



GE Mobile Communications



PHOENIX™ - SX

136-174 MHz, 40 WATT
MOBILE COMBINATION

See also:

Service Section for 136-174 MHz Phoenix-SX, LBI-31213

Transmit / Receive Board Assemblies, LBI-31588

Synthesizer / Interconnect Board, LBI-31733

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CAUTION

Although the highest DC voltage in this mobile equipment is supplied by the vehicle battery, high currents may be drawn under short circuit conditions. These currents can possibly heat metal 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*

FCC IDENTIFICATION NUMBER	TR-105-C
FREQUENCY RANGE	136-174 MHz
BATTERY DRAIN	
Receiver (with Channel Display)	
Squelched	0.55 milliamperes
Unsquelched	0.95 milliamperes
Transmitter	9.5 Amperes @ 13.6 Volts
Channel Memory (Radio "OFF")	25 milliamperes
FREQUENCY STABILITY	±0.0005%
VOLTAGE	13.8 ±20%
TEMPERATURE RANGE	-30°C (-22°F) to +60°C (140°F)
DUTY CYCLE	20% Transmit, 100% Receive
DIMENSIONS, LESS ACCESSORIES (H X W X D)	65 MM X 190 MM X 240 MM (2.55 X 7.5 X 9.4 inches)
WEIGHT, LESS ACCESSORIES	2.07 kg (4.5 pounds)

	TRANSMITTER		RECEIVER
POWER OUTPUT	40 Watts	AUDIO OUTPUT (to 4.0 ohms speaker	3 Watts (less than 5% distortion)
CONDUCTED SPURIOUS AND HARMONIC EMISSION	-75 dB	SENSITIVITY	12 dB SINAD 20 dB Quieting Method 0.30 uV 0.4 uV
MODULATION DEVIATION	0 to ±5 kHz (±3.75 kHz voice modulation and 0.75 kHz CG modulation)	SELECTIVITY	EIA Two-Signal Method -80 dB @ ±30 kHz
AUDIO SENSITIVITY	50 to 100 Millivolts at J911-4 20 to 50 Millivolts at J911-5	SPURIOUS REJECTION	-85 dB
AUDIO FREQUENCY CHARACTERISTICS	Within +1 dB to -3 dB of a 6 dB per octave pre-emphasis from 300 to 3000 Hz per EIA standards. Post limiter filter per FCC and EIA.	IMAGE REJECTION	-90 dB
DISTORTION	Less than 2% (1000 Hz) Less than 5% (300 to 3000 Hz)	INTERMODULATION (12 dB SINAD)	-78 dB
DEVIATION SYMMETRY	0.1 kHz	MODULATION ACCEPTANCE	±7.0 kHz
RF OUTPUT IMPEDANCE	50 ohms	SQUELCH SENSITIVITY	<8 dB SINAD <10 dB SINAD w/digital Channel Guard
FREQUENCY SEPARATION	17 MHz (Lo split) 24 MHz (Hi split)	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)
CARRIER ATTACK TIME	30 milliseconds	RF INPUT IMPEDANCE	50 ohms
AUDIO ATTACK TIME	30 milliseconds	FREQUENCY SEPARATION	17 MHz (Lo split) 24 MHz (Hi split)
CHANNEL GUARD TONE DISTORTION	5%	IMAGE REJECTION	-90 dB
FM NOISE	-55 dB	RECEIVER RECOVERY TIME	100 milliseconds @ 8 dB SINAD
MIC INPUT IMPEDANCE	Low	RECEIVER RESPONSE TIME	(≤ 25000) CG FREQ) Less than 250 milliseconds
POWER ADJUST RANGE	30 to 40 watts	Digital CG	
		RECEIVER ATTACK TIME	90 milliseconds @ 8 dB SINAD
		HUM AND NOISE	Squelched Unsquelched -80 dB -54 dB
		CG BANDWIDTH	>1%, <2% of marked frequency

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

COMBINATION NOMENCLATURE

Digits 1&2	Digit 3	Digit 4	Digit 5	Digit 6	Digits 7&8	Digit 9	Digit 10
Product Code	Transmit Frequency Range	Receive Frequency Range	Channel Spacing	Type	RF Power Output	Freq. Capacity	Oscillator Stability
N5	G 136-153 MHz	G 136-153 MHz	1 30 KHz	W Wide Band	40 40-Watts	A 1 Tx 1 Rx	A ±2.5 PPM
	H 150-174 MHz	H 150-174 MHz				B 2 Tx 2 Rx	B ±5 PPM
						P 16 Tx 16 Rx w/Scan	
						R 16 Tx 16 Rx w/Scan 8 Modes	
						T 16 Tx 16 Rx	

STRUCTURED OPTIONS

Digit A	Digit C	Digit D	Digit E	Digit H	Digit J	Digit M	Digit N	Digit P	Digit R	Digit S	Digit T
Programmed Frequencies	Option	Channel Guard	Channel Guard Hook Switch	DTMF Encoder	Carrier Control Timer	Microphones (w/Hanger)	Antenna	Power Source	Accessories	Speakers	Tone Cable
0 Test Program	0 None	0 CG Reject Filter	0 None	0 None	0 Phoenix w/Hanger	0 Phoenix w/Hanger	0 None	0 +12 VDC	0 Accessories As Ordered	0 Internal	0 None
1 Custom Programmed	D T-99 Dec. w/Ext. Alarm (4-Tone)	B Tone & Digital	1 Hook Switch	1 DTMF Enc.	1 1-Minute	1 MASTR II w/Hanger	A Antenna HB/UHF Whip	1 120 VAC 60 Hz	N Delete Mic. Power Cable & Mounting	1 Delta Window Mt.	1 Tone Cable Enc. or Dec.
	H Public Address w/ Int/Ext. Sw.					4 None		2 120 VAC 60 Hz DC Remote		2 Delta Style	2 Tone Cable Enc./Dec.
						5 Delta		3 120/240 VAC 50/60 Hz w/DC Remote		A Weatherproof Horn Int/Ext Spkr and Switch	
						7 MASTR II Mic. w/CG Monitor		4 120/240 VAC 50/60 HZ			

OPTION COMPATIBILITY CHART

	DB	CH
SA	X	X
MC01	X	X
P1-P4, PS01, PS02	X	X
P R S (DIGIT 9)	X*	

- SA - Internal/External Speaker
- MC01 - PHOENIX Microphone
- P1-P4, PS01, PS02 - Power Supply Options
- P, R, S - Dual Priority Scan; 16 Freq. less mode
- DB - Channel Guard
- CH - Public Address

NOTE - "X" indicates non-compatibility
 All other options are compatible

* Digital Channel Guard Only

DESCRIPTION

The General Electric synthesized-wideband Phoenix-SX Mobile radios are completely solid state utilizing microcomputer technology and integrated circuits (IC's) to provide high quality, high reliability, high performance radios. The 150-174 MHz Phoenix-SX provides 40 watts RF output power with allowable channel separation of 24 MHz transmit and 24 MHz receive.

The radio contains a transmit/receiver board, synthesizer/interconnect board, and a recessed front panel which houses the internal speaker and identifies the controls and indicators. Its small size makes it ideal for front mounting in conventional vehicles. The standard combinations are equipped with:

- Microcomputer controlled frequency synthesizer
- Channel Guard Tone/code Reject Filter
- One, two or 16 channels (with automatic channel advance)
- Seven Segment Channel Display
- .0005% Frequency Stability

Software options include:

- Carrier Control Timer
- Tone and Digital Channel Guard

The radio consists of an effective heat-dissipating, aluminum die cast "H" frame on which two circuit boards are mounted. The transmitter/receiver board is mounted on the bottom of the "H" frame and includes the exciter, power amplifier, and receiver audio circuitry. The synthesizer/interconnect board which is mounted on the top of the "H" frame, contains all interconnections, microcomputer, frequency synthesizer, transmitter audio processor, microphone pre-amplifier, and Channel Guard circuitry. All external connectors, controls and indicators are mounted directly on the two boards for reliability and ease of disassembly.

In radios equipped with 16 channels or more, a separate display board is provided for mounting the channel select pushbutton and the display and CAS indicators.

The boards plug into each other, eliminating the need for interconnecting wires. The only wires used in the radio are the plug-in leads for the internal speaker. The top and bottom covers enclose the "H" frame and provide optimum protection for the radio. The internal speakers mounts inside the front panel.

NOTE

When replacing boards, care should be taken to assure boards with gold contacts are not intermixed with boards having tin contacts.

The front control panel is made of highly durable ABS plastic with rounded corners and recessed controls to meet passenger safety requirements. The panel provides access to four standard operator controls: channel selector switch, a mode A/B switch (multi-frequency radios) a momentary MONITOR pushbutton (fixed squelch and Channel Guard monitor), and a rotary, edge-mounted Volume/ON-OFF control. A red Transmit indicator LED (Light Emitting Diode) and yellow Channel Busy indicator are provided. Power on is indicated by a green LED or the 7-segment channel display.

Supply voltage used in the radio is provided by the vehicle battery. The radio is designed for operation only in 12 Volts, negative ground vehicle systems.

The radio is of modular construction. Both major modules and tuning adjustments are easily accessible. Loosening the two screws in the rear of the top cover provides access to the synthesizer/interconnect board. Loosening the two screws in the rear of the bottom cover provides access to the transmitter/receiver board.

A PROM label located on the top cover inside the radio describes the radio's personality. This information provides the service man with a quick reference to the operating characteristics of the radio.

Information identified on the PROM label includes the PROM Kit number, the radio serial number, all transmit and receive channel numbers and frequencies, Channel Guard, tones/codes, and carrier control timer information for each channel. This information is provided for both operating modes A and B.

If the personality of the radio is changed (EE PROM reprogrammed) all information relating to the radio's new personality should be recorded either on the old label, if space is available, or on a new label. The part number of the PROM label is 19C850828P1 and may be ordered from General Electric Service Parts.

PROGRAMMING

The EE PROM allows the radio to be 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 EE PROM is reprogrammed through radio functional connectors J910 and J911 using the General Electric Universal Programmer Model No. TG2310. This programmer allows all information to be loaded simultaneously.

Alternatively, the General Electric Single Channel Programmer Model 4EX22A10 allows the user to reprogram the radio manually on a per channel basis through J802.

NOTE

When programming RF frequencies in the 150-174 MHz band, remember that all frequencies used must be divisible by either 5 or 6.25.

channel (1-8) is displayed. Mode A/B is indicated by the decimal point on the channel display. It is ON for mode B and OFF for mode A.

NOTE

The mode A/B switch may be used to provide mobile-to-mobile communications through an intermediate repeater (repeated path) or direct mobile-to-mobile communications. For example: channel 1 mode A may be programmed for the repeater frequency (repeated path) while channel 1 mode B would be programmed for the mobile receive frequency (direct path). Judicious programming will allow selection of direct or repeated paths on desired channels.

Programming instructions are provided in the maintenance manual for the programmer.

SYNTHESIZER/INTERCONNECT

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

The EE PROM 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 EE PROM and provides the correct Walsh bits to the channel guard board to generate the correct Channel Guard tone or digital code on a per channel basis.

CHANNEL SELECTION

In multi-frequency radios channel selection is accomplished through the use of two switches: channel select (^) and MODE A/B. The channel select switch automatically advances the selected channels, while depressed. The MODE A/B switch selects the bank of up to 8 channels accessed by the channel select switch.

In a 16 channel radio there are two banks, A & B, of eight channels.

By operating the A/B pushbutton switch the user can select two independent transmit and receive frequencies per channel number displayed, providing the radio with up to 16 independent transmit and receive frequencies. The selected

TRANSMITTER

The transmitter consists of a wide band exciter, audio processor power amplifier, and a solid state antenna switch. The audio processor is located on the synthesizer interconnect board. The RF power output level is set internally to rated output power, typically 40 watts.

Frequency stability for both the transmitter and receiver is maintained by an electronic temperature compensation network.

RECEIVER

The dual conversion receiver consists of a front end section and two mixer/IF sections operating at 45 MHz and 455 kHz. The receiver also contains a squelch and audio section. The squelch circuit is contained within the 2nd converter-FM detector IC. The audio section provides a 3-watt audio output into a 4-ohm load with less than 5% distortion.

CHANNEL GUARD

Channel Guard provides a means of restricting calls to specific radios through the use of a continuous tone coded squelch system (CTCSS) or a continuous digital coded system (CDCSS). Tone frequencies range from 71.9 Hz to 210.7 Hz. There are 83 standard programmable digital codes. The Channel Guard tone frequencies and codes are software programmable. Both tone frequencies and digital codes may be used. These codes and frequencies are listed in the Programmers Manual.

AC POWER SUPPLY OPTION

To use the radio as a base station, an optional 121 Volt AC, 60 Hertz power

supply is available. An eight foot cable connects the power supply to the radio. The cable length permits the power supply to be located away from the radio. A green Power On LED is located on the front panel of the power supply. In addition, a 120/240 Volt AC, 50/60 Hz supply is also available where its use is dictated. DC remote control may be provided with either supply.

When using the AC power supply, reduce the transmit power so that maximum current drain does not exceed 6 amperes. Adjust the Power Adjust Control accordingly.

MICROPHONE

The standard mobile combinations use an electret microphone. The Phoenix microphone is housed in a sturdy case, and the extendable coiled cord plugs into a jack at the back of the radio. The microphone is secured to the radio by means of a strain relief hook on the microphone cable. A microphone hanger is supplied with the microphone. Option microphones such as the MASTR II and MASTR Delta microphones may be used.

CG HOOKSWITCH OPTION

In Channel Guard applications, a microphone hookswitch may be supplied with the radio. The Channel Guard is disabled when the microphone is removed from the hookswitch.

EXTERNAL SPEAKER (OPTIONAL)

A five-inch speaker, contained in a LEXAN® housing, provides an audio output of 3 watts. The nominal speaker impedance is 3.2 ohms. The speaker leads are connected to pins 3 and 7 of Systems Plug P910. A weatherproof horn type speaker is available also. When the External Speaker is used, refer to the Installation Instructions and Interconnection diagram for jumper modifications in the appropriate maintenance manual.

UNIVERSAL TONE CABLE

A universal tone cable equipped with a 9-pin Winchester connector is required when an external tone encoder or decoder is used. The tone cable interconnects the tone encoder/decoder with the radio. It also may be used with the public address option. Refer to the installation diagrams in the option manual for jumper modifications. A second cable is required when both encode and decode functions are used.

DTMF ENCODER

The DTMF encoder option provides a unique front cap for the Phoenix radio which houses the DTMF touch tone pad

assembly. The external encoder is connected to the radio via a tone cable terminating at HL75-HL79 on the synthesizer/interconnect board. A second cable interconnects the touch pad to the synthesizer/interconnect board. An external speaker if required. Refer to the Installation Diagram for details.

DUAL PRIORITY SCAN (DPS), OPTIONAL

A SCAN/DISPLAY board located behind the radio front panel provides control and display circuits to select up to 16 channels for scanning. Two priority levels may be activated by front panel control allowing the user to select a main priority channel which is selected any time a signal is present. A second level priority channel is selected each time a signal is present, preempted only by priority channel 1. All other channels selected for scanning are preempted by both priority channels. DPS is available only in 16 channel radios. External speaker required.

OPERATION

Complete operating instructions for the Two-Way Radio are provided in a separate Operator's Manual. The basic procedures for receiving and transmitting messages follows:

TO RECEIVE A MESSAGE

1. Turn the radio on by turning the ON-OFF VOLUME control to the right.
2. Select desired mode by pressing the MODE A/B switch. Mode B indicated by illuminated decimal point.
3. Select the desired channel by pressing the channel increment "∧" switch.
4. Push in the MONITOR button to disable the squelch circuit and Channel Guard decoder. Adjust the volume control for a comfortable listening level and then release the MONITOR button for normal operation.

The radio is now ready to receive messages from other radios in the system.

TO TRANSMIT A MESSAGE

1. Turn the radio on as directed in the "To Receive a Message" section.
2. Select desired channel.
3. Press the PTT switch on the microphone and speak across the face of the microphone in a normal voice level. Release the PTT switch as soon as the message has been given. The red indicator light on the control panel will glow each time the microphone PTT switch is pressed,

indicating that the transmitter is on the air. The receiver is muted when the transmitter is keyed.

MAINTENANCE

The use of microcomputer technology allows self diagnostic routines to be incorporated in software. The diagnostic routines are easy to run and provide a quick analysis of microcomputer and frequency synthesizer operation. The routines should always be run first when troubleshooting the radio.

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

- System Interconnections
- Mechanical Layout Diagrams
- Disassembly Procedures
- IC and Chip Component Replacement Procedures
- Self-Diagnostic Routines
- Service Tips
- Transmitter and Receiver Alignment Procedures
- Troubleshooting Information

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