SP-150

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A World of Communications

SERVICE MANUAL

For use with serial numbers: 990601000-990601500

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Part Number: 680-100-0101 Preliminary
Septemeber 1999

SP-150
SERVICE MANUAL

This manual is intended for use by qualified technicians and includes information pertaining to the SP-150 circuit design and maintenance.

Publication Part Number: 680-100-0101 Preliminary

Printed in the United States of America.

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About This Manual

This Maxon Service Manual is a comprehensive guide to the operation, programming, maintenance and field repair of the SP-150 portable radio. The manual provides Service Technicians with testing, adjustment, alignment and parts replacement information. It covers all variants of the product ant its accessories. Before using this manual or servicing the SP-150 please read this page and the following chapters:

- **Electrostatic Discharge & Protection** (Page vii)
- **Battery Charging & Care** (Page viii)

Please observe the following symbols when servicing the radio:

- This symbol is used to identify a Warning or use of Caution. Use caution when following the outlined procedure.

- This symbol is used to identify a Electrostatic Discharge Sensitive (ESDS) device. Follow ESD protection guidelines when handling such devices.

Production Changes

Production or engineering changes may occur either after this manual is printed and before its next printing or before a Publication Change Notice can be provided. During this interim, technicians should check with Maxon America if discrepancies are found.

Amendments

Amendments to this service manual will be issued in the form of a Publication Change Notice (PCN). A PCN will be made available at no charge and distributed via regular mail and through the Maxon Website: www.maxonusa.com. Detailed information is included in the PCN to help incorporate the updates into your existing service manual. Look for the "Binder Icon" on future PCN's.

Safety Information

The Federal Communications Commission (FCC), with its action in General Docket 79-144, March 13, 1985, has adopted a safety standard for human exposure to Radio Frequency (RF) electromagnetic energy emitted by FCC regulated equipment. Maxon subscribes to the same safety standard for the use of its products. Proper operation of this radio will result in user exposure far below the Occupational Safety and Health Act (OSHA) and Federal Communications Commission limits.

! WARNING !

Do not hold the radio in such a manner that the antenna is next to, or touching, exposed parts of the body, especially the face or eyes, while transmitting.

! WARNING !

Do not allow children to operate transmitter - equipped radio equipment.

! WARNING !

Do not operate a radio transmitter near unshielded electrical blasting caps or in other explosive environments unless it is specifically approved for such use.

! CAUTION !

Do not key the transmitter or press the PTT button without an appropriate load connected to the antenna connector. Do not allow unauthorized persons to operate any radio transmitting equipment.

Electrostatic Discharge & Protection

What is Electrostatic Discharge (ESD)?

Whenever static electricity on an object comes into contact with an earth ground object, discharge takes place, most often by way of a spark. This is similar to a miniature lightning strike. Objects sensitive to such Electrostatic discharge are Electrostatic Discharge Sensitive (**ESDS**).

Static electricity is generated by many different products and in many different ways. Handling plastic packaging, walking across a carpet, wearing clothing that retains static charges and working at a workbench that is not earth grounded are only a few ways static electricity is generated.

Your body can generate the largest static charge likely to come in contact with a **ESDS** component, so it is important that all necessary precautions are taken to prevent this contact from occurring.

What is ESD damage?

There are two types of damages or failures: ***upset*** and ***catastrophic***.

Most ESD upset type damage will not normally show immediately. It may only show as a temporary loss of data but the next time everything passes the tests. Often the damage is so small that the damage to the component will not show up for some time, unlike damage caused by a short circuit which may cause a component to smoke, burn or explode. The component may not show any faults; however, at some point in time the component will fail, most likely at the most inconvenient time.

How do I protect against ESD damage?

There are several ways to protect electronic equipment from ESD damage. All of the following should be followed, but even following only one will help.

Prevent charges from forming.

1. Earth ground the workbench. Use an anti-static material on the surface of the workbench and make sure it is grounded. Do not use insulated underlays on the bench. Make sure the ground connections are secured.

2. Use an anti-static floor covering material. Wear anti-static shoes or heel straps. Your chair also must be anti-static.

3. Wear a wrist or heel strap connected to earth ground. Keep clean and tight. If your skin is dry, use lotion under the wrist strap. Check wrist or heel strap daily for proper grounding.

4. Keep non-anti-static plastic packaging and other plastic objects away from work area.

5. Use only anti-static plastic or foam material to protect components and boards. Place component or board **inside** anti-static bag, **not on top of it**.

6. Wear clothing that has been treated with a fabric softener during washing. This will not only reduce the risk of acquiring electrostatic charges but make your clothing more comfortable and stay cleaner longer.

7. Use earth grounded test equipment, soldering irons, etc. and hand tools without insulated handles.

8. Clean your workbench, chair, shoes, etc. with approved detergents and cleaning material only.

9. Observe ESD precautions when the ESDS label is present on components or units and/or in the product manuals.

Battery Charging & Care

WARNING

- Do not dispose of the battery pack in fire - it may explode, causing injury or death.
- Do not replace the battery in hazardous atmosphere locations.
- Do not carry battery loose in your pocket or purse.
- Do not attempt to repair battery.

The U.S. Environmental Protection Agency (EPA) classifies used Ni-Cd batteries as hazardous waste, unless certain exemptions apply.

The battery should be recycled at the end of its useful life. Under various state or local laws, such batteries must be recycled or disposed of properly and cannot be dumped in landfills or incinerators.

Maxon America, Inc. fully endorses and encourages the recycling of Ni-Cd batteries. A national program to collect and recycle used Ni-Cd batteries is being implemented by the Rechargeable Battery Recycling Corporation (RBRC ™). http://www.rbrc.org/. This program is being funded through the use of license fees paid by the battery and product manufacturers to place the RBRC™ Seal on the batteries.

The following is a list of facilities where the batteries can be shipped to be recycled. Contact these facilities for proper packaging and shipping guidelines.

Kinsbursky Brothers Inc.
1314 N. Lemon Street
Anaheim, CA. 92801
TEL: (714) 738-8516
FAX: (714) 441-0857
(800)-548-8797

INMETCO http://www.inmetco.com/
245 Portersville Road
Ellwood City, PA 16117
TEL: (412) 758-2800
FAX: (412) 758-2842

Your radio comes supplied with one 7.5 volt Ni-Cd battery pack, which can be recharged from 500 to 1000 times before requiring replacement. The actual number of charge/recharge cycles vary depending upon usage. We recommend that the battery be charged 14 to 16 hours on the first charge cycle and then in accordance with the charger model instructions thereafter.

If the battery is to be charged on the radio, ensure that the power switch on the radio is in the off position before charging. Failing to turn the power switch to off during the charge cycle will result in a less than full charge condition, which will noticeably reduce the operating time between charges!

Normal battery operation time is 8 hours. This may vary depending upon how much the receiver audio is present and how much you transmit. The actual time may vary from day to day depending upon operational requirements.

For Best Performance

1. Charge battery to full capacity, 14 hours at the standard C/10 rate (capacity X .10). For "rapid" chargers, allow additional time (2-3 hours) for "topping off" the charge after it switches from "fast" to "slow".

2. Use the battery soon and use as much of the battery capacity as possible or practical. A battery that is charged and discharged completely will maintain the longest running time capacity. Also, several charge/discharge cycles are recommended to bring a new battery up to its rated capacity.

3. Store and charge the batteries at room temperature 65°F to 75°F. Batteries that have been stored for over a month should be recharged before putting into service due to chemical self-discharge which occurs at a rate of approximately 1% per day. Do not charge cold batteries (40°F or below).

4. Reduced capacity or "memory effect" may result from repeated identical shallow discharge/full recharge cycles. If such a condition is suspected, run the battery until the instrumentation loses all power, then fully recharge and discharge again. Repeat this cycle 3-4 times.

General Information 1

Description

Maxon's SP-150 portable radios are compatible with LTR® Trunked Systems and Conventional radio system operation. The SP-150 is capable of sixteen (16) Systems/Groups combined and utilizes the latest technology in its design and manufacturing.

This model is PLL (Phase Lock Loop Synthesizer)/ microprocessor controlled, and offers 1 or 5 watts of power. Multiple functions including Scan, CTCSS / DCS signaling and 25 or 12.5 kHz channel spacing are standard in this fully programmable wide bandwidth handheld unit.

Operation and functions for Maxon's SP-150 radios are described in this manual.

We urge you to thoroughly read this manual before operating the radio.

Features

- LTR Trunked radio operation
- Conventional radio operation
- Wideband frequency separation
- 1Watt / 5 Watts Programmable output power
- Programmable 12.5/25 kHz channel spacing
- Two programmable option buttons
- Talk-around (Trunked operation)
- Busy System queuing
- Scanning function, including priority scanning
- Look back channel
- Scan list editing
- CTCSS/DCS (Conventional operation)
- Busy channel lockout
- Time-out-timer
- Embedded Messaging
- Password Protection

Accessories/Options

MPA-1200 . . . . . 1200 mAh Ni-Cd Battery
MPA-1400H . . . . . 1400 mAh Ni-Cd Battery
ACC-104UW . . . . . UHF Antenna (440-470 MHz)
ACC-404 . . . . . 4-Station Conditioning Charger
QPA-1135 . . . . . Pedestal Charger
QPA-1130 . . . . . Dual slot/dual rate "Smart" Desktop Charger
ACC-701 . . . . . Speaker/Microphone
ACC-901 . . . . . Programming Software
ACC-902 . . . . . Maintenance Software
ACC-2001 . . . . . Interface Module
QPA-1491 . . . . . Leather Case
QPA-1495 . . . . . Nylon Case
550-070-2000 . . . . . Spring Loaded Belt Clip

Licensing Information

FCC Information

The SP-150 complies with the Federal Communications Commission (FCC) requirements that regulate the Business Radio Service. The user must know and comply with all applicable parts of the FCC Rules and Regulations. Rules applicable to each service may be ordered from:

Federal Communications Commission
Branch License Division
Gettysburg, PA 17326
Tel: (717) 337-1212
http://www.fcc.gov/

- A valid station license and call sign issued by the FCC is required before operating the transceiver. It is the users's responsibility to apply for and obtain this radio license.

Industry Canada Information

To obtain the Industry Canada license application, contact your nearest field office, or write:

Industry Canada
1241 Clyde Avenue
Ottawa, Ontario K2C 1Y3
Canada
Tel: (613) 998-5968
http://info.ic.gc.ca/

Unpacking

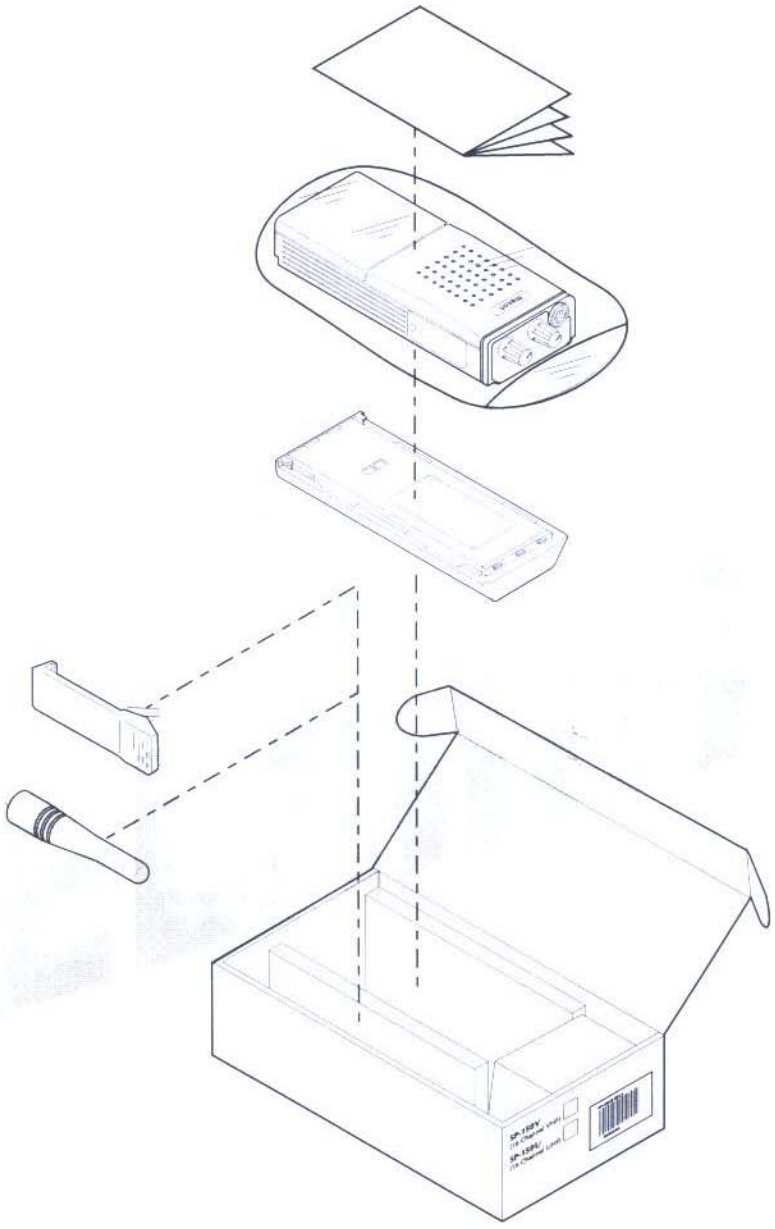


Figure 1-1 Unpacking

- Note: Battery and antenna may be shipped separately, shown for reference only.

Technical Specifications 2

General

General Specifications

Reference to ANSI/TIA/EIA-603 also includes ANSI/TIA/EIA-603-1 1998 Addendum.

Model	SP-150U and SP-150V
Equipment Type	UHF/VHF LTR Trunking and Conventional portable
Performance Specifications	FCC part 15, 74, 80, 90 (VHF) FCC part 15, 74, 80, 90, 95 (UHF) ANSI/TIA/EIA-603 Mil Standard 810 C,D, and E IC RSS119 (Industry Canada - formerly DOC) Intrinsic Safety (NFPA 500A) CSA (Canadian Standard Intrinsic Safety)
Band	406-430 (U1), 440-470 (U2), 470-490 (U3), 480-512 (U4) MHz 136-162 (V1), 148-174 (V2) MHz
Channel Spacings	12.5/20/25/30 kHz. 5 kHz & 6.25 kHz tuning programmable. (only 2 deviation settings)
RF Output Power	Programmable from 1 to 5 W
Modulation Type	F3E (FM) 3.8 kHz nominal for 25.0-kHz channel (16KO F3E) 1.8 kHz nominal for 12.5-kHz channel (11KO F3E) (without tones)
Audio Power	700 mW into 16 @ <5% distortion. Sound pressure level TBD @ TBD distance from radio.
Intermediate Frequencies	45.3 MHz 1st, 450 kHz 2nd
Number of Groups/Systems/Channels	16 position rotary switch. Programmable for a total of 16 groups and/or systems. For example: 16 systems and 1 group 8 systems and 2 groups 1 system and 16 groups
Frequency Source	Synthesized, dual VCO
Operation Rating	90:5:5 (STBY:RX:TX) Power output and freq. stable for ≤ 2 min TX. No damage will occur for ≤ 5 min TX.
Power Supply	7.5 V DC, 6 cell NiCad, 1100 mAh capacity
Temperature Range	-30 to +60 C, operating (radio) [battery spec is -10 to +60 C] -40 to +80 C, storage
Battery Life (minimum)	8 h for 90:5:5 (STBY:RX:TX) with 1100 mAh battery
Physical Parameters	43x57x142 mm (case outline, no protrusions)
Signaling	DTMF ANI TX only, DCS, CTCSS, LTR, 2-Tone, Sel-Call (with expansion)

Supply Current

MODE	CURRENT
OFF	< 20 A
Standby (Muted, non LTR) Battery Save On (Ratio 1:2) Battery Save Off	< TBD < 65 mA
RX Unmuted 25% Max. AF Power 50% Max. AF Power 100% Max. AF Power	180 mA 220 mA < 280 mA
Transmit 1 W RF Power 3 W RF Power 5 W RF Power	< 0.90 A 1.50 A < 1.90 A

Switching Bands

Switching Band	UHF, Freq. MHz				VHF, Freq. MHz			
	TX		RX		TX		RX	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
1	406	430	406	430	136	162	136	162
2	440	470	440	470	148	174	148	174
3	470	490	470	490				
4	490	512	490	512				

Transmitter

Specifications at Standard Conditions

Specification	Limit or Value (@ STD conditions) 7.5 V, 25 ±10 °C	Spec Source
Carrier Output Power Rating	1 to 5 W (programmable) ±10% per URS (FCC: ±20% max.)	FCC, TIA-603 5.2.1
Carrier Frequency Stability	VHF: ±5.0 ppm UHF: ±2.5 ppm	FCC, TIA-603 5.2.2
Modulation/Audio Limiting	between 60 - 100% of rated deviation: 12.5-kHz channel spacing: 2.5 kHz max. 25.0-kHz channel spacing: 5.0 kHz max.	FCC, TIA-603 5.2.3
Carrier Attack Time	50% carrier level in < 100 ms	TIA-603 5.2.4
Audio Sensitivity	Refer to URS Spec.	TIA-603 5.2.5
Audio Frequency Response	see graph in TIA-603 5.2.6.2	TIA-603 5.2.6
Audio Distortion	10% (at rated modulation)	TIA-603 5.2.7
FM Hum and Noise Ratio	34 dB (12.5 kHz spacing); 40 dB (25.0 kHz spacing)	TIA-603 5.2.8
AM Hum and Noise Ratio	> 34 dB	TIA-603 5.2.9
Acoustic Microphone Sensitivity	Refer to URS Spec.	TIA-603 5.2.10
Sideband Spectrum	meets FCC (see TIA-603 5.2.11.2): -25 dB (10-20 kHz from carrier) -35 dB (20-50 kHz from carrier) the lesser of -[43 + 10 log (Pout)] or -80 dB (> 50 kHz from carrier)	TIA-603 5.2.11
Occupied Bandwidth	see 47 CFR § 90.209(b)(5) 12.5 kHz spacing: see 47 CFR § 90.210(d) 25.0 kHz spacing: see 47 CFR § 90.210(b)	FCC
Radiated Spurious Emissions	-65 dBc	FCC, TIA-603 5.2.12
Conducted Spurious Emissions	-65 dBc	FCC, TIA-603 5.2.13
Adjacent Channel Power Ratio	12.5-kHz spacing: -60 dBc 25.0-kHz spacing: -70 dBc	TIA-603 5.2.14
VHF Audio Low Pass Filter Response	Versus attenuation at 1000 Hz: -40 log (f/3000) dB for 3 kHz f < 15 kHz, -28 dB for f 15 kHz	TIA-603 5.2.15
UHF Audio Low Pass Filter Response	Versus attenuation at 1000 Hz: -60 log (f/3000) dB for 3 kHz f < 20 kHz, -50 dB for f 20 kHz	TIA-603 5.2.15
Average Radiated Power Output	Refer to URS Spec.	TIA-603 5.2.17
Transmitter Stability Into SWR	-[43 + 10 log (Pout)] dB or -13 dBm (50 µW) @ 6:1 SWR (Unconditionally stable with all detuning conditions of antenna)	TIA-603 5.2.18
VHF Transient Frequency Behavior of Transmitter 12.5-kHz channel spacing: 25.0-kHz channel spacing: all spacings: all spacings:	maximum frequency deviation from carrier: ± 12.5 kHz up to 5.0 ms after turn on. ± 25.0 kHz up to 5.0 ms after turn on. ± 12.5 kHz up to 20.0 ms after turn on. ± 25.0 kHz up to 5.0 ms before turn off.	TIA-603 5.2.19

UHF Transient Frequency Behavior of Transmitter 12.5-kHz channel spacing: 25.0-kHz channel spacing: all spacings: all spacings:	maximum frequency deviation from carrier: ± 12.5 kHz up to 10.0 ms after turn on. ± 25.0 kHz up to 10.0 ms after turn on. ± 12.5 kHz up to 25.0 ms after turn on. ± 25.0 kHz up to 10.0 ms before turn off	TIA-603 5.2.19
DC Supply Noise Susceptibility	-6 dB DFS of TX FM Hum & Noise	TIA-603 5.3.6
Field Strength	-[43 + 10 log (Pout)] dB	FCC
CT/CDCSS Modulation Limiting	shall not exceed rated system deviation	TIA-603 6.4.10
CT/CDCSS Encoder Response Time	150 ms for 100 Hz, 15000/Freq (in Hz) for 100 Hz; 150 ms for CDCSS	TIA-603 6.4.11
CTCSS Encoder Frequency	±0.3% of assigned frequency	TIA-603 6.4.12
CTCSS Tone Distortion	< 5%	TIA-603 6.4.13
Transmitter SINAD	> 20 dB	TIA-603 6.4.14
CDCSS Waveform Distortion	< 30% droop after six ones or six zeros in a row	TIA-603 6.4.15
CDCSS Transmitter FM Hum and Noise Ratio	minimum of 35 dB on 5-kHz channel	TIA-603 6.4.16
CDCSS Transmitter Sub-Audible Deviation	500 to 1000 Hz on 5-kHz channel	TIA-603 6.4.17
CDCSS Transmitter Squelch Tail Elimination Burst	150-200 ms	TIA-603 6.4.18

Voltage Stability

(*DFS*: Degradation From Standard)

Specification	Standard Limit (@ 7.5 V, 25 ±10 °C)	Spec Source	Max. Limit	Voltage Range
Carrier Output Power Rating	1 to 5 W (programmable) ±10% per URS (FCC: ±20% max)	FCC, TIA-603 5.2.1	3 dB DFS 6 dB DFS	±10% ±20%
Carrier Frequency Stability	VHF: ±5.0 ppm UHF: ±2.5 ppm	FCC, TIA-603 5.2.2	No DFS	±15%
Modulation/Audio Limiting	between 60 - 100% of rated deviation: 12.5-kHz channel spacing: 2.5 kHz max. 25.0-kHz channel spacing: 5.0 kHz max.	FCC, TIA-603 5.2.3	≥50% of RSD	±10%
Audio Distortion	10% (at rated modulation)	TIA-603 5.2.7	No DFS	±10%
FM Hum and Noise Ratio	34 dB (12.5-kHz spacing); 40 dB (25.0-kHz spacing)	TIA-603 5.2.8	No DFS	±10%
Transmitter Stability Into SWR	-[43 + 10 log (Pout)] or -13 dBm (50 µW) @ 6:1 SWR (Unconditionally stable with all detuning conditions of antenna)	TIA-603 5.2.18	No DFS	±10%
CT/CDCSS Encoder Response Time	150 ms for 100 Hz, 15000/Freq (in Hz) for 100 Hz; 150 ms for CDCSS	TIA-603 6.4.11	No DFS	±10%
CTCSS Encoder Frequency	±0.3% of assigned frequency	TIA-603 6.4.12	No DFS	±10%
CTCSS Tone Distortion	< 5%	TIA-603 6.4.13	No DFS	±10%
Transmitter SINAD	> 20 dB	TIA-603 6.4.14	No DFS	±10%
CDCSS Waveform Distortion	< 30% droop after six ones or six zeros in a row	TIA-603 6.4.15	No DFS	±10%
CDCSS Transmitter FM Hum and Noise Ratio	minimum of 35 dB on 5-kHz channel	TIA-603 6.4.16	No DFS	±10%
CDCSS Transmitter Sub-Audible Deviation	500 to 1000 Hz on 5-kHz channel	TIA-603 6.4.17	No DFS	±10%
CDCSS Transmitter Squelch Tail Elimination Burst	150-200 ms	TIA-603 6.4.18	No DFS	±10%

Temperature Stability -30 °C TO +60 °C

(*DFS*: Degradation From Standard)

Specification	Standard Limit (@ 7.5 V, 25 ±10 °C)	Spec Source	Maximum Limit
Carrier Output Power Rating	1 to 5 W (programmable) ±10% per URS (FCC: ±20% max)	FCC, TIA-603 5.2.1	3 dB DFS
Carrier Frequency Stability	VHF: ±5.0 ppm UHF: ±2.5 ppm	FCC, TIA-603 5.2.2	No DFS
Modulation/Audio Limiting	between 60 - 100% of rated deviation: 12.5-kHz channel spacing: 2.5 kHz max. 25.0-kHz channel spacing: 5.0 kHz max.	FCC, TIA-603 5.2.3	≥40% of RSD
Audio Distortion	10% (at rated modulation)	TIA-603 5.2.7	10%
FM Hum and Noise Ratio	34 dB (12.5 kHz spacing); 40 dB (25.0 kHz spacing)	TIA-603 5.2.8	6 dB DFS
Transmitter Stability Into SWR	-[43 + 10 log (Pout)] or -13 dBm (50 µW) @ 6:1 SWR (Unconditionally stable with all detuning conditions of antenna)	TIA-603 5.2.18	No DFS
CT/CDCSS Encoder Response Time	150 ms for 100 Hz, 15000/Freq (in Hz) for 100 Hz; 150 ms for CDCSS	TIA-603 6.4.11	No DFS
CTCSS Encoder Frequency	±0.3% of assigned frequency	TIA-603 6.4.12	No DFS
CTCSS Tone Distortion	< 5%	TIA-603 6.4.13	No DFS
Transmitter SINAD	> 20 dB	TIA-603 6.4.14	No DFS
CDCSS Waveform Distortion	< 30% droop after six ones or six zeros in a row	TIA-603 6.4.15	No DFS
CDCSS Transmitter FM Hum and Noise Ratio	minimum of 35 dB on 5-kHz channel	TIA-603 6.4.16	No DFS
CDCSS Transmitter Sub-Audible Deviation	500 to 1000 Hz on 5-kHz channel	TIA-603 6.4.17	No DFS
CDCSS Transmitter Squelch Tail Elimination Burst	150-200 ms	TIA-603 6.4.18	No DFS

Humidity Stability 95% @ +50 °C

(*DFS*: Degradation From Standard)

Specification	Limit or Value (@ STD conditions) 7.5 V, 25 ±10 °C	Spec Source	Maximum Limit
Carrier Output Power Rating	1 to 5 W (programmable) ±10% per URS (FCC: ±20% max.)	FCC, TIA-603 5.2.1	3 dB DFS
Carrier Frequency Stability	VHF: ±5.0 ppm UHF: ±2.5 ppm	FCC, TIA-603 5.2.2	No DFS
Modulation/Audio Limiting	between 60 - 100% of rated deviation: 12.5-kHz channel spacing: 2.5 kHz max. 25.0-kHz channel spacing: 5.0 kHz max.	FCC, TIA-603 5.2.3	≥40% of RSD
Audio Distortion	10% (at rated modulation)	TIA-603 5.2.7	10%
FM Hum and Noise Ratio	34 dB (12.5-kHz spacing), 40 dB (25.0-kHz spacing)	TIA-603 5.2.8	6 dB DFS
CT/CDCSS Encoder Response Time	150 ms for 100 Hz, 15000/Freq (in Hz) for 100 Hz; 150 ms for CDCSS	TIA-603 6.4.11	No DFS
CTCSS Encoder Frequency	±0.3% of assigned frequency	TIA-603 6.4.12	No DFS
CDCSS Waveform Distortion	< 30% droop after six ones or six zeros in a row	TIA-603 6.4.15	No DFS
CDCSS Transmitter FM Hum and Noise Ratio	minimum of 35 dB on 5-kHz channel	TIA-603 6.4.16	No DFS
CDCSS Transmitter Sub-Audible Deviation	500 to 1000 Hz on 5-kHz channel	TIA-603 6.4.17	No DFS
CDCSS Transmitter Squelch Tail Elimination Burst	150-200 ms	TIA-603 6.4.18	No DFS

Vibration Stability During Vibration

The radio must meet all transmitter specifications after vibration. In addition, the unit must pass the following specifications during vibration:

(*DFS*: Degradation From Standard)

Specification	Limit or Value (@ STD conditions) 7.5 V, 25 ±10 °C	Spec Source	Maximum Limit
Carrier Output Power Rating	1 to 5 W (programmable) ±10% per URS (FCC: ±20% max.)	FCC, TIA-603 5.2.1	No DFS
Carrier Frequency Stability	VHF: ±5.0 ppm UHF: ±2.5 ppm	FCC, TIA-603 5.2.2	No DFS
Modulation/Audio Limiting	between 60 - 100% of rated deviation: 12.5-kHz channel spacing: 2.5 kHz max. 25.0-kHz channel spacing: 5.0 kHz max.	FCC, TIA-603 5.2.3	≥50% of RSD
FM Hum and Noise Ratio	34 dB (12.5-kHz spacing) 40 dB (25.0-kHz spacing)	TIA-603 5.2.8	15 dB DFS

Shock Stability

The equipment shall suffer no more than superficial mechanical damage and shall meet the requirements of transmitter specifications without degradation after being shocked.

Receiver

Specifications at Standard Conditions

Specification	Limit or Value (@ STD conditions) 7.5 V, 25 ±10 °C	Spec Source
Radiated Spurious Emissions	200 µV/m or -119 dBW @ 3 m	TIA-603 5.1.1
Conducted Spurious Emissions	316 µV across 50 (-87 dBW)	TIA-603 5.1.2
Power Line Conducted Spurious Emissions	250 µV from 450 kHz to 30 MHz	TIA-603 5.1.3
Reference Sensitivity	0.35 µV per URS	TIA-603 5.1.4
Signal Displacement Bandwidth	> 40% of RSD	TIA-603 5.1.5
Adjacent Channel Rejection	12.5-kHz spacing: 55 dB 25.0-kHz spacing: 65 dB	TIA-603 5.1.6
Spurious Response Rejection	60 dB	TIA-603 5.1.8
Intermodulation Rejection	> 50 dB	TIA-603 5.1.9
Audio Frequency Response	see graph in TIA-603 5.1.10.2.1	TIA-603 5.1.10
Hum and Noise Ratio	34 dB (12.5-kHz spacing) 40 dB (25.0-kHz spacing)	TIA-603 5.1.11
Audio Power Output	700 mW into 16 load (60% dev. @ 1 kHz)	TIA-603 1.3.3.5
Audio Distortion	10% (rated power), 5% (17 dB below rated power)	TIA-603 5.1.12
Audio Squelch Sensitivity (Preset)	< 12 dB SINAD	TIA-603 5.1.13
Squelch Blocking	10 dB drop	TIA-603 5.1.14
Receiver Attack Time	150 ms	TIA-603 5.1.15
Receiver Closing Time	250 ms	TIA-603 5.1.16
Audio Sensitivity	< 40% of RSD	TIA-602 5.1.17
Impulse Blanking Effectiveness	≥ 40 dB	TIA-603 5.1.18
Average Radiation Sensitivity	-95 dBm (4 µV)	TIA-603 5.1.19
Acoustic Audio Output	≥ 80 dB above 20 µPa + 10 log (Pout in W)	TIA-603 5.1.20
CT/CDCSS squelch opening SINAD	CTCSS: 8 dB, CDCSS: 10 dB	TIA-603 6.4.1
CT/CDCSS Audio Attack Time	CTCSS: 250 ms for 100 Hz, 25000/Freq (in Hz) for 100 Hz; CDCSS: 350 ms	TIA-603 6.4.2
CT/CDCSS Audio Closing Time	250 ms	TIA-603 6.4.3
CT/CDCSS Audio Attack Time with Carrier Offset	CTCSS: 250 ms for 100 Hz, 25000/Freq (in Hz) for 100 Hz; CDCSS: 350 ms	TIA-603 6.4.4
CT/CDCSS Hum and Noise ratio	±5-kHz deviation, 30 dB	TIA-603 6.4.5
CTCSS Decoder Response Bandwidth	1.005 times selected tone or next higher or lower tone	TIA-603 6.4.6
False Response Rate	1 false response in 30 min	TIA-603 6.4.7
Receiver Audio Response	+1, -3 dB standard with deviations below 500 Hz and above 2500 Hz	TIA-603 6.4.8
CT/CDCSS Squelch Tail Elimination Burst	50 ms reversed burst of tone	TIA-603 6.4.9

Voltage Stability

(*DFS*: Degradation From Standard)

Specification	Standard Limit (@ 7.5 V, 25 ±10 °C)	Spec Source	Max. Limit	Voltage Range
Radiated Spurious Emissions	200 µV/m or -119 dBW @ 3 m	TIA-603 5.1.1	none	@ ±20%
Conducted Spurious Emissions	316 µV across 50 (-87 dBW)	TIA-603 5.1.2	none	@ ±20%
Power Line Conducted Spurious Emissions	250 µV from 450 kHz to 30 MHz	TIA-603 5.1.3	none	@ ±20%
Reference Sensitivity	0.35 µV per URS	TIA-603 5.1.4	3 dB DFS	@ ±20%
Signal Displacement Bandwidth	> 40% of RSD	TIA-603 5.1.5	none	@ ±10%
Adjacent Channel Rejection	12.5-kHz spacing: 50 dB 25.0-kHz spacing: 60 dB	TIA-603 5.1.6	6 dB DFS	@ ±10%
Spurious Response Rejection	> 60 dB	TIA-603 5.1.8	no DFS	@ ±10%
Intermodulation Rejection	> 50 dB	TIA-603 5.1.9	3 dB DFS	@ ±10%
Audio Frequency Response	see graph in TIA-603 5.1.10.2.1	TIA-603 5.1.10	none	@ ±10%
Hum and Noise Ratio	34 dB (12.5-kHz spacing) 40 dB (25.0-kHz spacing)	TIA-603 5.1.11	3 dB DFS	@ ±10%
Audio Distortion	10% (rated power); 5% (17 dB below rated power)	TIA-603 5.1.12	5% @ -17 dB	@ ±20%
Audio Squelch Sensitivity (Preset)	< 12 dB SINAD	TIA-603 5.1.13	remain unsquelched	@ ±20%
Squelch Blocking	10 dB drop	TIA-603 5.1.14	no DFS	@ ±10%
Audio Sensitivity	< 40% of RSD	TIA-603 5.1.17	< 40% @ ½ rated power	@ ±10%
CT/CDCSS squelch opening SINAD	CTCSS: 8 dB CDCSS: 10 dB	TIA-603 6.4.1	3 dB DFS	@ ±10%
CT/CDCSS Audio Attack Time	CTCSS: 250 ms for 100 Hz, 25000/Freq (in Hz) for 100 Hz; CDCSS: 350 ms	TIA-603 6.4.2	2 X STD	@ ±10%
CT/CDCSS Audio Closing Time	250 ms	TIA-603 6.4.3	500 ms	@ ±10%
CTCSS Hum and Noise ratio	±5-kHz channel, 30 dB	TIA-603 6.4.5	no DFS	@ ±10%
CTCSS Decoder Response Bandwidth	1.005 times selected tone or next higher or lower tone	TIA-603 6.4.6	no DFS	@ ±10%
CT/CDCSS Squelch Tail Elimination Burst	50 ms reversed burst of tone	TIA-603 6.4.9	no DFS	@ ±10%

Temperature Stability -30 °C TO +60 °C

(*DFS*: Degradation From Standard)

Specification	Standard Limit (@ 7.5 V, 25 ±10 °C)	Spec Source	Maximum Limit
Radiated Spurious Emissions	200 µV/m or -119 dBW @ 3 m	TIA-603 5.1.1	no DFS
Conducted Spurious Emissions	316 µV across 50 (-87 dBW)	TIA-603 5.1.2	no DFS
Power Line Conducted Spurious Emissions	250 µV from 450 kHz to 30 MHz	TIA-603 5.1.3	no DFS
Reference Sensitivity	0.35 µV per URS	TIA-603 5.1.4	6 dB DFS
Signal Displacement Bandwidth	> 40% of RSD	TIA-603 5.1.5	20% of RSD
Adjacent Channel Rejection	12.5-kHz spacing: 50 dB 25.0-kHz spacing: 60 dB	TIA-603 5.1.6	12 dB DFS
Spurious Response Rejection	> 60 dB	TIA-603 5.1.8	10 dB DFS
Intermodulation Rejection	> 50 dB	TIA-603 5.1.9	6 dB DFS
Audio Frequency Response	see graph in TIA-603 5.1.10.2.1	TIA-603 5.1.10	no DFS
Hum and Noise Ratio	34 dB (12.5-kHz spacing); 40 dB (25.0-kHz spacing)	TIA-603 5.1.11	no DFS
Audio Distortion	10% (rated power); 5% (17 dB below rated power)	TIA-603 5.1.12	10% @ -17 dB
Audio Squelch Sensitivity	< 12 dB SINAD	TIA-603 5.1.13	16 dB SINAD
Squelch Blocking	10 dB drop	TIA-603 5.1.14	no DFS
Audio Sensitivity	< 40% of rated deviation	TIA-603 5.1.17	60% @ ½ rated power
CT/CDCSS squelch opening SINAD	CTCSS: 8 dB CDCSS: 10 dB	TIA-603 6.4.1	3 dB DFS
CT/CDCSS Audio Attack Time	CTCSS: 250 ms for 100 Hz, 25000/Freq (in Hz) for 100 Hz; CDCSS: 350 ms	TIA-603 6.4.2	2 X STD
CT/CDCSS Audio Closing Time	250 ms	TIA-603 6.4.3	500 ms
CT/CDCSS Audio Attack Time with Carrier Offset	CTCSS: 250 ms for 100 Hz, 25000/Freq (in Hz) for 100 Hz; CDCSS: 350 ms	TIA-603 6.4.4	2 X STD
CTCSS Hum and Noise ratio	+5-kHz channel. 30 dB	TIA-603 6.4.5	no DFS
CTCSS Decoder Response Bandwidth	1.005 times selected tone or next higher or lower tone	TIA-603 6.4.6	no DFS
CT/CDCSS Squelch Tail Elimination Burst	50 ms reversed burst of tone	TIA-603 6.4.9	no DFS

Humidity Stability 95% @ +50 °C

(*DFS*: Degradation From Standard)

Specification	Standard Limit (@ 7.5 V, 25 ±10 °C)	Spec Source	Maximum Limit
Radiated Spurious Emissions	200 µV/m or -119 dBW @ 3 m	TIA-603 5.1.1	none
Conducted Spurious Emissions	316 µV across 50 (-87 dBW)	TIA-603 5.1.2	none
Power Line Conducted Spurious Emissions	250 µV from 450 kHz to 30 MHz	TIA-603 5.1.3	none
Reference Sensitivity	0.35 µV per URS	TIA-603 5.1.4	10 dB DFS
Signal Displacement Bandwidth	> 40% of RSD	TIA-603 5.1.5	20% of RSD
Adjacent Channel Rejection	12.5-kHz spacing: 50 dB 25.0-kHz spacing: 60 dB	TIA-603 5.1.6	12 dB DFS
Spurious Response Rejection	> 60 dB	TIA-603 5.1.8	10 dB DFS
Intermodulation Rejection	> 50 dB	TIA-603 5.1.9	6 dB DFS
Audio Frequency Response	see graph in TIA-603 5.1.10.2.1	TIA-603 5.1.10	none
Hum and Noise Ratio	34 dB (12.5-kHz spacing) 40 dB (25.0-kHz spacing)	TIA-603 5.1.11	10 dB DFS
Audio Distortion	10% (rated power); 5% (17 dB below rated power)	TIA-603 5.1.12	10% @ -17 dB
Audio Squelch Sensitivity (Preset)	< 12 dB SINAD	TIA-603 5.1.13	16 dB SINAD
Squelch Blocking	10 dB drop	TIA-603 5.1.14	no DFS
Audio Sensitivity	< 40% of RSD	TIA-603 5.1.17	< 60% @ ½ rated power
CT/CDCSS squelch opening SINAD	CTCSS: 8 dB CDCSS: 10 dB	TIA-603 6.4.1	3 dB DFS
CT/CDCSS Audio Attack Time	CTCSS: 250 ms for 100 Hz, 25000/Freq (in Hz) for 100 Hz; CDCSS: 350 ms	TIA-603 6.4.2	2 X STD
CT/CDCSS Audio Closing Time	250 ms	TIA-603 6.4.3	500 ms
CT/CDCSS Audio Attack Time with Carrier Offset	CTCSS: 250 ms for 100 Hz, 25000/Freq (in Hz) for 100 Hz; CDCSS: 350 ms	TIA-603 6.4.4	2 X STD
CTCSS Hum and Noise ratio	±5-kHz channel. 30 dB	TIA-603 6.4.5	no DFS
CTCSS Decoder Response Bandwidth	1.005 times selected tone or next higher or lower tone	TIA-603 6.4.6	no DFS
CT/CDCSS Squelch Tail Elimination Burst	50 ms reversed burst of tone	TIA-603 6.4.9	no DFS

Vibration Stability During Vibration

he radio must meet all receiver specifications after vibration. In addition, the unit must pass the following specifications during vibration.

(*DFS*: Degradation From Standard)

Specification	Limit or Value (@ STD conditions) 7.5 V, 25 ±10 °C	Spec Source	Maximum Limit
Reference Sensitivity	0.35 V per URS	TIA-603 5.1.4	no DFS
CT/CDCSS squelch opening SINAD	CTCSS: 8 dB CDCSS: 10 dB	TIA-603 6.4.1	3 dB DFS

Shock Stability

he equipment shall suffer no more than superficial mechanical damage and shall meet the requirements of receiver specifications without degradation after being shocked.

Test Equipment

The following test equipment, or equivalent, should be used:

- HP 8920B RF Communications Test Set
- HP 6652A System DC Power Supply
- HP 8640B Signal Generator (2)
- Tektronics 465 Oscilloscope

Test Methods

Refer to TIA/EIA-603 Standards (Feb. 1993) *Methods of Measurement* section

Operation 3

Description of Controls

ITEM	DESCRIPTION
1. Antenna Connector	1/4" UNEF socket
2. 16 Channel Select Switch	Rotary switch, used to select one of sixteen channels
3. Status Indicator (busy TX/BT)	Tri-colored LED indicator
4. ON/OFF Volume Control	Main power switch and volume control. Fully counter-clockwise is OFF position
5. Battery Lock	Used to lock the battery in place
6. Push-To-Talk Button	Push to talk, release to listen
7. Option 1 Button	When pressed the radio performs the programmed option
8. Option 2 Button	When pressed the radio performs the programmed option
9. Speaker	Sound reception
10. Microphone	Sound transmission
11. Accessory Interconnect Housing	Multi-purpose socket used to connect to a remote speaker/microphone or other accessory
12. Belt Clip	Belt Clip
13. Battery	Power Supply
14. Battery Charger Contacts	Contacts used for charging battery
15. UHF Antenna	Antenna

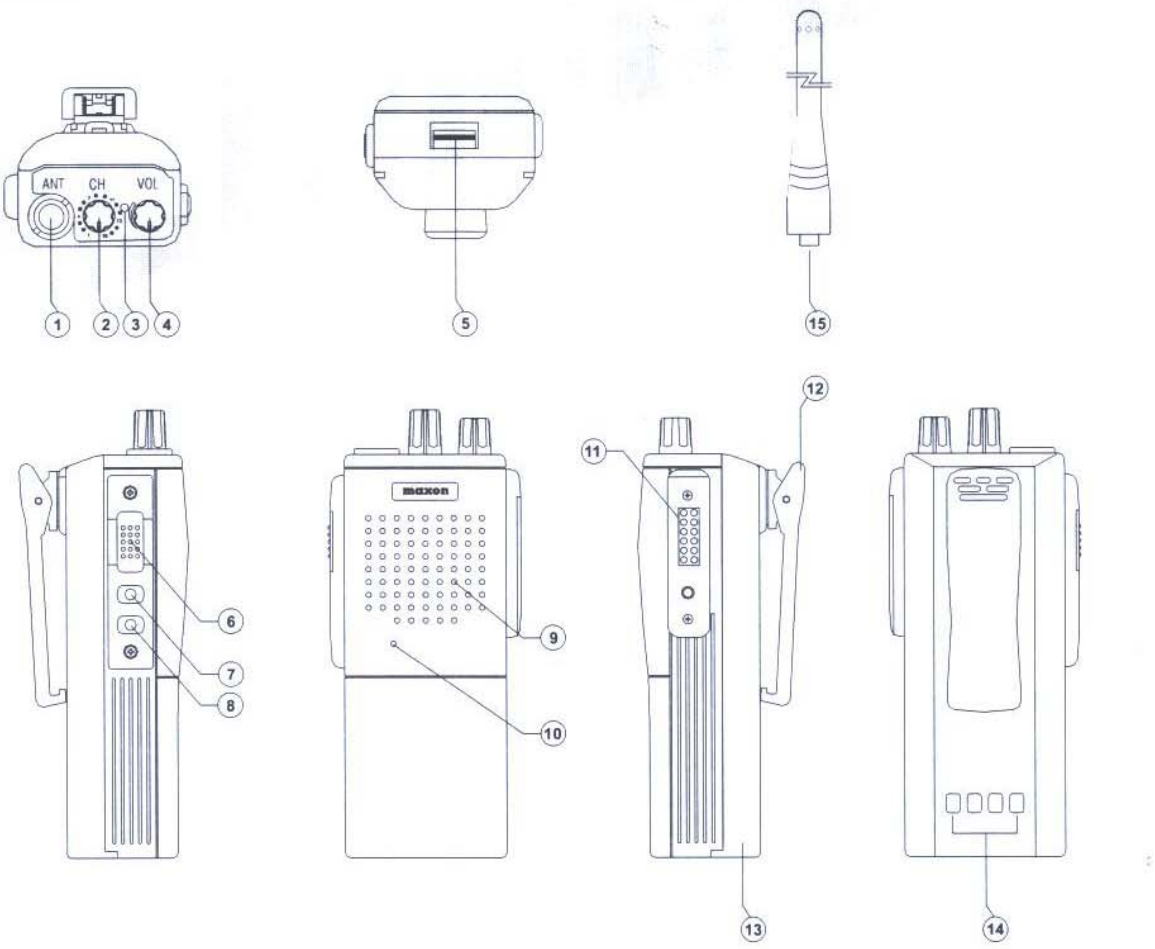


Figure 3-1 Description of Controls

SP-150 Operation

Your Maxon SP-150 can be programmed to operate in both Trunked and Conventional modes. Each System can be individually programmed to operate in either Trunked or Conventional Systems. There are only a few differences in their operation and these are detailed as follows:

Channel Monitoring

While on a Trunked System, channel monitoring is performed automatically by the radio transceiver. In accordance with the FCC Rules, while operating on a Conventional System, the channel must be monitored prior to transmitting. In both Trunked and Conventional Systems, operation may vary from System to System.

System "Handshaking"

In a Trunked System, when the P-T-T is pressed, the red TX LED flashes momentarily to allow the transceiver and System to connect properly. When the red TX LED glows steady, voice transmission may begin. If you have enabled the "Clear-to-Talk" tone option, the radio will emit a short tone signaling voice transmission may occur. In Conventional Systems, there is no System "handshaking" and voice transmission may start immediately upon pressing the P-T-T.

Busy System Queuing (Programmable Option)

If enabled, busy System queuing will monitor the System for activity. Once the System becomes available, the System will automatically be accessed and held for the programmed period of time, allowing you to transmit on the System. A tone will sound and a flashing yellow TX/Call LED will indicate when queuing has begun. The tone will sound again and the LED will flash red when the System has been acquired.

Talk-Around (Programmable Option)

Talk-Around mode, if enabled, allows you to bypass the System and talk from radio to radio. This is useful when your radios are out of range of any System. Talk-Around can be enabled by pressing one of the two option buttons* located on the side of the unit. An audible alert will sound (if enabled) when the option button is pressed, indicating the radio is active for Talk-Around mode.

* The option button designated to enable Talk-Around is programmable via the ACC-901 Programmer.

Transpond Mode (Programmable Option)

If transpond has been enabled, your radio will automatically send (transpond) an acknowledgment to the System indicating that your radio has received a transmission.

Power On - Volume - Power Off

Turn the radio on by rotating the off/on - volume control clockwise. You will hear a click and, if enabled, the radio's self-test alert tones. Increase the radio volume by continuing the clockwise rotation. To turn the radio off, rotate the control counter-clockwise to detent.

Transmitting on a Trunked System

1. Turn the radio on and adjust the volume to the desired level.

2. Select the desired System and/or Group using the System/Group/Channel selector knob, located on top of the unit.

3. Press and hold the P-T-T button on the side of the radio. (If a "Busy", "Intercept" or "Ringback" tone is heard, refer to "Status Indicators and Audible Alert Tones" section for more information).

4. Listen for the "Clear-to-Talk" tone (or wait for the red TX LED to glow steady) then begin talking. Hold the radio 1 to 2 inches from your mouth, speak clearly and distinctly into the microphone area of the front grill.

5. Release the P-T-T button as soon as the message is complete. The P-T-T button must be pressed continuously while speaking.

Receiving on a Trunked System

1. Confirm that the radio is on and receiving power. Select the desired System and Group.

2. When a message is received, the TX/Call LED will glow green.

3. Respond to a message by pressing the P-T-T button on the side of the radio. Press the P-T-T continuously while talking and release to listen.

Conventional Mode Operation

Your Maxon SP-150 may be programmed to operate in Conventional modes. Conventional mode may or may not require a Conventional repeater System. Radio to radio communications can also be accomplished in Conventional operation.

Transmitting on a Conventional System

1. Turn the radio on and adjust the volume to desired level.

2. Select the desired channel using the System/Group/ Channel selector knob, located on top of the unit.

3. In a Conventional System it is necessary to monitor the channel for activity before a transmission. Monitor the channel by pressing one of the two option buttons** located on the side of the unit or by observing the TX/Call LED for a solid yellow or green color. If solid yellow or green is observed, you must wait for the LED to leave before a transmission can be made. The option button designated to enable monitor is programmable via the ACC-901 Programmer.

4 Press and hold the P-T-T button on the side of the radio. Hold the radio 1 to 2 inches from your mouth, speak clearly and distinctly into the microphone area of the front grill.

5. Release the P-T-T button as soon as the message is complete. The P-T-T button must be pressed continuously while speaking.

Receiving on a Conventional System

1. Confirm that the radio is on and receiving power. Select the desired channel.

2. When a message is received, the TX/Call LED will glow solid yellow or green (depending if CTCSS or DCS tone has been programmed).

3. Respond to a message by pressing the P-T-T button on the side of the radio. Press the P-T-T continuously while talking and release to listen.

   If scanning modes are enabled, be sure to respond before scanning resumes. If you do not, another call may be received and the selected channel may have to be changed. Scanning is indicated by flashing green TX/ Call LED. Refer to "Scan Modes" section for more information.

Option Buttons

Your SP-150 has two programmable option buttons located on the side of the unit. These buttons can be programmed via the ACC-901 Programmer to enable a number of features, including:

- **Monitor:** (Conventional Systems) When programmed, pressing and holding the appropriate option button will open the squelch of the radio, defeating the CTCSS/DCS tone squelch and allowing you to listen for channel activity.
- **Nuisance Delete:** This function will allow you to temporarily delete an unwanted channel from the scan list. Nuisance delete can be activated only when receiving the unwanted channel. The feature can be programmed alone on a single option button or combined with the monitor function. Turning the unit off and on will return the unit to the original scan list.
- **Talk-Around:** When programmed, pressing the appropriate option button once will activate Talk-Around mode. Pressing the option button again, or rotating the channel selection knob will disable Talk-Around function.
- **Scan:** When programmed, pressing the appropriate option button will enable the radio's programmed scan function.
- **Edit Group Scan List:** When programmed, allows editing of channels you wish to scan.

Status Indicators and Audible Alert Tones

Your SP-150 has a sophisticated microprocessor control which provides a series of audible alert tones. Upon initial power up, a single tone indicates that the self-test of the microprocessor functions have been completed satisfactorily. A series of tones may sound with any of these conditions:

- Busy System Queuing, indicates your radio has been placed in the queuing mode and is attempting to access the System

- Low battery condition
- Selecting a Channel with no programmed frequency (The following are all initially programmed into the radio by Maxon).
- Attempt to transmit on a System/Channel that is already in use when busy channel lockout has been programmed to Call Received
- Clear-to-Talk/Transmit indicates you may begin speaking
- Transmit not available indicates you are denied transmission on that System/Channel
- Time-Out Timer indicates you have exceeded the maximum transmission time

STATUS	DESCRIPTION	COLOR	AUDIBLE TONE
NORMAL	Power On-Ready	Red, Yellow, Green (Single Flash Sequence)	Single Beep
	Call Received w/Audio	Yellow	Single Beep
	Call Received w/Audio	Green	Single Beep
	Transmit	Red	Single Beep
	Busy Channel No Audio	Yellow	N/A
	Transmit Not Allowed	Yellow-Flashing	Busy Tone Repeated
TRUNKED	Clear-To-Talk	Red	Single Beep
	Talk-Around	Yellow-Flashing	Busy Tone Repeated
	Out of Range	Red, Yellow-Flashing	Single Beep
SCANNING	In Scan Mode	Green-Flashing	N/A
	Enter Scan List Edit	Green-Flash Four Times	Four Beeps
	Exit Scan List Edit	Red-Flash Four Times	Four Beeps
	In Scan List	Green-Flash Two Times	Two Beeps
	Not In Scan List	Red-Flash Two Times	Two Beeps
WARNING	Busy System Queuing	Yellow-Flashing	Three Beeps Then A Single Beep Every 10 Seconds
	Busy System Access	Red-Flashing	Five Beeps
	Queue Time-out	N/A	Single Tone
	Time-out-Timer	Yellow Flashing	Single Tone
	Low Battery	Red-Flashing	Four Beeps Repeated
ERROR	EEPROM Error	Red-Flashing	Single Beep-Repeated
	Out-of-Lock	Red-Flash Two Times	Two Beeps-Repeated
	Hardware Error	Red-Flash Three Times	Three Beeps-Repeated
	NVRAM Error	Red-Flash Five Times	Five Beeps-Repeated

Table 3-1 Status Indicators & Audible Alert Tones

- **Note:** LED and/or Tones may be programmed on or off.

Scan Modes

Your SP-150 radio may be programmed for one or more scan modes depending upon your requirements.

LTR Manual Group Scan

To enable LTR Manual Group Scan, press the appropriate option button on the side of the radio. In this scan mode, the radio will scan all LTR receive Group ID's located in each selector knob position. Upon receiving the correct ID the radio will allow transmission on that Group ID until scanning resumes.

LTR Auto Group Scan

To enable LTR Auto Group Scan, rotate the selector knob to the LTR System which has Auto Group Scan enabled, determined by programming. Operation is the same as for LTR Manual Group Scan with the following exception; each rotary switch position can be programmed for Auto Group Scan.

System Scan

To enable System Scan, press the appropriate option button on the side of the radio. During System Scan the radio will scan all Systems in the scan list that have been programmed.

To enable Conventional Group Scan, press the appropriate option button on the side of the radio. Conventional Group Scan performs in the same manner as LTR Manual Group Scan with the exception that ID codes are not required. Only those Groups enabled in the Group scan list will be scanned.

Editing Group Scan List

As a user, you can edit your pre-programmed Group scan list by adding or deleting Groups from the Group Scan List for a given System. To activate scan list editing, press the appropriate option button on the side of the radio. (Note: In order to edit the Group scan list, the remaining option button must be programmed to activate scan mode.) Upon entering the edit scan list function, the LED located on top of the unit will flash green four times and a beep will be heard with each LED flash. To exit the edit scan list function, press the appropriate option button again. The LED will flash red four times and a beep will be heard with each LED flash.

Adding to Scan List

Once the option button has been enabled for scan list editing, rotate the selector knob to the desired System Group to be edited. To add this Group to the scan list, press the option button programmed for scan. When a Group is added, the LED will flash green two times and a beep will sound with each flash.

Deleting from Scan List

Once the option button has been enabled for scan list editing, rotate the selector knob to the desired System Group to be edited. To delete this Group from the scan list, press the option button programmed for scan. When deleted, the LED will flash red two times and a beep will sound with each flash.

- **Note:** Priority and Priority Look Back Groups cannot be edited from the scan list.

Priority Look-Back

If programmed, your SP-150 will "Look-Back" to the programmed priority channel if the selector knob is positioned on a System / Channel other than the programmed priority channel.

Conventional Scanning

Your SP-150 can be programmed for one of six different scan types. To enable scan, press the appropriate option button on the side of the radio. Only those channel Groups that have been pre-programmed will be in the scan list.

Talk Back Scan

Rx: The radio only receives calls from its selected channel and channels in the selected channel scan list.

Tx: The radio will transmit on the selected channel if a call is not received. If a scanned call is received, the radio will transmit on that scanned channel until scanning resumes.

Rx Only/Tx Disable

Rx: The radio will only receive calls on the selected channel and channels in the selected channel scan list.

Tx: No transmissions are allowed. If transmission is attempted, an alert will sound.

Priority Tx Scan

Rx: The radio will receive calls from its selected channel and channels in the selected channels scan list.

Tx: All transmissions will be made on the programmed priority channel, no matter where the selector knob is positioned. Transmissions can also be made only on those scanned calls which have been received before scanning resumes.

Priority Only Tx

Rx: The radio will receive calls from its selected channel and channels in the selected channel scan list.

Tx: All transmissions will be made on the programmed priority channel, no matter where the selector knob is positioned. No transmissions will be allowed on scanned calls.

Priority Look Back Scan

Rx: The radio will receive calls on its selected and priority channel. While the radio is receiving a call on its selected channel, it will look for a call from the programmed priority channel. If a call is detected on the priority channel, the radio will leave the current call and receive the priority call. After the priority call has ended, the radio remains on the priority channel for the programmed Scan Hang Time. When the Look Back Time expires, the radio will go back to the selected channel and resume Priority Look Back Scan.

Tx: The radio will only transmit on the selected channel. While transmitting, all receive operations will be disabled. Transmission will be allowed on the priority channel only after receiving a priority call.

Vacant Channel Scan

Rx: Conventional operation on the selected channel occurs.

Tx: The radio will step through the scan list and transmit on the first non-busy channel.

Nuisance Delete

If a channel contained in the scan list is constantly being scanned because of unwanted "chatter", you can temporarily delete the channel from your list by pressing the appropriate option button, (usually the monitor button). Nuisance delete can only be initiated when scan is active and the radio has finished receiving the call on the channel to be deleted. Nuisance Delete can be deactivated for all channels by turning scan off.

System Requirements

- IBM® compatible computer (486 or faster)
- 8 MB of RAM (16 MB recommended)
- 1MB of hard disk space
- 1.44MB floppy disk drive
- Windows® 95 Rel. 2 or later operating system
- Communications Port
- RS232 Serial Cable

Programming

Introduction

The programmer for the SP-150 (ACC-901 Software Assembly and the ACC-2001 Programming Kit) is sold separately and enables the parameters of the radio to be read, modified, programmed and printed.

The following features can be programmed into the radio by using the ACC-901 Software Assembly and the ACC-2001 Programming Kit:

Embedded Messaging

Embedded messaging is a programming feature which allows an unlimited custom text message to be programmed into the radio.

Password Protection

Password Protection is a programming feature which prevents any person from reading the current radio program without the correct password.

The programmer consists of the following items:

ACC-901 Software Assembly (P/N: 820-030-0027)

- Programming Software: 820-130-0027
- Programming Manual: 680-110-0024

ACC-2001 Programming Kit (P/N: 480-010-0013)

- ACC-2001 Interface Module: 510-050-0021
- SP-150 Programming Cable: 950-020-0011
- SM-6000 Programming Cable: 950-020-0009
- SM-6000 Audio Test Cable: 920-015-0006

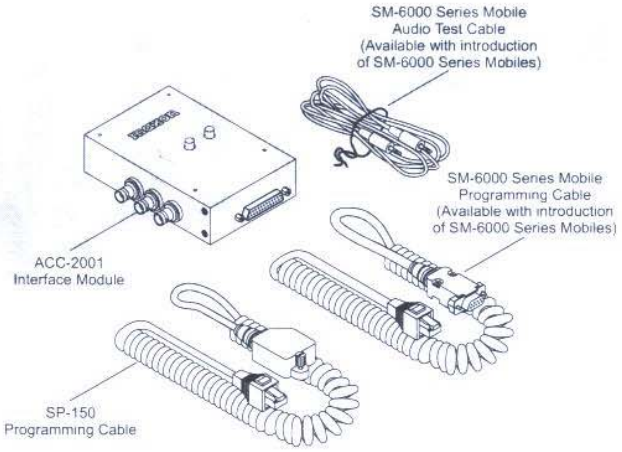


Figure 3-2 ACC-2001 Contents

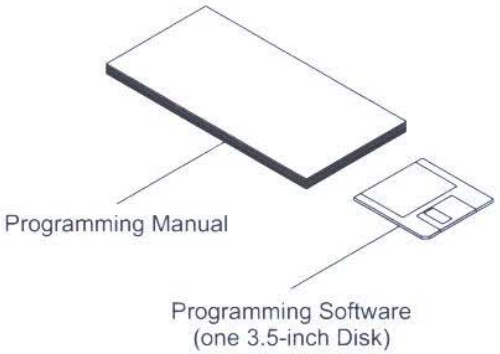


Figure 3-3 ACC-901 Contents

Accessory Operation

ACC-701 Speaker/Microphone

The ACC-701 is the Speaker/Microphone accessory for the SP-150 radio and is sold separately.

- Note: When the ACC-701 is connected, the microphone and speaker on the radio are inoperative, however, the PTT on the radio will continue to operate normally.

Components and Functions

1. Clip: Used to attach to a pocket or collar.
2. PTT: Press to transmit, release to receive.
3. Microphone: Used to transmit voice.
4. Speaker: Used for listening to a received call.
5. Connector: Connects the ACC-701 to the radio.
6. Fastening Screw: Used to secure the ACC-701.

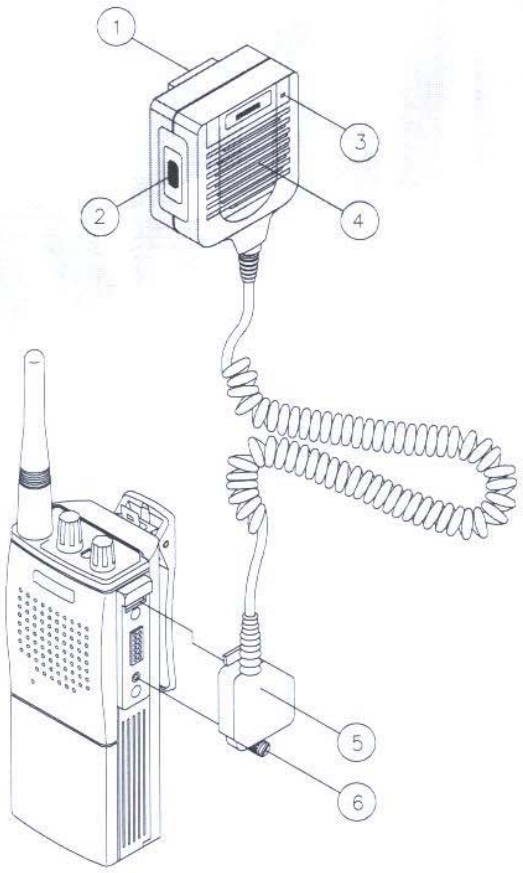


Figure 3-4 ACC-701 Installation

Theory of Operation 4

1 Introduction

1.1 Purpose

This document defines the Circuit Description (or Theory of Operation) for the SP-150 radio. This information is intended primarily for use by dealers and end-users, and is part of the radio's service manual. At the same time, it provides a description of the circuit theory and analysis of the SP-150 hardware design.

1.2 General Description

The UHF and VHF scanning hand-held series of radios is comprised of one main PCB. The main PCB contains the RF and digital circuits. The digital circuits include the microprocessor, digital control, and the audio base-band processing. The RF circuits include the transmitter, the PLL synthesizer, and the receiver.

2 Digital Circuits

2.1 Power Supplies

The battery pack supplies unregulated 7.5 V DC to the radio from a multi-cell battery pack. Some circuitry is fed directly from the battery because of voltage and current requirements. For the rest of the RF and digital circuitry the battery voltage is fed to U15, a 5 V voltage regulator, which takes +7.5 V input and supplies +5.0V, 100 mA output.

When RX_EN is active (low), RX +5V enables the receive circuitry. When TX_EN is active (low), TX +5V enables the transmit circuitry.

2.2 V_{REF} Supply

The Audio ASIC (U1-14) supplies a V 2.5 V DC to various Op Amps, Analog Multiplexer/Demultiplexer, and resistor components.

2.3 Control System

The microprocessor (U3) is operated by an external 38.4-kHz crystal (Y1), which is internally scaled to the operating frequency of 2 MHz. The software programming is stored and accessed in non-volatile FLASH memory (U6). The read and write signals to U6 are controlled through decode logic (U4B, C, D).

2.4 PTT Control Circuit

The PTT switch on the left side of the radio pulls J2-2 to ground when activated. It drives the microprocessor input (U3-6) low. Provision also exists for an external PTT through J3-9 in the case of an external speaker/mic accessory.

2.5 Option 1/Option 2 Button Controls

The Option 1 and Option 2 switches are mounted on the PTT assembly and enter J2-1and 3 respectively before directly driving the microprocessor (U3-8,9). These functions are enabled or disabled by the ACC-901 Programming Software.

2.6 Channel Select and Volume-Control Circuits

One of 16 channels may be selected using the channel switch (S1) on the top panel. The channel switch encodes the channel number selected into a 4-bit binary code. The binary code plus one is equal to the channel number. The binary is decoded by the microprocessor (U3-16, 17, 18, 19) enabling the appropriate Rx or Tx frequency.

The volume is controlled by potentiometer U9R1. Its analog output is read by the ASIC AD2 port (U1-6), where it is converted to digital and read by the microprocessor through the serial port.

2.7 External Speaker/Mic Control Circuit

The external microphone is connected to J3 on the right side of the radio. When an external microphone accessory is attached, it pulls the MIC_DSBL(not) line (J3-10) to ground which unbiases the internal microphone element. When an external speaker accessory is attached, it pulls the SPKR_DSBL(not) line (J3-6) to ground which breaks the path to the internal speaker.

2.8 Low-Battery Detect Circuit

The low-battery detect circuit applies a voltage, determined by (V_ * (R12/[R12+R13])), to the AD3 port of the ASIC (U1-7). The ASIC converts this analog voltage to a digital byte, which the microprocessor reads through the ASIC serial data path. When the

value of AD3 falls below a pre-defined threshold, the microprocessor disables the transmitter. If the alerts are programmed to be on, the low-battery alert LED (DS1-RED) flashes four times and the tone alert is sounded four times.

2.9. Sub-audible (LTR/CTCSS/DCS) Decode Circuits

Discriminator audio from the IF chip, U11-9, passes through a 3rd order, 500-Hz, Bessel, low-pass filter with a gain of 2.5 (U17A and associated components). The filter output goes into the Audio ASIC (U1-3) as Rx data input (RDIN). The data exits the ASIC at U1-23 (FLTOUT) and passes through a 3rd order, 500-Hz, Chebyshev, low pass filter (U17B and associated components) to strip out switched-capacitor clock noise.

For CTCSS, the Rx data is fed into the ASIC comparator COMPIN+ port (U1-22). The ASIC DAC2 output (U1-10) drives the non-inverting input of U17A-3 to set the DC average. The comparator output (U1-21) then feeds the microprocessor (U3-71) input capture port for CTCSS decoding.

For DCS and LTR, the Rx data on the ASIC Filter Output (U1-23) is directly decoded by the microprocessor's A-to-D port (U3-25). The microprocessor determines whether the data matches a preset value and then controls the speaker output based on the squelch data results.

2.10. Sub-audible (LTR/CTCSS/DCS) Encode Circuits

During Tx encode, the Sub-audible tone signals are generated on the TXSAT pulse-width port of the microprocessor (U3-3). They pass through a 500 Hz low-pass filter and are sent to the TDIN port of the ASIC (U1-4). The Tx data exits the ASIC at U1-23 (FLTOUT) and is then fed back into the ASIC comparator COMPIN+ port (U1-22) where it is summed with the Tx audio.

DTMF, Two-Tone, or Sel-Call data is generated by the microprocessor pulse-width port U3-2 and passes through a 4.5-kHz low pass filter. The Sub-audible data then enters the ASIC DTMF port (U1-25) where it is routed through the Tx Audio path.

2.11 Rx Audio

Discriminator audio from the IF chip (U11-9) is fed into Multiplexer U2B-3 and then to the ASIC MICAUDIN port (U1-29). The RXAUDOUT exits the ASIC at U1-28 and is amplified by U12 and U13 in a balanced audio bridge-amp to generate a minimum of 700 mW through a 16 Ω speaker.

2.12 Tx Audio and Filter Circuits

The Tx audio from the internal or external microphone is fed into Multiplexer U2B-5 and then to the ASIC MICAUDIN port (U1-29). The combined Tx audio and data exits the ASIC at the MOD1 (U1-1) and MOD2 (U1-32 for UHF) or MOD3 (U1-31 for VHF) output ports to directly control the VCO and TCXO FM modulation.

3 RF Circuits

3.1 TRANSMITTER

3.1.1 Buffer

The VCO output (A4-6) level of -6 dBm is amplified to +10 dBm (UHF) or +6 dBm (VHF). The buffer includes Q30 and Q31 for gain and isolation.

3.1.2 PA Module

The PA Module is a three-stage amplifier. Q501 amplifies the Tx signal from +10 dBm to 100 mW and Q502 amplifies it further by 7 dB to 0.5 W. Finally, Q503 amplifies it by 10.8 dB to approximately 6 W and matches it to 50 ohms using an LC network, reducing the harmonics to 30 dBc

3.1.3 Low-Pass Filter

C133, L7, C135, C136, L8, C137, C138, L9, C139 make up a 6 order, Elliptic, 550-MHz (UHF) low pass filter suppressing unwanted harmonics by 65 dBc. For VHF C134 is added. There is a loss of approximately 0.9 dB for this stage, giving an output power of 5 W.

3.1.4 Antenna Switch

In transmit, pin diodes D12 and D13 are forward biased and enable the RF signal to pass to the antenna.

3.1.5 Automatic Power Control (APC)

The APC keeps the current constant to the final PA stage (Q503). The current into Q503 of the PA Module is sensed across resistor R164. The voltage difference across R164 is amplified through U14 by the ratio of R169 to R165. The U18 Op Amp acts as a lead/lag loop filter comparing the output of U14 to the radio's output power setting from the ASIC DA2 port (U1-10). The U19 Op Amp mimics a VCO as an integrator and the U20 Op Amp is a voltage follower, which generates the supply current to the 2 stage amplifier in the PA (Q502).

During transmit, ground is supplied to the Automatic Power Control circuitry (**APCGND**). When not in transmit, this path is open to prevent battery leakage.

3.2 PLL SYNTHESIZER

3.2.1 14.95-MHz TCXO

The UHF 14.95-MHz, Voltage Controlled, Temperature Compensated, Crystal Oscillator (Y2) provides the reference to the PLL, has a frequency stability of 1.5 PPM, and a frequency adjust of 6 PPM.

3.2.2 PLL IC Dual-Modulus Pre-Scaler

The MC145190 (U8) divides the 14.95-MHz TCXO input frequency, at U8-20, down to 5 or 6.25 kHz. This is done by the internal reference counter, R, at the internal Phase-Frequency Detector input, f. The VCO output, PLL_FIN, enters U8-11, f (FIN), and is divided by 64, A, and N until the feedback frequency, f, entering the Phase-Frequency Detector equals 5 or 6.25 kHz. If f is leading f, then current-sinking pulses are output on PD (U8-6) to the passive low-pass filter (C117, R141, C118, R142) to lower the frequency of the VCO. If f is lagging f, then current-sourcing pulses are output on PD to increase the frequency of the VCO. The LPF settling time, when the VCO frequency is within 1 kHz of the RF frequency, is 10 ms. This reduces the residual sideband noise for the best signal-to-noise ratio.

To obtain the Tx or Rx VCO frequency the A, N, and R counters are programmed into the PLL by serial data from the microprocessor. Output port U8-1 (OSO) is used to generate the ASIC clock by f/4 = 14.95 MHz/4 = 3.7375 MHz.

3.2.3 DC to DC Converter

U7 is a switched-capacitor voltage converter that converts +5 V at U7-3 up to +10 V at U7-8. Q21 and R127 are configured as an emitter follower to generate a stable +9 V at the VPD input of the PLL (U8-5). This powers the internal phase-frequency detectors.

3.2.4 Dual VCO

The dual VCO module (A4) contains an Rx VCO and a Tx VCO. They are configured as Colpits oscillators and connected to power through cascade buffers. Only one VCO (Rx or Tx) is selected at a time. The power source to each block is switched by transistors Q29 and Q35, and is dependent on the states of TX_EN and RX_EN. The varicap diodes D201 and D301 produce a change in frequency with a change in voltage. L203 and L303 are resonant tuning coils, which adjust the operating frequency with specified DC tuning voltage applied. The D202 modulation diode modulates the Tx VCO RF signal.

3.3 RECEIVER

3.3.1 Front End

During receive, pin diodes D12 and D13 are reversed biased and pass the RF signal from the antenna through L10 and R184 to the Hybrid-Receiver Front End Module (A1-1) with minimum signal loss. Inside the module, the signal is band-pass filtered, amplified through Q601, and band-pass filtered again. The output at A1-6 is then coupled to the double-balanced mixer.

3.3.2 First Mixer

The RF signal from the Front End is mixed with the 1-Local Oscillator (from the Rx VCO) by T1, T2, and D18, to produce a 1-IF frequency of 45.3 MHz. The resulting signal passes through the 45.3-MHz, 4-pole, monolithic crystal filter (FL5, FL4) to reduce the adjacent spurious signals and provide maximum channel selectivity characteristics. Additionally, a 50 ohm shunt load to ground (R225, L23, and C214) dumps unwanted signals reflected back from the 45.3 MHz impedance match.

3.4 Second Local Oscillator, Mixer, Limiter, FM Detector, and Tripler

The RF signal is amplified by Q43 (1-IF amp) and coupled by C205 to the input of the IF chip at U11-16. U11 is a monolithic FM IF detector containing a mixer, a 2-LO buffer amplifier, a 2-IF amplifier and limiter, an RSSI level indicator, and a quadrature detector.

Inside U11, the 2-LO (44.85 MHz) is mixed with the 45.3-MHz IF to produce a 450-kHz 2-IF. The signal is amplified and then filtered through ceramic filters FL1 and then FL2 or FL3, to provide the necessary selectivity for narrow or standard channel spacing. The signal is detected by U11, then output as an audio frequency (AF) signal on U11-9.

The 2-LO input, U11-1, is generated by a tripler circuit. The 14.95 MHz VCTCXO frequency is amplified by Q24 and the 3 harmonic is filtered by L15, C186, C187, L16, C188, L17, C189 (2 LO = f * 3 = 14.95 MHz * 3 = 44.85 MHz).

3.5 Squelch (mute) Circuit and RSSI

A 4 order high-pass filter (U10, U16A, B, and associated components) extracts the noise component from the AF output of U11-9. The noise is amplified and precision rectified by U16C, D and D19 to produce a DC voltage corresponding to the noise level. The DC signal from the squelch circuit goes to the analog port of the microprocessor (U3-26).

RSSI is sent directly from the IF chip, U11-12, through a 3 order, 250-Hz, low pass filter (U17D and associated components) into the microprocessor analog port (U3-27). Based on RSSI and Squelch, the microprocessor determines whether a mute or unmute condition has been satisfied, by comparing the input voltages to the set threshold values in software. The microprocessor digital output port (U3-7) is the Audio-Amp-Enable signal, which enables or disables the 7.5-V power supply to the audio bridge amplifier.

Maintenance 5

Disassembly Procedure

Any repair or adjustment should only be made by or under the supervision of a qualified Radio Service Technician.

When removing or fitting, use the Exploded View and Parts List (Page 9-1) in conjunction with the following procedures.

Removing & Replacing the Belt Clip

Removing the belt clip:

1. Depress the metal release tab located on the top of the belt clip with one hand.
2. With the other hand push the belt clip out of the belt clip rail.

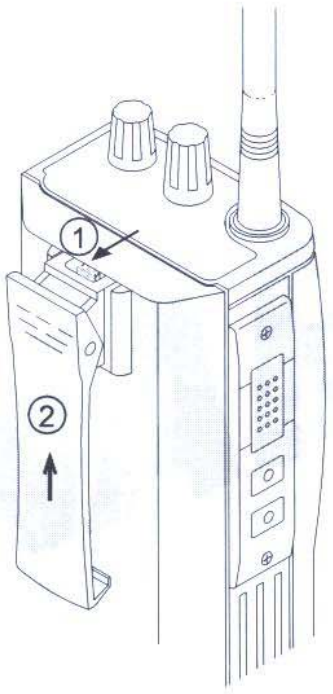


Figure 5-1 Belt Clip Removal

To replace the belt clip:

1. With the slides of the belt clip positioned in line with the belt clip guide rails, slide the belt clip into position until a click is heard.

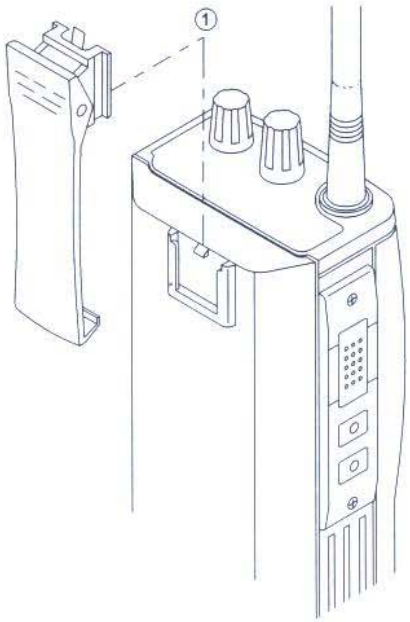


Figure 5-2 Belt Clip Installation

Removing & Replacing the Battery

To remove the battery:

1. Holding the radio chassis in one hand, press and hold the battery release catch on the bottom side.
2. Using the other hand, slide the battery toward the battery release catch.
3. Remove the battery from the radio.

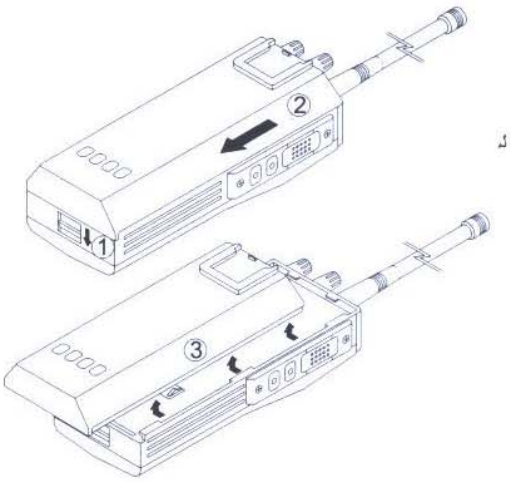


Figure 5-3 Battery Removal

To replace the battery:

1. Position the battery in line with the radio battery guide rails.
2. Slide the battery into position until a click is heard.

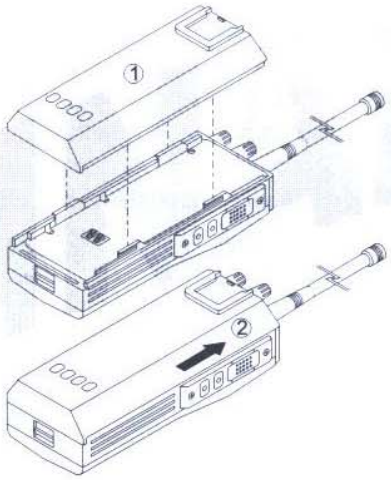


Figure 5-4 Battery Installation

Removing & Replacing PTT Assy.

To remove the PTT assembly:

1. Remove the 2 screws located at the top and bottom of the PTT switch holder housing. This will allow removal of the PTT holder (A) and PTT pad (B).
2. By placing thumb under bottom of the PTT assembly and gently pulling outward, unplug PTT Assembly from Main Board.

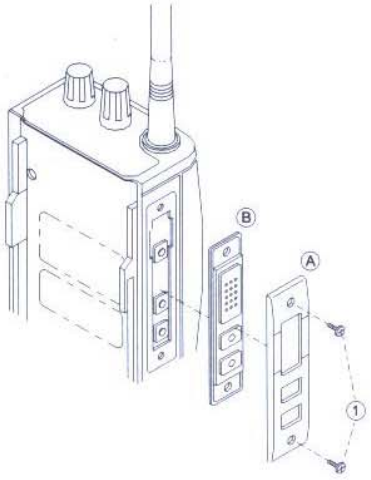


Figure 5-5 PTT Removal

To replace the PTT assembly:

1. Reverse the steps taken to remove the PTT assembly.

2. Insure that the PTT jack is aligned properly when inserting into Main Board.

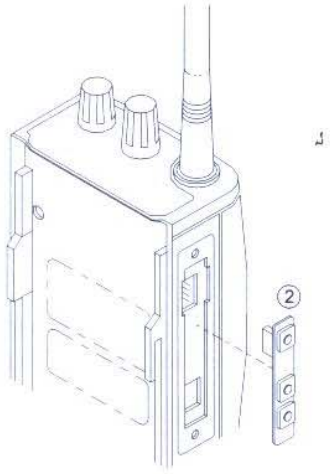


Figure 5-6 PTT Installation

Removing & Replacing the Accessory Connector

To remove the Accessory Connector:

1. Remove the Accessory Connector Cover (Item 2) by removing the screw (Item 1).

2. Remove the Accessory Connector (Item 5) by removing the two screws (Items 3 & 4) and pulling outwards on the Connector (Item 5).

To replace the Accessory Connector:

1. Reverse the steps taken to remove the Accessory Connector.

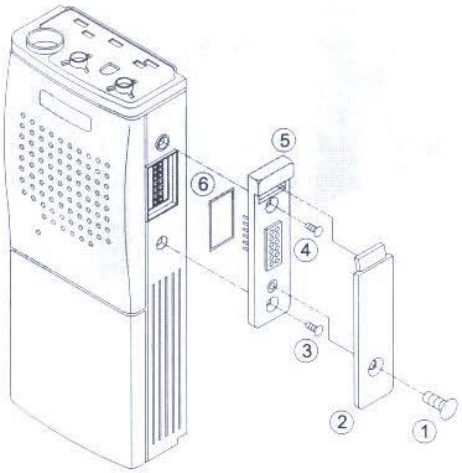


Figure 5-7 A/C Removal & Installation

Removing & Replacing the Antenna & Control Knobs

To remove the Antenna:

1. Turn the Antenna counterclockwise and unscrew to remove.

To replace the Antenna:

1. Reverse the steps taken to remove the Antenna.

To remove the Control Knobs:

1. Grip the control knobs firmly between thumb and index finger and pull in a straight upward direction.

To replace the Control Knobs:

1. Reverse the steps taken to remove the Control Knobs.

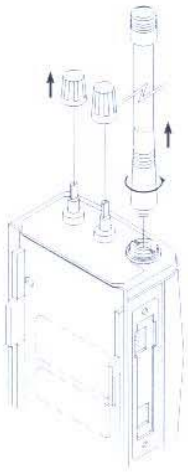


Figure 5-8 Control Knob Removal & Installation

Removing & Replacing the Back Cover

To remove the Back Cover:

1. Remove battery. (Refer to Removing & Replacing the Battery)

2. Unscrew the six back cover mounting screws located on the back cover of the radio.

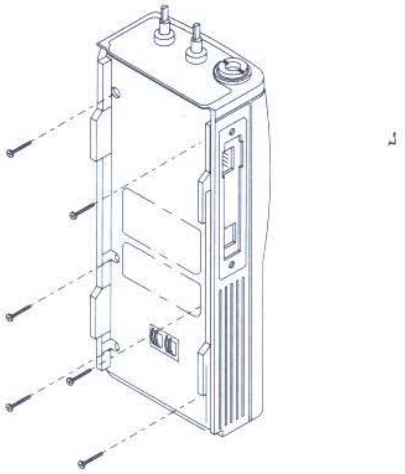


Figure 5-9 Back Cover Removal & Installation

3. Insert a small straight (Flat Head) screwdriver blade between the back cover and the radio chassis.

4. Gently pull backward with the screwdriver until the back cover has been unsnapped from the chassis.

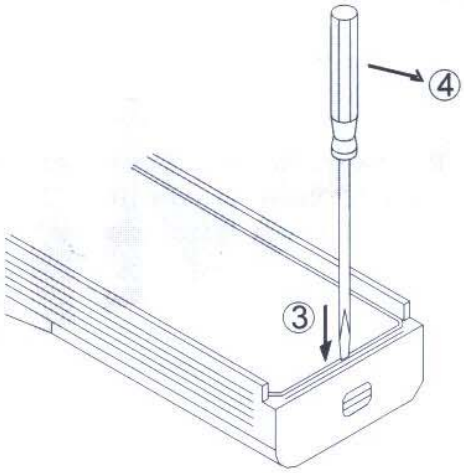


Figure 5-10 Back Cover Removal & Installation

5. The back cover can now be removed by pulling the back cover away from the radio chassis. The self forming gasket ring (A) should remain on the back cover.

To replace the Back Cover:

1. Reverse the steps taken to remove the back cover.

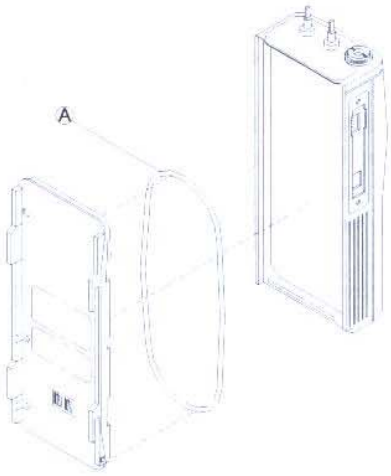


Figure 5-11 Back Cover Removal & Installation

Removing & Replacing the Main Board

To remove the Main Board:

1. Remove the Battery (Refer to Removing & Replacing the Battery).
2. Remove the PTT Assembly (Refer to Removing & Replacing the PTT Assembly).
3. Remove the Accessory Connector (Refer to Removing & Replacing the Accessory Connector).
4. Remove the Antenna & Control Knobs (Refer to Removing & Replacing the Antenna & Control Knobs).
5. Remove the Back Cover (Refer to Removing & Replacing the Back Cover).
6. Insert a small straight (Flat Head) screwdriver blade between the Main Board and the radio chassis.
7. Gently pull backward with the screwdriver until the Main Board has been unsnapped from he lower section of the chassis.
8. It may be necessary to pull the Main Board up a little more to gain easier handling for removal.

! CAUTION !

If performing step 8, insure that the screwdriver is placed on the metal frame of the Main Board and not directly on the Main Board PCB. Damage to the Main Board and Microprocessor could occur.

9. Insert a small straight (Flat Head) screwdriver blade between the Main Board and the radio chassis.
10. Gently push outward with the screwdriver until the Option Jack is clear of the chassis holes and the Main Board unsnaps from the chassis.

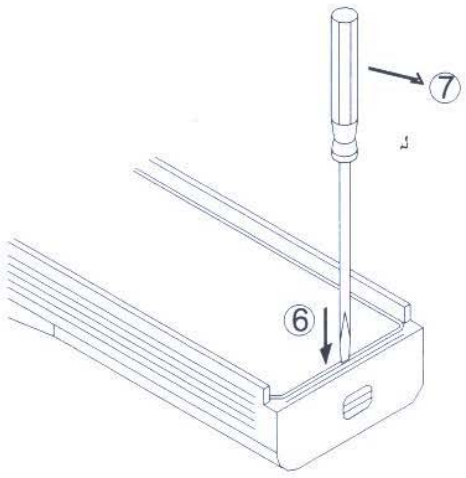


Figure 5-12 Main Board Removal & Installation

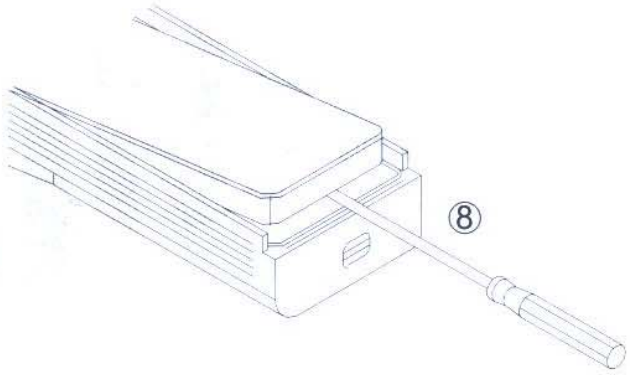


Figure 5-13 Main Board Removal & Installation

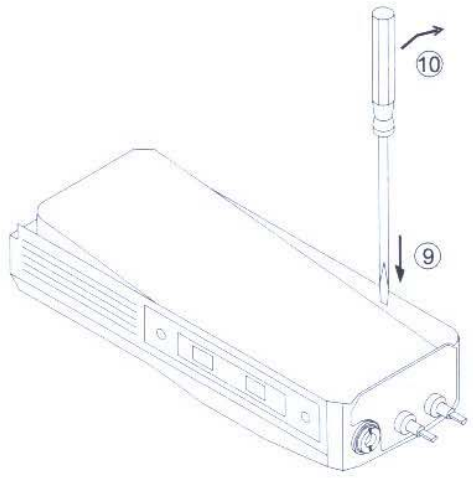


Figure 5-14 Main Board Removal & Installation

11. Continue to apply slight pressure against the chassis so that the Option Jack will clear the chassis.

12. Grip the Main Board near the indicated arrows as shown in Figure 5-15.

13. Gently work the Main Board in an up & down motion and pull in the direction indicated by the arrow in Figure 5-15.

! CAUTION !

Do not use excess force when removing the Main Board from the chassis. Damage to the speaker connection could occur.

NOTE

It is not necessary to remove the stud mount antenna jack from the radio.

14. Remove the Speaker wire connector from the Main Board connector.

To replace the Main Board

1. Reverse the steps taken to remove the Main Board.

2. When installing the Main Board into the chassis insure that the LED light guide is aligned properly.

3. When installing the Main Board into the chassis, place 2 fingers over the black rubber control knob dust covers to insure that the dust covers do not get pushed out of the appropriate seating position.

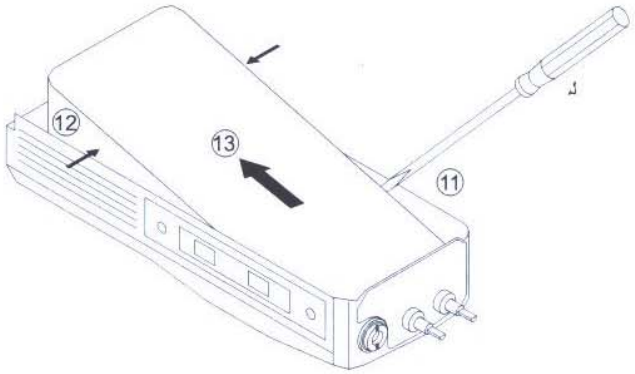


Figure 5-15 Main Board Removal & Installation

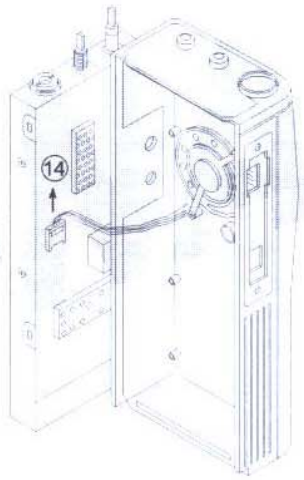


Figure 5-16 Main Board Removal & Installation

Removing & Replacing the Daughter Boards

The Daughter Boards are soldered into the Main Board Assembly.

1. Remove the Main Board (Refer to Removing & Replacing the Main Board).

2. Unsolder the appropriate Daughter Board from the Main Board Assembly.

To Replace a Daughter Board:

1. Ensure that the Main Board Assembly and Daughter Board are mechanically clean.

2. Insert the daughter board in the required position.

3. Ensure the Daughter Board is properly seated in the Main Board Assembly.

4. Solder the Daughter Board into position.

! CAUTION !

To avoid damage to the Main Board Assembly, soldering must be accomplished quickly. Refer to Component Replacement section of manual located on page 5-8.

If it becomes necessary to replace the V.C.O. module it is recommended that the radio be sent to Maxon America, Inc. for service.

Removing & Replacing the Speaker

To remove the speaker:

1. Remove the Main Board (Refer to Removing & Replacing the Main Board).

2. Unscrew the two speaker mounting bracket screws from the chassis.

3. Desolder the two pin wire harness from the speaker.

4. Remove the speaker.

To replace the speaker

1. Reverse the steps taken to remove the speaker.

Component Replacement

Surface Mount Components

Surface mount components should always be replaced using a temperature controlled soldering system. The soldering tools may be either a temperature controlled soldering iron or a temperature controlled hot-air soldering station. A hot-air system is recommended for the removal of components on these boards. With either soldering system, a temperature of 700° F (371° C) should be maintained.

The following procedures outline the removal and replacement of surface mount components. If a hot-air soldering system is employed, see the manufacturer's operating instructions for detailed information on the use of your system.

! CAUTION !

Avoid applying heat to the body of any surface mount component using standard soldering methods. Heat should be applied only to the metalized terminals of the components. Hot-air systems do not damage the components since the heat is quickly and evenly distributed to the external surface of the component.

! CAUTION !

The CMOS Integrated Circuit devices used in this equipment can be destroyed by static discharges. Before handling one of these devices, service technicians should discharge themselves by touching the case of a bench test 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 equipment should have a known good earth ground.

Surface Mount Removal

1. Grip the component with tweezers or small needle nose pliers.

2. Alternately heat the metalized terminal ends of the surface mount component with the soldering iron. If a hot-air system is used, direct the heat to the terminals of the component. Use extreme care with the soldering equipment to prevent damage to the printed circuit board (PCB) and the surrounding components.

3. When the solder on all terminals is liquefied, gently remove the component. Excessive force may cause the PCB pads to separate from the board if all solder is not completely liquefied.

4. It may be necessary to remove excess solder using a vacuum de-soldering tool or Solder wick . Again, use great care when de-soldering or soldering on the printed circuit boards. It may also be necessary to remove the epoxy adhesive that was under the surface mount component and any flux on the printed circuit board.

Surface Mount Component Replacement

1. "Tin" one terminal end of the new component and the corresponding pad of the PCB. Use as little solder as possible.

2. Place the component on the PCB pads, observing proper polarity for capacitors, diodes, transistors, etc.

3. Simultaneously touch the "tinned" terminal end and the "tinned" pad with the soldering iron. Slightly press the component down on the board as the solder liquefies. Solder all terminals, allowing the component time to cool between each application of heat. Do not apply heat for an excessive length of time and do not use excessive solder.

   With a hot-air system, apply hot air until all "tinned" areas are melted and the component is seated in place. It may be necessary to slightly press the component down on the board. Touch-up the soldered connections with a standard soldering iron if needed. Do not use excessive solder.

! CAUTION !

Some chemicals may damage the internal and external plastic parts of the radio.

4. Allow the component and the board to cool and then remove all flux from the area using alcohol or another approved flux remover.

Surface Mounted Integrated Circuit Replacement

Soldering and de-soldering techniques of the surface mounted IC's are similar to the above outlined procedures for the surface mounted chip components. Use extreme care and observe static precautions when removing or replacing the defective (or suspect) IC's. This will prevent any damage to the printed circuit board or the surrounding circuitry.

The hot-air soldering system is the best method of replacing surface mount IC's. The IC's can easily be removed and installed using the hot-air system. See the manufacturer's instructions for complete details on tip selection and other operating instructions unique to your system. If a hot-air system is not available, the service technician may wish to clip the pins near the body of the defective IC and remove it. The pins can then be removed from the PCB with a standard soldering iron and tweezers, and the new IC installed following the Surface Mount Component Replacement procedures. it may not be necessary to "tin" all (or any) of the IC pins before the installation process.

Troubleshooting Guide

General Requirements

The following equipment is required for troubleshooting:

Maxon Accessory Requirements

- ACC-901 Programming Software (P/N: 820-030-0027)
- ACC-2001 Programming Kit (P/N: 480-010-0013)
- ACC-902 Maintenance Software (P/N: 820-030-0025)

Computer System Requirements

- IBM® compatible computer (486 or faster)
- 8 MB of RAM (16 MB recommended)
- 1MB of hard disk space
- 1.44MB floppy disk drive
- Windows® 95 Rel. 2 or later operating system
- Communications Port
- RS232 Serial Cable

Test Equipment Requirements

- 3 Ampere Power Supply and cables
- Communications Service Monitor (HP-8920B, IFR Comm120, IFR 1200, IFR 500A or equivalent)
- Analog or Digital Oscilloscope
- Volt Meter (Digital or Analog Meter)
- Stud Mount to BNC Antenna Adapter

Optional Test Equipment:

- Sinadder
- Spectrum Analyzer
- Watt Meter (Bird 43 or equivalent with appropriate band slugs)

Receiver

No Receive

- Set test equipment for proper frequency and tone options (if any)
- Does the LED show yellow or green?
- LED is yellow, check audio amp and audio amp enable, if tone channel check programming and decoder circuits.
- LED is green, check audio amp and audio amp enable
- LED is off

✓ Check C140, L10 and the antenna connector for opens and shorts

✓ Check Q41 for proper voltages

✓ Is the base low? No, check pin 69 of U3

✓ Is the collector high? No, check pin 1 of U15

✓ Is the emitter high? No, check for short on emitter then replace Q41

✓ Check A1 for proper voltages

✓ Is pin 4 high? No, check for open R185 or L14

✓ Check A1 for gain

✓ Does A1 exhibit gain of at least 10dB? No, replace A1

✓ Check the mixer circuit for proper operation

✓ Is the Local Oscillator signal present on T1 pin 4? No, check Q36 for proper voltages. Check path from Q36 to T1

✓ Can the RF frequency be injected on T2 pin 4 and recovered? No, check T1, T2 and D18 for opens and shorts.

✓ Check the I.F. filters for proper operation

✓ Can a 45.3 MHz signal be injected on Q43 base and recovered? No, check Q43

✓ Can a 45.3 MHz signal be injected on T2 pin 2 and recovered? No, check FL4 and FL5 and associated components for opens and shorts.

✓ Check Q43 for proper voltages

- ✓ Is the collector approximately 3.30 volts? No, check L20, R223 and R222 for open then short on Q43 collector
- ✓ Is the base approximately 0.80 volts? No, check R224 for open then replace Q43.
- ✓ Check U11 for proper voltage
- ✓ Is pin 4 approximately 3.9 volts? No, check L18 and R221 for open then short on U11pin 4.
- ✓ Check U11 for proper signals
- ✓ Does pin 1 have the second L. O. frequency present? No, check Q24 for tripler output and proper DC voltages and 44.85 MHz BPF for opens
- ✓ Does pin 9 have recovered audio or noise present? No, check Y4 for proper operation
- ✓ Can a 450 kHz signal be injected at pin 5 and recovered? No, replace U11
- ✓ Can a 450 kHz signal be injected at pin 3 and recovered? No, check signal path through FL2 for standard spacing and FL3 for narrow spacing
- ✓ Can a 45.3 MHz signal be injected at pin 16 and recovered? No, replace U11
- ✓ Check U1 pin 29
- ✓ Is audio present? No, check U2 pin 4
- ✓ Is audio on pin 4? No, check pins 3 and 9 for proper signals
- ✓ Is audio on pin 3? No, check path back to U11 pin 9
- ✓ Check for audio output on U1 pin 28
- ✓ Is audio present? No, check volume control setting and wiper voltage, verify data between U3 and U1
- ✓ Check for audio output on U12 and U13 pin 5
- ✓ Is audio present? No, check U12 pin 2 and U13 pin 3
- ✓ Is audio present? No, check R33 and C21 and C29
- ✓ Is pin 6 of U12 and U13 at 7.5 VDC? No, check Q3 and Q2 for proper voltages
- ✓ Check Q4 and Q5 for audio output
- ✓ Is audio present on the Drains of Q4 and Q5? No, check voltages on Q4 and Q5. Drain must be high with no accessory present. Replace defective device.
- ✓ Check the speaker
- ✓ Is audio present on the speaker terminals? No, check the wiring harness.
- ✓ Is the speaker approximately 16 ? No, replace the speaker.

Low Sensitivity

- ✓ Check C140, L10 and the antenna connector for opens and shorts
- ✓ Check A1 for proper voltages
- ✓ Is pin 4 high? No, check for open R185 or L14
- ✓ Check A1 for gain
- ✓ Does A1 exhibit gain of at least 10dB? No, replace A1
- ✓ Check the mixer circuit for proper operation
- ✓ Is the Local Oscillator signal present on T1 pin 4? No, check Q36 for proper voltages. Check path from Q36 to T1
- ✓ Can the RF frequency be injected on T2 pin 4 and recovered? No, check T1, T2 and D18 for opens and shorts.
- ✓ Check the I.F. filters for proper operation
- ✓ Can a 45.3 MHz signal be injected on Q43 base and recovered? No, check Q43
- ✓ Can a 45.3 MHz signal be injected on T2 pin 2 and recovered? No, check FL4 and FL5and associated components for opens and shorts.
- ✓ Check Q43 for proper voltages
- ✓ Is the collector approximately 3.30 volts? No, check L20, R223 and R222 for open then short on Q43 collector

- ✓ Is the base approximately 0.80 volts? No, check R224 for open then replace Q43.
- ✓ Check U11 for proper voltage
- ✓ Is pin 4 approximately 3.9 volts? No, check L18 and R221 for open then short on U11.4
- ✓ Check U11 for proper signals
- ✓ Does pin 1 have the second L. O. frequency present? No, check Q24 for tripler output and proper DC voltages and 44.85 MHz BPF for opens
- ✓ Does pin 9 have recovered audio or noise present? No, check Y4 for proper operation
- ✓ Can a 450 kHz signal be injected at pin 5 and recovered? No, replace U11
- ✓ Can a 450 kHz signal be injected at pin 3 and recovered? No, check signal path through FL2 for standard spacing and FL3 for narrow spacing
- ✓ Can a 45.3 MHz signal be injected at pin 16 and recovered? No, replace U11

Transmitter

No Transmit Power Out

- ✓ Check programming for TX inhibit
- ✓ Check Q30 for proper operation
- ✓ Is Q30 biased properly? No check L4, R147 and R 148 for shorts and opens.
- ✓ Does Q30 have the transmit frequency present on the base? No, check C124.
- ✓ Does Q30 have the transmit frequency present on the collector? Replace Q30.
- ✓ Check Q31 for proper operation
- ✓ Is Q31 biased properly? No, check L5, R153, R154 and R155. Verify Q27 is on.
- ✓ Does Q31 have the transmit frequency present on the base? No, check path between Q30 and Q31
- ✓ Does Q31 have the transmit frequency present on the collector? Replace Q31.
- ✓ Check the power amplifier, A1
- ✓ Is the RF frequency present at A1 pin 6? No, check the input at A1 pin 1.
- ✓ Is the amplifier module properly biased? No, check Q23 for proper bias.
- ✓ Is the voltage at A1 pin 5 approximately B+? No, check R164.
- ✓ Is the RF frequency present at A1 pin 1? No, check C130.
- ✓ Does the amplifier have approximately 25 dB of gain? No, replace the A1 module.
- ✓ Check the low pass filter
- ✓ Is the RF frequency present at D12? No, check the path from A1 to D12 for opens and shorts.
- ✓ Check the RF switching circuit
- ✓ Are D12 and D13 properly biased? No, check L6 and R156 and R157. Check L10.
- ✓ Check the output coupling
- ✓ Check C140 and the antenna connector for opens and shorts

Low Power

- ✓ Check the power setting in the programming
- ✓ Check Q31 for proper operation
- ✓ Is Q31 biased properly? No, check L5, R153, R154 and R155. Verify Q27 is on.
- ✓ Does Q31 have the transmit frequency present on the base? No, check path between Q30 and Q31
- ✓ Does Q31 have the transmit frequency present on the collector? Replace Q31.
- ✓ Check the power amplifier, A1
- ✓ Is the RF frequency present at A1 pin 6? No, check the input at A1 pin 1.
- ✓ Is the amplifier module properly biased? No, check Q23 for proper bias.
- ✓ Is the voltage at A1 pin 5 approximately B+? No, check R164.

- ✓ Is the RF frequency present at A1 pin 1? No, check C130.
- ✓ Does the amplifier have approximately 25 dB of gain? No, replace the A1 module.
- ✓ Check the low pass filter
- ✓ Is the RF frequency present at D12? No, check the path from A1 to D12 for opens and shorts.
- ✓ Check the RF switching circuit
- ✓ Are D12 and D13 properly biased? No, check L6 and R156 and R157. Check L10.
- ✓ Check the output coupling

Radio Out of Lock

Radio Always Out of Lock

- ✓ Verify programming
- ✓ Check VCO for proper operation
- ✓ Is the RX VCO powered on? No, check Q41 for proper voltages.
- ✓ Check U8 for proper signals
- ✓ Is U8 pin 12 properly biased? No, check R137 and L3 for opens and shorts.
- ✓ Does U8 pin 11 have the local oscillator frequency present? No, check R160 and C144 for opens and shorts.
- ✓ Is the 14.95 MHz TCXO frequency present on pin 20 of U8? No, check the voltages on the TCXO and check R131 and C106 for opens and shorts. Verify 14.95 MHz output on TCXO Y5 pin 3
- ✓ Is the voltage on U8 pin 6 between 1.1VDC and 6.5 VDC, ramping or moving? No, check for open or short on pin 6.
- ✓ Is U8 pin 5 approximately 9VDC? No, check Q21 and U7 pin 8.
- ✓ Is the voltage measured on U8 pin 6 present on A4 pin 15? No, check R141 and R142. Verify C116, C117 and C118 are not shorted to ground.
- ✓ Is the base of Q25 high? No, check for short on base.
- ✓ Is the emitter of Q25 low? No, replace Q25.
- ✓ Are digital signals present on U8 pins 17, 18 and 19? No, check path back to microprocessor.
- ✓ Check Lock Detect signal at microprocessor
- ✓ Is U3 pin 20 low? No, verify path between Q25 and U3 pin 20.

Out of Lock during Transmit

- Verify programming
- ✓ Check VCO for proper operation
- ✓ Is the TX VCO powered on? No, check Q40 for proper voltages.
- ✓ Check U8 for proper signals
- ✓ Does U8 pin 11 have the transmit frequency present? No, check R146 and C123 for opens and shorts.
- ✓ Is the voltage on U8 pin 6 between 1.1VDC and 6.5 VDC, ramping or moving? No, check for open or short on pin 6.
- ✓ Are digital signals present on U8 pins 17, 18 and 19? No, check path back to microprocessor.
- ✓ Check RX Switching transistor Q41
- ✓ Is Q41 emitter low? No, replace Q41.

Audio

No Audio

- ✓ Check U1 pin 29
- ✓ Is audio present? No, check U2 pin 4
- ✓ Is audio on pin 4? No, check pins 3 and 9 for proper signals
- ✓ Is audio on pin 3? No, check path back to U11 pin 9
- ✓ Check for audio output on U1 pin 28

- ✓ Is audio present? No, check volume control setting and wiper voltage, verify data between U3 and U1
- ✓ Check for audio output on U12 and U13 pin 5
- ✓ Is audio present? No, check U12 pin 2 and U13 pin 3
- ✓ Is audio present? No, check R33 and C21 and C29
- ✓ Is pin 6 of U12 and U13 at 7.5 VDC? No, check Q3 and Q2 for proper voltages
- ✓ Check Q4 and Q5 for audio output
- ✓ Is audio present on the Drains of Q4 and Q5? No, check voltages on Q4 and Q5. Drain must be high with no accessory present. Replace defective device.
- ✓ Check the speaker
- ✓ Is audio present on the speaker terminals? No, check the wiring harness.
- ✓ Is the speaker approximately 16 ? No, replace the speaker.

Low Audio

- Verify programming for maximum audio and alert tone volume

Distorted Audio

- ✓ Check for audio output on U12 and U13 pin 5
- ✓ Is audio present? No, check U12 pin 2 and U13 pin 3
- ✓ Is audio present? No, check R33 and C21 and C29
- ✓ Is pin 6 of U12 and U13 at 7.5 VDC? No, check Q3 and Q2 for proper voltages
- ✓ Check Q4 and Q5 for audio output
- ✓ Is audio present on the Drains of Q4 and Q5? No, check voltages on Q4 and Q5. Drain must be high with no accessory present. Replace defective device.

Voltage Charts

Transmit Voltage			
Ref. #	E	B	C
Q1	0.00	5.00	0.00
Q2	7.50	7.50	0.70
Q3	0.00	0.00	8.00
Q4	1.10	0.70	0.50
Q5	1.10	0.70	0.50
Q6	0.00	4.30	0.00
Q7	5.00	0.00	0.00
Q8	0.00	5.00	5.00
Q9	5.00	5.00	5.00
Q10	0.00	5.00	0.00
Q11	0.00	0.00	0.00
Q12			
Q13			
Q14	0.00	0.00	5.00
Q15	5.00	5.00	0.00
Q16	0.00	0.00	5.00
Q17	7.50	6.80	7.50
Q18	0.00	7.00	0.00
Q19	0.00	0.00	0.00
Q20	0.00	7.50	7.50
Q21	9.30	9.80	9.80
Q22	0.00	4.60	0.00
Q23	7.50	6.70	7.30
Q24	0.00	0.00	0.00
Q25	5.00	5.00	0.00
Q26	0.00	4.80	0.00
Q27	7.60	0.00	6.90
Q28	0.00	0.00	4.30
Q29	4.30	4.90	4.90
Q30	1.40	2.10	4.90
Q31	0.00	0.80	4.50
Q32	7.50	6.80	7.30
Q33	3.20	7.00	7.60
Q34	0.00	4.90	0.00
Q35	0.00	0.00	0.00
Q36	0.00	0.00	0.00
Q37	4.90	4.30	1.30
Q38	1.20	1.80	1.30
Q39	0.00	5.00	0.00
Q40	5.00	0.80	4.90
Q41	5.00	5.00	0.00
Q42	0.00	4.70	0.00
Q43	0.00	0.00	0.00
Q44	0.00	0.00	0.00
Q45	0.00	4.80	0.00
Q46	0.00	0.00	5.00
Q47	5.00	5.00	0.00
Q48	5.00	0.00	5.00

Receive Voltage			
Ref. #	E	B	C
Q1	0.00	0.00	2.50
Q2	8.00	8.00	8.00
Q3	0.00	5.00	0.00
Q4	8.00	4.30	4.00
Q5	8.00	4.30	4.00
Q6	0.00	4.30	0.00
Q7	5.00	0.00	0.00
Q8	5.00	5.00	0.00
Q9	5.00	5.00	0.00
Q10	0.00	5.00	0.00
Q11	0.00	5.00	0.00
Q12			
Q13			
Q14	0.00	0.00	5.00
Q15	5.00	5.00	0.00
Q16	0.00	0.00	5.00
Q17	8.00	7.50	8.00
Q18	0.00	7.70	0.00
Q19	0.00	0.00	0.00
Q20	0.00	8.00	8.00
Q21	9.30	9.80	9.80
Q22	0.00	0.00	8.00
Q23	8.00	8.00	0.00
Q24	0.00	0.70	1.70
Q25	5.00	5.00	0.00
Q26	0.00	0.00	8.00
Q27	8.00	8.00	0.00
Q28	0.00	4.90	0.00
Q29	0.00	0.00	0.00
Q30	0.00	0.00	0.00
Q31	0.00	0.00	0.00
Q32	8.00	8.00	0.00
Q33	0.00	8.00	8.00
Q34	0.00	0.00	4.20
Q35	4.20	4.80	4.80
Q36	1.40	2.10	4.90
Q37	0.00	1.40	1.90
Q38	1.20	0.60	1.90
Q39	0.00	0.00	8.00
Q40	5.00	5.00	0.00
Q41	5.00	0.00	4.90
Q42	0.00	4.80	0.00
Q43	0.00	0.80	3.30
Q44	4.30	0.00	4.60
Q45	0.00	4.80	0.00
Q46	0.00	0.00	5.00
Q47	5.00	0.00	5.00
Q48	5.00	5.00	0.50

Standby Voltage			
Ref. #	E	B	C
Q1	0.00	0.00	2.50
Q2	8.00	8.00	0.70
Q3	0.00	0.00	8.00
Q4	1.10	0.70	0.50
Q5	1.10	0.70	0.50
Q6	0.00	4.30	0.00
Q7	0.00	0.00	5.00
Q8	5.00	5.00	0.00
Q9	5.00	5.00	0.00
Q10	0.00	5.00	0.00
Q11	0.00	0.00	0.00
Q12	0.00	5.00	0.00
Q13	0.00	5.00	0.00
Q14	0.00	0.00	5.00
Q15	5.00	5.00	0.00
Q16	0.00	0.00	5.00
Q17	8.00	7.50	8.00
Q18	0.00	7.70	0.00
Q19	0.00	0.00	0.00
Q20	0.00	8.00	8.00
Q21	9.30	9.80	9.80
Q22	0.00	0.00	8.00
Q23	8.00	8.00	0.00
Q24	0.00	0.70	1.70
Q25	5.00	5.00	0.00
Q26	0.00	0.00	8.00
Q27	8.00	8.00	0.00
Q28	0.00	4.90	0.00
Q29	0.00	0.00	0.00
Q30	0.00	0.00	0.00
Q31	0.00	0.00	0.00
Q32	8.00	8.00	0.00
Q33	0.00	8.00	8.00
Q34	0.00	0.00	4.20
Q35	4.20	4.80	4.80
Q36	1.40	2.10	4.90
Q37	0.00	1.40	1.80
Q38	0.00	0.60	1.90
Q39	0.00	0.00	8.00
Q40	5.00	5.00	0.00
Q41	5.00	0.00	4.90
Q42	0.00	4.80	0.00
Q43	0.00	0.80	3.30
Q44	4.30	0.00	4.30
Q45	0.00	4.80	0.00
Q46	0.00	0.00	5.00
Q47	5.00	5.00	0.00
Q48	5.00	5.00	0.50

U1				U2				U3							
Pin #	Voltage			Pin #	Voltage			Pin #	Voltage			Pin #	Voltage		
	TX	RX	Standby		TX	RX	Standby		TX	RX	Standby		TX	RX	Standby
1	2.45	2.40	2.44	1	2.44	2.44	2.44	1	ADDRESS LINE			41	DATA LINE		
2	4.88	4.89	4.89	2	4.45	2.43	2.44	2	2.45	2.45	2.45	42	DATA LINE		
3	2.96	2.40	2.44	3	2.23	2.36	2.36	3	2.49	2.49	2.49	43	DATA LINE		
4	2.50	2.50	2.50	4	2.36	2.36	2.36	4	4.88	4.76	4.75	44	DATA LINE		
5	4.05	4.03	3.96	5	2.36	2.24	2.24	5	4.93	4.95	4.94	45	DATA LINE		
6	2.47	0.96	2.44	6	0.00	0.00	0.00	6	0.03	4.95	4.95	46	DATA LINE		
7	4.57	4.94	4.95	7	0.00	0.00	0.00	7	4.92	0.00	4.92	47	DATA LINE		
8	4.43	4.38	4.37	8	0.00	0.00	0.00	8	4.92	4.93	4.93	48	DATA LINE		
9	2.77	2.77	2.77	9	0.89	4.96	4.96	9	4.92	4.93	4.93	49	DATA LINE		
10	2.25	0.08	0.08	10	0.00	0.00	0.00	10	4.96	4.98	4.97	50	0.00	0.00	0.00
11	4.88	4.77	4.76	11	0.00	0.00	0.00	11	4.93	4.95	4.95	51	2.50	2.50	2.50
12	CLOCK			12	2.46	2.45	2.44	12	0.00	0.00	0.00	52	2.50	2.50	2.50
13	4.97	4.98	4.98	13	2.44	2.45	2.45	13	4.96	4.97	4.96	53	2.25	2.25	2.25
14	2.44	2.45	2.44	14	2.44	2.44	2.43	14	0.00	0.00	0.00	54	4.96	4.96	4.96
15	4.96	4.97	4.96	15	2.45	2.44	2.43	15	4.96	4.97	4.97	55	3.00	3.00	3.00
16	1.93	1.92	1.94	16	4.97	4.98	4.97	16	0.00	0.00	0.00	56	4.98	4.98	4.98
17	1.73	1.73	1.75					17	0.00	0.00	0.00	57	4.97	4.98	4.97
18	DATA							18	0.00	0.55	0.06	58	4.98	4.99	4.99
19	0.00	0.00	0.00					19	4.16	4.10	4.09	59	4.98	4.99	5.00
20	0.04	0.00	0.00					20	0.00	0.00	0.00	60	0.00	0.00	0.00
21	4.87	4.88	4.88					21	0.00	0.02	0.16	61	4.96	4.97	4.96
22	2.02	2.45	2.34					22	0.00	4.92	4.92	62	0.00	0.00	0.00
23	2.05	2.49	2.33					23	0.00	0.04	0.00	63	4.96	4.97	4.97
24	0.00	0.00	0.00					24	4.95	4.97	4.96	64	0.00	4.97	0.00
25	2.47	2.47	2.47					25	2.01	2.63	2.37	65	4.93	4.97	0.00
26	2.43	0.73	0.78					26	1.14	1.19	4.48	66	4.89	4.93	4.92
27	2.42	1.07	1.07					27	0.00	4.97	1.42	67	0.13	4.97	4.96
28	2.45	2.45	2.44					28	0.00	0.00	0.00	68	4.98	4.99	4.99
29	2.36	2.36	2.36					29	4.96	4.97	4.96	69	4.93	0.04	0.14
30	2.47	2.47	2.47					30	0.00	0.00	0.00	70	4.98	4.98	4.98
31	2.44	2.45	2.45					31	ADDRESS LINE			71	4.42	4.44	4.43
32	2.45	2.44	2.43					32	ADDRESS LINE			72	4.96	4.97	4.97
								33	ADDRESS LINE			73	0.00	0.00	0.00
								34	ADDRESS LINE			74	ADDRESS LINE		
								35	ADDRESS LINE			75	ADDRESS LINE		
								36	ADDRESS LINE			76	ADDRESS LINE		
								37	ADDRESS LINE			77	ADDRESS LINE		
								38	ADDRESS LINE			78	ADDRESS LINE		
								39	4.95	4.96	4.95	79	ADDRESS LINE		
								40	DATA LINE			80	ADDRESS LINE		

U4				U5				U6				U7			
Pin #	Voltage			Pin #	Voltage			Pin #	Voltage			Pin #	Voltage		
	TX	RX	Standby		TX	RX	Standby		TX	RX	Standby		TX	RX	Standby
1	0.00	0.00	0.00	1	0.00	0.00	0.00	1	ADDRESS LINE			1	0.00	0.00	0.00
2	0.00	0.00	0.00	2	0.00	0.00	0.02	2	ADDRESS LINE			2	7.43	7.45	7.45
3	4.96	4.96	4.95	3	4.99	5.00	4.99	3	ADDRESS LINE			3	4.92	4.94	4.94
4	4.97	4.97	4.97	4	4.99	5.00	4.99	4	ADDRESS LINE			4	2.51	2.52	2.52
5	4.97	4.97	4.97	5	4.97	4.98	4.97	5	ADDRESS LINE			5	0.00	0.00	0.00
6	0.00	0.00	0.00	6	4.48	0.00	0.00	6	0.00	0.00	0.00	6	0.00	0.00	0.00
7	0.00	0.00	0.00	7	0.00	0.00	0.00	7	4.95	4.97	4.97	7	4.92	4.94	4.94
8	4.97	4.97	4.97	8	4.83	0.00	0.00	8	4.95	4.97	4.97	8	9.85	9.87	9.87
9	1.85	1.85	1.90	9	4.97	4.98	4.98	9	0.00	0.00	0.00				
10	0.00	0.00	0.00	10	4.63	0.00	0.00	10	0.00	0.00	0.00				
11	3.01	3.01	3.00	11	4.63	4.75	4.76	11	ADDRESS LINE						
12	4.97	4.97	4.97	12	4.92	0.33	0.33	12	ADDRESS LINE						
13	1.90	1.90	1.90	13	0.00	0.00	0.00	13	ADDRESS LINE						
14	4.97	4.97	4.97	14	4.98	4.98	4.98	14	ADDRESS LINE						
								15	ADDRESS LINE						
								16	ADDRESS LINE						
								17	ADDRESS LINE						
								18	ADDRESS LINE						
								19	ADDRESS LINE						
								20	ADDRESS LINE						
								21	DATA LINE						
								22	DATA LINE						
								23	DATA LINE						
								24	0.00	0.00	0.00				
								25	DATA LINE						
								26	DATA LINE						
								27	DATA LINE						
								28	DATA LINE						
								29	DATA LINE						
								30	0.00	0.00	0.00				
								31	ADDRESS LINE						
								32	2.66	2.87	2.47				

U8			
Pin #	Voltage		
	TX	RX	Standby
1	2.38	2.38	2.38
2	4.91	4.93	4.93
3	9.27	9.29	9.24
4	9.27	9.29	9.24
5	9.27	9.29	9.24
6	2.80	1.81	1.79
7	0.00	0.00	0.00
8	5.55	5.57	5.55
9	4.83	4.77	4.77
10	2.69	2.69	2.68
11	2.69	2.69	2.68
12	4.85	4.87	4.85
13	3.52	3.48	3.43
14	4.91	4.93	4.92
15	0.00	0.00	0.00
16	0.00	0.00	0.00
17	4.95	4.97	4.96
18	CLOCK		
19	DATA		
20	2.35	2.36	2.35

U10			
Pin #	Voltage		
	TX	RX	Standby
1	2.44	2.45	2.44
2	2.44	2.45	2.44
3	2.44	2.45	2.44
4	2.44	2.45	2.44
5	4.64	4.76	4.76
6	4.65	4.76	4.76
7	0.00	0.00	0.00
8	2.44	2.45	2.44
9	2.44	2.45	2.44
10	2.44	2.45	2.44
11	2.44	2.45	2.44
12	4.64	4.76	4.76
13	4.64	4.76	4.76
14	4.97	4.98	4.98

U11			
Pin #	Voltage		
	TX	RX	Standby
1	0.03	4.21	4.21
2	0.03	3.54	3.51
3	0.03	3.05	3.05
4	0.03	4.31	4.32
5	0.03	3.94	3.95
6	0.03	3.94	3.96
7	0.03	3.56	3.55
8	0.03	0.00	0.00
9	0.68	0.97	0.93
10	0.03	4.31	4.31
11	0.03	3.42	3.45
12	0.03	2.22	0.44
13	0.03	0.00	0.00
14	0.03	0.23	0.02
15	0.00	0.00	0.00
16	0.00	0.94	0.94

U12			
Pin #	Voltage		
	TX	RX	Standby
1	NC	NC	NC
2	0.00	0.00	0.00
3	0.00	0.00	0.00
4	0.00	0.00	0.00
5	0.00	4.25	0.27
6	0.58	8.37	0.58
7	NC	NC	NC
8	NC	NC	NC

U13				U14				U15				U16			
Pin #	Voltage			Pin #	Voltage			Pin #	Voltage			Pin #	Voltage		
	TX	RX	Standby		TX	RX	Standby		TX	RX	Standby		TX	RX	Standby
1	NC	NC	NC	1	1.93	8.37	8.39	1	4.98	4.98	4.98	1	2.44	2.44	2.44
2	0.00	0.00	0.00	2	7.85	8.40	8.41	2	4.98	4.98	4.98	2	2.44	2.44	2.44
3	0.00	0.00	0.00	3	7.55	8.39	8.39	3	0.00	0.00	0.00	3	2.43	2.44	2.44
4	0.00	0.00	0.00	4	7.59	8.39	8.41	4	0.00	0.00	0.00	4	4.97	4.98	0.00
5	0.34	4.25	0.34	5	0.08	8.21	8.17	5	4.97	4.97	4.97	5	2.42	2.42	0.00
6	0.58	8.87	0.58					6	1.24	1.24	1.24	6	2.44	2.44	0.00
7	NC	NC	NC					7	1.24	1.24	1.24	7	2.44	2.45	2.44
8	NC	NC	NC					8	7.75	8.27	8.25	8	1.27	1.08	1.07
												9	1.17	1.17	1.17
												10	1.16	1.16	1.16
												11	0.00	0.00	0.00
												12	1.16	1.16	1.16
												13	1.17	1.17	1.17
												14	1.14	1.19	4.55

U17				U18				U19				U20			
Pin #	Voltage			Pin #	Voltage			Pin #	Voltage			Pin #	Voltage		
	TX	RX	Standby		TX	RX	Standby		TX	RX	Standby		TX	RX	Standby
1	3.01	2.40	2.45	1	3.97	7.91	7.94	1	3.76	7.94	7.94	1	6.21	7.96	7.96
2	1.39	1.40	1.40	2	7.88	8.39	8.41	2	7.88	8.39	8.39	2	7.87	8.40	8.39
3	1.38	1.38	1.38	3	1.94	7.60	7.60	3	3.96	8.28	8.28	3	3.74	7.71	7.72
4	4.98	4.98	4.98	4	1.95	8.37	8.20	4	3.96	7.93	7.93	4	3.74	7.94	7.94
5	2.03	2.59	2.37	5	0.09	8.21	8.21	5	0.08	8.21	8.21	5	0.08	8.20	8.20
6	2.04	0.00	2.37												
7	2.04	0.00	2.37												
8	4.98	4.97	4.97												
9	0.00	0.00	0.00												
10	2.44	2.44	2.44												
11	0.00	0.00	0.00												
12	0.00	0.00	0.00												
13	0.00	1.54	0.44												
14	0.00	4.97	1.42												

Alignment Procedure

Introduction

The SP-150 is aligned by using the ACC-902 Software.

The ACC-902 and the ACC-2001 are required for alignment of the SP-150.

ACC-902 Software Assembly (P/N: 820-030-0025)

- Maintenance Software: 820-130-0025
- Flashing Software: 820-030-0028
- Maintenance Manual: 680-110-0036

ACC-2001 Programming Kit (P/N: 480-010-0013)

- ACC-2001 Interface Module: 510-050-0021
- SP-150 Programming Cable: 950-020-0011
- SM-6000 Programming Cable: 950-020-0009
- SM-6000 Audio Test Cable: 920-015-0006

Computer System Requirements

- IBM® compatible computer (486 or faster)
- 8 MB of RAM (16 MB recommended)
- 1MB of hard disk space
- 1.44MB floppy disk drive
- Windows® 95 Rel. 2 or later operating system
- Communications Port
- RS232 Serial Cable

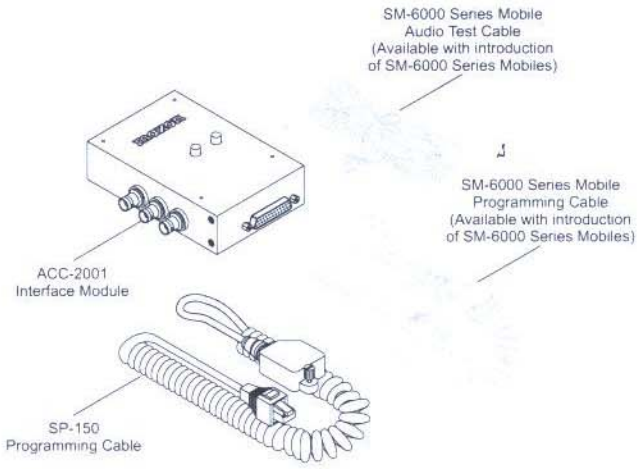


Figure 5-17 ACC-2001 Contents

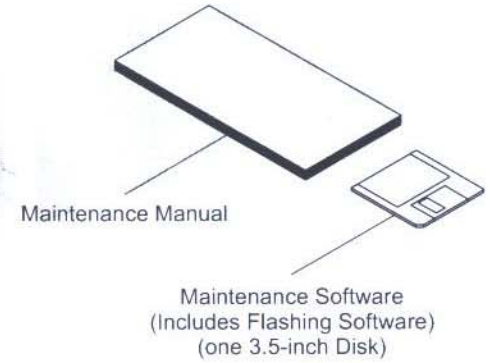


Figure 5-18 ACC-902 Contents

Parts List 6

REF	DESCRIPTION	PART NO.
	REPLACEMENT MODULES	
A1	FRONT-END ASSY, 440-470MHZ (SEE NOTE A)	650-110-0020
A3	POWER AMP ASSY, 440-470MHZ (SEE NOTE A)	650-230-0018
A4	VCO TX/RX ASSY, 440-470MHZ (SEE NOTE A)	650-030-0027
A5	TCXO ASSY, 440-470MHZ (SEE NOTE A)	650-120-0002
PTT	PTT ASSY, (SEE NOTE A)	650-180-0017
C1	CAP, CER,0.022UF,10%,50V,X7R,0603	100-621-1223
C2	CAP, CER,0.0033UF,10%,50V,X7R,0603	100-621-1332
C3	CAP, CER,0.01UF,10%,50V,X7R,0603	100-621-1103
C4	CAP, CER,0.0047UF,10%,50V,X7R,0603	100-621-1472
C5	CAP, CER,0.01UF,10%,50V,X7R,0603	100-621-1103
C6	CAP, CER,0.01UF,10%,50V,X7R,0603	100-621-1103
C7	CAP, CER,0.01UF,10%,50V,X7R,0603	100-621-1103
C8	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C9	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C10	CAP, CER,0.022UF,10%,50V,X7R,0603	100-621-1223
C11	CAP, CER,2200PF,5%,50V,X7R,0603	100-521-1222
C12	CAP, CER,0.0047UF,10%,50V,X7R,0603	100-621-1472
C13	CAP, CER,470PF,5%,50V,COG,0603	100-520-1471
C15	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C16	CAP, TA,10UF,20%,6.3V,3216,A	102-013-0106
C17	CAP, CER,0.022UF,10%,50V,X7R,0603	100-621-1223
C18	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C19	CAP, TA,4.7UF,20%,10V,3216	102-023-0475
C20	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C21	CAP, CER,0.01UF,10%,50V,X7R,0603	100-621-1103
C22	CAP, CER,120PF,5%,50V,COG,0603	100-520-1121
C23	CAP, CER,120PF,5%,50V,COG,0603	100-520-1121
C24	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C25	CAP, CER,220PF,5%,50V,COG,0603	100-520-1221
C26	CAP, TA,4.7UF,20%,10V,3216	102-023-0475
C27	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C28	CAP, CER,120PF,5%,50V,COG,0603	100-520-1121
C29	CAP, CER,0.01UF,10%,50V,X7R,0603	100-621-1103
C30	CAP, CER,120PF,5%,50V,COG,0603	100-520-1121
C31	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C32	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C33	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C34	CAP, CER,0.68UF,+80-20%,16V,Y5V,0805	100-803-2684
C35	CAP, CER,2200PF,5%,50V,X7R,0603	100-521-1222
C36	CAP, CER,0.01UF,10%,50V,X7R,0603	100-621-1103
C37	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C38	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C39	CAP, CER,0.01UF,10%,50V,X7R,0603	100-621-1103
C40	CAP, CER,0.68UF,+80-20%,16V,Y5V,0805	100-803-2684
C41	CAP, CER,0.68UF,+80-20%,16V,Y5V,0805	100-803-2684
C42	CAP, CER,0.68UF,+80-20%,16V,Y5V,0805	100-803-2684
C43	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C44	CAP, CER,0.01UF,10%,50V,X7R,0603	100-621-1103
C45	CAP, CER,470PF,5%,50V,COG,0603	100-520-1471
C46	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C47	CAP, CER,470PF,5%,50V,COG,0603	100-520-1471
C48	CAP, CER,0.01UF,10%,50V,X7R,0603	100-621-1103
C49	CAP, CER,0.01UF,10%,50V,X7R,0603	100-621-1103
C50	CAP, CER,470PF,5%,50V,COG,0603	100-520-1471
C51	CAP, CER,470PF,5%,50V,COG,0603	100-520-1471
C52	CAP, CER,0.01UF,10%,50V,X7R,0603	100-621-1103
C53	CAP, CER,0.68UF,+80-20%,16V,Y5V,0805	100-803-2684
C54	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C55	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C56	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C57	CAP, TA,4.7UF,20%,10V,3216	102-023-0475
C58	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C59	CAP, CER,0.047UF,+20-80%,25V,Y5V,0603	100-813-1473
C60	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C61	CAP, CER,0.01UF,10%,50V,X7R,0603	100-621-1103
C62	CAP, CER,0.01UF,10%,50V,X7R,0603	100-621-1103
C63	CAP, CER,0.01UF,10%,50V,X7R,0603	100-621-1103
C64	CAP, CER,0.01UF,10%,50V,X7R,0603	100-621-1103
C65	CAP, CER,470PF,5%,50V,COG,0603	100-520-1471
C66	CAP, CER,470PF,5%,50V,COG,0603	100-520-1471
C67	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C68	CAP, CER,0.01UF,10%,50V,X7R,0603	100-621-1103
C69	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C70	CAP, CER,470PF,5%,50V,COG,0603	100-520-1471
C71	CAP, CER,470PF,5%,50V,COG,0603	100-520-1471
C72	CAP, CER,470PF,5%,50V,COG,0603	100-520-1471
C73	CAP, CER,0.01UF,10%,50V,X7R,0603	100-621-1103
C74	CAP, CER,0.01UF,10%,50V,X7R,0603	100-621-1103
C75	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C76	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C77	CAP, CER,0.01UF,10%,50V,X7R,0603	100-621-1103
C78	CAP, TA,10UF,20%,6.3V,3216,A	102-013-0106
C79	CAP, CER,470PF,5%,50V,COG,0603	100-520-1471
C82	CAP, CER,0.01UF,10%,50V,X7R,0603	100-621-1103
C83	CAP, CER,43PF,5%,50V,COG,0603	100-520-1430
C84	CAP, CER,43PF,5%,50V,COG,0603	100-520-1430
C85	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C86	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C87	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C88	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C89	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C90	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C91	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C92	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C93	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C94	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C95	CAP, CER,0.01UF,10%,50V,X7R,0603	100-621-1103
C96	CAP, CER,0.68UF,+80-20%,16V,Y5V,0805	100-803-2684
C97	CAP, CER,0.68UF,+80-20%,16V,Y5V,0805	100-803-2684
C98	CAP, TA,4.7UF,20%,10V,3216	102-023-0475
C99	CAP, TA,4.7UF,20%,10V,3216	102-023-0475
C100	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C101	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C102	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C103	CAP, CER,27PF,5%,50V,COG,0603	100-520-1270
C104	CAP, CER,0.01UF,10%,50V,X7R,0603	100-621-1103
C105	CAP, CER,120PF,5%,50V,COG,0603	100-520-1121
C106	CAP, CER,470PF,5%,50V,COG,0603	100-520-1471
C107	CAP, CER,47PF,5%,50V,COG,0603	100-520-1470
C108	CAP, CER,18PF,5%,50V,COG,0603	100-520-1180
C109	CAP, CER,0.01UF,10%,50V,X7R,0603	100-621-1103
C110	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C111	CAP, CER,120PF,5%,50V,COG,0603	100-520-1121

Notes:

A. Components are not available, assembly is non-repairable.

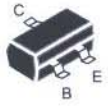
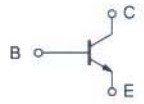
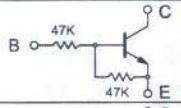
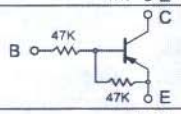
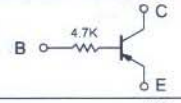
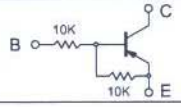
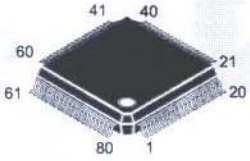
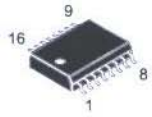
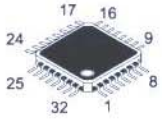
REF	DESCRIPTION	PART NO.
C112	CAP, TA,10UF,20%,6.3V,3216,A	102-013-0106
C113	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C114	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C115	CAP, CER,220PF,5%,50V,COG,0603	100-520-1221
C116	CAP, MF,0.1UF,5%,16V,1210	103-500-4104
C117	CAP, MF,0.0033UF,5%,16V,0805	103-500-2332
C118	CAP, MF,0.001UF,5%,50V,0805	103-520-2102
C120	CAP, CER,0.001UF,5%,50V,COG,0603	100-520-1102
C121	CAP, CER,120PF,5%,50V,COG,0603	100-520-1121
C122	CAP, TA,1UF,20%,16V,3216	102-033-0105
C123	CAP, CER,220PF,5%,50V,COG,0603	100-520-1221
C124	CAP, CER,3PF,0.25PF,50V,COG,0603	100-020-1030
C125	CAP, CER,220PF,5%,50V,COG,0603	100-520-1221
C126	CAP, CER,220PF,5%,50V,COG,0603	100-520-1221
C127	CAP, CER,6PF,0.5PF,50V,COG,0603	100-120-1060
C128	CAP, CER,12PF,5%,50V,COG,0603	100-520-1120
C129	CAP, CER,120PF,5%,50V,COG,0603	100-520-1121
C130	CAP, CER,12PF,5%,50V,COG,0603	100-520-1120
C131	CAP, CER,120PF,5%,50V,COG,0805	100-520-2121
C132	CAP, CER,470PF,5%,50V,COG,0603	100-520-1471
C133	CAP, CER,4.7PF,0.5PF,50V,COG,0805	100-120-24R7
C135	CAP, CER,9PF,0.25PF,50V,COG,0805	100-020-2090
C136	CAP, CER,1.2PF, +/-25PF,50V,COG	100-020-31R2
C137	CAP, CER,8.2PF,0.5PF,COG,50V,0805	100-120-28R2
C138	CAP, CER,1.2PF, +/-25PF,50V,COG	100-020-31R2
C139	CAP, CER,4PF,0.25PF,50V,COG,0805	100-020-2040
C140	CAP, CER,120PF,5%,50V,COG,0805	100-520-2121
C142	CAP, CER,7PF,0.5PF,50V,COG,0603	100-120-1070
C143	CAP, TA,4.7UF,20%,10V,3216	102-023-0475
C144	CAP, CER,220PF,5%,50V,COG,0603	100-520-1221
C145	CAP, CER,47PF,5%,50V,COG,0603	100-520-1470
C146	CAP, CER,470PF,5%,50V,COG,0603	100-520-1471
C147	CAP, CER,100PF,+/-5%,50V,COG,0603	100-520-1101
C148	CAP, CER,2.7PF,0.25PF,50V,COG,0603	100-020-12R7
C149	CAP, CER,6.8PF,0.5PF,50V,COG,0603	100-120-16R8
C150	CAP, CER,8PF,0.5PF,50V,COG,0603	100-120-1080
C151	CAP, CER,15PF,5%,50V,COG,0603	100-520-1150
C152	CAP, CER,18PF,5%,50V,COG,0603	100-520-1180
C153	CAP, CER,27PF,5%,50V,COG,0603	100-520-1270
C154	CAP, TA,4.7UF,20%,10V,3216	102-023-0475
C155	CAP, CER,470PF,5%,50V,COG,0603	100-520-1471
C156	CAP, CER,470PF,5%,50V,COG,0603	100-520-1471
C157	CAP, CER,470PF,5%,50V,COG,0603	100-520-1471
C158	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C159	CAP, CER,470PF,5%,50V,COG,0603	100-520-1471
C160	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C161	CAP, CER,0.001UF,10%,50V,X7R,0603	100-621-1102
C162	CAP, CER,470PF,5%,50V,COG,0603	100-520-1471
C163	CAP, CER,470PF,5%,50V,COG,0603	100-520-1471
C164	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C165	CAP, CER,0.001UF,10%,50V,X7R,0603	100-621-1102
C166	CAP, CER,470PF,5%,50V,COG,0603	100-520-1471
C167	CAP, TA,1UF,20%,16V,3216	102-033-0105
C168	CAP, CER,470PF,5%,50V,COG,0603	100-520-1471
C169	CAP, CER,0.0047UF,10%,50V,X7R,0603	100-621-1472
C170	CAP, CER,470PF,5%,50V,COG,0603	100-520-1471
C171	CAP, CER,22PF,5%,50V,COG,0603	100-520-1220
C172	CAP, CER,120PF,5%,50V,COG,0603	100-520-1121
C173	CAP, CER,47PF,5%,50V,COG,0603	100-520-1470
C174	CAP, CER,47PF,5%,50V,COG,0603	100-520-1470
C175	CAP, CER,47PF,5%,50V,COG,0603	100-520-1470
C176	CAP, CER,47PF,5%,50V,COG,0603	100-520-1470
C177	CAP, CER,470PF,5%,50V,COG,0603	100-520-1471
C178	CAP, TA,4.7UF,20%,10V,3216	102-023-0475
C179	CAP, CER,470PF,5%,50V,COG,0603	100-520-1471
C180	CAP, TA,4.7UF,20%,10V,3216	102-023-0475
C181	CAP, CER,470PF,5%,50V,COG,0603	100-520-1471
C182	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C183	CAP, CER,470PF,5%,50V,COG,0603	100-520-1471
C184	CAP, CER,470PF,5%,50V,COG,0603	100-520-1471
C185	CAP, CER,470PF,5%,50V,COG,0603	100-520-1471
C186	CAP, CER,82PF,5%,50V,COG,0603	100-520-1820
C187	CAP, CER,47PF,5%,50V,COG,0603	100-520-1470
C188	CAP, CER,47PF,5%,50V,COG,0603	100-520-1470
C189	CAP, CER,82PF,5%,50V,COG,0603	100-520-1820
C190	CAP, CER,0.022UF,10%,50V,X7R,0603	100-621-1223
C191	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C192	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C193	CAP, CER,0.001UF,10%,50V,X7R,0603	100-621-1102
C194	CAP, CER,0.001UF,10%,50V,X7R,0603	100-621-1102
C195	CAP, CER,0.001UF,10%,50V,X7R,0603	100-621-1102
C196	CAP, TA,1UF,20%,16V,3216	102-033-0105
C197	CAP, CER,0.001UF,10%,50V,X7R,0603	100-621-1102
C198	CAP, CER,0.001UF,10%,50V,X7R,0603	100-621-1102
C199	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C200	CAP, CER,0.01UF,10%,50V,X7R,0603	100-621-1103
C201	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C202	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C203	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C204	CAP, TA,10UF,20%,6.3V,3216,A	102-013-0106
C205	CAP, CER,0.01UF,10%,50V,X7R,0603	100-621-1103
C206	CAP, CER,33PF,5%,50V,COG,0603	100-520-1330
C207	CAP, CER,0.01UF,10%,50V,X7R,0603	100-621-1103
C208	CAP, CER,120PF,5%,50V,COG,0603	100-520-1121
C209	CAP, CER,15PF,5%,50V,COG,0603	100-520-1150
C210	CAP, CER,22PF,5%,50V,COG,0603	100-520-1220
C211	CAP, CER,4PF,0.25PF,50V,COG,0603	100-020-1040
C212	CAP, CER,12PF,5%,50V,COG,0603	100-520-1120
C213	CAP, CER,18PF,5%,50V,COG,0603	100-520-1180
C214	CAP, CER,82PF,5%,50V,COG,0603	100-520-1820
C215	CAP, CER,0.001UF,10%,50V,X7R,0603	100-621-1102
C216	CAP, CER,82PF,5%,50V,COG,0603	100-520-1820
C217	CAP, CER,0.0047UF,10%,50V,X7R,0603	100-621-1472
C218	CAP, CER,0.0047UF,10%,50V,X7R,0603	100-621-1472
C219	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C220	CAP, CER,120PF,5%,50V,COG,0603	100-520-1121
C221	CAP, CER,100PF,+/-5%,50V,COG,0603	100-520-1101
C222	CAP, CER,0.0047UF,10%,50V,X7R,0603	100-621-1472
C223	CAP, CER,10PF,0.5PF,50V,COG,0603	100-120-1100
C224	CAP, CER,47PF,5%,50V,COG,0603	100-520-1470
C225	CAP, CER,47PF,5%,50V,COG,0603	100-520-1470
C226	CAP, CER,3.3PF,0.25PF,50V,COG,0603	100-020-13R3
C227	CAP, CER,47PF,5%,50V,COG,0603	100-520-1470
C228	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C229	CAP, CER,0.001UF,10%,50V,X7R,0603	100-621-1102
C230	CAP, CER,0.001UF,10%,50V,X7R,0603	100-621-1102
C231	CAP, CER,0.1UF,10%,25V,X7R,0805	100-611-2104
C232	CAP, CER,0.001UF,10%,50V,X7R,0603	100-621-1102
C233	CAP, CER,0.001UF,10%,50V,X7R,0603	100-621-1102
C234	CAP, CER,0.001UF,10%,50V,X7R,0603	100-621-1102
D1	DIODE, SW,KDS160,6V,2PIN USC	220-010-0017
D2	DIODE, SW,KDS160,6V,2PIN USC	220-010-0017
D3	DIODE, SW,KDS160,6V,2PIN USC	220-010-0017
D4	DIODE, SW,KDS160,6V,2PIN USC	220-010-0017
D5	DIODE, SW,KDS160,6V,2PIN USC	220-010-0017
D6	DIODE, SW,KDS160,6V,2PIN USC	220-010-0017

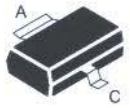
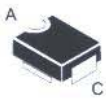
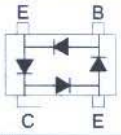
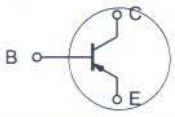
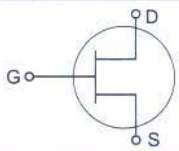
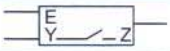
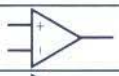
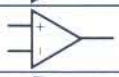
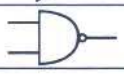
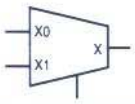
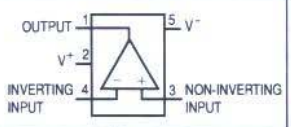
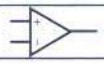
REF	DESCRIPTION	PART NO.
D7	DIODE, SW,KDS160,6V,2PIN USC	220-010-0017
D8	DIODE, SW,KDS160,6V,2PIN USC	220-010-0017
D9	DIODE, SW,KDS160,6V,2PIN USC	220-010-0017
D10	DIODE, SW,KDS160,6V,2PIN USC	220-010-0017
D11	DIODE, SW,KDS160,6V,2PIN USC	220-010-0017
D12	DIODE, PIN,UPP9401,(T&R)50V,2.5W	220-020-0001
D13	DIODE, PIN,UPP9401,(T&R)50V,2.5W	220-020-0001
D14	DIODE, SW,KDS160,6V,2PIN USC	220-010-0017
D15	DIODE, SW,KDS160,6V,2PIN USC	220-010-0017
D16	DIODE, SW,KDS160,6V,2PIN USC	220-010-0017
D17	DIODE, RECTIFIER,MRA4004,SMA	220-030-0002
D18	DIODE, SCHOTTKY,CHIP,HSMS-2817#L31	220-040-0009
D19	DIODE, SW,KDS160,6V,2PIN USC	220-010-0017
D20	DIODE, SW,KDS160,6V,2PIN USC	220-010-0017
D21	DIODE, SW,KDS160,6V,2PIN USC	220-010-0017
D22	DIODE, SW,KDS160,6V,2PIN USC	220-010-0017
D23	DIODE, SW,KDS160,6V,2PIN USC	220-010-0017
D24	DIODE, SW,KDS160,6V,2PIN USC	220-010-0017
D25	DIODE, SW,KDS160,6V,2PIN USC	220-010-0017
D26	DIODE, SW,KDS160,6V,2PIN USC	220-010-0017
D27	DIODE, SW,KDS160,6V,2PIN USC	220-010-0017
D28	DIODE, SW,KDS160,6V,2PIN USC	220-010-0017
D29	DIODE, SW,KDS160,6V,2PIN USC	220-010-0017
D30	DIODE, SW,KDS160,6V,2PIN USC	220-010-0017
DS1	LED, LAMP CHIP, RED/GRN,3.0X2.5	240-030-0035
E1	TERM, BATT CONTACT,SPG,BECU,T0.2,AU-PL	560-110-0100
E2	SHLD, PLATE,19X25XT0.25,NI-SLVR,C770	560-020-0085
E3	SHLD, PLATE,23.8X20.1XT0.25,NI-SLVR,C770	560-020-0086
E4	SHLD, CVR,26.2X30.7XT0.25,NI-SLVR,C770	560-024-0001
E5	SHLD, FENCE,"B",T0.25MM,NI-SLVR,C770	560-025-0002
E6	INSU, CAP,SI/RB,XTAL,GRAY	390-010-0006
E7	FNGR STRIP, 99-160-NT-80	560-140-0004
E9	INSU, SI/RB,XTAL,HS50,GRAY	390-010-0002
E10	INSU, SI/RB,XTAL,HS50,GRAY	390-010-0002
FL1	FILTER, CER,CFUCG450E	310-010-0018
FL2	FILTER, CER, 450KHZ,CFUCG450F	310-010-0019
FL3	FILTER, CER, 450KHZ, CFUCG450HX	310-010-0022
FL4-5	FILTER, CRYSTAL,45.3MHZ,KFN1110A(PAIR)	310-030-0004
J1	PIN, HDR,4P/SIP,R ANG,SHROUD,WAF	140-030-0043
J2	CONN, HDR STRIP,4P,2.0MM,RA,SMT	140-030-0062
J3	CONN, SKT,12P/DIP, 2.5MM RA, SMT	140-020-0054
J5	CONN, SKT,20P/DIP,2.0MM,ST,SMT	140-020-0057
L1	COIL, CHIP,2.7UH,+/-10%,LK16082R7K	371-001-42R7
L2	COIL, CHIP,100UH,5%,NL252018T-101J	371-804-3101
L3	COIL CHIP,10UH,CYLNDRCL,+/-10%,1206	371-005-3103
L4	COIL, CHIP,18NH,20%,LL2012-F18NM	371-010-5180
L5	COIL, CHIP,18NH,20%,LL2012-F18NM	371-010-5180
L6	COIL, CHIP,0.82UH:NL252018T-R82J	371-804-3R82
L7	COIL, SPRG,16.4NH,2.26X0.8X3T:L	350-000-0100
L8	COIL, SPRG,17.9NH,2.37X0.8 X3T:L	350-000-0099
L9	COIL, SPRG,16.4NH,2.26X0.8X3T:L	350-000-0100
L10	COIL, SPRG,17.9NH,2.37X0.8 X3T:L	350-000-0099
L11	COIL, CHIP,15NH,5%,LL1608-F15NJ	371-001-3150
L12	COIL, CHIP,15NH,5%,LL1608-F15NJ	371-001-3150
L13	COIL, CHIP,8.2NH,5%,LL1608-FH8N2J	371-001-38R2
L14	COIL, CHIP,2.7UH,+/-10%,LK16082R7K	371-001-42R7
L15	COIL, CHIP,220NH,+/-10%,LK1608-R22K	371-001-3R22
L16	COIL, CHIP,2.7UH,+/-10%,LK16082R7K	371-001-42R7
L17	COIL, CHIP,220NH,+/-10%,LK1608-R22K	371-001-3R22
L18	COIL, CHIP,2.7UH,+/-10%,LK16082R7K	371-001-42R7
L19	COIL, CHIP,2.7UH,+/-10%,LK16082R7K	371-001-42R7
L20	COIL, CHIP,27UH,5%,NL252018T-270J	371-004-3270
L21	COIL, CHIP,0.47UH:NL252018T-R47J	371-804-3R47
L22	COIL, CHIP,0.47UH:NL252018T-R47J	371-804-3R47
L23	COIL, CHIP,0.15UH,5%,NL252018T-R15J	371-004-3R15
L24	COIL, SPRG,1.2X0.3XT2:R, SMD	350-000-0119
PCB1	PCB, MAIN,132.3X50.5X1.2,SP-150	610-130-0029
Q1	TRANS, NPN,KRC104SND,SOT-23,SW	870-020-0001
Q2	TRANS, PNP,KTA1663(Y),SOT-89	870-150-0002
Q3	TRANS, NPN,KRC104SND,SOT-23,SW	870-020-0001
Q4	TRANS, TMOS FET,N-CH,2SK1579,SOT-89	870-030-0001
Q5	TRANS, TMOS FET,N-CH,2SK1579,SOT-89	870-030-0001
Q6	TRANS, NPN,KRC104SND,SOT-23,SW	870-020-0001
Q7	TRANS, NPN,KRC104SND,SOT-23,SW	870-020-0001
Q8	TRANS, PNP,KRA104S,SOT-23,SW,(PD)	870-010-0005
Q9	TRANS, PNP,KRA104S,SOT-23,SW,(PD)	870-010-0005
Q10	TRANS, NPN,KRC104SND,SOT-23,SW	870-020-0001
Q11	TRANS, NPN,KRC104SND,SOT-23,SW	870-020-0001
Q12	TRANS, NPN,KRC104SND,SOT-23,SW	870-020-0001
Q13	TRANS, NPN,KRC104SND,SOT-23,SW	870-020-0001
Q14	TRANS, NPN,KRC104SND,SOT-23,SW	870-020-0001
Q15	TRANS, PNP,KRA102SPB,SOT-23,SW	870-010-0007
Q16	TRANS, NPN,KRC104SND,SOT-23,SW	870-020-0001
Q17	TRANS, PNP,KTA1505(Y),SOT-23	870-100-0003
Q18	TRANS, NPN,KRC104SND,SOT-23,SW	870-020-0001
Q19	TRANS, NPN,KRC104SND,SOT-23,SW	870-020-0001
Q20	TRANS, PNP,KRA102SPB,SOT-23,SW	870-010-0007
Q21	TRANS, NPN,KTC3875(BL),SOT-23,	870-200-0006
Q22	TRANS, NPN,KRC104SND,SOT-23,SW	870-020-0001
Q23	TRANS, PNP,KTA1505(Y),SOT-23	870-100-0003
Q24	TRANS, NPN,LMMBT9426/KTC3880SY	870-200-0036
Q25	TRANS, PNP,KRA104S,SOT-23,SW,(PD)	870-010-0005
Q26	TRANS, NPN,KRC104SND,SOT-23,SW	870-020-0001
Q27	TRANS, PNP,KRA104S,SOT-23,SW,(PD)	870-010-0005
Q28	TRANS, NPN,KRC104SND,SOT-23,SW	870-020-0001
Q29	TRANS, NPN,KTC3875(BL),SOT-23,	870-200-0006
Q30	TRANS, NPN,BFR92A,SOT-23	870-200-0020
Q31	TRANS, 900MHZ AMP,MMBR951,SOT-23	870-200-0026
Q32	TRANS, PNP,KRA110SPK,SOT-23,SW,PK	870-010-0010
Q33	TRANS, PNP,KTA1663(Y),SOT-89	870-150-0002
Q34	TRANS, NPN,KRC104SND,SOT-23,SW	870-020-0001
Q35	TRANS, NPN,KTC3875(BL),SOT-23,	870-200-0006
Q36	TRANS, 900MHZ AMP,MMBR951,SOT-23	870-200-0026
Q37	TRANS, PNP,KST3906,SOT-23,GP,2A	870-100-0013
Q38	TRANS, NPN,MMBT3904LT1,SOT-23,GP	870-200-0023
Q39	TRANS, NPN,KRC104SND,SOT-23,SW	870-020-0001
Q40	TRANS, PNP,KRA110SPK,SOT-23,SW,PK	870-010-0010
Q41	TRANS, PNP,KRA110SPK,SOT-23,SW,PK	870-010-0010
Q42	TRANS, NPN,KRC104SND,SOT-23,SW	870-020-0001
Q43	TRANS, NPN,BFR92A,SOT-23	870-200-0020
Q44	TRANS, PNP,KRA104S,SOT-23,SW,(PD)	870-010-0005
Q45	TRANS, NPN,KRC104SND,SOT-23,SW	870-020-0001
Q46	TRANS, NPN,KRC104SND,SOT-23,SW	870-020-0001
Q47	TRANS, PNP,KRA104S,SOT-23,SW,(PD)	870-010-0005
Q48	TRANS, PNP,KRA104S,SOT-23,SW,(PD)	870-010-0005
R1	RES, TF,20K,5%,1/16W,+/-200,0603	741-102-1203
R2	RES, TF,47K,5%,1/16W,+/-200,0603	741-102-1473
R3	RES, TF,15K,5%,1/16W,+/-200,0603	741-102-1153
R4	RES, TF,180K,5%,1/16W,+/-200,0603	741-102-1184
R5	RES, TF,68K, 5%, 1/16W,+/-200, 0603	741-102-1683
R6	RES, TF,56K,5%,1/16W,+/-200,0603	741-102-1563
R7	RES, TF, 0, 5%,1/16W, +/-200,0603	741-102-1000
R8	RES, TF,1M,5%,1/16W,+/-200,0603	741-102-1105
R9	RES, TF, 0, 5%,1/16W, +/-200,0603	741-102-1000
R10	RES, TF,100K,5%,1/16W,+/-200,0603	741-102-1104
R11	RES, TF,750K,5%,1/16W,+/-200,0603	741-102-1754

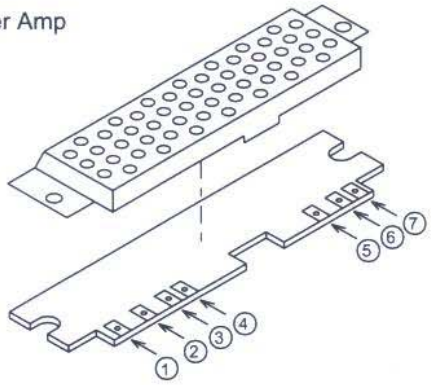
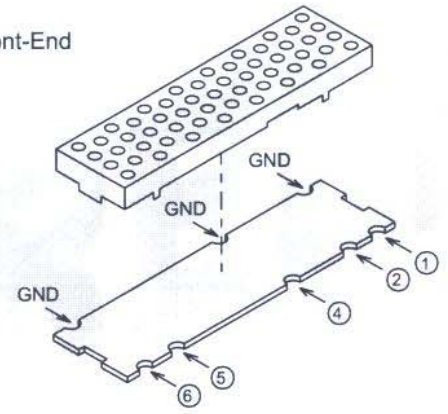
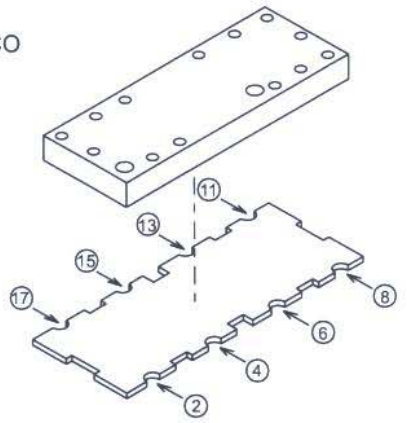
REF	DESCRIPTION	PART NO.
R12	RES, TF,510K,5%,1/16W,+/-200,0603	741-102-1514
R13	RES, TF,330K,5%,1/16W,+/-200,0603	741-102-1334
R14	RES, TF,22,5%,1/16W,+/-200,0603	741-102-1220
R15	RES, TF,22.5%,1/16W,+/-200,0603	741-102-1220
R16	RES, TF,20K,5%,1/16W,+/-200,0603	741-102-1203
R17	RES, TF,62K,5%,1/16W,TC200,0603	741-102-1623
R18	RES, TF,62K,5%,1/16W,TC200,0603	741-102-1623
R19	RES, TF,270K,5%,1/16W,+/-200,0603	741-102-1274
R22	RES, TF, 0, 5%,1/16W, +/-200,0603	741-102-1000
R23	RES, TF,75K,5%,1/16W,+/-200,0603	741-102-1753
R24	RES, TF,100K,5%,1/16W,+/-200,0603	741-102-1104
R25	RES, TF,270K,5%,1/16W,+/-200,0603	741-102-1274
R26	RES, TF,100K,5%,1/16W,+/-200,0603	741-102-1104
R27	RES, TF,100K,5%,1/16W,+/-200,0603	741-102-1104
R28	RES, TF,470K,5%,1/16W,+/-200,0603	741-102-1474
R29	RES, TF,1.5K,5%,1/16W,+/-200,0603	741-102-1152
R30	RES, TF,2.2,5%,1/10W,TC250,0805	741-117-2229
R31	RES, TF,470K,5%,1/16W,+/-200,0603	741-102-1474
R32	RES, TF,100K,5%,1/16W,+/-200,0603	741-102-1104
R33	RES, TF,100K,5%,1/16W,+/-200,0603	741-102-1104
R34	RES, TF,2.2,5%,1/10W,TC250,0805	741-117-2229
R35	RES, TF,47K,5%,1/16W,+/-200,0603	741-102-1473
R36	RES, TF,10K,5%,1/16W,+/-200,0603	741-102-1103
R37	RES, TF, 0, 5%,1/16W, +/-200,0603	741-102-1000
R38	RES, TF, 0, 5%,1/16W, +/-200,0603	741-102-1000
R39	RES, TF,10K,5%,1/16W,+/-200,0603	741-102-1103
R40	RES, TF,47K,5%,1/16W,+/-200,0603	741-102-1473
R41	RES, TF,47K,5%,1/16W,+/-200,0603	741-102-1473
R42	RES, TF,20K,5%,1/16W,+/-200,0603	741-102-1203
R43	RES, TF,1K,5%,1/16W,+/-200,0603	741-102-1102
R44	RES, TF,1M,5%,1/16W,+/-200,0603	741-102-1105
R45	RES, TF, 0, 5%,1/16W, +/-200,0603	741-102-1000
R46	RES, TF,1M,5%,1/16W,+/-200,0603	741-102-1105
R47	RES, TF,1M,5%,1/16W,+/-200,0603	741-102-1105
R48	RES, TF, 0, 5%,1/16W, +/-200,0603	741-102-1000
R50	RES, TF,100K,5%,1/16W,+/-200,0603	741-102-1104
R51	RES, TF,33K,5%,1/16W,+/-200,0603	741-102-1333
R52	RES, TF,10K,5%,1/16W,+/-200,0603	741-102-1103
R53	RES, TF, 0, 5%,1/16W, +/-200,0603	741-102-1000
R54	RES, TF,1M,5%,1/16W,+/-200,0603	741-102-1105
R55	RES, TF,220,5%,1/16W,+/-200,0603	741-102-1221
R56	RES, TF,4.7K,5%,1/16W,+/-200,0603	741-102-1472
R57	RES, TF,47K,5%,1/16W,+/-200,0603	741-102-1473
R58	RES, TF,6.8K, 5%, 1/16W,+/-200, 0603	741-102-1682
R59	RES, TF,4.7K,5%,1/16W,+/-200,0603	741-102-1472
R60	RES, TF,1K,5%,1/16W,+/-200,0603	741-102-1102
R61	RES, TF,220,5%,1/16W,+/-200,0603	741-102-1221
R62	RES, TF,220,5%,1/16W,+/-200,0603	741-102-1221
R63	RES, TF,100K,5%,1/16W,+/-200,0603	741-102-1104
R64	RES, TF,100K,5%,1/16W,+/-200,0603	741-102-1104
R65	RES, TF,100K,5%,1/16W,+/-200,0603	741-102-1104
R66	RES, TF,100K,5%,1/16W,+/-200,0603	741-102-1104
R67	RES, TF,100K,5%,1/16W,+/-200,0603	741-102-1104
R68	RES, TF,200K,5%,1/16W,+/-200,0603	741-102-1204
R69	RES, TF,100K,5%,1/16W,+/-200,0603	741-102-1104
R70	RES, TF,100K,5%,1/16W,+/-200,0603	741-102-1104
R71	RES, TF,15K,5%,1/16W,+/-200,0603	741-102-1153
R72	RES, TF,100K,5%,1/16W,+/-200,0603	741-102-1104
R73	RES, TF,220,5%,1/16W,+/-200,0603	741-102-1221
R74	RES, TF,220,5%,1/16W,+/-200,0603	741-102-1221
R75	RES, TF,220,5%,1/16W,+/-200,0603	741-102-1221
R76	RES, TF,1K,5%,1/16W,+/-200,0603	741-102-1102
R77	RES, TF,1K,5%,1/16W,+/-200,0603	741-102-1102
R78	RES, TF,47K,5%,1/16W,+/-200,0603	741-102-1473
R79	RES, TF,1K,5%,1/16W,+/-200,0603	741-102-1102
R80	RES, TF,1K,5%,1/16W,+/-200,0603	741-102-1102
R81	RES, TF,1K,5%,1/16W,+/-200,0603	741-102-1102
R82	RES, TF,1K,5%,1/16W,+/-200,0603	741-102-1102
R83	RES, TF,47K,5%,1/16W,+/-200,0603	741-102-1473
R84	RES, TF,47K,5%,1/16W,+/-200,0603	741-102-1473
R85	RES, TF,47K,5%,1/16W,+/-200,0603	741-102-1473
R86	RES, TF,3.3K,5%,1/16W,+/-200,0603	741-102-1332
R87	RES, TF,3.3K,5%,1/16W,+/-200,0603	741-102-1332
R88	RES, TF,220,5%,1/16W,+/-200,0603	741-102-1221
R89	RES, TF,220,5%,1/16W,+/-200,0603	741-102-1221
R90	RES, TF,47K,5%,1/16W,+/-200,0603	741-102-1473
R91	RES, TF,47K,5%,1/16W,+/-200,0603	741-102-1473
R92	RES, TF,1K,5%,1/16W,+/-200,0603	741-102-1102
R93	RES, TF,1K,5%,1/16W,+/-200,0603	741-102-1102
R94	RES, TF,1K,5%,1/16W,+/-200,0603	741-102-1102
R95	RES, TF,1K,5%,1/16W,+/-200,0603	741-102-1102
R96	RES, TF,220,5%,1/16W,+/-200,0603	741-102-1221
R97	RES, TF,220,5%,1/16W,+/-200,0603	741-102-1221
R98	RES, TF,220,5%,1/16W,+/-200,0603	741-102-1221
R99	RES, TF,220,5%,1/16W,+/-200,0603	741-102-1221
R100	RES, TF,220,5%,1/16W,+/-200,0603	741-102-1221
R101	RES, TF,1K,5%,1/16W,+/-200,0603	741-102-1102
R102	RES, TF,1K,5%,1/16W,+/-200,0603	741-102-1102
R103	RES, TF,1K,5%,1/10W,+/-250,0805	741-117-2102
R104	RES, TF,1K,5%,1/10W,+/-250,0805	741-117-2102
R105	RES, TF,4.7K,5%,1/16W,+/-200,0603	741-102-1472
R106	RES, TF,220K,5%,1/16W,+/-200,0603	741-102-1224
R107	RES, TF,47K,5%,1/16W,+/-200,0603	741-102-1473
R108	RES, TF,4.7K,5%,1/16W,+/-200,0603	741-102-1472
R109	RES, TF,47K,5%,1/16W,+/-200,0603	741-102-1473
R110	RES, TF,22,5%,1/16W,+/-200,0603	741-102-1220
R111	RES, TF,22K,5%,1/16W,+/-200,0603	741-102-1223
R112	RES, TF,1.2K,5%,1/16W, +/-200,0603	741-102-1122
R113	RES, TF,1.2K,5%,1/16W, +/-200,0603	741-102-1122
R114	RES, TF,47K,5%,1/16W,+/-200,0603	741-102-1473
R115	RES, TF,1K,5%,1/16W,+/-200,0603	741-102-1102
R116	RES, TF,220,5%,1/16W,+/-200,0603	741-102-1221
R117	RES, TF,220,5%,1/16W,+/-200,0603	741-102-1221
R118	RES, TF,1K,5%,1/16W,+/-200,0603	741-102-1102
R119	RES, TF,4.7K,5%,1/16W,+/-200,0603	741-102-1472
R120	RES, TF,390K, 5%, 1/16W,+/-200, 0603	741-102-1394
R121	RES, TF,4.7M,5%,1/16W,+/-200,0603	741-102-1475
R122	RES, TF,47K,5%,1/16W,+/-200,0603	741-102-1473
R123	RES, TF,2.2K,5%,1/16W,+/-200,0603	741-102-1222
R124	RES, TF,22,5%,1/16W,+/-200,0603	741-102-1220
R125	RES, TF,10K,5%,1/16W,+/-200,0603	741-102-1103
R127	RES, TF,10K,5%,1/16W,+/-200,0603	741-102-1103
R128	RES, TF,3.3K,5%,1/16W,+/-200,0603	741-102-1332
R129	RES, TF,150K,5%,1/16W,+/-200,0603	741-102-1154
R130	RES, TF,22,5%,1/16W,+/-200,0603	741-102-1220
R131	RES, TF,270,5%,1/16W,+/-200,0603	741-102-1271
R132	RES, TF,1K,5%,1/16W,+/-200,0603	741-102-1102
R133	RES, TF,10K,5%,1/16W,+/-200,0603	741-102-1103
R134	RES, TF,100K,5%,1/16W,+/-200,0603	741-102-1104
R135	RES, TF,47K,5%,1/16W,+/-200,0603	741-102-1473
R136	RES, TF,18,5%,1/16W,+/-200,0603	741-102-1180
R137	RES, TF,18,5%,1/16W,+/-200,0603	741-102-1180
R138	RES, TF,47K,5%,1/16W,+/-200,0603	741-102-1473
R139	RES, TF,36K,5%,1/16W,+/-200,0603	741-102-1363
R140	RES, TF,36K,5%,1/16W,+/-200,0603	741-102-1363
R141	RES, TF,75K,5%,1/16W,+/-200,0603	741-102-1753

REF	DESCRIPTION	PART NO.
R142	RES, TF,1.5K,5%,1/16W,+/-200,0603	741-102-1152
R144	RES, TF,10K,5%,1/16W,+/-200,0603	741-102-1103
R145	RES, TF,1.2K,5%,1/16W, +/-200,0603	741-102-1122
R146	RES, TF,18,5%,1/16W,+/-200,0603	741-102-1180
R147	RES, TF,5.6K,5%,1/16W,+/-200,0603	741-102-1562
R148	RES, TF,4.7K,5%,1/16W,+/-200,0603	741-102-1472
R149	RES, TF,220,5%,1/16W,+/-200,0603	741-102-1221
R150	RES, TF,300,5%,1/16W,+/-200,0603	741-102-1301
R151	RES, TF,18,5%,1/16W,+/-200,0603	741-102-1180
R152	RES, TF,300,5%,1/16W,+/-200,0603	741-102-1301
R153	RES, TF,12K,5%,1/16W,+/-200,0603	741-102-1123
R154	RES, TF,6.8K, 5%, 1/16W,+/-200, 0603	741-102-1682
R155	RES, TF,100,5%,1/16W,+/-200,0603	741-102-1101
R156	RES, TF,560,5%,1/10W,TC250,0805	741-117-2561
R157	RES, TF,560,5%,1/10W,TC250,0805	741-117-2561
R158	RES, TF,470K,5%,1/16W,+/-200,0603	741-102-1474
R159	RES, TF,4.7K,5%,1/16W,+/-200,0603	741-102-1472
R160	RES, TF,33,5%,1/16W,+/-200,0603	741-102-1330
R161	RES, TF,5.6K,5%,1/16W,+/-200,0603	741-102-1562
R162	RES, TF,4.7K,5%,1/16W,+/-200,0603	741-102-1472
R163	RES, TF,180,5%,1/16W,+/-200,0603	741-102-1181
R164	RES, TF,0.1,1%,1W, +/-100,0603	740-521-0R10
R165	RES, TF,1.2K,5%,1/16W, +/-200,0603	741-102-1122
R166	RES, TF,1.2K,5%,1/16W, +/-200,0603	741-102-1122
R167	RES, TF,30K,5%,1/16W,+/-200,0603	741-102-1303
R168	RES, TF,4.7K,5%,1/16W,+/-200,0603	741-102-1472
R169	RES, TF,27K,5%,1/16W,+/-200,0603	741-102-1273
R170	RES, TF,5.6K,5%,1/16W,+/-200,0603	741-102-1562
R171	RES, TF,82K,5%,1/16W,+/-200,0603	741-102-1823
R172	RES, TF,10K,5%,1/16W,+/-200,0603	741-102-1103
R173	RES, TF,5.6K,5%,1/16W,+/-200,0603	741-102-1562
R174	RES, TF,5.6K,5%,1/16W,+/-200,0603	741-102-1562
R175	RES, TF,1.5K,5%,1/16W,+/-200,0603	741-102-1152
R176	RES, TF,100K,5%,1/16W,+/-200,0603	741-102-1104
R177	RES, TF,470K,5%,1/16W,+/-200,0603	741-102-1474
R178	RES, TF,220K,5%,1/16W,+/-200,0603	741-102-1224
R179	RES, TF,220K,5%,1/16W,+/-200,0603	741-102-1224
R180	RES, TF,1.8K,5%,1/16W,+/-200,0603	741-102-1182
R181	RES, TF,470,5%,1/16W,+/-200,0603	741-102-1471
R182	RES, TF,10K,5%,1/16W,+/-200,0603	741-102-1103
R183	RES, TF,47K,5%,1/16W,+/-200,0603	741-102-1473
R184	RES, TF, 0, 5%,1/16W, +/-200,0603	741-102-1000
R185	RES, TF,22,5%,1/16W,+/-200,0603	741-102-1220
R186	RES, TF,47K,5%,1/16W,+/-200,0603	741-102-1473
R187	RES, TF,47K,5%,1/16W,+/-200,0603	741-102-1473
R188	RES, TF,47K,5%,1/16W,+/-200,0603	741-102-1473
R189	RES, TF,47K,5%,1/16W,+/-200,0603	741-102-1473
R190	RES, TF,100K,5%,1/16W,+/-200,0603	741-102-1104
R191	RES, TF, 0, 5%,1/16W, +/-200,0603	741-102-1000
R192	RES, TF,1K,5%,1/16W,+/-200,0603	741-102-1102
R193	RES, TF,1M,5%,1/16W,+/-200,0603	741-102-1105
R194	RES, TF,10K,5%,1/16W,+/-200,0603	741-102-1103
R195	RES, TF,20K,5%,1/16W,+/-200,0603	741-102-1203
R196	RES, TF,120K,5%,1/16W,+/-200,0603	741-102-1124
R197	RES, TF,120K,5%,1/16W,+/-200,0603	741-102-1124
R198	RES, TF,100,5%,1/16W,+/-200,0603	741-102-1101
R199	RES, TF,470K,5%,1/16W,+/-200,0603	741-102-1474
R200	RES, TF,150K,5%,1/16W,+/-200,0603	741-102-1154
R201	RES, TF,620K,5%,1/16W,+/-200,0603	741-102-1624
R202	RES, TF,120K,5%,1/16W,+/-200,0603	741-102-1124
R203	RES, TF,5.6K,5%,1/16W,+/-200,0603	741-102-1562
R204	RES, TF,30K,5%,1/16W,+/-200,0603	741-102-1303
R205	RES, TF,220K,5%,1/16W,+/-200,0603	741-102-1224
R206	RES, TF,22K,5%,1/16W,+/-200,0603	741-102-1223
R207	RES, TF,100,5%,1/16W,+/-200,0603	741-102-1101
R208	RES, TF,12K,5%,1/16W,+/-200,0603	741-102-1123
R209	RES, TF,62K,5%,1/16W,TC200,0603	741-102-1623
R210	RES, TF,10K,5%,1/16W,+/-200,0603	741-102-1103
R211	RES, TF,22K,5%,1/16W,+/-200,0603	741-102-1223
R212	RES, TF,10K,5%,1/16W,+/-200,0603	741-102-1103
R213	RES, TF,10K,5%,1/16W,+/-200,0603	741-102-1103
R214	RES, TF,10K,5%,1/16W,+/-200,0603	741-102-1103
R215	RES, TF,22K,5%,1/16W,+/-200,0603	741-102-1223
R216	RES, TF,22K,5%,1/16W,+/-200,0603	741-102-1223
R217	RES, TF,22K,5%,1/16W,+/-200,0603	741-102-1223
R218	RES, TF,56K,5%,1/16W,+/-200,0603	741-102-1563
R219	RES, TF,10K,5%,1/16W,+/-200,0603	741-102-1103
R220	RES, TF,150K,5%,1/16W,+/-200,0603	741-102-1154
R221	RES, TF,100,5%,1/16W,+/-200,0603	741-102-1101
R222	RES, TF,330,5%,1/16W,+/-200,0603	741-102-1331
R223	RES, TF,3K,5%,1/16W,+/-200,0603	741-102-1302
R224	RES, TF,470K,5%,1/16W,+/-200,0603	741-102-1474
R225	RES, TF,51,5%,1/16W,+/-200,0603	741-102-1510
R226	RES, TF,1.8K,5%,1/16W,+/-200,0603	741-102-1182
R227	RES, TF,1.5K,5%,1/16W,+/-200,0603	741-102-1152
R228	RES, TF,47K,5%,1/16W,+/-200,0603	741-102-1473
R229	RES, TF,180K,5%,1/16W,+/-200,0603	741-102-1184
R230	RES, TF,100K,5%,1/16W,+/-200,0603	741-102-1104
R231	RES, TF,220K,5%,1/16W,+/-200,0603	741-102-1224
R232	RES, TF,4.7K,5%,1/16W,+/-200,0603	741-102-1472
R233	RES, TF,220,5%,1/16W,+/-200,0603	741-102-1221
R234	RES, TF,10K,5%,1/16W,+/-200,0603	741-102-1103
R236	RES, TF, 0, 5%,1/16W, +/-200,0603	741-102-1000
R237	RES, TF,62K,5%,1/16W,TC200,0603	741-102-1623
R238	RES, TF,100K,5%,1/16W,+/-200,0603	741-102-1104
R239	RES, TF,100K,5%,1/16W,+/-200,0603	741-102-1104
R240	RES, TF,1M,5%,1/16W,+/-200,0603	741-102-1105
R241	RES, TF,62K,5%,1/16W,TC200,0603	741-102-1623
R242	RES, TF,4.7K,5%,1/16W,+/-200,0603	741-102-1472
R243	RES, TF,56,5%,1/16W,+/-200,0603	741-102-1560
RT1	THERM, 33K, 3216, SMT	700-050-0002
S1	SW, ROTARY,EC10SP16-68, 16CH	830-010-0011
T1	XFMR, B4F, FREQ.MIXER,617PT-1019,SMT	840-010-0002
T2	XFMR, B4F, FREQ.MIXER,617PT-1019,SMT	840-010-0002
U1	IC, AUDIO PROCESSOR,ASIC, XRC5640B	441-140-0001
U2	IC, A-MUX/DEMUX,MC14053BD,SO-16,3PDT	440-060-0001
U3	IC, CPU, OTP, MC68HC11FX32, QFP-80	443-100-0008
U4	IC, GD74HC00D (EPC590E),SO-14	444-020-0006
U5	IC, SW/MUX,MC14066BDR2,SO-14,A-SW	444-050-0001
U6	IC, AT29C010-15TI,5V,TSOP-32,-40C-85C	440-111-0002
U7	IC, V CONVERTER,MAX860,5.5V,50MA,SO-8	441-020-0006
U8	IC, PLL FREQ SYN,MC145190,SO-20	440-050-0008
U9	POT, ROTARY,100K,8.25MM,V,SPST	903-210-0104
U10	IC, SW/MUX,MC14066BDR2,SO-14,A-SW	444-050-0001
U11	IC, FM,IF DETECT,TA31136FN,SSOP-16	441-130-0002
U12	IC, AUDIO AMP,LM386MX-1,SO-8	441-040-0002
U13	IC, AUDIO AMP,LM386MX-1,SO-8	441-040-0002
U14	IC, OP AMP,LMC7101,SOT23-5	441-030-0008
U15	IC, VREG,LP2951CM,SO-8	401-010-0013
U16	IC, OP AMP,QUAD, LPC660AIM, SO-14	441-030-0009
U17	IC, OP AMP,QUAD,CMOS,MAX4044,SO-14	441-030-0013
U18	IC, OP AMP,LMC7101,SOT23-5	441-030-0008
U19	IC, OP AMP,LMC7101,SOT23-5	441-030-0008
U20	IC, OP AMP,LMC7101,SOT23-5	441-030-0008
Y1	XTAL, 38.400KHZ,MC-306,10PF,30PPM	162-000-0041
Y4	FILTER, CER,DISCRIMINATOR,450KHZ	315-012-0001

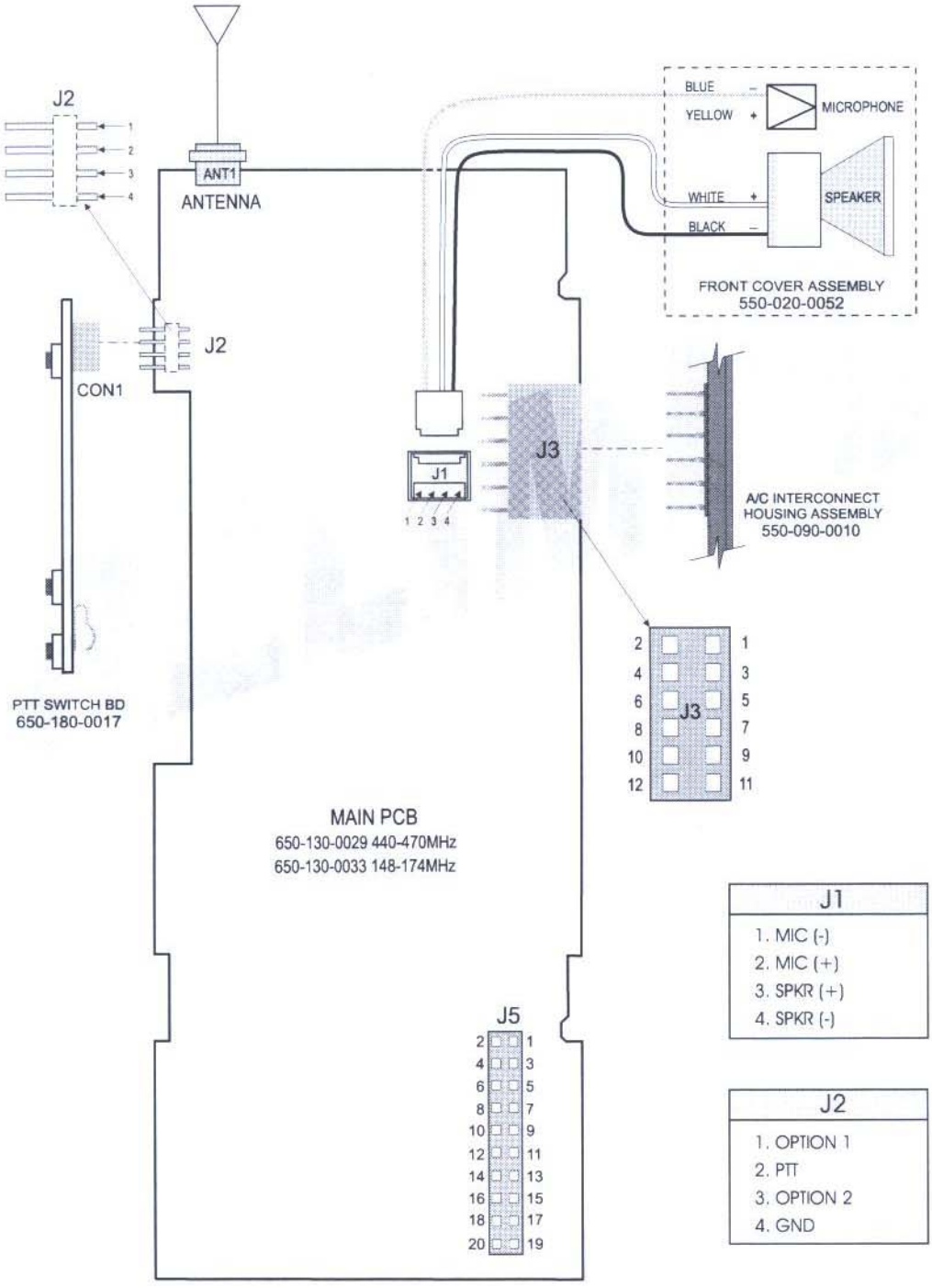
Component Pinout

BASE DIAGRAM	MANUFACTURER'S PART NUMBER	REFERENCE NO.	SCHEMATIC
	LMMBT9426	Q24	
	MMBR951	Q31,36	
	BFR92A	Q30,43	
	KTC3875 (BL)	Q21,29,35	
	MMBT3904LT1	Q38	
	KTA1505 (Y)	Q17,23	
	KST3906	Q37	
	KRC104S (ND)	Q1,3,6,7,10,11,12,13,14,16,18, Q19,22,26,28,34,39,42,45,46	
	KRA104S (PD)	Q8,9,25,27,44,47,48	
	KRA110S (PK)	Q32,40,41	
	KRA102S (PB)	Q15,20	
	MC68HC11FX32	U3	
	TA31136FN	U11	
	XRC5640B	U1	
	AT29C010-15TI	U6	

BASE DIAGRAM	MANUFACTURER'S PART NUMBER	REFERENCE NO.	SCHEMATIC
	UPP9401	D12,13	
	KDS160	D1,2,3,4,5,6,7,8,9,10,11,14, D15,16,19,20,21,22,23,24, D25,26,27,28,29,30	
	MRA4004	D17	
	HSMS-2817	D18	
	KTA1663	Q2,33	
	2SK1579	Q4,5	
	MC14066B	U5,10	
	LPC660AIM	U16	
	MAX4044	U17	
	GD74HC00D	U4	
	MC14053BD	U2	
	LMC7101	U14,18,19,20	
	LM386 (MC34119)	U12,13	
	LP2951CM	U15	
	MAX860	U7	
	MC145190	U8	

BASE DIAGRAM	PIN DESCRIPTION
(UHF) P.A. Assy. P/N: 650-230-0018 RF Power Amp 	Pin Number — Description 1 — Input 2 — GND 3 — Vcc (Pre Drive) 4 — Vcc Control (Drive) 5 — Vcc (Final) 6 — Output 7 — GND
(UHF) Front-End Assy. P/N: 650-110-0020 RX Front-End 	Pin Number — Description 1 — Input 2 — GND 4 — B+(4V) 5 — GND 6 — Output
(UHF) V.C.O. Assy. P/N: 650-030-0027 RX/TX VCO 	Pin Number — Description 2 — RX Out 4 — RX VCO Vcc 6 — TX Out 8 — TX VCO Vcc 13 — Modulation 15 — Tuning Voltage Note: All other pins are GND.

SP-150 Wiring Diagram



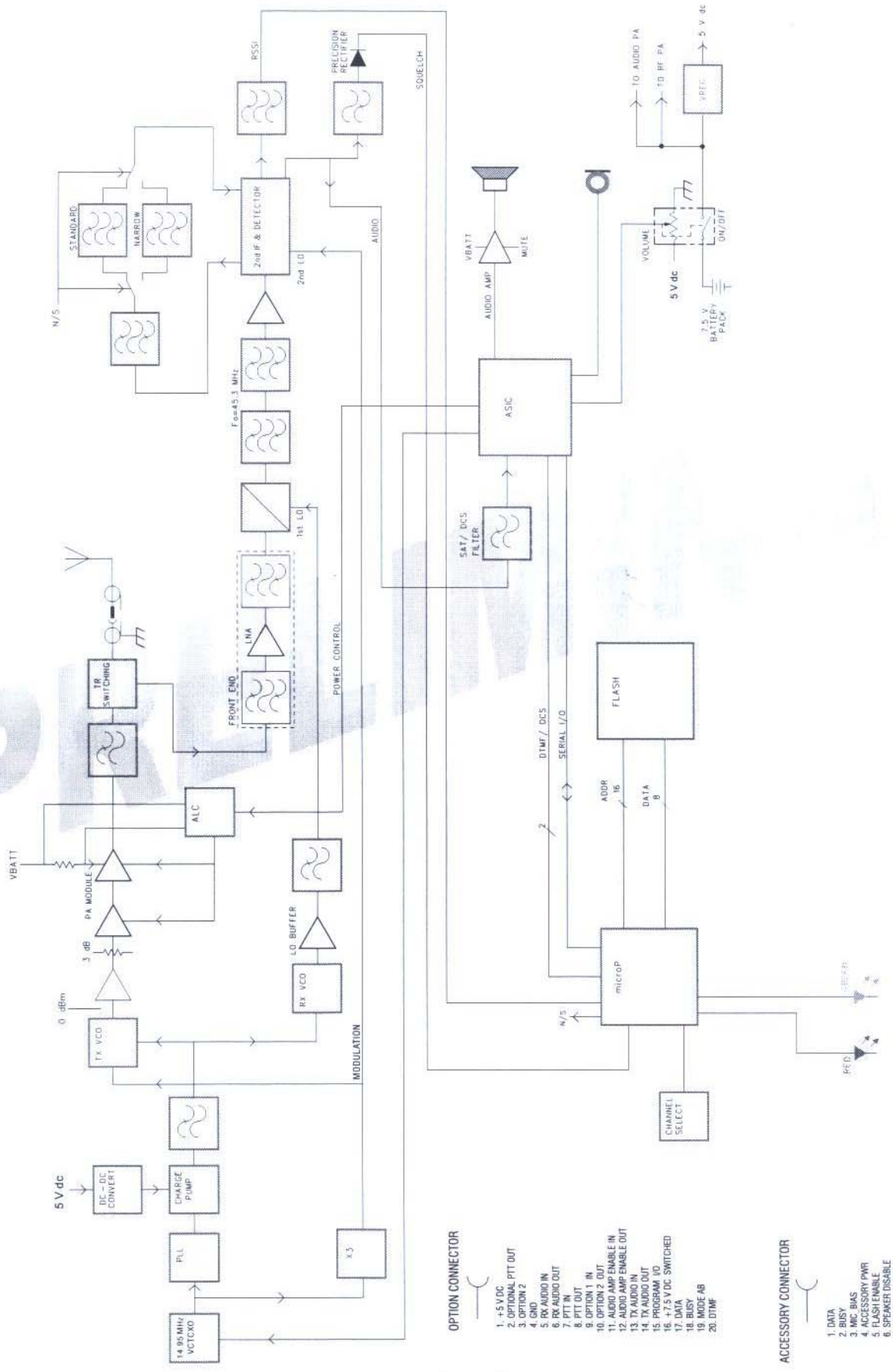
J3
1. DATA
2. BUSY
3. MIC_BIAS
4. PWR
5. FLASH_EN
6. SPKR_DSBL
7. GND
8. MIC (+)
9. PTT_EXT
10. MIC_DSBL
11. SPKR (+)
12. SPKR (-)

J5
1. +5 V dc
2. OPTIONAL PTT OUT
3. OPTION 2
4. GND
5. RX AUDIO IN
6. RX AUDIO OUT
7. PTT IN
8. PTT OUT
9. OPTION 1 IN
10. OPTION 1 OUT
11. AUDIO AMP ENABLE IN
12. AUDIO AMP ENABLE OUT
13. TX AUDIO IN
14. TX AUDIO OUT
15. PROGRAM I/O
16. +7.5 V dc SWITCHED
17. DATA
18. BUSY
19. MODE AB
20. DTMF

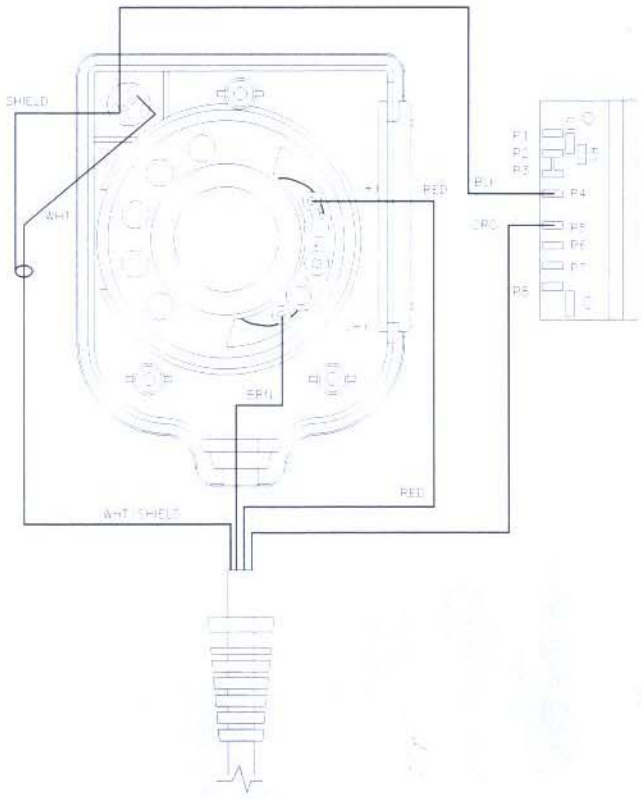
J1
1. MIC (-)
2. MIC (+)
3. SPKR (+)
4. SPKR (-)

J2
1. OPTION 1
2. PTT
3. OPTION 2
4. GND

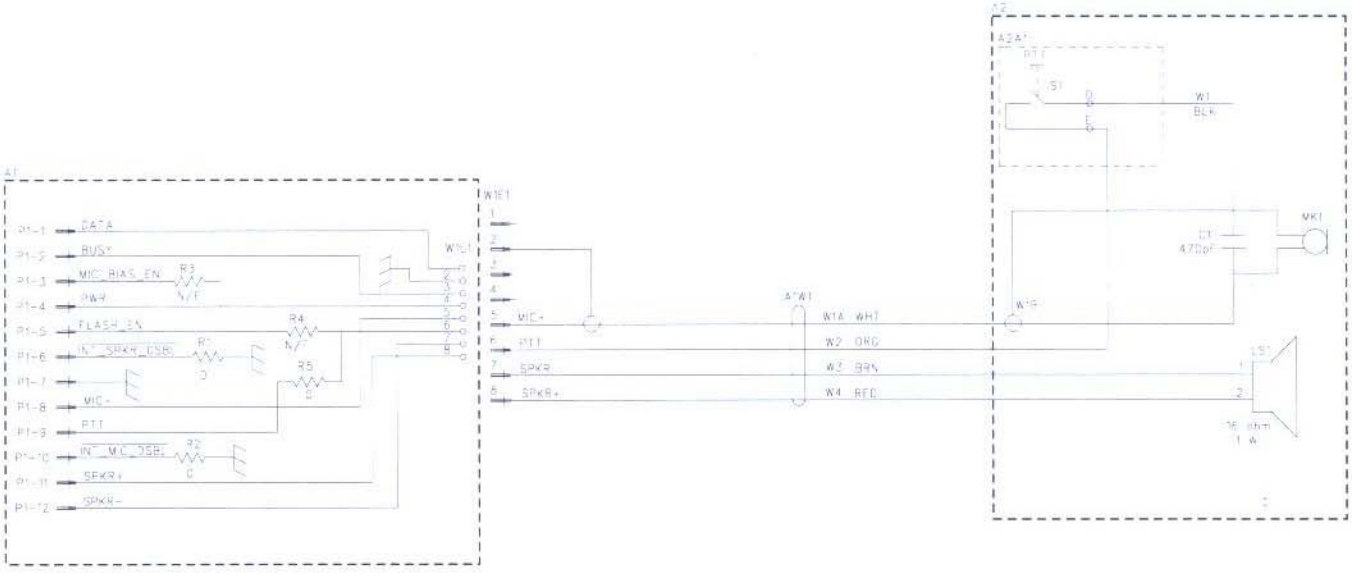
SP-150 Block Diagram

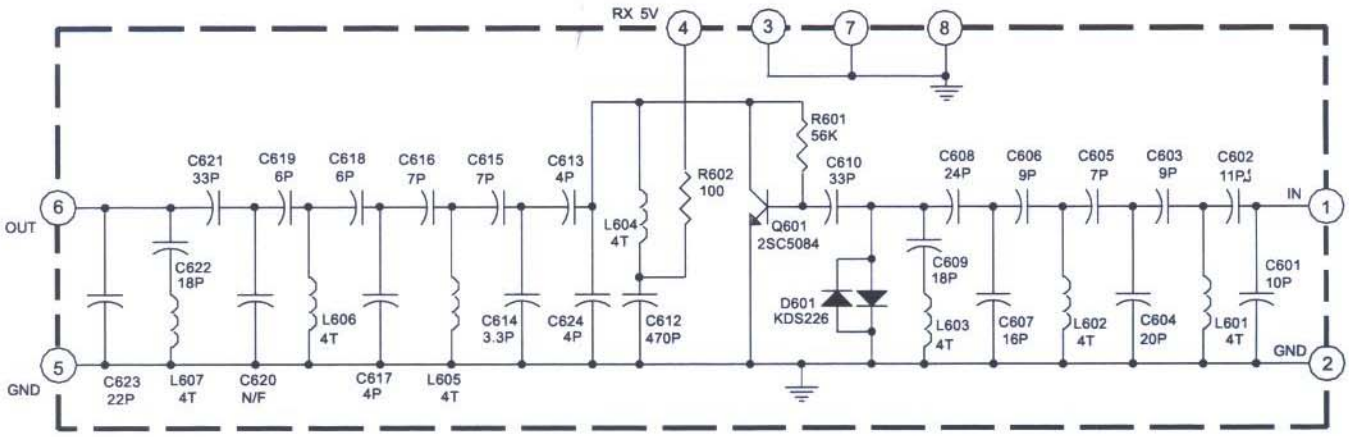


ACC-701 Wiring Diagram



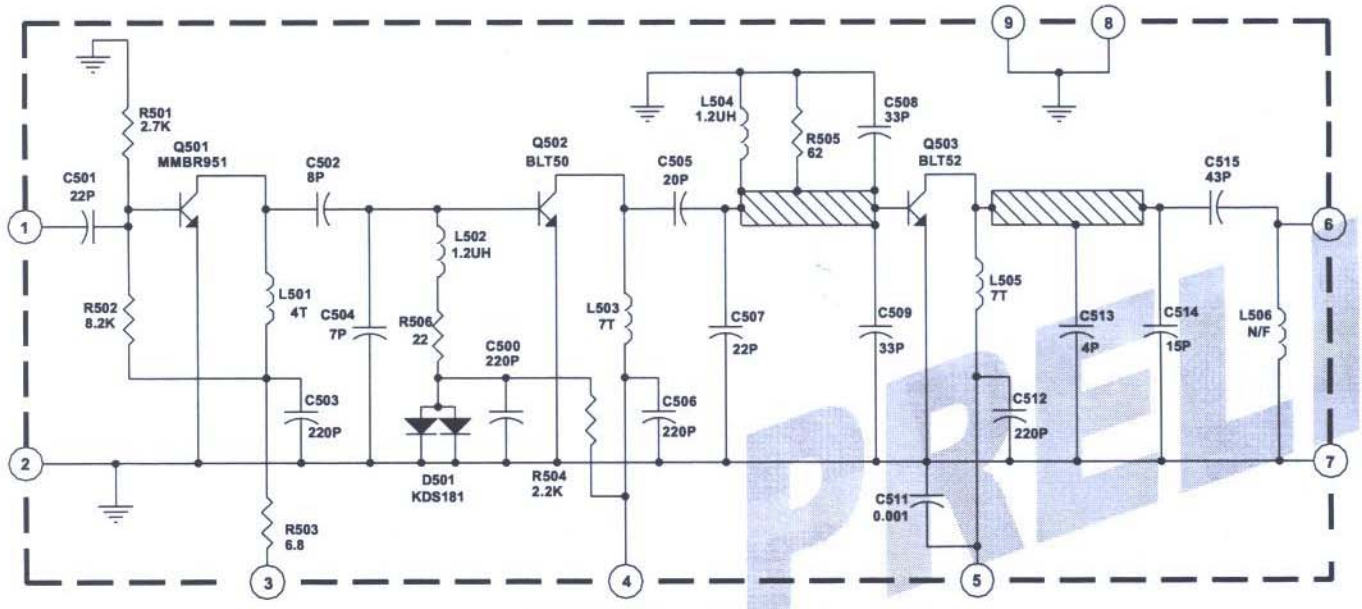
ACC-701 Schematic





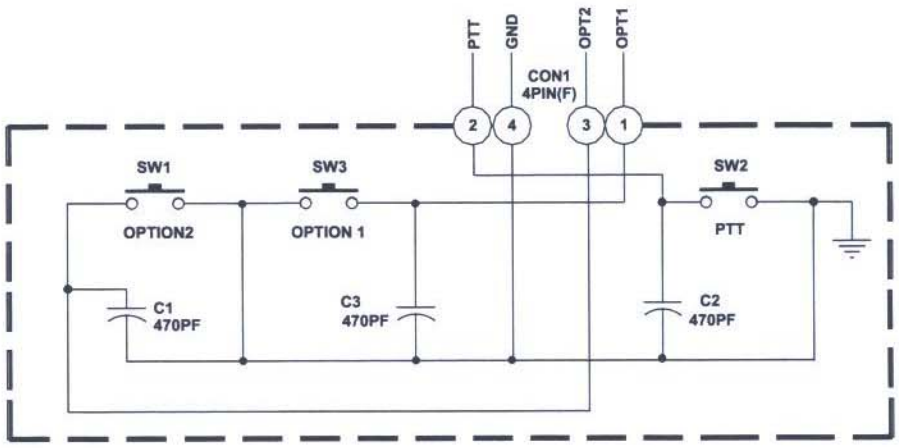
UHF FRONT-END (440-470MHz)

770-110-0020 Rev. A



UHF POWER AMP (440-470MHz)

770-230-0018 Rev. A



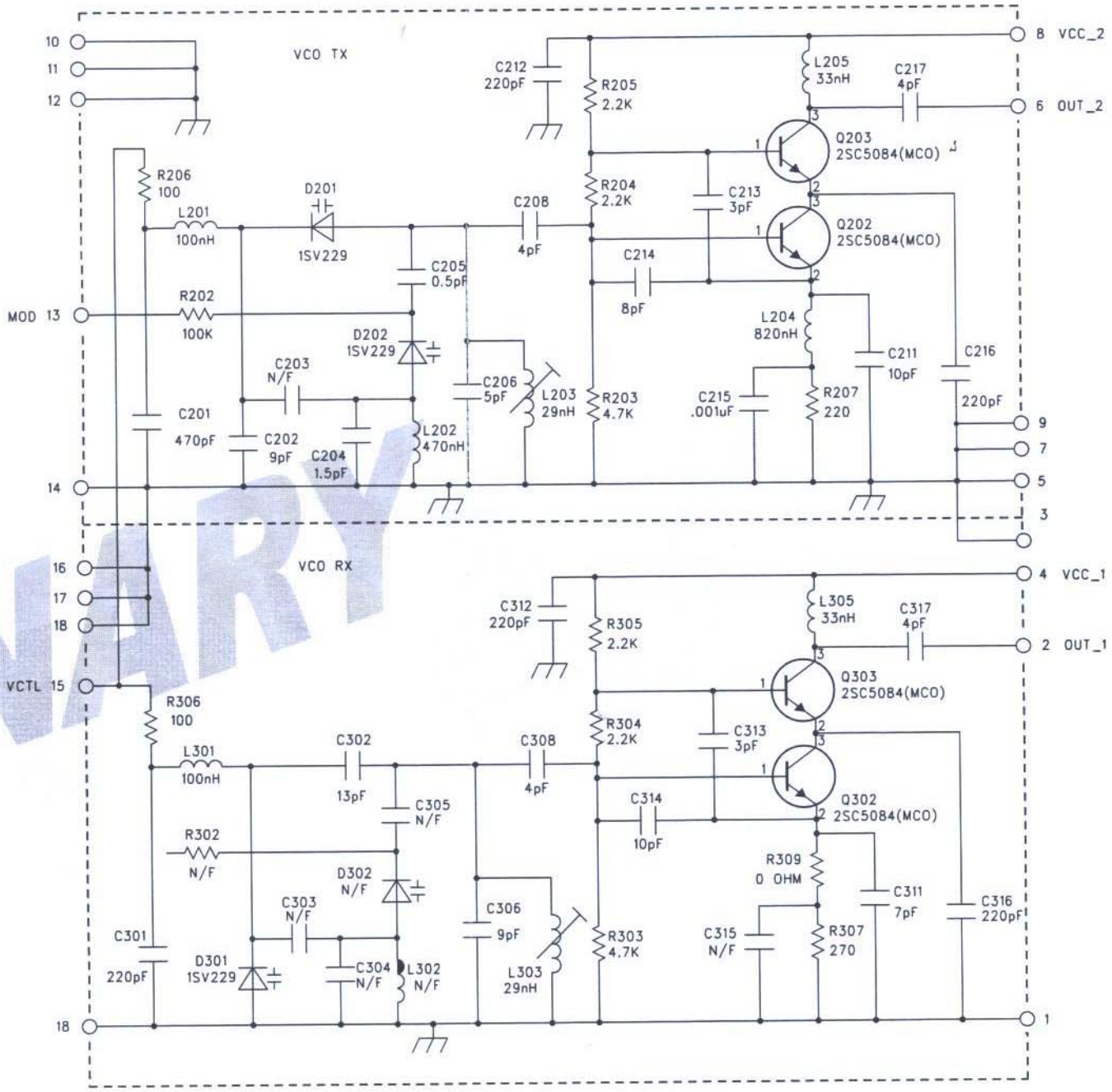
P.T.T.

770-180-0017 Rev. A

NOTES:

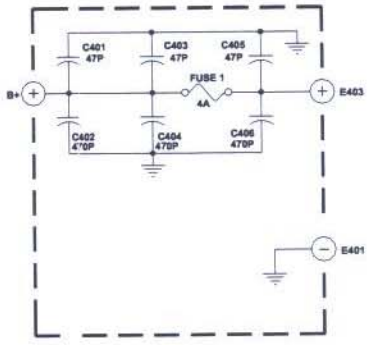
1. All valu
microhe
unless c
2. All res
unless c

Module Schematics



UHF V.C.O. (440-470MHz)

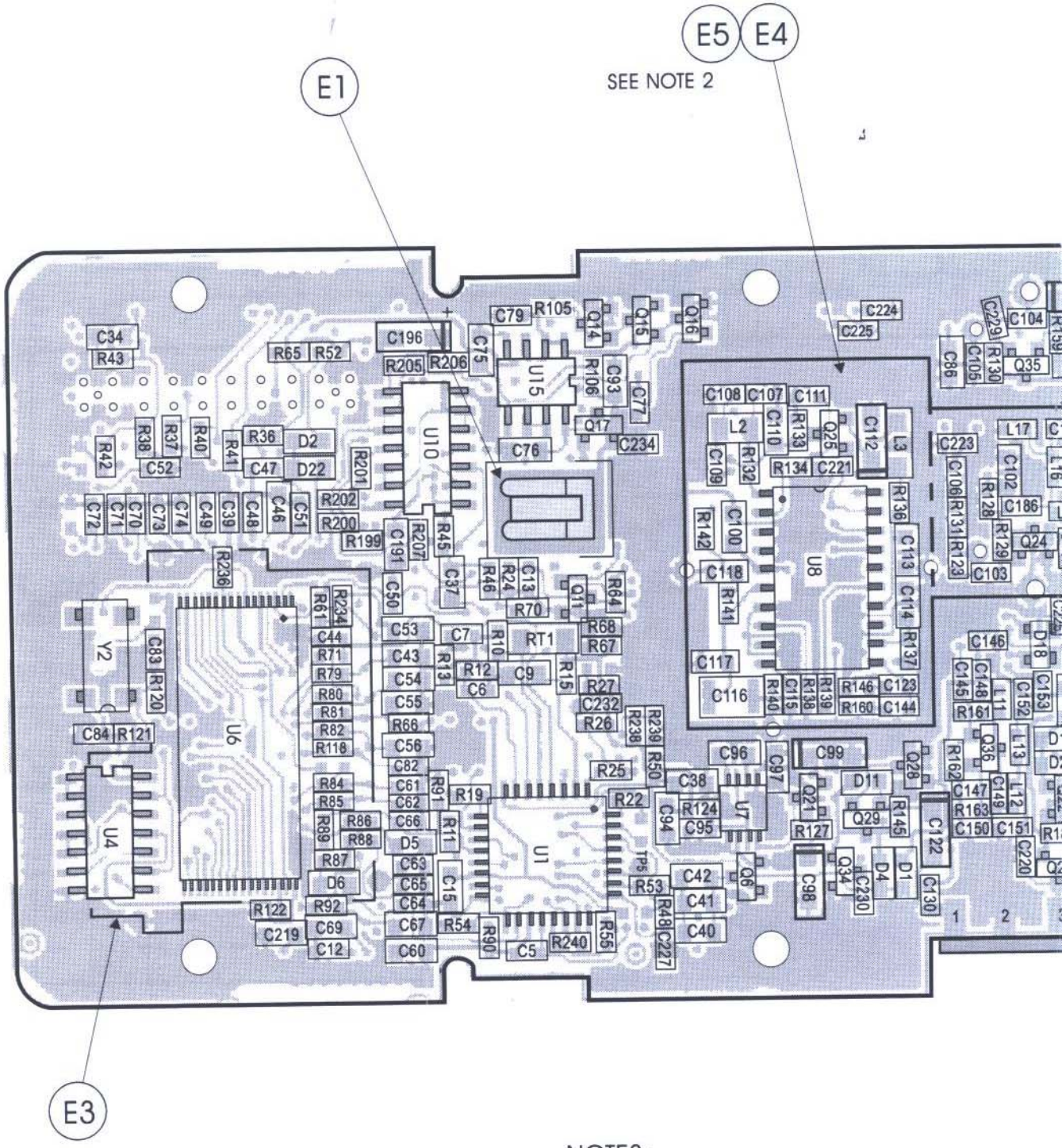
770-030-0027 Rev. B



FUSE

770-200-0004 Rev. B

es are in ohms,
nries or microfarads
therwise specified.
stors are 1/10 W 5%
therwise specified.



NOTES:

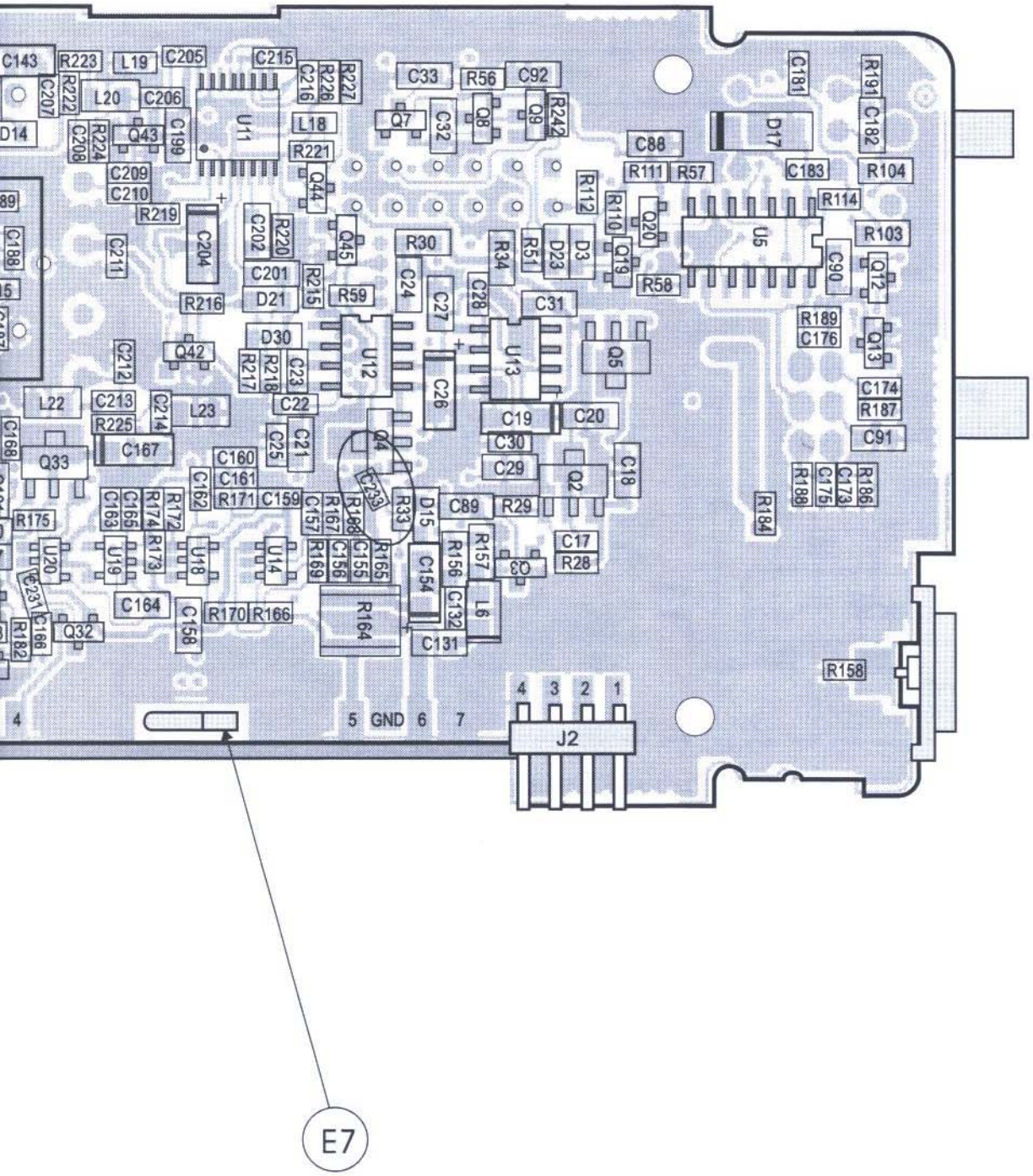
2.) FENCE, E5, SOLDERED AT LOCATING TABS ON PCB. SHIELD TOP, E4, IS REMOVABLE FOR SERVICE.

SOLDER OPPOSITE CORNERS, 2 PLACES, TO HOLD IN PLACE.

Main Board

Digital

650-130-00

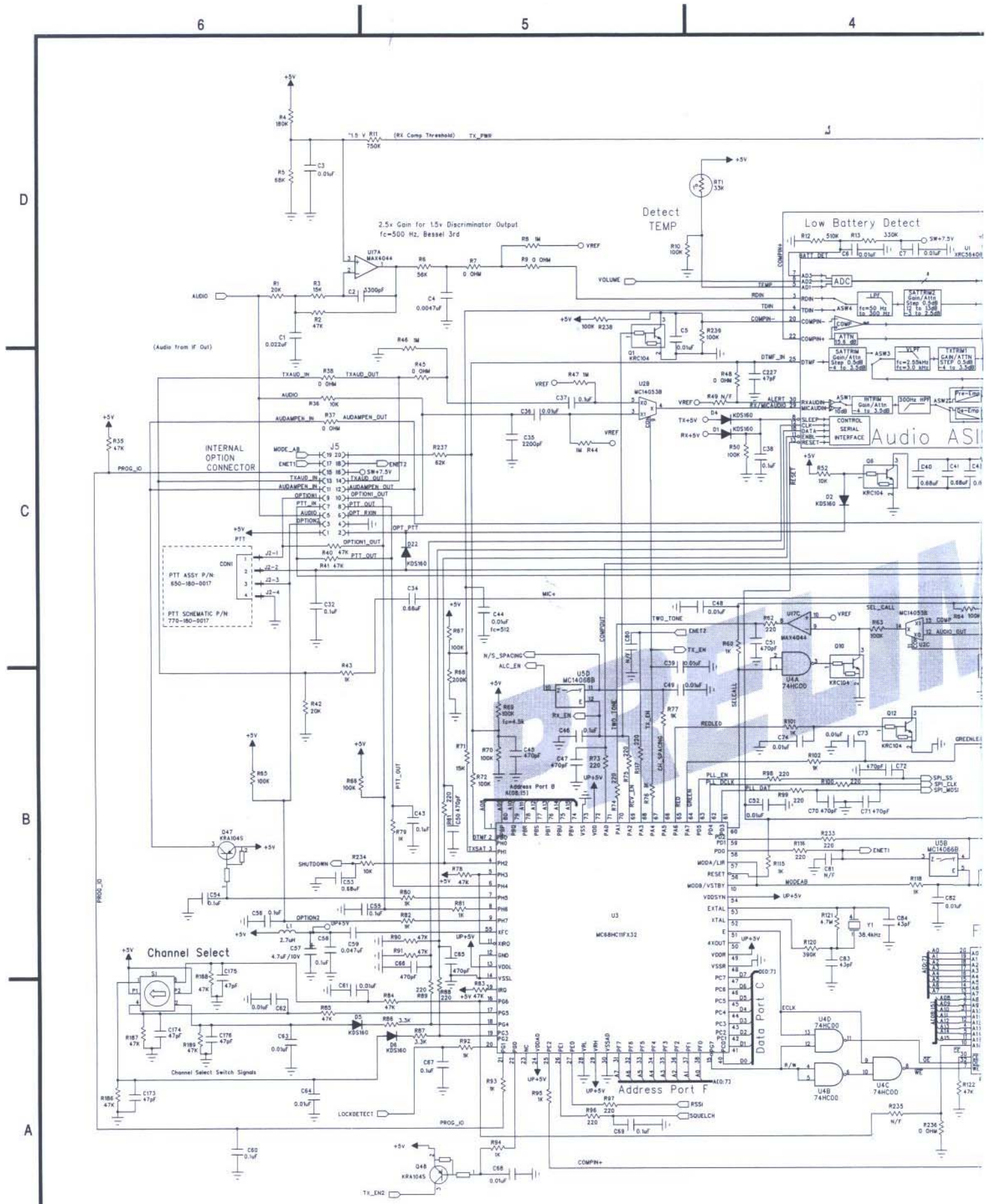


Assembly

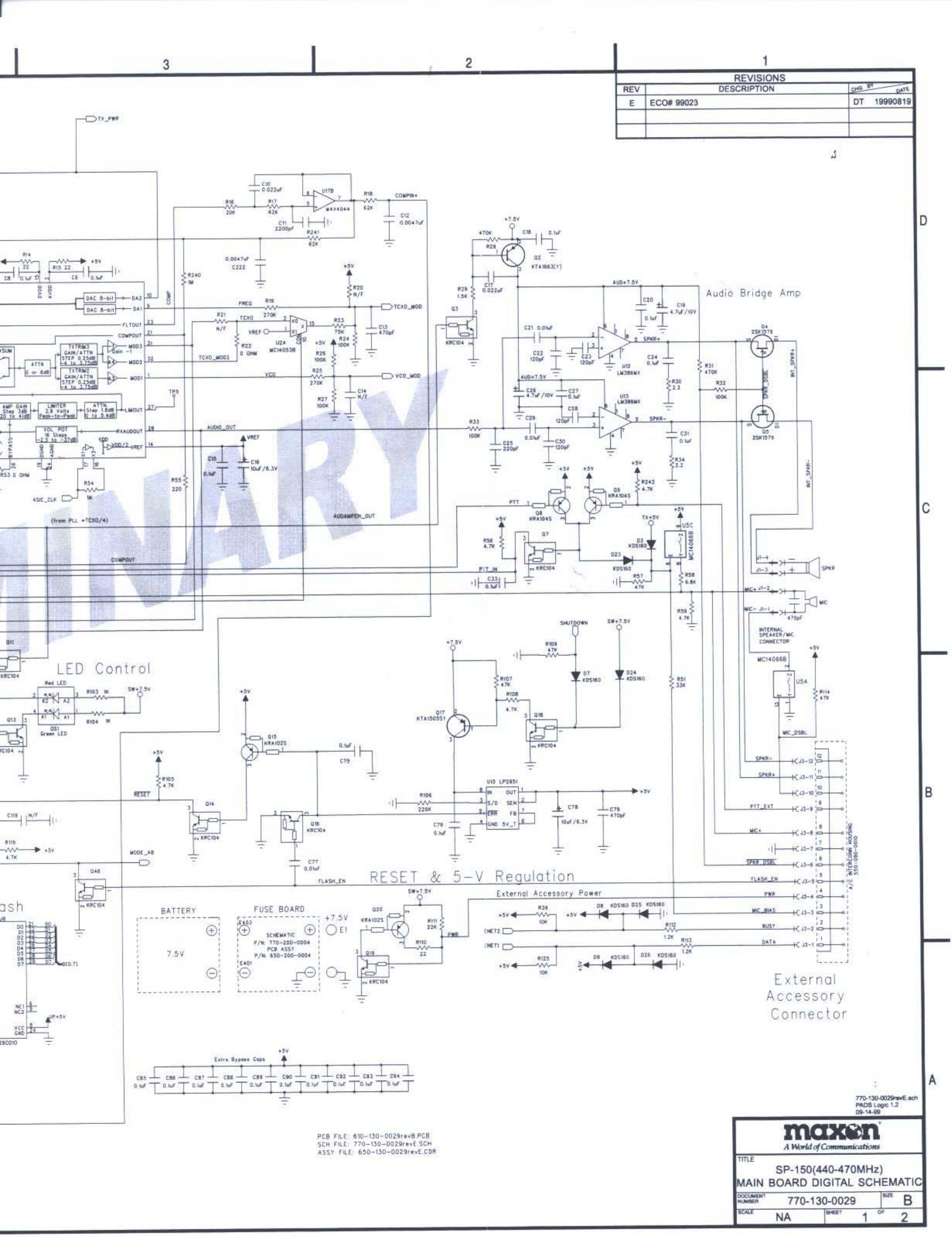
ide

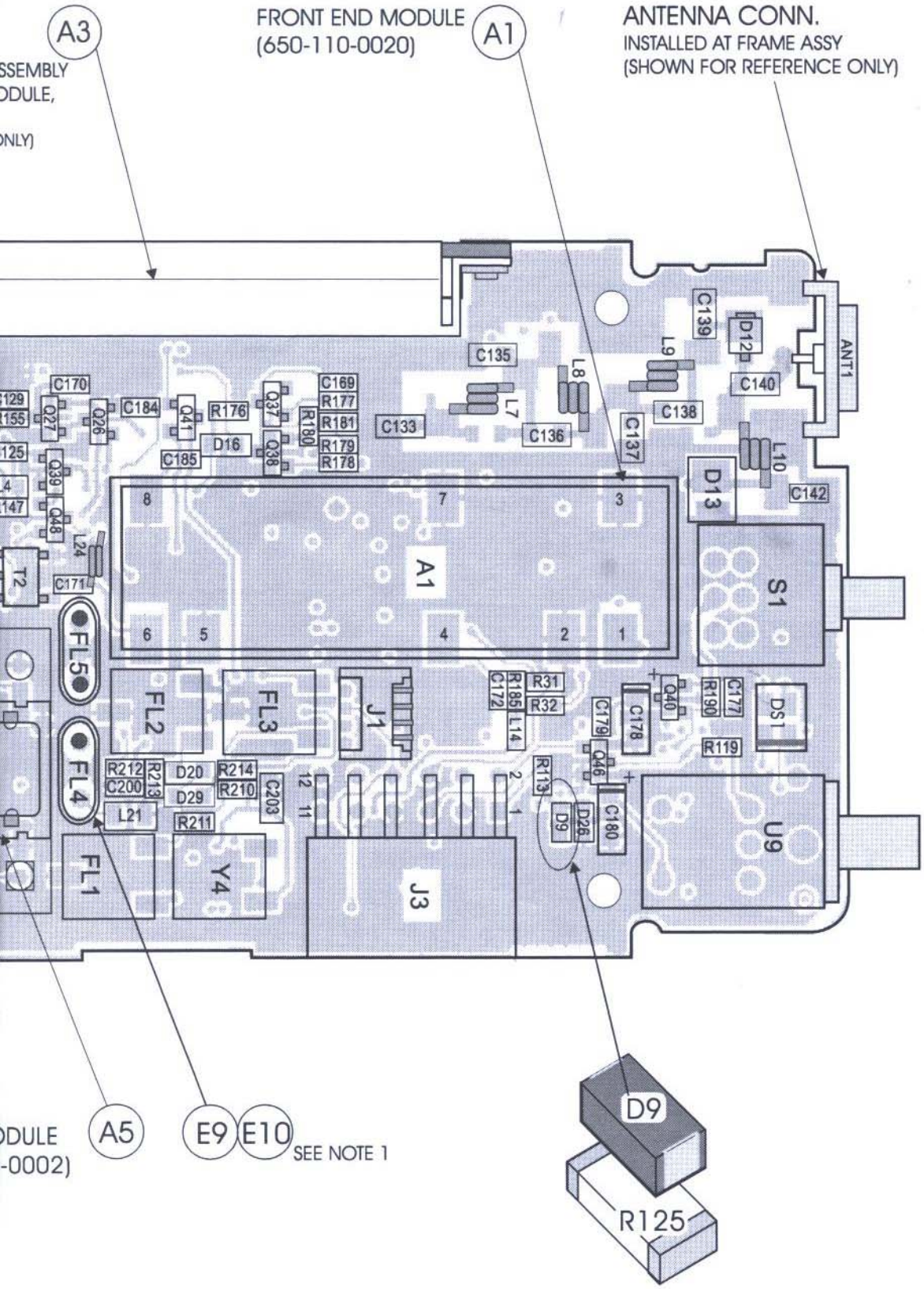
) Rev. E

Main Board Digital Side PCB Layout



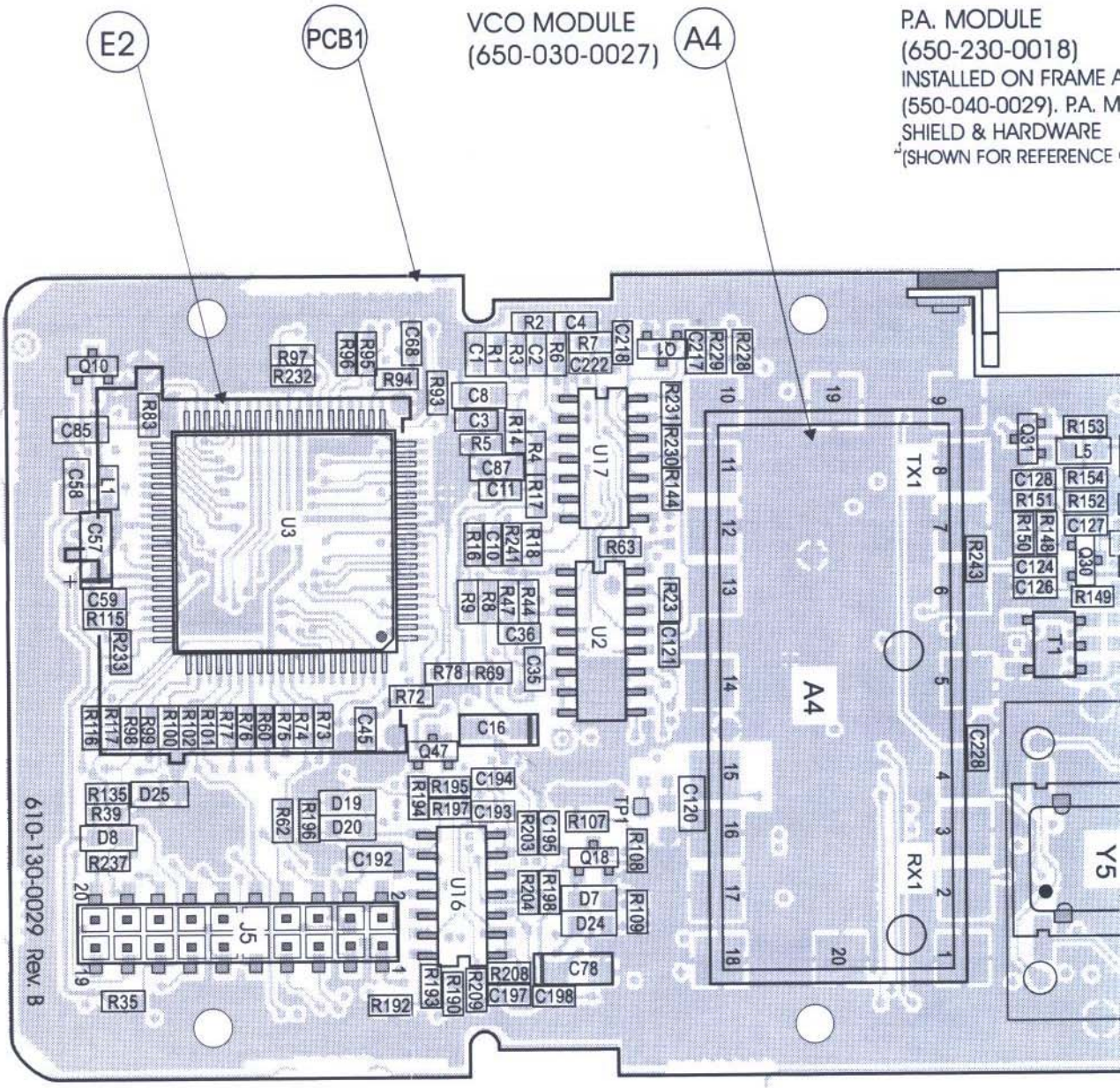
Main Board Digital Side Schematic


REVISIONS
REV
DESCRIPTION
CHG BY
DATE
E
ECO# 99023
DT
19990819
Audio Bridge Amp
LED Control
RESET & 5-V Regulation
External Accessory Power
External Accessory Connector
BATTERY
FUSE BOARD
7.5V
SCHEMATIC
P/N: 770-200-0004
PCB ASSY
P/N: 650-200-0004
Extra Bypass Caps
PRELIMINARY
maxon
A World of Communications
TITLE
SP-150(440-470MHz)
MAIN BOARD DIGITAL SCHEMATIC
DOCUMENT NUMBER
770-130-0029
SIZE
B
SCALE
NA
SHEET
1
OF
2
770-130-0029revE.sch
PADS Logic 1.2
09-14-99
PCB FILE: 610-130-0029revB.PCB
SCH FILE: 770-130-0029revE.SCH
ASSY FILE: 650-130-0029revE.CDR



Assembly
le
9 Rev. E

Main Board RF Side PCB Layout



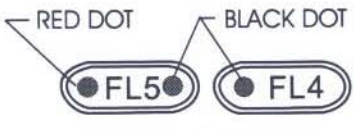


FIGURE "A"

NOTES:

1.) FL4 AND FL5 ARE MATCHED PAIR CRYSTALS FLITERS.

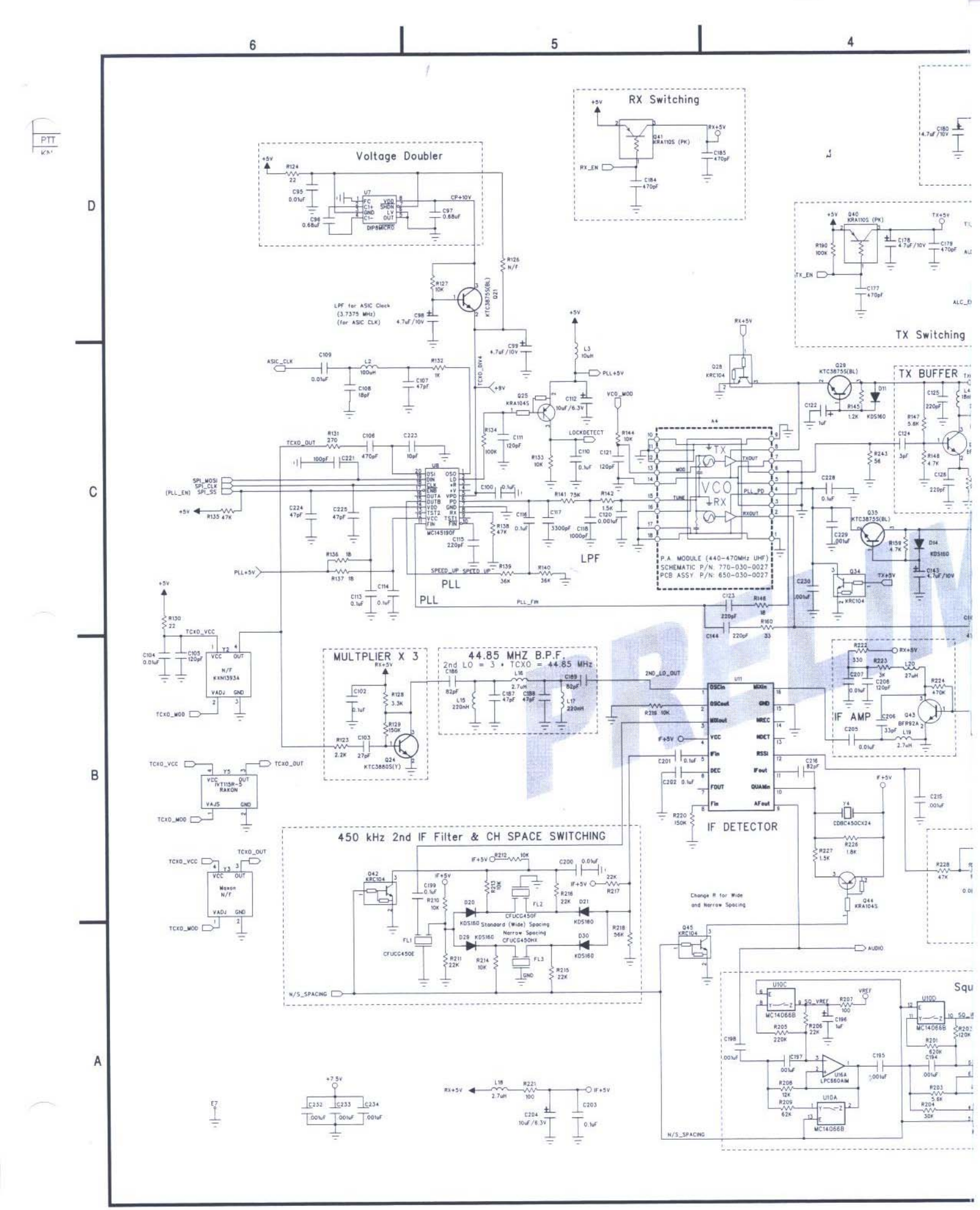
NOTE CRYSTAL ORIENTATION, INPUT CRYSTAL, RED/BLACK DOT AND COMMON CRYSTAL, BLACK DOT. INSTALL WITH RED DOT NEXT TO C171. SEE FIGURE "A"

TCXO M
(650-12

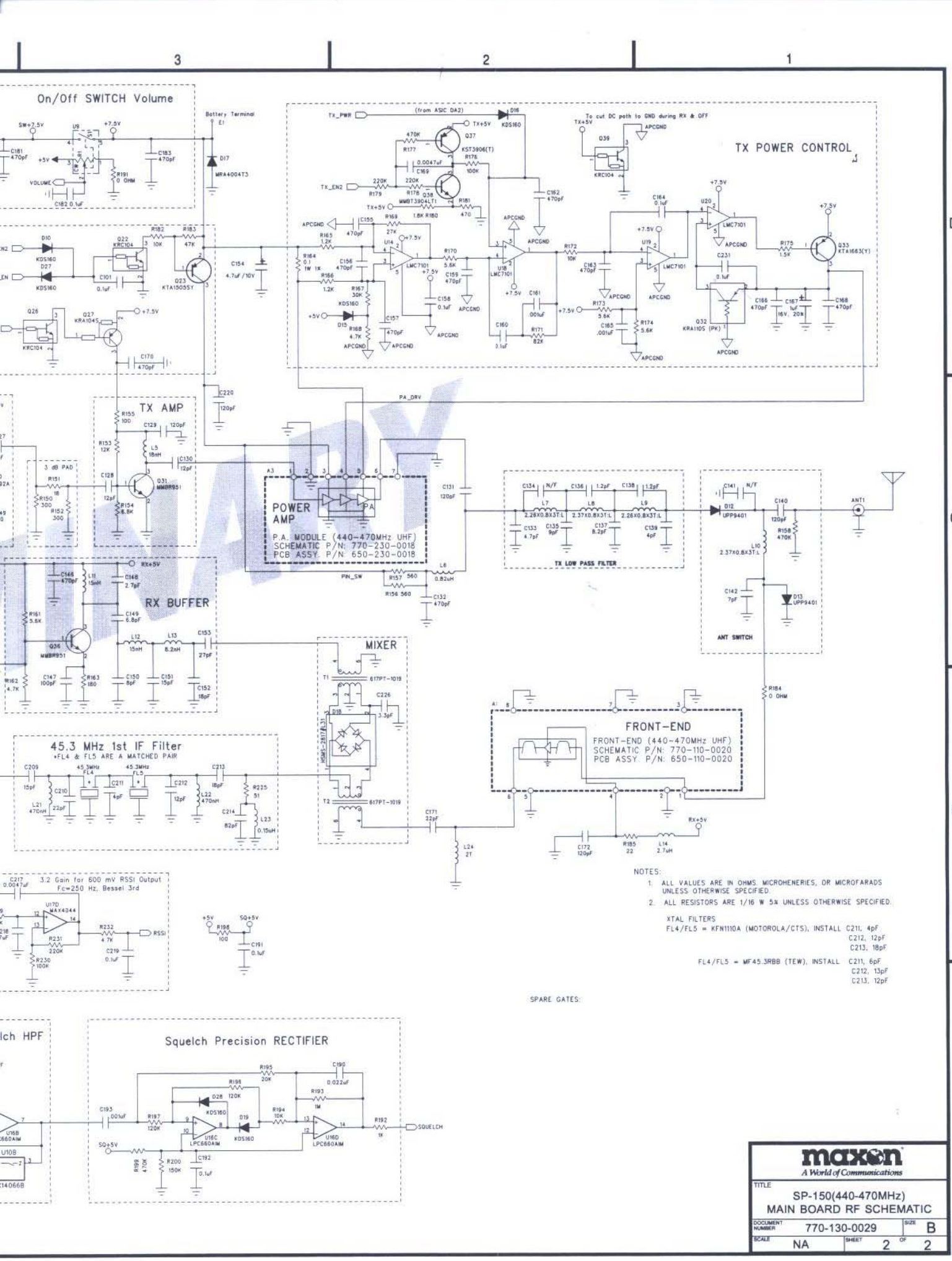
Main Board

RF S

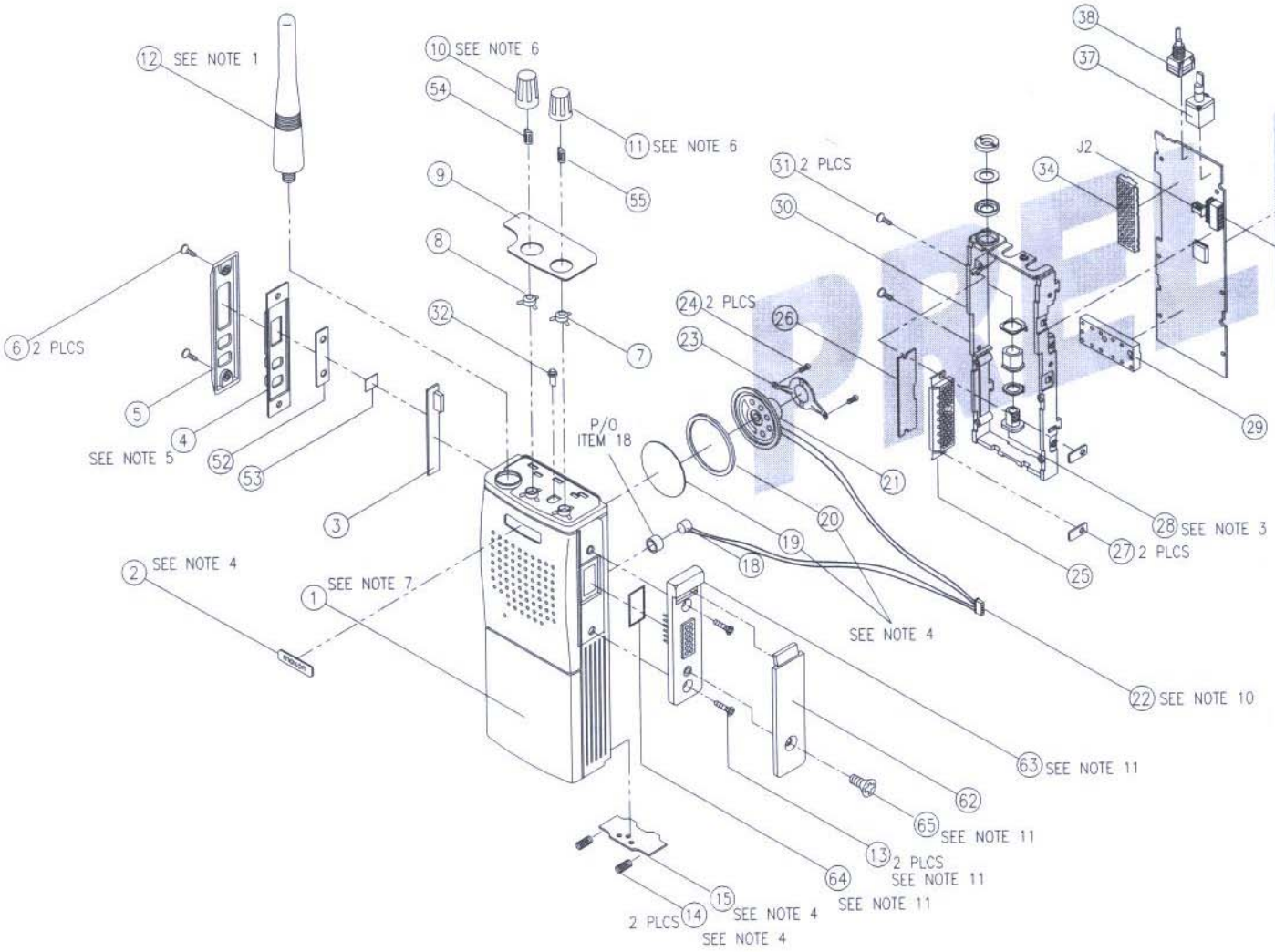
650-130-00



Main Board RF Side Schematic

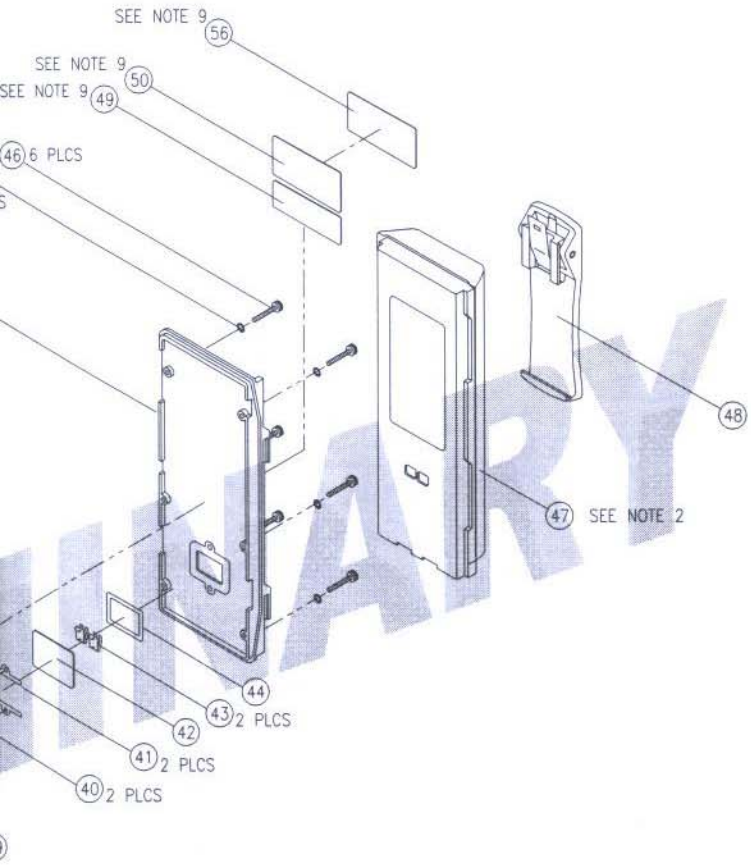

On/Off SWITCH Volume
TX POWER CONTROL
TX AMP
POWER AMP
P.A. MODULE (440-470MHz UHF)
SCHEMATIC P/N: 770-230-0018
PCB ASSY. P/N: 650-230-0018
TX LOW PASS FILTER
ANT SWITCH
RX BUFFER
MIXER
45.3 MHz 1st IF Filter
*FL4 & FL5 ARE A MATCHED PAIR
FRONT-END
FRONT-END (440-470MHz UHF)
SCHEMATIC P/N: 770-110-0020
PCB ASSY. P/N: 650-110-0020
Squelch Precision RECTIFIER
NOTES:
1. ALL VALUES ARE IN OHMS, MICROHENERIES, OR MICROFARADS UNLESS OTHERWISE SPECIFIED.
2. ALL RESISTORS ARE 1/16 W 5% UNLESS OTHERWISE SPECIFIED.
XTAL FILTERS
FL4/FL5 = KFN1110A (MOTOROLA/CTS), INSTALL C211, 4pF
C212, 12pF
C213, 18pF
FL4/FL5 = MF45.3RBB (TEW), INSTALL C211, 6pF
C212, 13pF
C213, 12pF
SPARE GATES:
maxon
A World of Communications
TITLE
SP-150(440-470MHz)
MAIN BOARD RF SCHEMATIC
DOCUMENT NUMBER 770-130-0029
SIZE B
SCALE NA
SHEET 2 OF 2

REPLACEMENT KITS		
DESCRIPTION	KIT PART NUMBER	ITEM # INCLUDED
REFURBISHING KIT	480-040-0006	1,2,4,5,6,7,8,9,10,11,14,15,18,19,20,21,22 23,24,32,52,53,54,55,62,65
PTT SPARE PARTS KIT	480-042-0005	4,5,6,52,53
KNOB KIT, VOL/CHAN	480-042-0008	10,11,54,55
UPPER COVER SPARE PARTS KIT	480-042-0006	1,2,14,15,19,20
ANTENNA HARDWARE KIT	480-020-0017	28
A/C INTERCONNECT HOUSING KIT	480-042-0020	13,63,64,65



NOTES:

1. Refer t
2. Refer t
3. Item 2
4. Items
5. Items
6. Item 5
7. It is re Front
8. Items
9. Contac
10. Conn
11. Items See "



REPAIRABLE/REPLACEABLE PARTS LIST			
ITEM #	QUANTITY	PART NUMBER	DESCRIPTION
1	1	SEE NOTE 4	UPPER COVER
2	1	490-070-0019	OVERLAY
3	1	650-180-0017	PTT PCB ASSEMBLY
4	1	550-090-0007	PTT PAD ASSEMBLY
5	1	560-050-0039	PTT HOLDER
6	2	330-110-0143	SCREW, M2X7
7	1	330-220-0017	VOLUME KNOB GASKET
8	1	330-220-0018	CHANNEL KNOB GASKET
9	1	490-200-0046	TOP OVERLAY (16 CHANNEL)
10	1	660-090-0097	CHANNEL KNOB
11	1	660-090-0096	VOLUME KNOB
12	1	SEE NOTE 1	ANTENNA
13	1	330-110-0147	SCREW, M2X8
14	2	SEE NOTE 4	SPRING
15	1	SEE NOTE 4	BATTERY LATCH
18	1	550-150-0031	MICROPHONE/CAP ASSEMBLY
19	1	330-230-0051	FELT
20	1	330-220-0019	GASKET
21	1	050-010-0028	SPEAKER, 16 OHM
22	1	950-010-0030	4 PIN WIRE HARNESS
23	1	560-090-0043	SPEAKER BRACKET
24	2	330-111-0069	SCREW, M2.6x5-2S
25	1	560-020-0082	P.A. SHIELD
26	1	650-230-0018	P.A. MODULE (UHF)
27	2	560-090-0012	BRACKET
28	1	480-020-0017	ANTENNA HARDWARE KIT
29	1	650-030-0027	VCO MODULE (UHF)
30	1	560-070-0011	CHASSIS
31	2	330-110-0131	SCREW, M2X6
32	1	660-160-0047	CLEAR LENS (LIGHT GUIDE)
34	1	650-110-0020	FRONT-END MODULE (UHF)
35	1	140-020-0054	12 PIN ACCESSORY JACK
37	1	901-002-0203	VOLUME (ON/OFF) SWITCH
38	1	830-010-0011	CHANNEL SELECT (16 CHANNEL)
39	1	330-220-0026	GASKET RING
40	2	330-110-0132	SCREW, M2x2
41	2	560-090-0072	BRACKET
42	1	650-200-0004	FUSE BOARD ASSEMBLY
43	2	560-110-0100	TERMINAL
44	1	010-051-0007	DOUBLE SIDED TAPE
45	1	550-030-0023	BACK COVER ASSEMBLY
46	6	330-110-0130	SCREW, M2x16
47	1	SEE NOTE 2	BATTERY PACK
48	1	550-070-2000	BELT CLIP ASSEMBLY
49	1	SEE NOTE 9	FCC COMPLIANCE LABEL
50	1	SEE NOTE 9	MODEL/SN FCC ID LABEL
51	1	150-000-0003	TCXO MODULE (UHF)
52	1	SEE NOTE 5	TENSION PLATE
53	1	SEE NOTE 5	CLEAR POLYESTER FILM
54	1	330-260-0005	SPRING INSERT, VOLUME
55	1	330-260-0004	SPRING INSERT, CHANNEL
56	1	SEE NOTE 9	CLEAR LABEL
57	6	330-220-0037	GASKET
61	1	480-042-0006	UPPER COVER SPARE PARTS KIT
62	1	660-010-0175	CONNECTOR COVER
63	1	SEE NOTE 11	A/C INTERCONNECT HOUSING KIT
64	1	760-100-0003	CONNECTOR SEAL
65	1	330-110-0146	SCREW, M3X5
AVAILABLE PARTS FOR SP-150			
FUSE	1	700-020-0002	FUSE 4-A 60V
DS1	1	240-030-0035	LED CHIP
TC701	1	910-009-0200	TRIMMER CAP 5-20pF
FL2	1	310-010-0019	CERAMIC FILTER CFUCG450F
FL3	1	310-010-0022	CERAMIC FILTER CFUCG450HX
Y1	1	162-000-0041	XTAL 38.400 kHz
FL4/FL5	1	310-030-0004	XTAL FILTER

Maxon Price Guides for available part substitutions.

Maxon Price Guides for battery options.

(Antenna Hardware Kit) includes all hardware to mount antenna.

2, 14, 15, 19 & 20 are included with Spare Parts Kit. See "Replacement Kits" chart.

2 and 53 are included with Item 4 (PTT Pad Assembly).

must be ordered when ordering Item 11. Item 54 must be ordered when ordering Item 10.

ommended that Items 7, 8, 9 & 32 be ordered as replacement parts when ordering over Sub-Assembly (Item 1).

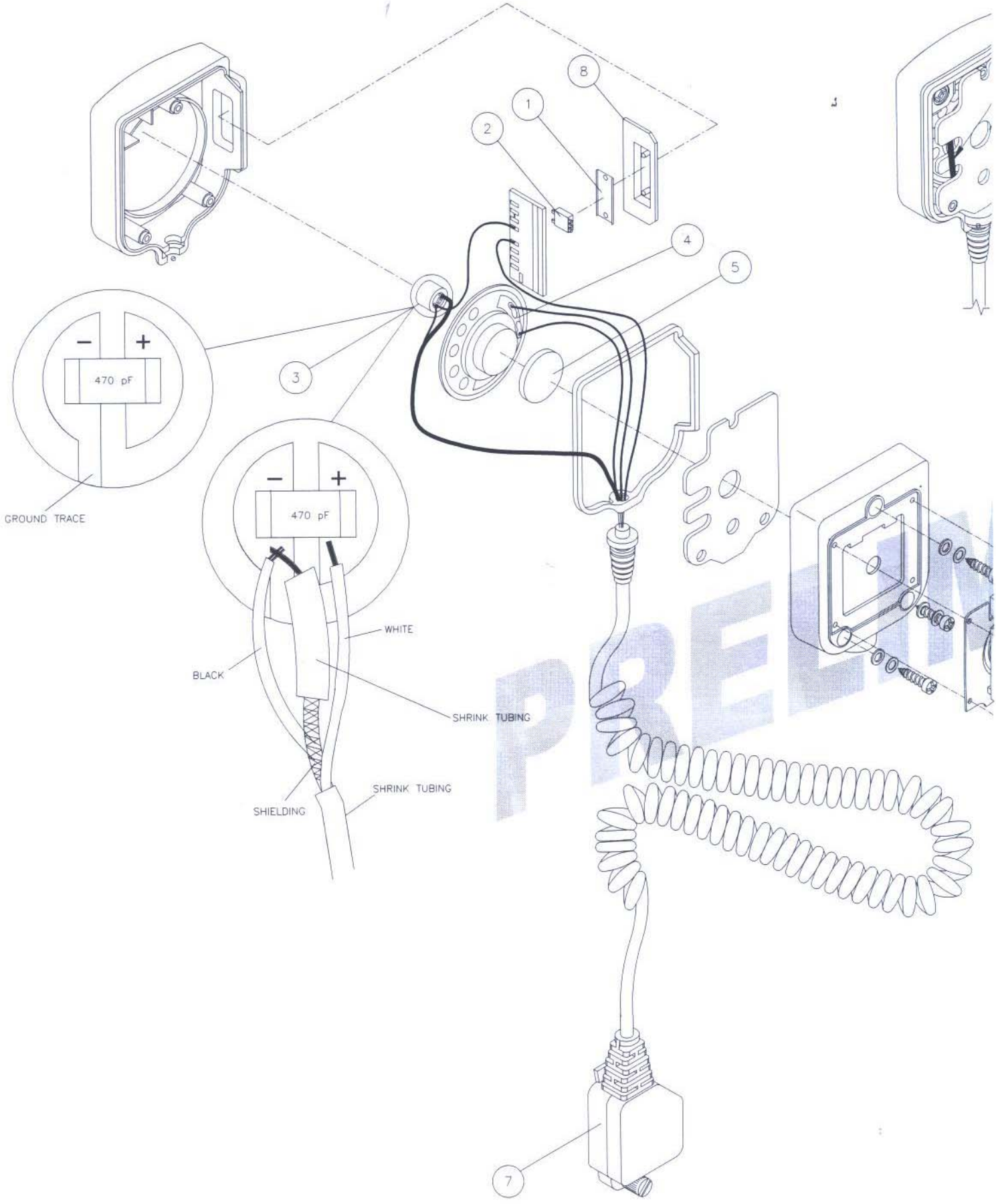
0, 41, 42, 43, & 44 are included with Item 45, Back Cover Assembly.

Maxon Customer Service to order FCC labels Items 49, 50 & 56.

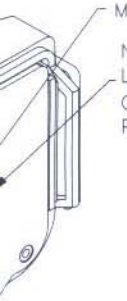
t wire harness to J2 on Main Board Assembly.

13, 63, 64 & 65 are included with A/C Interconnect Housing Kit.
eplacement Kits" chart.

SP-150 Exploded View & Parts List



ACC-701 Exploded View & Parts List



REPAIRABLE/REPLACEABLE PARTS LIST			
ITEM #	QUANTITY	PART NUMBER	DESCRIPTION
1	1	560-130-0039	PTT PAD TENSION PLATE
2	1	830-070-0004	PTT TACT SWITCH
3	1	050-020-0011	MICROPHONE
4	1	050-010-0028	SPEAKER, 16 OHM
5	1	330-200-0065	SPONGE CUSHION
6	1	480-042-0018	BELT CLIP REPLACEMENT KIT
7	1	950-020-0013	CORD ASSEMBLY WITH HOUSING
8	1	760-040-0023	PTT PAD BUTTON
9	1	490-010-0111	PRODUCT LABEL