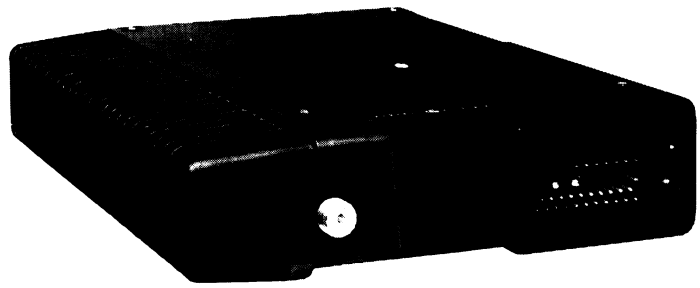
## GE Mobile Communications

# RANGR™

## 29-50 MHz



**INCLUDES**



Maintenance Manual

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## ILLUSTRATIONS



| | | | |
|---|---|---|---|
| FCC FILING NUMBER | AXA9HHTR-138-A | 29-42 MHz | 60W |
| | 139-A | 29-42 MHz | 110W |
| | 138-B | 35-50 MHz | 60W |
| | 139-B | 35-50 MHz | 110W |

**WARNING**

Although the highest DC voltage in Mobile Two-Way Radio equipment is supplied by the vehicle battery, high currents may be drawn under short circuit conditions. These currents can possibly heat objects such as tools, rings, watchbands, etc., enough to cause burns. Be careful when working near energized circuits!

High-level RF energy in the transmitter Power Amplifier assembly can cause RF burns upon contact. Keep away from these circuits when the transmitter is energized!

## SYSTEM SPECIFICATIONS

| | |
|---|---|
| FREQUENCY RANGE | 29 to 42 MHz and 35 to 50 MHz |
| BATTERY DRAIN | |
| Receive | |
| Squelched | 0.7 Amperes at 13.8 Volts |
| Unsquelched | 2.2 Amperes at 13.8 Volts |
| Transmit | |
| 60 Watts | 15 Amperes at 13.6 Volts |
| 110 Watts | 29.5 Amperes at 13.4 Volts |
| FREQUENCY STABILITY | 0.0005% |
| TEMPERATURE RANGE | -30°C (-22°F) to +60°C (140°F) |
| DUTY CYCLE | 100% Receive, 20% Transmit (EIA) |
| DIMENSIONS, LESS ACCESSORIES (H x W x D) | 67 mm x 240 mm x 339 mm (2.6 x 9.5 x 13.3 inches) |
| WEIGHT, LESS ACCESSORIES | 4.3 kg (9.5 pounds) |

## TRANSMITTER

| | |
|---|---|
| TRANSMIT OUTPUT POWER | 60W/110W |
| CONDUCTED SPURIOUS | -80 dB |
| MODULATION | ±4.5 kHz |
| AUDIO SENSITIVITY | 55 to 110 millivolts |
| AUDIO FREQUENCY CHARACTERISTICS | Within +1 dB to -4.5 dB of a 6 dB/octave pre-emphasis from 300 to 3000 Hz per EIA standards. Post-limiter filter per FCC and EIA |
| DISTORTION | Less than 2% (1000 Hz)<br>Less than 5% (300 to 3000 Hz) |
| DEVIATION SYMMETRY | 0.3 kHz maximum |
| MAXIMUM FREQUENCY SEPARATION | 29-42 MHz .... 13 MHz<br>35-50 MHz .... 15 MHz |
| MICROPHONE LOAD IMPEDANCE | 600 ohms |
| POWER ADJUST RANGE | 100% to 50% of rated power |
| RF OUTPUT IMPEDANCE | 50 ohms |
| FM NOISE | -60 dB |
| CARRIER ATTACK TIME | 20 milliseconds |
| AUDIO ATTACK TIME | 20 milliseconds |

| | |
|---|---|
| CHANNEL GUARD TX TONE DISTORTION | 5% |

## RECEIVER

| | |
|---|---|
| AUDIO OUTPUT (to 4.0 ohm speaker) | 10 Watts with less than 3% distortion |
| SENSITIVITY<br>12 dB SINAD (EIA Method) | 0.35 µV |
| SELECTIVITY<br>EIA Two-Signal Method (20 kHz channels) | -90 dB |
| SPURIOUS RESPONSE | -85 dB |
| INTERMODULATION 20 kHz | -80 dB |
| MODULATION ACCEPTANCE | ±7.0 kHz |
| MAXIMUM FREQUENCY SEPARATION | 29-42 MHz .... 13 MHz<br>35-50 MHz .... 15 MHz |
| FREQUENCY RESPONSE | Within +2 and -8 dB of a standard 6 dB per octave de-emphasis curve from 300 to 3000 Hz (1000 Hz reference) |
| RF INPUT IMPEDANCE | 50 ohms |
| HUM/NOISE RATIO<br>UNSQUELCHED<br>SQUELCHED | <br>-50 dB<br>-70 dB |
| RECEIVER RECOVERY TIME | 200 milliseconds |
| RECEIVER ATTACK TIME | 150 milliseconds |
| CHANNEL SPACING | 20 KHz |

* These specifications are intended primarily for use of the serviceman. Refer to the appropriate Specifications Sheet for the complete specifications.

# PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter" which is stamped on the label containing the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

Rev. A - LB Radio 19C852050P5-P8

To improve spurious response and adjacent channel intermodulation, a notch filter consisting of the components below was added in the input circuit of the Pulse Amplifier (TRI) on the Noise Blanker Board.

270 pF capacitor (B19/5CAAD00883)
27 pF capacitor (B19/5CAAD00793)
RF coil (B19/6LALD00050)
RF coil (B19/6LALD00049)

Rev. B - LB Radio 19C852050P5-P8

To improve intermodulation characteristics measured at a distance of two to four MHz from receiving frequency, an Automatic Gain Control (AGC) consisting of the components below was added in the Pulse Amplifier/Limitter ($IC_1$) on the Noise Blanker Board.

4700 pF capacitor (B19/5CAAD00957)
0.047 µF capacitor (B19/5CAAD01092)
47 ohms resistor (B19/5REAC01722)
1K ohms resistor (B19/5RDAC02446)
47K ohms resistor (B19/5RDAC02439)
100K ohms resistor (B19/5RDAC02449)
Transistor MTM3904 (B19/5TCAB01234)
Transistor MTM3906 (B19/5TCAB01233)

Rev. A - RANGR LB RADIO 19C852050P1-P4
Rev. C - RANGR LB RADIO 19C852050P5-P8
SYSTEM CONTROL BOARD B19/CMC383

To eliminate S550 scan noise in speaker with radio squelched a capacitor C754 was added from $\overline{\text{SQ DSBL}}$ (J701-1) to ground

C754 - B19/5CAAD01237; Ceramic, 0.1 µF ±10%, 25 VDCW

## DESCRIPTION

General Electric synthesized RANGR mobile radio combinations are completely solidstate utilizing microcomputer technology and integrated circuits to provide high-quality, high-reliability radios. Standard combinations may

- Microcomputer Controlled Frequency Synthesizer
- Up to 16 channels
- .0005% frequency stability
- Other structured options

The radio locks when the optional lock is installed but is not tamperproof. The cover can be removed in the locked or unlocked position.

The radio set is housed in a weather-resistant case only 6.7 centimeters high. The radio is secured to the vehicle by a bottom mounting plate. When unlocked, the radio may be pulled out of the mounting plate or the top cover removed for servicing.

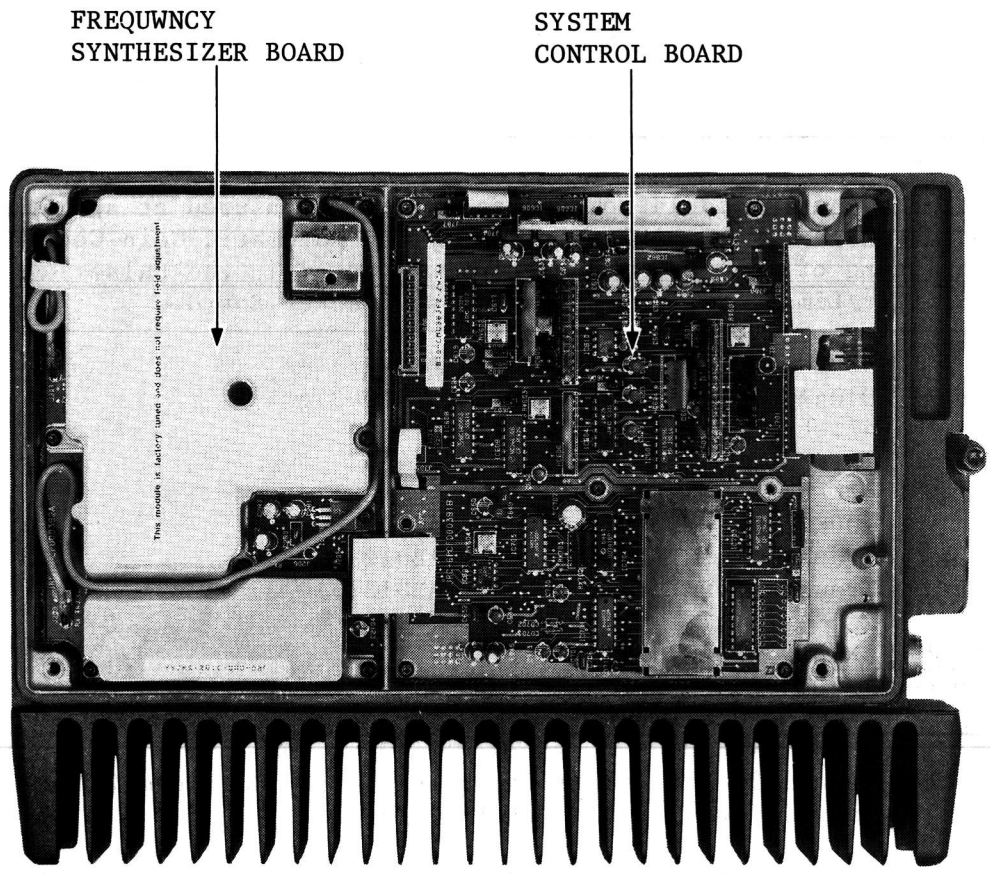
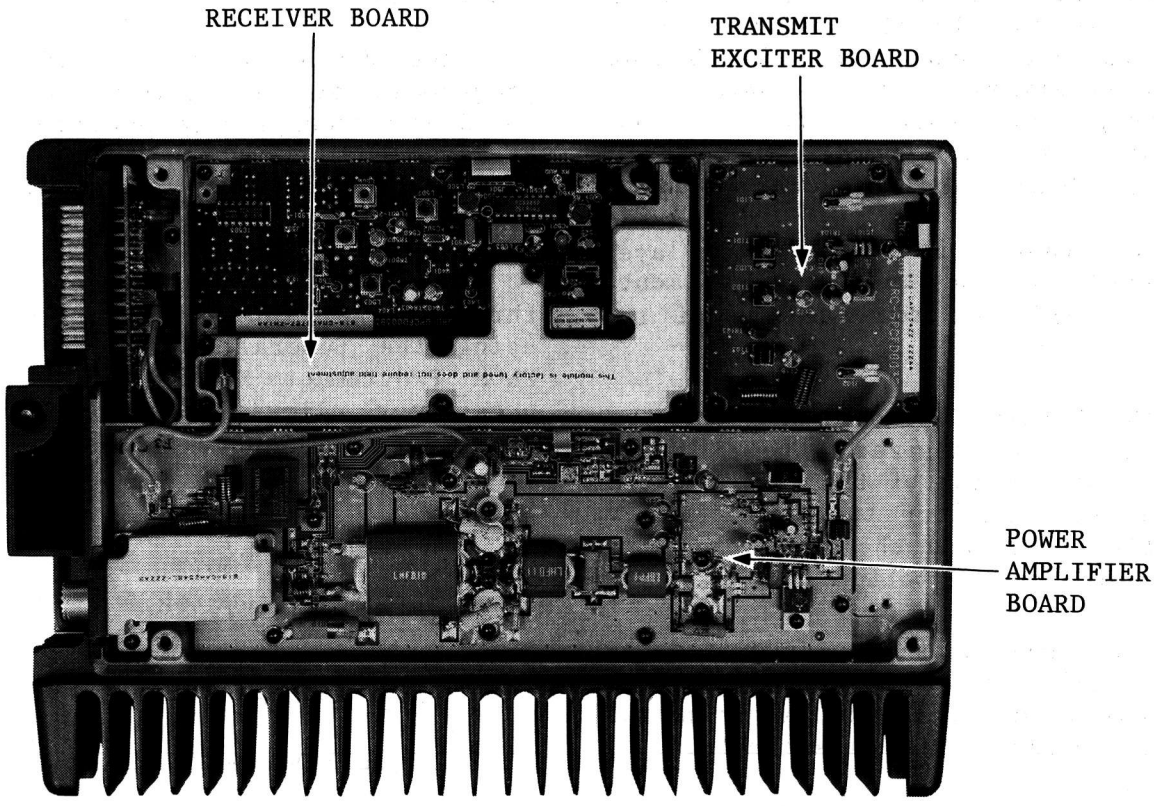
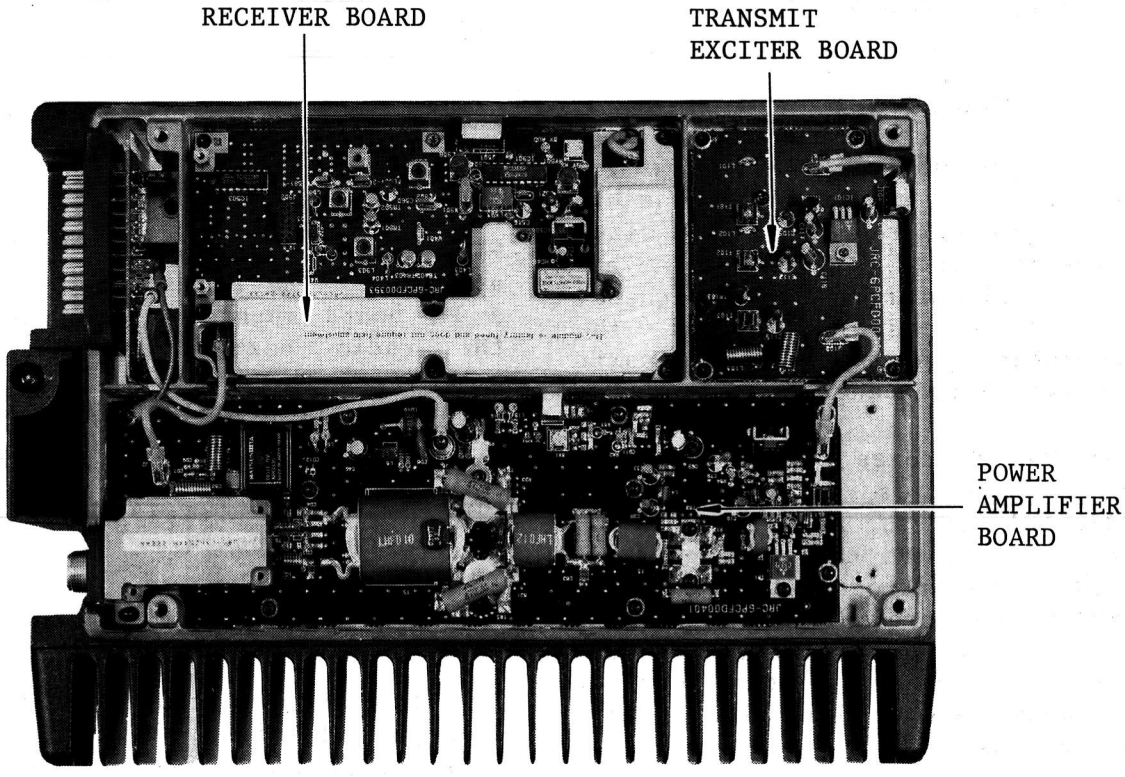



Figure 1. Typical Module Layout (Top View)




- 60 W TYPE -




- 110 W TYPE -

Figure 2. Typical Module Layout (Bottom View)

The basic radio consists of five printed wiring boards mounted in a cast aluminum frame. The five boards are the System Control board, the Frequency Synthesizer board, the Transmit Exciter board, the Power Amplifier board, and the Receiver board.

The radio is of double-layer construction with tuning adjustments easily accessible from the top of the radio.

The System Control board and the Frequency Synthesizer board are located on the top of the radio, while the Transmit Exciter board, the Power Amplifier board and the Receiver board are located on the bottom.

Interconnections are provided by ribbon cable between the boards. A power bus connects A+ and A- from the front connector to the PA assembly.

A centralized metering jack for the transmitter, receiver and system functions is provided for simplified alignment and troubleshooting.

## SYNTHESIZER/INTERCONNECT

The synthesizer consists of a microcomputer, electrically-erasable PROM (EEPROM), a frequency synthesizer IC, transmit and receive VCO's and associated circuitry. The frequency synthesizer under control of the microcomputer generates all transmit and receive RF frequencies.

The EEPROM stores binary data for all RF frequencies, Channel Guard tones/digital codes, and the timing function of the carrier control timer(CCT). The microcomputer accesses the EEPROM and provides the correct WALSH bits to the Channel Guard circuitry to generate the correct Channel Guard tone or digital code on a per-channel basis.

## PROGRAMMING

The EEPROM allows the radio to be programmed or reprogrammed as needed to adapt to changing system requirements. RF frequencies, Channel Guard tones and digital codes, and the CCT function can be reprogrammed.

The EEPROM can be reprogrammed through the radio front connector using the General Electric Universal PROM Programmer Model TQ2310. This programmer allows all information to be loaded simultaneously.

**NOTE**

When programming, remember that all RF frequencies must be divisible by 5 kHz.
Also insure that P706 is connected to J706-2 and 3 to enable programming.

Programming instructions are provided in the respective Programmer Maintenance Manuals.

## TRANSMITTER

The transmitter consists of the exciter, frequency synthesizer, transmit VCO, and a power amplifier (PA) assembly. The PA assembly consists of a PA board mounted along the side of the radio next to the heat sink assembly. The PA board also contains an antenna relay and a low-pass filter.

Audio and Channel Guard circuitry for the transmitter is located on the System Control board.

## RECEIVER

The receiver consists of the frequency synthesizer, RX VCO, injection amplifiers, front end, IF, and limiter detector. Audio, squelch and Channel Guard circuitry for the receiver is located on the System Control board.

SYSTEM CONTROL FUNCTION

A microprocessor on the System Control board controls the frequency synthesizer, the TX on/off, the decoding of CTCSS tones, the generation of CTCSS tones, etc. The audio processor circuitry for the transmitter and the receiver are located on the System Control board. Squelch circuitry, a jack for central metering and the digital voice guard circuit are also located on the System Control board.

CONTROL UNITS

S-series control units are available and may be used directly with RANGR radio combinations.

Refer to the applicable Maintenance Manual for detailed description of the Control Unit used with the RANGR radio combinations.

## OPERATION

Complete operating instructions for the Two-Way Radio are provided in the Operator's Manual for the control unit used.

## MAINTENANCE

The use of microcomputer technology allows self-diagnostic maintenance routines to be incorporated in the microcomputer software. These routines are easy to run and provide a quick analysis of microcomputer and frequency synthesizer operation.

The service section of this manual contains the diagnostic routines and other maintenance information to service this radio. The service section includes:

- System interconnections
- Mechanical layout
- Disassembly procedures
- Replacement of IC's, chip capacitors and resistors
- Microcomputer self diagnostics
- Alignment procedures for the transmitter and receiver
- Troubleshooting Procedure and waveforms

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