

TYPE ACCEPTANCE APPLICATION

FOR

ACR/RLB-35



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1.0 INTRODUCTION

This report contains the required information and test data for Type Acceptance Approval for the **ACR/RLB-35 406 MHz** Emergency Position Indicating Radio Beacon (EPIRB). The **ACR/RLB-35** meets all of the current FCC requirements for a 406 MHz EPIRB.

The **ACR/RLB-35** contains a battery pack consisting of three “D” size cells of Lithium Sulfur Dioxide chemistry. The battery pack will have a 5-year replacement cycle. The enclosure is made of high impact, corrosion resistant, ultra violet resistant plastic.

The **ACR/RLB-35** has an active internal GPS. The **ACR/RLB-35** can be operated manually or with an automatic release bracket. Hence, there is a Cat I and Cat II for the **ACR/RLB-35**. Throughout this document, the **ACR/RLB-35** may be referred to as the Beacon or EPIRB.

2.0 GENERAL INFORMATION REQUIRED FOR TYPE ACCEPTANCE

Per FCC 2.1033 (c)

- | | | |
|----|--|---|
| 1) | Name of Applicant:
Mailing Address: | ACR Electronics, Inc. (manufacturer)
5757 Ravenswood Road
Fort Lauderdale, FL 33312 |
| 2) | FCC ID: B66ACR-RLB-35 | Model: RLB-35 Cat I Class 1
RLB-35 Cat II Class 1 |
| 3) | Instruction Manual: | APPENDIX 2 |
| 4) | Type of Emission: | 406 MHz - 16K0G1D
121.5 MHz – 3K20A3X |
| 5) | Frequency Range: | 406.025 MHz ± .002 MHz
121.5 MHz ± .006 MHz |
| 6) | Range of Output Power: | 406 MHz - 5W ± 2dB
121.5 MHz - 50 mW ± 3 dB |
| 7) | Maximum Output Power (into 50 ohm): | 406 MHz - 7.9 W
121.5 MHz - 100 mW |
| 8) | DC Voltages and Currents: | 406 MHz - 8.2 V, 2.0 A @ U5-0635
121.5 MHz – 8.7 V, 11 mA @ Q3-0653 |
| 9) | Tune-up Procedures: | |

There is no tuning required for the 406 MHz 5 watt signal. There is no tuning required for the 121.5 MHz 0.05 watt signal. The antenna-matching network is tuned at 406 MHz by adjusting C38-0652 and L6-0652 and measuring the return loss into the antenna coupler network. The antenna matching network is tuned at 121.5 MHz by adjusting L3-0652 and L4-0652 and measuring the return loss into the antenna coupler network.

10) Schematic Diagram: APPENDIX 1

Description of Circuitry (Refer to Schematic ACR Y1-01-0635, Y1-01-0636, Y1-01-0652 and Y1-01-0653 (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, U4-0635. 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. U5-0636, Q3-0635 and U5-0635 then amplify the phase-modulated signal to provide 5W output at the antenna.

The Beacon also has a 121.5 MHz radio beacon output. The 121.5 MHz is generated by a crystal (Y1-0653) controlled oscillator (Q1-0653) for frequency stability of better than ± 50 PPM over the full operating temperature range. Q2-0653 and Q3-0653 amplify the carrier to provide a nominal power output at the antenna of 50 mW. This signal is AM modulated by switching the 121.5 MHz drive signal on and off using Q5-0653 and U1-0653.

The modulation and other controls for the Beacon are generated by a microprocessor (U5-0652). This processor provides digital signals for both the 406 MHz and the 121.5 MHz modulations as well as for LED's, a buzzer, strobe flashes, and other functions. The Beacon also incorporates a strobe light as required for 406 MHz EPIRBs.

The RLB-35 has an internal GPS receiver that operates while the beacon is turned ON. This GPS receiver sends GPS navigation data to the microprocessor (U5-0652) for incorporation into the 406 beacon message.

Description of Devices:

TABLE 1: FUNCTION OF ACTIVE ELEMENTS

DESIGNATOR	FUNCTION
U1,2-0635	VOLT REG., MIC2954
U3-0635	VOLT REG., LP2980
U5-0635	PWR AMP., M687321
Q1,7,8,9-0635	XSTR SWITCH, MMBT2907
Q2,4,5-0635	XSTR SWITCH, MMBT3904
Q3-0635	RF AMP, NE85633
Q6-0635	P-FET,SWITCH, RFD1505SM
U1A,B;U2A,B-0636	D FLIP-FLOP, MC74VHC74A
U3,7,8-0636	XOR, NC7SZ86
U4A,B,C,D-0636	AND, MC74VHC00A
U5-0636	RF AMP, HP2111
U6-0636	PRESCALER MC12080D
U9-0636	OVENIZED OSCILLATOR
Q1-0636	VCO, MMBR521LT
U1-0652	DUAL NAND GATE
U2-0652	VOLT REG, MAX667
U3-0652	VOLT SUPERVISOR
U4-0652	VOLT REG, MIC5201
U5-0652	MICROPROCESSOR, PIC16LF877
U6-0652	IR TRANSCEIVER, HSDL3610
U7-0652	GPS RECEIVER, SWIFT A1
Q1-0652	XSTR SWITCH, MMBT2222A

DESIGNATOR	FUNCTION
Q2,6,7,9-0652	XSTR SWITCH, BC850C
Q3-0652	FET SWITCH, ME8PO6
Q4-0652	XSTR SWITCH, FMMT718
Q5,-0652	XSTR SWITCH, MMBT3904
Q8-0652	XSTR SWITCH, MMBT3906
Q10,11-0652	FET SWITCH, 2N7002
CR1-0652	SCR, CMPS5064
CR2-0652	RECTIFIERS, CMPD2004S
CR3-0652	DIODES, BAV-74
D3-0652	DIODE, HSMS2800
U1-0653	RF SWITCH
U2-0653	XOR GATE
Q1-0653	RF OSCILLATOR
Q2-0653	RF AMP
Q3-0653	RF P.A.
Q4,5,-0653	BIAS
Q12-0653	LIMITER

Circuitry for Determining and Stabilizing Frequency:

The 406.025 MHz 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 (Y1-0653, Q1-0653).

Circuitry for Suppression of Spurious Radiation:

Spurious radiation is suppressed by means of power supply decoupling (various capacitors and inductors), low phase noise oscillators, and limited bandwidth features (L15, L23, C4, C5, C7, C48, C49-0653) and filtering by the antenna matching (L1, L2, L3, L4, L6, C9, C38 and C42-0652) networks.

Circuitry for Limiting Modulation:

Limitations to the modulation of the 406 MHz signal consists 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 U1 and Q5-0653 that digitally turns on or off the output power.

Circuitry for Limiting 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. (Q3-0653) saturated.

- 11) **Identification Label:** APPENDIX 4
- 12) **Photographs:** APPENDIX 5
- 13) **Digital Modulation:**

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 to ensure that spectral mask requirements are met.

The 121.5 MHz is digitally modulated by the microprocessor (U5-0652) that controls transistor (Q5-0653) and switch (U1-0653) to apply or remove the carrier from the P.A. (Q3-0653) stage.

- 14) **Measurement Test Data** (Refer to COSPAS-SARSAT Test Report, Appendix 6):

Index to Test Data Reports For 406 MHz:

<u>FCC REF.</u>	<u>RTCM STANDARD REF.</u>	<u>INTESPACE TEST REPORT :</u>
2.1046	2.1 Output Power	pg. 5
2.1047	2.1 Data Encoded	pg. 5
	2.1 Modulation Level	pg. 7
	2.1 Modulation Rise and Fall	pg. 7
	2.1 Digital Message	pg. 6

2.1049	2.1 Occupied Bandwidth	pg. 7 (<i>see graphs on pg 28 - 30</i>)
2.1051,53	2.1 Spurious Emissions	pg. 7
2.1055	2.1 Frequency Stability	pg. 9 & 10
2.1057	2.1 Frequency Spectrum	pg. 10

Index to Test Data Reports For 121.5 MHz:

<u>FCC REF.</u>	<u>RTCM STANDARD REF.</u>	<u>QC METALLURGICAL TEST REPORT :</u>
2.1046	2.1 Output Power	Para. 23.2
2.1047	2.1 Modulation Characteristics Frequency Duty Cycle Factor Sweep Rate	Para. 23.4
2.1049	2.1 Occupied Bandwidth	Para. 23.5
2.1051,53	2.1 Spurious Emissions	Para. 14.0
2.1055	2.1 Frequency Stability	Para. 23.1
2.1057	2.1 Frequency Spectrum	Para. 14.0
80.1061(b)	Carrier Coherence	Para. 23.2

15) Not Applicable

16) Not Applicable

17) Not Applicable