Maintenance Manual

DRC-200
DESKTOP REPEATER
450 - 470 MHz

ERICSSON

REVISION HISTORY

REVISION	DATE	REASON FOR CHANGE
R1A	9/96	Original
R1B	11/96	Corrected item 10 on page 11. Change phone numbers.

NOTICE!

This manual covers Ericsson and General Electric products manufactured and sold by Ericsson Inc.

NOTICE!

Repairs to this equipment should be made only by an authorized service technician or facility designated by the supplier. Any repairs, alterations or substitution of recommended parts made by the user to this equipment not approved by the manufacturer could void the user's authority to operate the equipment in addition to the manufacturer's warranty.

NOTICE!

TABLE OF CONTENTS

FIGURES

SPECIFICATIONS
(Subject to change without notice)

General

Regulatory Approval	
FCC	ARUDERU25B
DOC	491 195 162A
Frequency Range/Model	450-470 MHz
Number of Channels	1
Operating Temperature	-30°C to +60°C
Frequency Stability	± 2.5 PPM, -30°C to +60°C
Antenna Impedance (RX and TX)	50 Ohms
Speaker – Internal	8 Ohm, 2 Watts
– External	3.2 Ohm, 5 Watts
Supply Voltage	120 VAC, 50/60 Hz; 105 Watts (@ 25W TX) 240 VAC, 50/60 Hz; 105 Watts (@ 25W TX)
AC Line Protection	4A Fuse, fast blow type
Connectors – Antenna	Type N, female (jack)
– Microphone	Modular, 6-pin
– Multifunction Port	DB15, female
– External Speaker	3.5mm jack
Size (H x W x D)	5.625" x 13.187" x 15.750"
Weight	13 lbs., 12 oz.

Receiver

Sensitivity – 12 dB SINAD	0.3 µV Max.
Threshold Squelch	8 dB SINAD Max.
Selectivity – 25 kHz	75 dB Min.
– 50 kHz	80 dB Min.
Intermodulation	75 dB Min.
Spurious Response	85 dB Min. (w/o duplexer)

Continued

SPECIFICATIONS - Continued
(Subject to change without notice)

Receiver - Cont.	
Audio Output	2 Watts Max. (5 Watts External)
Audio Distortion	5% Max. @ 4.0 VRMS
Attack Time	50 ms Max.
Closing Time	100 ms Max.
Unsquelched Hum and Noise	45 dB Min.
Squelched Hum and Noise	-65 dBW Min.
FCC	Part 15
Transmitter	
Operational Bandwidth	10 MHz
RF Output – Standard	25 Watts Min. @ 50% Duty Cycle 10 Watts Min. @ Continuous
– Low Power (programmable)	Adjustable from 2 Watts to 10 Watts
Spurious/Harmonics Emissions	-70 dBc
FM Hum and Noise	-40 dB Min.
Modulation	± 5 kHz
Audio Distortion	3% Max.
Attack Time	100 ms Max.
Time-Out Timer (programmable)	0, 15, 30 or 60 seconds; 2, 4, 8 or 16 minutes
TX Hang Timer (programmable)	0 to 15 seconds @ 1 second increments
Identifier (programmable)	Call sign in Morse code (CW); up to 8 characters
Tone Frequency	1215.9 Hz
Modulation (40% ± 10%)	± 2kHz (± 0.5 kHz)
Transmission (Keying) Rate	21 – 22 WPM; Dot = 64 ms, Dash = 192 ms
Transmission Intervals	15, 30, 60 or 90 Minutes; Once at first transmission after 10 minutes of inactivity
FCC Type Acceptance	Part 90; Emission Designator 16K0F3E, 14K8F1D Part 95; Emission Designator 16K0F3E

DESCRIPTION

The DRC-200 is a state-of-the-art Desktop Repeater for operation in the Land Mobile UHF (450-470 MHz) frequency band.

The repeater operates in the UHF band with a 25 watt (without duplexer connected) RF output. Low power operation of 2 Watts is also available (Dealer programmable). The built-in switching power supply automatically configures itself for operation on 120 VAC or 240 VAC, 50/60 Hz.

The unit features built-in Digital Channel Guard (DCG) and standard Channel Guard (CG) tone squelch. In addition, an external encoder and decoder can be utilized. A programmable CW Identifier is also included.

The radio has been programmed by the dealer. A list of items determining the radio's configuration should be available from the dealer. See page 10 for a list of Dealer Programming Options and page 41 for a blank form for recording the Unit's configuration. The radio's program is stored in non-volatile memory, which does not require a battery back-up.

NOTE

In this manual, the words repeater, radio and unit are used interchangeably.

See Figure 1 below for Repeater Front Panel details.

The Unit comes with the following standard accessories:

- Duplexer, installed
- Microphone Hang-up Clip with mounting hardware
- Operator's/Installation Manual AE/LZT 123 1899
- Duplexer Tuning Manual AE/LZB 119 1910

Optional accessories include:

- Handheld Microphone with Coiled Cable
- Heavy Duty Desk Microphone

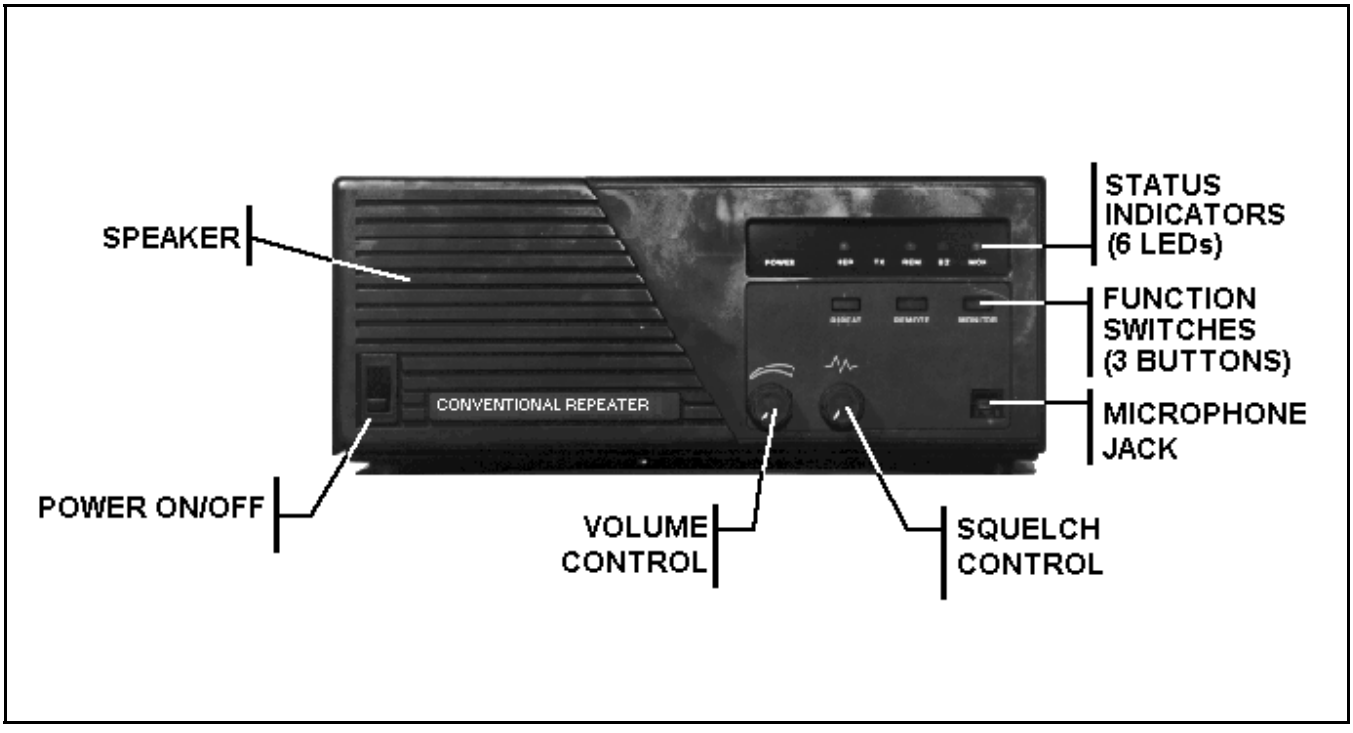


Figure 1 - Front Panel Details

INSTALLATION

NOTE

It is recommended that the repeater and antenna installations be performed by a technician qualified in 2-way radio.

LOCATION CONSIDERATION

Choose a location for the radio that permits several inches of clearance all around. This is necessary for proper heat dissipation, especially around the heat sink mounted on the rear panel.

CABLE CONNECTIONS

1. Install the TX and RX antenna cables on their respective N type connectors. See Figure 2 below.

NOTE

When duplexer is used, antenna connection is made to connector labeled ANTENNA.

2. If used, plug in the cable to the Multifunction Port's DB15 connector. See page 8 for more details.

3. If used, plug in the External Speaker. This disconnects the Unit's internal speaker.

4. Install the microphone's cable in the modular jack located on the front panel. There will be a click when the connector is fully seated.

5. Plug the AC cord into a suitable 120 or 240 VAC receptacle.

HANDHELD MICROPHONE

If a handheld microphone is used, a hang-up clip (supplied) can be mounted on the Unit's right side near the front panel. Using the one screw at the upper front corner and the one approximately 2 1/2" below it, install the clip so that the microphone's hang-up button can be easily slid downward in place.

OPERATING CONTROLS AND INDICATORS

This section gives a brief description of each control, button and status indicator. The OPERATION section provides more details on each of these and how they relate to the unit's overall operation.

As each button is pressed, a beep (if enabled; dealer programmable; see Page 10) will be heard. A high frequency beep indicates the ON or enabled state, while a low frequency beep indicates the OFF or disabled state.

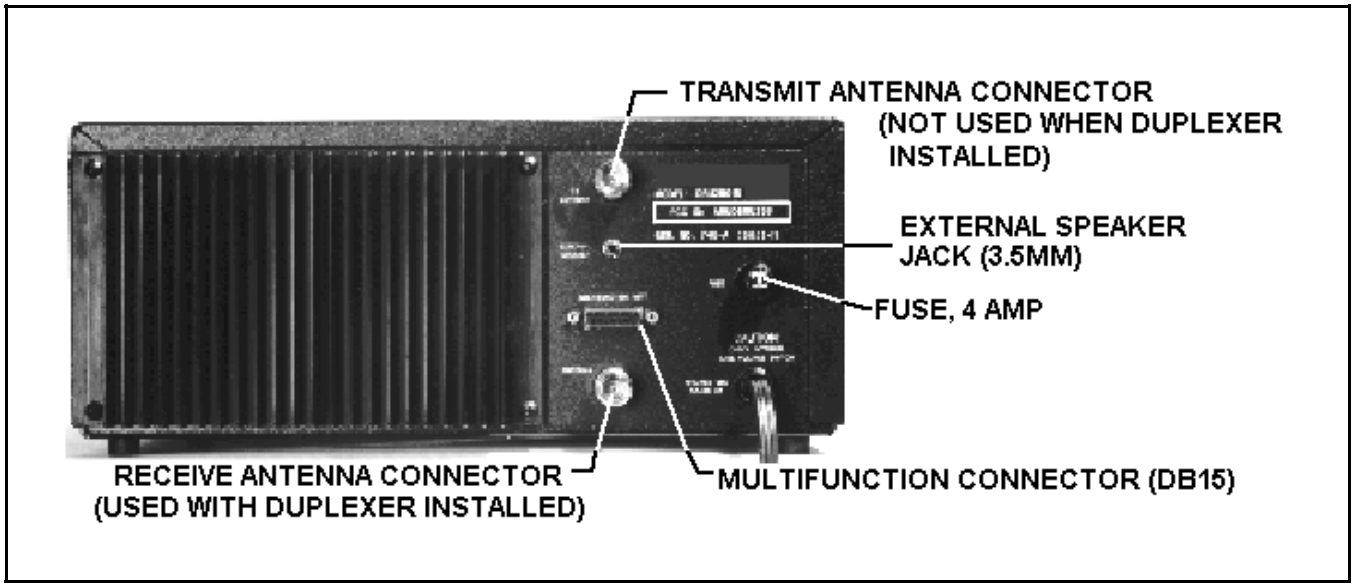


Figure 2 - Rear Panel Details.

POWER ON/OFF Switch

Power ON/OFF is a rocker switch. Press in at the top end to turn the unit ON. Press in at the bottom end of it to turn the radio OFF.

The indicator (LED) at the left end of the window (labeled **POWER**) should be lighted green when the unit is ON.

VOLUME Control

Use this knob to vary the receiver's audio output level. This also varies the audio level to an external speaker.

SQUELCH Control

NOTE

Do not turn the knob to maximum clockwise position. Turning the SQUELCH control significantly past (clockwise) the threshold of quieting may adversely reduce receiver sensitivity and communications range.

Use this knob to eliminate speaker noise when not receiving a transmission. For proper operation, turn the knob counter-clockwise until noise is heard. Then turn the knob clockwise until the noise just disappears.

NOTE

When adjusting the squelch control, the Radio should be in the MONITOR Mode.

MONITOR Button

Pressing this button toggles the unit into and out of the Monitor Mode. When the unit is in the Monitor Mode, the yellow LED labeled **MON** will be lighted. Also, any input signal to the unit's receiver can be heard, even if it has tone coding such as CG or DCG.

REPEAT Button

Pressing this button toggles the unit into and out the Repeater Mode. The yellow LED labeled **REP** is lighted when the Repeater Mode is enabled. The unit will NOT transmit as a repeater unless the Repeater Mode is enabled.

REMOTE Button

Not used.

REM Indicator

Not used.

BZ Indicator

This green LED labeled **BZ** will be lighted whenever a signal is received. In other words, the channel is busy (in use).

TX Indicator

When the repeater's transmitter section is activated, the red indicator labeled **TX** will be lighted.

MULTIFUNCTION CONNECTOR

The female DB15 connector, labeled MULTIFUNCTION PORT and located on the rear panel, provides for interfacing to a remote control device (DC, Tone or Local), an Interconnect Control panel or for RS232 data input. See Figure 3 for pin configuration. The purpose and/or specification of each pin is as follows:

Pin No.	Purpose/Specification
1	Ground
2	Remote PTT; a low (ground) will cause the Unit to transmit with User No. 1's tone and the Remote TX Audio (Pin 7).
3	Remote RX Audio Output; buffered de-emphasized receiver audio.
4	Data PTT; a low (ground) will cause the Unit to transmit with Data In audio (Pin 11).
5	Interconnect PTT; a low (ground) will cause the Unit to transmit with User #16 tone and the Interconnect TX Audio (Pin 14).
6	Switched +13.8 VDC; provides a low current (less than 1 A) voltage source.
7	Remote TX Audio Input; is pre-emphasized by the Unit.
8	Carrier Operated Signal (COS); output will be low (transistor turned on) when the Repeater's squelch opens (breaks), regardless if Repeater's audio is muted or not.

Continued

Continued

Pin No.	Purpose/Specification
9	Discriminator's Audio Output; buffered unprocessed (not de-emphasized) audio.
10	Interconnect RX Audio Output; buffered de-emphasized receiver audio.
11	Data In; 4800 BAUD (2400 Hz) Maximum.
12	Remote Audio B. Not Applicable
13	External CG/DCG Input; modulates the VCO/Reference Oscillator; External Encoding must be selected for the Encode Tone.
14	Interconnect TX Audio Input; is pre-emphasized by the Unit.
15	Interconnect Control Output; goes Low when User #16 tone is decoded (or if the External Decode pin is low).

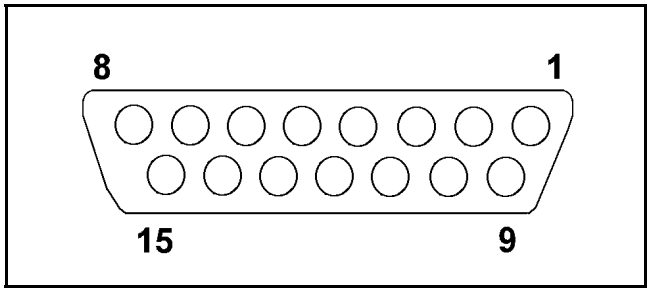


Figure 3 - DB15 Connector Pin Positions - Rear Panel View.

MULTIPLE CG/DCG DECODE

The unit's built-in decoder can be programmed to accept up to 16 different user's CG tones or DCG codes and properly decode each one. There can be any combination of tones or codes as long as the total is not more than 16. User No. 16's tone or code is always associated with Interconnect Control.

The tone or code that is actually transmitted is not the original one received, but one that is re-generated by the unit. The generated tone or code can be a different tone or code, as determined by the unit's configuration programmed by the dealer. For example, if the CG tone received is No. 12 (100.0 Hz), the Unit can be programmed to transmit No. 18 (123.0 Hz) or even a DCG code. However, a received tone (or code) cannot be re-generated for more than one tone (or code), whether it is the same or different tone (code). For example, if received tone No. 12 is to be re-generated as No. 18, it then cannot also be re-generated as No. 23 .

One of the 16 different tones or codes can be an input from an external encoder. The external encoder signal has priority over the Unit's built-in encoder.

OPERATION

INITIAL

Turn on the unit. If squelch hasn't been set yet, put the unit into the Monitor Mode. If the yellow MON LED is not lighted, press the MONITOR button. Set the Volume Control approximately to its 9 o'clock position. Then turn the Squelch Control counter-clockwise until "noise" is heard.

At this time, the Volume Control can now be set for the desired audio listening level. It can also be set later, when an actual signal is being received. The Volume Control has no effect on the transmitter audio.

Now turn the Squelch knob clockwise slightly past the point where the noise just disappears. This is the proper position for all normal squelched operations. If "noise" is occasionally heard, turn the Squelch Control slightly more clockwise. If desired, the unit can now be taken out of the Monitor Mode by pressing the MONITOR button. The MON indicator should turn off.

GENERAL

If the unit is to be used as a self-controlling (receiver operation) repeater, press the REPEAT button to light the REP LED.

PTT OPERATION

The operation of the radio's PTT function has 5 priority levels (1 being the highest) as follows:

1. Local (front panel jack) microphone.
2. Remote, if enabled (REM LED on).
3. DATA (via DB15 connector).
4. Interconnect Control panel.
5. Receiver, if REPEAT Mode enabled (REP LED on).

Although no repeater set-up would likely be configured to accept all 5 PTTs, it is quite possible that at least two of the five would be utilized. For example, the receiver's PTT action and the front panel's PTT would probably be used during the repeater's initial installation and its checkout.

What the effect of prioritizing the various PTTs means is that the TX audio of the PTT with the higher priority will always be transmitted. For example, if the unit is receiving a mobile unit, the audio being transmitted (repeated) is from the receiver. Then if a remote control PTT is activated, the audio from the remote is now transmitted (repeated).

MAINTENANCE

NOTE

All adjustments affecting transmitter power output, carrier frequency or modulation MUST be performed by a qualified electronics technician.

CAUTION

Do NOT tamper with internal adjustments. Damage to the equipment and/or improper operation may result.

Service Reminder

Have the Repeater checked periodically by a qualified electronics technician using this Maintenance Manual, AE/LZB 119 1882.

SIMPLIFIED TROUBLESHOOTING

Perform the simple checks indicated below prior to returning the Unit for service.

Trouble	Check
No reception.	Check antenna connections.
No sound.	AC power cord. Volume control setting. Check External speaker connection.
Doesn't repeat mobile's transmission.	Is REP indicator lighted?. If not, press REPEAT button.

NOTE

For In-Warranty service information, refer to the *Limited Warranty And Repair Information* paragraph.

For future reference, please record:

Product Code _____

FCC Identifier_____

Serial No._____

Date Purchased_____

Dealer_____

SUMMARY OF DEALER'S PROGRAMMING OPTIONS

1. Users – 1 to 16 users can be uniquely defined by: their decode/encode tone or code; whether or not there will be a courtesy beep; whether or not there will be an encoding tone or code transmitted during Hang Time. User No. 1 is frequently referred to as the "Boss tone". User No. 16 is reserved for Interconnect Control applications. A user may consist of one or many subscribers (or mobile units) assigned to the same tone or code.

   It should be noted that if no user tones (or codes) are selected, the unit will respond to any carrier received. In other words, if the unit is in the Repeater Mode it will repeat any carrier received, regardless if the carrier is tone (or code) encoded or not.

2. Channel Guard Tones – any one of 50 CG Tones can be programmed for any user. The Tone used for a User's decode (receive) tone can either be the same, or different, from the user's encode (transmit) tone. The same decode tone can not be used for more than one user. However, the same encode tone could be used for all 16 users if desired.

3. Digital Channel Guard Codes – any one of 104 DCG Codes can be programmed for any user. The Code used for a user's decode (receive) code can either be the same, or different, from the user's encode (transmit) code. The same decode code can

not be used for more than one user. However, the same encode code could be used for all 16 users if desired.

4. External Encoder/Decoder – any one of the 16 user tones or codes can be programmed for using an external encoder.

5. Courtesy Beep – each user can be programmed to provide a beep for 100 milliseconds after the originating transmission is stopped. This signals the receiving unit(s) that the originating unit has quit transmitting.

6. Button Beep – the unit can be programmed to either beep or not beep whenever one of the buttons (REPEAT, MONITOR) is pressed. A high frequency beep indicates the button's associated function is enabled. A low frequency beep indicates the function is disabled. Error beeps are not affected by this Option's selection.

7. Low RF Power – the unit can be set to High (Normal) RF Power Out or Low RF Power Out. Low Power Out can be manually adjusted to approximately 2 Watts.

8. Time-Out Timer – the unit's Time-Out (carrier control) Timer can either be disabled or set to allow a transmission of 15, 30 or 60 seconds or 2, 4, 8 or 16 minutes duration.

9. Hang Time – the unit's Hang Time (drop-out delay) can be disabled (0 seconds) or set from 1 to 15 seconds, in 1 second increments. Hang Time is the duration of time starting either with the release of any PTT Switch or when the unit's received carrier drops while in the Repeater Mode.

10. Squelch Tail Eliminator – the unit can be set to transmit a CTCSS tone at the end of a preset Hang Time that is 180-degrees out of phase from the tone transmitted during Hang Time.

11. CW Ident – the unit can be programmed to transmit a Continuous Wave (CW) Morse Code Identification (Ident) consisting of 1 to 8 characters comprised of any of the 26 letters (standard English alphabet) and any number 0 through 9.

12. CW Ident Interval – the unit can be programmed to send its CW Ident upon activation of any PTT (except DATA PTT) after every 15, 30, 60 or 90 minutes of activity. The unit will also automatically send its CW Ident upon the first PTT (except DATA PTT) after power up and after every 10 minutes of inactivity.

Channel Guard Tones (CTCSS) 50 Tones

CTCSS tones are specified by a code number in the PC programmer. The following is the relationship between the code number and the resulting CTCSS tone frequency in Hz.

Code 000 = No Tone = Carrier Squelch

001 = 67.0	011 = 97.4	021 = 136.5	031 = 192.8	041 = 165.5
002 = 71.9	012 = 100.0	022 = 141.3	032 = 203.5	042 = 171.3
003 = 74.4	013 = 103.5	023 = 146.2	033 = 210.7	043 = 177.3
004 = 77.0	014 = 107.2	024 = 151.4	034 = 218.1	044 = 183.5
005 = 79.7	015 = 110.9	025 = 156.7	035 = 225.7	045 = 189.9
006 = 82.5	016 = 114.8	026 = 162.2	036 = 233.6	046 = 196.6
007 = 85.4	017 = 118.8	027 = 167.9	037 = 241.8	047 = 199.5
008 = 88.5	018 = 123.0	028 = 173.8	038 = 250.3	048 = 206.5
009 = 91.5	019 = 127.3	029 = 179.9	039 = 69.4	049 = 229.1
010 = 94.8	020 = 131.8	030 = 186.2	040 = 159.8	050 = 254.1

Digital Channel Guard Codes 104 codes

CDCSS codes are specified by a code number in the PC programmer. The following is the relationship between the PC programming code number and the resulting TIA/EIA CDCSS code and its inverted equivalent.

Code	DCS	Inv. DCS	Code	DCS	Inv. DCS	Code	DCS	Inv. DCS	Code	DCS	Inv. DCS	Code	DCS	Inv. DCS
051	023	047	072	131	364	093	251	165	114	371	734	135	532	343
052	025	244	073	132	546	094	252	462	115	411	226	136	546	132
053	026	464	074	134	223	095	255	446	116	412	143	137	565	703
054	031	627	075	143	412	096	261	732	117	413	054	138	606	631
055	032	051	076	145	274	097	263	205	118	423	315	139	612	346
056	036	172	077	152	115	098	265	156	119	431	723	140	624	632
057	043	445	078	155	731	099	266	454	120	432	516	141	627	031
058	047	023	079	156	265	100	271	065	121	445	043	142	631	606
059	051	032	080	162	503	101	274	145	122	446	255	143	632	624
060	053	452	081	165	251	102	306	071	123	452	053	144	654	743
061	054	413	082	172	036	103	311	664	124	454	266	145	662	466
062	065	271	083	174	074	104	315	423	125	455	332	146	664	311
063	071	306	084	205	263	105	325	526	126	462	252	147	703	565
064	072	245	085	212	356	106	331	465	127	464	026	148	712	114
065	073	506	086	223	134	107	332	455	128	465	331	149	723	431
066	074	174	087	225	122	108	343	532	129	466	662	150	731	155
067	114	712	088	226	411	109	346	612	130	503	162	151	732	261
068	115	152	089	243	351	110	351	243	131	506	073	152	734	371
069	116	754	090	244	025	111	356	212	132	516	432	153	743	654
070	122	225	091	245	072	112	364	131	133	523	246	154	754	116
071	125	365	092	246	523	113	365	125	134	526	325			

ACCESSORIES

The following accessories are available:

KRD 103 121/11	PC Programming Kit (consists of the following)	
	KRD 103 121/12	Programming Software
	KRD 103 121/13	Instruction Sheet
	KRD 103 121/14	Interface Adapter
	KRD 103 121/15	Programming Cable
KRD 103 121/31	Handheld Microphone	

THEORY OF OPERATION

GENERAL INFORMATION

The Repeater circuitry is distributed on five PC boards as follows:

a. Main PC Board containing the receiver section and transmitter/audio control section

b. Microprocessor/Display PC Board.

c. Control PC Board which contains the audio and squelch controls,

d. PA PC Board.

e. Power Supply module.

MAIN BOARD

RECEIVER SECTION

The receiver section uses 13.8 V DC from the Power Supply module for the audio power amplifier **U404**. All other circuits use regulated +10.0 volts from **U405** or **U408**, regulated +5.0 volts from **U406** or **U407**, or regulated -5.0 volts from the transmitter section.

The RF signal enters the receiver section via a 3 pole helical resonator filter **L401** and is amplified by a low noise, wide dynamic range RF amplifier formed around **Q401**. The signal then passes through a 4 pole helical resonator filter **L404** before being feed to a double balanced mixer **HY401**.

The receiver fractional-n synthesizer IC **U403** receives its frequency information from the microprocessor **U201** on the Microprocessor/Display board. The synthesizer uses a 12.8 MHz TCXO (2.5 PPM temperature compensated crystal oscillator) **Y402** as the reference for the synthesizer frequency. The error voltage from the synthesizer IC is filtered by a passive loop filter before being applied to the VCO (voltage controlled oscillator) formed around **Q404**. The VCO operates at the local oscillator injection frequency 21.4 MHz below the receive frequency. The VCO is buffered by **Q405** and amplified by **Q406**. **Q407** acts as a constant current source for **Q406** to regulate the local oscillator injection level to the mixer. The output of **Q406** is coupled to the double balanced mixer **HY401**.

The desired output of mixer **HY401** is at 21.4 MHz and is buffered by **Q402** before being coupled to a 21.4 MHz six pole crystal filter **XF401**. The filtered output is amplified by **Q403** before being applied to **U401**. Inside **U401**, the 21.4 MHz signal becomes the input to a second mixer with an LO frequency of 20.945 MHz as determined by **Y401**. The second mixer output at 455 kHz is filtered by a six pole ceramic filter, **CF401**, then internally amplified and applied to an FM detector. The detector output level is maximized through adjustment of the quadrature detector coil **L409**. The detected audio is buffered by **U402D** before being routed to the Microprocessor/Display PC Board.

The detected audio from **U402D** is also routed to the Squelch control **R102** on the Control PC Board. The center arm of the squelch control is routed to a high pass filter and an amplifier internal to **U401**. **U401**'s output is routed to an additional high pass filter **U409B** before being rectified by **CR401**. The amount of ultrasonic noise on the detected audio from **U401** is used to determine the presence of an RF carrier. The DC voltage from **CR401** is routed to the Microprocessor/Display PC Board as an input to the microprocessor **U201**.

U404 is the audio power amplifier which drives either the internal speaker or an external speaker.

TRANSMITTER/AUDIO CONTROL SECTION

This section contains the -10.0 volt regulator **U514** whose output is further regulated to -5 volts by **U515**. The negative (–) 5 volt output is used by both the transmitter and the receiver VCO's. There are two +5.0 volts regulators **U510** and **U511**, as well as a +10.0 volt regulator **U513**, and a switched +10.0 volt regulator **U512** used for the transmit VCO and transmit driver sections.

The unit has provisions for connecting local microphone audio, remote station audio, interconnect audio, data or repeat audio to the transmitter's modulation circuitry. These audio signals, plus DCS, CTCSS or external tones, are controlled by information from the microprocessor **U201** on the Microprocessor/Display PC Board.

The microphone, remote, interconnect, data, and repeat audio signals are routed through a preamp section before being connected to the multiplexer **U502**. The preamp sections are **U503B** for local microphone audio, **U501A** with gain adjustment **R553** for remote station audio, **U501D** with gain adjustment **R548** for interconnect audio, **U503A** for buffering data and **U501B** with gain adjustment **R507** for repeat audio. The output of the multiplexer is routed to **U507B**, **U507C** and **U507D** which form a limiter and two stage (four pole) low pass filter. A master deviation control **R544** sets the signal level for the VCO modulation input while the balance adjustment **R538** sets the level for the

modulation of the transmit TCXO. For good broadband transmit frequency response, both the TCXO and the VCO are modulated. Two analog switches, **U504A** and **U504C**, control whether external CTCSS tones are to be transmitted or whether internal DCS or CTCSS signals are to be transmitted. These analog switches are controlled by **Q516**. An optional DTMF code can be generated by the microprocessor. This code is amplified by **U501C** with **R511** for deviation adjustment and connected to the audio limiter filter at **U507C**.

The transmitter fractional-n synthesizer IC **U509** receives its frequency information from the microprocessor **U201** on the Microprocessor/Display Board. Like the synthesizer for the receiver local oscillator, this synthesizer uses a 12.8 MHz TCXO (2.5 PPM crystal oscillator) **Y501** for its reference. The error voltage is filtered by the passive loop before being applied to the transmit VCO formed around **Q509**. The VCO operates at the transmitter frequency. The VCO output is buffered by **Q512** and amplified by **Q513**, **Q514** and **Q515** and provides a drive level of approximately 250 milliwatts for the PA PC Board.

Collector voltage is not applied to buffer amplifier transmitter **Q514** until and unless both the receiver and transmitter VCO's are in lock. ALC (automatic level control) dc voltage is feedback from the PA PC Board to differential amplifier **U505A** and comparator **U505B**. **R526** and **R528** set the voltage on the comparator for high and low power output from the PA. The output of the comparator **U505B** controls the supply voltage for **Q513** and base bias of Q514. Q503 and Q504 switch the drive required for high or low power.

MICROPROCESSOR/DISPLAY BOARD

The Microprocessor/Display PC Board contains the microprocessor **U201** which provides data to the receiver and transmitter synthesizers, data to the DTMF tone generator **U202** and **U203**, data to be latched into shift register **U207** which controls LED indicators on the front panel, and data to the receiver audio CTCSS decoder processor **U204**. **U201** and **U207** provides control information to the IC's that control the transmitter audio paths on the main board. The microprocessor **U201** generates the internal DCS and CTCSS tones. The CTCSS tone is routed to an active 4 pole low pass filter **U211** and then to the main PC board to modulate the transmitter. A 4 MHz crystal **Y201** is shared by **U201** and **U204**. The DTMF tone generator **U203** uses a 3.579 MHz crystal **Y202**. All programmed information is stored in a memory IC, **U206**.

Receiver audio from the main board is routed to the CTCSS decoder/audio processor IC **U204**. This IC performs the CTCSS decoding and the primary muting of the receiver audio. Audio from **U204** is routed to an active filter **U205B** which provides de-emphasis for the receiver audio signal. It is then routed back to the main board and to audio power amplifier, **U404**.

A 5.0 volt regulator **U210** supplies voltage to all active components on the Microprocessor/Display PC board.

In addition, the base station model has a two digit display **DP201**, and integrated circuits **U208** and **U209** which process the input from the channel selector switch, **SW101**, on the control PC board.

CONTROL BOARD

This board connects to the volume control **R101**, the squelch control **R102** and on base station models, the channel selection/scan switch **SW101**.

POWER AMPLIFIER (PA) BOARD – 25 WATT

The power amplifier module **U301** is a hybrid amplifier which can provide up to 25 watts of output power from the 250 milliwatts of drive provided by the transmitter section on the main board. PLC1 and PLC2 form an RF pickup loop that samples relative output power. This sampled output is rectified by **CR301** and then filtered and amplified by **U302A** and **U302B**. A thermistor temperature sensor provides for automatic power reduction if the power amplifier module's temperature limit is exceeded. The output from **U302A** is the ALC (automatic level control) DC voltage which is routed to the transmitter section of the main board for control of the output power. **U303** is a voltage regulator for **U302A** and **U302B**.

A switched 13.6 volt source from **Q505** supplies voltage to the transmit/receive RF switch. Pin diodes **CR302** and **CR303** connect the output power amplifier **U301** to the antenna while shorting out the coax cable to the receiver. In the repeater, the receiver is connected to its own antenna connector rather than the cable from the PA board. Between the transmit receive switch and the antenna connector is the RF output low pass filter. The low pass filter components are **L306**, **L307**, **L308** and associated capacitors, **C310**, **C316**, **C317**, **C319** and **C320**.

TRANSMIT RECEIVE SWITCH

When the transmit 13.6 Volt line (Pin 3 of **J301**) becomes active, current passes through **L316**, **R308**, **L311**, **CR301**, **L315**, **CR302** and **CR303** to ground. **L316**, **C340**, **C339**, **L311** and **C338** isolate and bypass the RF. **CR301** conducts RF from **Q303** to the low pass filter. **CR302** and **CR303** short to ground preventing RF from entering the receiver input **P303**. **L315** along with the distributed capacitance form a high impedance path to ground, thus preventing loss of transmit power.

During receive **CR301** opens, disconnecting **Q303**. **CR302** and **CR303** open, removing the short from the receiver path. **L315**, along with the distributed capacitance, then forms a low pass pi section that passes the signal from the antenna to the receiver input.

DC POWER DISTRIBUTION

DC power enters the PA Assembly from the power cable assembly which is plugged into **P301**. The four leads in this cord are:

1. Red, Pin 1 = (+) or 13.6 VSW
2. Black, Pin 2 = (–) or Ground
3. Orange, Pin 3 and 4; Jumper between Pin 3 and 4 to 13.6 VSW

The Black wire should go directly to the negative terminal of the power supply module. The Red wire goes directly to the positive terminal of the power supply module.

The Red wire, or high current path, goes directly to **Q303**, **Q302** and **Q301** through **L317** and **R306**. **C329** bypasses the RF. **CR305** protects this line from polarity reversal by blowing the fuse.

13.6 VSW enters at **P301**. **CR304** protects this line against polarity reversal. This 13.6 VSW line is connected to the Main Board through the power interconnect cable and Pin 1 of **J301**. This line is bypassed by **C326** and **C328**. The other pin connect of **J301** is Pin 4 (ALC OUT), the sensing voltage for thermal shut down and power leveling circuits.

A switched 13.6 volt source from **Q505** supplies voltage to the transmit receive switch. This voltage operates the TR switch through line limiting resistor **R308**. This line supplies 13.6V to **U301**, the 8V regulator, and is bypassed by C325.

RF POWER LEVELING AND THERMAL SHUTDOWN

L318 and **R310** form an RF pickup loop that samples relative output power. This sampled output is rectified by **CR307** and filtered by **C331**, **R309**, **R307** and **C342**. **Q305**'s bias is set by variable resistor **R317**. The detected output interacts with this variable DC voltage. **R317** is used to set **Q305**'s collector (the RF drive control line) to 4.3V at 45 Watts RF output. Any decrease in output power will lower the detected voltage of **CR307** causing **Q305**'s collector voltage to increase. This increased voltage is applied to the ALC circuitry (on the Main board) which will increase the exciter output power bringing the PA output power back up to 45 Watts output. Any increase in the 45 Watts output will have an opposite effect.

Q304 and **RT301** form a temperature sensing circuit with **RT301** thermally connected to **Q303**. When **Q303**'s case exceeds +90°C, **Q304** will start to conduct which in turn will increase the gain of **Q305**. **Q305**'s collector voltage will then be lower, causing the exciter output to decrease. This results in lower drive to the power amplifier, allowing it to cool. RF output power is decreased but still allows lower power operation. **C343** is a RF bypass.

POWER SUPPLY MODULE

The power supply module converts 120 volts or 220 volts at 50 Hz or 60 Hz to 13.8 volts DC. The power supply is a switch mode type which operates at high efficiency to keep internal temperatures low.

REAR PANEL DB-15 CONNECTOR I/O SPECIFICATIONS

The function, description and specifications of each pin of the Multifunction Port's connector is as follows:

Pin Number: **1**

Name: GND

Description: Chassis and circuit ground. This point serves as the voltage reference for the signals on all of the other pins.

Pin Number: **2**

Name: $\overline{\text{REMOTE PTT}}$

Type: Digital Input

Description: Unless superseded by a higher priority PTT input (see Table 1), when the REM LED on the front panel is illuminated, an active level at this input will cause the transmitter to transmit a carrier modulated by the audio signal on the REMOTE TX AUD input (pin 7).

Level: This input is active with input voltages less than 0.8 volts and inactive with input voltages greater than 3.5 volts or when left unconnected. Voltages between 0.8 and 3.5 volts should be avoided, except during switching. Voltages below 0 volts and above 5 volts should always be avoided. The driving source should be able to sink up to 5 mA to produce an active level.

Pin Number: **3**

Name: REMOTE RX AUD

Type: Analog Output

Description: Buffered and squelched de-emphasized receive audio output. This output is unbalanced to ground unless the optional balanced 600 ohm interface board is installed. When this board is installed, this output is one half of a balanced output. The other half would be on Pin 12.

Impedance: 600 ohm nominal, AC coupled.

Level: When the receiver is receiving a noise quieted signal that is modulated at ± 3 kHz by a 1 kHz tone, this output will vary between 75 mv and 1.5 volts RMS open circuit depending upon the setting of **R480** on the main PC board.

Frequency Response: From 300 Hz to 3 kHz within +1/-3 dB of a 6 dB/octave de-emphasis curve.

Pin Number: **4**

Name: $\overline{\text{DATA PTT}}$

Type: Digital Input

Description: Unless superseded by a higher priority PTT input, an active level at this input will cause the transmitter to transmit a carrier modulated by the signal on the DATA IN input (pin 11).

Level: This input is active with input voltages less than 0.8 volts and inactive with input voltages greater than 3.5 volts or when left unconnected. Voltages between 0.8 and 3.5 volts should be avoided, except during switching. Voltages below 0 volts and above 5 volts should always be avoided. The driving source should be able to sink up to 5 mA to produce an active level.

Pin Number: **5**

Name: $\overline{\text{INTERCONNECT PTT}}$

Type: Digital Input

Description: Unless superseded by a higher priority PTT input, an active level at this input will cause the transmitter to transmit a carrier modulated by the audio signal on the INTRCNT. TX AUD input (pin 14).

Level: This input is active with input voltages less than 0.8 volts and inactive with input voltages greater than 3.5 volts or when left unconnected. Voltages between 0.8 and 3.5 volts should be avoided, except during switching. Voltages below 0 volts and above 5 volts should always be avoided. The driving source should be able to sink up to 5 mA to produce an active logic level.

Pin Number: **6**

Name: +13.8VSW OUT

Type: Analog Output

Description: This is the output of the internal 13.8 volt power supply. Since this supply also supplies current for the radio, loads connected to this pin should be limited to less than 1 A current drain. This line is unfused, except for the primary fuse inside the power supply, but has internal shutdown on excessive load currents.

Pin Number: **7**

Name: REMOTE TX AUD

Type: Analog Input

Description: This pre-emphasized audio input modulates the transmit carrier when the REM LED is illuminated, when the REMOTE PTT is taken to its active state and when no higher priority PTT has been enabled.

Impedance: 600 ohms nominal, unbalanced.

Level: Depending upon the setting of R553 (REMOTE AUDIO ADJ.) on the main board, between 25 mv and 250 mv RMS nominal at 1 kHz will produce ± 3 kHz deviation.

Frequency Response: From 300 Hz to 3 kHz within +1/-3 dB of a 6 dB/octave pre-emphasis curve.

Pin Number: **8**

Name: $\overline{\text{COR OUT}}$

Type: Digital Output

Description: This is a transistor's open collector to ground output, which is active when a carrier of sufficient level to operate the BZ LED is being received.

Level: When active, this output will remain at a voltage less than 0.8 volts while sinking up to 50 mA. When inactive, the leakage current is less than 500 nA at voltages up to 50 volts. Voltages above 50 volts may damage the output transistor and should be avoided.

Pin: **9**

Name: DISCR OUT

Type: Analog Output

Description: Buffered, unsquelched output of the receiver discriminator.

Impedance: 600 ohms nominal, unbalanced, DC coupled.

Level: An on-channel signal will produce 1.3 volts DC nominal into an open circuit. Open circuit output level is 200 mv/kHz nominal.

Frequency Response: Flat within +1/-3 dB, DC to 3 kHz.

Polarity: Negative; an increase in frequency will cause a reduction in ouput voltage.

Pin: **10**

Name: INTRCNT. RX AUD

Type: Analog Output

Description: Buffered and squelched de-emphasized audio output.

Impedance: 600 ohms nominal, AC coupled.

Level: This output will be 350 mv RMS open circuit nominal when the receiver is receiving a noise quieted signal modulated at ± 3 kHz by a 1 kHz tone.

Frequency Response: From 300 Hz to 3 kHz within +1/-3 dB of a 6 dB/octave de-emphasis curve.

Pin: **11**

Name: DATA IN

Type: Analog/Digital Input

Description: This flat (no pre-emphasis) input modulates the transmit carrier when the DATA PTT is taken to its active state and no higher priority PTT has been enabled.

This input is designed primarily for digital (logic level) signals, but can accept analog signals of the proper level.

Impedance: 20 kohms, DC coupled.

Level: For digital inputs, the two logic levels are -15 to +0.5 volts and +3.5 to +15 volts. With these levels, either standard TTL/CMOS or RS-232 logic inputs may be used. For analog inputs, a 100 mv RMS signal nominal at 1 kHz will produce ± 3 kHz deviation. A capacitor in

series with analog inputs is required to block the 1.8 volts DC present at this pin.

Frequency Response: Flat within +1/-3 dB, 5 Hz to 2.4 kHz. Note: The input is DC coupled to allow for proper switching of both TTL/CMOS and RS-232 logic signals, but capacitive coupling is used later in the audio chain limiting the frequency response to 5 Hz on the low end.

Digital bit streams are limited to 4800 baud maximum and should not have any continuous string of 0's or 1's for longer than 100 ms.

Polarity: Positive; the most positive input voltage produces the highest carrier frequency.

Pin: **12**

Name: REMOTE AUDIO B

Type: Analog Output

Description: Normally not connected.

Pin Number: **13**

Name: EXT DCS/CTCSS

Type: Analog Input

Description: External input for either DCS (CDCSS) or CTCSS. The signal at this input is enabled through the programming software.

Impedance: 10 kohm.

Level: An input level between 250 mv and 750 mv RMS, depending upon the setting of **R581** (EXTERNAL CTCSS DEV. ADJ.), on the main board is required to produce 700 Hz deviation of a 100 Hz tone.

Frequency Response: Within +1/-3 dB from 10 Hz to 300 Hz.

Polarity: Negative; A positive input voltage change will produce a negative frequency change.

Pin Number: **14**

Name: INTRCNT. TX AUD

Type: Analog Input

Description: This pre-emphasized audio input modulates the transmit carrier when the INTERCONNECT PTT is taken to its active state and when no higher priority PTT has been enabled.

Impedance: 600 ohms nominal, unbalanced.

Level: Depending upon the setting of R548 (INTERCONNECT AUDIO) on the main board, between 25 mv and 250 mv RMS nominal at 1 kHz will produce ± 3 kHz deviation.

Frequency Response: From 300 Hz to 3 kHz within +1/-3 dB of a 6 dB/octave pre-emphasis curve.

Pin Number: **15**

Name: INTRCNT. CONT

Type: Digital Output

Description: This output goes to logic low state when the receiver properly decodes User Tone 16 as programmed.

Level: Active low CMOS output. Logic low level is 0 to 0.4 volts at up to a sink current of 6 mA. Logic high level is 3.7 to 5.0 volts when sourcing up to 6 mA.

PTT PRIORITIES AND TX AUDIO DETAILS

The PTT function has 5 priority levels. The TX audio input associated with each priority level (source) is detailed in Table 1 on the next page.

Table 1 - PTT Priorities and TX Audio Details vs. MUX Logic Levels

PTT PRIORITY	SOURCE	PTT INPUT	AUDIO INPUT	INPUT LEVEL RMS @ 1kHz	LEVEL ADJUSTMENT	FREQUENCY RESPONSE	MUX (U502)		
							Pin 9	Pin 10	Pin 11
1	Local Microphone	Mic. Connector Pin 3	Mic. Connector Pin 4	6 mv	None	Pre-emphasized; 300 Hz to 3 kHz	0	1	0
2	Remote Audio	DB-15 Connector Pin 2	DB-15 Connector Pin 7	25 mv to 250 mv	R553	Pre-emphasized; 300 Hz to 3 kHz	0	1	1
3	Data Input	DB-15 Connector Pin 4	DB-15 Connector Pin 11	TTL/CMOS RS-232 100 mv Audio	None	Flat 5 Hz to 2.4 kHz	1	1	1
4	Interconnect	DB-15 Connector Pin 5	DB-15 Connector Pin 14	25 mv to 250 mv	R548	Pre-emphasized; 300 Hz to 3 kHz	0	0	1
5	Receiver	Receiver Squelch	De-emphasized; Receive Audio	(only available internally)	None	Pre-emphasized; 300 Hz to 3 kHz	0	0	0

NOTES: Priority 1 is the highest level.
"MUX" is an abbreviation for MULTIPLEXER.

0=0 to 0.8 volts
1=3.5 to 5.0 volts

MAINTENANCE

RECEIVER

For optimum performance, the unit should be realigned before being put into service.

Preliminary

1. Program unit for the desired frequency(ies) and tones. Disable tone on a frequency at or near the middle of the range of frequency(ies) programmed. Set the front panel SQUELCH control to the maximum counter-clockwise position. Set the front panel VOLUME control to the mid-range position. Connect an audio RMS voltmeter, SINAD meter, and distortion meter, if available, to the speaker terminals.

2. For base station units, set the unit to a receive frequency nearest the middle of the frequency list.

NOTE

The maximum frequency spread is ± 5 MHz; ± 3 MHz for best sensitivity.

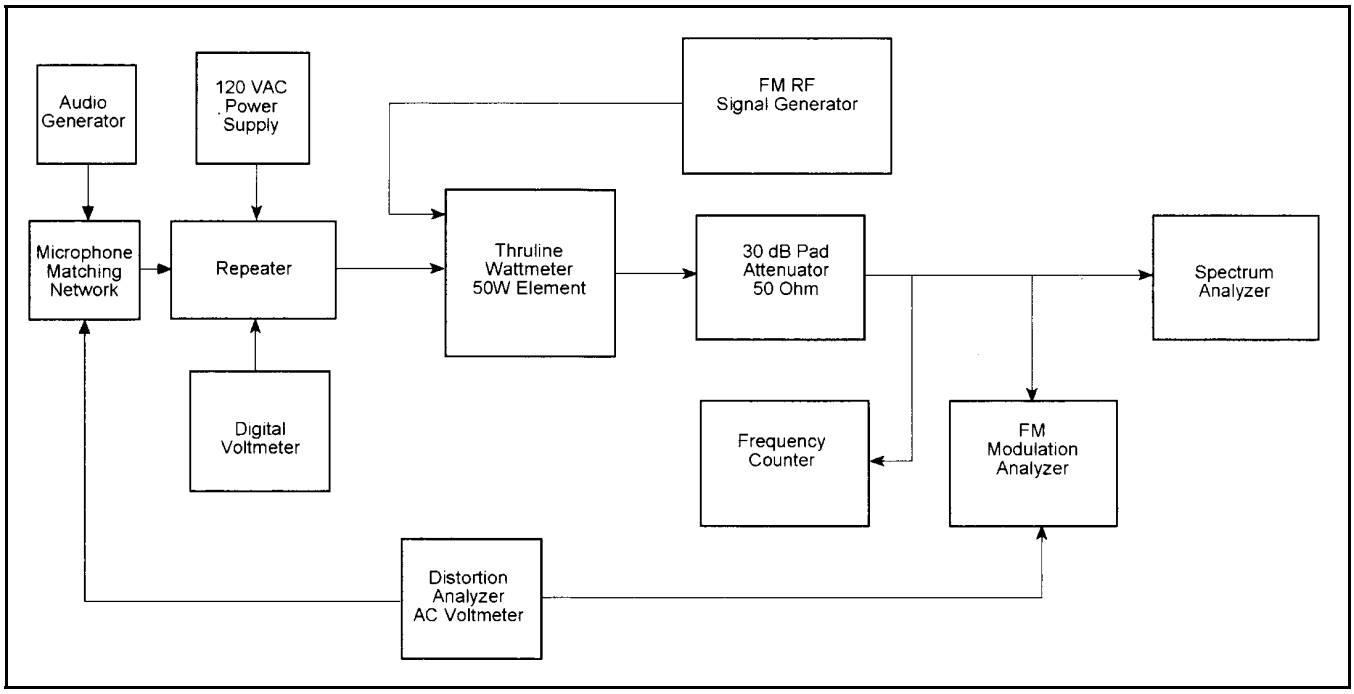


Figure 4 - Equipment Set-Up

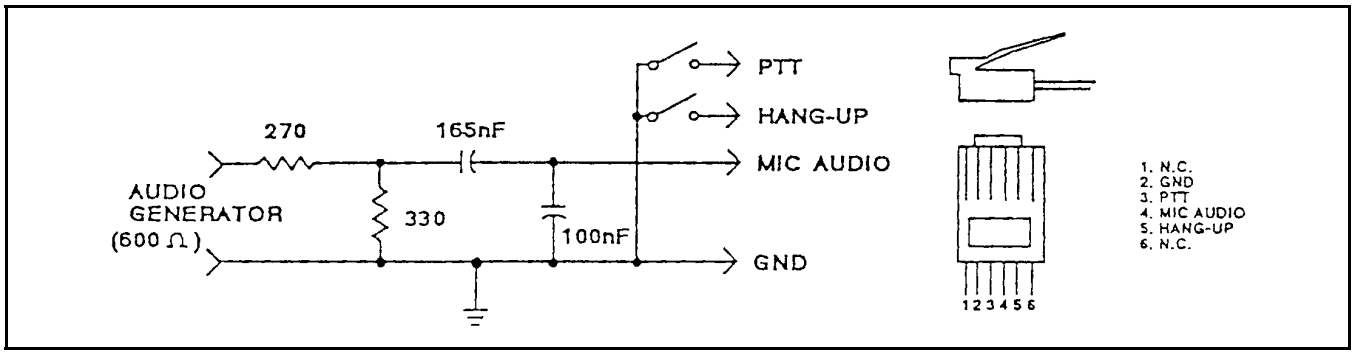
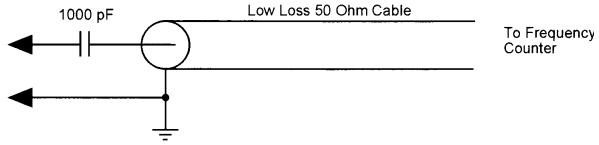


Figure 5 - Microphone Matching Network

VCO Tuning

3. Adjust **C435** for a DC voltage of 2.75 ± 0.05 volts at **TP402**. On base station units, check the maximum and minimum receive frequencies and insure that the voltage at **TP402** is between 1.6 and 4.4 volts.

4. Connect a frequency counter to the output of TEST PROBE A. See Figure below. Hold TEST PROBE A across **R456** and adjust the trimmer capacitor inside **Y402** so that the frequency counter shows a frequency 21.4000 MHz below the receive frequency to within ± 100 Hz.



Test Probe A is an RF coaxial cable with a 1000 pF, 50V min. DC blocking capacitor placed in series with the center conductor. Observe proper polarity of the probe when connecting the unit; one side is connected to test equipment ground.

Figure 6 - Test Probe A

IF Adjust

NOTE

The IF stages have been aligned at the factory and should not normally require realignment when the operating frequency range of the unit is changed.

5. Connect an oscilloscope to **TP401**.

6. Connect an RF signal generator to the ANTENNA Connector on the rear of the unit (on repeater units, make sure the REP LED is off and do not connect to the TX ANTENNA connector). Set the RF signal generator frequency to that of the unit and set the RF output level such that a 0.1 volt p-p 455 kHz signal appears on the oscilloscope.

7. Adjust **L408** and **L407** for maximum signal on the oscilloscope. If necessary, reduce the RF signal generator output level to keep the signal on the oscilloscope at 0.1 volt p-p.

8. Modulate the RF signal generator with a 1000 Hz tone modulated at ±3.0 kHz. Set the signal generator output level to 100 microvolts (-67 dBm). Adjust **L409** for maximum audio at the speaker terminals. Readjust **L408** and **L407** slightly, if necessary, for lowest distortion on the distortion analyzer.

Front End Alignment

9. Adjust L401A , B, and C and L404A, B, C, and D (in that order) for maximum signal on the oscilloscope. Repeat once more. On base station units, check at the maximum and minimum frequencies and readjust, if necessary for good sensitivity at all frequencies.

Remote Audio Output Adjustment

NOTE

This adjustment need only be made if the user wishes to use the remote audio output.

10. Increase the signal generator output level to 1mv (-47 dBm). Connect the audio voltmeter to pin 3 of **P502** on the rear of the unit.

11. Adjust **R480** on the Main PC board for the desired output level.

TRANSMITTER

Preliminary

NOTE

The transmitter PTT must be depressed to make the following adjustments.

1. For base station units, set the unit to a transmit frequency nearest the middle of the frequency list.

NOTE

Maximum frequency spread is ± 5 MHz; ± 3 MHz for best performance.

2. Preset **R528** (HI PWR Set) and **R526** (LO PWR Set) on the Main PC board fully counter-clockwise.

VCO Tuning

3. Adjust **C545** for a DC voltage of 2.45 ± 0.05 volts at **TP501**. On base station units, check the minimum and maximum transmitter frequencies to ensure that the DC voltage is between 1.0 and 4.0 volts.

4. With a frequency counter connected to the output of TEST PROBE A (see Figure 6), hold TEST PROBE A across **R593** and adjust the trimmer capacitor inside **Y501** for a frequency on the frequency counter that is within ± 100 Hz of the transmit frequency.

Exciter Tune-Up

5. On base units, set the unit to a channel which is programmed for high power. On repeater units, insure that the unit is programmed for high power.

6. Set **R526** (LO PWR Set) at mid range and set **R528** (HI PWR Set) fully clockwise. Connect a wattmeter and RF power attenuator/dummy load (50 watt minimum rating and 30 dB minimum attenuation) to the ANTENNA connector (TX ANTENNA connector on repeater units). Adjust **C566**, **C575**, and **C580** for maximum power output. Repeat once. The output power should exceed 25 watts.

Transmitter Auto Power Leveling Adjustment

7. For repeater units, if the unit is to be programmed for high power, adjust **R528** (HI PWR Set) for the desired output power. If the unit is to be programmed for low power, skip to the following step. On base station units, change to a channel which is programmed for high power and adjust **R528** for the desired output power.

8. For repeater units, if the unit is to be programmed for low power, re-program the unit for low power and adjust **R526** (LOW PWR Set) for the desired output power. On base station units, change to a channel programmed for low power and adjust **R526** for the desired output power.

Deviation Adjustment

9. Preset **R544** (MASTER DEVIATION) and **R583** (BALANCE) to mid-range.

10. For base station units, set the unit to a non-tone/data channel. For repeater units, insure that the unit has not been programmed for tones. Connect an FM demodulator through a power attenuator or a directional coupler to the output of the transmitter. The de-emphasis function should be turned off and all low pass and high pass filters in the demodulator removed except for a low pass filter with a cutoff frequency greater than 15 kHz. Connect the output of the demodulator to an oscilloscope.

11. Plug a dummy microphone circuit (see Figure 5) into modular microphone jack on the front panel. Connect an audio generator to the dummy microphone circuit and set the audio frequency to 1000 Hz . Adjust the output of the audio generator until the sine wave on the oscilloscope just shows clipping on the peaks. Increase the audio level by 20 dB (factor of 10 in voltage).

12. Adjust **R544** (MASTER DEVIATION) trimmer for ± 4.2 kHz deviation. Change the frequency of the audio generator to 300 Hz and adjust **R583** (BALANCE) for ±4.2 kHz deviation. Observe the demodulated signal on the oscilloscope. The correct waveform is shown below:

    a. Correct

    b. Incorrect

    c. Incorrect

13. Repeat steps 11 and 12 several times checking deviation and the demodulated waveform since **R544** and R583 interact.

Internal DCS Adjustment

14. Preset **R562** (INTERNAL DCS DEV. ADJ.) to mid-range, if not already done.

15. Remove the 1000 Hz tone.

16. Set the unit to a channel programmed for a DCS tone or on repeater units, program the unit for a DCS tone.

17. Adjust **R562** (INTERNAL DCS DEV. ADJ.) for ± 700 Hz deviation.

Internal CTCSS Adjustment

18. Set the unit to a channel programmed for a CTCSS tone or on repeater units, program the unit for a CTCSS tone.

19. Adjust R556 (INTERNAL CTCSS DEV. ADJ.) for ± 700 Hz deviation.

External CTCSS/DCS Adjustment

NOTE

This adjustment need only be performed if the user wishes to transmit CTCSS and/or DCS tones from an external source.

20. Connect a source of external tones to **P502-13** (DB-15 Connector on rear panel).

21. Set the unit to a channel programmed to an external tone or for repeater units, program the unit for external tones.

22. Adjust **R581** (EXTERNAL TONE ADJ.) for ± 700 Hz deviation.

23. Reconnect the audio generator. Set the generator for a 1000 Hz tone and check that ± 5 kHz deviation is not exceeded in any channel that was used in step numbers 9 through 22. Repeat steps 9 through 22, if necessary.

DTMF/ID Tone Adjustment

24. Turn the unit OFF. Wait at least 30 seconds. Depress the **T** button (**MON** button on the repeater) and activate the PTT while turning the unit on. The unit should begin transmitting, with dual-tone modulation for a base unit and single tone modulation for a repeater. The PTT switch and the **T** (or **MON**) button may be released. The unit should continue transmitting.

25. On base units, adjust **R511** (DTMF ADJ.) for ± 3 kHz deviation. On repeater units, adjust **R511** for ± 2 kHz deviation. Turn the unit OFF, wait at least 30 seconds and turn the unit back ON for the remainder of the alignment steps.

NOTE

A base unit's test modulation is dual-tone, while a repeater's test modulation is single tone.

Repeat Audio Adjustment

NOTE

Repeater units only.

26. Reprogram the unit so that no tones are programmed on receive. If the REP LED is not illuminated, depress the **REPEAT** button. The REP LED should illuminate.

27. Connect an RF signal generator to the ANTENNA (not TX ANTENNA) connector input on the rear of the unit. Set the generator to the receive channel frequency with an RF level of 100 microvolts and with 1000 Hz tone modulated at ± 3.0 kHz deviation.

28. Adjust **R507** (REPEAT AUDIO ADJ.) for ± 3.0 kHz deviation shown on the demodulator.

Interconnect Audio Adjustment

NOTE

This adjustment need only be made if the user wishes to use the interconnect input.

29. Connect the audio generator to pin 14 of P502 on the rear of the unit. The generator should be set for a 1 kHz sine wave at the desired output level.

30. Ground pin 5 of P502. The unit should begin transmitting.

31. Adjust R548 (INTERCONNECT AUDIO ADJ.) on the Main PC board for ± 3.0 kHz deviation as shown on the FM demodulator.

Remote Audio Adjustment

NOTE

This adjustment need only be made if the user wishes to use the remote audio input.

32. Connect the audio generator to pin 7 of **P502** on the rear of the unit. The generator should be set for a 1 kHz sine wave at the desired output level.

33. If the REM LED on the front panel is not illuminated, depress the **REMOTE** button. The REM LED should now become illuminated.

34. Ground pin 2 of **P502**. The unit should begin transmitting.

35. Adjust **R553** (REMOTE AUDIO ADJ.) on the Main PC board for ±3.0 kHz deviation.

The alignment process is complete. Reprogram the unit for the desired tones and frequencies before putting the unit in service.

TROUBLESHOOTING

Troubleshooting charts are given in Figures 7 thru 11. The following lists the problems likely to be encountered, and the reference figure and page numbers.

PROBLEM	FIGURE NO.
Receiver Completely Dead	7
Noise Present But No Signal Received	8
No Transmit Power	9
Receive Synthesizer	10
Transmit Synthesizer	11

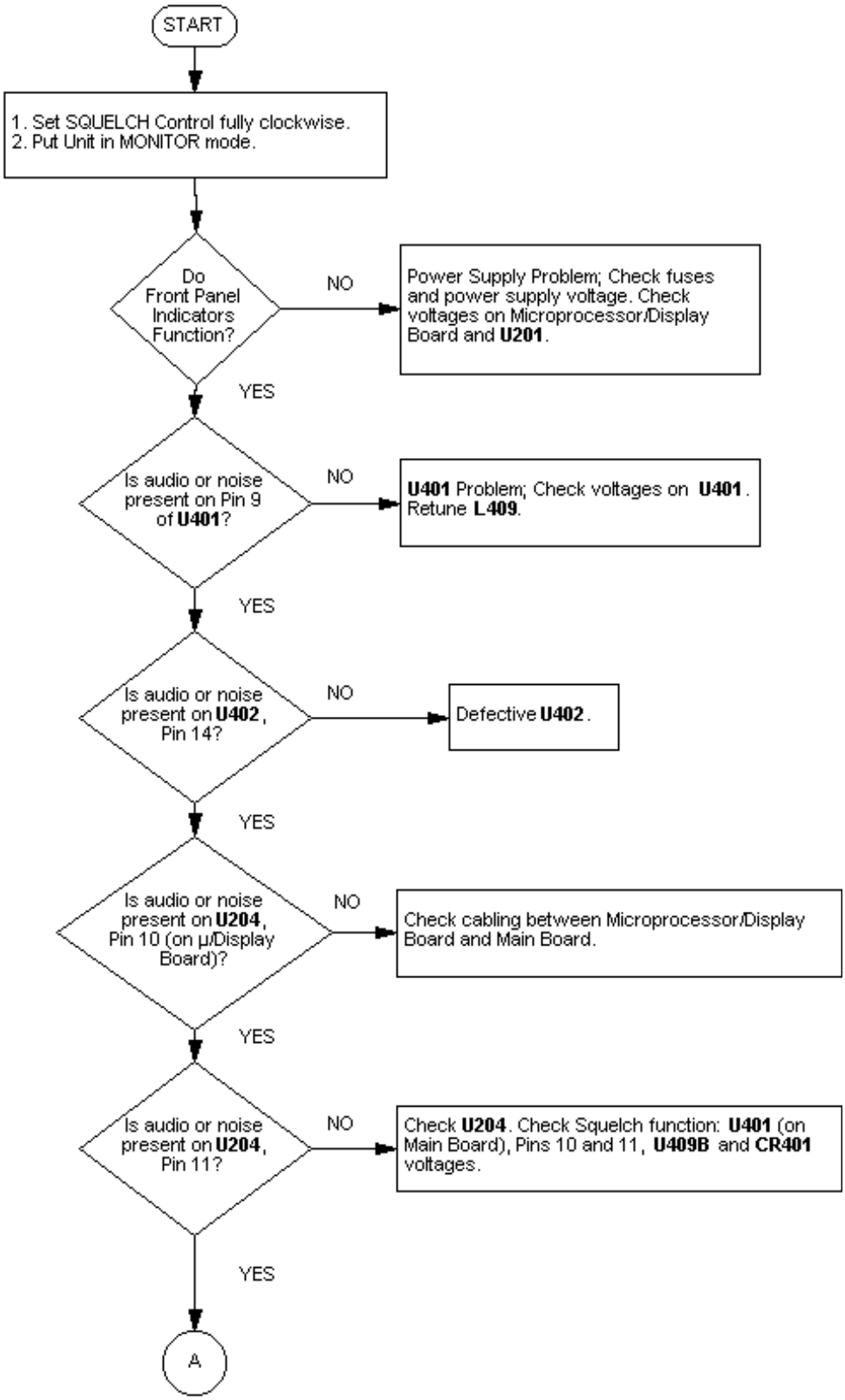


Figure 7 - Troubleshooting: Receiver Completely Dead (Page 1 of 2)

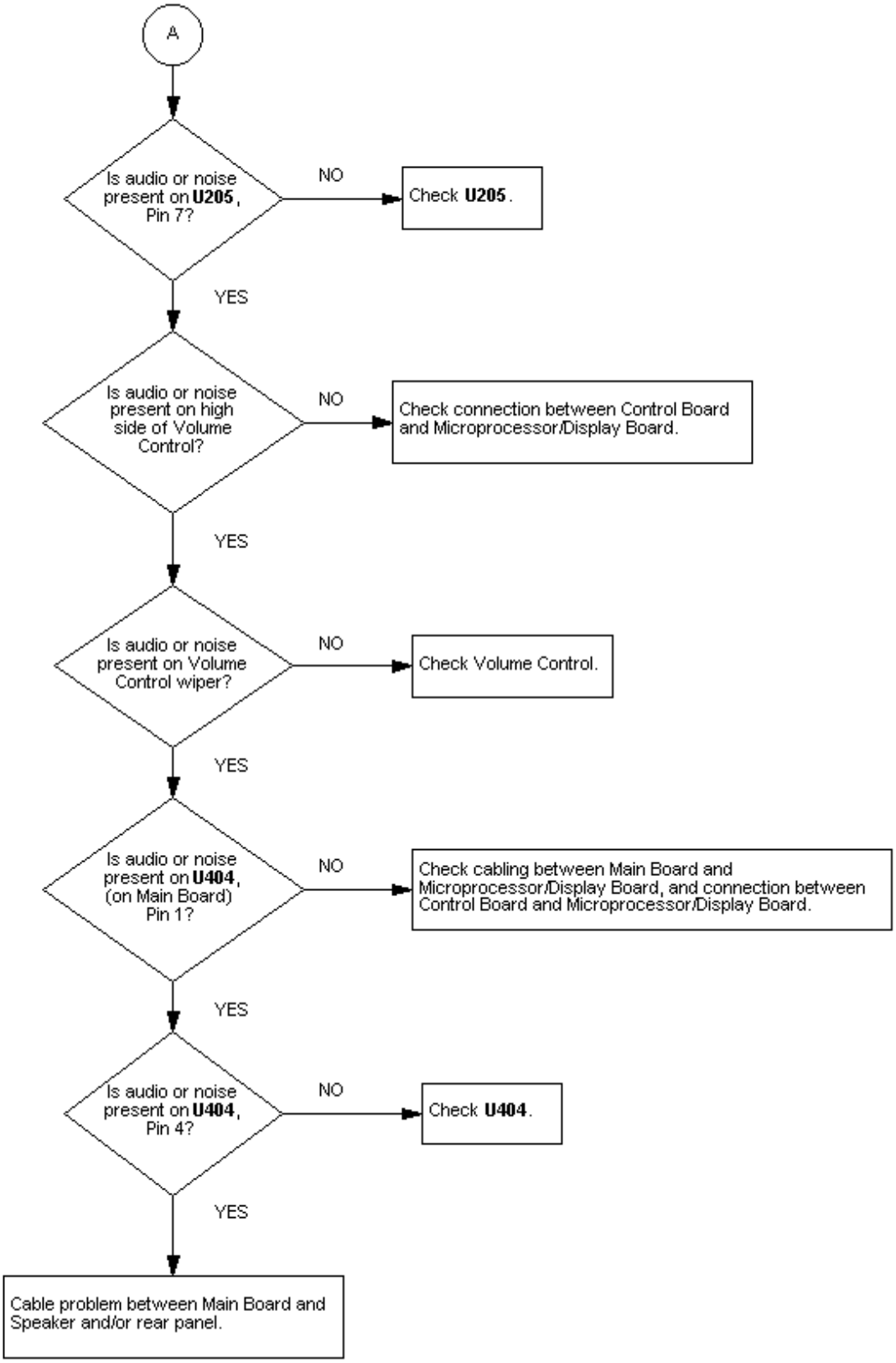


Figure 7 - Troubleshooting: Receiver Completely Dead (Page 2 of 2)

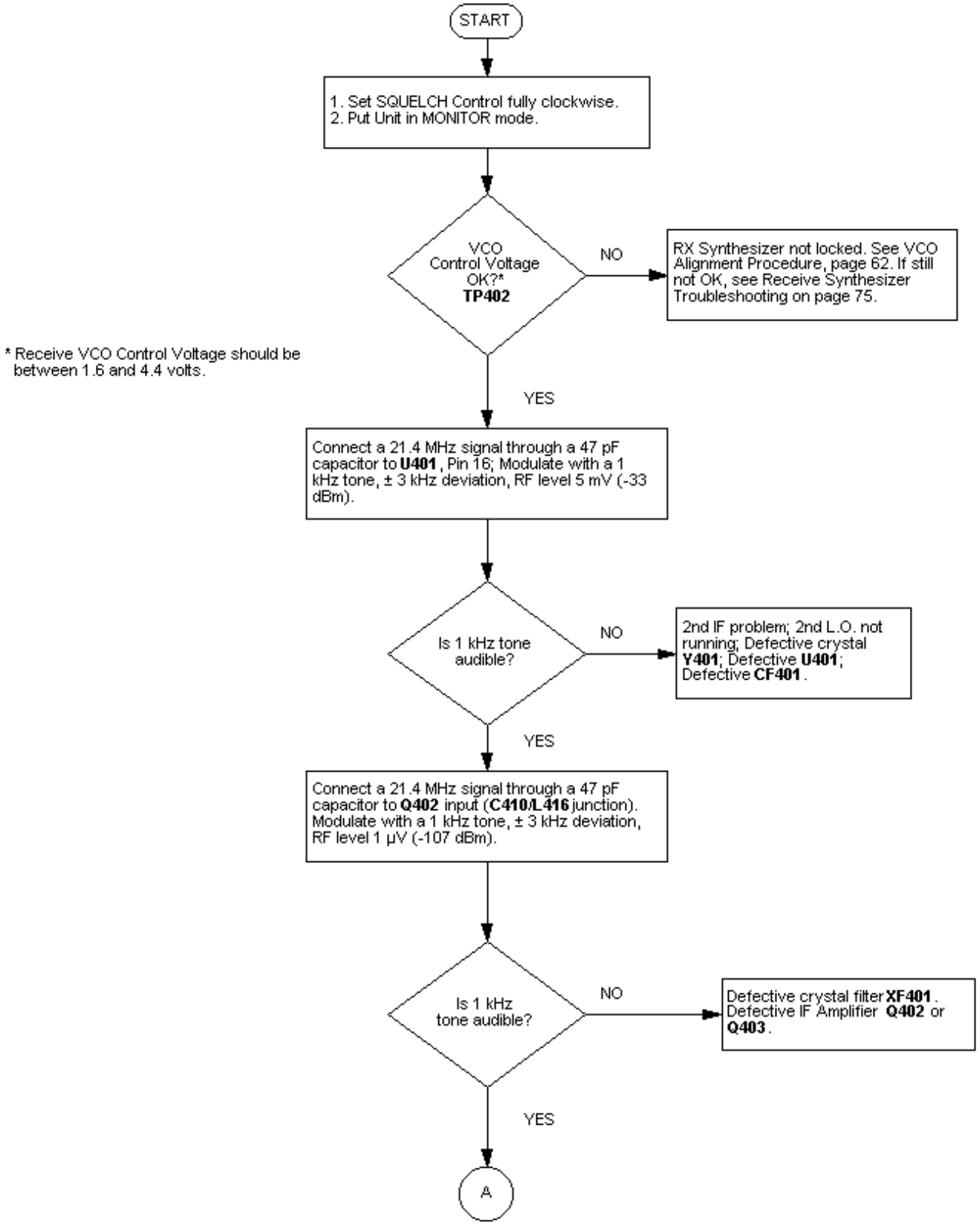


Figure 8 - Troubleshooting: Noise Present But No Signal Received (Page 1 of 2)

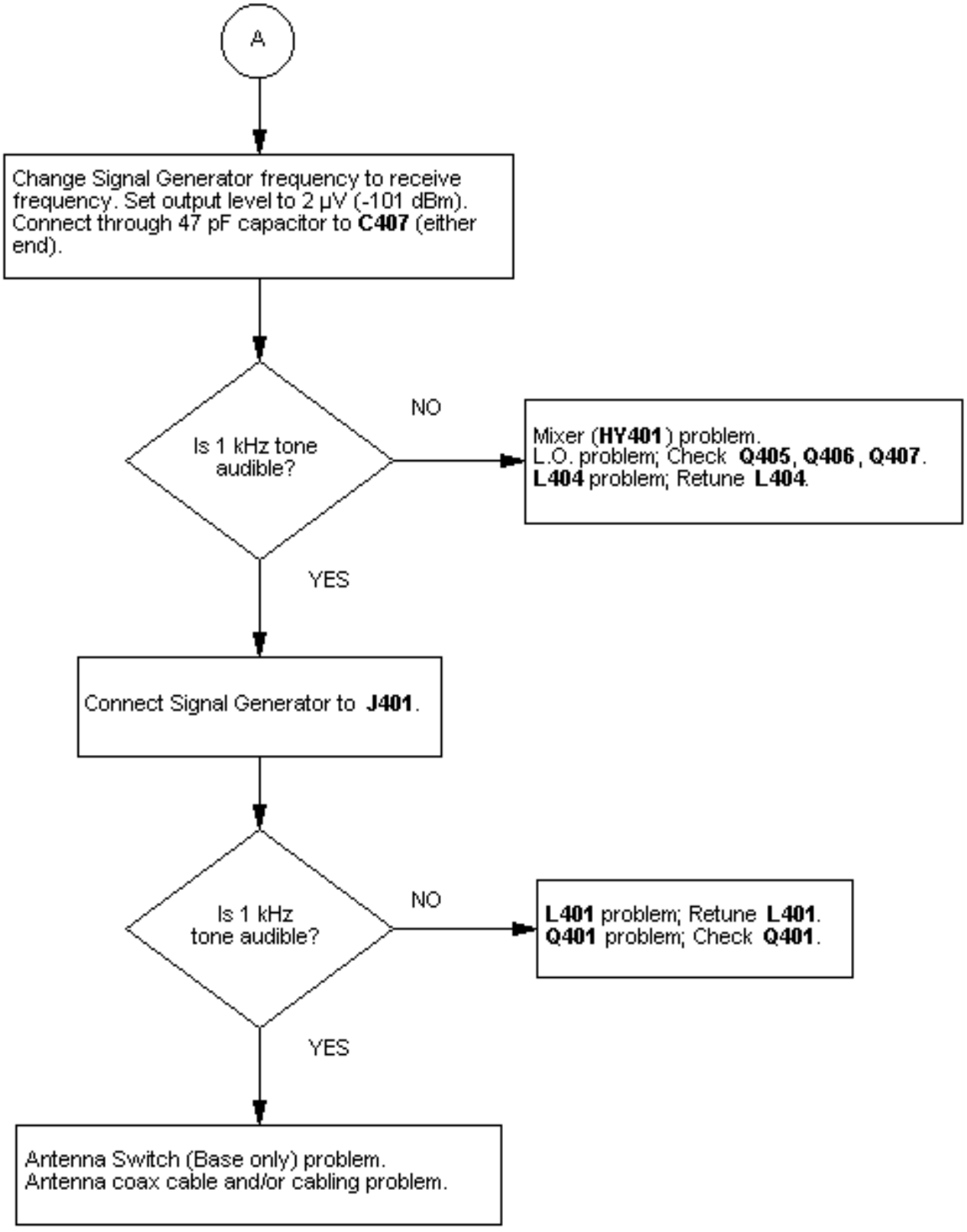


Figure 8 - Troubleshooting: Noise Present But No Signal Received (Page 2 of 2)

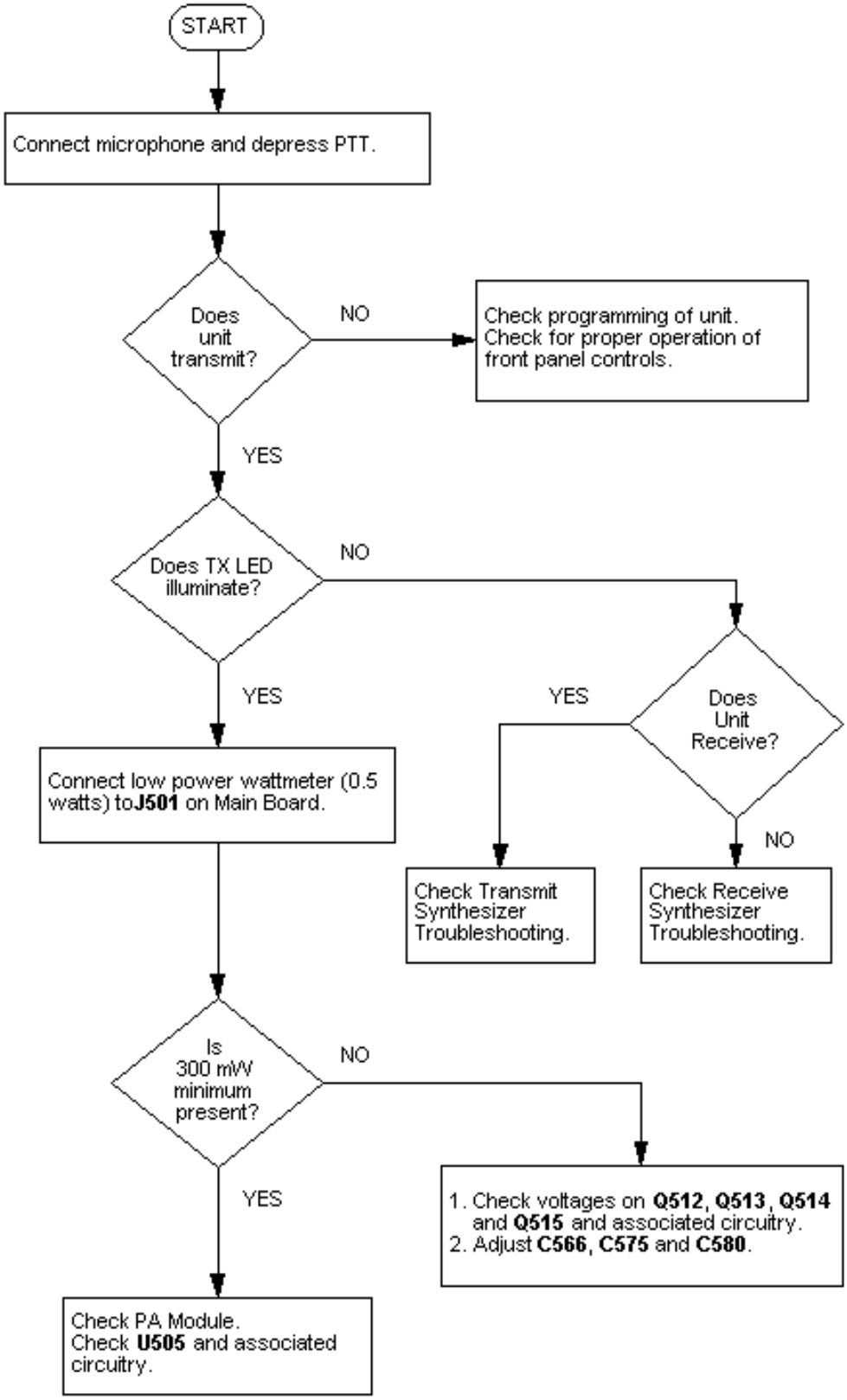


Figure 9 - Troubleshooting: No Transmit Power

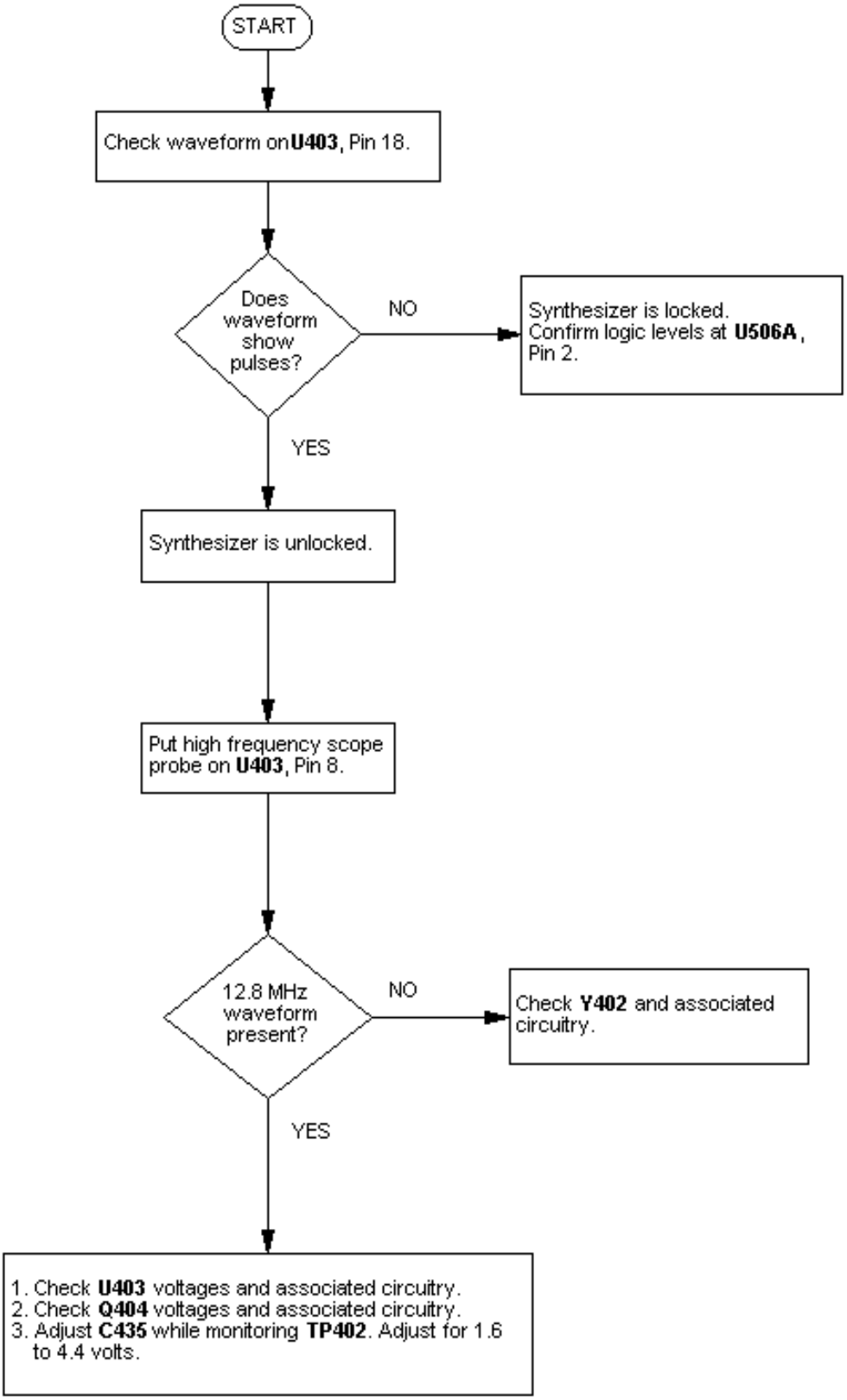


Figure 10 - Troubleshooting: Receive Synthesizer

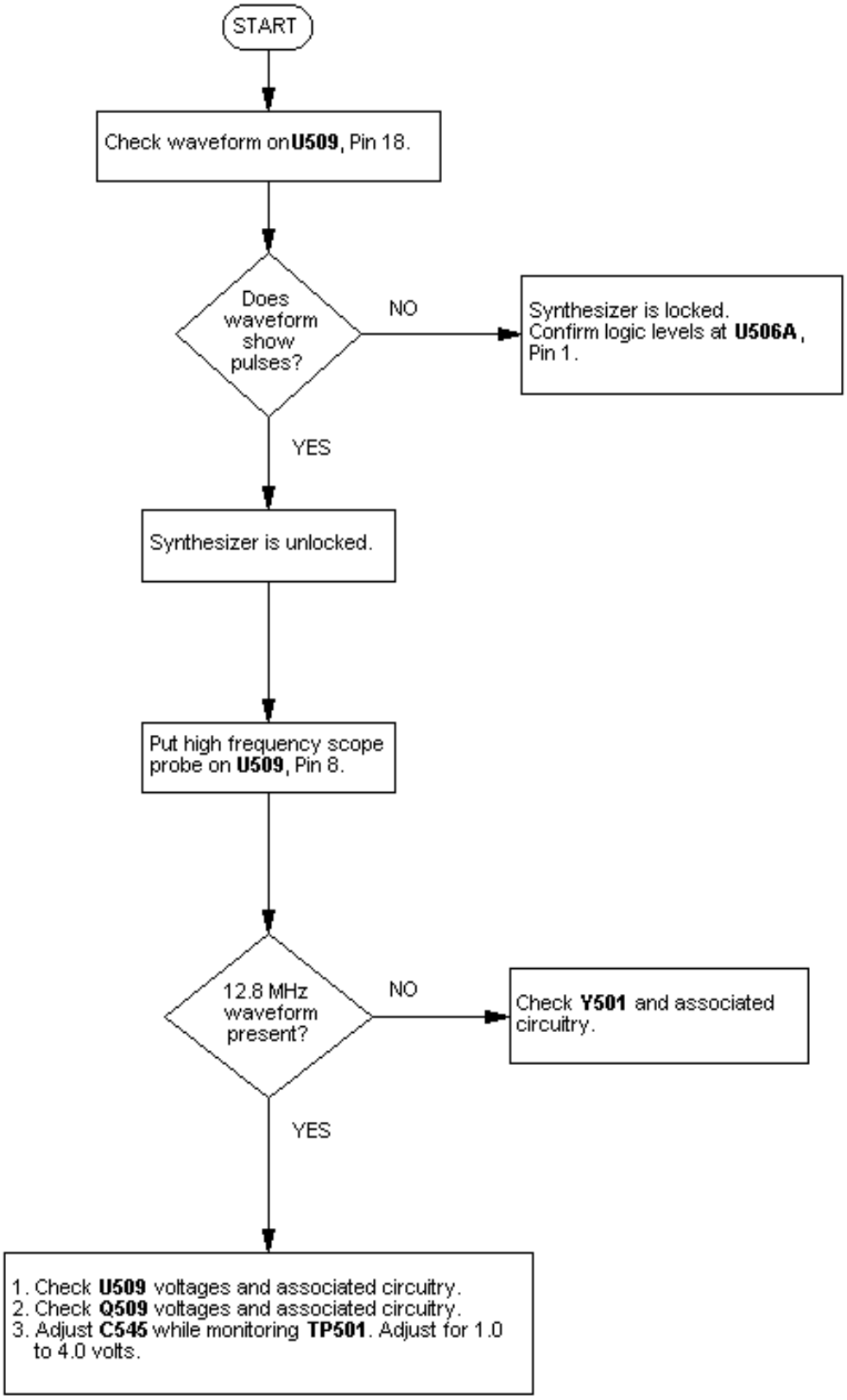


Figure 11 - Troubleshooting: Transmit Synthesizer

DUPLEXER REMOVAL AND REPLACEMENT

The following procedures should be followed to remove and replace the duplexer.

1. Turn off the Unit and unplug the AC Cord.

2. Disconnect the TX and RX coaxial cables from the rear panel.

3. Remove the 8 black Phillips head screws that fasten the wrap to the chassis.

4. Remove the wrap by sliding it off towards the rear of the Unit.

5. Remove the top cover, using a T9 TORX screwdriver for the 16 screws that hold the cover in place.

6. Remove the following cable connectors from the Main Board Assembly:

   a. **P401**, 2-conductor, black, white wires.

   b. **P501**, 4-conductor, red brown orange. yellow wires. This connector has a locking latch which must be released before removal.

   c. **P502**, 1 pin 1 with orange wire.

   d. **P503**, 15-conductor; pin 1 with green wire.

   e. **P504**, 1 pin 1 with green wire.

   f. **P505**, 4-conductor; pin 1 with purple wire.

   g. **P401**, miniature coax; at front of Main Board.

   h. **P501**, miniature coax; at rear of Main Board.

7. Remove the 6 TORX (T9) screws that fasten the Main Board Assembly in the chassis.

8. Carefully lift the Main Board Assembly out of the chassis.

9. Remove the crossbrace (retaining bracket) by first removing the 1 black Phillips screw from the chassis' side. Lift up the end of the brace that was held in by the screw and remove the brace from the chassis.

10. Disconnect the following coax cables:

    a. **P401's** miniature coax from rear panel's lower BNC connector labeled ANTENNA.

    b. PA Module's RG-58 coax from rear panel's upper BNC connector labeled TX ANTENNA.

11. Place the Duplexer on the chassis bottom with its BNC connectors towards the rear panel.

12. Fasten the Duplexer to the chassis bottom, using the two supplied 8-32 black Phillips screws and kepnuts. The screw heads go on the outside bottom.

13. Re-install the retaining bracket removed in Step 9. Use the two holes in the center wall located towards the front of Unit The sponge rubber pad on the bracket should be down on the Duplexer.

14. Install the supplied RG-58 coax cable.

    a. Connect one BNC end to the Duplexer's center port labeled ANTENNA.

    b. Connect the other BNC end to the Unit's lower rear panel connector labeled ANTENNA.

NOTE

Typically, the TX frequency is lower than the RX Frequency. Thus, the normal connections to a Duplexer are: TX coax cable to Low Pass Port; RX coax cable to High Pass Port.

15. Connect the PA Module's RG-58 coax cable to the Duplexer's port labeled LOW PASS.

16. Connect the **P401's** miniature coax cable BNC end to the Duplexer's port labeled HIGH PASS. Dress the miniature coax cable over the Duplexer with its **P401** end near the Unit's front panel.

17. Carefully position the Main Board Assembly back on the mounting flanges (feet) located on the center and right side walls. The proper orientation for the Assembly is with the small heatsink and electrolytic capacitor- area located next to the side wall.

NOTE

It may be easier to perform Steps 19 and 20 BEFORE the Main Board Assembly is fully lowered into place.

18. Fasten the Main Board Assembly in place, using the 6 TORX screws removed in Step 7.
19. Insert **P401** (miniature coax) Into **J401** located at the front right corner of the Main Board Assembly.
20. Insert **P501** (miniature coax) Into **J501** located at the rear right corner of the Main Board Assembly.
21. Install the following cable connectors into the center area of the Main Board Assembly:
    a. **P401** (2-conductor)
    b. **P501** (4-conductor)
    c. **P502** (15-conductor, orange wire)
    d. **P503** (15-conductor, blue wire)
    e. **P504** (15-conductor, green wire)
    f. **P505** (4-conductor, purple wire)
22. Make sure all connectors are fully seated. The **P401** (2-conductor) and **P502** (15-conductor; orange wire) cables must be fully pushed down into the notch In the center wall before the top cover is installed.
23. Install the top cover, using the 16 screws removed in Step 5.
24. Slide the wrap back on and fasten in place with the 8 screws removed in Step 3.
25. Connect the antenna's coax cable to the lower N-type connector labelled ANTENNA.
26. Plug in AC cord. The unit is now ready for use.

DUPLEXER TUNING PROCEDURES

The following procedures must be used to tune the duplexer to the transmit and receive operating frequencies. The duplexer must be retuned any time the frequencies change or whenever the unit has been repaired or any module (duplexer, etc.) has been replaced. Refer to Figures 12 and 12 when performing these procedures for connections and tuning screws.

NOTE

The duplex has been factory tuned for 462.675 MHz transmit and 467.675 MHz receive frequencies.

EQUIPMENT REQUIRED

- Signal Generator with 50 ohm output impedance and output attenuator
- Communications Monitor with 50 ohm input impedance and signal level indicator
- 50 ohm pads (quantity of 3); a 6, 10 or 20 dB pad may be used
- 50 ohm termination load
- Hollow shaft nut driver
- Slotted screwdriver with long, narrow shaft to work with nut driver
- Phillips head screwdriver

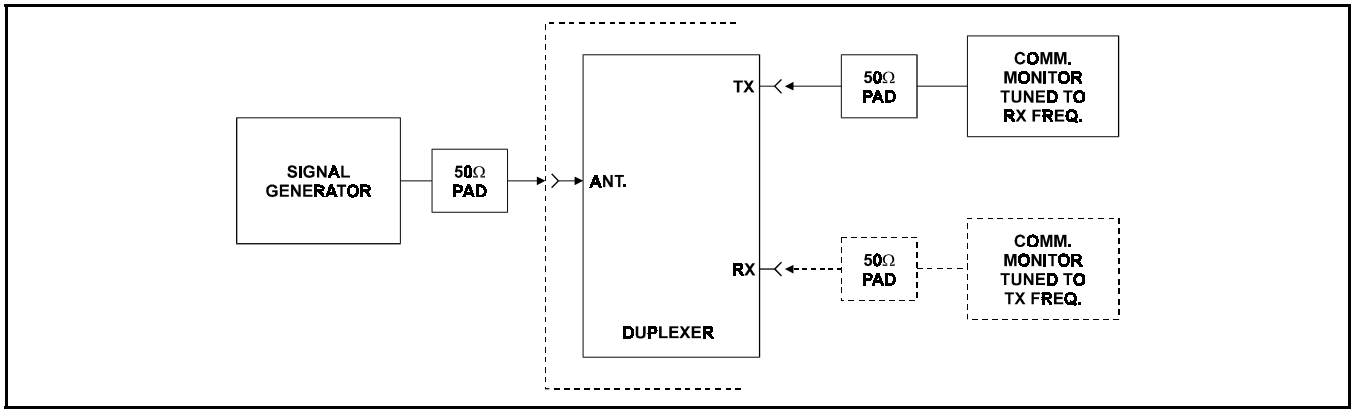


Figure 12 - Duplexer Test Setup

TUNING INSTRUCTIONS

1. Turn off the DRC-200 with the front panel POWER ON/OFF switch and unplug AC power cord
2. Remove the eight (8) black Phillips head screws that fasten the cover wrap to the chassis and slide the cover wrap off towards the rest of the unit.
3. Connect the signal generator output through the 50 ohm pad to the ANTENNA connector on the rear panel.
4. Disconnect the cable from the TX port on the duplexer and connect the communications monitor through a 50 ohm pad to the TX port.
5. Tune the communications monitor to the receive frequency.
6. Unloosen the tuning screw shaft locking nuts (Figure 13) on all six. (6) tuning screws.
7. Tune the signal generator to the receive frequency and adjust for a high output.
8. Adjust the three transmitter port tuning screws for minimum signal level on the communications monitor. Adjustment of all three screws, one at a time, may require that each screw be adjusted more than once to obtain a minimum signal level indications.

   Tighten the tuning screw locking nuts after final adjustment of the transmitter port.
9. Disconnect the communications monitor and 50 ohm pad from the TX port and reconnect the cable to the TX port that was removed in step 4.
10. Disconnect the cable from the RX port and connect the communications monitor through the 50 ohm pad to the RX port.
11. Tune the communications monitor to the transmit frequency.
12. Tune the signal generator to the transmit frequency and adjust for a high output.
13. Adjust the three receiver port tuning screws for minimum signal level on the communications monitor. Adjustment of all three screws, one at a time, may require that each screw be adjusted more than once to obtain a minimum signal level indication.
14. Tighten the tuning screw locking nuts after final adjustment of the receiver port.
15. Disconnect the cable from the RX port and reconnect the cable to the RX port that was removed in Step 10.
16. Disconnect the signal generator and 50 ohm pad from the ANTENNA connector on back panel.
17. Slide the cover wrap back on and fasten in place with the eight (8) screws removed in Step 2.

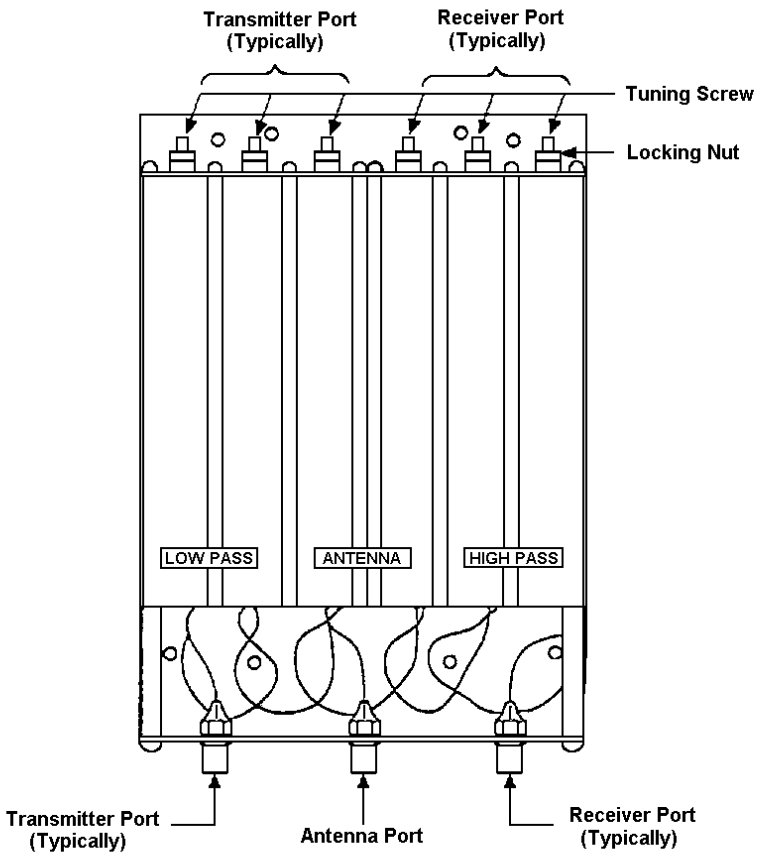


Figure 13 - Duplexer Connections and Tuning Adjustements

REPLACEMENT PARTS LISTS

Replacement Parts are arranged in Tables 2 through 7 as follows.

Figure references to the relevant parts placement diagrams are also included.

TABLE NO.	DESCRIPTION
2	Replacement Parts List, Microprocessor/ Display Board
3	Replacement Parts List, PA Board
4	Replacement Parts List, Main Board
5	Replacement Parts List, Control Board
6	Replacement Parts List, Power Supply Board
7	Replacement Parts List, Miscellaneous Items

Parts labeling is per the following nomenclature:

Control Board	1XX
Microprocessor/Display Board	2XX
PA Board	3XX
Main Board	4XX, 5XX
Power Supply Board	XX

NOTE

Any component described as "SMD" is a Surface Mounted Device. All "Chip" capacitors and resistors are also SMD type components.

Table 2 - Replacement Parts, Microprocessor/Display Board

ITEM REF. NUMBER	DESCRIPTION
C201, 203	Capacitor, Chip; .22 µF; SMD
C202	Capacitor, Chip; 150 pF, 50V; SMD
C204, 228	Capacitor, Chip; 1000 pF, 10V; SMD
C205, 207, 211, 214, 217, 232	Capacitor, Tant; 1.0 µF, 35V; SMD
C206, 209, 229, 245	Capacitor, Chip; .01 µF; SMD
C208, 220, 221, 235, 243, 244	Capacitor, Chip; 470 pF, 50V; SMD
C210, 216	Capacitor, Chip; .1 µF, 50V; SMD
C212, 213	Capacitor, Chip; 33 pF, 50V; SMD
C215	Capacitor, Tant; 22 µF, 16V; SMD
C218	Capacitor, Poly; 0.15 µF
C219	Capacitor, Chip; 1000 pF, 50V; SMD
C225, 242, 246	Capacitor, Chip; .047 µF, 50V; SMD
C226, 227	Capacitor, Tant; 10 µF, 16V; SMD
C230, 231	Capacitor, Poly; .47 µF
C233	Capacitor, Poly; .022mF
C234 (mounted on back)	Capacitor, E; 470 µF, 16V
C238	Capacitor, Chip; 2200 pF, 50V; SMD
C239	Capacitor, Chip; .015 µF, 50V; SMD
C240	Capacitor, Chip; 3300 pF, 50V; SMD
C241	Capacitor, Chip; 6800 pF; SMD
CR201	Zener; SMD
CR202	Diode, Zener
CR203, 204, 205, 207, 215	Diode, Dual; SMD
CR210, 213, 214	Diode; SMD
CR211, 212	Diode, Silicon; SMD
J202	Connector, Header; 15-Pos.
L201	Choke, 10 µH; SMD
LD201, 206	Diode, LED; Green
LD202	Diode, LED; Red
LD203, 204, 205	Diode, LED; Yellow
P201 (mounted on back)	Connector, Header; 2-Pin
P203, 204 (mounted on back)	Connector, Header; 15-Pos.
Q201	Transistor, NPN; SMD
Q202, 207, 215, 217, 219, 221	Transistor, W/Bias; SMD
Q203, 204, 208, 212	Transistor, NPN; SMD
Q210, 213, 214, 216, 218, 220	Transistor, W/Bias; SMD
Q222	Transistor, W/Bias; SMD
NOTE: All resistor values are 5%, 1/8W unless noted otherwise.	
R201, 202, 203, 207, 214, 215, 216, 218, 220, 221, 222, 234, 236, 237, 239, 240, 241, 246, 253, 263, 270, 275, 290, 291, 292, 293	Resistor, Chip; 10K Ohm, SMD
R204	Resistor, Chip; 4700 Ohm, SMD
R206, 212	Resistor, Chip; 12K Ohm, SMD
R208, 277, 280	Resistor, Chip; 24K Ohm, SMD
R209	Resistor, Chip; 16K Ohm, SMD
R210, 278, 279	Resistor, Chip; 56K Ohm, SMD
R211, 230, 269	Resistor, Chip; 22K Ohm, SMD
R213, 229	Resistor, Chip; 120K Ohm, SMD
R217	Resistor, Chip; 100K Ohm, SMD
R219	Resistor, Chip; 39 Ohm, SMD
R223	Resistor, Chip; 1500 Ohm, SMD
R224, 287	Resistor, Chip; 2200 Ohm, SMD
R225, 226	Resistor, Chip; 270K Ohm, 1%, SMD
R228, 231	Resistor, Chip; 1.0M Ohm, SMD
R232	Resistor, Chip; 150K Ohm, SMD
R233	Resistor, Chip; 330K Ohm, SMD
R235	Resistor, Chip; 2700 Ohm, SMD
R238, 245, 264, 265, 284	Resistor, Chip; 470 Ohm, SMD
R242	Resistor, Chip; 10 Ohm, SMD
R250, 251, 252	Resistor, Chip; 180 Ohm, SMD
R254, 262	Resistor, Chip; 220 Ohm, SMD
R258	Resistor, Carbon Film; 10 Ohm, 1/2W
R260, 272, 282, 294	Resistor, Chip; 68K Ohm, 2%, SMD
R261, 273	Resistor, Chip; 15K Ohm, SMD
R266	Resistor, Chip; 33K Ohm, SMD
R267, 276	Resistor, Chip; 470K Ohm, SMD
R268	Resistor, Chip; 47K Ohm, SMD
R281	Resistor, Chip; 15K Ohm, 2%, SMD
R283	Resistor, Chip; 220K Ohm, 2%, SMD
R285, 286	Resistor, Chip; 0 Ohm, SMD
R288, 289, 295, 296	Resistor, Chip; 5100 Ohm, SMD
U201	IC; SMD
U202, 207	IC; SMD
U203	IC, DTMF Generator; SMD
U204	IC; SMD
U205, 211	IC, Op Amp; Dual; SMD
U206	IC, EEPROM; SMD
U210 (mounted on back)	IC, Regulator; 5.0V
Y201	Crystal, 4.0 MHz
Y202	Crystal, 3.579545 MHz
	Socket, IC; SMD (for U201)

Table 3 - Replacement Parts, PA Board

ITEM REF. NUMBER	DESCRIPTION
C301, 303, 305, 325	Capacitor, E; 10 µF, 25V
C302, 304, 306	Capacitor, Chip; 3300 pF, 10V; SMD
C307, 321, 333, 334	Capacitor, Chip; 100 pF, 10V; SMD
C308, 313, 332	Capacitor, Chip; 100 pF, 50V; SMD
C309	Capacitor, E; 1 µF, 50V
C310	Capacitor, HF; 3.9 pF .25pF, 200V; SMD
C311	Capacitor, HF; 100 pF, 200V, 5%; SMD
C312	Capacitor, Chip; 4 pF, 50V; SMD
C316, 320	Capacitor, HF; 4.3 pF .25 pF, 200V; SMD
C317	Capacitor, HF; 10 pF .5pF, 200V; SMD
C319	Capacitor, HF; 8.2 pF .25 pF, 200V; SMD
C322, 323	Capacitor, Chip; .01 µF, 10V; SMD
C325, 326, 327, 328, 329	Capacitor, Feedthru; .001 µF
C326	Capacitor, Chip; .22 µF; SMD
C335	Capacitor, HF; 18pF, 200V, 5%; SMD
CR301	Diode, Schottky
CR302, 303	Diode, Pin
CR305	Diode, Silicon, Rectifier
CR306	Diode, Silicon, Rectifier
JP301	Header, Right Angle
L301, 302, 303, 304, 309	Choke, LM-2; 10.5T
L305	Coil, AW; 1.5T, 20 Awg
L306	Coil, AW; 2.5T, 20 Awg
L307, 308	Coil, AW; 1.5T, 20 Awg
NOTE: All resistor values are 5%, 1/8W unless noted otherwise.	
R301	Resistor, Chip; 51 Ohm, SMD
R302	Resistor, Met Oxide; 150 Ohm, 2W, 5%
R303	Resistor, Chip; 33K Ohm, SMD
R304	Resistor, Chip; 120K Ohm, SMD
R305	Resistor Chip; 100K Ohm, SMD
R306, 309	Resistor, Chip; 10K Ohm, SMD
R307, 308	Resistor, Chip; 470 Ohm, SMD
RT301	Thermistor
TP1, 2	Contact Pin w/Star, .025 Sq.
U301	Module, RF PA
U302	IC, Op Amp; Dual, SMD
U303	IC, Regulator; 8.0V

Table 4 - Replacement Parts, Main Board

ITEM REF. NUMBER	DESCRIPTION
C402, 407, 467, 490, 491, 549, 562	Capacitor, Chip; 100 pF, 50V; SMD
C403, 598, 599	Capacitor, Chip; 100 pF; SMD
C404, 409, 427, 451, 473, 480, 487, 511, 587, 590	Capacitor, Chip; .01 µF; SMD
C408, 426, 484	Capacitor, Chip; 6.8 pF; SMD
C410, 412, 413, 414, 425, 438, 439, 441, 446, 447, 448, 449, 452, 453, 454, 455, 456, 457, 461, 463, 465, 488, 493, 495, 517, 519, 533, 537, 538, 540, 542, 550, 552, 556, 558, 559, 560, 563, 564, 565, 570, 571, 572, 577, 579	Capacitor, Chip; 1000 pF; SMD
C411	Capacitor, E; 4.7 µF, 25V
C415, 478, 479, 481, 483, 485, 486, 496, 581, 583, 585, 586, 588, 589, 592	Capacitor, E; 10 µF, 16V; SMD
C416, 417, 418	Capacitor, Chip; .047 µF, 50V; SMD
C419	Capacitor, Chip; 68 pF, 50V; SMD
C420	Capacitor, Chip; 47 pF; SMD
C421	Capacitor, Chip; 330 pF; SMD
C422, 423	Capacitor, Chip; 1000 pF; SMD
C424	Capacitor, Chip; 1800 pF; SMD
C428, 601	Capacitor, E; 1 µF, 50V
C429	Capacitor, Chip; 470 pF; SMD
C430, 489, 527	Capacitor, Poly Stkd; .22 µF
C431, 432, 433, 502, 504, 505, 510, 520, 531, 532, 593	Capacitor, E; 2.2 µF, 50V; SMD
C434, 458	Capacitor, Poly Stkd; 0.1 mF
C435, 545, 566, 575, 580	Capacitor, Trim; 2.5-10 pF; SMD
C436, 443, 444, 445, 547, 548, 554, 555, 557	Capacitor, Chip; 15 pF, 50V; SMD
C437, 450, 573	Capacitor, Chip; 12 pF, 50V; SMD
C440, 442, 462, 464, 472, 492, 509, 551, 553, 602	Capacitor, E; 100 µF, 16V
C459	Capacitor, Poly; 1 µF, 63V
C460	Capacitor, Poly Stkd; .47 µF
C466, 543, 603	Capacitor, Chip; 10 pF, 50V; SMD
C468, 476, 477, 497, 498, 513, 518, 595	Capacitor, Chip; .1 µF, 50V; SMD
C469	Capacitor, Chip; 470 pF, 50V; SMD
C470, 475	Capacitor, E; .47 µF, 50V
C471, 474, 596	Capacitor, E; 470 µF, 16V
C482, 594	Capacitor, Chip; 2200 pF, 50V; SMD
C494	Capacitor, Chip; 150 pF, 50V; SMD
C499, 582	Capacitor, Chip; 47 pF, 50V; SMD
C501, 503, 512, 528	Capacitor, Chip; 3300 pF; SMD
C506, 514, 516	Capacitor, Chip; .015 µF; SMD
C507	Capacitor, Chip; 0.1 µF, 25V; SMD
C515	Capacitor, Chip; 4700 pF; SMD
C534	Capacitor, Mylar; .022 mF, 100V
C535	Capacitor, Poly Stkd; .33 µF
C536	Capacitor, Mylar; .047 µF, 100V
C539, 541, 569, 578, 591, 597	Capacitor, Tant; 10 µF, 16V; SMD
C544	Capacitor, Mylar; .0056 µF, 100V
C546	Capacitor, Chip; 1.6 pF; SMD
C561	Capacitor, Chip; 27 pF, 50V; SMD
C567, 576	Capacitor, Chip; 0.47 pF, 50V; SMD
C568	Capacitor, Chip; 5 pF, 50V; SMD
C574	Capacitor, Tant; 2.2 µF, 16V; SMD
C604	Capacitor, Chip; 3.9 pF; SMD
CF401	Filter, Ceramic; 455 kHz
CR401	Diode, Dual; SMD
CR402, 403, 501, 502, 503	Diode; SMD
CR504	Diode, Silicon; SMD
HY401	Mixer Circuit
J401, 501	Min Pin Jack Typ Low
L401	Filter, Helical; 3-Sec.

Table 4 - Replacement Parts, Main Board

ITEM REF. NUMBER	DESCRIPTION
L402	Coil, AW; 16 Ga.
L403	Coil, AW; 2.5T, Grn
L404	Filter, Helical; 4-Sec.
L407, 408	Coil, IF; 21.4 MHz
L409	Coil, IF
L410, 412, 501, 503	Choke, 390 nH; SMD
L411	Choke, 0.27 µHy; SMD
L413, 504	Choke, 33 nH; SMD
L414, 415, 505	Choke, 100 nH; SMD
L416	Choke, 8.2 µH, 10%; SMD
L506	Choke, 6T
P401	Connector, Header, 2-Pin
P501	Connector, Header, 4-Pin
P502, 503, 504	Connector, Header, 15-Pos.
P505	Connector, Header, 4-Pin
Q401, 405, 512	Transistor
Q402	Transistor, FET; SMD
Q403	Transistor, FET; SMD
Q404, 509	Transistor
Q406, 515	Transistor, RF Power
Q407	Transistor, PNP; SMD
Q409, 507, 508, 516	Transistor, W/Bias; SMD
Q503, 504	Transistor, W/Bias; SMD
Q505, 506, 510	Transistor, W/Bias; SMD
Q513	Transistor; SMD
Q514	Transistor; SMD
NOTE: All resistor values are 5%, 1/8W unless noted otherwise.	
R401, 432	Resistor, Chip; 270 Ohm, SMD
R402, 404, 405, 431	Resistor, Chip; 56 Ohm, SMD
R403, 446, 471, 475, 620	Resistor, Chip; 2200 Ohm, SMD
R406, 449, 450, 451, 452, 454, 455, 465	Resistor, Chip; 180 Ohm, SMD
R407	Resistor, Chip; 150 Ohm, SMD
R408, 410	Resistor, Chip; 1800 Ohm, SMD
R409, 433, 436, 439, 445, 565, 575, 578, 586, 609	Resistor, Chip; 10 Ohm, SMD
R411, 473, 537	Resistor, Chip; 3600 Ohm, SMD
R412, 442, 444, 570, 589	Resistor, Chip; 68 Ohm, SMD
R413, 457	Resistor, Chip; 27 Ohm, SMD
R414	Resistor, Chip; 68K Ohm, 2%, SMD
R415, 531, 532, 539, 597, 607	Resistor, Chip; 1000 Ohm, SMD
R416, 611	Resistor, Chip; 180K Ohm, SMD
R417	Resistor, Chip; 6200 Ohm, SMD
R418	Resistor, Chip; 3900 Ohm, SMD
R419, 424, 429, 579, 613	Resistor, Chip; 470 Ohm, SMD
R420, 423, 447, 509, 514, 517, 518, 519, 520, 551, 554, 561, 573, 582	Resistor, Chip; 4700 Ohm, SMD
R421	Resistor, Chip; 39K Ohm; SMD
R422, 425, 426, 427, 477, 478, 502, 505, 506, 508, 510, 521, 522, 523, 524, 525, 529, 559, 560, 605, 614, 619	Resistor, Chip; 10K Ohm, SMD
R428, 515, 516, 547, 550, 610	Resistor, Chip; 20K Ohm, SMD
R430, 461	Resistor, Chip; 1200 Ohm, SMD
R434, 437, 571, 576	Resistor, Chip; 330 Ohm, SMD
R435	Resistor, Chip; 15 Ohm, SMD
R438, 440, 464, 580, 590	Resistor, Chip; 51 Ohm, SMD
R441, 588	Resistor, Chip; 30K Ohm, SMD
R443, 530, 591, 594, 598, 599	Resistor, Chip; 100 Ohm, SMD
R448, 533, 552, 555	Resistor, Chip; 6800 Ohm, SMD
R453, 456, 458, 595	Resistor, Chip; 220 Ohm, SMD
R459, 600	Resistor, Chip; 5100 Ohm, SMD
R460, 566, 572	Resistor, Chip; 3000 Ohm, 2%, SMD
R462, 467, 568	Resistor, Chip; 33K Ohm, SMD
R463	Resistor, Chip; 18K Ohm, SMD
R468	Resistor, Carbon Film; 180 Ohm, 1/2W
R469	Resistor, Chip; 2.7 Ohm, SMD
R470	Resistor, Chip; 1 Ohm, SMD

Table 4 - Replacement Parts, Main Board (Cont'd)

ITEM REF. NUMBER	DESCRIPTION
R472, 501, 503	Resistor, Chip; 680 Ohm, SMD
R476, 558	Resistor, Chip; 150K Ohm, SMD
R479	Resistor, Chip; 16K Ohm, SMD
R480, 548, 553, 583	Resistor, Variable; 100K, 20%, SMD
R504	Resistor, Chip; 5600 Ohm, SMD
R507, 544, 556, 562, 581	Resistor, Variable; 10K, SMD
R511	Resistor, Variable; 200K, SMD
R526	Resistor, Variable; 5K Ohm, 5MM
R527	Resistor, Chip; 1500 Ohm, SMD
R528	Resistor, Variable; 100K Ohm, 5MM
R534, 536	Resistor, Chip; 470K Ohm, SMD
R535, 538, 541, 564	Resistor, Chip; 22K Ohm, SMD
R540, 543	Resistor, Chip; 15K Ohm, 2%, SMD
R542, 593	Resistor, Chip; 12K Ohm, SMD
R545, 567, 596	Resistor, Chip; 3300 Ohm, SMD
R546	Resistor, Chip; 3.92K Ohm, 1%, SMD
R549, 557, 563, 574, 603	Resistor, Chip; 100K Ohm, SMD
R569	Resistor, Chip; 15K Ohm, SMD
R577, 587	Resistor, Chip; 39 Ohm, SMD
R592	Resistor, Chip; 24K Ohm, SMD
R601	Resistor, Chip; 750 Ohm, SMD
R602	Resistor, Chip; 47 Ohm, SMD
R604	Resistor, Chip; 75K Ohm, 1%, SMD
U401	IC, IF Sys; SMD
U402, 501, 507	IC, Op Amp; SMD
U403, 509	IC; SMD
U404	IC, Audio
U405, 408, 513	IC, Regulator; 10.0V
U406, 407, 510, 511	IC, Regulator; 5.0V; SMD
U409, 505, 508	IC, Op Amp; Dual; SMD
U502	IC; SMD
U503	IC, Op Amp; SMD
U504	IC, Analog Switch; SMD
U506	IC; SMD
U512	IC, Regulator; 10.0V; SMD
U514	IC
U515	IC, Regulator; Neg. 5.0V
XF401	Filter, Crystal; 21.4 MHz
Y401	Crystal, 20.945 MHz; Wire leads
Y402	Crystal, TCXO 12.8 MHz
Y501	Crystal, TCXO, 12.8 MHz

Table 5 - Replacement Parts, Control Board

ITEM REF. NUMBER	DESCRIPTION
P101	Jack, Right Angle Modular; Microphone
P102	Connector, Header; 15 Pos.
R101	Resistor, Var; 10K; Volume
R102	Resistor, Var; 10K; Squelch
SW101	Switch, w/Push Sw (DBU)

Table 6 - Replacement Parts, Power Supply Board

ITEM REF. NUMBER	DESCRIPTION
BD1	Diode Bridge; 4A, 800V
C1, 4	Capacitor, CD; 0.1µF, 250V
C2, 3	Capacitor, CD; 4700pF, 250V
C5, 6	Capacitor, E; 330µF, 200V
C7	Capacitor, CD; 2.2µF, 250V
C8	Capacitor, CD; 1500pF, 1000V
C9, 10, 12, 16	Capacitor, E; 1µF, 50V
C11	Capacitor, CD; 2200pF, 50V
C13	Capacitor, Mylar; 0.001µF, 50V
C15	Capacitor, Mylar; 0.022µF, 50V
C17	Capacitor, CD; 330pF, 50V
C18, 19	Capacitor, CD; 0.1µF, 100V
C20	Capacitor, E; 47µF, 50V
C24, 25, 30, 31	Capacitor, CD; 0.01µF, 100V
C29	Capacitor, E; 4.7µF, 50V
C32	Capacitor, CD; .02µF, 1000V
C34, 35	Capacitor, E; 2200µF, 35V
C36, 37	Capacitor, CD; 0.01µF, 1000V
CN1	Connector, Header; 2-Pin
CN2	Connector, Header; 3-Pin
CN3	Connector, Header; 2-Pin
D1, 2	Diode,
D3, 4	Diode, 1N4001
D6, 9, 10, 12, 18	Diode, 1N4148
D13	Diode,
D15, 16	Diode,
L1	Inductor, Toroid
LF2	Filter, Line
Q1, 2	Transistor, NPN
Q3, 4	Transistor, NPN
Q5	Transistor, NPN
Q6, 7	Transistor, PNP
NOTE: All resistors are 5%, 1/4W unless specified otherwise.	
R1, 2	Resistor, Carbon Film; 150K, 1/2W
R3	Resistor; 51Ohm, 5W
R6	Resistor, Carbon Film; 680K Ohm, 1/2W
R7, 10, 15, 17	Resistor, Carbon Film; 2.7K Ohm
R8, 11	Resistor, Carbon Film; 10 Ohm
R9, 12	Resistor, 390K Ohm, 1%, 1/2W
R13, 14	Resistor, Carbon Film; 2.2 Ohm 1/2W
R16, 18, 42, 44, 45	Resistor, Carbon Film; 1K Ohm
R19	Resistor, Carbon Film; 22K Ohm
R20, 23	Resistor, Carbon Film; 5.6K Ohm
R21, 34, 46	Resistor, Carbon Film; 47K Ohm
R22	Resistor, Carbon Film; 33K Ohm
R24	Resistor, Carbon Film; 100K Ohm
R25	Resistor, Carbon Film; 1.8K Ohm
R31	Resistor, Carbon Film; 470 Ohm
R32	Resistor, Carbon Film; 9.1K Ohm
R33	Resistor, Carbon Film; 390 Ohm
R35	Resistor, Carbon Film; 1.5K Ohm, 1/2W
R36, 47	Resistor, Carbon Film; 10K Ohm
R37	Resistor, 270 Ohm, 2W
R40	Resistor, 5.6 Ohm
R43	Resistor, Carbon Film; 3.3K Ohm
R41	Resistor, Carbon Film; 47 Ohm
R48	Resistor, Carbon Film; 7.5K Ohm
R49, 50	Resistor, Carbon Film; 10 Ohm, 1/2W
RTH1, 2	Thermistor
SW1	Switch, Slide; Select 110/220 VAC
T1	Transformer
T2	Transformer
U1	IC
VR1	Potentiometer, 1K; Voltage Adjust
ZD1	Diode, Zener; 16.1V
ZD2, 3	Diode, Zener; 33V, 1W
ZNR1, 2, 3, 4, 5	Zener, Avalanche
	Shield, Power Supply
	Screw, 4-40 x 5/16 PPH; Qty. 4; PCB Mtg.
	Screw, 4 x 1/4, Type AB; Qty. 4; Shield Mtg.

Table 7 - Replacement Parts, Miscellaneous

ITEM REF. NUMBER	DESCRIPTION
F1	Fuse, 4 Amp; 3 AG, 250V
J1	Jack, 3.5MM Phone; w/Nut
J2	Cable Assembly, 15 Cond.; Multifunction Port
J3, J4	Connector, BNC to N; Qty. 2
PS1	PCB Assembly, Power Supply
SPKR1	Speaker, 8 Ohm
SW1	Switch, Rocker; ON/OFF
	Bracket, Ground; Qty. 2
	Bracket, Duplexer Retainer (DRU)
	Foot, Rubber; Qty. 4
	Chassis
	Front Panel, Desktop
	Top Cover
	Keyboard (Button); Qty. 3
	Fuse Holder; w/Nut and Washer
	Lug, Solder; Qty. 1
	Connector, BNC, Female
	Terminal Ring
	Connector, Screw Lock; Qty. 2
	Knob, Volume/Squelch; Qty. 2
	Shield, VCO
	Shield, VCO; Qty. 2
	Shield, Power Supply
	Shield, PA Mod.
	Shield, Bottom; Qty. 2
	Shield, Partition
	Shield Walls; Qty. 2
	Top Shield; Qty. 2
	Shield, Spur Radiation
	Display, Mask
	Plate, PA End
	Spacer, Module
	Screw, 4-40 x 5/16; Cad/Zinc; Qty. 2
	Screw, 4-40 x 5/16; Qty. 4
	Screw, 6-32 x 1/2; Qty. 4
	Screw, 6-32 x 3/8; Qty. 13 (DRU)
	Screw, 8-32 x 3/8; Qty. 2
	Screw, Pushtite, 4 x 5/16; Qty. 8
	Screw, Pushtite, 4 x 1/4; Qty. 4
	Screw, 4 x 1/4; Qty. 31
	Standoff; Qty. 10
	Screw, 4-40 x 1/4; TORX; Qty. 27 (DRU)
	Screw, 4-40 x 1/4; Pan Head; Qty. 4
	Screw, 4-40 x 3/8; TORX; Qty. 12
	Hang Up Clip; Microphone
	Grommet, Rubber
	Grommet, Flex Strip
	Washer, 1/8 x 9/32 x 032CD; Qty. 4
	Washer, Solder; Qty. 5
	Kep Nut, 4-40 x 1/4 St Cad; Qty. 2
	Kep Nut, 8-32 x 11/32, Cad/Zinc; Qty. 2
	Lens (DRU)
	Heatsink; Qty. 2
	Heatsink
	Strain Relief
	Cord, AC w/Plug
	Instruction Manual (DBU)
	Cable Assembly, Coax
	Cable Assembly, Coax (DRU)
	Cable Assembly, Coax; w/BNC
	Wire Assembly, Black
	Wire Assembly, Black
	Cable Assembly, 2 Cond.
	Cable Assembly, 15 Cond.
	Cable Assembly, 15 Cond.
	Cable Assembly, 4 Cond.
	Cable Assembly, 4 Cond.
	Cable Assembly, 2 Cond.

SERVICE PARTS

The following parts will be available as replacement parts.

RV/1411-7112-502	FRONT PANEL
RV/5115-5343-801	SWITCH
RV/2402-5384-204	VOLUME/SQUELCH KNOB
RV/1301-3299-602	SPEAKER
RV/7011-2166-900	MAIN BOARD
RV/7011-2204-300	PA BOARD
RV/7011-2124-600	MICROPROCESSOR BOARD

You may use this form to record the Unit's configuration.

User	Memo	Decode Tone (Hz) or Code	Encode Tone (Hz) or Code	Encode During Hang Time	Courtesy Beep	Notes/Comments
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
				Y/N	Y/N	

Receive Frequency:_____MHz

Transmit Frequency:_____MHz

RF Output Power:_____(High/Low or record Watts)

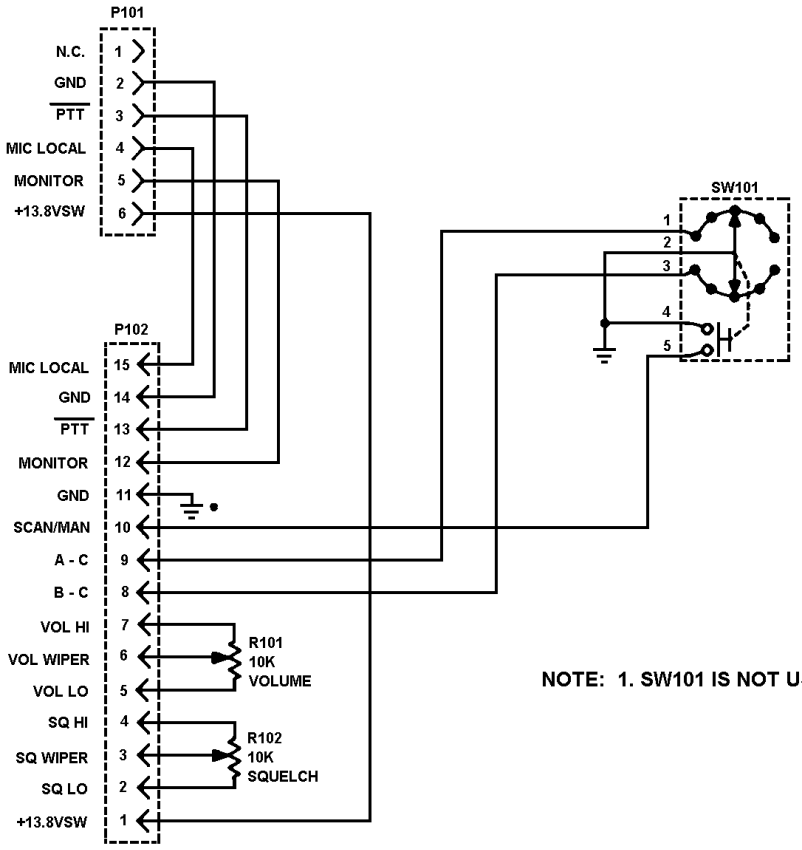
Beep on Button Press:_____(Yes/No)

Time-Out Timer:_____❑ Seconds❑ Minutes

Hang Time:_____Seconds

CW Ident Interval:_____Minutes

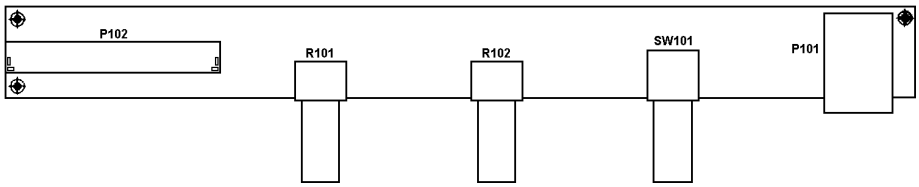
CW Ident:_____(up to 8 characters)



NOTE: 1. SW101 IS NOT USED ON REPEATER MODELS.

NOTE:
1. SW101 IS NOT USED ON REPEATER MODELS.

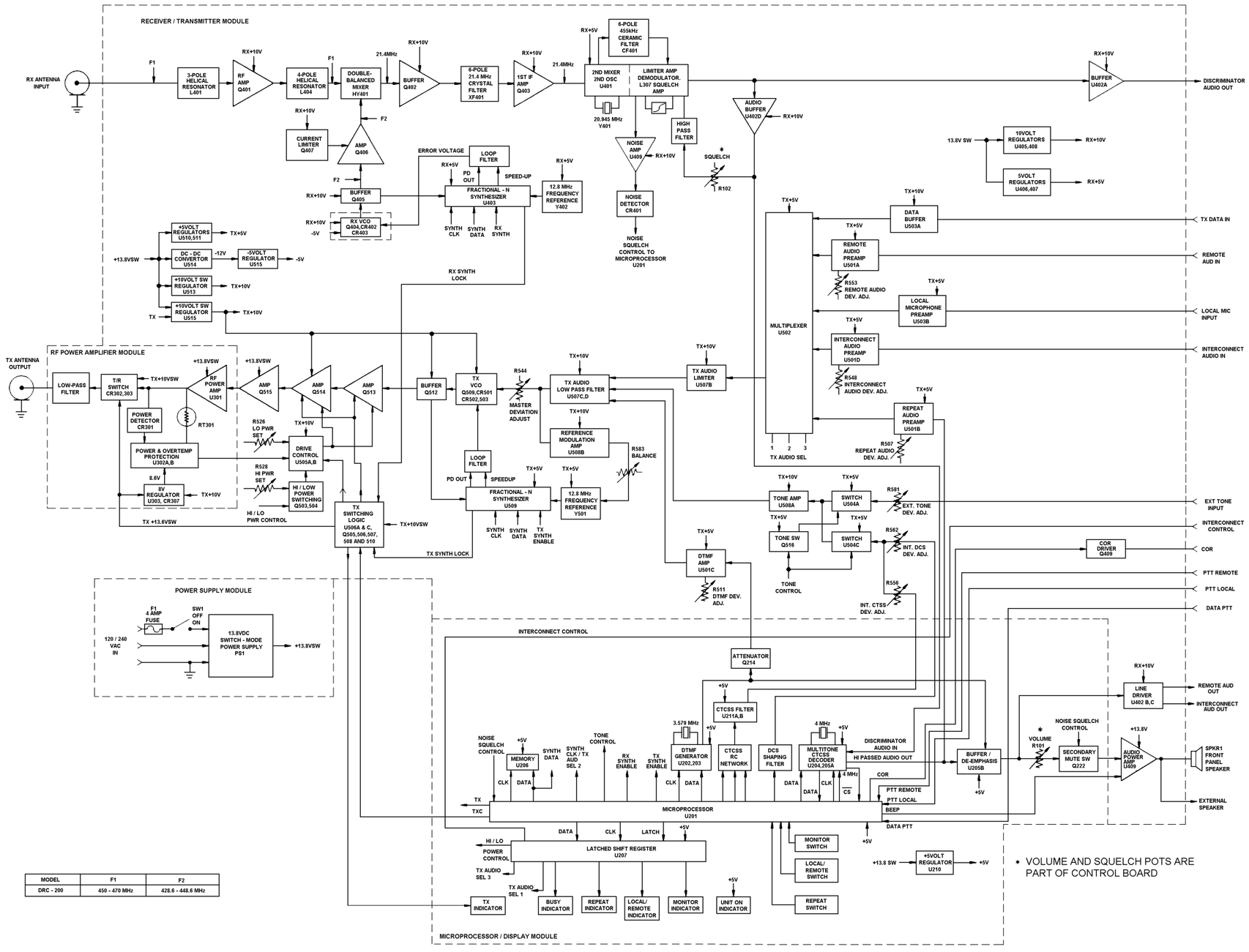
KEYBOARD
PARTS PLACEMENT



CONTROL BOARD

(305-187, Rev. A)

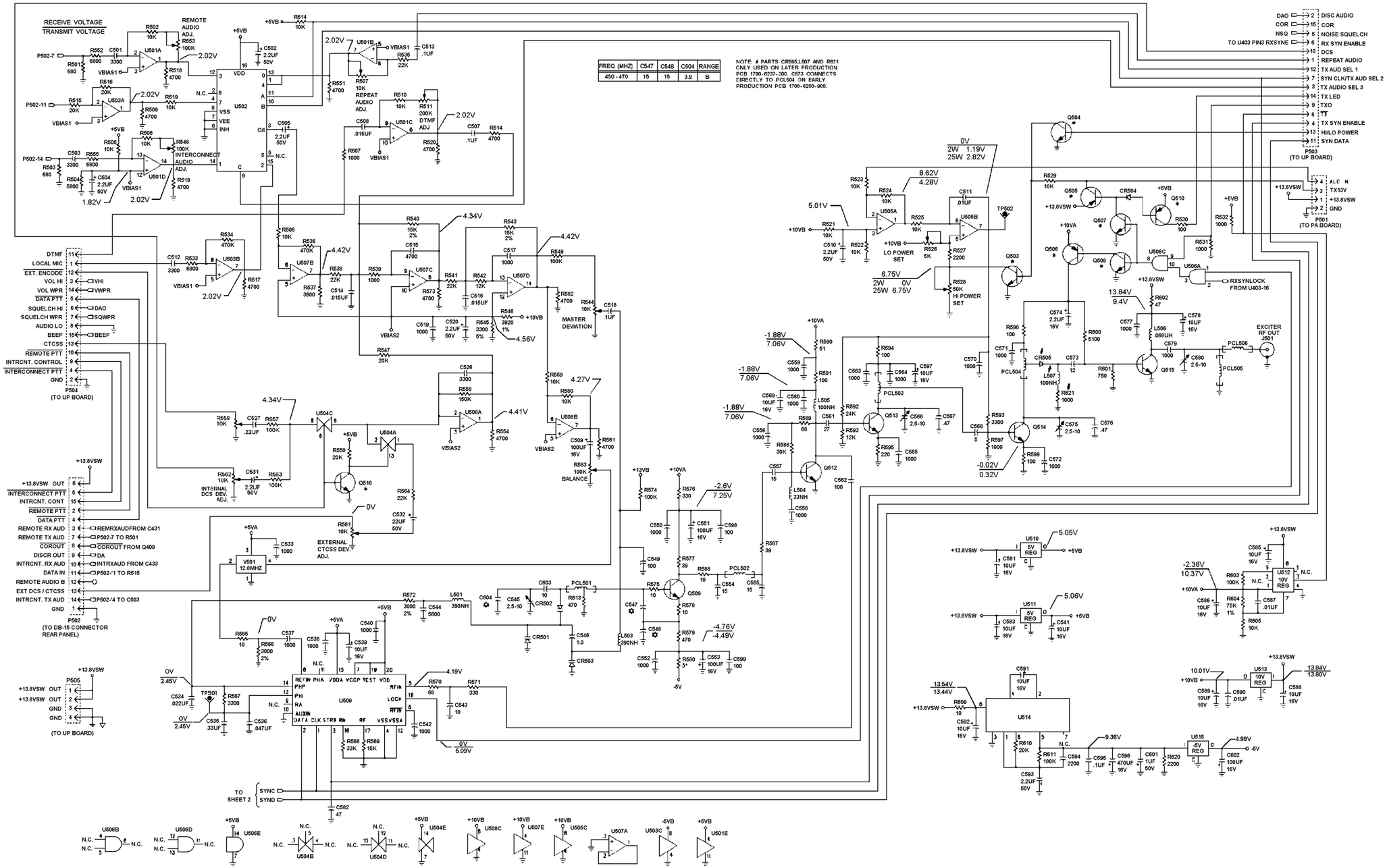
(305-684, Rev. A)



MODEL	F1	F2
DRC - 200	450 - 470 MHz	428.6 - 448.6 MHz

BLOCK DIAGRAM

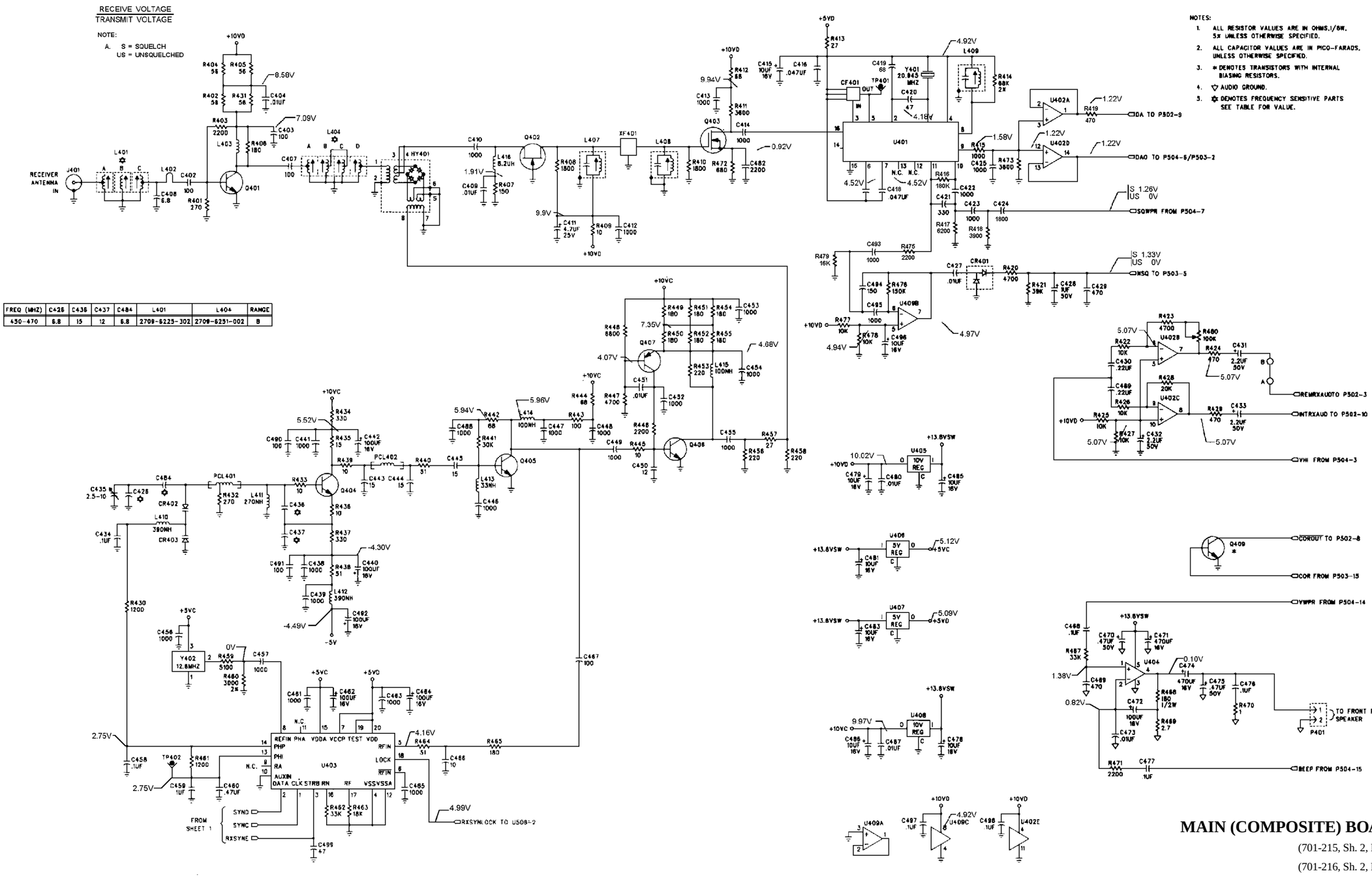
(701-174, Rev. C)



MAIN (COMPOSITE) BOARD

(701-215, Sh. 1, Rev. A)

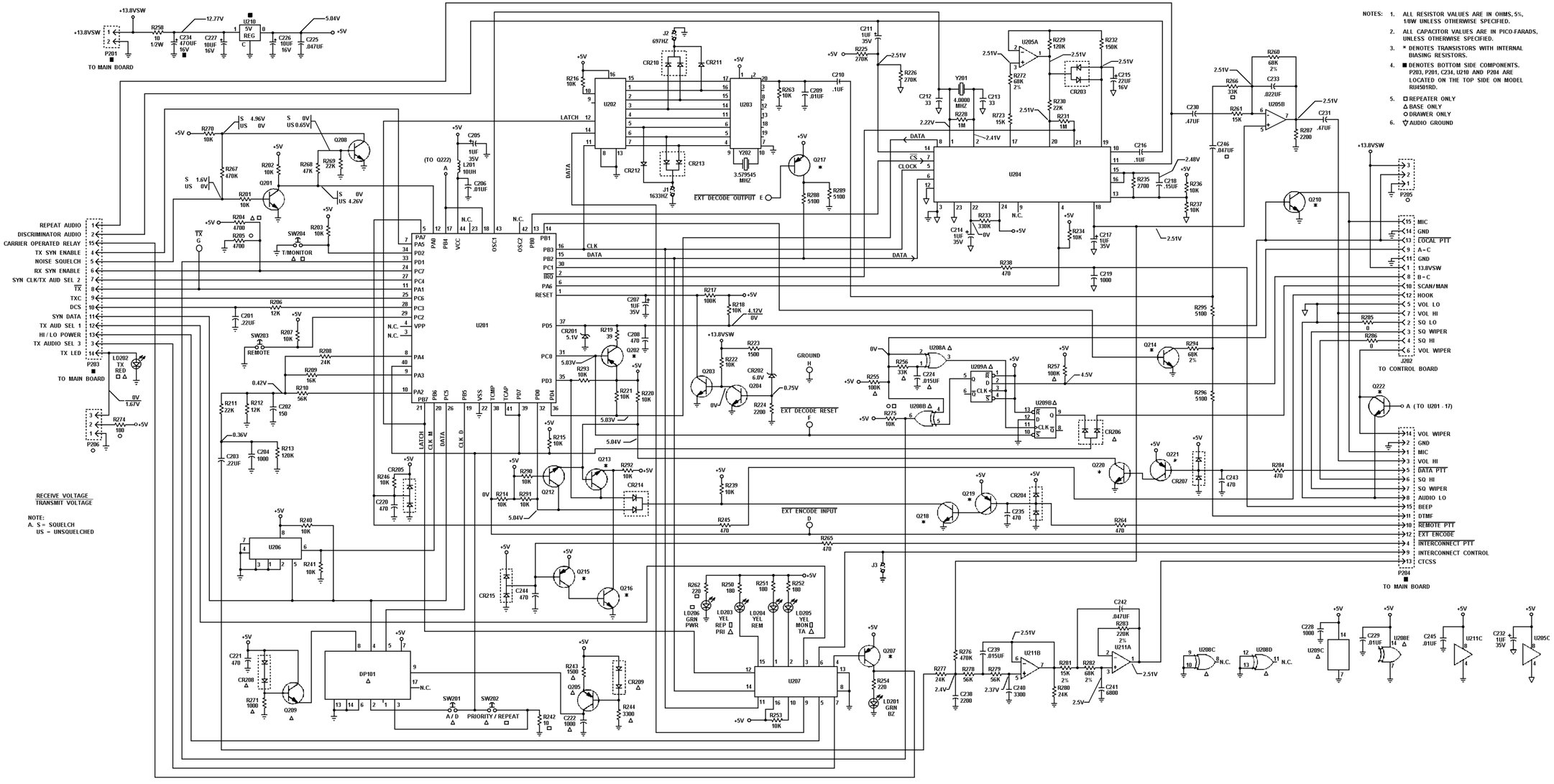
(701-216, Sh. 1, Rev. A)



MAIN (COMPOSITE) BOARD

(701-215, Sh. 2, Rev. A)

(701-216, Sh. 2, Rev. A)

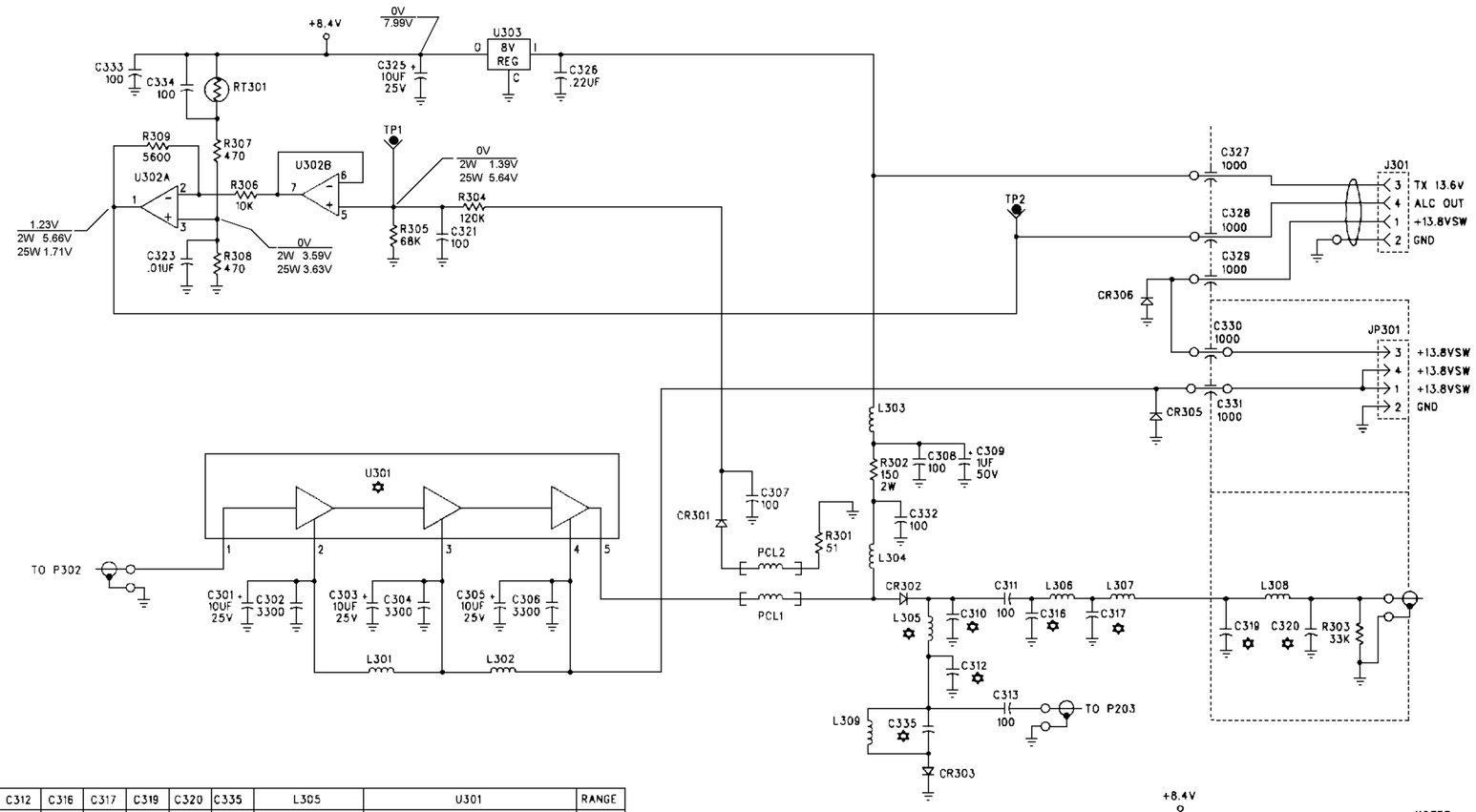


MICROPROCESSO/DISPLAY BOARD

(701-130, Rev. M)

(701-203, Rev. M)

RECEIVE VOLTAGE
TRANSMIT VOLTAGE



FREQ (MHZ)	C310	C312	C316	C317	C319	C320	C335	L305	U301	RANGE
450-470	3.9	4	4.3	10	8.2	4.3	18	1801-3341-520	M57729H 3132-5535-303	8

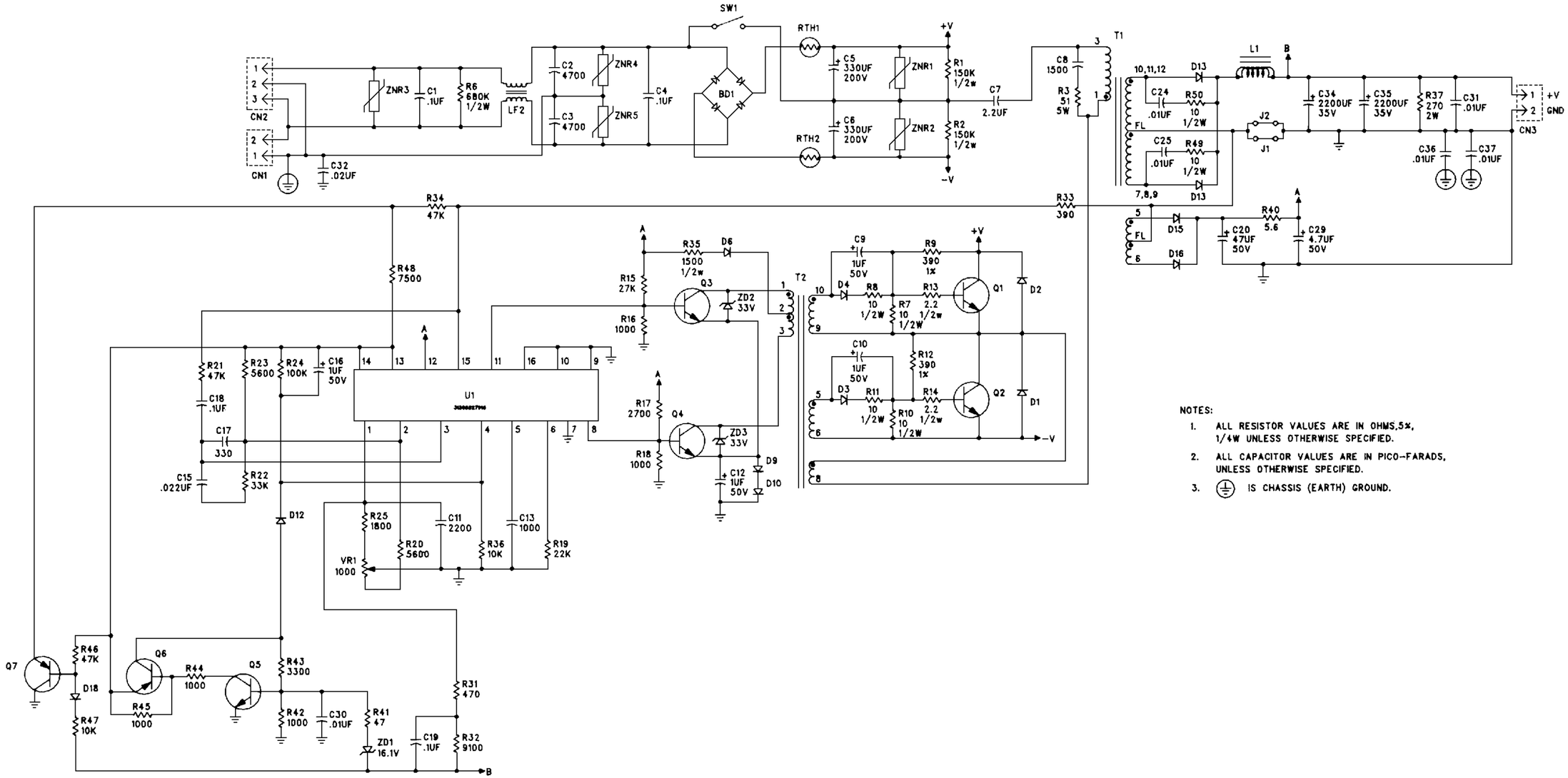
NOTES:

1. ALL RESISTOR VALUES ARE IN OHMS,5%, 1/8W UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITOR VALUES ARE IN PICO-FARADS, UNLESS OTHERWISE SPECIFIED.
3. ✡ DENOTES FREQUENCY SENSITIVE PARTS SEE TABLE FOR VALUE.

PA BOARD

(602-752, Rev. A)

(602-753, Rev. A)

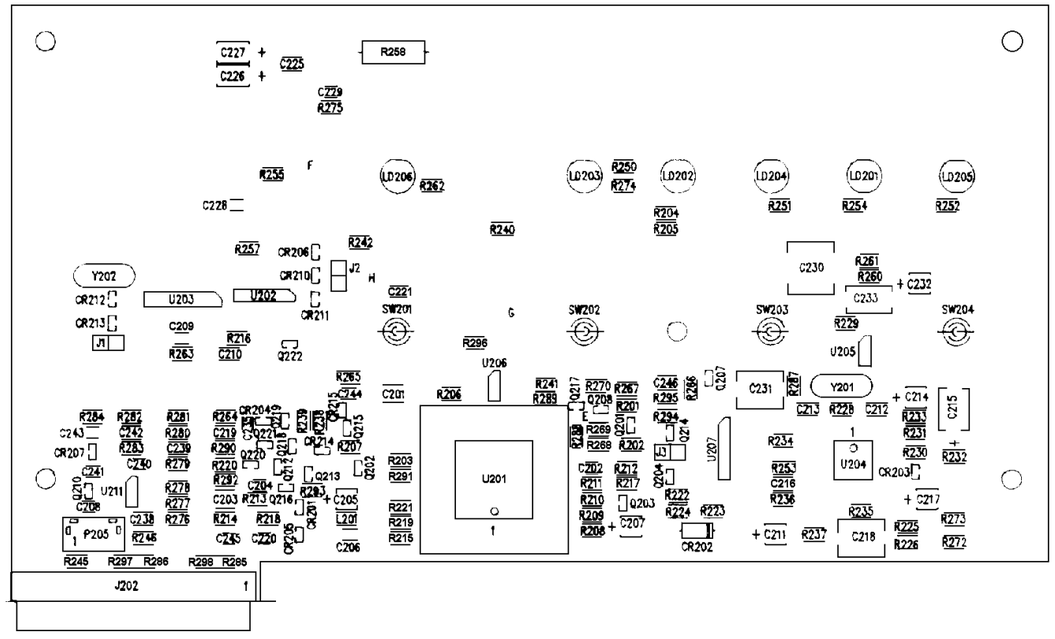


NOTES:

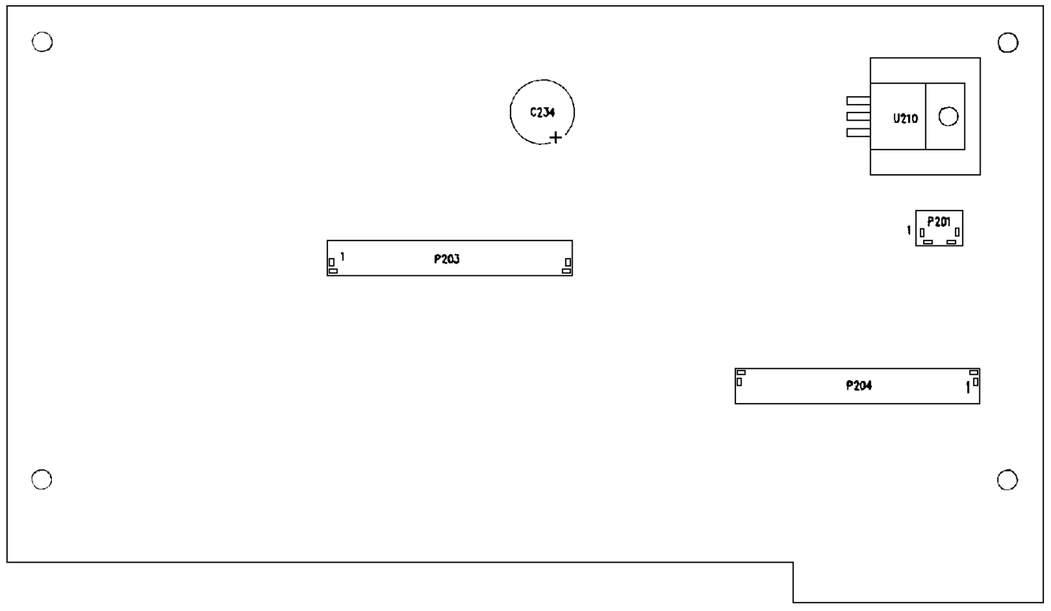
1. ALL RESISTOR VALUES ARE IN OHMS,5%, 1/4W UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITOR VALUES ARE IN PICO-FARADS, UNLESS OTHERWISE SPECIFIED.
3. ⏚ IS CHASSIS (EARTH) GROUND.

POWER SUPPLY BOARD

(602-589, Rev. B)



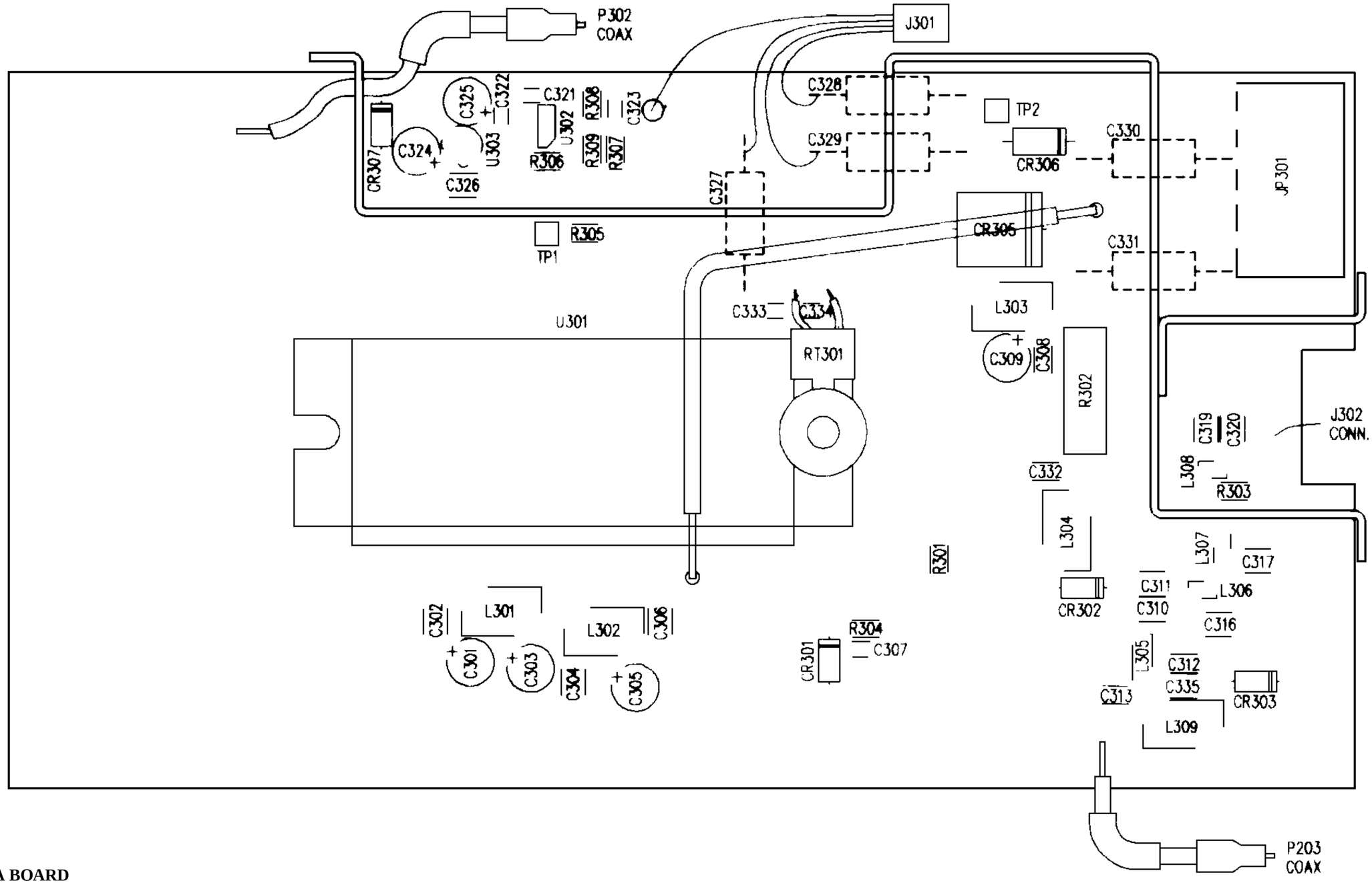
TOP SIDE
VIEWED FROM TOP SIDE



BOTTOM SIDE
VIEWED FROM BOTTOM SIDE

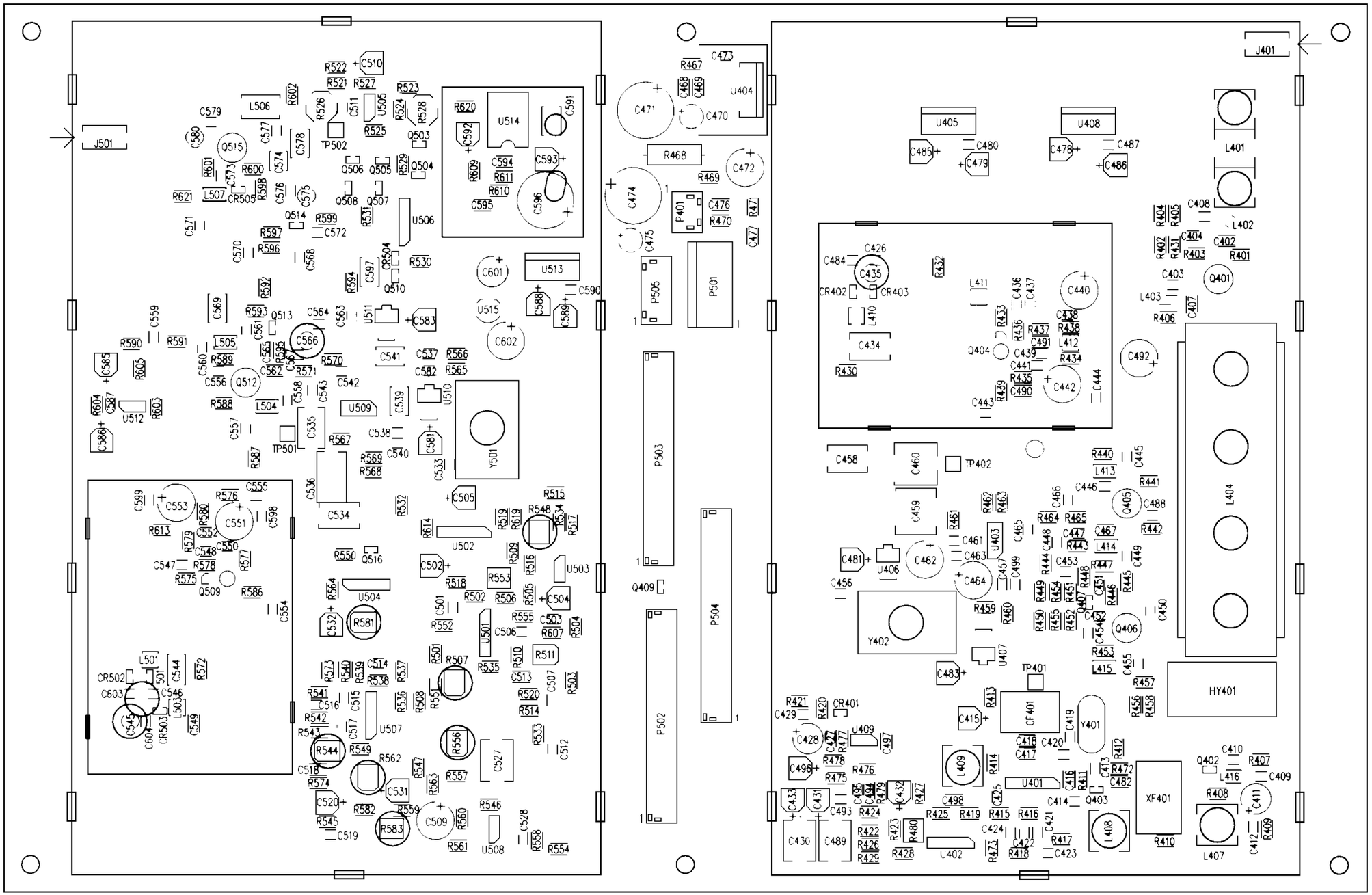
MICROPROCESSOR/DISPLAY BOARD

(305-536, Rev. C)



PA BOARD

(305-537, Rev. C)



MAIN BOARD

(305-703, Rev. A)

Ericsson Inc.
Private Radio Systems
Mountain View Road
Lynchburg, Virginia
1-800-592-7711 (Outside USA, 804-592-7711)

AE/LZB 119 1882 R1B
Printed in U.S.A.