Exhibit 8 – User's Manual RevA

General Dynamics C4 Systems

VHF URC-200 Transceiver

FCC ID: MIJURC-200XCVR-V2

Model No. URC-200 (V2)

8 Product Functional Requirements (User Manual)

URC-200 (V2) LIGHTWEIGHT VHF/UHF TRANSCEIVER

OPERATION AND LIMITED MAINTENANCE MANUAL

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SECTION 1. INTRODUCTION

1-1 GENERAL INFORMATION

This manual provides operation and maintenance instructions for the URC-200 (V2) Radio Set shown in Figure 1-1. The radio set is a lightweight VHF/UHF transceiver providing AM/FM transmission and reception of non-secure voice or data in the frequency bands used in maritime, land, mobile and tactical line-of sight communications as well as military and civilian air traffic control operations. Secure communications can be achieved with an appropriate external encryption device and with the transceiver in the data [Cipher Text (CT)] mode.

NOTICE

The URC-200 (V2) is FCC certified in the 115-149.995 (AM) and 115 - 173.995 (FM) bands.

1. The URC-200 (V2) transceiver is to be tuned only to those frequencies that the transceiver user, by law, is permitted to use.
2. Operation and tuning of the transceiver should be restricted to those users who are knowledgeable about which frequencies are authorized for use.
3. Transceiver operation on unauthorized frequencies is a violation of the law.
4. The capabilities of this transceiver allow users the freedom for authorized personnel to easily tune the transceiver. This allows the transceiver to work with other communication systems within the band, provided that the transceiver's tuned frequencies are permitted by regulation.

Figure 1-1. URC-200 (V2) Transceiver Set

1-2 ABBREVIATIONS AND ACRONYMS

ACK	Acknowledge
ADC	Analog-To-Digital converter
AGC	Automatic Gain Control
ALC	Automatic Level Control
AM	Amplitude Modulation
ANT	Antenna
APPS	Audio Processor Power Supply
BCN	Beacon
CALRF	Calibration RF
CH	Channel
COMSEC	Communication Security
CT	Cipher Text (Data)
dB	Decibel
DSB	Double Sideband
EEPROM	Electrically-Erasable-Programmable-Read-Only-Memory
EPROM	Erasable Programmable Read-Only Memory
ESD	Electrostatic Discharge
FM	Frequency Modulation
FREQ	Frequency
GRD	Guard
HDST	Handset/Headset
HI	High Power
Hz	Hertz
IF	Intermediate Frequency
kHz	Kilohertz
L.O.	Local Oscillator
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LNA	Low Noise Amplifier
LO	Low Power
LOS	Line-Of-Sight
MED	Medium Power
MHz	Megahertz
mW	Milliwatt
NAK	Not-Acknowledge
nom	Nominal
PCV	Plain Text/Cipher Text/Voice Privacy
PLL	Phase-Locked Loop
ppm	parts per million
PS	Power Supply
PT	Plain Text (Voice)
PTT	Push-To-Talk
PWR	Power
R/T	Receive/Transmit
RAM	Random-Access Memory
RCU	Remote Control Unit
RCV	Receive
RF	Radio Frequency
RRKS	Release Remote Key Sequence
SINAD	Ratio: $\frac{Signal + noise + distortion}{noise + distortion}$
SPKR	Loudspeaker
SQ	Squelch
STO	Store
T/R	Transmit/Receive
TX	Transmit
UBS	UHF Band Selector

UHF	Ultra-High Frequency
VCA	Voltage-Controlled Attenuator
VCO	Voltage-Controlled Oscillator
Vdc	Volts, direct current
V_f	Forward voltage
VHF	Very-High Frequency
VOL	Volume
V_r	Reverse voltage
VSWR	Voltage Standing-Wave Ratio
W	Watt
X-mode	Interface connector for COMSEC equipment
XMT	Transmit

1-3 EQUIPMENT DESCRIPTION

The URC-200 (V2) VHF/UHF Transceiver is a lightweight, tactical, Line-Of-Sight (LOS) transceiver that provides AM and FM communication of nonsecure voice or data. It is suitable for manpack, vehicular, or fixed station applications. The transceiver can be used with other AM or FM transceivers operating in the same VHF and UHF frequency ranges.

- In the AM mode the VHF frequency range is 115 to 149.9950 MHz
- In the FM mode the VHF frequency range is 115 to 173.9950 MHz
- In both the AM and FM modes the UHF frequency range is 225 to 399.9950 MHz

The transceiver has standard tuning increments of 25 kHz, 12.5 kHz and 5 kHz with a channel spacing as detailed in Table 1-2. The transceiver is capable of transmitting and receiving analog Plain Text (PT) voice and digital Cipher Text (CT) voice or data. With an appropriate external encryption device and the transceiver in the data (CT) mode, secure communications can be achieved. The URC-200 (V2) can be operated in all weather conditions and can be remote controlled.

Three options are available. Refer to SECTION 5, OPTIONS, for a full description of each.

- A 30-90 MHz FM Low VHF option
- An extended 400-420 MHz FM UHF option
- An 8.33 kHz tuning increment and channel spacing option

1-4 FEATURES

- Microprocessor controlled, fully synthesized transceiver.
- COMSEC compatibility.
- Multi-band capability including civilian and military frequencies.
- Easy access front panel controls.
- Built-in speaker.
- RS-232 remote control for all programmable functions.
- Backlit display and keypad.
- Ten preset memory channels with fully programmable frequencies, including transmit/receive offsets and AM/FM selection.
- Self-calibrating varactor-tuned receiver front-end.

1-5 URC-200 (V2) SYSTEM

The following items constitute a URC-200 (V2) system.

1-5.1 TRANSCEIVER - URC-200 (V2)

The transceiver is contained in cast-aluminum housing with all operating controls and connectors located on the front panel. The battery connectors, for two batteries, are located on the rear panel. The front panel components are protected by handles and an extension on the top cover to protect the volume and squelch controls.

1-5.2 ANTENNA - UVU-100

CAUTION

To comply with RF exposure requirements, a minimum separation distance of 20 cm (7.9 inches) is required between the antenna and all persons while the transceiver is transmitting.

The antenna is a 12-inch long, broadband, VHF/UHF vertically polarized antenna that is attached to the front panel antenna connector. The antenna connector is a BNC type connector, surrounded by a threaded sleeve. The antenna is screwed onto this sleeve.

1.5.3 BATTERY CASE - UBC-100

The battery case holds two batteries. Always use two of the same type battery when replacing batteries. Refer to Table 1-1 for available battery types and part numbers.

Table 1-1. Battery Types

Part Number	Composition	Type
BA-5390/U	Lithium Manganese Dioxide	Non-rechargable
BA-5590B/U	Lithium Sulfur Dioxide	Non-rechargable
BB-390A/U	Nickel Metal Hydride	Rechargable
BB-590/U	NiCad	Rechargable
BB-2590/U	Lithium Ion	Rechargable

WARNING

DO NOT THROW BATTERIES IN THE TRASH

Dispose of all used batteries in accordance with all Federal, State and local laws and regulations. Lithium batteries may be used in the URC-200 (V2) Transceiver however lithium batteries contain hazardous materials.

Improper handling, reverse-current operation or high environmental temperatures may cause internally generated heat, fire or toxic materials and gasses to be released from the battery.

The following precautions must be strictly observed to prevent injury to personnel or damage to equipment:

- **DO NOT** heat, incinerate, crush, puncture, disassemble or mutilate the batteries.
- **DO NOT** recharge primary Non- rechargeable) batteries.
- **DO NOT** store in equipment during periods of non-use for more than 30 days.
- **DO** follow all safety instructions that come with the batteries or printed on them.
- **TURN OFF** the equipment immediately if you (1) detect that the battery compartment is becoming unduly hot, (2) hear battery cells venting (hissing), or (3) smell irritating sulfur dioxide gas. Remove the battery only after it is cool (after 30 to 60 minutes), and dispose of it by following approved procedures.

Quick release latches enable the battery case to be securely attached to the unit for operation. When the battery case is attached to the unit, the battery case is watertight. The case contains a vent to permit venting of battery gasses.

1-5.4 HANDSET - H-189/GR

The handset contains a microphone and receiver for transmitting and receiving audio signals. A retractable cord with a 5-pin connector attaches to the transceiver front panel. A push-to-talk switch is located in the handset handle.

1-6 MINIMUM EQUIPMENT REQUIREMENT

As a minimum, the items shown in Figure 1-2 are required for an LOS system.

1-7 REFERENCE DATA

The operating parameters of the URC-200 (V2) transceiver are listed in Table 1-2. The physical characteristics are listed in Table 1-3, and the environmental data in Table 1-4.

Find No.	Qty Req.	Part No.	Nomenclature
1	1	01-P36744M003	Receiver-Transmitter
2	1	85-P35988M001	Antenna VHF/UHF
3	1	01-P04535L001	Handset, H-189/GR
4	1	01-P36751M001	Battery Box

Figure 1-2. URC-200 (V2) Minimum System Requirement

Table 1-2. Operating Parameters
Standard Test Conditions: 28Vdc Input, +25°C

Characteristics	Specifications
General	
Frequency Range	VHF - (FM) 115 to 173.995 MHz (AM) 115 to 149.995 MHz. UHF - (FM) 225 to 399.995 MHz (AM) 225 to 399.995 MHz.
Tuning Increments	25 kHz 12.5 kHz and 5 kHz
Channel Spacing	25 kHz
Stability	±1 ppm
Preset Channels	10 transmit and 10 receive preset channels.
Modulation	AM or FM
Power	
Voltage	+22 to +34 Vdc
Current	3.5 Amps Maximum
Estimated Battery Life	Hours, based on 9:1 ratio receive to transmit.
BB-590/U	7
BA-5590/U	23
BB-2590/U	19
BA-5390/U	30
BB-390/U	11
Operating Modes	
Plain Text (PT)	AM or FM
Cipher Text (CT)	AM or FM
T-R	Relay mode, each of the ten preset channels may have separate receive and transmit frequencies.
Beacon	Transmit an emergency audio sweep tone on any selected frequency.
Scan	Scan up to 10 channels.
Bandwidth	
IF Selectivity	PT - ±9.5 kHz, 6 dB down CT - ±15 kHz, 6 dB down
Audio Response	PT - 300 to 3000 Hz. (+2, -4 dB) CT - 30 Hz to 10.24 kHz. (+2, -4 dB)
Receiver Characteristics	
Sensitivity (10 dB SINAD)	
AM-CT	≤ -105 dBm (1.3μV), 16 kb/sec with 70% modulation
AM-PT	≤ -103.5 dBm (1.5μV), 1 kHz modulation at 30%
FM-CT	≤ -107 dBm (1.0μV), 16 kb/sec with ±5.6 kHz deviation
FM-PT	≤ -114 dBm (0.4μV), 1 kHz modulation with ±6.5 kHz deviation
Input Impedance	50Ω nominal
RF Signal Level at the Antenna Port	FM - No Signal to +23 dBm No signal to 200 mW) (typical) AM - No Signal to 0 dBm No signal to 1.0 mW) (typical) FM or AM - +27 dBm (500 mW) maximum for short durations to prevent damage
Image Response	80 dB (typical)
Spurious Response	80 dB (typical)
Squelch	Manual adjust, Carrier-to-noise ratio squelch, changing to carrier-level squelch at stronger signal levels.
Squelch Range	-110 dBm (0.7μV) to -80 dBm (22.3μV) nominal.

Table 1-2. Operating Parameters
Standard Test Conditions: 28Vdc Input, +25°C

Characteristics	Specifications
Distortion	AM - 10% Maximum, RF = -33dBm (5 mV), 1 kHz @ 85% AM Modulation FM - 10% Maximum, RF = -33dBm (5 mV), 1 kHz @ ±6.5 kHz Modulation

Transmitter Characteristics

High Power Output Mode	Tolerance	Expressed in Watts	Expressed in dBm
AM (at 80% AM PT ±5%)	Maximum (+2 dBm)	15.85 Watts Avg.	42 dBm Avg.
	Typical	10 Watts Avg.	40 dBm Avg.
	Minimum (-2 dBm)	6.31 Watts Avg.	38 dBm Avg.
FM	Maximum (+2 dBm)	15.85 Watts	42 dBm
	Typical	10 Watts	40 dBm
	Minimum (-2 dBm)	6.31 Watts	38 dBm
Medium Power Output Mode	Tolerance	Expressed in Watts	Expressed in dBm
FM	Maximum (+2 dBm)	7.94 Watts	39 dBm
	Typical	5 Watts	37 dBm
	Minimum (-2 dBm)	3.16 Watts	35 dBm
Low Power Output Mode	Tolerance	Expressed in Watts	Expressed in dBm
AM (at 80% AM PT ±5%)	Maximum (+2 dBm)	7.94 Watts Avg.	39 dBm Avg.
	Typical	5 Watts Avg.	37 dBm Avg.
	Minimum (-2 dBm)	3.16 Watts Avg.	35 dBm Avg.
FM	Nominal	0.1 Watts or 100 mW	20 dBm
Modulation			
AM (PT)	60% to 90% at 1 kHz. : Distortion 10% Max. @ 30% AM; 15% Max. @ 80% AM		
AM (CT)	70% nominal at 8 kHz. : Distortion 10% Max. @ 30% AM		
FM (PT)			
VHF	±3.3 kHz at 1 kHz. : Distortion 10% Max.		
UHF	±6.5 kHz at 1 kHz. : Distortion 10% Max.		
FM (CT)			
VHF	±5.0 kHz at 1 kHz.		
UHF	±5.6 kHz at 1 kHz.		
Spurious Outputs	>=70 dB below CW carrier (typical)		
Harmonic Outputs	>=53 dB below CW carrier		
Output Impedance	50Ω nominal		
Protection	No damage from open or short circuits at the antenna port. Gradual transmit power reduction for high VSWR loads.		
Transmit Duty Cycle when in the Hi Power Output Mode (10 W)	25 degrees C: continuous 55 degrees C: 9:1 receive to transmit duty cycle		

Table 1-3. Mechanical Data

Characteristics	Specification
Transceiver	
Height	3.1 inches
Width	10.8 inches
Depth	9.75 inches (including handles)
Weight (approximate)	9.2 pounds
Battery Case	
Height	3.10 inches
Width	10.80 inches
Depth	5.20 inches
Weight (approximate)	1.1 pounds without batteries 6.9 lbs with two BA-5390/U batteries 5.5 lbs with two BA-5590B/U batteries 9.1 lbs with two BB-390A/U batteries 6.9 lbs with two BB-590/U batteries 7.4 lbs with two BB-2590/U batteries

Table 1-4. Environmental Data

Characteristics	Specification
Temperature (Operating)	-20° C to +55° C
Humidity	95% relative
Altitude (Operating)	15,000 feet, MSL

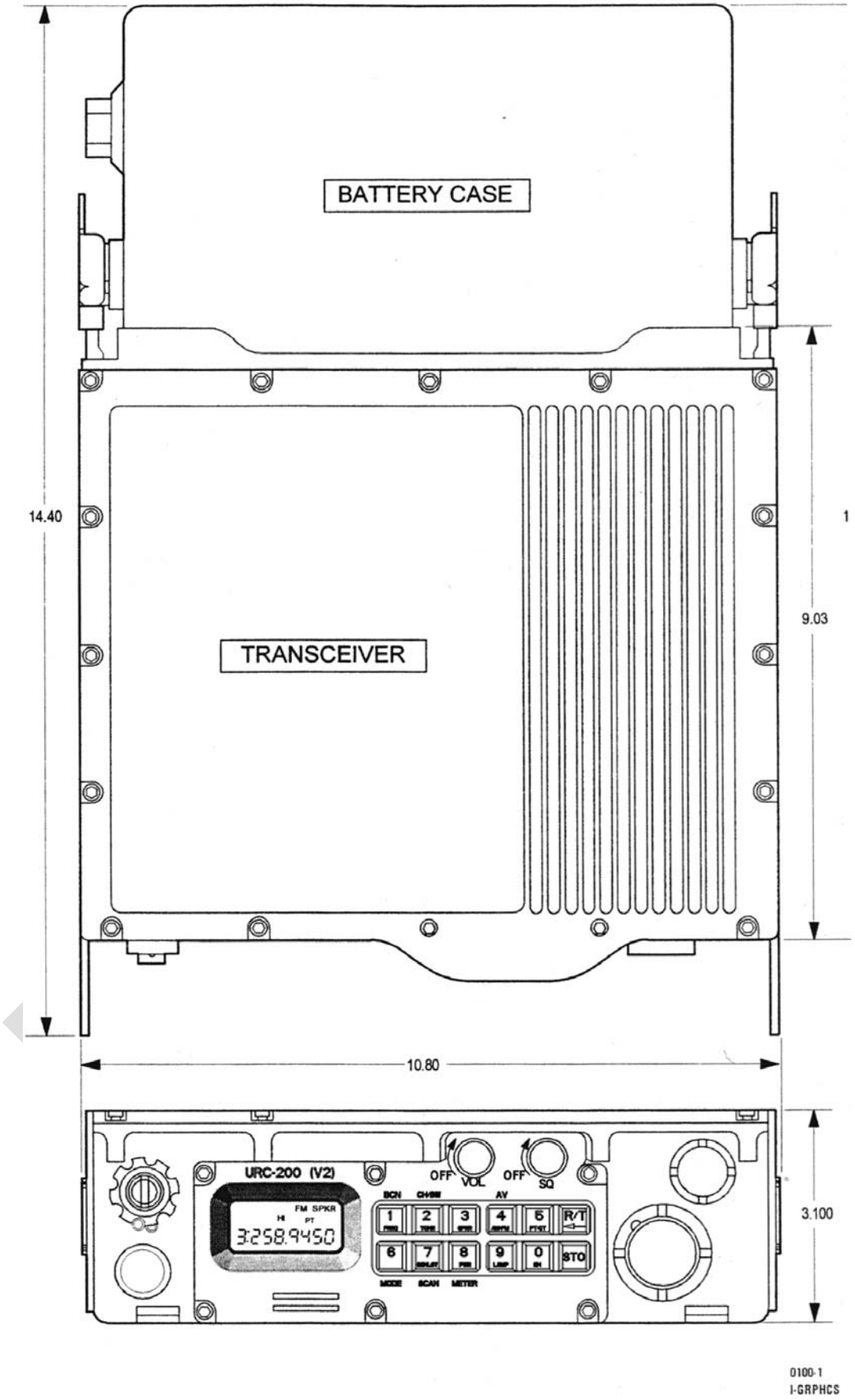

BATTERY CASE
TRANSCEIVER
14.40
9.03
10.80
3.100
URC-200 (V2)
OFF
VOL
OFF
SQ
FM SPKR
HI
PT
3258.9450
BCN
CHSW
AV
1
2
3
4
5
R/T
6
7
8
9
0
STO
MODE
SCAN
METER
0100-1
I-GRPHCS

Figure 1-3. Mechanical Configuration

1-8 AVAILABLE OPTIONS

Various options are available for purchase to extend the URC-200 (V2) frequency range or change the tuning increments or channel spacing.

1-8.1 30-90 MHZ OPTION

This option adds frequency range of 30-90 MHz to the URC-200 (V2). This option is for FM only in both receive and transmit modes. Plain or cipher text types of signals may be used. See Section 5 for a detailed description of this option.

1-8.2 400-420 MHZ OPTION

This option extends the UHF frequency range of the URC-200 (V2) to 420 MHz. In 400-420 MHz region this option is for FM only in both receive and transmit modes. Both plain text and cipher text signals may be used in 400 to 420 MHz frequency range. See Section 5 for a detailed description of this option.

1-8.3 ECS-8, 8.33 KHZ OPTION

This option allows 8.33 kHz tuning in the VHF/UHF bands, and user selectable 8.33 kHz receive channel spacing in the 117.9750 to 136.9750 MHz band.

It also allows the operator to place the radio into Aviation mode, which restricts the operating frequency range from 117.9750 to 136.9750 kHz, with tuning increments of 25 and 8.33 kHz. Channel spacings of 25 or 8.33 kHz are assigned automatically by frequency, following the ICAO standards for frequency entry.

This mode also restricts modulation to AM, and allows PT only, disabling the CT feature of the radio.

1-9 COMPATIBLE ACCESSORIES

The following paragraphs describe various accessories which can be attached and/or used with the URC-200 (V2) transceiver. Unless otherwise noted, they may be selected and purchased as required from General Dynamics C4 Systems. Other accessories are also available. Please contact General Dynamics C4 Systems or refer to our website at **http://www.gdc4s.com** for more information.

NOTE

The list of accessories offered by General Dynamics C4 Systems may change over time. Please contact GDC4S or refer to our website at **http://www.gdc4s.com** for the most up-to-date product information.

1-9.1 POWER SUPPLIES

- **UAC-100** **Power Supply, AC Input**

  The UAC-100 power supply powers the URC-200 (V2) transceiver from a 110/220-Vac source.

- **UDD-100A** **Power Supply, DC Input**

  The UDD-100A power supply powers the URC-200 (V2) transceiver from a 12 Vdc source.

- **UAC-350** **AC Power Supply**

The UAC-350 power supply powers the URC-200 (V2) transceiver and the UPA-50 or UPA-55/55H power amplifiers from a 110/220-Vac source.

- **UAD-100A Uninterruptible Power Supply**

  Intended for “jerk-and-run” applications, the UAD-100A power supply operates from a110/220-Vac source but includes two batteries which power the radio when disconnected from the source.

1-9.2 BATTERY CHARGERS

- **UBS-110 Battery Charger**

  Commercial grade battery charger charges a single battery.

- **LSBC-102 Battery Charger**

  Ruggedized, military grade battery charger charges a two batteries at once.

1-9.3 INTERFACE BOXES

- **UIB-100/100A Power Interface Box**

  Power distribution box that attaches to the rear of the URC-200 (V2) transceiver. Provides the mechanical connections to distribute unfiltered 28Vdc from a power supply or other source to the transceiver and power amplifier.

- **UFB-100/100A Power Filter Box**

  Power distribution box with internal filter that attaches to the rear of the URC-200 (V2) transceiver. Provides the mechanical connections to distribute filtered 28Vdc from a power supply or other source to the transceiver and power amplifier.

- **UBC-100 Battery Box**

  Attaches batteries to the rear of the URC-200 (V2) Transceiver

1-9.4 SHOCK TRAYS AND MOUNTS

- **UST-100 Shock Tray**

  Used to mount the URC-200 (V2) Transceiver and power interface/filter box in a vehicular or other setting where shock and vibration damping is required.

- **UST-200 Shock Tray Mounts**

  Used to mount the URC-200 (V2) Transceiver in a 10 watt or 30/50 watt system configuration in a vehicular or other setting where shock and vibration damping is required.

- **URM-100 Rack Mount**

  Used to mount the URC-200 (V2) Transceiver in a 10 watt or 30/50 watt system configuration in a 19” rack.

1-9.5 CABLES

In addition to the cables shown below, other cables for data and audio connections, remote control, power, and RF/Antenna connections are available.

- **LSCA-103A and LSCA-110 Cable Assemblies**

  Used to remote the PTSH-104 Amplified Speaker assembly.

- **PTKY-103 CRYPTO Cable Assembly**

  Shielded, three-foot long water-tight cable assembly used to connecting the transceiver to a COMSEC device for secure operation.

1-9.6 UEC-120/ UEC-200 REMOTE CONTROL UNIT

Two remote control units are available. The UEC-120 controls one transceiver. The UEC-220 can control one or two transceivers.

1-9.7 POWER AMPLIFIERS

The UPA-50 and the UPA-55/55H are 50 Watt power amplifiers that cover frequency range of 100 to 420 MHz.

- **UPA-50 50 WATT – FM/AM Power Amplifier**

  The UPA-50 supplies 50 Watt FM and 30 Watt AM when connected to the output of the URC-200 (V2) Transceiver. This model has been replaced by the UPA-55 and UPA-55H models and is longer available for purchase.

- **UPA-55 50 WATT – FM/AM Power Amplifier**

  The UPA-55 supplies 50 Watt FM and 50 Watt AM when connected to the output of the URC-200 (V2) Transceiver.

1-9.8 ANTENNAS

In addition to the antennas shown in this manual, a variety of single, dual and tri-band antennas are available for operation with the URC-200 (v2) Transceiver. Applications include mobile, manpack and base station installations. Mounting brackets are supplied in some cases.

1-9.9 OTHER ACCESSORIES

Other accessories include (but are not limited to) the following:

- **UCB-200, UCB-300, and UCB-500 Carrying Bag**

  The convenient canvas carrying case is available in woodland camouflage, black, and desert camouflage, respectively.

- **PTSH-104 Remote Speaker**

  Used to remote the transceiver audio.

SECTION 2. OPERATION

2-1. GENERAL INFORMATION

This section provides information for operating the URC-200 (V2) Transceiver. It includes a functional description of all operating controls, indicators, and connectors and procedures for set-up and operation.

NOTE

Lithium Battery Pre-Conditioning

When using BA-5590/U lithium batteries, General Dynamics C4 Systems recommends that the user consult MIL-B-49430 (ER), "MIL-SPEC, Batteries, non-rechargeable, Lithium Sulfur Dioxide", and MIL-B-49430/3D (ER) "MIL-SPEC, Batteries, non-rechargeable, Lithium Sulfur Dioxide BA-5590/U." Particular attention should be paid to the paragraphs relating to voltage delay of the BA-5590/U.

It is recommended that the batteries be changed in pairs. New, unconditioned, lithium batteries may not be able to deliver the current required to allow the transceiver to transmit in high power. To condition the lithium batteries the user can, after installing the new batteries, set the transceiver to low power and key the transmitter for 20 to 30 seconds, then set the transceiver to medium power and again key the transmitter for 20 to 30 seconds, the batteries should now be conditioned and capable of supplying sufficient current to allow the transceiver to transmit in the high power mode.

2-2. CONTROLS, INDICATORS AND CONNECTORS

The URC-200 (V2) uses a microprocessor to control and display all operating functions. A key-pad with 12 key switches is used with a Liquid Crystal Display (LCD) to select frequencies and operating modes for each of the 10 preset channels and to store each channel's operating parameters. Separate volume and squelch controls are provided to adjust the handset and loudspeaker audio level and the receiver squelch threshold. The controls, indicators and connectors shown in Figure 2-1 are explained in Table 2-1. The display and key-pad functions are shown and explained in Figure 2-2.

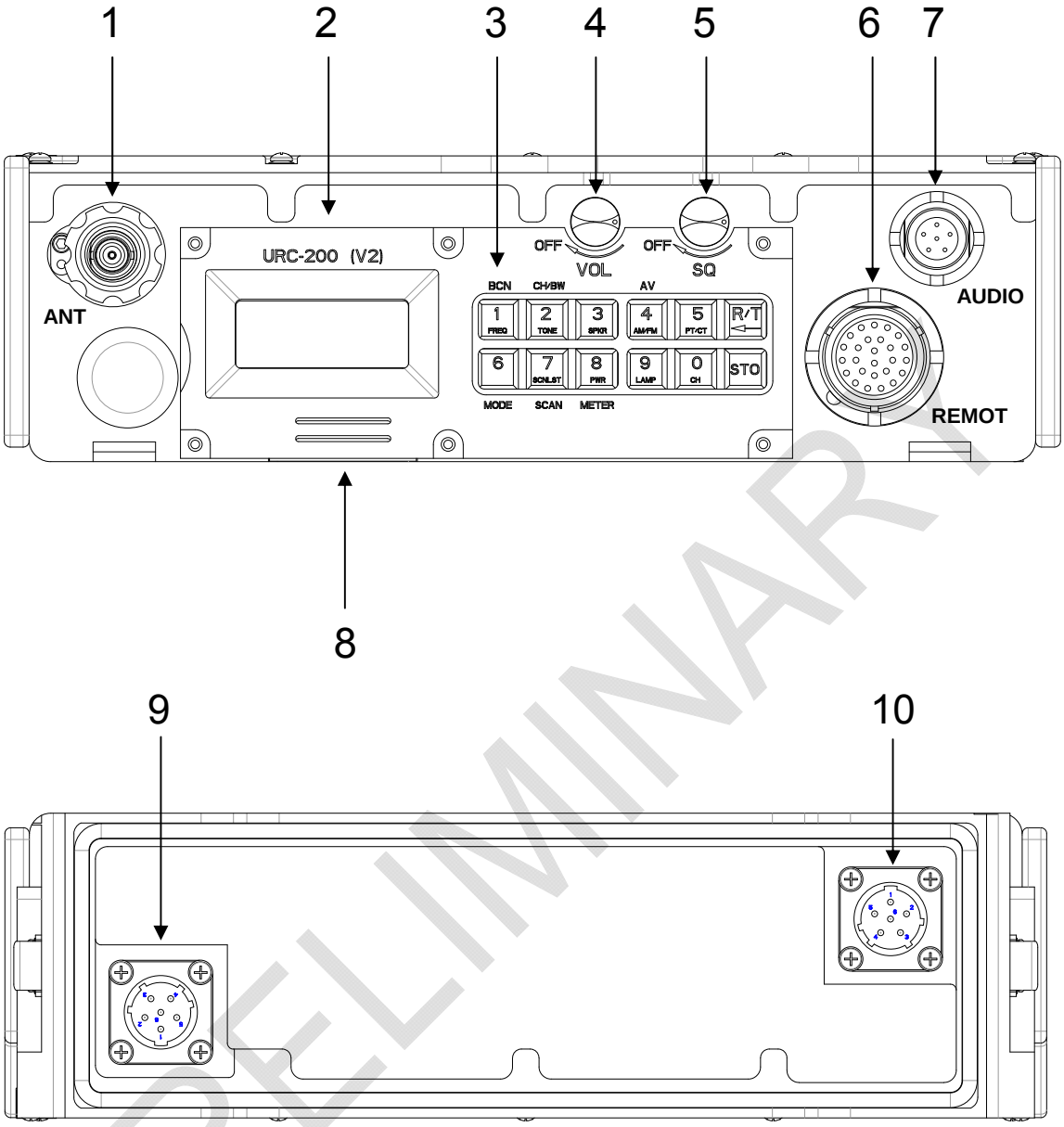


Figure 2-1. URC-200 (V2) Front and Rear Panel Controls, Indicators and Connectors

Table 2-1. Front Panel Controls, Indicators and Connector and Rear Panel Connectors

Find No.	Controls, Indicators, Connectors	Type	Function
1	Antenna connector, J3	BNC	Connects VHF/UHF Antenna, threaded sleeve is provided to securely fasten flexible antenna to the transceiver.
2	Liquid Crystal Display (LCD)	7-segment display	Alpha-numeric display that shows operating modes, frequency, messages and measurements.
3	Keypad	12-push-button keypad	Used to select all operating modes and frequencies.
4	VOL/OFF a) OFF b) VOL	Rotary control with switch	Full CCW position turns transceiver off. Continuously variable control adjusts handset and speaker audio level.
5	SQ/OFF	Rotary control with switch	Continuously variable control adjusts squelch threshold in the PT mode of operation. Full CCW position turns squelch off. Squelch is not operational when CT is selected.
6	X-mode J2	26-pin connector	Connects transceiver to peripheral devices such as COMSEC equipment, remote control unit and test equipment.
7	HDST J4	6-pin audio connector	Handset connector for H-189/GR or H-250/U handset
8	Speaker		
9	Battery connector J1 (Located on back-panel)	6-pin battery connector	Connects transceiver to a power source such as the UBC-100 battery case or UAC-100 AC supply. See Paragraph 1-9 for power source options.
10	Battery connector J5 (Located on back-panel)	6-pin battery connector	Connects transceiver to a power source such as the UBC-100 battery case or UAC-100 AC supply. See Paragraph 1-9 for power source options.

2-3. KEYPAD AND DISPLAY FUNCTIONS

The following procedures describe how to set-up the transceiver for operation in any of the possible operating modes. Figure 2-2 shows the display and the key-pad and identifies the key functions. Each will be discussed in further detail as specific operating modes are described.

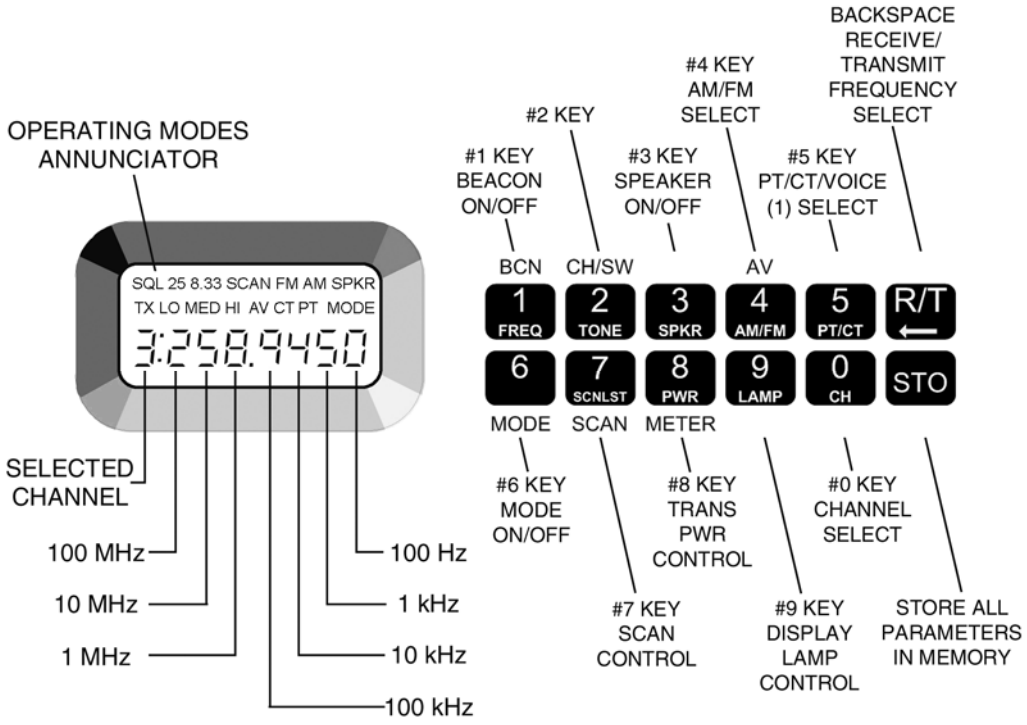
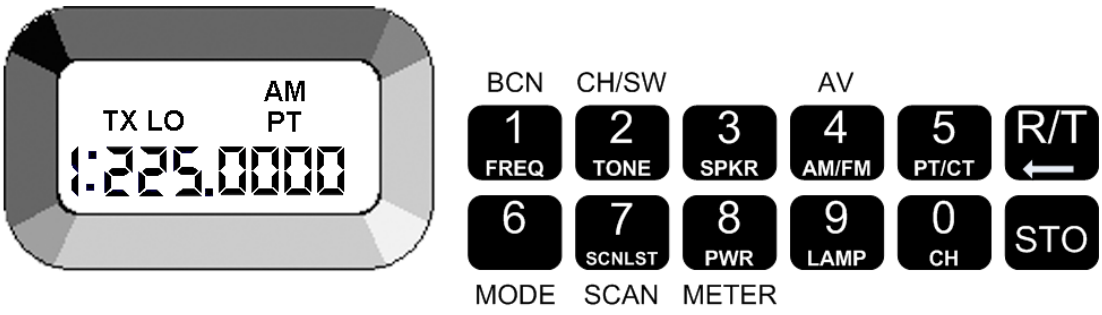


Figure 2-2. Key-pad and Display Functions

2-3.1. NORMAL OPERATING MODE CONFIGURATION PROCEDURES

The transceiver can be used for operation once it has been installed as described in Section 3. The transceiver is fully micro-processor-controlled from push button instructions selected at the front panel. The frequency is tuned either by selecting one of ten preset channels or by manually setting up the frequency on the LCD display. The preset frequencies may be stored in memory and may be changed any time the transceiver is turned on. The memory is maintained using an EEPROM that allows the presets to be stored even when the power is turned off or the transceiver batteries are removed. The EEPROM provides non-volatile memory and does not require the use of a keep-alive-voltage.

In normal operating mode, the display will show the channel currently in use. The receive frequency and its associated data for that channel will be displayed while the transceiver is in receive mode. When the PTT is pressed, the transmit frequency and its associated data for that channel will be displayed. When transmitting, the transmit annunciator (**TX**) will be on.



If the [R/T] key is pressed while in receive mode, the transmit frequency will be displayed, but the transceiver will still be receiving on the current channel's receive frequency. This situation is indicated by a blinking transmit annunciator. Pressing PTT at this point will put the transceiver in transmit mode, causing the transmit annunciator to come on steadily. When the PTT is released, the transceiver will go back into receive mode with the receive frequency and data for this channel being displayed.

2-3.1.1 Turning on the Unit

Before performing the following steps, refer to Paragraph 2-2 for the location and functional description of the controls and indicators.

1. Make sure the transceiver set is connected for operation according to the installation instructions in Section 3.

2. Turn on the transceiver by turning the VOL control clockwise.

3. Set the VOL control for the desired volume (the SQ control must be in maximum counter clockwise position). To hear audio from the loudspeaker the speaker must be enabled per Paragraph 2-3.1.4.

4. Adjust the SQ control for the threshold by advancing clockwise slowly, just until the noise stops. Advancing the control further will reduce the sensitivity of squelch break.

2-3.1.2 Cancellation of Presets

If the transceiver is powered-up while the [MODE] key is pressed, the transceiver will preset all the channel data for each channel to the default values (225 MHz, PT, AM, low power). It is this default condition that is used as the starting point for the following discussions.

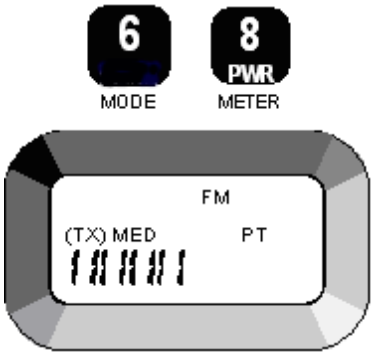
2-3.1.3 Front Panel Illumination

Pressing the [LAMP] key Controls the backlighting of the display and keyboard. Consecutive key strokes cycles through the four levels of brightness -- off No backlighting), low, medium, and high.
When the transceiver is turned ON, the normal default from the factory is with the backlighting off.

2-3.1.4 Select Speaker ON/OFF

Pressing the [SPKR] key toggles the loudspeaker ON and OFF. When the [SPKR] key toggles the loudspeaker ON, the **SPKR** annunciator will appear in the upper right corner of the display. This is to signify that the loudspeaker has been turned ON. When the [SPKR] key toggles the loudspeaker OFF, the **SPKR** annunciator will disappear.
When the transceiver is turned ON, the normal default from the factory is with the speaker off.

2-3.1.5 Select Meter Mode



Pressing the [MODE] key and then the [PWR] key activates the METER MODE. When the transceiver is in the receive mode, the display becomes a signal strength meter in the form of a bargraph, indicating the relative strength of the incoming receive signal. The meter will indicate a single bar at approximately -115 dBm and be full scale at approximately +3 dBm.
When the transceiver is in the transmit mode (PTT pressed), indicated by the **TX** annunciator, the display becomes a power meter. At high UHF frequencies its accuracy is approximately 1 Watt per bar. As frequency decreases the power meter may be indicating a decrease in output power. This does not reflect a true reduction in output power. The true output power will be within specification across the frequency band.

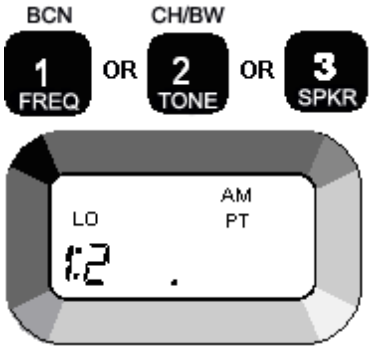
2-3.2. SETTING PRESET CHANNELS

This section describes how the preset channels are set. The transceiver is initially assumed to be set-up with the following conditions: low power, AM, plain text (PT), and a frequency of 225 MHz (for both receive and transmit), these are default values that are achieved when the transceiver is powered-up with the [MODE] key pressed, as described in Paragraph 2-3.1., above. The transceiver does not need to be set-up with these default settings; the following procedure applies for any settings except that the display examples will be different.

2-3.2.1 Select Preset Channels

Pressing the [CH] key and then one of the numbered [n] keys, selects channel [n], the display shows the frequency and the attributes associated with that channel. This example shows the key-press sequence for selecting Preset Channel 1. Any channel from 0 to 9 may be selected.

2-3.2.2 Select Frequencies



With a channel set-up as above, pressing the [FREQ] key (key-pad [1]) the transceiver will go into the "enter frequency" mode. The main display is blanked out except for the channel number (the number shown to the left the colon). The first digit of the desired frequency (1, 2, or 3) is pressed next and is displayed to the right of the colon. At this point, the transceiver will still be receiving on the same frequency as before. As the remaining digits of the desired frequency are entered, they will be displayed. Pressing the [<--] key will cause the last digit entered to be erased. If the first digit of the frequency is erased, the display will go back to showing the current receive frequency for this channel. When the sixth digit of the frequency is entered, the rest of the frequency is automatically determined, so the correct frequency is displayed and the transceiver is set to that frequency. Note that this can be used as a "manual" receive channel since the new frequency and any other associated data that has been changed will not be stored in memory until the [STO] key is pressed. If the Receive mode display is shown, entering the frequency will change the frequency for both Receive and Transmit frequencies. If the Transmit mode display is shown, entering the frequency changes only the Transmit frequency. If a flashing frequency is displayed on the transceiver's screen, it may be an indication that an invalid frequency was entered into the transceiver. Reenter the frequency with a valid frequency.

NOTE

It is possible to enter a frequency in the 30 to 90MHz frequency band either through the transceiver's front panel keypad or through the RS-232 ports on the J2 Remote Connector even though the 30 to 90MHz Enhancement Option is not installed in the transceiver. If a frequency in this range is entered and the 30 to 90MHz Enhancement Option is not installed, the frequency displayed on the transceiver's front panel will flash. Also, the transceiver's receiver and transmitter will not respond to the invalid frequency.

By reentering the frequency with a valid frequency from the keypad or through the RS-232 ports the flashing display will cease and the transceiver will return to normal operation.

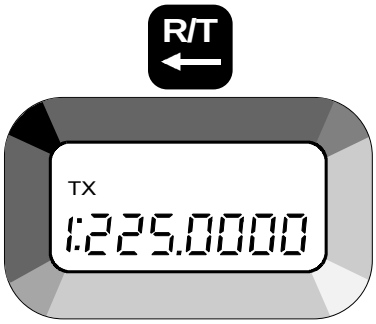
2-3.2.3 Select Modulation Mode

Pressing the [AM/FM] key causes the transceiver to toggle between the AM and FM modulation modes for the currently-displayed channel. The new value will take effect immediately, as indicated by the annunciator, but will not be stored until the [STO] key is pressed. This select automatically applies to both sides of the preset channel, i.e., if AM is selected for the receive frequency, the transmit frequency is also AM. If the new modulation is AM and the transmit power level was MED, the power level will be automatically changed to HI (there is no AM MED level). If the Receive mode display is shown, the new modulation will apply to both the Receive and Transmit frequencies. If the Transmit mode display is shown, the new modulation will apply to the transmit frequency only.

2-3.2.4 Select Cipher Text/Plain Text

Pressing the [PCV] key toggles between the plain-text and cipher-text (data) modes for the currently-displayed channel. The new value will take effect immediately when the [STO] key is pressed, as indicated by the annunciator.

2-3.2.5 Select Receive/Transmit Data



Pressing the [R/T] key switches the display between the receive frequency and its operating data for the selected channel and the transmit frequency and data for that channel. When the transmit data is displayed, the transmit annunciator, **TX** will blink. This key is also used as "back-space" when in the frequency select mode as described in Paragraph 2-3.2.2.

2-3.2.6 Storing Presets

Pressing the [STO] key stores into memory the frequencies (receive and transmit), mode (PT/CT), modulation (AM/FM), transmit power (Tx), bandwidth, and scan list membership for the selected channel.

2-3.2.7 Select Scan Channels

Pressing the [SCAN] key switches the selected preset channel on or off the scan list. The scan list must contain from two to ten of the preset channels before the scan mode can operate. The **SCAN** annunciator will light to indicate that this preset channel is on the scan list.

2-3.2.8 Select Transmit Power Levels

Pressing the [PWR] key selects the transmit power levels for the transceiver. The power level annunciator will show the current setting. There are three power levels, **LO**, **MED**, and **HI**, available in the FM modulation mode and two power levels, **LO** and **HI**, when AM is selected.

2-3.3. SELECTING SPECIAL MODES

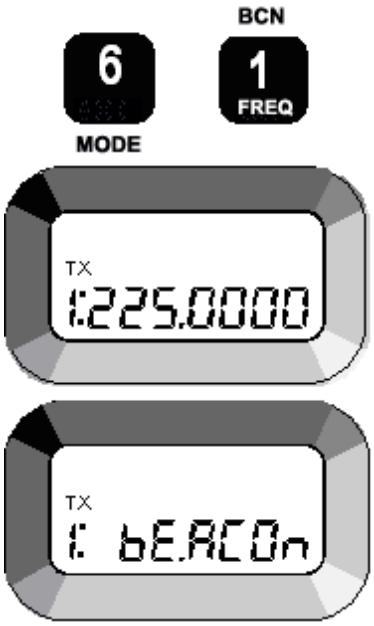
The following paragraphs describe the procedures for special operating modes and functions of the transceiver. The special operating modes consist of the Beacon-, Guard-, and Scan-mode of operation. The special functions consist of Self Calibration of Receive Filters, Internal Voltage Measurements, and Return to Local Control from Remote operation.

2-3.3.1 Select Scan Mode

Pressing the [MODE] key and then the [SCAN] key activates or de-activates the SCAN MODE. The scan mode causes the transceiver to cycle through the preset channels which are flagged as "scan channels", (see Paragraph 2-3.2.7), searching for an active channel I.e., one where incoming signal strength is sufficiently large to break squelch). While scanning, the display will show the channel that it is scanning. The transceiver will scan for 0.5 second on each selected scan channel. If an active channel is found, the transceiver will lock on that channel. If that channel becomes inactive for approximately four seconds, the transceiver will continue the scan with the next flagged channel. If the operator wishes to continue the scan while on a channel that is (or was) active, the [SCAN] key can be pressed. When an active channel is found, that channel's receive frequency will be displayed. If the push-to-talk key (PTT) is pressed while the transceiver is scanning, it will be ignored. If the PTT is pressed while a channel is active, the transceiver will go out of scan mode and into the normal mode using that channel, transmitting on that channel's preset transmit frequency. If the scan list has less than two channels, then the LCD will blink "**Err-noSC**" indicating the transceiver cannot enter the scan mode. To return to normal operation press the [CH] key followed by one of the 10 channel numbers [0 through 9]. The Scan Mode will be cancelled and the transceiver will go to the selected channel.

When the scan mode is de-activated normally, by using the [MODE] plus [SCAN] keys, or by turning the transceiver OFF then ON, the transceiver will return to normal operation on the channel which was in use immediately prior to entering the SCAN MODE.

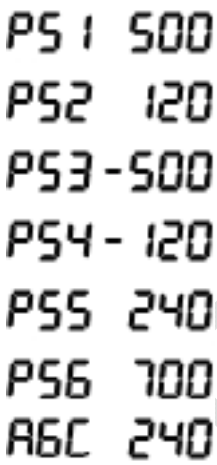
2-3.3.2 Select Beacon Mode



Pressing the [MODE] key and then the [BCN] key activates or de-activates the BEACON MODE. When the BEACON MODE is selected, the transceiver transmits a sweeping emergency audio signal on the selected channel frequency and in the selected modulation mode (AM or FM). The display alternately switches between the word "**BEACON**" and the selected channel information. No other operating functions are available when the BEACON is active.

When the beacon mode is de-activated (by toggling the mode off or by turning the power OFF and then ON), the transceiver will go back into normal mode using the channel that was in use immediately prior to entering the BEACON MODE.

2-3.3.3 Internal Voltage Measurements



With the transceiver set-up in the meter-mode per Paragraph 2-3.1.5., pressing the [R/T] key will display the voltages of the internal power supplies and of the batteries. The first time [R/T] is pressed the voltage of the +5Vdc supply - PS1 is displayed. Each consecutive press of [R/T] brings up the next supply; PS2: +12Vdc, PS3: -5Vdc, PS4: -12Vdc, PS5: +24Vdc (external power batteries), PS6: +70Vdc and AGC.

NOTE

The voltages displayed on the front panel are relative voltages. If a voltage/s appears to be too low or too high, measure the suspected voltage using a lab type voltmeter. The AGC level displayed is not a voltage. The AGC level is expressed as a digital value from 000 to 255.

2-3.3.4 Release from Remote Control

Pressing the [MODE] key and then the [R/T] key returns the transceiver to local control from remote control. This sequence is called Release Remote Key Sequence (RRKS). This key sequence has no effect if the transceiver is not in the remote control mode. There is no on-screen indication that the transceiver is back in local mode.

2-4. ECS-8 8.33 KHZ OPTION

This is the 8.33 kHz tuning increment / channel spacing option. The features of this option are only available if this option has been installed. If your transceiver has this option installed, refer to Section 5 for detailed information and operating procedures.

2-5. OPERATING PROCEDURE

2.5.1 SITING

The transceiver operates in the VHF and UHF frequency bands, these are Line-Of Sight (LOS) frequencies; therefore, siting of the transceiver greatly affects its operating range. The longest range is normally obtained when a direct LOS is maintained between the transceivers. Use of hilltop or tower locations will increase the LOS range. Location in valleys with intervening hills, behind buildings or in dense woods may reduce or prevent communications. If possible, avoid locations near electrical interference sources, such as power and telephone lines, radars, welders and electrical generators.

2-5.1. UNENCRYPTED OPERATION

The following procedure allows unencrypted operation.

1. Attach the VHF/UHF antenna and H-189/GR handset to the transceiver.
2. Turn the transceiver on by rotating the VOL control clockwise.
3. Set the transceiver **PT.**
4. Set the SQ control to OFF and set the VOL control until noise is heard from the handset or the loudspeaker If enabled per Paragraph 2-3.1.4).
5. Select operating modes and frequencies per Paragraph 2-3.
6. To transmit, hold the H-189/GR handset Push-To-Talk (PTT) switch down while talking into the mouthpiece.
7. To receive, release the PTT switch and listen to the handset earpiece or to the loudspeaker.
8. To eliminate the background noise when no receive signal is present, turn the SQ control clockwise just until the noise turns off. Adjusting the control further clockwise reduces the sensitivity of the squelch-break.

2-6. URC-200 (V2) EEPROM LIMITATIONS

The URC-200 (V2) transceivers use the Freescale MC9S08DN60AMLH microprocessor for control and interface operations of the transceiver. The processor has 2048 bytes of internal EEPROM that is capable of storing data after the power has been turned off. The EEPROM's write cycle (an erase followed by a write) is only guaranteed for 100,000 operations. However, typical operational life at ambient temperatures (approximately +25°C) is much greater.

Excessive use of the following commands will result in a reduction in the EEPROM's write cycle.

2-6.1. FRONT PANEL USER COMMAND LIMITATIONS

The following front panel user commands should be used only as needed.

2-6.1.1 Select Scan Channels

When a preset channel is selected or deselected for the scan list, the preset channel data is updated. Repeated use of this command may result in defective channel data. (Reference: Paragraph 2-3.2.7 and Table 3-3, "C" code.

2-6.1.2 Cancellation of Presets

This command is used to initialize all channels to a default configuration (AM, low power, 225 MHz receive and transmit, PT, wideband, and off scan list). (Reference: Paragraph 2-3.1.2 and Table 3-3, "I" code.

2-6.1.3 Select Preset Channels

This command changes the currently selected preset and updates the current preset channel number in the EEPROM. Excessive use of this command may result in the transceiver

always starting in preset channel 0 at power up. (Reference: Paragraph 2-3.2.1 and Table 3-3, "P" code.

2-6.1.4 Storing Presets

This command allows the user to change the stored information for the current preset channel. (Receive/transmit frequency, and selection of AM or FM. Excessive use of the Q command may result in defective channel data and/or the transceiver may always start in preset channel 0 at power up. (Reference: Paragraph 2-3.2.6 and Table 3-3, "Q" code.

2-6.2. ALIGNMENT COMMAND LIMITATIONS

The following alignment commands should be used only as needed.

2-6.2.1 Warp Alignment Command

This is a factory setting used to set the crystal warp. This value should rarely require adjustment (typically once a year or less often). Excessive use of the warp command may result in defective crystal operation and/or loss of lock at some or all frequencies and/or the transceiver will behave as if factory initialization has not been completed. (Reference: Table 3-3, "W" code.

2-7. ERROR MESSAGES

The following eight error messages are produced by the URC-200 (V2) Transceiver and are displayed on the front panel screen. The displayed error, the error title, and a description of the error are indicated below in Table 2-2.

Table 2-2. Error Messages

Display	Error Title	Description
Err – bEAC	Beacon Lock Failure	This message indicates that there is no synthesizer lock on beacon.
Err – EEPr	EEprom Failure	This message indicates that data could not be written into the EEPROM and that the processor should be replaced.
Err – FACt	Factory Init Incomplete	This message is produced after the installation of a newly programmed microprocessor. It indicates that the initialization has not been completed for this transceiver.
Err – noSC	Scan Error	This message indicates that an attempt to begin scanning failed because less than two channels are selected for Scan mode.
Err – trPr	PA Path Over	This message indicates that the VFWD is below the calculated threshold value.
Err – UOLt	Voltage Out of Range	This message indicates that the 70 volt supply is out of its normal range either high (>80 V) or low (<60 V).
tOO – HOt	Over Temp Error	This message indicates that the transmitter's power amplifier temperature is above normal range. When this alarm condition exists, the transceiver will automatically reduce the transmitter power by half until the temperature returns to normal range.

SECTION 3. INSTALLATION

3-1. GENERAL INFORMATION

This section contains information necessary for preparing the URC-200 (V2) Transceiver for use. Included is information on installation of the battery, handset and antenna. Also provided are connector pin-outs, levels and impedances and computer interface information for remote control of the transceiver via a RS-232 interface.

3-2. ASSEMBLY AND PREPARATION FOR USE

3-2.1. CHECKING UNPACKED EQUIPMENT

After unpacking it, check the equipment as follows:

1. Inspect the equipment for possible damage incurred during shipment.
2. Check to see that equipment is complete.

3-2.2. INSTALLING OR REPLACING THE BATTERIES

The following batteries may be used in the transceiver:

• BA-5390/U	Lithium Manganese Dioxide	Non-rechargable
• BA-5590B/U	Lithium Sulfur Dioxide	Non-rechargable
• BB-390A/U	Nickel Metal Hydride	Rechargable
• BB-590/U	NiCad	Rechargable
• BB-2590/U	Lithium Ion	Rechargable

WARNING

DO NOT THROW BATTERIES IN THE TRASH

Dispose of all used batteries in accordance with all Federal, State and local laws and regulations. Lithium batteries may be used in the URC-200 (V2) Transceiver however lithium batteries contain hazardous materials.

Improper handling, reverse-current operation or high environmental temperatures may cause internally generated heat, fire or toxic materials and gasses to be released from the battery.

The following precautions must be strictly observed to prevent injury to personnel or damage to equipment:

- **DO NOT** heat, incinerate, crush, puncture, disassemble or mutilate the batteries.
- **DO NOT** recharge primary Non- rechargeable) batteries.
- **DO NOT** store in equipment during periods of non-use for more than 30 days.
- **DO** follow all safety instructions that come with the batteries or printed on them.
- **TURN OFF** the equipment immediately if you (1) detect that the battery compartment is becoming unduly hot, (2) hear battery cells venting (hissing), or (3) smell irritating sulfur dioxide gas. Remove the battery only after it is cool (after 30 to 60 minutes), and dispose of it by following approved procedures.

NOTE

Lithium Battery Pre-Conditioning

When using BA-5590/U lithium batteries, General Dynamics – C4 Systems recommends that the user consult MIL-B-49430 (ER), 'MIL-SPEC, Batteries, non-rechargeable, Lithium Sulfur Dioxide', and MIL-B-49430/3D (ER) 'MIL-SPEC, Batteries, non-rechargeable, Lithium Sulfur Dioxide BA-5590/U.' Particular attention should be paid to the paragraphs relating to voltage delay of the BA-5590/U.

It is recommended that the batteries be changed in pairs. New, unconditioned, lithium batteries may not be able to deliver the current required to allow the transceiver to transmit in high power. To condition the lithium batteries the user can, after installing the new batteries, set the transceiver to low power and key the transmitter for 20 to 30 seconds, then set the transceiver to medium power and again key the transmitter for 20 to 30 seconds, the batteries should now be conditioned and capable of supplying sufficient current to allow the transceiver to transmit in the high power mode.

The battery case holds two batteries. Always use two of the same type battery when replacing batteries. To replace the batteries, follow these instructions:

1. Turn off the transceiver by turning VOL/OFF control to OFF.
2. Set transceiver face down on the front panel handles.
3. Undo the two latches, located on the side of the transceiver to unlatch the battery case from the transceiver.
4. Pull the battery case straight up and away from the transceiver.
5. Remove the used batteries from the transceiver by pulling straight up.
6. Plug new batteries into the transceiver.
7. Slide battery case over the batteries and into the rear skirt of the transceiver, fastening it into place with the two latches.

3-2.3. ATTACHING AND REMOVING THE HANDSET

Attach the handset to the HDST connector. The O-ring seal on the handset may require considerable exertion before rotating the mating connector clockwise into a locked position.

3-2.4. ATTACHING THE ANTENNA

3-2.4.1 Attaching the Antenna

Before attaching the UVU-100 LOS antenna to the transceiver, verify the ball and swivel joint at the mounting base of the antenna is free to swivel. If it is not free, then loosen the swivel clamp ring from the collar ring. These two rings are located at the antenna base. With the ball and swivel joint free to swivel, screw the antenna to the ANT connector with only the collar ring. **Exercise Extreme Care** to prevent the threads on the collar ring from cross-threading with the threads on the ANT connector. To set the antenna in a vertical position, tighten the swivel joint clamp ring against the collar ring with the antenna in its proper position. With the swivel joint clamp ring tightened, **DO NOT** use the antenna as a lever to cinch the collar ring to the ANT connector.

CAUTION

Several conditions must be observed when using the UVU-100 LOS antenna mounted on the transceiver's front panel, as serious damage to the transceiver may result if high RF power is allowed to leak into the interior of the transceiver directly from the antenna.

1. Transmit **ONLY** with the cover of the transceiver securely fastened in place.

2. Use **ONLY** vendor supplied power supplies, such as the RF shielded battery case (UBC-100) or power supply (UAC-100).

3. Use **ONLY** TEMPEST approved shielded cables to the X-MODE connector.

3. Use **ONLY** TEMPEST approved shielded cables to the X-MODE connector.

CAUTION

To comply with RF exposure requirements, a minimum separation distance of 20 cm (7.9 inches) is required between the antenna and all persons while the transceiver is transmitting.

3-2.4.2 Removing the Antenna

To remove the antenna from the transceiver, first loosen the swivel clamp ring to allow the ball and swivel joint, at the antenna's mounting base, to freely swivel. Then unscrew the collar ring from the ANT connector and remove the antenna. With the swivel joint clamp ring tightened, **DO NOT** use the antenna as a lever to loosen or remove the collar ring from the ANT connector.

3-3. REMOTE OPERATION

The Remote Control Unit (RCU) shown in Figure 3-1 can either be a personal computer or it can be a Remote Terminal Unit (a handset, or a control head connected by a cable of up to 250 ft). As shown, the RCU is connected in a master/slave relationship to the transceiver and the RCU always initiates a given command. All commands are sent as a series of ASCII characters over the RS232 connection.

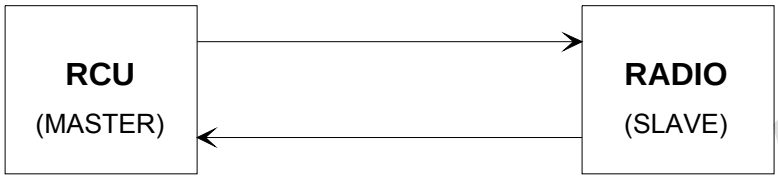


Figure 3-1. Remote-Control Unit

When first powered up, the RCU sends an ID interrogation code to query what type of radio it is connected to (what options have been attached). Given this information, the RCU restricts the type of commands that it can transmit to the transceiver. When the remote command is recognized by the transceiver as a valid command, the transceiver will enter into the slave mode (the RCU is the master with the transceiver as the slave). The transceiver will also lock out all local keyboard inputs (except for the Release Remote Key Sequence, RRKS: [Mode] [R/T]) allowing all commands to come from the RCU.

3-3.1. REMOTE CONTROL INTERCONNECT

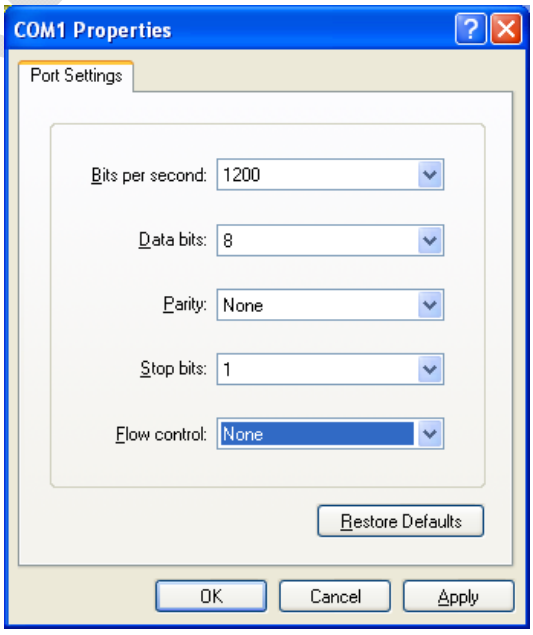
3-3.1.1 X-mode Connector

The X-mode pins used for remote-control of the transceiver are:

Pin #	Description
S	Remote Data Out (ASCII data from the transceiver)
a	Remote Data In (ASCII data to the transceiver)
A	Ground

3-3.1.2 Data Rates and Logic Levels

If using HyperTerminal, configure as shown.



The data rate is 1200 bps ±5%. The data code is serial 8-bit ASCII including no parity, one start bit and one stop bit, no flow control. The logic levels for the three-wire serial interface are as follows.

Pin #	Description	IMPEDANCE	LOGIC LEVEL
S	Remote Data Out	470 Ω	RS232
a	Remote Data In	6.8 kΩ	RS232
A	Ground		

3-3.1.3 Data Exchange Protocol

The RCU initiates all configuration commands and status inquiries to the transceiver using the RS-232 data communication protocol. Configuration commands control a change of state or a parameter of the transceiver such as AM/FM or transmit frequency. Status inquiries return transceiver data such as internal power supply voltage levels.

Each command or inquiry results in a response from the transceiver. If the transceiver receives a valid command, it performs the command and responds with an ACK reply to the RCU. If the transceiver receives an inquiry that requires a data response, the data is sent first, followed by ACK. If the transceiver receives an invalid command, it responds with a NAK reply. In the case where the transceiver is in manual (keypad) mode and it is commanded to change to the remote mode, it first responds with HT and then responds to further commands with ACK or NAK.

The ACK, NAK, and HT remote responses are summarized in Table 3-1.

Table 3-1. Remote Responses

CODE	NAME	DESCRIPTION
ACK	Acknowledge	Response from the transceiver to a valid RCU command. If the command requires data from the transceiver, the data is sent first, followed by ACK.
NAK	No Acknowledge	Response from the transceiver to an invalid RCU command.
HT	New acknowledge	A response from the transceiver indicating that the transceiver was in the keypad (manual) command mode at the time it received a remote command. The transceiver changes mode to the remote command mode and sends HT. This acknowledge is used instead of an ACK for the first valid remote command received when transceiver was in keypad command mode.

The RCU cannot send a new command until it receives an ACK/NAK/HT or times out, whichever occurs first. If the RCU receives a NAK or times out, send the Z command to re-establish sync with the transceiver.

Provisions must be made on the RCU side to poll the status of the transceiver especially in the over-temp, scan, and synth lock conditions. Another provision that the RCU should make is that after three (3) NAKs from the transceiver for the same command, the RCU should display an error code to indicate that an interface problem or an invalid command has occurred.

The RCU (handset or control head) should display the status on its LCD display only after it has queried the transceiver for data. In this way, the RTU and the transceiver displays will always agree.

NOTE

To conserve power, the RS232 transmitter in the transceiver is automatically turned off after an ACK or HT is sent. This essentially puts the TX in the break state. The remote software must handle any special interrupts etc. that may occur as a result of a break.

3-3.2. REMOTE CONTROL CODES

The following tables show the remote control command codes for the URC-200 (V2) Transceiver. The commands are organized as follows:

- Remote Transceiver Operation Commands
- Transceiver Customizing Commands
- Transceiver Status Inquiry Commands

The codes for the basic transceiver as well as those for the available options are included in the tables. The available options are:

- 30 - 90 MHz extended frequency option, EBN-30
- 400 - 420 MHz extended frequency option, EBN-400
- 8.33 kHz tuning increment / channel spacing option, ECS-8

Many of the commands are only valid for certain transceiver configurations and frequency ranges, Table 3-2 provides a mapping of these dependencies. In Table 3-3, the commands affected by these dependencies are indicated by a reference to “Note 1” below the command. For example, if the transceiver is equipped with the 30-90 MHz option, AM is not available, but FM, PT and CT are, including the other parameters in the remainder of the column. Similarly, 8.33 kHz tuning is available only for the 115 - 173.995 MHz and 225 - 399.995 MHz bands.

Table 3-2 URC-200 (V2) Operational Frequency-Based Dependencies.

	30-90 MHz[1]	115 - 173.995 MHz	225 - 399.995 MHz	400-420 MHz[1]
AM	N	Y[2]	Y	N
FM	Y	Y	Y	Y
PT	Y	Y	Y	Y
CT	Y	Y	Y	Y
Tone Squelch (150 Hz)	PT only (unless custom code used)	N	N	N
25 kHz Tuning	Y	Y	Y	Y
12.5 kHz Tuning	Y	Y N in Aviation Mode)	Y N in Aviation Mode)	Y
5 kHz Tuning	N	Y N in Aviation Mode)	Y N in Aviation Mode)	Y
8.33 kHz Tuning[1]	N	Y	Y	N
RX IF Filter[1,3] Selectable (AM PT)	NA	Non-Aviation: Y Aviation: N (Auto) [4]	NA	NA
Pre/De-Emphasis (FM PT)	N	Y (132-173.995 MHz)	N	Y
FM RF Output Power	5, 1, or 0.15 Watts	10, 5, or 0.1 Watts	10, 5, or 0.1Watts	10, 5, or 0.1Watts
AM RF Output Power	NA	10 or 5 Watts	10 or 5 Watts	NA

[1] Indicates an option.
[2] Transceiver operates over full band, but spec is guaranteed from 115 - 149.995 MHz only.
[3] The 8.33 kHz filter only applies to 117.975 – 136.975 MHz.
[4] (Auto). Indicates that as you enter the frequency, an 8.33 or 25 kHz channel is selected and the correct filter is automatically selected, depending on the value entered.

Table 3-3. Remote Transceiver Operation Commands

CODE	NAME	DESCRIPTION	EQUIVALENT TRANSCEIVER KEYPAD COMMAND
Z	Zap	Command sent to the transceiver to disregard the current remote command (or partial command) and re-sync. Transceiver will ACK/HT	None)
$	Squelch Control	The "$" Command followed by three digits in the following format will adjust the remote squelch. "$xxx" where: 'xxx' = a decimal number from 000–255. When in remote mode, the transceiver uses the remote squelch value rather than the squelch knob setting. The remote value is initialized to the knob value when a remote session is initiated.	(There is no equivalent keypad response for the $ Command. The $ Command is equivalent to the SQUELCH Control on the Transceiver's front panel, see Paragraph 2-3.1.1-4)
I	Channel Initialization	Initializes all channels to the default values (AM, PT, low power, 225 MHz, Wideband (25 kHz), Aviation Mode Off).	Press 6 MODE and turn ON transceiver (See Paragraph 2-3.1.2)
L	Lamp Control	The "L" Command followed by a 0, 1, 2, or 3 will select the intensity of the transceiver's display backlighting "L0" = Lamp Off "L1" = Lamp Low "L2" = Lamp Med "L3" = Lamp Hi	9 LAMP (See Paragraph 2-3.1.3)
J	Speaker On/Off	The "J" Command followed by a 0 or 1 will select whether the transceiver's internal speaker is OFF or ON. "J0" = Speaker Off "J1" = Speaker On	3 SPKR (See Paragraph 2-3.1.4)
P	Preset Channel Select	The "P" Command selects the preset channel to be displayed and used. The "P" Command followed by a decimal digit from 0 to 9 will select the preset channel. "P0" = Channel 0 "P1" = Channel 1 : : "P9" = Channel 9	0 CH BCN 1 FREQ (See Paragraph 2-3.2.1)

Table 3-3. Remote Transceiver Operation Commands (Cont)

CODE	NAME	DESCRIPTION	EQUIVALENT TRANSCEIVER KEYPAD COMMAND
R Note 1	Receive Frequency	The "R" Command sets the receive frequency value for the current preset channel. The “R” Command followed by 6 digits will define a receive frequency value. The 7th digit is automatically determined by the transceiver. The ‘x’ values, along with the 7th digit, must be divisible by 25 kHz, 12.5 kHz, or 5 kHz. "Rxxxxxx" = receive frequency Transceivers with the EBN-30 Option, for the 30-90 MHz band, the first digit following the “R” Command will be a "0" which is then followed by 5 digits to define the receive frequency value. The 7th digit is automatically determined by the transceiver. The ‘x’ values, along with the 7th digit, must be divisible by 25 kHz or 12.5 kHz. “R0xxxxx” = receive frequency for the 30-90 Band Transceivers with the EBN-400 Option, for the 400-420 MHz band, the first digit following the “R” Command will be a "4" which is then followed by 5 digits to define the receive frequency value. The 7th digit is automatically determined by the transceiver. The ‘x’ values, along with the 7th digit, must be divisible by 25 kHz, 12.5 kHz, or 5 kHz. “R4xxxxx” = receive frequency for the 400-420 Band	BCN 1 FREQ 0 - 9 *XXX* (ENTER 6 DIGITS) Note: When using the keypad to input the receive frequency, the transmit frequency is also entered simultaneously. (See Paragraph 2-3.2.2)

Table 3-3. Remote Transceiver Operation Commands (Cont)

CODE	NAME	DESCRIPTION	EQUIVALENT TRANSCEIVER KEYPAD COMMAND
T Note 1	Transmit Frequency	The “T” Command sets the transmit frequency value for the current preset channel. The “T” Command followed by 6 digits will define a transmit frequency value. The 7th digit is automatically determined by the transceiver. The ‘x’ values, along with the 7th digit, must be divisible by 25 kHz, 12.5 kHz, or 5 kHz. "Txxxxxx" = transmit frequency Transceivers with the EBN-30 Option, for the 30-90 MHz band, the first digit following the “T” Command will be a "0" which is then followed by 5 digits to define the transmit frequency value. The 7th digit is automatically determined by the transceiver. The ‘x’ values, along with the 7th digit, must be divisible by 25 kHz or 12.5 kHz. “T0xxxxx” = transmit frequency for the 30-90 Band Transceivers with the EBN-400 Option, for the 400-420 MHz band, the first digit following the “T” Command will be a "4" which is then followed by 5 digits to define the transmit frequency value. The 7th digit is automatically determined by the transceiver. The ‘x’ values, along with the 7th digit, must be divisible by 25 kHz, 12.5 kHz, or 5 kHz. “T4xxxxx” = transmit frequency for the 400-420 Band	R/T ← BCN 1 FREQ 0 – 9 *XXX* (ENTER 6 DIGITS) (See paragraphs 2-3.2.5 and 2-3.2.2)
M Note 1	Modulation Mode TRANSMIT/RECEIVE	The “M” Command followed by a 0 or 1 will select the transmit and receive modulation mode that is to be displayed and used. "M0" = TRANSMIT/RECEIVE AM "M1" = TRANSMIT/RECEIVE FM	AV 4 AM/FM (See Paragraph 2-3.2.3)
N Note 1	Modulation Mode TRANSMIT only	The “N” Command followed by a 0 or 1 will select only the transmit modulation mode that is to be displayed and used. "N0" = TRANSMIT AM "N1" = TRANSMIT FM	R/T ← AV 4 AM/FM (See paragraphs 2-3.2.5 and 2-3.2.3)

Table 3-3. Remote Transceiver Operation Commands (Cont)

CODE	NAME	DESCRIPTION	EQUIVALENT TRANSCEIVER KEYPAD COMMAND
X Note 1	Text Mode	The “X” Command followed by a 0 or 1 will select between PT (Plain Text, Voice) and CT (Cipher Text, Data). "X0" = Plain Text (PT) "X1" = Cipher Text (CT) (Returns a NAK if in Aviation Mode) For transceivers with the EBN-30 and/or the UPL-100 Option: If the 150Hz Tone Squelch is activated the transceiver will revert to the Plain Text (PT) mode only.	5 PT/CT (See Paragraph 2-3.2.4)
Q	Store Function	The “Q” Command will store the entered data in EEPROM for the current preset channel.	STO (See Paragraph 2-3.2.6)
C	Scan list member	The “C” Command followed by a 0 or 1 will select whether the current preset channel is ON or OFF the Scan List. "C0" = OFF the scan list "C1" = ON the scan list	7 SCNLST SCAN (See Paragraph 2-3.2.7)
# Note 1	Power Level Setting	The “#” Command followed by a 0, 1, or 2 will select the transmitter’s output power for the current preset channel. "#0" = FM: Lo power, AM: Lo power "#1" = FM: Med power, AM: Hi power "#2" = FM: Hi power, AM: Hi power	8 PWR METER (See Paragraph 2-3.1.5)
S	Scan Mode	The “S” Command followed by a 0 or 1 will place the transceiver in the Scan Mode. "S0" = Scan Mode Off "S1" = Scan Mode On Note, if the scan list has less than two preset channels, the transceiver will return a "NAK". Only Inquiry Command ?02 is available during the scan operation.	6 MODE 7 SCNLST SCN (See Paragraph 2-3.3.1)
*	Beacon Mode	The “*” Command followed by a 0 or 1 will place the transceiver in the Beacon Mode. "*0" = Beacon Mode Off, "*1" = Beacon Mode On	6 BCN 1 FREQ (See Paragraph 2-3.3.2)

Table 3-3. Remote Transceiver Operation Commands (Cont)

CODE	NAME	DESCRIPTION	EQUIVALENT TRANSCEIVER KEYPAD COMMAND
+	Keypad Control	When in the Remote Mode, the "+" Command remotely re-enables the keypad.	6 MODE R/T ← (See Paragraph 2-3.3.4)
B	Transmit Command	The "B" Command sets the transceiver into the transmit mode from the receive mode. Note, to set the transceiver back to the receive mode, use the "E" Command as described below.	None)
E	Receive Mode	The "E" Command returns the transceiver from the transmit mode back to the receive mode. Note, to set the transceiver into the transmit mode, use the "B" Command as described above.	None)
The following command applies to transceivers with the EBN-30 Option, 30-90 MHz Band Enhancement			
> Note 1	150 Hz Tone Squelch	This command is only effective for 30 - 90 MHz range frequencies. Transceivers with the EBN-30 Option, for the 30-90 MHz band, the ">" Command followed by a 0, 1, 2, or 3 will enable/disable the 150 tone squelch. ">0" = Turns OFF the 150 Hz tone squelch for both receive and transmit. ">1" = Turns ON the 150 Hz tone squelch for receive only. ">2" = Turns ON the 150 Hz tone squelch for transmit only. ">3" = Turns ON the 150 Hz tone squelch for both receive and transmit. Transceivers with the UPL-100 Option, Private Line (PL), will note that if the Private Line tone is currently ON, the ">" Command will return a "NAK".	CH/BW 2 TONE

Note 1 – Please see Table 3-2 (Operational Frequency-Based Dependencies) for restrictions.

Table 3-4. Transceiver Customizing Codes

CODE	NAME	DESCRIPTION
e	Transceiver's Internal Speaker	The "e" Command followed by the appropriate two decimal digits will set the state of the transceiver's internal speaker upon turn ON of the transceiver. "e00" = Speaker is OFF at transceiver turn ON (default) "e01" = Speaker is ON at transceiver turn ON
	Transceiver's Front Panel Backlighting	The "e" Command followed by the appropriate two decimal digits will set the intensity of the backlighting on the transceiver's front panel keyboard and display upon turn ON of the transceiver. "e10" = Backlighting OFF (default) "e11" = Backlighting at intensity level 1 (low) "e12" = Backlighting at intensity level 2 (medium) "e13" = Backlighting at intensity level 3 (high)
q	Squelch Control when in the CT mode	The "q" Command followed by the appropriate three decimal digits will set the state of the CT squelch. "q020" = CT squelch is always broken. The Squelch Control has no effect. (default) "q021" = CT squelch is broken by the signal level as controlled by the Squelch Control. Notes: 1. The Squelch Control can be either the front panel SQUELCH Control or the remote squelch as controlled by the "$xxx" command. 2. PT squelch is unaffected by the "qxxx" command.
	Scan Control	The "q" Command followed by the appropriate three decimal digits will set the state of the Scan function. "q030" = Scanning stops upon completion of a transmission. (default) "q031" = Scanning resumes upon a completion of a transmission.
^	Delay and Timing Parameters	xx = 00 to 01 yyy = 000 to 255. xx = device number yyy = device value Device descriptions: ***00:*** *DVI Shutdown Time (Obsolete)* ***01:*** *PTT Check Squelch Delay* Specifies the amount of time In 10 ms units) to wait before checking squelch after entering receive mode following a PTT release. Example: ^01060 sets delay to 600 msecs.
!	Aviation Mode	Initializes all channels to the default values including Aviation Mode On(AM, PT, low power, 225 MHz, Wideband 25 kHz, Aviation Mode On).
<	Wideband vs. Narrowband selection	<1: Enable Wideband Filter If "833 authorized" option is enabled. <2: Enable Narrowband Filter If "833 authorized" option is enabled. Returns a NAK if "833 authorized" option is not enabled.

Table 3-5. Transceiver Status Inquiry Commands

CODE	NAME	DESCRIPTION
?01	Synth Lock/Unlock	The transceiver will respond to whether its synthesizer is in a lock or unlock condition. "A0" = synthesizer is unlocked "A1" = synthesizer is locked
?02	Channel Scan Detect	This inquiry is used to determine whether or not squelch has been broken during scan mode. If so, the channel number is identified. "Q0" = Channel 0 detected during scan "Q1" = Channel 1 detected during scan : : "Q9" = Channel 9 detected during scan "QN" = No channel currently detected Note: This is the only inquiry command allowed while in the Scan mode.
?03	Receive Sig Strength	The transceiver will respond to the value of the SQ CL, which represents the signal strength of a received signal. "Nxxx" – where 'xxx' = a decimal value (000-255) representing the signal strength.
?04	Calibration Status	The transceiver will respond with the status of the tuning procedure. H0 if calibration is not complete. H1 if calibration is complete.
?05	Power Supply Status	The transceiver will respond with the decimal values of the power supplies (without the decimal points). "Vaaabbbcccdddeeefff" – where: 'aaa' = the +5 Vdc reading (a.aa) 'bbb' = the +12 Vdc reading (bb.b) 'ccc' = the -5 Vdc reading (c.cc) 'ddd' = the -12 Vdc reading (dd.d) 'eee' = the +24 Vdc reading (ee.e) 'fff' = the +70 Vdc reading (ff.f)
?06	VFWD Status	The transceiver will respond by sending back the value of the VFWD read. "Zxxx" – where 'xxx' = the decimal value
?07	VRFD Status	The transceiver will respond by sending back the value of the VRFD read. "Ixxx" – where 'xxx' = the decimal value.
?08	SW Version	The transceiver will respond by sending back a value representing the software version followed by the date and time of compilation. "Ux" – 'U' represents the URC-200 (V2) version and 'x' represents the Rev level followed by the date and time as follows: "tr ccccccccc **Ver**vv ‘Mmm dd yyyy hh:mm:ss’ “ t = Radio type (‘V’ = urc200/500) r = Revision level. ccc… = Control drawing number Ie: 98-P41135F) vv = Version number. mmm = Month (Jan, Feb, …) dd = Day. yyyy = Year. hh = Hour. mm = Minute. ss = Second.
?09	Squelch Level Setting	The value of the squelch setting of the transceiver. This command returns the front panel control setting or the remote setting depending on whether the transceiver is in local or remote at the time the inquiry is sent. "$xxx" – where 'xxx' is a decimal number from 0 to 255.

Table 3-5. Transceiver Status Inquiry Commands

CODE	NAME	DESCRIPTION
?10	Current Preset Status	Gives status of the various values of the current preset. "Txxxxxxx" = Transmit Frequency "Rxxxxxxx" = Receive Frequency "Mx" – AM/FM – TRANSMIT/RECEIVE “M0” = TRANSMIT/RECEIVE AM “M1” = TRANSMIT/RECEIVE FM "Nx" – AM/FM – TRANSMIT only “N0” = TRANSMIT AM “N1” = TRANSMIT FM "Cx" – SCAN LIST ON/OFF “C0” = Not on scan list “C1” = On scan list "Px" – PRESET NUMBER "#x" – Power Level “#0” = Lo Power “#1” = Med Power “#2” = High Power
?11	General Status	Gives the general status of the transceiver in the form : “**XxJjLldyFfv**zzz” "Xx" – PT/CT “X0” = PT “X1” = CT "Jx" – SPEAKER OFF/ON “J0” = Speaker OFF “J1” = Speaker ON "Lx" – LAMP OFF/LO/MED/HI “L0” = Lamp Off “L1” = Lamp Lo “L2” = Lamp Med “L3” = Lamp Hi "dx" – Option Status "d0" - no options "d1" - PL option selected "d2" - 30_90 option selected "d3" - both PL and 30_90 option selected "d4" - 420 option selected "d5" - both PL and 420 option selected "d6" - both 30_90 and 420 option selected "d7" - all three options selected "Fx" – Overtemp Condition “F0” - Temperature OK “F1” - Overtemp Condition zzz = 000 if no options are selected = 001 to 255 depending on the options enabled (see the ‘d’ cmd..
?12	General Mode Status	Gives the mode of the transceiver with one of the codes shown below. This will indicate whether it is in the Beacon, normal receive, or transmit mode. "*1" = Beacon mode "U0" = Receive mode "U1" = Transmit mode
?13	Squelch Status	"[0" = Transceiver Squelched "[1" = Transceiver Squelch Broken
?14	Warp Value	Returns the current warp value in the following format: "Wxxx" where: ‘W’ = Warp and 'xxx' = the current Warp value

Table 3-5. Transceiver Status Inquiry Commands

CODE	NAME	DESCRIPTION
?15	Crystal Values	Value is returned in the form: "**%**xxyyzzaa" See "%" remote command.
?16	Power Level Values	Returns the value in the form: "**&**aaabbbcccdddeeefffgggghhhiiijjjkkk" aaa = AM Low value. bbb = AM High value. ccc = FM Low value. ddd = FM Medium value. eee = FM High value. fff = AM high value at 115 MHz. ggg = AM high value at 152 MHz. hhh = AM high value at 174 MHz. iii = AM high value at 225 MHz. jjj = AM high value at 400 MHz. kkk = AM high value at 420 MHz.
?17	Tuning Filter Value	Returns the value of the tuning filter pot. "}nnn" is the value returned where: 'nnn' = a value from 0 - 255.
?18	Reserved	
?19	30_90 Tone	Returns the value in the form "**>**n" n = 0 if receive and transmit tones are off. = 1 if 150 Hz receive-tone is on. = 2 if 150 Hz transmit-tone is on. = 3 if both receive and transmit tones are on.
?20 to ?70	Deviation Values Non-VP)	Returns the value in the form "**F**xxx" xxx = current value of that variable.
?71	Flat Slope Status	Returns "fx" where 'x' = 0 if no flat slope and 'x' = 1 if flat slope is set.
?72	5 kHz Spacing	Return the value in the form: "**n**x" x = 0 if 5 kHz spacing is disabled. X = 1 if 5 kHz spacing is enabled.
?73	Startup Enable Values	Returns the startup enable values as shown below: "e.0a.1b" -- where: a = 0 if speaker is off. = 1 if speaker is on. b = 0 if display lamp is off. = 1 if display lamp is at intensity level 1. = 1 if display lamp is at intensity level 2. = 1 if display lamp is at intensity level 3.
?74	Transceiver Control Modes	Value is returned in the form: "**q.00**a**.01**b**.02**c**.03**d" a = 0 if transceiver in old RF card mode. = 1 if transceiver in new RF card mode. b = 0 if PT & CT are channel specific. = 1 if PT & CT are global. c = 0 if CT squelch control is static. = 1 if CT squelch control is dynamic. d = 0 if scan stops after a PTT press/release. = 1 if scan continues after a PTT press/release
?75	Timing and Delay Parameters	Value is returned in the form: "**^.00**aaa**.01**bbb" aaa = DVI Shutdown Time (obsolete) bbb = PTT Squelch Delay In 10 ms units)

Table 3-5. Transceiver Status Inquiry Commands

CODE	NAME	DESCRIPTION
?76	Squelch Detect Parameters	Value is returned in the form: "**w.0**aaa**.1**bbb**.2**ccc **.3**ddd**.4**eee**.5**fff" aaa = 30 to 90 MHz squelch level scalar bbb = Carrier level slope scalar ccc = Noise level slope scalar ddd = Squelch level offset eee = Squelch pot slope scalar fff = Squelch threshold offset
?77 to ?79	Reserved	
?80 to ?85	Deviation Values (VP)	Returns the value in the form "**F**xxx" xxx = current value of that variable.
?86	Read PA-PATH discrete	Return values in the from: "Dx". x = 0 if PA-PATH discrete low, x = 1 if PA-PATH discrete high.
?87	Read muxed analog values	Returns value in the form: "abbbcccdddeeefff" bbb = CAL_DET_CTRL, ccc = B3_CAL_DET_CTRL, ddd = B3_LOCK_DET_CTRL, eee = B3_TONE_DET_CTRL, fff = LOCK_DET_CTRL.
?88	Read analog values	Returns value in the form: "bxxxcccdddeeefff" xxx = A2D_OVERTEMP, ccc = A2D_VOL_POT, ddd = A2D_SQL_NL, eee = A2D_SQL_CL, fff = A2D_SQL_POT.
?89	Aviation Mode	Returns value in the form: "!" n=0 Disable Aviation Mode n=1 Enable Aviation Mode
?90	Receiver Filter Bandwidth Selection	Returns value in the form: "<xxxx" xxxx = bandwidth value for the current channel (wideband or narrowband)
?99	Debug Inquiry	Returns value in the form: "?" The string returned by this command depends on debug code provided by the developer. If the chip was not compiled with the debug option, then this command will return a NAK.
The following inquiry command applies to transceivers with the EBN-30 Option, 30-90 MHz Band Enhancement.		
?19	30_90 SQL	Returns the status of the 150 Hz tone squelch. See ">" command in the Transceiver Adjustment Commands. Returns ">n" where 'n' = 0 for unsquelched, and 'n' = 1 for squelched.

3-4. INTERFACE CHARACTERISTICS

Figure 3-2 shows interface connector locations for the URC-200 (V2). The following tables list the interface characteristics of the voltages and signals of the URC-200 (V2) power, HDST, and X-mode connectors, respectively. Connector reference designation and connector part numbers are given in each table title. Table 3-10 provides part identification data for each connector.

Table 3-6. Power Connector J1 (CA110821-1) Pin Characteristics

PIN	FUNCTION
1	12V Battery 1 - Negative / Transceiver Ground for External Power Source

2	12V Battery 2 - Negative
3	No Connection for Lithium Battery, Grounded in a NiCad Battery.
4	12V Battery 1 - Positive
5	12V Battery 2 - Positive / +24 V transceiver power from External Power Source
6	No Connection

Table 3-7. Power Connector J5 (CA110821-1) Pin Characteristics

PIN	FUNCTION
1	12V Battery 1 - Negative / Transceiver Ground for External Power Source
2	12V Battery 2 - Negative
3	No Connection for Lithium Battery, Grounded in a NiCad Battery.
4	12V Battery 1 - Positive
5	12V Battery 2 - Positive / +24 V transceiver power from External Power Source
6	No Connection

Table 3-8. Handset Connector J4 (GC283F-1-050) Pin Characteristics

PIN	FUNCTION
A	GND - Ground
B	PT OUT. Adjustable from 0 to approximately 6.0 V Peak into 600 Ω
C	PTT-N. Push-to-Talk, . Ground to Transmit
D	PT IN. 1 mV nominal for full modulation into 150 Ω load.
E	Connected to pin B. (See Pin B)
F	Squelch. Receiver Squelch Output for RETRANSMIT, 0 TO +5v, 100 kΩ pull-up to +5Vdc. Logic gate output with a 50 Ω series resistor.

Table 3-9. X-MODE Connector J2 (MS3114E16-26S) Pin Characteristics

PIN	Signal Label	Function	Impedance	Level
TX AUDIO – PLAIN TEXT (VOICE)				
C	PT IN	Plain Text (Voice) Input	150 Ω	1 mV RMS
D	GND	Ground, Audio	GND	GND
H	HI LVL PT IN	Hi-Level PT In, Bal.	600 Ω	0.77 V RMS
J	HI LVL PT IN RTN	Hi-Level PT In, Bal.	2 MΩ to Ground	0.77 V RMS
RX AUDIO – PLAIN TEXT (VOICE)				
E	PT OUT	Plain Text (Voice) Output	600 Ω	0 V to approximately 6V Peak
D	GND	Ground, Audio	GND	GND
M	REM PT OUT	Plain Text Output, Bal.	600 Ω	5.5 V RMS @ Max. Mod.
Z	REM PT OUT RTN	Plain Text Output, Bal.	Balanced	5.5 V RMS
TX CIPHER TEXT (CT) - DATA				
B	CT IN	Cipher/Data Input	-	RS232
D	GND	Ground, Audio	GND	GND
RX CIPHER TEXT (CT) - DATA				
T	CT OUT	Cipher Text Output	-	RS232
D	GND	Ground, Audio	GND	GND
TX KEY LINE - PUSH-TO-TALK (PTT)*				
F	PTT-N	Push-To-Talk Input, Ground to Transmit	10 kΩ to +5V	RCV: +5 V XMT: GND
D	GND	Ground, Audio	GND	GND
		or		
X	GND-SIGNAL	DC Ground	-	-
RS-232 REMOTE				
S	RS232 TX	Remote Control Output	470 Ω	RS232
a	RS232 RCV	Remote Control Input	6.8 kΩ	RS232
X	GND-SIGNAL	DC Ground	-	-
ON/OFF REMOTE				
V	ON/OFF	Remote Power On/Off	-	+24 V @ 7 mA. (Source)
W	ON/OFF RTN	Remote Power On/Off	-	+24 V @ 7 mA. Input)

Table 3-9. X-MODE Connector J2 (MS3114E16-26S) Pin Characteristics (Continued)

PIN	Signal Label	Function	Impedance	Level
OTHER REMOTE LINES				
N	PT/CT CTRL	Plain Text/Cipher Text Control	150 kΩ	PT - Open CT - Ground
P	UHF/VHF-N	Amplifier Control	-	HI = UHF
R	FM/AM-N	Amplifier Control	-	HI = FM
X	GND-SIGNAL	DC Ground	-	-
24Vdc OUTPUT VOLTAGE				
G	+24VX	+24 Vdc Output	Battery or Power Source	30 VDC Maximum, 500 mA Maximum Drain
X	GND-SIGNAL	DC Ground	-	-
		or		
A	GND-CHASSIS	Chassis Ground	-	GND
SQUELCH OUTPUT				
U	SQUELCH	-	-	HI = Squelched
X	GND-SIGNAL	DC Ground	-	-
		or		
A	GND-CHASSIS	Chassis Ground	-	GND
SPARE				
K	-	-	-	-
Y	-	-	-	-
B	-	-	-	-
C	-	-	-	-
L	-	-	-	-
GROUNDS				
A	GND-CHASSIS	Chassis Ground	-	GND
D	GND	Ground, Audio	GND	GND
X	GND-SIGNAL	DC Ground	-	-

* The standard PTT configuration is 5-wire. A 4-wire configuration is available. Please contact General Dynamics C4 Systems Customer Service for further information.

Table 3-10. URC-200 (V2) Connector Identification

Connector Number	Name	Part Number	Next Higher Assembly	NHA Reference Designator	Mating Connector
J1	Power	CA110821-1	30-P35832M	P1	44249-6S HIRELCO
J2	X Mode	MS3114E16-26S	01-P35780M	J3	MS3116J16-26P
J3	Ant	3204-7388-10	30-P35833M	P1	STD BNC (Male)
J4	Handset	GC283F-1-050	01-P35780M	J2	GC329/U
J5	Power	CA110821-1	30-P35332M	P1	44249-6S HIRELCO

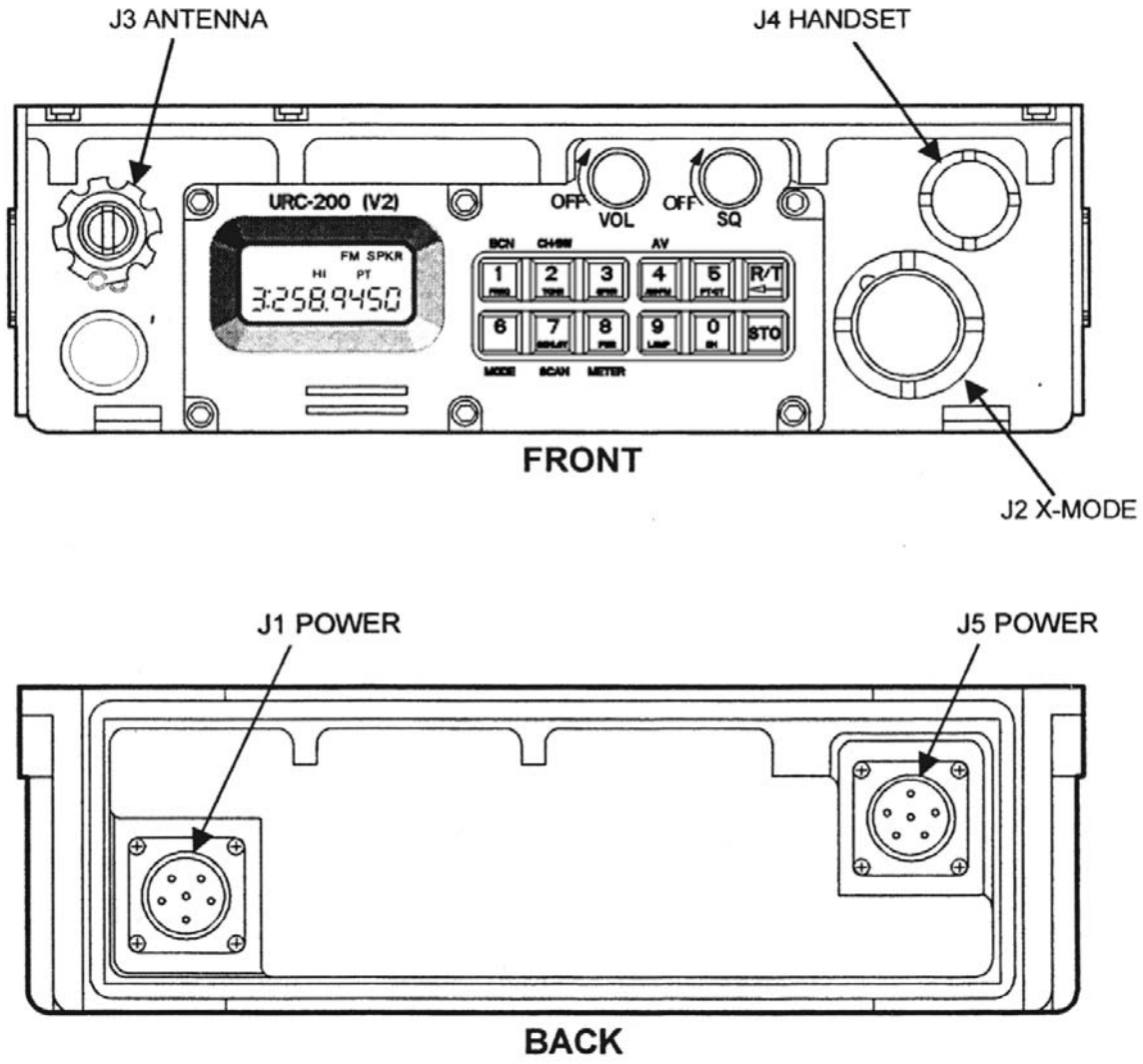


Figure 3-2. URC-200 (V2) Interfaces

SECTION 4. SYSTEM MAINTENANCE

4-1. GENERAL INFORMATION

This section provides a system-level performance test to check all operations of the URC-200 (V2) Radio Set. The following are also provided:

- Procedures to localize a malfunction to a defective module.
- Procedures for removal and replacement of all replaceable modules.
- List of required tools and test equipment.

NOTE

This section does not include system-level performance tests to check the various URC-200 (V2) options listed in Paragraph 1-8 of Section 1.

4-2. MANUAL SYSTEM TEST

The manual system test checks the operating parameters of the URC-200 (V2) under test, using Motorola's Communications System Analyzer (R2600 series) as the primary test equipment.

CAUTION

To comply with RF exposure requirements, a minimum separation distance of 20 cm (7.9 inches) is required between the antenna and all persons while the transceiver is transmitting.

4-2.1. TEST EQUIPMENT REQUIRED

Testing and troubleshooting the transceiver requires the test equipment listed in Table 4-1. If a R2600 Communications System Analyzer is not available, the alternate test equipment listed in Table 4-2 may be substituted to perform its functions. A schematic diagram for the breakout box is shown in Figure 4-4 at the end of the section.

Table 4-1. Test Equipment Required

Qty.	Description	Part No.	Supplier
1	Power Supply, 28 Vdc, 5A	HP-6291 A	Hewlett-Packard
1	Communications System Analyzer	R2600	General Dynamics
1	Breakout Box For X-MODE Connector	-	-
1	Current Meter	HP-428B	Hewlett-Packard

NOTE

- Verify the test equipment has been calibrated.
- When verifying the various test measurements against the operating parameters as listed in Table 1-1, take into consideration the accuracy of the test equipment being used.

Table 4-2. Alternate Test Equipment

Qty.	Description	Part No.	Supplier
1	Frequency Counter	HP-5383A	Hewlett-Packard
1	Signal Generator	HP-8640B	Hewlett-Packard
1	Distortion Analyzer	HP-334A	Hewlett-Packard

Table 4-2. Alternate Test Equipment

Qty.	Description	Part No.	Supplier
1	Digital Voltmeter	HP-3465A	Hewlett-Packard
1	RMS Voltmeter	HP-3400A	Hewlett-Packard
1	30 dB, 100-Watt Power Attenuator	769-30	Narda
1	3 dB Power Attenuator	766-3	Narda

Table 4-2. Alternate Test Equipment (Cont)

Qty.	Description	Part No.	Supplier
1	Power Meter	HP-436A	Hewlett-Packard
1	Modulation Meter	HP-8901 A	Hewlett-Packard
1	Audio Oscillator	HP-201 C	Hewlett-Packard
1	Oscilloscope	465	Tektronix
1	Power Supply, 28 Vdc, 5A	HP-6291A	Hewlett-Packard
1	Breakout Box For X-MODE Connector	-	-
1	Current Meter	HP-428B	Hewlett-Packard

4-2.2. RECEIVER TESTS

WARNING

DO NOT THROW BATTERIES IN THE TRASH

Dispose of all used batteries in accordance with all Federal, State and local laws and regulations. Lithium batteries may be used in the URC-200 (V2) Transceiver however lithium batteries contain hazardous materials.

Improper handling, reverse-current operation or high environmental temperatures may cause internally generated heat, fire or toxic materials and gasses to be released from the battery.

The following precautions must be strictly observed to prevent injury to personnel or damage to equipment:

- **DO NOT** heat, incinerate, crush, puncture, disassemble or mutilate the batteries.
- **DO NOT** recharge primary Non- rechargeable) batteries.
- **DO NOT** store in equipment during periods of non-use for more than 30 days.
- **DO** follow all safety instructions that come with the batteries or printed on them.
- **TURN OFF** the equipment immediately if you (1) detect that the battery compartment is becoming unduly hot, (2) hear battery cells venting (hissing), or (3) smell irritating sulfur dioxide gas. Remove the battery only after it is cool (after 30 to 60 minutes), and dispose of it by following approved procedures.

The following tests evaluate the performance of the receiver circuits. The functions that will be tested are receiver sensitivity and distortion at various frequencies in AM and FM, and in CT and PT modes. Squelch sensitivity will also be checked. If the transceiver fails any of the tests, or if it cannot be adjusted to specified values, it must be sent to General Dynamics C4 Systems for repair.

4-2.2.1 FM PT Sensitivity and Distortion

1. Set up the test equipment as shown in Figure 4-1. Connect the VERT/SINAD/DIST/DVM/COUNTER IN connector on the R2600 to Pin E (PT OUT) of the Breakout Box. Pin A or D of the remote connector is return ground.
2. Set the input power supply to 28 ± 0.1 Vdc.

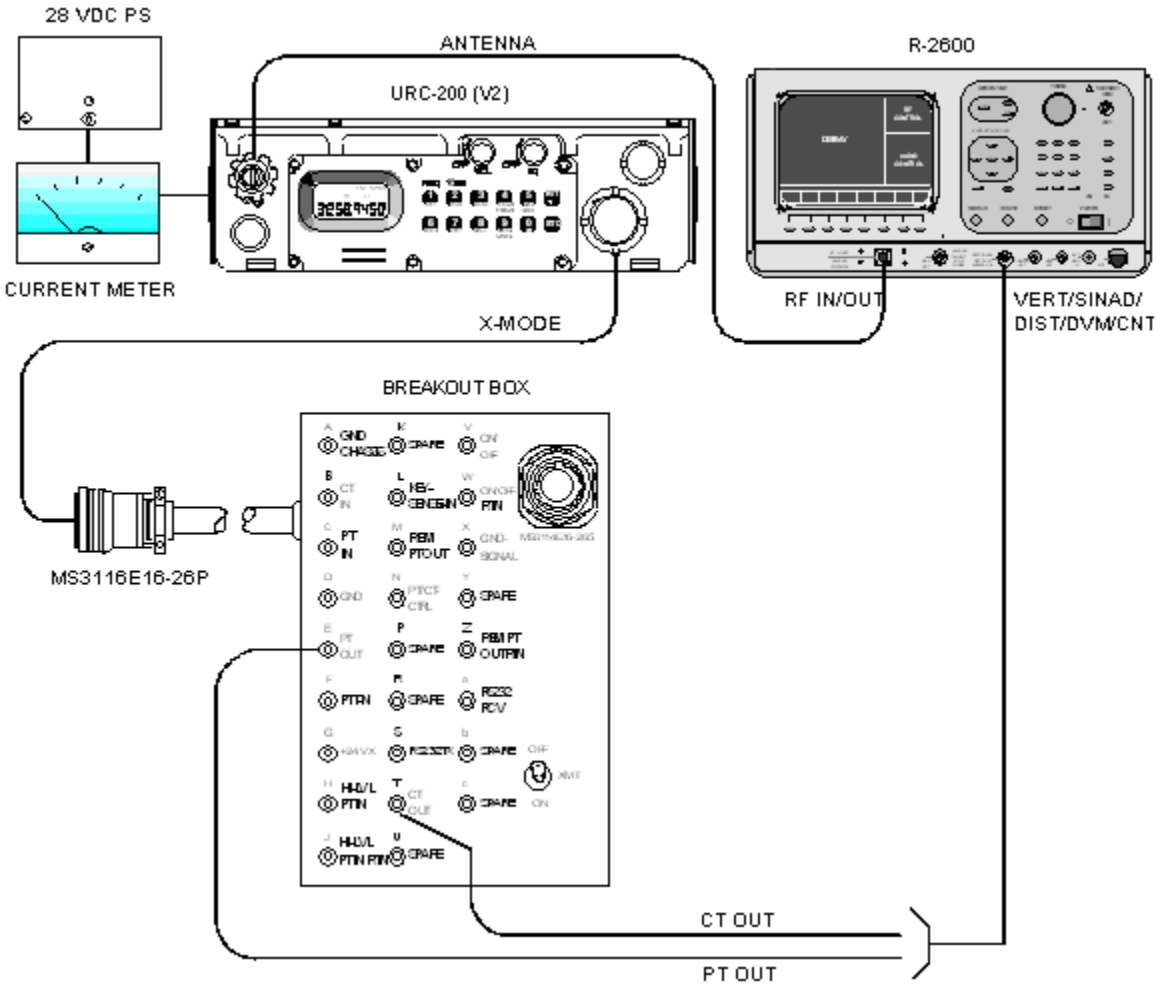


Figure 4-1. Receiver Test Equipment Setup

3. Preset the R2600 by performing the following steps.

   a. Press the MEM (Memory) key on the R2600 panel for the preset-screen.

   b. Use the CURSOR POSITION keys to highlight preset 01.

   c. Press the "view preset" softkey. Note: The softkeys are the eight keys under the CRT screen on the R2600.

   d. Using the CURSOR POSITION keys move to the Monitor Frequency position and enter 115.000 from the R2600 keypad.

   e. Move the cursor to Modulation Type and press the "FM" softkey.

   f. Move the cursor to the Generate Frequency position and enter 115.000 from the R2600 keypad.

   g. Move the cursor to Modulation Type and press the "FM" softkey.

   h. Move the cursor to bandwidth and press the "NARROW ±5 kHz" softkey.

   i. Move the cursor to the Duplex Offset position and press the "DON'T CARE" softkey.

   j. Move the cursor to Synth. Format Sel (Synthesizer Format Select) and select the "Tone A" softkey.

   k. Move the cursor to Freq (Frequency) and enter 01000.0 from the keypad.

   l. Move the cursor to the DTMF Code position and press the "DON'T CARE" softkey. Note: The "more" softkey may have to be depressed for the "DON'T CARE" softkey to be displayed.

m. Use Table 4-3 to program the frequency presets in steps D and F above.

n. Press the "return" softkey.

Table 4-3. FM Frequency Presets

Preset		Frequency
URC-200 (V2)	R2600	MHz
CH1	CH01	115.000
CH2	CH02	145.025
CH3	CH03	173.975
CH4	CH04	225.075
CH5	CH05	275.000
CH6	CH06	299.975
CH7	CH07	300.000
CH8	CH08	312.000
CH9	CH09	355.000
CH0	CH10	399.975

4. Perform the following steps to complete the setup on the R2600 analyzer.

   a. Press RF key on the R2600 panel. Move the cursor to RF Control and press the "GEN" softkey.

   b. Move the cursor to the Output Lvl (RF Output Level) position and enter a level of -050.0 dBm from the keypad.

   c. Move the cursor to the Gen RF Out position and press the "RF IN/OUT" softkey.

   d. Depress the AUD (Audio) key on the R2600 panel. Move the cursor to the Synth (Synthesizer) position and enter 6.50 kHz from the keypad. Note: This is FM deviation. Depress the RIGHT ARROW CURSOR CONTROL key and depress the "Cont" (Continuous) softkey.

   e. Move the cursor to the Fixed 1 kHz position. Depress the LEFT ARROW CURSOR CONTROL key and then depress the "Off" softkey.

   f. Verify the DTMF position and the External position are both OFF.

   g. Depress the DISP (Display) key on the R2600 panel. Move the cursor to the Meter position and depress the "AC VOLTS" softkey.

   h. Move the cursor to the Range position and depress the "AUTO" softkey.

   i. Move the cursor to the Display position and depress the "EXT SCOPE" softkey.

   j. Move the cursor to the Coupling position and depress the "AC" softkey.

   k. Move the cursor to the Trigger position and depress the "AUTO" softkey.

   l. Move the cursor to the Trigger Lvl (Trigger Level) position and enter 500 from the keypad.

   m. Move the cursor to the Horiz (Horizontal) position and depress the "500 us" softkey.

   n. Move the cursor to the Vert (Vertical) position and depress the "1 V" softkey.

   o. Move the cursor to the Pos (Position) position and depress the "move up" or "move down" softkeys as appropriate to center the displayed scope screen trace. Note: The TUNING knob on the R2600 panel may be used in lieu of the "move up" or "move down" softkeys.

   p. Adjust both the SQUELCH and VOLUME controls on the front panel to their maximum CCW positions.

5. Setup the URC-200 (V2) as follows:

   a. Turn the transceiver on and note the input current. It should be approximately 240mA. If the current exceeds 330mA, a problem exists in the transceiver. Turn off the power and troubleshoot the transceiver.

b. Set the frequency presets as listed in Table 4-3 on the URC-200 (V2). For each preset channel, adjust the URC-200 (V2) for the following. Note: Information on presetting the URC-200 (V2) is given in Paragraph 2-3.2 located in Section 2 of this manual.

FM, PT, SCN OFF, BCN OFF,

6. On the R2600, do the following:

   a. Verify the "AC VOLTS" is on in the Meter position of the DISP (Display) segment.

   b. Verify the "AUTO" is on in the Range position of the DISP (Display) segment.

   c. Set the presets on both the URC-200 (V2) and the R2600 to channel 01. Adjust the Volume control on the URC-200 (V2) to give an output level of 1.0 Vac ±0.1 Vac as read on the R2600 display.

   d. Receiver FM PT Sensitivity Measurement**:** Move the cursor to the Meter position and depress the "SINAD" softkey. Depress the RF key on the R2600 panel and move the cursor to the Output Lvl (RF Output Level) position. Position the highlight to the one-tenth position by depressing the RIGHT ARROW CURSOR POSITION key three times. Rotate the TUNING control counter-clockwise on the R2600 panel until an average of 10 dB of SINAD is read on the CRT display. Verify compliance with Table 1-1 located in Section 1 of this manual.

   e. Readjust the Output Lvl back to -50 dBm by rotating the TUNING control clockwise to -50 dBm. This can also be accomplished by moving the highlight back to the beginning of the Output Lvl position by using the CURSOR CONTROL keys and then entering -50 dBm on the keypad.

   f. Receiver FM PT Distortion Measurement**:** Depress the DISP (Display) and move the cursor to the Meter position. Depress the "EXT DIST" (External Distortion) softkey. The FM PT Distortion is displayed in percent in the Display area of the CRT screen. Verify compliance with Table 1-1 located in Section 1 of this manual.

   g. On both the URC-200 (V2) and the R2600 repeat steps A through F for preselect channels 2 through 9 and channel 0 on the URC-200 (V2) with the R2600 set on preset channel 10.

4-2.2.2 FM CT Sensitivity

1. Set up the test equipment as shown in Figure 4-1. Connect the VERT/SINAD/DIST/DVM/COUNTER IN connector on the R2600 to Pin T (CT Out) of the Remote connector. Pin A of the Remote connector is return ground.
2. Set the input power supply to 28 ± .1 Vdc.
3. Preset the R2600 by performing the following steps.

   a. Press the MEM (Memory) key on the R2600 panel for the preset-screen.

   b. Use the CURSOR POSITION keys to highlight preset 01.

   c. Press the "view preset" softkey. Note: The softkeys are the eight keys under the CRT screen on the R2600.

   d. Use the CURSOR POSITION keys to the Monitor Frequency position and enter 115.000 from the R2600 keypad.

   e. Move the cursor to Modulation Type and press the "FM" softkey.

   f. Move the cursor to the Generate Frequency position and enter 115.000 from the R2600 keypad.

   g. Move the cursor to Modulation Type and press the "FM" softkey.

   h. Move the cursor to bandwidth and press the "NARROW ±5 kHz" softkey.

   i. Move the cursor to the Duplex Offset position and press the "DON'T CARE" softkey.

   j. Move the cursor to Synth. Format Sel (synthesizer format select) and select the "Tone B" softkey.

k. Move the cursor to Freq (frequency) and enter 08000.0 from the keypad.

l. Move the cursor to the DTMF Code position and press the "DON'T CARE" softkey. Note: The "more" softkey may have to be depressed for the "DON'T CARE" softkey to be displayed.

m. Press the "return" softkey. Repeat steps A through K for presets 02 through 10. Use Table 4-3 to program the frequency presets in steps D and E above.

n. Press the "return" softkey.

4. Perform the following steps to complete the setup on the R2600 analyzer.

a. Press RF key on the R2600 panel. Move the cursor to RF Control and press the "GEN" softkey.

b. Move the cursor to the Output Lvl (RF Output Level) position and enter a level of -050.0 dBm from the keypad.

c. Move the cursor to the Gen RF Out position and press the "RF IN/OUT" softkey.

d. Depress the AUD (Audio) key on the R2600 panel. Move the cursor to the Synth (Synthesizer) position and from the keypad enter 5.00 kHz for VHF frequencies or 5.6 kHz for UHF frequencies. Note: This is FM deviation. Depress the RIGHT ARROW CURSOR CONTROL key and depress the "Cont" (Continuous) softkey.

e. Move the cursor to the Fixed 1 kHz position. Depress the LEFT ARROW CURSOR CONTROL key and then depress the "Off" softkey.

f. Verify the DTMF position and the External position are both OFF.

g. Depress the DISP (Display) key on the R2600 panel. Move the cursor to the Meter position and depress the "AC VOLTS" softkey. Note: The "more" softkey may have to be depressed for the "AC VOLTS" softkey to be displayed.

h. Move the cursor to the Range position and depress the "AUTO" softkey.

i. Move the cursor to the Display position and depress the "EXT SCOPE" softkey.

j. Move the cursor to the Coupling position and depress the "AC" softkey.

k. Move the cursor to the Trigger position and depress the "AUTO" softkey.

l. Move the cursor to the Trigger Lvl (Trigger Level) position and enter 500 from the keypad.

m. Move the cursor to the Horiz (Horizontal) position and depress the "50 us" softkey. Note: The "more" softkey may have to be depressed for the "50 us" softkey to be displayed.

n. Move the cursor to the Vert (Vertical) position and depress the "5 V" softkey. Note: The "more" softkey may have to be depressed for the "5 V" softkey to be displayed.

o. Move the cursor to the Pos (Position) position and depress the "move up" or "move down" softkeys as appropriate to center the displayed scope screen trace. Note: The TUNING knob on the R2600 panel may be used in lieu of the “move up" or "move down" softkeys.

p. Adjust both the SQUELCH and VOLUME controls on the front panel to their maximum CCW positions.

5. Setup the URC-200 (V2) as follows:

a. Turn the transceiver on and note the input current. It should be approximately 240mA. If the current exceeds 330mA, a problem exists in the transceiver. Turn off the power and troubleshoot the transceiver.

b. Set the frequency presets as listed in Table 4-3 on the URC-200 (V2). For each preset channel, adjust the URC-200 (V2) for the following. Note: Information on presetting the URC-200 (V2) is given in Paragraph 2-3.2 located in Section 2 of this manual.

FM, CT, SCN OFF, BCN OFF,

6. Receiver FM CT Sensitivity Measurement:

   a. Depress the RF key on the R2600 panel. Move the cursor to the Preset position and set it for Preset 01. Adjust the URC-200 (V2) for channel 1.

   b. Move the cursor to the Output Lvl (RF Output Level) position. Position the highlight to the one-tenth position by depressing the RIGHT ARROW CURSOR POSITION key three times. Rotate the TUNING control counter-clockwise on the R2600 panel until the RF Output Level reads the limit for FM CT Sensitivity as stated in Table 1-1 located in Section 1 of this manual.

   c. Verify the 8kHz waveform pattern on the screen of the R2600 has an amplitude of 4 VPP to 24 VPP. Verify the square wave pattern is the same as it was with a -50dBm signal except for the slight jumping around of the 8kHz pattern. Note, it may be helpful to observe the 8kHz pattern as the RF input level is decreased. The jumping around of the pattern will turn into a random breakup of the pattern.

   d. On both the URC-200 (V2) and the R2600 repeat steps A through C for preselect channels 2 through 9 and channel 0 on the URC-200 (V2) with the R2600 set on preset channel 10.

4-2.2.3 Receive AM PT Sensitivity and Distortion

1. Set up the test equipment as shown in Figure 4-1. Connect the VERT/SINAD/DIST/DVM/COUNTER IN connector on the R2600 to Pin E (PT OUT) of the Remote connector. Pin A or D of the remote connector is return ground.
2. Set the input power supply to 28 ±.1 Vdc.
3. Preset the R2600 by performing the following steps.

   a. Press the MEM (Memory) key on the R2600 panel for the preset-screen.

   b. Use the CURSOR POSITION keys to highlight preset 01.

   c. Press the "view preset" softkey. Note: The softkeys are the eight keys under the CRT screen on the R2600.

   d. Use the CURSOR POSITION keys to the Monitor Frequency position and enter 115.000 from the R2600 keypad.

   e. Move the cursor to Modulation Type and press the "AM" softkey.

   f. Move the cursor to the Generate Frequency position and enter 115.000 from the R2600 keypad.

   g. Move the cursor to Modulation Type and press the "AM" softkey.

   h. Move the cursor to bandwidth and press the "NARROW ±5 kHz" softkey.

   i. Move the cursor to the Duplex Offset position and press the "DON'T CARE" softkey.

   j. Move the cursor to Synth. Format Sel (synthesizer format select) and select the "Tone A" softkey.

   k. Move the cursor to Freq (frequency) and enter 01000.0 from the keypad.

   l. Move the cursor to the DTMF Code position and press the "DON'T CARE" softkey. Note: The "more" softkey may have to be depressed for the "DON'T CARE" softkey to be displayed.

   m. Press the "return" softkey. Repeat steps A through K for presets 02 through 10. Use Table 4-4 to program the frequency presets in steps D and E above.

   n. Press the "return" softkey.

Table 4-4. AM Frequency Presets

Preset		Frequency
URC-200 (V2)	R2600	MHz
CH1	CH01	115.000
CH2	CH02	133.025
CH3	CH03	149.975
CH4	CH04	225.075
CH5	CH05	275.000
CH6	CH06	299.975
CH7	CH07	300.000
CH8	CH08	312.000
CH9	CH09	355.000
CH0	CH10	399.975

4. Perform the following steps to complete the setup on the R2600 analyzer.
   a. Press RF key on the R2600 panel. Move the cursor to RF Control and press the "GEN" softkey.
   b. Move the cursor to the Output Lvl (RF Output Level) position and enter a level of -050.0 dBm from the keypad.
   c. Move the cursor to the Gen RF Out position and press the "RF IN/OUT" softkey.
   d. Depress the AUD (Audio) key on the R2600 panel. Move the cursor to the Synth (Synthesizer) position and enter 30% from the keypad. Note: This is AM modulation. Depress the RIGHT ARROW CURSOR CONTROL key and depress the "Cont" (Continuous) softkey.
   e. Move the cursor to the Fixed 1 kHz position. Depress the LEFT ARROW CURSOR CONTROL key and then depress the "Off" softkey.
   f. Verify the DTMF position and the External position are both OFF.
   g. Depress the DISP (Display) key on the R2600 panel. Move the cursor to the Meter position and depress the "AC VOLTS" softkey. Note: The "more" softkey may have to be depressed for the "AC VOLTS" softkey to be displayed.
   h. Move the cursor to the Range position and depress the "AUTO" softkey.
   i. Move the cursor to the Display position and depress the "EXT SCOPE" softkey.
   j. Move the cursor to the Coupling position and depress the "AC" softkey.
   k. Move the cursor to the Trigger position and depress the "AUTO" softkey.
   l. Move the cursor to the Trigger Lvl (Trigger Level) position and enter 500 from the keypad.
   m. Move the cursor to the Horiz (Horizontal) position and depress the "500 us" softkey. Note: The "more" softkey may have to be depressed for the "500 us" softkey to be displayed.
   n. Move the cursor to the Vert (Vertical) position and depress the "1 V" softkey. Note: The "more" softkey may have to be depressed for the "1 V" softkey to be displayed.
   o. Move the cursor to the Pos (Position) position and depress the "move up" or "move down" softkeys as appropriate to center the displayed scope screen trace. Note: The TUNING knob on the R2600 panel may be used in lieu of the "move up" or "move down" softkeys.
   p. Adjust both the SQUELCH and VOLUME controls on the front panel to their maximum CCW positions.

5. Setup the URC-200 (V2) as follows:

a. Turn the transceiver on and note the input current. It should be approximately 240mA. If the current exceeds 330mA, a problem exists in the transceiver. Turn off the power and troubleshoot the transceiver.

b. Set the frequency presets as listed in Table 4-4 on the URC-200 (V2). For each preset channel, adjust the URC-200 (V2) for the following. Note: Information on presetting the URC-200 (V2) is given in Paragraph 2-3.2 located in Section 2 of this manual.

AM, PT, SCN OFF, BCN OFF

6. On the R2600, do the following:

a Verify the "AC VOLTS" is on in the Meter position of the DISP (Display) segment.

b. Verify the "AUTO" is on in the Range position of the DISP (Display) segment.

c. Set the presets on both the URC-200 (V2) and the R2600 to channel 01. Adjust the Volume control on the URC-200 (V2) to give an output level of 1.0 Vac ±0.1 Vac as read on the R2600 display.

d. Receiver AM PT Sensitivity Measurement**:** Move the cursor to the Meter position and depress the "SINAD" softkey. Depress the RF key on the R2600 panel and move the cursor to the Output Lvl (RF Output Level) position. Position the highlight to the one-tenth position by depressing the RIGHT ARROW CURSOR POSITION key three times. Rotate the TUNING control counter-clockwise on the R2600 panel until an average of 10 dB of SINAD is read on the CRT display. Verify compliance with Table 1-1 located in Section 1 of this manual.

e. Readjust the Output Lvl back to -50 dBm by rotating the TUNING control clockwise to -50 dBm. This can also be accomplished by moving the highlight back to the beginning of the Output Lvl position by using the CURSOR CONTROL keys and then entering -50 dBm on the keypad.

f. Receiver AM PT Distortion Measurement**:** Depress the DISP (Display) and move the cursor to the Meter position. Depress the "EXT DIST" (External Distortion) softkey. The AM PT Distortion is displayed in percent in the Display area of the CRT screen. Verify compliance with Table 1-1 located in Section 1 of this manual.

g. On both the URC-200 (V2) and the R2600 repeat steps A through F for preselect channels 2 through 9 and channel 0 on the URC-200 (V2) with the R2600 set on preset channel 10.

4-2.2.4 Receiver AM CT Sensitivity

1. Set up the test equipment as shown in Figure 4-1. Connect the VERT/SINAD/DIST/DVM/COUNTER IN connector on the R2600 to Pin T (CT Out) of the Remote connector. Pin A or D of the remote connector is return ground.
2. Set the input power supply to 28 ± .1 Vdc.
3. Preset the R2600 by performing the following steps.
   a. Press the MEM (Memory) key on the R2600 panel for the preset-screen.
   b. Use the CURSOR POSITION keys to highlight preset 01.
   c. Press the "view preset" softkey. Note: The softkeys are the eight keys under the CRT screen on the R2600.
   d. Use the CURSOR POSITION keys to the Monitor Frequency position and enter 115.000 from the R2600 keypad.
   e. Move the cursor to Modulation Type and press the "AM" softkey.
   f. Move the cursor to the Generate Frequency position and enter 115.000 from the R2600 keypad.
   g. Move the cursor to Modulation Type and press the "AM" softkey.
   h. Move the cursor to bandwidth and press the "NARROW ±5 kHz" softkey.

i. Move the cursor to the Duplex Offset position and press the "DON'T CARE" softkey.

j. Move the cursor to Synth. Format Sel (synthesizer format select) and select the "Tone B" softkey.

k. Move the cursor to Freq (frequency) and enter 08000.0 from the keypad.

l Move the cursor to the DTMF Code position and press the "DON'T CARE" softkey. Note: The "more" softkey may have to be depressed for the "DON'T CARE" softkey to be displayed.

m. Press the "return" softkey. Repeat steps A through K for presets 02 through 10. Use Table 4-4 to program the frequency presets in steps D and E above.

n. Press the "return" softkey.

4. Perform the following steps to complete the setup on the R2600 analyzer.

a. Press RF key on the R2600 panel. Move the cursor to RF Control and press the "GEN" softkey.

b. Move the cursor to the Output Lvl (RF Output Level) position and enter a level of -050.0 dBm from the keypad.

c. Move the cursor to the Gen RF Out position and press the "RF IN/OUT" softkey.

d. Depress the AUD (Audio) key on the R2600 panel. Move the cursor to the Synth (Synthesizer) position and enter 70% from the keypad. Note: This is AM modulation. Depress the RIGHT ARROW CURSOR CONTROL key and depress the "Cont" (Continuous) softkey.

e. Move the cursor to the Fixed 1 kHz position. Depress the LEFT ARROW CURSOR CONTROL key and then depress the "Off" softkey.

f. Verify the DTMF position and the External position are both OFF.

g. Depress the DISP (Display) key on the R2600 panel. Move the cursor to the Meter position and depress the "AC VOLTS" softkey. Note: The "more" softkey may have to be depressed for the "AC VOLTS" softkey to be displayed.

h. Move the cursor to the Range position and depress the "AUTO" softkey.

i. Move the cursor to the Display position and depress the "EXT SCOPE" softkey.

j. Move the cursor to the Coupling position and depress the "AC" softkey.

k. Move the cursor to the Trigger position and depress the "AUTO" softkey.

l. Move the cursor to the Trigger Lvl (Trigger Level) position and enter 50 from the keypad.

m. Move the cursor to the Horiz (Horizontal) position and depress the "50 us" softkey. Note: The "more" softkey may have to be depressed for the "50 us" softkey to be displayed.

n. Move the cursor to the Vert (Vertical) position and depress the "5 V" softkey. Note: The "more" softkey may have to be depressed for the "5 V" softkey to be displayed.

o. Move the cursor to the Pos (Position) position and depress the "move up" or "move down" softkeys as appropriate to center the displayed scope screen trace. Note: The TUNING knob on the R2600 panel may be used in lieu of the "move up" or "move down" softkeys.

p. Adjust both the SQUELCH and VOLUME controls on the front panel to their maximum CCW positions.

5. Setup the URC-200 (V2) as follows:

a. Turn the transceiver on and note the input current. It should be approximately 240mA. If the current exceeds 330mA, a problem exists in the transceiver. Turn off the power and troubleshoot the transceiver.

b. Set the frequency presets as listed in Table 4-4 on the URC-200 (V2). For each preset channel, adjust the URC-200 (V2) for the following. Note: Information on presetting the URC-200 (V2) is given in Paragraph 2-3.2 located in Section 2 of this manual.

AM, CT, SCN OFF, BCN OFF

6. Receiver AM CT Sensitivity Measurement:

   a. Depress the RF key on the R2600 panel. Move the cursor to the Preset position and set it for Preset 01. Adjust the URC-200 (V2) for channel 1.

   b. Move the cursor to the Output Lvl (RF Output Level) position. Position the highlight to the one-tenth position by depressing the RIGHT ARROW CURSOR POSITION key three times. Rotate the TUNING control counter-clockwise on the R2600 panel until the RF Output Level reads the limit for AM CT Sensitivity as stated in Table 1-1 located in Section 1 of this manual.

   c. Verify the 8kHz waveform pattern on the screen of the R2600 has an amplitude of 4 VPP to 24 VPP. Verify the square wave pattern is the same as it was with a -50dBm signal except for the slight jumping around of the 8kHz pattern. Note, it may be helpful to observe the 8kHz pattern as the RF input level is decreased. The jumping around of the pattern will turn into a random breakup of the pattern.

   d. On both the URC-200 (V2) and the R2600 repeat steps A through C for preselect channels 2 through 9 and channel 0 on the URC-200 (V2) with the R2600 set on preset channel 10.

4-2.2.5 CT Audio Response

1. Set up the test equipment as shown in Figure 4-1. Connect the VERT/SINAD/DIST/DVM/COUNTER IN connector on the R2600 to Pin T (CT Out) of the Remote connector. Pin A of the Remote connector is return ground.

2. Set the input power supply to 28 ± .1 Vdc.

3. Preset the R2600 by performing the following steps.

   a. Press the MEM (Memory) key on the R2600 panel for the preset-screen.

   b. Use the CURSOR POSITION keys to highlight preset 08.

   c. Press the "view preset" softkey. Note: The softkeys are the eight keys under the CRT screen on the R2600.

   d. Use the CURSOR POSITION keys to the Monitor Frequency position and enter 312.000 from the R2600 keypad.

   e. Move the cursor to Modulation Type and press the "FM" softkey.

   f. Move the cursor to the Generate Frequency position and enter 312.000 from the R2600 keypad.

   g. Move the cursor to Modulation Type and press the "FM" softkey.

   h. Move the cursor to bandwidth and press the "NARROW ±5 kHz" softkey.

   i. Move the cursor to the Duplex Offset position and press the "DON'T CARE" softkey.

   j. Move the cursor to Synth. Format Sel (synthesizer format select) and select the "Tone A" softkey.

   k. Move the cursor to Freq (frequency) and enter 01000.0 from the keypad.

   l. Move the cursor to the DTMF Code position and press the "DON'T CARE" softkey. Note: The "more" softkey may have to be depressed for the "DON'T CARE" softkey to be displayed.

m. Press the "return" softkey twice.

4. Perform the following steps to complete the setup on the R2600 analyzer.

   a. Press RF key on the R2600 panel. Move the cursor to RF Control and press the "GEN" softkey.

   b. Move the cursor to the Output Lvl (RF Output Level) position and enter a level of -080.0 dBm from the keypad.

   c. Move the cursor to the Gen RF Out position and press the "RF IN/OUT" softkey.

   d. Depress the AUD (Audio) key on the R2600 panel. Move the cursor to the Synth (Synthesizer) position and from the keypad enter 5.00 kHz for VHF frequencies or 5.6 kHz for UHF frequencies. Note: This is FM deviation. Depress the RIGHT ARROW CURSOR CONTROL key and depress the "Cont" (Continuous) softkey.

   e. Move the cursor to the Fixed 1 kHz position. Depress the LEFT ARROW CURSOR CONTROL key and then depress the "Off" softkey.

   f. Verify the DTMF position and the External position are both OFF.

   g. Depress the DISP (Display) key on the R2600 panel. Move the cursor to the Meter position and depress the "AC VOLTS" softkey. Note: The "more" softkey may have to be depressed for the "AC VOLTS" softkey to be displayed.

   h. Move the cursor to the Range position and depress the "AUTO" softkey.

   i. Move the cursor to the Display position and depress the "EXT SCOPE" softkey.

   j. Move the cursor to the Coupling position and depress the "DC" softkey.

   k. Move the cursor to the Trigger position and depress the "AUTO" softkey.

   l. Move the cursor to the Trigger Lvl (Trigger Level) position and enter 500 from the keypad.

   m. Move the cursor to the Horiz (Horizontal) position and depress the "500 us" softkey. Note: The "more" softkey may have to be depressed for the "500 us" softkey to be displayed.

   n. Move the cursor to the Vert (Vertical) position and depress the "10 V" softkey. Note: The "more" softkey may have to be depressed for the "10 V" softkey to be displayed.

   o. Move the cursor to the Pos (Position) position and depress the "move up" or "move down" softkeys as appropriate to center the displayed scope screen trace. Note: The TUNING knob on the R2600 panel may be used in lieu of the "move up" or "move down" softkeys.

   p. Adjust both the SQUELCH and VOLUME controls on the front panel to their maximum CCW positions.

5. Setup the URC-200 (V2) as follows:

   a. Turn the transceiver on and note the input current. It should be approximately 240mA. If the current exceeds 330mA, a problem exists in the transceiver. Turn off the power and troubleshoot the transceiver.

   b. Adjust the URC-200 (V2) for preset channel 8. On the URC-200 (V2) set the frequency to the preset frequency as listed in Table 4-3 for channel 8. Adjust the URC-200 (V2) for the following. Note: Information on presetting the URC-200 (V2) is given in Paragraph 2-3.2 located in Section 2 of this manual.

FM, CT, SCN OFF, BCN OFF,

6. CT Audio Response Measurement (1 kHz):

   a. Note amplitude of the waveform in Vpp.

7. CT Audio Response Measurement (10 Hz): Measure the 10 Hz audio response by doing the following on the R2600:
   a. Depress the AUD (Audio) key
   b. Depress the cursor keys for the Tone A frequency. Adjust it to 10 Hz
   c. Depress the DISP (Display) key.
   d. Depress the Horizontal key.
   e. Depress the cursor control keys for 50 mS.
   f. Read and record the amplitude of the waveform in Vpp. This reading should be the same as the reading in step 6a.
8. CT Audio Response Measurement (10 kHz)**:** Measure the 10 kHz audio response by doing the following on the R2600:
   a. Depress the AUD (Audio) key
   b. Depress the cursor keys for the Tone A frequency. Adjust it to 10 kHz
   c. Depress the DISP (Display) key.
   d. Depress the cursor control keys for 50 uS
   e. Read and record the amplitude of the waveform in Vpp. This reading should be 4 to 24 VPP.

4-2.2.6 Squelch Sensitivity

1. Set up the test equipment as shown in Figure 4-1. Connect the VERT/SINAD/DIST/DVM/COUNTER IN connector on the R2600 to Pin E (PT OUT) of the Remote connector. Pin D of the Remote connector is return ground.
2. Set the input power supply to 28 ± .1 Vdc.
3. Preset the R2600 by performing the following steps.
   a. Press the MEM (Memory) key on the R2600 panel for the preset-screen.
   b. Use the CURSOR POSITION keys to highlight preset 08.
   c. Press the "view preset" softkey. Note: The softkeys are the eight keys under the CRT screen on the R2600.
   d. Use the CURSOR POSITION keys to the Monitor Frequency position and enter 312.000 from the R2600 keypad.
   e. Move the cursor to Modulation Type and press the "FM" softkey.
   f. Move the cursor to the Generate Frequency position and enter 312.000 from the R2600 keypad.
   g. Move the cursor to Modulation Type and press the "FM" softkey.
   h. Move the cursor to bandwidth and press the "NARROW ±5 kHz" softkey.
   i. Move the cursor to the Duplex Offset position and press the "DON'T CARE" softkey.
   j. Move the cursor to Synth. Format Sel (synthesizer format select) and select the "Tone A" softkey.
   k. Move the cursor to Freq (frequency) and enter 01000.0 from the keypad.
   l. Move the cursor to the DTMF Code position and press the "DON'T CARE" softkey. Note: The "more" softkey may have to be depressed for the "DON'T CARE" softkey to be displayed.
   m. Press the "return" softkey twice.
4. Perform the following steps to complete the setup on the R2600 analyzer.

a. Press RF key on the R2600 panel. Move the cursor to RF Control and press the "GEN" softkey.

b. Move the cursor to the Output Lvl (RF Output Level) position and enter a level of -080.0 dBm from the keypad.

c. Move the cursor to the Gen RF Out position and press the "RF IN/OUT" softkey.

d. Depress the AUD (Audio) key on the R2600 panel. Move the cursor to the Synth (Synthesizer) position and enter 6.50 kHz from the keypad. Note: This is FM deviation. Depress the RIGHT ARROW CURSOR CONTROL key and depress the "Cont" (Continuous) softkey.

e. Move the cursor to the Fixed 1 kHz position. Depress the LEFT ARROW CURSOR CONTROL key and then depress the "Off" softkey.

f. Verify the DTMF position and the External position are both OFF.

g. Depress the DISP (Display) key on the R2600 panel. Move the cursor to the Meter position and depress the "AC VOLTS" softkey. Note: The "more" softkey may have to be depressed for the "AC VOLTS" softkey to be displayed.

h. Move the cursor to the Range position and depress the "AUTO" softkey.

i. Move the cursor to the Display position and depress the "EXT SCOPE" softkey.

j. Move the cursor to the Coupling position and depress the "AC" softkey.

k. Move the cursor to the Trigger position and depress the "AUTO" softkey.

l. Move the cursor to the Trigger Lvl (Trigger Level) position and enter 500 from the keypad.

m. Move the cursor to the Horiz (Horizontal) position and depress the "500 us" softkey. Note: The "more" softkey may have to be depressed for the "500 us" softkey to be displayed.

n. Move the cursor to the Vert (Vertical) position and depress the "1 V" softkey. Note: The "more" softkey may have to be depressed for the "1 V" softkey to be displayed.

o. Move the cursor to the Pos (Position) position and depress the "move up" or "move down" softkeys as appropriate to center the displayed scope screen trace. Note: The TUNING knob on the R2600 panel may be used in lieu of the "move up" or "move down" softkeys.

p. Adjust both the SQUELCH and VOLUME controls on the front panel to their maximum CCW positions.

5. Setup the URC-200 (V2) as follows:

a. Turn the transceiver on and note the input current. It should be approximately 240mA. If the current exceeds 330mA, a problem exists in the transceiver. Turn off the power and troubleshoot the transceiver.

b. Adjust the URC-200 (V2) for preset channel 8. On the URC-200 (V2) set the frequency to the preset frequency as listed in Table 4-3 for channel 8. Adjust the URC-200 (V2) for the following. Note: Information on presetting the URC-200 (V2) is given in Paragraph 2-3.2 located in Section 2 of this manual.

FM, PT, SCN OFF, BCN OFF, SPKR ON

c. Adjust the SQ (Squelch) control fully counter-clockwise, past its detent, to the OFF position.

6. Squelch Sensitivity Measurements:

a. On the R2600 front panel depress the RF key. Move the cursor to the Output Lvl (RF Output Level) position. Using the TUNING knob on the front panel adjust the RF Output Level to <-130 dBm.

b. Adjust the Squelch control clockwise until the speaker just squelches. Adjust the TUNING knob which is adjusting the RF Output Level clockwise until the speaker just unsquelches. Note: The TUNING knob's resolution may have to be adjusted so it is controlling tenths of a dB of RF Output Level. To do this depress the RIGHT or LEFT ARROW CURSOR CONTROL keys to position the cursor on the RF Output Level's tenth of a dB position.

c. Read the RF Output Level. Verify compliance with Table 1-1 located in Section 1 of this manual.

4-2.2.7 Scan Function

1. Set up the test equipment as shown in Figure 4-1. Connect the VERT/SINAD/DIST/DVM/COUNTER IN connector on the R2600 to Pin E (PT Out) of the Remote connector. Pin A of the Remote connector is return ground.
2. Set the input power supply to 28 ±.1 Vdc.
3. Preset the R2600 by performing the following steps.
   a. Press the MEM (Memory) key on the R2600 panel for the preset-screen.
   b. Use the CURSOR POSITION keys to highlight preset 06.
   c. Press the "view preset" softkey. Note: The softkeys are the eight keys under the CRT screen on the R2600.
   d. Use the CURSOR POSITION keys to the Monitor Frequency position and enter 299.975 from the R2600 keypad.
   e. Move the cursor to Modulation Type and press the "FM" softkey.
   f. Move the cursor to the Generate Frequency position and enter 299.975 from the R2600 keypad.
   g. Move the cursor to Modulation Type and press the "FM" softkey.
   h. Move the cursor to bandwidth and press the "NARROW ±5 kHz" softkey.
   i. Move the cursor to the Duplex Offset position and press the "DON'T CARE" softkey.
   j. Move the cursor to Synth. Format Sel (synthesizer format select) and select the "Tone A" softkey.
   k. Move the cursor to Freq (frequency) and enter 01000.0 from the keypad.
   l. Move the cursor to the DTMF Code position and press the "DON'T CARE" softkey. Note: The "more" softkey may have to be depressed for the "DON'T CARE" softkey to be displayed.
   m. Press the "return" softkey. Repeat steps A through K for presets 07 and 08. Use Table 4-3 to program the frequency presets in steps D and E above.
   n. Press the "return" softkey.
4. Perform the following steps to complete the setup on the R2600 analyzer.
   a. Press RF key on the R2600 panel. Move the cursor to RF Control and press the "GEN" softkey.
   b. Move the cursor to the Output Lvl (RF Output Level) position and enter a level of -080.0 dBm from the keypad.
   c. Move the cursor to the Gen RF Out position and press the "RF IN/OUT" softkey.
   d. Depress the AUD (Audio) key on the R2600 panel. Move the cursor to the Synth (Synthesizer) position and enter 6.50 kHz from the keypad. Note: This is FM deviation. Depress the RIGHT ARROW CURSOR CONTROL key and depress the "Cont" (Continuous) softkey.
   e. Move the cursor to the Fixed 1 kHz position. Depress the LEFT ARROW CURSOR CONTROL key and then depress the "Off" softkey.

f. Verify the DTMF position and the External position are both OFF.

g. Depress the DISP (Display) key on the R2600 panel. Move the cursor to the Meter position and depress the "AC VOLTS" softkey. Note: The "more" softkey may have to be depressed for the "AC VOLTS" softkey to be displayed.

h. Move the cursor to the Range position and depress the "AUTO" softkey.

i. Move the cursor to the Display position and depress the "EXT SCOPE" softkey.

j. Move the cursor to the Coupling position and depress the "AC" softkey.

k. Move the cursor to the Trigger position and depress the "AUTO" softkey.

l. Move the cursor to the Trigger Lvl (Trigger Level) position and enter 500 from the keypad.

m. Move the cursor to the Horiz (Horizontal) position and depress the "500 us" softkey. Note: The "more" softkey may have to be depressed for the "500 us" softkey to be displayed.

n. Move the cursor to the Vert (Vertical) position and depress the "1 V" softkey. Note: The "more" softkey may have to be depressed for the "1 V" softkey to be displayed.

o. Move the cursor to the Pos (Position) position and depress the "move up" or "move down" softkeys as appropriate to center the displayed scope screen trace. Note: The TUNING knob on the R2600 panel may be used in lieu of the "move up" or "move down" softkeys.

p. Adjust both the SQUELCH and VOLUME controls on the front panel to their maximum CCW positions.

5. Setup the URC-200 (V2) as follows:

   a. Turn the transceiver on and note the input current. It should be approximately 240mA. If the current exceeds 330mA, a problem exists in the transceiver. Turn off the power and troubleshoot the transceiver.

   b. Set the channels 6, 7, and 8 for the preset frequencies as listed in Table 4-3. Adjust the URC-200 (V2) for the following. Note: Information on presetting the URC-200 (V2) is given in Paragraph 2-3.2 located in Section 2 of this manual.

      FM, PT, SCN ON, BCN OFF, SPKR ON, CH 8

   c. Adjust the SQ (Squelch) control fully counter-clockwise, past its detent, to the OFF position.

6. Scan Function Measurements**:**

   a. On the R2600 front panel depress the RF key. Move the cursor to the Output Lvl (RF Output Level) position. Using the TUNING knob on the front panel adjust the RF Output Level to <-130 dBm.

   b. Adjust the Squelch control clockwise until the speaker just squelches. Adjust the TUNING knob which is adjusting the RF Output Level clockwise until the speaker just unsquelches. Note: The TUNING knob's resolution may have to be adjusted so it is controlling tenths of a dB of RF Output Level. To do this depress the RIGHT or LEFT ARROW CURSOR CONTROL keys to position the cursor on the RF Output Level's tenth of a dB position.

   c. Set the transceiver to SCAN channels 6 through 8 as described in Paragraph 2-3.2.7 of Section 2.

   d. Turn SCN ON as described in Paragraph 2-3.3.1 of Section 2.

   e. Adjust SQ control clockwise until speaker squelches. After approximately 8 seconds, the display should show that channels 6 through 8 are being scanned.

f. On the R2600, increase the RF Output Level with the TUNING control until the speaker unsquelches. The display on the transceiver should now stop scanning and show Channel 8 (312 MHz).

g. Using the TUNING knob on the front panel adjust the RF Output Level to <-130 dBm. Select preset channel 6.

h. On the R2600, increase the RF Output Level with the TUNING control, until the speaker unsquelches. The display on the transceiver should now stop scanning and show Channel 6 (300.000 MHz).

4-2.2.8 Signal-Strength Meter

1. Set up the test equipment as shown in Figure 4-1. Connect the VERT/SINAD/DIST/DVM/COUNTER IN connector on the R2600 to Pin E (PT Out) of the Remote connector. Pin A of the Remote connector is return ground.
2. Set the input power supply to 28 ± .1 Vdc.
3. Preset the R2600 by performing the following steps.

   a. Press the MEM (Memory) key on the R2600 panel for the preset-screen.

   b. Use the CURSOR POSITION keys to highlight preset 03.

   c. Press the "view preset" softkey. Note: The softkeys are the eight keys under the CRT screen on the R2600.

   d. Use the CURSOR POSITION keys to the Monitor Frequency position and enter 173.975 from the R2600 keypad.

   e. Move the cursor to Modulation Type and press the "FM" softkey.

   f. Move the cursor to the Generate Frequency position and enter 173.975 from the R2600 keypad.

   g. Move the cursor to Modulation Type and press the "FM" softkey.

   h. Move the cursor to bandwidth and press the "NARROW ±5 kHz" softkey.

   i. Move the cursor to the Duplex Offset position and press the "DON'T CARE" softkey.

   j. Move the cursor to Synth. Format Sel (synthesizer format select) and select the "Tone A" softkey.

   k. Move the cursor to Freq (frequency) and enter 01000.0 from the keypad.

   l. Move the cursor to the DTMF Code position and press the "DON'T CARE" softkey. Note: The "more" softkey may have to be depressed for the "DON'T CARE" softkey to be displayed.

   m. Press the "return" softkey twice.

4. Perform the following steps to complete the setup on the R2600 analyzer.

   a. Press RF key on the R2600 panel. Move the cursor to RF Control and press the "GEN" softkey.

   b. Move the cursor to the Output Lvl (RF Output Level) position and enter a level of -130.0 dBm from the keypad.

   c. Move the cursor to the Gen RF Out position and press the "RF IN/OUT" softkey.

   d. Depress the AUD (Audio) key on the R2600 panel. Move the cursor to the Synth (Synthesizer) position and enter 6.50 kHz from the keypad. Note: This is FM deviation. Depress the RIGHT ARROW CURSOR CONTROL key and depress the "Cont" (Continuous) softkey.

   e. Move the cursor to the Fixed 1 kHz position. Depress the LEFT ARROW CURSOR CONTROL key and then depress the "Off" softkey.

   f. Verify the DTMF position and the External position are both OFF.

g. Depress the DISP (Display) key on the R2600 panel. Move the cursor to the Meter position and depress the "AC VOLTS" softkey. Note: The "more" softkey may have to be depressed for the "AC VOLTS" softkey to be displayed.

h. Move the cursor to the Range position and depress the "AUTO" softkey.

i. Move the cursor to the Display position and depress the "EXT SCOPE" softkey.

j. Move the cursor to the Coupling position and depress the "AC" softkey.

k. Move the cursor to the Trigger position and depress the "AUTO" softkey.

l. Move the cursor to the Trigger Lvl (Trigger Level) position and enter 500 from the keypad.

m. Move the cursor to the Horiz (Horizontal) position and depress the "500 us" softkey. Note: The "more" softkey may have to be depressed for the "500 us" softkey to be displayed.

n Move the cursor to the Vert (Vertical) position and depress the "1 V" softkey. Note: The "more" softkey may have to be depressed for the "1 V" softkey to be displayed.

o. Move the cursor to the Pos (Position) position and depress the "move up" or "move down" softkeys as appropriate to center the displayed scope screen trace. Note: The TUNING knob on the R2600 panel may be used in lieu of the "move up" or "move down" softkeys.

p. Adjust both the SQUELCH and VOLUME controls on the front panel to their maximum CCW positions.

5. Setup the URC-200 (V2) as follows:

a. Turn the transceiver on and note the input current. It should be approximately 240mA. If the current exceeds 330mA, a problem exists in the transceiver. Turn off the power and troubleshoot the transceiver.

b. Set the channel 3 for the preset frequency as listed in Table 4-3. Adjust the URC-200 (V2) for the following. Note: Information on presetting the URC-200 (V2) is given in Paragraph 2-3.2 located in Section 2 of this manual.

FM, PT, SCN OFF, BCN OFF, SPKR ON, CH 3

c. Adjust the SQ (Squelch) control fully counter-clockwise, past its detent, to the OFF position.

d. Select METER MODE per Paragraph 2-3.1.5 located in Section 2 of this manual.

6. Signal-Strength Meter Measurement:

a. Move the cursor to the Gen RF Out position and select GEN. Move the cable from the RF IN/OUT connector to the GEN OUT connector. Position the cursor to the Output Lvl position and enter a signal level to -80.0 dBm. Verify at least one bar is present. Readjust the Output Lvl to 0dBm and verify fourteen 14 bars are present on the URC-200 (V2) display with the possibility that the 14th bar may be flickering on and off.

b. Move the cursor back to the Gen RF Out position and select RF IN/OUT. Move the cable back to the RF IN/OUT connector.

4-2.3. TRANSMITTER TESTS

The following tests evaluate the performance of the XMT circuits. Tests include frequency accuracy, output power, PT/CT modulation, modulation distortion, and beacon. If the transceiver fails any of the tests, or if it cannot be adjusted to specified values, it must be sent to General Dynamics C4 Systems for repair.

WARNING

DO NOT THROW BATTERIES IN THE TRASH

Dispose of all used batteries in accordance with all Federal, State and local laws and regulations. Lithium batteries may be used in the URC-200 (V2) Transceiver however lithium batteries contain hazardous materials.

Improper handling, reverse-current operation or high environmental temperatures may cause internally generated heat, fire or toxic materials and gasses to be released from the battery.

The following precautions must be strictly observed to prevent injury to personnel or damage to equipment:

- **DO NOT** heat, incinerate, crush, puncture, disassemble or mutilate the batteries.
- **DO NOT** recharge primary Non- rechargeable) batteries.
- **DO NOT** store in equipment during periods of non-use for more than 30 days.
- **DO** follow all safety instructions that come with the batteries or printed on them.
- **TURN OFF** the equipment immediately if you (1) detect that the battery compartment is becoming unduly hot, (2) hear battery cells venting (hissing), or (3) smell irritating sulfur dioxide gas. Remove the battery only after it is cool (after 30 to 60 minutes), and dispose of it by following approved procedures.

Do not attempt to change the operating frequency while the transmitter is keyed on. Although the radio set will not be damaged, the radiated frequency will be uncontrolled during retuning and can cause unnecessary interference to other radio systems.

CAUTION

DO NOT attempt to change the operating frequency while the transmitter is keyed on. Although the radio set will not be damaged, the radiated frequency will be uncontrolled during tuning and can cause unnecessary interference to other radio systems.

CAUTION

DO NOT install the LOS antenna on the transceiver during testing in the transmit mode with (1) the cover removed or (2) the transceiver powered from an external power supply via test leads that are unshielded. RF from the antenna can radiate into the transceiver, circumvent the protection loops, and cause severe damage to the transmitter circuits.

4-2.3.1 Frequency Accuracy and FM Power Output

1. Set up the test equipment as shown in Figure 4-2. Connect the VERT/SINAD/DIST/DVM/COUNTER IN connector to the DEMOD connector on the R2600. For now, do not connect the R2600 MOD OUT port to either pins B or H of the X-Mode connector on the URC-200 (V2). Also for now, do not connect the PTT (Push-to-Talk) line (pin F) to ground. Note, when the PTT line is grounded the URC-200 (V2) transmitter is keyed and begins transmitting.
2. Set the input power supply to 28 ±.1 Vdc.

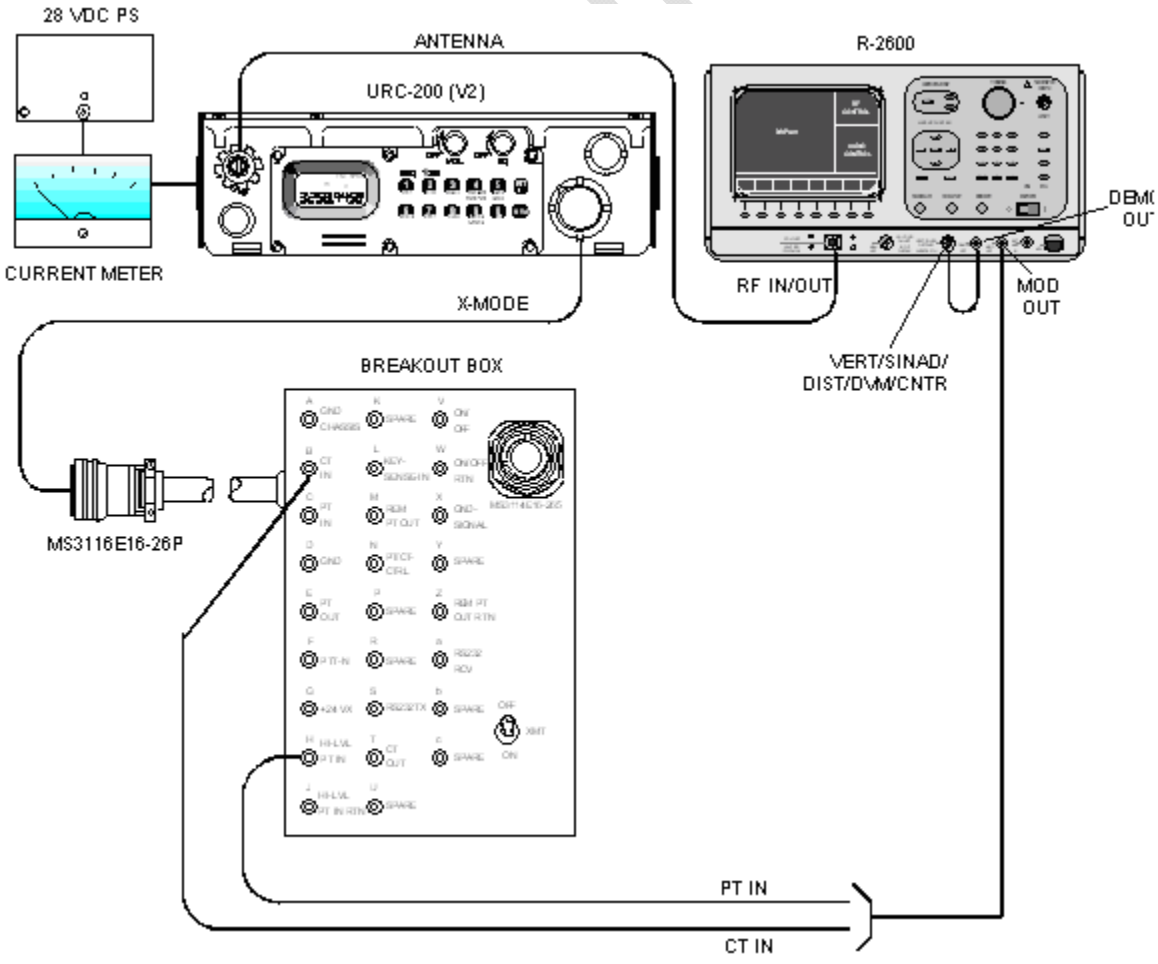


Figure 4-2. Transmitter Test Setup

3. Preset the R2600 by performing the following steps.

   a. Press the MEM (Memory) key on the R2600 panel for the preset-screen.

   b. Use the CURSOR POSITION keys to highlight preset 01.

   c. Press the "view preset" softkey. Note: The softkeys are the eight keys under the CRT screen on the R2600.

   d. Using the CURSOR POSITION keys move to the Monitor Frequency position and enter 115.000 from the R2600 keypad.

   e. Move the cursor to Modulation Type and press the "FM" softkey.

   f. Move the cursor to the Generate Frequency position and enter 115.000 from the R2600 keypad.

   g. Move the cursor to Modulation Type and press the "FM" softkey.

   h. Move the cursor to bandwidth and press the "NARROW ±5kHz" softkey.

   i. Move the cursor to the Duplex Offset position and press the "DON'T CARE" softkey.

   j. Move the cursor to Synth. Format Sel (Synthesizer Format Select) and select the "Tone A" softkey.

   k. Move the cursor to Freq (Frequency) and enter 01000.0 from the keypad.

   l. Move the cursor to the DTMF Code position and press the "DON'T CARE" softkey. Note: The "more" softkey may have to be depressed for the "DON'T CARE" softkey to be displayed.

   m. Press the "return" softkey. Repeat steps A through K for presets 02 through 10. Use Table 4-3 to program the frequency presets in steps D and E above.

   n. Press the "return" softkey.

4. Perform the following steps to complete the setup on the R2600 analyzer.

   a. Press RF key on the R2600 panel. Move the cursor to RF Control and press the "MON" softkey.

   b. Move the cursor to the Attenuation position and press the "40" softkey.

   c. Move the cursor to the Mon RF Out position and press the "RF IN/OUT" softkey.

   d. Depress the AUD (Audio) key on the R2600 panel. Move the cursor to the Synth (Synthesizer) position and enter 0.77 V RMS from the keypad. Note: This is FM deviation. Depress the RIGHT ARROW CURSOR CONTROL key and depress the "Cont" (Continuous) softkey.

   e. Move the cursor to the Fixed 1 kHz position. Depress the LEFT ARROW CURSOR CONTROL key and then depress the "Off" softkey.

   f. Verify the DTMF position and the External position are both OFF.

   g. Depress the DISP (Display) key on the R2600 panel. Move the cursor to the Meter position and depress the "RF DISPLAY" softkey. Note: The "more" softkey may have to be depressed for the "RF DISPLAY" softkey to be displayed.

   h. Move the cursor to the Input Lvl Input Level) position and depress the "dBm" softkey.

   i. Move the cursor to the Display position and depress the "EXT SCOPE" softkey.

   j. Move the cursor to the Coupling position and depress the "AC" softkey.

   k. Move the cursor to the Trigger position and depress the "AUTO" softkey.

   l. Move the cursor to the Trig Lvl (Trigger Level) position and enter 500 from the keypad.

m. Move the cursor to the Horiz (Horizontal) position and depress the "500 us" softkey. Note: The "more" softkey may have to be depressed for the "500 us" softkey to be displayed.

n. Move the cursor to the Vert (Vertical) position and depress the "200 mV" softkey. Note: The "more" softkey may have to be depressed for the "200 mV" softkey to be displayed.

o. Move the cursor to the Pos (Position) position and depress the "move up" or "move down" softkeys as appropriate to center the displayed scope screen trace. Note: The TUNING knob on the R2600 panel may be used in lieu of the "move up" or "move down" softkeys.

p. Adjust both the SQUELCH and VOLUME controls on the front panel to their maximum CCW positions.

5. Setup the URC-200 (V2) as follows:

   a. Turn the transceiver on and note the input current. It should be approximately 240mA. If the current exceeds 330mA, a problem exists in the transceiver. Turn off the power and troubleshoot the transceiver.

   b. Set the frequency presets as listed in Table 4-3 on the URC-200 (V2). For each preset channel, adjust the URC-200 (V2) for the following. Note: Information on presetting the URC-200 (V2) is given in Paragraph 2-3.2 located in Section 2 of this manual.

FM, LO POWER, PT, SCN OFF, BCN OFF

6. Transmitter Frequency Accuracy and FM Power Output Measurements:

   a. Set the presets on both the URC-200 (V2) and the R2600 to channel 01. Verify the URC-200 (V2) is in the LO POWER mode.

   b. Key the transceiver into the R2600 test set and read the frequency error displayed on the screen. Verify the ppm as listed in Table 1-1 in Section 1 of this manual is within compliance by dividing the frequency error by the operating frequency. Note: In keying the transceiver the PTT line, pin F, will be grounded.

   c. Measure the transmit power on the R2600 screen. Verify compliance with Table 1-1 in Section 1 of this manual.

   d. Unkey the URC-200 (V2) and adjust it for MED POWER. Rekey the URC-200 (V2) and verify compliance with Table 1-1 in Section 1 of this manual.

   e. Unkey the URC-200 (V2) and adjust it for HI POWER. Rekey the URC-200 (V2) and verify compliance with Table 1-1 in Section 1 of this manual.

   f. On both the URC-200 (V2) and the R2600 repeat steps A through E for preselect channels 2 through 9 and channel 0 on the URC-200 (V2) with the R2600 set on preset channel 10.

4-2.3.2 FM PT Deviation and Distortion

1. Set up the test equipment as shown in Figure 4-2. Connect the VERT/SINAD/DIST/DVM/COUNTER IN connector to the DEMOD connector on the R2600. On the R2600 connect the MOD OUT connector to pins H and J of the X-MODE connector on the URC-200 (V2). Note: Use Pin J as the return line, ground. Do not connect the PTT (Push-to-Talk) line (pin F) to ground. Note: When the PTT line is grounded the URC-200 (V2)'s transmitter will key itself ON.

2. Set the input power supply to 28 ± .1 Vdc.

3. Preset the R2600 by performing the following steps.

   a. Press the MEM (Memory) key on the R2600 panel for the preset-screen.

   b. Use the CURSOR POSITION keys to highlight preset 01.

c. Press the "view preset" softkey. Note: The softkeys are the eight keys under the CRT screen on the R2600.

d. Using the CURSOR POSITION keys move to the Monitor Frequency position and enter 115.000 from the R2600 keypad.

e. Move the cursor to Modulation Type and press the "FM" softkey.

f. Move the cursor to the Generate Frequency position and enter 115.000 from the R2600 keypad.

g. Move the cursor to Modulation Type and press the "FM" softkey.

h. Move the cursor to bandwidth and press the "NARROW ±5kHz" softkey.

i. Move the cursor to the Duplex Offset position and press the "DON'T CARE" softkey.

j. Move the cursor to Synth. Format Sel (Synthesizer Format Select) and select the "Tone A" softkey.

k. Move the cursor to Freq (Frequency) and enter 01000.0 from the keypad.

l. Move the cursor to the DTMF Code position and press the "DON'T CARE" softkey. Note: The "more" softkey may have to be depressed for the "DON'T CARE" softkey to be displayed.

m. Press the "return" softkey. Repeat steps A through K for presets 02 through 10. Use Table 4-3 to program the frequency presets in steps D and E above.

n. Press the "return" softkey.

4. Perform the following steps to complete the setup on the R2600 analyzer.

a. Press RF key on the R2600 panel. Move the cursor to RF Control and press the "MON" softkey.

b. Move the cursor to the Attenuation position and press the "40" softkey.

c. Move the cursor to the Mon RF Out position and press the "RF IN/OUT" softkey.

d. Depress the AUD (Audio) key on the R2600 panel. Move the cursor to the Synth (Synthesizer) position and enter 0.77 V RMS from the keypad. Note: This is FM deviation. Depress the RIGHT ARROW CURSOR CONTROL key and depress the "Cont" (Continuous) softkey.

e. Move the cursor to the Fixed 1 kHz position. Depress the LEFT ARROW CURSOR CONTROL key and then depress the "Off" softkey.

f. Verify the DTMF position and the External position are both OFF.

g. Depress the DISP (Display) key on the R2600 panel. Move the cursor to the Meter position and depress the "RF DISPLAY" softkey. Note: The "more" softkey may have to be depressed for the "RF DISPLAY" softkey to be displayed.

h. Move the cursor to the Input Lvl Input Level) position and depress the "dBm" softkey.

i. Move the cursor to the Display position and depress the "EXT SCOPE" softkey.

j. Move the cursor to the Coupling position and depress the "AC" softkey.

k. Move the cursor to the Trigger position and depress the "AUTO" softkey.

l. Move the cursor to the Trig Lvl (Trigger Level) position and enter 500 from the keypad.

m. Move the cursor to the Horiz (Horizontal) position and depress the "500 us" softkey. Note: The "more" softkey may have to be depressed for the "500 us" softkey to be displayed.

n. Move the cursor to the Vert (Vertical) position and depress the "200 mV" softkey. Note: The "more" softkey may have to be depressed for the "200 mV" softkey to be displayed.

o. Move the cursor to the Pos (Position) position and depress the "move up" or "move down" softkeys as appropriate to center the displayed scope screen trace. Note: The TUNING knob on the R2600 panel may be used in lieu of the "move up" or "move down" softkeys.

p. Adjust both the SQUELCH and VOLUME controls on the front panel to their maximum CCW positions.

5. Setup the URC-200 (V2) as follows:

a. Turn the transceiver on and note the input current. It should be approximately 240mA. If the current exceeds 330mA, a problem exists in the transceiver. Turn off the power and troubleshoot the transceiver.

b. Set the frequency presets as listed in Table 4-3 on the URC-200 (V2). For each preset channel, adjust the URC-200 (V2) for the following. Note: Information on presetting the URC-200 (V2) is given in Paragraph 2-3.2 located in Section 2 of this manual.

FM, LO POWER, PT, SCN OFF, BCN OFF

6. Transmitter FM PT Deviation and Distortion Measurements:

a. Set the presets on both the URC-200 (V2) and the R2600 to channel 01. Verify the URC-200 (V2) is in the LO POWER mode.

b. Key the transceiver into the R2600 test set and read the FM deviation on the R2600 screen. Verify compliance with Table 1-1 in Section 1 of this manual. Note: In keying the transceiver the PTT line, pin F, will be grounded.

c. Depress the DISP key on the R2600 front panel and move the cursor to the Meter position and press the "EXT DIST" softkey. Note: The "more" softkey may have to be depressed for the "EXT DIST" softkey to be displayed.

d. Read the FM distortion on the R2600 screen and verify compliance with Table 1-1 in Section 1 of this manual.

e. Depress the DISP key on the R2600 front panel and move the cursor to the Meter position and press the "RF DISPLAY" softkey. Note: The "more" softkey may have to be depressed for the "RF DISPLAY" softkey to be displayed.

f. On both the URC-200 (V2) and the R2600 repeat steps A through E for preselect channels 2 through 9 and channel 0 on the URC-200 (V2) with the R2600 set on preset channel 10.

4-2.3.3 FM CT Deviation and Distortion

1. Set up the test equipment as shown in Figure 4-2. Connect the VERT/SINAD/DIST/DVM/COUNTER IN connector to the DEMOD connector on the R2600. On the R2600 connect the MOD OUT connector to pin B of the X-MODE connector on the URC-200 (V2). Do not connect the PTT (Push-to-Talk) line (pin F) to ground. Note: When the PTT line is grounded the URC-200 (V2)'s transmitter will key itself ON.

2. Set the input power supply to 28 $\pm$ .1 Vdc.

3. Preset the R2600 by performing the following steps.

a. Press the MEM (Memory) key on the R2600 panel for the preset-screen.

b. Use the CURSOR POSITION keys to highlight preset 01.

c. Press the "view preset" softkey. Note: The softkeys are the eight keys under the CRT screen on the R2600.

d. Using the CURSOR POSITION keys move to the Monitor Frequency position and enter 115.000 from the R2600 keypad.

e. Move the cursor to Modulation Type and press the "FM" softkey.

f. Move the cursor to the Generate Frequency position and enter 115.000 from the R2600 keypad.

g. Move the cursor to Modulation Type and press the "FM" softkey.

h. Move the cursor to bandwidth and press the "WIDE ±100kHz" softkey.

i. Move the cursor to the Duplex Offset position and press the "DON'T CARE" softkey.

j. Move the cursor to Synth. Format Sel (Synthesizer Format Select) and select the "Tone A" softkey.

k. Move the cursor to Freq (Frequency) and enter 01000.0 from the keypad.

l. Move the cursor to the DTMF Code position and press the "DON'T CARE" softkey. Note: The "more" softkey may have to be depressed for the "DON'T CARE" softkey to be displayed.

m. Press the "return" softkey. Repeat steps A through K for presets 02 through 10. Use Table 4-3 to program the frequency presets in steps D and E above.

n. Press the "return" softkey.

4. Perform the following steps to complete the setup on the R2600 analyzer.

a. Press RF key on the R2600 panel. Move the cursor to RF Control and press the "MON" softkey.

b. Move the cursor to the Attenuation position and press the "40" softkey.

c. Move the cursor to the Mon RF Out position and press the "RF IN/OUT" softkey.

d. Depress the AUD (Audio) key on the R2600 panel. Move the cursor to the Synth (Synthesizer) position and enter 0.77 V RMS from the keypad. Note: This is FM deviation. Depress the RIGHT ARROW CURSOR CONTROL key and depress the "Cont" (Continuous) softkey.

e. Move the cursor to the Fixed 1 kHz position. Depress the LEFT ARROW CURSOR CONTROL key and then depress the "Off" softkey.

f. Verify the DTMF position and the External position are both OFF.

g. Depress the DISP (Display) key on the R2600 panel. Move the cursor to the Meter position and depress the "RF DISPLAY" softkey. Note: The "more" softkey may have to be depressed for the "RF DISPLAY" softkey to be displayed.

h. Move the cursor to the Input Lvl Input Level) position and depress the "dBm" softkey.

i. Move the cursor to the Display position and depress the "EXT SCOPE" softkey.

j. Move the cursor to the Coupling position and depress the "AC" softkey.

k. Move the cursor to the Trigger position and depress the "AUTO" softkey.

l. Move the cursor to the Trig Lvl (Trigger Level) position and enter 500 from the keypad.

m. Move the cursor to the Horiz (Horizontal) position and depress the "500 us" softkey. Note: The "more" softkey may have to be depressed for the "500 us" softkey to be displayed.

n. Move the cursor to the Vert (Vertical) position and depress the "200 mV" softkey. Note: The "more" softkey may have to be depressed for the "200 mV" softkey to be displayed.

o. Move the cursor to the Pos (Position) position and depress the "move up" or "move down" softkeys as appropriate to center the displayed scope screen trace. Note: The TUNING knob on the R2600 panel may be used in lieu of the "move up" or "move down" softkeys.

p. Adjust both the SQUELCH and VOLUME controls on the front panel to their maximum CCW positions.

5. Setup the URC-200 (V2) as follows:

   a. Turn the transceiver on and note the input current. It should be approximately 240mA. If the current exceeds 330mA, a problem exists in the transceiver. Turn off the power and troubleshoot the transceiver.

   b. Set the frequency presets as listed in Table 4-3 on the URC-200 (V2). For each preset channel, adjust the URC-200 (V2) for the following. Note: Information on presetting the URC-200 (V2) is given in Paragraph 2-3.2 located in Section 2 of this manual.

FM, LO POWER, CT, SCN OFF, BCN OFF

6. Transmitter FM CT Deviation and Distortion Measurements:

   a. Set the presets on both the URC-200 (V2) and the R2600 to channel 01. Verify the URC-200 (V2) is in the LO POWER mode.

   b. Key the transceiver into the R2600 test set and read the FM deviation on the R2600 screen. Verify compliance with Table 1-1 in Section 1 of this manual. Note: In keying the transceiver the PTT line, pin F, will be grounded.

   c. Observe the scope display on the R2600, it should be showing a pseudo square wave 1 kHz signal.

   d. On both the URC-200 (V2) and the R2600 repeat steps A through C for preselect channels 2 through 9 and channel 0 on the URC-200 (V2) with the R2600 set on preset channel 10.

4-2.3.4 AM Power Output, PT % Modulation and PT Distortion

1. Set up the test equipment as shown in Figure 4-2. Connect the VERT/SINAD/DIST/DVM/COUNTER IN connector to the DEMOD connector on the R2600. Connect the R2600 MOD OUT port to pin H of the X-Mode connector on the URC-200 (V2). Do not connect the PTT (Push-to-Talk) line (pin F) to ground. Note: When the PTT line is grounded the URC-200 (V2)'s transmitter will key itself ON.

2. Set the input power supply to 28 ±.1 Vdc.

3. Preset the R2600 by performing the following steps.

   a. Press the MEM (Memory) key on the R2600 panel for the preset-screen.

   b. Use the CURSOR POSITION keys to highlight preset 01.

   c. Press the "view preset" softkey. Note: The softkeys are the eight keys under the CRT screen on the R2600.

   d. Using the CURSOR POSITION keys move to the Monitor Frequency position and enter 115.000 from the R2600 keypad.

   e. Move the cursor to Modulation Type and press the "AM" softkey.

   f. Move the cursor to the Generate Frequency position and enter 115.000 from the R2600 keypad.

   g. Move the cursor to Modulation Type and press the "AM" softkey.

   h. Move the cursor to bandwidth and press the "NARROW ±5kHz" softkey.

   i. Move the cursor to the Duplex Offset position and press the "DON'T CARE" softkey.

   j. Move the cursor to Synth. Format Sel (Synthesizer Format Select) and select the "Tone A" softkey.

   k. Move the cursor to Freq (Frequency) and enter 01000.0 from the keypad.

   l. Move the cursor to the DTMF Code position and press the "DON'T CARE" softkey. Note: The "more" softkey may have to be depressed for the "DON'T CARE" softkey to be displayed.

   m. Press the "return" softkey. Repeat steps A through K for presets 02 through 10. Use Table 4-4 to program the frequency presets in steps D and E above.

n. Press the "return" softkey.

4. Perform the following steps to complete the setup on the R2600 analyzer.

   a. Press RF key on the R2600 panel. Move the cursor to RF Control and press the "MON" softkey.

   b. Move the cursor to the Attenuation position and press the "40" softkey.

   c. Move the cursor to the Mon RF Out position and press the "RF IN/OUT" softkey.

   d. Depress the AUD (Audio) key on the R2600 panel. Move the cursor to the Synth (Synthesizer) position and enter 0.77 V RMS from the keypad. Note: This is AM modulation. Depress the RIGHT ARROW CURSOR CONTROL key and depress the "Cont" (Continuous) softkey.

   e. Move the cursor to the Fixed 1 kHz position. Depress the LEFT ARROW CURSOR CONTROL key and then depress the "Off" softkey.

   f. Verify the DTMF position and the External position are both OFF.

   g. Depress the DISP (Display) key on the R2600 panel. Move the cursor to the Meter position and depress the "RF DISPLAY" softkey. Note: The "more" softkey may have to be depressed for the "RF DISPLAY" softkey to be displayed.

   h. Move the cursor to the Input Lvl Input Level) position and depress the "dBm" softkey.

   i. Move the cursor to the Display position and depress the "EXT SCOPE" softkey.

   j. Move the cursor to the Coupling position and depress the "AC" softkey.

   k. Move the cursor to the Trigger position and depress the "AUTO" softkey.

   l. Move the cursor to the Trig Lvl (Trigger Level) position and enter 500 from the keypad.

   m. Move the cursor to the Horiz (Horizontal) position and depress the "500 us" softkey. Note: The "more" softkey may have to be depressed for the "500 us" softkey to be displayed.

   n. Move the cursor to the Vert (Vertical) position and depress the "200 mV" softkey. Note: The "more" softkey may have to be depressed for the "200 mV" softkey to be displayed.

   o. Move the cursor to the Pos (Position) position and depress the "move up" or "move down" softkeys as appropriate to center the displayed scope screen trace. Note: The TUNING knob on the R2600 panel may be used in lieu of the "move up" or "move down" softkeys.

   p. Adjust both the SQUELCH and VOLUME controls on the front panel to their maximum CCW positions.

5. Setup the URC-200 (V2) as follows:

   a. Turn the transceiver on and note the input current. It should be approximately 240mA. If the current exceeds 330mA, a problem exists in the transceiver. Turn off the power and troubleshoot the transceiver.

   b. Set the frequency presets as listed in Table 4-4 on the URC-200 (V2). For each preset channel, adjust the URC-200 (V2) for the following. Note: Information on presetting the URC-200 (V2) is given in Paragraph 2-3.2 located in Section 2 of this manual.

AM, LO POWER, PT, SCN OFF, BCN OFF

6. Transmitter AM Power Output, PT % Modulation, and PT Distortion Measurements:

   a. Set the presets on both the URC-200 (V2) and the R2600 to channel 01. Verify the URC-200 (V2) is in the LO POWER mode.

b. Key the transceiver by grounding pin F, see Figure 4-2, and measure the transmit output power on the R2600 screen. Verify compliance with Table 1-1 in Section 1 of this manual.

NOTE

When measuring AM transmitter output power on the R2600 or on any power meter that has a peak detector, which includes virtually all of the portable inline or direct power meters, the carrier power that is read on the wattmeter will need to be converted to average power to verify compliance as indicated above. To convert carrier power to average power use the following formula:

$$P_{AVG} = P_C [1 + (m^2 / 2)]$$

where:
P_{AVG} = Average Power
P_C = Carrier Power
m = modulation as a decimal; i.e., 80% = .8
It should be noted, that in order to obtain the modulation value for the above formula, the next step (c) will need to be completed.

c. Read the AM % modulation on the R2600 screen. Verify compliance with Table 1-1 in Section 1 of this manual.

d. Depress the DISP key on the R2600 front panel. Move the cursor to the Meter position and press the "EXT DIST" softkey. Note: The "more" softkey may have to be depressed for the "EXT DIST" softkey to be displayed. Read the % of distortion on the R2600 screen. Verify compliance with Table 1-1 in Section 1 of this manual.

e. Unkey the URC-200 (V2) and adjust it for HI POWER. Depress the DISP key on the R2600 front panel. Move the cursor to the Meter position and press the "RF DISPLAY" softkey. Note: The "more" softkey may have to be depressed for the "RF DISPLAY" softkey to be displayed. Rekey the URC-200 (V2) and verify compliance with Table 1-1 in Section 1 of this manual.

NOTE

When measuring AM transmitter output power on the R2600 or on any power meter that has a peak detector, which includes virtually all of the portable inline or direct power meters, the carrier power that is read on the wattmeter will need to be converted to average power to verify compliance as indicated above. To convert carrier power to average power use the following formula:

$$P_{AVG} = P_C [1 + (m^2 / 2)]$$

where:
P_{AVG} = Average Power
P_C = Carrier Power
m = modulation as a decimal; i.e., 80% = .8
It should be noted, that the modulation has to be measured in order to obtain the modulation value for the above formula.

f. On both the URC-200 (V2) and the R2600 repeat steps A through E for preselect channels 2 through 9 and channel 0 on the URC-200 (V2) with the R2600 set on preset channel 10.

4-2.3.5 AM CT % Modulation and CT Distortion

1. Set up the test equipment as shown in Figure 4-2. Connect the VERT/SINAD/DIST/DVM/COUNTER IN connector to the DEMOD connector on the R2600. On the R2600 connect the MOD OUT connector to pin B of the X-MODE connector on the URC-200 (V2). Do not connect the PTT (Push-to-Talk) line (pin F) to ground. Note: When the PTT line is grounded the URC-200 (V2)'s transmitter will key itself ON.

2. Set the input power supply to 28 ±.1 Vdc.

3. Preset the R2600 by performing the following steps.

a. Press the MEM (Memory) key on the R2600 panel for the preset-screen.

b. Use the CURSOR POSITION keys to highlight preset 01.

c. Press the "view preset" softkey. Note: The softkeys are the eight keys under the CRT screen on the R2600.

d. Using the CURSOR POSITION keys move to the Monitor Frequency position and enter 115.000 from the R2600 keypad.

e. Move the cursor to Modulation Type and press the "AM" softkey.

f. Move the cursor to the Generate Frequency position and enter 115.000 from the R2600 keypad.

g. Move the cursor to Modulation Type and press the "AM" softkey.

h. Move the cursor to bandwidth and press the "WIDE ±100kHz" softkey.

i. Move the cursor to the Duplex Offset position and press the "DON'T CARE" softkey.

j. Move the cursor to Synth. Format Sel (Synthesizer Format Select) and select the "Tone A" softkey.

k. Move the cursor to Freq (Frequency) and enter 01000.0 from the keypad.

l. Move the cursor to the DTMF Code position and press the "DON'T CARE" softkey. Note: The "more" softkey may have to be depressed for the "DON'T CARE" softkey to be displayed.

m. Press the "return" softkey. Repeat steps A through K for presets 02 through 10. Use Table 4-4 to program the frequency presets in steps D and E above.

n. Press the "return" softkey.

4. Perform the following steps to complete the setup on the R2600 analyzer.

a. Press RF key on the R2600 panel. Move the cursor to RF Control and press the "MON" softkey.

b. Move the cursor to the Attenuation position and press the "40" softkey.

c. Move the cursor to the Mon RF Out position and press the "RF IN/OUT" softkey.

d. Depress the AUD (Audio) key on the R2600 panel. Move the cursor to the Synth (Synthesizer) position and enter 0.77 V RMS from the keypad. Note: This is AM modulation. Depress the RIGHT ARROW CURSOR CONTROL key and depress the "Cont" (Continuous) softkey.

e. Move the cursor to the Fixed 1 kHz position. Depress the LEFT ARROW CURSOR CONTROL key and then depress the "Off" softkey.

f. Verify the DTMF position and the External position are both OFF.

g. Depress the DISP (Display) key on the R2600 panel. Move the cursor to the Meter position and depress the "RF DISPLAY" softkey. Note: The "more" softkey may have to be depressed for the "RF DISPLAY" softkey to be displayed.

h. Move the cursor to the Input Lvl Input Level) position and depress the "dBm" softkey.

i. Move the cursor to the Display position and depress the "EXT SCOPE" softkey.

j. Move the cursor to the Coupling position and depress the "AC" softkey.

k. Move the cursor to the Trigger position and depress the "AUTO" softkey.

l. Move the cursor to the Trig Lvl (Trigger Level) position and enter 500 from the keypad.

m. Move the cursor to the Horiz (Horizontal) position and depress the "500 us" softkey. Note: The "more" softkey may have to be depressed for the "500 us" softkey to be displayed.

n. Move the cursor to the Vert (Vertical) position and depress the "200 mV" softkey. Note: The "more" softkey may have to be depressed for the "200 mV" softkey to be displayed.

o. Move the cursor to the Pos (Position) position and depress the "move up" or "move down" softkeys as appropriate to center the displayed scope screen trace. Note: The TUNING knob on the R2600 panel may be used in lieu of the "move up" or "move down" softkeys.

p. Adjust both the SQUELCH and VOLUME controls on the front panel to their maximum CCW positions.

5. Setup the URC-200 (V2) as follows:

   a. Turn the transceiver on and note the input current. It should be approximately 240mA. If the current exceeds 330mA, a problem exists in the transceiver. Turn off the power and troubleshoot the transceiver.

   b. Set the frequency presets as listed in Table 4-4 on the URC-200 (V2). For each preset channel, adjust the URC-200 (V2) for the following. Note: Information on presetting the URC-200 (V2) is given in Paragraph 2-3.2 located in Section 2 of this manual.

AM, LO POWER, CT, SCN OFF, BCN OFF

6. Transmitter AM CT % Modulation and Distortion Measurements:

   a. Set the presets on both the URC-200 (V2) and the R2600 to channel 01. Verify the URC-200 (V2) is in the LO POWER mode.

   b. Key the transceiver into the R2600 test set and read the AM modulation on the R2600 screen. Verify compliance with Table 1-1 in Section 1 of this manual. Note: In keying the transceiver the PTT line, pin F, will be grounded.

   c. Observe the scope display on the R2600, it should be showing a square wave 1 kHz signal.

   d. On both the URC-200 (V2) and the R2600 repeat steps A through C for preselect channels 2 through 9 and channel 0 on the URC-200 (V2) with the R2600 set on preset channel 10.

4-2.3.6 Beacon

1. Set up the test equipment as shown in Figure 4-2. Connect the VERT/SINAD/DIST/DVM/COUNTER IN connector to the DEMOD connector on the R2600. On the R2600 connect the MOD OUT connector to pin B of the X-MODE connector on the URC-200 (V2). Do not connect the PTT (Push-to-Talk) line (pin F) to ground. Note: When the PTT line is grounded the URC-200 (V2)'s transmitter will key itself ON.
2. Set the input power supply to 28 $\pm$.1 Vdc.
3. Preset the R2600 by performing the following steps.

   a. Press the MEM (Memory) key on the R2600 panel for the preset-screen.

   b. Use the CURSOR POSITION keys to highlight preset 08.

   c. Press the "view preset" softkey. Note: The softkeys are the eight keys under the CRT screen on the R2600.

   d. Using the CURSOR POSITION keys move to the Monitor Frequency position and enter 312.000 from the R2600 keypad.

   e. Move the cursor to Modulation Type and press the "FM" softkey.

   f. Move the cursor to the Generate Frequency position and enter 312.000 from the R2600 keypad.

   g. Move the cursor to Modulation Type and press the "FM" softkey.

h. Move the cursor to bandwidth and press the "WIDE ±100kHz" softkey.

i. Move the cursor to the Duplex Offset position and press the "DON'T CARE" softkey.

j. Move the cursor to Synth. Format Sel (Synthesizer Format Select) and select the "Tone A" softkey.

k. Move the cursor to Freq (Frequency) and enter 01000.0 from the keypad.

l. Move the cursor to the DTMF Code position and press the "DON'T CARE" softkey. Note: The "more" softkey may have to be depressed for the "DON'T CARE" softkey to be displayed.

m. Press the "return" softkey twice.

4. Perform the following steps to complete the setup on the R2600 analyzer.

a. Press RF key on the R2600 panel. Move the cursor to RF Control and press the "MON" softkey.

b. Move the cursor to the Attenuation position and press the "40" softkey.

c. Move the cursor to the Mon RF Out position and press the "RF IN/OUT" softkey.

d. Depress the AUD (Audio) key on the R2600 panel. Move the cursor to the Synth (Synthesizer) position and enter 0.77 V RMS from the keypad. Note: This is FM deviation. Depress the RIGHT ARROW CURSOR CONTROL key and depress the "Cont" (Continuous) softkey.

e. Move the cursor to the Fixed 1 kHz position. Depress the LEFT ARROW CURSOR CONTROL key and then depress the "Off" softkey.

f. Verify the DTMF position and the External position are both OFF.

g. Depress the DISP (Display) key on the R2600 panel. Move the cursor to the Meter position and depress the "RF DISPLAY" softkey. Note: The "more" softkey may have to be depressed for the "RF DISPLAY" softkey to be displayed.

h. Move the cursor to the Input Lvl Input Level) position and depress the "dBm" softkey.

i. Move the cursor to the Display position and depress the "EXT SCOPE" softkey.

j. Move the cursor to the Coupling position and depress the "AC" softkey.

k. Move the cursor to the Trigger position and depress the "AUTO" softkey.

l. Move the cursor to the Trig Lvl (Trigger Level) position and enter 500 from the keypad.

m. Move the cursor to the Horiz (Horizontal) position and depress the "500 us" softkey. Note: The "more" softkey may have to be depressed for the "500 us" softkey to be displayed.

n. Move the cursor to the Vert (Vertical) position and depress the "200 mV" softkey. Note: The "more" softkey may have to be depressed for the "200 mV" softkey to be displayed.

o. Move the cursor to the Pos (Position) position and depress the "move up" or "move down" softkeys as appropriate to center the displayed scope screen trace. Note: The TUNING knob on the R2600 panel may be used in lieu of the "move up" or "move down" softkeys.

p Adjust both the SQUELCH and VOLUME controls on the front panel to their maximum CCW positions.

5. Setup the URC-200 (V2) as follows:

a. Turn the transceiver on and note the input current. It should be approximately 240mA. If the current exceeds 330mA, a problem exists in the transceiver. Turn off the power and troubleshoot the transceiver.

a. On the URC-200 (V2) set the frequency presets to channel 8 and program it to 312.000 MHz. Adjust the URC-200 (V2) for the following. Note: Information on presetting the URC-200 (V2) is given in Paragraph 2-3.2 located in Section 2 of this manual.

FM, LO POWER, CT, SCN OFF, BCN OFF

6. Transmitter Beacon Measurements:

   a. Set the presets on both the URC-200 (V2) and the R2600 to channel 08. Verify the URC-200 (V2) is in the LO POWER mode.

   b. On the transceiver, set BCN ON per Paragraph 2-3.3.2.

   c. Read the transmitter output power on the R2600. Verify compliance of the output power (LO POWER mode) with Table 1-1 in Section 1 of this manual. Turn up the VOLUME control on the R2600; the variable frequency emergency beacon tone should be audible and visible on the R2600 display.

4-3. POWER SUPPLY VOLTAGES

The internal power supply in the URC-200 (V2) is located on the Audio, Processor, Power Supply (APPS) printed wiring board. The power supply has one input voltage (+24 Vdc) and five output voltages (+5 Vdc, -5 Vdc, +12 Vdc, -12 Vdc, and +70 Vdc).

4-3.1. INPUT VOLTAGE

The input voltage can be measured on pin G of the X-Mode connector which is located on the front panel. Depending on what is being used to supply power to the transceiver (batteries, external power supply, or etc., the normal input voltage can vary from approximately 22 Vdc to 30 Vdc. This voltage can also be displayed on the front panel of the transceiver using the R/T key as described in Paragraph 4-3.2.

NOTE

If the transceiver is being operated from batteries and the voltage reading is below 22 Vdc, install fresh batteries in the battery pack.

4-3.2. INTERNAL VOLTAGES

Six internal voltages can be displayed on the front panel. The following table shows the tolerance range for each. If the input voltage is within the specified range and any of the internal voltages are out of tolerance, the transceiver should be returned to General Dynamics for repair.

Display	Internal Voltage	Tolerance
PS1	+5 Vdc	4.4 to 5.6 Vdc
PS2	+12 Vdc	10.5 to 13.4 Vdc
PS3	-5 Vdc	-4.4 to –5.6 Vdc
PS4	-12 Vdc	-10.5 to –13.4 Vdc
PS6	+70 Vdc	61.6 to 78.4 Vdc

4-3.2.1 Voltage Measurements

PS1 500
PS2 120
PS3 -500
PS4 - 120
PS5 240
PS6 700
AGC 240

With the transceiver set-up in the meter-mode per Paragraph 2-3.1.5., pressing the [R/T] key will display the voltages of the internal power supplies and of the batteries. The first time [R/T] is pressed the voltage of the +5Vdc supply - PS1 is displayed. Each consecutive press of [R/T] brings up the next supply; PS2: +12Vdc, PS3: -5Vdc, PS4: -12Vdc, PS5: +24Vdc (external power batteries), PS6: +70Vdc and AGC.

NOTE

The AGC level displayed is not a voltage. The AGC is expressed as a digital value from 000 to 255.

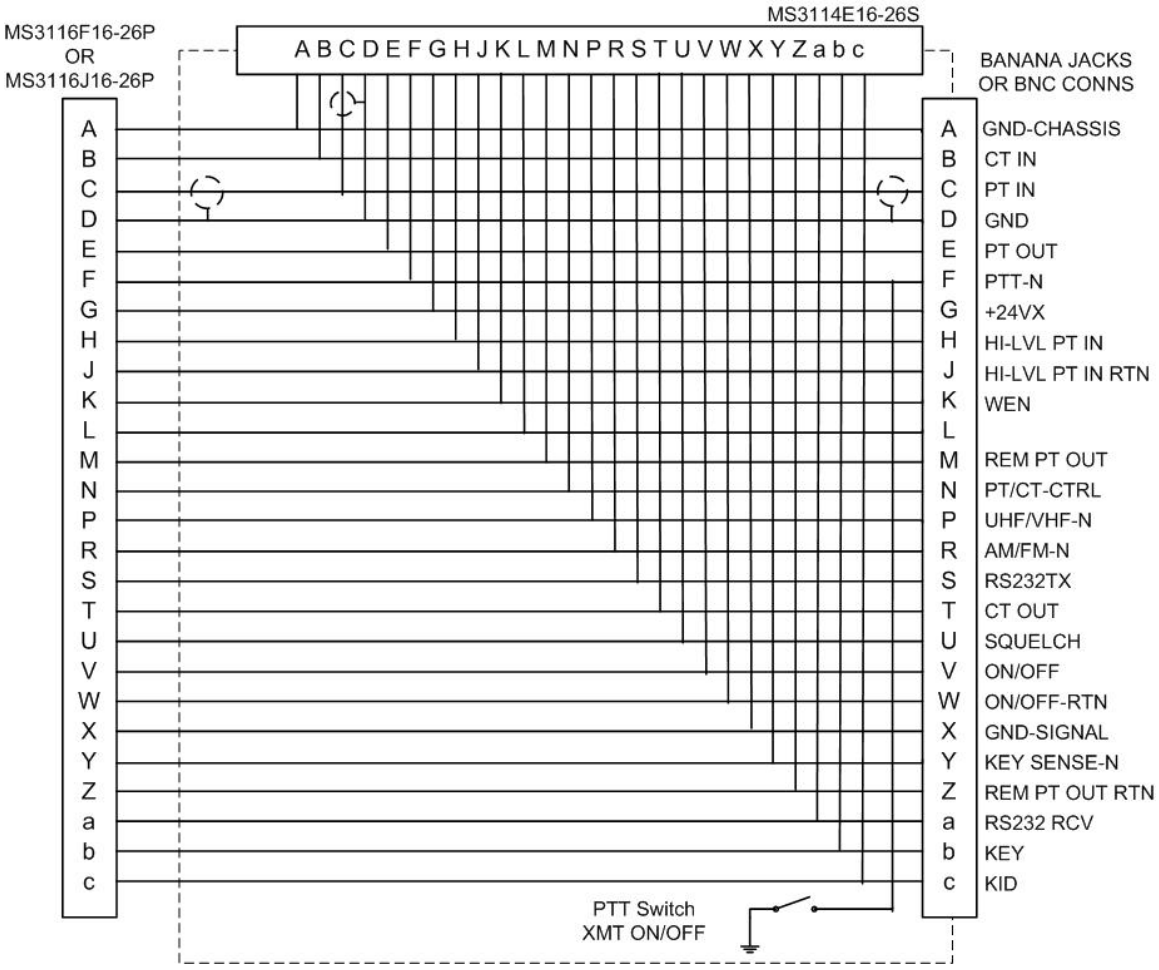


Figure 4-4. Breakout Box Schematic

Note:
When performing the Receiver Tests in accordance with Paragraph 4-2.2 and Figure 4-1:

- For the PT OUT on pin E of the Breakout Box, Pin D is the ground return.

● For the CT OUT on pin T of the Breakout Box, Pin D is the ground return.

When performing the Transmitter Tests in accordance with Paragraph 4-2.3 and Figure 4-2:

● For the CT IN on pin B of the Breakout Box, Pin D is the ground return.
● For the HI-LVL PT IN on pin H of the Breakout Box, Pin J is the ground return.

SECTION 5. OPTIONS

5-1. 30 TO 90 MHZ OPTION 01-P37200N001 TO THE URC-200 (V2) TRANSCEIVER

5-1.1. GENERAL INFORMATION

This option provides the 30 to 90 MHz (LVHF) band to the URC-200 (V2) Radio Set. Many of the operational features in the 30 to 90 MHz frequency band are the same as in the VHF or UHF frequency bands.

5-1.2. FEATURES

5-1.2.1 Frequency Range:

The 30 to 90 MHz range of frequencies resides in the Low VHF (LVHF) band of frequencies. The LVHF frequencies on the URC-200 (V2) has a center frequency tuning increment of 12.5 kHz.

5-1.2.2 Tone Squelch:

Normally the URC-200 (V2) in the LVHF band will use a 150 Hz Tone Squelch which is compatible with other radios in this band of frequencies. If desired, the tone may be turned OFF, however, “white-noise” will be coming from the speaker.

5-1.3. LIMITATIONS

5-1.3.1 Modulation:

The URC-200 (V2) using the 30 to 90 MHz option will receive and transmit FM modulation only.

5-1.3.2 Carrier-to-Noise Squelch:

The carrier-to-noise squelch, which is set by the Squelch Control when the URC-200 (V2) is in the VHF or UHF frequency bands, is effectively disabled in 30-90 MHz band.

5-1.3.3 Select Meter Mode:

The front panel display signal strength meter and power meter do not operate when the transceiver is in the 30 to 90 MHz band.

5-1.3.4 UEC-120/220 Remote Control Optional Accessory:

Use only the UEC-120/220 Remote Control Units when operating the URC-200 (V2) with the 30 to 90 MHz Option. The optional remote control accessory, UEC-100/200, was designed only for the VHF and UHF frequency bands. The UEC-100/200 will not operate in the 30 to 90 MHz (LVHF) frequency band and, therefore, cannot be used with the URC-200 (V2) when using the LVHF band.

5-1.4. SPECIFICATIONS

The following specifications pertain only to the 30 to 90 MHz option within a URC-200 (V2) transceiver.

General

Frequency Range:	LVHF - 30 to 90 MHz
Modulation:	FM only

Receiver Characteristics

Sensitivity:	
PT - 10 dB SINAD:	≤ -110 dBm, 1 kHz modulation with ±10 kHz deviation
CT - BER (Bit Error Rate):	≤ -105 dBm, 16 kb/sec (kilo bits per second) with ±6.5 kHz deviation
Spurious Response:	≥ 80 dB
Squelch Type:	• 150 Hz Tone Squelch (tone ON) • No squelch when the 150 Hz tone is OFF
Squelch Range:	• Tone Squelch: <-110 dBm, fixed trip point • No squelch when the 150 Hz tone is OFF.

Transmitter Characteristics

High Power Output:	5 watts +2/-1 dB (37 dBm +2/-1 dB)
Medium Power Output:	1 watts +3/-2 dB (30 dBm +3/-2 dB)
Low Power Output:	150 mW +3/-2 dB (21.8 dBm +3/-2 dB)
Modulation:	
PT:	±10.0 kHz at 1 kHz
CT:	±6.5 kHz at 8 kHz

5-1.5. REQUIRED SYSTEM EQUIPMENT

The following equipment is the minimum required for a self contained LOS communications device that will operate in the LVHF band.

Quantity Required	Part Number	Nomenclature
1	01-P36744M003	URC-200 (V2) Transceiver
1	01-P37200N001	30 to 90 MHz URC-200 (V2) Module Assembly. EBN -30 Option
1	85-P35988M001	Antenna VHF/UHF
1	10454	Antenna LVHF
1	01-P04535L001	Handset, H-189/GR
1	01-P36751M001	Battery Box

5-1.6. INSTALLATION AND OPERATION

5-1.6.1 Siting:

Although ionospheric scatter propagation is possible in the 30 to 90 MHz range, the results can be unpredictable and sporadic. When using the URC-200 (V2) in the 30 to 90 MHz

frequency band (LVHF) it is recommended that the same line-of-sight (LOS) siting considerations be applied as when operating in the VHF or UHF frequency bands.

5-1.6.2 Antenna Installation:

Connect the LVHF antenna to the type “N” connector on the front panel. Route the gooseneck portion of the antenna base so the antenna is oriented vertically. Satisfactory performance is achieved with the LVHF antenna and the VHF/UHF antenna mounted on the URC-200 (V2) at the same time. However, the unused antenna should be removed for optimum antenna performance.

5-1.6.3 Selecting LVHF Frequencies:

Press the [FREQ] key (keypad [1]) to select the frequency entry mode. To select a frequency in the LVHF band, a zero (0) must be pressed before entering the desired frequency. For example, to enter 35.6 MHz, press [0] [3] [5] [6] [0] [0].

5-1.6.4 Squelch:

The 30 to 90 MHz band employs a 150 Hz Tone Squelch. To activate the Tone Squelch, press the [TONE] key (keypad [2]). A lower case “t” will appear at the 100 MHz position on the display when the Tone Squelch is active, or turned ON. When using the 150 Hz Tone Squelch, the Squelch Control will not effect the tone squelch threshold. It should be noted that the only signals that will break the receiver’s squelch, when the Tone Squelch is ON, are those that are on-channel and are being modulated with a 150 Hz tone that has a sufficient deviation level to break the receiver’s tone squelch threshold.

If desired, the 150 Hz Tone Squelch may be deactivated, or turned OFF. The lower case “t” will disappear from the 100 MHz position on the display when the Tone Squelch is turned OFF. With the tone turned OFF there is no squelching of the white-noise on the URC-200 (V2).

5-2. 400 TO 420 MHZ OPTION 01-P39234N001 TO THE URC-200 (V2) TRANSCEIVER

5-2.1. GENERAL INFORMATION

This option extends the URC-200 (V2) Radio Set's UHF band to 420 MHz. Many of the operational features in the 400 to 420 MHz frequency band are the same as in the UHF band.

5-2.2. FEATURES

5-2.2.1 Frequency Range:

The 400 to 420 MHz band of frequencies in the URC-200 (V2). Tuning increments are 25, 12.5 and 5 kHz.

5-2.3. LIMITATIONS

5-2.3.1 Modulation:

The URC-200 (V2) with the 400 to 420 MHz option will receive and transmit using FM modulation.

5-2.3.2 Text Mode:

When in 400 to 420 MHz band, received data will be inverted whether the URC-200 (V2) is in Plain Text (PT) mode or Cipher Text (CT) mode.

5-2.4. SPECIFICATIONS

The following specifications pertain only to the 400 to 420 MHz option within a URC-200 (V2) transceiver.

General

Frequency Range:	400 to 420 MHz
Modulation:	FM

Operating Modes

Text Mode:	PT or CT

Transmitter Characteristics

High Power Output:	10 watts +/- 2dB
Medium Power Output:	5 watts +/- 2dB
Low Power Output:	100 mW nominal

5-2.5. REQUIRED SYSTEM EQUIPMENT

The following equipment is the minimum required for a self contained LOS communications device that will operate in the 400 to 420 MHz band.

Quantity Required	Part Number	Nomenclature
1	01-P36744M003	URC-200 (V2) Transceiver
	01-P39234N001	400 to 420 MHz URC-200 (V2) Module Assembly Option
1	85-P35988M001	Antenna VHF/UHF
1	01-P04535L001	Handset, H-189/GR
1	15-P35722M001	Battery Box

5-2.6. INSTALLATION AND OPERATION

5-2.6.1 Selecting 400 to 420 MHz Frequencies:

Press the [FREQ] key (keypad [1]) to select frequency entry mode. To select a frequency, enter the desired frequency.

5-3. ECS- 8 OPTION - PART NUMBER 01-P42311K001

5-3.1. GENERAL INFORMATION

This option allows 8.33 kHz tuning in the VHF/UHF bands, and user selectable 8.33 kHz receive channel spacing in the 117.9750 to 136.9750 MHz band.

It also allows the operator to place the radio into Aviation mode, which restricts the operating frequency range from 117.9750 to 136.9750 kHz, with tuning increments of 25 and 8.33 kHz. Channel spacings of 25 or 8.33 kHz are assigned automatically by frequency, following the ICAO standards for frequency entry.

This mode also restricts modulation to AM, and allows PT only, disabling the CT feature of the radio.

5-3.2. ENABLING AVIATION MODE

To place the transceiver in the Aviation Mode, start with the transceiver powered off and then press and hold the 4 [AV] keypad while turning on the power. The unit will remain in the aviation mode through subsequent power cycles until it is returned to the normal operating mode.

The transceiver will set all the channel data for each channel to a default value (118 MHz, PT, AM, 25 kHz bandwidth, low power).

To return to the normal operating mode, start with the transceiver powered off and press and hold the 6 [MODE] key while turning on power.

The transceiver will reset all the channel data for each channel to the default values (225 MHz, PT, AM, 25 kHz bandwidth, low power).

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5-3.3. TUNING AND CHANNEL SPACING IN AVIATION MODE

When in the Aviation Mode, the manner in which the frequency is entered and displayed determines the actual operating frequency and the channel spacing. The ICAO standard mandates that specific channel spacings (either 25 or 8.33 kHz) shall be assigned to specific frequency entries. This also means the frequency that is entered and displayed may be different from the actual frequency the transceiver is tuned to.

The Aviation Mode Frequency Chart below shows an example of how to enter frequencies to select the desired operating frequency and channel spacing. 118 MHz is used in the table as an example; however any frequency from 117.9750 to 136.9750 kHz may be selected.

For example, if the desired actual operating frequency is 118.000 MHz with a channel spacing of 25 kHz, enter 118000 using the keypad or remote command. The result will be what is shown in line 1 of the chart. If, however, the desired frequency is still 118.000 MHz but this time with a channel spacing of 8.33kHz, enter 118005 and the result will be as shown in line 2 of the chart. Note that the transceiver will display 118005 even though it is tuned to 118.000 MHz.

In some cases, only 8.33 kHz channel spacing is allowed. Examine lines 3 and 4 of the chart. Because tuning increments of 8.33 kHz are allowed, the next possible operating frequency after 118.000 MHz is 118.0083 MHz. In this case only 8.33 kHz channel spacing is available for

this frequency. To tune this frequency, enter 118010 into the transceiver. The entered value is what will be displayed even though the transceiver will be operating at 118.0083 MHz.

In a similar fashion, line 4 of the chart shows that the next available frequency is 118.0166 MHz. This also is only allowed to have a channel spacing of 8.33 kHz. But to operate at this setting, enter 118015 to the transceiver.

Lines 5 and 6 of the chart show that the process repeats at this point.

If the user attempts to enter a frequency that is not allowed, the transceiver will simply not accept the input until a valid value is entered.

Aviation Mode Frequency Chart

Line Number	Frequency Entered (MHz)	Actual Operating Frequency (MHz)	Channel bandwidth (KHz)
1	118.000	118.0000	25
2	118.005	118.0000	8.33
3	118.010	118.0083	8.33
4	118.015	118.0166	8.33
5	118.025	118.0250	25
6	118.030	118.0250	8.33
7	118.035	118.0333	8.33
8	118.040	118.0416	8.33
9	118.050	118.0500	25
10	118.055	118.0500	8.33
11	118.060	118.0583	8.33
12	118.065	118.0666	8.33
13	118.075	118.0750	25
14	118.080	118.0750	8.33
15	118.085	118.0833	8.33
16	118.090	118.0916	8.33
17	118.100	118.1000	25
18	118.105	118.1000	8.33
19	etc.	etc.	etc.

5-3.4. TUNING INCREMENT VS. CHANNEL SPACING, ELECTRICAL CHARACTERISTICS

The terms “tuning increment” and “channel spacing” are often misinterpreted. By definition:

- The “tuning increment” is the minimum incremental change in operating frequency of which a transceiver is capable.
- The “channel spacing” is the window (or the bandwidth in kHz) that a tuned transceiver will operate in and represents the minimum acceptable adjacent channel separation. This window or bandwidth is determined by the receiver’s IF selectivity (bandwidth). In the URC-200 (V2), whether the tuning increment is 5kHz, 12.5kHz, 8.33kHz, or 25kHz the IF selectivity does not change. (The IF selectivity specifications for the URC-200 (V2) is outlined in Table 1-1 of this manual.

NOTE

Exercise care when communicating between various transceivers. If a 5kHz, 8.33kHz, or 12.5kHz tuning increment is used, the URC-200 (V2) Transceiver could receive an adjacent channel’s signal. Depending what the channel spacing specification is of the adjacent channel transceiver, the URC-200 (V2) Transceiver may not be able to communicate back to it unless it is re-tuned to the on-channel frequency of the adjacent channel transceiver.