

APPENDIX 7

USCG Approved Lab Test Report to RTCM Specification 76-2002/SC110-STD

Dated 3/17/1999

FCC ID: B66-ACR-PLB100

Type acceptance under Part 95 Subpart K

ACR ELECTRONICS INC
5757 Ravenswood Road
FT. Lauderdale Fl.
(954) 981-3333



DRAWN.	DATE.	
Bill Cox	4/9/2003	
CHECKED.	DATE.	
ENG	DATE.	
Bill Cox	4/9/2003	
APVD	DATE.	
A	18560	Cover Sheet

**RTCM
Test Report
PLB-100**

DRAWING NO
APPENDIX 7

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2870 Stirling Road Hollywood, FL 33020-1199 (954) 925-0499

ENVIRONMENTAL AND OPERATIONAL PERFORMANCE TEST PLAN FOR PLB-100

Test Conducted for
ACR Electronics
5757 Ravenswood Rd.
Ft. Lauderdale, FL 33312
PH (954) 981-3333 Fax (954) 983-5087

Test Conducted by:
QC Metallurgical, Inc

QCM Job No. QKM-2035



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1.0 SEQUENCE OF TESTS

All environmental tests were conducted in the sequence in which the tests are listed herein. The performance parameters at room ambient temperature ($25^{\circ} \pm 5^{\circ}$) was measured before beginning the environmental tests.

- 2.0 General Test Conditions/Initial Aliveness Test
- A3.0 Vibration Test, Frequency
- A4.0 Bump Test
- A5.0 Salt Fog Test
- A6.0 Drop Test
- A7.0 Leakage and Immersion Tests
- A8.0 Spurious Emissions Test
- A11.0 Buoyancy Test (Category 1 only)
- 3.0 Performance Measurements/Extensive Aliveness Test



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2.0

GENERAL TEST CONDITIONS / INITIAL ALIVENESS TEST

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

No adjustments were made to the unit under test throughout the complete test program except for removal and application of primary power as required by the detailed test procedure. All testing, wherever possible, was conducted in a manner that did not emit radiation from the test site. Unless otherwise stated, the tests were conducted at a temperature of $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$, except for unavoidable seasonal temperatures for any outdoor tests.

A log of battery on time was maintained for the PLB being tested. Batteries were not be replaced during a test unless it was probable that the battery on time would exceed the prescribed operating lifetime before the test was completed. The test would be terminated in the case of critical failure.



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A3.0

VIBRATION TEST, FREQUENCY

The EUT was secured to the vibration table. The EUT was mounted in the same position (with respect to the direction of gravity) for all vibration tests and was subjected to the sinusoidal motion in each of its three orthogonal axes according to the following profile.

Procedure

The PLB was 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 was not used. The PLB was mounted in the same position (with respect to the direction of gravity) for all vibration tests. Sinusoidal vibratory motion was 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 changed either linearly or logarithmically with time between 4 and 33 Hz such that a complete cycle (4-33-4 Hz) would take approximately 5 minutes.
- (c) The PLB was vibrated in each orthogonal axes for a period of at least 30 minutes.
- (d) The unit did not activate during the vibration tests.



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A4.0

BUMP TEST

The EUT was 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 were not used.

The EUT was 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

The Bump test was conducted in three orientations; once with the EUT mounted in each of its three axis. Upon completion of the bump test, an exterior mechanical inspection was performed and an aliveness test conducted.

Unit did not activate during test.



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A5.0

SALT FOG TEST

The salt fog test was conducted on a complete Category 1 satellite PLB. The EUT was turned OFF during the test.

The salt fog was prepared from a $5\% \pm 1\%$ 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 was 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 was added and maintained at the saturation point for 48 hours.

After exposure to salt fog, the EUT was 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 was inspected for corrosion, peeling paint, and other signs of deterioration and the aliveness test conducted.

After the test, salt deposits and water stains were washed off with clean warm water not exceeding a temperature of 38°C .

ALIVENESS TEST is the successful completion of the units built in self-test.



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A6.0

DROP TEST

Drop Test on Hard Surface

The EUT was soaked at minimum stowage temperature (-55°C) for 2 hours. Then the unit was soaked for an additional 2 hours at -40°C . The drop test was then performed within five minutes after removal from a temperature chamber.

The height of the lowest part of the EUT relative to the test surface at the moment of release was $1000 \pm 10\text{mm}$. The EUT was dropped six times onto the test surface. It was released once with each surface of the EUT facing downwards. The antenna was secured in its normal stowage position for the test. The Satellite PLB was removed from pouch before conducting the drop test.

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

Upon completion of the test an exterior and interior mechanical inspection and aliveness test was performed. The interior mechanical inspection was deferred until the conclusion of the leakage and immersion tests.



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A7.0

LEAKAGE AND IMMERSION TESTS

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

1. The equipment was placed in an atmosphere of $+65 \pm 3^{\circ}\text{C}$ for one hour. It was then immediately immersed in water at $+20 \pm 3^{\circ}\text{C}$ to a depth of $100\text{mm} \pm 5\text{ mm}$, measured from the highest point of the equipment to the surface of the water, for a period of 48 hours.
2. The EUT was then completely submerged at a depth of 1 meter for one hour.
3. At the end of the test period the equipment was removed from the water, wiped dry and then subjected to an aliveness test.
4. The EUT was opened up and inspected for damage and visible ingress of water viewed with the unaided eye.



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A8.0

SPURIOUS EMISSIONS TEST

The spurious and harmonic emissions measurements for the 406 MHz and 121.5MHz was performed with the EUT at the Minimum and maximum and ambient temperatures. These emissions did not exceed the limits given in figures 2-1 and 2-5, respectively, when measured in a nominal 100Hz bandwidth. Measurements of the 121,5Mhz signal were performed during the testing of the Auxiliary Radio Locating Device Transmitter test.



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A11.0

BUOYANCY TEST (Category 1 only)

The satellite PLB was allowed to float in calm fresh water. The satellite PLB was removed from pouch before conducting test.

Please submit picture of unit floating with test report.





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3.0 PERFORMANCE MEASUREMENTS / EXTENSIVE ALIVENESS TEST.

Upon Completion of the environmental test the EUT was subjected to the following performance measurements. Tests were conducted by ACR and witnessed by QC Metallurgical, Inc.

- 1.) 406 RF output power
- 2.) 406 Frequency stability, Short Medium and long term stabilities.
- 3.) Message format
- 4.) Data encoding
- 5.) Modulation (including rise and fall times).

Procedure: The above measurements were taken on the ACR Beacon automated test system that measures all of the above parameters. Testing was monitored by QC Metallurgical, Inc. at the ACR Facility.

A sample data sheet can be seen below.

SUMMARY OF RTCM TEST RESULTS

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min.} (____ °C)	T _{amb.} (____ °C)	T _{max.} (____ °C)	
1. N/A						
2 Initial Aliveness Test						
• Carrier Frequency	406.025 ± 0.002	MHz		406.02496		
• Power Output	35 – 39	dBm		38.23		
• Data Message	<u>278E368854FFBFF</u> (attach Data Sheet Fig # 1)	[		<u>278E3688</u> <u>54FFBFF</u>		
A 3.0 Vibration Test						
• Mechanical Inspection	No Damage.	[		PASS		
• Activation	Unit did not activate.	[		PASS		
A4.0 Bump Test						
Peak Acceleration	98 m/s ²					
Pulse Duration	16 ms					
Waveshape	Half-cycle Sinewave					
Number of Bumps	4000					
Activation	Unit did not activate	[		PASS		

SUMMARY OF RTCM TEST RESULTS

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min.} (°C)	T _{amb.} (°C)	T _{max.} (°C)	
A5.0 Salt Fog Test • Exterior Mechanical Inspection • Aliveness Test: - Self Test	No Damage	[]	PASS PASS			
A 6.0 Drop Test (122 cm x 6) <i>On Hard Surface 6 drops each surface @ -40 °C.</i> • Exterior Mechanical Inspection (nothing loose) • Aliveness Test - Self Test <i>INTERIOR INSPECTION DEFERRED UNTIL AFTER A 7.0 LEAKAGE and IMMERSION TEST.</i>	No Damage	[]	PASS PASS			

SUMMARY OF RTCM TEST RESULTS

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min.} (____°C)	T _{amb.} (____°C)	T _{max.} (____°C)	
-						
A 7.0 Leakage & Immersion Test						
• Aliveness Test		[		PASS		
- SELF TEST		[		PASS		
• Interior Inspection	No visible ingress of water or damage					
A 8.0 Spurious Emissions Test						
• 121.5 MHz	(attach graphs)	[		See Fig 3	See Fig 4	
• Amb, -40 & +55°C	Figure 2, 3 & 4.		See Fig 2			
A 11.0 Buoyancy Test (Cat 1 only)						
• Aliveness Test		[		PASS		
- SELF TEST		[		PASS		
- FLOATS						

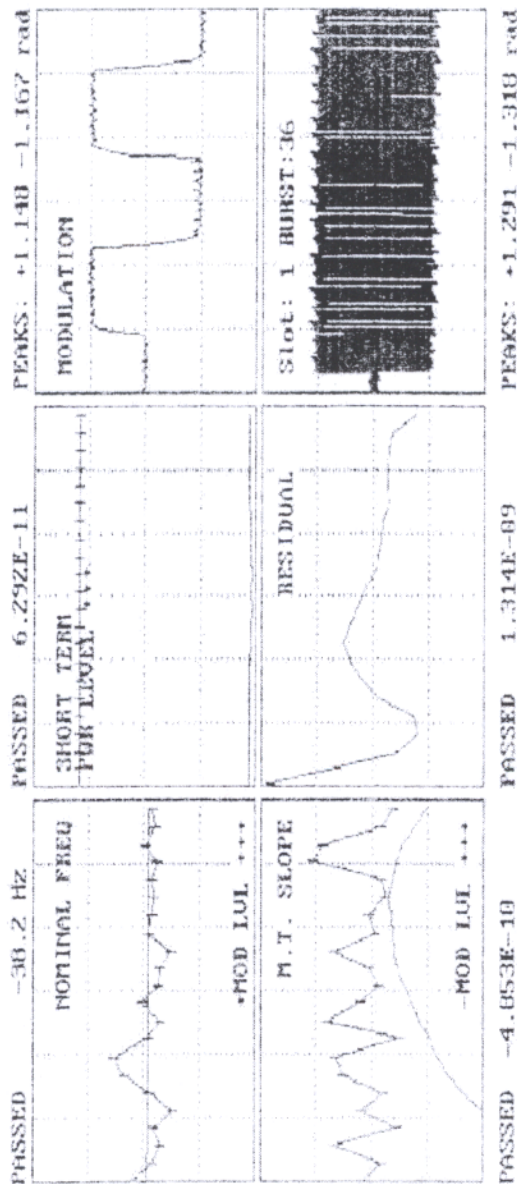
SUMMARY OF RTCM TEST RESULTS

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min.} (°C)	T _{amb.} (°C)	T _{max.} (°C)	
3.0 Extensive Aliveness Test • Power Output • Frequency Stability - Medium - Short Term - • Message Format • Data Message • Modulation Index • Modulation Rise time • Modulation Fall Time • ACR Data sheet	35 – 39	dBm		37.85		
	406.025 ± 0.002 (See attach Data Sheet Fig 5)	MHz		406.025		
	Long STD serialized <u>278E368854FFBFF</u>	[[[		1.078 150µS 150µS		
	(See attach Data Sheet Fig 5)					

Initial Alignment Test

DATE: 11-09-2000 TIME: 11:28:12 RLB303C Ver.7.7 9/2/1999
 278E36854FFBFF >>Engineering Report<< PASSED

C/S-109-CANADA-1066



NOMINAL FREQUENCY: 400.02000 MHz POWER OUTPUT: 0.372 Watts C11.850 dB: +36.23 dBm POWER STABILITY: 10.30 % POWER RISE TIME: 60 msec PEAK VOLTAGE: +2.989 Volts DRIFT SLOPE: 1) -0.99E-02 rad/sec 2) -6.99E-02 rad/sec 3) -6.99E-02 rad/sec MODULATION LEVELS: +1.079 radians -1.104 -1.086 OFFSET: -1.023 radians +0.009 MODULATION TIMES: RISE 149 msec FALL 196 msec DUTY CYCLE: 0.75 % REGULATION BIT RATE: 968.73 Hz BURST TIMES: AVERAGE 50.3 msec CARRIER VARIATION 159.9 msec MESSAGE VARIATION 361.1 msec TOTAL DURATION 521.0 msec PEAK-TO-PEAK LEAKAGE LEVEL: 35.0 dBc LEAKAGE LENGTH: 0.1 msec	Slot: Box 1 HEXADECIMAL MESSAGE: 278E36854FFBFF BIT SYNCHRONIZATION: OK FRAME SYNCHRONIZATION: OK MESSAGE FORMAT: 1086 PROTOCOL FLAG: STANDARD CHANNEL: CANADA PROTOCOL CODE: SERIALIZED C/S IDENTIFIER No.: 109 SERIAL NUMBER: 1066 LATITUDE: Default (127.75) LONGITUDE: Default (256.75) ERROR CORRECTION CODE 1: OK ENCODED DATA SOURCE: External 121.5 MHz HOURS: Yes FIXED Baud: OK LATITUDE OFFSET: Default (+ 0° 60') LONGITUDE OFFSET: Default (+ 0° 60') ERROR CORRECTION CODE 2: OK
---	--

FIGURE 1.

11:53:54 DEC 14, 2000

Amb +25°C

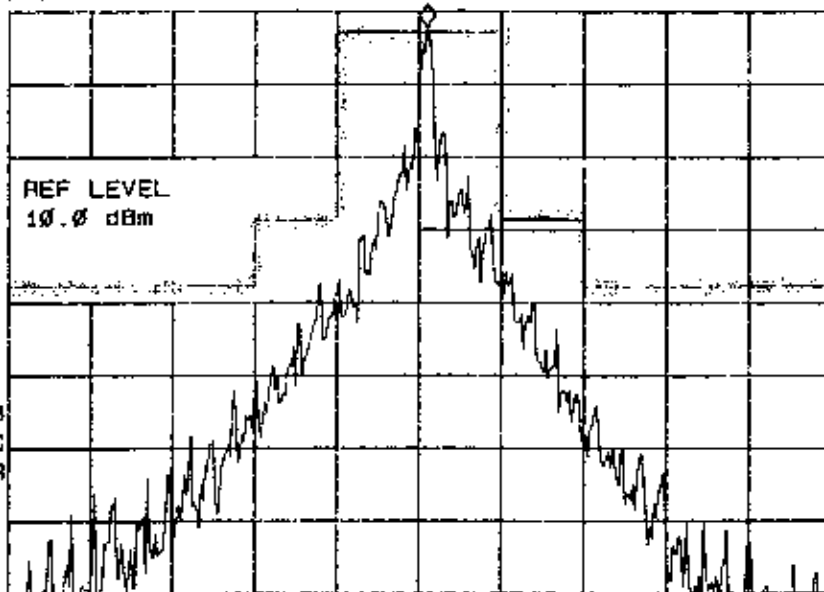
REF 10.0 dBm

AT 20 dB

MKR 121.5013 MHz

7.79 dBm

PEAK
LOG
10
dB/



MARKER
→ CF

MARKER
Δ

NEXT
PEAK

NEXT PK
RIGHT

NEXT PK
LEFT

More
1 of 2

CENTER 121.5000 MHz

*RES BW 300 Hz

*VBW 100 Hz

SPAN 125.0 kHz

SWP 12.5 sec

FIGURE 2

12/14/00
✗

13:22:23 DEC 14, 2000

-40°C

17

MKR Δ 12.2 kHz

REF 10.0 dBm

AT 20 dB

-31.56 dB

PEAK

LOG

10

dB/

MARKER
NORMAL

MARKER
4

MARKER Δ
12.2 kHz
-31.56 dB

MARKER
AMPTD

SELECT
1 2 3 4

WA SB
SC FC
CORR

MARKER 1
ON OFF

More
1 of 2

CENTER 121.5000 MHz

#RES BW 300 Hz

#VBW 100 Hz

SPAN 125.0 kHz

SWP 12.5 sec

12/14/00

FIGURE 3

14:52:31 DEC 14, 2000

455²⁰

REF 9.0 dBm

AT 20 dB

MARKER Δ -12.5 kHz

-35.19 dB

PEAK

LOG

10

dB/

MARKER

→ CF

MARKER

Δ

MARKER Δ

-12.5 kHz

-35.19 dB

NEXT

PEAK

NEXT PK

RIGHT

NEXT PK

LEFT

More

1 of 2

WA SB
SC FC
CORR

CENTER 121.5000 MHz

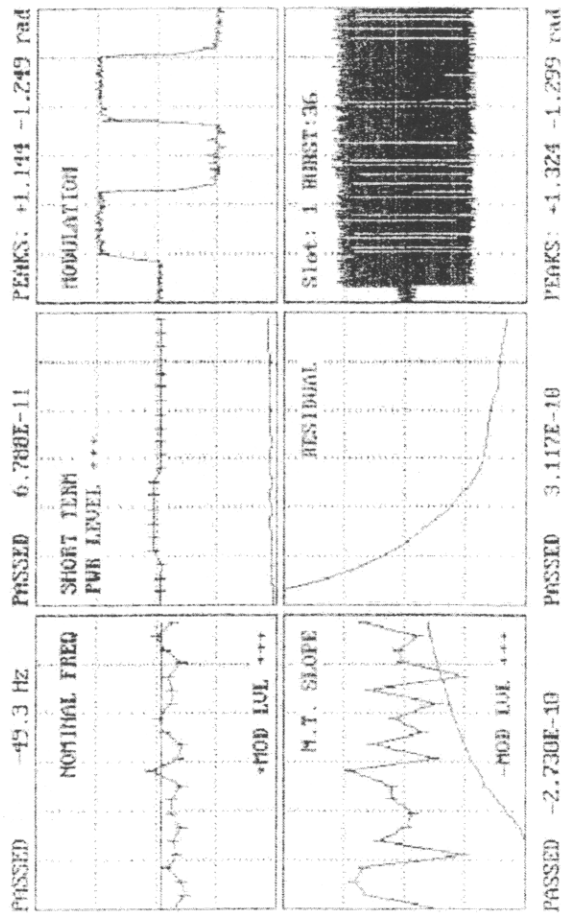
#RES BW 300 Hz

#VBW 100 Hz

SPAN 125.0 kHz

SWP 12.5 sec

FIGURE 4



INITIAL FREQUENCY:	406.00875 Mc
PEAK OUTPUT:	4.734 dbm's
CARRIER FREQUENCY:	+36.75 dbm
PULLER STABILITY:	1E-07 %
POWER RISE TIME:	50 nsec
PEAK VOLTAGE:	+0.256 volts
DUTY CYCLE:	1) +6.30E-02 rad/sec 2) -6.30E-02 rad/sec 3) +6.30E-02 rad/sec
MODULATION LEVELS:	+1.078 radians -1.078 radians
MODULATION TIMES:	-0.011 OFFSET RISE 150 nsec FALL 150 nsec
SWEEP RATE:	0.25 %
MODULATION BIT PERIOD:	398.7 Hz
BURST TIMES:	AG BURST: 50.3 sec CARRIER DURATION 159.9 msec MESSAGE DURATION 36.1 msec TOTAL DURATION 507.1 msec
REAR-END LEAKAGE LEVEL:	35.0 dbc
LEAKAGE LENGTH:	1 msec

FIGURE 5.



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SUMMARY

All tests were conducted in accordance with special procedures as identified at the beginning of each sequential procedure.

Results indicate that unit PLB-100 successfully met all minimum requirements as established in each test procedure.

- 1.0 Sequence of tests
- 2.0 General Test Conditions/Initial Aliveness Test
- A3.0 Vibration Test, Frequency
- A4.0 Bump Test
- A5.0 Salt Fog Test
- A6.0 Drop Test
- A7.0 Leakage and Immersion Tests
- A8.0 Spurious Emissions Test
- A11.0 Buoyancy Test (Category 1 only)
- 3.0 Performance Measurements/Extensive Aliveness Test

This concludes the Testing of the ACR Electronics PLB-100 testing to meet the performance standard of the RTCM Standard for 406 MHz Satellite Personal Locator BEACONS (PLB), RTCM PAPER 5-97/SC110-STD.



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SIGNATURE PAGE

Test conducted for:

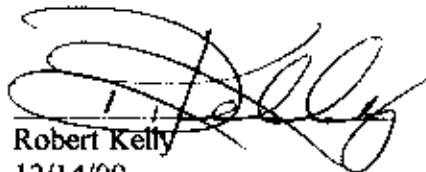
ACR Electronics, Inc.
5757 Ravenswood Road
Ft. Lauderdale, FL 33312-6645

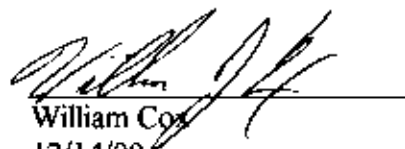
Test Program Directed By:
Q.C. Metallurgical, Inc.

Test Witnessed By:
ACR Electronics, Inc.

Test conducted by:

Q.C. Metallurgical, Inc.
2870 Stirling Road
Hollywood, FL 33020


Robert Kelly
12/14/00


William Cox
12/14/00