MAINTENANCE MANUAL
SERVICE SECTION
DUAL FORMAT MDR 800 MHZ TRUNKED MOBILE RADIO

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(Cont.)

ERICSSON

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CONNECTOR DESCRIPTION

The Service Section contains the information necessary for aligning and troubleshooting the Dual Format MDR mobile radio. In addition, information is provided for disassembling the radio and replacing chip components.

INITIAL ADJUSTMENT

After the radio has been installed as described in the Installation Manual, the following adjustments should be made by a certified electronics technician.

TRANSMITTER ADJUSTMENT

The transmitter has been adjusted at the factory and should require no readjustment. However, the antenna length should be adjusted for optimum VSWR, and the frequency and modulation measured and recorded for future reference. For complete transmitter alignment, refer to the Alignment Procedures.

RECEIVER ADJUSTMENT

No initial adjustments to the receiver are required. Refer to the Receiver Alignment Procedure when service is required.

RE-INSTALLATION

The radio is designed to operate in 12 volt, negative ground vehicles only. If the mobile radio is moved to a different vehicle, always check the battery polarity of the new vehicle system.

PREVENTATIVE MAINTENANCE

To ensure high operating efficiency and to prevent mechanical and electrical failures from interrupting system operations, routine checks should be made of all mechanical and electrical parts at regular intervals. Preventive maintenance should include the following checks.

CONNECTIONS

Ground connections to the voltage source should be periodically checked for tightness. Loose or poor connections to the power source will cause excessive voltage drops and faulty operation. When ground connections are not made directly to the battery, the connection from the battery to vehicle chassis must be checked for low resistance. A high resistance may cause excessive voltage drops and alternator noise problems.

ELECTRICAL SYSTEM

Check the voltage regulator and alternator or generator periodically to keep the electrical system within safe operational limits. Overvoltage is indicated when the battery loses water rapidly. Usage of 1 or 2 ounces of water per cell per week is acceptable for batteries in continuous operation. A weak battery will often cause excessive noise or faulty operation.

MECHANICAL INSPECTION

Since mobile units are subject to constant shock and vibration, check for loose plugs, nuts, screws and other parts to make sure that nothing is working loose.

ANTENNA

Should the antenna, base and all contacts become coated or poorly grounded, loss of radiation and a weak transmitted signal will result.

ALIGNMENT

The transmitter and receiver meter readings should be checked periodically and the alignment optimized when necessary. Refer to the Alignment Procedure.

FREQUENCY CHECK

Check transmitter frequency and deviation. Normally, these checks are made when the unit is first placed in operation, after the first six months, and once a year thereafter.

DISASSEMBLY PROCEDURES

Disassembly procedures are provided to completely disassemble the radio. In general, reassembly is in the reverse order. Included are procedures to remove the top and bottom covers, duplexer, RF board, audio amplifier, audio/logic board, duplexer/interface board, system board, and front cap assembly including the audio amplifier board. Refer to Assembly Diagrams located in LBI-38840 when assembling or disassembling the radio or replacing component boards.

NOTE

Remove power from the radio before servicing.

TO REMOVE BOTTOM COVER

1. Remove the four screws securing the bottom cover to the radio.
2. Gently lift the bottom cover from the radio.

TO REMOVE TOP COVER

1. Remove the bottom cover and slide the top cover up out of the casting.

TO REMOVE DUPLEXER ASSEMBLY

1. Remove the radio bottom cover.
2. Next, remove the single M3.0-0.8 X 20 (#10 drive) TORX screw that secures the duplexer assembly to the casting. This screw is located on the rear of the radio.
3. Disconnect the SMB connectors from the TX and RX inputs of the duplexer and the TNC connector from the ANT port of the duplexer. The duplexer can now be removed.

NOTE

Servicing the radio while the duplexer is not properly secured may cause electrical shorts. Special care must be taken to ensure that the duplexer does not make contact with any circuitry while power is being supplied to the radio.

TO REMOVE RF BOARD A2

l. Remove the top and bottom covers from the radio. Then, remove the duplexer assembly (refer to the procedures above).
2. Pry off the friction fit covers covering the RF board.
3. Gently pry interconnect plug P702 from the logic and RF boards using a small standard screwdriver.
4. Remove the two clips securing Q101 and U102 to the frame (on top side of board).
5. Remove the two M3.5-0.6 x 20 TORX screws (#15 drive) securing PA module U101 to the frame.
6. Remove the six M3.5-0.6 x 8 TORX screws (#15 drive) from the bottom side of the board.
7. Disconnect wires attached to J105, J704, J705 and cables going to the duplexer interface board.
8. Remove the six spring clips protruding through the RF board from the bottom side.
9. Gently push the RF board out of the radio casting.

TO REMOVE FRONT CAP ASSEMBLY

l. Remove the top and bottom covers of the radio.
2. Remove the four TORX screws (#15 drive) from the front cap assembly.
3. Gently pull the front cap assembly away from the radio.

TO REMOVE AUDIO AMPLIFIER BOARD A3

1. Remove front cap assembly.
2. Remove the four M3.5-0.6 x 8 TORX screws (#15 drive) securing the audio amplifier board to the radio casting. Gently pull board away from the casting.
3. Disconnect interconnecting cables between the audio amplifier board and the system board.

TO REMOVE AUDIO/LOGIC BOARD A1

1. Remove the top cover, bottom cover, front cap assembly and the audio amplifier board from the radio. Refer to the disassembly procedures for each.
2. Remove interconnect plug P702 from the RF and audio/logic boards on the bottom of the radio.
3. Remove the four M3.5-0.6 x 8 TORX screws (#15 drive) securing the audio/logic board to the radio frame.
4. Carefully work the audio/logic board out of the radio, being careful not to damage the plug going to the front cap assembly.

TO REMOVE DUPLEXER INTERFACE BOARD A4

l. Remove the radio top cover.
2. Disconnect the cables going back to the RF board.
3. Disconnect the cables from the duplexer or talk-around board.
4. Remove the four M3.5-0.6 TORX screws (#15 drive) securing the board to the frame. Carefully work the board out of the radio, unplugging it from feed through assembly Z903.

TO REMOVE SYSTEM BOARD A5

1. Remove radio bottom cover.
2. Disconnect the ribbon cable from J902.
3. Disconnect the option cable, if used.
4. Remove the three M3.5-0.6 x 8 TORX screws (#15 drive) securing the system board to the frame.
5. Carefully work the board out of the radio, unplugging it from feed through assembly Z903.

CHIP COMPONENT REPLACEMENT

The procedure for removing chip components is given below. Replacement procedures for other unique components are found in the appropriate board instruction manual where the component is used (PA module replacement can be found in the RF board manual).

Replacement of chip capacitors should always be done with a temperature controlled soldering iron, using a controlled temperature of 700°F (371°C). However, **DO NOT** touch black metal film of the resistors or the ceramic body of capacitors with the soldering iron. **NOTE:** The metallized end terminations of the parts may be touched with the soldering iron without causing damage.

CAUTION

The CMOS Integrated Circuit devices used in this equipment can be destroyed by static discharges. When handling one of these devices, the serviceman should discharge himself by touching the case of a bench instrument that has a 3-prong power cord connected to an outlet with a known good earth ground. When soldering or desoldering a CMOS device, the soldering iron should also have a 3-prong power cord connected to an outlet with a known good earth ground. A battery-operated soldering iron may be used in place of the regular soldering iron.

TO REMOVE CHIP COMPONENTS

l. Using two soldering irons heat each end of the chip at the same time until solder flows, and then remove and discard the chip.
2. Remove excess solder with a vacuum solder extractor.
3. Carefully remove the epoxy adhesive and excess flux to prevent damage to the printed board.

TO REPLACE CHIP COMPONENTS

1. Using as little solder as possible, "tin" one end of the component and one of the pads on the printed wiring board.
2. Place the "tinned" end of the component on the "tinned" pad on the board and simultaneously touch the component and the pad with a well "tinned" soldering iron while pressing the component down on the board.
3. Place the "tinned" soldering iron on the other end of the component and the pad simultaneously. Apply solder to the top of the end of the component until the solder starts to flow. Use as little solder as possible while getting a good joint.
4. After the component has cooled, remove all flux from the component and printed wiring board with alcohol.

TROUBLESHOOTING PROCEDURES

This section should help isolate a problem to a particular board or circuit. Block diagrams for power distribution and signal flow are given at the end of this manual. Refer to the appropriate instruction manual for more information.

The Dual Format MDR radio is divided into six functionalized boards or assemblies. To aid in identifying the suspect board, the major functions provided by each board are listed below.

- RF board
  - Synthesizer: generates all transmit and receive frequencies.
  - Receiver: provides detected audio to the audio board.
  - Transmitter: includes exciter and PA Module.
  - Power control circuitry: for transmitter RF output power.
- Duplexer Interface or Optional Talk-Around board
  - DC power Distribution
  - RF Power Sensing

NOTE

The talk-around option also includes the facility to switch the transmitter output to the RX input of the duplexer when a talk-around frequency is selected.

- Audio/logic board
  - Analog filtering of the RX and TX audio (voice, low speed data, high speed data, and signalling tones).
  - CAS squelch processing.
  - Conventional analog tone filtering and processing.
  - Routes signals between the RF amplifier and audio boards.
  - Contains the EEPROM for the radio personality.
  - Contains the main radio microprocessor.
  - Accepts serial PTT from the handset.
  - Provides DPTT to turn on the transmitter.
  - Provides synthesizer channel data to the RF board.
  - Processes RX and TX audio using an analog processor.
  - Decodes tone data from the audio board.
  - Generates the Channel Guard tones and data.
  - Controls all audio switches on the audio/logic board.
- System Board
  - A+ switching circuitry.
  - Option connections.
- Front Cap Audio Assembly
  - Contains the audio amplifier board and 10 watt audio amplifier.

ERROR MESSAGES

During normal operation, the following error messages could appear:

- SYN LOCK – occurs when the synthesizer is unable to lock on frequency.
- E9 – indicates that no personality is programmed into the radio.
- E1 – is displayed when the Group/Version number is displayed to indicate that invalid operational code is loaded into the radios FLASH memory.

SYMPTOMS AND CHECKS

SYMPTOMS	CHECKS
Handset blank on Power Up	Refer to the Power Distribution Block Diagram. Check for filtered A+ to the handset at J701-3, 8 volts at J702-6 or switched A+ at J905-5 (system board). If no conventional or GEMARC systems are programmed and Encryption Not Valid, the handset will be blank.
Radio will not go into test mode	The radio must be PC programmed to enable the test mode. Enable it on the options screen.
Low, distorted, or no RX Audio	Check the receiver VOL/SQ HI output. If distorted, the problem is most likely in the RF board. If the synthesizer load commands are not correct, the problem may be on the audio/logic board. If the audio is correct at VOL/SQ HI, check the RX audio out. If improper, check the audio/logic board for proper unmute commands. Improper commands indicate a faulty audio/logic board.
No RX Alert Tone	Check the signalling tone output from the audio/logic board. Operate the volume control. If tones are not present, the audio/logic board may be faulty.
Poor RX Sensitivity	Simplex operations: Suspect the RF board. Check receiver alignment. Refer to the RF board maintenance manual. Duplex Operation: If receiver OK, check lead placement on duplexer/talk-around board.
No TX Power	Check the DPTT command to the RF board. If present, then the problem is likely on the RF board. If the DPTT is not present, the problem is likely on the audio/logic board.
Low TX Power	Check the transmit frequency. If its not OK, check the synthesizer on the RF board load commands from the audio/logic board. If the commands are not present, a problem in the audio/logic board is likely. If the TX frequency is correct, refer to the maintenance manual for the RF board and troubleshoot the transmitter.
No TX Modulation	Check the TX MOD input to the RF board. If present, the RF board may be faulty. If not present, determine what is missing: tone, voice, or both. Missing tones - Look for the signalling tone and busy tone on the audio/logic board. If the tones are not present, the audio/logic board may be faulty. Tones present - look for the proper unmute commands on the audio/logic board. If the commands are not present, the audio/logic board may be faulty. If the commands are present, the audio/amplifier board may be faulty. Missing Voice Signal - Check the mute commands on the audio/logic board and the TX Audio input. If all signals are correct, the problem is likely a faulty audio/logic board. If no signal is present at the audio/logic board, check the output from the audio amplifier board and the handset outputs.
Radio will not program when plugged into the TQ3310 or TQ3370 interface module	Verify radio is getting turned "on" by programmer.
Distorted TX Audio	Check grounding between all boards and the casting. Check the TX mod input to the RF board. If distorted, a faulty audio/logic board is likely. Check the mute commands. If incorrect a faulty audio/logic board is likely. If the tones are distorted, check the tone generation circuitry on the audio/logic board.
Transmitter Off Frequency	Suspect the RF board. Refer to "Frequency Set" procedure in the Transmitter Alignment section of this manual. Check the synthesizer load command. If the load command is wrong, a faulty audio/logic board is likely.
Calls Processed Incorrectly	Check personality PROM programming. Check for proper TX and RX operation. Refer to TX and RX Verification Procedures. If verification OK, determine if the problem is in the transmit or receive circuit. RX decode check: Use the decode T test mode command. Modulate the

generator with the correct tone sequence and busy tone. If the test fails, check the audio/logic board.

TX encode check: Use the encode test. If the test fails, the audio/logic board may be faulty. Look for the proper tones on the audio/logic board and proper unmute commands. If all inputs are correct, the board may be faulty.

TX/RX/Encode/Decode OK: Check proper synthesizer switching time. Use BAND SWT test. If the switching time is incorrect, the RF board may be faulty.

Improper Direct Mode

Key the radio on a direct mode channel, and check the BANDSWITCH LINE. If the command is correct, the RF board may be faulty. If the command is incorrect, the audio/logic board may be faulty.

CAUTION

The radio must be equipped with talk-around option for direct mode operation to work properly. DAMAGE to the radio may occur if the radio is placed in talk-around transmit mode without the talk-around option board installed.

TEST PREPARATION

Field test mode can be disabled using the PC programmer. If enabled, the following describes the "User Test Mode" that will be employed by the Dual Format MDR radio.

It is recommended that the users test frequency set include at least 4 conventional channels with one of the channels being a talk-around channel, if a talk-around board is installed.

TEST MODE COMMANDS

At any time during the test if "TESTSET?" is displayed then there is no Test Set programmed to perform the test. If "TONESET?" is displayed then there is no GE-MARC tone set programmed to perform the test. At this point you will have to PC program your radio with a Test/Tone Set to execute the desired test. The suggested personality frequency set will contain at least four frequencies, preferably one a talk-around frequency, if talk-around option is installed.

Test mode enables the technician to exercise test functions in the field using the radio's handset. To enter the radios test mode the user must press the **FCN** key followed by the **"A"** key.

When test mode is first entered "TESTMODE" appears in the display. Once in test mode the user may step through the various commands by pressing the **VOLUME UP/DOWN** button.

Once the desired test has been selected with the volume buttons the **END** key is pressed to activate the selected test.

The selected commands are:

- Default Setup (DEFAULT)
- Set Channel Test (SET CHAN)
- Volume Control (VOLUME)
- Key/Unkey Transmitter (XMITCON)
- Mute/Unmute Receiver Audio (AUDICON)
- Mute/Unmute Mic Audio (PHONCON)
- Generate Dotting (4800 Hz)
- Generate Pseudo Random HS Data (9600 PRD)
- Encode Channel Guard Tone (150 Hz)
- Report Receiver Carrier Sense (CAS TEST)
- Across Band Switching (BAND SWT)
- Generate Alert Tone (ALERT TN)
- External RAM Test (RAM TEST)
- Software Version Number (UPR)
- Checksum Test (PROG TS)
- 11 Hertz (11 HERTZ)
- TX Standard Busy Tone (TX BSYTN)
- Tone Set Select (TONE SEL)
- DTMF Tone (TX DTMF)
- Decode Test (DECODE T)
- Encode Test (ENCODE T)
- Relay Switch (RELAY)
- MDR Handset Test (HANDSET)

KEY/UNKEY TRANSMITTER (XMITCON)

Selecting the "XMITCON" menu selection allows the user to toggle the state of the transmitter, "XMIT ON" or "XMIT OFF". Press the **END** button to display the last state of the transmitter. Use the **"*" (up),"#" (down)** buttons to toggle the transmitter on/off. Press the **END** button to exit the transmit control mode and leave the transmitter in the last state selected.

MUTE/UNMUTE RECEIVER AUDIO (AUDICON)

The "AUDI CON" menu selection displays the state of the audio, "AUDIO ON" or "AUDIO OFF". Press the **END** button to exit the audio control mode, leaving the audio in the last state selected.

MUTE/UNMUTE MIC AUDIO (PHONCON)

Selecting the "PHONCON" Menu selection indicates the current microphone audio state; "PHON ON" or "PHON OFF". Press the **END** button to exit the microphone control mode, leaving the microphone in the last state selected.

GENERATE DOTTING (4800 HZ)

This command causes the radio to generate a "dotting" (i.e. "1010101010") pattern with its modem chip. To modulate the transmitter with this pattern, the transmitter must have been keyed, using the "Key Transmitter" command.

Select the "4800 HZ" menu selection. Press the **END** button. The pattern will continue until another button is pressed.

GENERATE PSEUDO RANDOM HS DATA (9600 PRD)

This command causes the radio to generate pseudo random data with its modem chip. This data is sent at 9600 baud. To modulate the transmitter with this data, the transmitter must have been keyed using the "key transmitter" command.

Select the "9600 PRD" menu selection. Press the **END** button to begin the test. The pattern will continue until another button is pressed.

ENCODE CHANNEL GUARD TONE (150 HZ)

This command causes the radio to begin generating a subaudible CG tone. To modulate the transmitter with this tone, the transmitter must have been keyed using the "key transmitter" command.

Select the "150 HZ" menu selection. Pressing the **END** button will begin the test. The tone will be generated until another button is pressed.

REPORT RECEIVER CARRIER SENSE (CAS TEST)

This command causes the radio to indicate opening/closing squelch on its display.

Select the "CAS TEST" menu selection. Press the **END** button. The display indicates the state of the CAS signal, either "RCV SIG" or "NO SIG". The radio monitors the signal and displays any changes in the CAS signal. Pressing any button results in the termination of the test.

ACROSS BAND SWITCHING (BAND SWT)

This command causes the radio to begin switching its synthesizer between personality channels 1 and 4 at approximately 2 second intervals.

Select the "BAND SWT" test from the menu. Press the **END** button and the display will alternate between "CHANN 1" and "CHANN 4" as the channels are changed. Pressing any button exits the test.

GENERATE ALERT TONE (ALERT TN)

This command causes the radio to generate a 528 Hz alert tone.

Select the "ALERT TN" test from the menu. The beeping continues until another button is pressed.

EXTERNAL RAM TEST (RAM TEST)

This test causes the radio to conduct a test of its 8K RAM chip.

Select the "RAM TEST" command from the menu. Press the **END** button; the display indicates either "RAM PASS" or RAM FAIL", depending on the test results.

SOFTWARE VERSION NUMBER (UPR)

This command displays the software version number.

Select the "UPR" command from the menu. Press the **END** button to display the version number. "GXX VXX" indicates the Group/Version revision number of the software.

CHECKSUM TEST (PROG TS)

This command instructs the radio to conduct a checksum test of its program memory.

Select "PROG TS" from the menu. Press the **END** button. The test is performed and the display indicates "PRG PASS" or "PRG FAIL".

DEFAULT SETUP (DEFAULT)

This command causes the radio to revert to its default setting. The radio turns off the transmitter, disables the transmit audio, and returns the ASP to its power-up state.

Select the "DEFAULT" command. Press the **END** button. The display changes to "TESTMODE", indicating the default setup is selected.

SET CHANNEL (SET CHAN)

This command causes the radio to steer to one of the channels on the testmode frequency set that is in the current personality.

Select the "SET CHAN" command from the menu. Press the **END** button to display the channel selection. Pressing the **"∗" (up),"#" (down)** buttons scroll through the channel selections. Pressing any button terminates the test.

VOLUME CONTROL (VOLUME)

This command causes the radio to adjust the volume control of the ASP.

Select the "VOLUME" command from the menu. Press the **END** button. Pressing the **VOLUME UP/DOWN** buttons increment or decrement the volume level by one step. Pressing the **END** button stops the test.

11 HERTZ TEST (11 HERTZ)

This command is used to generate an 11 Hz square wave on the low speed data (Channel Guard) output.

To modulate the transmitter with this data, the transmitter must have been keyed using the "key transmitter" command.

Select the "11 HERTZ" test from the menu. Press the **END** button and the display flashes indicating the signal is being generated. Pressing any key will terminate the test.

TX STANDARD BUSY TONE (TX BSYTN)

This command is used to generate a standard GE-MARC busy tone. To modulate the transmitter with this data, the transmitter must have been keyed using the "key transmitter" command.

Select the "TX BSYTN" command from the menu. Press the **END** button to begin the test. Pressing any key terminates the test.

TX ALTERNATE BUSY TONE (TX ABTON)

This command is used to generate an alternate GE-MARC busy tone. To modulate the transmitter with this data, the transmitter must have been keyed using the "key transmitter" command.

Select the "TX ABTON" command from the menu. Press the **END** button to begin the test. Pressing any key terminates the test.

TX GE-MARC TONE (TX GMARC)

This command causes the radio to transmit the user specified GE-MARC tone.

Select the "TX GMARC" command from the menu. Press the **END** button to display the GE-MARC tone. Pressing the **"∗" (up),"#" (down)** key scrolls through the possible GE-MARC tone selections. To modulate the transmitter with this data, the transmitter must have been keyed using the "key transmitter" command. See Appendix A for a listing of the GE-MARC tones.

TONE SET SELECT (TONE SEL)

This command causes the radio to steer to one of the channels in the user specified GE-MARC testmode tone set.

Select the "TONE SEL" command from the menu. Press the **END** button to display the tone set. Pressing the **"∗" (up),"#" (down)** button scrolls through the tone set selections. Pressing the **END** button terminates the selection. This selection is then retained until a new tone set is selected (or until test mode is exited). To modulate the transmitter with this data, the transmitter must have been keyed using the "key transmitter" command.

DTMF TONE (TX DTMF)

This command causes the radio to transmit the DTMF tone selected (0-9,∗,#).

Select the "TX DTMF" command from the menu. Press the **END** button to display the DTMF tone selected. Pressing the **"∗" (up),"#" (down)** button scrolls through the possible selections. Pressing the **END** button terminates the test. To modulate the transmitter with this data, the transmitter must have been keyed using the "key transmitter" command.

DECODE TEST (DECODE T)

This command causes the radio to attempt to decode a GE-MARC tone set. The call is looked for on the currently selected channel (SET CHAN) using the currently selected tone set (TONE SEL).

Select the "DECODE T" command from the menu and press the **END** button. The radio immediately attempts to decode the selected tone set and continues until it is decoded (at which time "DEC COMP" is displayed) or the user terminates the function by pressing any key.

ENCODE TEST (ENCODE T)

This command causes the radio to attempt to encode a GE-MARC tone set. The call is originated on the currently selected channel (SET CHAN) using the currently selected tone set (TONE SEL).

Select the "ENCODE T" command from the menu and press the **END** button. This will initiate the test and once completed "ENC COMP" will be displayed. To modulate the transmitter with this data, the transmitter must have been keyed using the "key transmitter" command.

RELAY SWITCH (RELAY)

This command causes the relay (external alarm) line to toggle at a rate of once per second.

Select the "RELAY" command from the menu. Press the **END** button to begin the test. Pressing any key terminates the test.

HANDSET TEST (HANDSET)

The test sends a command to the handset, causing it to enter the self-test mode. The handset will display **[SELFTEST]** then **[RAM PASS]** or **[RAM FAIL]** and then begin running i.e. [000 00 0]. At this time the handset will display the name of any key (except END) that is being pushed, eg. [KEY 4] indicates the STO key is pressed, etc. Pressing the **END** key will terminate the self test and **[TEST-MODE]** is displayed. The handset will return to test mode.

Select the "HANDSET" command from the menu and press **END** to begin the test. After the test has been terminated the "**HS PASS**" or "**HS FAIL**" message will be displayed to report the status of the test.

RADIO ALIGNMENT PROCEDURE

To align the radio, test mode operation must be used as described in the Test Preparation section. Refer to Figure 1 for location of adjustment controls. Refer to Figures 2, 3, and 4 for Troubleshooting, Power Distribution, and Control Signal Diagrams.

TEST EQUIPMENT AND SERVICE AIDS

The following list of test equipment and service aids is provided to facilitate servicing.

- TQ0618 Test Interface Box
- TQ3370 PC Programming Adapter - includes 19D438367G1 Programming Interface Box w/LBI-31986, cable 19B235027P1 (interface to PC Computer), and Power Supply 19B800850P2.
- TQ3371 Programming cable - interface to Dual Format MDR Series radios.
- 19A705235P2 Service cable - provides a two foot extension between the system and audio amplifier boards. Not required for most servicing if existing cable is not looped through the front of the radio assembly.
- 19A801348P4 Provides a two foot extension between the 9-pin "D" connectors on the audio/logic and audio amplifier boards. Permits servicing all assemblies in the audio amplifier while power is applied.
- ST3712 Pin Extractor Tool (11-03-0038) - Allows removal of contacts from connector shell that mates with option cable CC01. The option cable is required with all external options.
- ST2513 Alignment Tool - with two ceramic tips - used for squelch control and other adjustments.
- ST2617 Crimping Tool for field attachment of TNC - series male connectors 19A115903P1 to RG-58/U (and similar) coaxial cable.

TRANSMITTER ALIGNMENT

Frequency Set

Enter the test mode and key the transmitter. Measure the transmit frequency. The frequency should be within ±250 Hz of the test mode channel frequency. If not, adjust U204 to within ±100 Hz.

NOTE

The temperature should be 25 ±5°C. Confirm frequency counter calibration is better than ±0.1 PPM.

Normal Mode Modulation Set

1. Apply a 1 kHz, 1.0 Vrms signal to the TX AUDIO input of the test box (TQ0618 or TQ3310).
2. Select a channel near 814.000 MHz. Turn on the TX audio and key the transmitter. Turn on the Tone Channel Guard. Adjust modulation control R254 for a deviation of 4.2 +0.1, -0.2 kHz.

Direct Mode Modulation Set

1. Apply a 1 kHz, 1.0 Vrms signal to the TX AUDIO input of the test box (TQ0618).
2. Select a talk-around channel near 859.000 MHz. Turn on the TX audio and key the transmitter. Turn on the Tone Channel Guard. Adjust modulation control R226 for deviation of 4.2 +0.1, -0.2 kHz.

NOTE

Pressing **RCL** resets the radio to the first frequency in the frequency set and also sets the bandswitch line high.

Transmitter Power Set

1. While on a channel near 814.000 MHz, key the transmitter, and adjust R111 in the power control circuit for 11 watts.
2. Unkey the transmitter.

RECEIVER ALIGNMENT

Frequency Set

1. Verify that the transmitter is on frequency as verified by the transmitter alignment procedures.
2. Inject a strong, unmodulated on-channel signal (-60 dBm) at the antenna input, J101.
3. Monitor J501 with a frequency counter and adjust L508 for a reading of 455 kHz ±100 Hz.

IF Tuning

1. Monitor J501 with an AC voltmeter and, at the antenna jack, inject an on-channel signal modulated with a 60 Hz ramp at 5 kHz deviation.

NOTE

A 1 kHz tone may be used if a 60 hz ramp is not available.

2. Peak L504, L506, and L507 as indicated on the AC voltmeter. Adjust the level of the signal generator to keep the signal at J501 out of limiting (approximately -65dBm).
3. Repeak the coils.

Quadrature Detector Adjustment

1. Inject a strong on-channel signal (-60 dBm) at the antenna jack modulated with a 1 kHz tone at 3 kHz deviation.
2. Monitor the **VOL/SQ HI** output at J705-3 with an AC voltmeter and adjust L509 for a peak indication on the meter.

Receiver Audio Level

1. Inject a strong on-channel signal at the antenna jack modulated with a 1 kHz tone at 3 kHz deviation.
2. Monitor **VOL/SQ HI** J705-3 with an AC voltmeter and adjust R513 for a reading of 150 mVrms. A+ supply current should be less than 2 amperes with 10 watts of audio to the external speaker, if equipped.

NOTE

The external speaker audio has balanced outputs and must be monitored with the test circuit shown in Figure 2.

Sidetone Adjustment

The following adjustment requires duplex operation. The RF signal generator must be isolated from the transmitter RF power using a 15 watt 30 dB attenuator or other isolation device in series with the RF signal generator.

1. Inject a strong on-channel signal modulated by 1 kHz tone at 3 kHz deviation at the RF input.
2. Turn the RX audio on and set the volume at maximum. Measure the RX audio output at the external speaker: 6.3 Vrms.
3. Turn off the 1 kHz modulation while leaving on the RF generator signal.
4. Apply a 1 kHz tone to the TX Audio input at TX MOD jack of the test box (J701-4). Turn on the TX audio and key the transmitter. Adjust the 1 kHz tone level for 3 kHz deviation.
5. Turn on the RX audio and rekey. Measure the RX audio output and adjust R359 & R361 on the audio amplifier board for a null. The null should be greater than -18 dB down from the 6.3 Vrms reference taken above. Unkey the transmitter.

Squelch Adjustment

The squelch setting may be adjusted by pressing and holding the "FCN" key for 10 seconds. After the 10 second time period, the display will change to "SQL ADJ" and the user may decrement the current squelch value by pressing the **system/**∗ button or decrement the squelch value buy pressing the group/# button. Additionally, the squelch adjust state can only be entered into while the radio is on a conventional or an EDACS working channel.

Note that entry into and exit from this function has been defined within tight constraints in order to keep from accidentally entering the squelch adjust state, (i.e. if the user presses the "FCN "key for longer than 10 seconds the squelch adjust state is exited or if no key press takes place within 2 seconds, the squelch adjust state is exited).

TRANSMITTER VERIFICATION

Place the radio in the test mode for the following tests.

Transmit Frequency

Key the transmitter and measure the transmit frequency (default test mode channel is the first frequency in the test frequency set). The measured frequency should be within ±250 Hz of the assigned transmit frequency. Unkey the transmitter.

Transmit Power

Select a channel near 814.0000 MHz. Key the transmitter. Power should be a minimum of 10 watts. Unkey the transmitter.

Modulation Limiting

1. Apply a 1 kHz tone at 1.0 Vrms to the TX AUDIO input of the test box or TQ3310/TQ3370.

2. Select a channel near 814.0000 MHz. Turn on the TX audio and key the transmitter. Turn on the Channel Guard tone (150 Hz).

3. Measure the deviation. It should be 4.2 ±0.2 kHz. Unkey the transmitter.

Busy Tone Deviation

1. Select a channel near 814.0000 MHz. Key the transmitter and turn on the busy tone.

2. Measured the deviation. It should be 1 kHz +0.2, -0.3 kHz.

RECEIVER VERIFICATION

SINAD

1. Select a channel near the middle of the frequency band. Apply a corresponding RF frequency, modulated with a 1 kHz tone at 3 kHz deviation, to the antenna jack. Set the RF frequency level to -116 dBm.

2. Check for greater than 12 dB SINAD at the RX AUDIO output.

3. Repeat the test for channel band edge.

Audio Output

Refer to Figure 2 for the Test Setup Diagram to measure audio output.

1. Apply a strong (-60 dBm) on-channel signal modulated with a 1 kHz tone at 3 kHz deviation to the antenna jack.

2. Set the volume control to maximum. Monitor the external outputs at J905-2,9. The output level should be approximately 6.3 Vrms with less than 5% distortion.

Duplex Receive Sensitivity

The following test requires a completely assembled radio with all covers in place. A calibrated attenuator pad (30 dB, 15 watts) must be inserted between the radio's antenna jack and the RF signal generator to isolate the generator from the 10W transmitter power output.

1. Set the RF generator to a channel frequency and the radio to the corresponding channel. Modulate the RF generator output with a 1 kHz tone at 3 kHz deviation. Adjust the RF level so -113 dBm is present after the attenuator at the antenna jack.

2. Turn on the transmitter. Measured SINAD should be greater than 12 dB.

3. Unkey the transmitter.

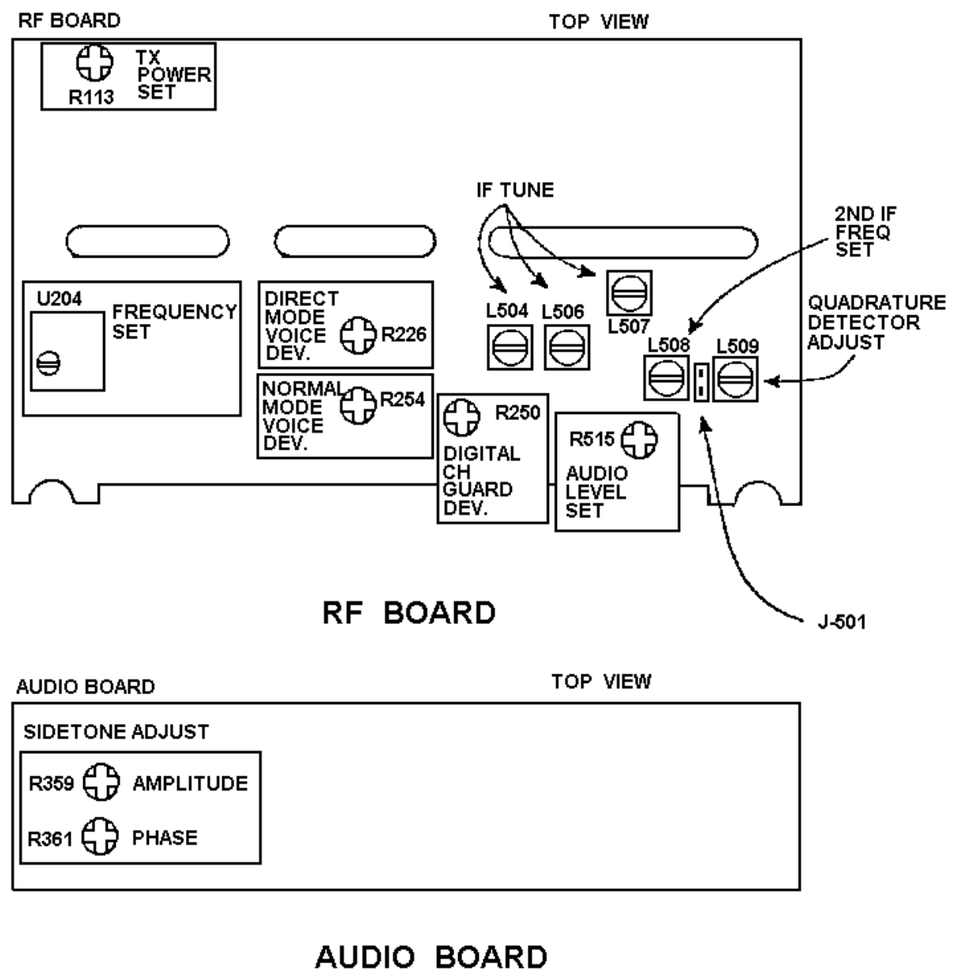

Figure 1 - Location Of Adjustment Controls

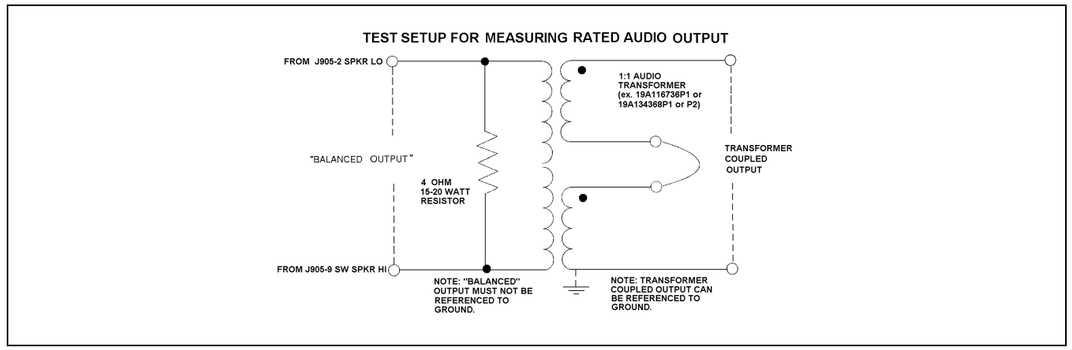

Figure 2 - Audio Output Test Set-Up Diagram

APPENDIX A. GE-MARC TONES

NUMBER	FREQUENCY	NUMBER	FREQUENCY
01	604.2 Hz	22	1556.7 Hz
02	631.5 Hz	23	1628.3 Hz
03	662.3 Hz	24	1717.1 Hz
04	693.0 Hz	25	1795.6 Hz
05	727.1 Hz	26	1877.5 Hz
06	761.3 Hz	27	2051.6 Hz
07	795.4 Hz	28	2143.8 Hz
08	832.9 Hz	29	2239.4 Hz
09	870.5 Hz	30	2341.8 Hz
10	911.5 Hz	31	2447.6 Hz
11	952.4 Hz	32	2556.9 Hz
12	996.8 Hz	33	2672.9 Hz
13	1041.2 Hz	34	2792.4 Hz
14	1089.0 Hz	35	508.6 Hz
15	1140.2 Hz	36	529.1 Hz
16	1191.4 Hz	37	553.0 Hz
17	1243.0 Hz	38	576.9 Hz
18	1304.0 Hz	39	1962.9 Hz(acq)
19	1362.1 Hz	40	2918.7 Hz(alt)
20	1423.5 Hz	41	3051.9 Hz(std)
21	1488.4 Hz	42	466.0 Hz

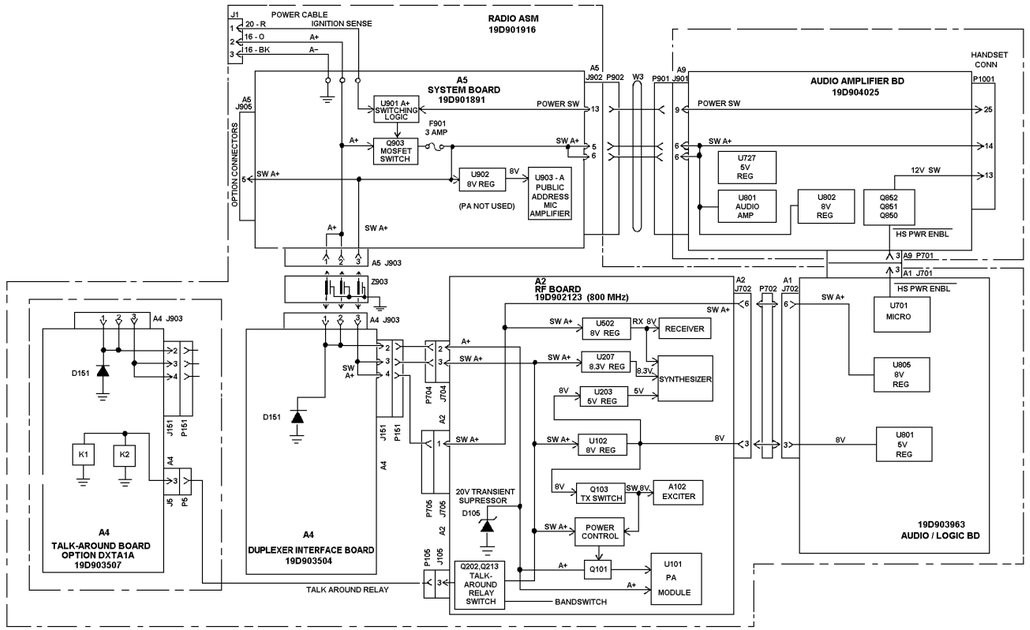

Figure 3 - Power Distribution Diagram

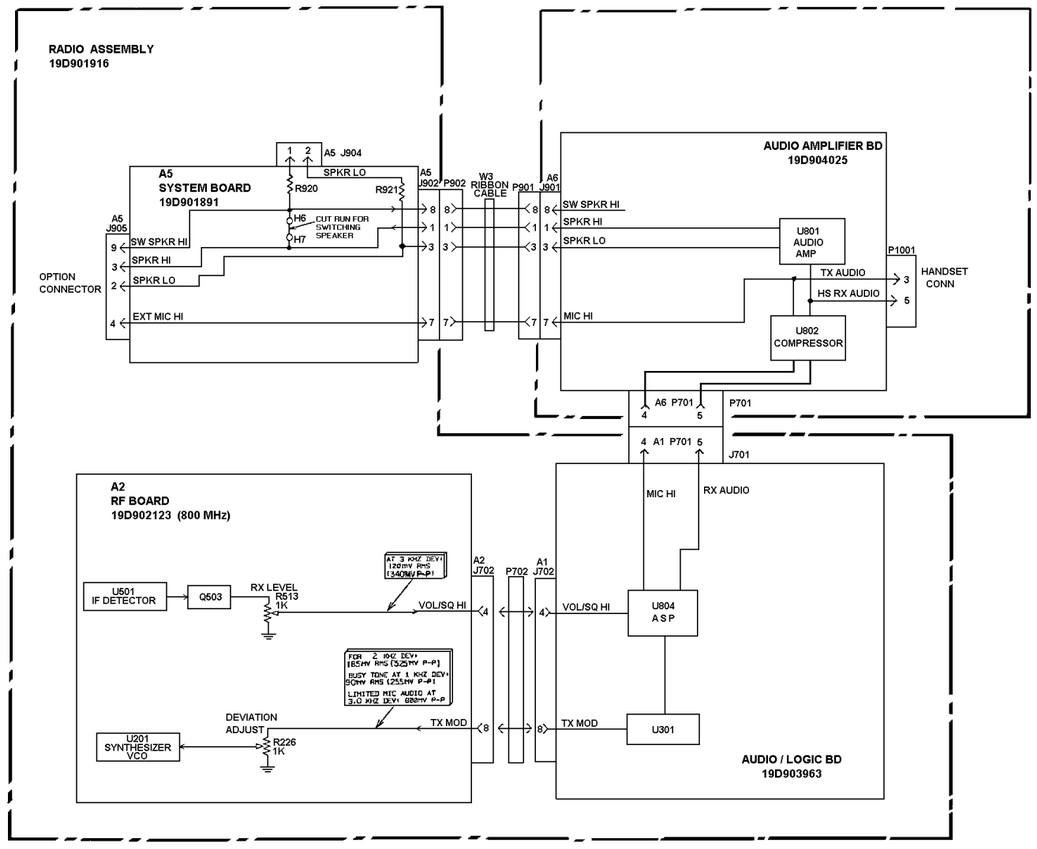

Figure 4 - Audio Signal Flow Diagram

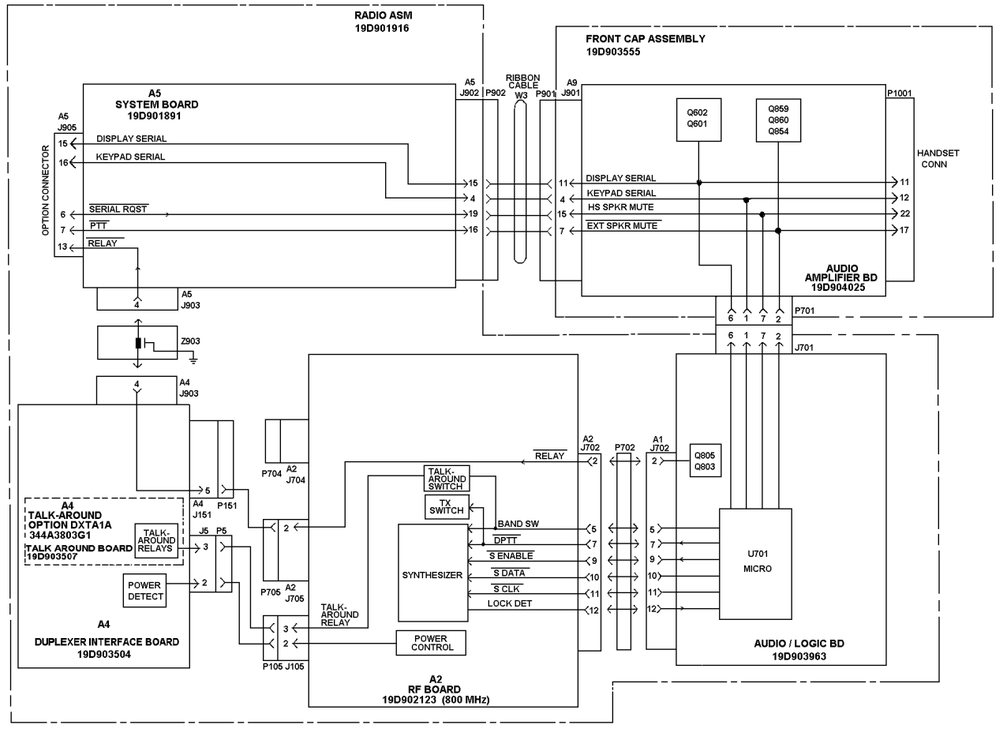

Figure 5 - Data Control Diagram