FCC TYPE ACCEPTANCE DOCUMENTATION
FOR THE
MCC-54530001 REMOTE EMERGENCY DEVICE (RED)

December 15, 1998

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TABLE OF CONTENTS

INTRODUCTION

The Meteor Communications Corporation (MCC) Remote Emergency Device (RED) is a low power, RF transmitter, designed for use with the MCC-545A RF Modem. The unit was developed as a personal emergency-signaling device that provides short-range connectivity between the user and a nearby 545A.

DESCRIPTION

The RED is a battery operated, handheld device with a minimum operational range of 1,500 feet. In an emergency, the operator presses the red button on the unit to transmit an alert message. There is also a test button and battery indicator to periodically determine the functional status of the unit. When not in use, the unit can be clipped to the user's belt.

SPECIFICATIONS

Transmitter	
Frequency Range	36-50MHz
Frequency Stability	+/- 20ppm (-30 to +60 ^{o} C)
Transmit Power	250mW (at 9VDC)
Rated Emission	16KOG1WWN
Spurious and Harmonic Emissions	-37dBc
Modulation	BPSK
Data Rate	4k bps
Transmit Data Sequence Duration	300ms
Antenna Gain	-36 dBd
Power Requirements	
Voltage	9VDC
Transmit Current	250mA
Battery Life (Alkaline)	
Continuous Transmit	2 hours
Standby	5 years
Dimensions	4.0"L x 2.4"W x 1.4"H
Weight	5 ounces

OPERATION

Battery

The RED requires a 9-volt alkaline battery to operate. It is installed through an access panel on the back of the unit. A light on the front of the unit provides a visual indication of the battery's status whenever the test button is pressed. It will light as long as the battery voltage is greater than 8VDC.

Message Transmission

The RED will transmit two types of messages to the 545A, alert or test. Both messages are automatically sent 10 times with each button push for redundancy. In the event of an emergency, press the large, red button on the front of the unit to send an alert message. To test unit functionality, press the small, black button on the side of the unit to send a test message. To ensure message transmission, the buttons must be held down at least 100ms. When the button is released, the unit will complete its transmission cycle and then power down. If the button is held down, the unit will transmit message sequences continuously.

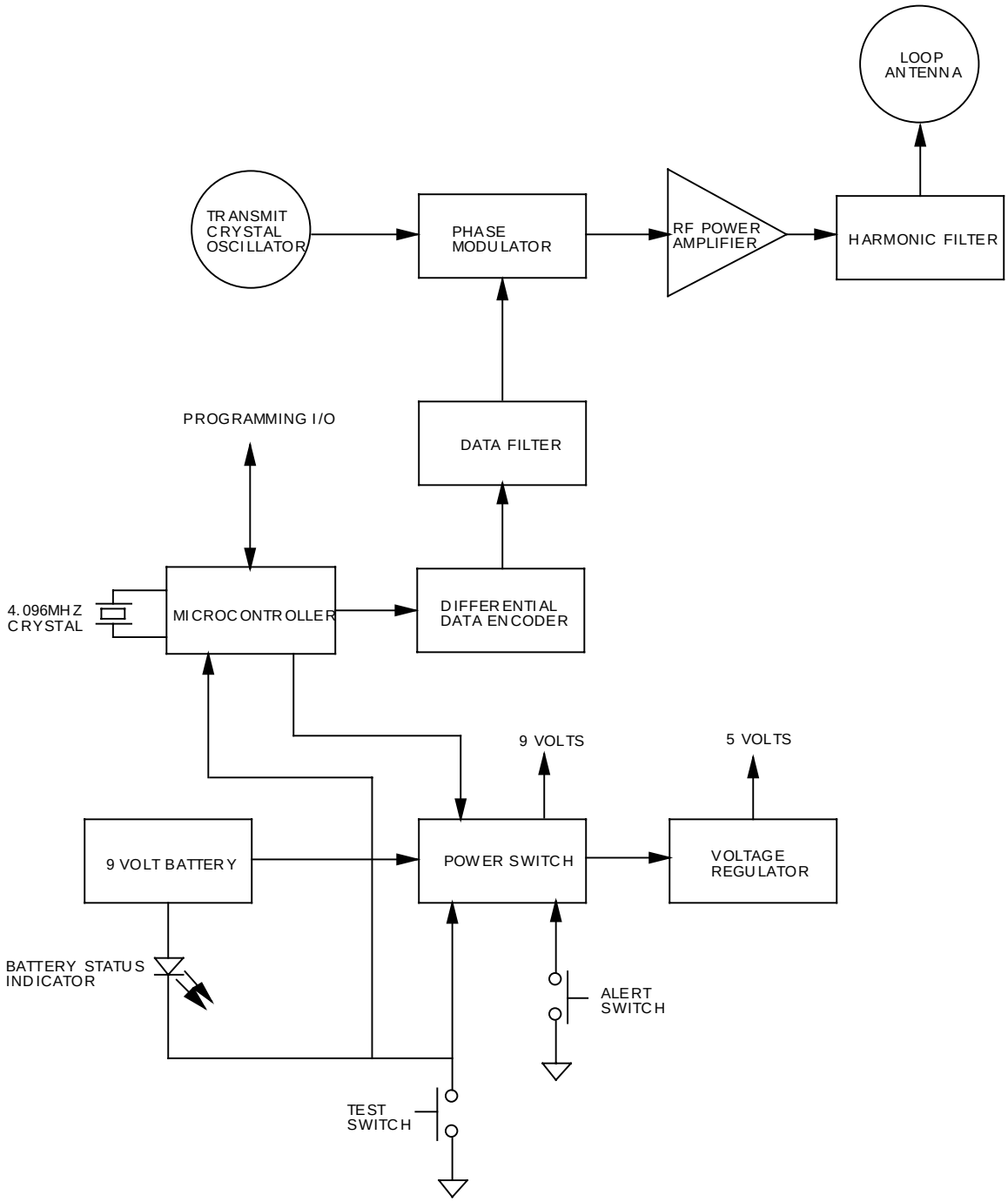
Range

The operational range of the RED is affected by its distance from the receiver, the type of terrain in between, and the noise floor at the receiver. The RED is specified at 1,500 feet over level terrain, with a noise floor off 0.1uV at the 545A. Any deviation from these conditions will produce variations in the operational range of the unit accordingly.

THEORY OF OPERATION

The MCC RED is a low-power (250mW) radio transmitter designed for one-way data communications in the low VHF band (36-50 MHz). Information is transmitted in Binary Phase Shift Key (BPSK) form, using a monolithic quadrature modulator. See Appendix A for assembly and schematic drawings.

Block Diagram



Power Switch and Battery Status Indicator

Whenever switch SW1 or S2 is pressed, components Q1, Q2, CR1, R2, R3, R5, and R6 switch battery power to all the circuits, except for the final power amplifier stage, which is always connected. The circuits include the 5-volt regulator, and the first and second stages of the power amplifier circuit. Whenever S2 is pressed, power is also routed to the light emitting diode CR2, through components CR3, and R24 as a visual indication of the battery status. The indicator will not light when the battery voltage is below 8 volts.

5 Volt Regulator

A linear voltage regulator (U1) provides 5 volts to the microcontroller, differential data encoder, data filter, crystal oscillator, and modulator circuits.

Microcontroller

An 8-bit, CMOS microcontroller (U3) is used to generate the binary data sequence for transmission. It outputs the appropriate sequence whenever switch SW1 or S2 is pressed. A 4.096MHz crystal (Y2) along with capacitors C15 and C16 determine the operating frequency of the device. The microcontroller also stores the application code and user identification information in internal flash and E^2PROM memory respectively.

Differential Data Encoder

A CMOS J-K flip-flop (U6A) is used to differentially encode the binary date prior to entering the data filter.

Data Filter

An Op-Amp (U5A) based circuit is used to filter the encoded binary data. Capacitors C10, and C13, and resistors R9, R10, and R11 form a second order, low-pass filter with a cut-off frequency of 2 kHz. Resistor R21 reduces the amount of crossover distortion from U5. R15 scales the input to the filter from 0-5VDC to 0-3.2VDC.

Transmit Crystal Oscillator

A temperature compensated crystal oscillator (Y1) is used to generate the transmitter carrier signal. A trimmer capacitor located on the oscillator allows for fine frequency adjustment of approximately +/- 200Hz. The oscillator's frequency stability is better than +/- 20ppm over a temperature range of -30^{o} C to $+60^{o}$ C.

Phase Modulator

A monolithic quadrature modulator (U4) is used to generate the BPSK modulated carrier signal. The output of the data filter is directly connected to the in-phase (I) input of the modulator and through C36 to the quadrature (Q) input. This configuration prevents zero crossings of the phase-modulated carrier. This, together with the data filter, maintains the transmitter modulation sidebands within the limits of the FCC requirement.

RF Power Amplifier

A three-stage, solid-state amplifier provides about 33dB of total gain. The first stage is implemented with a monolithic amplifier (U2). It provides about 17dB of gain. The 50-ohm amplifier input is matched to the modulator output with components C8, C24 and L3. The second stage is also implemented with a monolithic amplifier (U11). It provides about 4dB of gain.

The final stage is implemented with transistor Q3. It provides about 12dB of gain. The output is series tuned with inductor L7 and trimmer capacitor C33. Because the stage operates class C, the battery voltage is directly connected to it. Only a small amount of current drain (< 50nA) is incurred, which is due to leakage through Q3.

Harmonic Filter

A third order, low-pass filter attenuates the harmonics of the transmitter center frequency to a level that meets FCC requirements. At a 250mW output, the harmonics must be 37 dB below the unmodulated carrier. Capacitors C34 and C35 and inductor L8 form this filter. The cut-off frequency is set to obtain about 20 dB of attenuation at twice the transmitter center frequency.

Loop Antenna

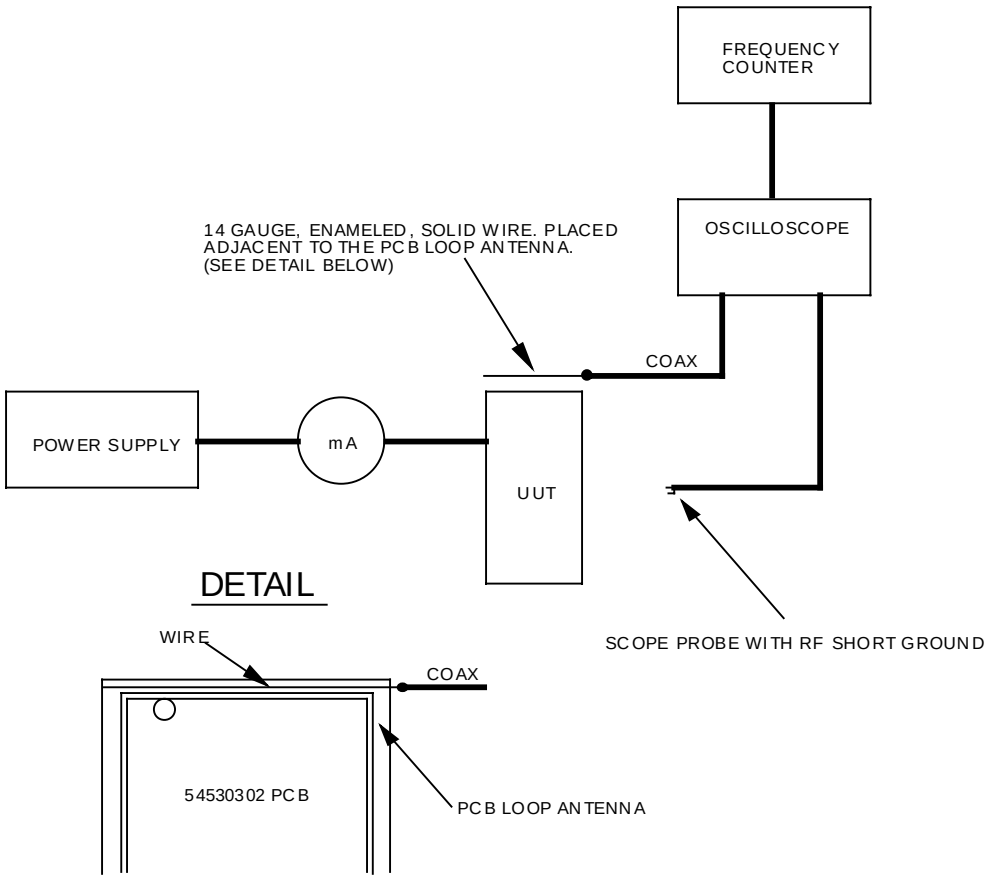
A printed circuit board loop antenna is used to radiate the RF signal from within the RED enclosure. Capacitor C1 on the board is used to tune the antenna.

TEST PROCEDURE

Equipment List

100 MHz Oscilloscope and probe with RF short ground
100 MHz Frequency counter
9VDC, 500mA Power supply
Digital Multimeter (DMM)

Equipment Set Up



Record the following measurements on the test results form located in Appendix B

Transmit Crystal Oscillator Frequency
While pressing SW1 of the UUT, measure the oscillator frequency using a scope probe (with an RF short ground) at pin 2 of Y1. The frequency should measure within +/- 10Hz of the transmit frequency. If it doesn't, then adjust trimmer C2 on the oscillator.

Radiated Voltage
Adjust trimmer potentiometer R23 fully clockwise. While pressing SW1 of the UUT, adjust trimmer capacitors C33 (on main PCA) and C1 (on antenna PCA) for maximum peak to peak voltage on the oscilloscope. The peak to peak voltage should be greater than 1.5Vpp.

Transmit Current
While pressing SW1 of the UUT, record the transmit current indicated on the DMM. It should be less than 250mA.

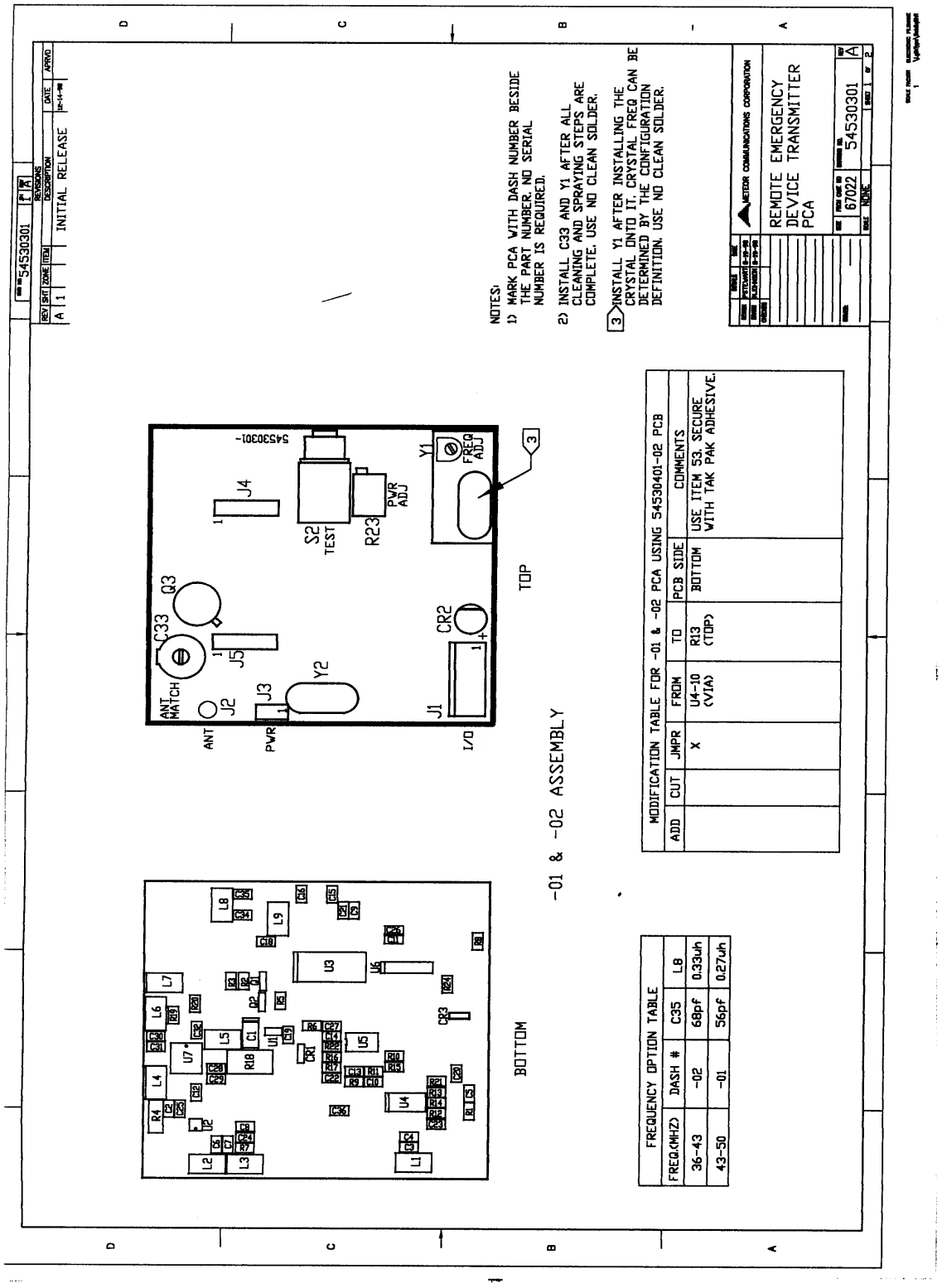
Leakage Current
With the UUT off, record the leakage current indicated on the DMM. It should be less than 1uA.

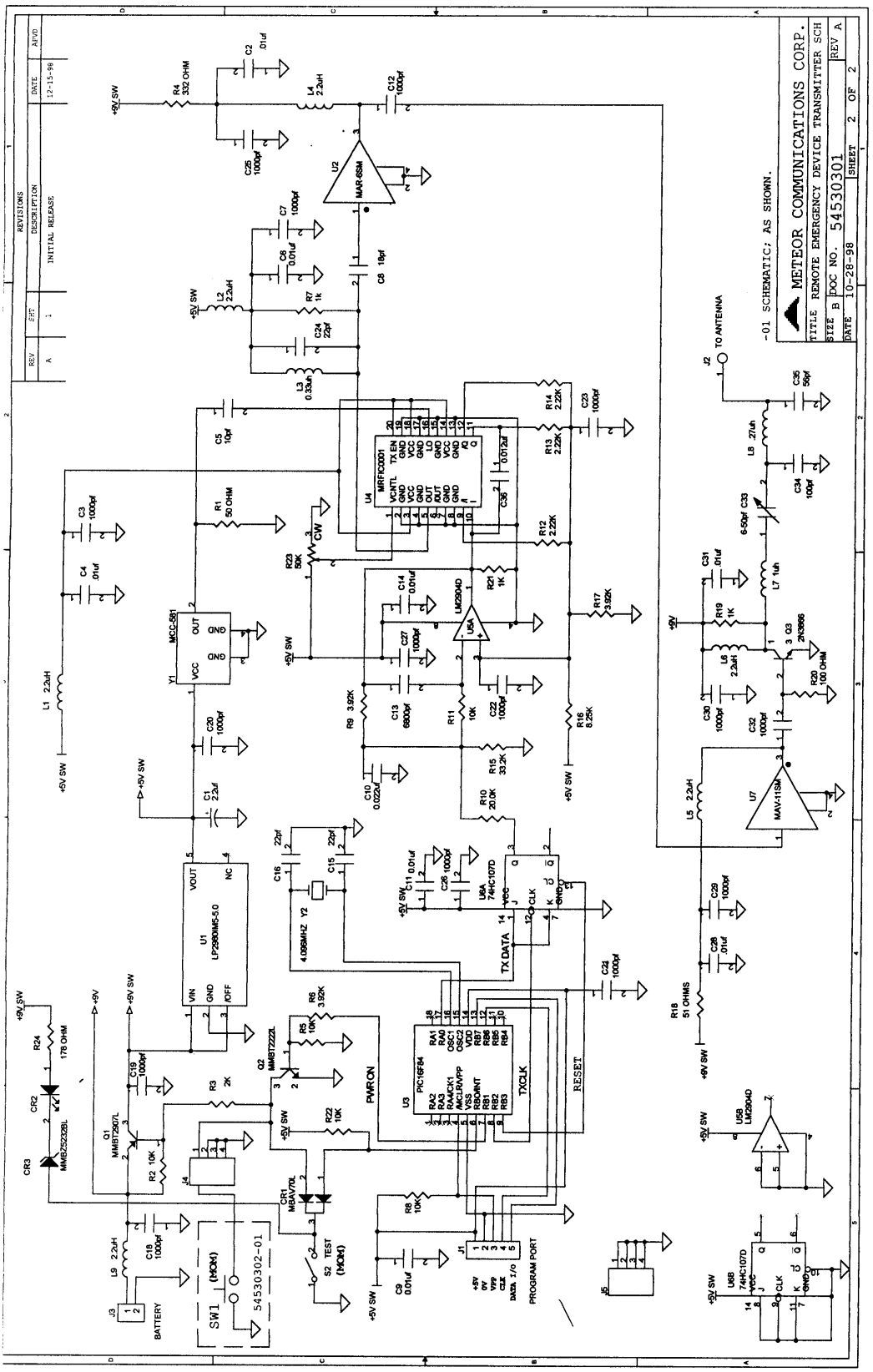
Disconnect the UUT from the 9VDC power supply.
Attach the UUT enclosure cover and install a 9-volt battery.

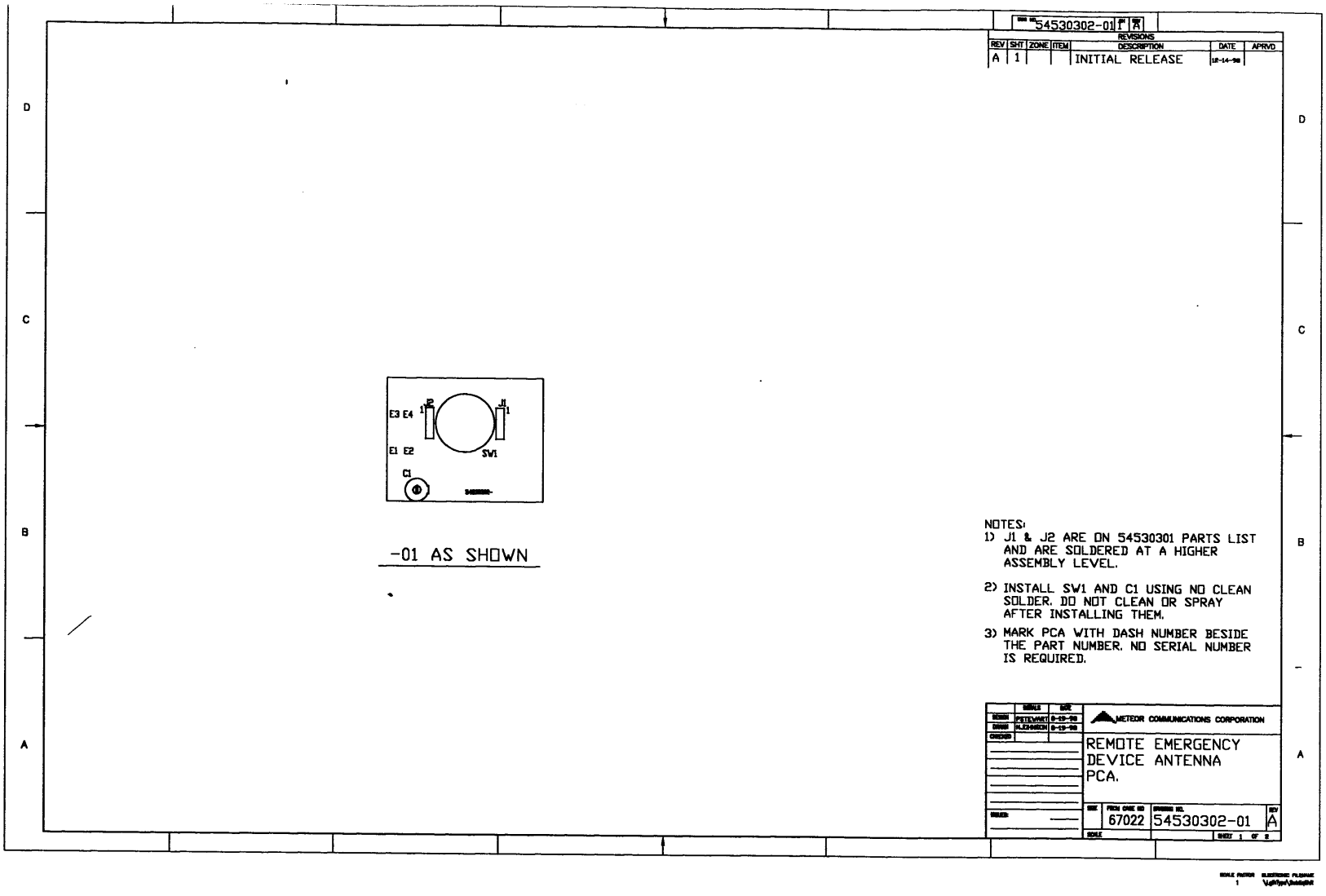
Battery Status Indicator
Push the small, black test button on the UUT. Verify that the LED lights brightly.

APPENDIX A

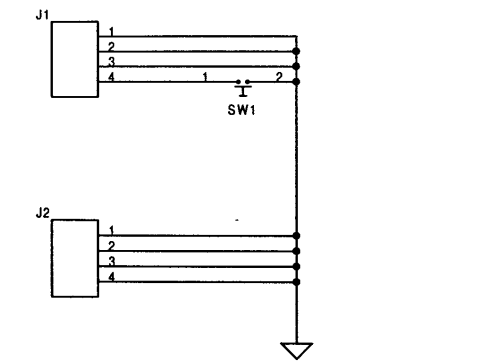
Drawings

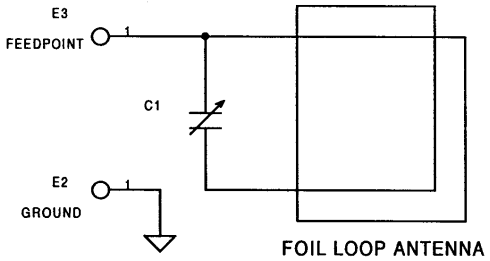



METEOR COMMUNICATIONS CORP.
TITLE REMOTE EMERGENCY DEVICE TRANSMITTER SCH
DOC NO. 54530301
REV A
SIZE B
DATE 10-28-98
SHEET 2 OF 2
-01 SCHEMATIC; AS SHOWN.
REVISIONS
REV
DESCRIPTION
DATE
APVD
INITIAL RELEASE
12-15-98
TO ANTENNA
BATTERY
PROGRAM PORT
TEST
PWRON
RESET
TXCLK
TX DATA
54530302-01


54530302-01
REVISIONS
REV | SHT | ZONE | ITEM | DESCRIPTION | DATE | APRVD
A | 1 | | | INITIAL RELEASE
E3 E4
E1 E2
J2
J1
SW1
C1
-01 AS SHOWN
NOTES:
1) J1 & J2 ARE ON 54530301 PARTS LIST AND ARE SOLDERED AT A HIGHER ASSEMBLY LEVEL.
2) INSTALL SW1 AND C1 USING NO CLEAN SOLDER. DO NOT CLEAN OR SPRAY AFTER INSTALLING THEM.
3) MARK PCA WITH DASH NUMBER BESIDE THE PART NUMBER. NO SERIAL NUMBER IS REQUIRED.
METEOR COMMUNICATIONS CORPORATION
REMOTE EMERGENCY DEVICE ANTENNA PCA.
67022
54530302-01
A

REV	SHT	DESCRIPTION	DATE	APRVD
A	1	INITIAL RELEASE	12-14-98	





FOIL LOOP ANTENNA

Title: REMOTE EMERGENCY DEVICE ANTENNA SCHEMATIC			
Size: A	Document Number: 54530302-01		Rev: A
Date: Thursday, December 17, 1998	Sheet 2 of 2		

APPENDIX B
Test Results Form

Transmit Crystal Oscillator Frequency _____MHz,	+/- 10Hz	_____Hz
Radiated Voltage	>1.5Vpp	_____Vpp
Transmit Current	<250mA	_____mA
Leakage Current	<1uA	_____uA
Battery Status Indicator		_____OK

APPENDIX C
Final Assembly Pictures

FIGURE 5 Front

FIGURE 6 Bottom

APPENDIX D
Printed Circuit Assembly Pictures

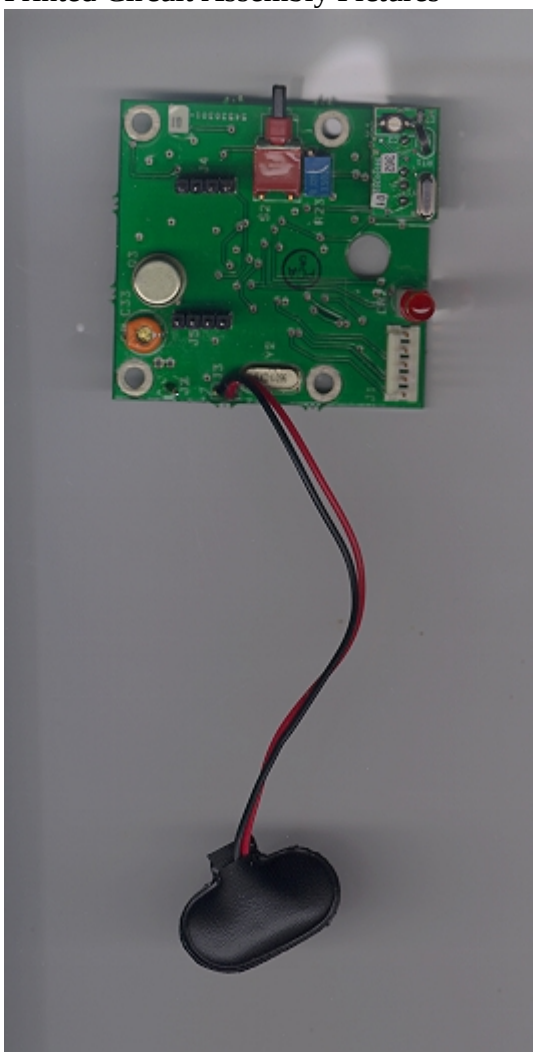


FIGURE 1 Transmitter top

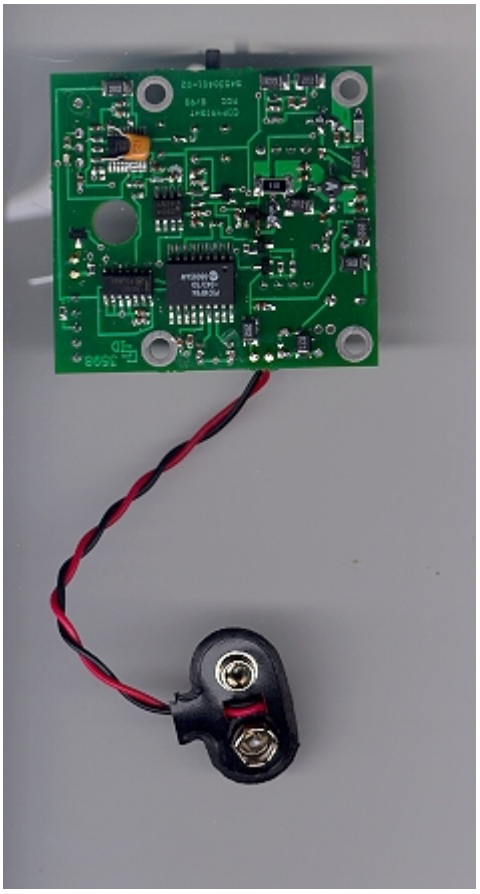


FIGURE 2 Transmitter bottom

FIGURE 3 Antenna top

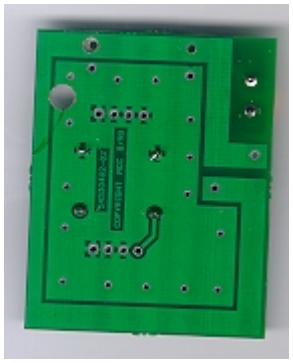
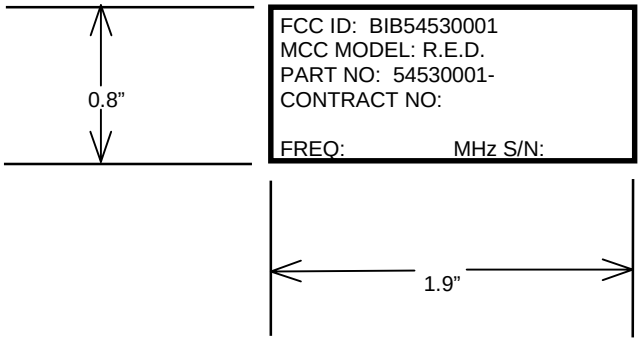


FIGURE 4 Antenna bottom

APPENDIX E

Source Control Drawing



Label Material:	Silver Matte Mylar #7222 Clear Matte Imprintable Mylar Overlay #PM-200-CM/T
Process:	Hot Stamp
Thickness:	4mils total
Color:	Black Lettering
Actions:	Laminate Diecut Strip Waste

Approval: Phil Stewart

Revision A - Initial Release

005-201-0058 FCC Type Acceptance Label for the MCC Model R.E.D.