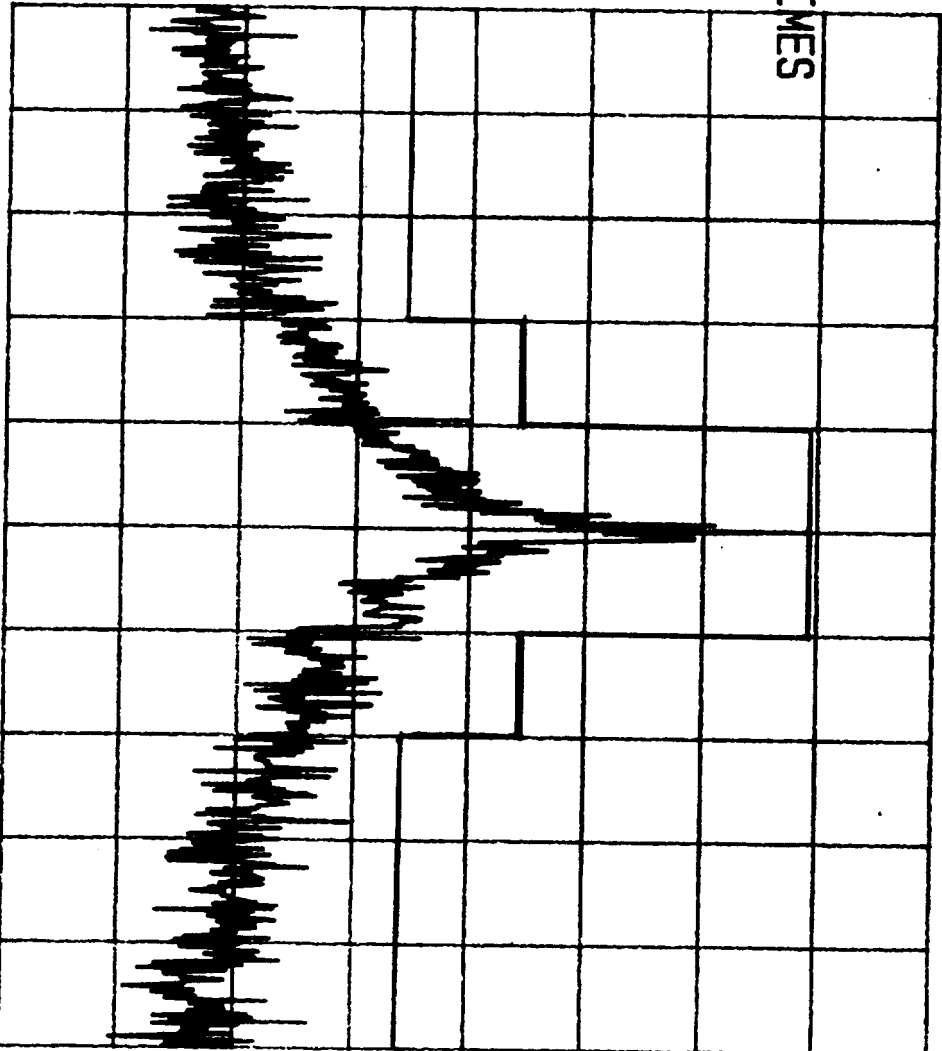
REF 0.0 dBm
10dB/

ATT 10 dB

A_view B_blank

AVG A TIMES
10

RBW 100 Hz
VBW 100 Hz
SMP 30 s



CENTER 121.5012 MHz

SPAN 125.0 KHz

RLB-33

S/N 1

TEMP AMBIENT

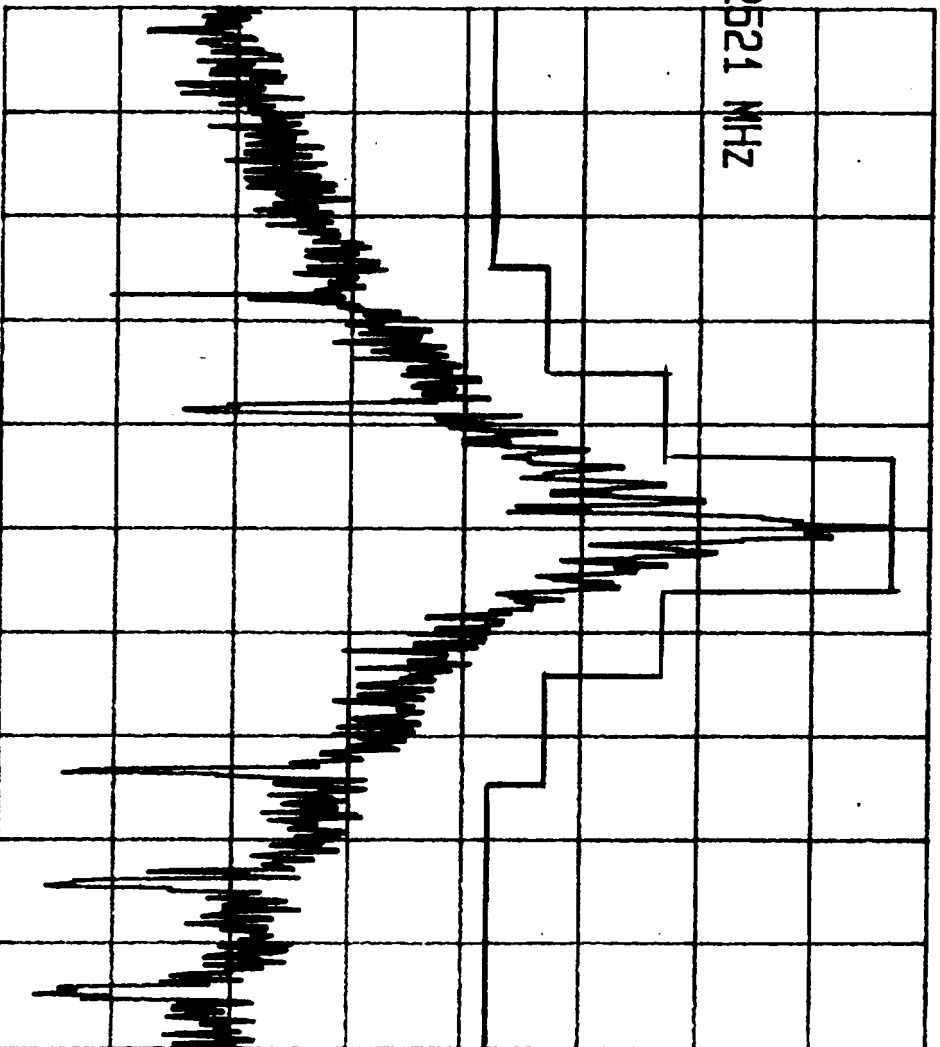
02/26/99

REF 28.0 dBm
10dB/

ATT 40 dB A_writexm B_blank

CENTER
406.02521 MHz

RBW
100 Hz
VBW
100 Hz
SMP
10 s



CENTER 406.02521 MHz

SPAN 48.0 kHz

REF 17.0 dBm
10dB/

ATT 30 dB

A_view B_blank

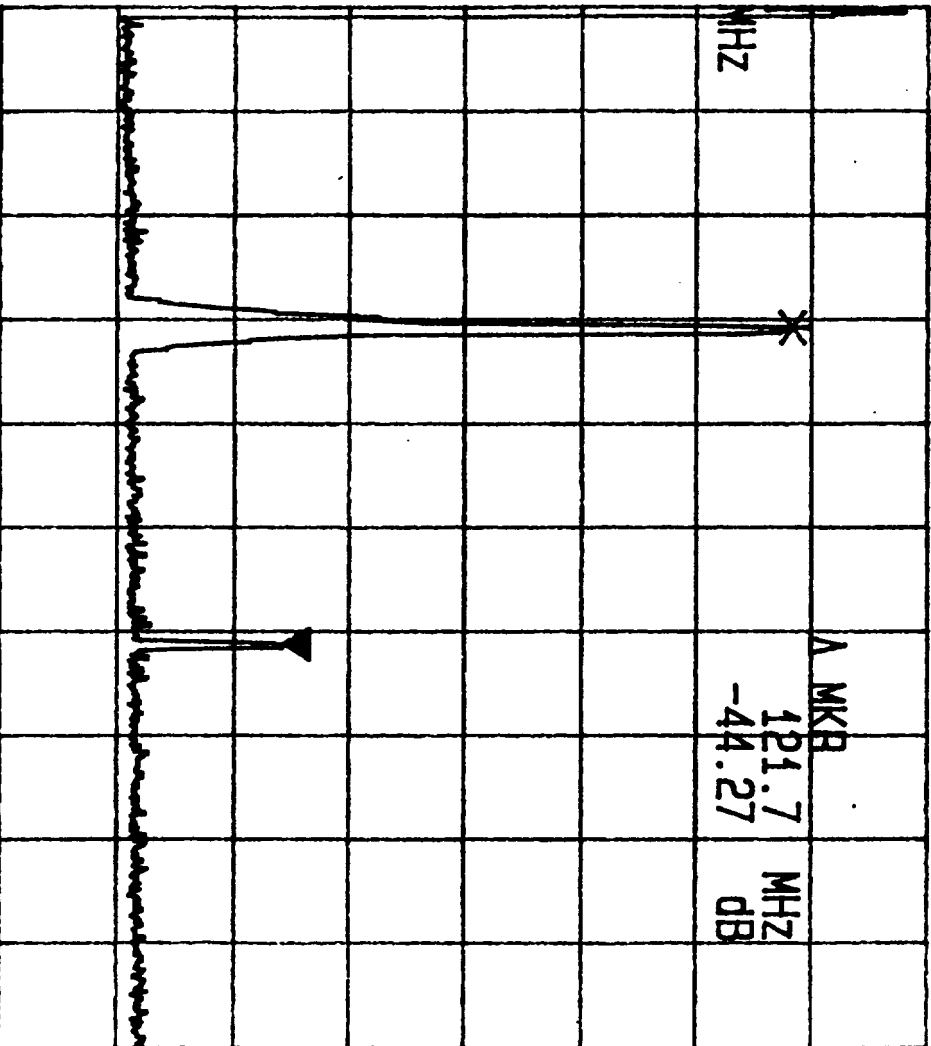
A MKR
121.7

MHZ

A MKR
121.7
-44.27

MHZ
dB

RBW 1 MHz
VBW 1 MHz
SMP 30 ms



CENTER 200.0 MHz

SPAN 400.0 MHz

RLB-33

S/N 1

TEMP AMBIENT

02/26/99

REF 28.0 dBm
10dB/

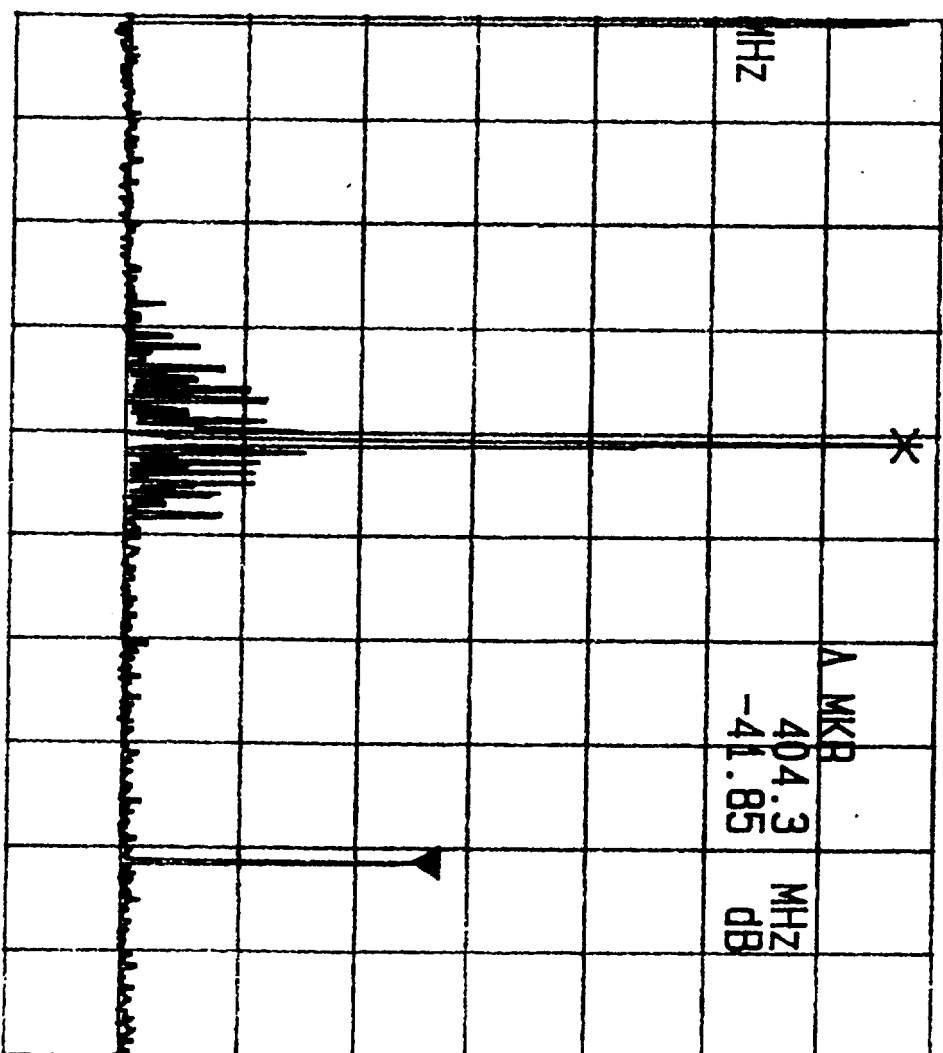
ATT 40 dB

A_view B_blank

Δ MKR
404.3 MHz

Δ MKR
404.3 MHz
-41.85 dB

RBW 1 MHz
VBW 1 MHz
SWP 30 ms



CENTER 500.0 MHz

SPAN 1000 MHz

RLB-33

S/N 1

TEMP -40 DEG C

02/26/99

REF 10.0 dBm

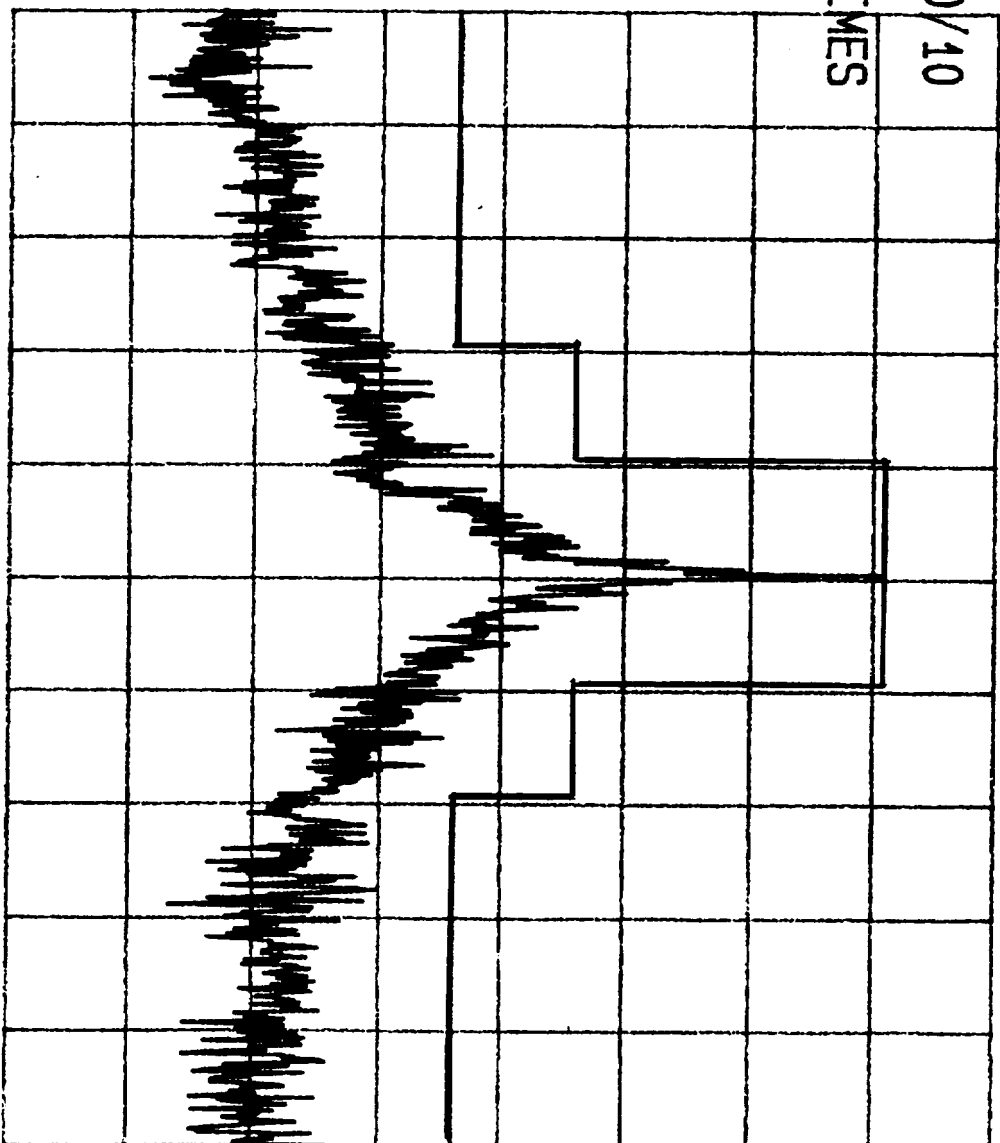
ATT 20 dB A_write B_blank

10dB/

AVG A 10/10

AVG A TIMES
10

RBW 100 Hz
VBW 100 Hz
SWP 30 s



CENTER 121.5014 MHz

SPAN 125.0 kHz

RLB-33

S/N 1

TEMP -40 DEG C

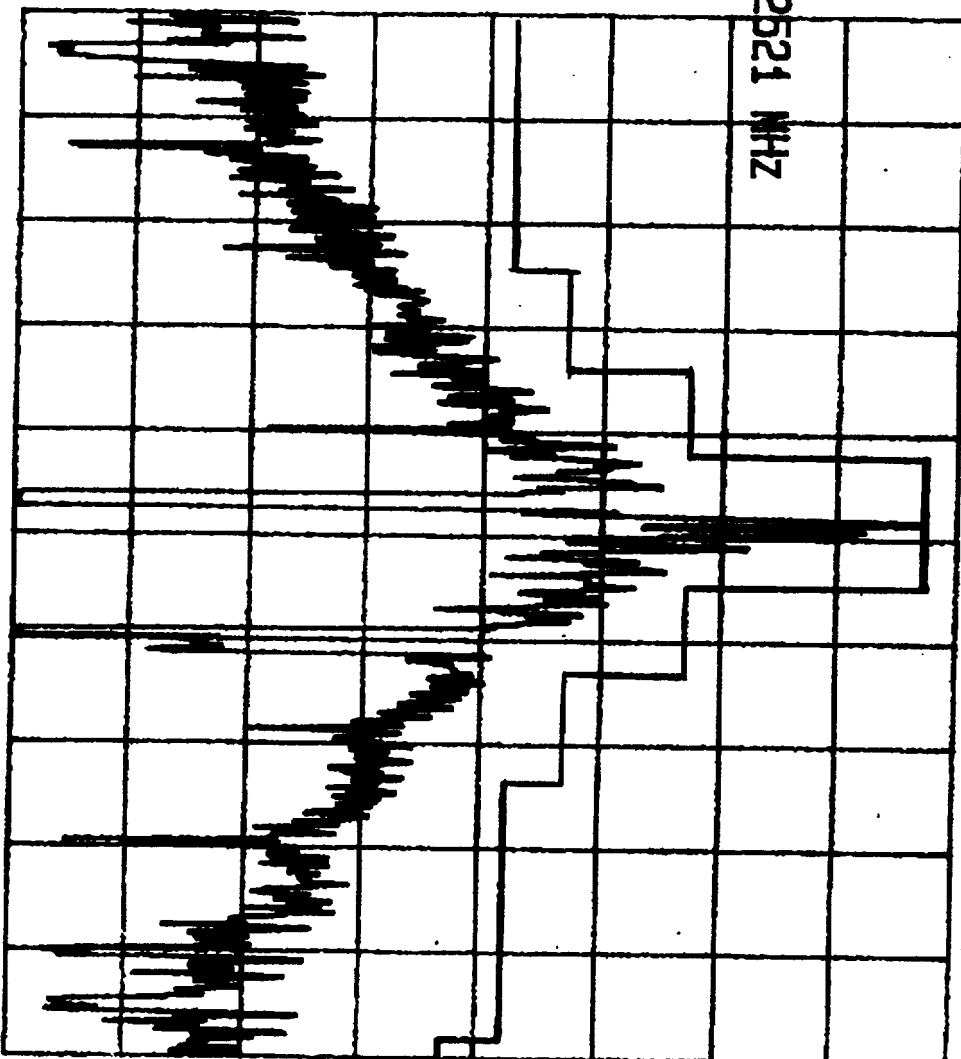
02/26/99

REF 28.0 dBm
10dB/

ATT 40 dB A_write B_blank

CENTER
406.02521 MHz

RBW 100 Hz
VBW 100 Hz
SMP 10 s



CENTER 406.02521 MHz

SPAN 48.0 kHz

RLB-33

S/N 1

TEMP -40 DEG C

02/26/99

REF 20.0 dBm
10dB/

ATT 30 dB

A_view B_blank

A MKR
121.7

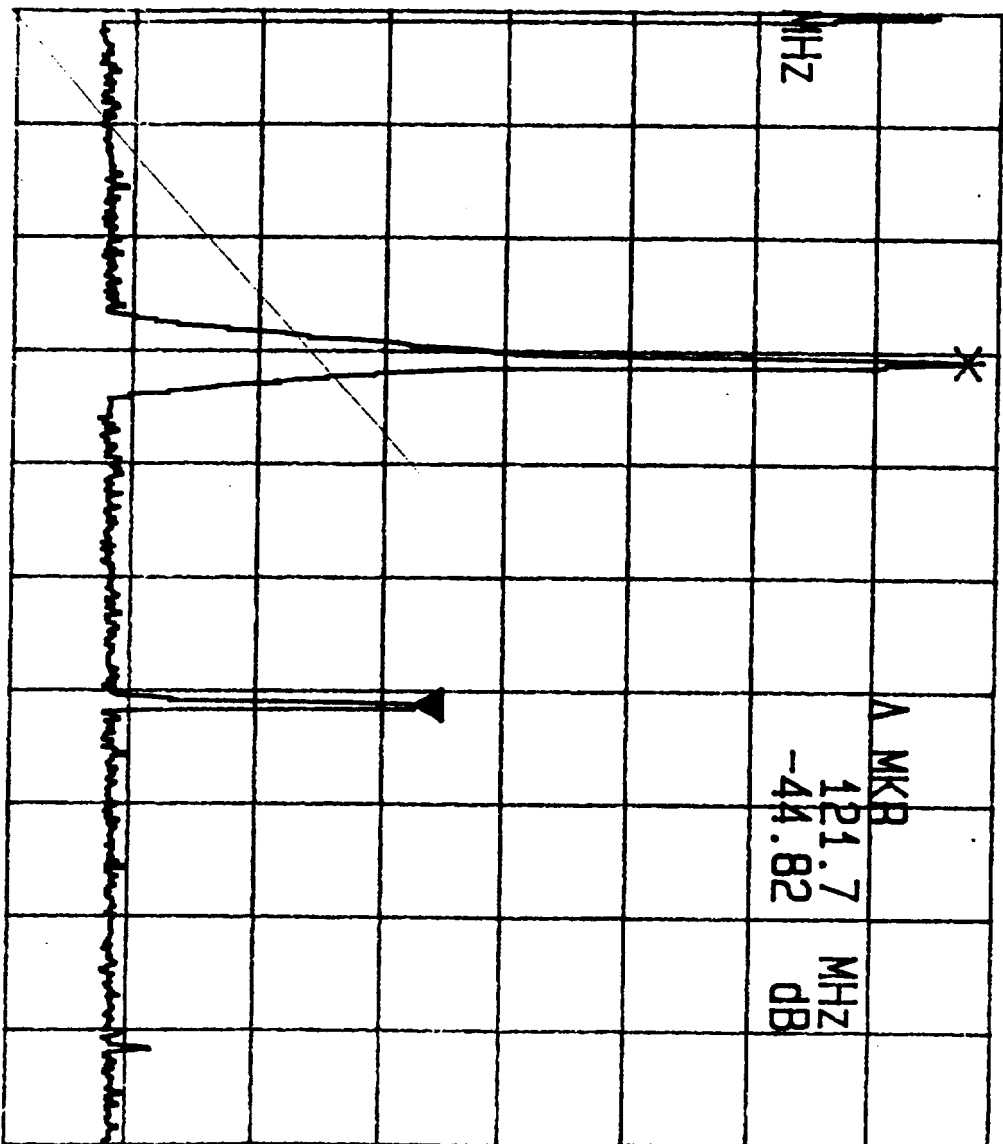
MHZ

A MKR

121.7
-44.82

MHZ
dB

RBW 1 MHz
VBW 1 MHz
SWP 30 ms



CENTER 200.0 MHz

SPAN 400.0 MHz

RLB-33

S/N 1

TEMP -40 DEG C

02/26/99

REF 28.0 dBm
10dB/

ATT 40 dB

A_view B_blank

Δ MKR
405.7

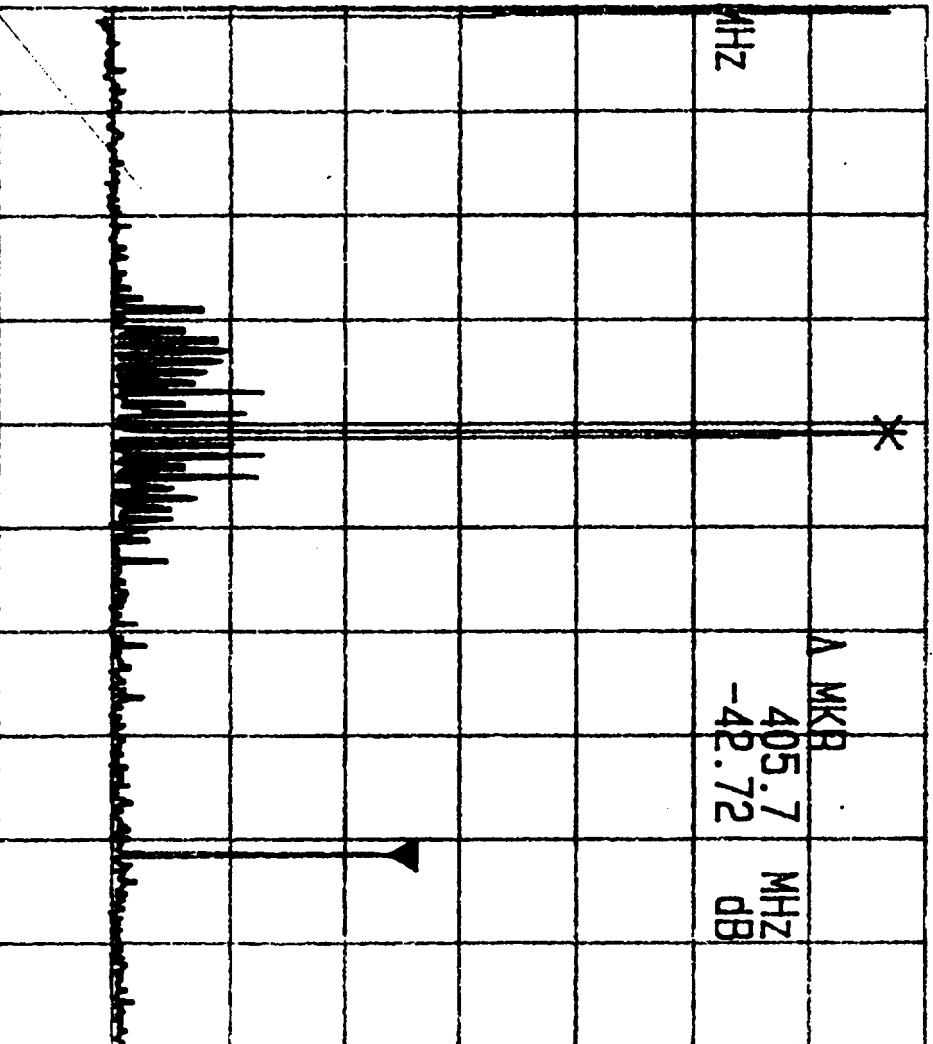
MHZ

Δ MKR

405.7
-42.72

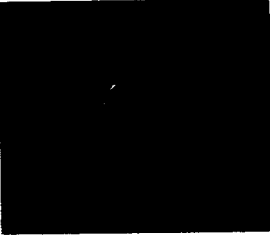
MHZ
dB

RBW 1 MHz
VBW 1 MHz
SWP 30 MS



CENTER 500.0 MHz

SPAN 1000 MHz



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15.0 Thermal Shock Test

15.1 Low Temperature Thermal Shock Test

RLB-33, S/N 1 was conditioned at minimum stowage temperature for > 3 hours.

The unit was then removed and totally immersed in fresh water for 5-10 seconds. The procedure was repeated immersing this time in salt water (5% NaCl).

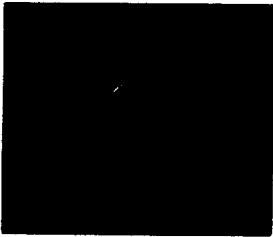
The unit activated within 5 minutes specified. After 20 minutes the following measurements were checked:

- (1) Aliveness test.
- (2) Short-term frequency stability.
- (3) Medium term frequency stability.
 - (a) Mean slope.
 - (b) Residual frequency variation.

RLB-33, S/N 1 passed the requirements outlined in the Environmental and Operational Performance Test Plan Section 15.1.

SUMMARY OF TEST RESULTS

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min} * (<u>-55</u> °C)	T _{amb.} (<u> </u> °C)	T _{max.} (<u> </u> °C)	
15.1 Thermal Shock Test (Low-Temperature)						
• Self-activation in water	≤ 5	minutes	/sec.			
• Aliveness Test						
- Carrier Frequency	406.025 ± 0.002	MHz	406.02522			
- Power Output	35 - 39	dBm	37.02			
- Data Message	<u>FFFE2F96E</u>	✓	✓			
• Frequency Stability	<u>E2EC0017F</u>					
- short term stability	≤ 0.002	parts / million in 100 ms	.0005677			
- medium term stability:	<u>DFFC0A6D3</u>					
▪ mean slope	<u>5B3E0FAA8</u>					
	≤ 0.001	parts / million / minute	.0006284			
▪ residual frequency variation	≤ 0.003	parts / million	.0003621			



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15.0 Thermal Shock Test

15.2 High Temperature Thermal Shock Test

RLB-33, S/N 1 was conditioned at maximum stowage temperature for > 3 hours.

The unit was then removed and totally immersed in fresh water for 5-10 seconds. The procedure was repeated immersing this time in salt water (5% NaCl).

The unit activated within the 5 minutes specified. After 20 minutes the following measurements were checked:

- (1) Aliveness test.
- (2) Short-term frequency stability.
- (3) Medium term frequency stability.
 - (a) Mean slope.
 - (b) Residual frequency variation.

RLB-33, S/N 1 passed the requirements outlined in the Environmental and Operational Performance Test Plan Section 15.2.

SUMMARY OF TEST RESULTS

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min.} (<u> </u> °C)	T _{amb.} (<u> </u> °C)	T _{max.} (<u>+70</u> °C)	
15.2 Thermal Shock Test (High-Temperature)	≤ 5	minutes			/ sec.	
• Self-activation in water						
• Aliveness Test						
- Carrier Frequency	406.025 ± 0.002	MHz			406.02521	
- Power Output	35 - 39	dBm			37.37	
- Data Message	<u>FFFEZF96E</u> <u>EZEC0017F</u>	✓			✓	
• Frequency Stability	≤ 0.002	parts/ million in 100 ms			.0001561	
- short term stability	<u>DFFCOA6D3</u>					
- medium term stability:	<u>5B3E0FAA8</u>					
▪ mean slope	≤ 0.001	parts / million / minute			.0001648	
▪ residual frequency variation	≤ 0.003	parts / million			.0002111	

DATE: 03-01-1999 TIME: 12:17:38

ACR v6.0

2DDC5D8002FFBFF
C/S-187-USA-1

PASSED

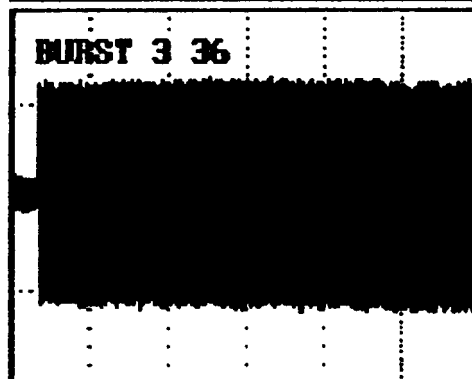
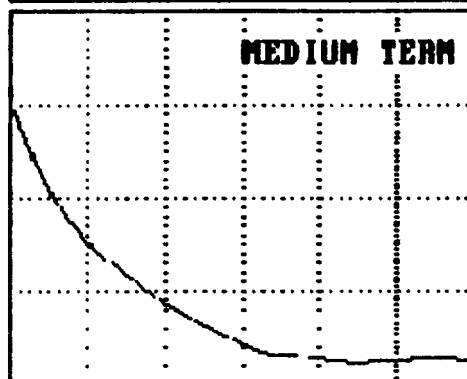
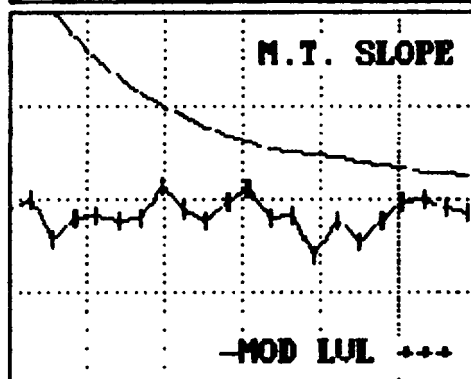
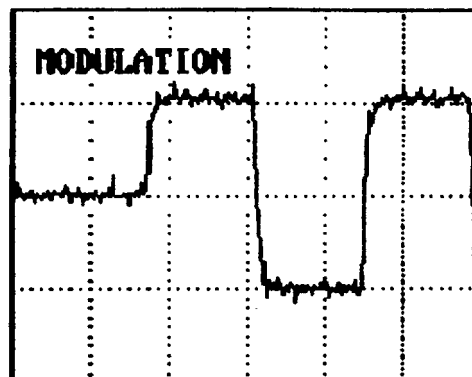
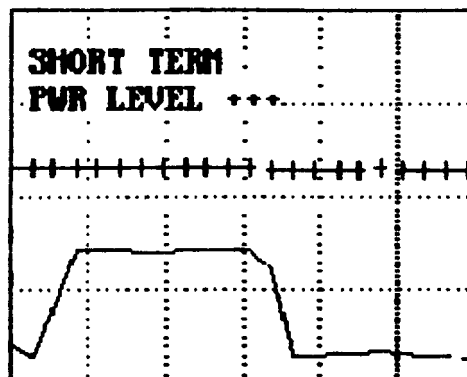
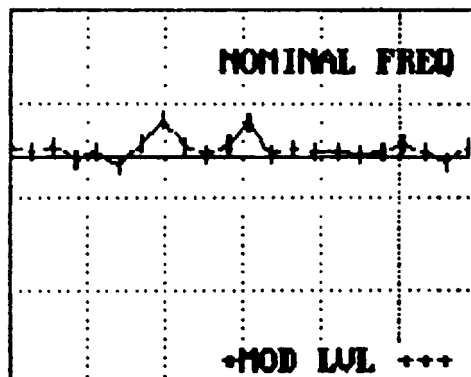
PASSED

216.9 Hz

PASSED

1.561E-10

PEAKS: +1.345 -1.270 rad



PASSED

1.648E-10

PASSED

2.111E-10

PEAKS: +1.404 -1.366 rad

NOMINAL FREQUENCY: 406.02521 MHz
POWER OUTPUT: 5.461 Watts
+37.37 dBm
POWER STABILITY: 8.96 %
POWER RISE TIME: 690 µsec
PEAK VOLTAGE: +2.592 Volts
DRIFT SLOPES: 1) +1.13E-01 rad/sec
2) +1.13E-01 rad/sec
3) +1.13E-01 rad/sec
MODULATION LEVELS: +1.130 radians
+1.151 -1.121 -1.135 radians
+0.015 OFFSET -0.003 radians
MODULATION TIMES: RISE 149 µsec
FALL 153 µsec
SYMMETRY 0.16 %
MODULATION BIT RATE: 398.65 Hz
BURST TIMES: AVG PERIOD 50.6 sec
CARRIER DURATION 160.0 msec
MESSAGE DURATION 361.2 msec
TOTAL DURATION 521.2 msec
PREAMBLE LEAKAGE LEVEL 35.0 dBc
LEAKAGE LENGTH 0.1 msec

HEXADECIMAL MESSAGE

2DDC5D8002FFBFF
FFFE2F96EE2ED0017FDFFD0A6D35B3E0FAA8
BIT SYNCHRONIZATION..... OK
FRAME SYNCHRONIZATION... OK
MESSAGE FORMAT..... LONG
PROTOCOL FLAG..... STANDARD
COUNTRY..... USA
SERIALIZED USER..... TEST MODE
C/S CERTIFICATE No..... 187
SERIAL NUMBER..... 1
LATITUDE..... N 127.75
LONGITUDE..... E 255.75
ERROR CORRECTION CODE 1. OK
ENCODED DATA SOURCE..... Internal
121.5 MHz HOMING..... No
SPARES status..... Not OK
LATITUDE OFFSET..... + 0 60
LONGITUDE OFFSET..... + 0 60
ERROR CORRECTION CODE 2. OK



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17.0 Operational Life Test

RLB-33, S/N 7 was tested using a fresh battery pack and turned on for the period of time equal to the extension interval.

The unit was then turned off and subjected to a cold soak (minimum operating temperature) for > 2 hours.

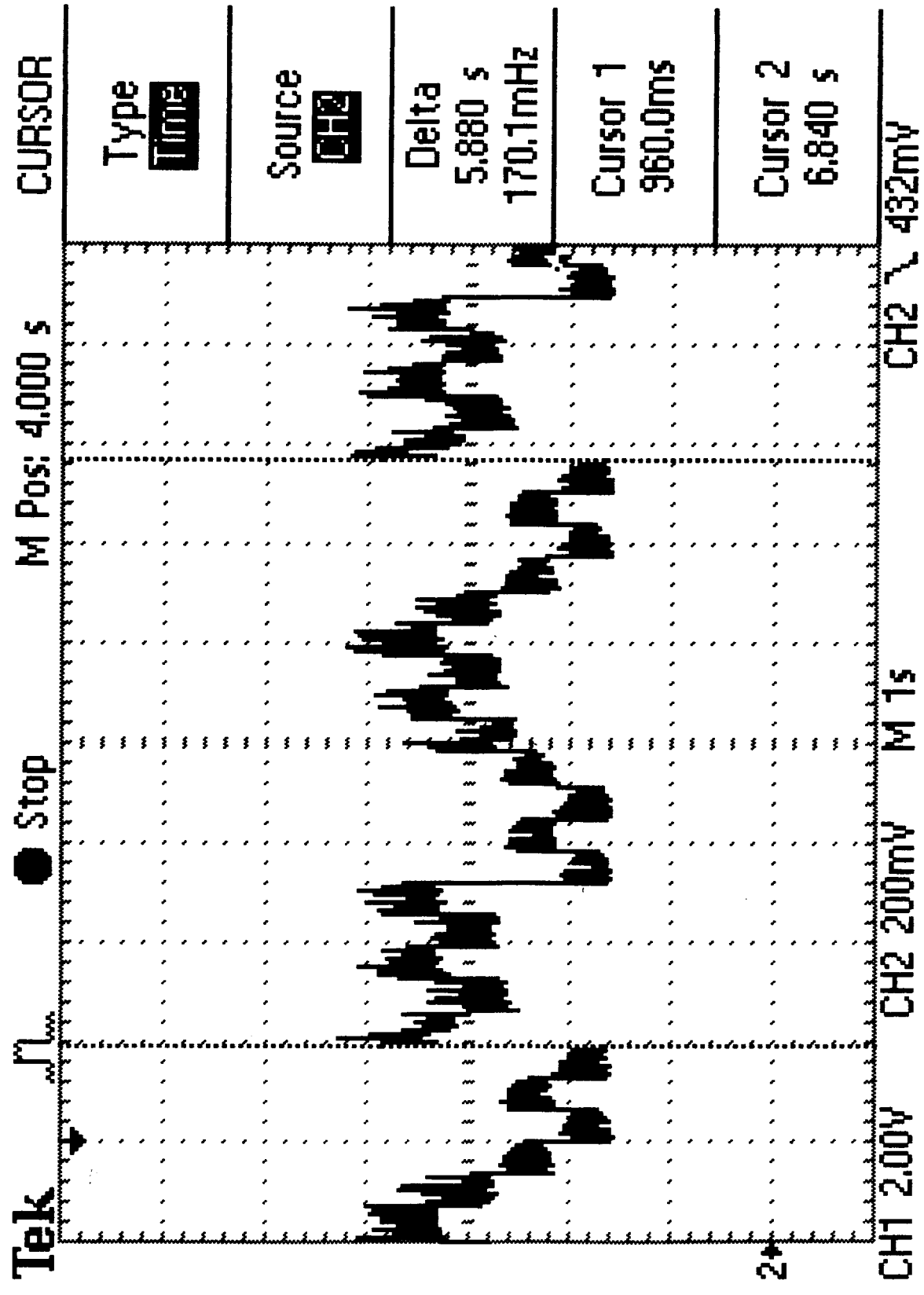
After 2 hours the unit remained in the chamber and was turned on for the remainder of the test period. The following measurements were made:

- (1) Nominal carrier frequency.
- (2) Short-term frequency stability.
- (3) Medium term frequency stability.
 - (a) Mean slope.
 - (b) Residual frequency variation.
- (4) R.F. output power (5w+/-2dB).
- (5) Strobe light flash rate 20 to 30/min.
- (6) Auxiliary radio-locating device peak envelope output power.

RLB-33, S/N 7 passed the requirements outlined in the Environmental and Operational Performance Test Plan Section 17.0.

3/25/79

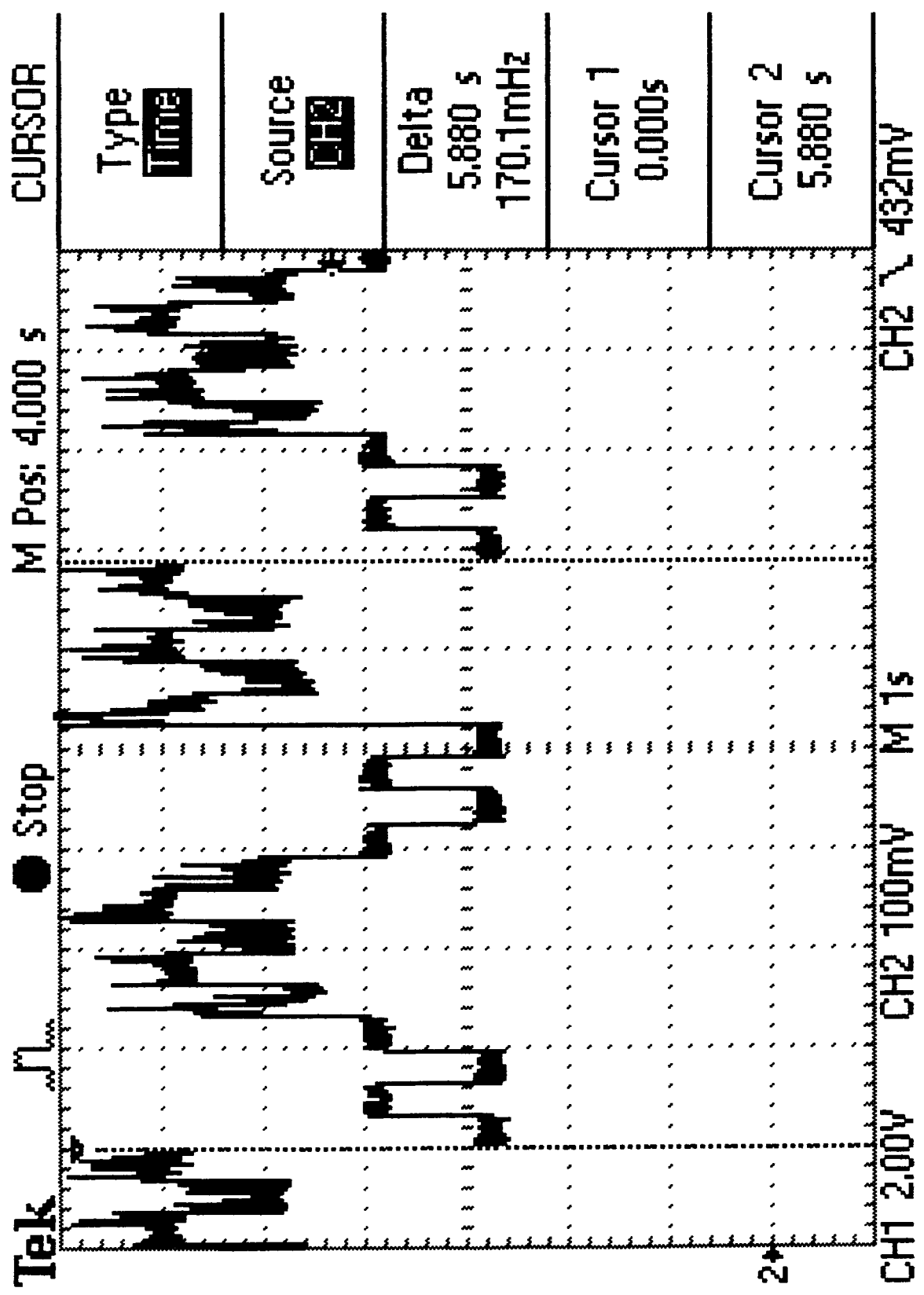
RLB-33 BACKGROUND CURRENT



3/23/99

RLB-33 BACKGROUND CURRENT

121.5 MHz UNLOADED



3/25/99

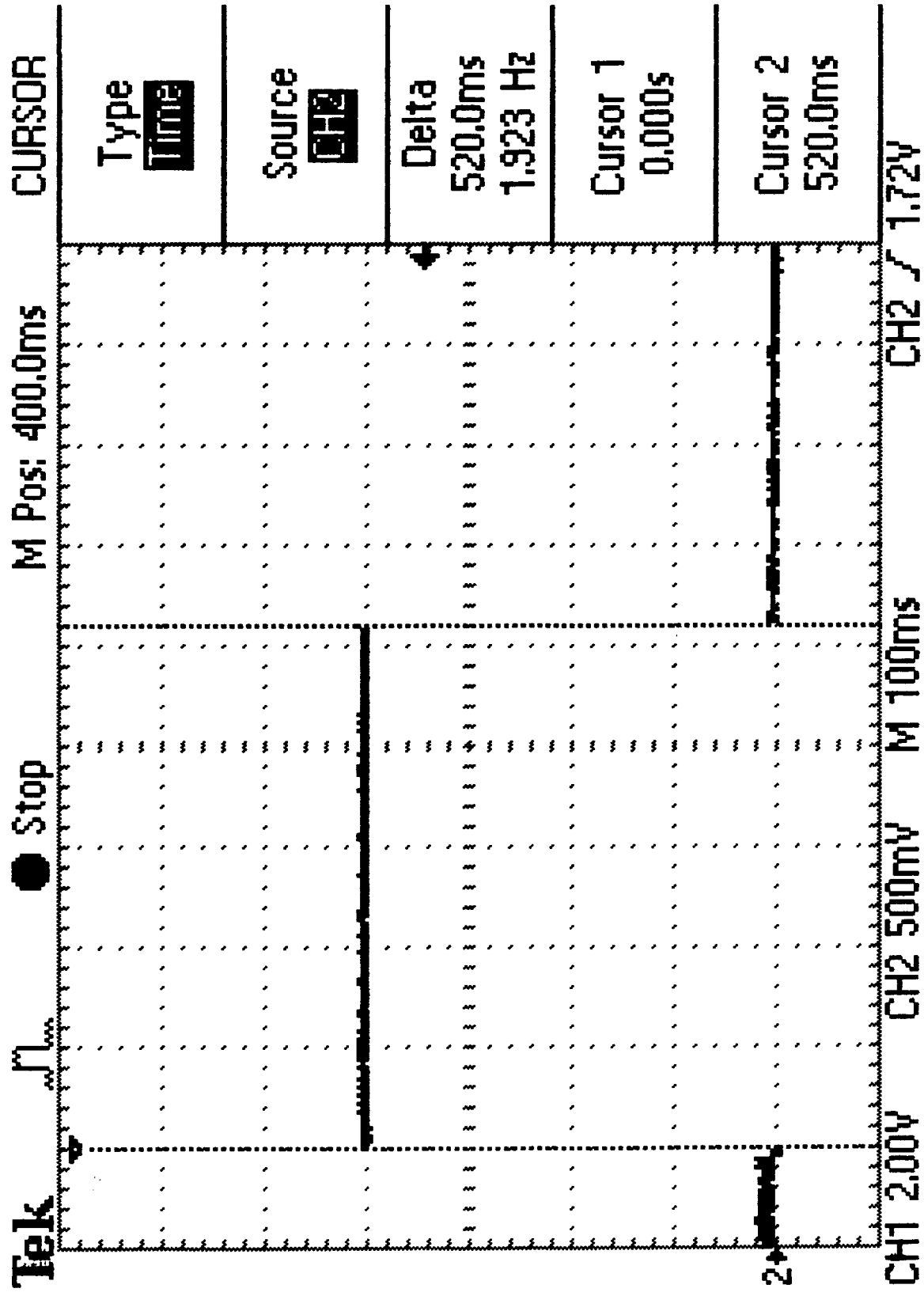
RLB-33

CALCULATION OF AVERAGE BATTERY DRAIN IN ON MODE

5.88 seconds/cycle divided by 18 equals 0.326667

.3267 ms interval Number	Background Current Level from measured background current waveform mA	
1	28	Average time between bursts = 50.5 seconds
2	39	
3	28	Burst time 0.521 seconds
4	39	
5	51	Burst current = 2000 mA
6	59	
7	42	Average Burst current 20.63366 mA
8	54	over 50.5 seconds
9	51	
10	39	
11	28	
12	39	
13	28	
14	62	
15	50	
16	61	
17	52	
18	61	
Average background	45.05556 mA	
Total average current drain in On Mode =	65.68922	mA

RLB-33 Burst Count 0/20/100



3/25/99

RLB-33 (S/N 7) **CALCULATION OF AVERAGE BATTERY DRAIN IN ON MODE**

5.88 seconds/cycle divided by 18 equals 0.326667

.3267 ms interval	Background Current Level from measured background current waveform	
Number	mA	
1	36	Average time between bursts = 50.5 seconds
2	48	
3	36	Burst time 0.521 seconds
4	48	
5	59	Burst current = 2000 mA
6	64	
7	59	Average Burst current 20.63366 mA
8	66	over 50.5 seconds
9	60	
10	48	
11	36	
12	48	
13	36	
14	70	
15	58	
16	71	
17	69	
18	71	
Average background	54.61111 mA	
Total average current drain in On Mode =	75.24477	mA

3/25/99

RLB-33 S/N 7 CALCULATIONS FOR BATTERY DRAIN PRIOR TO LIFE TEST

GPS INTERFACE:

RLB33 #7 with GPS data (searching every 19.5 min) with GPS plug attached = 13.38uA

Worst case RLB-33 GPS current over battery life of 5 years = 0.00001338 Amps

Hours in 5 years = $365 \times 24 \times 5 = 43800$ Hours

GPS INTERFACE AMP-HOURS = 0.586044 AMP-HOURS

SELF-TEST:

Four self tests per year for 5 years = 20 tests

Background current = 0.25 Amps

Duration = 7 Seconds

Burst current = 2 Amps

Duration = 0.44 Seconds

Total self-test charge battery drain in 5 years = 52.6 Coulombs

Total seconds in 5 years = $5 \times 365 \times 24 \times 60 \times 60 = 157680000$ Seconds

Average battery self-test battery drain = 3.33587×10^{-7} Amps

Self-Test AMP-HOURS = 0.014611111 AMP-HOURS

Total Self-Test AMP-HOURS = 0.600655111 AMP-HOURS

COSPAS/SARSAT TEST FACTOR = 1.65

Total AMP-HOUR burn off battery for -40 C life test = 0.991080933 AMP-HOURS

RLB-33 On Mode average current drain = 0.07524477 Amps

Total On time required to burn 0.991081 Amp-hour 13.17142618 Hours

13 hours 10 minutes 17 seconds

3/25/99

BATTERY DRAIN MEASUREMENTS PRIOR TO LIFE TEST ON RLB-33 S/N 7

Total RLB-33 On time required to burn 0.99108 Amp-hours = 13.1714 Hours

Total RLB-33 On time required = 13 hours 10 minutes 17 seconds

Time RLB-33 turned on

with fresh battery

Time RLB-33 turned off

Battery on in RLB-33

1:30:00 PM 2:40:17 PM
3/25/99 3/26/99

13 hours 10 minutes 17 seconds

RLB-33 On Mode average current drain =

0.07524477 Amps

SUMMARY OF TEST RESULTS

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min.} (-40 °C)	T _{amb.} (°C)	T _{max.} (°C)	
16. Cospas-Sarsat Type Approval Tests	C-S Certificate (attach test report)	✓				
17. Operation Life, Strobe Light and Self Tests	2:30 PM 3/27/99					
Operational Life						
• Frequency						
• Nominal Carrier	406.025 ± 0.002	MHz	406.025611			
• Short-term stability	≤ 0.002	parts/ million in 100 ms	0.000262			
• Medium-term stability						
- Mean slope	≤ 0.001	parts/ million/ minute	0.000108			
- Residual variation	≤ 0.003	parts/ million	0.000146			
• RF output power	35 – 39	dBm	38.27			
• Strobe flash rate	20 – 30	/min	20.4			
• Auxiliary radio-locating Peak envelope output power	14 – 20	dBm	15.6			

SUMMARY OF TEST RESULTS

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min} (-40°C)	T _{amb.} (°C)	T _{max.} (°C)	
16. Cospas-Sarsat Type Approval Tests	C-S Certificate (attach test report)	✓				
17. Operation Life, Strobe Light and Self Tests	12:30 PM 3/28/99	QUEST 1				
Operational Life						
• Frequency	406.025 ± 0.002	MHz	406.025607			
• Nominal Carrier	≤ 0.002	parts/ million in 100 ms	0.000149			
• Short-term stability						
• Medium-term stability						
- Mean slope	≤ 0.001	parts/ million/ minute	0.000114			
- Residual variation	≤ 0.003	parts/ million	-0.0000614			
• RF output power	35 - 39	dBm	38.48			
• Strobe flash rate	20 - 30	/min	20.4			
• Auxiliary radio-locating Peak envelope output power	14 - 20	dBm	15.65			

SUMMARY OF TEST RESULTS

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min} (-40°C)	T _{amb.} (°C)	T _{max.} (°C)	
16. Cospas-Sarsat Type Approval Tests	C-S Certificate (attach test report)	✓				
17. Operation Life, Strobe Light and Self Tests	7:30 PM 3/23/99	Boost 162				
Operational Life						
• Frequency	406.025 ± 0.002	MHz	406.02564			
• Nominal Carrier	≤ 0.002	parts/ million in 100 ms	0.000276			
• Short-term stability						
• Medium-term stability						
- Mean slope	≤ 0.001	parts/ million/ minute	0.000102			
- Residual variation	≤ 0.003	parts/ million	-0.000197			
• RF output power	35 - 39	dBm	38.48			
• Strobe flash rate	20 - 30	/min	20.4			
• Auxiliary radio-locating Peak envelope output power	14 - 20	dBm	16.30			

SUMMARY OF TEST RESULTS

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min} * (-40°C)	T _{amb.} (°C)	T _{max.} (°C)	
16. Cospas-Sarsat Type Approval Tests	C-S Certificate (attach test report)	✓				
17. Operation Life, Strobe Light and Self Tests	12:30 AM 3/29/99 (756.9594 MHz) On time	Burst 901 MHz	406.025604			
• Frequency	406.025 ± 0.002	parts/ million in 100 ms	0.000398			
• Nominal Carrier	≤ 0.002	parts/ million/ minute	0.000132			
• Short-term stability		parts/ million	.0000190			
• Medium-term stability	≤ 0.001					
- Mean slope	≤ 0.003					
- Residual variation	35 - 39 20 - 30 14 - 20					
• RF output power			38.41			
• Strobe flash rate			20.4			
• Auxiliary radio-locating Peak envelope output power			16.20			

SUMMARY OF TEST RESULTS

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min} (-40 °C)	T _{amb.} (°C)	T _{max} (°C)	
16. Cospas-Sarsat Type Approval Tests	C-S Certificate (attach test report)	✓				
17. Operation Life, Strobe Light and Self Tests	7:30 AM 3/29/99 (1117.012 mm) 0.015K	Burst /333 MHz	406.025604			
• Frequency	406.025 ± 0.002	parts/ million in	0.000302			
• Nominal Carrier	≤ 0.002	100 ms				
• Short-term stability						
• Medium-term stability		parts/ million/ minute	,0000816			
- Mean slope	≤ 0.001					
- Residual variation	≤ 0.003	parts/ million	,0000114			
• RF output power	35 - 39	dBm	38.20			
• Strobe flash rate	20 - 30	/min	20.4			
• Auxiliary radio-locating Peak envelope output power	14 - 20	dBm	16.12			

SUMMARY OF TEST RESULTS

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min} (-40°C)	T _{amb.} (°C)	T _{max.} (°C)	
16. Cospas-Sarsat Type Approval Tests	C-S Certificate (attach test report)	✓				
17. Operation Life, Strobe Light and Self Tests	1:30PM 3/29/99					
Operational Life						
• Frequency	406.025 ± 0.002 ≤ 0.002	MHz	406.02569			
• Nominal Carrier		parts/ million in 100 ms	0.000213			
• Short-term stability						
• Medium-term stability						
- Mean slope	≤ 0.001	parts/ million/ minute	0.000189			
- Residual variation	≤ 0.003	parts/ million	0.000154			
• RF output power	35 - 39	dBm	37.68			
• Strobe flash rate	20 - 30	/min	20.4			
• Auxiliary radio-locating Peak envelope output power	14 - 20	dBm	16.08			



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18.0 Strobe Light Test

RLB-33, S/N 7 was soaked at minimum operating temperature for > 3 hours.

The unit was checked for flash rate and effective intensity. This procedure was repeated at maximum operating temperature and at ambient temperature.

RLB-33, S/N 7 passed the requirements outlined in the Environmental and Operational Performance Test Plan Section 18.0.



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19.0 Self Test

RLB-33, S/N 7 was tested at minimum and maximum operating temperature as well as ambient temperature.

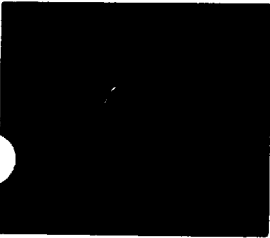
The unit was checked for:

- (a) R.F. pulse duration.
- (b) Frame synchronization pattern.
- (c) Number of burst.

RLB-33, S/N 7 passed the requirements outlined in the Environmental and Operational Performance Test Plan Section 19.0.

SUMMARY OF TEST RESULTS

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min.} (-40 °C)	T _{amb.} (23 °C)	T _{max.} (+55 °C)	
18. Strobe Light Test						
• Flash Rate	20 – 30	/min	20.5	20.4	20.5	
• Effective intensity	0.75	Cd	2.26	1.90	1.47	
• Pulse duration	10 ⁻⁸ to 10 ⁻²	s	8.0x10 ⁻⁶	8.0x10 ⁻⁶	9.8x10 ⁻⁶	
19. Self Test						
• RF pulse duration	≤ 0.444 sec	✓	0.4410	0.4409	0.4409	
• Frame synchronization pattern	0 1101 0000 (FFEDO)	✓	✓	✓	✓	
• Number of RF bursts	1-burst	✓	✓	✓	✓	



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20.0 Stability and Buoyancy Test

RLB-33, S/N 7 was tested for stability and buoyancy.

The unit was submerged horizontally and released to check its' ability to return to an upright position.

The actual waterline was checked and the reserve buoyancy was determined.

RLB-33, S/N 7 passed the requirements outlined in the Environmental and Operational Performance Test Plan Section 20.0.



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21.0 Inadvertent Activation Test

RLB-33, S/N 7 was tested to verify that it would not inadvertently be activated by waves washing over the ship.

The unit was placed in its' bracket and exposed to a stream of water delivering > 2300 liters of water per minute.

RLB-33, S/N 7 did not activate at any time during the 5 minute exposure.

RLB-33, S/N 7 passed the requirements outlined in the Environmental and Operational Performance Test Plan Section 21.0.

SUMMARY OF TEST RESULTS

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min} * (°C)	T _{amb.} (21 °C)	T _{max} (°C)	
20. Stability and Buoyancy Test						
• Time to upright	≤ 2	s		.67		
• Reserve buoyancy	≥ 5	%		29.86		
• Float upright; Antenna base	> 4	cm		5.335		
21. Inadvertent Activation Test						
• EUT not release from bracket		✓		✓		
• EUT not automatically activate		✓		✓		

DATE: 03-08-1999 TIME: 15:49:09

SELF-TEST MODE

ACR v6.0

2DDC5D8002EFBFF
C/S-187-USA-1

-40°C

PASSED

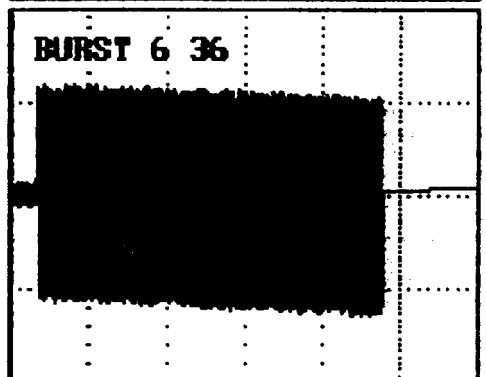
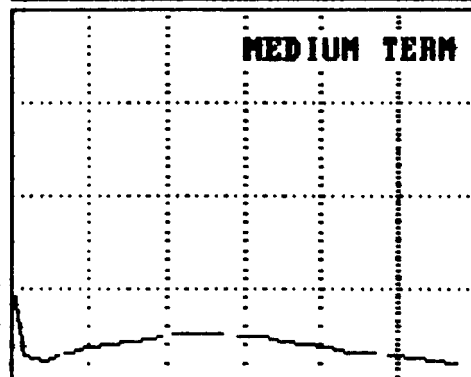
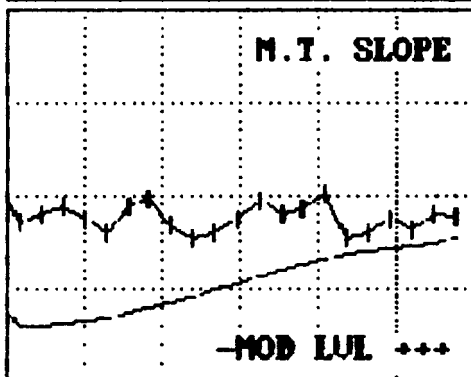
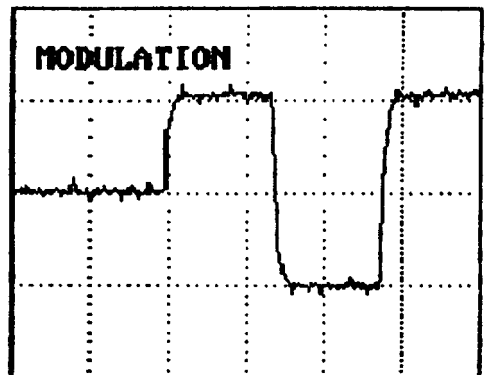
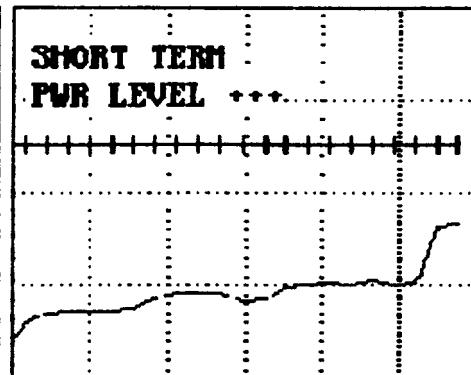
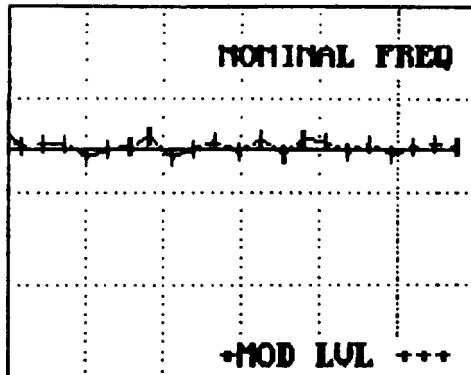
PASSED

228.1 Hz

PASSED

8.218E-10

PEAKS: +1.274 -1.199 rad



PASSED -2.668E-10

PASSED 1.898E-10

PEAKS: +1.323 -1.417 rad

NOMINAL FREQUENCY: 406.02522 MHz
POWER OUTPUT: 6.169 Watts
+37.90 dBm
POWER STABILITY: 11.42 %
POWER RISE TIME: 840 µsec
PEAK VOLTAGE: +2.640 Volts
DRIFT SLOPES: 1) -2.25E-01 rad/sec
2) -2.25E-01 rad/sec
3) -2.25E-01 rad/sec
MODULATION LEVELS: +1.135 radians
+1.155 -1.111 -1.143 radians
+0.022 OFFSET -0.004 radians
MODULATION TIMES: RISE 150 µsec
FALL 148 µsec
SYMMETRY 0.36 %
MODULATION BIT RATE: 398.69 Hz
BURST TIMES: AVG PERIOD 49.3 sec
CARRIER DURATION 160.1 msec
MESSAGE DURATION 280.9 msec
TOTAL DURATION 441.0 msec
PREAMBLE LEAKAGE LEVEL 35.0 dBc
LEAKAGE LENGTH 0.3 msec

HEXADECIMAL MESSAGE

2DDC5D8002EFBFF
FFFE096EE2ED0017FDFFC0A6D35
BIT SYNCHRONIZATION..... OK
FRAME SYNCHRONIZATION... NOT OK
MESSAGE FORMAT..... LONG
PROTOCOL FLAG..... STANDARD
COUNTRY..... USA
SERIALIZED USER..... TEST MODE
C/S CERTIFICATE No..... 187
SERIAL NUMBER..... 1
LATITUDE..... N 127.75
LONGITUDE..... E 255.75
ERROR CORRECTION CODE 1. OK
ENCODED DATA SOURCE..... Internal
121.5 MHz HOMING..... No
SPARES status..... Not OK
LATITUDE OFFSET..... - 0 0
LONGITUDE OFFSET..... - 0 0
ERROR CORRECTION CODE 2. NOT OK

DATE: 03-04-1999 TIME: 1:01:01

SELF TEST MODE
ROOM TEMP

ACR v6.0

2DDC5D8002FFBFF

C/S 187-USA-1

PASSED

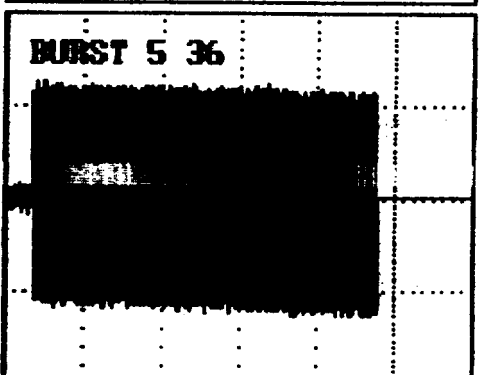
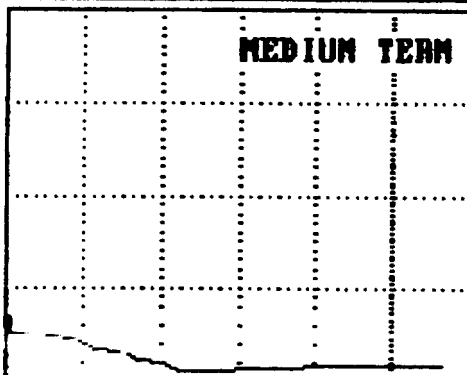
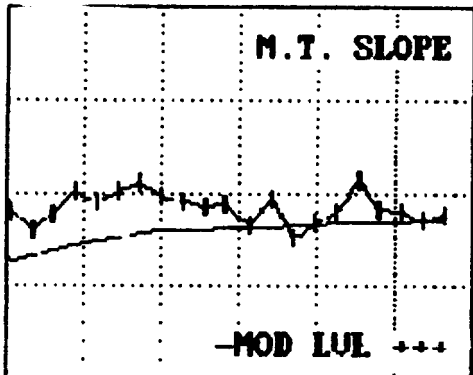
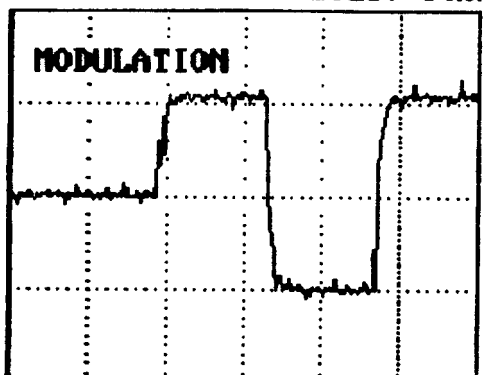
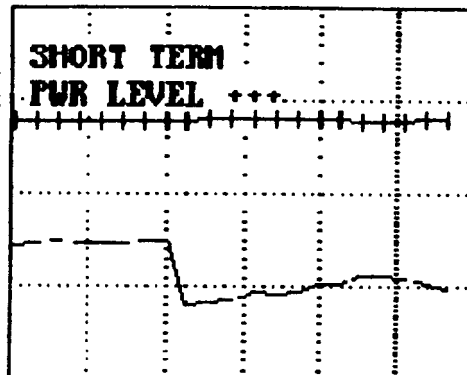
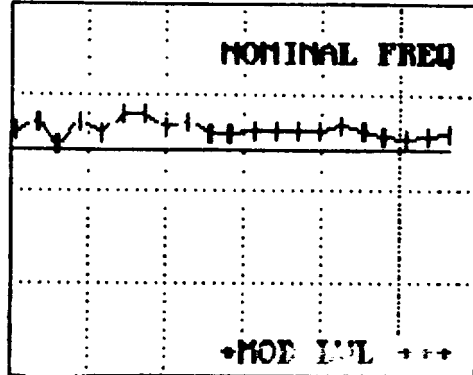
PASSED

212.0 Hz

PASSED

5.426E-10

PEAKS: +1.371 -1.197 rad



PASSED -1.588E-10

PASSED 1.364E-10

PEAKS: +1.395 -1.398 rad

NOMINAL FREQUENCY: 406.02521 MHz
POWER OUTPUT: 6.979 Watts
+38.44 dBm
POWER STABILITY: 10.55 %
POWER RISE TIME: 920 µsec
PEAK VOLTAGE: +2.813 Volts
DRIFT SLOPES: 1) -5.68E-02 rad/sec
2) -5.68E-02 rad/sec
3) -5.68E-02 rad/sec
MODULATION LEVELS: +1.139 radians
+1.166 -1.109 -1.148 radians
+0.029 -0.004 radians
MODULATION TIMES: RISE 156 µsec
FALL 160 µsec
SYMMETRY 0.77 %
MODULATION BIT RATE: 398.72 Hz
BURST TIMES: AVG PERIOD 48.3 sec
CARRIER DURATION 160.0 msec
MESSAGE DURATION 280.9 msec
TOTAL DURATION 440.9 msec
PREAMBLE LEAKAGE LEVEL 35.0 dBc
LEAKAGE LENGTH 0.2 msec

HEXADECIMAL MESSAGE

2DDC5D8002FFBFF
FFFD096EE2ED0017FDFFD0A6D35
BIT SYNCHRONIZATION..... OK
FRAME SYNCHRONIZATION... NOT OK
MESSAGE FORMAT..... LONG
PROTOCOL FLAG..... STANDARD
COUNTRY..... USA
SERIALIZED USER..... TEST MODE
C/S CERTIFICATE No..... 187
SERIAL NUMBER..... 1
LATITUDE..... N 127.75
LONGITUDE..... E 255.75
ERROR CORRECTION CODE 1. OK
ENCODED DATA SOURCE..... Internal
121.5 MHz HOMING..... No
SPARES status..... Not OK
LATITUDE OFFSET..... - 0 0
LONGITUDE OFFSET..... - 0 0
ERROR CORRECTION CODE 2. NOT OK



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22.0 Orientation Test

RLB-33, S/N 7 was tested in three different positions: horizontal, upside down and upright.

The unit was checked for carrier frequency and power output to verify its' ability to function in all three positions.

RLB-33, S/N 7 passed the requirements outlined in the Environmental and Operational Performance Test Plan Section 22.0.

00-05-1999 TIME: 14:25:47

SE - TEST MODE
+55°C

ACR v6.0

2DDC5D8002FFBF
C/S-187-USA-1

PASSED

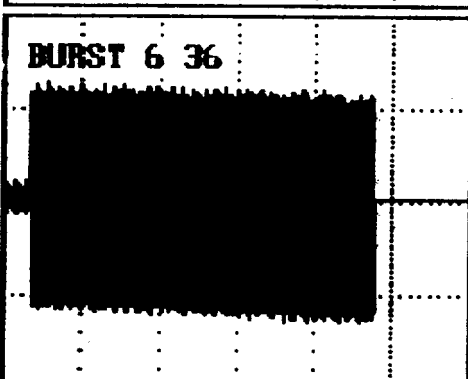
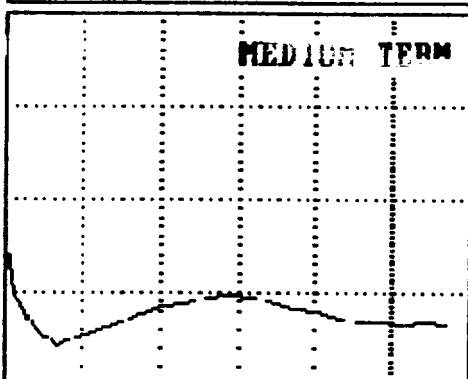
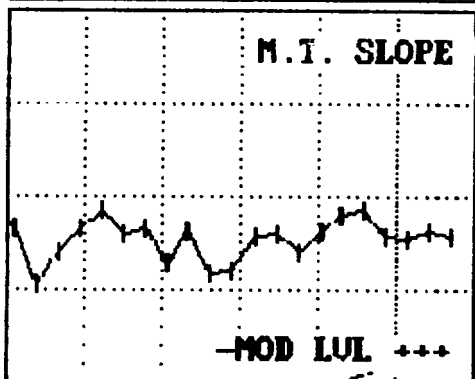
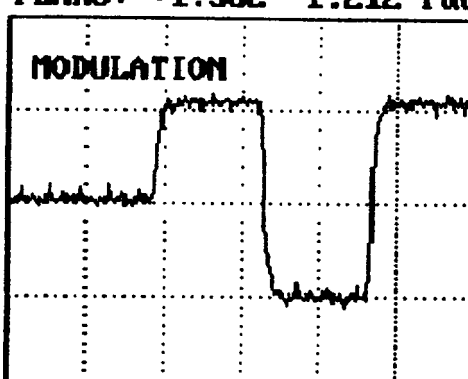
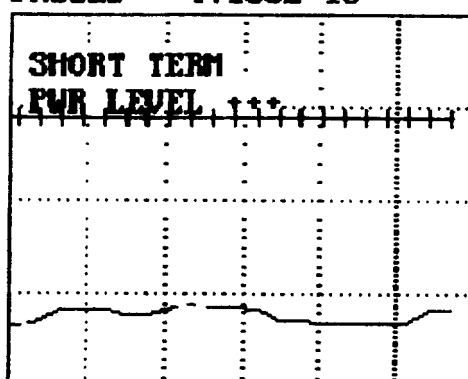
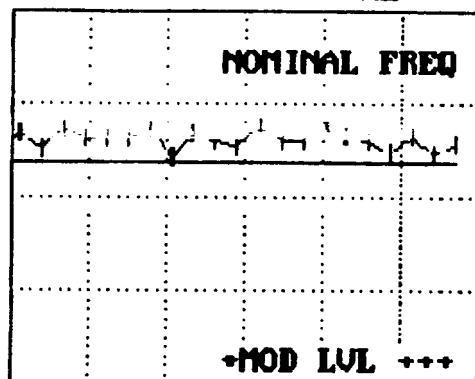
PASSED

187.1 Hz

PASSED

4.158E-18

PEAKS: +1.382 -1.212 rad



PASSED -8.483E-10

PASSED

5.133E-18

PEAKS: +1.411 -1.428 rad

NOMINAL FREQUENCY: 406.02518 MHz
POWER OUTPUT: 7.248 Watts
+38.60 dBm
POWER STABILITY: 8.46 %
POWER RISE TIME: 880 µsec
PEAK VOLTAGE: +2.874 Volts
DRIFT SLOPES: 1) -5.08E-02 rad/sec
2) -5.08E-02 rad/sec
3) -5.08E-02 rad/sec
MODULATION LEVELS: +1.150 radians
+1.167 -1.135 -1.158 radians
+0.016 OFFSET -0.004 radians
MODULATION TIMES: RISE 149 µsec
FALL 148 µsec
SYMMETRY 0.71 %
MODULATION BIT RATE: 398.78 Hz
BURST TIMES: AVG PERIOD 48.8 sec
CARRIER TURN ON 160.0 msec
MESSAGE DURATION 280.9 msec
TOTAL DURATION 440.9 msec
PREAMBLE LEAKAGE LEVEL 35.0 dBc
LEAKAGE LENGTH 0.3 msec

HEXADECIMAL MESSAGE

2DDC5D8002FFBF
FFFD096EE2ED0017FDFFD0A6D35
BIT SYNCHRONIZATION..... OK
FRAME SYNCHRONIZATION... NOT OK
MESSAGE FORMAT..... LONG
PROTOCOL FLAG..... STANDARD
COUNTRY..... USA
SERIALIZED USER..... TEST MODE
C/S CERTIFICATE No..... 187
SERIAL NUMBER..... 1
LATITUDE..... N 127.75
LONGITUDE..... E 255.75
ERROR CORRECTION CODE 1. OK
ENCODED DATA SOURCE..... Internal
121.5 MHz HOMING..... No
SPARES status..... Not OK
LATITUDE OFFSET..... - 0 0
LONGITUDE OFFSET..... - 0 0
ERROR CORRECTION CODE 2. NOT OK

SUMMARY OF TEST RESULTS

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min} * (<u> </u> °C)	T _{amb.} (<u>27</u> °C)	T _{max.} (<u> </u> °C)	
22. Orientation Test Initial Vertical - Carrier Frequency - Power Output Horizontal • Aliveness Test:	406.025 ± 0.002 35 – 39	MHz dBm		406.02535 38.56		
- Carrier Frequency - Power Output Upside Down • Aliveness Test:	406.025 ± 0.002 35 – 39	MHz dBm		406.02535 38.69		
- Carrier Frequency - Power Output Upright • Aliveness Test:	406.025 ± 0.002 35 – 39	MHz dBm		406.02535 38.67		
- Carrier Frequency - Power Output	406.025 ± 0.002 35 – 39	MHz dBm		406.02535 38.68		



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23.0 121.5 MHz Auxiliary Radio-Locating Device Transmitter Test

The testing of RLB-33, S/N 7 for sections 23.0 through 23.6 was performed by James Jesse of Atlantic Coast Engineering Systems on behalf of Q.C. Metallurgical, Inc.

RLB-33, S/N 7 passed all the requirements outlined in the Environmental and Operational Performance Test Plan Sections 23.0 through 23.6.

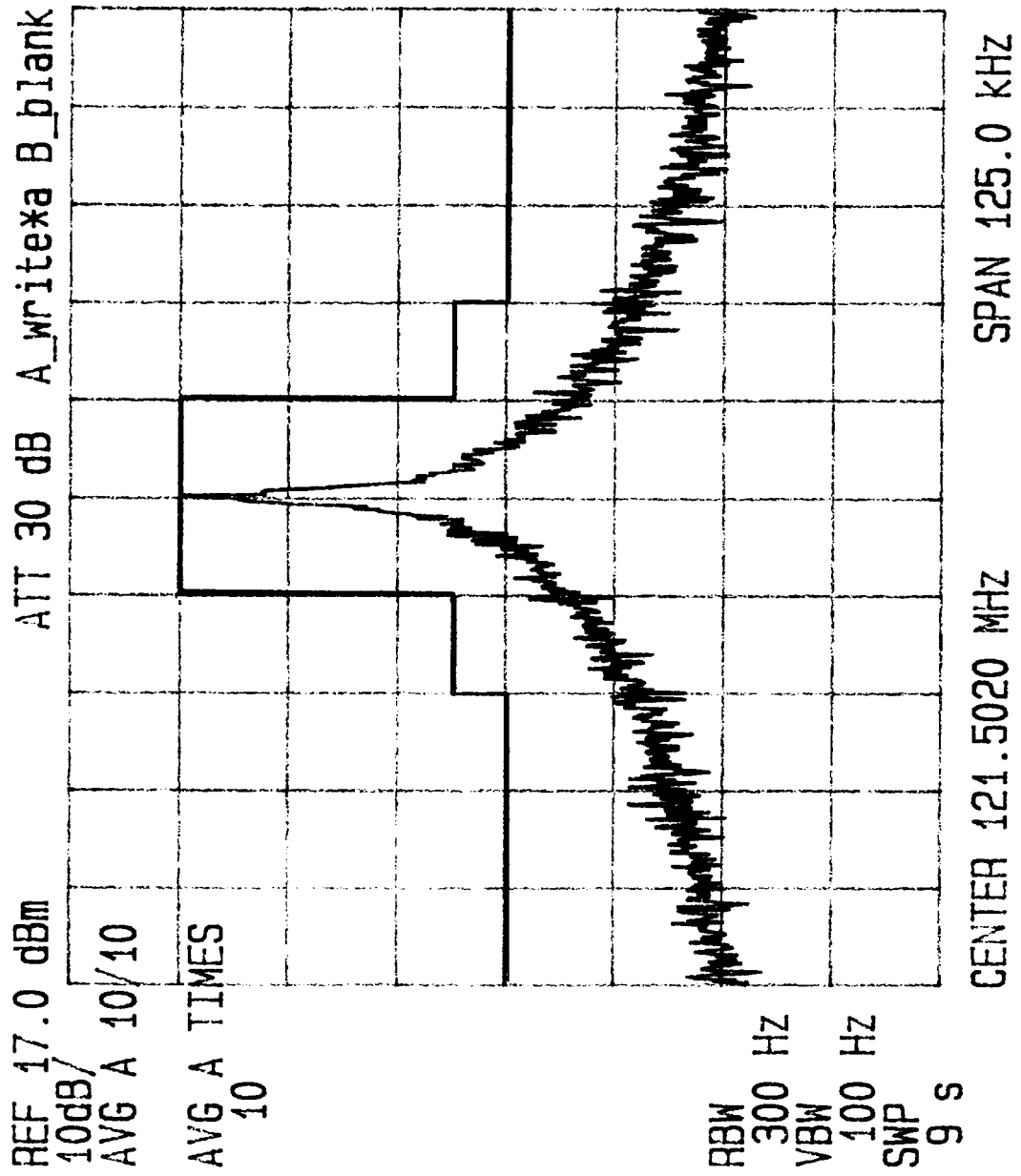
SUMMARY OF TEST RESULTS

Nominal Supply Voltage 8.7 V

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS										
			-40°C	-30°	-20°	-10°	0°	+10°	+20°	+35°	+45°	+55°	
23.1 Auxiliary Radio-locating Device Transmitter test													
• Carrier Frequency	121.5 MHz ± 6.075	KHz	1.16	2.03	2.5	2.79	2.85	2.74	2.58	2.23	2.11	2.1	
• Carrier Frequency (20°C) +15% Supply Voltage	121.5 MHz ± 6.075	KHz							2.58				
• Carrier Frequency (20°C) -15% Supply Voltage	121.5 MHz ± 6.075	KHz							2.57				
23.2 Auxiliary Radio-locating Device Transmitter Test													
• Output Power	14 Min	dBm	18.6	18.6	18.5	18.4	18.3	18.2	17.9	17.5	17.3	17	
• Output Power (20°C) +15% Supply Voltage	14 Min	dBm							18.5				
• Output Power (20°C)-15% Supply Voltage	14Min	dBm							17				

SUMMARY OF TEST RESULTS

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min.} (-40°C)	T _{amb.} (20°C)	T _{max.} (55 °C)	
23.3 Auxiliary Radio-locating Device Transmitter Test						
• Spurious Emissions 121 MHz	Figure 1	(attach graph)				
23.4 Auxiliary Radio-locating Device Transmitter Test						
• Modulation						
- Frequency	≥ 700 Hz within range of 300 – 1600 Hz	Hz	895.3 339 1234.3	894.4 339 1233.4	909.5 340.1 1249.6	DIFFERENCE MIN MAX
- Direction	Upward		Yes	Yes	Yes	
- Duty Cycle	33 – 55	%	36.4%	34.7%	35.3%	
- Factor	0.85 – 1.0	#	1	1	1	
- Sweep repetition rate	2 - 4	Hz	3.1	3.1	3.1	



SUMMARY OF TEST RESULTS

PARAMETERS TO BE MEASURED DURING TESTS	Power in dBm	Power in mW	Power in Carrier	Carrier Bandwidth	COMMENTS
23.5 Auxiliary Radio-locating Device Transmitter Test					
• Spectrum					
- Range of specification			≥30%	≤ 60 Hz	
- Carrier	8.8	7.6			
- LSB1	6.6	4.6			
- LSB3	-0.8	0.8			
- LSB5	-5.7	0.27			
- LSB7	-11.0	0.08			
- LSB9	-14.0	0.04			
- USB1	6.7	4.7			
- USB3	-0.6	0.87			
- USB5	-5.5	0.28			
- USB7	-10.6	0.09			
- USB9	-13.8	0.04			
- % Power in Carrier			39.2	30	
- Carrier Bandwidth				Hz	

REF 14.0 dBm ATT 30 dB A_writen blank

5dB/

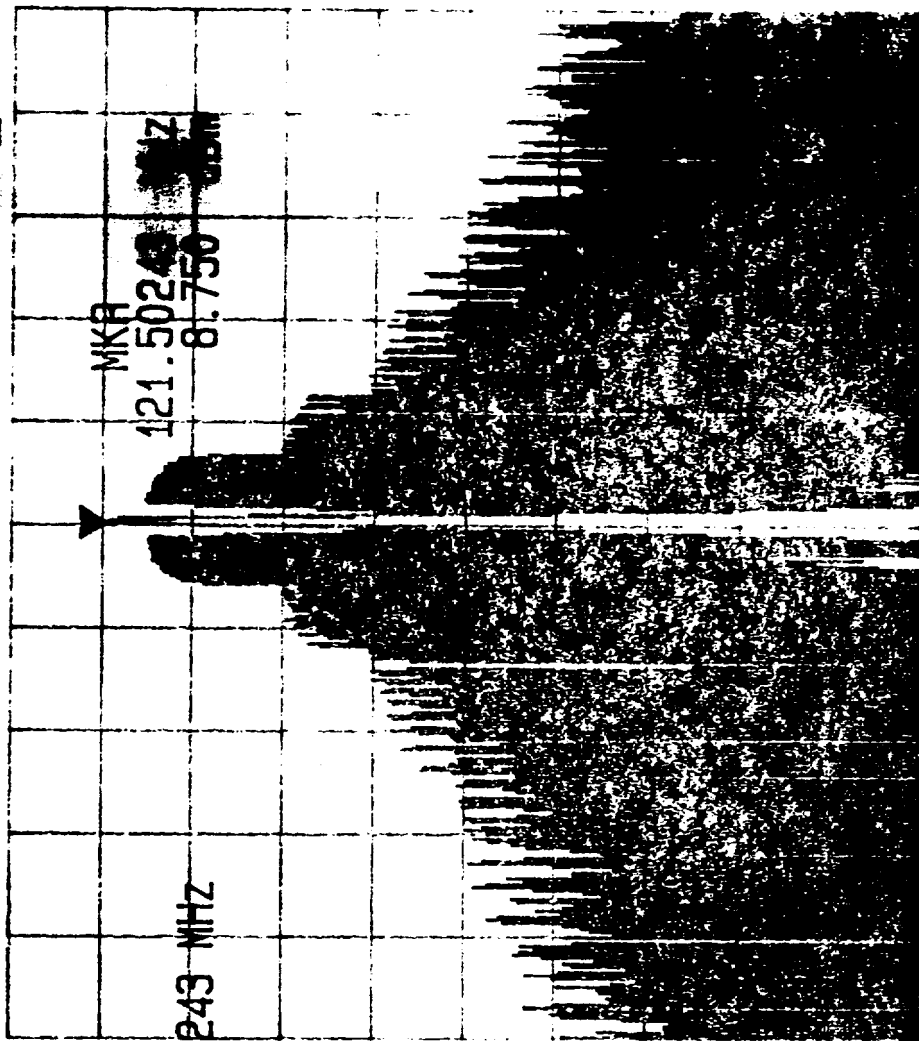
MARKER

121.50243 MHz

MKR

121.50243 MHz

8.750 dBm



RBW 100 Hz
VBW 100 Hz
SWP 200 s

CENTER 121.50240 MHz SPAN 20.00 MHz

SEARCH ANT. REFERENCE DATA TABLE NO 1

Measured standard quarter wavelength monopole gain at 121.6 MHz and 20 degree elevation angle on 8 foot diameter Aluminum ground plane 75 cm. above ground = **1.13 dB**

1.13

Distance of search antenna from unit under test = 10 meters (32 feet 10 inches)

h = height of search antenna above ground plane is to b 12 feet

Therefore, the elevation angle = arctan of 12/32.8 = 20 degrees

Monopole on 8 Foot Diameter Aluminum Ground Plane 75 cm. Above Ground:

Transmitter input power at beginning of test = **20.531 dBm**

Transmitter input power at end of test = **20.321 dBm**

Average transmitter input power = **20.42727 dBm**

Measuring Ant:

h = 12 ft F = 121.6 MHz

Azim Ang Reference level at receiver

Degrees	dBm	uW	Degrees	dBm	uW
0	-21.603	6.913532	180	-21.834	6.555412
30	-21.775	6.845077	210	-21.834	6.555412
60	-21.753	6.878824	240	-21.912	6.438727
90	-21.793	6.817592	270	-21.921	6.425398
120	-21.74	6.898846	300	-21.9	6.456542
150	-21.725	6.722023	330	-21.953	6.378227

Average = 6.590468 uW equals -21.8108 dBm

EPIRB PEIRP DATA TABLE NO 1

Spectrum analyzer measured comparative levels of beacon at 20 degrees
elevation angle on 150 cm diameter ground plane, 10 meters from
measuring antenna:

F = 121.6 MHz

h = 12 ft	EUT rcvr level		11highest	PEIRP	PEIRP
<u>Angle</u>	<u>dBm</u>	<u>uW</u>	<u>values</u>	<u>dBm</u>	<u>mW</u>
0	-27.565	1.751862	<u>dBm</u>	14.67311	29.32991
30	-27.678	1.706868	-27.565	14.56011	28.57661
60	-27.7	1.698244	-27.678	14.53811	28.43221
90	-27.728	1.68733	-27.7	14.51011	28.24949
120	-27.746	1.680351	-27.728	14.49211	28.13265
150	-27.653	1.716722	-27.746	14.58511	28.74158
180	-27.662	1.713168	-27.653	14.57611	28.68208
210	-27.721	1.690052	-27.662	14.51711	28.29506
240	-27.831	1.647783	-27.721	14.40711	27.58739
270	-27.875	1.631173	-27.831	14.36311	27.30931
300	-27.881	1.628921	-27.875	14.35711	27.2716
330	-27.859	1.637193	-27.859	14.37911	27.4101
ave. uW = 1.682472		max =	-27.565 dBm		
ave. dBm = -27.7405		min =	-27.875 dBm	Average =	28.16817 mW
max to min of 11highest values =			0.31 dB	Average =	14.49759 dBm

SUMMARY OF TEST RESULTS

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			$T_{min.}$ (<u> </u> °C)	$T_{amb.}$ (<u>28</u> °C)	$T_{max.}$ (<u> </u> °C)	
23.6 Auxiliary Radio-locating Device Transmitter Test • Peak Effective Radiated Power - Pattern - Polarization - Median PERP (of 12) - Maximum – minimum (of 11)	Omnidirectional Vertical 25 – 100 ≤ 6	✓ ✓ mW dB		✓ ✓ 28.168 0.31		

APPENDIX 8

ACR QUALITY ASSURANCE MANUAL

