

 **MOBILE RADIO**

RANGR

**SYNTHESIZED
MOBILE COMMUNICATIONS**

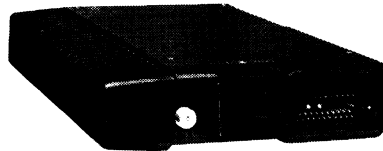
**MAINTENANCE MANUAL
LBI-31621C**

INCLUDES

**SERVICE SECTION LBI-31730C
BOARD ASSEMBLIES LBI-31731C**

403-512 MHz

**TWO-WAY FM
MOBILE RADIO**



**35/100 WATT
30/80 WATT
MOBILE RADIO**

GENERAL  ELECTRIC

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FCC FILING NUMBER

PART #	FCC ID #	FREQUENCY SPLIT (MHz)	TX POWER OUT (W)	OSCILLATOR STABILITY (ppm)
1	AXA9HHTR-142-B2	450-470	35	2
2	AXA9HHTR-143-B2	450-470	100	2
3	AXA9HHTR-142-C2	470-488	30	2
4	AXA9HHTR-143-C2	470-488	80	2
5	AXA9HHTR-142-D2	482-500	30	2
6	AXA9HHTR-143-D2	482-500	80	2
7	AXA9HHTR-142-E2	494-512	30	2
8	AXA9HHTR-143-E2	494-512	80	2
9	AXA9HHTR-142-B	450-470	35	5
10	AXA9HHTR-143-B	450-470	100	5

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	403-423 MHz, 410-430 MHz, 420-440 MHz MHz 440-460 MHz, 450-470 MHz, 470-488 MHz MHz 482-500 MHz, and 494-512 MHz
BATTERY DRAIN	
Receive	
Squelched	0.7 Amperes at 13.8 Volts
Unsquelched	2.2 Amperes at 13.8 Volts
Transmit	
30W/35W Watts	13 Amperes at 13.6 Volts
80W/100W Watts	29.5 Amperes at 13.4 Volts
FREQUENCY STABILITY	0.0005%/0.0002% depending on model.
TEMPERATURE RANGE	-30°C (-22°F) to +60°C (140°F)
DUTY CYCLE	100% Receive, 14% Transmit
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	30W/35W/80W/100W
CONDUCTED SPURIOUS	-80 dB
MODULATION	<u>+4.5</u> 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) Less than 5% (300 to 3000 Hz)
DEVIATION SYMMETRY	0.3 kHz maximum
MAXIMUM FREQUENCY SEPARATION	403-470 MHz ---- 20 MHz 470-512 MHz ---- 18 MHz
MICROPHONE LOAD IMPEDANCE	600 ohms
POWER ADJUST RANGE	100% to 50% of rated power
RF OUTPUT IMPEDANCE	50 ohms
FM NOISE	-50 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 12 dB SINAD (EIA Method)	0.35 μ V
SELECTIVITY EIA Two-Signal Method (25 kHz channels)	-80 dB
SPURIOUS RESPONSE	-85 dB
INTERMODULATION 25 kHz	-80 dB
MODULATION ACCEPTANCE	<u>+7</u> kHz
MAXIMUM FREQUENCY SEPARATION	403-470 MHz --- 20 MHz 470-512 MHz --- 18 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 UNSQUELCHED SQUELCHED	-45 dB -70 dB
RECEIVER RECOVERY TIME	200 milliseconds
RECEIVER ATTACK TIME	150 milliseconds
CHANNEL SPACING	25 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 - UHF Radio 19C852450

A 10 pf capacitor (19A700219P26) was added from TR503-B to ground on Receiver Board to prevent receiver 1st IF (82.2 MHz) parasitic oscillation.

Rev. B - UHF Radio 19C852450

A 5 pf capacitor (B19/5CAAD00800) and a 7 pf capacitor (B19/5CAAD00977) was added in series from TR503-B to ground on Receiver Board to prevent receiver 1st IF (82.2 MHz) parasitic oscillation.

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 be equipped with:

- Microcomputer Controlled Frequency Synthesizer
- Up to 16 channels
- .0005% 1.0002% 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.

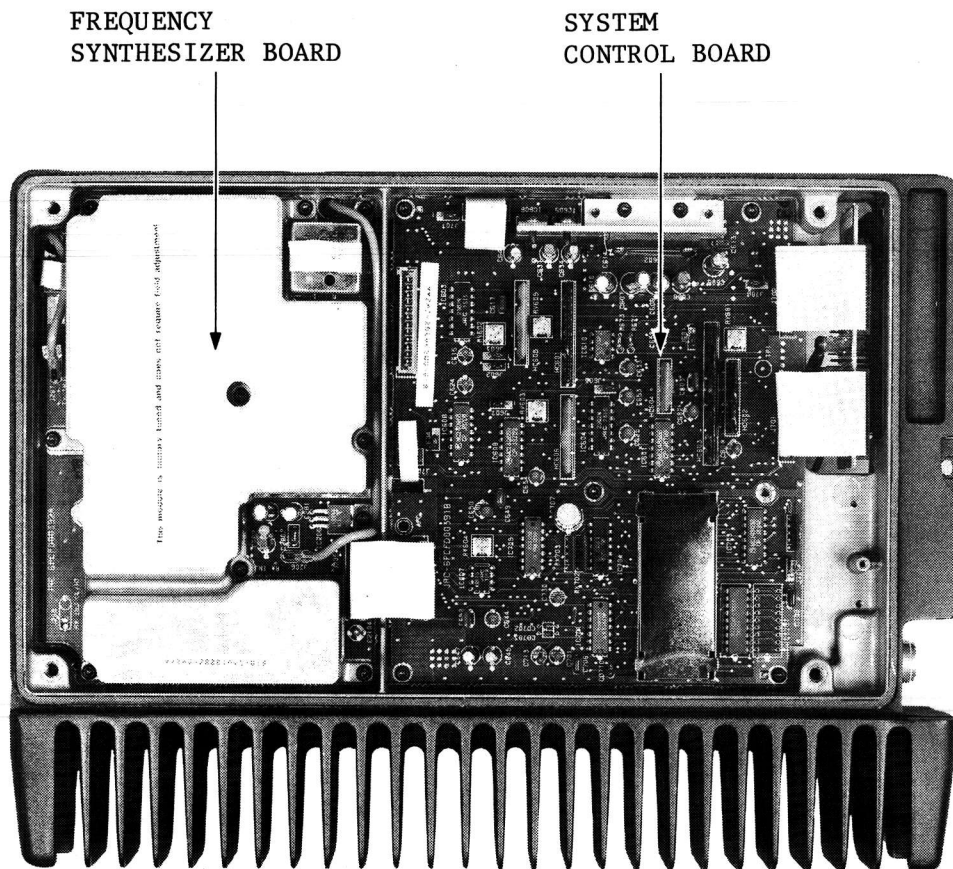
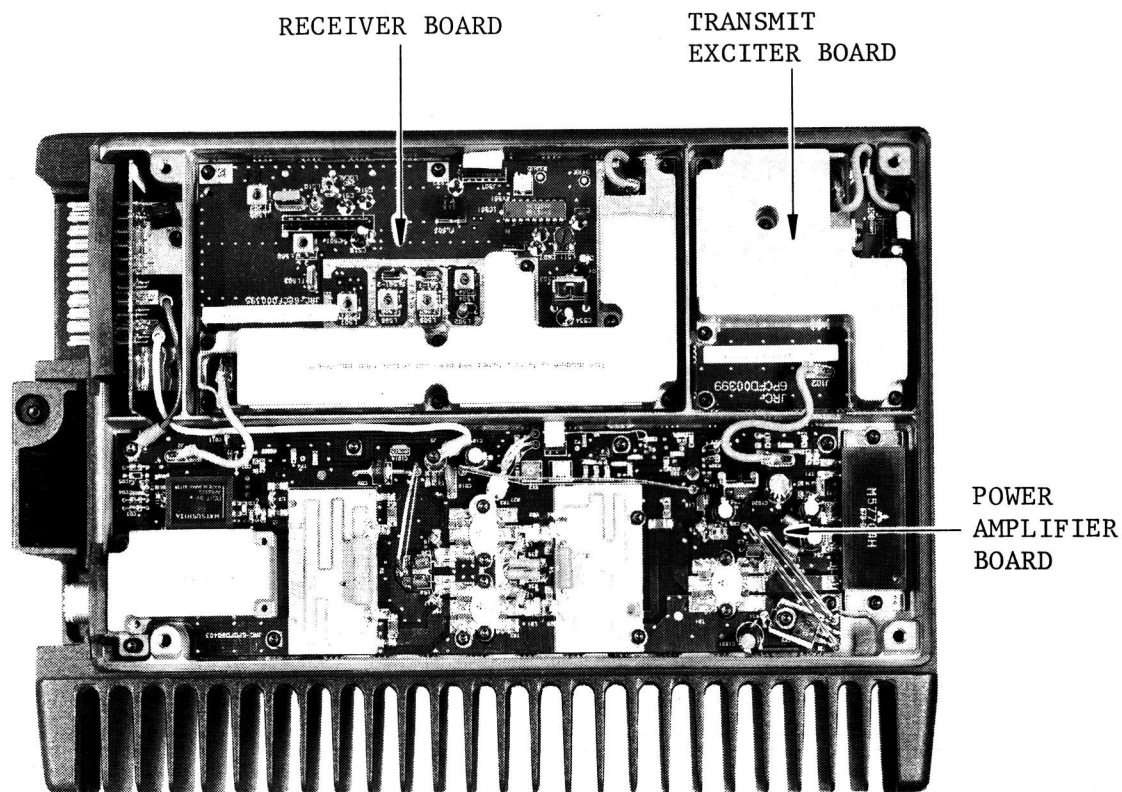
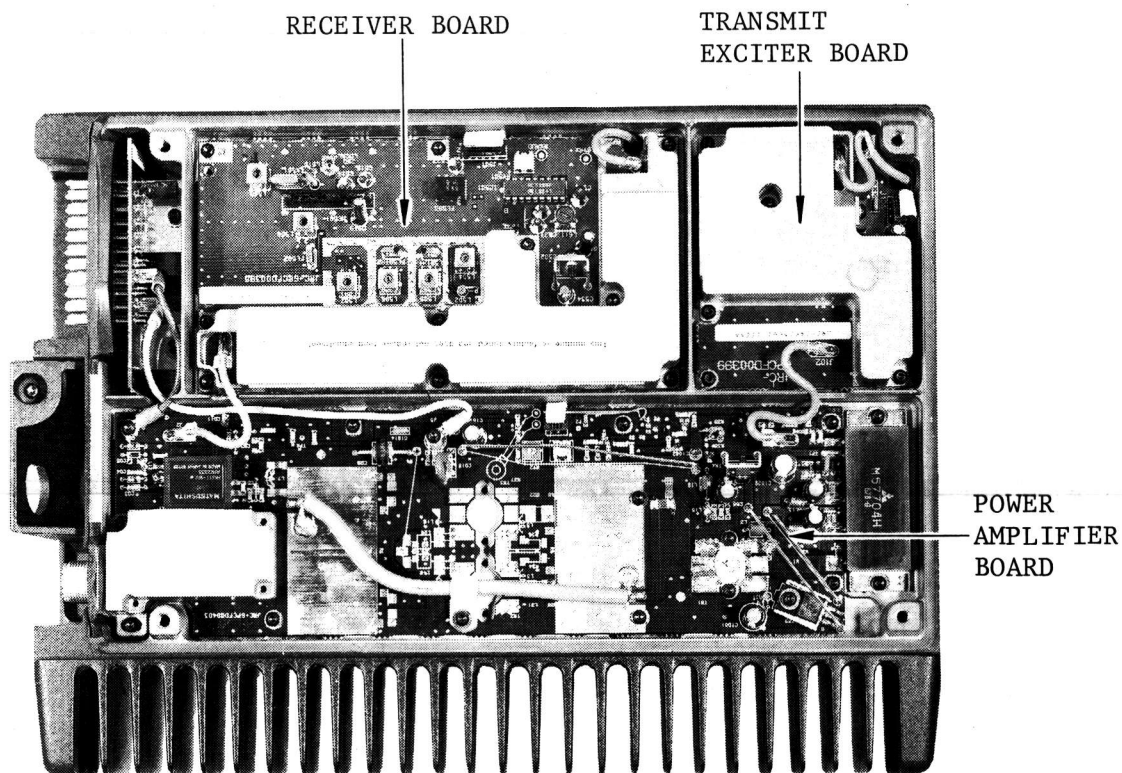


Figure 1 - Typical Module Layout (Top View)



- 80/100 W TYPE -



- 30/35 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 12.5 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 in 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 detail 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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