

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

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

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



DRAWN. Bill Cox	DATE 3/31/2003	
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ENG Bill Cox	3/31/2003	
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SIZE	CODE IDENT NO	Of 14

PLB-100
FCC TYPE
ACCEPTANCE
95.1402
PART K

DRAWING NO
PLB-100

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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.

2.0 INFORMATION REQUIRED FOR TYPE ACCEPTANCE as per FCC 2.1033, 12C

- 1) **Name of Applicant:** ACR Electronics, Inc. (manufacturer)
5757 Ravenswood Road
Ft. Lauderdale, Fl.
33312

- 2) **Identification of Equipment:**
FCC ID: B66-ACR-PLB100
Class 1 Temp Range
Category 1
Model: PLB-100
Operating 1 -40° to +55 °C
Stowage -55° to +70°C
Unit Floats

- 3) **Operation Instructions** See Appendix 2

- 4) **Type of Emissions:** 406 MHz 16K0G1D
121.5 MHz (Swept Tone) 3K20A3X
121.5 MHz (Morse P) 2K00A2A

- 5) **Frequency Range:** 406.0-406.100 MHz $\pm$.0005%
121.5 MHz $\pm$.005%
The 406MHz carrier is phase locked to a high stability oven controlled oscillator as required for the COSPAS-SARSAT system. The 121.5 MHz carrier is generated by a crystal controlled oscillator (Y1-01-0636, Q12-0636).

- 6) **Range of Operating Power:** 406 MHz - 5W $\pm$ 2dB
121.5 MHz - 25 mW -0, +6 dB

- 7) **Maximum Output Power** 406 MHz - 7.9 W
121.5 MHz - 99 mW

- 8) **DC Voltages and Currents:** 406 MHz - 8.2 V, 1.95 A @ U1-0644
121.5 MHz - 8.7 V, 13 mA @ Q5-0644

- 9) **Tune up procedure for power range**

There is no tuning required for the 406 MHz 5 watt signal. For the 121.5 MHz output, the power output is peaked by tuning L9-0644. The antenna-matching network is tuned at 406 MHz by adjusting C8-0624 and L3-0624 and measuring the return loss into the antenna coupler network. The antenna matching network is tuned at 121.5 MHz by adjusting L4-0624 and L2-0624 and measuring the return loss into the antenna coupling network.

- 10) **DESCRIPTION OF CIRCUITRY:** (Refer to Schematics ACR Y1-01-0624, Y1-01-0644 and Y1-01-0629 Appendix 1)

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 ± 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 LiSO₂ 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 μ 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
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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
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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	Appx 6 pg. 2-1, A-1, Appx 7 Fig 5
	2.1 Modulation Level	Appx 6 pg. 2-1, A-3 Appx 7 Fig 5
	2.1 Modulation Rise and Fall	Appx 6 pg. 2-1, A-3 Appx 7 Fig 5
	2.1 Digital Message	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	Appx 8, Par 9.4
	Frequency	
	Duty Cycle	
	Factor	
	Sweep Rate	
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
		Appx 7, Par. A8.0
80.1061(b)	Carrier Coherence	Appx 8, Par. 9.5

TABLE 1: FUNCTION OF ACTIVE ELEMENTS

DESIGNATOR	FUNCTION
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

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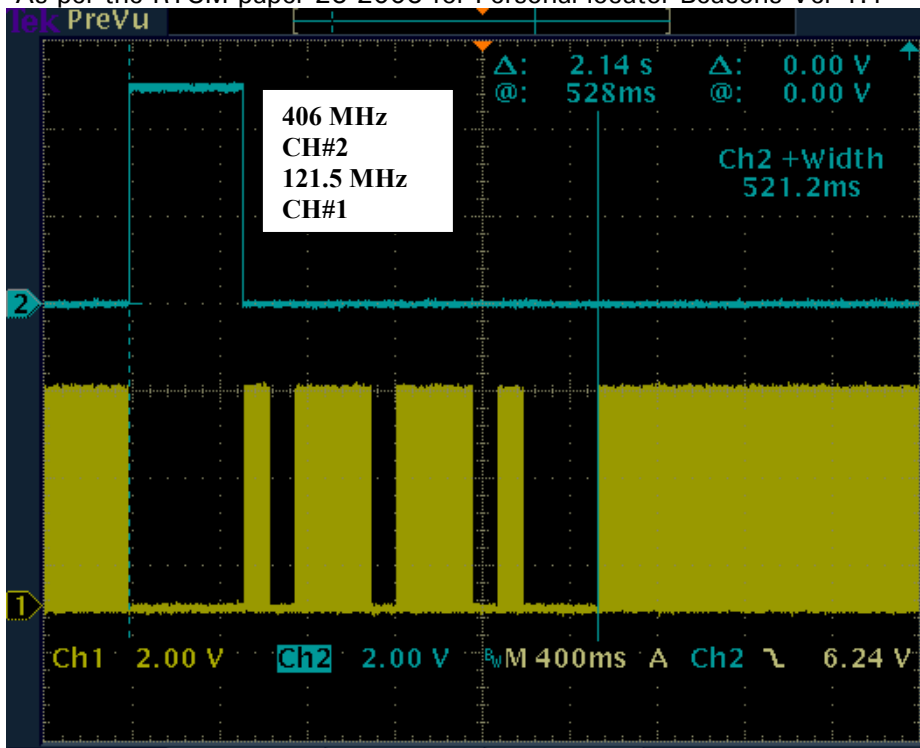
CODE IDENT
NO
18560

SHEET
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TEST PROCEDURE
PLB-100

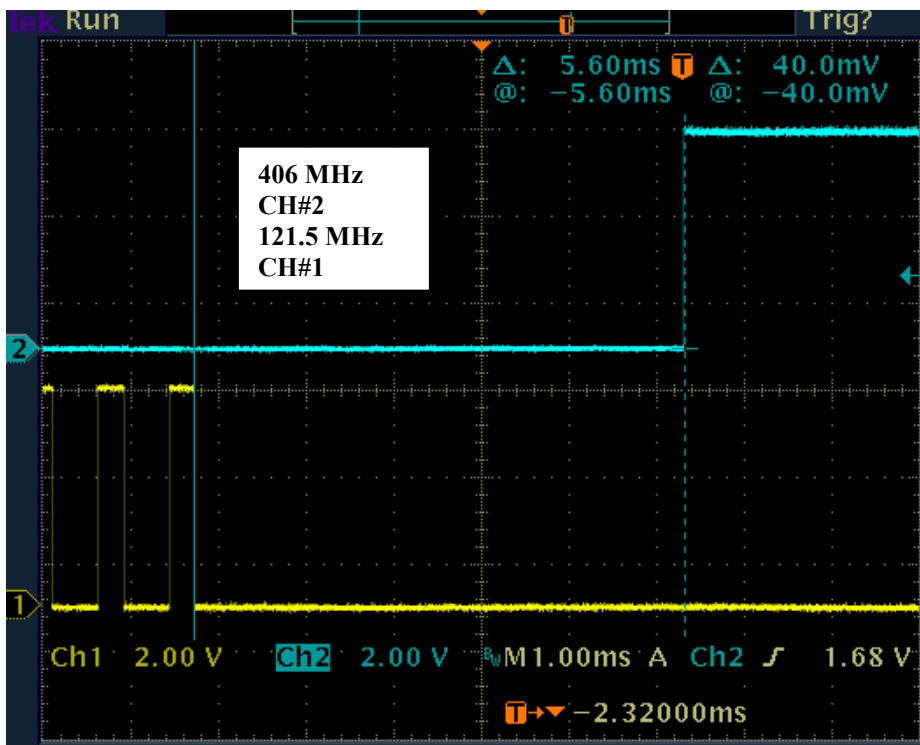
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Part 95.1402 Morse P data: Following data shows compliance of the MORSE P in the homing signal.
As per the RTCM paper 23-2003 for Personal locator Beacons Ver 1.1



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

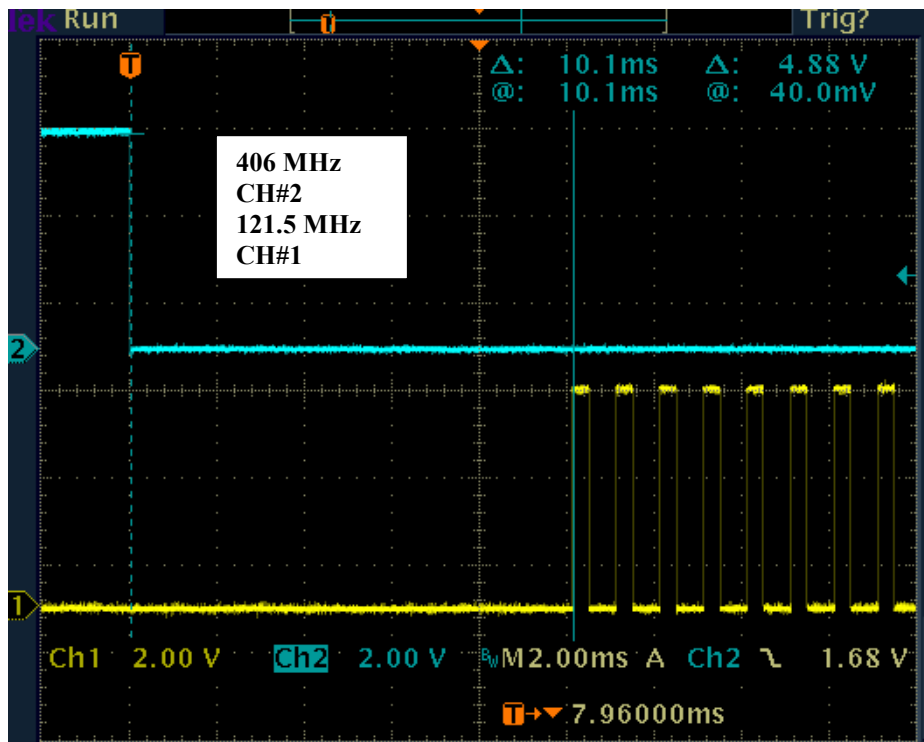
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CODE IDENT
NO
18560

SHEET
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TEST PROCEDURE
PLB-100

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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

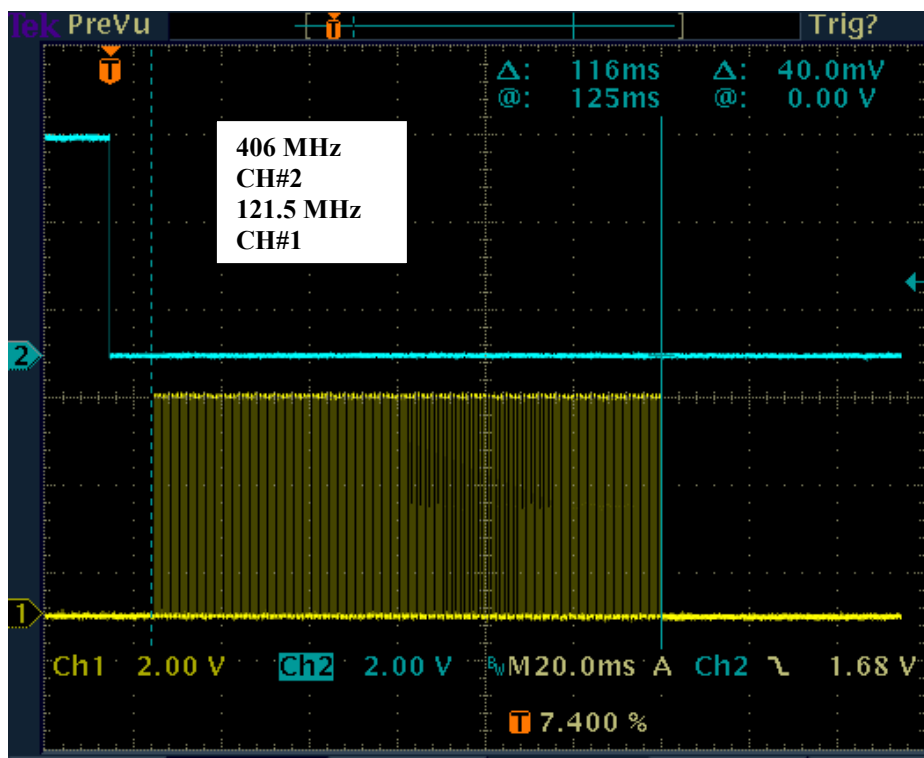
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CODE IDENT
NO
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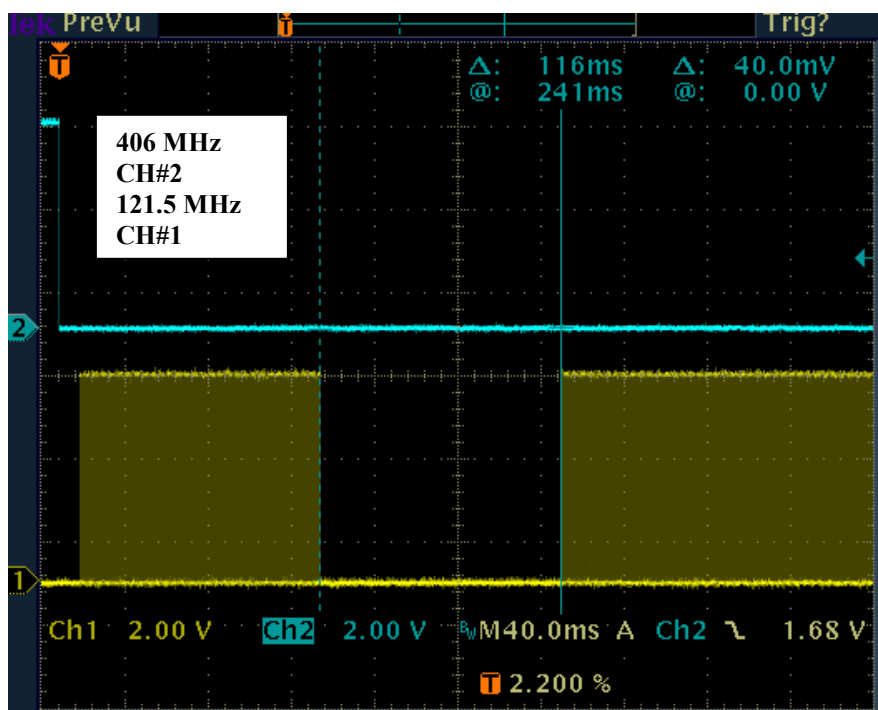
TEST PROCEDURE
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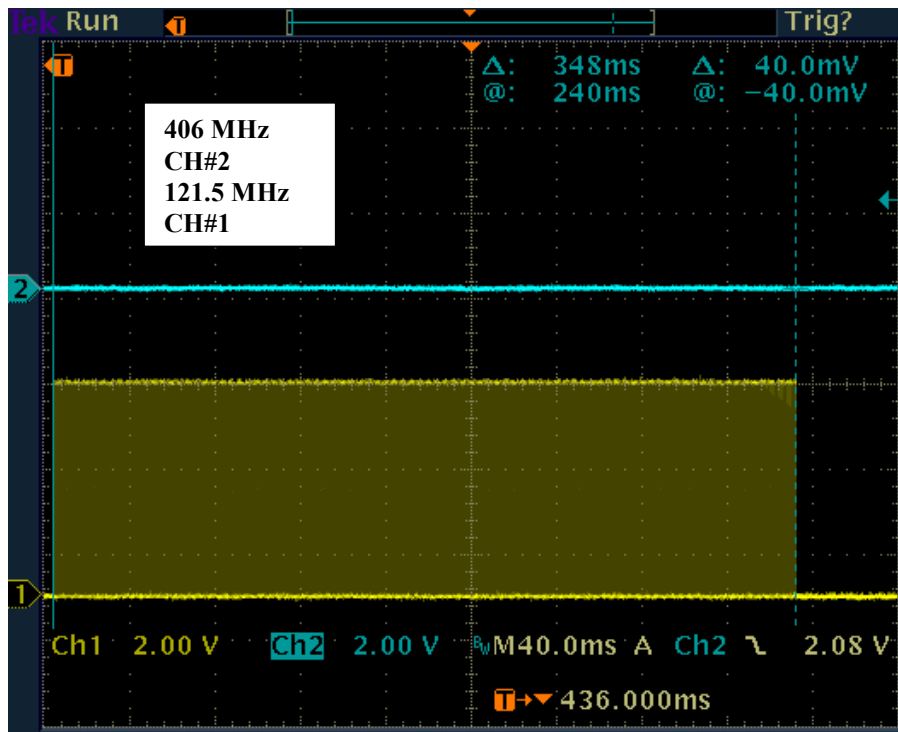
Timing shows Morse code character "Dot" in specification. 116 mS.

Complies to RTCM Addendum 76-2002 For PLBs Ver 1.1



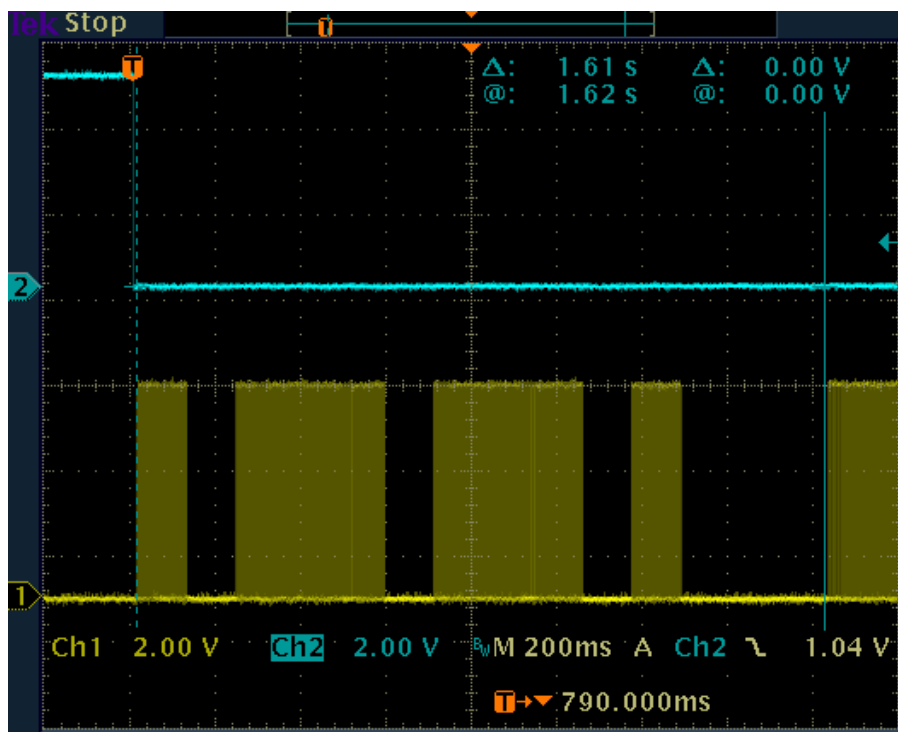
Timing shows Morse code character "Space" in specification. 116 mS.

Complies to RTCM Addendum 76-2002 For PLBs Ver 1.1



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

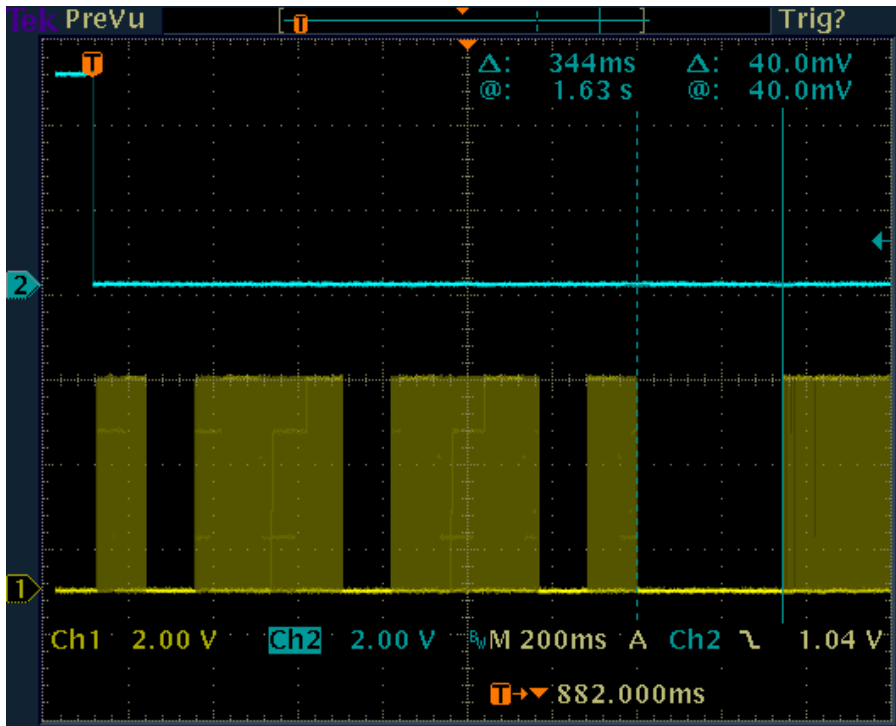
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-12-

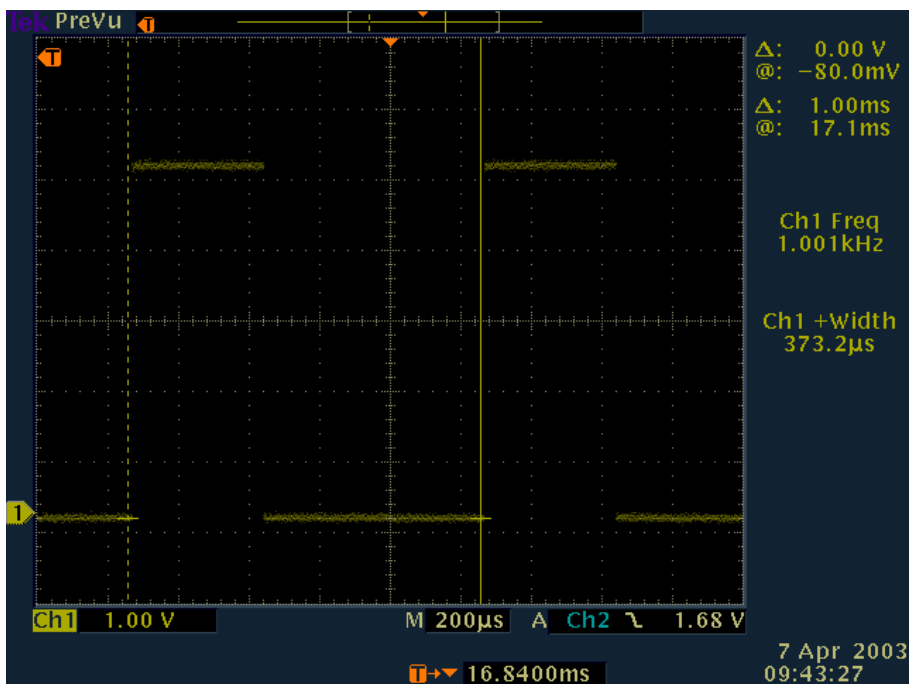
TEST PROCEDURE
PLB-100

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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

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TEST PROCEDURE
PLB-100

REV
B

This concludes the test report for the PLB-100.

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