9800 Series

MOBILE

SERVICE MANUAL

984X Series (UHF)
988X Series (800 MHz)
989X Series (900 MHz)

25 or 40 Watts (UHF); 15 or 30 Watts (800/900 MHz)
13.6 VDC
Part No. 242-98xx-xxx

Remote-Mount

EFJohnson®

First Printing
January 2001

98xx-SERIES
FM TWO-WAY RADIO
SERVICE MANUAL

13.6 VDC
25 or 40 Watts, UHF
15 or 30 Watts, 800/900 MHz

Part No. 242-984x-2xx (UHF)
Part No. 242-988x-2xx (800 MHz)
Part No. 242-989x-2xx (900 MHz)

The E.F. Johnson Company, which was founded in 1923, provides wireless communication systems solutions for public safety, government, and commercial customers. The company designs, manufactures, and markets conventional and trunked radio systems, mobile and portable subscriber radios, repeaters, and Project 25 digital radio products.

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SECTION 1 GENERAL INFORMATION

1.1 SCOPE OF MANUAL

1.1.1 GENERAL

This service manual contains installation and service information for all current 9800 series mobile transceivers. These include the UHF 984x, 800 MHz 988x, and 900 MHz 989x models.

This manual does not include operation, programming, or alignment information. This information is covered by a separate operation/programming manual (addendum) for each operating protocol as follows:

Protocol	Operation and Programming Manual
98xx Multi-Net®	001-9880-400
98xx LTR-Net™	001-9800-600/-601
98xx SMARTNET™/ SmartZone®	001-9800-501

Therefore, use this manual to install and service 98xx transceivers, and use the above manual for operation, programming, and tuning information.

NOTE: The above Multi-Net manual also includes 98xx servicing information but has not been updated with the latest changes that are in this manual.

1.1.2 LTR®, LOW TIER, AND DATA MODELS

NOTE: LTR, low tier, and data versions of the 98xx transceiver are no longer available.

The LTR versions of the 98xx are covered by LTR 98xx Service Manual, Part No. 001-9800-200. This is a complete LTR manual that includes LTR operation and programming information and 98xx hardware servicing information. There are also -201 and -202 revisions that should accompany this manual.

The LTR models of the 98xx mobile were available in both high and low tier versions, and the Multi-Net, LTR-Net, and SMARTNET/SmartZone models are available in only the high tier version. Therefore, only high tier models are covered by this manual. For servicing information on low tier models, refer to the LTR manual described in the preceding paragraph.

The data version of the 98xx transceiver has a front panel that is blank except for the programming jack. For servicing information on data models, refer to the LTR manual just described.

The Multi-Net version of the 98xx transceiver has a data interface that supports external data equipment. For information on this interface and the serial control protocol it uses, refer to the Multi-Net manual described in the preceding section.

NOTE: External data equipment is currently not supported by the LTR-Net and SMARTNET/SmartZone versions of this transceiver.

1.2 TRANSCEIVER DESCRIPTION

1.2.1 GENERAL

The 98xx-series transceivers combine the latest two-way radio features and technology into a rugged and dependable package for the business, industrial, and public safety markets. These transceivers are digitally synthesized, microcomputer-controlled, and field programmable.

1.2.2 AVAILABLE FREQUENCY BANDS

UHF Models

- 430-470 MHz or 470-512 MHz models available.
- All currently available models are dual bandwidth (12.5/25 kHz). Therefore, they can be programmed to operate on both types of channels.
- High power (40W) or medium power (25W) models available.

800 MHz Models

- Full band (806-824 MHz) operation.
- All currently available models are dual bandwidth (12.5/25 kHz).
- High power (30W) and medium power (15W) models available.

900 MHz Models

- Full band (896-902 MHz) operation.
- Only narrow band (12.5 kHz) models are available because the 900 MHz band has always had a 12.5 kHz channel spacing.
- High power (30W) and medium power (15W) models available.

1.2.3 FRONT AND REMOTE MOUNTING

High tier models are available in both front- and remote-mount versions, and low tier models were available in a front mount version only. Remote mount versions are intended to be mounted in a remote location up to approximately 17 feet away from the control unit such as the vehicle's trunk. Front mount versions are intended to be mounted within reach of the operator.

The control unit connects to the remote pigtail cable coming from the back panel of the transceiver. This cable is standard with remote mount models and optional with front mount models. The remote control unit uses the high tier front panel assembly. A Remote Conversion Kit is available for converting a front mount high tier model to remote mounting (see Table 1-3). The transceiver does not have dual-control capability. Therefore, either the front panel or a remote control unit can be used for control, but not both.

1.2.4 NPSPAC MODELS (800 MHZ ONLY)

All 800 MHz 988x transceivers capable of operating on 25 kHz channels meet the stricter specifications established by NPSPAC (National Public Safety Panel Advisory Committee) for public safety frequencies from 821-824 and 866-869 MHz. Since deviation is less on NPSPAC channels, an additional screen is may be displayed by the tuning software with 800 MHz models for setting NPSPAC deviation. Then when a public safety channel is selected, the deviation automatically changes to the level set in this screen.

1.2.5 PROGRAMMING

Transceiver programming is performed using a PC-compatible computer, the E.F. Johnson Remote Programming Interface (RPI), and E.F. Johnson programming software. Programming is described in separate manuals as described in Section 1.1.1.

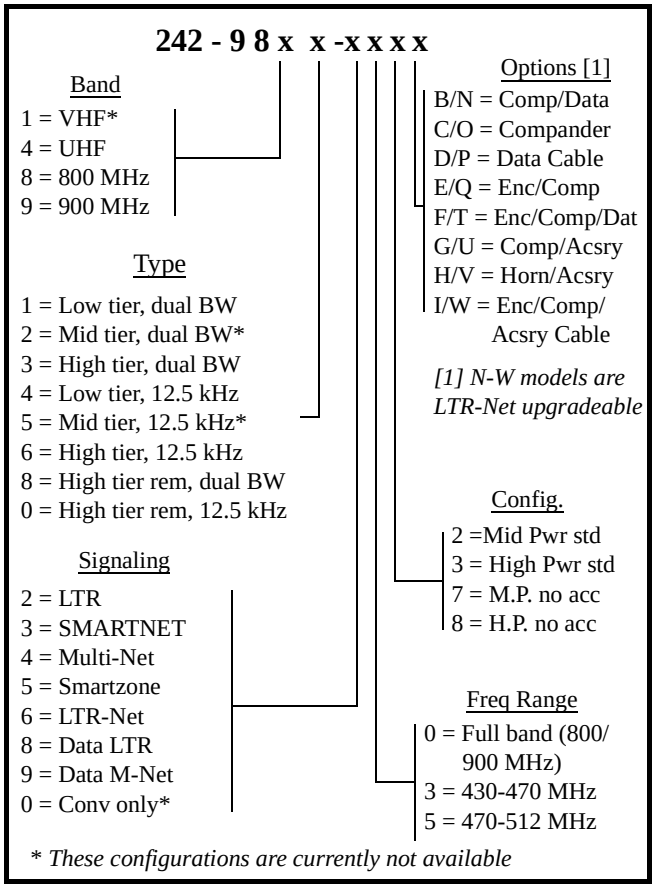
1.2.6 TRANSCEIVER ALIGNMENT

Alignment is performed using the standard Personality programming setup and special Radio Tune software. There are only two or three adjustments that are made by physically adjusting a component on the PC board. All other adjustments are set digitally. The desired setting is selected using the computer, and it is then automatically stored in the transceiver memory. If the manual adjustments do not need to be readjusted, transceiver alignment can usually be performed without removing the covers. Alignment is described in separate manuals as described in Section 1.1.1.

1.3 PART NUMBER BREAKDOWN

The breakdown of the part number used to identify this transceiver is shown in Table 1-1. With LTR-Net and Multi-Net models, digits 4-7 of this number are displayed briefly at power up.

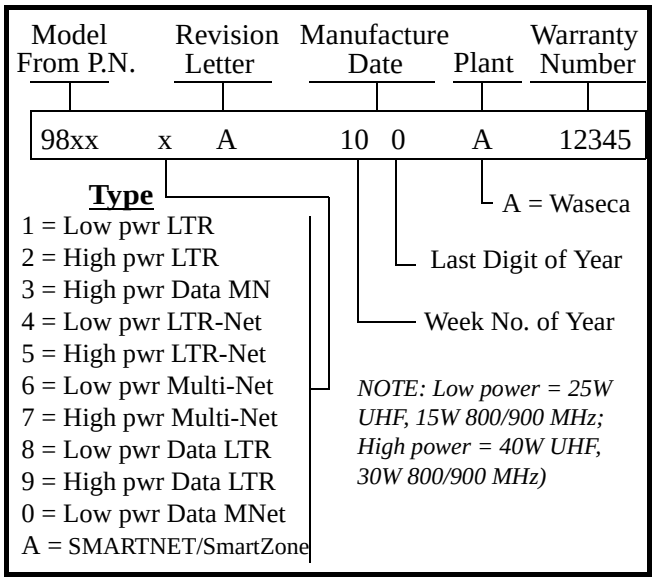
Table 1-1 Part Number Breakdown



1.4 TRANSCEIVER IDENTIFICATION

The transceiver identification number is printed on a label that is attached to the chassis. The information is contained in this number is shown in Table 1-2. This number is stored electronically and can be read using the programming software.

Table 1-2 Identification Number Breakdown



1.5 ACCESSORIES

The accessories available for this transceiver are listed in Table 1-3. The following is a brief description of most of these accessories.

Mounting Accessories - The -030 mounting kit contains mounting knobs and four self-drilling screws. The -610 kit contains mounting knobs, a remote mounting bracket, and four self drilling screws. The 10- and 22-ft. cable kits include a fused power cable and microphone hanger with a ground wire

Table 1-3 98xx Accessories

Accessory	Part No.
Mounting Accessories	
Front mounting kit	023-9800-030
Remote mounting kit	023-9800-040
10 ft. DC power cable and hardware kit	023-9800-410
22-ft. DC power cable and hardware	023-9800-422
Standard mounting bracket	017-2229-005
Low-profile mounting bracket	017-2229-010

Table 1-3 98xx Accessories (Continued)

Accessory	Part No.
Standard Key Cap Kits (5 key caps)	
Multi-Net	587-9840-001
LTR-Net	587-9840-002
SMARTNET/SmartZone	587-9840-003
Optional Key Cap Kits (20+ key caps)	
Multi-Net/LTR-Net	587-9840-004
SMARTNET/SmartZone	587-9840-105
Microphones	
Standard amplified dynamic	250-0740-300
Standard DTMF w/lighted keypad	250-0751-021
WR 805 DTMF (weather resistant)	589-0016-029
Desk-type	250-0742-010
Remote Speaker, 5”, 15W, 4.7 ohm	250-0151-010
Remote conversion kit	250-9800-001
Remote control extension cable, 11 ft.	597-9800-009
Remote control pigtail cable (for xcvr)	597-9800-011
Accessory cable components	
Accessory pigtail cable	597-9800-003
Accessory wire kit	023-9750-011
Data/accessory cable kit (both cables included, w/o data connector)	597-9800-001
Data pigtail cable (data cable only w/o data connector)	597-9800-005
Compander kit	250-9800-310
Encryption kit, Transcrypt® SC20-4xx	SC20-4xx
Desktop Power Supply	
15 A, 117 VAC	239-0226-113
15 A, 230 VAC	239-0226-213
Wedge mounting pedestal kit (includes 10 ft. power cable)	023-8610-914
Programming Accessories	
Remote Programming Interface (RPI)	023-9800-000
Cable, RPI to transceiver	597-2002-200
Cable, RPI to computer, 6 ft. (DB9F to DB9M)	597-5900-002
Programming software (see manual listed in Section 1.1.1)	

Key Cap Kit - A key cap kit which includes five caps labeled for common functions is standard with each transceiver. Optional kits are also available. Refer to Section 2.8 for more key cap information.

Microphones and Speaker - The microphones have an impedance of 620 ohms, and all DTMF models have backlighted keypad but no memory for storing numbers. The WR805 microphone is environmentally sealed against such things as rain, sand, and dust. The desk microphone has a monitor button that can be locked down if desired.

The remote 15-watt speaker can be used instead of the internal speaker. It is non-amplified and weather resistant, and has a 6-ft. cable. It plugs into the external speaker jack in the back panel (with both front and remote mount applications), and the internal speaker is automatically disabled when it is used.

Remote Mounting Components - The remote conversion kit converts the front panel of a front mount high tier transceiver to a remote control unit. It includes a blank front cover for the transceiver, a housing and 5-ft. control cable for the front panel, and a 1-ft. pigtail cable for connecting the control unit to the transceiver. If the control unit is to be mounted more than approximately 6 feet from the transceiver, the 11-ft. extension cable is required (see Figure 2-2).

Accessory Cable - The -003 pigtail cable installs in the transceiver, and the wire kit is used to connect accessories to this cable. Included in the wire kit are two 22-ft. and three 2-ft. wire assemblies that can be used as desired. The accessory cable is required if such things as ignition switch control of power or the horn alert are used. Refer to Section 2.4 for installation information.

Data/Accessory Cable - The -001 cable assembly includes a data pigtail cable that plugs into J301 on the audio/logic board and also the accessory pigtail described above. The -005 cable assembly is a data cable only without the accessory cable. Neither cable includes the connector that interfaces with the data equipment, so it must be user supplied and installed. Installation of this cable is described in Section 2.7.

Compandor and Encryption Kits - The compandor kit includes a board assembly that installs in the option wire-outs on the audio/logic board to provide companding. Likewise, the encryption kit includes a board assembly that connects to the other option wire-outs on the audio/logic board. Contact your sales representative for more information on available encryption options.

Desktop Accessories - The -113 and -213 power supplies include a pedestal for mounting the transceiver and also include an internal speaker. The wedge mounting pedestal includes a 10-ft power cable. Also required when this pedestal is used is one of the power supplies and the -010 low profile mounting bracket.

Programming Accessories - This RPI has design enhancements required for Flash programming the 9800-series transceivers. It also has jacks for injecting a microphone audio signal and monitoring receive audio when aligning the transceiver. Earlier RPIs (such as 023-9750-000 and 023-5810-000) can be used to program personality information if desired.

1.6 PRODUCT WARRANTY

The warranty statement for this transceiver is available from your product supplier or from the Warranty Department, E.F. Johnson Company, 299 Johnson Avenue, P.O. Box 1249, Waseca, MN 56093-0514. This information may also be requested from the Warranty Department by phone as described in Section 1.7. The Warranty Department may also be contacted for Warranty Service Reports, claim forms, or any other questions concerning warranties or warranty service.

1.7 FACTORY CUSTOMER SERVICE

The Customer Service Department of the E.F. Johnson Company provides customer assistance on technical problems and the availability of local and factory repair facilities. Regular Customer Service hours are 7:30 a.m. - 5:30 p.m. Central Time, Monday - Friday. The Customer Service Department can be reached at the following telephone numbers:

Toll-Free: 1-800-328-3911
(From within continental United States only)
International: (507) 835-6911
FAX: (507) 835-6969
E-Mail: First Initial/Last Name@efjohnson.com
(You need to know the name of the person you want to reach. Example: jsmith@efjohnson.com)

NOTE: Emergency 24-hour technical support is also available at the 800 and preceding numbers during off hours, holidays, and weekends.

When your call is answered, you will hear a brief message informing you of numbers that can be entered to reach various departments. This number may be entered during or after the message using a tone-type telephone. When you enter some numbers, another number is requested to further categorize the type of information you need.

You may also contact the Customer Service Department by mail. Please include all information that may be helpful in solving your problem. The mailing address is as follows:

E.F. Johnson Company
Customer Service Department
299 Johnson Avenue
P.O. Box 1249
Waseca, MN 56093-0514

1.8 FACTORY RETURNS

Repair service is normally available through local authorized EFJohnson Land Mobile Radio Service Centers. If local service is not available, the equipment can be returned to the factory for repair. However, it is recommended that you contact the Customer Service Department before returning equipment. A service representative may be able to suggest a solution to the problem making return of the equipment unnecessary.

Be sure to fill out a Factory Repair Request Form #271 for each unit to be repaired, whether it is in or out of warranty. These forms are available free of charge by calling Customer Service (see Section 1.7) or by requesting them when you send a unit in for repair. Clearly describe the difficulty experienced in the space provided and also note any prior physical damage to the equipment. Include this form in the shipping container with each unit. Your telephone number and contact name are important as there are times when the technicians may have specific questions that need to be answered in order to completely identify and repair a problem.

When returning equipment for repair, it is also a good idea to use a PO number or some other reference number on your paperwork in case you need to call the repair lab about your unit. These numbers are referenced on the repair order making it easier and faster to locate your unit in the lab.

Return Authorization (RA) numbers are not necessary unless you have been given one by the Field Service Department. RA numbers are required for exchange units or if the Field Service Department wants to be aware of a specific problem. If you have been given an RA number, reference this number on the Factory Repair Request Form sent with the unit. The repair lab will then contact the Field Service Department when the unit arrives.

1.9 REPLACEMENT PARTS

EFJohnson replacement parts can be ordered directly from the Service Parts Department. To order parts by phone, dial the toll-free number as described in Section 1.7. When ordering, please supply the part number and quantity of each part ordered. EFJohnson dealers also need to give their account number. If there is uncertainty about the part number, include the designator (C512, for example) and the model number of the equipment the part is from.

You may also send your order by mail or FAX. The mailing address is as follows and the FAX number is shown in Section 1.7.

E.F. Johnson Company
Service Parts Department
299 Johnson Avenue
P.O. Box 1249
Waseca, MN 56093-0514

1.10 INTERNET HOME PAGE

The E.F. Johnson Company has a site on the World Wide Web that can be accessed for information on the company about such things as products, systems, and regulations. The address is http://www.efjohnson.com.

UHF 984x SPECIFICATIONS

The following are general specifications intended for use in testing and servicing this transceiver. For current advertised specifications, refer to the specification sheet available from your sales representative. Specifications are subject to change without notice.

GENERAL

Frequency Range	430-470 MHz and 470-512 MHz
Operating Modes	LTR (trunked) and Conventional (non-trunked)
Systems and Groups Selectable	Low Tier: Up to 16 system/group combinations High Tier: Variable from 100 1-group systems up to 40 16-group systems
Mounting Location	Dash (low tier), Dash or Remote (high tier)
Transmit/Receive Separation	Any frequency within the range
Channel Spacing	12.5 kHz (2.5 kHz maximum deviation) 25 kHz (5 kHz maximum deviation) (12.5 kHz or dual bandwidth models available)
Frequency Stability	2.0 PPM from –22° to +140° F (–30° to +60° C)
Dimensions	2.1” x 6.0” x 7.5” (HxWxD)
Weight	3.5 lbs (1.59 kg)
Power Requirement	13.6 volts DC nominal, negative ground
Current Drain	300 mA maximum (receive standby) 1.5 A maximum (receive, rated audio output) 10.0 A maximum (transmit, 25 W output) 15.0 A maximum (transmit, 40 W output)
FCC Compliance	Parts 15 and 90

RECEIVER

Sensitivity (12 dB SINAD)	0.35 µV
Selectivity	–70 dB at 25 kHz, –60 dB at 12.5 kHz
Spurious and Image Rejection	–70 dB
Intermodulation	–70 dB
Hum and Noise	–45 dB at 25 kHz, –40 dB at 12.5 kHz
Maximum Frequency Spread	Any spread within the range
Audio Power Output	5 watts (external 4.7-ohm speaker), 3 watts (internal 8-ohm speaker)
Audio Distortion	Less than 5% at 1 kHz with 60% deviation
Audio Response	+1, –3 dB per octave de-emphasis per standard TIA
RF Input Impedance	50 ohms

TRANSMITTER

RF Power Output	25W Version - 25 watts (adjustable to 2-25 watts) 40W Version - 40 watts (adjustable to 10-40 watts)
Spurious and Harmonic Emissions	–70 dB
FM Hum and Noise	–40 dB (25 kHz), –35 dB (12.5 kHz)
Audio Modulation	25 kHz - 16K0F3E (voice) 16K0F1D (data)
Audio Distortion	Less than 3% at 1 kHz with 40% modulation
Audio Frequency Response	6 dB per octave pre-emphasis per standard TIA
Maximum Frequency Spread	Any spread within the band
RF Output Impedance	50 ohms
Duty Cycle	20% standard TIA

800 MHz 988x SPECIFICATIONS

The following are general specifications intended for use in testing and servicing this transceiver. For current advertised specifications, refer to the specification sheet available from your sales representative. Specifications are subject to change without notice.

GENERAL

Frequency Range	Transmit - 806-824 MHz Std., 851-869 MHz conv. talk-around Receive - 851-869 MHz
Operating Modes	LTR (trunked) and Conventional (non-trunked)
Systems and Groups Selectable	Low Tier: Up to 16 system/group combinations High Tier: Variable from 100 1-group to approx. 40 16-group systems
Mounting Location	Dash (low tier), Dash or Remote (high tier)
Transmit/Receive Separation	45 MHz standard, 0 MHz conventional talk-around
Channel Spacing	12.5 kHz (2.5 kHz maximum deviation) 25 kHz (5 kHz max deviation std, 4 kHz max NPSPAC)
Frequency Stability	1.5 PPM from –22° to +140° F (–30° to +60° C)
Dimensions	2.1” x 6.0” x 7.5” (HxWxD)
Weight	3.5 lbs (1.59 kg)
Power Requirement	13.6 volts DC nominal, negative ground
Current Drain	300 mA maximum (receive standby) 1.5 A maximum (receive, rated audio output) 7.0 A maximum (transmit, 15 W output) 11.0 A maximum (transmit, 30W output)
FCC Compliance	Parts 15 and 90

RECEIVER

Sensitivity (12 dB SINAD)	0.35 µV
Selectivity	–70 dB at 25 kHz, –60 dB at 12.5 kHz
Spurious and Image Rejection	–70 dB
Intermodulation	–70 dB
Hum and Noise	–40 dB at 25 kHz, –35 dB at 12.5 kHz
Maximum Frequency Spread	Any spread within the range
Audio Power Output	5 watts (external 4.7-ohm speaker), 3 watts (internal 8-ohm speaker)
Audio Distortion	Less than 5% at 1 kHz with 60% deviation
Audio Response	+1, –3 dB per octave de-emphasis per standard TIA
RF Input Impedance	50 ohms

TRANSMITTER

RF Power Output	Medium power version - 15 watts (adjustable to 2-15 watts) High power version - 30 watts (adjustable to 10-30 watts)
Spurious and Harmonic Emissions	–70 dB
FM Hum and Noise	–45 dB (25 kHz), –38 dB (12.5 kHz)
Audio Modulation	25 kHz - 16K0F3E (voice) 19K6F1D (data) NPSPAC - 14K0F3E (voice) 17K6F1D (data)
Audio Distortion	Less than 5% at 1 kHz with 40% modulation
Audio Frequency Response	6 dB per octave pre-emphasis per standard TIA
RF Output Impedance	50 ohms
Duty Cycle	20% standard TIA

900 MHz 989x SPECIFICATIONS

The following are general specifications intended for use in testing and servicing this transceiver. For current advertised specifications, refer to the specification sheet available from your sales representative. Specifications are subject to change without notice.

GENERAL

Frequency Range	Transmit - 896-902 MHz Std., 935-941 MHz conv. talk-around Receive - 935-941 MHz
Operating Modes	LTR (trunked) and Conventional (non-trunked)
Systems and Groups Selectable	Low Tier: Up to 16 system/group combinations Mid Tier: Up to 16 systems with up to 16 groups each High Tier: Variable from 100 1-group to approx. 40 16-group systems
Mounting Location	Dash (low tier), Dash or Remote (high tier)
Transmit/Receive Separation	39 MHz standard, 0 MHz talk-around
Channel Spacing	12.5 kHz
Frequency Stability	1.5 PPM from –22° to +140° F (–30° to +60° C)
Dimensions	2.1” x 6.0” x 7.5” (HxWxD)
Weight	3.5 lbs (1.59 kg)
Power Requirement	13.6 volts DC nominal, negative ground
Current Drain	300 mA maximum (receive standby) 1.5 A maximum (receive, rated audio output) 7.0 A maximum (transmit, 15 W output) 11.0 A maximum (transmit, 30W output)
FCC Compliance	Parts 15 and 90

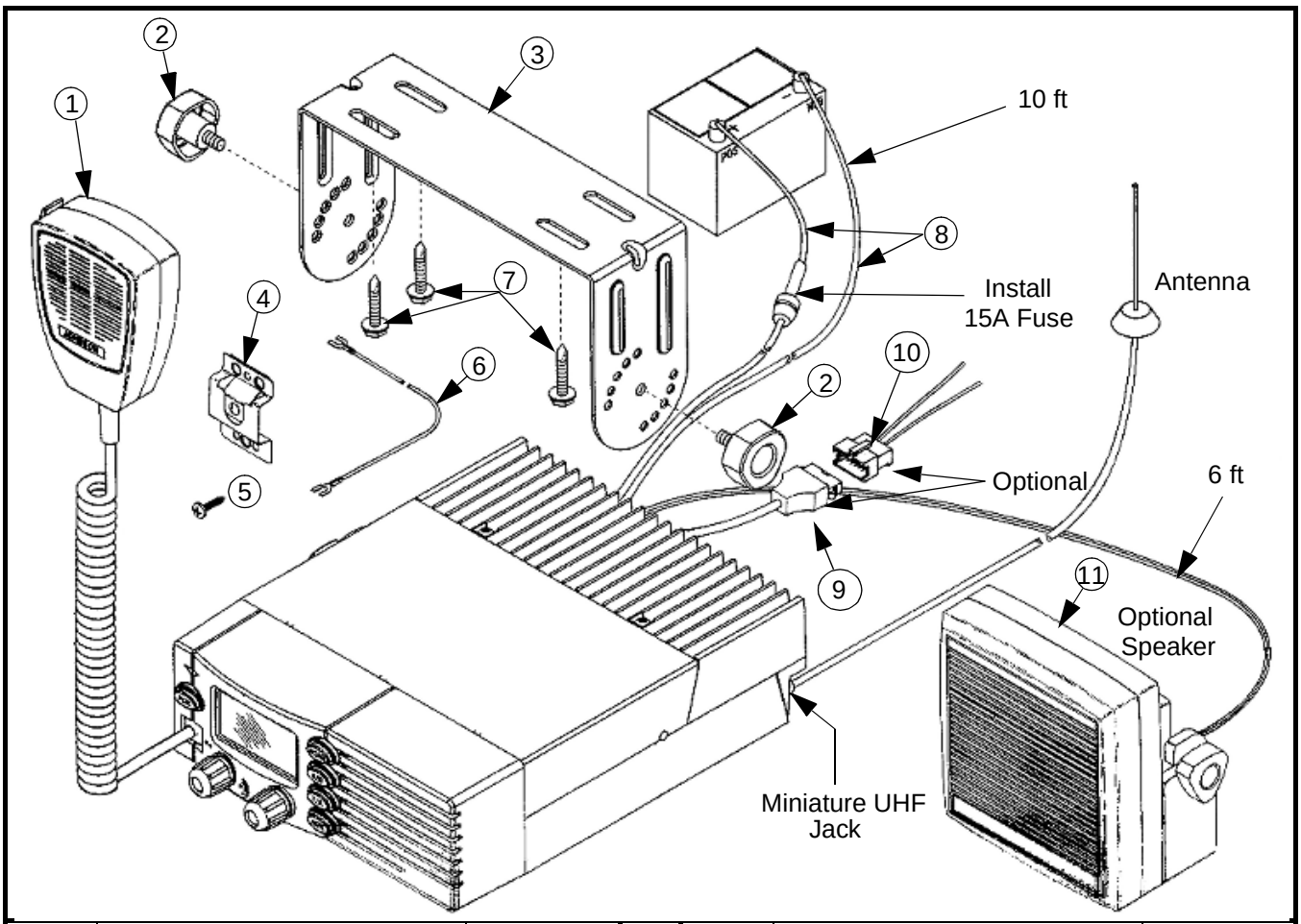
RECEIVER

Sensitivity (12 dB SINAD)	0.35 µV
Selectivity	–65 dB
Spurious and Image Rejection	–70 dB
Intermodulation	–70 dB
Hum and Noise	–38 dB
Maximum Frequency Spread	Any spread within the range
Audio Power Output	5 watts (external 4.7-ohm speaker), 3 watts (internal 8-ohm speaker)
Audio Distortion	Less than 5% at 1 kHz with 60% deviation
Audio Response	+1, –3 dB per octave de-emphasis per standard TIA
RF Input Impedance	50 ohms

TRANSMITTER

RF Power Output	Medium power version - 15 watts (adjustable to 2-15 watts) High power version - 30 watts (adjustable to 10-30 watts)
Spurious and Harmonic Emissions	–70 dB
FM Hum and Noise	–40 dB
Audio Modulation	12.5 kHz - 11K0F3E (voice) 11K6F1D (data)
Audio Distortion	Less than 5% at 1 kHz with 40% modulation
Audio Frequency Response	6 dB per octave pre-emphasis per standard TIA
Maximum Frequency Spread	Any spread within the band
RF Output Impedance	50 ohms
Duty Cycle	20% standard TIA

SECTION 2 INSTALLATION



Item No.	Description	Part No.	Item No.	Description	Part No.
1	Amplified dynamic microphone	250-0740-300	7	Screw, No. 10 self-drilling (4)	575-9077-545
2	Tri-knob (2)	547-0016-008	8	10-ft. DC power cable & hardware	023-9800-410
3	Standard mounting bracket	017-2229-005	9	Accessory pigtail cable (optional)	597-9800-003
4	Microphone hanger	023-3514-001	10	Accessory wire kit (optional)	023-9750-011
5	Screw, 4-24 x 5/16” sheet metal (3)	575-3604-010	11	5”, 4.7 ohm external spkr (optional)	250-0151-010
6	Hanger grounding wire assembly	023-7171-911			

Figure 2-1 Front Mount Installation Components

2.1 GENERAL

2.1.1 SCOPE OF INSTRUCTIONS

Since each installation is somewhat unique, the installation instructions which follow are intended only as a general guide to installing this transceiver.

2.1.2 PERFORMANCE TESTS

Although each transceiver is carefully tested and aligned at the factory, it is good practice to verify transceiver performance before it is placed in service. Performance tests are located in Sections 7.5 and 7.6.

2.1.3 TRANSCEIVER PROGRAMMING

The transceiver needs to be programmed before it is placed in service unless it was ordered as factory programmed. Programming instructions are located in the manuals listed in Section 1.1.1. Transceivers are normally shipped with preprogrammed factory test channels and test parameters.

2.1.4 REQUIRED POWER SOURCE

This transceiver is designed for installation in vehicles which have a nominal 12-volt, negative ground electrical system (negative battery terminal connected directly to the chassis). If the vehicle has some other type of electrical system, a voltage converter is required.

2.2 MOUNTING THE TRANSCEIVER

2.2.1 SELECTING A MOUNTING LOCATION

Front mount transceivers are designed for mounting in a location within convenient reach of the operator such as the dash, console, or floor. Remote mount models are designed for mounting in a remote location such as under a seat or in the trunk that is up to 6 feet (or up to 17 feet with optional extension cable) from the control unit.

WARNING

The mounting location of the transceiver or control unit can affect safe operation of the vehicle. Follow these precautions when mounting this transceiver:

- Mount it where it does not interfere with operation of the vehicle controls.
- Mount it where the operator can easily see the display and reach the controls.
- Mount it where it will be least likely to cause injury in case of an accident.
- Airbags deploy with great force. Therefore, do not mount it anywhere near the deployment area. In addition, do not place any other objects in the deployment area.

2.2.2 INSTALLATION COMPONENTS

The following mounting kits are used to install the transceiver. These components and other components are shown in Figure 2-1.

Mounting Kit, Part No. 023-9800-030

- Two tri-knobs for attaching the transceiver to the mounting bracket
- Four No. 10 self-drilling screws

Universal Cable and Hardware Kit
Part No. 023-9800-410 (10 ft)
Part No. 023-9800-422 (22 ft)

- 10 ft or 22 ft fused power cable
- Microphone clip and ground wire
- One 7A and one 15A fuse (7A not used)

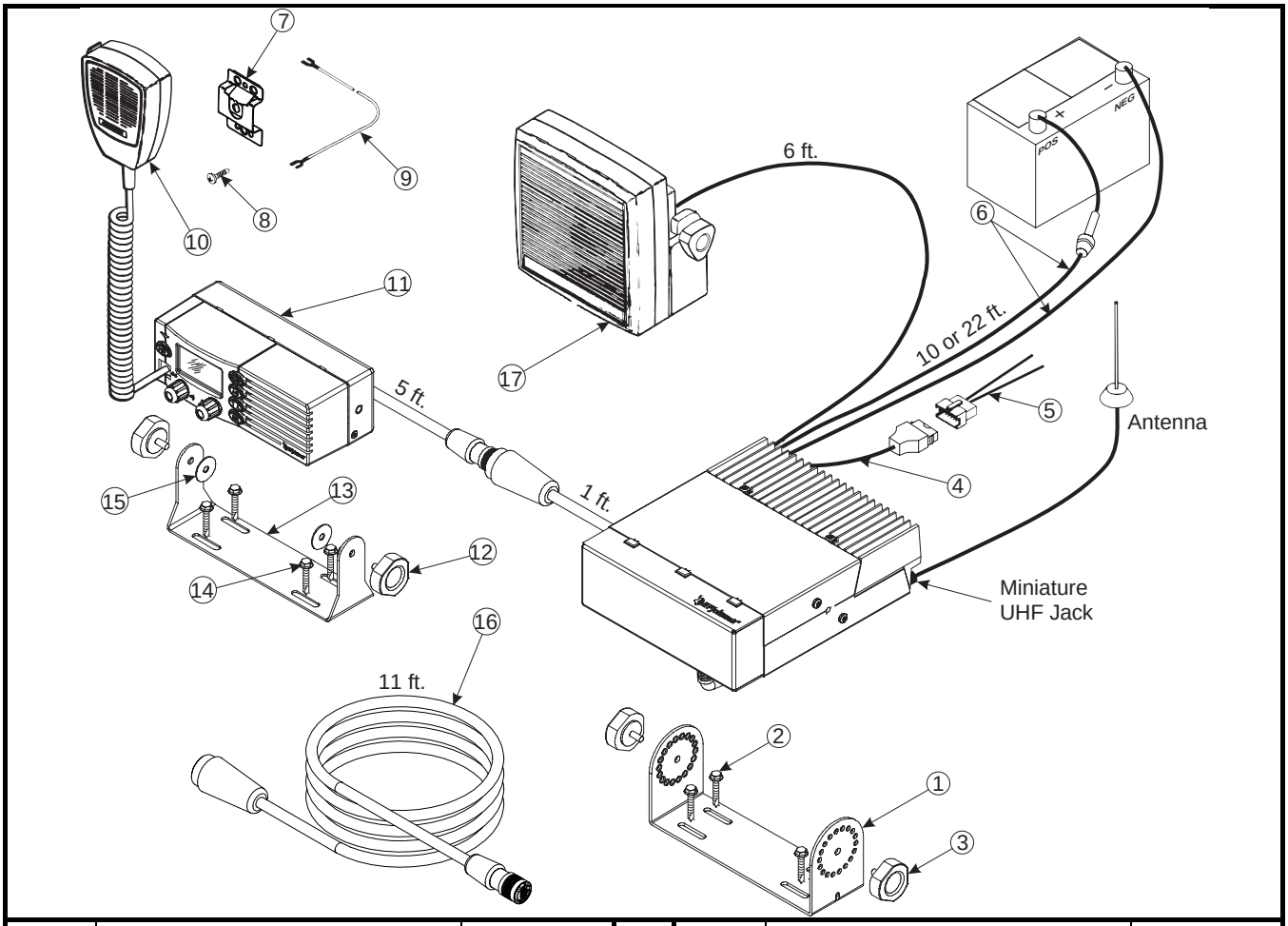
2.2.3 ATTACHING MOUNTING BRACKET

Either Standard Mounting Bracket, Part No. 017-2229-005, or Low Profile Mounting Bracket, Part No. 017-2229-010, can be used to mount the transceiver. Proceed as follows:

1. Check the area underneath the selected mounting surface for such things as wires, electrical components, and brake and gas lines that could be damaged when the mounting bracket screws are installed. Then install the mounting bracket using the included self-tapping screws or other screws if desired.

2. Install the transceiver in the bracket using the included knobs.

3. With front mount transceivers, install the included microphone hanger in a convenient location using the included sheet metal screws or others. For proper operation of functions such as the monitor mode and scan, the hanger must be connected to chassis ground. If required, ground the hanger using the included ground wire.



Item No.	Description	Part No.		Item No.	Description	Part No.
1	Low profile mounting bracket	017-2229-010		9	Hanger ground wire assembly	023-7171-911
2	Screw, No. 10 self-drilling (4)	575-9077-545		10	Amplified dynamic microphone	250-0740-300
3	Tri-knob (2)	547-0016-008		11	Remote control unit	---
4	Accessory pigtail cable (optional)	597-9800-003		12	Tri-knob (2)	547-0016-008
5	Accessory wire kit (optional)	023-9750-011		13	Mounting bracket, control unit	017-2227-057
6	10-ft. DC power cable & hardware	023-9800-410		14	Screw, No. 10 self-drilling (4)	575-9077-545
	22-ft DC power cable & hardware	023-9800-422		15	Flat washer, vulcanized (2)	596-6400-030
7	Microphone hanger	023-3514-001		16	Extension control cable, 11 ft (opt.)	597-9800-009
8	Screw, 4-24 x 5/16” sheet metal (3)	575-3604-010		17	5”, 4.7 ohm external spkr (optional)	250-0151-010

Figure 2-2 Remote Mount Installation Components

2.3 POWER CABLE INSTALLATION

It is recommended that both wires of the power cable be connected directly to the vehicle battery. Connection of either wire to other points may result in increased interference from the vehicle’s electrical system. If noise is still a problem with both wires connected to the battery, a noise filter should be used.

*NOTE: With LTR-Net models, do not connect the power cable to a switched power source such as the ignition switch or a relay. Always use the front pane*l p*ower switch or the ignition sense input described in Section 2.4.3 to switch power. When power is switched externally with LTR-Net models, the de-registration message cannot be sent and the current user settings are not saved.*

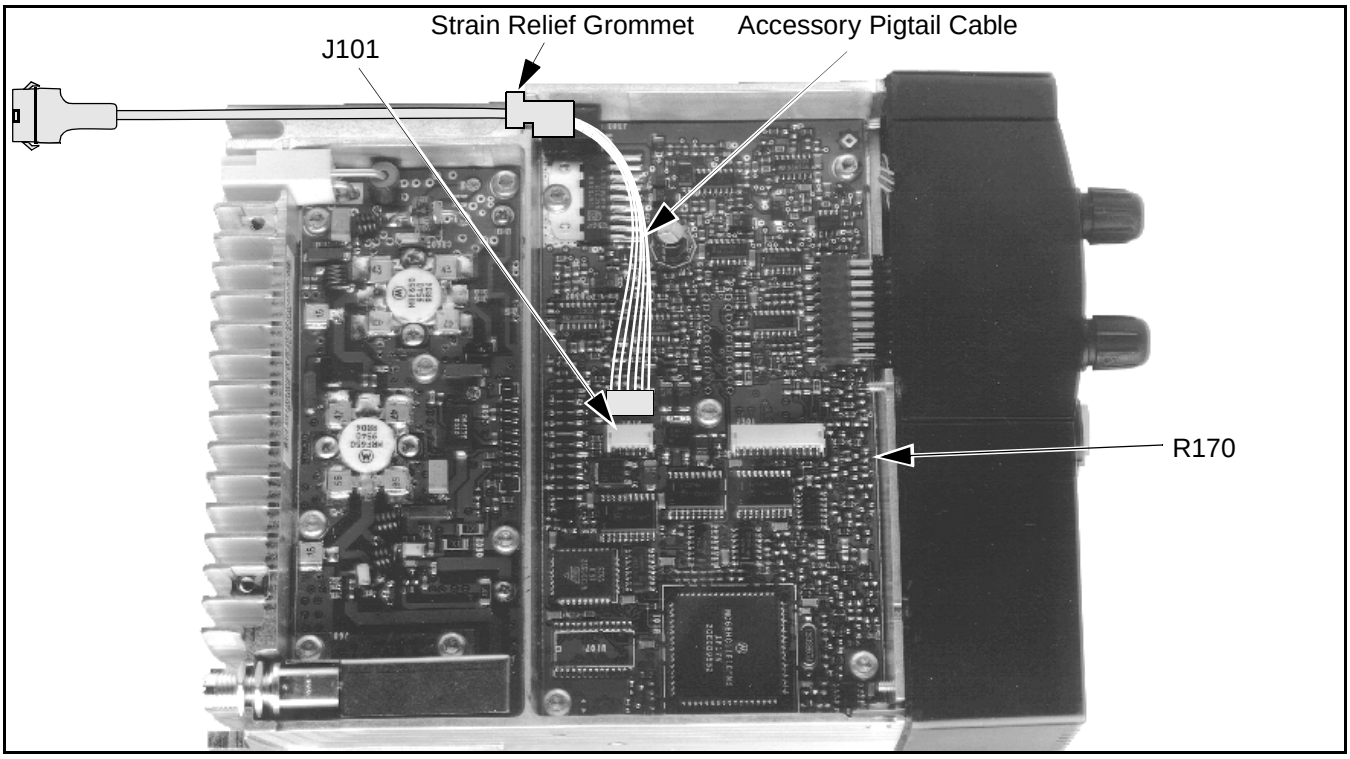


Figure 2-3 Accessory Cable Installation

Proceed as follows to install the power cable:

1. Before beginning power cable installation, remove the negative cable from the battery to prevent damage from accidental short circuits.

2. Route the red and blue wires of the power cable to the vehicle battery. You may need to cut the cable if it must be routed through an opening that is not large enough to clear the fuseholder. The -422 kit includes butt splice connectors that can be used to splice the cable back together.

3. Connect the red power cable to the positive (+) battery terminal. To minimize the chance of a short circuit occurring in an unfused part of the power cable, the fuseholder should be as close as possible to the battery terminal.

4. Connect the blue power cable wire to the negative (–) battery terminal.

5. Both 7- and 15-ampere fuses are included with the power cable. Install the 15-ampere fuse in this application.

6. Plug the power cable into the transceiver and reconnect the negative battery cable.

7. Install the antenna according to the manufacturer's instructions. This transceiver has a miniature UHF connector. If the antenna has some other type, an adapter is required. Check VSWR. Reflected power should be less than 4% of forward power (VSWR less than 1.5 to 1).

2.4 ACCESSORY CABLE INSTALLATION

2.4.1 GENERAL

If transceiver power is to be controlled by the vehicle's ignition switch, a horn alert installed, or other accessory connector outputs utilized, the optional accessory pigtail cable is installed in the transceiver (see Figure 2-1). Also required is the accessory wire kit which includes two 8-pin connectors which plug into the pigtail cable, two 22-ft and three 2-ft wire assemblies, and a fuseholder assembly. These components are installed as required for each application. Proceed as follows to install this cable.

Pin	Function
1	Speaker Out*
2	Sw Bat Out
3	NC
4	Horn Alert
5	Ground
6	Ign Sense
7	Output D
8	NC

* This is a low level output (see Section 2.4.5)

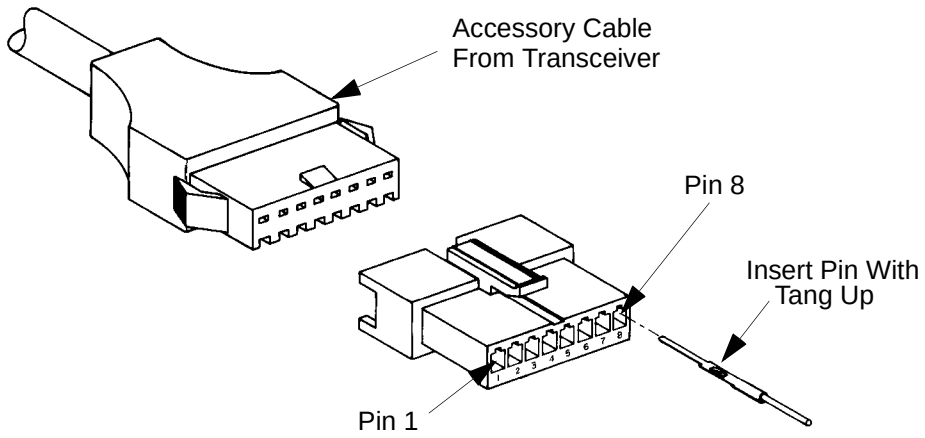


Figure 2-4 Accessory Cable Connector

2.4.2 ACCESSORY PIGTAIL INSTALLATION

1. Remove the bottom cover of the transceiver to access the audio/logic board.

2. Plug the pigtail cable from the kit into J101 as shown in Figure 2-3. The plug can be inserted only one way.

3. Position the strain relief in the external speaker jack slot of the chassis (see Figure 2-3).

4. If installing the ignition sense function, proceed to the next section to remove R170. Otherwise, reinstall the bottom cover.

2.4.3 CONNECTING IGNITION SENSE WIRE

NOTE: If the ignition sense function is not used, no transceiver modifications are required and this section can be skipped. However, then be sure that the Ignition Sense Delay Time is set to "Forever/Infinite". If it is not, improper transceiver operation may result when starting the vehicle.

General

When the ignition sense line is connected, the following additional functions are provided:

- The transceiver turns on and off with the vehicle ignition switch (if the front panel power switch is on).
- The horn alert (LTR-Net/Multi-Net) may be automatically disabled when the ignition switch is on.
- A transceiver power turn-off delay can be programmed. Standby current (receive mode, audio squelched) is about 1 ampere.
- With LTR-Net models, the de-registration message is sent and settings saved (see NOTE on page 2-3).

Removing R170

When the ignition sense function is used, resistor R170 on the audio/logic board must be removed. The general location of this resistor is shown in Figure 2-3, and the exact location is shown in Figure 2-5. Carefully remove R170, taking care not to damage board traces or adjacent components.

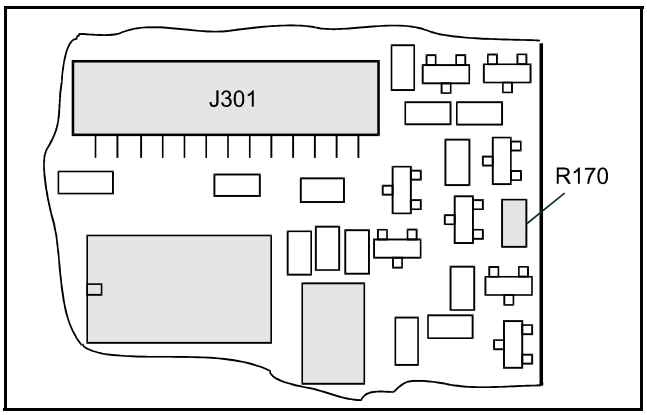


Figure 2-5 R170 Location Diagram

Installing Ignition Sense Wire Assembly

The ignition sense input is connected using the connector with the 22-foot red wire pre-installed in pin 6. The white jumper between pins 1 and 3 is not used with this transceiver, so it can be clipped off or left as is. It is used only Summit® or Viking® HT/GT transceivers to route audio to the internal speaker. The other connector and wire assemblies in the kit can also be used if desired.

The red wire from pin 6 (see Figure 2-4) is connected to a 13.6-volt source that is switched by the vehicle ignition switch. Connect this wire using the included fuseholder and 1-amp fuse. Be sure to install the fuse as close as possible to the connection point so that it provides optimum short circuit protection.

2.4.4 CONNECTING HORN ALERT WIRE

NOTE: The horn alert feature is not available with SMARTNET/SmartZone models.

To utilize the horn alert, the horn alert output of the accessory connector is connected and special programming is required. When the horn alert sounds, pin 4 of the accessory connector goes low. The disabled condition is a high impedance state.

Maximum sink current of the horn alert output is 500 mA. Therefore, some type of horn alert driver circuit is usually required. If connecting to a relay, a diode should be connected across the relay coil with the cathode toward the battery side. This protects Q100 on the audio/logic board when the relay de-energizes.

The horn alert output is connected by using one of the 22- or 2-foot wire assemblies included in the Accessory Wire Kit. Insert the pin of the wire assembly into the pin 4 slot of the connector as shown in Figure 2-4. Then connect the other end to the horn alert driver.

2.4.5 OTHER ACCESSORY CABLE OUTPUTS

Speaker Output (pin 1) - This is a low-level, volume controlled, speaker output. It provides drive to an external device such as an audio power amplifier. The input impedance of the external device should be greater than 20k ohms.

For this output to operate properly, the audio amplifier requires an 8-ohm load. Therefore, if not using the internal speaker and no speaker is connected to the external speaker jack, connect an 8-ohm, 5-watt resistor to the external speaker jack.

Sw Bat Out (pin 2) - This output can provide a switched battery output current of up to 1.5 A (including the current supplied to the microphone connector). This current is limited by fuse F100 on the audio/logic board. *CAUTION: Do not change this fuse to one with a higher current rating because PC board damage may result.*

Horn Alert (pin 4) - See Section 2.4.4.

Ignition Sense (pin 6) - See Section 2.4.3.

Output D (pin 7) - This output is available with LTR-Net/Multi-Net models only. It is controlled by the menu OPTION parameter or by an option switch programmed for that function. It can also be controlled by several I/O functions (see Appendix B).

2.5 REMOTE CONTROL UNIT INSTALLATION

2.5.1 GENERAL

NOTE: Install the remote mount transceiver, power cable, and accessory cable as described in Sections 2.2, 2.3, and 2.4, respectively.

No special control unit programming or PC board modifications are required prior to installing the remote control unit. An diagram showing a remote installation is located in Figure 2-2. As indicated in this diagram, the control unit has a 5-ft pigtail cable and the transceiver has a 1-ft pigtail cable. These cables can be directly connected if the control unit is mounted within approximately 6-ft of the transceiver. Otherwise, the optional 11-ft extension cable can be used to allow a mounting distance of up to approximately 17 feet.

2.5.2 MOUNTING REMOTE CONTROL UNIT

1. Check the area underneath the selected mounting surface for such things as wires, electrical components, and brake and gas lines that could be damaged when the mounting bracket screws are

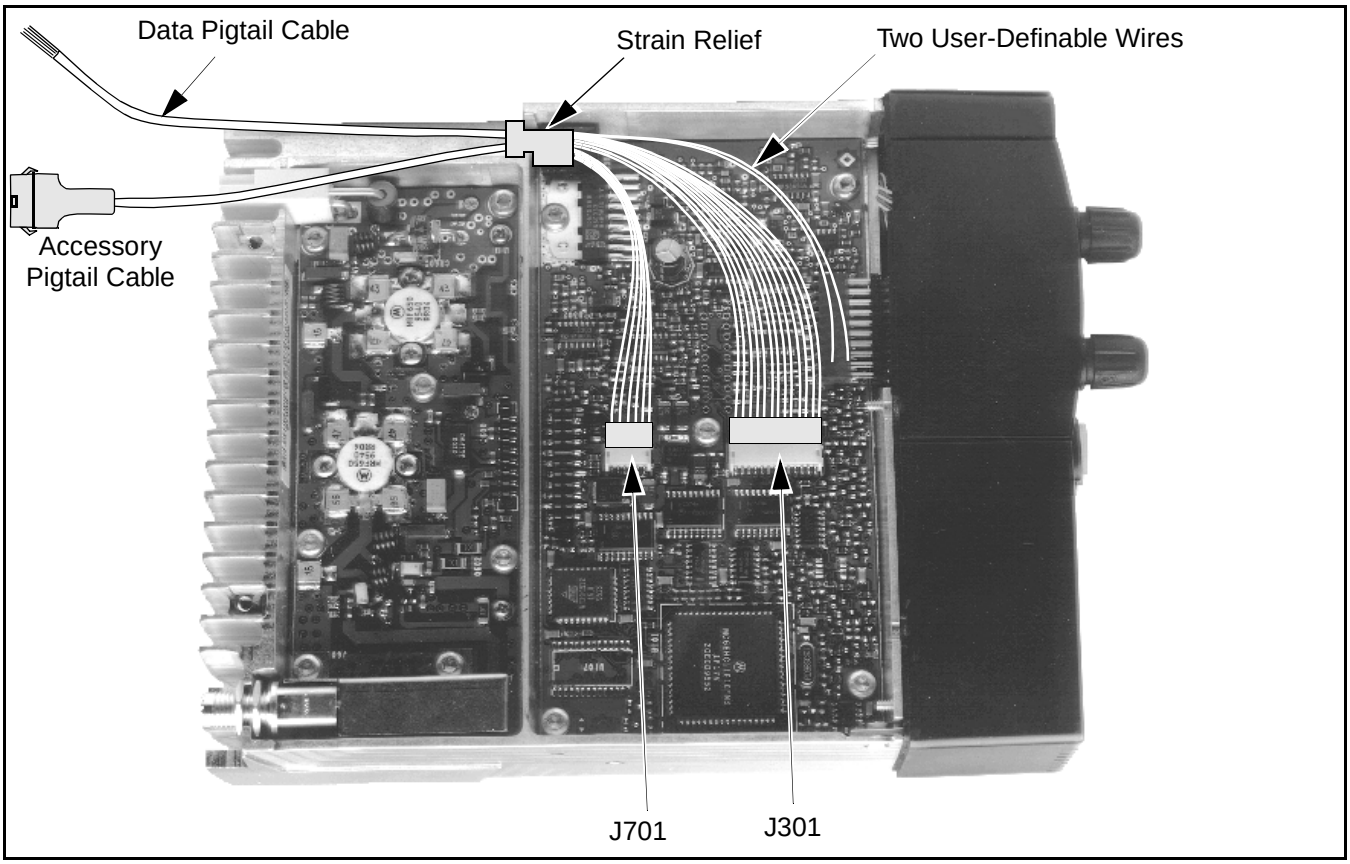


Figure 2-6 Data Cable Installation (-001 Cable Shown)

installed. Then install the mounting bracket using the included self-tapping screws or other screws if desired.

2. Install the control unit in the bracket using the included knobs and vulcanized washers (the washers are installed between the bracket and control unit).

3. Install the included microphone hanger in a convenient location using the included sheet metal screws or other screws. For proper operation of functions such as the monitor mode and scan, the hanger must be connected to chassis ground. If required, ground the hanger using the included ground wire.

2.6 USING AN EXTERNAL SPEAKER

Power output with the internal 8-ohm speaker in the front panel or remote control unit is approximately 3 watts. For up to 5 watts of power, a 4.7-ohm external speaker can be used. This speaker is plugged into the external speaker jack on the back of the transceiver. This is a standard 1/8", two-conductor phone jack. The internal speaker is automatically disabled when an external speaker is used.

The impedance of the external speaker must not be less than 4.0 ohms. Using a speaker with an impedance less than 4.0 ohms could result in audio amplifier U306 overheating and does not provide 5 watts of power. Therefore, to allow for tolerances, a speaker with a nominal impedance of 4.7 ohms is recommended. The E.F. Johnson remote speaker listed in Figure 2-1 or Table 1-3 meets this requirement. This speaker has a 6-ft cable, and in some applications (such as remote mounting) an extension cable may be required to connect it to the transceiver.

2.7 DATA CABLE INSTALLATION

CAUTION

DO NOT apply power a transceiver that has one of the data cables installed without first properly terminating the wires of that cable. These wires carry differing potentials and transceiver damage may result if they inadvertently contact each other.

2.7.1 GENERAL

The optional data pigtail cable is supported by Multi-Net versions only. It is installed when a modem or some other type of data device is to be connected to the transceiver. This cable connects the data equipment to data connector J301 on the audio/logic board. Two data cables are available (see Table 1-3), and descriptions of each follow.

Data/Accessory Pigtail Cable, Part No. 597-9800-001

This cable is a combination data and accessory pigtail cable. It does not include a connector for interfacing with the data equipment. The wires are unterminated and connected to a user-supplied connector as desired. The cable has 15 conductors. All 13 pins of J301 are brought out, and there are two additional wires that can be connected inside the transceiver as desired.

Data Pigtail Cable, Part No. 597-9800-005

This is a data cable only (it does not include the accessory cable). The data cable is similar to the one included with the -001 cable. It has 15 unterminated wires, and a user supplied connector is installed as desired.

2.7.2 DATA CABLE INSTALLATION

1. Remove the bottom cover of the transceiver to access the audio/logic board.

2. Refer to Figure 2-6 and plug the 13-pin connector of the data cable into J301. If also installing the accessory cable, plug the 7-pin connector into J701. Refer to Section 2.4 for more accessory cable installation information.

3. Refer to the wiring chart in Table 2-1 and connect the data cable wires to the user supplied connector as required for the data equipment being used.

4. If required, install the purple and pink wires to the desired points in the transceiver.

5. Position the strain relief grommet of the accessory/data cable in the external speaker jack slot of the chassis as shown in Figure 2-6 and reinstall the bottom cover. bottom cover.

Table 2-1 Data Cable Wire Chart

J301 Pin No.	Function	Wire Color
1	Sw Bat Out	White
2	Rx Filt Out	Green
3	Tx Filt In	Yellow
4	TxD	Blue
5	RxD	Orange
6	Transmit	Gray
7	IN2	Brown
8	Ext Serv Req	White/Red
9	Option 1	White/Green
10	Output C	White/Black
11	Ext Pwr Sw	White/Blue
12	8V Out	Red
13	Ground	Black
NC	User Defined	Purple
NC	User Defined	Pink

2.8 KEY CAP KITS

NOTE: To remove a key cap, insert a tool with a sharp tip in the slot on the bottom of the cap and carefully pry against the front panel to release the cap.

2.8.1 MULTI-NET AND LTR-NET MODELS

Key Cap Kit, Part No. 587-9840-001, is standard with each Multi-Net transceiver and includes the five caps indicated below.

FCN SCAN A/D TA AUX

Key Cap Kit, Part No. 587-9840-002, is standard with each LTR-Net transceiver and includes the five caps indicated by an asterisk (*) in the list which follows.

An optional key cap kit, Part No. 587-9840-004, is also available which includes all of the caps in the following list:

FCN*	**SCAN***	**A/D***	**ROAM***	**TEL***
TA	**AUX**	**HOME**	**PAGE**	**HORN**
C/G	**PRI**	**USR1**	**USR2**	**MON**
CPND	**MHNG**	**STLH**	**MICPA**	**BANK**
EMER	**ENCPT**	**Rx PA**	**CALL**	
(Blank)	**(Blank)**			

2.8.2 SMARTNET/SMARTZONE MODELS

Key Cap Kit, Part No. 587-9840-003, is included with each SMARTNET/SmartZone transceiver. This kit includes the five key caps listed below.

EMER	**F1**	**F2**	**F3**	**SCAN**

Key Cap Kit, Part No. 587-9840-105, is also included with each transceiver. This kit includes the key caps shown below.

F1	**F2**	**F3**	**F4**	**SCAN**
BKLHT	**MSG**	**HORN**	**C/S**	**DISP**
PRIED	**SELSQ**	**MON**	**TGSEL**	**PHONE**
RESP	**NUIS**	**STATUS**	**TXPWR**	**(Blank)**
ALERT	**EMER**	**RWS**	**TONES**	**(Blank)**

SECTION 3 CIRCUIT DESCRIPTION

3.1 GENERAL TRANSCEIVER DESCRIPTION

3.1.1 INTRODUCTION

NOTE: A block diagram of the audio and data processing circuitry on the audio/logic board is located in Figure 3-3, and block diagrams of the RF boards are located in Figures 3-4 and 3-7.

The 9800-series transceivers contain the PC board assemblies listed below. Components are mounted on only the top side of all boards. Therefore, most components can be changed without removing the board from the chassis.

Audio/Logic - Control logic and audio processing.

Display - This board contains the LCD display and controller and interface microcontroller.

Interface - This small board provides the electrical connections between the display and audio/logic boards, and contains the front panel rotary controls and microphone jack.

RF Board - Receiver, synthesizer, and exciter.

PA Board - Transmitter power amplifier.

General descriptions of the main sections such as the receiver, synthesizer, and exciter follow, and detailed descriptions are located in later sections.

3.1.2 CIRCUIT PROTECTION (FUSES)

Circuit protection is provided by a 15-ampere in-line power cable fuse, 4-ampere fuse F500 on the RF board (in the unswitched battery supply line from the PA board), and by voltage regulators which automatically limit current. The 15-ampere power cable fuse protects the power amplifier module and final stages on the power amplifier board, and the 4-ampere fuse protects the remainder of the circuitry. In addition, there are two fuses on the audio/logic board. One fuse (F100, 2A) limits the current of the switched battery supply fed to accessory connector J101, the microphone jack, and also the display board. The other fuse (F300, 0.6A) limits the current of the 8-volt supply fed to modem jack J301. For information on power distribution and switching, refer to Section 3.2.

3.1.3 SYNTHESIZER

The synthesizer output signal is the transmit frequency in the transmit mode and the receive first injection frequency in the receive mode. The synthesizer also provides the receiver second injection signal by tripling the TCXO frequency.

Channels are selected by programming the main divider in synthesizer integrated circuit U804 to divide by a certain number. This programming is provided by microcontroller U101 on the audio/logic board. The minimum frequency resolution is 6.25 or 10 kHz. The frequency stability of the synthesizer is determined by the stability of TCXO U806 (Temperature Compensated Crystal Oscillator). The TCXO has a frequency stability of ± 2.0 PPM (UHF) or ± 1.5 PPM (800/900 MHz) from –22° to +140° F (–30 to +60° C).

3.1.4 AUDIO/LOGIC BOARD

Microcontroller U101 on the audio/logic board provides transceiver control functions including synthesizer programming, system and group scan, data encoding and decoding, squelch, and gating of audio and data signals. The audio/logic board also has analog circuitry which provides filtering, amplification, and other processing of the audio, data, and Call Guard signals.

The U101 operating program is stored in Flash EPROM U108. This type of memory can be reprogrammed in the field using the standard programming setup and special programming software. This allows the operating software to be easily updated without the need to change a microprocessor or EPROM. Flash EPROM memory devices retain data indefinitely without the need for battery backup, and can be reprogrammed many times.

Parameters which change from transceiver to transceiver such as programmed system and groups and option key programming are also stored in the

Flash EPROM and also EEPROM U102. This information is programmed when data is downloaded to the transceiver by the programming software described in Section 4.

A second microcontroller (U2) on the display board controls the front panel display and tri-color indicator and also detects the option switch, Select switch, and microphone on/off hook state. Control information is exchanged between U101 and this microcontroller via a serial bus. The use of a second microcontroller minimizes the number of interconnections that are required between the audio/logic and display boards. The operating program for this microcontroller is permanently stored on the chip and cannot be changed.

3.1.5 RECEIVER

The receiver is a double conversion type with the following intermediate frequencies:

UHF Models - 45 MHz and 450 kHz
800 MHz Models - 52.950 MHz and 450 kHz
900 MHz Models - 45 MHz and 450 kHz

Two bandpass filters in the front end attenuate the image, half IF, injection, and other frequencies outside the selected receive band. Receiver selectivity is enhanced by a four-pole crystal filter and two 450 kHz ceramic filters.

3.1.6 TRANSMITTER

The transmitter amplifies the synthesizer signal to produce a power output of up to either 25 or 40 watts (UHF) or 15 or 30 watts (800/900 MHz) at the antenna jack. Frequency modulation of the transmit signal is performed by modulating the synthesizer TCXO and VCO frequencies. A control circuit senses forward power to maintain constant power output. It also senses final amplifier current and cuts back power if it becomes excessive.

The use of a digital potentiometer allows the power output to be set from the front panel when the test mode is selected and also allows two different power levels to be programmed for each system. The microcontroller also monitors power amplifier ambient temperature and voltage and cuts back power or disables the transmitter if either are excessive.

3.2 POWER DISTRIBUTION AND SWITCHING

3.2.1 POWER SWITCHING CONTROL

A diagram of the power distribution and switching circuits is shown in Figure 3-1. The main power switching is performed on the RF board by Q510 and other transistors. This switch is controlled by the front panel power switch, the ignition sense input, and the microcontroller as shown in Figure 3-2. For the front panel on-off switch to be detected, Q109 must be turned on by a high signal applied through R170 or from the ignition switch. R170 is installed if the ignition switch is not used to control power. Q107 and Q108 provide power switch on and ignition on signals to the microcontroller so that it can sense those conditions.

Q110 allows the microcontroller to hold power on for a time after it has been turned off by the power or ignition switch. For example, when the microcontroller senses that power was switched off by the front panel switch, it holds power on for a short time so that switch settings can be saved to memory. It also holds power on when a power-off delay is used. Once power turns off, power is also removed from the microcontroller. Therefore, power can be turned on only by the power and ignition switches.

NOTE: The front panel power switch is a push on, push off type (pressing it toggles between open and closed). It is not a momentary switch.

3.2.2 SUPPLY SWITCHING

When power is turned on by the front panel power switch, the base of Q514 on the RF board is grounded through the power switch. Q514 then turns on which also turns on the Darlington amplifier formed by Q511 and Q512. These transistors are turned on by a 13.6-volt signal applied through R535. Series-pass transistor Q510 is then turned on and 13 volts appears on its collector. The diodes in CR505 and CR506 become forward biased only if the 8-volt supply applied to the collector of Q514 becomes shorted. This provides current limiting which prevents damage to the transistors.

Q513 controls the Q511 base current in order to maintain approximately a 0.8-volt drop across the emitter and collector of Q510. This provides noise

POWER DISTRIBUTION (ALL MODELS)

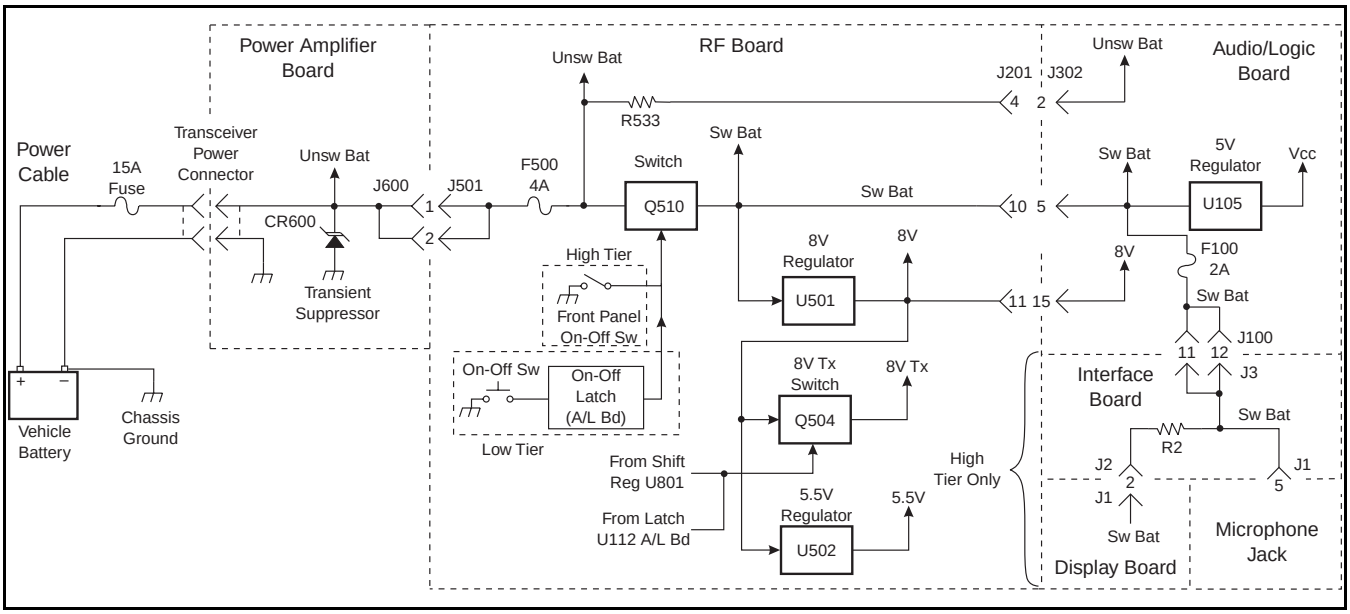


Figure 3-1 Power Distribution and Switching

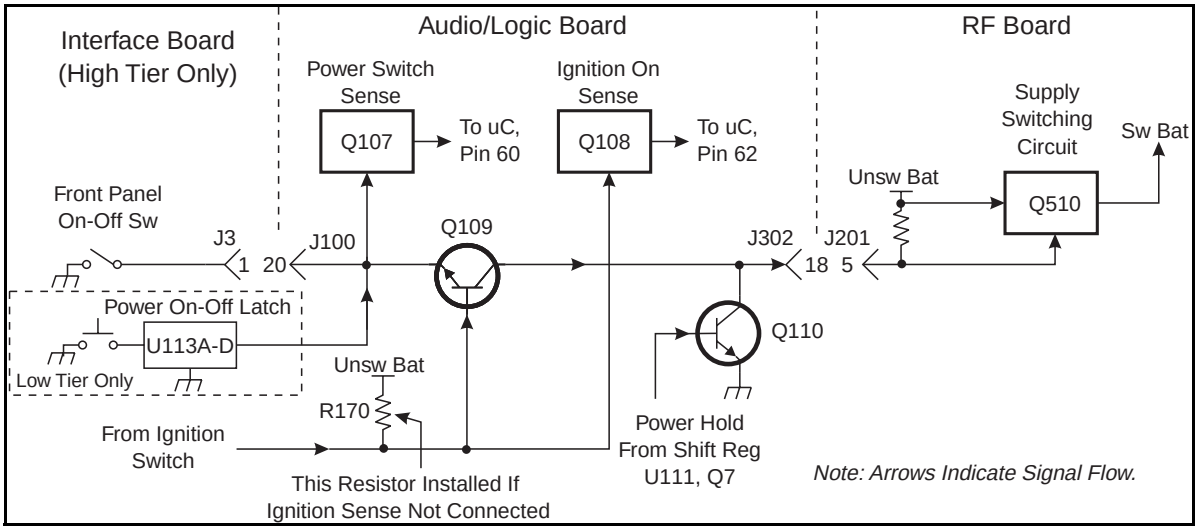


Figure 3-2 Power On-Off Control Circuit

filtering of the 13.6-volt supply. The emitter of Q513 is biased at about 4.5 volts by R538 and R542 (with a battery voltage of 13.6 volts). CR504 mirrors the base-emitter voltage of Q513, and the voltage across R541 is the same as the voltage across R542 when the voltage applied to R536 is approximately 12.8 volts.

Noise pulses less than 1.6 volt P-P then do not appear on the output of Q510 because of the emitter voltage filtering provided by C565. This reduces the amount of noise applied to circuits powered by the switched 13.6-volt supply such as audio power amplifier U306. Additional filtering of the switched and unswitched battery supplies is provided by C548-C553. Resistor R534 turns Q514 off when power is turned off.

AUDIO/LOGIC DESCRIPTION (ALL MODELS)

3.3 AUDIO/LOGIC BOARD DIGITAL CIRCUIT

3.3.1 MICROCONTROLLER (U101)

General

The control logic is based on an MC68HC11F1 eight-bit microcontroller (U101). This device has an internal 1K-byte static RAM and 512-byte EEPROM but no internal ROM or EEPROM. Therefore, all program memory is contained in the external flash memory device (U108). In addition, the microcontroller has several general purpose input and output pins, an eight-channel A/D converter, and synchronous (SPI) and asynchronous (SCI) serial ports. The A/D converter port allows analog signals to be monitored such as the power amplifier temperature, RSSI signal, and vehicle battery voltage.

Separate buses are used for data and memory addressing. The data bus consists of D0-D7, and the address bus consists of A0-A15. The operating speed of the microcontroller is set by crystal Y100. The 9.38 MHz frequency of this crystal is divided by an internal divider to produce a lower internal operating frequency.

Memory

The operating program and most of the personality information used by the microcontroller is stored in 128K x 8 Flash EPROM U108. The use of a Flash memory device allows the program to be conveniently updated using the standard programming setup and special Flash programming software. This eliminates the need to replace the microcontroller or a memory device such as an EPROM. To reprogram the Flash device, the microcontroller is placed in a special bootstrap mode by turning power on with the MODA/MODB inputs pulled low. This is done by the RPI by applying 20 volts to the PTT pin of the microphone jack.

Radio tuning information is stored in the 512-byte EEPROM in microcontroller U101. External 4K x 8 EEPROM U102 is used in high tier and data models to store additional personality information. An EEPROM can be programmed many times, does not require a constant power supply, and retains data indefinitely.

Temporary data storage is provided by an internal 1K x 8 RAM in microcontroller U101 and by external 8K x 8 RAM U107. These devices are used as a “scratchpad” during program execution.

Reset

The microcontroller resets when power is turned on and also when the 5-volt supply drops below the normal range. Reset clears several internal registers and restarts the operating program. This prevents improper operation which may result during low - voltage conditions.

The microcontroller resets itself automatically for 4064 clock cycles when power is applied to the VCC input. Low-voltage reset is triggered by low-voltage sensor U100. When the 5-volt supply drops to approximately 4.25 volts, the RESET output goes low. This resets the microcontroller and also inhibits operation for as long as it is low. The microcontroller also has internal reset circuits which trigger reset if problems occur with the clock signal, illegal op codes, or the watchdog timer circuit.

Reset is also triggered when the transceiver is Flash programmed. A low pulse is created by C363 and R421 when the MODA/MODB inputs of the microcontroller are pulled low to initiate this programming. This automatically places the microcontroller in the flash programming mode. However, reset does not occur when flash programming is complete, so power must be turned off and then on again to resume normal operation.

Data Bus

A bi-directional data bus consisting of D0-D7 is used to transfer data in and out of the microcontroller. It is used to transfer parallel data in and out of memory chips U107 (high tier only) and U108, and also program latches U110-U112. The logic level on the R/$\overline{W}$ pin determines the direction of data on the data bus. If it is high, data is read into U101, and if it is low, data is written out. The E output goes high to indicate when data on the data bus is valid or when an external device can place data on the data bus.

AUDIO/LOGIC DESCRIPTION (ALL MODELS)

Address Bus

The address bus consisting of A0-A15 is used for addressing the memory location in U107 or U108 that data is being written to or read from. In addition, it provides chip select signals to latches U110-U112. Refer to Section 3.3.2 for more information on memory and I/O addressing.

A/D Converter Inputs

VRH/VRL - These inputs provide the reference voltages for the A/D converter circuitry. R115 and C105 attenuate noise present in the 5-volt supply applied to VRH.

PE0 - RSSI (Receive Signal Strength Indicator) input from limiter/detector U201 in the receiver. This signal is used along with the squelch signal to determine when valid data may be present and when to unmute the receive audio.

PE1 - Battery voltage input. The switched 13.6-volt supply is divided down by R161 and R168 to provide a 0-5 volt input. If the battery voltage is excessively high, the transmitter is disabled.

PE2 - Power amplifier temperature input from thermistor R601 on the PA board. The DC voltage of this signal decreases as temperature increases.

PE3 - Lock detect input from synthesizer IC U804. If this signal is high (near 5 volts) the synthesizer is locked on frequency (see Section 3.7.6).

PE4 - Power switch sense input. This input is high when the power switch is on and low when it is off. When the off condition is sensed, the microcontroller saves the current settings and then powers down the transceiver by turning Q110 off (see Section 3.2.1).

PE5 - Ignition switch sense input. This input is low when the ignition switch is on and high when it is off. The microcontroller senses the ignition switch to control such features as the power-off delay and horn alert.

PE6 - This input senses the voltage on the IN2 pin of data modem connector J301 and Option 2 slot wire-out W311.

PE7 - This input senses the voltage on the IN3 pin of Option 1 slot wire-out W301.

Serial Peripheral Interface Port (SPI), OR Gate (U103)

This serial port is formed by the MOSI, MISO, and SCK pins (31, 30, 32) of the microcontroller. It is a synchronous port which means that a clock signal is used to indicate when data on the data line is valid. This port has both master and slave configurations and in this application, the master configuration is always used. In the master configuration the microcontroller generates the clock and other signals.

MOSI (Master Out, Slave In) - This is the serial data output for the port.

MISO (Master In, Slave Out) - This is the serial data input for this port.

SCK - Serial clock output. This pin provides the clock signal to all devices served by this port.

This port provides two-way serial data communication with EEPROM U102 (high tier and data models) and microcontroller U2 on the display board (high tier only). In addition, it provides programming data to the RF board for shift registers U800 and U801, digital potentiometer U802, and synthesizer IC U804 (see Section 3.7.8). It also provides programming data to shift register U305 (on the audio/logic board) which controls the squelch level.

OR gates U103A-D provide routing of the serial port signals to the RF and display boards. When the PD5 output (pin 33) of the microcontroller goes low, U103A and U103B route the data and clock signals to the RF board and shift register U305. Then when the Q4 output (pin 15) of latch U110 goes low, U103D routes the clock signal to the display board and U103C routes the display board data signal to the MISO pin. When communicating with the display board, PD5 goes high to block the data path through U103A and U103B.

Asynchronous Serial Communications Interface (SCI)

This is a full duplex serial port formed by the RxD (data input) and TxD (data output) pins (28, 29) of the microcontroller. This port uses a standard non-

return-to-zero (NRZ) format consisting of one start bit, eight or nine data bits, and one stop bit.

This port is used to provide data communication with the computer used to program the transceiver. Connection is made via the front panel microphone connector. Another use for this port is data communication with an external data device such as a modem. Connection is made via connector J301. Communication cannot occur simultaneously over both of these paths.

Other General Purpose Inputs and Outputs

The PA0-PA7 pins are used for general purpose inputs and outputs as follows:

PA0 - Input for PTT signal from the microphone jack and W302/W312 option slot wire-outs. This signal is low when the transmitter is keyed.

PA1 - Input for the receive LTR or Call Guard data signal.

PA2 - Service request input from microcontroller U2 on the display board. This tells U101 that it has data to send on the SPI bus described previously.

PA3 - Input from the Option 1 pin of modem connector J301.

PA4/PA5 - Transmit LTR/Call Guard data output. These two outputs are used to create a pseudo sine-wave signal. See Section 3.5.4 for more information.

PA6 - Output for supervisory tones generated by the microcontroller such as busy and out-of-range.

PA7 - Input from the squelch circuit (see Section 3.4.4). When the received signal strength increases to the squelch threshold level, this input goes high. The microcontroller uses this information to determine when receive data is valid and to control audio muting.

3.3.2 MEMORY AND LATCH PROGRAMMING

RAM U107

When a data read or write to U107 occurs, the location in U107 is selected by address lines A0-A12, and the data appears on data bus lines D0-D7. Chip select is performed by pulling the CE1 input (pin 20) low. The CE2 input is always pulled high by R114. The A13 and A14 address lines can be connected by changing jumpers if a 16K or 32K part is required. Data is read from U107 by pulling the OE input (pin 22) low. Likewise, data is written by pulling the WE input (pin 27) low. See the U104 description which follows for more information.

Flash EPROM (U108)

As described in Section 3.3.1, U108 can store up to 128K bytes of data. The memory space is arranged as 32K of common code space and twelve 8K blocks of bank code space. The A15 line of the microcontroller determines if common or bank code space is selected. When A15 is high, common space is selected, and when it is low, bank space is selected.

The A15 line controls the four two-input multiplexers in U109. When A15 is low, the A input is connected to Y which routes the PG0-PG3 outputs of the microcontroller to U108. PG0-PG3 then select the desired bank. Then when A15 is high, the B input is routed to Y and the A13-A15 address lines of the microcontroller are routed to U108.

Therefore, when a data read or write to U108 occurs, the lower 13 bits of the address are specified by address lines A0-A12 and the rest of the address is specified as just described. The data appears on data bus lines D0-D7. Data is read from U108 by pulling the $\overline{OE}$ input (pin 24) low, and data is written by pulling the $\overline{WE}$ input (pin 31) low. Refer to the following U104 description for more information. Chip select is provided by pulling the $\overline{CE}$ input (pin 22) low.

Read/Write Strobe Select (U104A-D)

NAND gates U104C and U104B select the read and write signals applied to U107 and U108. When a memory read occurs, the R/$\overline{W}$ output of the microcontroller goes high. This signal is inverted by U104C and applied to the $\overline{OE}$ of U108. When a memory write operation occurs, the R/$\overline{W}$ output of the microcontroller goes low. U104B is then enabled by the high output of U104C, and the high E signal is inverted by U104B and applied to the $\overline{WE}$ pin of U107 and to U104D.

AUDIO/LOGIC DESCRIPTION (ALL MODELS)

NAND gates U104A and U104D provide gating of the write signal to U108. Data is written to this device only during Flash programming. Therefore, when Flash programming occurs, the Q3 output (pin 16) of shift register U111 goes high which enables U104A. A double inversion of the write signal then occurs and it is applied to the $\overline{WE}$ input of U108.

Latch Programming (U106, U110-U112)

Decoder U106 provides chip select to octal latches U110, U111, and U112. When data is written to U106 address space, a low signal is applied to chip select input $\overline{G2A}$ (pin 4) and a high signal is applied to chip select input G1 (pin 6). The three address bits applied to the A, B, and C inputs of U106 select one of the eight outputs. When an output is selected, it goes low.

Data is latched by U110-U112 on a rising edge of a clock signal from U106. Therefore, when the U106 output is disabled, data is latched. The outputs of the latches are enabled when the $\overline{OC}$ input (pin 1) is low, and the outputs are a high impedance state when it is high.

3.4 RECEIVE AUDIO/DATA PROCESSING

NOTE: A block diagram of the audio and data processing circuitry is shown in Figure 3-3.

3.4.1 AMPLIFIER (U301B)

The demodulated receive audio/data signal from limiter/detector U201 in the receiver is applied to amplifier U301B. The gain of this amplifier is controlled by analog switch U307B. The gain is higher for narrow-band (12.5 kHz) channels to compensate for the lower detected signal level that results from the lower deviation used with those channels. The gain is approximately four with narrowband channels and two with wideband (25 kHz) channels.

The control input of U307B (pin 5) is low for narrowband channels and high for wideband channels. When it is high, the switch is closed and R327 is switched into the circuit. This adds more feedback which decreases the gain. The control signal comes from the Q0 output (pin 19) of latch U111. Transistor Q305 inverts this signal and also provides level translation from 5-volt logic levels of U111 to the 8-volt logic levels of U307B.

From U301B the receive audio/data signal is fed to audio, data, and squelch circuits. Refer to the following descriptions for more information.

3.4.2 RECEIVE AUDIO PROCESSING

Bandpass Filter (U301C, U301D)

U301C and U301D form a bandpass filter which passes frequencies in the 300-3000 Hz range. This attenuates frequencies below 300 Hz such as LTR data and Call Guard signaling, and frequencies above 3 kHz such as noise. These stages also provide 6 dB per octave de-emphasis to remove the pre-emphasis that was added to the signal when it was transmitted.

Mute Gate (U307C), Summing Amplifier (U301A)

The receive audio signal is then routed via the option wireouts to mute gate U307C. This gate mutes the signal when no carrier is being received or if the message is intended for someone else. It is controlled by the Q5 output (pin 14) of latch U110. When the audio signal is muted, this output is high. This signal is then inverted by Q301 resulting in a low signal on the control input (pin 6) of gate U307C.

U301A is a summing amplifier which combines the supervisory tone signal from microcontroller pin 36 (PA6) with the receive audio signal. Supervisory tones include the busy and intercept tones and other beeps that are heard by the user. C320 provides additional feedback of the higher frequencies present in the square-wave output of the microcontroller. C323 and R352 also provide shaping of this signal.

Audio Power Amplifier (U306)

The output signal from U301A is fed to the microphone connector through C321 and to audio power amplifier U306. This is a 5-watt (with an 8-ohm load) bridge-type amplifier. Therefore, both outputs are connected directly to the speaker and neither speaker terminal is grounded. This device is internally protected from damage resulting from shorting either output to ground or B+, or shorting across the outputs.

AUDIO/LOGIC DESCRIPTION (ALL MODELS)

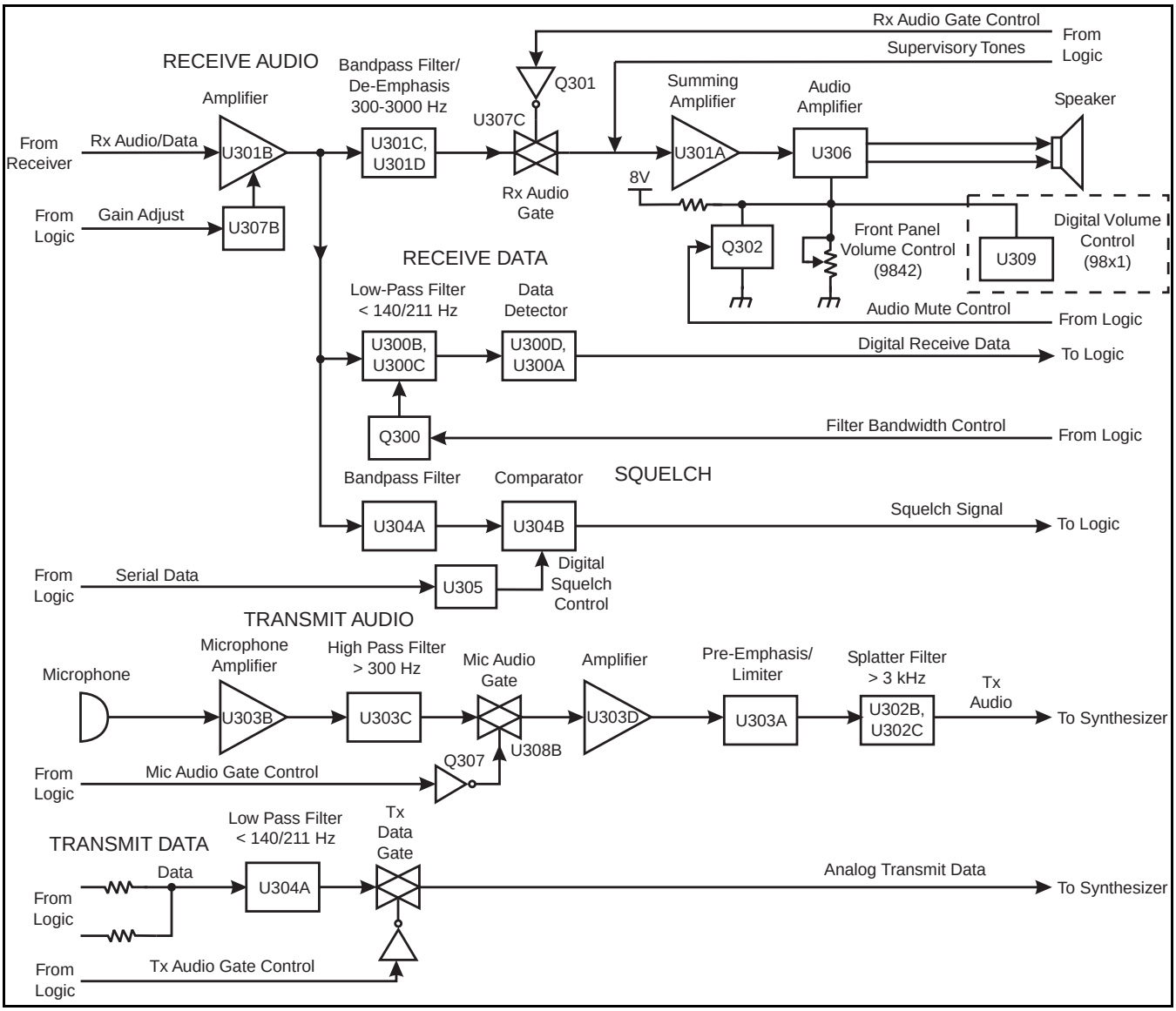


Figure 3-3 Audio and Data Processing Circuitry Block Diagram

Pin 5 is the input of an internal gain control stage. Gain increases in proportion to increases in the DC voltage on this pin. With the low tier models, volume control is provided by a D/A converter formed by shift register U309 and several resistors. The six-bit output controls the volume in 64 steps. U309 is programmed by the SPI bus described in Section 3.3.1. With the mid and high tier models, the front panel volume control is part of a voltage divider which includes R356 and R426.

If the voltage on pin 5 falls below approximately 0.4 volt DC, the output is muted. Speaker muting is controlled by the Q7 output (pin 12) of latch U110. When this output goes high, inverter/level translator Q302 turns on which grounds the volume control input of U306 and mutes the speaker.

3.4.3 RECEIVE DATA PROCESSING

The receive audio/data signal from amplifier U301B is applied to a low-pass filter formed by U300B and U300C. This filter attenuates voice and harmonic frequencies occurring above the data band.

AUDIO/LOGIC DESCRIPTION (ALL MODELS)

The passband of this filter is controlled by the Q1 output (pin 18) of latch U111. When LTR or digital Call Guard data or low-frequency Call Guard tones are received, this output goes high which turns Q300 on. This switches additional capacitance into the circuit and the filter cut-off frequency decreases to approximately 150 Hz. Then when high-frequency Call Guard tones are received, the output goes low and turns Q300 off. This increases the cut-off frequency to approximately 220 Hz.

From U300C the data signal is fed to a DC restoration circuit formed by U300D and U300A. This circuit converts it from an analog signal floating at half supply to a digital signal at 0 and 5 volt levels that can be detected by the microcontroller. U300D is a standard noninverting amplifier with a gain set by R308, R316, and R317 (R317 is AC grounded by C309).

Two attenuation levels are selected by gate U307D similar to gate U307B described in Section 3.4.1. When wideband (25 kHz) channels are selected, the control input (pin 12) of U307D is high and R317 is effectively shorted which increases gain. The gain of U300D is approximately 3 with wideband channels and 2 with narrow-band channels. This compensates for excess amplification of the data signal in the narrowband mode by U301B.

The CR301 diodes charge and discharge C309 to establish a DC reference on pin 2 of comparator U300A. This reference voltage is the average of the positive and negative alternations of the data signal. When pin 3 of U300A rises above the reference on pin 2, the output goes high (8 volts) and vice versa. Voltage divider R304/R311 provides the 5-volt level required by the microcontroller.

3.4.4 SQUELCH CIRCUIT (U304A, U304B)

The microcontroller uses the output from the squelch circuit and also the RSSI output of the limiter/detector (see Section 3.8.4) to determine when to mute and unmute the receive audio and also when valid data may be present. The squelch circuit is controlled by the amount of noise present in the receive audio signal. When no signal or a weak signal is being received, there is a large amount of noise present. Conversely, when a strong signal is received, there is very little noise present.

The receive audio, data, and noise signal from amplifier U301B is applied to a bandpass filter and amplifier formed by U304A and other components. This stage attenuates voice frequencies and LTR and Call Guard signaling so that only noise frequencies in the range of approximately 7-8 kHz are passed. The output signal of U304A is applied across a resistor network which sets the input level to a rectifier. Thermistor R318 provides temperature compensation of this network.

C304 charges through the forward biased diode in CR300 and discharges through R306. C303 discharges through the other diode in CR300. When the voltage on pin 6 of comparator U304B rises above the reference on pin 5, the output goes low. For example, when received signal strength is low, more noise is rectified which causes the voltage on pin 6 of U304B to increase and the output on pin 7 to go low (squelched condition). A voltage divider formed by R416 and R417 reduces the 8-volt output of U304B to the 5-volt level required by the microcontroller.

The squelch threshold level is set by a D/A converter formed by shift register U305 and several resistors. The eight-bit output of U305 can control the reference voltage applied to U304B in 256 steps. U305 is programmed by the SPI serial port described in Section 3.3.1. R310 provides hysteresis to the threshold level to prevent intermittent squelching when receiving a weak or fading signal.

3.5 TRANSMIT AUDIO/DATA PROCESSING

NOTE: A block diagram of the audio and data processing circuitry is shown in Figure 3-3.

3.5.1 MICROPHONE AMPLIFIER (U303B), HIGH-PASS FILTER (U303C)

The microphone audio signal is coupled by C349 to amplifier U303B which provides a gain of approximately two. R410, R414, and C354 provide a bias voltage of approximately 3.2 volts on the noninverting input. An 8-volt supply voltage to the microphone amplifier is provided by R401, C348, and R406.

From U303B the microphone signal is coupled by C350 to a high-pass filter formed by U303C and several other components. This filter attenuates

frequencies below 300 Hz that could cause interference with LTR data and Call Guard signals.

Gate U308B blocks the microphone signal when microphone audio is not transmitted such as during the data handshake to set up the call. A high signal on pin 5 closes the gate and passes the signal. This gate is controlled by the Q6 output (pin 13) of latch U110. Transistor Q307 functions as an inverter and level translator.

3.5.2 SUMMING AMPLIFIER (U303D), PRE-EMPHASIS/LIMITER (U303A)

U303D amplifies the transmit audio signal and also the transmit data signal from an optional modem if one is used. Jumper R398 is installed to route the modem signal to U303D and the filtering circuitry, or jumper R399 is installed to route a wideband signal directly to the synthesizer so that it bypasses the filtering circuitry. U308A closes when wideband (25 kHz) channels are selected. This bypasses R403 which provides a higher deviation level with those channels.

NOTE: If the wideband data input is used, the external device must provide FCC-approved modulation limiting and splatter filter circuitry and a stable DC level.

The output signal from U303D is then routed via the option wireouts to U303A which provides limiting and 6 dB per octave pre-emphasis. This stage is an amplifier which limits by saturating. Limiting prevents over-modulation caused by high-level input signals. R370 and R378 set the input level to the next stage, and C334 provides DC blocking.

3.5.3 SPLATTER FILTER (U302B, U302C)

U302B and U302C form a five-pole, low-pass splatter filter which attenuates frequencies above 3 kHz. This prevents adjacent channel interference. Frequencies over 3 kHz may be produced if limiting occurs in the limiter stage just described. The signal is then fed to digital potentiometer U802 on the RF board which sets the deviation level. Refer to Section 3.7.4 for more information.

3.5.4 TRANSMIT DATA CIRCUIT (U302D, U302A)

The transmit LTR data and Call Guard tone/data signals are generated by the microcontroller on pins 37 and 38. The four logic combinations possible with these two outputs are applied to a resistor network consisting of R389, R392, R386, and R395. This network creates a four-step pseudo sine wave from the digital outputs. This signal is applied to a low-pass filter formed by U302D and U302A. This filter attenuates harmonics present in the signal which provides smoothing of the stepped sine wave.

The passband of this filter is controlled by Q306 which switches additional capacitance into the circuit. When LTR or digital Call Guard data or low-frequency tone Call Guard signaling is being transmitted, Q306 is turned on and the cut-off frequency decreases to approximately 150 Hz. Then when a high-frequency tone Call Guard signal is being transmitted, Q306 is turned off and the cut-off frequency increases to approximately 220 Hz. Q306 is controlled by the same signal used to control Q300 in the receive data circuit (see Section 3.4.3).

U308C provides gating of the transmit data signal. When the control input (pin 6) is high, the gate is closed and the signal is passed. Test gate U307A is used in the test mode to bypass the data filter to provide the wideband data signal required for setting modulation balance. Q303 and Q308 provide level translation and inversion. The transmit data signal is then fed to digital potentiometer U802 on the RF board which sets the data deviation level. Refer to Section 3.7.4 for more information.

3.6 DISPLAY BOARD

Control of most display board functions is provided by microcontroller U2. This device contains a 2K byte ROM and 128 byte RAM and has 20 I/O lines. It communicates with microcontroller U101 on the audio/logic board via the SPI serial bus consisting of SCK, MOSI, and MISO lines (see Section 3.3.1). When there is data to send to the audio/logic board, such as if an option switch is pressed, U2 issues a service request on the Service Request Out line (J1, pin 6).

DISPLAY DESCRIPTION

The functions controlled by U2 are as follows:

- Display controller U1 programming
- Backlight control
- Transmit/Busy indicator CR4 control
- Front panel option switch detection
- Front panel Select switch detection
- Microphone hanger off-hook detection.

The use of a separate microcontroller on the display board minimizes the number of interconnections required with the audio/logic board because separate lines are not required for each of the preceding functions.

When the front panel Select switch is pressed, the two PBNO lines are shorted together. Then when it is rotated clockwise, low pulses appear on the CW line, and when it is rotated counterclockwise, low pulses appear on the CCW line. The contrast and viewing angle of the display are set by potentiometer R46.

3.7 SYNTHESIZER CIRCUIT DESCRIPTION (UHF MODELS)

3.7.1 INTRODUCTION

The synthesizer block diagram is part of the RF/PA board diagram shown in Figure 3-4. The synthesizer output signal is produced by a VCO (Voltage Controlled Oscillator) located in a separate module attached to the RF board. The frequency of the VCO is controlled by a DC voltage from the phase detector in synthesizer integrated circuit U804.

The phase detector senses the phase and frequency difference between a highly stable signal from the reference oscillator (fR) and a frequency produced by dividing down the VCO signal (fV). When the signal from the VCO is the same as the reference frequency, the VCO is on the correct frequency. If the VCO-derived signal is not the same, the VCO control voltage increases or decreases to change the VCO frequency until they are the same. The VCO is then “locked” on frequency.

The reference input (fR) to the phase detector is produced by dividing down the signal from reference oscillator U806. The fR input is 50 kHz for all UHF channels. Therefore, the reference divider in U804 divides the 14.850 MHz reference oscillator signal by 297. The TCXO frequency stability is 2.0 PPM, so this is also the stability of the synthesizer (and the second injection signal which is derived from the TCXO frequency).

The VCO-derived input to the phase detector (fV) is the VCO frequency divided down by programmable dividers in synthesizer U804. The prescaler and main divider are programmed for each channel to produce an input frequency to the phase detector (fV) that is the same as the 50 kHz reference frequency (fR) when the VCO is oscillating on the correct frequency. Refer to Section 3.7.5 for more information on U804 operation.

3.7.2 VOLTAGE-CONTROLLED OSCILLATOR

Introduction

The VCO module is a separate assembly that is soldered directly to the RF board and covered by a metal shield. It uses a ceramic substrate that can easily be damaged by excessive heat; therefore, it is recommended that modules which have been removed using a standard soldering iron not be reused. In addition, the VCO center frequency is set by laser tuning ceramic resonator L101. Therefore, it is not possible to adjust this frequency if it changes as the result of changing a part. For these reasons, the VCO is considered not field serviceable.

Oscillator (Q102)

The VCO is formed by bipolar transistor Q102, ceramic resonator L101, and several capacitors and varactor diodes. It oscillates at the transmit frequency in the transmit mode and 45 MHz below the receive frequency in the receive mode (the first injection frequency).

Biasing of Q102 is provided by R108 and R112, and stabilization is provided by R114. Inductor L102 functions as an RF choke, and an AC voltage divider formed by C112, C115, and C119 starts and maintains oscillation and matches Q102 to the tank circuit.

The tank circuit consists of laser tuned inductor L101, varactor diodes CR101, CR103-CR106, and several capacitors. Inductor L101 is laser trimmed to

set the VCO to the center of the operating band when the control voltage is at its midpoint.

The output signal on the collector of Q102 is coupled by C108 to a cascode buffer amplifier formed by Q100 and Q101. This is a shared-bias amplifier which provides amplification and also isolation between the VCO and stages which follow. C113 provides impedance matching on the input, and the resistors in the circuit provide biasing and stabilization (R100 also provides current limiting). C100, C101, and C106 are RF decoupling capacitors, and C105 provides an AC ground on the base of Q100.

The output signal on the collector of Q101 is directly coupled to the emitter of Q100. Impedance matching on the output of Q100 is provided by L100, C102, and C103. Resistor R102 lowers the Q of L100 to make is less frequency selective. The VCO signal is then fed to buffer Q801 and synthesizer chip U804 on the RF board.

VCO Frequency Shifting

In a particular UHF band, the VCO must be capable of producing frequencies from the receiver first injection frequency for the lowest channel up to the transmit frequency for the highest channel. Since the first injection frequency is 45 MHz below the receive frequency and the frequency band could be up to approximately 42 MHz wide, this results in a required VCO frequency spread of up to 87 MHz. If this large frequency shift was achieved only by varying the VCO control voltage, the VCO gain would be undesirably high. Instead, capacitance is switched in and out of the tank circuit to provide a coarse shift in frequency and fine shift is provided by the control voltage.

This switching is provided by PIN diodes CR104 and CR105 and controlled by a logic signal from the Q0 and Q1 outputs (pins 4 and 5) of shift register U800. When a PIN diode is forward biased, it presents a very low impedance to RF signals. Conversely, when it is reverse biased, it presents a very high impedance to RF signals.

Forward biasing one of these PIN diodes adds capacitance to the tank circuit which lowers its resonant frequency. Capacitance is added to the circuit when the control signal is low. Therefore, the lowest frequency is selected when both control lines are low, and the highest frequency is selected when both are high.

For example, when Shift 1 goes low, CR104 is forward biased by current flowing through R103 and L105. Capacitor C111, which is part of the tank circuit, is then effectively AC grounded through CR104 and C107/C123. The control line is isolated from tank circuit RF by choke L105 and decoupling capacitor C104. The Shift 1 and Shift 2 logic signals for each band segment are listed in Section 4.3.3.

Frequency Control and Modulation

Fine VCO frequency control is performed by varying the DC voltage across varactor diodes CR103 and CR106 (coarse control is provided as described in the preceding description). As the DC voltage applied to a reverse-biased varactor diode increases, its capacitance decreases. Therefore, the VCO frequency increases as the control voltage increases and vice versa. The amount of frequency change produced by CR103 is set by series capacitor C118 and varactor diode CR106. The control line is isolated from tank circuit RF by L103 and C122.

The VCO is frequency modulated in a similar manner. Another capacitance leg of the tank circuit is formed by C116 and CR101. The audio and data modulation signal is applied across varactor diode CR101, and a fixed bias from a voltage divider formed by R853 and R854 is applied through R851 to pin 5. Isolation and filtering of this DC supply is provided by C838, C839, C840, and R852. Refer to Section 3.7.4 for more information on modulation.

3.7.3 ACTIVE FILTER (Q800), BUFFER AMPLIFIER (Q801)

Q800 functions as a capacitance multiplier to provide a filtered 5.5-volt supply to the VCO. Resistor R827 provides bias, and C814 provides the capacitance that is multiplied. CR800 decreases the time required to charge C814 when power is turned on. If a noise pulse or other voltage change appears on the collector, the base voltage does not change significantly because of C814. Therefore, base current does not change and the voltage on the emitter remains constant.

UHF SYNTHESIZER DESCRIPTION

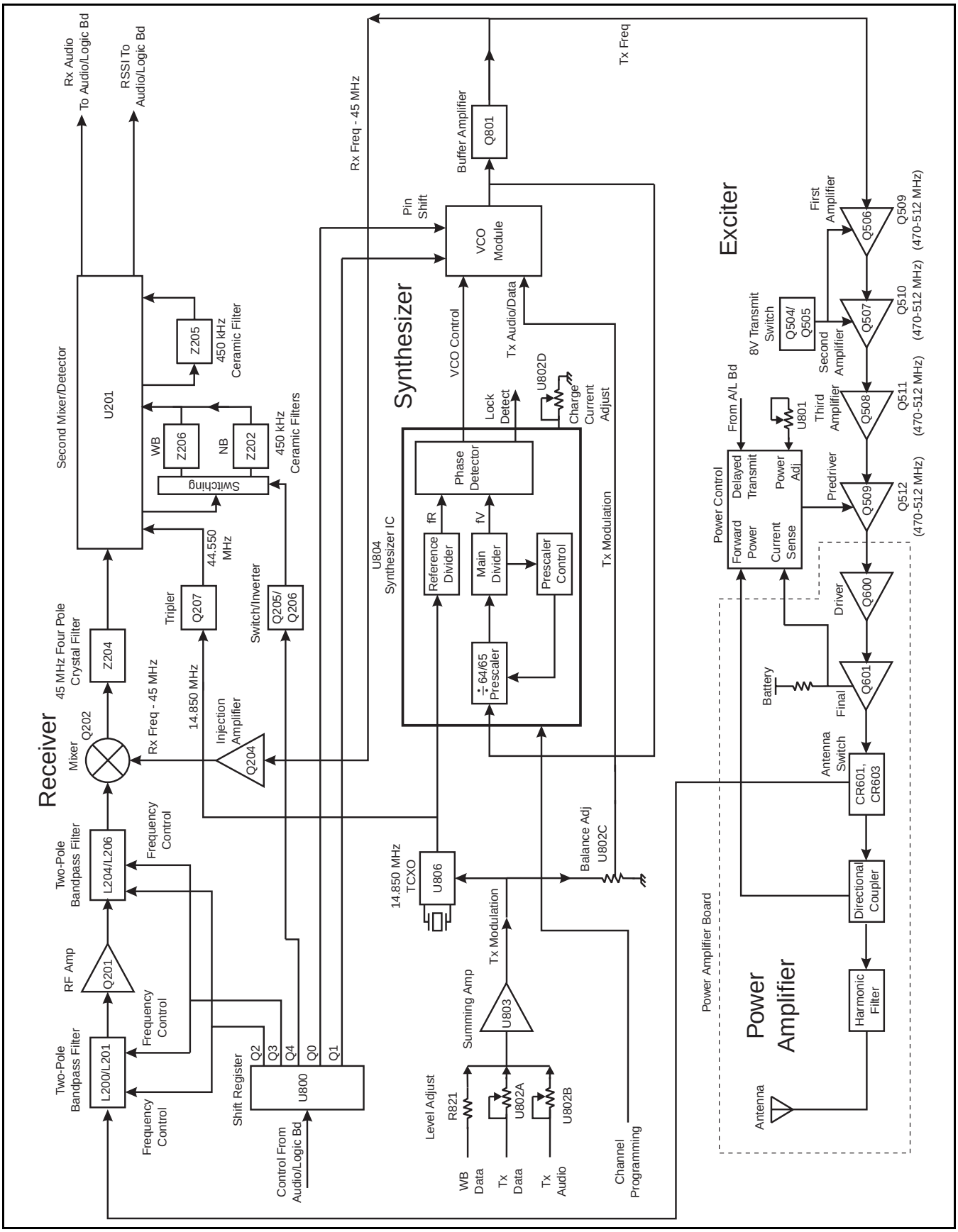


Figure 3-4 RF Block Diagram (UHF Models)

UHF SYNTHESIZER DESCRIPTION

Part of the VCO output signal is fed out of the VCO on pin 2 and applied to a second harmonic filter formed by C842 and L802. A 50-ohm load is provided by R855, with C841 providing impedance matching.

Part of the VCO signal is also fed out of the VCO on pin 1 and applied to a 50-ohm, 3 dB pad formed by R842, R839, and R843. The signal is then fed to buffer amplifier Q801. Impedance matching is provided by C822, C826, and L801, and temperature-compensated bias is provided by R830, R833, R844, and CR801. Transistor Q801 provides isolation and also amplifies the signal to produce an output level of approximately 0 dBm. Capacitors C817 and C813 decouple RF signals, and L800, C818, C827, R836, R837, and R847 provide impedance matching and the proper signal levels to the receiver and exciter. R832 lowers the Q of L800 to make it less frequency selective.

3.7.4 VCO AND TCXO MODULATION

NOTE: If the wideband data input is used, the external device must provide FCC-approved modulation limiting and splatter filter circuitry and a stable 2.5 VDC reference level.

Both the reference oscillator and VCO are modulated in order to provide the required frequency response. If only the VCO was modulated, the phase detector in U804 would sense the frequency change and change the control voltage to counteract the change, especially at the lower audio frequencies. If only the reference oscillator was modulated, the VCO frequency would not change fast enough, especially at the higher audio frequencies. By modulating both, a relatively flat response is provided to all modulation frequencies.

Separate audio, data, and wideband data modulation signals are applied to the synthesizer on J201, pins 18, 17, and 16, respectively. The data signal includes LTR and Call Guard signaling, while the wideband data signal comes directly from an external device such as a modem without passing through the limiting and filtering circuitry.

The levels of the audio and data signals are set by digitally controlled variable resistors in U802. These resistors are adjusted in 256 steps by serial data from the microcontroller (see Section 3.3.1). The transmit audio signal is applied to pins 2 and 4 which are the wiper and one leg of a potentiometer. It is fed out on pin 3 which is the other leg of the potentiometer (see Figure 3-4). Likewise, the data signal is fed in on pins 22 and 24 and out on pin 23.

These variable resistors set the modulation level of the audio and data signals and also allow the microcontroller to provide frequency compensation. This compensation is required because modulation tends to increase as the VCO frequency increases (tank circuit capacitance decreases).

The output signals on pins 23 and 3 of U802 are then combined with the wideband data signal and applied to summing amplifier U803. The output signal from U803 is then applied to the reference oscillator on pin 1 and also to a potentiometer on pin 19 of U802. The output on pin 18 of U802 is applied to the VCO on pin 5. This modulates both the reference oscillator and VCO, and the potentiometer in U802 adjusts the balance of these signals.

3.7.5 SYNTHESIZER INTEGRATED CIRCUIT (U804)

Introduction

A block diagram of synthesizer IC U804 is shown in Figure 3-5. This integrated circuit contains the following stages. The basic operation of U804 is described in Section 3.7.1.

- Reference divider
- Main divider
- Prescaler (÷64/65)
- Phase and lock detectors
- Charge pump and divider programming circuitry.

Channel Programming

Channels are selected by programming the main divider in U804 to divide by a certain number. This programming is performed by the microcontroller over the SPI serial data bus which consists of CLOCK, DATA, and STROBE lines (see Section 3.3.1). As previously described, this divider is programmed so that when the VCO is oscillating on the correct frequency, the fR and fV inputs to the phase detector are the same frequency.

UHF SYNTHESIZER DESCRIPTION

Operation

As stated in Section 3.7.1, the fR input to the main phase detector is 50 kHz for all channels (either 6.25 or 10 kHz channel spacing). The 14.850 MHz reference oscillator frequency is divided by 297 to produce this signal. Fractional-N division with modulo 5 or 8 selection allows the loop frequency to be 5 or 8 times the channel spacing. Modulo 8 is used to allow 6.25 kHz (12.5 kHz) channel spacing.

The fV input is produced by dividing down the VCO frequency applied to the RF IN input. The first divider is a prescaler which is a special counter capable of operating at relatively high frequencies. This counter divides by 64 and 65 in this application. This divides a signal in the 400 MHz range down to approximately 6 MHz. For each main divider output pulse, the prescaler divides by 65 for a certain number of pulses and then 64 for an additional number of pulses. The number counted in each mode is determined by the programming of the "N" and "A" divide numbers. The basic operation is as follows:

The main divider begins counting down from the "A" number. Then when zero is reached, it begins counting down from the "N" number until zero is reached. The cycle then repeats. While it is counting down the "A" number, the prescaler divides by 65, and while it is counting down the "N" number, it divides by 64.

To illustrate the operation of these dividers, an example will be used. Assume a transmit frequency of 450.750 MHz is selected. Since the VCO oscillates on the transmit frequency in the transmit mode, this is the frequency that must be produced by the VCO. To produce this frequency, the "N" and "A" divide numbers are programmed as follows:

N = 83 A = 55

To determine the overall divide number of the prescaler and main divider, the number of input pulses required to produce one main divider output pulse can be determined. Although the programmed "N" number is 83 in this example, the divide number is always two higher (85) because of reset cycles and other effects. Therefore, the prescaler divides by 65 for 55 x 65 or 3575 input pulses. It then divides by 64 for 85 x 64 or 5440 input pulses. The overall divide number K is therefore 3575 + 5440 or 9015. The VCO frequency of 450.750 MHz divided by 9015 equals 50 kHz which is the fR input to the phase detector.

If the VCO frequency is not evenly divisible by 50 kHz, there is also a fractional-N number programmed that provides the required fractional divide number. Refer to the 800/900 MHz description in Section 3.10.6 for more information.

NOTE: The formulas for calculating the N and A divide numbers are described in Section 4.3.5.

3.7.6 LOCK DETECT

When the synthesizer is locked on frequency, the LOCK output of U804 (pin 18) is a logic high voltage. Then when the synthesizer is unlocked, this voltage is low. A locked condition exists when the phase difference at the TCXO input is less than one cycle.

3.7.7 CHARGE PUMP

The charge pump circuit in U804 charges and discharges C833-C836 in the loop filter to produce the VCO control voltage. Resistors connected to the RN and RF pins set the charge current. The RF pin resistance is set by a digitally controlled potentiometer in U802. This resistance changes with the frequency band in order to minimize fractional-N spurious signals. The loop filter provides low-pass filtering which controls synthesizer stability and lockup time and suppresses the loop reference frequency (50 kHz).

3.7.8 SHIFT REGISTER (U800, U801) AND DIGITAL POTENTIOMETER (U802) PROGRAMMING

Shift register U800 functions as an I/O port expander, and shift register U801 functions as a D/A converter to provide a 256-step output voltage for adjusting transmitter power. In addition, the Q7 output of U801 provides the transmit/receive signal. U802 contains four digitally controlled potentiometers that are also adjustable in 256 steps.

These devices are cascaded together on the serial bus so that data is shifted out of one device into

UHF SYNTHESIZER DESCRIPTION

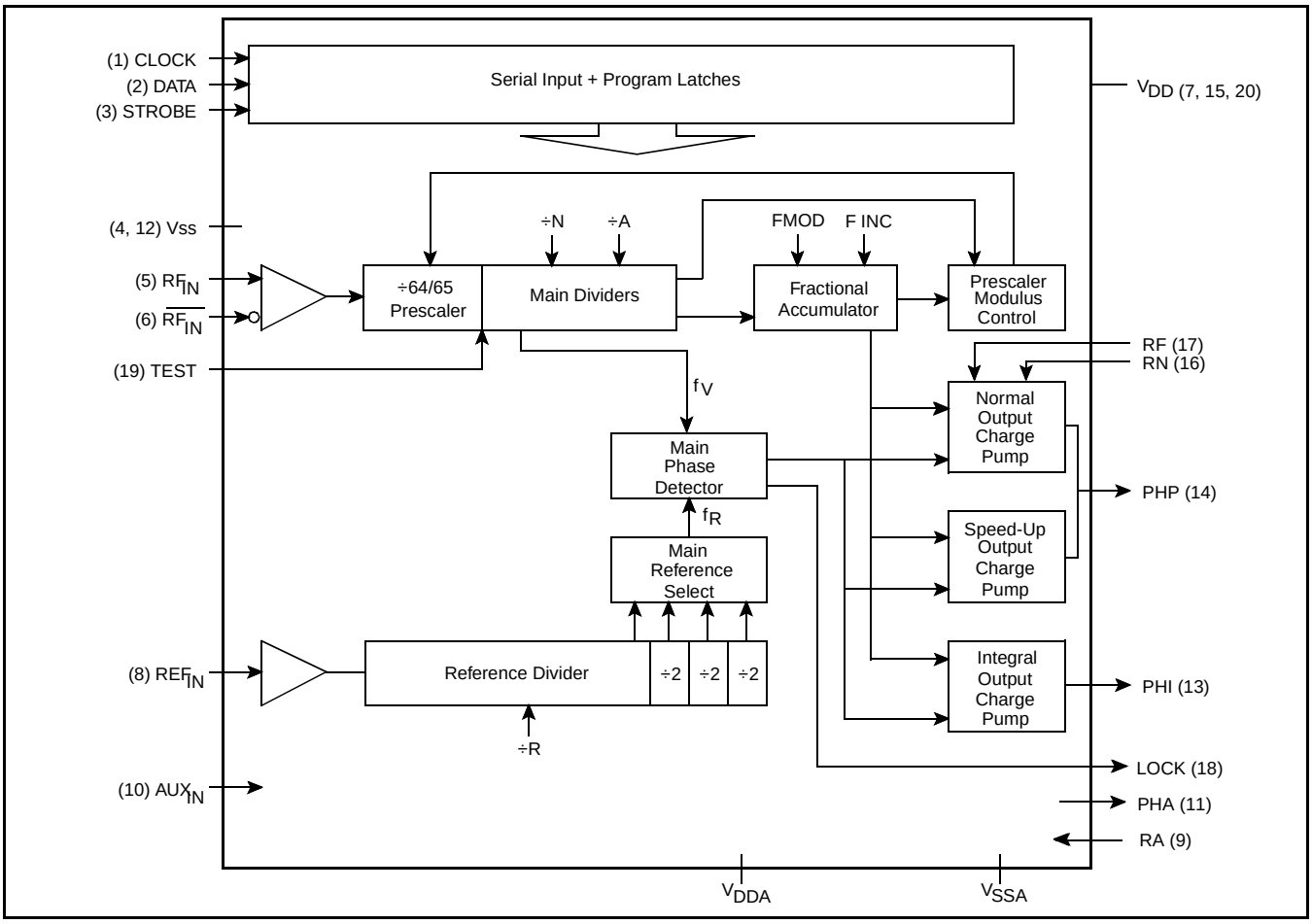


Figure 3-5 Synthesizer Chip U804 Block Diagram

another. Programming is performed using the SPI serial port of the microcontroller described in Section 3.3.1. The input to the internal shift register of these devices is the DATA pin (U800/U801) or SDI pin (U802), and the output of the last shift register stage in U800 and U801 is the $\overline{QS}$ pin. Therefore, serial data on the Data line from the audio/logic board (J201, pin 14) is first shifted into U801, then U800, and then U802.

Data is clocked through the devices by the CLOCK signal (J201, pin 13) when the STROBE input (J201, pin 12) is high and latched when it goes low. Synthesizer IC U804 is also programmed by the SPI port. However, data does not pass through the other devices, and it is controlled by different STROBE signal (J201, pin 1).

3.8 RECEIVER CIRCUIT DESCRIPTION (UHF MODELS)

NOTE: The receiver block diagram is shown in Figure 3-4.

3.8.1 FRONT END FILTER

The receive signal is fed from the antenna switch circuit on the PA board to the receiver front end on the RF board. The signal is fed through a section of microstrip that is part of a quarter-wave line for the antenna switch. Also part of the antenna switch circuit is C201, CR200, and R200. Refer to Section 3.9.4 for more antenna switch information.

The receive signal is applied to a two-pole band-pass filter formed by ceramic resonators L200 and L201, several capacitors, and PIN diodes CR201 and

CR202. The function of this filter is to attenuate frequencies outside the receive band such as the first injection, image, and half IF frequencies. The passband frequency of the filter is shifted in four steps using PIN diodes. These diodes are controlled by microcontroller through the Q2 and Q3 outputs of shift register U800. The control signals for each of four band segments are listed in Section 4.4.

The PIN diodes present a very low impedance at RF frequencies when forward biased and a very high impedance when reverse biased. This allows them to be used to switch capacitance in and out of the filter. For example, when the lowest segment of the frequency band is selected, both control signals are high and the diodes are forward biased by current flowing through R201-R204. Therefore, C207, C208, C218, and C219 are effectively connected to ground through CR201 and CR202 which lowers the passband frequency of the filter.

Ceramic resonators L200 and L201 have a very high Q and therefore cause very little receive signal loss. Capacitors on the input and output of the filter provide impedance matching with the adjoining stages.

3.8.2 RF AMPLIFIER (Q201)

RF amplifier Q201 improves and stabilizes receiver sensitivity and also recovers filter losses. Several capacitors on the input and also L202 provide impedance matching. CR203 protects the base-emitter junction of Q201 from damage caused by high level input signals.

The bias current of Q201 is fixed at a constant level by Q200. The collector current of Q201 flows through R207. The voltage drop across that resistor (and therefore the current) is set by R205 and R206. For example, if current through R207 attempts to increase, the emitter voltage of Q200 decreases. Q200 then conducts less and turns Q201 off slightly to maintain a constant bias current. This provides a stable bias over changes in temperature.

The output signal of Q201 is fed to another two-pole bandpass filter similar to the one on the input of Q201 as described in the preceding section. Impedance matching with the filter is provided by L203, C227, C228, C234, and C235. Resistor R209 lowers the Q of L203 to make it less frequency selective. C222-C226 decouple various unwanted AC signals from the circuit.

3.8.3 FIRST MIXER (Q202), INJECTION AMPLIFIER (Q204)

Q202 is a dual-gate MOSFET mixer. Impedance matching at one gate is provided by C245, R214, and L207. The first injection frequency from the synthesizer is applied to the other gate. Since the first IF is 45 MHz and low-side injection is used, the injection frequency is 45 MHz below the receive frequency.

The signal from the synthesizer is amplified by Q204. A 3 dB pad on the output, consisting of R225-R227, sets the input level to the mixer. A low-pass filter network formed by C262-C264 and L211 attenuates spurious frequencies occurring above the injection frequency band. Q203 provides a stable bias current similar to Q200 described in Section 3.8.2. Temperature compensation is provided by CR206 which mirrors the voltage drop across the base-emitter junction of Q204.

Impedance matching on the output of mixer Q202 is provided at 45 MHz by L208, C251, and C252. The signal is then fed to Z204 which is a four-pole crystal filter with a nominal –3 dB bandwidth of 15 kHz. This filter attenuates wideband noise, adjacent channels, frequencies resulting from intermodulation, and other undesired frequencies. Impedance matching on the input is provided by C251, C252, C266, C268, and L213; impedance matching on the output is provided by C270, C271, C272, L215, and R228.

3.8.4 SECOND MIXER/DETECTOR (U201)

Second Mixer

U201 contains second mixer, IF amplifier, detector, RSSI, and audio amplifier stages as shown in Figure 3-6. The 45 MHz IF signal is applied to pin 2 which is the input of an internal IF amplifier stage. From the IF amplifier the signal is internally fed to the mixer which combines it with the 44.550 MHz second injection frequency to produce a second IF of 450 kHz.

UHF RECEIVER DESCRIPTION

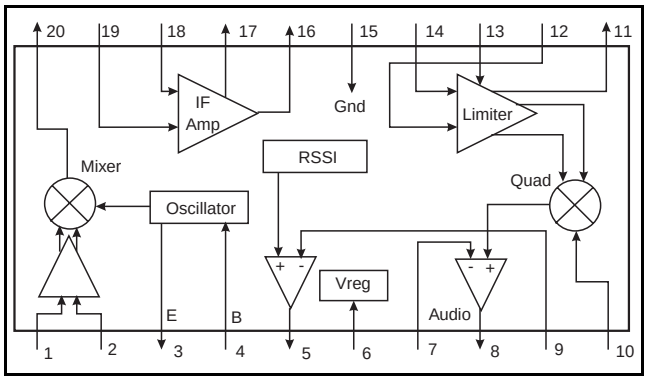


Figure 3-6 Limiter/Detector U201 Block Diagram

The 44.550 MHz injection frequency on pin 4 is produced by tripling the 14.850 MHz frequency of reference oscillator U806. To do this, a portion of the reference oscillator signal is applied to Q207 which is an amplifier with the output tuned for the third harmonic of the reference oscillator frequency. This output tuning is provided by a two-pole bandpass filter formed by L219, C287, C288, L217, and C290. The output level of this filter is approximately 0.25 V rms.

Ceramic Filters (Z202/Z206, Z205)

The 450 kHz output of the internal mixer is fed out of U201 on pin 20. It is then routed through ceramic filter Z202 for narrow-band (12.5 kHz) channels and through Z206 for wideband (25 kHz) channels. Z202 has a nominal bandwidth at the –3 dB points of 8 kHz, and Z206 has a nominal bandwidth of 15 kHz. The function of this filter is to attenuate wideband noise present in the IF signal.

Routing of the IF signal to the appropriate filter is provided by Q205 and Q206, PIN diodes CR207-CR210, and several resistors and capacitors. It is controlled by the microcontroller through the Q4 output of shift register U800. This output is low for narrow-band channels and high for wideband channels.

If a narrow-band channel is selected, a low signal is applied to the base of Q205. That transistor then turns off and inverter Q206 turns on. CR209/CR210 are then forward biased and CR207/CR208 reverse biased. This routes the 450 kHz IF signal through Z202 and blocks it from Z206. If a wideband channel is selected, the opposite occurs. For more information on the operation of PIN diodes, refer to Section 3.8.1.

The filtered 450 MHz IF signal is then applied to pin 18, amplified by an internal amplifier, and then fed back out on pin 16 and applied to ceramic filter Z205. This filter is identical to Z206 and provides additional attenuation of wideband noise. The loss introduced by each ceramic filter is approximately 12 dB.

Limiter/Detector

The signal from Z205 is applied to an internal limiter connected to pin 14. The limiter amplifies the 450 kHz signal and then limits it to a specific value to remove amplitude variations. From the limiter, the signal is fed internally to the quadrature detector. An external phase shift network connected to pin 10 shifts the phase of one of the detector input signals 90° at 450 kHz (the other input is unshifted in phase). When modulation occurs, the frequency of the IF signal changes at an audio rate as does the phase of the shifted signal. The detector, which has no output with a 90° phase shift, converts this phase shift into an audio signal. Inductor L219 is tuned to provide maximum undistorted output from the detector.

The audio signal is then fed internally to an audio amplifier. The gain of this stage is set at about three by R255 and R256. The audio output signal on pin 8 is then fed to the audio/logic board.

Also in U201 is an RSSI detector which provides a temperature compensated RSSI (Receive Signal Strength Indicator) signal on pin 5. This is a low impedance (2k ohm) output with a dynamic range of 70 dB. It provides an indication of IF signal strength which changes in proportion to changes in signal strength. It is routed to an A/D input of the microcontroller (pin 59) and used along with the squelch signal to determine receive signal strength. R259/C304 and R258/C303 provide low pass filtering, and C305 and C306 decouple RF on the audio and RSSI output lines.

UHF TRANSMITTER DESCRIPTION

3.9 TRANSMITTER CIRCUIT DESCRIPTION (UHF MODELS)

NOTE: A transmitter block diagram is in Figure 3-4.

3.9.1 FIRST AND SECOND AMPLIFIERS

Revised 430-470 MHz and all 470-512 MHz Models

The input signal to the exciter is the transmit frequency from buffer amplifier Q801 in the synthesizer. It is at a level of approximately 0 dBm and is applied to first amplifier Q509. Impedance matching on the input of Q509 is provided by C540, C552, L503, C550, C551, and L504. Biasing is provided by R531 and R535, and C526/C527 and C521/C523 decouple RF signals. Impedance matching on the output is provided by L501, C541, C555, and C556. Second amplifier Q510 is similar in design to Q509. These stages together produce about 20 dB of gain.

Power to Q509 is switched on in the transmit mode by Q506 and Q507. This switch is controlled by the microcontroller through the Q7 output (pin 11) of shift register U801. This output is high in the transmit mode and low in the receive mode. This signal also controls the antenna switch circuit on the PA board described in Section 3.9.4.

This transmit 8V supply is not delayed which allows Q509 and the transmitter frequency to stabilize before power is produced. The delayed PTT signal is applied to the RF board on J201, pin 2. This signal controls the power control circuit described in Section 3.9.6. The emitters of Q505 and Q507 are grounded through Q508. That transistor is turned off when the logic is in an undetermined state such as during Flash programming. This ensures that the transmitter is turned off during these times.

Unrevised 430-470 MHz Models

The input signal to the exciter is the transmit frequency from buffer amplifier Q801 in the synthesizer. It is at a level of approximately 0 dBm and is applied to first amplifier Q506. Impedance matching on the input of Q506 is provided by C529, C537, L505, and C530. The input level is set by R528 and R530. Biasing is provided by R520 and R525, and C525/C526 and C520/C521 decouple RF signals. Impedance matching on the output is provided by L502, C570, C531, L506, and C532. Second amplifier Q507 is similar in design to Q506. These stages together produce about 20 dB of gain. The 8-volt supply to Q506 and Q507 is switched by Q504 similar to the revised 430-470 MHz version just described.

3.9.2 THIRD AMP AND PREDRIVER

Revised 430-470 MHz and all 470-512 MHz Models

From Q510 the signal is fed to third amplifier Q511 which is a power MOSFET that provides approximately 10 dB of gain. Impedance matching with Q510 is provided by L502, C542, C557. L505, and C543. Resistors R532 and R534 lower the Q of the input matching circuit which improves stability. The gate of Q511 is biased by R527 and R528. Decoupling of RF signals is provided by C528/C529 and C516/C517.

Supply voltage to Q511 is from the power control circuit described in Section 3.9.6. This circuit varies the supply voltage to change the power output of Q511 in order to maintain constant transmitter power output.

Impedance matching with between Q511 and predriver Q512 is provided by several capacitors and sections of microstrip. Microstrip is a form of transmission line with distributed series inductance and shunt capacitance. The characteristic impedance is determined by the width of the microstrip and the PC board material and thickness (distance from ground plane).

Class C biasing of Q512 is provided by L506 and ferrite bead EP2. Several more capacitors and sections of microstrip on the output of Q512 provide matching with the 50-ohm input impedance of the power amplifier. This stage provides a gain of approximately 10 dB, resulting in a power input to the PA board of up to approximately 8 watts.

Unrevised 430-470 MHz Models

From Q507 the signal is fed to third amplifier Q508 which provides approximately 10 dB of gain. Impedance matching with Q507 is provided by L503, C571, C533, C538, L504, L507, C579, and C539. Biasing is provided by R5542, R555, and R532.

UHF TRANSMITTER DESCRIPTION

Impedance matching between Q508 and Q509 is provided by L501, several capacitors, and two sections of microstrip (microstrip is described in the preceding section). Resistor R523 lowers the Q of L501 to make it less frequency selective. Q508 is powered by the switched battery supply. AC signals are decoupled from this supply by C517-C519 and ferrite bead EP500.

Predriver Q509 is an RF power MOSFET. The gate is biased at approximately one-half the drain voltage by R519 and R522. Capacitors C512-C516, C522, and C523 provide decoupling of AC signals. R524 and R527 lower the Q of the input matching circuit which improves stability.

Supply voltage to Q509 is from the power control circuit described in Section 3.9.6. This circuit varies the supply voltage to change the power output of Q509 in order to maintain constant transmitter power output. RF choke L500, ferrite bead EP501, and several capacitors isolate the power control circuit from RF signals. Several capacitors and sections of microstrip on the drain of Q509 provide an output impedance of 50 ohms to the power amplifier board. This stage provides a gain of approximately 10 dB, resulting in a power input to the PA board of up to approximately 8 watts.

3.9.3 DRIVER (Q600), FINAL (Q601)

Driver Q600 on the power amplifier board is used with high power (40 watt) versions only. It is matched to the 50 ohms by several capacitors and sections of microstrip on the input. Class C self bias is provided by L608 and ferrite bead EP603. From Q600 the signal is fed to final amplifier Q601 which is similar in design to Q600. Each stage has a gain of approximately 5 dB, resulting in an output power from Q601 of approximately 55 watts.

The supply voltage to these stages is the unswitched battery supply. Therefore, power is applied even when transceiver power is turned off. Two RF chokes, a ferrite bead, and several capacitors isolate this supply from RF signals. Current to final amplifier Q601 flows through R600, and the power control circuit monitors transmitter current by sensing the voltage drop across it.

3.9.4 ANTENNA SWITCH

The antenna switch circuit consists of Q602, CR601, CR603, several other components, and also a section of microstrip and CR200 on the RF board. This circuit switches the antenna to the receiver in the receive mode and the transmitter in the transmit mode.

Switching transistor Q602 is controlled by the transmit signal from the Q7 output (pin 11) of shift register U807. This is the same signal that controls transmit 8-volt supply switch Q506/Q507. This signal is high in the transmit mode and low in the receive mode. Therefore, Q602 turns on in the transmit mode and current flows from the collector of final amplifier Q601 through L601, CR601/R602, L606, R608/ CR603, R609, and R610.

Diodes CR601 and CR603 are PIN diodes like those in the receiver front end (see Section 3.8.1). When a PIN diode is forward biased, it presents a very low impedance. Therefore, the transmit signal has a low-impedance path through CR601 to the directional coupler and C614. With CR603 also forward biased, it effectively connects L606 to AC ground through C652. A parallel resonant circuit is then formed by L606 and C643 which presents a high impedance into the receiver for the transmit signal.

Further receiver isolation in the transmit mode is provided by a grounded quarter-wave line. This quarter-wave line is formed by the section of microstrip connected to C650/C651 and another section on the RF board. The receiver end of this quarter-wave line is AC grounded by PIN diode CR200 on the RF board. This diode is forward biased in the transmit mode by the 8-volt transmit supply applied through R200. When one end of a quarter-wave line is grounded, the other end presents a high impedance to the quarter-wave frequency (the transmit frequency band in this case). C650 and C651 on the PA board provide impedance matching.

In the receive mode, all three PIN diodes are reverse biased. Therefore, CR601 presents a high impedance into the transmitter for the receive signal, L606 presents a low impedance because it is no longer resonant, and the quarter-wave line presents a low impedance because it is no longer grounded by CR200.

UHF TRANSMITTER DESCRIPTION

3.9.5 DIRECTIONAL COUPLER, LOW-PASS FILTER

The transmit signal is fed to a directional coupler formed by adjacent sections of microstrip. The forward component of output power is rectified by CR602 and developed across R607 and fed to the power control circuit. Reverse power is not detected in this transceiver.

From the directional coupler the transmit signal is fed to a low-pass harmonic filter formed by L602-L604 and several capacitors. This filter attenuates harmonic frequencies occurring above the transmit band. R603 dissipates static buildup on the antenna.

The ambient power amplifier temperature is sensed by thermistor R601. The resistance of a thermistor decreases as temperature increases. R601 and R143 on the audio/logic board form a voltage divider, and the voltage across this divider is monitored by an A/D converter input of the microcontroller (pin 63). If the PA temperature increases above limits set in software, the power is first cut back. Then if it continues to rise, the transmitter is turned off.

3.9.6 POWER CONTROL (U500A/B, Q500-Q503)

Introduction

The power control circuit maintains a constant power output as changes occur in temperature and voltage. It does this by varying the supply voltage to predriver Q509 (unrevised 430-470 MHz) or third amplifier Q511 (all others). This changes the power output of that stage which in turn controls the power output of the transmitter. The power control circuit senses forward power to control power output. The current to final amplifier Q601 is also sensed, but it affects power output only if it becomes excessive. Gradual power shutdown then occurs.

The power output level is set in 127 steps by D/A converter U801 that is controlled by the microcontroller. This allows power to be adjusted from the front panel using the test mode and also different power levels to be programmed for each system. In addition, it allows the microcontroller to cut back power when power amplifier temperature is excessive as just described.

U500A, Q500/Q502 Operation

The forward power signal from the directional coupler is applied to pin 2 of amplifier U500A. This is a DC signal that increases in proportion to forward power. The other input to U500A is a DC voltage from a D/A converter formed by shift register U801 and several resistors. This stage is similar in design to D/A converter U305 described in Section 3.4.4. Programming of U801 is described in Section 3.7.8. The voltage from this D/A converter sets the reference voltage on pin 3 which sets the power output of the transmitter.

U500A is a difference amplifier which amplifies the difference between the reference voltage on pin 3 and the forward power signal on pin 3. The turn-on time of U500A is controlled by the time constant of C502 and R508. Negative AC feedback to prevent oscillation is also provided by C502. This circuit operates as follows: Assume the output power attempts to increase. The DC voltage applied to U500A, pin 2 then increases which causes the output voltage on pin 1 to decrease. Transistors Q502 and Q500 then turn off slightly which decreases the supply voltage to predriver Q509 (or third amplifier Q511). The output power then decreases to maintain a constant power output. R510 and R513 limit the voltage gain of Q500 and Q503 to approximately two.

Delayed PTT

Transistor Q503 is used to delay power output for a short time after the transmitter is keyed. This allows the synthesizer and the exciter to stabilize so that the transmitter does not transmit off-frequency. The signal which controls Q503 is from the Q2 output (pin 17) of latch U111 on the audio/logic board. In the receive mode this output is low, so Q503 is off. Pin 2 of U500A is then pulled high by the 8-volt supply applied through R505 and CR503. This causes the output on pin 1 of U500A to go low which shuts off power to Q509 (or Q511). Then when the transmitter is keyed, the Q503 control signal goes high after a short delay. Q503 then turns on and diode CR503 is reverse biased. Only the forward power signal is then applied to pin 2 of U500A.

Over Current Shutdown

Current to final amplifier Q601 on the PA board is monitored by sensing the voltage drop across R680. Pins 5 and 6 of U500B are effectively connected across this resistor. As current increases, the voltage on U500B, pin 6 decreases which causes the output voltage on pin 7 to increase. The gain of each U500B input is set at ten by R509/R504 and R507/R502.

Emitter biasing for Q501 is provided by R506 and R511. Normally, the output voltage of U500B is not high enough to turn on Q501. However, if current becomes excessive, for example because of an antenna mismatch, Q501 begins turning on. This decreases the base voltage of Q502 which turns off Q500 slightly and cuts back power output.

3.10 SYNTHESIZER CIRCUIT DESCRIPTION (800/900 MHz MODELS)

3.10.1 INTRODUCTION

The synthesizer block diagram is part of the RF/PA board diagram shown in Figure 3-7. The synthesizer output signal is produced by a VCO (Voltage Controlled Oscillator) located on a separate module attached to the RF board. The frequency of the VCO is controlled by a DC voltage from the phase detector in synthesizer integrated circuit U804.

The phase detector senses the phase and frequency difference between a highly stable signal from the reference oscillator (fR) and a frequency produced by dividing down the VCO signal (fV). When the signal from the VCO is the same as the reference frequency, the VCO is on the correct frequency. If the VCO-derived signal is not the same, the VCO control voltage increases or decreases to change the VCO frequency until they are the same. The VCO is then “locked” on frequency.

The reference input (fR) to the phase detector is produced by dividing down the signal from reference oscillator U806. The fR input is 50 kHz for all 800 and 900 MHz channels. Therefore, with 900 MHz models, the reference divider in U804 divides the 14.850 MHz reference oscillator signal by 297, and with 800 MHz models, it divides the 17.500 MHz reference oscillator signal by 350. The TCXO frequency stability is 1.5 PPM, so this is also the stability of the synthesizer (and the second injection signal which is derived from the TCXO frequency).

The VCO-derived input to the phase detector (fV) is the VCO frequency divided down by programmable dividers in synthesizer U804. The prescaler and main divider are programmed for each channel to produce an input frequency to the phase detector (fV) that is the same as the 50 kHz reference frequency (fR) when the VCO is oscillating on the correct frequency. Refer to Section 3.10.6 for more information on U804 operation.

3.10.2 VOLTAGE-CONTROLLED OSCILLATOR

Introduction

The VCO module is a separate assembly that is soldered directly to the RF board and covered by a metal shield. It uses a ceramic substrate that can easily be damaged by excessive heat; therefore, it is recommended that modules which have been removed using a standard soldering iron not be reused. In addition, the VCO center frequency is set by laser tuning ceramic resonator L907. Therefore, it is not possible to adjust this frequency if it changes as the result of changing a part. For these reasons, the VCO is considered not field serviceable.

Oscillator (Q902)

The VCO is formed by bipolar transistor Q902, ceramic resonator L907, and several capacitors and varactor diodes. It oscillates at the transmit frequency in the transmit mode and 52.950 (800 MHz) or 45 MHz (900 MHz) below the receive frequency in the receive mode (the first injection frequency).

Biasing of Q902 is provided by R906 and R908, and stabilization is provided by R912. Inductor L906 functions as an RF choke, and C924 is an AC bypass capacitor. An AC voltage divider formed by C913, C917, and C921 starts and maintains oscillation and matches Q902 to the tank circuit.

The tank circuit consists of laser tuned inductor L907, varactor diodes CR902-CR904, and several capacitors. Inductor L907 is laser trimmed to set the

800/900 MHz SYNTHESIZER DESCRIPTION

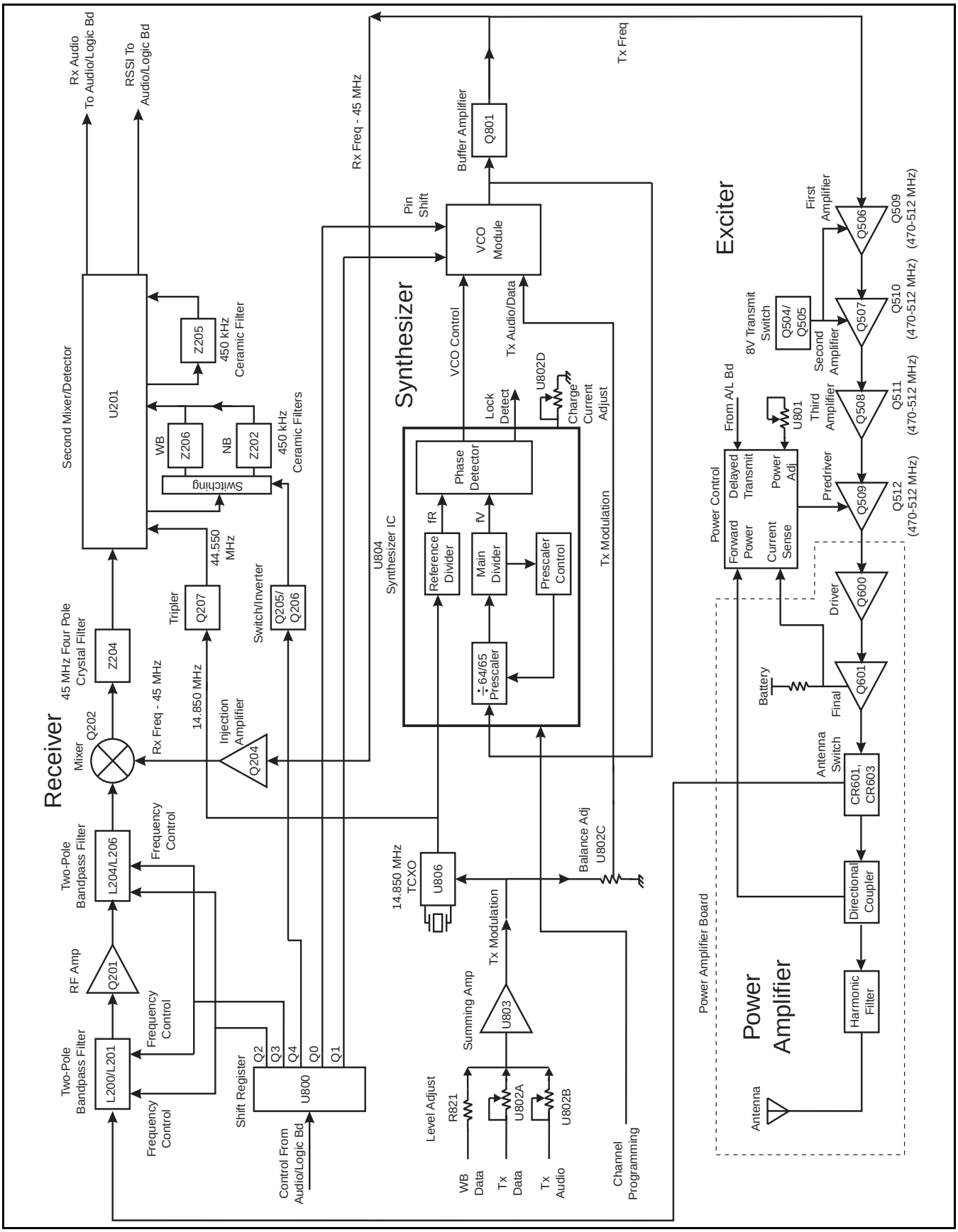


Figure 3-7 RF Block Diagram (800/900 MHz Models)

VCO to the center of the operating band when the control voltage is at its midpoint.

The output signal on the collector of Q902 is coupled by C911 to a buffer amplifier formed by Q901 and Q903. This is a shared-bias amplifier which provides amplification and also isolation between the VCO and stages which follow. C918 provides impedance matching on the input, and the resistors in the circuit provide biasing and stabilization (R913 also provides current limiting). C901, C902, and C908 are RF decoupling capacitors, and C909 and C919 provide an AC ground on the emitters of Q901 and Q903.

The output signal on the collector of Q903 is fed through C914 to synthesizer U804. A 50-ohm load is provided by R855, and C841, C842, and C849 provide impedance matching. Likewise, the output signal on the collector of Q901 is fed through C904 to buffer amplifier Q801 (see Section 3.10.5). Resistor R902 lowers the Q of L903 to make is less frequency selective.

VCO Frequency Shifting

In the applicable 800 or 900 MHz band, the VCO must be capable of producing frequencies from the lowest receiver first injection frequency up to the highest talk-around mode transmit frequency. At 800 MHz, the lowest VCO frequency is 798.0625 MHz (52.950 MHz below the lowest receive frequency of 851.0125 MHz) and the highest talk-around frequency is 869.9875 MHz. Therefore, the VCO frequency band spread is approximately 72 MHz. If this large frequency shift was achieved only by varying the VCO control voltage, the VCO gain would be undesirably high. Instead, capacitance is switched in and out of the tank circuit to provide a coarse frequency shift.

This switching is provided by PIN diode CR901 which is controlled by the logic signals from the Q0 and Q1 outputs (pins 4 and 5) of shift register U800. Q803 and Q804 function as inverters and drivers. When a PIN diode is forward biased, it presents a very low impedance to RF signals. Conversely, when it is reverse biased, it presents a very high impedance.

Forward biasing of PIN diode CR901 adds capacitance to the tank circuit which lowers its resonant frequency. The diode is forward biased in the normal mode and reverse biased in the talk-around mode (both 800 and 900 MHz). The logic levels on pins 3 and 4 of the VCO are as follows:

	Pin 3	**Pin 4**
Normal Mode	H (5.5V)	L (0V)
Talk-Around Mode	L (0V)	H (5.5V)

In the normal mode, CR901 is forward biased by current flowing through R903, L905, CR901, and L902. Capacitors C907 and C912 are then effectively AC grounded through CR901 and C905. The control lines are isolated from tank circuit RF by L902/C903, L905/C906, C811, C812, C823, and C824.

Frequency Control and Modulation

Fine VCO frequency control is performed by varying the DC voltage across varactor diodes CR903 and CR904 (coarse control is provided as described in the preceding description). As the DC voltage applied across a reverse-biased varactor diode increases, its capacitance decreases. Therefore, the VCO frequency increases as the control voltage increases and vice versa. The amount of frequency change produced by CR903 and CR904 is set by series capacitor C922. A DC ground is provided by L908, and the control line is isolated from tank circuit RF by L909 and C925.

The VCO is frequency modulated in a similar manner. Another capacitance leg of the tank circuit is formed by C915, C920, and varactor diode CR902. The audio and data modulation signal is applied across CR902, and a fixed bias from a voltage divider formed by R853 and R854 is applied through R851 to pin 5. Isolation and filtering of this DC bias is provided by C838, C839, C840, and R852. Refer to the next section for more information on modulation.

3.10.3 VCO AND TCXO MODULATION

NOTE: If the wideband data input is used, the external device must provide FCC-approved modulation limiting and splatter filter circuitry and a stable 2.5 VDC reference level.

Both the reference oscillator and VCO are modulated in order to provide the required frequency response. If only the VCO was modulated, the phase detector in U804 would sense the frequency difference and change the control voltage to counteract it, espe-

cially at the lower audio frequencies. Conversely, if only the reference oscillator was modulated, the VCO frequency would not change fast enough, especially at the higher audio frequencies. By modulating both, a relatively flat response is provided for all modulation frequencies.

Separate audio, data, and wideband data modulation signals are applied to the synthesizer on J201, pins 18, 17, and 16, respectively. The data signal includes LTR and Call Guard signaling, and the wideband data signal (if used) comes directly from an external device such as a modem and does not pass through the limiting and filtering circuitry.

The levels of the audio and data signals are set by digitally controlled variable resistors in U802. These resistors are adjusted in 256 steps by serial data from the microcontroller (see Section 3.3.1). The transmit audio signal is applied to pins 2 and 4 which are the wiper and one end of a potentiometer. It is fed out on pin 3 which is the other end of the potentiometer (see Figure 3-7). Likewise, the data signal is fed in on pins 22 and 24 and out on pin 23. These variable resistors set the modulation level of the audio and data signals and also allow the microcontroller to provide frequency compensation. This compensation is required because modulation tends to increase as the VCO frequency increases (tank circuit capacitance decreases).

The output signals on pin 23 and 3 are then combined with the wideband data signal and applied to summing amplifier U803. The output signal from U803 is then applied to the reference oscillator on pin 1 and also across the potentiometer connected to pin 19 of U802. The output on pin 18 is applied to the VCO on pin 5. This modulates both the reference oscillator and VCO. The resistor across pins 19 and 18 of U802 adjusts the balance of these signals.

3.10.4 ACTIVE FILTER (Q800)

Q800 functions as a capacitance multiplier to provide a filtered 7.0-volt supply to the VCO. Resistor R827 provides bias, and C814 provides the capacitance that is multiplied. CR800 decreases the time required to charge C814 when power is turned on. If a noise pulse or other voltage change appears on the collector, the base voltage does not change significantly because of C814. Therefore, base current does not change and the voltage on the emitter remains constant.

3.10.5 BUFFER AMPLIFIER (Q801), TX/TX SWITCH (CR801/CR802)

The output signal on pin 2 of the VCO is applied to buffer amplifier Q801. Impedance matching on the input is provided by C822, a section of microstrip, and C826. Microstrip is a form of transmission line with distributed series inductance and shunt capacitance. The characteristic impedance is determined by the width of the microstrip and the PC board material and thickness (distance from ground plane). This stage provides isolation and also amplifies the signal to produce an output level of approximately 0 dBm.

The bias current of Q801 is fixed at a constant level by Q802. The collector current of Q801 flows through R830. The voltage drop across that resistor (and therefore the current) is set by R836 and R837. For example, if current through R830 attempts to increase, the emitter voltage of Q802 decreases. Q802 then conducts less and turns Q801 off slightly to maintain a constant bias current. This provides a stable bias over changes in temperature.

Capacitors C813, C817, C827, and C844 decouple RF signals, and a section of microstrip and C818 provide impedance matching with the transmit/receive switch. R832 lowers the Q of the microstrip to make it less frequency selective.

The transmit/receive switch formed by CR801, CR802, and several other components switches the VCO signal to the receiver in the receive mode and the transmitter in the transmit mode. CR801 and CR802 are PIN diodes similar to CR901 described in Section 3.10.2. Therefore, they present a very low impedance when forward biased and a very high impedance when reverse biased.

These diodes are controlled by the Q2 signal from shift register U800. This signal is high in the transmit mode and low in the receive mode. Therefore, when the transmitter is keyed, both Q805 and Q806 turn on and CR801 and CR802 are forward biased by the current flowing through Q806, R856, L800, CR801, CR802, R857, and Q805.

This effectively AC grounds the receiver end of the quarter-wave line through CR802 and C847. When one end of a quarter-wave line is grounded, the other end presents a high impedance to the quarter-wave frequency. Therefore, the VCO signal is blocked from the receiver by the quarter-wave line and has a low impedance path through CR801 to the transmitter.

In the receive mode, both diodes are reverse biased. The quarter-wave line is then no longer grounded and provides a low impedance path to the receiver while CR802 provides a high impedance into the transmitter. L801/C846 and L800/C845 improve isolation by neutralizing the slight capacitance of CR801 and CR802 when they are reverse biased.

3.10.6 SYNTHESIZER INTEGRATED CIRCUIT (U804)

Introduction

A block diagram of synthesizer IC U804 is shown in Figure 3-5 on page 5-16. This integrated circuit contains the following stages. The basic operation of U804 was described in Section 3.10.1.

- Reference (R) divider
- Main divider
- Prescaler (÷64/65)
- Phase and lock detectors
- Charge pump and divider programming circuitry

Channel Programming

Channels are selected by programming the main divider in U804 to divide by a certain number. This programming is performed by the microcontroller over the SPI serial data bus which consists of CLOCK, DATA, and STROBE lines (see Section 3.3.1). As previously described, this divider is programmed so that when the VCO is oscillating on the correct frequency, the fR and fV inputs to the phase detector are the same frequency.

Operation

As stated in Section 3.10.1, the fR input to the main phase detector is 50 kHz for all channels. The reference oscillator frequency is divided by 350 (800 MHz) or 297 (900 MHz) to produce this signal. Fractional-N division with modulo 5 or 8 selection allows the loop frequency to be 5 or 8 times the channel spacing. With 800 and 900 MHz channels, modulo 8 is used to allow 6.25 kHz (12.5 kHz) channel spacing.

The fV input is produced by dividing down the VCO frequency applied to the RF IN input. The first divider which divides this signal is a prescaler which is a special counter capable of operating at relatively high frequencies. The prescaler divides by 64 and 65 which reduces a signal in the 800 MHz range down to approximately 12 MHz. For each main divider output pulse (fV), the prescaler divides by 65 for a certain number of pulses and then 64 for an additional number of pulses. The number counted in each mode is determined by the programming of the “N” and “A” numbers. The basic operation is as follows:

The main divider begins counting down from the “A” number. Then when zero is reached, it begins counting down from the “N” number until zero is reached. The cycle then repeats. While it is counting down the “A” number, the prescaler divides by 65, and while it is counting down the “N” number, it divides by 64.

To illustrate the operation of these dividers, an example will be used. Assume a transmit frequency of 813.4875 MHz is selected (800 MHz FCC channel 300). Since the VCO oscillates on the transmit frequency in the transmit mode, this is the frequency that must be produced by the VCO. To produce this frequency, the “N” and “A” divide numbers are programmed as follows:

N = 239 A = 13

To determine the overall divide number of the prescaler and main divider, the number of prescaler input pulses required to produce one main divider output pulse can be determined. Although the “N” number is 239 in this example, the actual divide number is always two higher (241) because of reset cycles and other effects. Therefore, the prescaler divides by 65 for 13 x 65 or 845 input pulses. It then divides by 64 for 241 x 64 or 15,424 input pulses.

Since the VCO frequency is not evenly divisible by 50 kHz, there is also a fractional-N number programmed that provides the required fractional

divide number. In this example the fractional-N increment is .75 x 8 (modulo N) or 6. This causes the prescaler to divide by 65 for one additional output pulse for 6 of 8 main divider cycles. This produces a divide number that is .75 higher. Therefore, with the preceding example, the overall divide number K is 845 + 15,424 + .75 or 16,269.75. The VCO frequency of 813.4875 MHz divided by 16,269.75 equals 50 kHz which is the fR input to the phase detector.

NOTE: The formulas for calculating the "N" and "A" divide numbers are described in Section 4.3.5.

3.10.7 LOCK DETECT

When the synthesizer is locked on frequency, the LOCK output of U804 (pin 18) is a logic high voltage. Then when the synthesizer is unlocked, this voltage is low. A locked condition exists when the phase difference at the TCXO input is less than one cycle.

3.10.8 CHARGE PUMP

The charge pump circuit in U804 charges and discharges C833-C837 in the loop filter to produce the VCO control voltage. Resistors connected to the RN and RF pins set the charge current. The RF pin resistance is set by a digitally controlled potentiometer in U802. This resistance changes with the frequency band in order to minimize fractional-N spurious signals. The loop filter provides low-pass filtering which controls synthesizer stability and lockup time and suppresses the loop reference frequency (50 kHz).

3.10.9 SHIFT REGISTER (U800, U801) AND DIGITAL POTENTIOMETER (U802) PROGRAMMING

Shift register U800 functions as an I/O port expander, and shift register U801 functions as a D/A converter to provide a 256-step output voltage for adjusting transmitter power. In addition, the Q7 output of U801 provides the delayed transmit signal. U802 contains four digitally controlled potentiometers that are adjustable in 256 steps.

These devices are cascaded together on the serial bus so that data is shifted out of one device into another. Programming is performed using the SPI serial port of the microcontroller described in Section 3.3.1. The input to the internal shift register of these devices is the DATA (U800/U801) or SDI (U802) pin, and the output of the last shift register stage in U800 and U801 is the $\overline{QS}$ pin. Therefore, serial data on the Data line from the audio/logic board (J201, pin 14) is first shifted into U801, then U800, and then U802.

Data is clocked through the devices by the CLOCK signal (J201, pin 13) when the STROBE input (J201, pin 12) is high and latched when it goes low. Synthesizer IC U804 is also programmed by the SPI port. However, data does not pass through the other devices because it is controlled by a different STROBE signal (J201, pin 1).

3.11 RECEIVER CIRCUIT DESCRIPTION (800/900 MHz MODELS)

NOTE: The receiver block diagram is in Figure 3-7.

3.11.1 FRONT END FILTER

The receive signal is fed from the antenna switch circuit on the PA board to the receiver front end on the RF board. The signal is fed through a quarter-wave line that is part of the antenna switch as are C202, CR200, and R200. Refer to Section 3.12.3 for more antenna switch information. The receive signal is then applied to bandpass filter Z200. With 800 MHz models, this is a three-pole filter with a center frequency of 860 MHz and a bandwidth of 18 MHz. With 900 MHz models, it is a two-pole filter with a center frequency of 938 MHz and a bandwidth of 6 MHz. This filter attenuates frequencies outside the receive band such as the first injection, image, and half IF frequencies.

3.11.2 RF AMPLIFIER (Q201)

RF amplifier Q201 improves and stabilizes receiver sensitivity and also recovers filter losses. A section of microstrip and C214 provide impedance matching on the input. CR203 protects the base-emitter junction of Q201 from damage caused by high level input signals.

The bias current of Q201 is fixed at a constant level by Q200. The collector current of Q201 flows through R207, and the voltage drop across that resistor (and therefore the current) is set by R205 and R206.

For example, if current through R207 attempts to increase, the emitter voltage of Q200 decreases. Q200 then conducts less and turns Q201 off slightly to maintain a constant bias current. This provides a stable bias over changes in temperature.

The output signal of Q201 is fed to another bandpass filter similar to the one on the input described in the preceding section. Impedance matching with the filter is provided by a section of microstrip on the collector and C227. Resistor R209 lowers the Q of the microstrip to make it less frequency selective. C222-C226 decouple various unwanted AC signals from the circuit.

3.11.3 FIRST MIXER (Q202), CRYSTAL FILTER (Z204)

The signal from Z201 is then applied to mixer Q202. A 3-dB pad on the output of Z201 formed by R215-R217 sets the input level to the mixer. Impedance matching between the pad and mixer is provided by a section of microstrip and C245.

Q202 is biased by constant current source Q203 similar to Q200 described in the preceding section. The injection signal is applied to the emitter of Q202 and is at a level of approximately 10 dBm. With 800 MHz models, the injection frequency is 52.950 MHz below the receive frequency, and with 900 MHz models, it is 45 MHz below the receive frequency. Filtering of the injection signal is provided by two-pole bandpass filter Z203. With 800 MHz models, it has a center frequency of 807 MHz and a bandwidth of 18 MHz; and with 900 MHz models, it has a center frequency of 893 MHz and a bandwidth of 6 MHz.

The 52.950 or 45.000 MHz output signal of mixer Q202 is then applied to crystal filter Z204. Impedance matching between Q202 and 50-ohm, 3 dB pad R210-R212 is provided by L220, C231, and C232. Resistor R214 lowers the Q of L220 to make it less frequency selective. Matching between the pad and Z204 is provided by C265, C266, C268, and L213.

Z204 is a four-pole crystal filter. With 800 MHz models it has a center frequency of 52.950 MHz and a -3 dB bandwidth of 15 kHz, and with 900 MHz models it has a center frequency of 45 MHz and a -3 dB bandwidth of 7.5 kHz. This filter attenuates wideband noise, adjacent channels, frequencies resulting from intermodulation, and other undesired frequencies. Impedance matching between this filter and U201 is provided by C271, C272, L215, and R228.

3.11.4 SECOND MIXER/DETECTOR (U201)

Introduction

U201 contains second mixer, IF amplifier, detector, RSSI, and audio amplifier stages as shown in Figure 3-6 on page 5-18. The IF signal is applied to pin 1 which is the input of an internal IF amplifier stage.

Second Mixer

From the IF amplifier the signal is internally fed to the mixer which combines it with the 52.500 MHz (800 MHz models) or 44.550 MHz (900 MHz models) second injection frequency to produce a second IF of 450 kHz.

The injection frequency on pin 4 is produced by tripling the frequency of reference oscillator U806. To do this, part of the reference oscillator signal is applied to tripler Q207. This stage is an amplifier with the output tuned for the third harmonic of the reference oscillator frequency. This output tuning is provided by a two-pole bandpass filter formed by L219, C287, C288, L217, and C290. The output level of this filter is approximately 0.25 V rms.

Ceramic Filters (Z202/Z206, Z205)

The 450 kHz output of the internal mixer is fed out of U201 on pin 20 and routed to ceramic filter Z202 for all 900 MHz and 800 MHz narrow-band (12.5 kHz) channels, or Z206 for 800 MHz wideband (25 kHz) channels. Z202 has a nominal bandwidth at the –3 dB points of 8 kHz, and Z206 has a bandwidth of 15 kHz. The function of these filters is to attenuate wideband noise present in the IF signal.

Routing of the IF signal to the appropriate filter is provided by Q205 and Q206, PIN diodes CR207-CR210, and several resistors and capacitors. It is controlled by the microcontroller through the Q4 output of shift register U800. This output is low for narrow-band channels and high for wideband channels.

If a narrowband channel is selected, a low signal is applied to the base of Q205. That transistor is then turned off and inverter Q206 turned on. CR209/CR210 are then forward biased and CR207/CR208 reverse biased. This routes the 450 kHz IF signal through Z202 and blocks it from Z206. If a wideband channel is selected, the opposite occurs. For more information on the operation of PIN diodes, refer to Section 3.11.1.

The filtered 450 MHz IF signal is then applied to pin 18, amplified by an internal amplifier, and fed back out on pin 16 and applied to ceramic filter Z205. This filter is identical to Z206 and provides additional attenuation of wideband noise. The loss introduced by each ceramic filter is approximately 12 dB.

Limiter/Detector

The signal from Z205 is applied to an internal limiter connected to pin 14. The limiter amplifies the 450 kHz signal and then limits it to a specific value to remove amplitude variations. From the limiter, the signal is fed internally to the quadrature detector. An external phase shift network connected to pin 10 shifts the phase of one of the detector input signals 90° at 450 kHz (the other input is unshifted in phase). When modulation occurs, the frequency of the IF signal changes at an audio rate as does the phase of the shifted signal. The detector, which has no output with a 90° phase shift, converts this phase shift into an audio signal. L218 is tuned to provide maximum undistorted output from the detector.

The audio signal is then fed internally to an audio amplifier. The gain of this stage is set at about three by R255 and R256. The audio signal is then fed out on pin 8 and routed to the audio/logic board.

Also in U201 is an RSSI detector which provides a temperature compensated RSSI (Receive Signal Strength Indicator) signal on pin 5. This is a low impedance (2k ohm) output with a dynamic range of 70 dB. The DC voltage of this output changes in proportion to IF signal strength. This signal is routed to an A/D input of the microcontroller (pin 59) and used along with the squelch signal to determine receive signal strength. R259/C304 and R258/C303 provide low pass filtering of the audio and RSSI signals, and C305 and C306 decouple RF.

3.12 TRANSMITTER CIRCUIT DESCRIPTION (800/900 MHz MODELS)

NOTE: The transmitter block diagram is located in Figure 3-7.

3.12.1 PREDRIVER (Q506), DRIVER (Q507)

The input signal to the exciter is the transmit frequency from buffer amplifier Q801 in the synthesizer. It is at a level of approximately 0 dBm and is applied to predriver Q506. Impedance matching on the input of Q506 is provided by C529, C515, two sections of microstrip (see description in Section 3.10.5), R518, and C516. Biasing is provided by R519, R520, R522, and R523. Various AC signals are decoupled from the DC supply by C520, C525, C526, C528, and C531.

The 8-volt supply voltage to this stage is switched on in the transmit mode by Q505 and Q504. This switch is controlled by the microcontroller through the Q7 output (pin 11) of shift register U801. This output is high in the transmit mode and low in the receive mode. This signal also controls the antenna switch circuit on the PA board described in Section 3.12.3.

This transmit 8V supply is not delayed which allows Q505 and the transmitter frequency to stabilize before power is produced. The delayed PTT signal is applied to the RF board on J201, pin 2. This signal controls the power control circuit described in Section 3.12.5. The emitters of Q503 and Q505 are grounded through Q509. That transistor is turned off when the logic is in an undetermined state such as during Flash programming. This ensures that the transmitter is turned off during these times.

From Q506 the transmit RF output signal is then applied to driver Q507. Impedance matching between Q506 and Q507 is provided by several capacitors and sections of microstrip and L501. Resistor R521 lowers the Q of the parallel microstrip which makes it less frequency selective. Q507 is biased for class C operation by L504 and ferrite bead EP501.

Supply voltage to Q507 is from the power control circuit described in Section 3.12.5. This circuit varies the supply voltage of Q507 which changes its power output to maintain constant transmitter power output.

RF chokes L502 and L503, ferrite bead EP502, and several capacitors isolate the power control circuit from RF signals.

A 50-ohm, 3 dB pad formed by R529-R531 provides an output impedance of 50 ohms at the J602. Impedance matching between Q507 and this pad is provided by two sections of microstrip, C524, and C527. Power output at J602 is typically up to 250 milliwatts.

3.12.2 POWER AMPLIFIER MODULE (U600), FINAL (Q651)

Power amplifier module U600 on the PA board has approximately 19 dB of gain. Pins 2, 3, and 4 of U600 are the supply voltage inputs to three separate gain stages. The supply voltage on pin 2 (VS1) is switched by Q600 and limited to 12 volts by CR601 and R600. Switch Q600 is controlled by the same signal used to control 8V transmit switch Q505/Q504 (see Section 3.12.1).

The supply voltage applied to pins 3 and 4 (VS2/VS3) is the unswitched battery from the power jack fed through R601. Therefore, power is applied to these pins of U800 even when transceiver power is turned off. The power control circuit senses transmitter current by monitoring the voltage drop across R601.

The output signal on U600, pin 5 is then applied to Q651 (30 watt models only). With lower power models, Q651 is not used. Amplifier Q651 provides approximately 5 dB of gain. The output impedance on U600, pin 5 is 50 ohms, and it is matched to Q651 by a section of microstrip, C651, C652, and C653. Class C bias of Q651 is provided by L651. The unswitched battery supply applied to Q651 is isolated from RF by L602, EP601, and several capacitors. Impedance matching is provided on the output by C654-C656, C614, and two sections of microstrip.

3.12.3 ANTENNA SWITCH

The antenna switch circuit consists of Q602, CR602, CR604, several other components, and also a quarter-wave section of microstrip and CR200 on the RF board. This circuit switches the antenna to the receiver in the receive mode and the transmitter in the transmit mode.

Switching transistor Q602 is controlled by the transmit signal from the Q7 output (pin 11) of shift register U801. This is the same signal that controls transmit 8-volt supply switch Q505/Q504. This signal is high in the transmit mode and low in the receive mode. Therefore, Q602 turns on in the transmit mode and current flows from the collector of Q601 through R610, R609, CR604, L604, CR602/R602, and L602. In addition, 8 volts is applied through R200 to CR200 located at the input of the receiver on the RF board.

CR200, CR602 and CR604 are PIN diodes like CR901 described in Section 3.10.2. When a PIN diode is forward biased, it presents a very low impedance. Therefore, in the transmit mode the transmit signal has a low-impedance path to the antenna through CR602 and coupling capacitor C621.

The signal is blocked from the receiver by two grounded quarter-wave lines. A discrete quarter-wave line is formed by C635, C622, and L604 is effectively AC grounded on the receiver end by CR604 and C633. When one end of a quarter-wave line is grounded, the other end presents a high impedance to the quarter-wave frequency. Therefore, this line presents a high impedance into the receiver for the transmit signal. Further receiver isolation is provided by another quarter-wave line in the receiver. This line is grounded through C202 by CR200.

In the receive mode, all three PIN diodes are reverse biased. Therefore, CR602 presents a high impedance into the transmitter for the receive signal, and since the two quarter-wave lines into the receiver are no longer grounded, there is a low-impedance path into the receiver. L604 presents a low impedance because it is no longer grounded by CR604, and the quarter-wave line presents a low impedance because it is no longer grounded by CR200. Resistors R602 and R608 improve the isolation provided by CR602 and CR604 when they reverse biased (receive mode).

3.12.4 DIRECTIONAL COUPLER, LOW-PASS FILTER

A directional coupler is formed by adjacent sections of microstrip near C621. The forward component of output power is rectified by CR603 and devel-

oped across R606 and then fed to the power control circuit. Reverse power is not detected in this transceiver.

From the directional coupler the transmit signal is fed to a low-pass harmonic filter formed by C624-C627 and several sections of microstrip. This filter attenuates harmonic frequencies occurring above the transmit band. R607 dissipates static buildup on the antenna.

The ambient power amplifier temperature is sensed by thermistor R601. The resistance of a thermistor decreases as temperature increases. This thermistor forms a voltage divider with R143 on the audio/logic board, and the voltage across this divider is monitored by an A/D converter input of the microcontroller (pin 63). If the PA temperature increases above limits set in software, the power is first cut back. Then if it continues to rise, the transmitter is turned off.

3.12.5 POWER CONTROL (U500A/B, Q500-Q503)

Introduction

The power control circuit maintains a constant power output as changes occur in temperature and voltage. It does this by varying the supply voltage to driver Q507. This changes the power output of that stage which in turn controls the power output of the transmitter.

The primary signal sensed to control power output is forward power from the directional coupler. The current to final amplifier Q601 is also sensed, but it affects power output only if it becomes excessive. Gradual power shutdown then occurs.

The power output level is set in 127 steps by the microcontroller through D/A converter U801. This allows power to be adjusted from the front panel using the test mode and also different power levels to be programmed for each system. In addition, it allows the microcontroller to cut back power when power amplifier temperature or transceiver voltage is excessive as just described in Section 3.12.4.

U500A, Q500/Q502 Operation

U500A is a differential amplifier which amplifies the difference between the reference voltage on pin 3 and the forward power signal on pin 2. The forward power signal from the directional coupler is a DC signal that increases in proportion to forward power. The reference input is a DC voltage from the D/A converter formed by shift register U801 and several resistors. This stage is similar to U305 described in Section 3.4.4, and programming of U801 is described in Section 3.10.9. This reference voltage effectively sets the power output of the transmitter.

The turn-on time of U500A is controlled by the time constant of C502 and R508. Negative AC feedback to prevent oscillation is also provided by C502. This circuit operates as follows: Assume the output power attempts to increase. The DC voltage applied to U500A, pin 2 then increases which causes the output voltage on pin 1 to decrease. Transistors Q502 and Q500 then turn off slightly which decreases the supply voltage to driver Q507. The output power then decreases to maintain a constant power output. R510 and R513 limit the voltage gain of Q500 and Q503 to approximately two.

Delayed PTT

Transistor Q503 is used to delay power output for a short time after the transmitter is keyed. This allows the synthesizer, Q506 in the exciter, and the first stage of PA module U600 to stabilize so that the transmitter does not transmit off-frequency. The signal which controls Q503 is from the Q2 output (pin 17) of latch U111 on the audio/logic board. In the receive mode, this output is low which turns Q503 off. U500A, pin 2, is then pulled high by 8 volts applied through R505 and CR503. The output of U500A on pin 1 is then low which shuts off power to Q507. Then when the transmitter is keyed, Q503 turns on after a short delay and diode CR503 is no longer forward biased. Only the forward power signal is then applied to pin 2 of U500A.

800/900 MHz TRANSMITTER DESCRIPTION

Over Current Shutdown

Current to the second and third amplifier stages in power module U600 on the PA board is monitored by sensing the voltage drop across R601. Pins 5 and 6 of U500B are effectively connected across this resistor. As current increases, the voltage on U500B, pin 6 decreases which causes the output voltage on pin 7 to increase. The gain of each U500B input is set at about ten by R509/R504 and R502/R507.

Emitter biasing for Q501 is provided by R506 and R511. Normally, the output voltage of U500B is not high enough to turn on Q501. However, if current becomes excessive, for example because of an antenna mismatch, Q501 begins turning on. This decreases the base voltage of Q502 which turns off Q500 slightly and cuts back power output. Over-current shutdown is disabled in 15-watt models because CR500 is not used.

SECTION 4 SERVICING

4.1 GENERAL

CAUTION

LTR-Net models may automatically transmit during normal operation and at power off to send registration and de-registration messages. Therefore, when a signal generator is connected to these models, be sure to use an isolation pad.

4.1.1 PERIODIC CHECKS

This transceiver should be placed on a periodic maintenance schedule to ensure that it continues to operate properly. Important checks are receiver sensitivity and transmitter frequency, deviation, and power output.

4.1.2 SCHEMATIC DIAGRAMS AND COMPONENT LAYOUTS

Schematic diagrams and component layouts for the various PC boards used in this transceiver are located in the back of this manual. Included are RF and audio/logic board and interconnect schematics.

The component layouts permit easy location of components and measurement points. For the RF and audio/logic boards, a component locator guide and grid around the boards are provided to aid in locating components. All boards in this transceiver have components mounted on one side only. Therefore, most servicing can be done without removing the board from the chassis.

4.1.3 REPLACEMENT PARTS

A replacement parts list for this transceiver is located in Section 5. The main listing includes the RF board and chassis parts and another listing includes the audio/logic board parts. Parts are listed alphanumerically according to designator. For information on ordering parts, refer to Section 1.9. An exploded view of the transceiver is also included at the end of Section 6 to show the various mechanical parts.

4.1.4 CONFIGURING TRANSCEIVER FOR TESTING

Multi-Net versions of this transceiver have a test mode which can be selected to perform testing. This mode is described in Section 3.13 of the manual listed in Section 1.1.1, and it permits the transceiver to be operated manually. To select the test mode, turn power on with the top two options switches pressed (to right of display).

LTR-Net and SMARTNET/SmartZone transceivers do not have a separate test mode that can be selected to perform testing. With these transceivers, temporary conventional channels should be programmed to control the transceiver manually.

If adjustments must be made to the various audio and data levels, a computer and special tune software are required. The software and procedure is different with each operating protocol. Refer to the separate manual listed in Section 1.1.1 for transceiver alignment instructions.

4.2 SURFACE MOUNTED DEVICES (SMDs)

4.2.1 SERVICING TECHNIQUES

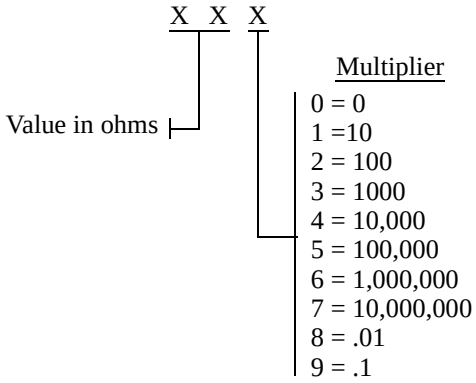
Most of the components used in this transceiver are the surface mounted type. Since these components and the circuit traces on which they are mounted are very small in size, special care must be used when they are replaced. Multi-leaded components such as integrated circuits must usually be removed using a heat gun or some other type of heat source that heats the entire device. Take care so that nearby components are not damaged. Surface mounted components should not be reused since they may be damaged by the unsoldering process.

4.2.2 IDENTIFYING SMD RESISTORS

The value of resistors is indicated by a number printed on the resistor. A three-digit number is used to identify ±5% and ±10% resistors, and a four-digit number is used to identify ±1% resistors. Refer to the following information.

± 5% and ± 10% Resistors (P.N. 569-0105-xxx)

The three-digit number used to identify ±5% and ±10% resistors corresponds to the last three digits of the EFJohnson part number. This number is derived as follows. For example, “273” indicates a 27k ohm resistor and “339” indicates a 3.3 ohm resistor.



± 1% Resistors (P.N. 569-0111-xxx)

Some resistors with a ±1% tolerance are identified by a four-digit number and others may not have a marking. When identified with a four-digit number, the first three digits are the value and the fourth is the multiplier. For example, “5761” indicates a 5.76k ohm resistor.

4.2.3 SMD CAPACITOR IDENTIFICATION

Ceramic SMD Capacitors (P.N. 510-36xx-xxx)

Ceramic SMD capacitors are identified using either an American or Japanese EIA standard. The American standard uses a single letter or number to indicate the value, and the color of this letter or number to indicate the multiplier. The Japanese standard uses a letter to indicate the value followed by a number to indicate the multiplier. The values for both standards are shown in the following table. For example, if there is a single black “E” on the capacitor, it uses the American standard and its value is 15 pF. The same value is identified with the Japanese standard by “E1”.

The Japanese standard may also utilize a bar to indicate the temperature coefficient. The following coefficients are indicated by this bar. For example, “A2” indicates a 100 pF NPO capacitor.

$\overline{XX}$ = NPO $\overline{X}X$ = N150 $X\overline{X}$ = N220

$\underline{XX}$ = N330 $\underline{X}X$ = N470 $X\underline{X}$ = N750

|XX = X7R

Table 4-1 Ceramic SMD Capacitor Identification

American EIA Standard		Japanese EIA Standard	
First Letter/ Number	**Value (pF)**	**First Letter/ Number**	**Value (pF)**
A	10	A	1.0
B	11	B	1.1
C	12	C	1.2
D	13	D	1.3
E	15	E	1.5
H	16	F	1.6
I	18	G	1.8
J	20	H	2.0
K	22	J	2.2
L	24	K	2.4
N	27	L	2.7
O	30	M	3.0
R	33	N	3.3
S	36	P	3.6
T	39	Q	3.9
V	43	R	4.3
W	47	S	4.7
X	51	T	5.1
Y	56	U	5.6
Z	62	V	6.2
3	68	W	6.8
4	75	X	7.5
7	82	Y	8.2
9	91	Z	9.1

Color	**Multi-plier**	**Second Number**	**Multi-plier**
Orange	0.1	0	1
Black	1	1	10
Green	10	2	100
Blue	100	3	1000
Violet	1000	4	10,000
Red	10,000	5	100,000

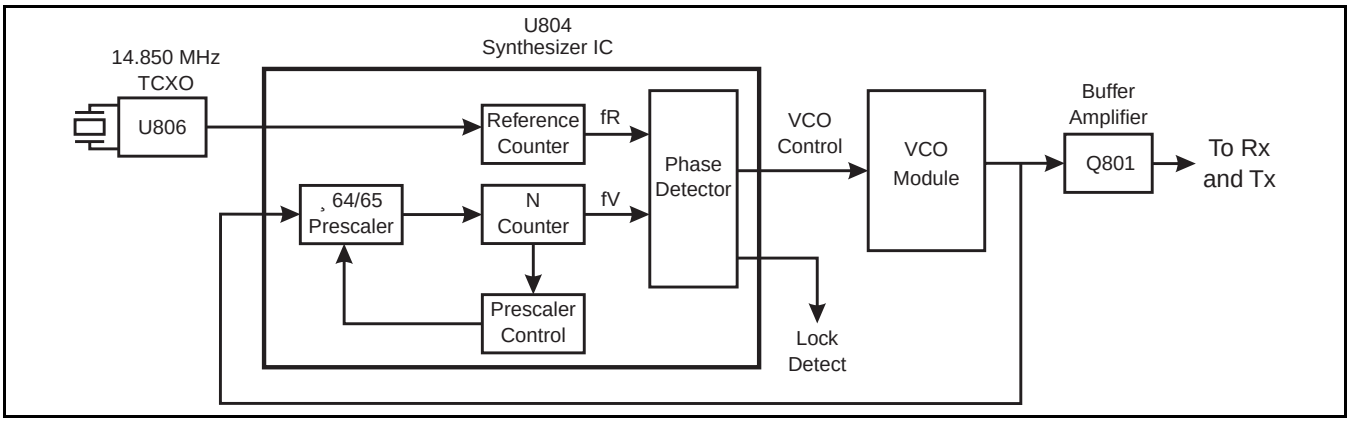


Figure 4-1 Simplified Synthesizer Block Diagram

Tantalum SMD Capacitors (P.N. 510-26xx-xxx)

Tantalum SMD capacitor identification varies with vendor and physical size of the capacitor. The positive (+) end is usually indicated by a colored band or beveled edge. The value and voltage may be indicated by printing on the capacitor or by using a special code.

4.2.4 SMD INDUCTOR IDENTIFICATION

SMD inductors (P.N. 542-9000-xxx) use three colored dots to indicate the value. The two dots on the left side indicate the first and second digits of the value in nanohenries, and the single dot on the right side indicates the multiplier (see Table 4-2). For example, brown, black, and red dots indicate a value of 10 nH x 100 which is 1000 nH (1.0 μH). The last three digits of the part number are also the value and multiplier.

4.2.5 TRANSISTOR/DIODE IDENTIFICATION

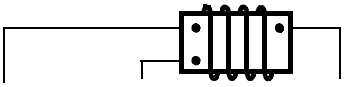
Surface mounted transistors and diodes are identified by a special number. Refer to page 6-1 for more information.

4.3 SYNTHESIZER TROUBLESHOOTING

4.3.1 INTRODUCTION

When there is a synthesizer malfunction, the VCO is usually not locked on frequency. When the VCO is unlocked, the LOCK output on U804, pin 18, is low. This is detected by the logic which then disables both the transmitter and receiver.

Table 4-2 SMD Inductor Identification



Color	1st Digit	2nd Digit	Multiplier (Last PN Digit)
Black	0	0	1 (7)
Brown	1	1	10 (8)
Red	2	2	100 (9)
Orange	3	3	1000 (0)
Yellow	4	4	10,000 (1)
Green	5	5	100,000 (2)
Blue	6	6	---
Violet	7	7	---
Gray	8	8	---
White	9	9	0.1 (6)

When the VCO is unlocked, the fR and fV inputs to the phase detector in U804 are usually not the same frequency (see Figure 4-1). The phase detector in U804 then causes the VCO control voltage to go to the high or low end of its operating range. This, in turn, causes the VCO to oscillate at the high or low end of its frequency range.

As shown in Figure 4-1, a loop is formed by the VCO and the prescaler, N counter, and phase detector in U804. Therefore, if any of these components malfunction, improper signals appear throughout the loop. However, correct operation of the counters can still be verified by measuring the input and output frequencies to check the divide number. Proceed as follows:

4.3.2 REFERENCE OSCILLATOR (U806)

Check the signal at U806, pin 8. With 800 MHz models, it should be 17.500 MHz, and with UHF and 900 MHz models, 14.850 MHz. The level should be approximately 400 mV rms. If this signal is not present, replace the reference oscillator because it is not serviceable.

Mode		Shift 1 (Pin 4)	Shift 2 (Pin 3)
UHF MODELS			
Rx Mode	430-449 MHz	L	L
	449-470 MHz	H	L
	470-491 MHz	L	L
	491-512 MHz	H	L
Tx Mode	430-449 MHz	L	H
	449-470 MHz	H	H
	470-491 MHz	L	H
	491-512 MHz	H	H
800/900 MHz MODELS			
Normal Mode		H	L
Talk-around Mode		L	H

4.3.3 VCO MODULE

The VCO is a separate assembly that is covered by a metal shield and soldered directly to the RF PC board. This module cannot be repaired. One reason for this is that the center frequency is set by laser tuning ceramic resonator L101 (UHF) or L907 (800/900 MHz) and cannot be readjusted if it changes as a result of changing a part. In addition, the VCO has a ceramic substrate that can easily be damaged by excessive heat. It is also recommended that modules that have been removed using a standard soldering iron not be reused.

Perform the following checks on the VCO module to determine if it is defective.

Supply Voltage - The supply voltage at pin 15 should be 5.0 VDC (UHF) or 7.0 VDC (800/900 MHz).

Output Level - The output level on pins 1 or 2 can be measured with an RF voltmeter or some other type of high-impedance meter. The typical output level at these points should be 0 dBm.

Control Voltage - Check the DC voltage on pin 7 with a channel near the middle of the band selected. If the VCO is locked on frequency, it should be a steady voltage between 1.1 and 5.2 volts. If it is not locked on frequency, it should be near the lower (1.1 V) or upper (5.2 V) end of its range.

Frequency Shift Inputs - The pin shift signals on pins 4 and 3 should be as follows (L = 0V, H = 5V):

Frequency - If the VCO is locked on frequency, in the receive mode the output frequency should be the receive frequency – 52.950 MHz (800 MHz models) or the receive frequency – 45 MHz (UHF and 900 MHz models). In the transmit mode it should be the transmit frequency. If it is not locked on frequency, it should be near the low end of its operating frequency range when the control voltage is low and near the high end of its range when the control voltage is high.

4.3.4 SYNTHESIZER IC (U804)

Since U804 does not have output pins from the various counters, their operation cannot be checked. However, the following signals can be checked to verify proper operation of U804.

Ref Osc In (pin 8) - Check the reference oscillator output frequency and level as described in Section 4.3.2.

VCO RF In (pin 6) - Check the VCO output as described in the preceding section.

VCO Control Voltage (pins 13, 14) - If the VCO frequency is too low, the signal on these pins should be high with very narrow negative-going pulses. Conversely, if the VCO frequency is too high, the signal should be low with very narrow positive-going pulses.

Lock Detect Output (pin 18) - This output should be high when the synthesizer is locked on frequency and low when it is unlocked.

4.3.5 DETERMINING SYNTHESIZER COUNTER DIVIDE NUMBERS

NOTE: For more information on the operation of the counters in U801, refer to Section 3.7.5.

Overall Div No. (K) = VCO freq ÷ .050

Example: 813.4875 ÷ .050 = 16,269.75

"A" Divide No. = 64 x Fraction (Integer K ÷ 64)

Example: 16,269 ÷ 64 = 254.20312
Fraction 254.20312 = 0.20312
64 x 0.20312 = 13

"N" Divide No. = Integer [K ÷ 64] – A

Example: Integer 254.20312 = 254
254 – 13 = 241

Fractional-N Div No. = (Fraction K) x 8

Example: Fraction 16,269.75 = 0.75
0.75 x 8 = 6

4.4 RECEIVER SERVICING

To isolate a receiver problem to a specific section, check the DC and RF voltages shown on the schematic diagram.

With UHF models only, the front end filter frequency shift inputs on U800, pins 6 and 7 should be as follows (L = 0V, H = 5V):

Frequency	Shift F1 (Pin 6)	Shift F2 (Pin 7)
430-440 MHz	H	H
440-450 MHz	L	H
450-460 MHz	H	L
460-470 MHz	L	L
470-480 MHz	H	H
480-491 MHz	L	H
491-502 MHz	H	L
502-512 MHz	L	L

4.5 TRANSMITTER SERVICING

To isolate a transmitter problem to a specific stage, check the DC and RF voltages shown on the schematic diagram.

4.6 AUDIO/LOGIC BOARD SERVICING

4.6.1 DIGITAL CIRCUITS

Because of the complexity and dynamic operation of the digital portion of the audio/logic board, servicing may be difficult. Special test equipment and knowledge of the operating software are usually needed to isolate a problem. Therefore, if a problem is suspected with the digital circuitry, it may be best to first make sure that the proper supply voltages are present and then replace the audio/logic board.

4.6.2 ANALOG CIRCUITS

The analog circuits on the audio/logic board can be checked by measuring the AC and DC voltages shown on the schematic diagram.

SECTION 5 PARTS LIST

Ref No	Description	Part No.
	FRONT PANEL ASSEMBLY AND MECHANICAL PARTS	
A 400	Display PC board assembly, complete board	585-3000-340
A 475	Display wire harness	023-9800-475
A 700	Plastic front panel assembly	See MP700
C 001	1.0 µF 10V tantalum smd	510-2624-109
C 002	1.0 µF 10V tantalum smd	510-2624-109
C 003	1.0 µF 10V tantalum smd	510-2624-109
C 004	.01 µF X7R ±10% 50V smd	510-3605-103
C 005	10 pF ±5% NPO 50V smd	510-3615-100
C 006	.1 µF X7R ±10% 50V smd	510-3606-104
C 007	24 pF ±5% NPO 50V cer smd	510-3615-240
C 008	.01 µF X7R ±10% 50V cer smd	510-3605-103
CR 001	Green LED	549-4001-203
CR 002	Yellow LED	549-4001-202
CR 003	Red LED	549-4001-201
CR 004	LED, dual color, red/grn (included in A400)	549-4001-215
DS 001	LED green	549-4001-145
DS002	LED green smd	549-4001-145
DS 003	LED green smd	549-4001-145
DS 004	LED green smd	549-4001-145
DS 005	LED green smd	549-4001-145
EP 010	Ferrite noise suppressor (J201/ J302)	515-9034-065
EP 181	Ground clip, DSP board (SN/SZ)	017-2229-016
EP 182	Ground clip, J style	017-2229-017
HW 001	Screw, 4-40 x 1/4” flt hd (rem hd)	575-8204-008
	Nut, RF hex .375 x 24	560-9060-010
HW 002	Screw, #2-56 x 3/4 ss phil ph	575-9902-024
HW 003	Screw, 6-32 pan Torx	575-0006-008
HW 004	Screw, No. 4 x 3/16” flt hd zps	575-1204-006
HW 005	Screw, 4-40 x 5/16” pan hd zps	575-1604-010
	Screw, 4-40 x 1/4” pan hd	575-1604-008

Ref No	Description	Part No.
HW 006	Insert, 2-56 RF brd	537-2501-031
HW 007	Lockwasher, No. 2	596-2102-006
HW 008	Washer, split lock No. #4	596-1304-008
HW 009	Screw, 6-32 x .1875 rd hd Torx	575-9406-406
HW 010	Screw, 4-40 x 1/8 pan hd zps (spkr)	575-1604-004
HW 011	No. 4 washer	596-1104-008
	Screw, 6-32 x 5/16” pan hd Torx	575-0006-010
HW 012	No. 4 swage spacer	574-5100-116
	Screw, 4-40 x 1/4” pan hd	575-0604-008
HW 021	Support bar (SN/SZ)	017-2226-026
HW 021	Fish paper, .0625 x 3.1(SN/SZ)	574-3001-038
HW 022	Board clamp (SN/SZ)	574-3001-039
HW 023	Screw, 6-32 x 1/4 (SN/SZ)	575-1606-008
HW 024	Washer, split #6 (SN/SZ)	596-1306-008
HW 025	1/4” hex spacer 6-32 x 3/8 (SN/SZ)	537-9047-106
HW 026	Washer, flat #8 (SN/SZ)	596-2408-012
HW 027	Washer, insulating #6 (SN/SZ)	596-4406-010
HW 028	Screw, 2-56 x 3/16 (SN/SZ)	575-1602-006
HW 701	Washer, .438 x.274 x.030	596-9410-010
HW 702	Spanner nut, 3/8 x 7mm	013-1313-018
HW 703	Screw, 2-28 x 1/4” ph phil cps	575-5602-008
J 001	Connector housing, 2-pin (speaker jack)	515-9031-281
	Connector, 12-pin (display boards)	515-7111-287
	Connector, 12-pin (display harness)	515-7100-928
	Modular jack, 8-pin spec (mic jack)	515-2006-040
J 002	Connector, 12-pin (interface bd)	515-7100-946
	Connector, 12-pin (display harness)	515-7100-928
J 003	Connector, 20-pin (interface bd)	515-7100-945
J 701	Connector housing, 2-pin (spkr jk)	515-9031-281
LS 001	Speaker, 3 x 2, 8-ohm	589-1015-003
MP 001	Chassis, metal (800/900 MHz)	015-0980-002
	Chassis, metal (UHF)	015-0980-004
	Display cover (remote head)	017-2227-051
MP 002	Speaker box/bracket	017-2226-024
	1/4 in. coil shield	578-0003-001
	Cable housing (remote head)	017-2227-053

FRONT PANEL ASSEMBLY AND MECHANICAL PARTS (CONT'D)

Ref No	Description	Part No.
MP 003	TO-220 clip	017-2226-022
	Speaker plate (remote head)	017-2227-055
MP 004	Foam mounting pad	018-1134-105
MP 005	Mounting bracket, 98xx	017-2229-005
MP 006	Acoustic insert	574-3002-140
MP 007	Low pass filter shield	017-2229-003
	Foam mounting pad (remote head)	018-1134-105
MP 008	RF shield, PA cavity (except following)	017-2229-012
	RF shield, PA cavity (430-470 MHz, low power only)	017-2229-013
MP 010	Cover, top	017-2227-001
MP 011	Cover, bottom	017-2227-003
MP 012	Insulator (under RF bd)	018-1132-018
MP 013	Alum clad foam shield (on cover)	574-3001-035
MP 014	Alum clad foam pad	574-3001-036
MP 015	Foam, RF cavity	574-3001-037
MP 016	RF cavity shield	017-2227-007
MP 509	Heat sink sleeving (Q509)	016-2229-001
MP 600	Jumper strap	017-2224-340
MP 700	Front panel assembly	
	Front mount models	587-9840-005
	Remote mount models	017-2227-059
MP 701	Elastomeric key pad	032-0793-007
MP 702	Key cap set, M-Net (5 caps)	587-9840-001
	Key cap set, LTR-Net (5 caps)	587-9840-002
	Key cap set SN/SZ (5 caps)	587-9840-003
	Key cap set SN/SZ (25 caps)	587-9840-105
MP 703	Control knob	032-0792-010
MP 704	Membrane speaker	018-1136-124
MP 705	Block, acoustic	574-3002-141
MP 706	Speaker gasket	018-1136-126
MP 900	Can-VCO	017-2225-752
P 001	Connector, 2-pin right angle (speaker harness)	515-7100-602
PC 400	PC board, display, incld in A400)	035-9800-400
PC 450	PC board, interface	035-9800-450
Q 001	NPN general purpose	576-0003-658
Q 002	NPN general purpose	576-0003-658
Q 003	NPN general purpose	576-0003-658
Q 004	NPN general purpose	576-0003-658
Q 005	NPN general purpose	576-0003-658
Q 006	NPN general purpose	576-0003-658
Q 007	NPN general purpose	576-0003-658
Q 100	NPN UHF low noise	576-0003-651
R 001	Pot 50k ohm w/push-on sw	562-0018-075
R 002	22 ohm ±10% 2W wire-wound	569-2004-220
R 003	47k ohm ±5% 1/8W smd	569-0105-473
R 004	47k ohm ±5% 1/8W smd	569-0105-473
R 005	47k ohm ±5% 1/8W smd	569-0105-473
R 006	47k ohm ±5% 1/8W smd	569-0105-473
R 007	47k ohm ±5% 1/8W smd	569-0105-473
R 008	47k ohm ±5% 1/8W smd	569-0105-473
R 009	47k ohm ±5% 1/8W smd	569-0105-473
R 010	10k ohm ±5% 1/8W smd	569-0105-103
R 011	10k ohm ±5% 1/8W smd	569-0105-103
R 012	10k ohm ±5% 1/8W smd	569-0105-103
R 013	10k ohm ±5% 1/8W smd	569-0105-103
R 014	10k ohm ±5% 1/8W smd	569-0105-103
R 015	10k ohm ±5% 1/8W smd	569-0105-103
R 016	10k ohm ±5% 1/8W smd	569-0105-103
R 017	10k ohm ±5% 1/8W smd	569-0105-103
R 018	10k ohm ±5% 1/8W smd	569-0105-103
R 020	10k ohm ±5% 1/8W smd	569-0105-103
R 021	10k ohm ±5% 1/8W smd	569-0105-103
R 023	4.7k ohm ±5% 1/8W smd	569-0105-472
R 024	4.7k ohm ±5% 1/8W smd	569-0105-472
R 025	4.7k ohm ±5% 1/8W smd	569-0105-472
R 026	4.7k ohm ±5% 1/8W smd	569-0105-472
R 027	4.7k ohm ±5% 1/8W smd	569-0105-472
R 029	1.0k ohm ±5% 1/8W smd	569-0105-102
R 030	1.0k ohm ±5% 1/8W smd	569-0105-102
R 031	1.0k ohm ±5% 1/8W smd	569-0105-102
R 032	1.0k ohm ±5% 1/8W smd	569-0105-102
R 033	180 ohm ±5% 1/8W smd	569-0115-181
R 034	180 ohm ±5% 1/8W smd	569-0115-181
R 035	68 ohm ±5% 1/8W smd	569-0115-680
R 036	68 ohm ±5% 1/8W smd	569-0115-680
R 037	22 ohm ±5% 1/8W smd	569-0115-220
R 038	22 ohm ±5% 1/8W smd	569-0115-220
R 039	22 ohm ±5% 1/8W smd	569-0115-220
R 040	22 ohm ±5% 1/8W smd	569-0115-220
R 041	10k ohm ±5% 1/8W smd	569-0105-103
R 042	10k ohm ±5% 1/8W smd	569-0105-103
R 043	Thermistor, 10k ohm ±5%	569-3013-007
R 044	95.3k ohm ±1% 1/8W smd	569-0111-495
R 046	4.7k ohm trimmer smd	562-0138-472
R 047	8.06k ohm ±1% 1/8W smd	569-0111-388

UHF RF AND PA BOARDS

Ref No	Description	Part No.
R 048	1.0k ohm ±5% 1/8W smd	569-0105-102
R 049	1.0k ohm ±5% 1/8W smd	569-0105-102
R 050	10k ohm ±5% 1/8W smd	569-0105-103
S 001	Switch, rotary and push	583-2042-001
U 001	LCD controller HD66710	544-2027-014
U 002	Microcontroller, 68HC705P9	023-9998-401
U 003	Regulator, 5V 1/2A 78M05	544-2003-079
U 004	Scmitt trigger/invrtr TC7S14	544-3123-014
W 001	Rem pigtail cable, control unit 5 ft	597-9800-007
	Data/accessory pigtail cable, 1 ft	597-9800-001
	Data only pigtail cable, 1 ft	597-9800-005
W 003	Rem pigtail cable, transceiver 1 ft	597-9800-011

Ref No.	Description	Part No.
	UHF RF AND PA BOARDS	
A 533	Q600 Stabilizer Bd Assembly, 430-470 MHz, 40W only, includes:	023-9800-531
	.01 µF X7R ±10% 50V cer smd	510-3606-103
	33 ohm 1W resistor	569-0175-330
	33 ohm resistor	
A 900	VCO module (430-470 MHz)	023-9840-931
	VCO module (470-512 MHz)	023-9840-951
C 201	33 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3615-330
	27 PF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-270
C 202	100 pF NPO ±5% 50V cer smd	510-3601-101
C 203	5.6 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3615-569
	3.6 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-369
C 204	6.8 pF NPO ±5% 50V cer smd (430-470 MHz)	510-3601-689
	5.1 pF NPO ±5% 50V cer smd (470-512 MHz)	510-3615-519
C 205	47 pF NPO ±5% 50V cer smd (430-470 MHz)	510-3601-470
	39 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-390
C 206	2.7 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3615-279
	3.3 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-339
C 207	1.8 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3601-189
	1.5 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-159
C 208	3.3 pF NPO ±5% 50V cer smd (430-470 MHz)	510-3601-339
	2.4 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-249
C 209	100 pF NPO ±5% 50V cer smd	510-3601-101
C 210	100 pF NPO ±5% 50V cer smd	510-3601-101
C 211	6.8 pF NPO ±5% 50V cer smd (430-470 MHz)	510-3601-689
	3.6 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-369
C 212	2.2 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3601-229
	1.6 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-169
C 213	47 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3601-470
	39 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-390
C 214	6.8 pF NPO ±5% 50V cer smd (430-470 MHz)	510-3601-689
	5.1 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-519
C 215	5.6 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3615-569
	3.6 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-369
C 216	6.8 pF NPO ±5% 50V cer smd (430-470 MHz)	510-3601-689
	4.3 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-439
C 217	2.7 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3615-279
	3.3 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-339

UHF RF AND PA BOARDS (CONT'D)

Ref No.	Description	Part No.
C 218	3.3 pF NPO ±5% 50V cer smd (430-470 MHz)	510-3601-339
	2.4 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-249
C 219	1.8 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3601-189
	1.5 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-159
C 220	100 pF NPO ±5% 50V cer smd	510-3601-101
C 221	6.8 pF NPO ±5% 50V cer smd	510-3601-689
C 222	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 223	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 224	100 pF NPO ±5% 50V cer smd	510-3601-101
C 225	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 226	100 pF NPO ±5% 50V cer smd	510-3601-101
C 227	22 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3615-220
	10 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-100
C 228	8.2 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3615-829
	4.7 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-479
C 229	100 pF NPO ±5% 50V cer smd	510-3601-101
C 230	100 pF NPO ±5% 50V cer smd	510-3601-101
C 231	3.0 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3601-309
	2.4 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-249
C 232	3.3 pF NPO ±5% 50V cer smd (430-470 MHz)	510-3601-339
	2.4 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-249
C 233	1.8 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3601-189
	1.6 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-169
C 234	4.3 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3601-439
	3.3 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-339
C 235	6.8 pF NPO ±5% 50V cer smd (430-470 MHz)	510-3601-689
	5.6 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-569
C 236	22 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3615-220
	18 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-180
C 237	10 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3615-100
	7.5 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-759
C 238	3.3 pF NPO ±5% 50V cer smd	510-3601-339
C 239	1.8 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3601-189
	1.5 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-159
C 240	3.3 pF NPO ±5% 50V cer smd (430-470 MHz)	510-3601-339
	2.7 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-279
C 241	22 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3615-220
	18 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-180
C 242	6.8 pF NPO ±5% 50V cer smd (430-470 MHz)	510-3601-689
	5.6 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-569
C 243	4.3 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3601-439
	3.3 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-339
C 244	10 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3615-100
	6.8 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-689
C 245	8.2 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3615-829
	5.6 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-569
C 246	3.9 pF NPO ±5% 50V cer smd	510-3601-399
C 247	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 248	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 249	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 251	18 pF NPO ±5% 50V cer smd	510-3601-180
C 252	150 pF NPO ±5% 50V cer smd	510-3601-151
C 253	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 255	100 pF NPO ±5% 50V cer smd	510-3601-101

UHF RF AND PA BOARDS (CONT'D)

Ref No.	Description	Part No.
C 256	6.8 pF NPO ±5% 50V cer smd	510-3601-689
C 258	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 259	100 pF NPO ±5% 50V cer smd	510-3601-101
C 260	9.1 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3601-919
	8.2 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-829
C 261	9.1 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3601-919
	6.8 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-689
C 262	3.3 pF NPO ±5% 50V cer smd	510-3601-339
C 263	2.7 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3615-279
	2.4 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-249
C 264	7.5 pF ±5% NPO 50V cer smd	510-3601-759
C 266	27 pF NPO ±5% 50V cer smd	510-3601-270
C 268	150 pF NPO ±5% 50V cer smd	510-3601-151
C 269	5.6 pF ±5% NPO 50V cer smd	510-3615-569
C 270	22 pF ±5% NPO 50V cer smd	510-3615-220
C 271	27 pF NPO ±5% 50V cer smd	510-3601-270
C 272	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 274	.001 µF X7R ±10% 50V cer smd	510-3605-102
C 275	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 276	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 277	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 278	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 281	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 282	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 283	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 284	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 285	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 286	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 287	47 pF NPO ±5% 50V cer smd	510-3601-470
C 288	7.5 pF ±5% NPO 50V cer smd	510-3601-759
C 289	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 290	36 pF NPO ±5% 50V cer smd	510-3601-360
C 291	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 292	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 293	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 294	47 µF 10V tantalum smd	510-2624-470
C 295	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 296	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 297	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 298	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 299	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 300	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 301	10 pF ±5% NPO 50V cer smd	510-3602-100
C 302	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 303	.33 µF X7R ±10% 16V cer smd	510-3631-334
C 304	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 305	100 pF NPO ±5% 50V cer smd	510-3601-101
C 306	100 pF NPO ±5% 50V cer smd	510-3601-101
C 307	3.9 pF NPO ±5% 50V cer smd (430-470 MHz)	510-3601-399
	4.3 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-439
C 500	100 pF NPO ±5% 50V cer smd (unrevised 430-470 MHz)	510-3601-101
	.1 µF X7R ±10% 50V cer smd (all others)	510-3606-104
C 501	.1 µF X7R ±10% 50V cer smd (unrevised 430-470 MHz)	510-3606-104
	100 pF NPO ±5% 50V cer smd (all others)	510-3601-101
C 502	.01 µF X7R ±10% 50V cer smd (unrevised 430-470 MHz)	510-3605-103
	100 pF NPO ±5% 50V cer smd (all others)	510-3601-101
C 503	100 pF NPO ±5% 50V cer smd (unrevised 430-470 MHz)	510-3601-101
	.01 µF X7R ±10% 50V cer smd (all others)	510-3605-103
C 504	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 505	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 506	100 pF NPO ±5% 50V cer smd	510-3601-101
C 507	100 pF NPO ±5% 50V cer smd	510-3601-101
C 508	100 pF NPO ±5% 50V cer smd	510-3601-101
C 509	100 pF NPO ±5% 50V cer smd	510-3601-101
C 510	100 pF NPO ±5% 50V cer smd	510-3601-101
C 511	100 pF NPO ±5% 50V cer smd (unrevised 430-470 MHz)	510-3601-101
	6.8 µF 35V tantalum smd (all others)	510-2635-689
C 512	10 µF 25V tantalum smd (unrevised 430-470 MHz)	510-2627-100
	100 pF NPO ±5% 50V cer smd (all others)	510-3601-101
C 513	.1 µF X7R ±10% 50V cer smd (unrevised 430-470 MHz)	510-3606-104

UHF RF AND PA BOARDS (CONT'D)

Ref No.	Description	Part No.
	100 pF NPO ±5% 50V cer smd (all others)	510-3601-101
C 514	.1 µF X7R ±10% 50V cer smd (unrevised 430-470 MHz)	510-3606-104
	10 µF 25V tantalum smd (all others)	510-2627-100
C 515	100 pF NPO ±5% 50V cer smd (unrevised 430-470 MHz)	510-3601-101
	.1 µF X7R ±10% 50V cer smd (all others)	510-3606-104
C 516	.01 µF X7R ±10% 50V cer smd (unrevised 430-470 MHz)	510-3605-103
	100 pF NPO ±5% 50V cer smd (all others)	510-3601-101
C 517	10 µF 25V tantalum smd (unrevised 430-470 MHz)	510-2627-100
	.01 µF X7R ±10% 50V cer smd (all others)	510-3605-103
C 518	100 pF NPO ±5% 50V cer smd	510-3601-101
C 519	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 520	100 pF NPO ±5% 50V cer smd	510-3601-101
C 521	100 pF NPO ±5% 50V cer smd	510-3601-101
C 522	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 523	100 pF NPO ±5% 50V cer smd (unrevised 430-470 MHz)	510-3601-101
	.01 µF X7R ±10% 50V cer smd (all others)	510-3605-103
C 524	220 pF ±5% NPO 50V cer smd (unrevised 430-470 MHz)	510-3615-221
	100 pF NPO ±5% 50V cer smd (all others)	510-3601-101
C 525	100 pF NPO ±5% 50V cer smd (unrevised 430-470 MHz)	510-3601-101
	.01 µF X7R ±10% 50V cer smd (all others)	510-3605-103
C 526	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 527	100 pF NPO ±5% 50V cer smd	510-3601-101
C 528	.01 µF X7R ±10% 50V cer smd (unrevised 430-470 MHz)	510-3605-103
	100 pF NPO ±5% 50V cer smd (all others)	510-3601-101
C 529	12 pF NPO ±5% cer smd (unrevised 430-470 MHz)	510-3601-120
	.01 µF X7R ±10% 50V cer smd (all others)	510-3605-103
C 530	39 pF NPO ±5% 50V cer smd (unrevised 430-470 MHz)	510-3601-390
	.01 µF X7R ±10% 50V cer smd (all others)	510-3605-103
C 531	5.6 pF ±5% NPO 50V cer smd (unrevised 430-470 MHz)	510-3615-569
	100 pF NPO ±5% 50V cer smd (all others)	510-3601-101
C 532	51 pF ±5% NPO 50V cer smd (unrevised 430-470 MHz)	510-3601-510
	12 pF ±5% NPO 50V cer smd (revised 430-470 MHz)	510-3615-120
	10 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-100
C 533	43 pF NPO ±5% 50V cer smd (unrevised 430-470 MHz)	510-3601-430
	12 pF ±5% NPO 50V cer smd (revised 430-470 MHz)	510-3615-120
	10 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-100
C 534	56 pF ±5% NPO 50V cer smd (unrevised 430-470 MHz)	510-3615-560
C 535	12 pF 250V mini mica (revised 430-470 MHz)	510-0019-120
	11 pF 250V mini mica (470-512 MHz)	510-0019-110
C 536	100 pF NPO ±5% 50V cer smd (unrevised 430-470 MHz)	510-3601-101
	39 pF 250V mini mica (revised 430-470 MHz)	510-0019-390
	33 pF 250V mini mica (470-512 MHz)	510-0019-330
C 537	10 pF ±5% NPO 50V cer smd (unrevised 430-470 MHz)	510-3615-100
	100 pF ±10% 50V hi Q smd (all others)	510-3663-101
C 538	15 pF ±5% NPO 50V cer smd (unrevised 430-470 MHz)	510-3615-150
	12 pF ±5% NPO 50V cer smd (revised 430-470 MHz)	510-3615-120
	10 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-100
C 539	6.8 pF NPO ±5% 50V cer smd (unrevised 430-470 MHz)	510-3601-689

UHF RF AND PA BOARDS (CONT'D)

Ref No.	Description	Part No.
	12 pF ±5% NPO 50V cer smd (revised 430-470 MHz)	510-3615-120
	10 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-100
C 540	3.9 pF ±5% NPO 50V cer smd (unrevised 430-470 MHz)	510-3615-399
	100 pF NPO ±5% 50V cer smd (all others)	510-3601-101
C 541	24 pF ±5% NPO 50V cer smd (unrevised 430-470 MHz)	510-3602-240
	16 pF ±5% NPO 50V cer smd (revised 430-470 MHz)	510-3615-160
	15 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-150
C 542	20 PF ±5% NPO 50V cer smd (unrevised 430-470 MHz)	510-3615-200
	10 pF ±5% NPO 50V cer smd (revised 430-470 MHz)	510-3615-100
	8.2 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-829
C 543	22 pF ±5% NPO 50V cer smd (unrevised 430-470 MHz)	510-3615-220
	100 pF ±5% NPO 50V cer smd (all others)	510-3615-101
C 544	30 pF ±5% NPO 50V cer smd (unrevised 430-470 MHz)	510-3615-300
	100 pF ±5% NPO 50V cer smd (all others)	510-3615-101
C 545	24 pF ±5% NPO 50V cer smd (unrevised 430-470 MHz)	510-3602-240
	12 pF 250V mini mica (revised 430-470 MHz)	510-0019-120
	11 pF 250V mini mica (470-512 MHz)	510-0019-110
C 546	24 pF ±5% NPO 50V cer smd (unrevised 430-470 MHz)	510-3602-240
	12 pF ±5% NPO 50V cer smd (revised 430-470 MHz)	510-3615-120
	10 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-100
C 547	24 pF ±5% NPO 50V cer smd (unrevised 430-470 MHz)	510-3602-240
	12 pF ±5% NPO 50V cer smd (revised 430-470 MHz)	510-3615-120
	10 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-100
C 548	10 µF 25V tantalum smd (unrevised 430-470 MHz)	510-2627-100
	5.1 pF ±5% NPO 50V cer smd (revised 430-470 MHz)	510-3615-519
	4.7 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-479
C 549	470 µF 25V electrolytic (unrevised 430-470 MHz)	510-4064-471
	7.5 pF ±5% NPO 50V cer smd (revised 430-470 MHz)	510-3615-759
	6.8 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-689
C 550	.01 µF X7R ±10% 50V cer smd (unrevised 430-470 MHz)	510-3605-103
	13 pF ±5% NPO 50V cer smd (revised 430-470 MHz)	510-3615-130
	12 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-120
C 551	100 pF NPO ±5% 50V cer smd (unrevised 430-470 MHz)	510-3601-101
	13 pF ±5% NPO 50V cer smd (revised 430-470 MHz)	510-3615-130
	12 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-120
C 552	10 µF 25V tantalum smd (unrevised 430-470 MHz)	510-2627-100
	13 pF ±5% NPO 50V cer smd (revised 430-470 MHz)	510-3615-130
	12 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-120
C 553	470 µF 25V electrolytic (unrevised 430-470 MHz)	510-4064-471
C 554	100 pF NPO ±5% 50V cer smd (unrevised 430-470 MHz)	510-3601-101
	43 pF 250V mini mica (revised 430-470 MHz)	510-0019-430
	33 pF 250V mini mica (470-512 MHz)	510-0019-330
C 555	100 pF NPO ±5% 50V cer smd (unrevised 430-470 MHz)	510-3601-101
	5.1 pF ±5% NPO 50V cer smd (revised 430-470 MHz)	510-3615-519
	4.7 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-479
C 556	4.7 µF 10V tantalum smd (unrevised 430-470 MHz)	510-2624-479

UHF RF AND PA BOARDS (CONT'D)

Ref No.	Description	Part No.
	5.1 pF ±5% NPO 50V cer smd (revised 430-470 MHz)	510-3615-519
	4.7 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-479
C 557	.01 µF X7R ±10% 50V cer smd (unrevised 430-470 MHz)	510-3605-103
	2.0 pF ±5% NPO 50V cer smd (revised 430-470 MHz)	510-3615-209
	1.0 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-109
C 558	100 pF NPO ±5% 50V cer smd (unrevised 430-470 MHz)	510-3601-101
	10 pF ±5% NPO 50V cer smd (all others)	510-3615-100
C 559	100 pF NPO ±5% 50V cer smd (unrevised 430-470 MHz)	510-3601-101
	12 pF ±5% NPO 50V cer smd (revised 430-470 MHz)	510-3615-120
	10 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-100
C 560	100 pF NPO ±5% 50V cer smd (unrevised 430-470 MHz)	510-3601-101
	10 µF 25V tantalum smd (all others)	510-2627-100
C 561	4.7 µF 10V tantalum smd (unrevised 430-470 MHz)	510-2624-479
	470 µF 25V electrolytic (all others)	510-4064-471
C 562	100 pF NPO ±5% 50V cer smd (unrevised 430-470 MHz)	510-3601-101
	.01 µF X7R ±10% 50V cer smd (all others)	510-3605-103
C 563	.01 µF X7R ±10% 50V cer smd (unrevised 430-470 MHz)	510-3605-103
	100 pF NPO ±5% 50V cer smd (all others)	510-3601-101
C 564	100 pF NPO ±5% 50V cer smd (unrevised 430-470 MHz)	510-3601-101
	10 µF 25V tantalum smd (all others)	510-2627-100
C 565	10 µF 25V tantalum smd (unrevised 430-470 MHz)	510-2627-100
	470 µF 25V electrolytic (all others)	510-4064-471
C 566	.01 µF X7R ±10% 50V cer smd (unrevised 430-470 MHz)	510-3605-103
	100 pF NPO ±5% 50V cer smd (all others)	510-3601-101
C 567	33 pF ±5% NPO 50V cer smd (unrevised 430-470 MHz)	510-3615-330
	100 pF NPO ±5% 50V cer smd (all others)	510-3601-101
C 568	15 pF ±5% NPO 50V cer smd (unrevised 430-470 MHz)	510-3602-150
	4.7 µF 10V tantalum smd (all others)	510-2624-479
C 569	15 pF ±5% NPO 50V cer smd (unrevised 430-470 MHz)	510-3602-150
	.01 µF X7R ±10% 50V cer smd (all others)	510-3605-103
C 570	2.7 pF ±5% NPO 50V cer smd (unrevised 430-470 MHz)	510-3615-279
	100 pF NPO ±5% 50V cer smd (all others)	510-3601-101
C 571	1.5 pF ±5% NPO 50V cer smd (unrevised 430-470 MHz)	510-3601-159
	100 pF NPO ±5% 50V cer smd (all others)	510-3601-101
C 572	20 PF ±5% NPO 50V cer smd (unrevised 430-470 MHz)	510-3615-200
	100 pF NPO ±5% 50V cer smd (all others)	510-3601-101
C 573	24 pF ±5% NPO 50V cer smd (unrevised 430-470 MHz)	510-3615-240
	4.7 µF 10V tantalum smd (all others)	510-2624-479
C 574	22 pF ±5% NPO 50V cer smd (unrevised 430-470 MHz)	510-3615-220
	100 pF NPO ±5% 50V cer smd (all others)	510-3601-101
C 575	10 pF ±5% NPO 50V cer smd (unrevised 430-470 MHz)	510-3615-100
	.01 µF X7R ±10% 50V cer smd (all others)	510-3605-103
C 576	15 pF ±5% NPO 50V cer smd (unrevised 430-470 MHz)	510-3602-150
	100 pF NPO ±5% 50V cer smd (all others)	510-3601-101
C 577	15 pF ±5% NPO 50V cer smd (unrevised 430-470 MHz)	510-3602-150
	10 µF 25V tantalum smd (all others)	510-2627-100

UHF RF AND PA BOARDS (CONT'D)

Ref No.	Description	Part No.
C 578	15 pF ±5% NPO 50V cer smd (unrevised 430-470 MHz)	510-3615-150
	.01 µF X7R ±10% 50V cer smd (all others)	510-3605-103
C 579	100 pF NPO ±5% 50V cer smd (unrevised 430-470 MHz)	510-3601-101
	7.5 pF ±5% NPO 50V cer smd (revised 430-470 MHz)	510-3615-759
	6.8 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-689
C 581	0.1 µF X7R ±10% 50V cer smd	510-3605-104
C 600	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 601	470 pF X7R ±10% 50V cer smd	510-3605-471
C 602	68 pF ±5% NPO 50V cer smd	510-3601-680
C 603	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 604	68 pF ±5% NPO 50V cer smd	510-3601-680
C 605	6.8 µF 35V tantalum smd (470-512 MHz, 40 watt)	510-2635-689
C 606	100 pF ±5% NPO 50V cer smd (470-512 MHz, 40 watt)	510-3601-101
C 607	6.8 µF 35V tantalum smd	510-2635-689
C 608	100 pF ±5% NPO 50V cer smd	510-3601-101
C 609	.01 µF X7R ±10% 50V cer smd (40 watt)	510-3605-103
	4.7 pF ±5% NPO 50V cer smd (25 watt)	510-3615-479
C 610	100 pF ±5% NPO 50V cer smd	510-3601-101
C 611	68 pF ±5% NPO 50V cer smd	510-3601-680
C 612	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 613	100 pF ±5% NPO 50V cer smd	510-3601-101
C 614	100 pF ±10% 50V hi Q cer smd	510-3663-101
C 615	56 pF 250V mini mica (430-470 MHz)	510-0019-560
	47 pF 250V mini mica (470-512 MHz)	510-0019-470
C 616	33 pF ±5% NPO 50V cer smd (430-470 MHz, 25 watt)	510-3615-330
	24 pF ±5% NPO 50V cer smd (430-470 MHz, 40 watt)	510-3615-240
	47 pF ±5% NPO 50V cer smd (470-512 MHz, 25 watt)	510-3615-470
	24 pF ±5% NPO 50V cer smd (470-512 MHz, 40 watt)	510-3615-240
C 617	47 pF 250V mini mica	510-0019-470
C 618	5.6 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3615-569
	4.3 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-439
C 619	5.1 pF ±5% NPO 805 smd (430-470 MHz)	510-3615-519
	4.3 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-439
C 620	2.7 pF ±5% NPO 50V cer smd	510-3615-279
C 621	2.7 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3615-279
C 622	5.1 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3615-519
	3.3 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-339
C 623	4.7 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3615-479
	3.3 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-339
C 624	4.7 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3615-479
	3.3 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-339
C 625	2.7 pF ±5% NPO 50V cer smd	510-3615-279
C 626	5.6 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3615-569
	4.3 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-439
C 627	33 pF ±5% NPO 50V cer smd (430-470 MHz, 25 watt)	510-3615-330
	27 pF ±5% NPO 50V cer smd (430-470 MHz, 40 watt)	510-3615-270
	47 pF ±5% NPO 50V cer smd (470-512 MHz, 25 watt)	510-3615-470
	27 pF ±5% NPO 50V cer smd (470-512 MHz, 40 watt)	510-3615-270
C 628	3.9 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3615-399
	3.0 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-309
C 629	3.9 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3615-399
	3.0 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-309

UHF RF AND PA BOARDS (CONT'D)

Ref No.	Description	Part No.
C 630	2.2 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3615-229
	1.5 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-159
C 631	33 pF ±5% NPO 50V cer smd	510-3615-330
C 632	56 pF 250V mini mica (430-470 MHz, 40 watt)	510-0019-560
	27 pF 250V mini mica (470-512 MHz, 40 watt)	510-0019-270
C 633	47 pF 250V mini mica (430-470 MHz, 40 watt)	510-0019-470
	43 pF 250V mini mica (470-512 MHz, 40 watt)	510-0019-430
C 634	2.2 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3615-229
	2.7 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-279
C 635	3.3 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3615-339
	2.7 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-279
C 636	3.3 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3615-339
C 637	18 pF 250V mini mica (430-470 MHz, 40W)	510-0019-180
	15 pF 250V mini mica (470-512 MHz, 40W)	510-0019-150
C 638	56 pF 250V mini mica (430-470 MHz)	510-0019-560
	47 pF 250V mini mica (470-512 MHz)	510-0019-470
C 640	47 pF 250V mini mica	510-0019-470
C 641	33 pF ±5% NPO 50V cer smd	510-3615-330
C 642	6.8 pF ±5% NPO 50V cer smd (430-470 MHz, 25 watt)	510-3615-689
	56 pF 250V mini mica (430-470 MHz, 40 watt)	510-0019-560
	4.7 pF ±5% NPO 50V cer smd (470-512 MHz, 25 watt)	510-3615-479
	27 pF 250V mini mica (470-512 MHz, 40 watt)	510-0019-270
C 643	3.9 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3615-399
	2.7 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-279

Ref No.	Description	Part No.
C 644	12 pF ±5% NPO 50V cer smd (430-470 MHz, 40 watt)	510-3615-120
	6.8 pF ±5% NPO 50V cer smd (470-512 MHz, 40 watt)	510-3615-689
C 645	47 pF 250V mini mica (430-470 MHz, 40 watt)	510-0019-470
	39 pF 250V mini mica (470-512 MHz, 40 watt)	510-0019-390
C 646	10 pF ±5% NPO 50V cer smd (430-470 MHz, 25 watt)	510-3615-100
	43 pF 250V mini mica (430-470 MHz, 40 watt)	510-0019-430
	27 pF 250V mini mica (470-512 MHz, 25 watt)	510-0019-270
	27 pF 250V mini mica (470-512 MHz, 40 watt)	510-0019-270
C 647	12 pF ±5% NPO 50V cer smd	510-3615-120
C 648	100 pF ±5% NPO 50V cer smd	510-3615-101
C 649	68 pF ±5% NPO 50V cer smd	510-3601-680
C 650	12 pF ±5% NPO 50V cer smd (25 watt)	510-3615-120
	22 pF ±5% NPO 50V cer smd (40 watt)	510-3615-220
C 651	2.2 pF ±5% NPO 50V cer smd	510-3615-229
C 652	30 pF ±5% NPO 50V cer smd	510-3615-300
C 653	68 pF ±5% NPO 50V cer smd	510-3601-680
C 655	3.3 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3615-339
	3.0 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-309
C 657	15 pF ±10% 50V hi Q cer smd (430-470 MHz, 40W)	510-3663-150
	7.5 pF ±5% NPO 50V cer smd (470-512 MHz, 40W)	510-3615-759
C 658	4.7 pF ±5% NPO 50V cer smd (470-512 MHz, 40W)	510-3601-479
C 800	100 pF NPO ±5% 50V cer smd	510-3601-101
C 801	100 pF NPO ±5% 50V cer smd	510-3601-101
C 802	100 pF NPO ±5% 50V cer smd	510-3601-101
C 803	100 pF NPO ±5% 50V cer smd	510-3601-101
C 804	100 pF NPO ±5% 50V cer smd	510-3601-101
C 805	100 pF NPO ±5% 50V cer smd	510-3601-101
C 807	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 808	100 pF NPO ±5% 50V cer smd	510-3601-101
C 809	150 pF NPO ±5% 50V cer smd	510-3601-151
C 810	100 pF NPO ±5% 50V cer smd	510-3601-101

UHF RF AND PA BOARDS (CONT'D)

Ref No.	Description	Part No.
C 811	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 812	100 pF NPO ±5% 50V cer smd	510-3601-101
C 813	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 814	4.7 µF 10V tantalum smd	510-2624-479
C 815	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 816	.001 µF X7R ±10% 50V cer smd	510-3605-102
C 817	100 pF NPO ±5% 50V cer smd	510-3601-101
C 818	9.1 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3601-919
	8.2 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-829
C 819	1.0 µF 10V tantalum smd	510-2624-109
C 820	100 pF NPO ±5% 50V cer smd	510-3601-101
C 821	.001 µF X7R ±10% 50V cer smd	510-3605-102
C 822	100 pF NPO ±5% 50V cer smd	510-3601-101
C 823	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 824	100 pF NPO ±5% 50V cer smd	510-3601-101
C 825	1.0 µF 10V tantalum smd	510-2624-109
C 826	6.8 pF NPO ±5% 50V cer smd	510-3601-689
C 827	9.1 pF ±5% NPO 50V cer smd (430-470 MHz)	510-3601-919
	6.8 pF ±5% NPO 50V cer smd (470-512 MHz)	510-3615-689
C 828	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 829	100 pF NPO ±5% 50V cer smd	510-3601-101
C 830	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 831	1.0 µF 10V tantalum smd	510-2624-109
C 832	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 833	100 pF NPO ±5% 50V cer smd	510-3601-101
C 834	.22 µF X7R ±10% 50V cer smd	510-3607-224
C 835	.01 µF NPO ±2% 50V cer smd	510-3617-103
C 836	4700 pF NPO ±2% 50V cer smd	510-3616-472
C 837	.01 µF NPO ±2% 50V cer smd	510-3617-103
C 838	4.7 µF 10V tantalum smd	510-2624-479
C 839	100 pF NPO ±5% 50V cer smd	510-3601-101
C 840	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 841	.001 µF X7R ±10% 50V cer smd	510-3605-102
C 842	3.9 pF ±5% NPO 50V cer smd (revised 430-470 MHz)	510-3615-399
	8.2 pF ±5% NPO 50V cer smd (all others)	510-3615-829
CR 200	Pin switching diode	523-1504-001
CR 201	Band switching diode	523-1504-035
CR 202	Band switching diode	523-1504-035
CR 203	Switching diode SOT-23	523-1504-002
CR 204	Band switching diode	523-1504-035
CR 205	Band switching diode	523-1504-035
CR 206	Switching diode SOT-23	523-1504-002
CR 207	Pin switching diode	523-1504-001
CR 208	Pin switching diode	523-1504-001
CR 209	Pin switching diode	523-1504-001
CR 210	Pin switching diode	523-1504-001
CR 211	Dual switching diode SOT-23	523-1504-023
CR 212	Dual switching diode SOT-23	523-1504-023
CR 500	Switching diode SOT-23	523-1504-002
CR 501	Dual switching diode SOT-233	523-1504-023
CR 502	Dual switching diode SOT-23	523-1504-023
CR 503	Switching diode SOT-23	523-1504-002
CR 504	Switching diode SOT-23 (unrevised 430-470 MHz)	523-1504-002
	5.1V zener SOT-23 (revised 430-470 MHz)	523-2016-519
	4.7V zener SOT-23 (470-512 MHz, 40W only)	523-2016-479
CR 505	Dual switching diode SOT-23 (470-512 MHz)	523-1504-023
CR 506	Switching diode SOT-23 (470-512 MHz)	523-1504-002
CR 507	Dual switching diode SOT-23 (470-512 MHz)	523-1504-023
CR 600	Transient suppressor	523-2906-001
CR 601	Pin diode	523-1504-032
CR 602	HC diode	523-1504-016
CR 603	Pin diode	523-1504-032
CR 800	Switching diode SOT-23	523-1504-002
CR 801	Switching diode SOT-23	523-1504-002
CR 802	5.1V zener SOT-23 (unrevised 430-470 MHz)	523-2016-519
EP 001	Transistor ground tab	017-2225-527
EP 001	Ferrite bead smd (470-512 MHz)	517-2503-010
EP 002	Ferrite bead smd (470-512 MHz)	517-2503-010
EP 003	Ferrite bead smd (470-512 MHz)	517-2503-010
EP 200	Mini crystal pin insulator	010-0345-280
EP 500	Ferrite bead smd (430-470 MHz)	517-2503-001

UHF RF AND PA BOARDS (CONT'D)

Ref No.	Description	Part No.
EP 501	Ferrite bead smd	517-2503-010
	(430-470 MHz)	
EP 501	.055 ID x .015 teflon tubing	058-0053-515
EP 600	Ferrite bead smd	517-2503-010
EP 601	Ferrite bead smd	517-2503-010
EP 602	Ferrite bead smd	517-2503-010
EP 603	Ferrite bead smd	517-2503-010
EP 606	Ferrite bead, .296 x.296	517-2002-006
F 500	4 amp fuse smd very fast blow	534-5000-140
J 201	Connector, 2 x 10 pin male (RF bd)	515-7100-944
J 501	Connector 1 x 8 pin male (RF bd)	515-7100-942
J 600	Connector, 8-pin female	515-7102-115
J 601	Antenna jack, right angle	515-3011-020
L 200	0.5in long smd resonator	542-9004-005
L 201	0.5in long smd resonator	542-9004-005
L 202	15 nH inductor	542-9003-157
	(430-470 MHz)	
	12 nH inductor	542-9003-127
	(470-512 MHz)	
L 203	12 nH inductor	542-9003-127
L 204	0.5in long smd resonator	542-9004-005
L 205	47 nH inductor	542-9003-477
	(430-470 MHz)	
	56 nH inductor	542-9003-567
	(470-512 MHz)	
L 206	0.5in long smd resonator	542-9004-005
L 207	15 nH inductor	542-9003-157
L 208	.68 µH smd inductor	542-9000-688
L 209	12 nH inductor	542-9003-127
L 210	22 nH inductor	542-9003-227
L 211	12 nH inductor	542-9003-127
L 213	.68 µH smd inductor	542-9000-688
L 215	.68 µH smd inductor	542-9000-688
L 217	.27 µH ±5% smd inductor	542-9000-278
L 218	455 kHz variable with cap	542-1012-010
L 219	.22 µH ±5% smd	542-9000-228
L 220	Smd inductor	542-9003-277
L 500	5T 18.5 nH smd air core inductor	542-0030-005
	(unrevised 430-470 MHz)	
	6T 17.5 nH smd air core inductor	542-0030-006
	(all others)	

Ref No.	Description	Part No.
L 501	5T 18.5 nH smd air core inductor	542-0030-005
	(unrevised 430-470 MHz)	
	3T 24 AWG .080 id inductor	542-0030-003
	(revised 430-470 MHz)	
	2T 24 AWG .080 id inductor	542-0030-002
	(470-512 MHz)	
L 502	12.5 nH smd air core inductor	542-0030-004
	(unrevised 430-470 MHz)	
	3T 24 AWG .080 id inductor	542-0030-003
	(revised 430-470 MHz)	
	2T 24 AWG .080 id inductor	542-0030-002
	(470-512 MHz)	
L 503	9T 35.5 nH smd air core inductor	542-0030-009
	(unrevised 430-470 MHz)	
	2T 24 AWG .080 id inductor	542-0030-002
	(all others)	
L 504	1T 2.5 nH smd air core inductor	542-0030-001
L 505	8.0 nH smd air core inductor	542-0030-003
	(unrevised 430-470 MHz)	
	2T 24 AWG .080 id inductor	542-0030-002
	(all others)	
L 506	8.0 nH smd air core inductor	542-0030-003
	(unrevised 430-470 MHz)	
	9T 35.5 nH smd air core inductor	542-0030-009
	(all others)	
L 507	8.0 nH smd air core inductor	542-0030-003
	(430-470 MHz)	
L 600	4T .1 ID inductor	542-0020-044
L 601	4T .1 ID inductor	542-0020-044
L 602	4T .080 ID inductor	542-0020-034
L 603	3T .060 ID inductor	542-0020-013
	(430-470 MHz)	
	3T .1 ID inductor	542-0020-043
	(470-512 MHz)	
L 604	3T .1 ID inductor	542-0020-043
	(430-470 MHz)	
	3T .12 ID inductor	016-0020-053
	(470-512 MHz)	
L 605	4T .1 ID inductor	542-0020-044
L 606	3T .1 ID inductor	542-0020-043
L 607	7T 35.5 nH air core inductor	542-0030-007
	(430-470 MHz, 40W)	
	9T 35.5 nH air core inductor	542-0030-009
	(all others)	
L 608	9T 35.5 nH air core inductor	542-0030-009

UHF RF AND PA BOARDS (CONT'D)

Ref No.	Description	Part No.
L 800	22 nH inductor	542-9003-227
L 801	12 nH inductor	542-9003-127
L 802	39 nH inductor	542-9003-397
MP 013	.120 isodamp foam	018-1132-019
MP 131	Shim substrate	010-0345-450
MP 208	1/4 in. coil shield	578-0003-001
MP 213	1/4 in. coil shield	578-0003-001
MP 215	1/4 in. coil shield	578-0003-001
MP 509	Heat sink sleeving	016-2229-001
	(430-470 MHz)	
MP 900	Can, VCO	017-2225-752
P 001	Power connector assembly, dual	023-4110-012
PC 200	PC board, RF	
	Unrevised 430-470 MHz	035-9840-200
	All others	035-9840-250
PC 600	PC board, PA	
	430-470 MHz, 25 watt	035-9843-500
	470-512 MHz, 25 watt	035-9843-550
	All 40 watt	035-9844-520
Q 200	PNP general purpose	576-0003-612
Q 201	NPN low noise medium power	576-0003-636
Q 202	N-channel dual MOSFET	576-0006-234
Q 203	PNP general purpose	576-0003-612
Q 204	NPN low noise med power amp	576-0003-636
Q 205	NPN digital w/resistors	576-0003-616
Q 206	NPN digital w/resistors	576-0003-616
Q 207	VHF/UHF amp	576-0003-634
Q 500	PNP power Darlington	576-0007-013
	(unrevised 430-470 MHz)	
	NPN low noise amp	576-0001-300
	(all others)	
Q 501	NPN general purpose	576-0003-658
	(unrevised 430-470 MHz)	
	PNP power Darlington	576-0007-013
	(all others)	
Q 502	NPN general purpose	576-0003-658
Q 503	NPN general purpose	576-0003-658
	(unrevised 430-470 MHz)	
	PNP general purpose	576-0003-612
	(all others)	
Q 504	PNP general purpose	576-0003-612
	(unrevised 430-470 MHz)	

Ref No.	Description	Part No.
	NPN general purpose	576-0003-658
	(all others)	
Q 505	NPN general purpose	576-0003-658
Q 506	NPN low noise amp	576-0003-618
	(unrevised 430-470 MHz)	
	PNP general purpose	576-0003-612
	(all others)	
Q 507	NPN low noise amp	576-0003-618
	(unrevised 430-470 MHz)	
	NPN general purpose	576-0003-658
	(all others)	
Q 508	NPN UHF 1.5W amp	576-0004-401
	(unrevised 430-470 MHz)	
	NPN gernal purpose	576-0003-658
	(all others)	
Q 509	N-channel FET UHF 7W amp	576-0006-120
	(unrevised 430-470 MHz)	
	NPN low noise amp	576-0003-618
	(all others)	
Q 510	PNP med power switch	576-0002-057
	(unrevised 430-470 MHz)	
	NPN low noise amp	576-0003-618
	(all others)	
Q 511	N-channel RF power MOSFET	576-0006-450
	(470-512 MHz)	
Q 512	NPN high current amp	576-0006-027
	(unrevised 430-470 MHz)	
	NPN UHF 10W amp	576-0002-070
	(all others)	
Q 513	NPN low noise amp	576-0001-300
	(unrevised 430-470 MHz)	
	PNP med power switch	576-0002-057
	(all others)	
Q 514	PNP general purpose	576-0003-612
	(unrevised 430-470 MHz)	
	NPN low noise amp	576-0001-300
	(all others)	
Q 515	NPN low noise amp	576-0001-300
	(unrevised 430-470 MHz)	
	NPN high current amp	576-0006-027
	(all others)	
Q 516	PNP general purpose	576-0003-612
	(unrevised 430-470 MHz)	
	NPN low noise amp	576-0001-300
	(all others)	

UHF RF AND PA BOARDS (CONT'D)

Ref No.	Description	Part No.
Q 517	NPN general purpose	576-0003-658
	(unrevised 430-470 MHz)	
	PNP general purpose	576-0003-612
	(all others)	
Q 600	NPN 50W amplifier	576-0004-402
Q 601	NPN 50W amplifier	576-0004-402
Q 602	NPN general purpose amp	576-0003-658
Q 800	NPN low noise amp	576-0001-300
Q 801	NPN low noise med power amp	576-0003-636
R 200	1.0k ohm ±5% 1/8W smd	569-0105-102
R 201	10k ohm ±5% 1/8W smd	569-0105-103
R 202	10k ohm ±5% 1/8W smd	569-0105-103
R 203	10k ohm ±5% 1/8W smd	569-0105-103
R 204	10k ohm ±5% 1/8W smd	569-0105-103
R 205	1.0k ohm ±5% 1/8W smd	569-0105-102
R 206	3.9k ohm ±5% 1/8W smd	569-0105-392
R 207	100 ohm ±5% 1/8W smd	569-0105-101
R 208	4.7k ohm ±5% 1/8W smd	569-0105-472
R 209	470 ohm ±5% 1/8W smd	569-0105-471
R 210	10k ohm ±5% 1/8W smd	569-0105-103
R 211	10k ohm ±5% 1/8W smd	569-0105-103
R 212	10k ohm ±5% 1/8W smd	569-0105-103
R 213	10k ohm ±5% 1/8W smd	569-0105-103
R 214	330 ohm ±5% 1/8W smd	569-0105-331
	(430-470 MHz)	
	270 ohm ±5% 1/8W smd	569-0105-271
	(470-512 MHz)	
R 215	10k ohm ±5% 1/8W smd	569-0105-103
R 216	390 ohm ±5% 1/8W smdl	569-0105-391
R 217	47k ohm ±5% 1/8W smd	569-0105-473
R 218	10k ohm ±5% 1/8W smd	569-0105-103
R 219	100 ohm ±5% 1/8W smd	569-0105-101
R 220	100 ohm ±5% 1/8W smd	569-0105-101
R 221	1.0k ohm ±5% 1/8W smd	569-0105-102
R 222	3.3k ohm ±5% 1/8W smd	569-0105-332
R 223	4.7k ohm ±5% 1/8W smd	569-0105-472
R 224	1.0k ohm ±5% 1/8W smd	569-0105-102
R 225	270 ohm ±5% 1/8W smd	569-0105-271
R 226	18 ohm ±5% 1/8W smd	569-0105-180
R 227	270 ohm ±5% 1/8W smd	569-0105-271
R 228	8.2k ohm ±5% 1/8W smd	569-0105-822
R 229	Zero ohm ±5% 1/8W smd	569-0105-001
R 231	4.7k ohm ±5% 1/8W smd	569-0105-472
R 232	4.7k ohm ±5% 1/8W smd	569-0105-472

Ref No.	Description	Part No.
R 233	22k ohm ±5% 1/8W smd	569-0105-223
R 234	22k ohm ±5% 1/8W smd	569-0105-223
R 237	20k ohm ±5% 1/8W smd	569-0105-203
R 238	20k ohm ±5% 1/8W smd	569-0105-203
R 239	510 ohm ±5% 1/8W smd	569-0105-511
R 240	510 ohm ±5% 1/8W smd	569-0105-511
R 241	20k ohm ±5% 1/8W smd	569-0105-203
R 242	20k ohm ±5% 1/8W smd	569-0105-203
R 243	10 ohm ±5% 1/8W smd	569-0105-100
R 244	15k ohm ±5% 1/8W smd	569-0105-153
R 245	680 ohm ±5% 1/8W smd	569-0105-681
R 246	390 ohm ±5% 1/8W smd	569-0105-391
R 247	4.7k ohm ±5% 1/8W smd	569-0105-472
R 248	180 ohm ±5% 1/8W smd	569-0105-181
R 249	47 ohm ±5% 1/8W smd	569-0105-470
R 250	390 ohm ±5% 1/8W smd	569-0105-391
R 251	100 ohm ±5% 1/8W smd	569-0105-101
R 252	100 ohm ±5% 1/8W smd	569-0105-101
R 253	3.3k ohm ±5% 1/8W smd	569-0105-332
R 254	2.2k ohm ±5% 1/8W smd	569-0105-222
R 255	56k ohm ±5% 1/8W smd	569-0105-563
R 256	27k ohm ±5% 1/8W smd	569-0105-273
R 257	62k ohm ±5% 1/8W smd	569-0105-623
R 258	10k ohm ±5% 1/8W smd	569-0105-103
R 259	330 ohm ±5% 1/8W smd	569-0105-331
R 260	100 ohm ±5% 1/8W smd	569-0115-101
	(430-470 MHz)	
R 261	10 ohm ±5% 1/8W smd	569-0115-100
	(430-470 MHz)	
R 500	2.2k ohm ±5% 1/8W smd	569-0105-222
R 501	10k ohm ±5% 1/8W smd	569-0105-103
R 502	10k ohm ±5% 1/8W smd	569-0105-103
R 503	10k ohm ±5% 1/8W smd	569-0105-103
	(430-470 MHz)	
R 504	1.0k ohm ±5% 1/8W smd	569-0105-102
	(430-470 MHz)	
	10k ohm ±5% 1/8W smd	569-0105-103
	(470-512 MHz)	
R 505	10k ohm ±5% 1/8W smd	569-0105-103
R 506	1.0k ohm ±5% 1/8W smd	569-0105-102
	(unrevised 430-470 MHz)	
	10k ohm ±5% 1/8W smd	569-0105-103
	(all others)	
R 507	1.0k ohm ±5% 1/8W smd	569-0105-102

UHF RF AND PA BOARDS (CONT'D)

Ref No.	Description	Part No.
R 508	220k ohm ±5% 1/8W smd	569-0105-224
	(unrevised 430-470 MHz)	
	10k ohm ±5% 1/8W smd	569-0105-103
	(all others)	
R 509	10k ohm ±5% 1/8W smd	569-0105-103
R 510	1.2k ohm ±5% 1/8W smd	569-0105-122
	(unrevised 430-470 MHz)	
	10k ohm ±5% 1/8W smd	569-0105-103
	(all others)	
R 511	120 ohm ±5% 1/8W smd	569-0105-121
	(unrevised 430-470 MHz)	
	680 ohm ±5% 1/8W smd	569-0105-681
	(all others)	
R 512	47k ohm ±5% 1/8W smd	569-0105-473
	(unrevised 430-470 MHz)	
	1.0k ohm ±5% 1/8W smd	569-0105-102
	(all others)	
R 513	1.0k ohm ±5% 1/8W smd	569-0105-102
	(unrevised 430-470 MHz)	
	220k ohm ±5% 1/8W smd	569-0105-224
	(all others)	
R 514	47k ohm ±5% 1/8W smd	569-0105-473
	(unrevised 430-470 MHz)	
R 515	10k ohm ±5% 1/8W smd	569-0105-103
R 516	4.7k ohm ±5% 1/8W smd	569-0105-472
	(unrevised 430-470 MHz)	
	1.2k ohm ±5% 1/8W smd	569-0105-122
	(all others)	
R 517	10k ohm ±5% 1/8W smd	569-0105-103
	(unrevised 430-470 MHz)	
	120 ohm ±5% 1/8W smd	569-0105-121
	(all others)	
R 518	100 ohm ±5% 1/8W smd	569-0105-101
	(unrevised 430-470 MHz)	
	47k ohm ±5% 1/8W smd	569-0105-473
	(all others)	
R 519	2.7k ohm ±5% 1/8W smd	569-0105-272
	(unrevised 430-470 MHz)	
	1.0k ohm ±5% 1/8W smd	569-0105-102
	(all others)	
R 520	47 ohm ±5% 1/8W smd	569-0105-470
	(unrevised 430-470 MHz)	
	47k ohm ±5% 1/8W smd	569-0105-473
	(all others)	

Ref No.	Description	Part No.
R 521	47 ohm ±5% 1/8W smd	569-0105-470
	(unrevised 430-470 MHz)	
	4.7k ohm ±5% 1/8W smd	569-0105-472
	(all others)	
R 522	1.2k ohm ±5% 1/8W smd	569-0105-122
	(unrevised 430-470 MHz)	
	4.7k ohm ±5% 1/8W smd	569-0105-472
	(all others)	
R 523	270 ohm ±5% 1/8W smd	569-0105-271
	(unrevised 430-470 MHz)	
	10k ohm ±5% 1/8W smd	569-0105-103
	(all others)	
R 524	47 ohm ±5% 1/8W smd	569-0105-470
	(unrevised 430-470 MHz)	
	47k ohm ±5% 1/8W smd	569-0105-473
	(all others)	
R 525	10k ohm ±5% 1/8W smd	569-0105-103
	(unrevised 430-470 MHz)	
	47k ohm ±5% 1/8W smd	569-0105-473
	(all others)	
R 526	10k ohm ±5% 1/8W smd	569-0105-103
	(unrevised 430-470 MHz)	
	3.3k ohm ±5% 1/8W smd	569-0105-332
	(all others)	
R 527	10 ohm ±5% 1/8W smd	569-0105-100
	(unrevised 430-470 MHz)	
	5k ohm smd top adj	562-0135-502
	(all others)	
R 528	47 ohm ±5% 1/8W smd	569-0105-470
	(unrevised 430-470 MHz)	
	10k ohm ±5% 1/8W smd	569-0105-103
	(all others)	
R 529	10 ohm ±5% 1/8W smd	569-0105-100
	(unrevised 430-470 MHz)	
	68 ohm ±5% 1/8W smd	569-0115-680
	(all others)	
R 530	1.8k ohm ±5% 1/8W smd	569-0105-182
	(unrevised 430-470 MHz)	
	68 ohm ±5% 1/8W smd	569-0115-680
	(all others)	
R 531	1.8k ohm ±5% 1/8W smd	569-0105-182
	(unrevised 430-470 MHz)	
	10k ohm ±5% 1/8W smd	569-0105-103
	(all others)	

UHF RF AND PA BOARDS (CONT'D)

Ref No.	Description	Part No.
R 532	18 ohm ±5% 1/8W smd	569-0105-180
	(unrevised 430-470 MHz)	
	15 ohm ±5% 1/8W smd	569-0115-150
	(all others)	
R 533	510 ohm ±5% 1/8W smd	569-0105-511
	(unrevised 430-470 MHz)	
	10k ohm ±5% 1/8W smd	569-0105-103
	(all others)	
R 534	100k ohm ±5% 1/8W smd	569-0105-104
	(unrevised 430-470 MHz)	
	33 ohm ±5% 1/8W smd	569-0105-330
	(all others)	
R 535	100k ohm ±5% 1/8W smd	569-0105-104
	(unrevised 430-470 MHz)	
	1.5k ohm ±5% 1/8W smd	569-0105-152
	(all others)	
R 536	100k ohm ±1% 1/8W smd	569-0111-501
	(unrevised 430-470 MHz)	
	1.2k ohm ±5% 1/8W smd	569-0105-122
	(all others)	
R 537	1.0k ohm ±5% 1/8W smd	569-0105-102
	(unrevised 430-470 MHz)	
	51 ohm ±5% 1W smd	569-0175-510
	(all others)	
R 538	17.8k ohm ±1% 1/8W smd	569-0111-425
	(unrevised 430-470 MHz)	
	510 ohm ±5% 1/8W smd	569-0105-511
	(all others)	
R 539	42.2k ohm ±1% 1/8W smd	569-0111-461
	(unrevised 430-470 MHz)	
	100k ohm ±5% 1/8W smd	569-0105-104
	(all others)	
R 540	10k ohm ±5% 1/8W smd	569-0105-103
	(unrevised 430-470 MHz)	
	100k ohm ±5% 1/8W smd	569-0105-104
	(all others)	
R 541	54.9k ohm ±1% 1/8W smd	569-0111-472
	(unrevised 430-470 MHz)	
	100k ohm ±1% 1/8W smd	569-0111-501
	(all others)	
R 542	7.5k ohm ±1% 1/8W smd	569-0111-385
	(unrevised 430-470 MHz)	
	100 ohm ±5% 1/8W smd	569-0115-101
	(all others)	
R 543	12.1k ohm ±1% 1/8W smd	569-0111-409
	(unrevised 430-470 MHz)	
	1.0k ohm ±5% 1/8W smd	569-0105-102
	(all others)	
R 544	10 ohm ±5% 1/8W smd	569-0115-100
R 545	17.8k ohm ±1% 1/8W smd	569-0111-425
R 546	100 ohm ±5% 1/8W smd	569-0105-101
	(unrevised 430-470 MHz)	
	42.2k ±1% 1/8W smd	569-0111-461
	(all others)	
R 547	10k ohm ±5% 1/8W smd	569-0105-103
R 548	54.9k ohm ±1% 1/8W smd	569-0111-472
R 549	7.5k ohm ±1% 1/8W smd	569-0111-385
R 550	10k ohm ±5% 1/8W smd	569-0105-103
	(unrevised 430-470 MHz)	
	12.1k ohm ±1% 1/8W smd	569-0111-409
	(all others)	
R 551	10k ohm ±5% 1/8W smd	569-0105-103
	(unrevised 430-470 MHz)	
R 552	10k ohm ±5% 1/8W smd	569-0105-103
	(unrevised 430-470 MHz)	
R 553	10k ohm ±5% 1/8W smd	569-0105-103
	(unrevised 430-470 MHz)	
R 554	150 ohm ±5% 1/8W smd	569-0105-151
	(unrevised 430-470 MHz)	
R 555	180 ohm ±5% 1/8W smd	569-0105-181
	(unrevised 430-470 MHz)	
R 556	47k ohm ±5% 1/8W smd	569-0105-473
	(unrevised 430-470 MHz)	
R 557	47k ohm ±5% 1/8W smd	569-0105-473
	(unrevised 430-470 MHz)	
R 558	2.2k ohm ±5% 1W smd	569-0175-222
	(unrevised 430-470 MHz)	
R 559	2.2k ohm ±5% 1W smd	569-0175-222
	(unrevised 430-470 MHz)	
R 600	.030 ohm ±5% 2W WW smd	569-2019-307
R 601	10k ohm ±5% thermistor	569-3013-007
R 602	220k ohm ±5% 1/8W smd	569-0105-224
R 603	220k ohm ±5% 1/8W smd	569-0105-224
R 604	100 ohm ±5% .75W smd	569-0135-101
R 605	330 ohm ±5% 1/8W smd	569-0105-331
R 606	100k ohm ±5% 1/8W smd	569-0105-104
	(430-470 MHz, 40W)	
	68k ohm ±5% 1/8W smd	569-0105-683
	(all others)	
R 607	100k ohm ±5% 1/8W smd	569-0105-104
	(all 25W)	

UHF RF AND PA BOARDS (CONT'D)

Ref No.	Description	Part No.
	75k ohm ±5% 1/8W smd	569-0105-753
	(430-470 MHz 40W)	
	56k ohm ±5% 1/8W smd	569-0105-563
	(470-512 MHz 40W)	
R 608	220k ohm ±5% 1/8W smd	569-0105-224
R 609	100 ohm ±5% .75W smd	569-0135-101
R 610	100 ohm ±5% .75W smd	569-0135-101
R 611	4.7k ohm ±5% 1/8W smd	569-0105-472
R 612	330 ohm ±5% 1W smd	569-0175-331
	(430-470 MHz 40W)	
	100 ohm ±5% 1W smd	569-0175-101
	(470-512 MHz 40W)	
R 613	470 ohm ±5% 1W smd	569-0175-471
	(25 watt and 470-512 MHz 40W)	
	100 ohm ±5% 1W smd	569-0175-101
	(430-470 MHz 40 watt)	
R 614	330 ohm ±5% 1W smd	569-0175-331
	(430-470 MHz 40 watt)	
R 615	330 ohm ±5% 1W smd	569-0175-331
	(430-470 MHz 40 watt)	
R 616	330 ohm ±5% 1W smd	569-0175-331
	(430-470 MHz 40 watt)	
R 800	20k ohm ±5% 1/8W smd	569-0105-203
R 801	20k ohm ±5% 1/8W smd	569-0105-203
R 802	10k ohm ±5% 1/8W smd	569-0105-103
R 803	20k ohm ±5% 1/8W smd	569-0105-203
R 804	4.7k ohm ±5% 1/8W smd	569-0105-472
R 805	10k ohm ±5% 1/8W smd	569-0105-103
R 806	20k ohm ±5% 1/8W smd	569-0105-203
R 807	4.7k ohm ±5% 1/8W smd	569-0105-472
R 808	10k ohm ±5% 1/8W smd	569-0105-103
R 809	20k ohm ±5% 1/8W smd	569-0105-203
R 810	4.7k ohm ±5% 1/8W smd	569-0105-472
R 811	10k ohm ±5% 1/8W smd	569-0105-103
R 812	20k ohm ±5% 1/8W smd	569-0105-203
R 813	10k ohm ±5% 1/8W smd	569-0105-103
R 814	20k ohm ±5% 1/8W smd	569-0105-203
R 815	10k ohm ±5% 1/8W smd	569-0105-103
R 816	20k ohm ±5% 1/8W smd	569-0105-203
R 817	10k ohm ±5% 1/8W smd	569-0105-103
R 818	10k ohm ±5% 1/8W smd	569-0105-103
R 819	Zero ohm ±5% 1/8W smd	569-0105-001
R 820	Zero ohm ±5% 1/8W smd	569-0105-001
R 821	Zero ohm ±5% 1/8W smd	569-0105-001

Ref No.	Description	Part No.
R 822	10k ohm ±5% 1/8W smd	569-0105-103
R 823	33k ohm ±5% 1/8W smd	569-0105-333
R 824	Zero ohm ±5% 1/8W smd	569-0105-001
R 825	100 ohm ±5% 1/8W smd	569-0105-101
R 826	10k ohm ±5% 1/8W smd	569-0105-103
R 827	4.7k ohm ±5% 1/8W smd	569-0105-472
R 828	Zero ohm ±5% 1/8W smd	569-0105-001
R 829	4.7k ohm ±5% 1/8W smd	569-0105-472
R 830	100 ohm ±5% 1/8W smd	569-0105-101
R 831	100 ohm ±5% 1/8W smd	569-0105-101
R 832	1.0k ohm ±5% 1/8W smd	569-0105-102
R 833	15k ohm ±5% 1/8W smd	569-0105-153
R 834	12k ohm ±5% 1/8W smd	569-0105-123
R 835	100 ohm ±5% 1/8W smd	569-0105-101
R 836	18 ohm ±5% 1/8W smd	569-0105-180
R 837	68 ohm ±5% 1/8W smd	569-0105-680
R 838	24k ohm ±5% 1/8W smd	569-0105-243
R 839	39 ohm ±5% 1/8W smd	569-0105-390
R 840	10k ohm ±5% 1/8W smd	569-0105-103
R 841	10k ohm ±5% 1/8W smd	569-0105-103
R 842	150 ohm ±5% 1/8W smd	569-0105-151
R 843	150 ohm ±5% 1/8W smd	569-0105-151
R 844	1.0k ohm ±5% 1/8W smd	569-0105-102
R 845	10 ohm ±5% 1/8W smd	569-0105-100
R 846	5.6k ohm ±5% 1/8W smd	569-0105-562
R 847	18 ohm ±5% 1/8W smd	569-0105-180
R 848	18k ohm ±5% 1/8W smd	569-0105-183
R 849	470k ohm ±5% 1/8W smd	569-0105-474
R 850	100 ohm ±5% 1/8W smd	569-0105-101
R 851	47k ohm ±5% 1/8W smd	569-0105-473
R 852	1.0k ohm ±5% 1/8W smd	569-0105-102
R 853	10k ohm ±5% 1/8W smd	569-0105-103
R 854	10k ohm ±5% 1/8W smd	569-0105-103
R 855	150 ohm ±5% 1/8W smd	569-0105-151
	(revised 430-470 MHz)	
	47 ohm ±5% 1/8W smd	569-0105-470
	(all others)	
R 856	82 ohm ±5% 1/8W smd	569-0105-820
U 201	FM IF system SA676DK	544-2002-037
U 500	Op amp, dual 2904	544-2019-004
U 501	Regulator, 8V 0.5A 78M08	544-2003-081
U 502	Regulator, adj 180mA TK11900	544-2603-093
U 800	Shift register, 8-stage 4094	544-3016-094
U 801	Shift register, 8-stage 4094	544-3016-094

800/900 MHz RF AND PA BOARDS

Ref No.	Description	Part No.
U 802	Potentiometer, 4-chnl AD8403	544-0004-211
U 803	Op amp, dual 2904	544-2019-004
U 804	Synthesizer SA7025	544-3954-027
U 806	TCXO, 14.85 MHz ±2.0 ppm	518-7009-523
Z 202	450 kHz 9 kHz bw ceramic filter	532-2006-034
Z 204	45 MHz 4-pole crystal filter	532-0009-027
Z 205	450 khz, 20 kHz bw ceramic filter	532-2004-013
Z 206	450 khz, 20 kHz bw ceramic filter	532-2004-013

Ref No	Description	Part No.
	800/900 MHZ RF AND PA BOARDS	
A 020	Pwr connector assembly includes:	
	.001 µF 500V feedthrough	510-3151-102
	Contact (2)	515-9033-006
	Shield	017-2227-031
	Connector body	515-9033-012
	13 AWG tinned copper wire	597-0271-013
A 533	Stabilization board, Q651 (800/900 MHz, 30W only) includes:	023-9884-531
	.01 µF X7R ±10% 50V cer smd	510-3606-103
	.01 µH smd inductor	542-9001-107
	33 ohm resistors	
A 900	VCO module, 800 MHz	023-9880-901
	VCO module, 900 MHz	023-9890-901
C 202	12 pF NPO ±5% cer smd (800 MHz models)	510-3601-120
	10 pF ±5% NPO 50V cer smd (900 MHz models)	510-3615-100
C 214	8.2 pF ±5% NPO 50V cer smd	510-3615-829
C 222	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 223	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 224	39 pF ±5% NPO 50V cer smd	510-3615-390
C 225	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 226	39 pF ±5% NPO 50V cer smd	510-3615-390
C 227	1.8 pF ±5% NPO 50V cer smd (800 MHz models)	510-3615-189
	2.2 pF ±5% NPO 50V cer smd (900 MHz models)	510-3615-229
C 231	39 pF NPO ±5% 50V cer smd	510-3601-390
C 232	56 pF NPO ±5% 50V cer smd	510-3601-560

Ref No	Description	Part No.
C 244	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 245	100 pF ±5% NPO 50V cer smd	510-3615-101
C 246	30 pF ±5% NPO 50V cer smd (800 MHz models)	510-3615-300
	16 pF NPO ±5% 50V cer smd (900 MHz models)	510-3601-160
C 247	39 pF ±5% NPO 50V cer smd	510-3615-390
C 248	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 249	39 pF ±5% NPO 50V cer smd	510-3615-390
C 250	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 255	100 pF NPO ±5% 50V cer smd	510-3601-101
C 264	3.9 pF NPO ±5% 50V cer smd (800 MHz models)	510-3601-399
	3.3 pF NPO ±5% 50V cer smd (900 MHz models)	510-3601-339
C 265	47 pF NPO ±5% 50V cer smd	510-3601-470
C 266	11 pF NPO ±5% 50V cer smd (800 MHz models)	510-3601-110
	30 pF NPO ±5% 50V cer smd (900 MHz models)	510-3601-300
C 268	39 pF NPO ±5% 50V cer smd (800 MHz models)	510-3601-390
	150 pF NPO ±5% 50V cer smd (900 MHz models)	510-3601-151
C 269	15 pF NPO ±5% 50V cer smd (900 MHz models only)	510-3601-150
C 270	6.8 pF NPO ±5% 50V cer smd (800 MHz models)	510-3601-689
	27 pF NPO ±5% 50V cer (900 MHz models)	510-3601-270
C 271	15 pF NPO ±5% 50V cer smd (800 MHz models)	510-3601-150
	27 pF NPO ±5% 50V cer smd (900 MHz models)	510-3601-270
C 272	100 pF NPO ±5% 50V cer smd (800 MHz models)	510-3601-101
	.01 µF X7R ±10% 50V cer smd (900 MHz models)	510-3605-103
C 274	.001 µF X7R ±10% 50V cer smd	510-3605-102
C 275	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 276	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 277	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 278	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 280	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 281	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 282	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 283	.01 µF X7R ±10% 50V cer smd	510-3605-103

800/900 MHz RF AND PA BOARDS (CONT'D)

Ref No	Description	Part No.
C 284	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 285	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 286	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 287	33 pF NPO ±5% 50V cer smd (800 MHz models)	510-3601-330
	47 pF NPO ±5% 50V cer smd (900 MHz models)	510-3601-470
C 288	7.5 pF ±5% NPO 50V cer smd	510-3601-759
C 289	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 290	24 pF NPO ±5% 50V cer smd (800 MHz models)	510-3601-240
	36 pF NPO ±5% 50V cer smd (900 MHz models)	510-3601-360
C 291	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 292	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 293	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 294	47 µF 10V tantalum smd	510-2624-470
C 295	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 296	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 297	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 298	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 299	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 300	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 301	10 pF ±5% NPO 50V cer smd	510-3602-100
C 302	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 303	.33 µF X7R ±10% 16V cer smd	510-3631-334
C 304	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 305	100 pF NPO ±5% 50V cer smd	510-3601-101
C 306	100 pF NPO ±5% 50V cer smd	510-3601-101
C 500	39 pF NPO ±5% 50V cer smd	510-3601-390
C 501	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 502	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 503	39 pF NPO ±5% 50V cer smd	510-3601-390
C 504	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 505	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 511	39 pF NPO ±5% 50V cer smd	510-3601-390
C 513	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 514	39 pF NPO ±5% 50V cer smd	510-3601-390
C 515	5.6 pF NPO ±5% 50V cer smd	510-3601-569
C 516	16 pF NPO ±5% 50V cer smd	510-3601-160
C 517	39 pF NPO ±5% 50V cer smd	510-3601-390
C 518	1.6 pF ±5% NPO 50V cer smd	510-3615-169
C 519	6.8 pF NPO ±5% 50V cer smd	510-3615-689
C 520	39 pF NPO ±5% 50V cer smd	510-3601-390
C 522	4.3 pF NPO ±5% 50V cer smd	510-3615-439
C 523	10 pF NPO ±5% 50V cer smd	510-3601-100

Ref No	Description	Part No.
C 524	39 pF NPO ±5% 50V cer smd	510-3601-390
C 525	39 pF NPO ±5% 50V cer smd	510-3601-390
C 526	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 527	1.6 pF ±5% NPO 50V cer smd	510-3615-169
C 528	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 529	39 pF NPO ±5% 50V cer smd	510-3601-390
C 530	39 pF NPO ±5% 50V cer smd	510-3601-390
C 531	1 µF ±10% 50V X7R cer smd	510-3606-105
C 532	1 µF 16V tantalum smd	510-2625-109
C 547	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 548	10 µF 25V tantalum smd	510-2627-100
C 549	470 µF 25V electrolytic	510-4064-471
C 550	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 551	39 pF NPO ±5% 50V cer smd	510-3601-390
C 552	10 µF 25V tantalum smd	510-2627-100
C 553	470 µF 25V electrolytic	510-4064-471
C 554	39 pF NPO ±5% 50V cer smd	510-3601-390
C 555	39 pF NPO ±5% 50V cer smd	510-3601-390
C 556	4.7 µF 10V tantalum smd	510-2624-479
C 557	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 558	39 pF NPO ±5% 50V cer smd	510-3601-390
C 559	39 pF NPO ±5% 50V cer smd	510-3601-390
C 561	4.7 µF 10V tantalum smd	510-2624-479
C 562	39 pF NPO ±5% 50V cer smd	510-3601-390
C 563	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 564	39 pF NPO ±5% 50V cer smd	510-3601-390
C 565	10 µF 25V tantalum smd	510-2627-100
C 566	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 599	.047 µF X7R ±10% 50V cer smd	510-3605-473
C 600	.018 µF X7R ±10% cer smd	510-3605-183
C 601	39 pF ±5% NPO 50V cer smd	510-3615-390
C 603	1 µF ±10% 16V 50V cer smd	510-3606-105
C 604	39 pF ±5% NPO 50V cer smd	510-3615-390
C 605	.018 µF X7R ±10% 50V cer smd	510-3605-183
C 606	1 µF ±10% 16V 50V cer smd	510-3606-105
C 607	39 pF ±5% NPO 50V cer smd	510-3615-390
C 608	.018 µF X7R ±10% 50V cer smd	510-3605-183
C 609	39 pF ±5% NPO 50V cer smd	510-3615-390
C 610	.018 µF X7R ±10% 50V cer smd	510-3605-183
C 611	1 µF ±10% 16V 50V cer smd	510-3606-105
C 612	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 613	56 pF ±10% 50V high q smd	510-3653-560
C 614	4 pF 250V mini mica (30W 800/900 MHz models)	510-0019-409
C 615	1 µF ±10% 16V 50V cer smd	510-3606-105

800/900 MHz RF AND PA BOARDS (CONT'D)

Ref No	Description	Part No.
C 619	1 µF ±10% 16V 50V cer smd	510-3606-105
C 620	1.0 pF ±5% NPO 50V cer smd	510-3615-109
C 621	56 pF ±10% 50V high q smd	510-3653-560
C 622	1.8 pF ±5% NPO 50V cer smd	510-3615-189
C 623	12 pF ±5% NPO 50V cer smd	510-3615-120
C 624	3.9 pF ±10% 50V high q smd	510-3653-399
C 625	7.5 pF ±10% 50V high q smd	510-3663-759
C 626	7.5 pF ±10% 50V high q smd	510-3663-759
C 627	3.9 pF ±10% 50V high q smd	510-3653-399
C 628	39 pF ±5% NPO 50V cer smd	510-3615-390
C 629	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 630	39 pF ±5% NPO 50V cer smd	510-3615-390
C 631	39 pF ±5% NPO 50V cer smd	510-3615-390
C 632	39 pF ±5% NPO 50V cer smd	510-3615-390
C 633	10 pF ±5% NPO 50V cer smd (15W 800 MHz/30W 900 MHz)	510-3615-100
	12 pF ±5% NPO 50V cer smd (15W 900 MHz)	510-3615-120
	56 pF ±10% 50V high q smd (30W, 800 MHz)	510-3653-560
C 634	39 pF ±5% NPO 50V cer smd	510-3615-390
C 635	1.8 pF ±5% NPO 50V cer smd	510-3615-189
C 636	39 pF ±5% NPO 50V cer smd	510-3615-390
C 637	.018 µF X7R k50V cer smd	510-3605-183
C 638	39 pF ±5% NPO 50V cer smd	510-3615-390
C 639	3.6 pF ±5% NPO 50V cer smd	510-3615-369
C 640	2.2 µF 16V tantalum smd	510-2625-229
C 651	3.0 pF ±5% NPO 50V cer smd	510-3615-309
C 652	10 pF 250V mini mica	510-0019-100
C 653	12 pF 250V mini mica	510-0019-120
C 654	18 pF 250V mini mica (30W, 800 MHz)	510-0019-180
	12 pF 250V mini mica (30W, 900 MHz)	510-0019-120
C 655	18 pF 250V mini mica (30W, 800 MHz)	510-0019-180
	15 pF 250V mini mica (30W, 900 MHz)	510-0019-150
C 656	1.0 to 4.5 pF smd var	512-1008-001
C 657	3.3 pF ±10% 50V high q smd (800 MHz models only)	510-3653-339
C 807	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 808	100 pF NPO ±5% 50V cer smd	510-3601-101
C 809	330 pF NPO ±5% 50V cer smd (800 MHz models)	510-3601-331
	150 pF NPO ±5% 50V cer smd (900 MHz models)	510-3601-151
C 811	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 812	100 pF NPO ±5% 50V cer smd	510-3601-101
C 813	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 814	10 µF 16V tantalum smd	510-2625-100
C 815	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 816	.001 µF X7R ±10% 50V cer smd	510-3605-102
C 817	100 pF NPO ±5% 50V cer smd	510-3601-101
C 818	5.6 pF NPO ±5% 50V cer smd	510-3601-569
C 819	1.0 µF 10V tantalum smd	510-2624-109
C 820	100 pF NPO ±5% 50V cer smd	510-3601-101
C 821	.001 µF X7R ±10% 50V cer smd	510-3605-102
C 822	39 pF ±5% NPO 50V cer smd	510-3615-390
C 823	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 824	100 pF NPO ±5% 50V cer smd	510-3601-101
C 825	1.0 µF 10V tantalum smd	510-2624-109
C 826	12 pF NPO ±5% cer smd (800 MHz models)	510-3601-120
	5.6 pF NPO ±5% 50V cer smd (900 MHz models)	510-3601-569
C 827	39 pF ±5% NPO 50V cer smd	510-3615-390
C 828	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 829	39 pF ±5% NPO 50V cer smd	510-3615-390
C 830	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 831	1.0 µF 10V tantalum smd	510-2624-109
C 832	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 833	39 pF ±5% NPO 50V cer smd	510-3615-390
C 834	0.1 µF X7R ±5% 50V cer smd	510-3610-104
C 835	.01 µF NPO ±2% 50V cer smd	510-3617-103
C 836	4700 pF NPO ±2% 50V cer smd	510-3616-472
C 838	4.7 µF 10V tantalum smd	510-2624-479
C 839	39 pF ±5% NPO 50V cer smd	510-3615-390
C 840	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 841	.001 µF X7R ±10% 50V cer smd	510-3605-102
C 842	39 pF ±5% NPO 50V cer smd (800 MHz models)	510-3615-390
	27 pF ±5% NPO 50V cer smd (900 MHz models)	510-3601-270
C 843	5.6 pF NPO ±5% 50V cer smd	510-3601-569
C 844	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 845	10 pF NPO ±5% 50V cer smd	510-3601-100
C 846	10 pF NPO ±5% 50V cer smd	510-3601-100
C 847	4.7 pF NPO ±5% 50V cer smd	510-3601-479
C 848	39 pF ±5% NPO 50V cer smd	510-3615-390

800/900 MHz RF AND PA BOARDS (CONT'D)

Ref No	Description	Part No.
C 849	47 pF NPO ±5% 50V cer smd (800 MHz models)	510-3601-470
	27 pF ±5% NPO 50V cer smd (900 MHz models)	510-3601-270
C 850	39 pF ±5% NPO 50V cer smd	510-3615-390
CR 200	PIN switching diode	523-1504-001
CR 203	Switching diode SOT-23	523-1504-002
CR 207	PIN switching diode	523-1504-001
CR 208	PIN switching diode	523-1504-001
CR 209	PIN switching diode	523-1504-001
CR 210	PIN switching diode	523-1504-001
CR 500	Switching diode SOT-23 (30W models only)	523-1504-002
CR 501	Switching diode SOT-23	523-1504-002
CR 502	Switching diode SOT-23	523-1504-002
CR 503	Switching diode SOT-23	523-1504-002
CR 504	Switching diode SOT-23	523-1504-002
CR 505	Dual sw diode SOT-23	523-1504-023
CR 506	Dual sw diode SOT-23	523-1504-023
CR 600	Transient suppressor	523-2906-001
CR 601	Zener diode 12V	523-2016-120
CR 602	PIN diode	523-1504-032
CR 603	HC diode	523-1504-016
CR 604	PIN diode	523-1504-032
CR 603	PIN diode	523-1504-032
CR 800	Switching diode SOT-23	523-1504-002
CR 801	PIN switching diode	523-1504-001
CR 802	PIN switching diode	523-1504-001
CR 803	5.1V zener SOT-23	523-2016-519
EP 010	Ferrite noise suppressor (J201/J302)	515-9034-065
EP 200	Crystal pin insulator	010-0345-280
EP 500	.055" x .015" teflon tubing	058-0053-515
EP 501	Ferrite bead	517-2503-002
EP 502	.03" teflon tubing	058-0053-510
EP 502	Ferrite bead	517-2503-002
EP 600	Ferrite bead smd	517-2503-010
EP 601	Ferrite bead smd	517-2503-010
F 500	Fuse, 4A smd very fast blow	534-5000-140
J 201	Connector, 2 x 10 pin male (RF bd)	515-7100-944
J 501	Connector 1 x 8 pin male (RF bd)	515-7100-942

Ref No	Description	Part No.
J 600	Connector, 8-pin female (PA bd)	515-7102-115
J 601	Antenna jack, right angle	515-3011-020
L 200	12 nH smd inductor (800 MHz models only)	542-9003-127
L 201	39 µH smd inductor (800 MHz models only)	542-9003-397
L 207	.047 µH smd inductor	542-9001-477
L 213	Variable inductor (800 MHz models)	542-1012-015
	.68 µH smd inductor (900 MHz models)	542-9000-688
L 214	3.9 µH inductor (800 MHz models)	542-9000-399
L 215	Variable inductor (800 MHz models)	542-1012-015
	.68 µH smd inductor (900 MHz models)	542-9000-688
L 217	.27 µH smd inductor	542-9000-278
L 218	455 kHz variable w/cap	542-1012-010
L 219	.22 µH inductor	542-9000-228
L 220	0.39 µH smd inductor	542-9001-398
L 501	8 nH smd inductor	542-0030-003
L 502	8 nH smd inductor	542-0030-003
L 503	9T 35.5 nH inductor	542-0030-009
L 504	12.5 nH smd inductor	542-0030-004
L 601	9T 35.5 nH inductor	542-0030-009
L 602	.033 µH smd inductor (15W models)	542-9001-337
	8T 22 AWG .090 ID inductor (30W models)	542-0016-008
L 603	.033 µH smd inductor	542-9001-337
L 604	8.0 nH smd inductor	542-0030-003
L 651	8T 22 AWG .090 ID inductor	542-0016-008
L 800	.047 µH smd inductor	542-9001-477
L 801	.047 µH smd inductor	542-9001-477
MP 002	1/4 in. coil shield	578-0003-001
MP 509	Heat sink sleeving (Q509)	016-2229-001
MP 600	Jumper strap	017-2224-340
MP 601	RF shield (900 MHz)	537-5001-008
P 001	Power connector, dual	See A020
PC 200	PC board, RF	
	800 MHz models (rev 2)	035-9880-200
	900 MHz models (rev 2)	035-9890-200

800/900 MHz RF AND PA BOARDS (CONT'D)

Ref No	Description	Part No.
PC 500	PC board, power amp	
	800/900 MHz 15W (rev 2)	035-9882-500
	800/900 MHz 30W (rev 3)	035-9884-500
Q 200	PNP switching	576-0003-612
Q 201	NPN low noise high freq	576-0003-618
Q 202	NPN low noise high freq	576-0003-618
Q 203	PNP switching	576-0003-612
Q 205	NPN digital w/resistors	576-0003-616
Q 206	NPN digital w/resistors	576-0003-616
Q 207	VHF/UHF amp	576-0003-634
Q 500	PNP power Darlington	576-0007-013
Q 501	NPN general purpose	576-0003-658
Q 502	NPN general purpose	576-0003-658
Q 503	NPN general purpose	576-0003-658
Q 504	PNP switching	576-0003-612
Q 505	NPN general purpose	576-0003-658
Q 506	NPN low noise amp	576-0003-604
Q 507	NPN 750 mW UHF/800 MHz amp	576-0004-098
Q 508	PNP switching	576-0003-612
Q 509	NPN general purpose	576-0003-658
Q 510	PNP med power amp/switch	576-0002-057
Q 511	NPN low noise amp	576-0001-300
Q 512	NPN high current	576-0006-027
Q 513	NPN low noise amp	576-0001-300
Q 514	PNP switching	576-0003-612
Q 600	PNP switching xstr	576-0003-612
Q 602	NPN general purpose	576-0003-658
Q 651	NPN 806-870 MHz 45W amp	576-0004-817
Q 800	NPN low noise amp	576-0001-300
Q 801	NPN low noise high freq	576-0003-618
Q 802	PNP switching	576-0003-612
Q 803	NPN digital w/resistors	576-0003-616
Q 804	NPN digital w/resistors	576-0003-616
Q 805	NPN digital w/resistors	576-0003-616
Q 806	PNP switching	576-0003-612
R 200	1.0k ohm ±5% 1/8W smd	569-0105-102
R 205	4.7k ohm ±5% 1/8W smd	569-0105-472
R 206	10k ohm ±5% 1/8W smd	569-0105-103
R 207	100 ohm ±5% 1/8W smd	569-0105-101
R 208	4.7k ohm ±5% 1/8W smd	569-0105-472
R 209	220 ohm ±5% 1/8W smd	569-0105-221
R 210	18 ohm ±5% 1/8W smd	569-0105-180
R 211	270 ohm ±5% 1/8W smd	569-0105-271

Ref No	Description	Part No.
R 212	270 ohm ±5% 1/8W smd	569-0105-271
R 213	4.7k ohm ±5% 1/8W smd	569-0105-472
R 214	560 ohm ±5% 1/8W smd	569-0105-561
R 215	150 ohm ±5% 1/8W smd (800 MHz models)	569-0105-151
	270 ohm ±5% 1/8W smd (900 MHz models)	569-0105-271
R 216	39 ohm ±5% 1/8W smd (800 MHz models)	569-0105-390
	18 ohm ±5% 1/8W smd (900 MHz models)	569-0105-180
R 217	150 ohm ±5% 1/8W smd (800 MHz models)	569-0105-151
	270 ohm ±5% 1/8W smd (900 MHz models)	569-0105-271
R 218	180 ohm ±5% 1/8W smd (800 MHz models)	569-0105-181
	100 ohm ±5% 1/8W smd (900 MHz models)	569-0105-101
R 219	100 ohm ±5% 1/8W smd	569-0105-101
R 221	2.2k ohm ±5% 1/8W smd	569-0105-222
R 222	4.7k ohm ±5% 1/8W smd	569-0105-472
R 226	Zero ohm jumper	569-0105-001
R 228	8.2k ohm ±5% 1/8W smd	569-0105-822
R 229	Zero ohm jumper	569-0105-001
R 231	4.7k ohm ±5% 1/8W smd	569-0105-472
R 232	4.7k ohm ±5% 1/8W smd	569-0105-472
R 233	22k ohm ±5% 1/8W smd	569-0105-223
R 234	22k ohm ±5% 1/8W smd	569-0105-223
R 237	20k ohm ±5% 1/8W smd	569-0105-203
R 238	20k ohm ±5% 1/8W smd	569-0105-203
R 239	510 ohm ±5% 1/8W smd	569-0105-511
R 240	510 ohm ±5% 1/8W smd	569-0105-511
R 241	20k ohm ±5% 1/8W smd	569-0105-203
R 242	20k ohm ±5% 1/8W smd	569-0105-203
R 243	10 ohm ±5% 1/8W smd	569-0105-100
R 244	15k ohm ±5% 1/8W smd	569-0105-153
R 245	680 ohm ±5% 1/8W smd	569-0105-681
R 246	390 ohm ±5% 1/8W smd	569-0105-391
R 247	4.7k ohm ±5% 1/8W smd	569-0105-472
R 248	180 ohm ±5% 1/8W smd	569-0105-181
R 249	47 ohm ±5% 1/8W smd	569-0105-470
R 250	390 ohm ±5% 1/8W smd	569-0105-391
R 251	100 ohm ±5% 1/8W smd	569-0105-101
R 252	100 ohm ±5% 1/8W smd	569-0105-101
R 253	3.3k ohm ±5% 1/8W smd	569-0105-332

800/900 MHz RF AND PA BOARDS (CONT'D)

Ref No	Description	Part No.
R 254	2.2k ohm ±5% 1/8W smd	569-0105-222
R 255	56k ohm ±5% 1/8W smd	569-0105-563
R 256	27k ohm ±5% 1/8W smd	569-0105-273
R 257	62k ohm ±5% 1/8W smd	569-0105-623
	(800 MHz models)	
	47k ohm ±5% 1/8W smd	569-0105-473
	(900 MHz models)	
R 258	10k ohm ±5% 1/8W smd	569-0105-103
R 259	330 ohm ±5% 1/8W smd	569-0105-331
R 500	2.2k ohm ±5% 1/8W smd	569-0105-222
R 501	10k ohm ±5% 1/8W smd	569-0105-103
R 502	11.0k ohm ±1% 1/8W smd	569-0101-405
	(800 MHz models)	
	10.0k ohm ±1% 1/8W smd	569-0101-401
	(900 MHz models)	
R 503	10k ohm ±5% 1/8W smd	569-0105-103
R 504	1.15k ohm ±1% 1/8W smd	569-0101-307
R 505	10k ohm ±5% 1/8W smd	569-0105-103
R 506	1.0k ohm ±5% 1/8W smd	569-0105-102
R 507	1.15k ohm ±1% 1/8W smd	569-0101-307
R 508	220k ohm ±5% 1/8W smd	569-0105-224
R 509	11.0k ohm ±1% 1/8W smd	569-0101-405
	(800 MHz models)	
	10.0k ohm ±1% 1/8W smd	569-0101-401
	(900 MHz models)	
R 510	1.2k ohm ±5% 1/8W smd	569-0105-122
R 511	56 ohm ±5% 1/8W smd	569-0105-560
	(800 MHz models)	
	120 ohm ±5% 1/8W smd	569-0105-121
	(900 MHz models)	
R 512	47k ohm ±5% 1/8W smd	569-0105-473
R 513	1.0k ohm ±5% 1/8W smd	569-0105-102
R 514	47k ohm ±5% 1/8W smd	569-0105-473
R 515	4.7k ohm ±5% 1/8W smd	569-0105-472
R 516	4.7k ohm ±5% 1/8W smd	569-0105-472
R 517	10k ohm ±5% 1/8W smd	569-0105-103
R 518	51 ohm ±5% 1/8W smd	569-0105-510
R 519	5.1k ohm ±5% 1/8W smd	569-0105-512
R 520	1.2k ohm ±5% 1/8W smd	569-0105-122
R 521	100 ohm ±5% 1/8W smd	569-0105-101
R 522	100 ohm ±5% 1/8W smd	569-0105-101
R 523	100 ohm ±5% 1/8W smd	569-0105-101
R 524	10k ohm ±5% 1/8W smd	569-0105-103
R 525	10k ohm ±5% 1/8W smd	569-0105-103
R 526	100 ohm ±5% 1/8W smd	569-0115-101

Ref No	Description	Part No.
R 527	10 ohm ±5% 1/8W smd	569-0115-100
R 528	100 ohm ±5% 1/8W smd	569-0115-101
R 529	680 ohm ±5% 1/8W smd	569-0115-681
R 530	10 ohm ±5% 1/8W smd	569-0115-100
R 531	680 ohm ±5% 1/8W smd	569-0115-681
R 533	510 ohm ±5% 1/8W smd	569-0105-511
R 534	100k ohm ±5% 1/8W smd	569-0105-104
R 535	100k ohm ±5% 1/8W smd	569-0105-104
R 536	100k ohm ±1% 1/8W smd	569-0111-501
R 537	1.0k ohm ±5% 1/8W smd	569-0105-102
R 538	17.8k ohm ±1% 1/8W smd	569-0111-425
R 539	42.2k ohm ±1% 1/8W smd	569-0111-461
R 540	10k ohm ±5% 1/8W smd	569-0105-103
R 541	54.9k ohm ±1% 1/8W smd	569-0111-472
R 542	7.5k ohm ±1% 1/8W smd	569-0111-385
R 543	12.1k ohm ±1% 1/8W smd	569-0111-409
R 546	47k ohm ±5% 1/8W smd	569-0105-473
R 547	47k ohm ±5% 1/8W smd	569-0105-473
R 548	1.0k ohm ±5% 1/8W smd	569-0105-102
R 549	1.0k ohm ±5% 1/8W smd	569-0105-102
R 600	470 ohm ±5% 1/8W smd	569-0115-471
R 601	.030 ohm 2W ±5% smd ww	569-2019-307
	(all 15W, 800 MHz 30W)	
	.015 ohm 2W ±5% smd ww	569-2019-157
	(900 MHz, 30W)	
R 602	220k ohm ±5% 1/8W smd	569-0105-224
R 603	330 ohm ±5% 1/8W smd	569-0105-331
R 604	100 ohm ±5% .75W smd	569-0135-101
R 605	100k ohm ±5% 1/8W smd	569-0105-104
R 606	220k ohm ±5% 1/8W smd	569-0105-224
R 607	220k ohm ±5% 1/8W smd	569-0105-224
R 608	220k ohm ±5% 1/8W smd	569-0105-224
R 609	100 ohm ±5% .75W smd	569-0135-101
R 610	100 ohm ±5% .75W smd	569-0135-101
R 611	4.7k ohm ±5% 1/8W smd	569-0105-472
R 612	1k ohm ±5% 1/8W smd	569-0115-102
R 613	10k ohm ±5% 1/8W smd	569-0115-103
R 614	330 ohm ±5% 1W smd	569-0175-331
R 615	100 ohm ±5% 1/8 smd	569-0105-101
	(15W models)	
	2k ohm ±5% 1W smd	569-0175-202
	(30W models)	
R616	100 ohm ±5% 1/8 smd	569-0105-101
R617	430 ohm ±5% 1/8 smd	569-0115-431
R618	10 ohm ±5% 1/8 smd	569-0115-100

800/900 MHz RF AND PA BOARDS (CONT'D)

Ref No	Description	Part No.
R619	430 ohm ±5% 1/8 smd	569-0115-431
R 800	20k ohm ±5% 1/8W smd	569-0105-203
R 801	20k ohm ±5% 1/8W smd	569-0105-203
R 802	10k ohm ±5% 1/8W smd	569-0105-103
R 803	20k ohm ±5% 1/8W smd	569-0105-203
R 804	4.7k ohm ±5% 1/8W smd	569-0105-472
R 805	10k ohm ±5% 1/8W smd	569-0105-103
R 806	20k ohm ±5% 1/8W smd	569-0105-203
R 807	4.7k ohm ±5% 1/8W smd	569-0105-472
R 808	10k ohm ±5% 1/8W smd	569-0105-103
R 809	20k ohm ±5% 1/8W smd	569-0105-203
R 810	4.7k ohm ±5% 1/8W smd	569-0105-472
R 811	10k ohm ±5% 1/8W smd	569-0105-103
R 812	20k ohm ±5% 1/8W smd	569-0105-203
R 813	10k ohm ±5% 1/8W smd	569-0105-103
R 814	20k ohm ±5% 1/8W smd	569-0105-203
R 815	10k ohm ±5% 1/8W smd	569-0105-103
R 816	20k ohm ±5% 1/8W smd	569-0105-203
R 817	10k ohm ±5% 1/8W smd	569-0105-103
R 818	10k ohm ±5% 1/8W smd	569-0105-103
R 819	Zero ohm jumper	569-0105-001
R 820	Zero ohm jumper	569-0105-001
R 821	Zero ohm jumper	569-0105-001
R 822	4.7k ohm ±5% 1/8W smd (800 MHz models)	569-0105-472
	100k ohm ±5% 1/8W smd (900 MHz models)	569-0105-104
R 823	100k ohm ±5% 1/8W smd	569-0105-104
R 824	Zero ohm jumper	569-0105-001
R 825	560 ohm ±5% 1/8W smd	569-0115-561
R 826	4.7k ohm ±5% 1/8W smd (800 MHz models)	569-0105-472
	10k ohm ±5% 1/8W smd (900 MHz models)	569-0105-103
R 827	4.7k ohm ±5% 1/8W smd	569-0105-472
R 828	Zero ohm jumper	569-0105-001
R 829	15k ohm ±5% 1/8W smd (800 MHz models)	569-0105-153
	10k ohm ±5% 1/8W smd (900 MHz models)	569-0105-103
R 830	100 ohm ±5% 1/8W smd	569-0105-101
R 831	100 ohm ±5% 1/8W smd	569-0105-101
R 832	180 ohm ±5% 1/8W smd	569-0105-181
R 833	15k ohm ±5% 1/8W smd	569-0105-153
R 834	12k ohm ±5% 1/8W smd	569-0105-123

Ref No	Description	Part No.
R 835	560 ohm ±5% 1/8W smd	569-0115-561
R 836	33k ohm ±5% 1/8W smd	569-0105-333
R 837	68k ohm ±5% cer smd	569-0105-683
R 838	27k ohm ±5% 1/8W smd (800 MHz models)	569-0105-273
	24k ohm ±5% 1/8W smd (900 MHz models)	569-0105-243
R 839	Zero ohm jumper	569-0105-001
R 840	10k ohm ±5% 1/8W smd	569-0105-103
R 841	10k ohm ±5% 1/8W smd	569-0105-103
R 845	10 ohm ±5% 1/8W smd	569-0105-100
R 846	10k ohm ±5% 1/8W smd (800 MHz models)	569-0105-103
	11k ohm ±5% 1/8W smd (900 MHz models)	569-0105-113
R 848	15k ohm ±5% 1/8W smd	569-0105-153
R 849	470k ohm ±5% 1/8W smd	569-0105-474
R 850	100 ohm ±5% 1/8W smd	569-0105-101
R 851	100k ohm ±5% 1/8W smd (800 MHz models)	569-0105-104
	47k ohm ±5% 1/8W smd (900 MHz models)	569-0105-473
R 852	1.0k ohm ±5% 1/8W smd	569-0105-102
R 853	10k ohm ±5% 1/8W smd	569-0105-103
R 854	10k ohm ±5% 1/8W smd	569-0105-103
R 855	47 ohm ±5% 1/8W smd	569-0105-470
R 856	1.0k ohm ±5% 1/8W smd	569-0105-102
R 857	1.0k ohm ±5% 1/8W smd	569-0105-102
R 858	4.7k ohm ±5% 1/8W smd	569-0105-472
R 859	10k ohm ±5% 1/8W smd	569-0105-103
R 860	4.7k ohm ±5% 1/8W smd	569-0105-472
R 861	15 ohm ±5% 1/8W smd (800 MHz models)	569-0105-150
	0 ohm jumper (900 MHz models)	569-0105-001
R 862	22k ohm ±5% 1/8W smd	569-0105-223
R 863	22k ohm ±5% 1/8W smd	569-0105-223
RT 601	10k ohm ±5% thermistor	569-3013-007
S 001	Switch, rotary and push	583-2042-001
U 201	FM IF system SA676DK	544-2002-037
U 500	Op amp, dual 2904	544-2019-004
U 501	Regulator, 8V 0.7A 78M08	544-2003-081
U 502	Regulator, adjust 180 mA	544-2603-093
U 600	Power module, 20W 870 MHz (800 MHz models)	544-4001-127

AUDIO/LOGIC BOARD

Ref No	Description	Part No.
	Power module, 18W 900 MHz (900 MHz models)	544-4001-008
U 800	Shift register, 8-stage 4094	544-3016-094
U 801	Shift register, 8-stage 4094	544-3016-094
U 802	Potentiometer, 4-ch AD8403	544-0004-211
U 803	Op amp, dual 2904	544-2019-004
U 804	Synthesizer SA7025	544-3954-027
U 806	17.5 MHz TCXO ±1.5 ppm (800 MHz models)	518-7009-521
	14.85MHz TCXO ±1.0 ppm (900 MHz models)	518-7009-524
Z 200	860 MHz 20 MHz bw 3-p filter (800 MHz models)	532-2007-011
	938 MHz 6 MHz bw 3-p filter (900 MHz models)	532-2007-012
Z 201	860 MHz 20 MHz bw 3-p (800 MHz models)	532-2007-011
	938 MHz 6 MHz bw 3-p filter (900 MHz models)	532-2007-012
Z 202	450 kHz 9 kHz bw ceramic filter	532-2006-034
Z 203	807 MHz 18 MHz bw 2-p filter (800 MHz models)	532-2006-011
	888 MHz 3-pole ceramic filter (900 MHz models)	532-2006-042
Z 204	52.95 MHz 15 kHz bw 4-p filter (800 MHz models)	532-0009-009
	45 MHz 7.5 kHz bw 4-p filter (900 MHz models)	532-0009-028
Z 205	450 kHz 9 kHz bw ceramic filter	532-2006-034
Z 206	450 kHz ceramic filter	532-2004-016

Ref No	Description	Part No.
	AUDIO/LOGIC BOARD (ALL MODELS)	
C 100	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 101	470 pF NPO ±5% cer smd	510-3601-471
C 102	22 pF NPO ±5% cer smd	510-3601-220
C 103	22 pF NPO ±5% cer smd	510-3601-220
C 104	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 105	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 106	.22 µF X7R ±10% 50V cer smd	510-3606-224
C 107	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 108	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 109	470 pF NPO ±5% 50V cer smd	510-3601-471
C 110	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 111	10 µF 16V tantalum smd	510-2625-100
C 112	10 µF 16V tantalum smd	510-2625-100
C 113	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 114	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 115	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 116	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 117	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 118	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 119	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 120	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 121	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 300	.0012 µF X7R ±10% 50V cer smd	510-3605-122
C 301	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 302	.0012 µF X7R ±10% cer smd	510-3605-122
C 303	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 304	.033 µF X7R ±10% 50V cer smd	510-3606-333
C 305	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 306	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 307	.0033 µF X7R ±10% 50V cer smd	510-3605-332
C 308	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 309	4.7 µF 20V tantalum smd	510-2626-479
C 310	.0022 µF X7R ±10% 50V smd	510-3605-222
C 311	820 pF NPO ±5% 50V cer smd	510-3601-821
C 312	.039 µF X7R ±10% 50V cer smd	510-3605-393
C 313	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 314	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 315	4.7 µF 10V tantalum smd	510-2624-479
C 316	.0018 µF X7R ±10% 50V cer smd	510-3605-182
C 317	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 318	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 319	1.0 µF 35V tantalum smd	510-2628-109
C 320	680 pF ±5% NPO 50V cer smd	510-3601-681
C 321	.047 µF X7R ±10% 50V cer smd	510-3605-473
C 322	4.7 µF 20V tantalum smd	510-2626-479
C 323	.047 µF X7R ±10% 50V cer smd	510-3605-473
C 324	4.7 µF 20V tantalum smd	510-2626-479
C 325	.047 µF X7R ±10% 50V cer smd	510-3605-473
C 326	220 µF 25V electrolytic	510-4425-221
C 327	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 328	1.0 µF 35V tantalum smd	510-2628-109

AUDIO/LOGIC BOARD (CONT'D)

Ref No	Description	Part No.
C 329	.047 µF X7R ±10% 50V cer smd	510-3605-473
C 330	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 331	.0033 µF X7R ±10% 50V cer smd	510-3605-332
C 332	.0047 µF X7R ±10% 50V cer smd	510-3605-472
C 333	.0068 µF X7R ±10% 50V cer smd	510-3605-682
C 334	4.7 µF 20V tantalum smd	510-2626-479
C 335	4.7 µF 20V tantalum smd	510-2626-479
C 336	560 pF NPO ±5% 50V cer smd	510-3601-561
C 337	.047 µF X7R ±10% 50V cer smd	510-3605-473
C 338	56 pF NPO ±5% 50V cer smd	510-3601-560
C 339	4.7 µF 20V tantalum smd	510-2626-479
C 340	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 341	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 342	.0033 µF X7R ±10% 50V cer smd	510-3605-332
C 343	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 344	.0022 µF X7R ±10% 50V cer smd	510-3605-222
C 345	470 pF NPO ±5% 50V cer smd	510-3601-471
C 346	.22 µF X7R ±10% 50V cer smd	510-3606-224
C 347	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 348	4.7 µF 20V tantalum smd	510-2626-479
C 349	.047 µF X7R ±10% 50V cer smd	510-3605-473
C 350	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 351	.01 µF X7R ±10% 50V cer smd	510-3605-103
C 352	.22 µF X7R ±10% 50V cer smd	510-3606-224
C 353	.22 µF X7R ±10% 50V cer smd	510-3606-224
C 354	4.7 µF 20V tantalum smd	510-2626-479
C 355	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 356	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 357	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 358	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 359	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 360	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 361	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 362	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 363	.1 µF X7R ±10% 50V cer smd	510-3606-104
C 364	470 pF X7R ±10% 50V cer smd	510-3605-471
CR 100	18V zener SOT-23	523-2016-180
CR 101	5.6V zener SOT-23	523-2016-569
CR 102	5.6V zener SOT-23	523-2016-569
CR 103	5.6V zener SOT-23	523-2016-569
CR 104	5.6V zener SOT-23	523-2016-569
CR 105	5.6V zener SOT-23	523-2016-569
CR 106	Switching diode SOT-23	523-1504-002
CR 107	5.6V zener SOT-23	523-2016-569
CR 108	5.6V zener SOT-23	523-2016-569

Ref No	Description	Part No.
CR 109	5.6V zener SOT-23	523-2016-569
CR 110	5.6V zener SOT-23	523-2016-569
CR 111	5.6V zener SOT-23	523-2016-569
CR 112	5.6V zener SOT-23	523-2016-569
CR 113	5.6V zener SOT-23	523-2016-569
CR 114	Switching diode SOT-23	523-1504-002
CR 115	5.6V zener SOT-23	523-2016-569
CR 116	5.6V zener SOT-23	523-2016-569
CR 118	Switching diode SOT-23	523-1504-002
CR 119	5.6V zener SOT-23	523-2016-569
CR 120	Switching diode SOT-23	523-1504-002
CR 121	Switching diode SOT-23	523-1504-002
CR 122	18V zener SOT-23	523-2016-180
CR 123	18V zener SOT-23	523-2016-180
CR 128	Switching diode SOT-23	523-1504-002
CR 129	5.6V zener SOT-23	523-2016-569
CR 300	Dual sw diode SOT-23	523-1504-023
CR 301	Dual sw diode SOT-23 (early versions)	523-1504-023
	Switching diode SOT-23 (later versions w/separate diodes)	523-1504-012
CR 302	3.3V zener SOT-23 (early versions)	523-2016-339
	Switching diode SOT-23 (later versions)	523-1504-012
CR 303	18V zener SOT-23	523-2016-180
CR 304	Switching diode SOT-23	523-1504-002
CR 305	Dual diodes-com anodes	523-1504-024
CR306	3.3V zener SOT-23 (later versions)	523-2016-339
DS 003	LED, green	549-4003-011
DS 004	LED, red	549-4003-012
F 100	Fuse, 2.0 A smd	534-5001-009
F 300	Fuse, 0.6A smd	534-5001-002
J 100	Connector, 20-pin	515-7111-286
J 101	Connector, 6-pin male	515-7111-255
J 301	Connector, 13-pin male	515-7111-262
J 302	Connector, 20-pin female	515-7111-230
J 303	3.6mm spkr jack enclosed	515-2001-011
J 304	Modular jack, 8-pin spec (mic jk)	515-2006-040
MP 101	Isodamp foam	018-1132-019
MP 450	Shim substrate	010-0345-450

AUDIO/LOGIC BOARD (CONT'D)

Ref No	Description	Part No.
PC 100	PC board, audio/logic	035-9800-100
Q 100	N-channel MOSFET DPAK	576-0006-114
Q 101	NPN general purpose	576-0003-658
Q 102	NPN general purpose	576-0003-658
Q 103	PNP low noise amp	576-0003-657
Q 104	NPN digital, w/resistors	576-0003-616
Q 105	PNP low noise amp	576-0003-657
Q 106	NPN digital w/resistors	576-0003-616
Q 107	PNP low noise amp	576-0003-657
Q 108	NPN general purpose	576-0003-658
Q 109	NPN general purpose	576-0003-658
Q 110	NPN general purpose	576-0003-658
Q 111	NPN digital, w/resistors	576-0003-616
Q 115	NPN general purpose	576-0003-658
Q 300	NPN general purpose	576-0003-658
Q 301	NPN digital, w/resistors	576-0003-616
Q 302	NPN digital, w/resistors	576-0003-616
Q 303	NPN digital, w/resistors	576-0003-616
Q 304	NPN digital, w/resistors	576-0003-616
Q 305	NPN digital, w/resistors	576-0003-616
Q 306	NPN general purpose	576-0003-658
Q 307	NPN digital, w/resistors	576-0003-616
Q 308	NPN digital, w/resistors	576-0003-616
R 100	1.0k ohm ±5% 1/8W smd	569-0105-102
R 101	47k ohm ±5% 1/8W smd	569-0105-473
R 102	10k ohm ±5% 1/8W smd	569-0105-103
R 103	1.0k ohm ±5% 1/8W smd	569-0105-102
R 104	47k ohm ±5% 1/8W smd	569-0105-473
R 105	10k ohm ±5% 1/8W smd	569-0105-103
R 106	4.7k ohm ±5% 1/8W smd	569-0105-472
R 107	47k ohm ±5% 1/8W smd	569-0105-473
R 108	680k ohm ±5% 1/8W smd	569-0105-684
R 109	47k ohm ±5% 1/8W smd	569-0105-473
R 110	1M ohm ±5% 1/8W smd	569-0105-105
R 111	10k ohm ±5% 1/8W smd	569-0105-103
R 112	10k ohm ±5% 1/8W smd	569-0105-103
R 113	10k ohm ±5% 1/8W smd	569-0105-103
R 114	Zero ohm smd jumper	569-0105-001
R 115	10k ohm ±5% 1/8W smd	569-0105-103
R 116	47k ohm ±5% 1/8W smd	569-0105-473
R 117	47k ohm ±5% 1/8W smd	569-0105-473
R 118	470 ohm ±5% 1/8W smd	569-0105-471
R 119	47k ohm ±5% 1/8W smd	569-0105-473

Ref No	Description	Part No.
R 120	4.7k ohm ±5% 1/8W smd	569-0105-472
R 121	10k ohm ±5% 1/8W smd	569-0105-103
R 122	10k ohm ±5% 1/8W smd	569-0105-103
R 123	47k ohm ±5% 1/8W smd	569-0105-473
R 124	10k ohm ±5% 1/8W smd	569-0105-103
R 125	47k ohm ±5% 1/8W smd	569-0105-473
R 126	1M ohm ±5% 1/8W smd	569-0105-105
R 127	10k ohm ±5% 1/8W smd	569-0105-103
R 128	1.0k ohm ±5% 1/8W smd	569-0105-102
R 129	10k ohm ±5% 1/8W smd	569-0105-103
R 130	47k ohm ±5% 1/8W smd	569-0105-473
R 131	10k ohm ±5% 1/8W smd	569-0105-103
R 132	10k ohm ±5% 1/8W smd	569-0105-103
R 133	47k ohm ±5% 1/8W smd	569-0105-473
R 134	47k ohm ±5% 1/8W smd	569-0105-473
R 135	47k ohm ±5% 1/8W smd	569-0105-473
R 136	10k ohm ±5% 1/8W smd	569-0105-103
R 137	470 ohm ±5% 1/8W smd	569-0105-471
R 138	10k ohm ±5% 1/8W smd	569-0105-103
R 139	47k ohm ±5% 1/8W smd	569-0105-473
R 140	470 ohm ±5% 1/8W smd	569-0105-471
R 141	10k ohm ±5% 1/8W smd	569-0105-103
R 142	10k ohm ±5% 1/8W smd	569-0105-103
R 143	2.7k ohm ±5% 1/8W smd	569-0105-272
R 144	1.0k ohm ±5% 1/8W smd	569-0105-102
R 145	10k ohm ±5% 1/8W smd	569-0105-103
R 146	470 ohm ±5% 1/8W smd	569-0105-471
R 147	47k ohm ±5% 1/8W smd	569-0105-473
R 148	10k ohm ±5% 1/8W smd	569-0105-103
R 149	10k ohm ±5% 1/8W smd	569-0105-103
R 150	470 ohm ±5% 1/8W smd	569-0105-471
R 151	470 ohm ±5% 1/8W smd	569-0105-471
R 152	470 ohm ±5% 1/8W smd	569-0105-471
R 153	10k ohm ±5% 1/8W smd	569-0105-103
R 154	470 ohm ±5% 1/8W smd	569-0105-471
R 155	10k ohm ±5% 1/8W smd	569-0105-103
R 156	470 ohm ±5% 1/8W smd	569-0105-471
R 157	47k ohm ±5% 1/8W smd	569-0105-473
R 158	470 ohm ±5% 1/8W smd	569-0105-471
R 159	10k ohm ±5% 1/8W smd	569-0105-103
R 160	10k ohm ±5% 1/8W smd	569-0105-103
R 161	24.3k ohm ±1% 1/8W smd	569-0111-438
R 162	10k ohm ±5% 1/8W smd	569-0105-103
R 164	10k ohm ±5% 1/8W smd	569-0105-103
R 165	47k ohm ±5% 1/8W smd	569-0105-473

AUDIO/LOGIC BOARD (CONT'D)

Ref No	Description	Part No.
R 166	10k ohm ±5% 1/8W smd	569-0105-103
R 167	47k ohm ±5% 1/8W smd	569-0105-473
R 168	3.40k ohm ±1% 1/8W smd	569-0111-352
R 169	22k ohm ±5% 1/8W smd	569-0105-223
R 170	4.7k ohm ±5% 1/8W smd	569-0115-472
R 171	10k ohm ±5% 1/8W smd	569-0105-103
R 172	22k ohm ±5% 1/8W smd	569-0105-223
R 173	22k ohm ±5% 1/8W smd	569-0105-223
R 174	4.7k ohm ±5% 1/8W smd	569-0105-472
R 175	4.7k ohm ±5% 1/8W smd	569-0105-472
R 176	10k ohm ±5% 1/8W smd	569-0105-103
R 177	100 ohm ±5% 1/8W smd	569-0105-101
R 178	470 ohm ±5% 1/8W smd	569-0105-471
R 179	470 ohm ±5% 1/8W smd	569-0105-471
R 193	4.7k ohm ±5% 1/8W smd	569-0105-472
R 194	10k ohm ±5% 1/8W smd	569-0105-103
R 196	10k ohm ±5% 1/8W smd	569-0105-103
R 197	10k ohm ±5% 1/8W smd	569-0115-103
R 198	Zero ohm smd jumper	569-0105-001
R 199	10k ohm ±5% 1/8W smd	569-0115-103
R 200	1.0k ohm ±5% 1/8W smd	569-0105-102
R 300	6.8k ohm ±5% 1/8W smd	569-0105-682
R 301	4.7k ohm ±5% 1/8W smd	569-0105-472
R 302	620 ohm ±5% 1/8W smd	569-0105-621
R 303	100k ohm ±5% 1/8W smd	569-0105-104
R 304	10k ohm ±5% 1/8W smd	569-0105-103
R 305	390k ohm ±5% 1/8W smd	569-0105-394
R 306	180k ohm ±5% 1/8W smd	569-0105-184
R 307	5.6k ohm ±5% 1/8W smd	569-0105-562
R 308	100k ohm ±5% 1/8W smd (early versions)	569-0105-104
	150k ohm ±5% 1/8W smd (later versions)	569-0105-154
R 310	150k ohm ±5% 1/8W smd	569-0105-154
R 311	20k ohm ±5% 1/8W smd	569-0105-203
R 312	47k ohm ±5% 1/8W smd	569-0105-473
R 313	47k ohm ±5% 1/8W smd	569-0105-473
R 314	100k ohm ±5% 1/8W smd	569-0105-104
R 315	100k ohm ±5% 1/8W smd	569-0105-104
R 316	47k ohm ±5% 1/8W smd	569-0105-473
R 317	27k ohm ±5% 1/8W smd	569-0105-273
R 318	Thermistor, 10k ohm ±5%	569-3013-007
R 319	330k ohm ±5% 1/8W smd	569-0105-334
R 320	62k ohm ±5% 1/8W smd	569-0105-623

Ref No	Description	Part No.
R 321	470 ohm ±5% 1/8W smd	569-0105-471
R 322	10k ohm ±5% 1/8W smd	569-0105-103
R 323	62k ohm ±5% 1/8W smd	569-0105-623
R 324	33k ohm ±5% 1/8W smd	569-0105-333
R 325	5.6k ohm ±5% 1/8W smd	569-0105-562
R 326	33k ohm ±5% 1/8W smd	569-0105-333
R 327	33k ohm ±5% 1/8W smd	569-0105-333
R 328	62k ohm ±5% 1/8W smd	569-0105-623
R 329	33k ohm ±5% 1/8W smd	569-0105-333
R 330	62k ohm ±5% 1/8W smd	569-0105-623
R 331	33k ohm ±5% 1/8W smd	569-0105-333
R 332	47k ohm ±5% 1/8W smd	569-0105-473
R 333	62k ohm ±5% 1/8W smd	569-0105-623
R 334	390k ohm ±5% 1/8W smd	569-0105-394
R 335	33k ohm ±5% 1/8W smd	569-0105-333
R 336	62k ohm ±5% 1/8W smd	569-0105-623
R 337	33k ohm ±5% 1/8W smd	569-0105-333
R 338	62k ohm ±5% 1/8W smd	569-0105-623
R 339	10k ohm ±5% 1/8W smd	569-0105-103
R 340	47k ohm ±5% 1/8W smd	569-0105-473
R 341	47k ohm ±5% 1/8W smd	569-0105-473
R 342	33k ohm ±5% 1/8W smd	569-0105-333
R 343	27k ohm ±5% 1/8W smd	569-0105-273
R 344	560k ohm ±5% 1/8W smd	569-0105-564
R 345	62k ohm ±5% 1/8W smd	569-0105-623
R 346	62k ohm ±5% 1/8W smd	569-0105-623
R 347	10k ohm ±5% 1/8W smd	569-0105-103
R 348	150k ohm ±5% 1/8W smd	569-0105-154
R 349	1.5k ohm ±5% 1/8W smd	569-0105-152
R 350	5.6k ohm ±5% 1/8W smd	569-0105-562
R 351	1.0k ohm ±5% 1/8W smd	569-0105-102
R 352	820k ohm ±5% 1/8W smd	569-0105-824
R 353	18k ohm ±5% 1/8W smd	569-0105-183
R 354	Zero ohm smd jumper	569-0115-001
R 355	100k ohm ±5% 1/8W smd	569-0105-104
R 356	180k ohm ±5% 1/8W smd	569-0105-184
R 357	Zero ohm smd jumper	569-0115-001
R 358	4.7k ohm ±5% 1/8W smd	569-0105-472
R 359	4.7k ohm ±5% 1/8W smd	569-0105-472
R 360	470 ohm ±5% 1/8W smd	569-0105-471
R 362	Zero ohm smd jumper	560-0105-001
R 363	Zero ohm smd jumper	560-0105-001
R 364	Zero ohm smd jumper	560-0105-001
R 365	470k ohm ±5% 1/8W smd	569-0105-474
R 366	Zero ohm smd jumper	560-0105-001

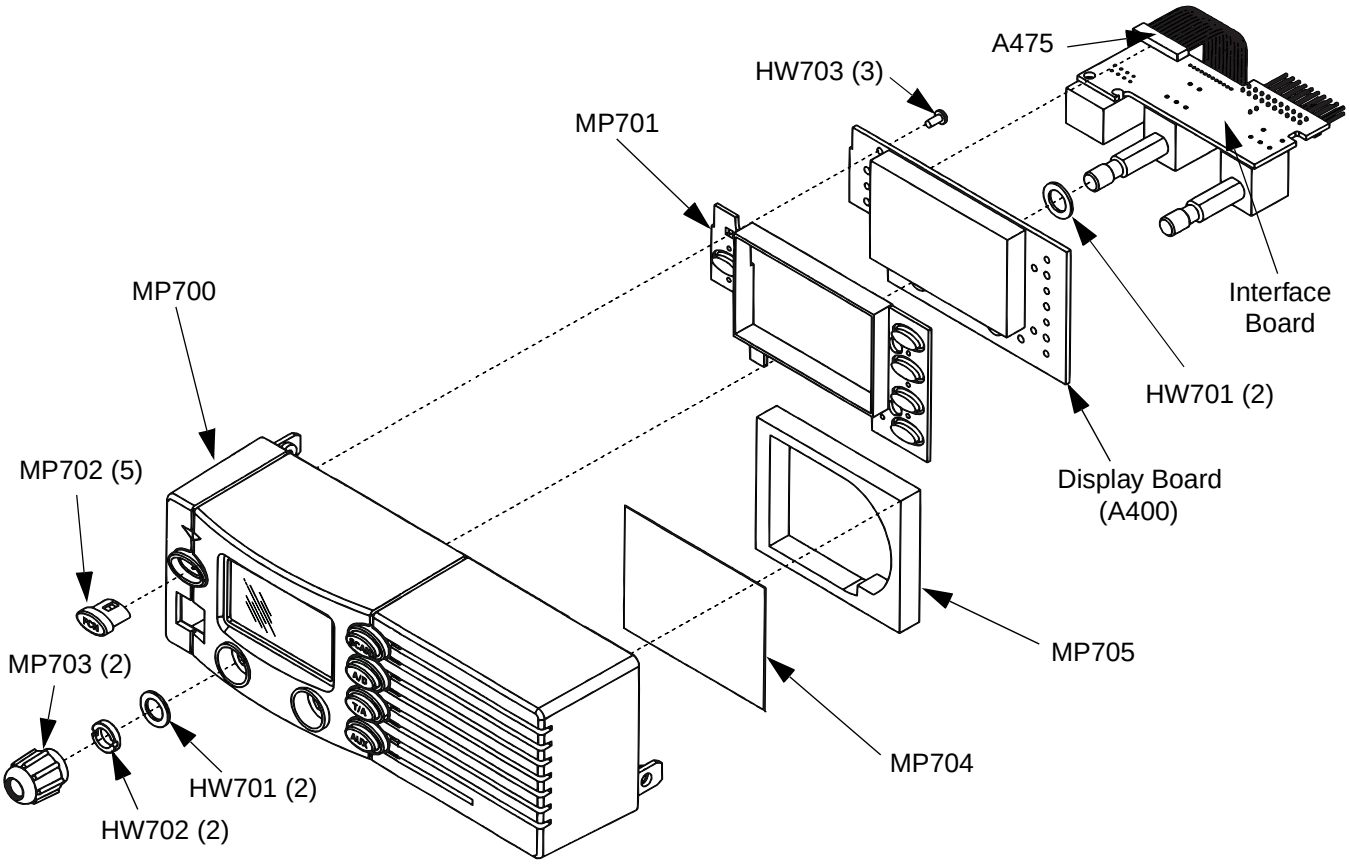
AUDIO/LOGIC BOARD (CONT'D)

Ref No	Description	Part No.
R 367	470k ohm ±5% 1/8W smd	569-0105-474
R 368	Zero ohm smd jumper	560-0105-001
R 369	5.6k ohm ±5% 1/8W smd	569-0105-562
R 370	470 ohm ±5% 1/8W smd	569-0105-471
R 371	39k ohm ±5% 1/8W smd	569-0105-393
R 372	82k ohm ±5% cer smd	569-0105-823
R 373	3.3k ohm ±5% 1/8W smd	569-0105-332
R 374	68k ohm ±5% cer smd	569-0105-683
R 375	150k ohm ±5% 1/8W smd	569-0105-154
R 376	Zero ohm smd jumper	560-0105-001
R 377	4.7k ohm ±5% 1/8W smd	569-0105-472
R 378	470 ohm ±5% 1/8W smd	569-0105-471
R 379	6.8k ohm ±5% 1/8W smd	569-0105-682
R 380	1.0k ohm ±5% 1/8W smd	569-0105-102
R 381	1.0k ohm ±5% 1/8W smd	569-0105-102
R 382	4.7k ohm ±5% 1/8W smd	569-0105-472
R 383	Zero ohm smd jumper	569-0115-001
R 384	4.7k ohm ±5% 1/8W smd	569-0105-472
R 385	4.7k ohm ±5% 1/8W smd	569-0105-472
R 386	27k ohm ±5% 1/8W smd	569-0105-273
R 387	47k ohm ±5% 1/8W smd	569-0105-473
R 388	47k ohm ±5% 1/8W smd	569-0105-473
R 389	82k ohm ±5% cer smd	569-0105-823
R 390	100k ohm ±5% 1/8W smd	569-0105-104
R 391	100k ohm ±5% 1/8W smd	569-0105-104
R 392	330k ohm ±5% 1/8W smd	569-0105-334
R 393	330k ohm ±5% 1/8W smd	569-0105-334
R 394	10k ohm ±5% 1/8W smd	569-0105-103
R 395	27k ohm ±5% 1/8W smd	569-0105-273
R 397	10k ohm ±5% 1/8W smd	569-0105-103
R 399	Zero ohm smd jumper	569-0115-001
R 400	20k ohm ±5% 1/8W smd	569-0105-203
R 401	620 ohm ±5% 1/8W smd	569-0105-621
R 402	330k ohm ±5% 1/8W smd	569-0105-334
R 403	20k ohm ±5% 1/8W smd	569-0105-203
R 404	120k ohm ±5% 1/8W smd	569-0105-124
R 405	10k ohm ±5% 1/8W smd	569-0105-103
R 406	620 ohm ±5% 1/8W smd	569-0105-621
R 407	10k ohm ±5% 1/8W smd	569-0105-103
R 408	150k ohm ±5% 1/8W smd	569-0105-154
R 409	10k ohm ±5% 1/8W smd	569-0105-103
R 410	6.8k ohm ±5% 1/8W smd	569-0105-682
R 411	22k ohm ±5% 1/8W smd	569-0105-223
R 412	1.0k ohm ±5% 1/8W smd	569-0105-102

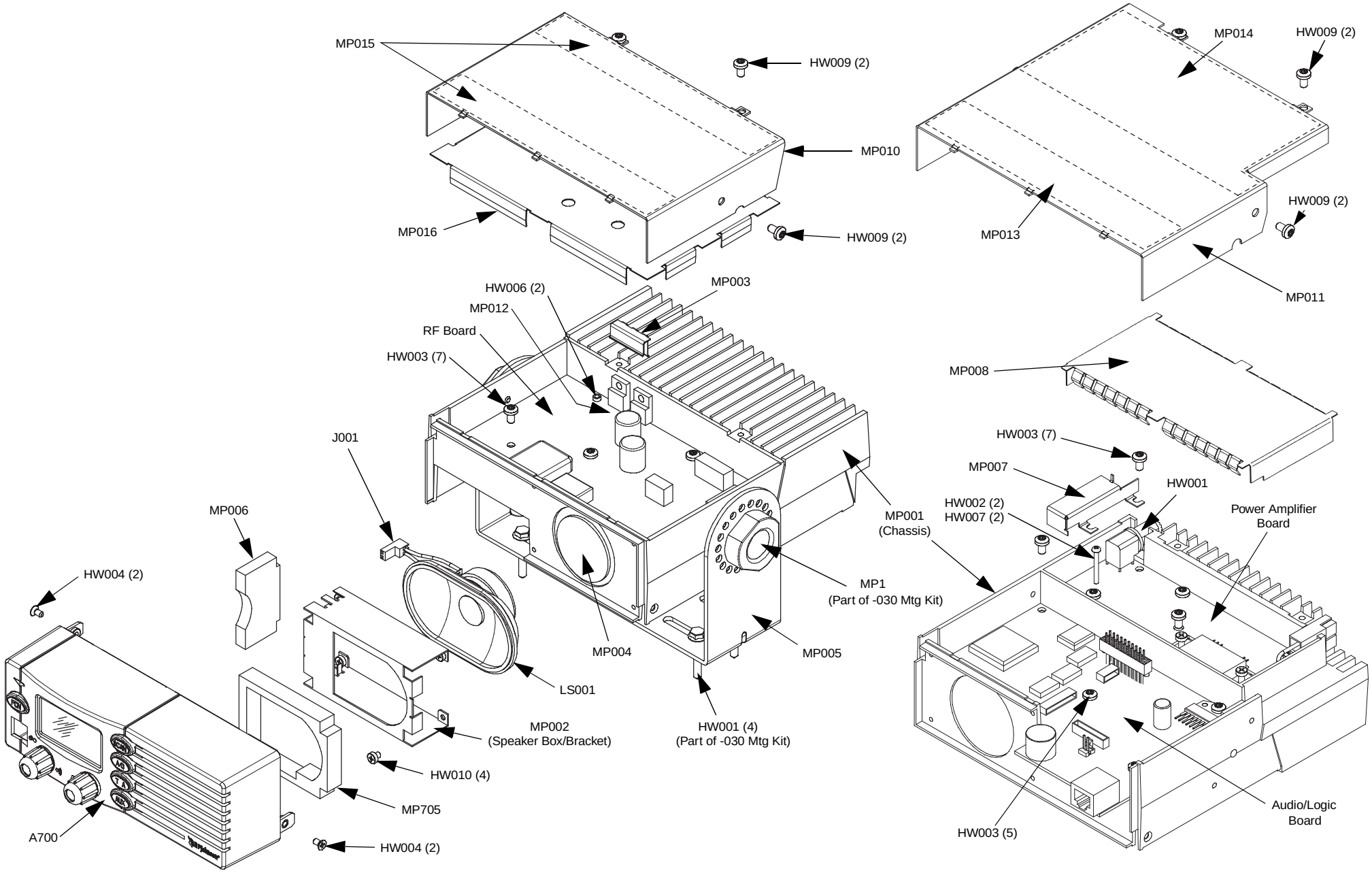
Ref No	Description	Part No.
R 413	1.0k ohm ±5% 1/8W smd	569-0105-102
R 414	4.7k ohm ±5% 1/8W smd	569-0105-472
R 415	10k ohm ±5% 1/8W smd	569-0105-103
R 416	10k ohm ±5% 1/8W smd	569-0105-103
R 417	27k ohm ±5% 1/8W smd	569-0105-273
R 418	10k ohm ±5% 1/8W smd	569-0105-103
R 419	10k ohm ±5% 1/8W smd	569-0105-103
R 420	10k ohm ±5% 1/8W smd	569-0105-103
R 421	10k ohm ±5% 1/8W smd	569-0105-103
R 422	1.0k ohm ±5% 1/8W smd	569-0105-102
R 423	4.7k ohm ±5% 1/8W smd	569-0105-472
R 424	1.0k ohm ±5% 1/8W smd	569-0105-102
R 425	4.7k ohm ±5% 1/8W smd	569-0105-472
R 426	7.5k ohm ±5% 1/8W smd	569-0105-752
R 428	51 ohm ±5% 1/8W smd	569-0105-510
RT 301	10k ohm thermistor	569-3013-007
U 100	Low volt sensor MC33164D	544-2003-074
U 101	Microcomputer, MC68HC11	544-5001-018
U 102	4k x 8 bit serial EEPROM X25320	544-5001-416
U 103	OR, 2-input quad 74HC32	544-3766-032
U 104	NAND, 2-input quad 74HC00	544-3766-000
U 105	Regulator, 5V .5A 78M05	544-2003-079
U 106	Demux, 10 of 8 74HC138	544-3766-138
U 107	8k x 8 CMOS static RAM AT3864	544-5002-115
U 108	EPROM, Flash 128k x 8 AT29C010	544-5001-211
U 109	Mux, 2-input quad 74HC157	544-3766-157
U 110	D-flip flop octal 74HC574	544-3766-574
U 111	D-flip flop octal 74HC574	544-3766-574
U 112	D-flip flop octal 74HC574	544-3766-574
U 300	Op amp, quad MC3303	544-2020-008
U 301	Op amp, quad MC3303	544-2020-008
U 302	Op amp, quad MC3303	544-2020-008
U 303	Op amp, quad MC3303	544-2020-008
U 304	Op amp, dual 2904	544-2019-004
U 305	Shift reg. 8-stage MC4094	544-3016-094
U 306	Audio amp, 3W w/vol control	544-2006-025
U 307	Bilateral switch, quad MC4066	544-3016-066
U 308	Bilateral switch, quad MC4066	544-3016-066
Y 100	9.8304 MHz crystal	521-0009-830

Ref No	Description	Part No.
	9800-SERIES RADIO MOUNTING KIT PART NO. 023-9800-030	
HW 001	Screw, No. 10 self drilling (4)	575-9077-545
MP 001	Tri knob (2)	547-0016-008
	9800-SERIES REMOTE MOUNTING KIT PART NO. 023-9800-040	
HW 001	Screw, No. 10 self drilling (4)	575-9077-545
HW 002	Flat washer, vulcanized (2)	596-6400-030
MP 004	Mounting bracket, rem ctrl unit	017-2227-057
MP 001	Tri knob (2)	547-0016-008
	DC POWER CABLE AND HARDWARE KIT PART NO. 023-9800-410 (10 Ft) PART NO. 023-9800-422 (22 Ft)	
A 001	Mic clip ground wire assembly	023-7171-911
EP101	Power connector contact (2)	515-9033-006
EP104	Ring term, 3/8” 10-12 AWG (1)	586-0001-019
EP105	Ring term, 3/4" 10-12 AWG (1)	586-0001-036
F 201	Fuse kit, 15A and 7A	534-0003-100
FH101	Fuseholder assembly includes:	
	Body	534-1004-031
	Knob w/washer	534-1004-032
	Contact, 14-16 AWG (2)	534-1004-037
	Spring	534-1004-035
HW201	Screw, 4-24 x 5/16"sheet metal (3)	575-3604-010
MP201	HD mic clip	023-3514-001
P 101	Power connector housing, dual	515-9033-012
W 101	Wire, 12 AWG stranded red	597-7021-202
W 103	Wire, 12 AWG stranded blue	597-7021-206
	ACCESSORY WIRE KIT PART NO. 023-9750-011	
F 001	Fuse, 1A 250V FB AGC	534-0003-020
FH001	Fuseholder includes:	
	Fuse contact, 16-20 AWG (2)	586-9004-001
	Body	534-1004-031
	Knob	534-1004-032
	Spring	534-1004-035
HW001	Crimp pin contact (7)	515-1501-055
P 100	Receptacle housing, 8-pin (2)	515-1501-050

Ref No	Description	Part No.
	AMPLIFIED DYNAMIC MICROPHONE PART NO. 250-0740-300	
C 001	3.3 µF 16V tantalum chip	510-2625-339
C 002	220 pF ±5% NPO 50V cer chip	510-3602-221
EP001	Contact .038" diameter	586-9008-100
EP002	Mic cord w/mod connector	597-2002-113
EP004	Terminal (on hanger)	022-0069-011
HW001	Screw 4-20 x 3/8	575-5604-012
HW004	Screw 2-56 x 3/8	575-1602-012
MK001	Dynamic mic cartridge	589-1011-003
MP001	Case front black	032-0426-100
MP002	Case back black	032-0427-100
MP003	Actuator black	032-0428-050
MP004	Cartridge gasket	032-0429-075
MP005	Blast filter	018-1033-002
MP006	Switch bracket	017-1885-030
MP007	Hanger button	013-1216-005
MP008	Crimp retainer	017-2222-005
MP009	Rubber bumper	018-0798-009
MP010	Backing plate	015-0876-026
MP011	Strain relief, mic cord	032-0429-085
MP012	Shim support, rubber bumper	017-2222-007
MP020	Foam support	018-0798-012
NP001	Nameplate	559-0039-026
PC001	PC board, amplifier	035-0441-020
Q 001	NPN amplifier SOT-23	576-0003-658
R 001	51k ohm ±5% 1/8W chip	569-0115-513
R 002	18 ohm ±5% 1/8W chip	569-0115-180
S 001	Leaf switch SPST	583-1004-031
	15 WATT, 4.7-OHM SPEAKER (BLACK) PART NO. 250-0151-010	
HW000	Screw, self-drilling	575-9077-543
HW001	Strain relief (in case back)	574-0003-008
HW003	Screw, 4-20 x 1/2 pan head	575-5604-016
HW005	Foam gasket	018-1126-001
HW006	Retaining washer	596-9210-012
LS001	Speaker, 5" 15W 4.7 ohm	589-1016-004
MP000	Mounting bracket (black)	032-0760-004
MP000	Tri knob 10-32	547-0016-004
MP001	Case front (black)	032-0758-004
MP002	Case back (black)	032-0759-004
NP001	Overlay, speaker front	559-0072-010
P 001	Miniature phone plug	515-0020-003
W 001	Cable, 2-cond 18 AWG	597-2006-100



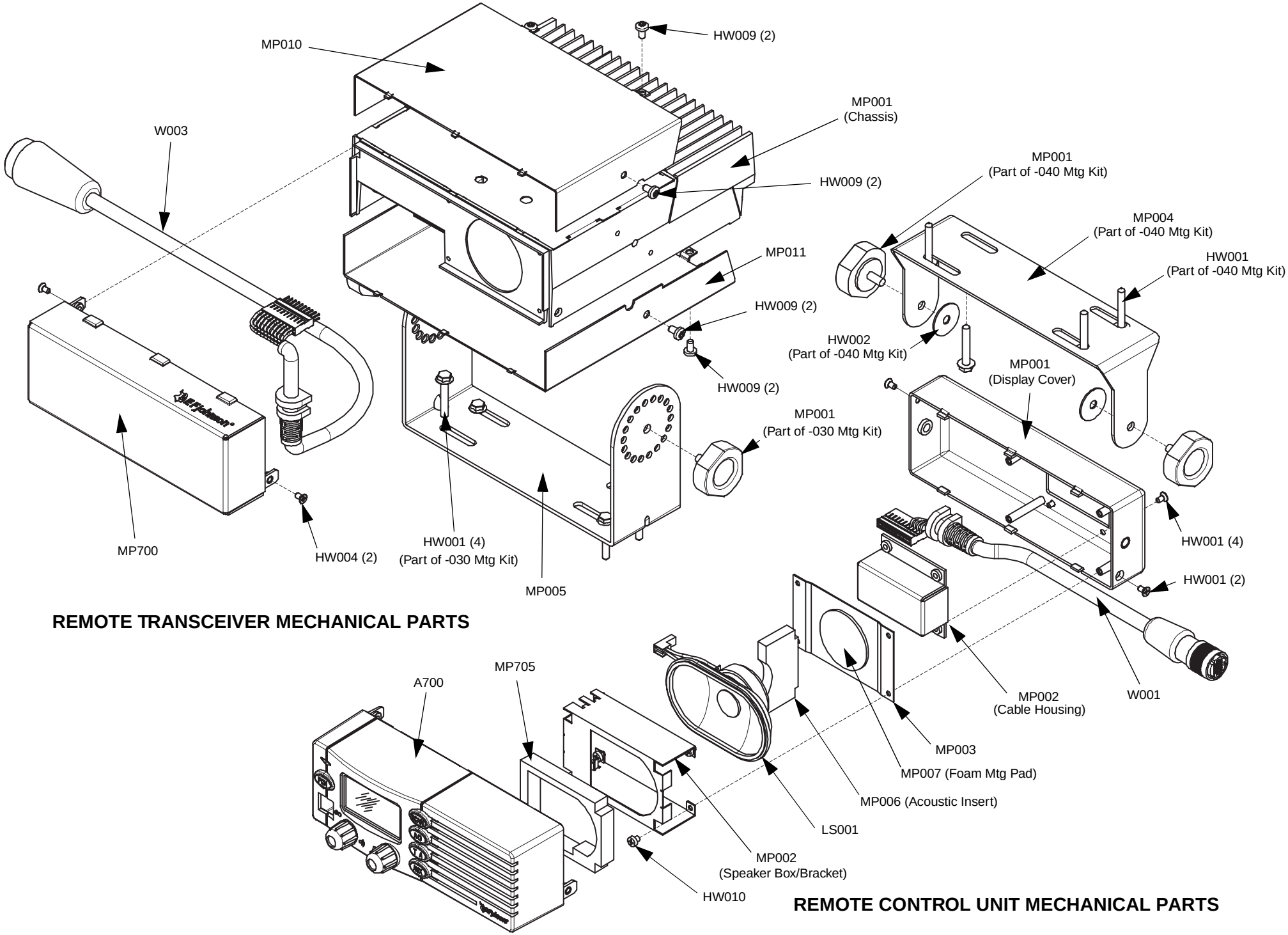
FRONT PANEL EXPLODED VIEW



FRONT AND TOP MECHANICAL PARTS

BOTTOM MECHANICAL PARTS

February 2001
Part No. 001-9800-001



REMOTE TRANSCEIVER MECHANICAL PARTS

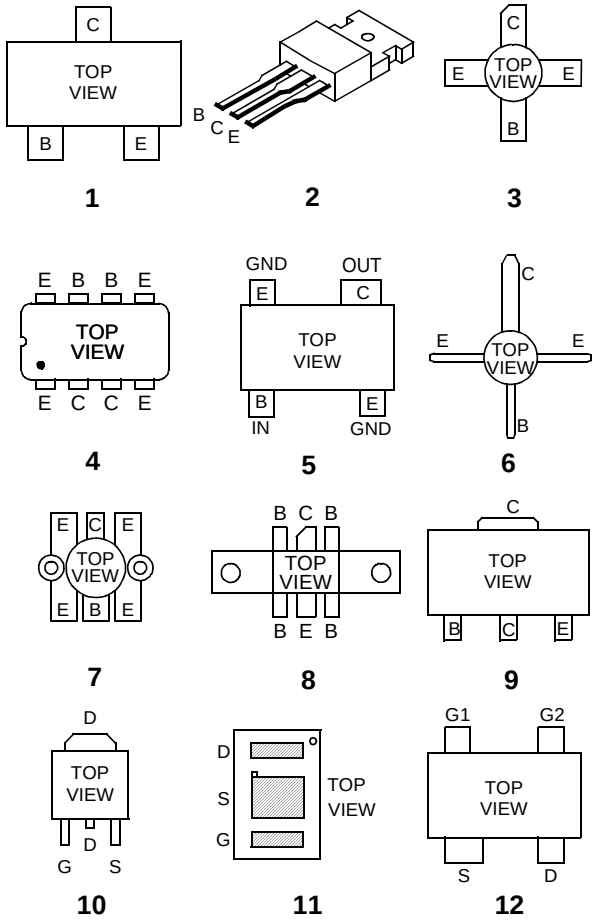
REMOTE CONTROL UNIT MECHANICAL PARTS

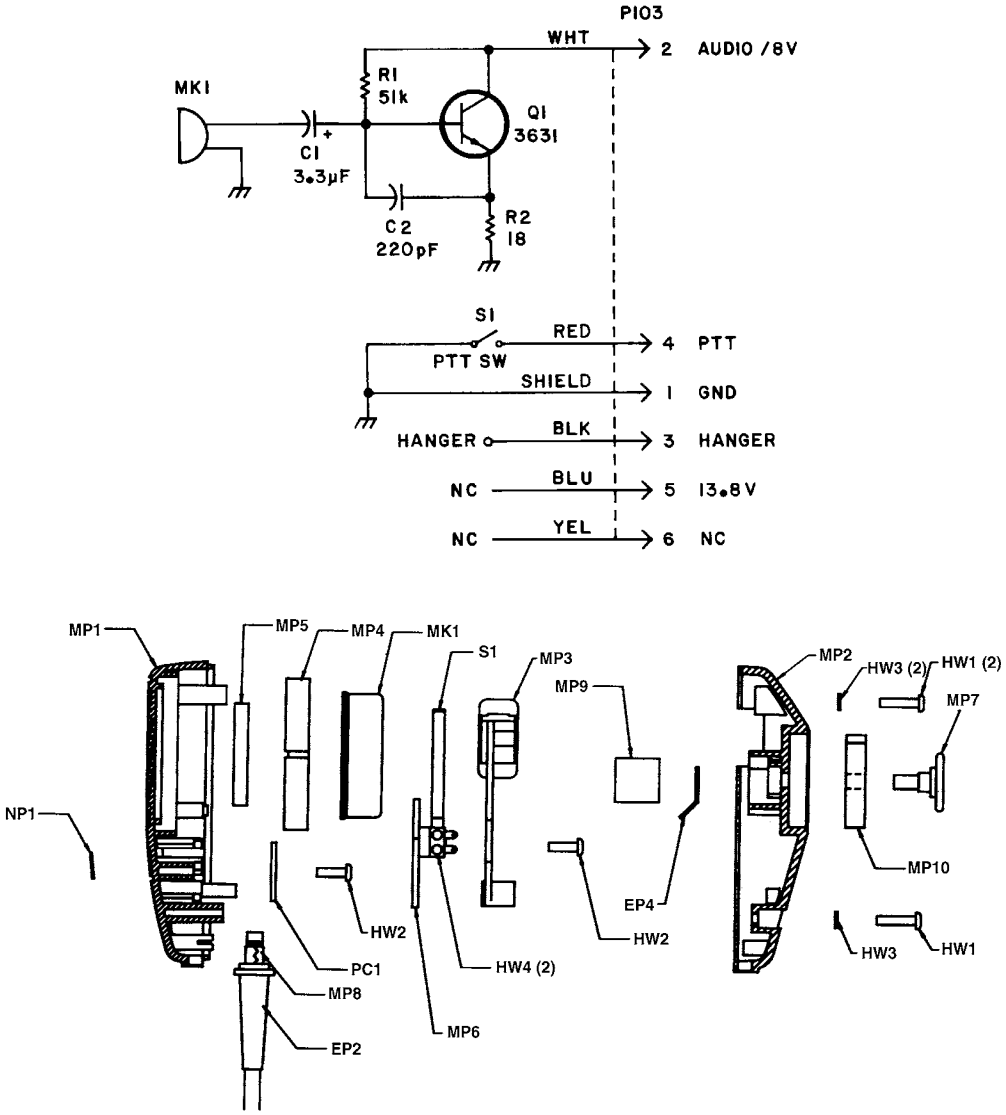
February 2001
Part No. 001-9800-001

SECTION 6 SCHEMATIC DIAGRAMS AND COMPONENT LAYOUTS

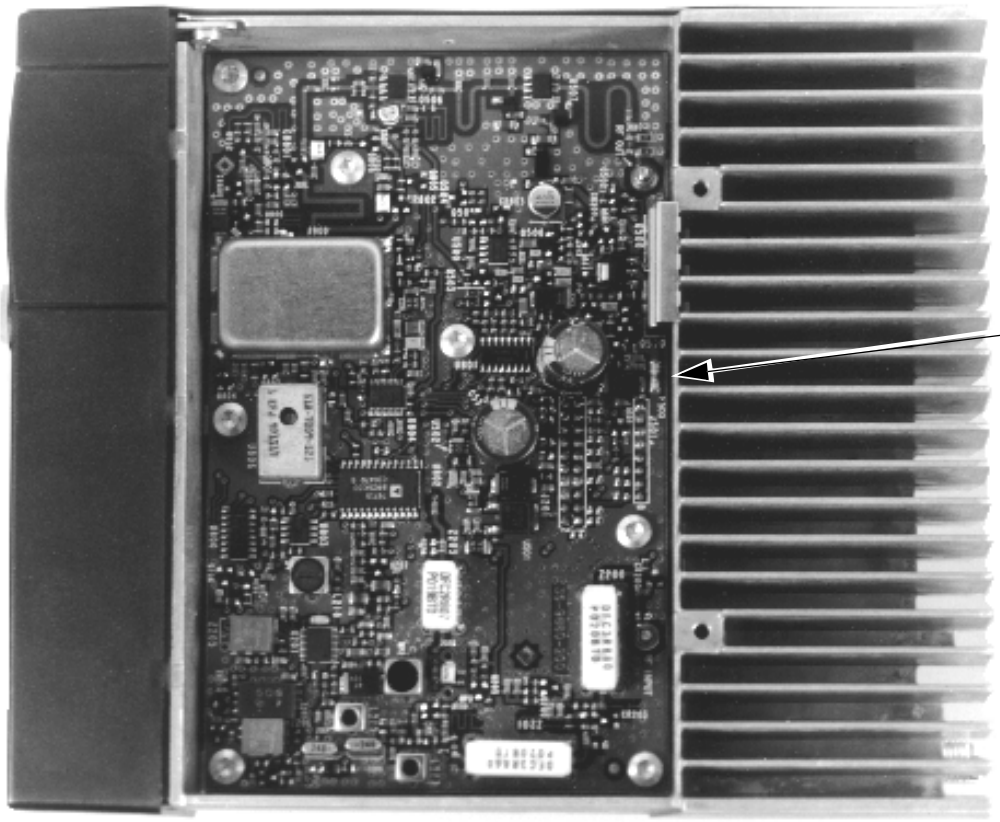
TRANSISTOR AND DIODE BASING DIAGRAMS

TRANSISTORS		
Part Number	**Basing Diagram**	**Identification**
576-0001-300	1	1R
576-0002-057	2	-
576-0002-070	3	-
576-0003-604	4	3604
576-0003-612	1	2T
576-0003-616	1	26
576-0003-618	5	10
576-0003-634	1	3B
576-0003-636	1	R25
576-0003-651	1	24
576-0003-657	1	2A
576-0003-658	1	1A
576-0004-098	4	-
576-0004-401	6	-
576-0004-402	7	-
576-0004-817	8	-
576-0006-027	9	-
576-0006-114	10	-
576-0006-120	11	-
576-0006-234	12	MO
576-0006-450	11	-
576-0007-013	2	-
Number on Schematic		
DIODES		
523-1504-001	-	4D
523-1504-002	-	5A
523-1504-016	-	5F
523-1504-023	-	A7
523-1504-024	-	A1
523-1504-032	-	-
523-1504-035		AS
523-2016-120	-	Y2
523-2016-180	-	Y6
523-2016-339	-	W6 or Z14
523-2016-519	-	Z2
523-2016-569	-	Z3

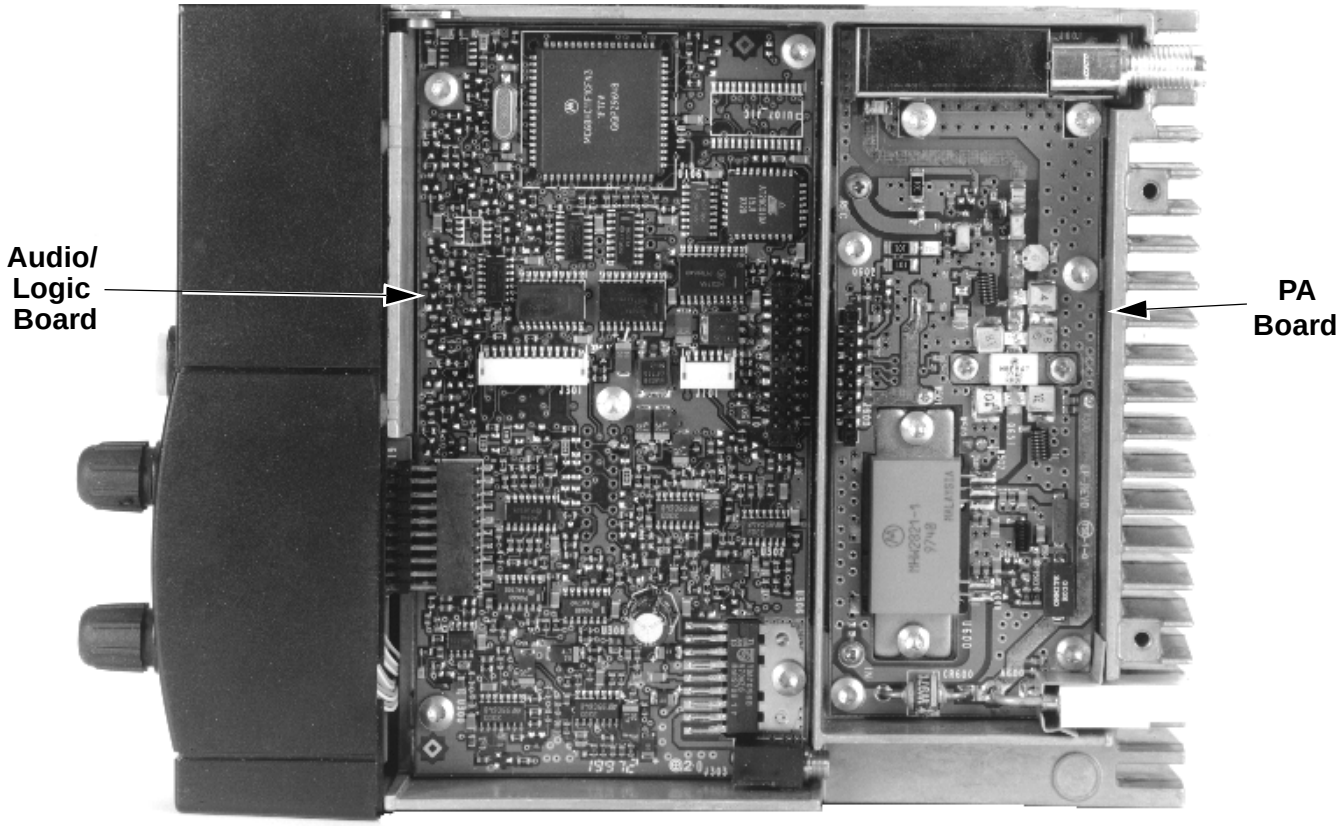




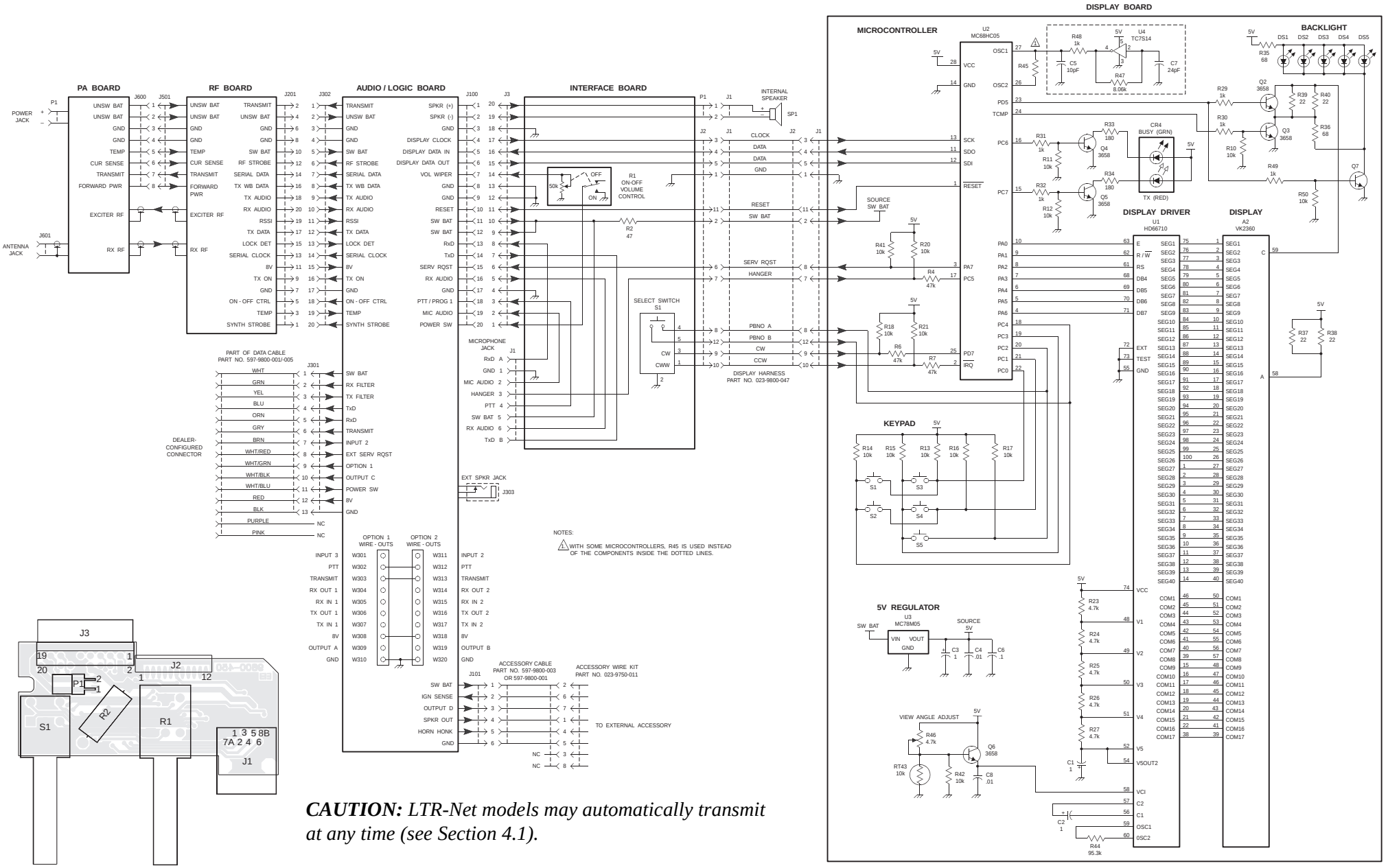
AMPLIFIED DYNAMIC MICROPHONE SCHEMATIC AND MECHANICAL PARTS
Part No. 250-0740-300



TRANSCEIVER TOP PHOTO (800 MHZ SHOWN)



TRANSCEIVER BOTTOM PHOTO (800 MHZ, 30W SHOWN)

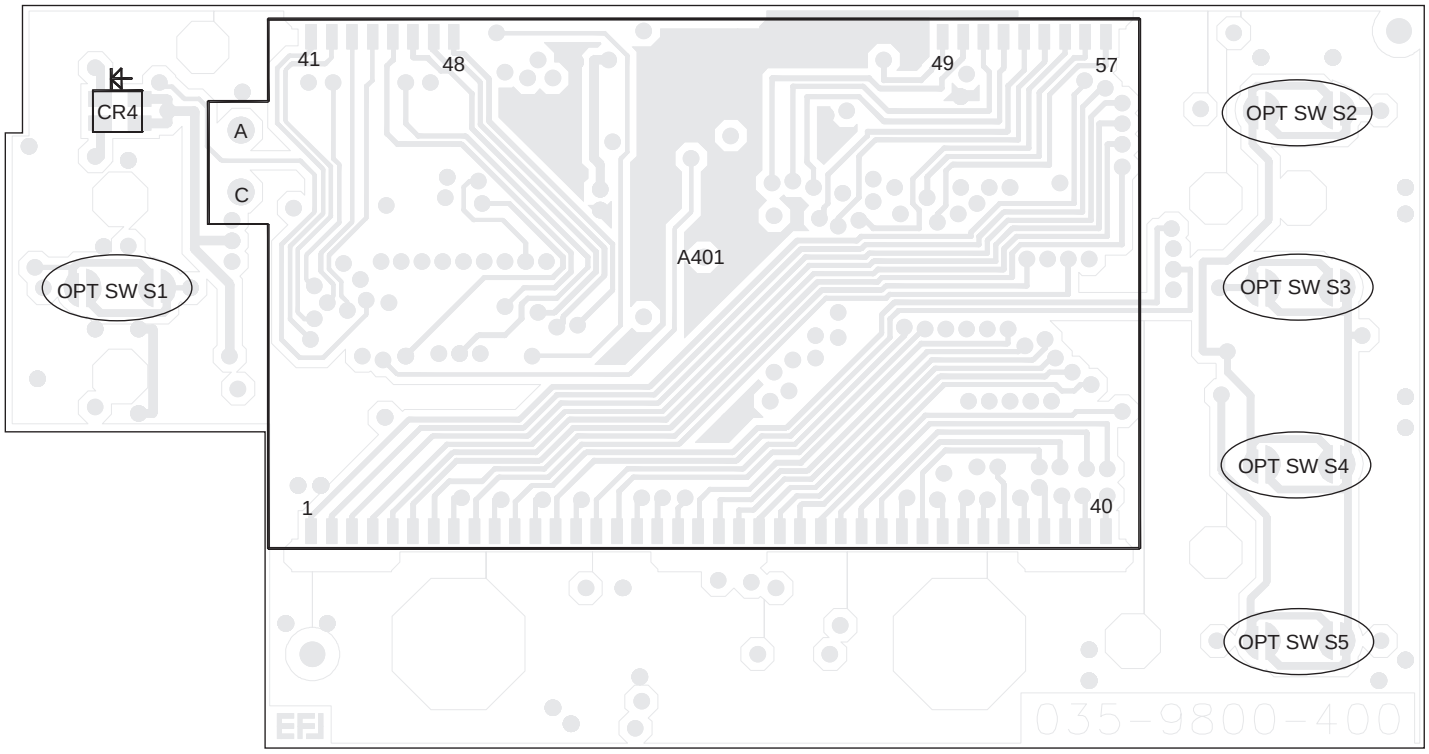


INTERFACE BOARD LAYOUT

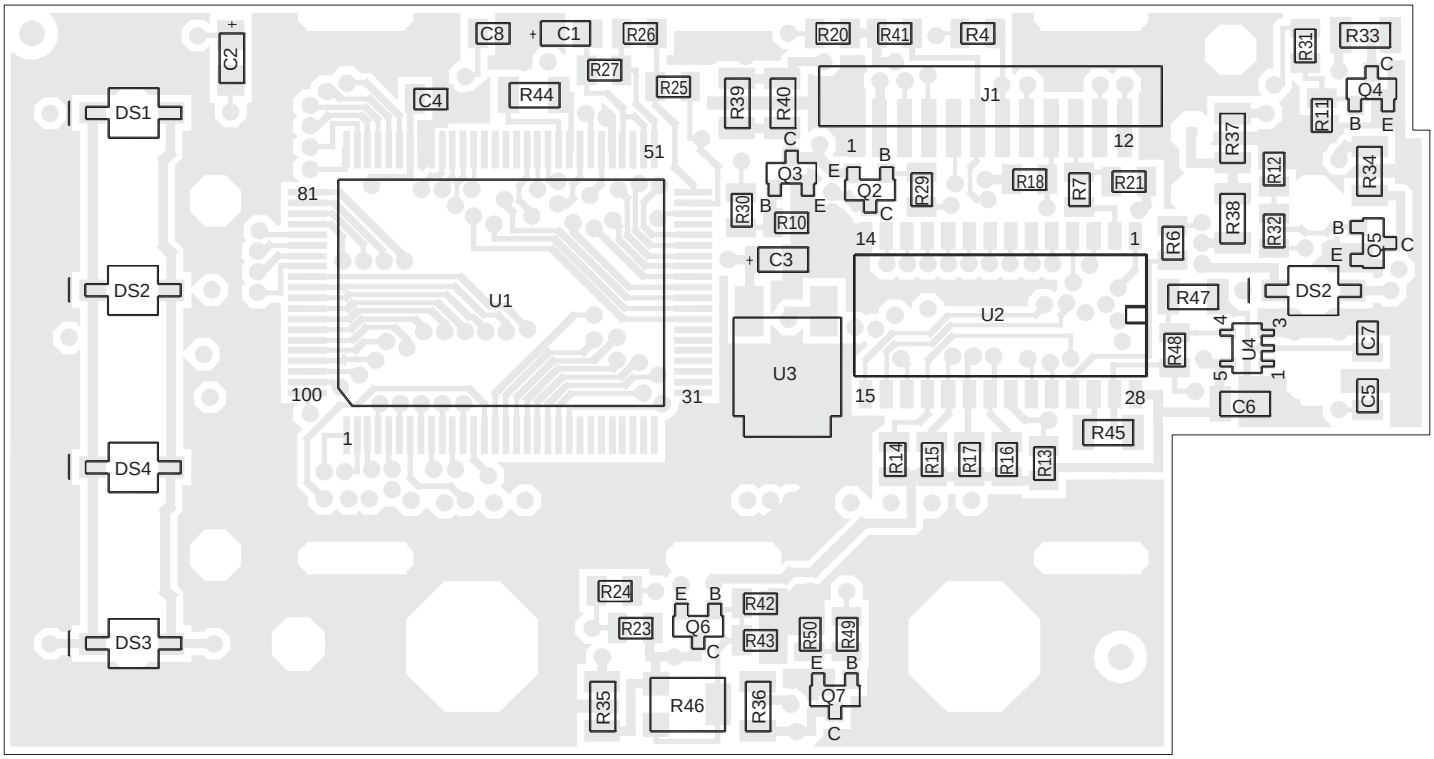
INTERCONNECT SCHEMATIC

CAUTION: *LTR-Net models may automatically transmit at any time (see Section 4.1).*

February 2001
Part No. 001-9800-001

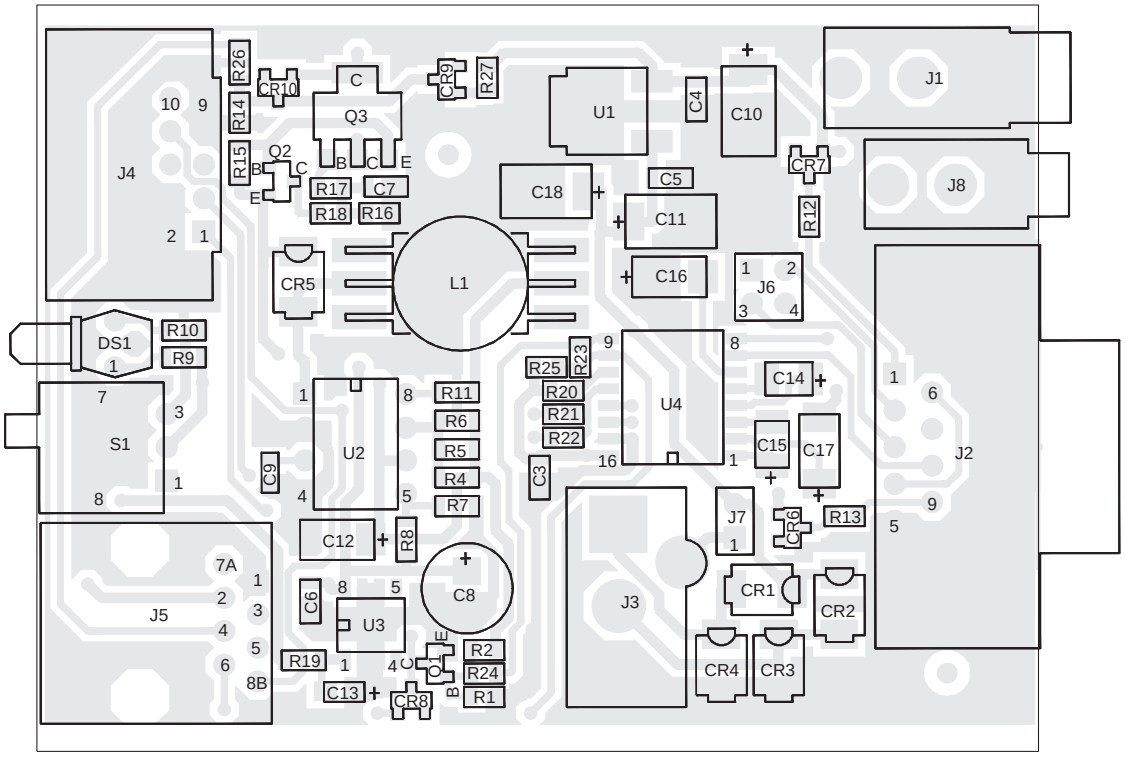


DISPLAY BOARD TOP VIEW

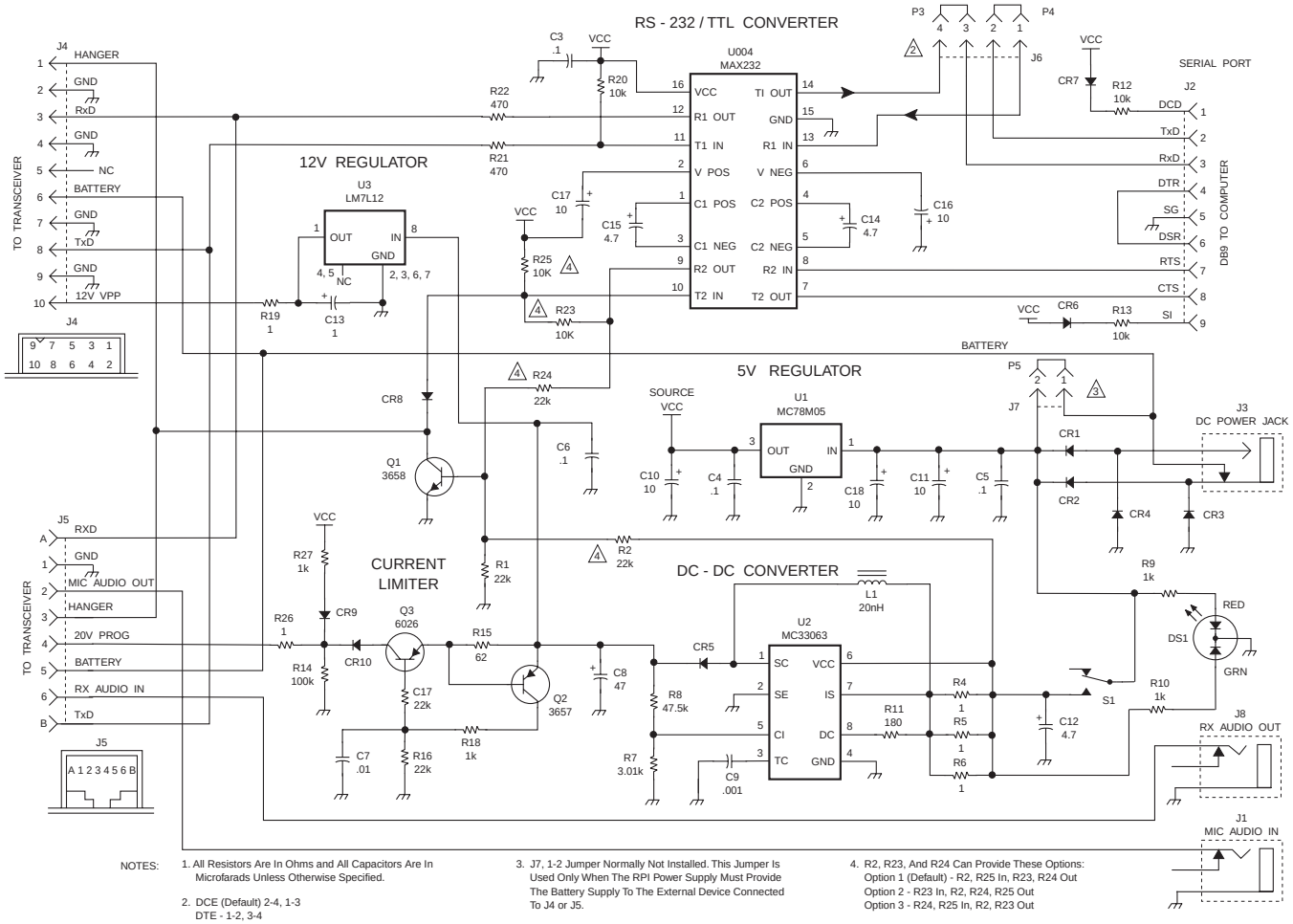


DISPLAY BOARD BOTTOM VIEW

PROGRAMMING CABLE (P.N. 597-2002-200)



RPI (P.N. 023-9800-000) BOARD LAYOUT



RPI (P.N. 023-9800-000) SCHEMATIC

RF BOARD COMPONENT LOCATOR GUIDE (UHF)

The following guide can be used to locate components on the 430-470 and 470-512 MHz RF board layouts on pages 6-8 and 6-11. Refer to the grid around the board to determine the approximate location of a component.

NOTE: When the location of a component is different on the board unrevised 430-470 MHz board, the location on the unrevised board is listed first and the location on the revised 430-512 MHz board is listed second.

Comp.	Location
A 900	C2
C 201	A4
C 202	A5
C 203	A4
C 204	A4
C 205	A4
C 206	A4
C 207	A4
C 208	A4
C 209	A4
C 210	A4
C 211	A4
C 212	A4
C 213	A4
C 214	A4
C 215	A4
C 216	A4
C 217	A4
C 218	A4
C 219	A4
C 220	A5
C 221	A5
C 222	A5
C 223	A5
C 224	A5
C 225	A5
C 226	A5
C 227	A5
C 228	A5
C 229	B5
C 230	B5
C 231	A5
C 232	A5
C 233	A5
C 234	B5/A5
C 235	B5
C 236	B5
C 237	B5
C 238	B5
C 239	B5
C 240	B5

Comp.	Location
C 241	B5
C 242	B5
C 243	B5
C 244	B5
C 245	B5
C 246	B5
C 247	B5
C 248	B5
C 249	B4
C 251	B5
C 252	B5
C 253	B5
C 255	B4
C 256	B4
C 258	B4
C 259	B4
C 260	B4
C 261	B4
C 262	B4
C 263	B4
C 264	B4
C 266	B5
C 268	B5
C 269	C5
C 270	C5
C 271	C5
C 272	C5
C 274	C5
C 275	C4
C 276	C4
C 277	C4
C 278	C5
C 281	C5
C 282	C5
C 283	B4
C 284	C4
C 285	B4
C 286	C4
C 287	C4
C 288	B4
C 289	C5

Comp.	Location
C 290	C4
C 291	C5
C 292	B4
C 293	C5
C 294	B5
C 295	C5
C 296	C5
C 297	C5
C 298	C5
C 299	C4
C 300	C4
C 301	C4
C 302	C4
C 303	B4
C 304	B5
C 305	A3
C 306	A3
C 307	B5
C 500	B2
C 501	A2/B2
C 502	B2
C 503	A2
C 504	A2
C 505	A2
C 506	A3
C 507	A4
C 508	A4
C 509	A3
C 510	A4
C 511	A3/B2
C 512	A1/A4
C 513	A2/A3
C 514	B1/B2
C 515	A1/B2
C 516	A1/C1
C 517	B1/B2
C 518	B1/C1
C 519	B1/A1
C 520	C1/A1
C 521	C1
C 522	A1/C1

Comp.	Location
C 523	A1/C1
C 524	A1/B1
C 525	C1/B1
C 526	C1
C 527	C1
C 528	C1/B1
C 529	C1/B1
C 530	C1
C 531	C1
C 532	C1/A1
C 533	C1/A1
C 534	B1/A1
C 535	A1
C 536	B1
C 537	C1/A1
C 538	C1/B1
C 539	B1
C 540	B1/C1
C 541	B2/C1
C 542	B1/C1
C 543	B1
C 544	B1
C 545	A1
C 546	A1
C 547	A1
C 548	A3A1
C 549	A3/A1
C 550	A3/C1
C 551	A3/C1
C 552	B3/C1
C 553	B3/C1
C 554	A3/B1
C 555	A3/C1
C 556	B4/C1
C 557	B4/C1
C 558	B4/B1
C 559	A4/B1
C 560	A3
C 561	B4/A3
C 562	B3/A3
C 563	B3/A3

UHF RF BOARD COMPONENT LOCATOR GUIDE (CONT'D)

Comp.	Location
C 564	B3
C 565	A2/B3
C 566	B3/A3
C 567	B1/A3
C 568	A1/B4
C 569	A1/B4
C 570	C1/B4
C 571	C1A3
C 572	B1/A3
C 573	B1/B4
C 574	B1/B3
C 575	B1/B3
C 576	A1/B3
C 577	A1/A2
C 578	B1/B3
C 579	B1/A1
C 800	A3
C 801	A3
C 802	A3
C 803	A4
C 805	A3
C 807	C2
C 808	C2
C 809	C4
C 810	A3
C 811	C3
C 812	C3
C 813	C1
C 814	C2
C 815	B3
C 816	C3
C 817	C1
C 818	C2
C 819	C3
C 820	C4
C 821	B3
C 822	C2
C 823	C3
C 824	C3
C 825	C4
C 826	C2/C1
C 827	C2
C 828	C3
C 829	C3
C 830	B3

Comp.	Location
C 831	B2
C 832	B3
C 833	B3
C 834	B2
C 835	B2
C 836	B2
C 837	B2
C 838	B2
C 839	B2
C 840	B2
C 841	B3
C 842	C3
CR200	A5
CR201	A4
CR202	A4
CR203	B5
CR204	A5
CR205	B5
CR206	B4
CR207	C5
CR208	C5
CR209	C5
CR210	C5
CR211	A3
CR212	A2
CR500	A2
CR501	A2
CR502	A2
CR503	B2
CR504	A2
CR505	A3
CR506	A2
CR507	A2
CR800	C1
CR801	C1
CR802	B2
EP001	A2
EP002	B1
EP003	B1
EP500	B1
EP501	A1
F 500	A3
J 201	A3

Comp.	Location
J 501	A3
L 200	A4
L 201	B4
L 202	A5
L 203	A5
L 204	A5
L 205	B5
L 206	B5
L 207	B5
L 208	B5
L 209	B4
L 210	B4
L 211	B4
L 213	B5
L 215	C5
L 217	C4
L 218	C4
L 219	B4
L 220	B5
L 500	A1
L 501	B1/C1
L 502	C1
L 503	C1
L 504	C1
L 505	C1
L 506	C1/B1
L 507	B1
L 800	C2
L 801	C2
L 802	C3
Q 200	A5
Q 201	A5
Q 202	B5
Q 203	B4
Q 204	B4
Q 205	C4
Q 206	C4
Q 207	B4
Q 500	A2
Q 501	A2
Q 502	A2
Q 503	B2/A2
Q 504	C1/A2
Q 505	C1/B2

Comp.	Location
Q 506	C1
Q 507	C1
Q 508	B1/A3
Q 509	A1/C1
Q 510	A2/C1
Q 511	A2/B1
Q 512	A2/A1
Q 513	A2
Q 514	A2
Q 515	A2
Q 516	A2
Q 517	A3/A2
Q 800	C2
Q 801	C2
R 200	A4
R 201	A4
R 202	A4
R 203	A4
R 204	A4
R 205	A5
R 206	A5
R 207	A5
R 208	A5
R 209	A5
R 210	B5
R 211	A5
R 212	B5
R 213	B5
R 214	B5
R 215	B5
R 216	B5
R 217	B5
R 218	B5
R 219	B4
R 220	B4
R 221	B4
R 222	B4
R 223	B4
R 224	B4
R 225	B4
R 226	B4
R 227	B4
R 228	C5
R 229	C5
R 231	C4

UHF RF BOARD COMPONENT LOCATOR GUIDE (CONT'D)

Comp.	Location
R 232	C4
R 233	C5
R 234	C5
R 237	C5
R 238	C5
R 239	C5
R 240	C5
R 241	C5
R 242	C5
R 243	B4
R 244	B4
R 245	C4
R 246	C4
R 247	C4
R 248	C4
R 249	B4
R 250	B4
R 251	B4
R 252	C5/B5
R 253	C5
R 254	C5
R 255	C5
R 256	C4/B5
R 257	C4
R 258	C4
R 259	B4
R 260	A2
R 261	A2
R 500	B2
R 501	A2/B2
R 502	A2
R 503	B2
R 504	A2
R 505	B2/A2
R 506	A2/B2
R 507	A2/B2
R 508	B2/A2
R 509	B2/A2
R 510	A2/B2
R 511	A2

Comp.	Location
R 512	B2/A2
R 513	A2/B2
R 514	B2/A2
R 515	C1/B2
R 516	C1/A2
R 517	C1/A2
R 518	A1/B2
R 519	B1/A2
R 520	C1/B2
R 521	C1
R 522	B1/C1
R 523	B1/C1
R 524	B1/A3
R 525	C1/A3
R 526	C1/B2
R 527	B1
R 528	C1/B1
R 529	C1
R 530	C1
R 531	C1
R 532	B1
R 533	A3/C1
R 534	A3/B1
R 535	A2/C1
R 536	A2/C1
R 537	A2/A1
R 538	A2/A3
R 539	B3
R 540	B3/A2
R 541	A2
R 542	A2
R 543	B3/A2
R 544	B2
R 545	A2
R 546	C1/B3
R 547	B3
R 548	A2
R 549	A2
R 550	A2/B3
R 551	A2

Comp.	Location
R 552	A2
R 553	A2
R 554	B1
R 555	B1
R 556	A3
R 557	A3
R 800	B2
R 801	A2
R 802	B2
R 803	B2
R 804	A2
R 805	B2
R 806	B2
R 807	A2
R 808	B2
R 809	B2
R 810	A2
R 811	B3
R 812	A3
R 813	B3
R 814	B3
R 815	B3
R 816	B3
R 817	C4
R 818	C3
R 819	C4
R 820	A3
R 821	C4
R 822	A3
R 823	B3
R 824	C4
R 825	C3
R 826	C4
R 827	C2
R 828	A3
R 829	B3
R 830	C1
R 831	C3
R 832	C2
R 833	C1

Comp.	Location
R 834	C4
R 835	C3
R 836	C2
R 837	C2
R 838	B3
R 839	C2
R 840	C4
R 841	C4
R 842	C2
R 843	C2
R 844	C1
R 845	B3
R 846	B3
R 847	C2
R 848	B3
R 849	B2
R 850	C4
R 851	B2
R 852	B2
R 853	B2
R 854	B2
R 855	B3
R 856	B2
U 201	C5
U 500	B2
U 501	B4
U 502	B3
U 800	C4
U 801	B3
U 802	B4
U 803	C4
U 804	B3
U 806	C3
Z 202	C5
Z 204	C5
Z 205	C5
Z 206	C5

RF BOARD COMPONENT LOCATOR GUIDE (800/900 MHZ)

The following guide can be used to locate components on the 800 MHz RF board layout on page 6-16 and the 900 MHz RF board layout on page 6-17. Refer to the grid around the board to determine the approximate location of a component.

Comp.	Location
A 900	A2
C 202	C4
C 214	C5
C 222	C5
C 223	B5
C 224	C5
C 225	C5
C 226	C5
C 227	C5
C 228	C5
C 231	B5
C 232	B5
C 244	B5
C 245	B5
C 246	B5
C 247	B5
C 248	B5
C 249	B5
C 250	B5
C 255	B4
C 264	B5
C 265	B5
C 266	B5
C 267	B5
C 268	B5
C 269	A5
C 270	A5
C 271	A5
C 272	A5
C 273	A5
C 274	A5
C 275	A4
C 276	A4
C 277	A4
C 278	A5
C 280	A5
C 281	A5
C 282	A5
C 283	B4
C 284	B4
C 285	B4
C 286	B4

Comp.	Location
C 287	B4
C 288	B4
C 289	A5
C 290	B4
C 291	A5
C 292	B4
C 293	A5
C 294	B5
C 295	A5
C 296	A5
C 297	A5
C 298	A5
C 299	A4
C 300	A4
C 301	A4
C 302	A4
C 303	B4
C 304	B4
C 305	C3
C 306	C3
C 500	B2
C 501	C2
C 502	B2
C 503	C2
C 504	C2
C 505	C2
C 506	C3
C 507	C4
C 508	C4
C 509	C3
C 510	C4
C 511	C3
C 512	C2
C 513	C1
C 514	C1
C 515	A1
C 516	B1
C 517	B1
C 518	B1
C 519	B1
C 520	B1
C 521	B1

Comp.	Location
C 522	B1
C 523	B1
C 524	C1
C 525	B1
C 526	B1
C 527	C1
C 528	B1
C 529	A1
C 530	C1
C 531	B1
C 532	C1
C 537	A1
C 547	B2
C 548	C3
C 549	C3
C 550	C3
C 551	C3
C 552	B3
C 553	B3
C 554	C3
C 555	C3
C 556	B4
C 557	B4
C 558	B4
C 559	C3
C 560	C3
C 561	B4
C 562	B3
C 563	B3
C 564	B3
C 565	C2
C 566	B3
C 599	C2
C 800	C3
C 801	C3
C 802	C3
C 803	C4
C 804	C3
C 805	C3
C 806	C3
C 807	A1
C 808	A1

Comp.	Location
C 809	A4
C 810	C3
C 811	A3
C 812	A3
C 813	A1
C 814	A2
C 815	B3
C 816	B3
C 817	A1
C 818	A1
C 819	B3
C 820	A4
C 821	B3
C 822	A2
C 823	A3
C 824	A3
C 825	A4
C 826	A2
C 827	A1
C 828	A3
C 829	A3
C 830	B3
C 831	B2
C 832	B3
C 833	B3
C 834	B2
C 835	B2
C 836	B2
C 837	B2
C 838	B2
C 839	B2
C 840	B2
C 841	A3
C 842	A3
C 843	A3
C 844	A1
C 845	A1
C 846	B1
C 847	B1
C 848	A1
C 849	A3
C 850	A2

800/900 MHz RF BOARD COMPONENT LOCATOR GUIDE (CONT'D)

Comp.	Location
CR 200	C4
CR 203	C5
CR 207	A5
CR 208	A5
CR 209	A5
CR 210	A5
CR 500	C2
CR 501	C2
CR 502	C2
CR 503	B2
CR 504	C2
CR 505	C2
CR 506	C2
CR 800	A1
CR 801	A1
CR 802	B2
CR 803	B2
EP 501	B1
EP 502	C1
F 500	C3
J 201	C3
J 501	C3
L 200	C4
L 201	B4
L 207	B5
L 213	B5
L 214	A5
L 215	A5
L 217	B4
L 218	A4
L 219	B4
L 220	B5
L 501	B1
L 502	C1
L 503	C1
L 504	B1
L 800	A1
L 801	B2
Q 200	C5
Q 201	C5
Q 202	B5
Q 203	B5

Comp.	Location
Q 205	A4
Q 206	A4
Q 207	B4
Q 500	C2
Q 501	C2
Q 502	C1
Q 503	B2
Q 504	B1
Q 505	B2
Q 506	B1
Q 507	C1
Q 508	C2
Q 509	C3
Q 510	C2
Q 511	C2
Q 512	C2
Q 513	C2
Q 514	C3
Q 800	A2
Q 801	A1
Q 802	A1
Q 803	A3
Q 804	A3
Q 805	B1
Q 806	B1
R 200	C4
R 205	C5
R 206	C5
R 207	C5
R 208	C5
R 209	C5
R 210	B5
R 211	B5
R 212	B5
R 213	B5
R 214	B5
R 215	B5
R 216	B5
R 217	B5
R 218	B5
R 219	B5
R 221	B5
R 222	B5
R 225	B4
R 226	B4
R 228	A5

Comp.	Location
R 229	A5
R 230	A5
R 231	A4
R 232	A4
R 233	A5
R 234	A5
R 237	A5
R 238	A5
R 239	A5
R 240	A5
R 241	A5
R 242	A5
R 243	B4
R 244	B4
R 245	B4
R 246	B4
R 247	B4
R 248	B4
R 249	B4
R 250	B4
R 251	B4
R 252	B5
R 253	A5
R 254	A5
R 255	B5
R 256	B5
R 257	A4
R 258	A4
R 259	B4
R 500	B2
R 501	C2
R 502	C2
R 503	B2
R 504	C2
R 505	B2
R 506	C2
R 507	C2
R 508	B2
R 509	B2
R 510	C2
R 511	C2
R 512	B2
R 513	C1
R 514	B2
R 515	B1
R 516	B1
R 517	B2

Comp.	Location
R 518	B1
R 519	B1
R 520	B1
R 521	B1
R 522	B1
R 523	B1
R 524	C2
R 525	C2
R 526	C2
R 527	C2
R 528	B1
R 529	C1
R 530	C1
R 531	C1
R 533	C3
R 534	C3
R 535	C2
R 536	C2
R 537	C3
R 538	C2
R 539	B3
R 540	B3
R 541	C2
R 542	C2
R 543	B3
R 544	C2
R 545	C2
R 546	C3
R 547	C3
R 548	B1
R 549	C1
R 800	B2
R 801	C2
R 802	B2
R 803	B2
R 804	C2
R 805	B2
R 806	B2
R 807	C2
R 808	B2
R 809	B2
R 810	C2
R 811	B3
R 812	C3
R 813	B3
R 814	B3
R 815	B3

800/900 MHz RF BOARD COMPONENT LOCATOR GUIDE (CONT'D)

Comp.	Location
R 816	B3
R 817	A4
R 818	A3
R 819	A4
R 820	C3
R 821	A4
R 822	C3
R 823	B3
R 824	A4
R 825	A3
R 826	A4
R 827	A2
R 828	C3
R 829	B3
R 830	A1
R 831	A3
R 832	A1

Comp.	Location
R 833	A1
R 834	A4
R 835	A3
R 836	A1
R 837	A1
R 838	B3
R 839	A2
R 840	A4
R 841	A4
R 842	A2
R 843	A2
R 845	B3
R 846	B3
R 848	B3
R 849	B2
R 850	A4
R 851	B2

Comp.	Location
R 852	B2
R 853	B2
R 854	B2
R 855	B3
R 856	A1
R 857	B1
R 858	B1
R 859	B1
R 860	A1
R 861	A1
R 862	A1
R 863	B1
U 201	A4
U 500	B2
U 501	B4
U 502	B3

Comp.	Location
U 800	A4
U 801	B3
U 802	B3
U 803	A4
U 804	B3
U 806	A3
Z 200	C5
Z 201	C5
Z 202	A5
Z 203	B4
Z 204A	B5
Z 204B	A5
Z 205	A4
Z 206	A5

AUDIO/LOGIC BOARD COMPONENT LOCATOR GUIDE

The following guide can be used to locate components on the audio/logic board layout on pages 6-22. Refer to the grid around the board to determine the approximate location of a component.

Comp.	Location
C 100	A3
C 101	C1
C 102	C1
C 103	C1
C 104	A1
C 105	C1
C 106	C1
C 107	A1
C 108	C2
C 109	C2
C 110	C1
C 111	A2
C 112	B2
C 113	C1
C 114	C2
C 115	B2
C 116	A1
C 117	A2
C 118	B2
C 119	A2
C 120	B2

Comp.	Location
C 121	B3
C 300	C4
C 301	C4
C 302	C4
C 303	C5
C 304	C5
C 305	C5
C 306	C5
C 307	C5
C 308	C5
C 309	C5
C 310	C5
C 311	B5
C 312	B5
C 313	B5
C 314	B5
C 315	B5
C 316	B5
C 317	B5
C 318	C4
C 319	B5

Comp.	Location
C 320	B5
C 321	B5
C 322	B5
C 323	B5
C 324	B5
C 325	C4
C 326	B4
C 327	A4
C 328	B5
C 329	C3
C 330	B5
C 331	A4
C 332	A4
C 333	A3
C 334	A4
C 335	A4
C 336	A4
C 337	A4
C 338	A4
C 339	A3
C 340	A4

Comp.	Location
C 341	A4
C 342	A3
C 343	A4
C 344	A3
C 345	A4
C 346	B4
C 347	B4
C 348	B3
C 349	B4
C 350	B4
C 351	B4
C 352	B4
C 353	A4
C 354	B3
C 355	C5
C 356	B5
C 357	A4
C 358	A4
C 359	C5
C 360	B4
C 361	B4

AUDIO/LOGIC BOARD COMPONENT LOCATOR GUIDE (CONT'D)

Comp.	Location
C 362	B4
C 363	C1
C 364	A4
CR100	C1
CR101	A2
CR102	C2
CR103	C1
CR104	C1
CR105	A1
CR106	C2
CR107	A1
CR108	C3
CR109	C2
CR110	A3
CR111	C2
CR112	C2
CR113	C2
CR114	C3
CR115	C2
CR116	C2
CR117	C1
CR118	C3
CR119	C2
CR120	C3
CR121	C2
CR122	C2
CR123	C3
CR129	C3
CR300	C5
CR301	C5
CR302	A4
CR303	C1
CR304	C2
CR305	C2
DS003	D5
DS004	D5
F 100	A3
F 300	B3
J 100	C4
J 101	A3
J 301	C3
J 302	A3
J 303	A5
J 305	C4
Q 100	A2

Comp.	Location
Q 101	C1
Q 102	C1
Q 103	B4
Q 104	B4
Q 105	B4
Q 106	B4
Q 107	C3
Q 108	C3
Q 109	C3
Q 110	C3
Q 111	A3
Q 112	D4
Q 113	D4
Q 114	D5
Q 115	D5
Q 300	C5
Q 301	C4
Q 302	A4
Q 303	B2
Q 304	B3
Q 305	B4
Q 306	A3
Q 307	B4
Q 308	C5
Q 309	D5
R 100	A3
R 101	A3
R 102	C1
R 103	C1
R 104	C1
R 105	C2
R 106	C1
R 107	B2
R 108	C1
R 109	C1
R 110	A1
R 111	A2
R 112	A2
R 113	A2
R 114	A1
R 115	C2
R 116	B2
R 117	B2
R 118	C2
R 119	B2
R 120	B2

Comp.	Location
R 121	A2
R 122	C1
R 123	B4
R 124	C1
R 125	A1
R 126	A1
R 127	B2
R 128	B4
R 129	C1
R 130	B2
R 131	C1
R 132	B4
R 133	B2
R 134	B2
R 135	B2
R 136	A1
R 137	A1
R 138	A1
R 139	B4
R 140	A1
R 141	C2
R 142	C2
R 143	A2
R 144	B4
R 145	B4
R 146	C3
R 147	C2
R 148	C2
R 149	B2
R 150	C2
R 151	C2
R 152	B2
R 153	C2
R 154	A3
R 155	C2
R 156	C2
R 157	C2
R 158	C2
R 159	C3
R 160	C2
R 161	C1
R 162	C2
R 163	C1
R 164	C2
R 165	C3
R 166	C3
R 167	C3
R 168	C1

Comp.	Location
R 169	C3
R 170	C2
R 171	C3
R 172	C3
R 173	C3
R 174	C2
R 175	C3
R 176	C3
R 177	B3
R 197	C2
R 198	D5
R 199	C2
R 200	D5
R 300	C4
R 301	C5
R 302	C4
R 303	B5
R 304	C5
R 305	C4
R 306	C5
R 307	C5
R 308	C5
R 309	C4
R 310	C5
R 311	C5
R 312	C5
R 313	C5
R 314	C5
R 315	C5
R 316	C5
R 317	C5
R 318	C5
R 319	C5
R 320	C3
R 321	C3
R 322	C5
R 323	C4
R 324	C3
R 325	B5
R 326	C3
R 327	B5
R 328	C4
R 329	C3
R 330	C4
R 331	C4
R 332	B5
R 333	C4
R 334	B5

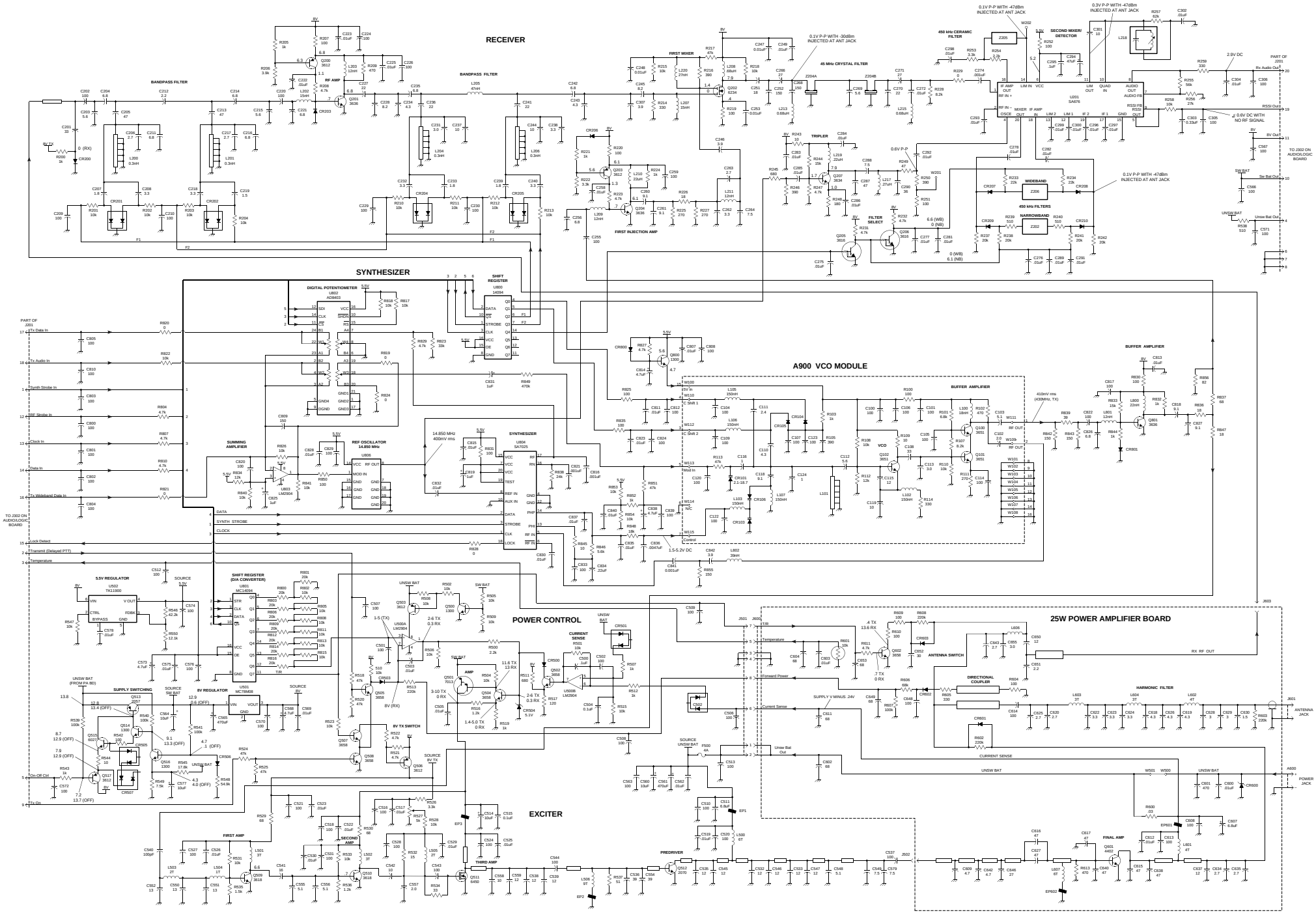
AUDIO/LOGIC BOARD COMPONENT LOCATOR GUIDE (CONT'D)

Comp.	Location
R 335	C4
R 336	C4
R 337	B2
R 338	C4
R 339	B5
R 340	B5
R 341	B5
R 342	C4
R 343	B5
R 344	B5
R 345	C4
R 346	C4
R 347	B5
R 348	B5
R 349	B5
R 350	B5
R 351	B5
R 352	B5
R 353	B5
R 354	B3
R 355	B5
R 356	A4
R 357	C3
R 358	C4
R 359	B5
R 360	A4
R 361	C3
R 362	B3
R 363	B3
R 364	B3
R 365	A3
R 366	B3
R 367	A3
R 368	B4
R 369	A3
R 370	A3
R 371	A3

Comp.	Location
R 372	A4
R 373	A4
R 374	A4
R 375	A4
R 376	B4
R 377	B4
R 378	A3
R 379	B3
R 380	A4
R 381	A4
R 382	A3
R 383	B3
R 384	B4
R 385	B3
R 386	A4
R 387	A4
R 388	A3
R 389	A4
R 390	A4
R 391	A4
R 392	A4
R 393	A3
R 394	B4
R 395	A4
R 397	A3
R 398	C3
R 399	C3
R 400	B4
R 401	B3
R 402	B4
R 403	B4
R 404	B4
R 405	A4
R 406	B4
R 407	B4
R 408	B4
R 409	A4

Comp.	Location
R 410	B4
R 411	B4
R 412	B4
R 413	A4
R 414	B3
R 415	B4
R 416	C5
R 417	C5
R 418	A4
R 419	C5
R 420	B4
R 421	C1
R 422	C1
R 423	C2
R 424	C3
R 425	B5
R 426	A4
R 427	C4
R 443	C4
U 100	C1
U 101	B1
U 102	C2
U 103	C2
U 104	B2
U 105	B3
U 106	A2
U 107	A1
U 108	A2
U 109	B2
U 110	A2
U 111	B2
U 112	B2
U 300	C5
U 301	B5
U 302	A4
U 303	A4

Comp.	Location
U 304	C5
U 305	C4
U 306	A4
U 307	C4
U 308	B4
W 100	B2
W 101	B2
W 102	B2
W 103	B2
W 301	B3
W 302	B3
W 303	B3
W 304	B3
W 305	B4
W 306	B4
W 307	B4
W 308	B4
W 309	B4
W 310	B4
W 311	B3
W 312	B3
W 313	B3
W 314	B3
W 315	B4
W 316	B4
W 317	B4
W 318	B4
W 319	B4
W 320	B4
Y 100	C1



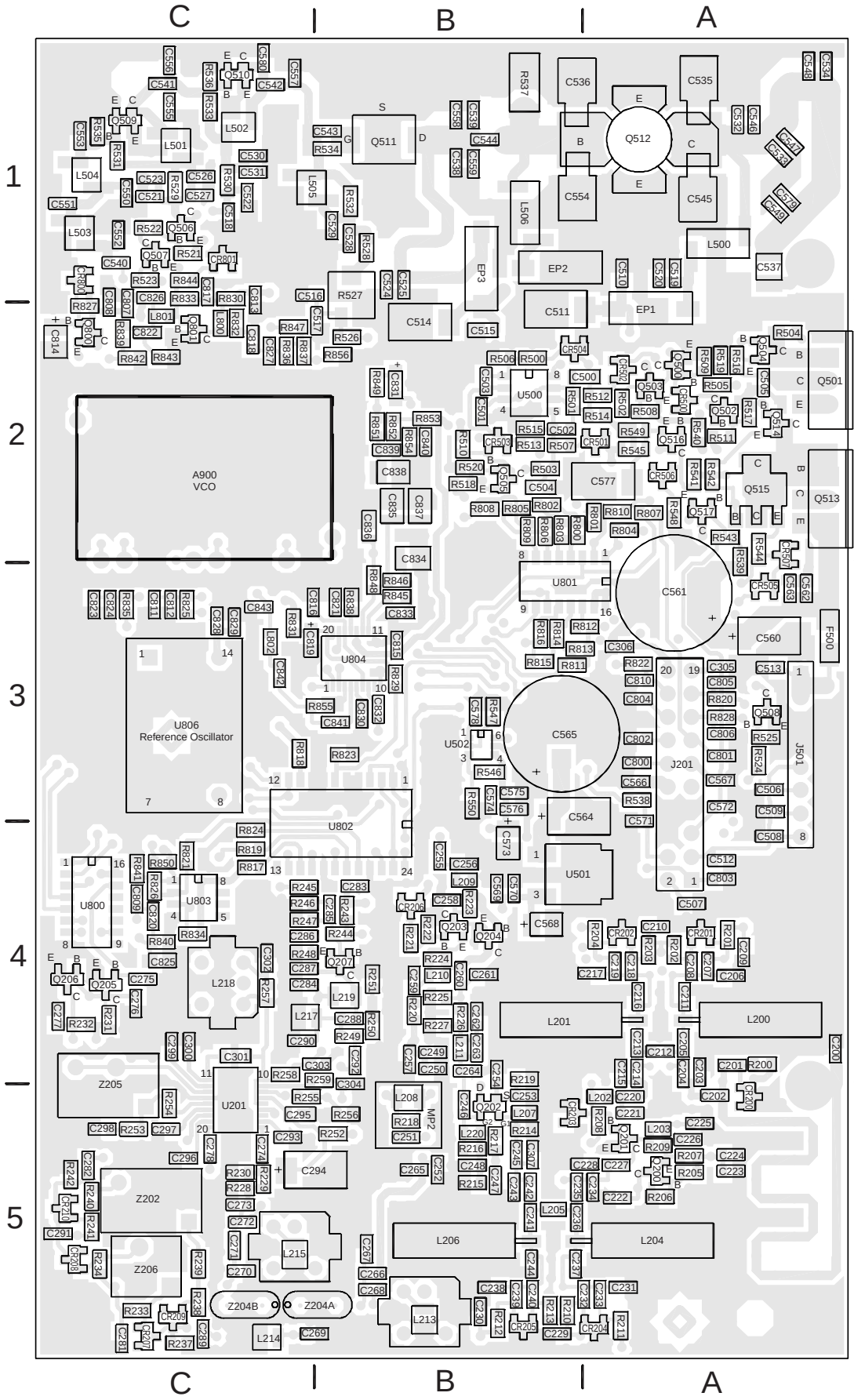
NOTES:

1. ALL RESISTORS ARE IN OHMS AND ALL CAPACITORS ARE IN PICOFARADS UNLESS OTHERWISE SPECIFIED.

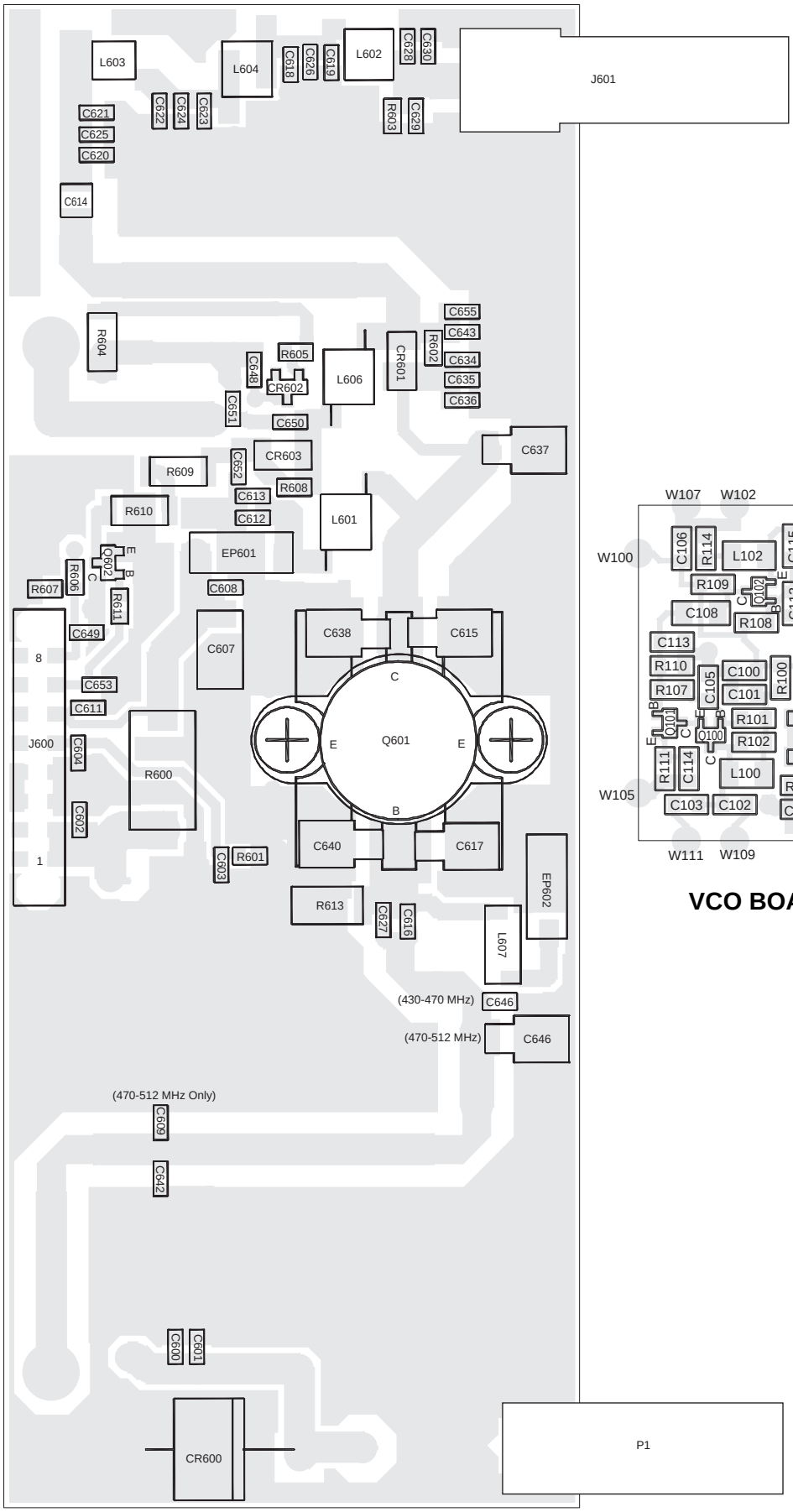
RF BOARD SCHEMATIC (REVISED 430-470 MHZ)

PA BOARD SCHEMATIC (25W, 430-470 MHZ)

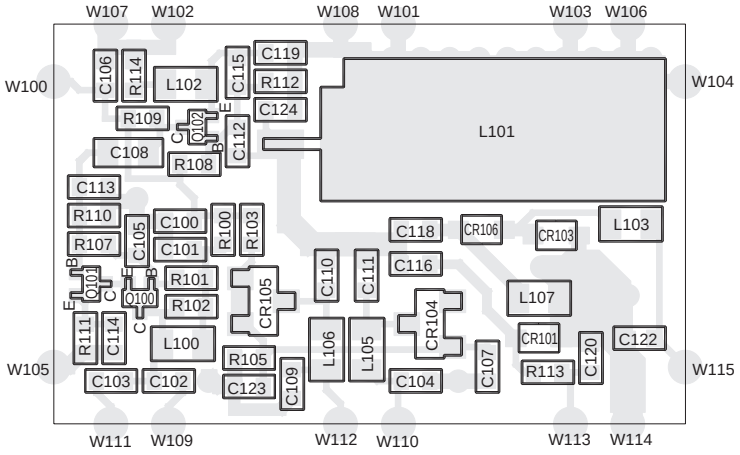
February 2001
Part No. 001-9800-001



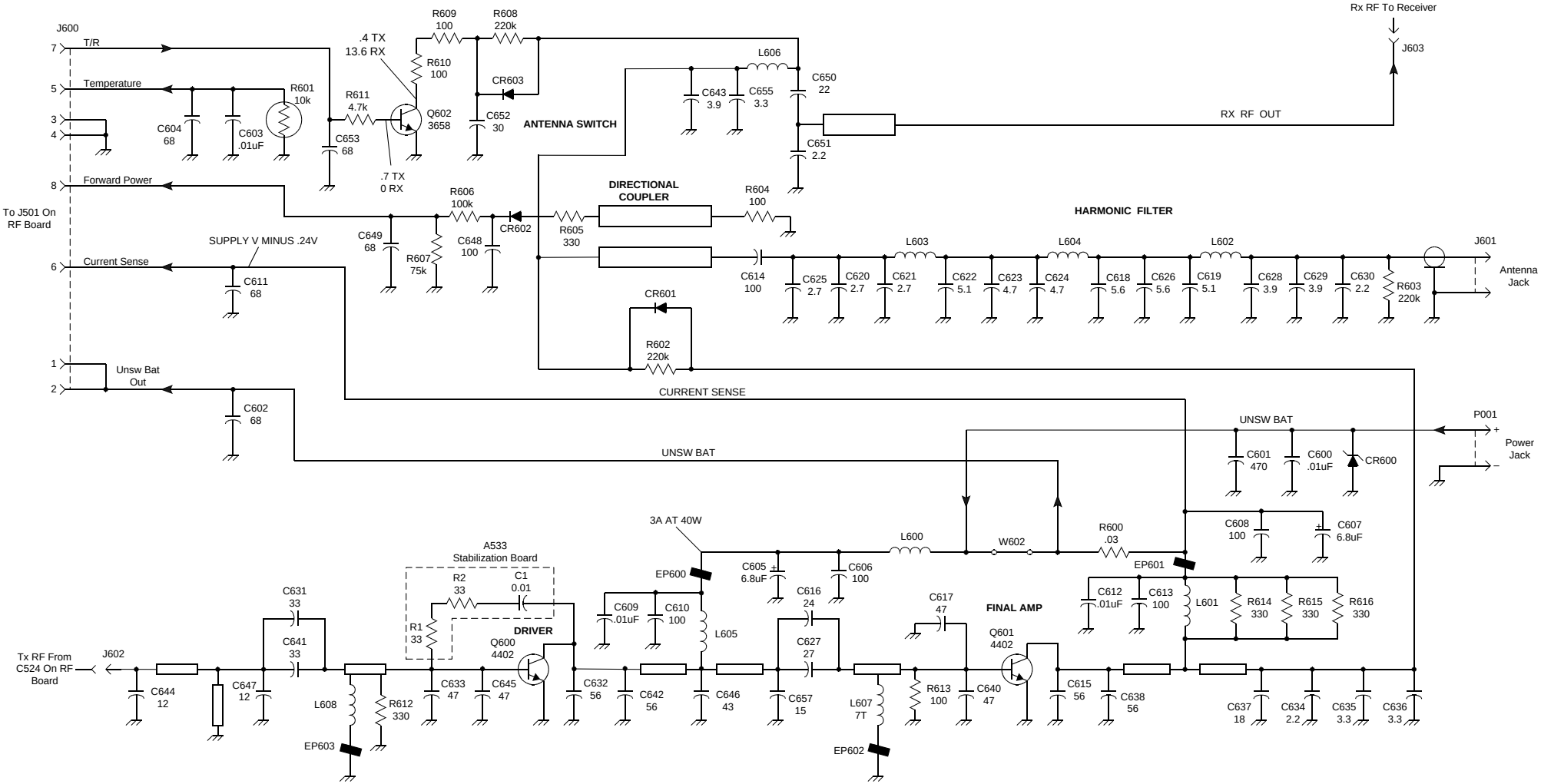
RF BOARD LAYOUT (430-512 MHZ)



PA BOARD LAYOUT (25W, 430-512 MHZ)

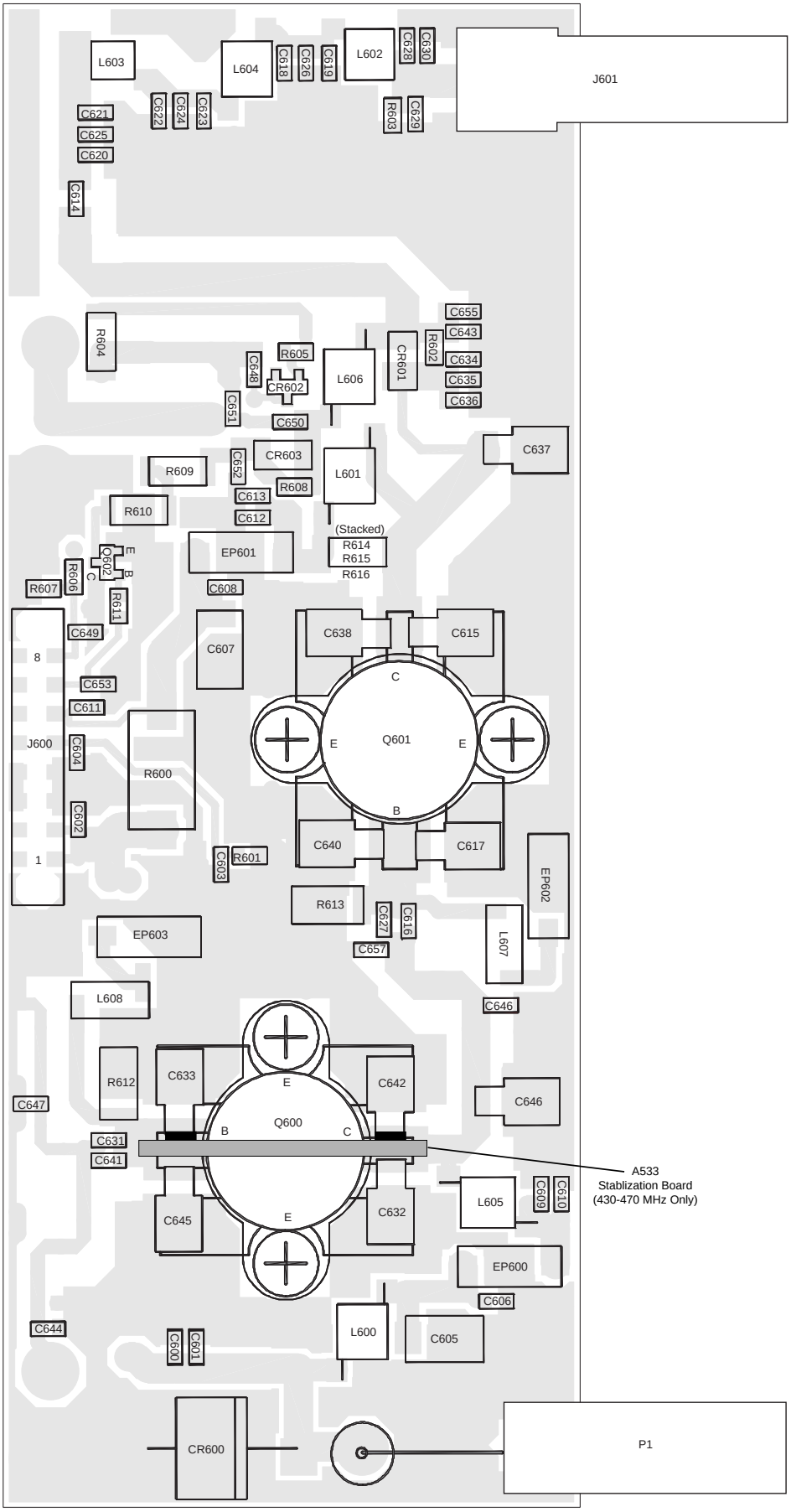


VCO BOARD LAYOUT (430-512 MHZ)

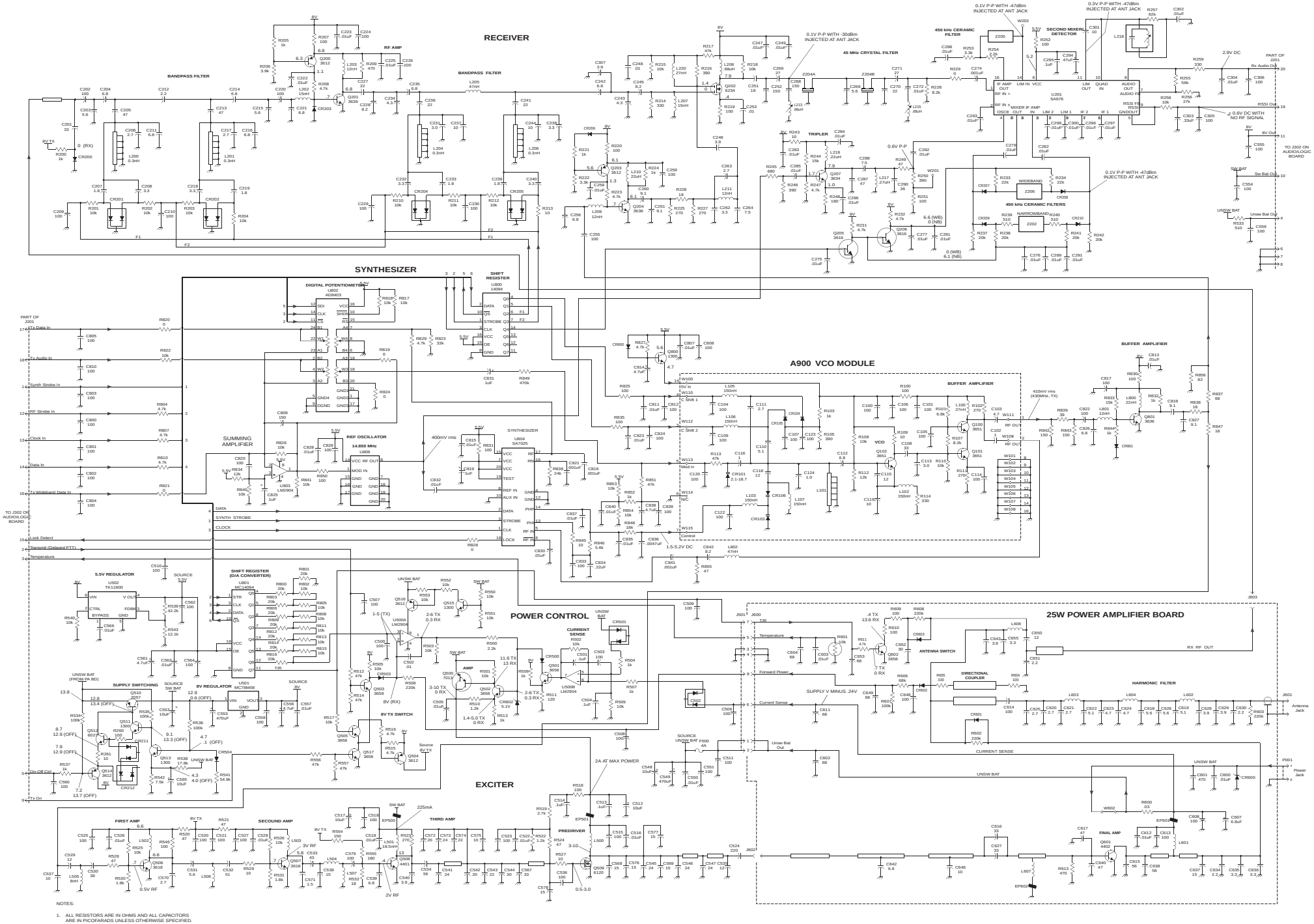


PA BOARD SCHEMATIC (40W, 430-470 MHZ)

February 2001
Part No. 001-9800-001



PA BOARD LAYOUT (40W, 430-512 MHZ)

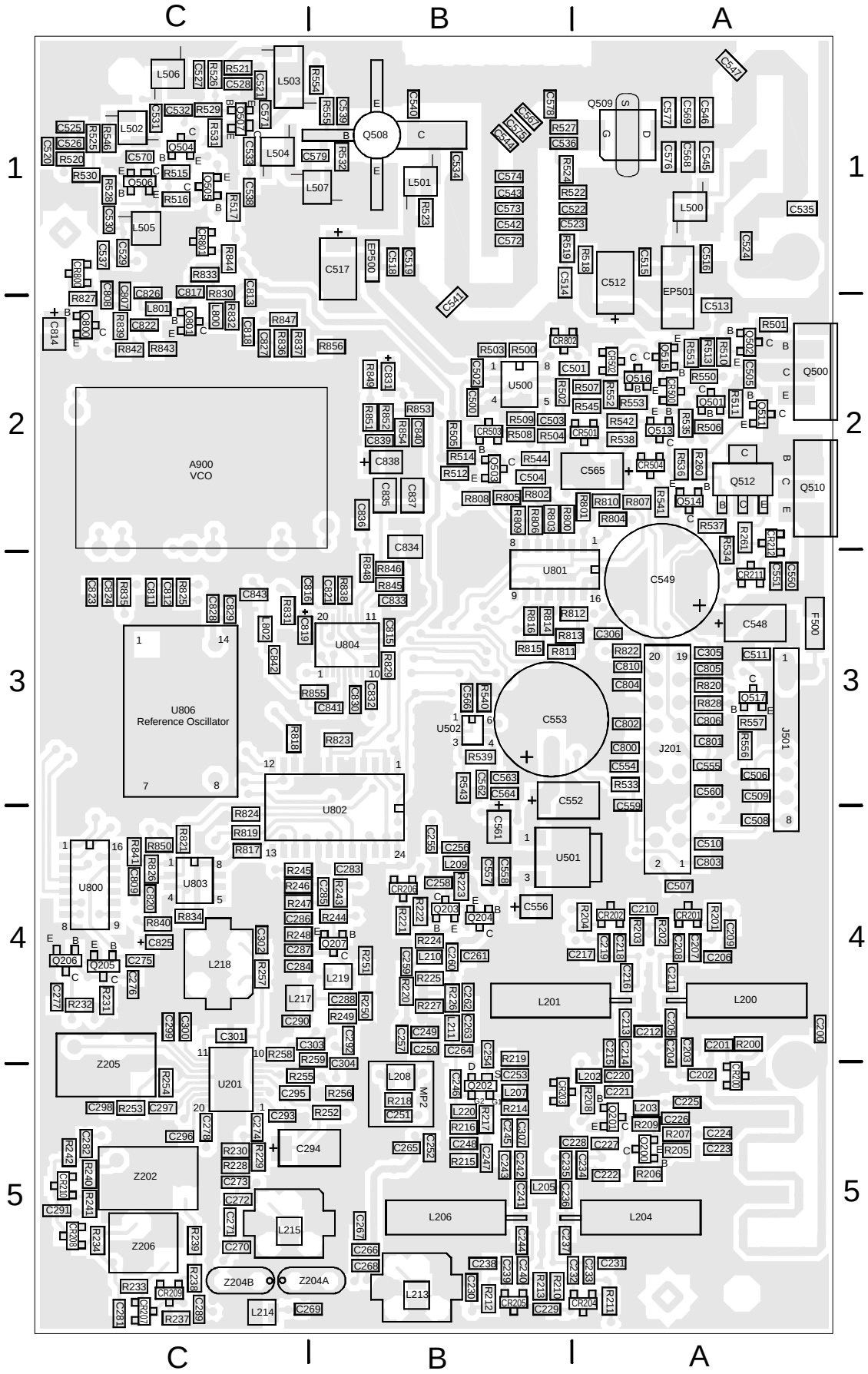


NOTES:

1. ALL RESISTORS ARE IN OHMS AND ALL CAPACITORS ARE IN PICOFARADS UNLESS OTHERWISE SPECIFIED.

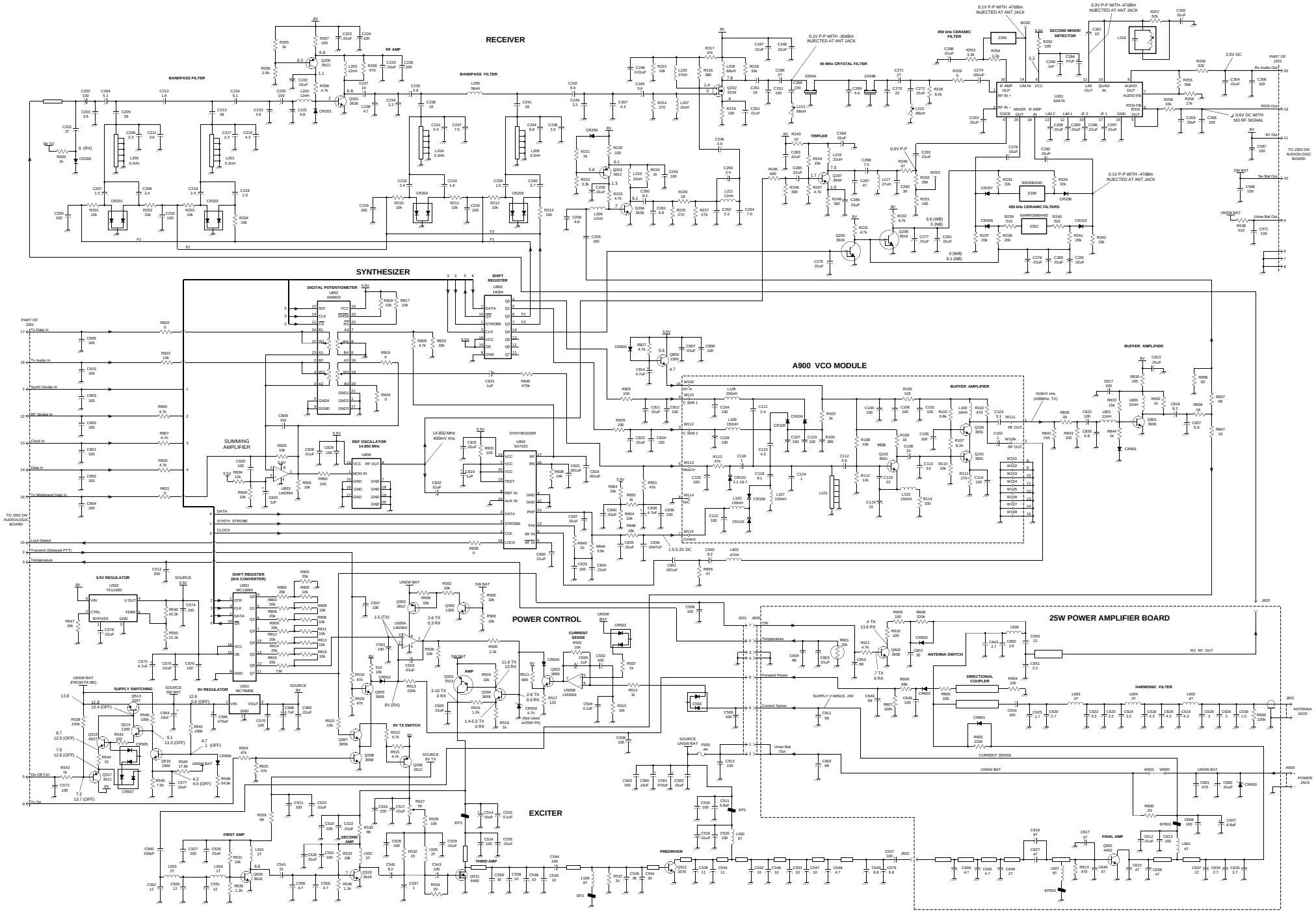
RF BOARD SCHEMATIC (UNREVISED 430-470 MHZ)

February 2001
Part No. 001-9800-001



RF BOARD LAYOUT (UNREVISED 430-470 MHZ)

Go To Page 6-22



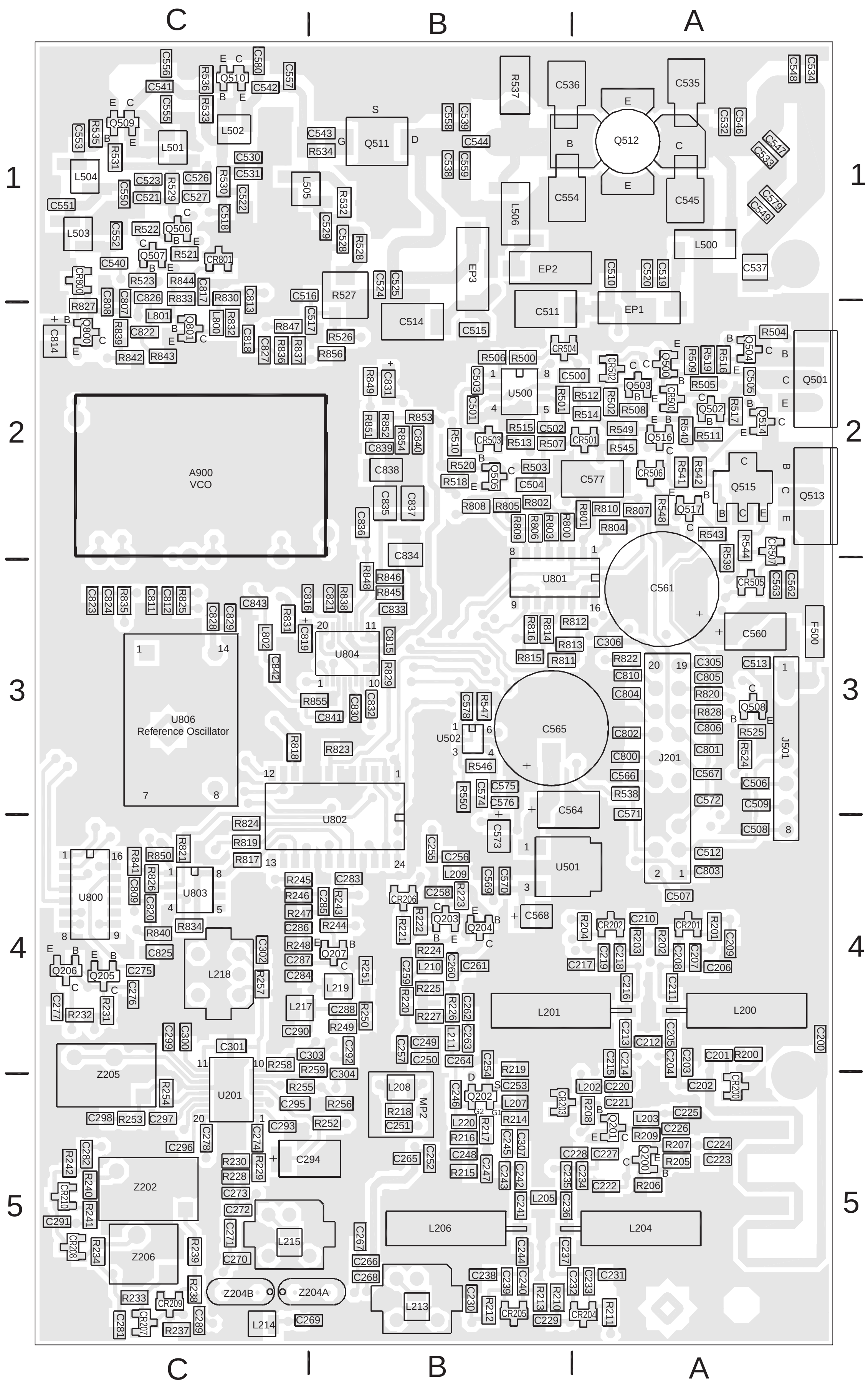
NOTES:

1. ALL RESISTORS ARE IN OHMS AND ALL CAPACITORS ARE IN PICOFARADS UNLESS OTHERWISE SPECIFIED.

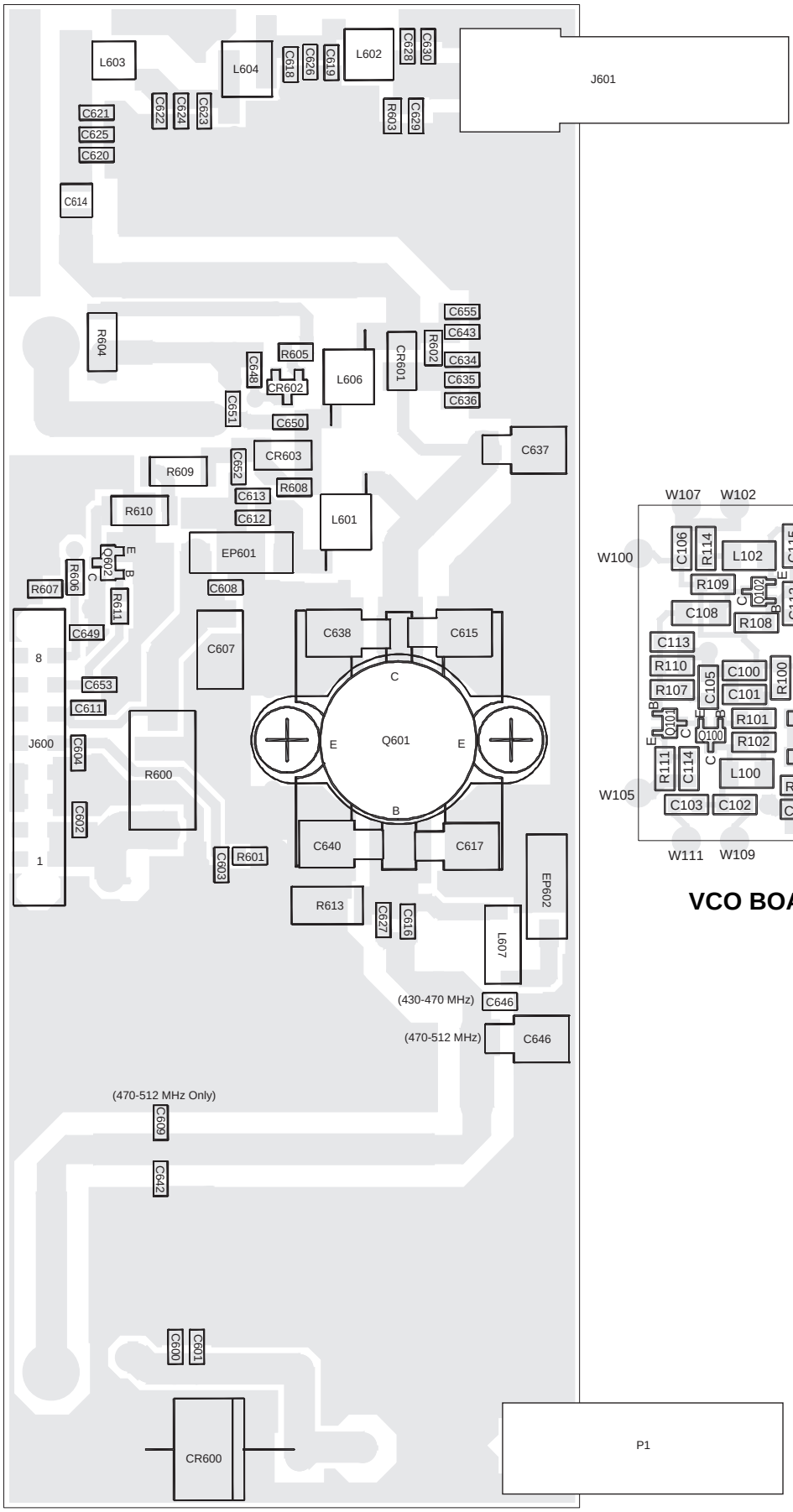
RF BOARD SCHEMATIC (470-512 MHZ)

PA BOARD SCHEMATIC (25W, 470-512 MHZ)

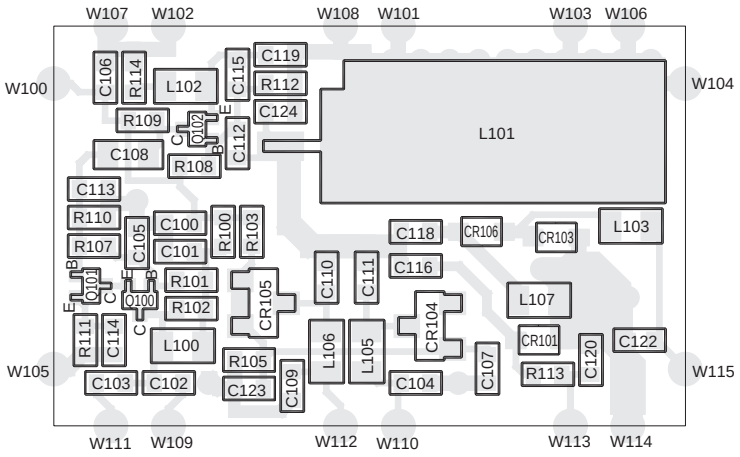
February 2001
Part No. 001-9800-001



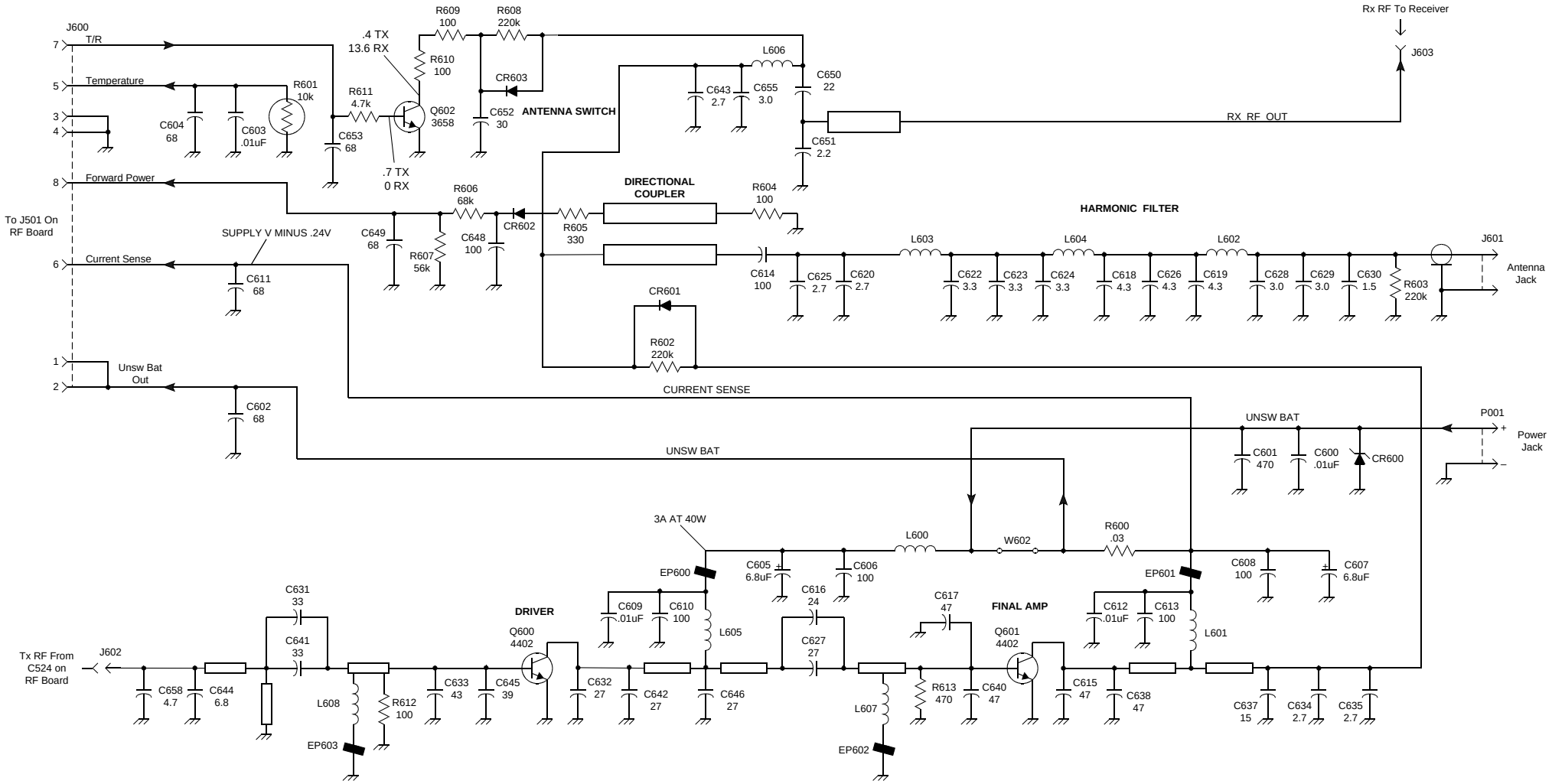
RF BOARD LAYOUT (430-512 MHZ)



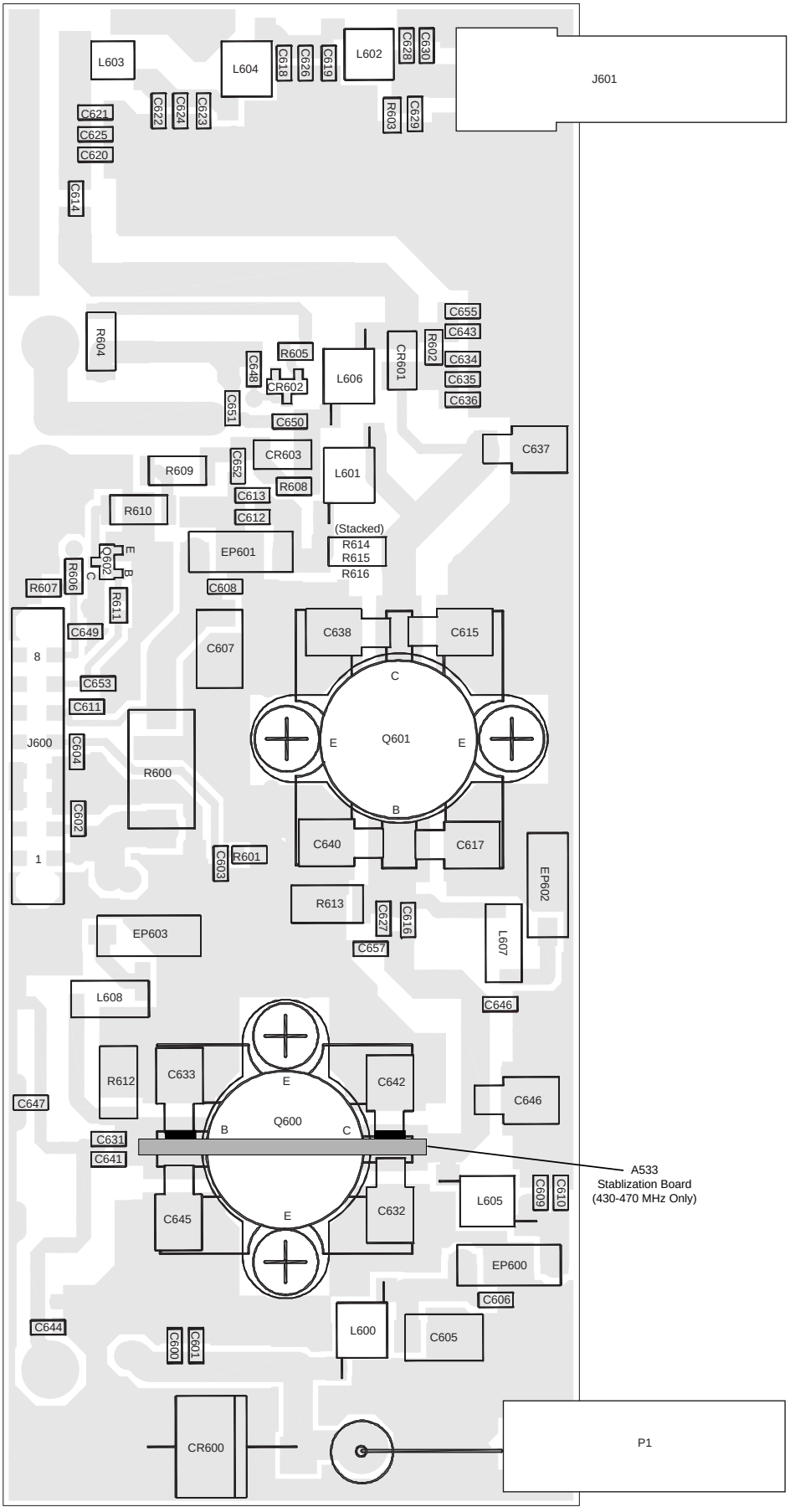
PA BOARD LAYOUT (25W, 430-512 MHZ)



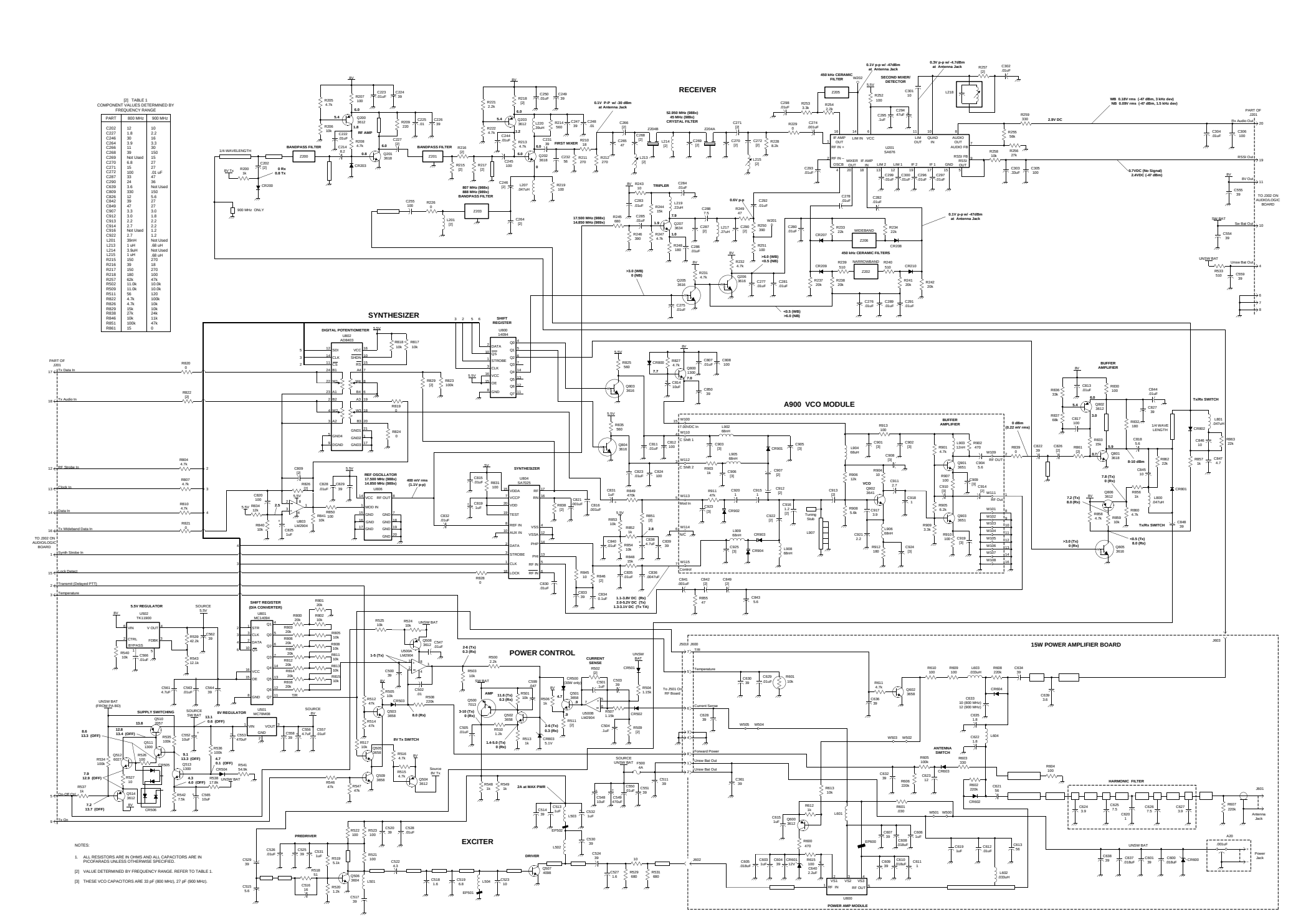
VCO BOARD LAYOUT (430-512 MHZ)



PA BOARD SCHEMATIC (40W, 470-512 MHZ)



PA BOARD LAYOUT (40W, 430-512 MHZ)



[2] TABLE 1
COMPONENT VALUES DETERMINED BY FREQUENCY RANGE

PART	800 MHz	900 MHz
C202	12	10
C227	1.8	2.2
C246	30	16
C264	3.9	3.3
C266	11	30
C268	39	150
C269	Not Used	15
C270	6.8	27
C271	15	27
C272	100	.01 uF
C287	33	47
C290	24	36
C639	3.6	Not Used
C809	330	150
C826	12	5.6
C842	39	27
C849	47	27
C907	3.3	3.0
C912	3.0	1.8
C913	2.2	2.2
C914	2.7	2.2
C916	Not Used	1.2
C922	2.7	1.2
L201	39nH	Not Used
L213	1 uH	.68 uH
L214	3.9uH	Not Used
L215	1 uH	.68 uH
R215	150	270
R216	39	18
R217	150	270
R218	180	100
R257	62k	47k
R502	11.0k	10.0k
R509	11.0k	10.0k
R511	56	120
R822	4.7k	100k
R826	4.7k	10k
R829	15k	10k
R838	27k	24k
R846	10k	11k
R851	100k	47k
R861	15	0

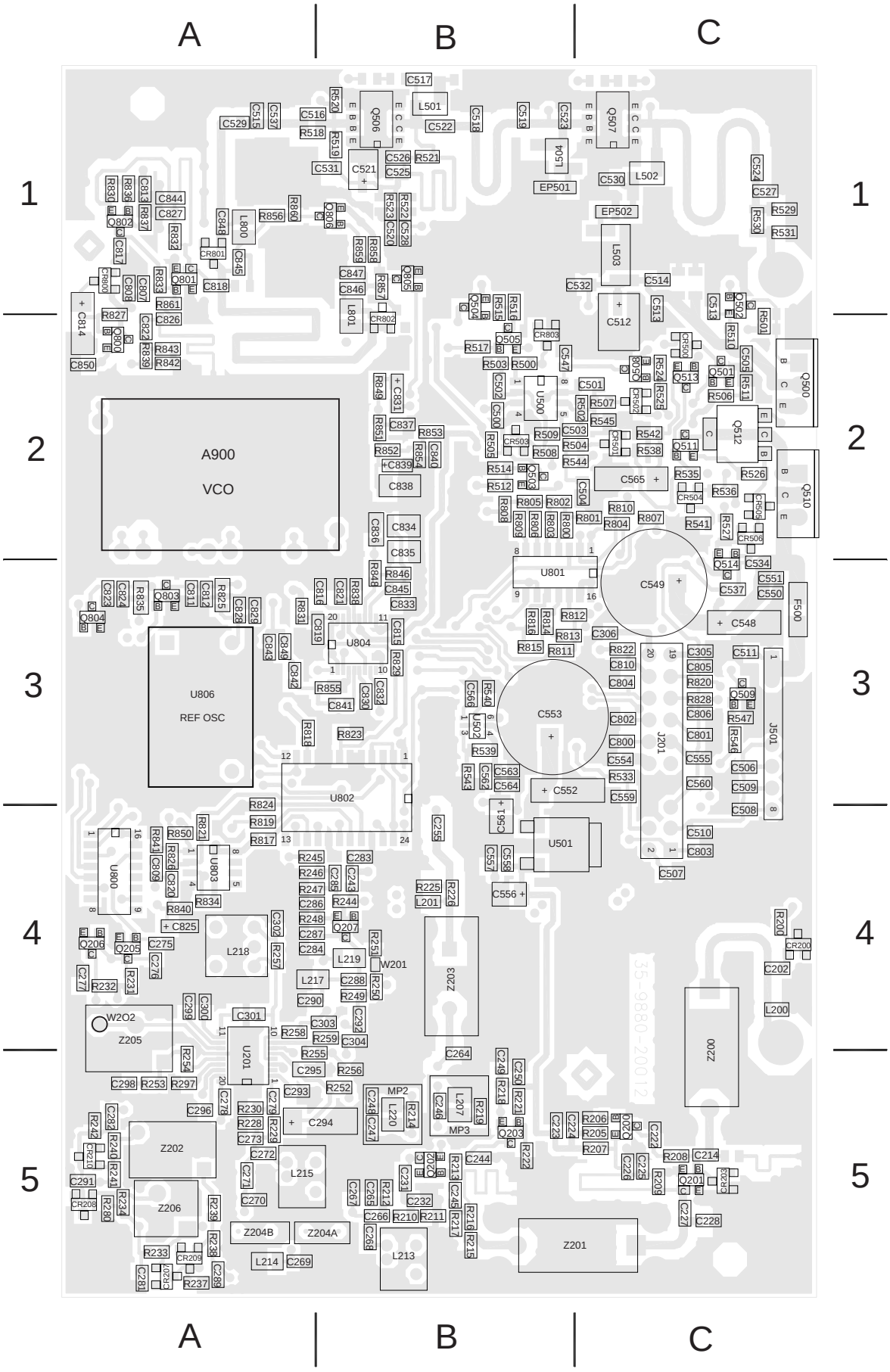
NOTES:

1. ALL RESISTORS ARE IN OHMS AND ALL CAPACITORS ARE IN PICOFARADS UNLESS OTHERWISE SPECIFIED.
[2] VALUE DETERMINED BY FREQUENCY RANGE. REFER TO TABLE 1.
[3] THESE VCO CAPACITORS ARE 33 pF (800 MHz), 27 pF (900 MHz).

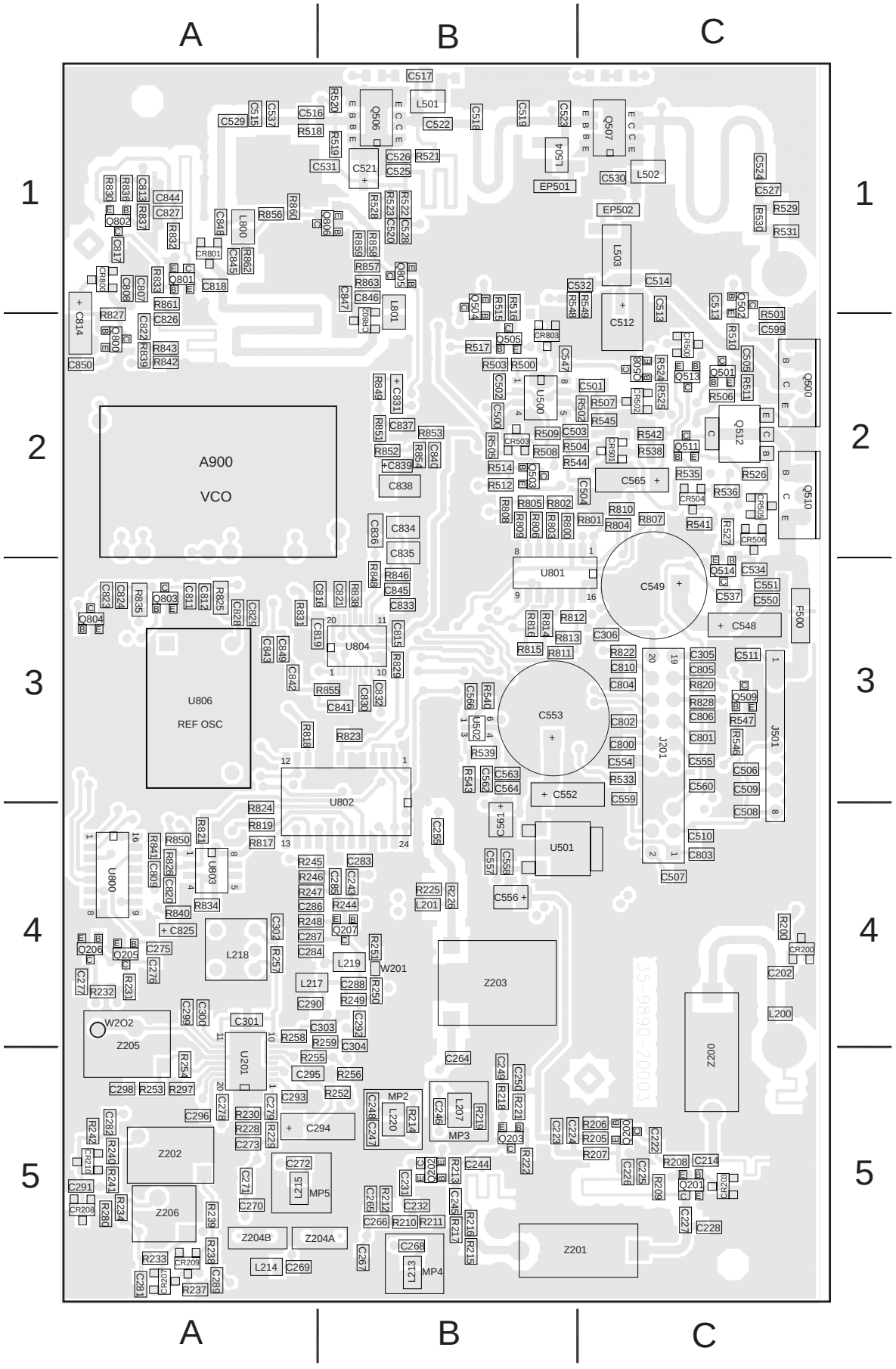
RF BOARD SCHEMATIC (800/900 MHZ)

PA BOARD SCHEMATIC (15W, 800/900 MHZ)

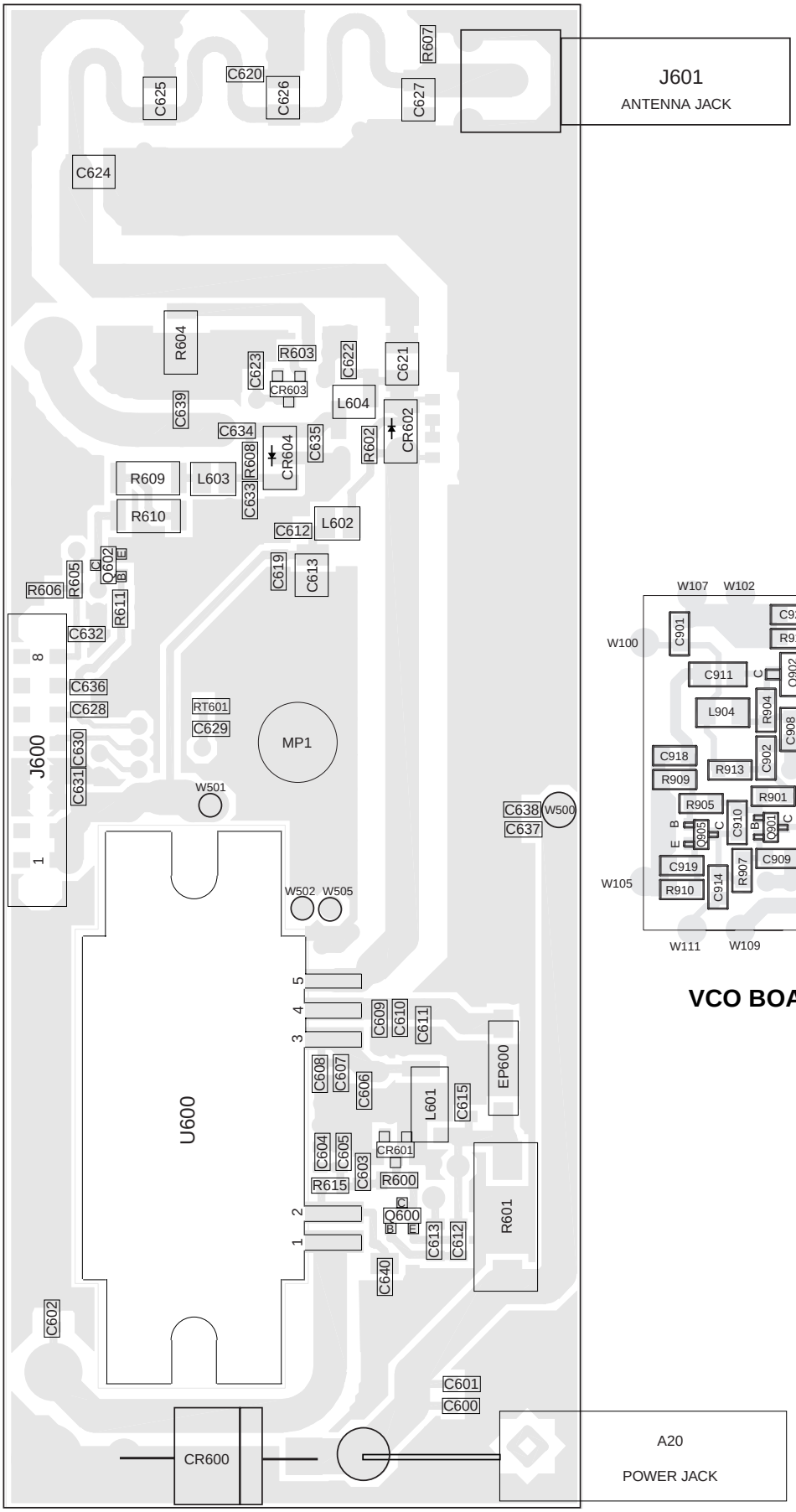
February 2001
Part No. 001-9800-001



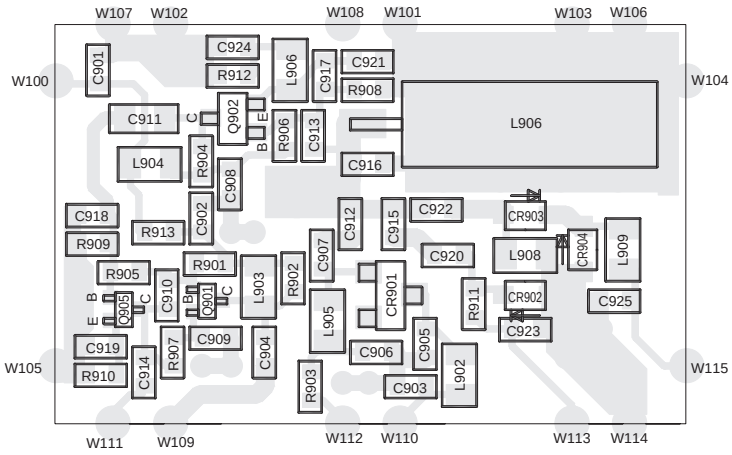
RF BOARD LAYOUT (800 MHZ)



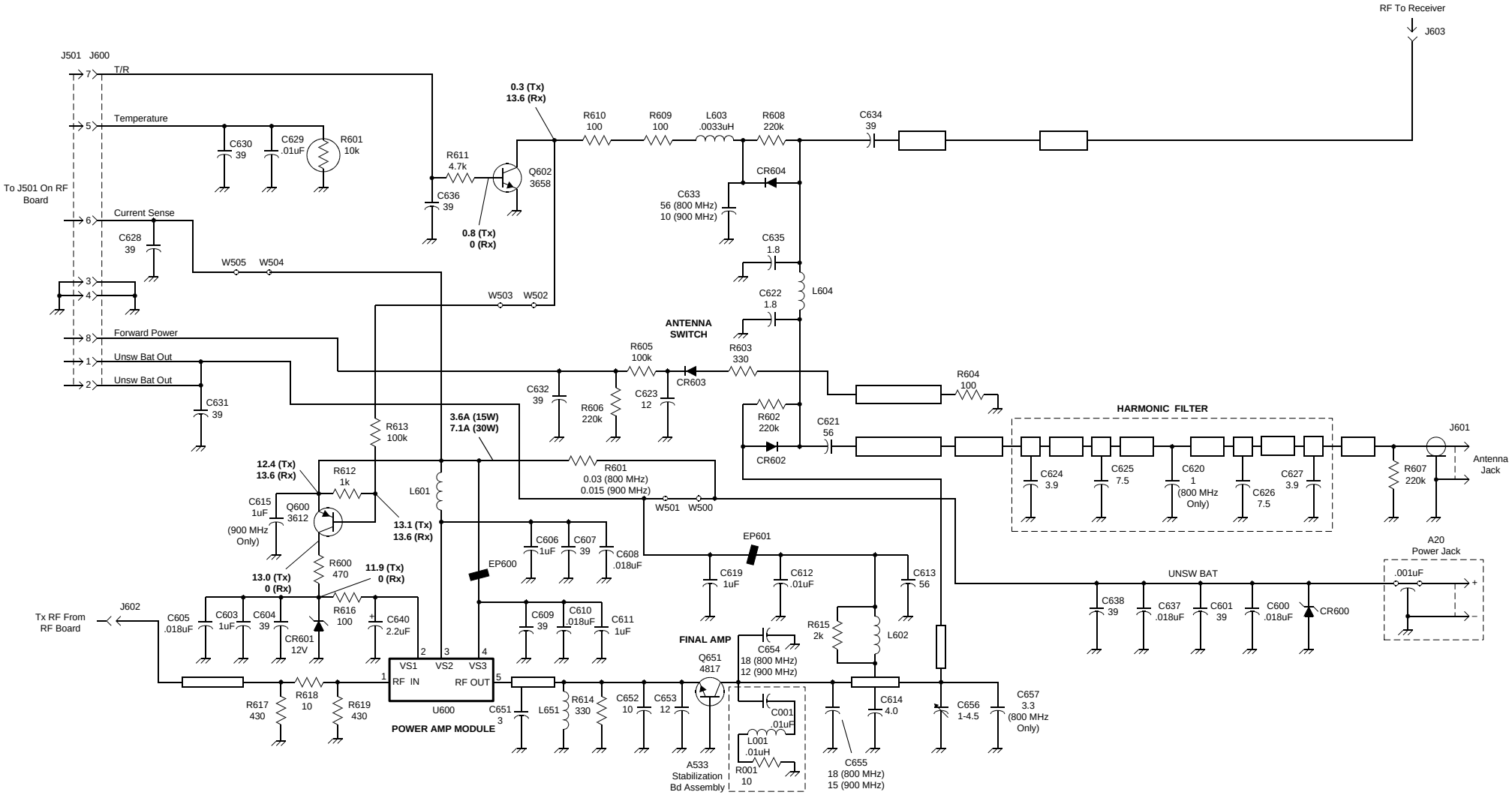
RF BOARD LAYOUT (900 MHZ)



PA BOARD LAYOUT (15W, 800/900 MHZ)

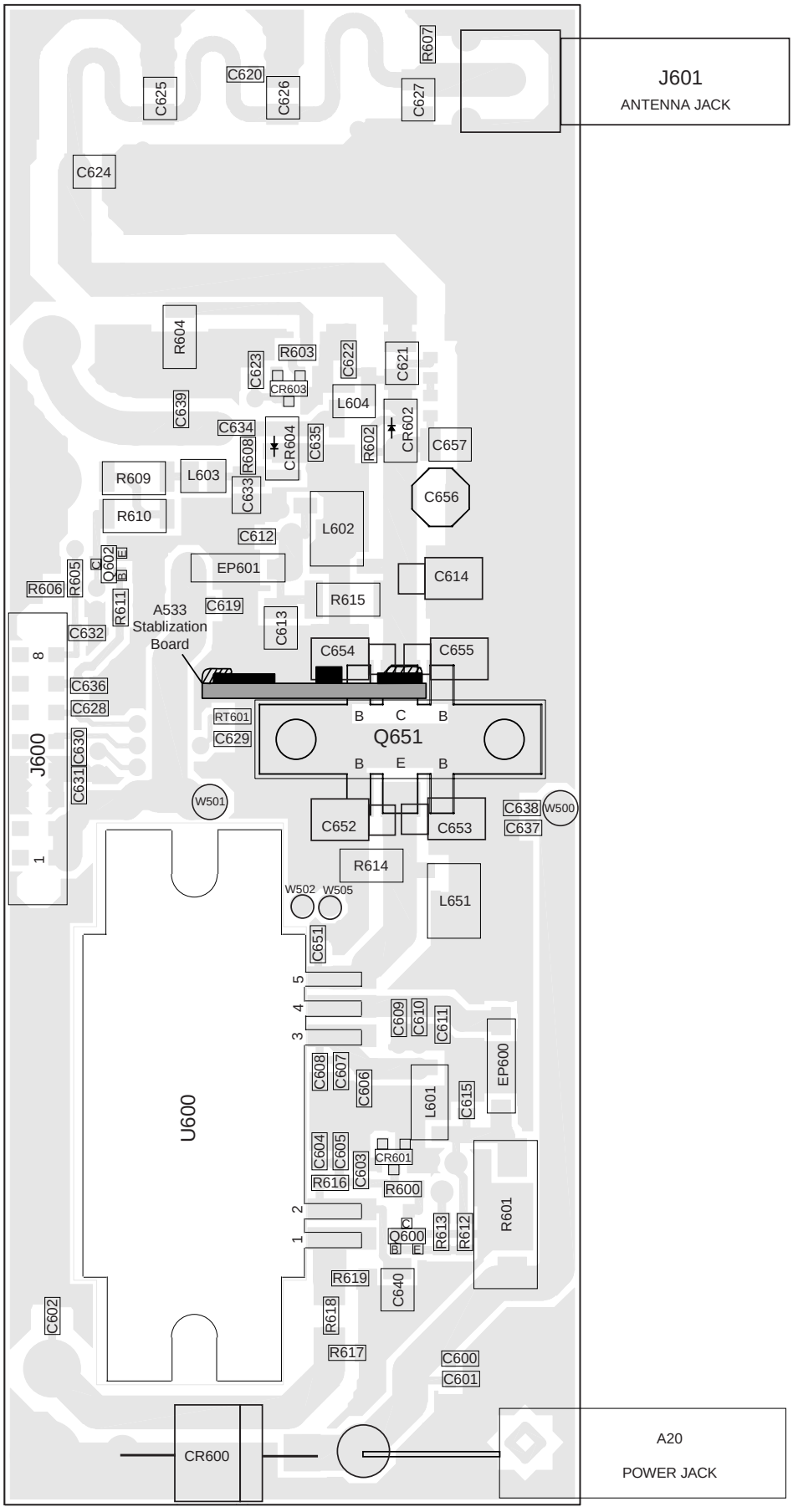


VCO BOARD LAYOUT (800/900 MHZ)

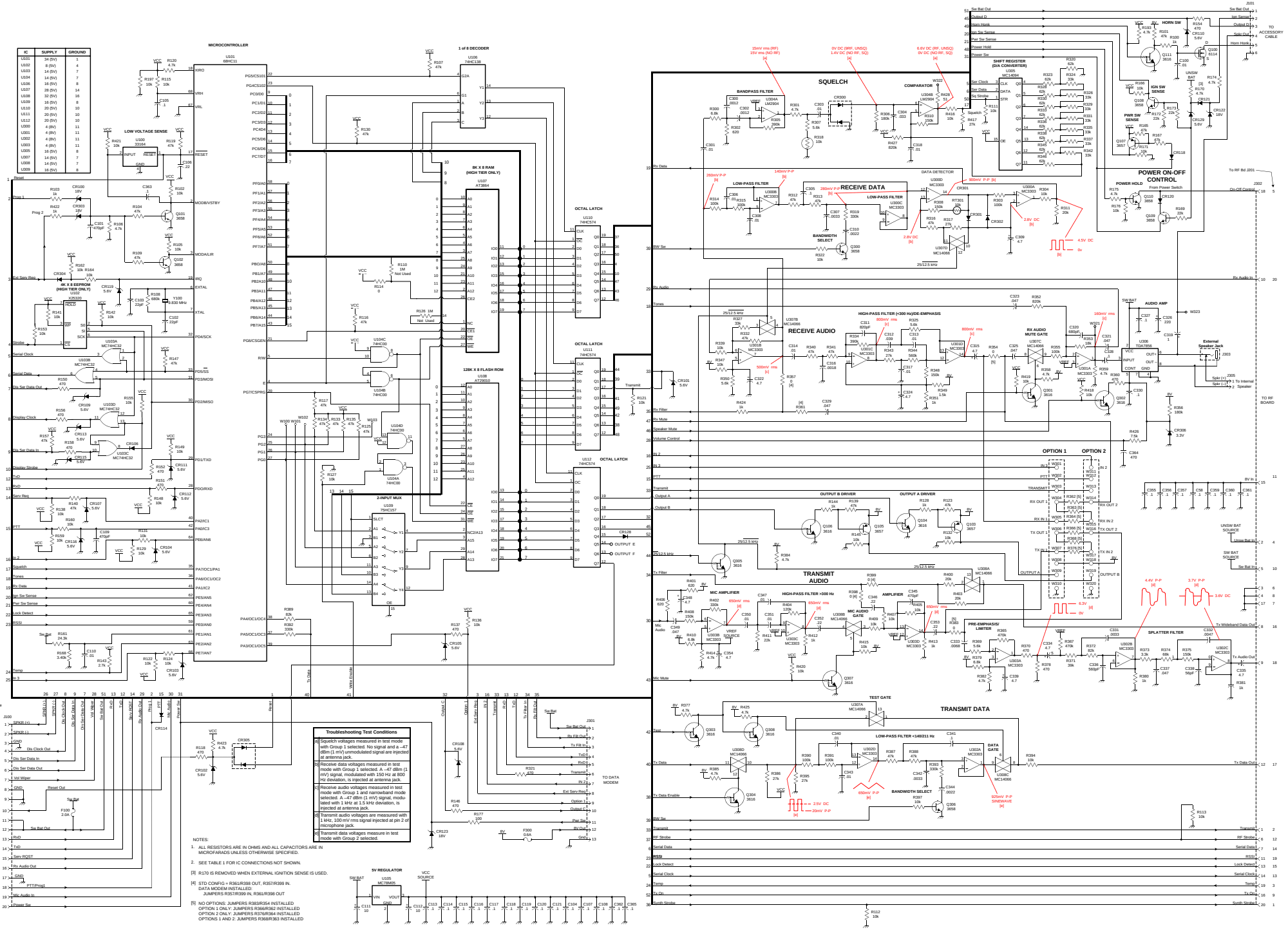


PA BOARD SCHEMATIC (30W, 800/900 MHZ)

February 2001
Part No. 001-9800-001

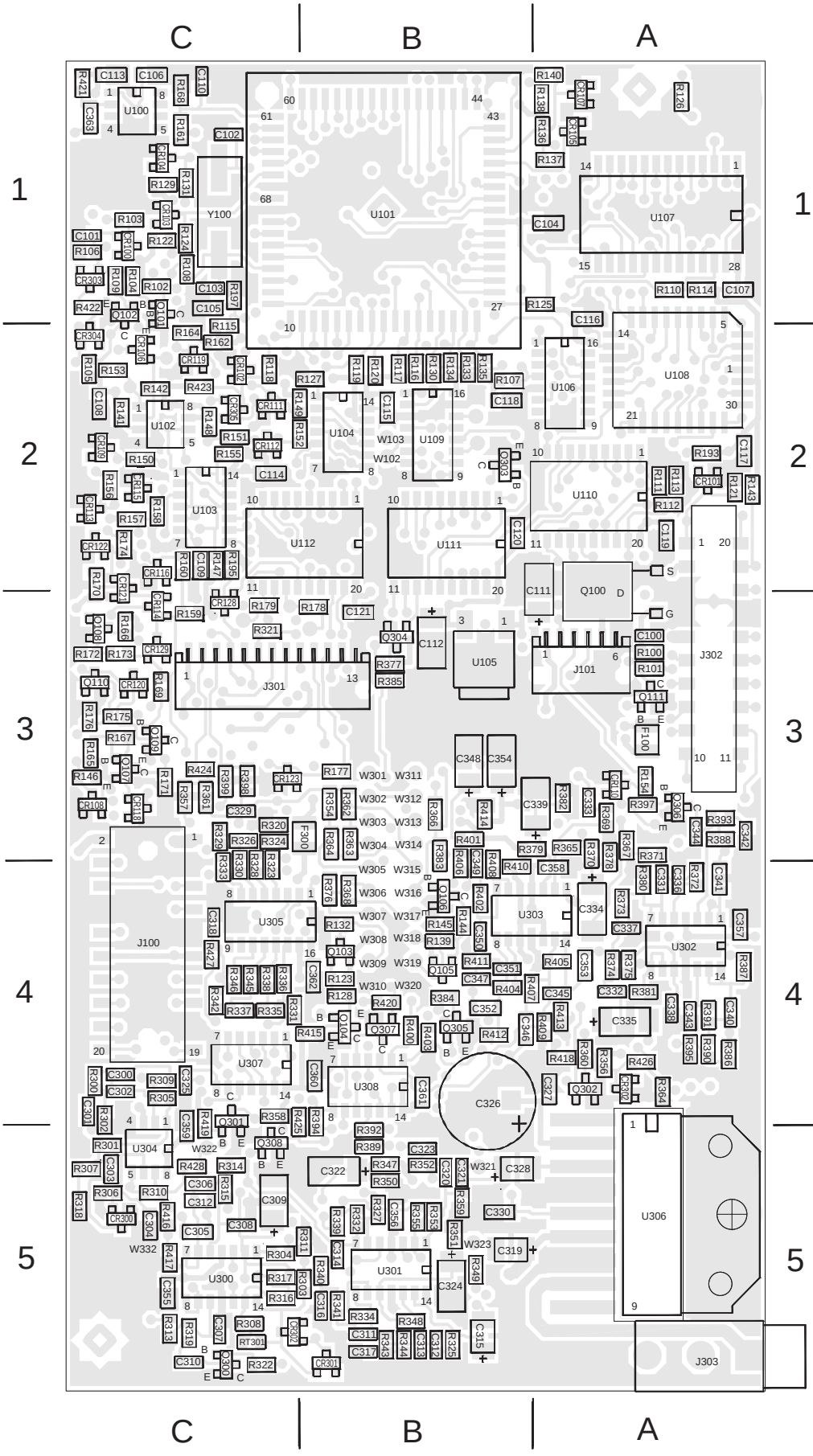


PA BOARD LAYOUT (30W, 800/900 MHZ)



AUDIO/LOGIC BOARD SCHEMATIC

February 2001
Part No. 001-9800-001



AUDIO/LOGIC BOARD LAYOUT

Part Number 001-9800-001CD
1-01 hph Printed in U.S.A.