


**APPENDIX 12**  
**FCC PART 95.1402 COMPLIANCE REPORT**  
**Special Requirements for 406MHz PLBs.**  
**and**  
**FCC PART 2 SUBPART K**  
**Type Approval Application Requirements**  
**2.1033, 12 C**

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FCC ID: B66-ACR-PLB100  
Class 1/Category 1  
406MHz Personal Locator Beacon (PLB)  
Model PLB-100

|  |                    |                   |   |  |                              |                           |
|--|--------------------|-------------------|---|--|------------------------------|---------------------------|
| <b>ACR ELECTRONICS INC</b><br>5757 Ravenswood Road<br>FT. Lauderdale Fl.<br>(954) 981-3333 | DRAWN.<br>Bill Cox | DATE<br>3/31/2003 | <p align="center"><b>PLB-100</b><br/> <b>FCC TYPE</b><br/> <b>ACCEPTANCE</b><br/> <b>95.1402</b><br/> <b>PART K</b></p> |  |                              |                           |
|         | CHECKED.           |                   |   |  | DRAWING NO<br><b>PLB-100</b> |                           |
|  | ENG<br>Bill Cox    | 3/31/2003         |   |  |                              |                           |
|  | APVD               |                   |   |  | A<br>SIZE                    | 18560<br>CODE IDENT<br>NO |

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(ii) **LIST OF APPENDICES**

Appendix 1 .....Circuit Diagrams ..... Y1-01-0624  
 ..... Y1-01-0629  
 ..... Y1-01-0644  
 Circuit Diagrams are submitted as Proprietary data pursuant to 47 CFR 0.459 of the FCC rules with proprietary legend marked on the drawings.

Appendix 2 .....Instruction Manual

Appendix 3 .....Assembly Drawings  
 ACR A3-06-1961 ..... PLB Top Assy.  
 ACR A3-06-1990 ..... Battery Pack Assy.

Appendix 4 .....Label Drawings

Appendix 5 .....Photographs

Appendix 6 .....Independent Lab Test Report Cospas Sarsat T.001/.007 (US Army, EPG)

Appendix 7 .....Coast Guard approved Lab Test Report RTCM PAPER 76-2002/SC110-STD. (QC Metallurgical) 12/14/2000

Appendix 8 .....Coast Guard approved Lab Test Report RTCM PAPER 76-2002/SC110-STD. (QC Metallurgical) 3/17/1999

Appendix 9 .....Coast Guard RTCM testing approval and recommendation letter.

Appendix 10 .....Approval Certificates:  
 .....Cospas Sarsat ..... C/S T.001, T.007  
 .....Canada ..... RSS 187  
 .....Australia .....ACA Radio STD No 1,1996

Appendix 11 .....RTCM VER 1.1 76/2002/SC110-STD Compliance matrix

Appendix 12 .....FCC part 95.1402 and Part 2 compliance matrix (This Document)

**1.0 Compliance Statement for 95.1402:**

**As per 95.1400** This unit is intended for use to provide individuals in remote areas a means to alert others of an emergency situation and to aid search and rescue personal to locate those in distress,

**As per 95.1401** The ACR PLB-100 meets all the requirements for a G1D emission in the 406 to 406.1 MHz frequency range.

**As per 95.1402** This report and attached appendices contain the required information and relevant test data for Type Acceptance Approval for the **PLB-100** under PART 95.1402 Subpart K of CFRs 47. The **PLB-100** has met the entire RTCM recommended standard for a Class 1 Category 1 406 MHz PLB of Version 1.1 RTCM paper 76-2002/SC110-STD including the Addendum 23-2003/SC110-274 adding Morse P code to the homing beacon signal.

In meeting all the specification on the above mentioned rules ACR request a type approval grant per the FCC rule 95.1402 and request a type approval grant stating such.



The Beacon generates a phase modulated 406 MHz signal for transmission of the distress message. The 406 MHz carrier is frequency synthesized by a PLL, U5-0629. It is locked to an OCXO (U9-0636) to provide the high frequency stability required for the COSPAS-SARSAT system. The VCO is built around Q1-0636 in a common base configuration. The carrier is phase modulated by the phase lock loop filter of the PLL, U4-0635. U1-0644 and Q10-0644 then amplify the phase-modulated signal to provide 5W output at the antenna.

The Beacon also has a 121.5 MHz homing signal. The 121.5 MHz is generated by a crystal (Y1-0644) controlled oscillator (Q7-0644) for frequency stability of better than  $\pm 50$  PPM over the full operating temperature range. Q5-0644 and Q6-0644 amplify the carrier to provide a nominal power output at the antenna of 50 mW. This signal is AM modulated by a microprocessor controlled switch interrupting the regulated supply voltage for Q5-0644. The Microprocessor modulates the carrier in an audio swept tone and controls the Morse P in the homing signal.

The modulation and other controls for the Beacon are generated by a microprocessor (U2-0629). This processor provides digital signals for both the 406 MHz and the 121.5 MHz modulations. Microprocessor (U1-0624) controls the LED's, a buzzer, and other intrinsic timing functions.

The **PLB-100** contains a battery pack consisting of three "5/4 C" size cells of Lithium Sulfur Dioxide LiSO<sub>2</sub> chemistry. The battery pack will have a 5-year replacement cycle. The enclosure is made of high impact, corrosion resistant, ultra violet resistant plastic that is in a high vis yellow color.

The **PLB-100** is operated manually by activation of the on/off switch. The PLB-100 is CAT 1 PLB. Throughout this document, the **PLB-100** may be referred to as the Beacon or PLB.

**11) Label photographs/Drawings** See appendix 5

**12) Unit photographs** See appendix 5

**13) Digital Modulation system**

The modulation for the 406 MHz signal passes through a one pole RC filter provided by R11-0636, R12-0636 and C16-0636. The purpose for this filter is to provide the rise and fall times (150  $\mu$ s nominal) for the modulating data. This provides the necessary filtering of the 400 baud data rate to ensure that spectral mask requirements are met.

The 121.5 MHz is digitally modulated by the microprocessor (U2-0629) that applies or removes voltage from the intermediate amplifier (Q5-0644) to apply or remove the carrier from the P.A. (Q5-0644) stage.

**3.0 ) Data required by 2.1041, and**

**2.1046 RF POWER OUTPUT Complies Appx 6 pg. 2-1, A-5, Appx 7 Fig 5**

The unit complied by laboratory testing and met the specified output power requirement of 37 dBm as per the Cospas Sarsat T.001 specification and also the 121.5 MHz power requirement was met as per the RTCM Ver 1.1 Standard for personal locator beacon. ERP and 50 ohm measurements where made to ensure compliance see test reports.

**2.1047 Digital Modulation: Complies Appx 6 pg. 2-1, A-1, Appx 7 Fig 5**

Unit complied by laboratory testing by meeting the digital modulation requirements as per the Cospas Sarsat T.001 specification.

**2.1049 Occupied Bandwidth Measurement Complies Appx 7 Section 9 and Appendix 6**

Unit complied by laboratory testing by meeting the occupied bandwidth requirements as per the Cospas Sarsat T.001 specification and as per the RTCM standard 1.1 for personal locator beacons.

**2.1051 Spurious Radiation Suppression Complies Appx 6 pg. 2-1, A-12**

Unit complied by laboratory testing with the spectrum and mask requirements as per the Cospas Sarsat T.001 specification and as per the RTCM standard 1.1 for personal locator beacons.

Spurious radiation is suppressed by means of power supply decoupling (various capacitors and inductors), low phase noise oscillators, and limited bandwidth features (L5-0636-, C37-0636- ) and filtering by the antenna matching (L1, L2, L3, L4, C1 and C24-0636- ) networks.

Limitations to the modulation of the 406 MHz signal consist of a current source provided by resistors (R6, R7, R11 and R12-0636). These resistors limit the current into the phase lock loop detector circuit (U4B-0636) and the currents set the level of modulation. The 121.5 MHz modulation is limited by microprocessor control of Q5-0644 that digitally turns on or off the output power.

A regulated control voltage limits the maximum power output of the 406 MHz amplifier (U5-0635). Under best battery voltage, maximum power is limited to 7.9W.

Power limiting for the 121.5 MHz output is obtained by operating the P.A. (Q5-0644) saturated.

ITU Radio Regulations state that Personal locator beacons have no spurious limits under Appendix 3 Table II page 19 of the rules. 1998.

**2.1053 Field Strength of Spurious Radiation Complies Appx 6 pg. 2-1, A-12**

Unit complied by laboratory testing with the spectrum and mask requirements as per the Cospas Sarsat T.001 specification and as per the RTCM standard 1.1 for personal locator beacons.

ITU Radio Regulations state that Personal locator beacons have no spurious limits under Appendix 3 Table II page 19 of the rules. 1998.

**2.1055 Frequency Stability Complies** **Appx 6 pg. 2-2, D1-4 Appx 7 Fig 5**  
 Unit complied by laboratory testing for the frequency stability requirements as per the Cospas Sarsat T.001 specification and as per the RTCM standard 1.1 for personal locator beacons.

**2.1057 Frequency spectrum to be investigated.**

Unit complied by laboratory testing with the spectrum requirements as per the Cospas Sarsat T.001 specification and as per the RTCM standard 1.1 for personal locator beacons.

ITU Radio Regulations state that Personal locator beacons have no spurious limits under Appendix 3 Table II page 19 of the rules. 1998.

**4.0) INDEX FOR REQUIRED TEST DATA** (Reference to COSPAS-SARSAT Test Report, Appendix 6 and QC Metallurgical Test Report, Appendix 7 & 8; Per FCC 2.1041.

| <u>FCC REF.</u> | <u>PLB RTCM STANDARD REF.</u>   | <u>Test data Appendix List:</u>   |
|-----------------|---|---|
| 2.1046          | 2.1 Output Power  | Appx 6 pg. 2-1, A-5, Appx 7 Fig 5   |
| 2.1047          | 2.1 Data Encoded<br>2.1 Modulation Level<br>2.1 Modulation Rise and Fall<br>2.1 Digital Message | Appx 6 pg. 2-1,A-1, Appx 7 Fig 5<br>Appx 6 pg. 2-1, A-3 Appx 7 Fig 5<br>Appx 6 pg. 2-1, A-3 Appx 7 Fig 5<br>Appx 6 pg. 2-1, Appx 7 Figure 5 |
| 2.1049          | 2.1 Occupied Bandwidth  | Appx 6 pg. 2-1, A-13  |
| 2.1051,53       | 2.1 Spurious Emissions  | Appx 6 pg. 2-1, A-12  |
| 2.1055          | 2.1 Frequency Stability   | Appx 6 pg. 2-2, D1-4 Appx 7 Fig 5   |
| 2.1057          | 2.1 Frequency Spectrum  | Appx 6 pg. 2-1, A16   |

**Index to Test Data Reports for 121.5 MHz:**

| <u>FCC REF.</u> | <u>PLB RTCM STANDARD REF.</u>   | <u>Test data Appendix List:</u>       |
|-----------------|---|---------------------------------------|
| 2.1046          | 2.1 Output Power.   | Appx 8, Par. 9.2,                     |
| 2.1047          | 2.1 Modulation Characteristics<br>Frequency<br>Duty Cycle<br>Factor<br>Sweep Rate | Appx 8, Par 9.4                       |
| 2.1049          | 2.1 Occupied Bandwidth  | Appx 8, Par. 9.5                      |
| 2.1051,53       | 2.1 Spurious Emissions  | Appx 8, Par. 9.5                      |
| 2.1055          | 2.1 Frequency Stability   | Appx 8, Par. 9.4                      |
| 2.1057          | 2.1 Frequency Spectrum  | Appx 8, Par. 9.5<br>Appx 7, Par. A8.0 |
| 80.1061(b)      | Carrier Coherence   | Appx 8, Par. 9.5                      |

**TABLE 1: FUNCTION OF ACTIVE ELEMENTS**

| <b>DESIGNATOR</b> | <b>FUNCTION</b>                 |
|-------------------|---------------------------------|
| U3,4-0629         | VOLT REG., MIC2954              |
| U7-0629           | VOLT REG., LP2980               |
| Q2,5,6-0629       | XSTR SWITCH, MMBT2907           |
| U2-0629           | MICROPROCESSOR, PIC16C57A       |
| Q1-0629           | XSTR SWITCH, MMBT3904           |
| U1-0629           | EEPROM, X24C01                  |
| Q7-0629           | VOLT SUPERVISOR, MAX809         |
| Q7-0629           | Power Supervisor, 3.8V          |
| Q1-0629           | XSTR SWITCH, MMBT3904           |
| U5-0636           | RF AMP, HP2111                  |
| U6-0636           | PRESCALER MC12080D              |
| U9-0636           | OVENIZED OSCILLATOR             |
| Q1-0636           | VCO, MMBR521LT                  |
| U1-0644           | PWR AMP., M687321               |
| Q3-0644           | P-FET, SWITCH, RFD1505SM        |
| U2-0644           | VOLT REG, MAX667                |
| Q5,Q10-0644       | RF AMP, NE85633                 |
| Q1,9-0644         | XSTR SWITCH, MMBT3904           |
| Q7,8,9-0644       | 121.5 MHz RF AMP / OSC, MMBR901 |
| U1-0624           | MICROPROCESSOR, PIC16C622       |
| Q3-0624           | XSTR SWITCH, MMBT3906           |
| Q3,4-0624         | XSTR SWITCH, MMBT3904           |
| Q2-0624           | PHOTODETECTOR, QSC112           |
| Q5-0624           | XSTR SWITCH, CMPT930            |

**ACR ELECTRONICS INC.**

CODE IDENT  
NO  
18560

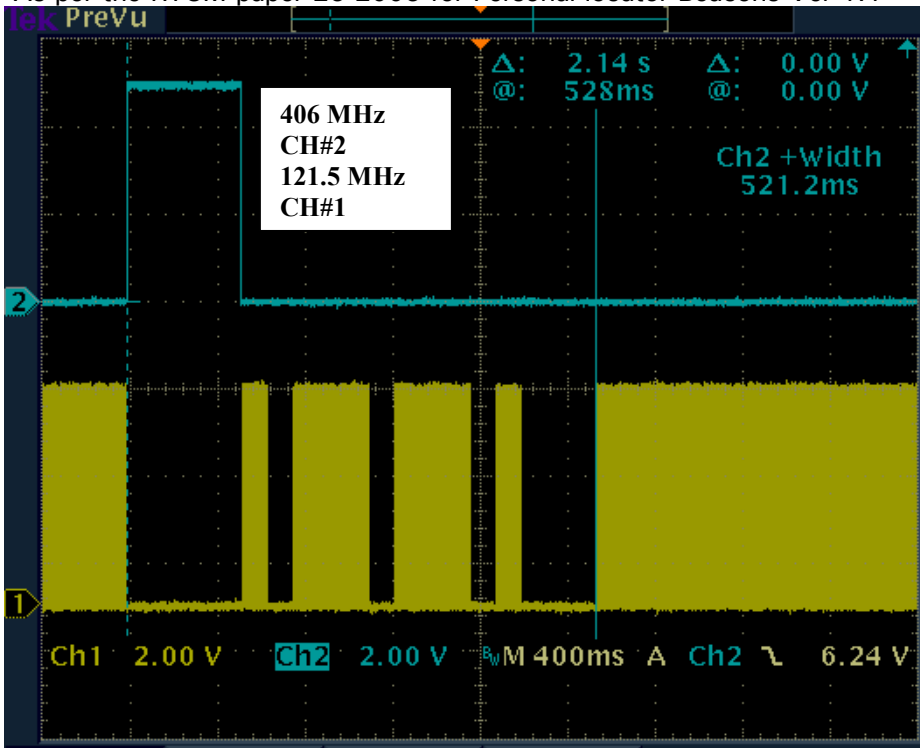
SHEET  
-8-

TEST PROCEDURE  
**PLB-100**

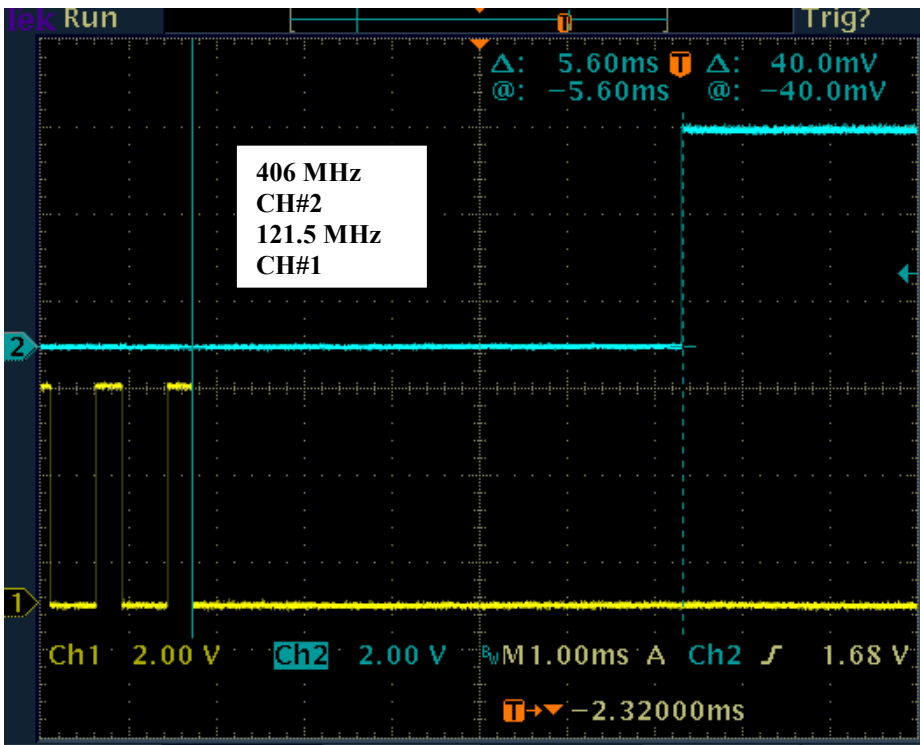
REV  
B



Part 95.1402 Morse P data: Following data shows compliance of the MORSE P in the homing signal.  
As per the RTCM paper 23-2003 for Personal locator Beacons Ver 1.1

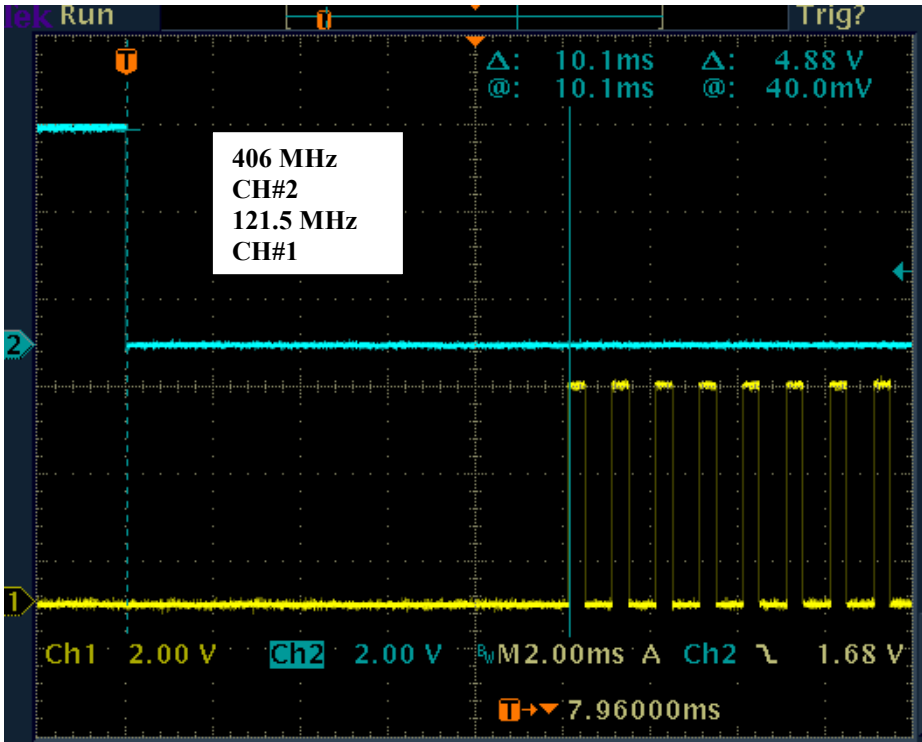


Timing shows end of Homer, 406 Burst and start and end of Morse P.  
Complies to RTCM Addendum 76-2002 For PLBs Ver 1.1



Timing shows end of Homer modulation, and beginning of 406 MHz Burst 5.6mS.  
Complies to RTCM Addendum 76-2002 For PLBs Ver 1.1

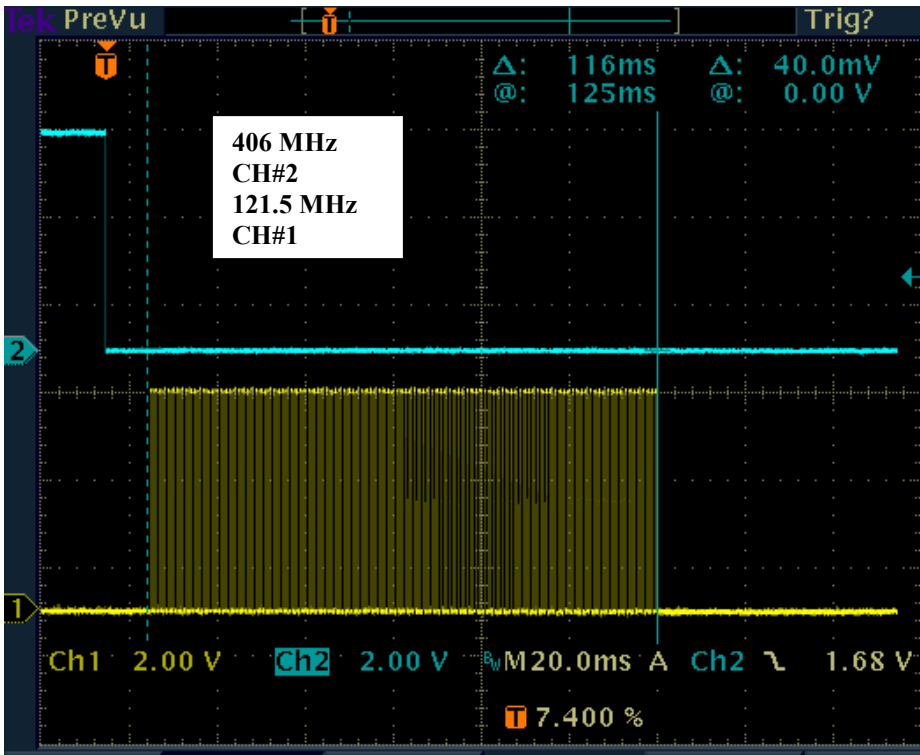
|                      |                        |              |                           |          |
|----------------------|------------------------|--------------|---------------------------|----------|
| ACR ELECTRONICS INC. | CODE IDENT NO<br>18560 | SHEET<br>-9- | TEST PROCEDURE<br>PLB-100 | REV<br>B |
|----------------------|------------------------|--------------|---------------------------|----------|



Timing shows end of 406 MHz burst, and beginning of Morse P 10.1mS.

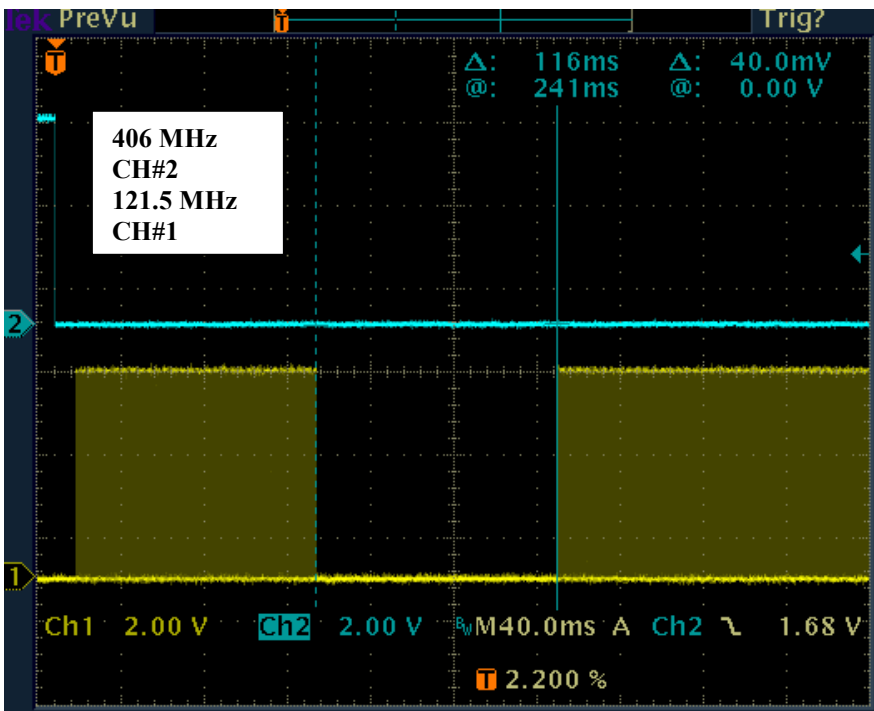
Complies to RTCM Addendum 76-2002 For PLBs Ver 1.1

|                      |                        |               |                                  |          |
|----------------------|------------------------|---------------|----------------------------------|----------|
| ACR ELECTRONICS INC. | CODE IDENT NO<br>18560 | SHEET<br>-10- | TEST PROCEDURE<br><b>PLB-100</b> | REV<br>B |
|----------------------|------------------------|---------------|----------------------------------|----------|



Timing shows Morse code character "Dot" in specification. 116 mS.

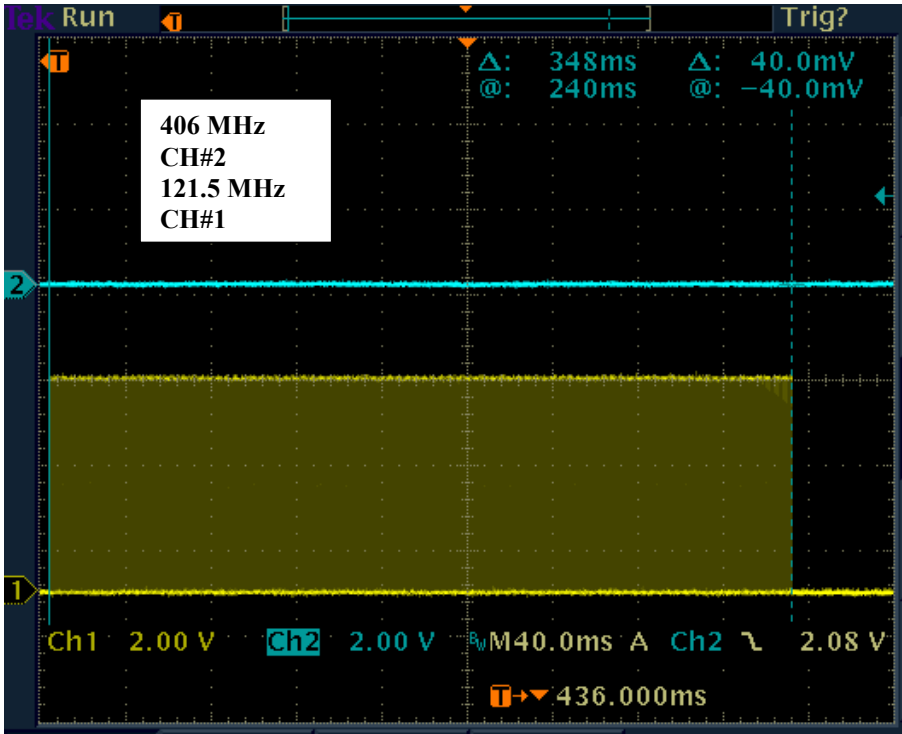
Complies to RTCM Addendum 76-2002 For PLBs Ver 1.1



Timing shows Morse code character "Space" in specification. 116 mS.

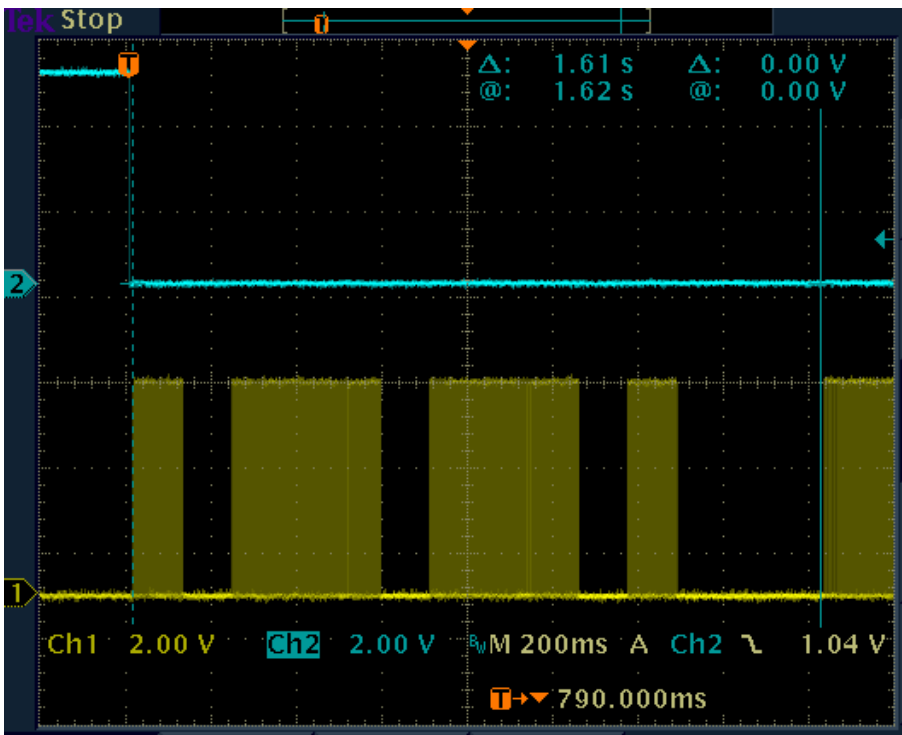
Complies to RTCM Addendum 76-2002 For PLBs Ver 1.1

|                      |                        |               |                           |          |
|----------------------|------------------------|---------------|---------------------------|----------|
| ACR ELECTRONICS INC. | CODE IDENT NO<br>18560 | SHEET<br>-11- | TEST PROCEDURE<br>PLB-100 | REV<br>B |
|----------------------|------------------------|---------------|---------------------------|----------|



Timing shows Morse code character "Dash" in specification. 348 mS.

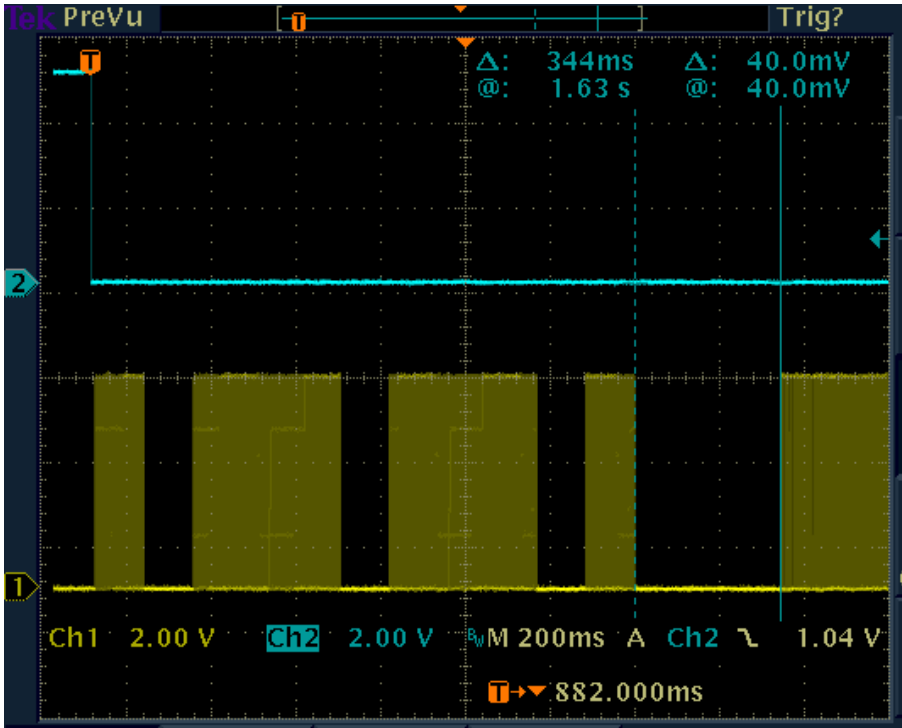
Complies to RTCM Addendum 76-2002 For PLBs Ver 1.1



Timing shows Entire Morse code character "P" in specification. 1.61 Second.

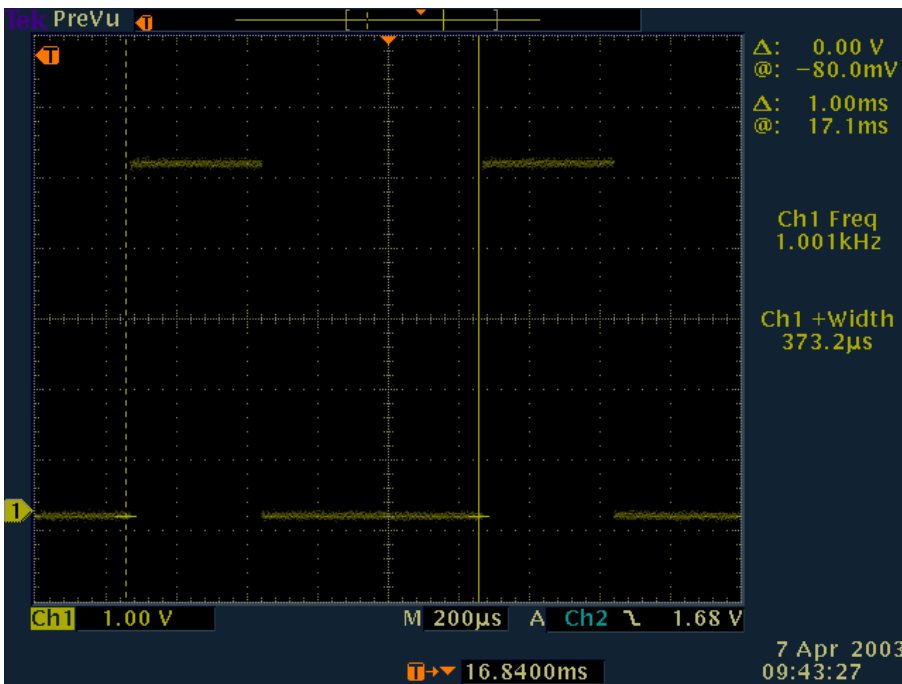
Complies to RTCM Addendum 76-2002 For PLBs Ver 1.1

|                      |                        |               |                           |          |
|----------------------|------------------------|---------------|---------------------------|----------|
| ACR ELECTRONICS INC. | CODE IDENT NO<br>18560 | SHEET<br>-12- | TEST PROCEDURE<br>PLB-100 | REV<br>B |
|----------------------|------------------------|---------------|---------------------------|----------|



Timing shows complete Morse character is in specification.  
1.63 Seconds

Complies to RTCM Addendum 76-2002 For PLBs Ver 1.1



Timing shows modulation of Morse P character to be 1 kHz.  
37.3% Duty Cycle

Complies to RTCM Addendum 76-2002 For PLBs Ver 1.1

This concludes the test report for the PLB-100.

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|                             |                           |               |                                  |          |
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| <b>ACR ELECTRONICS INC.</b> | CODE IDENT<br>NO<br>18560 | SHEET<br>-14- | TEST PROCEDURE<br><b>PLB-100</b> | REV<br>B |
|-----------------------------|---------------------------|---------------|----------------------------------|----------|