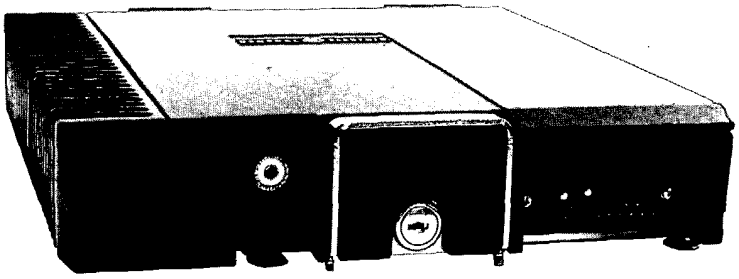
N3NMN

LBI-31566

(REPLACES LBI-31416)

ERICSSON

Mobile Communications



DELTA™-SX

WIDEBAND-SYNTHESIZED

403-470 MHz 40 & 100 WATT MOBILE COMBINATIONS

(NEGATIVE GROUND ONLY)

Maintenance Manual

TABLE OF CONTENTS

ILLUSTRATIONS

FCC FILING NUMBER

RECEIVER	TRANSMITTER	POWER OUTPUT	FREQUENCY	OSCILLATOR
ER-156-A	KT-245-A2	40-WATTS	440-470 MHz	A } 2 PPM
	KT-247-A2	100-WATTS	440-470 MHz	A }
	KT-245-A	40-WATTS	440-470 MHz	B } 5 PPM
	KT-247-A	100-WATTS	440-470 MHz	B }

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!

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SYSTEM SPECIFICATIONS*

FREQUENCY RANGE	403-470 MHz
BATTERY DRAIN (Maximum)	
Receive	
Squelched	0.7 Amperes
Unsquelched	2.2 Amperes
Transmit	
40 Watts	13.0 Amperes at 13.6 Volts
50 Watts	14.0 Amperes at 13.6 Volts
100 Watts	28.0 Amperes at 13.4 Volts
FREQUENCY STABILITY	0.0005% or optional 0.0002%
TEMPERATURE RANGE	-30°C (-22°F) to +60°C (140°F)
DUTY CYCLE	100% Receive, 20% Transmit (EIA)
DIMENSION, LESS ACCESSORIES (H X W X D)	
40,50 Watts	65 mm X 260 mm X 325 mm (2.5 X 10.2 X 12.7 inches)
100 Watts	65 mm X 290 mm X 325 mm (2.5 X 11.4 X 12.7 inches)
WEIGHT, LESS ACCESSORIES	
40 Watts, 50 W.	5.9 kg (12.9 pounds)
100 Watts	6.5 kg (14 pounds)
INPUT POWER	13.8 VDC ±20 %

TRANSMITTER

CONDUCTED SPURIOUS	-85 dB
MODULATION	±4.5 kHz (2.25 kHz)**
AUDIO SENSITIVITY	55 to 110 Millivolts
AUDIO FREQUENCY CHARACTERISTICS	Within +1 dB to -3 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 (2550 Hz)**
DEVIATION SYMMETRY	0.5 kHz (0.3 Hz)** maximum
MAXIMUM FREQUENCY SEPARATION	20 MHz
POWER OUTPUT	Rated power across band. ±0.5 dB
RF OUTPUT IMPEDANCE	50 ohms
CARRIER ATTACK TIME	25 m seconds
AUDIO ATTACK TIME	25 m seconds

RECEIVER

AUDIO OUTPUT (to 4.0 ohm speaker)	12 Watts with less than 3% distortion	
SENSITIVITY	Standard	UHS Preamp
12 dB SINAD (EIA Method)	0.35 uV	0.20 uV
20 dB Quieting Method	0.50 uV	0.30 uV
SELECTIVITY		
EIA Two-Signal Method	-83 dB (73 dB)**	-83 dB (73 dB)**
SPURIOUS RESPONSE	-90 dB	-80 dB
INTERMODULATION	-80 dB (73 dB)**	-75 dB (73 dB)**
MODULATION ACCEPTANCE	±7.0 kHz (±3.5 kHz)**	
SQUELCH SENSITIVITY	6 dB SINAD	
MAXIMUM FREQUENCY SEPARATION	20 MHz	
FREQUENCY RESPONSE	Within +2 and -8 dB of a standard 6 dB per octave de-emphasis curve from 300 to 3000 Hz (2550 Hz)** (1000 Hz reference)	
RF INPUT IMPEDANCE	50 ohms	
RECEIVER RESPONSE TIME W/TONE SQUELCH	≤25000 CG Freq.	
RECEIVER ATTACK TIME	150 ms.	

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

** 12.5 kHz channel spacing.

COMBINATION NOMENCLATURE

Digits 1 & 2	Digit 3	Digit 4	Digit 5	Digit 6	Digits 7 - 9	Digit 10	Digit 11
Product Code	Transmit Frequency Range	Receive Frequency Range	Channel Spacing	Type	RF Power Output	Freq. Capacity	Oscillator Stability
N3 Delta-SX	**R** 403-440 MHz	**R** 403-440 MHz	**2** 25 kHz	**N** Narrowband	**040** 40 Watts	**T** 16 Channel	**A** ±2 PPM
	U 440-470 MHz	**U** 440-470 MHz	**4** 12.5 kHz	**W** Wideband	**050** 50 Watts	**Z** 32 Channel	**B** ±5 PPM
					100 100 Watts		

STRUCTURED OPTIONS

Digit A	Digit D	Digit F	Digit M	Digit N	Digit R	Digit S	Digit V
Program-ming	Channel Guard	TX Fuse Block	Mounting	Antenna	Receiver Type	Sweep Tune Option	Voice Guard
0 Test Program	**0** None	**0** Standard	**0** Std Frame & Mtg Hdwe	**0** None	**0** None	**0** Standard 403-423 450-470	**0** None
1 Customer Program	**B** Tone/ Digital	**N** None	**N** None	**A** Whip	**A** UHS Pre-Ampl	**1** Alternate 420-440 440-460	**G** Voice Guard
2 S950 Download (Digit 6=N)						**2** Alternate 410-430	
3 S950 Download (Digit 6=W)						**3** Customer Specified	

DESCRIPTION

General Electric DELTA-SX mobile radio combinations are completely solid state utilizing microcomputer technology and integrated circuits to provide high quality - high reliability radios. The DELTA-SX radio is designed for use in vehicles having a negative ground battery system. In vehicles having a positive ground battery system a polarity converter must be used. Standard combinations may be equipped with:

- Microcomputer Controlled Frequency Synthesizer
- Up to 32 channels
- .0002% or .0005% frequency stability
- UHS Preamplifier (Ultra High Sensitivity), optional
- Tone and/or Digital Channel Guard, optional

The radio set is housed in a weather resistant case only 2 1/2 inches high. The radio is secured to the vehicle by a bottom mounting plate, and is tamperproof when locked into the plate. When unlocked, the handle can be pulled down and the radio pulled out of the mounting plate or the top cover removed for servicing. When pulled down, the handle can be used to carry the radio.

The PA board is inserted into the radio from the top of the frame, while the TRS board is inserted from the bottom. There are no wires used in the basic radio. Interconnections are provided by pins on the TRS board that mate with connectors on the PA assembly. A power bus connects A+ and A- from the front connector to the PA assembly. The PA board is isolated from ground (floating). Power is supplied directly from the battery to the PA power output stage.

The radio is of single-layer construction with all major modules and tuning adjustments easily accessible from the top of the radio.

Centralized metering jacks for the transmitter, receiver and system functions are provided for simplified alignment and troubleshooting.

Excluding option boards, the basic radio consists of two printed wiring boards mounted in a cast aluminum frame. The two boards are the transmitter-receiver-system (TRS) board 19D901670 and the power amplifier board (See Figure 1). The TRS board is connected to chassis ground allowing it to be used in vehicles with a negative ground battery system only. Option boards include the Channel Guard board and VG Interface board. The VG Interface board is used in radios equipped with VOICE GUARD.

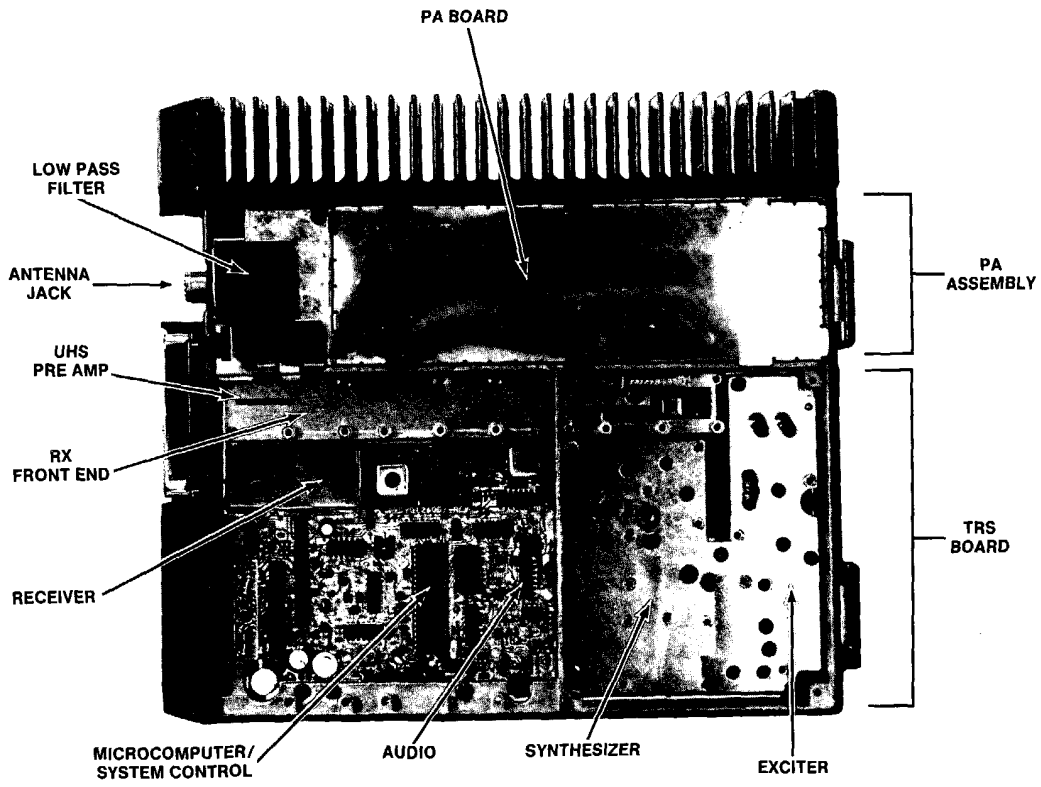

Figure 1 - Typical Module Layout

FREQUENCY SYNTHESIZER

The frequency synthesizer consists of a microcomputer, electrically erasable PROM(S) (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 carrier control timer (CCT). The microcomputer accesses the EEPROMS 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.

The EEPROM 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.

Depending on the configuration of the radio, one or two EEPROMS may be provided. Radios not equipped with a MODE A/B switch will have one EEPROM. Radios with more than 16 channels and those with the MODE switch will have two EEPROMS.

NOTE

When programming, remember that all RF frequencies must be divisable by 12.5 kHz.

The EEPROMS 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.

Alternatively, a single channel Programmer Model 4EX22A10 allows the user to reprogram the radio on a per channel basis. This programmer requires the removal of the radio top cover and any option boards present. A special programming jack, J711, is used when programming with the 4EX22A10.

Programming instructions are provided in the respective Programmer Maintenance Manuals.

TRANSMITTER

The transmitter consists of the exciter, frequency synthesizer, TX VCO, and a power amplifier 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 a hermetically sealed antenna relay and a low pass filter.

RECEIVER

The receiver consists of the frequency synthesizer, RX VCO, injection amplifiers, front end, IF and limiter detector. In UHS receivers, a preamplifier board is added in the receiver front end. Audio and squelch circuitry for the receiver is located in the system section of the TRS board. Jacks for the Channel Guard and other structured options are also located in the system area.

CONTROL UNITS

Three S series control units, the S-500, S-600 and the S-900 series, are available and may be used directly with DELTA-S,SX radio combinations.

The S-500 control unit contains an on-off volume control switch, a rotary channel selector switch for 1, 8, or 16 channels, a MODE A/B switch (optional) to expand the channel select capability to 32, seven segment channel indicators(s), a red transmit indicator, channel busy indicator (optional), and a tone option jack. Options that may be used with this control unit include Type 90 and 99 tone, squelch operated relay SOR, GE-STAR encoder, and public address. The S500 control unit uses the same power/control cables as the C500 control unit.

The S600 control unit contains an on-off volume control switch, squelch disable switch, red transmit indicator, and a 7 segment channel indicator. A rotary channel select switch permits selection of up to eight channels. A white power on indicator is used for back lighting the front panel. Space is provided for two optional pushbutton switches and two optional indicators. The S600 control unit uses the same power/control cables as the C600 control unit.

The S-900 series Control Units designed specifically for the DELTA class radios are highly versatile, software controlled units providing numerous functions and options including.

- Dual Priority Scan
- Digital Volume Control
- Digital Squelch Control
- Type 90 or 99 Encode Tones
- GE-STAR Identification
- 128 Channels in -
  8 Modes of 16 Channels each
  or
  4 Modes of 32 Channels each
- Carrier Control Timer (per mode basis)*

- Channel Guard - Tone or Digital*
- Channel Frequencies*
- Home Channel Revert
- Auxiliary Relay Control

SELECTION

Depending on the control unit used, a single rotary or pushbutton selector switch will select up to 16 channels. In radios equipped with more than 16 channels, the control unit contains a MODE A/B switch. The MODE switch allows the user to select a second set of 16 channels (17-32).

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 repeated or direct communications paths on selected channels.

MICROPHONE AND HANDSET

A hand held microphone with a built-in transistorized microphone preamplifier is available for use with radio. The microphone is housed in a sturdy two piece case, and the extendable coiled cord plugs into the microphone jack at the back of the control unit. The plug is secured to the jack by a retaining screw.

An optional telephone-type handset is available for use with the radio. The handset uses a dynamic microphone with a built-in microphone preamplifier. The extendable coiled cord plugs into the microphone jack on the back of the control unit, and is secured to the jack by a retaining screw.

HOOKSWITCHES

In Channel Guard or other tone applications, a microphone or handset hookswitch is supplied with the radio. The hookswitches are equipped with a Channel Guard disable switch.

* These functions are actually performed in the radio. If you have downloaded, the data is held in the control unit.

Placing the switch in the "up" position (towards the small speaker symbol) disables the Channel Guard decoder. With the switch in the "down" position, the Channel Guard is disabled when the microphone or handset is removed from the hookswitch.

SPEAKER

A three by five-inch speaker contained in a molded plastic housing provides an audio output of 12 watts with a speaker impedance of four ohms. The speaker leads are terminated in Vehicle Systems Plug P3 which connects to J1-A on the rear of the control unit.

OPERATION

Complete operating instructions for the Two-Way Radio are provided in the Operator's Manual for the control unit used. The basic procedures for receiving and transmitting messages in mobile combinations are as follows:

TO RECEIVE A MESSAGE

1. Turn the radio on by turning the OFF-VOLUME control halfway to the right.
2. Turn the SQUELCH control clockwise (to the right) as far as possible. A noise will be heard from the speaker.
3. Adjust the VOLUME control until the noise is easily heard, but is not annoyingly loud.
4. Take MIC OFF hook if Channel Guard is used. Turn the squelch control clockwise as far as possible, then set the VOLUME control to the desired listening level. Now, slowly turn the squelch control counterclockwise until the noise just cuts off.
5. In multi-frequency radios, select the proper channel.

The radio is now ready for use.

TO TRANSMIT A MESSAGE

1. Turn the radio on and select the proper channel.
2. If a lengthy message (or several messages) are to be sent, the vehicle engine should be running to maintain the battery charge.
3. Pick up the microphone and listen briefly to the speaker to make sure that no one else is using the channel.

4. Press the Push-to-Talk (PTT) switch on the microphone and send the message. The red transmit light on the control unit will glow while the PTT switch is pressed.

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 flow charts and waveforms

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