

**Business Portable Radio
Service Manual**
VHF 136-174 MHz
UHF 435-480 MHz

Motorola, Inc.
1301 E. Algonquin Road
Schaumburg, IL 60196

6881096C38-B

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Circuit Board Details									
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Manual No.: 6881096C38

Foreword

This manual is intended for use by service technicians familiar with similar types of equipment. It contains service information required for the equipment described and is current as of the printing date. Changes which occur after the printing date may be incorporated by a complete Manual revision or alternatively as additions.

Note: Before operating or testing these units, please read the Product Safety and RF Exposure Compliance section.

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DOCUMENT HISTORY

The following major changes have been implemented in this manual since the previous edition:

Edition	Description	Date
6881096C38-B	Chapter 2: Maintenance Updated parts list	Apr. 2006
	Chapter 4: CPS Programming Changed part number HVN4196_ to RVN4196_	
	Chapter 6: Accessories Updated description of HLN9844_, PMNN4063_R. Added 6881098C60 CP125 Radio UG (Eng/ French)	
	Chapter 7: VHF (136-174 MHz) Band Info. Updated model chart and specifications	
	Chapter 8: UHF (435-480 MHz) Band Info. Updated model chart and specifications	

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User Safety, Training, and General Information

Product Safety and RF Exposure Compliance



CAUTION: Before using this product, read the operating instructions for safe usage contained in the Product Safety and RF Exposure booklet enclosed with your radio.

ATTENTION!

This radio is restricted to occupational use only to satisfy FCC RF energy exposure requirements. Before using this product, read the RF energy awareness information and operating instructions in the Product Safety and RF Exposure booklet enclosed with your radio (Motorola Publication part number 68P81095C98) to ensure compliance with RF energy exposure limits.

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Chapter 1 Introduction

1.1 Scope of Manual

This manual is intended for use by service technicians familiar with similar types of equipment. It contains service information required for the equipment described and is current as of the printing date. Changes which occur after the printing date may be incorporated by a complete Manual revision or alternatively as additions.

NOTE: Before operating or testing these units, please read the Product Safety and RF Exposure Compliance section in the front of this manual.

1.2 Warranty

Motorola offers long term support for its products. This support includes full exchange and/or repair of the product during the warranty period, and service/ repair or spare parts support out of warranty. Any “return for exchange” or “return for repair” by an authorized Motorola Dealer must be accompanied by a Warranty Claim Form. Warranty Claim Forms are obtained by contacting an Authorized Motorola Dealer.

1.2.1 Warranty Period and Return Instructions

The terms and conditions of warranty are defined fully in the Motorola Dealer, Distributor, or Reseller contract. These conditions may change from time to time and the following notes are for guidance purposes only.

In instances where the product is covered under a “return for replacement” or “return for repair” warranty, a check of the product should be performed prior to shipping the unit back to Motorola. This is to ensure that the product has been correctly programmed or has not been subjected to damage outside the terms of the warranty.

1.2.2 After Warranty Period

After the Warranty period, Motorola continues to support its products in two ways.

1. Motorola's Radio Products and Services Division (RPSD)* offers a repair service to both end users and dealers at competitive prices.
2. Radio Products and Services Division (RPSD) supplies individual parts and modules that can be purchased by dealers who are technically capable of performing fault analysis and repair.

* The Radio Products and Services Division (RPSD) was formerly known as the Accessories and Aftermarket Division (AAD)

1.3 Replacement Parts Ordering

1.3.1 Basic Ordering Information

When ordering replacement parts or equipment information, the complete identification number should be included. This applied to all components, kits, and chassis. If the component part number is not known, the order should include the number of the chassis or kit of which it is a part, a sufficient description of the desired component to identify it.

1.3.2 Motorola Online

Motorola online users can access our on-line catalog at:

[HTTPS://WWW.MOTOROLA.COM/BUSINESSONLINE](https://www.motorola.com/businessonline)

To register for online access, please call 800-814-0601 (for U.S. and Canada Service Centers only).

1.3.3 Mail Orders

Send written orders to the following addresses:

**Replacement Parts/Test
Equipment/Manuals/Crystal
Service Items:**

Motorola, Inc.
Radio Products and Services Division
Attention: Order Processing
2200 Galvin Dr.
Elgin, IL 60123
U.S.A.

1.3.4 Telephone Orders

Radio Products and Services Division (RPSD)*
(United States and Canada)
7:00 AM to 7:00 PM (Central Standard Time)
Monday through Friday (Chicago, U.S.A.)
1-800-422-4210

1.3.5 Fax Orders

Radio Products and Services Division (RPSD)
(United States and Canada)
1-800-622-6210

1.3.6 Parts Identification

Radio Products and Services Division (RPSD)
(United States and Canada)
1-800-422-4210, menu 3

* The Radio Products and Services Division (RPSD) was formerly known as the Accessories and Aftermarket Division (AAD)

1.3.7 Product Customer Service

Customer Response Center
(Non-technical Issues)
1-800-247-2346
FAX: 1-800-247-2347

1.4 Technical Support

Technical support is available to assist the dealer/distributor in resolving any malfunction which may be encountered. Initial contact should be by telephone wherever possible. When contacting Motorola Technical Support (Customer Resources), be prepared to provide the product **model number** and the unit's **serial number**.

Motorola Radio Support Center

2204 Glavin Drive
Elgin, Illinois 60123
1-800-227-6772
1-815-489-1000

Canadian Technical Logistics Centre

400 Matheson Blvd. W,
Mississauga, Ontario, Canada L5R 3M1
1-800-543-3222
1-416-756-5841
1-888-331-9872 (Fax)

1.5 Radio Model Information

The model number and serial number are located on a label attached to the back of your radio. You can determine the RF output power, frequency band, protocols, and physical packages. The example below shows one portable radio model number and its specific characteristics.

Table 1-1. Radio Model Number (Example: AAH49KDF8AA1A_)

	Type of Unit	Model Series	Frequency Band	Power Level	Physical Packages	Channel Spacing	Protocol	Feature Level
AA	H	49	K (136-174 MHz)	D 5 W	F Limited Keypad with Display	8 12.5/25K	AA Conventional	1 Limited Keypad
			R (435-480 MHz)	C 4 W				

H = Portable
 Internal Use

1.6 Radio Features

CPS = Customer Programming Software
(for Reseller)

Feature	Business Portable	
	CPS	Front Panel
Factory Reset	X	
Radio Information	X	
Radio Configuration		
Scan Interval Timer	X	
Scan Hang Timer	X	
Alert Tone	X	X
Backlight Status	X	X
Battery Saver	X	X
Battery Type	X	X
Time Out Timer	X	X
Prime (Home) Ch	X	X
Prime Ch Return Hang Time	X	
Squelch Level	X	X
Tx Repeater Hang Time	X	
VOX Parameter1	X	
VOX Parameter2	X	
Reverse Burst Phase	X	
Offset Freq	X	
Special (Non Standard) PL 1,2,3	X	
RX/TX DPL Invert	X	
Conventional Personality		
Channel Enable	X	
Ch Alias	X	
Rx Freq	X	
Tx Freq	X	
PL/DPL Select	X	X
Power Level	X	
Reverse Burst/Turn Off Code	X	
VOX	X	X
Busy Channel Lockout (BCL)	X	
Tx Offset(Repeater Offset)	X	

Feature	Business Portable	
	CPS	Front Panel
Scan Type Select	X	
Ch Spacing	X	
Scan		
Programmable Scan List	X	X
Scan List Select	X	
Programmable Button Options		
Channel Alias	X	
Backlight	X	
Volume Set	X	
Keypad Lock	X	
Prime Channel	X	
Power Select	X	
Talkaround (Repeater)	X	
Scan On/Off	X	
Nuisance Channel Delete	X	
PL/DPL Select	X	
No Function	X	

X = Indicates available
Blank = Indicates unavailable

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Chapter 2 Maintenance

2.1 Introduction

This chapter provides details about the following:

- Preventive Maintenance
- Safe Handling of CMOS and LDMOS Devices
- General Repair Procedures and Techniques
- Disassembling and Reassembling the Radio

2.2 Preventive Maintenance

The radio does not require a scheduled preventive maintenance program; however, periodic visual inspection and cleaning is recommended.

2.2.1 Inspection

Check that the external surfaces of the radio are clean, and that all external controls and switches are functional. It is not recommended to inspect the interior electronic circuitry.

2.2.2 Cleaning Procedures

The following procedures describe the recommended cleaning agents and the methods to be used when cleaning the external and internal surfaces of the radio. External surfaces include the front cover, housing assembly and battery case. These surfaces should be cleaned whenever a periodic visual inspection reveals the presence of smudges, grease, and/or grime.

NOTE Internal surfaces should be cleaned only when the radio is disassembled for service or repair.

The only recommended agent for cleaning external radio surfaces is a 0.5% solution of a mild dishwashing detergent in water. The only factory recommended liquid for cleaning printed circuit boards and their components is isopropyl alcohol (70% by volume).



CAUTION: The effects of certain chemicals and their vapors can have harmful results on certain plastics. Avoid using aerosol sprays, tuner cleaners, and other chemicals.

2.2.2.1 Cleaning External Plastic Surfaces

Apply the 0.5% detergent-water solution sparingly with a stiff, non-metallic, short-bristled brush to work all loose dirt away from the radio. Use a soft, absorbent, lintless cloth or tissue to remove the solution and dry the radio. Make sure that no water remains entrapped near the connectors, cracks, or crevices.

2.2.2.2 Cleaning Internal Circuit Boards and Components

Apply Isopropyl alcohol (70%) with a stiff, non-metallic, short-bristled brush to dislodge embedded or caked materials located in hard-to-reach areas. The brush stroke should direct the dislodged material out and away from the inside of the radio. Make sure that controls or tunable components are not soaked with alcohol. Do not use high-pressure air to hasten the drying process since this could cause the liquid to collect in unwanted places. After completing the cleaning process, use a soft, absorbent, lintless cloth to dry the area. Do not brush or apply any isopropyl alcohol to the frame, front cover, or back cover.

NOTE Always use a fresh supply of alcohol and a clean container to prevent contamination by dissolved material (from previous usage).

2.3 Safe Handling of CMOS and LDMOS Devices

Complementary metal-oxide semiconductor (CMOS) devices are used in this family of radios, and are susceptible to damage by electrostatic or high voltage charges. Damage can be latent, resulting in failures occurring weeks or months later. Therefore, special precautions must be taken to prevent device damage during disassembly, troubleshooting, and repair.

Handling precautions are mandatory for CMOS circuits and are especially important in low humidity conditions. DO NOT attempt to disassemble the radio without first referring to the following CAUTION statement.



CAUTION: This radio contains static-sensitive devices. Do not open the radio unless you are properly grounded. Take the following precautions when working on this unit:

- Store and transport all CMOS devices in conductive material so that all exposed leads are shorted together. Do not insert CMOS devices into conventional plastic “snow” trays used for storage and transportation of other semiconductor devices.
- Ground the working surface of the service bench to protect the CMOS device. We recommend using the Motorola Static Protection Assembly (part number 0180386A82), which includes a wrist strap, two ground cords, a table mat, and a floor mat.
- Wear a conductive wrist strap in series with a 100k resistor to ground. (Replacement wrist straps that connect to the bench top covering are Motorola part number RSX-4015.)
- Do not wear nylon clothing while handling CMOS devices.
- Do not insert or remove CMOS devices with power applied. Check all power supplies used for testing CMOS devices to be certain that there are no voltage transients present.
- When straightening CMOS pins, provide ground straps for the apparatus used.
- When soldering, use a grounded soldering iron.
- If at all possible, handle CMOS devices by the package and not by the leads. Prior to touching the unit, touch an electrical ground to remove any static charge that you may have accumulated. The package and substrate may be electrically common. If so, the reaction of a discharge to the case would cause the same damage as touching the leads.

2.4 Repair Procedures and Techniques — General

2.4.1 Parts Replacement and Substitution

When damaged parts are replaced, identical parts should be used. If the identical replacement part is not locally available, check the parts list for the proper Motorola part number and order the part from the nearest Motorola Communications parts center listed in the Replacement Parts Ordering section of this manual.

2.4.2 Rigid Circuit Boards

This radio uses bonded, multi-layer, printed circuit boards. Since the inner layers are not accessible, some special considerations are required when soldering and unsoldering components. The printed-through holes may interconnect multiple layers of the printed circuit. Therefore, exercise care to avoid pulling the plated circuit out of the hole.

When soldering near the 20-pin and 40-pin connectors:

- Avoid accidentally getting solder in the connector.
- Be careful not to form solder bridges between the connector pins.
- Examine your work closely for shorts due to solder bridges.

2.4.3 Flexible Circuits

The flexible circuits are made from a different material than the rigid boards, and require different soldering techniques. Excessive prolonged heat on a flexible circuit can damage the material. Therefore, avoid excessive heat and excessive bending.

For parts replacement, use the ST-1087 Temperature-Controlled Solder Station with a 600-700 degree F tip, and use small diameter solder such as ST-633. The smaller size solder will melt faster and require less heat to be applied to the circuit.

To replace a component on a flexible circuit:

1. Grasp with seizers (hemostats) the edge of the flexible circuit near the part to be removed.
2. Pull gently.
3. Apply the tip of the soldering iron to the component connections while pulling with the seizers.

NOTE Do not attempt to puddle-out components. Prolonged application of heat may damage the flexible circuit.

2.4.4 Chip Components

Use either the RLN-4062 Hot-Air Repair Station or the Motorola 0180381B45 Repair Station for chip component replacement. When using the 0180381B45 Repair Station, select the TJ-65 mini-thermojet hand piece. On either unit, adjust the temperature control to 700 degrees F. (370 degrees C), and adjust the airflow to a minimum setting. Airflow can vary due to component density.

- To remove a chip component, select a hot-air hand piece and position the nozzle of the hand piece approximately 1/8" above the component to be removed. Begin applying hot air. Once the solder reflows, remove the component using a pair of tweezers. Using solder wick and a soldering iron or a power desoldering station, remove the excess solder from the pads.

- To replace a chip component using a soldering iron, select the appropriate micro-tipped soldering iron and apply fresh solder to one of the solder pads. Using a pair of tweezers, position the new chip component in place while heating the fresh solder. Once solder wicks onto the new component, remove the heat from the solder. Heat the remaining pad with the soldering iron and apply solder until it wicks to the component. If necessary, touch up the first side. All solder joints should be smooth and shiny.
- To replace a chip component using hot air, select the hot-air hand piece and reflow the solder on the solder pads to smooth it. Apply a drop of solder paste flux to each pad. Using a pair of tweezers, position the new component in place. Position the hot-air hand piece approximately 1/8" above the component and begin applying heat. Once the solder wicks to the component, remove the heat and inspect the repair. All joints should be smooth and shiny.

2.4.5 Shields

Removing and replacing shields will be done with the R-1070 station with the temperature control set to approximately 415°F (215°C); 445°F (230°C) max.

- To remove the shield, place the circuit board in the R-1070's holder. Select the proper heat focus head and attach it to the heater chimney. Add solder paste flux around the base of the shield. Position the shield under the heat-focus head. Lower the vacuum tip and attach it to the shield by turning on the vacuum pump. Lower the focus head until it is approximately 1/8" (0.3cm) above the shield. Turn on the heater and wait until the shield lifts off the circuit board. Once the shield is off, turn off the heat, grab the part with a pair of tweezers, and turn off the vacuum pump. Remove the circuit board from the R-1070's circuit board holder.
- To replace the shield, add solder to the shield if necessary, using a micro-tipped soldering iron. Next, rub the soldering iron tip along the edge of the shield to smooth out any excess solder. Use solder wick and a soldering iron to remove excess solder from the solder pads on the circuit board. Place the circuit board back in the R1070's circuit board holder. Place the shield on the circuit board using a pair of tweezers. Position the heat-focus head over the shield and lower it to approximately 1/8" above the shield. Turn on the heater and wait for the solder to reflow.
Once complete, turn off the heat, raise the heat-focus head and wait approximately one minute for the part to cool. Remove the circuit board and inspect the repair. No cleaning should be necessary.

2.5 Disassembling and Reassembling the Radio — General

Since these radios may be disassembled and reassembled with the use of only four (board to casting) screws, it is important to pay particular attention to the snaps and tabs, and how parts align with each other.

The following tools are required for disassembling the radio:

- Phillips screwdriver
- 4mm socket wrench
- Flathead screwdriver

If a unit requires more complete testing or service than is customarily performed at the basic level, send this unit to a Motorola Authorized Service Center.

2.6 Radio Disassembly — Detailed

2.6.1 Front Cover from Chassis Disassembly

1. Turn off the radio.
2. Remove the battery:
 - a. Slide the battery clasp away from the radio (See Figure 2-1).



Figure 2-1.

- b. Slide battery down and away from radio.
3. Remove the antenna.
4. Pull the On/Off Volume knob off of its shaft.
5. Remove the two screws at the back of the rear chassis (See Figure 2-2).

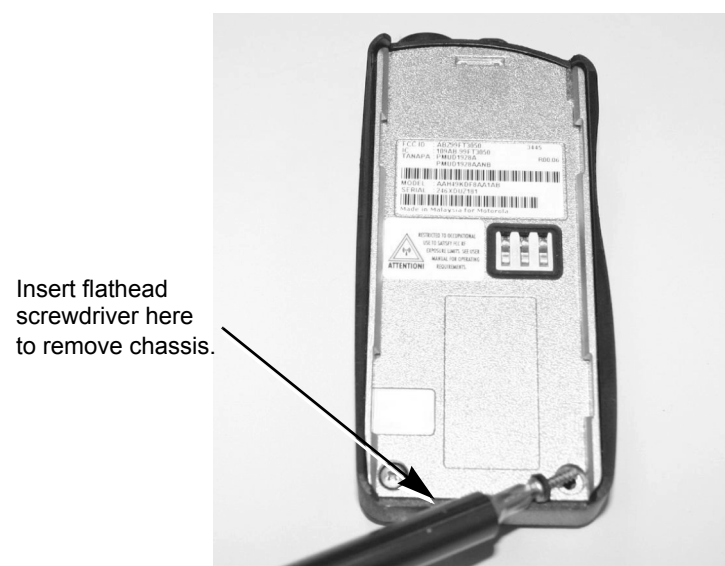


Figure 2-2.

6. Insert a small flathead screwdriver at the bottom of the radio, between the chassis and housing (location marked in [Figure 2-2](#)), and lift the chassis gently. Be careful not to damage the housing or the O-ring underneath.
7. Lift the rear chassis away from the front cover ([See Figure 2-3](#)). Be careful not to damage the speaker wire underneath.

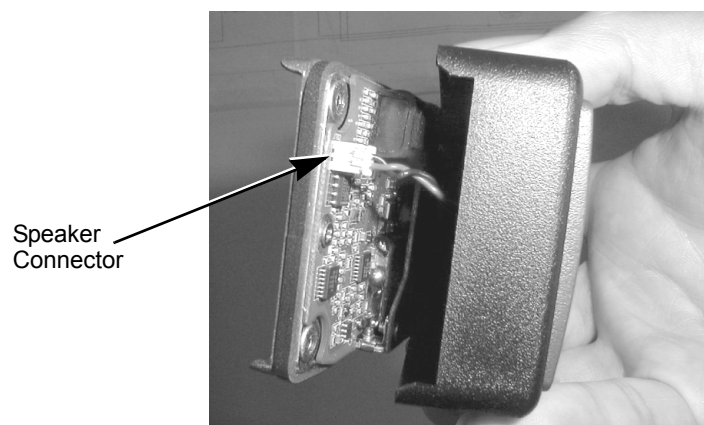


Figure 2-3.

8. Slide the rear chassis downwards, and away from the front cover.
9. Remove the speaker connector, which connects between RF Board and the internal speaker on the front cover ([See Figure 2-4](#)).

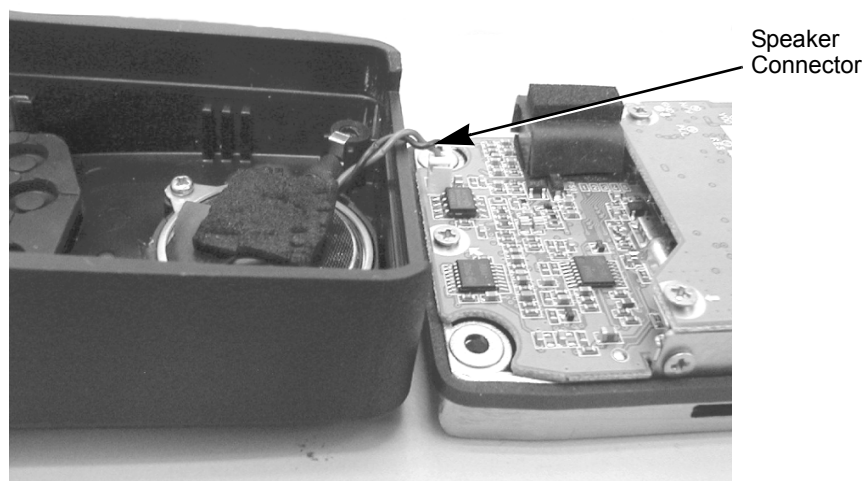


Figure 2-4.

2.6.2 Control Board Disassembly

1. Remove the screws which hold the control board to the RF board.
2. Remove the control board which is connected to the RF board through a board-to-board connector (See [Figure 2-5](#)).

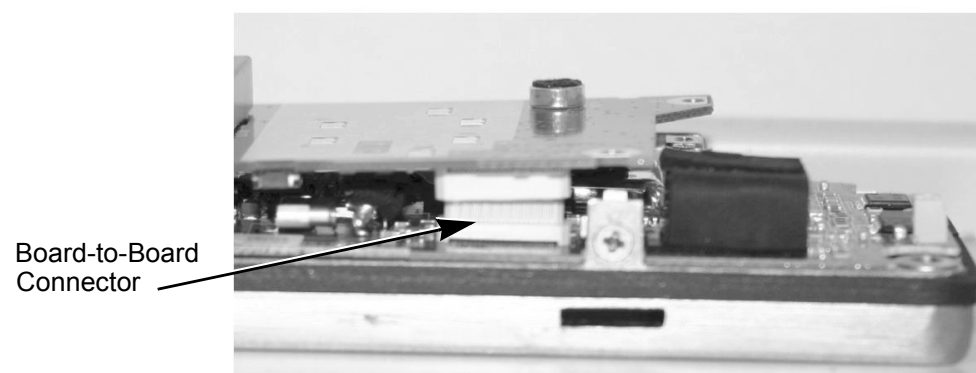


Figure 2-5.

2.6.3 RF Board Disassembly

1. Remove the screws and the stud which hold the RF board to the rear diecast with the Phillips head screwdriver and socket wrench respectively.
2. Gently remove the RF board from rear diecast. Then, completely disassembled radio is shown in [Figure 2-6](#).

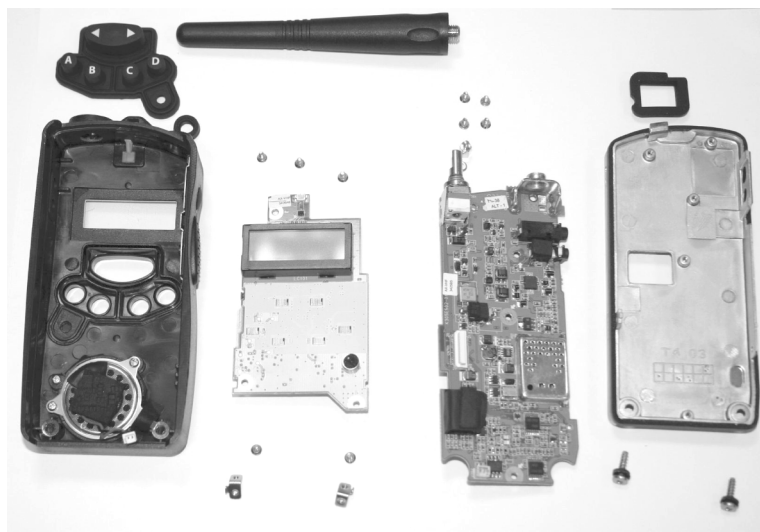


Figure 2-6.

Note: The Control and RF boards are mounted with cross recess screws meeting the Phillips Cross Slot number 1 standard. Using a Phillips 0 will damage the screw recesses as will a poorly fitting Phillips 1 screwdriver. One example of a correct fitting screwdriver is manufactured by PB Baumann (http://www.pbtools.ch/index_e.html) and is available from many electronic tool dealers. The PB Baumann item number is 121/1-70. Other high quality manufacturer's products meeting the Phillips 1 standard are also acceptable.

2.7 Radio Reassembly — Detailed

2.7.1 RF Board Reassembly

1. Place the RF board on the rear diecast.
2. Tighten the screws and the stud.

2.7.2 Control Board Reassembly

1. Place the control board on the RF board.
2. Connect the control board to the RF board by pressing it firmly downwards at the board-to-board connector (See Figure 2-7).

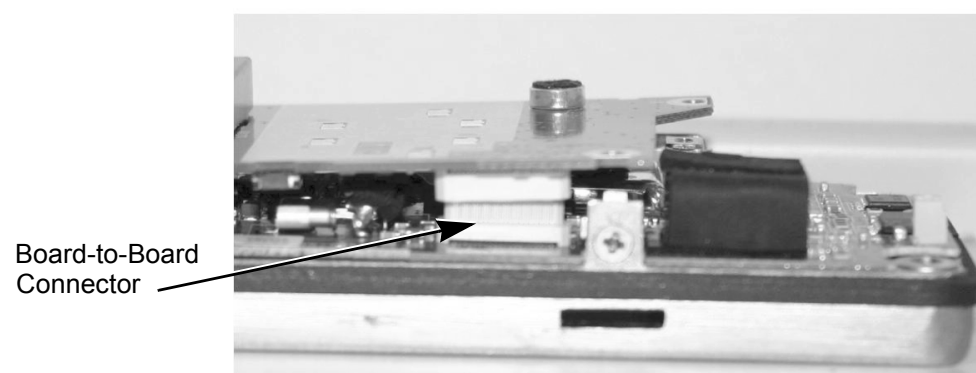


Figure 2-7.

3. Tighten the screws using a screwdriver to hold the control board in place.

2.7.3 Chassis and Front Cover Reassembly

1. Assemble the front keypad into the front cover (See Figure 2-8).
2. Press the keypad firmly to the front cover to make sure the keypad ribs are fully flush to groove on front cover.



Figure 2-8.

3. Place the front cover over the tabs on the rear diecast.

4. Insert the On/Off shaft and antenna nut into the front cover opening.
5. Lower the front cover closed to the diecase bottom edges.
6. Connect the RF Board to the internal speaker on the front cover with the speaker connector (See Figure 2-9).

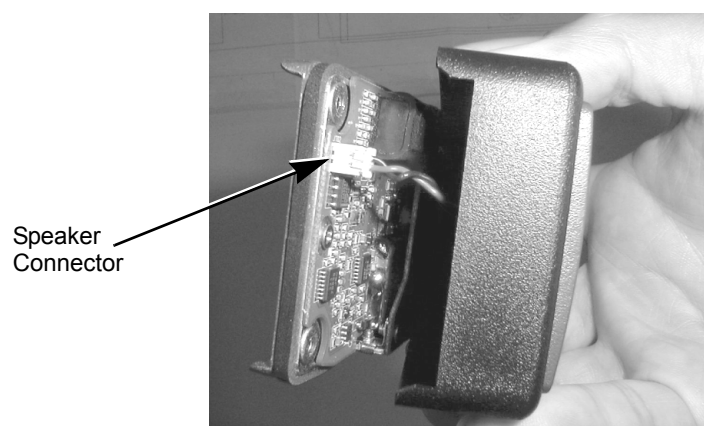


Figure 2-9.

7. Snap the front cover firmly into place on the rear diecast (See Figure 2-10).



Figure 2-10.

8. Tighten the two (2) screws at the bottom of rear diecast using a screwdriver (See [Figure 2-11](#)).



Figure 2-11.

9. Attach the battery.
10. Attach the On/Off Volume knob and the antenna.



Figure 2-12.

2.8 Mechanical View and Parts List

2.8.1 Exploded View and Parts List

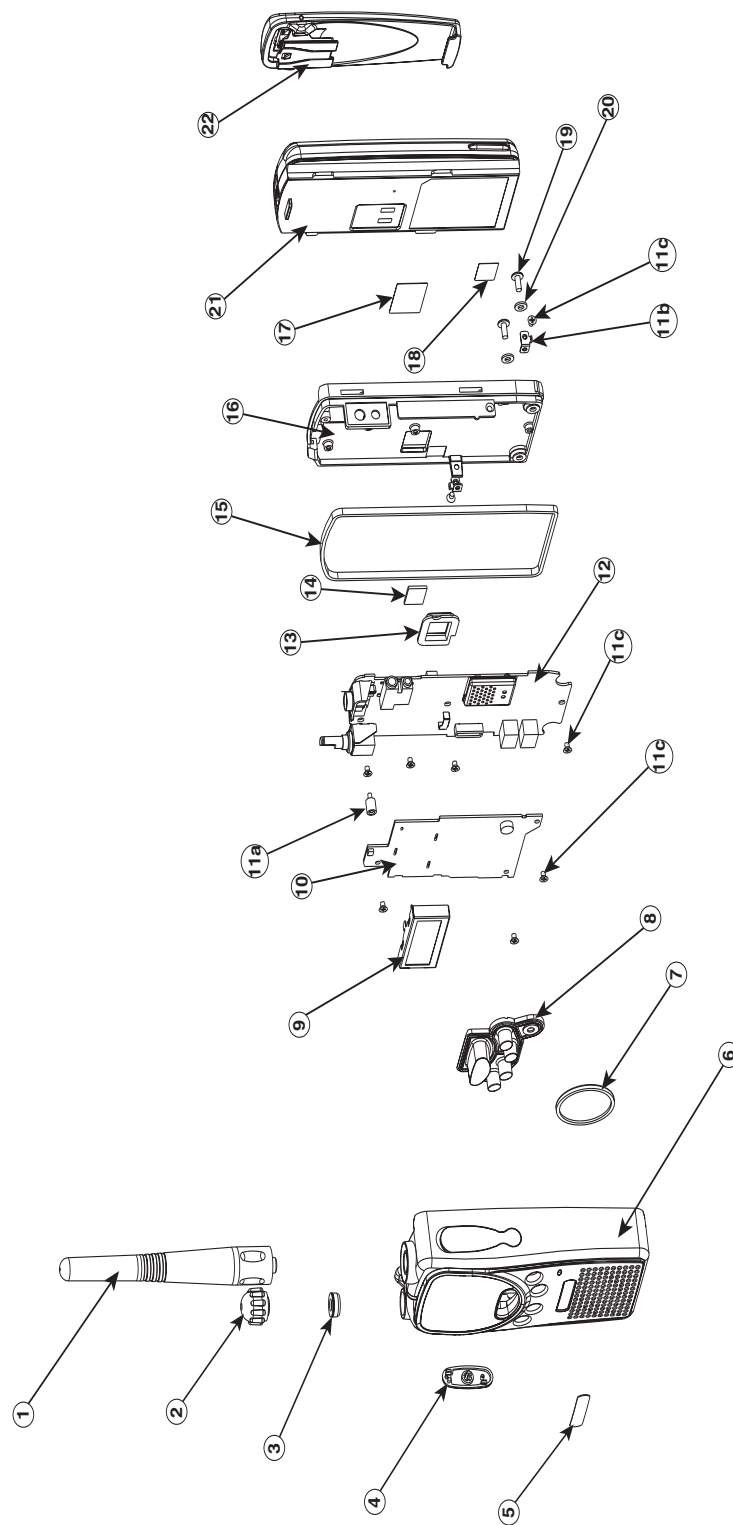


Figure 2-13.

Item	Part Number	Description	Item	Part Number	Description
1	Frequency dependent. Please see "6.1 Antennas" on page 6-1	Antenna	12	PMDD4004_	RF Board Assembly, VHF 136-174 MHz R2
2	DSAXRA110001	Volume Knob Assembly		PMDE4004_	RF Board Assembly, UHF 435-480 MHz R2
3	DSAXRM120001	Volume Knob Gasket	13	DSAXRM2A0001	Battery Contact Gasket
4	DSAXRM140001	PTT Button	14	DSAXRM280001	Heatsink Thermal Pad
5	3380384W23	CP125 Nameplate	15	DSAXRM250001	Main Gasket
	DSAXRM160001	BC120 Nameplate	16	DSM5190001	Back Chassis Kit (2-Piece Audio Jack)
6	DSAXRK210004	Front Housing Kit, Black CP125		PMDN4063_	Back Chassis Kit (1-Piece Audio Jack)
	DSAXRK210001	Front Housing Kit, Black BC120	17	DSAXRP320001	RF-Warning Label
	DSAXRK210002	Front Cover Assembly, Grey	18	DSAXRM130001	Tuning Port Sticker
7	DSAXRA220001	Speaker Assembly	19	DSAXRM2B0001	Screw M2.6
8	DSAXRP310001	Keypad	20	DSAXRM2C0001	Washer / Gasket (for screw M2.6)
9	DSAXRK290001	LCD Kit Assembly	21	PMNN4063_R	Std. NiMH Battery
10	DSAXRA231V25	Controller Board Kit, VHF 16 Ch Vx	22	HLN9844_	Belt Clip
	DSAXRA234V35	Controller Board Kit, UHF 16 Ch Vx			
	DSAXRA231V22	Controller Board Kit, VHF 4 Ch Vx			
	DSAXRA234V31	Controller Board Kit, UHF 4 Ch Vx			
11	DS1M001120	Chassis Hardware Kit (2-Piece Audio Jack)			
	PMDN4061_	Chassis Hardware Kit (1-Piece Audio Jack R2)			
11a		Rod M2			
11b		PCB bracket			
11c		Screw M2 fims			

2.9 Service Aids

Table 2-1 lists service aids recommended for working on the Business Portable Radio. While all these items are available from Motorola, most are standard shop equipment items, and any equivalent item capable of the same performance may be substituted for the item listed.

Table 2-1.

Motorola Part No.	Description	Application
RVN4196_	Customer Programming and Tuning Software (CD)	Program customer options, channel data, and tuner hardware parameters, front end, power, etc.
DSK001C706	Programming Cable (2.5mm)	Connects radio and IF Test Box to Computer.
AAPMKN4003_	Cloning Cable (2.5mm)	To clone programmable information from one radio to another radio.
DSK001C704	Test Cable	Connects radio to IF Test Box.
DSK001C714	Interconnect Service Cable	Connects RF board and CPU board.
DSK001C702	IF Test Box	Enables connection to the audio/accessory jack. Allows switching for radio testing.
DSK001C705	Battery Eliminator	Interconnects radio to power supply (red-and-black power cable included).
DSK001C719	Antenna Ground Plate	To improve the grounding while tuning and doing conducted measurement.
HLN8262_	BNC Adaptor	Adapts radio's antenna port to BNC cabling of test equipment.

2.10 Test Equipment

Table 2-2 lists test equipment required to service the Business Portable Radio and other two-way radios.

Table 2-2.

Motorola Part No.	Description	Characteristics	Application
*R1049	Digital Multimeter		Two meters recommended for AC/DC voltage and current measurements
*S1100	Audio Oscillator	67 to 200Hz tones	Used with service monitor to inject PL tones
*S1053, *SKN6009, *SKN6001	AC Voltmeter, Power Cable for meter, Test leads for meter	1 mV to 300 V, 10 Mega Ohm input impedance	Audio voltage measurements
R1053	Dual-trace Oscilloscope	20 MHz bandwidth, 5 mV/cm - 20 V/cm	Waveform measurements
*S1350, *ST1215 (VHF) *ST1223 (UHF) *T1013	Wattmeter, Plug-in Elements (VHF & UHF), RF Dummy Load	50-Ohm, $\pm 5\%$ accuracy 10 W, max. 0-1000 MHz, 300 W	Transmitter power output measurements
S1339	RF Millivolt Meter	100 μ V to 3 VRF, 10 kHz to 1.2 GHz	RF level measurements
*R1013	SINAD Meter		Receiver sensitivity measurements
S1347 or S1348 (prog)	DC Power Supply	0-20 Vdc, 0-5 Amps	Bench supply for 7.5Vdc

*Frequency/deviation meter and signal generator for wide-range troubleshooting and alignment

2.11 Programming Cable (DSK001C706)

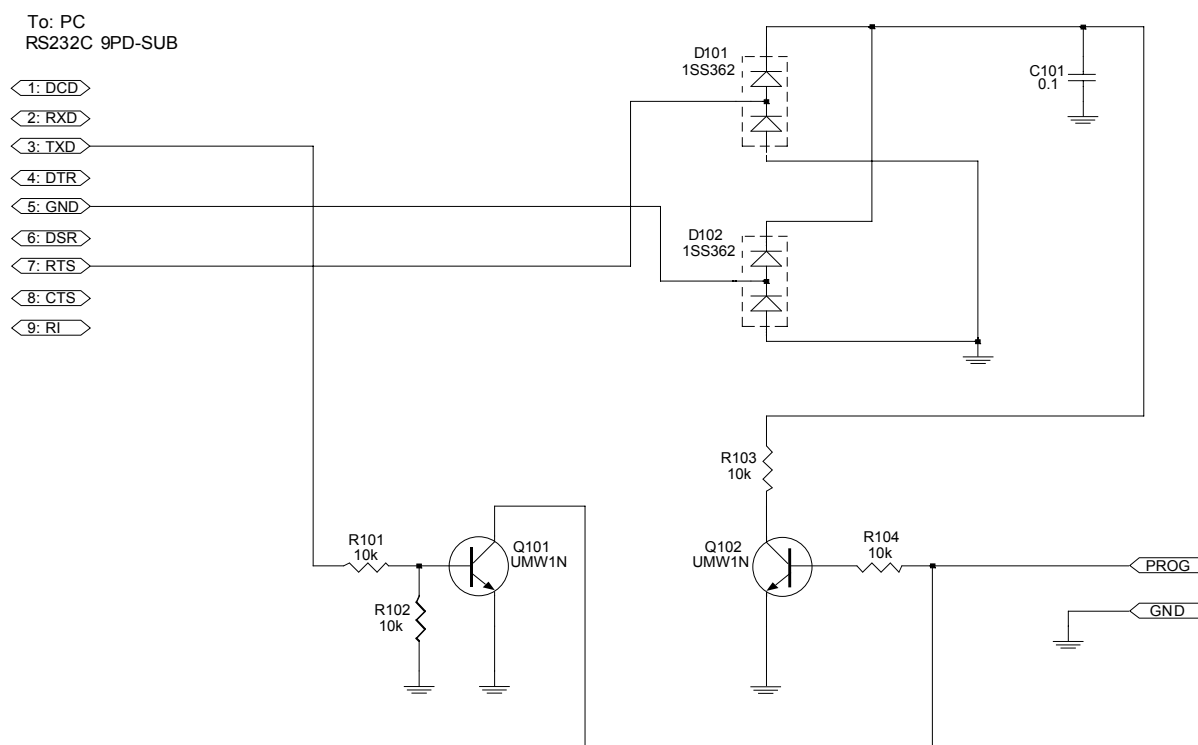


Figure 2-14.

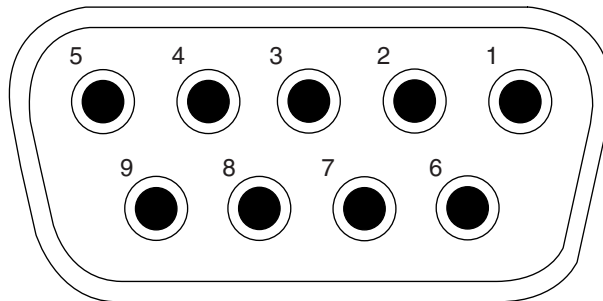


Figure 2-15.

2.12 IF Test Box (DSK001C702)

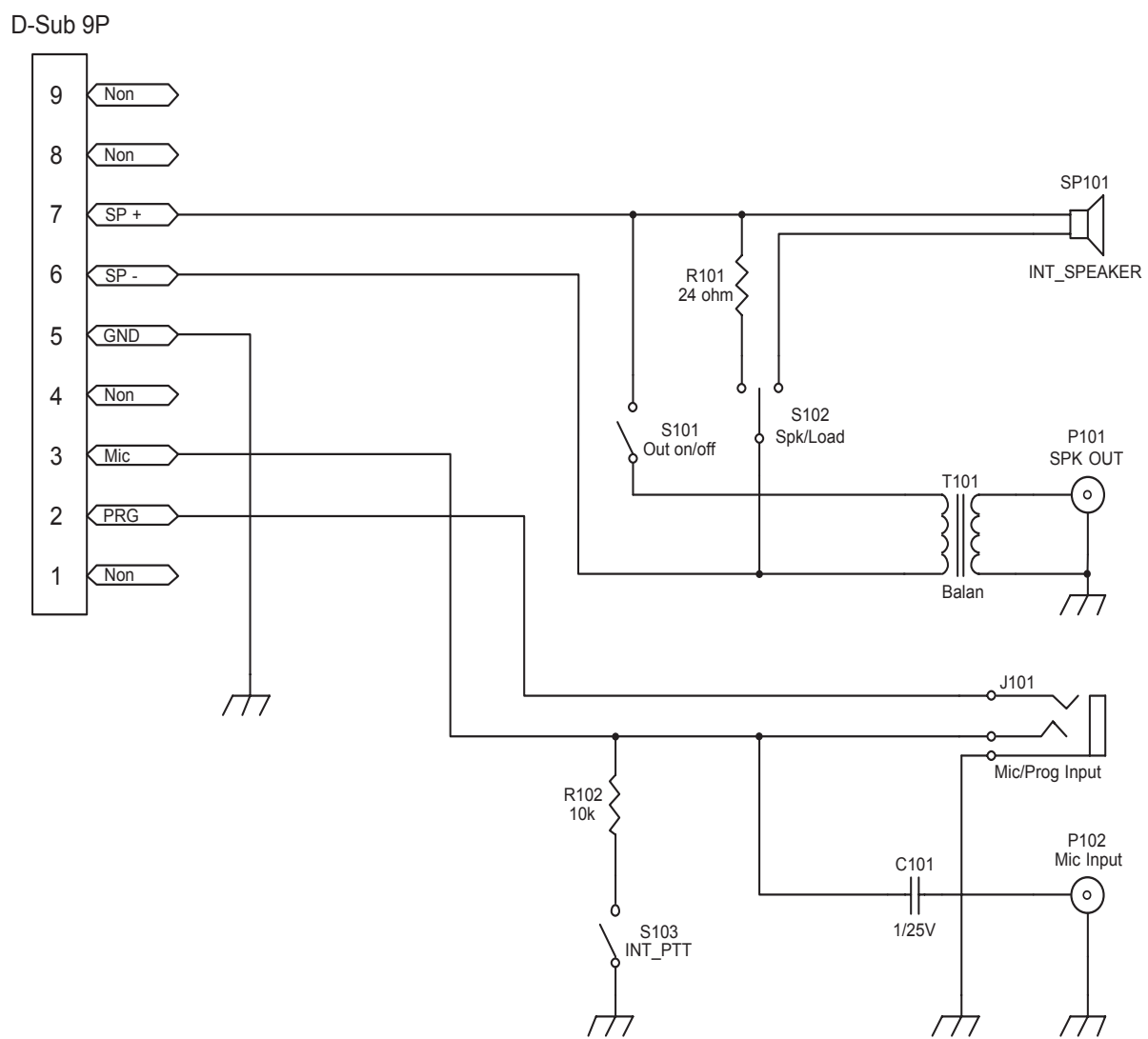


Figure 2-16.

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Chapter 3 Radio Tuning

3.1 Introduction

This chapter provides an overview of the software and hardware tuning material available for the Business Portable Radio.

The Business Portable Customer Programming Software and Tuner Software are designed for use in a Windows 95/98/NT/2000/XP environment. This software covers all the functions of the traditional Radio Service Software (RSS) package.

An Installation instruction manual is contained within each kit.

Description	Kit Number
Customer Programming and Tuning Software (CD)	RVN4196_

3.2 Software Tuning Setup

A Windows 95/98/NT/2000/XP PC (personal computer) and Tuner are required to tune parameters such as power, sensitivity, squelch and RSSI. To perform the tuning procedures, the radio must be connected to the PC and IF Test Set as shown in [Figure 3-1](#).

Refer to online help files for specific tuning procedures. See [Figure 3-2](#), how to attach the radio.

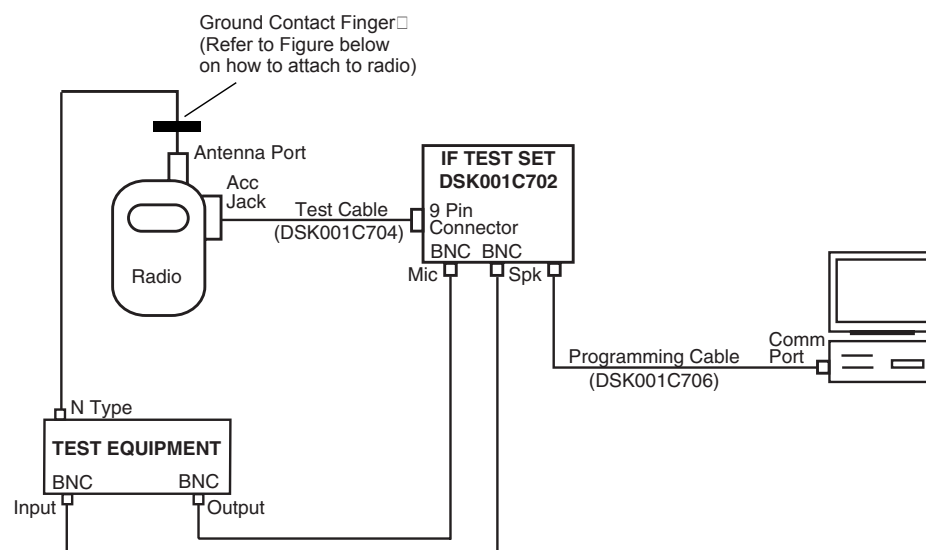


Figure 3-1.

3.3 Affixing Antenna Ground Plate

(Strictly for Radio's Testing and Tuning Purpose Only)

1. Insert the antenna ground plate (DSK001C719) through the antenna adaptor (HLN8262).

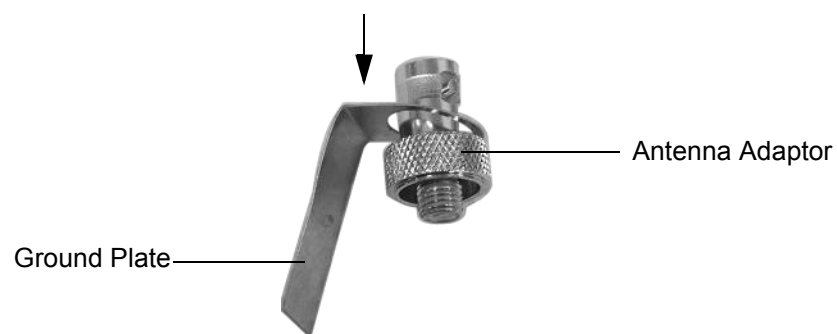


Figure 3-2.

2. Screw the antenna adaptor into the radio's antenna jack as shown in [Figure 3-3](#).

Note: Make sure the antenna ground plate is placed properly before the battery eliminator is inserted to the radio. This is to ensure that the radio has a better grounding.

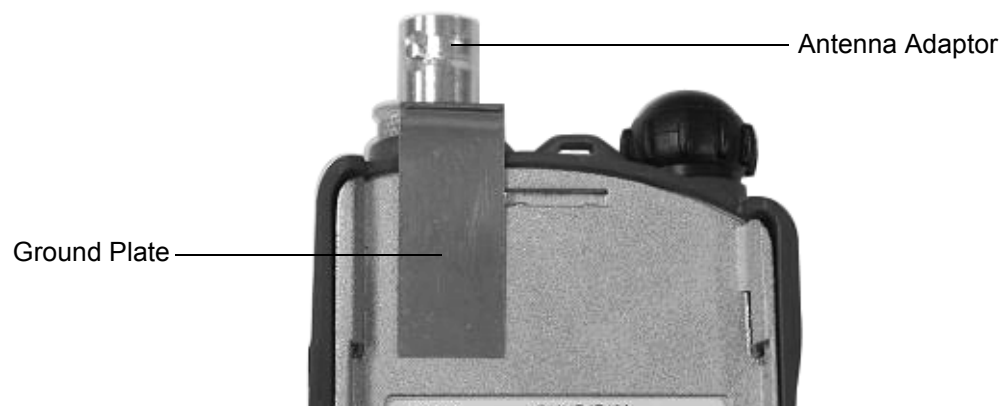


Figure 3-3.

3.4 Hardware Tuning Setup and Procedure

There is a silver seal on the bottom left of the radio chassis. Remove the seal to expose the two potentiometers for audio and sub-audio (CTCSS) modulation adjustment. RV601, which is slightly higher, is the trimmer potentiometer for audio modulation tuning. The lower trimmer potentiometer (RV602) is meant for sub-audio modulation tuning.

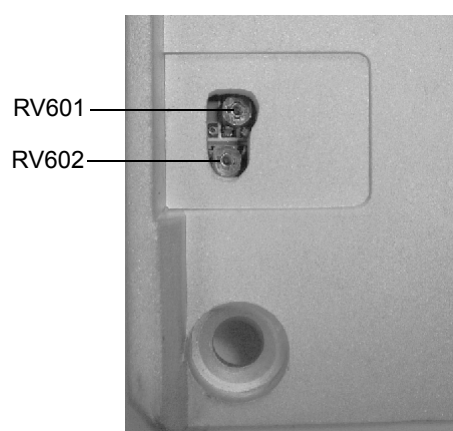


Figure 3-4.

3.4.1 Audio Modulation Tuning

1. Set the radio to transmit at the appropriate tuning frequency (See "Tuning Frequency" in Table 3-1) with low power. Set Channel Spacing to "CS-25.0" for 25 kHz (see "Radio Programming" section).
2. On the test equipment, set it to receive at the appropriate tuning frequency (See "Tuning Frequency" on page 3-4) and with the following configurations:
Audio bandwidth: 0.25 Hz to 15,000 Hz.
De-emphasis: OFF
3. Inject a 60 mV 1 kHz tone to the radio through the external mic connector.
4. Key up the radio.
5. Using a ceramic tuning tool, adjust RV601 to tune the audio modulation deviation to settle between 4.3 kHz to 4.5 kHz.

3.4.2 Sub-Audio Modulation Tuning

1. Set the radio to transmit at the appropriate tuning frequency (See "Tuning Frequency" on [Table 3-1](#)) with low power and TX PL frequency of 100.0 Hz. Set Channel Spacing to "CS-25.0" for 25 kHz (see "[Chapter 4 Radio Programming](#)" section).
2. On the test equipment, set it to receive at the appropriate tuning frequency (see "[Chapter 4 Radio Programming](#)" section) and with the following configurations:
Audio bandwidth: 0.25 Hz to 3,000 Hz.
De-emphasis: OFF
3. Do **NOT** inject any tone to the radio.
4. Key up the radio.
5. Using a ceramic tuning tool, adjust RV602 to tune the sub-audio modulation deviation to settle between 0.65 kHz to 0.75 kHz.

3.4.3 Tuning Frequency

Table 3-1.

Band	Frequency (MHz)
VHF 136-174 MHz	155.025
UHF 435-480 MHz	457.5

Chapter 4 Radio Programming

4.1 Introduction

The Business Portable Radio can be programmed by using the Customer Programming Software (CPS).

4.2 Programming Your Radio

4.2.1 Overview of the Programming Process

To prepare properly programmed radios for your customers, you should:

Program one radio with all the necessary parameters, as required by your customers.

4.3 CPS Programming

The CPS is designed for use in the Windows 95/98/NT/2000/XP environment.

An Installation instruction manual is contained within the CPS kit.

Description	Kit Number
Customer Programming and Tuning Software (CD)	RVN4196_

Refer to online help files for the CPS Programming procedures.

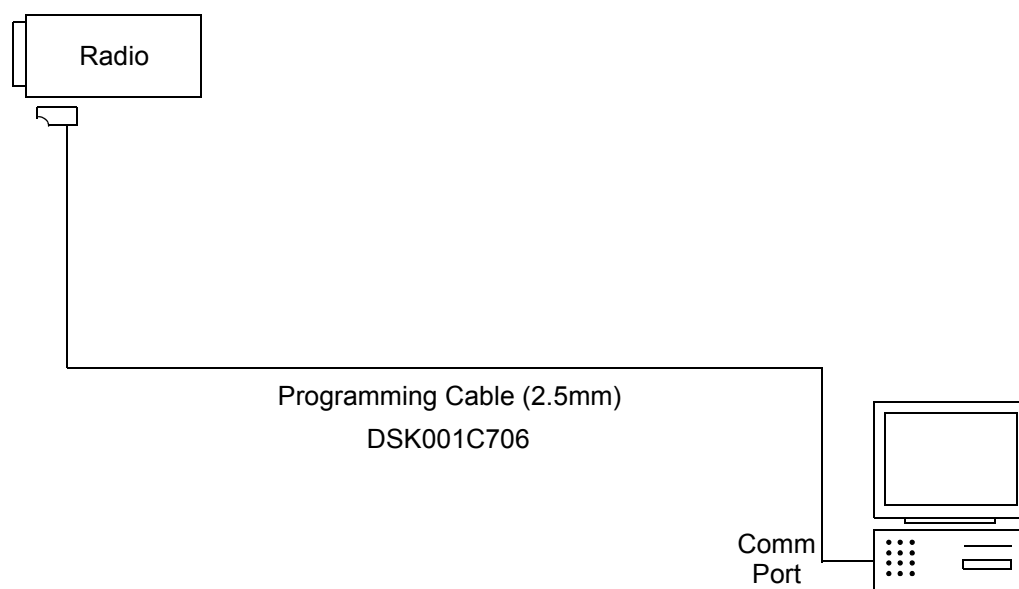


Figure 4-1.

4.4 Programming

4.4.1 PL Frequencies and Codes

PL Freq (Hz)	Motorola Code	Equiv. PL Code		PL Freq (Hz)	Motorola Code	Equiv. PL Code
67	001	XZ		136.5	022	4Z
69.3	002	WZ		141.3	023	4A
71.9	003	XA		146.2	024	4B
74.4	004	WA		151.4	025	5Z
77	005	XB		156.7	026	5A
79.7	006	WB		162.2	027	5B
82.5	007	YZ		167.9	028	6Z
85.4	008	YA		173.8	029	6A
88.5	009	YB		179.9	030	6B
91.5	010	ZZ		186.2	031	7Z
94.8	011	ZA		192.8	032	7A
97.4	012	ZB		203.5	033	M1
100	013	1Z		206.5	034	8Z
103.5	014	1A		210.7	035	M2
107.2	015	1B		218.1	036	M3
110.9	016	2Z		225.7	037	M4
114.8	017	2A		229.1	038	9Z
118.8	018	2B		233.6	039	M5
123	019	3Z		241.8	040	M6
127.3	020	3A		250.3	041	M7
131.8	021	3B		254.1	042	0Z
				PL1	PL1	
				PL2	PL2	
				PL3	PL3	

NOTE: PL1, PL2, PL3 are the User Defined PL Frequencies.

4.4.2 DPL Codes

DPL Code	Motorola Code	DPL Code	Motorola Code	DPL Code	Motorola Code	DPL Code	Motorola Code
23	043	152	065	343	087	606	109
25	044	155	066	346	088	612	110
26	045	156	067	351	089	624	111
31	046	162	068	364	090	627	112
32	047	165	069	365	091	631	113
43	048	172	070	371	092	632	114
47	049	174	071	411	093	645*	115
51	050	205	072	412	094	654	116
54	051	223	073	413	095	662	117
65	052	226	074	423	096	664	118
71	053	243	075	431	097	703	119
72	054	244	076	432	098	712	120
73	055	245	077	445	099	723	121
74	056	251	078	464	100	731	122
114	057	261	079	465	101	732	123
115	058	263	080	466	102	734	124
116	059	265	081	503	103	743	125
125	060	271	082	506	104	754	126
131	061	306	083	516	105		
132	062	311	084	532	106		
134	063	315	085	546	107		
143	064	331	086	565	108		

NOTE: The codes marked with an asterisk are not part of the 83 standard EIA/TIA-603 codes.

4.4.3 Examples

4.4.3.1 Setting Up a Scan List

Scenario: To setup Scan List 1 with the following channels - CH 001, CH 003, CH 015, CH 025, CH 032.

Steps:

1. Turn off the radio.
2. Enter Programming Mode, by pressing and holding the *Monitor* button while turning on the radio. A ringing tone is heard, indicating that your radio is in Programming Mode. The K indicator illuminates and *RW* is displayed.

3. Press PTT or the *Monitor* button until **SCANLST1** is displayed.
4. Press **▶**. The first scan list member holder, **1-01-**, will be displayed. Press the **A** or **C** button to scroll to **001**.
5. Press **▶** again. When **1-02-** appears, press the **A** or **C** button to scroll to **003** and subsequently in this manner, enter the other channels.

Note: If a mistake is made, use **▶** or **◀** to move to the appropriate scan list member holder and press **D** to erase the channel number.

6. Press PTT or the *Monitor*, when all the channel numbers have been entered.
7. Turn off your radio, if you have completed the programming, or proceed to the next parameter.

Chapter 5 Error Code Displays

5.1 Error Codes

The radio performs cursory tests during start-up and during operations to determine if its basic electronics and software are in working order. Problems detected during these tests are presented as error codes on the radio display. The presence of an error code means that a problem exists and that the user should contact a service technician. Use the following table to aid in understanding particular error code displays.

Table 5-1.

Failure Display	Description
MEM ERR	Defective ROM.
EEP ERR	Defective external EEPROM. Codeplug data is corrupted.
PLL ERR	The radio cannot receive or transmit on the programmed frequencies.

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Chapter 6 Accessories

6.1 Antennas

PMAD4012	136-155 MHz, Helical Antenna, 9cm
PMAD4013	155-174 MHz, Helical Antenna, 9cm
PMAE4011	435-480 MHz, Helical Antenna, 10cm
PMAD4014	136-155 MHz, Helical Antenna, 14cm
PMAD4027	136-155 MHz, Helical Antenna, 15cm
PMAD4028	148-174 MHz, Helical Antenna, 15cm
PMAD4015	155-174 MHz, Helical Antenna, 14cm
PMAE4003	430-470 MHz, Helical Antenna, 9cm
NAE6483	403-520 MHz, Whip Antenna
NAD6502	146-174 MHz, Heliflex Antenna

6.2 Carrying Accessories

4285820Z01	Shoulder Strap
HLN9844_	2" Spring Belt Clip
RLN4815_	Fanny Pack
HLN9985_	Waterproof Bag
JMZN4020_	Handstrap for Radio
4280384H01	Radio Pak Replacement Retaining Strap w/Snap
4280384F89	Radio Pak Belt Lengthener for RLN4815

6.3 Chargers

PMTN4087	Rapid Charger Kit, 120 V
RLN4940	Slow Desktop Charger Kit, 120 V
PMTN4073	13 Hour Charger, 120 V

6.4 Batteries

PMNN4063_R	NiMH, 1500 mAH
------------	----------------

6.5 Audio Accessories

PMLN4294	Ear Set Mic w/PTT
PMLN4425	Ear Set Boom Mic w/Remote Ring PTT
HMN9030	Remote Speaker Mic
HMN9013	Lightweight Handset w/Boom Mic

6.6 Manuals

6881096C35 Business Portable Radio User Guide (English)
6881098C60 CP125 Radio User Guide (English/French)

6.7 Software

RVN4196_ Business Portable Radio Customer Programming Software (CD)

Chapter 7 VHF (136-174 MHz) Band Information

7.1 Model Chart

Business Portable Radio, VHF, 136-174 MHz			
Model		Description	
AAH49KDF8AA1A_		Business Portable, 136-174 MHz, 2-5W, 12.5/25 kHz, 16 Ch.	
AAH49KDF8AA1A_		Business Portable, 136-174 MHz, 2-5W, 12.5/25 kHz, 4 Ch.	
	Item	Description	
X	PMUD1925_	Business Portable, 136 -174 MHz, 2-5W, 12.5/25 kHz, 16 Ch.	
	X PMUD1922_	Business Portable, 136 -174 MHz, 2-5W, 12.5/25 kHz, 4 Ch.	
	X DSAXRK210004	Front Housing Kit, Black CP125	
X	DSAXRK210001	Front Housing Kit, Black BC120	
X	X DSAXRK210002	Front Housing Kit, Grey	
X	X PMDN4061_	Chassis Hardware Kit (1-Piece Audio Jack R2)	
X	X DS1M001120	Chassis Hardware Kit (2-Piece Audio Jack)	
X	X DSAXRA110001	Volume Knob Assembly	
X	X DSAXRK290001	LCD Kit	
X	X DSAXRA220001	Speaker Assembly	
X	X DSAXRM2B0001	Screw M2.6	
X	X DSAXRM2A0001	Battery Contact Gasket	
X	X DSAXRM250001	Main Gasket	
X	X DSAXRM120001	Volume Knob Gasket	
X	X DSAXRM2C0001	Gasket (Screw 26)	
X	X PMDN4063A	Back Chassis Kit (1-Piece Audio Jack)	
X	X DSM5190001	Back Chassis Kit (2-Piece Audio Jack)	
X	X DSAXRM140001	PTT Button	
X	X PMNN4063_R	Battery Std NiMH	
X	X PMAD4012_	VHF Stubby 9cm Antenna, 136-155 MHz	
X	X PMAD4013_	VHF Stubby 9cm Antenna, 155-174 MHz	
X	X PMAD4014_	VHF Helical 14cm Antenna, 136-155 MHz	
X	X PMAD4015_	VHF Helical 14cm Antenna, 155-174 MHz	

Business Portable Radio, VHF, 136-174 MHz			
Model			Description
X	X	PMAD4027_	VHF Helical 15cm Antenna, 136-155 MHz
X	X	PMAD4028_	VHF Helical 15cm Antenna, 148-174 MHz
X	X	NAD6502_	Standard VHF Heliflex Antenna, 150-162 MHz
X	X	PMTN4087_	Standard Rapid Rate Charger Kit, 120V
	X	3380384W23	CP125 Nameplate
X		DSAXRM160001	BC120 Nameplate
X	X	HLN9844_	2" Spring Belt Clip
X		6881096C35	Business Portable Radio User Guide (English)
	X	6881098C60	CP125 Radio User Guide (English/French)

X = indicates one of each is required.

7.2 Specifications

General

	VHF	
Frequency:	136-174 MHz	
Channel Capacity:	16, 4	
Power Supply:	7.5 Volts \pm 20%	
Dimensions with Standard High Capacity NiMH Battery:	115.5mm x 56mm x 35mm	
Weight: with Standard High Capacity NiMH Battery:	350 g	
Average Battery Life @ (5-5-90 Duty Cycle)	(Low Power) >11 hrs	(High Power) >8 hrs
Sealing:	Passes rain testing per IPX4 (EN60529=1991)	
Shock and Vibration:	Meets MIL STD 810C, D and E	
Dust:	Meets MIL STD 810C, D and E	
Humidity:	Weather resistant housing passes EIA RS-316B	

Transmitter

	VHF	
RF Output NiMH @ 7.5V:	Low 2 W	High 5 W
Channel Spacing	12.5/25 kHz	
Freq. Stability (-30°C to +60°C)	0.00025%	
Spurs/Harmonics:	-26 dBm	
Audio Response: (from 6 dB/oct. Pre-Emphasis, 300 to 3000Hz)	+1, -3 dB	
Audio Distortion: @ 1000 Hz, 60% Rated Max. Dev.	<5%	
FM Noise:	40 dB	

Receiver

	VHF 12.5 kHz	VHF 25 kHz
Sensitivity 12dB SINAD:	0.25 μ V	0.25 μ V
Adjacent Channel Selectivity EIA	60 dB	65 dB
Intermodulation	60 dB	65 dB
Spur Rejection:	60 dB	65 dB
Image Rejection:	60 dB	65 dB
Hum and Noise	40 dB	
Audio Distortion	< 5%	
Conducted Emmission	-57 dBm	
Audio Output @ <5% Distortion	500 mW	500 mW

All specifications are subject to change without notice.

7.3 Theory of Operation

7.3.1 General Information

Your radio has two printed circuit boards: the Controller board, and the Radio Frequency (RF) and Audio Frequency board. The Controller board contains the CPU/Control section. The RF board contains the VCO/Synthesizer section, Transmitter section, Receiver section, Transmitter Audio circuitry, Receiver Audio circuitry, and Battery section.

7.3.2 Power Distribution

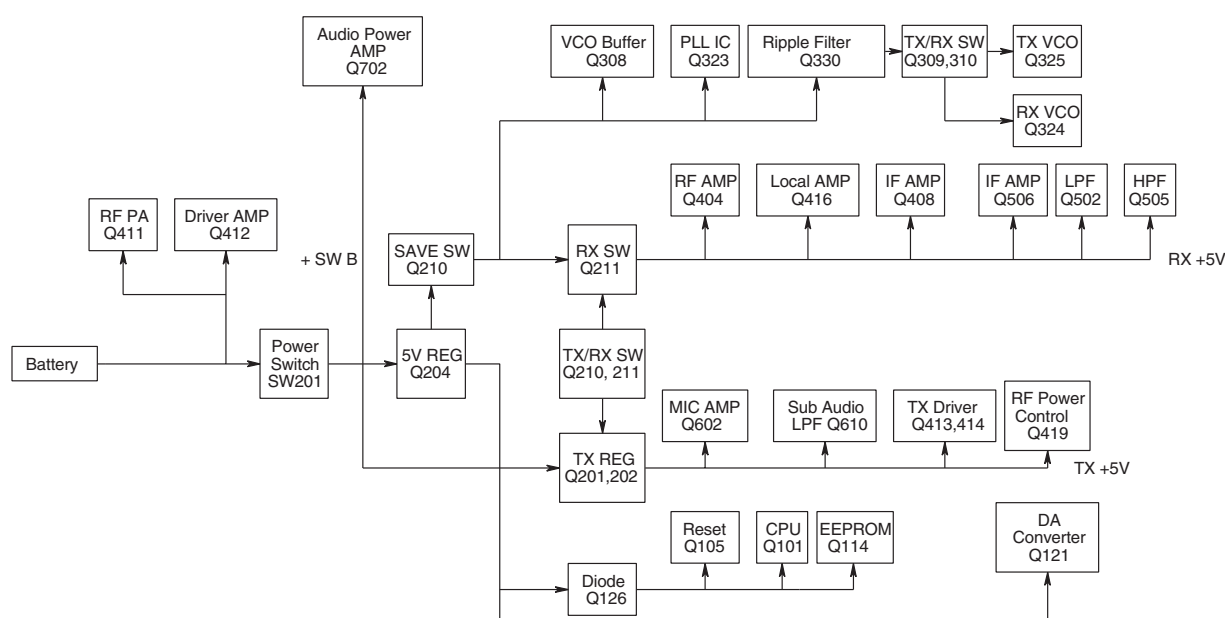


Figure 7-1.

The above figure illustrates the DC distribution throughout the radio board. A battery supplies power directly to the electronic on/off control. Radio power supply is triggered by the **Power Switch** (On/Off/Volume control) and **+SW B** is distributed as show in the figure. Regulator output 5V is supplied to the CPU. **+SW B** continues to support the Audio Power AMP, 5V Regulator, TX Regulator until the radio is turned off.

The radio can be turned off on two ways:

1. **Power Switch** turned-off
2. Low Battery

When a low battery level is detected by the CPU, it stores the radio personality data to EEPROM before turning off the radio.

7.3.3 Power up Sequence

1. Power supply is turned on by the On/Off/Volume Control (Power Switch).
2. Power from battery is supplied to the regulator through the switch.
3. Output (5V) from the regulator is directed to the CPU (**Q101**).
4. **Q105** resets the CPU (**Q101**).
5. The CPU loads radio personality data from EEPROM after the reset.
6. This personality data is used to initialize the radio.

7. The radio restores last power up state (i.e. state before the radio was turned-off).
8. Power is supplied to PLL circuitry.
9. Power is supplied to Rx and Rx VCO circuitry.
10. CPU sends data to PLL circuitry. If LOCK status is confirmed, radio continues the power-up sequence. Otherwise, PLL ERR is displayed.
11. If the Rx audio level is less than the pre-programmed squelch level, and other unmuting conditions are met, the radio will open squelch.

7.3.4 CPU / Control Section

When the radio is turned ON, the CPU (**Q101**) reads the radio status from the EEPROM **Q114**. It also monitors the keypad, the PTT line and other inputs such as the squelch detect, etc. continuously. When there is a channel change, the CPU sends the correct frequency information to the synthesizer via pins 2, 87, and 100. The CPU is clocked by the 8.388608MHz oscillator, which is composed of **X101**, **C101**, **C106**, and **R158**.

7.3.5 VCO / Synthesizer Section

This section consists of the Temperature-Compensated Crystal Oscillator (TCXO), Voltage Controlled Oscillator (VCO), Synthesizer and the Loop Filter. These circuits are found on the RF board.

7.3.5.1 Temperature-Compensated Crystal Oscillator (TCXO)

The reference oscillator is a temperature compensated crystal-controlled, Pierce type circuit. It utilizes a logic gate within **Q323** as a gain element. **C335** is used to adjust the oscillator on frequency (14.4MHz) at room temperature (22°C). Temperature variations cause resistance changes in thermistor **R330** and **R567**, which is on the base of **Q320**, thus varying the voltage applied to varactor **Q322**. This changes the impedance across crystal **X301** in a manner complementary to the temperature drift characteristic of the crystal. In this way, the reference oscillator is held within the specified ± 2.5 PPM from -30 to +60°C.

7.3.5.2 Voltage-Controlled Oscillators

Only one of the VCOs runs at a time, which is controlled by **Q310** and **Q101**. The receive VCO consists of **C344-C351**, **L302**, **L305**, **L306**, **L312-L314**, **Q311**, and **Q324**. This VCO oscillates at 45.1 MHz above the programmed receive frequency. The VCO's oscillating frequency is tuned by the varactor **Q311**. The tuning voltage is supplied from the output of the Loop Filter. The output of the VCO is AC coupled (**C352**) to the synthesizer and the output buffer Q308 respectively. The output of the VCO buffer Q308 is AC coupled (C475 and R442-R444, C312, C313) to the synthesizer and the output buffer Q416 respectively.

When the PTT is pressed, **Q101** pin 36 goes low (approx. 0V) disabling the receive VCO by the **Q310** and biases on **Q309** to enable the transmitter VCO. The transmitter VCO consists of **C353**, **C355**, **C357**, **C358**, **L315**, **L317**, **L318**, **Q325**, **Q326**, and **Q329**. This VCO oscillates on the programmed transmit frequency. The VCO's oscillating frequency is tuned by the varactor **Q326**. The tuning voltage is supplied from the output of the Loop Filter. The transmit voltage controlled oscillator is directly frequency-modulated and operates on the carrier frequency. In the receive mode, the transmit VCO is disabled and the receive VCO is enabled, producing the receive local oscillator signal at a frequency 45.1 MHz above the incoming receive frequency. The synthesizer is tuned in 5.00 kHz or 6.25 kHz steps.

7.3.5.3 Synthesizer

The frequency synthesizer is a large-scale monolithic synthesizer integrated circuit **Q323**. The synthesizer IC contains a dual modulus prescaler, programmable divide-by-N counter, prescale control (swallow) counter, reference oscillator, reference divider, phase detector, charge pump and lock detector. Also, included in **Q323** are shift registers and control circuits for frequency controls and general device control.

RF output from the active VCO is AC coupled to the synthesizer **Q323** prescaler input at Pin 8. The divide counter chain in **Q323**, consisting of the dual-modulus prescaler, swallow counter and programmable counter, divides the VCO signal down to a frequency very close to 5.00 kHz or 6.25 kHz which is applied to the phase detector. The phase comparator compares the phase with the 5.00 kHz or 6.25 kHz reference signal from the reference divider and drives the external charge pump (**Q314**, **Q315** and **Q301**). The synthesizer unlock detector circuit prevents the operation of the transmitter and receiver, when the phase lock loop (PLL) is unlocked. The following discussion assumes the unit has been placed in the transmit mode. **Q323** lock detector Pin 7 goes high when the PLL is locked. This high level is applied to Pin 25 of the CPU **Q101**. A software timing routing brings the RX/TX line low (Pin 36 of **Q101**). With the RX/TX line goes low, **Q209** is cut off and **Q208** is biased on passing **+5VTX-B** to **Q202**; it biases on **Q201** to pass switched **TX-B** to the transmitter amplifier string which enables transmission.

When the PLL is unlocked, the lock detector at **Q323** Pin 7 will begin pulsing low. A RC circuit converts this low pulse to a low level for the CPU. The CPU then changes the RX/TX line to a high, thus signaling the other transistor switches to drive **Q201** into cutoff, which disables transmission. Therefore, the transmitter remains disabled while the loop remains out of lock, and "PLL ERR" is displayed.

7.3.5.4 Loop Filter

The Loop Filter, a passive lead-lag filter consisting of **R314-R317**, **R356**, **C323**, **C369**, and **C371**, integrates the charge pump output to produce the DC turning voltage for the VCO. One parasitic pole, consisting of RF chokes **L306/L318**, prevent modulation of the VCOs by the 5.00 kHz or 6.25 kHz reference energy remaining at the output of the loop filter. Direct FM is obtained for modulating frequencies outside the PLL bandwidth by applying the CTCSS/DCS signals and the pre-emphasized, limited microphone audio to the VCO modulation circuit. The modulation circuit consists of **R347** and **Q329**.

7.3.6 Transmitter Section

7.3.6.1 RF Power Amplifier

After the PTT is pressed, the **+5VTX-B** line switches to approximately 5V. **Q309** is turned on, enabling transmit VCO. The VCO buffer, pre-driver, driver and power amplifier are biased on by **Q201**. **Q201** is biased on by the **+5VTX-B** line switching to 5V. RF output from the transmit VCO (**Q325**) is applied to the VCO output buffer **Q308**. Output from **Q308** feeds the buffer **Q414**. The output signal from **Q414** feeds the pre-driver amplifier **Q413**, and feeds the driver amplifier **Q412**, whose output from the driver stage feeds the final RF power amplifier **Q411** to produce the rated output power of 5 watts. The final output feeds to a low-pass filter (**C446-C448**, **C451**, **C452**, **L418**, and **L419**) and then to the transmit/receive switch **Q410**. RF power is then fed to the antenna via the output low-pass filter consisting of **C440-C445**, **L415**, and **L416**.

7.3.6.2 Antenna Switching

Switching of the antenna between the transmitter and the receiver is accomplished by the antenna transmit/receive switch consisting of diodes **Q409** and **Q410**. In the transmit mode, switched **TX B+** is applied through **R419** and RF choke **L417**, hard forward biasing the two diodes on **Q410**, thus permitting the flow of RF power from the output of the low-pass filter. **L414** and **C445** isolate the receiver circuit from the transmitter power input.

7.3.7 Power Control

Output power is controlled by the CPU (**Q101**), the D/A converter (**Q121**), the dual Op-Amp (**Q419**), which is used as a differential amplifier and comparator. Current is sensed by the voltage drop across **R445**. When the radio is in high power mode, this voltage is compared to the D/A converter voltage at 5-watt. When the radio is in low power mode, this voltage is compared to the D/A converter voltage at 1-watt. The power output is then reduced or increased by varying the applied voltage to the gate of the power amplifier **Q411** and **Q412**.

7.3.7.1 Transmitter Audio Circuits

The transmitter audio circuits consist of the audio processing circuits, the CTCSS circuits and the DCS circuits.

7.3.7.1.1 Audio Processing

Transmit speech audio is provided by either the internal electric microphone M101 or the external microphone. The audio is pre-emphasized by 6 dB per octave by C615 and R655, and then its signal is amplified. The microphone audio is directed to amplifier Q602B, Q602A, low-pass filter Q602C, and Q602D. Q602A has limiting function. The modulation adjustment is done by potentiometer RV601, and directed to a four-pole active low-pass filter. The resulting signal is then limited, and is directed to a low pass filter (-18 dB per octave roll-off above 3 KHz). The audio is then directed through the 25 KHz/12.5 KHz channel spacing SW Q601 to varactor diode Q329 in transmit VCO. By varying the voltage on the varactor diode Q329 at an audio rate, VCO output is frequency-modulated.

7.3.7.1.2 CTCSS Tone Encoder / Digital Code Squelch (DCS) Encoder

CTCSS signals and DCS signals are synthesized by CPU **Q101** and appear as pulse waveform on I/O line Pin 7. This I/O line is directed to a digital-to-analog converter network (consisting of **C136**, **C173**, **R150**, **R177** and **R182**), which produces a pseudo-sine wave at its output. The waveform is smoothed by low pass filters **Q610B** to produce an acceptable sine wave output. The CTCSS tone signal is adjusted to the proper level by **RV602**.

7.3.8 Receiver Section

7.3.8.1 Receiver Front End

In the receive mode, the RF signal enters through the antenna, then through the low-pass filter **C439-C445**, and **L414-L416**. The diodes **Q409** and **Q410** are biased off, so that the output of the low-pass filter is coupled (**C437**, **C438**, **L413** and **R418**) to the first band-pass filter **C401-C406**, **C408-C410**, **L401**, **L402**, **PCB_L1**, **Q401**, **R401**, and to the Front End RF overload protection diode pair **Q403**. The signal from the band-pass filter is directed to the input of the RF amplifier **Q404**. The output of the RF amplifier is sent to three stages of band-pass filters, consisting of **C415-C429**, **C486**, **L404-L406**, **Q405** and **R410**. The output from the band-pass filter is directed to the mixer **Q407/L407**.

7.3.8.2 Local Oscillator (LO)

The Receive VCO (**C344-C351**, **L302**, **L305**, **L306**, **L312-L314**, **Q311**, and **Q324**) provides the LO signal. The VCO runs at 45.1 MHz above the desired receive frequency and is applied to output Buffer **Q308/Q416**. The output of the buffer is sent through the low-pass filter **C430**, **C431**, **L409**, and to the mixer **Q407/L408**.

7.3.8.3 Mixer

The mixer is a DBM type (**L407**, **Q407**, **L408**). The mixer LO frequency is 45.1 MHz above the desired receiver frequency. When the receiver frequency is present, the mixer output will be a 45.1 MHz signal. The mixer output is peaked for 45.1 MHz at **L410**, **C432** and **R413**, and the signal is filtered by crystal filter **F402** and amplified by **Q408** before being directed to IF IC **Q506**. The 45.1 MHz IF signal and LO frequency of 44.645 MHz (**X501**) are mixed in **Q506**. The 455 kHz ceramic filter, **F501** or **F502**, filters the second mixer's output. The resulting signal is the second IF signal. The mixer's output is then fed to the internal limiting amplifier, and consequently to the FM decoder.

7.3.8.4 FM Detector and Squelch

The FM detector output is used for squelch, decoding tones and audio output. The squelch amplifier is inside of **Q506**, and its output is fed to an internal rectifier and squelch detector. The output on **Q506** Pin 14 signals the CPU **Q101** with a low (~0V) to unmute the radio. The audio is unmuted by the CPU **Q101** Pin 41 switching to a high (~5V), thus biasing on **Q503**. The audio is then routed to the audio amplifier **Q702** via the volume control **SW201**.

7.3.8.5 Receiver Audio Circuit

The detector's audio output is fed to the tone (CTCSS and DCS) low-pass filter **Q505A**. Then the output of the low-pass filter is routed to the second stage filter **Q505B**. The output of **Q505B** is passed to **Q505C**. The output of **Q505C** is directed to the squaring circuit **Q505D**, and finally to the CPU **Q101** Pin 22 for decoding.

The detector output feeds the audio high-pass filter **Q502**. The output of the audio high-pass filter feeds the Volume Control **SW201** (VOL). From the wiper arm on the Volume Control, the audio is routed to Pin 4, which is the input to the audio power amplifier **Q702**. The output of the audio power amplifier is routed through the earphone jack **J701** to the internal speaker **SP701**.

7.3.9 Battery Section

The battery connects to the contact (**CN201**). The positive terminal of the battery connects to the ON/OFF Volume control switch (**SW201**), and the negative terminal connects to PWB ground. Low battery is detected by **R127/R128** and voltage regulator **Q204**.

Battery voltage status is monitored by Pin 19 of the CPU **Q101** through **R127/R128**. When the battery voltage goes below the threshold voltage, "LOW BATT" is displayed on LCD **LC101**. When the Radio is on a channel with no tone programmed, the BATTERY SAVER Mode is enabled when programmed. In the BATTERY SAVER Mode, the CPU **Q101** generates a square wave signal on Pin 37. The signal's duty cycle varies according to what the BATTERY SAVE TIMER is set. When the CPU **Q101** Pin 37 goes high (approximately 5 V), **Q210** is biased off, and **Q211** is cut off, thus turning the supply off to IF IC **Q506**.

7.4 Block Diagrams

7.4.1 Complete

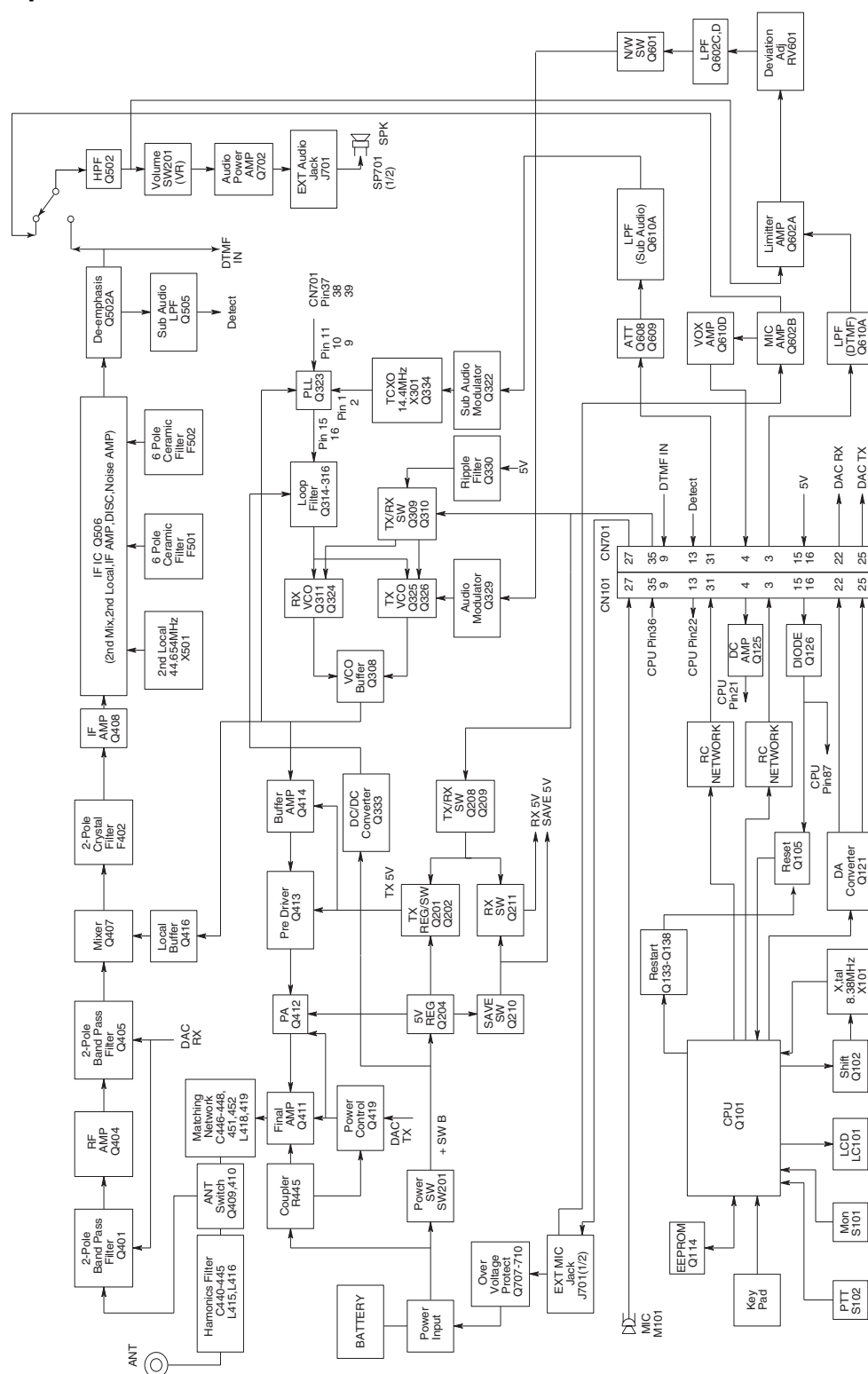


Figure 7-2.

7.4.2 Controller

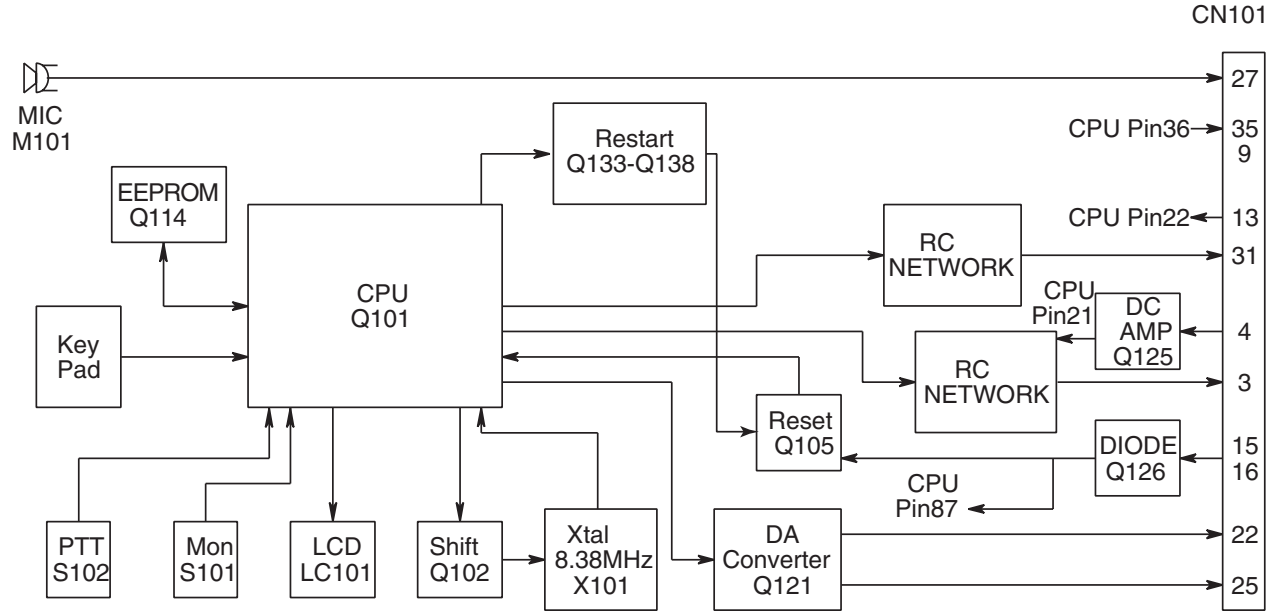


Figure 7-3.

7.4.3 VCO

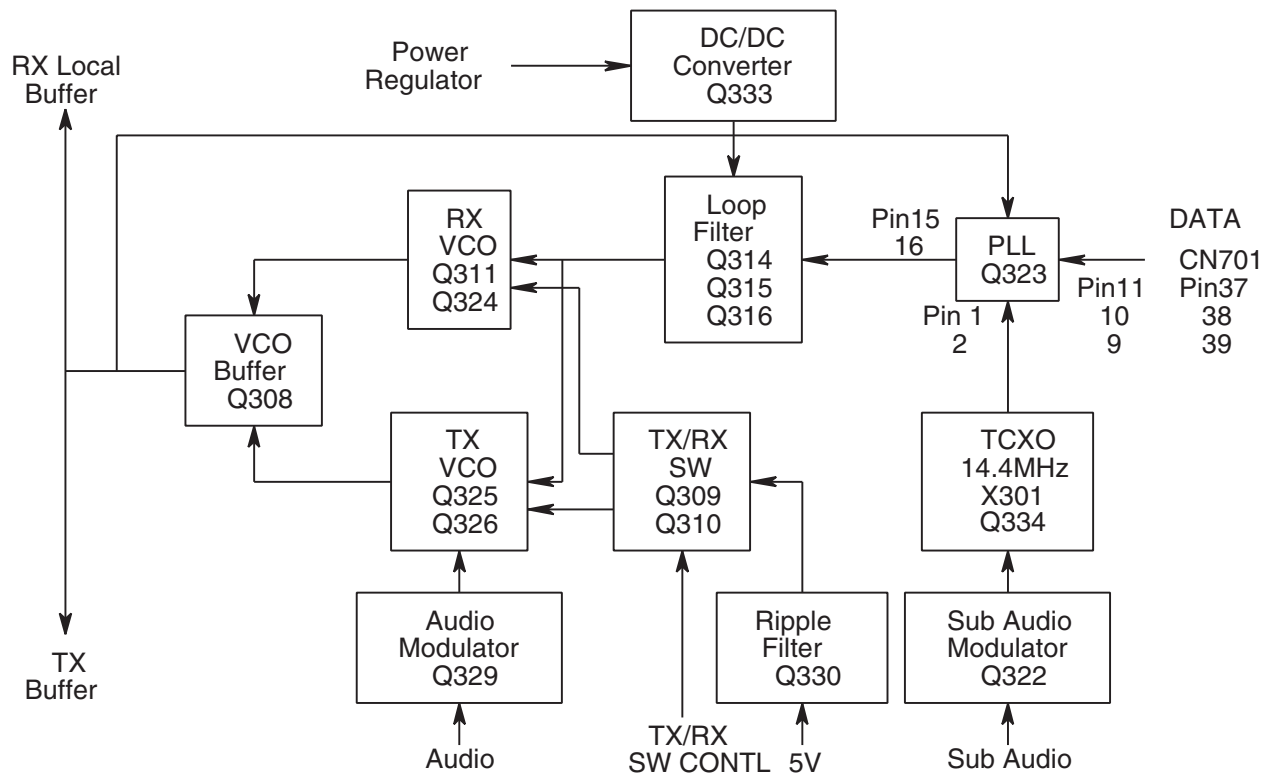


Figure 7-4.

7.4.4 Transmitter

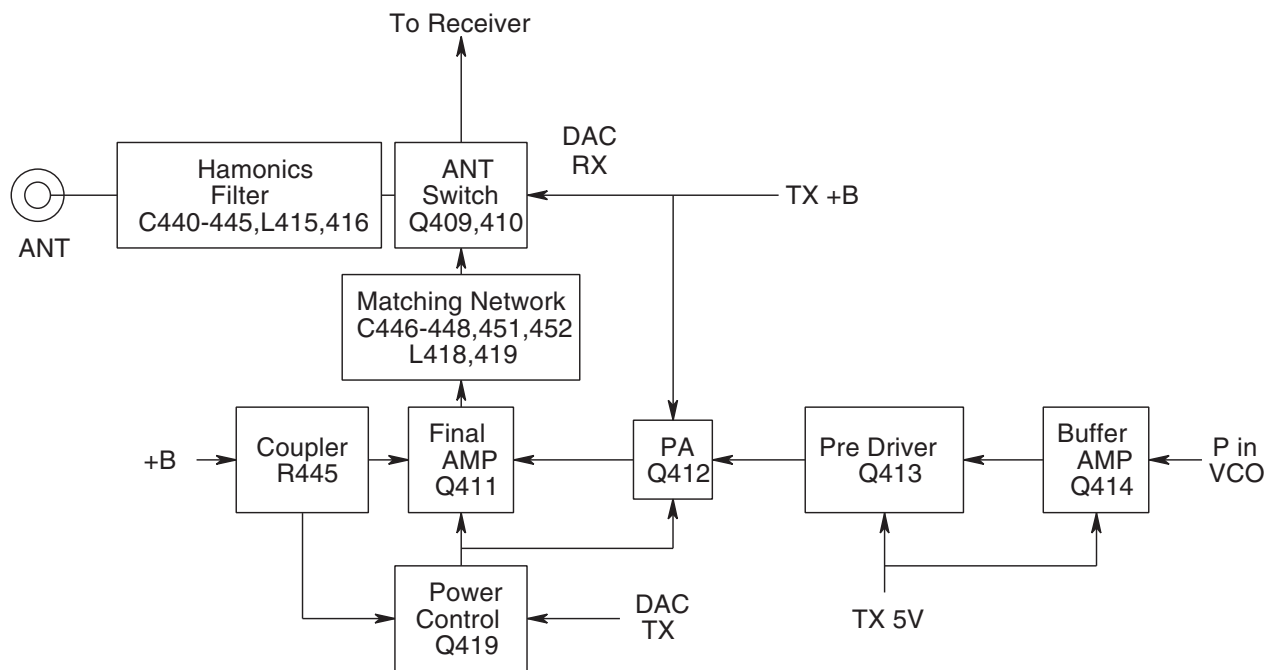


Figure 7-5.

7.4.5 Receiver

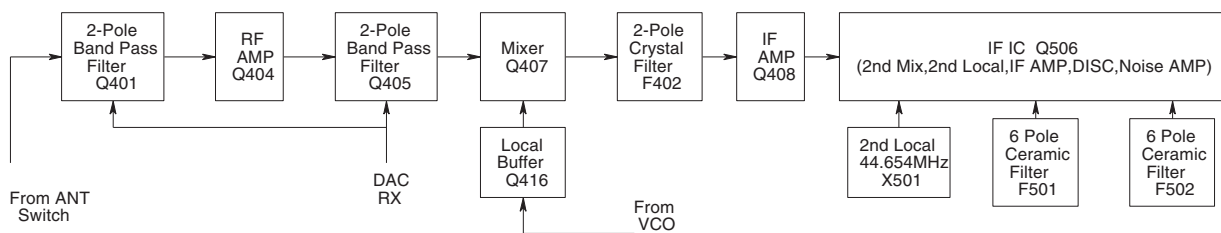
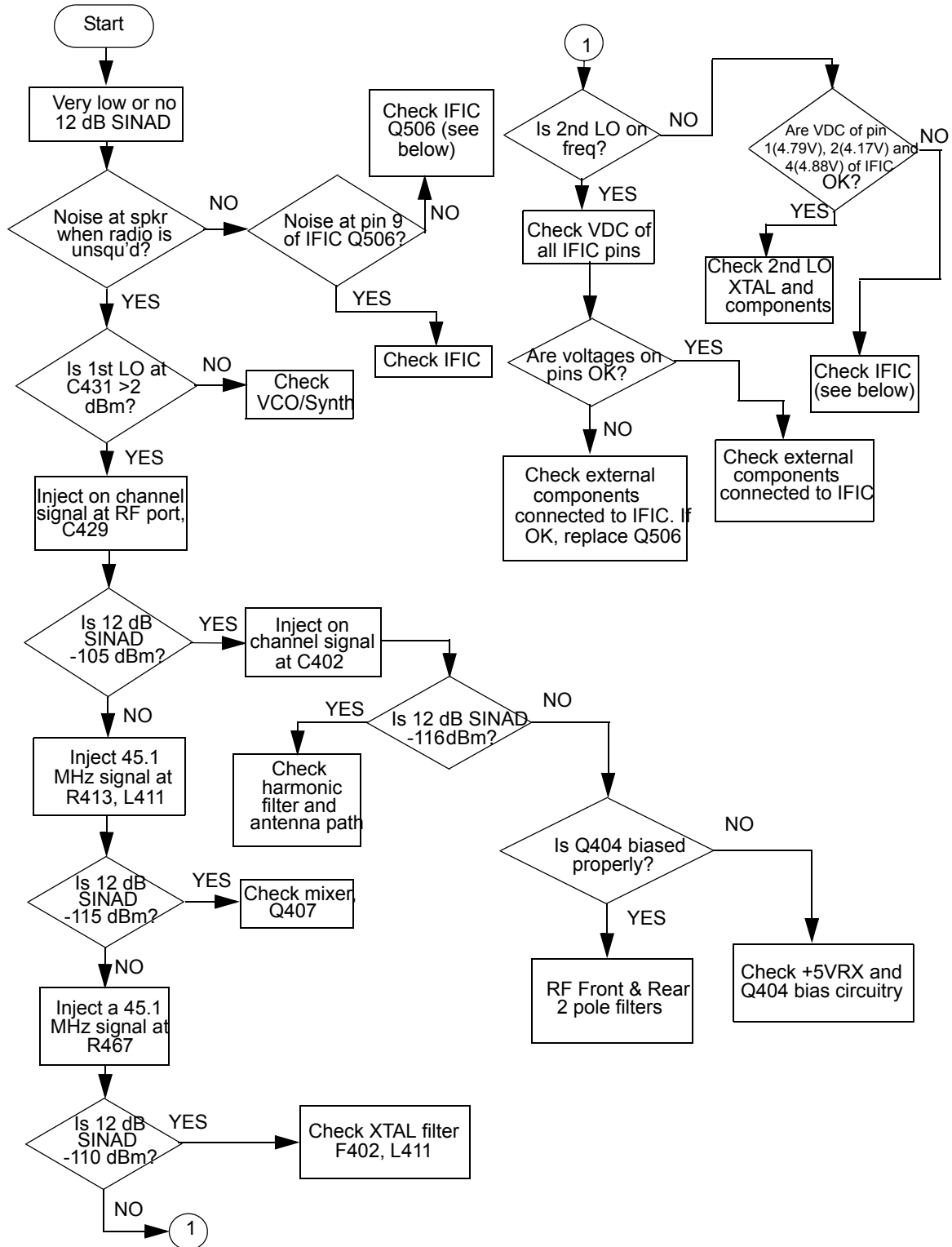


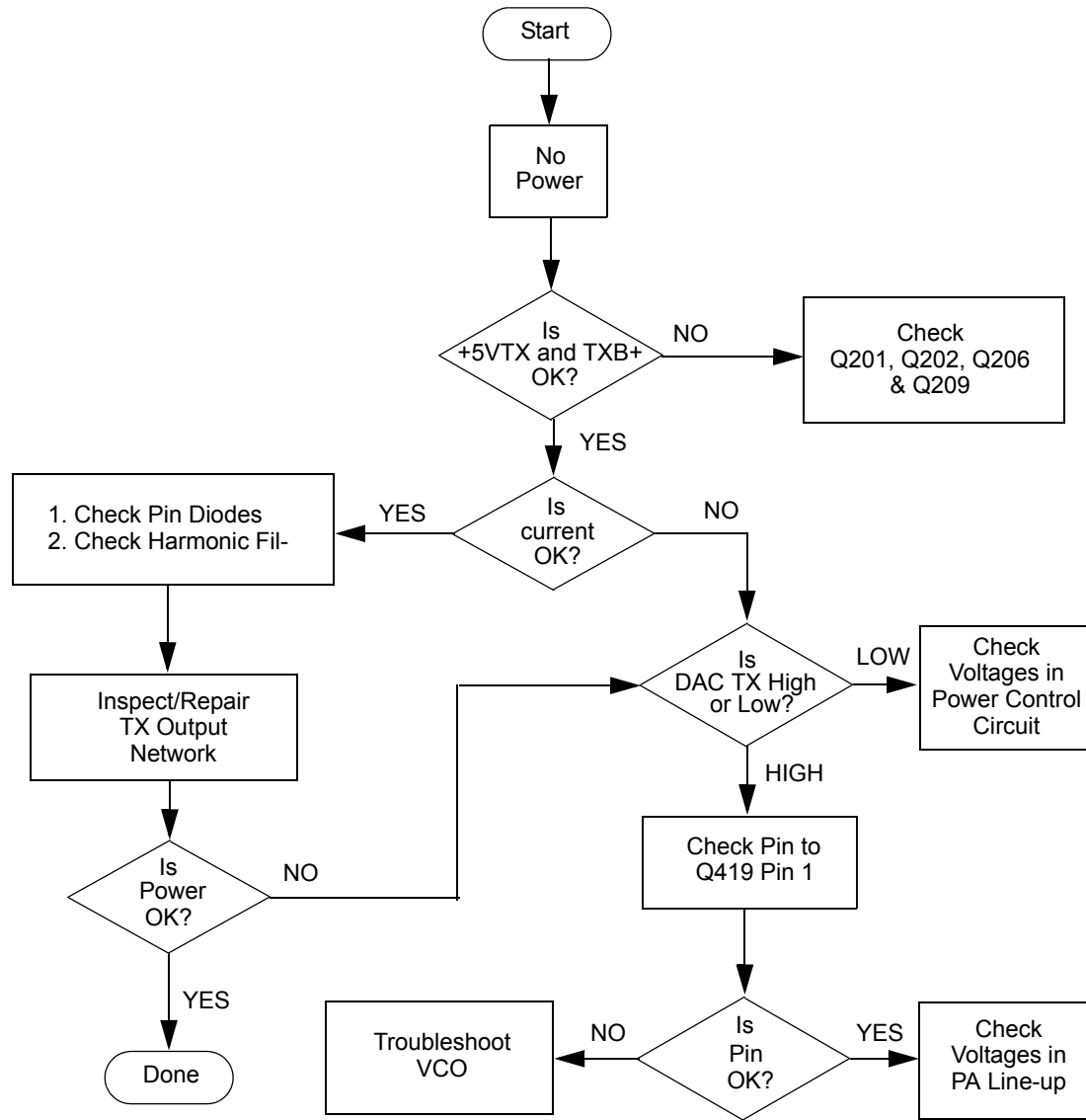
Figure 7-6.

7.5 Troubleshooting Charts



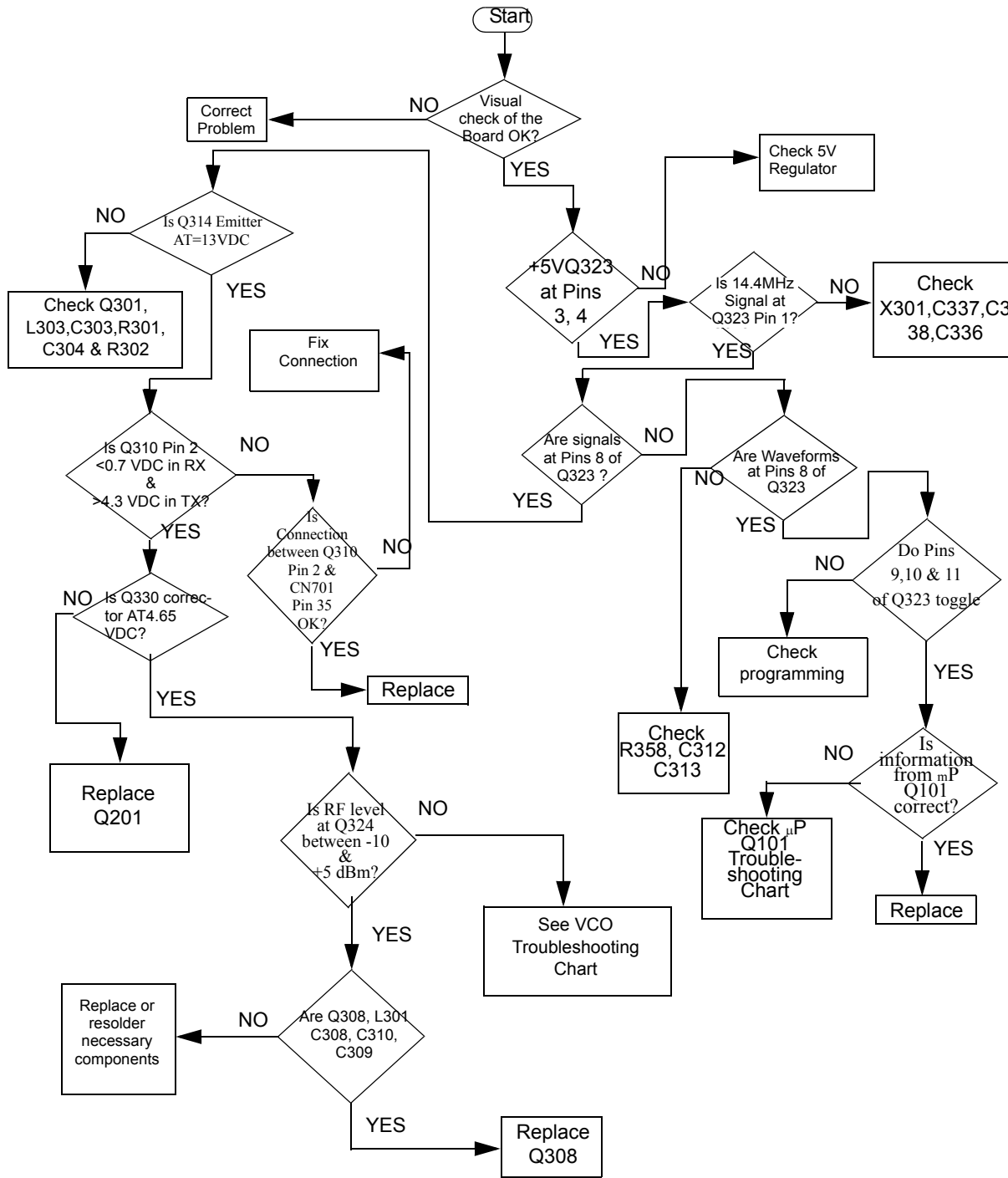
Troubleshooting Flow Chart for Receiver

Figure 7-7.



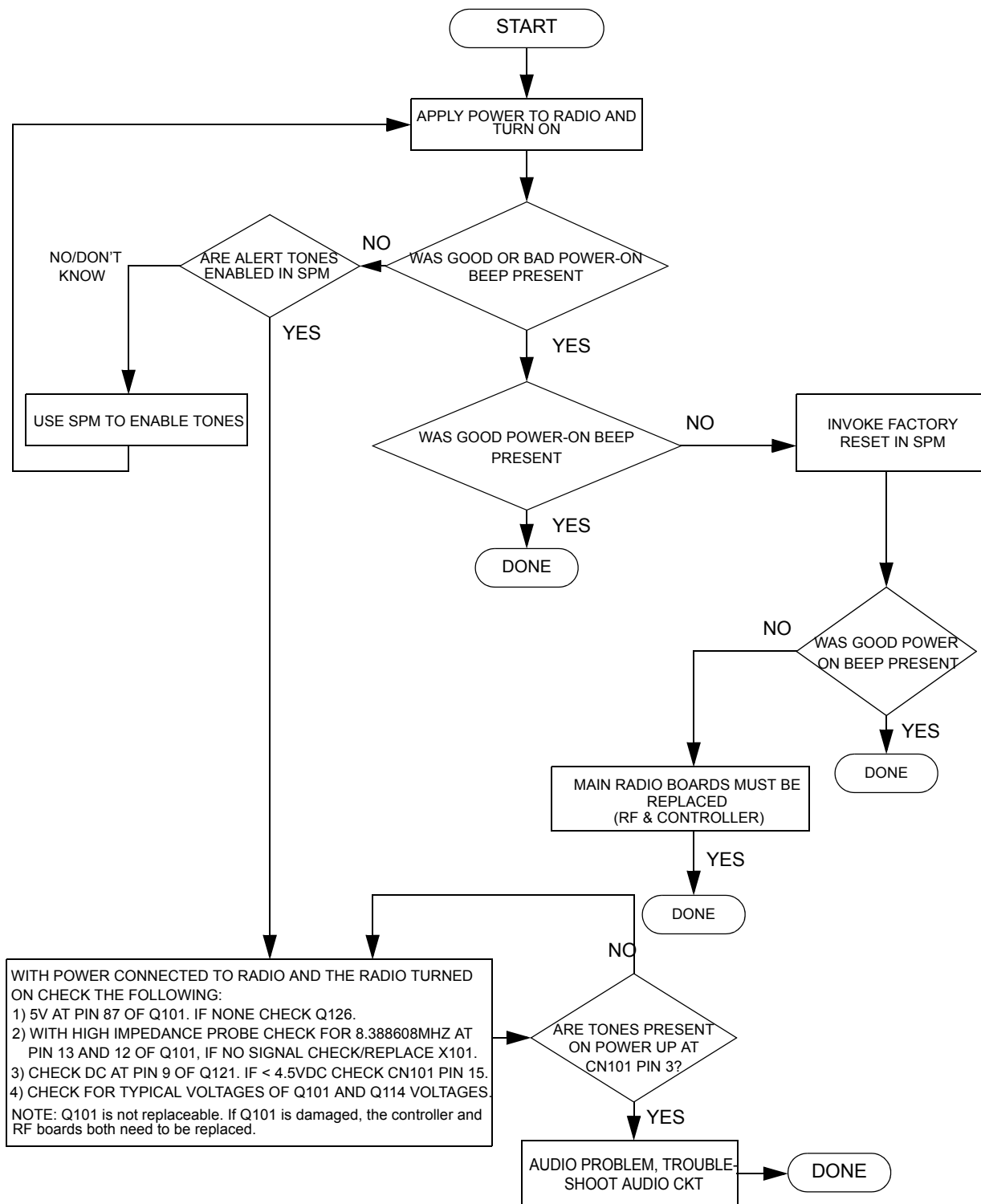
Troubleshooting Flow Chart for Transmitter

Figure 7-8.



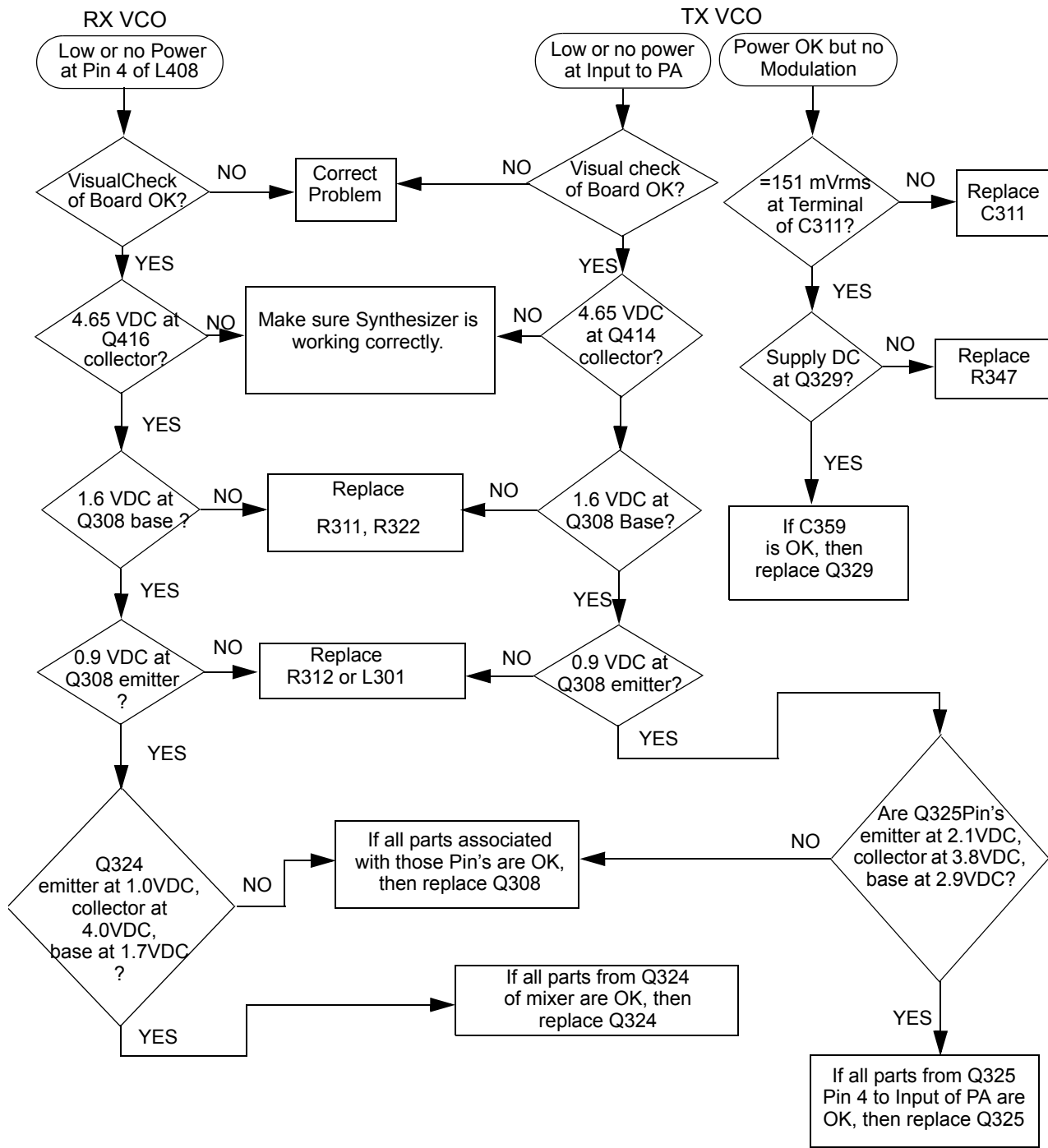
Troubleshooting Flow Chart for Synthesizer

Figure 7-9.



Troubleshooting Flow Chart for Microcontroller

Figure 7-10.



Note: Test Frequency 158MHz

Troubleshooting Flow Chart for VCO

Figure 7-11.

7.6 VHF 136-174 MHz Circuit Board/Schematic Diagrams and Parts List

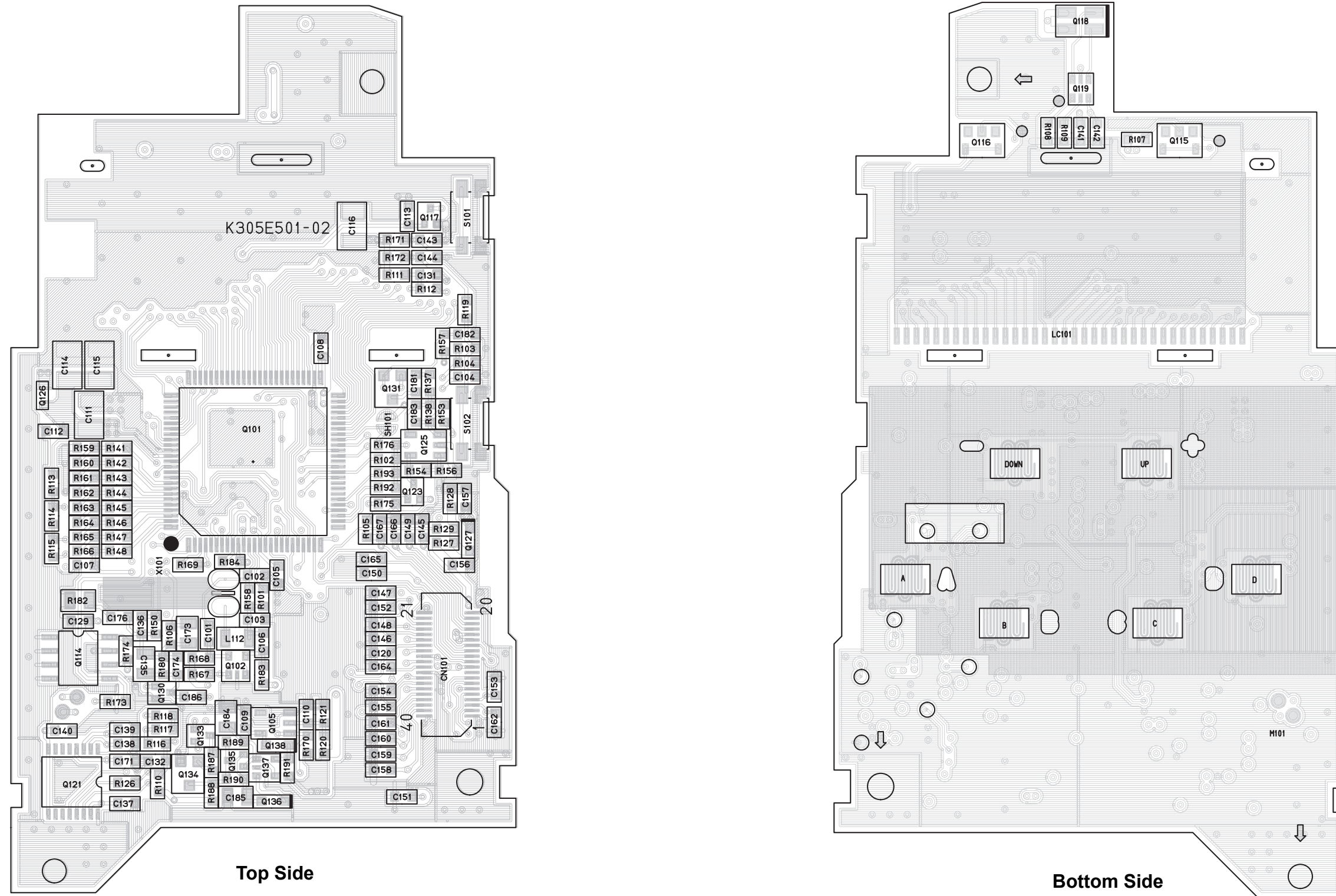


Figure 7-12. VHF 136-174 MHz Controller Board (K305E501-01)

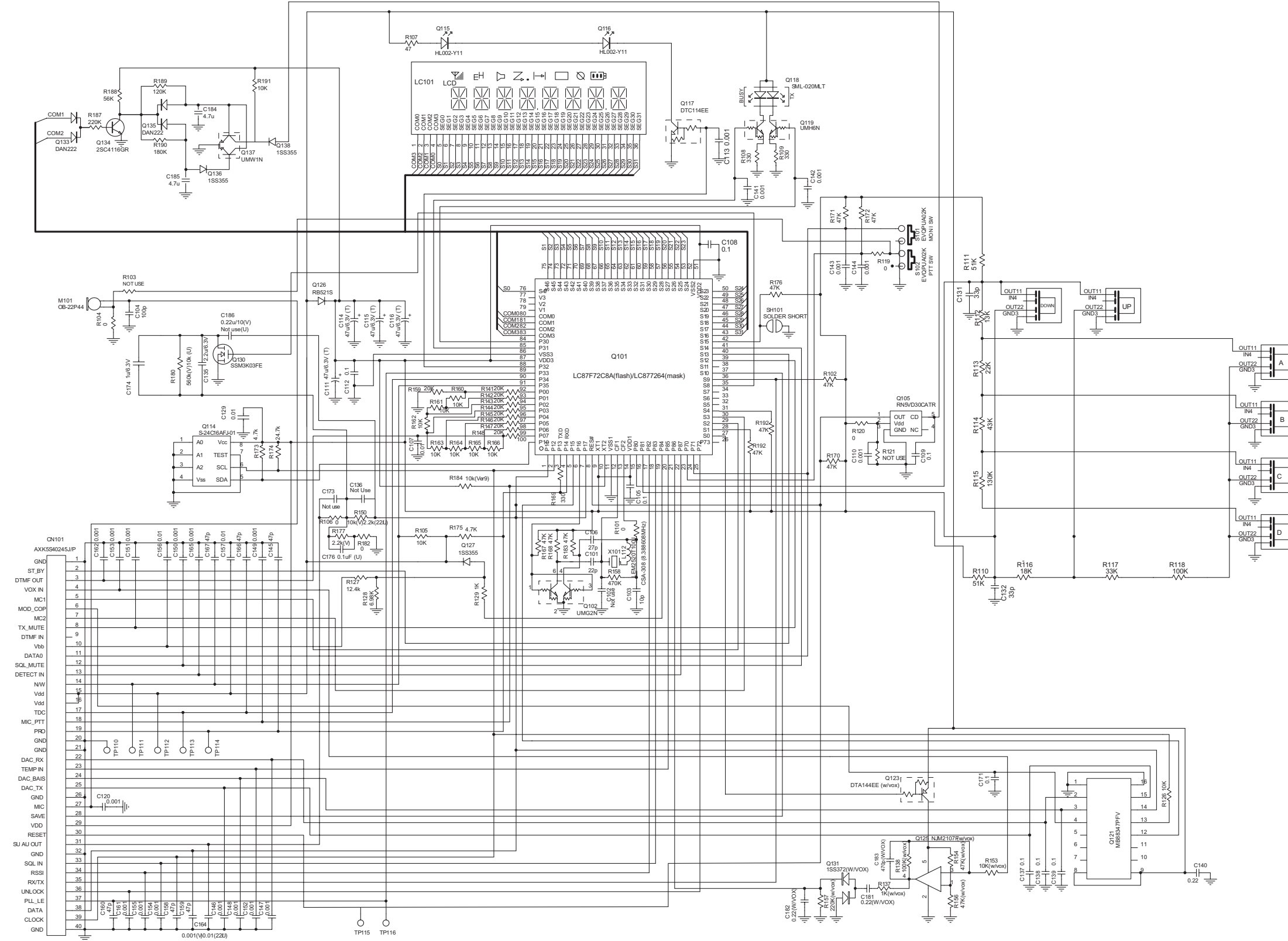


Figure 7-13. VHF 136-174 MHz Complete Controller Board Schematic Diagram (K305E501-01)

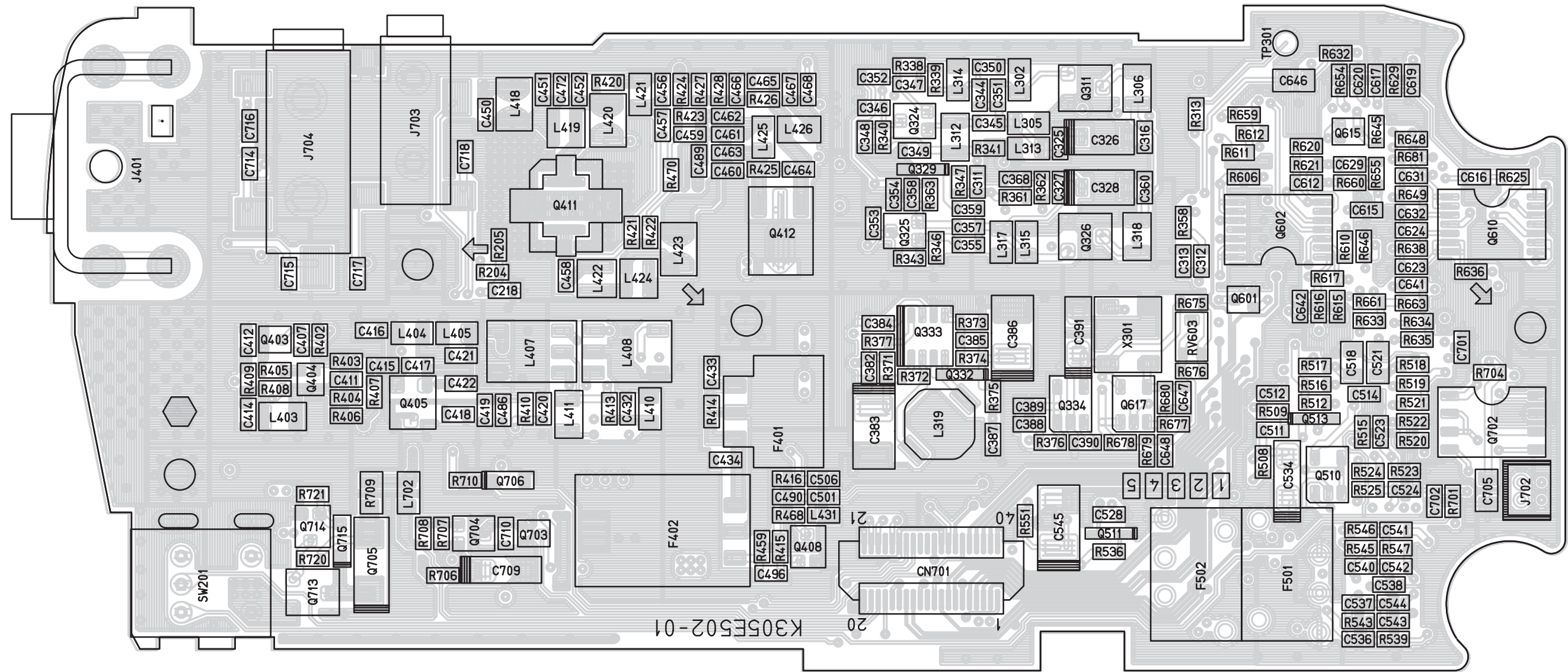


Figure 7-14. VHF 136-174 MHz Main Board Top Side (K305E502-01)

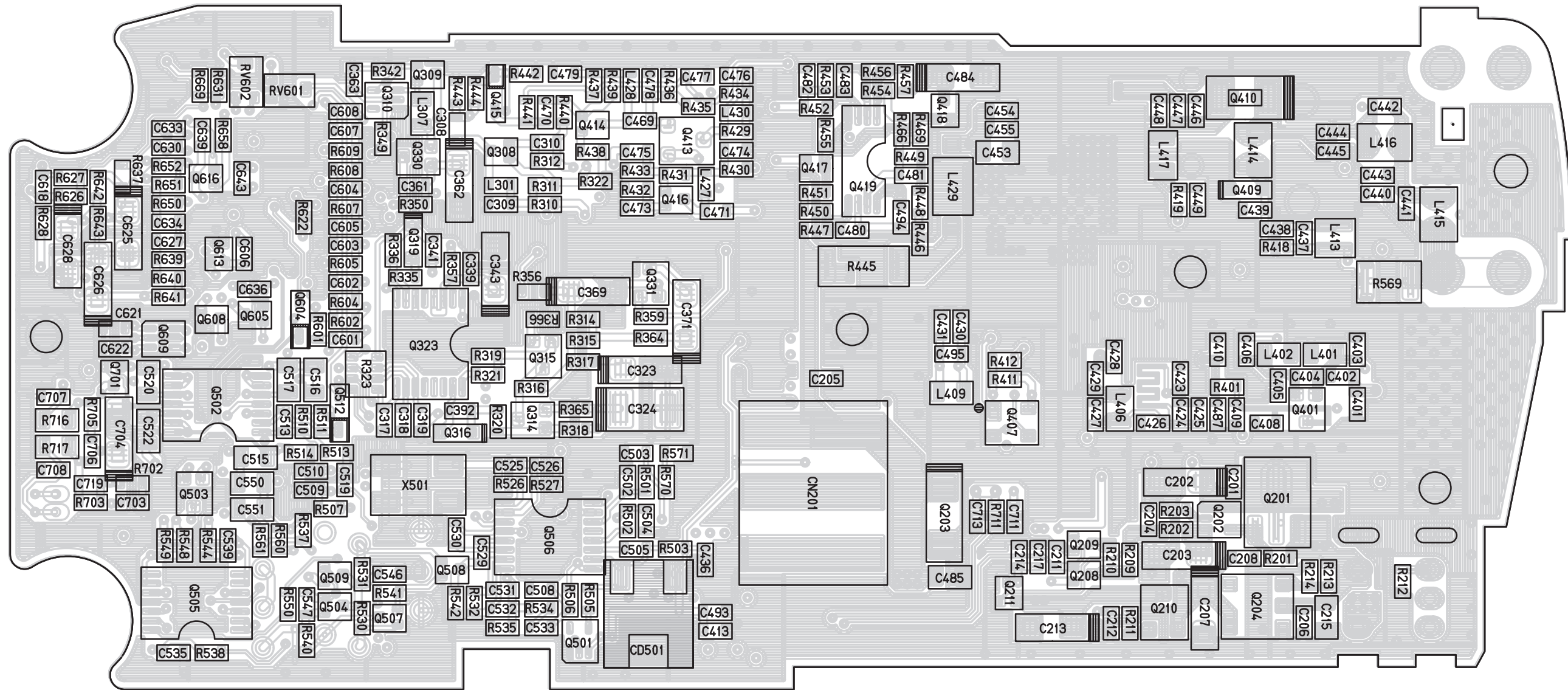


Figure 7-15. VHF 136-174 MHz Main Board Bottom Side (K305E502-01)

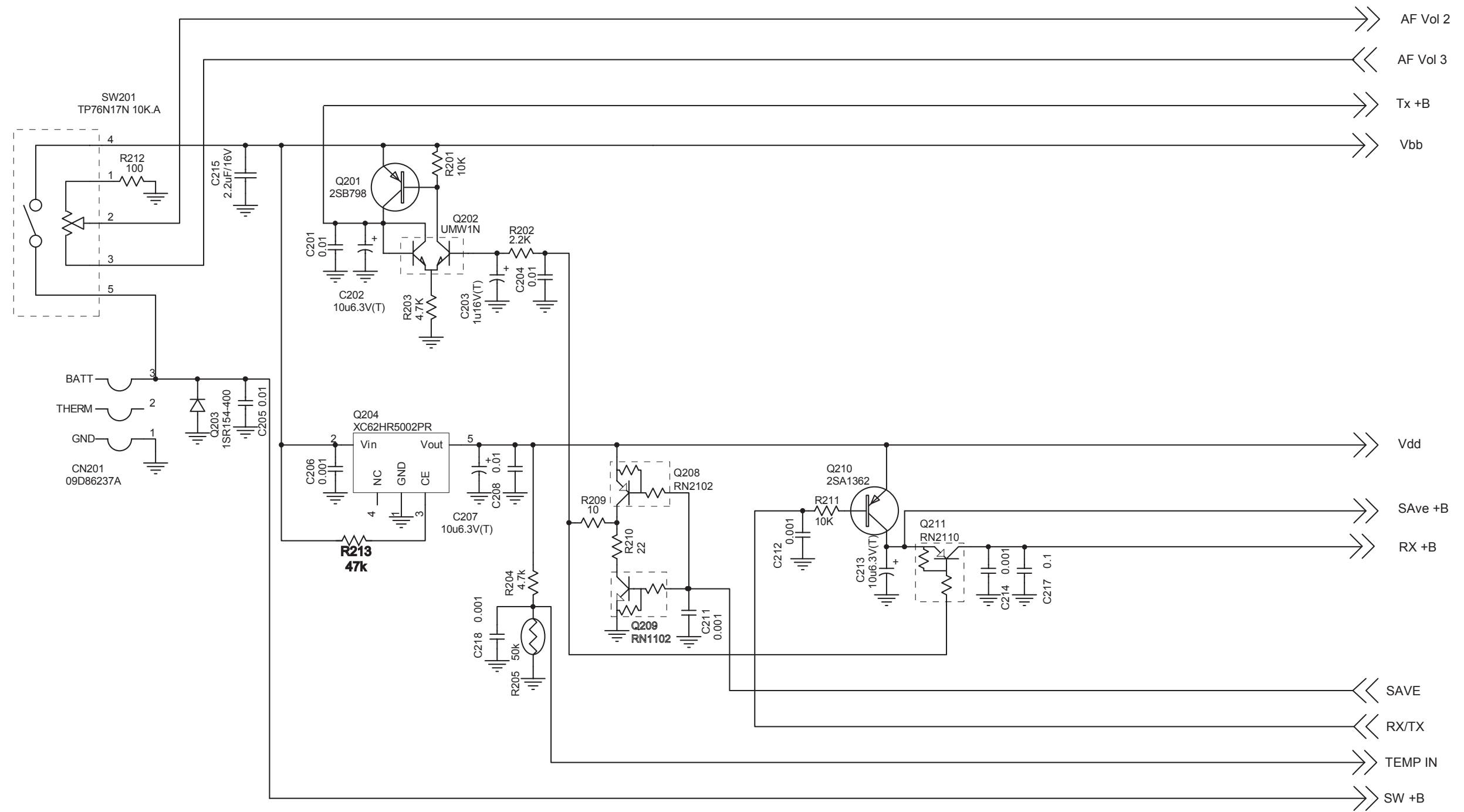


Figure 7-16. VHF 136-174 MHz Switches and Battery Schematic Diagram (K305E502-01)

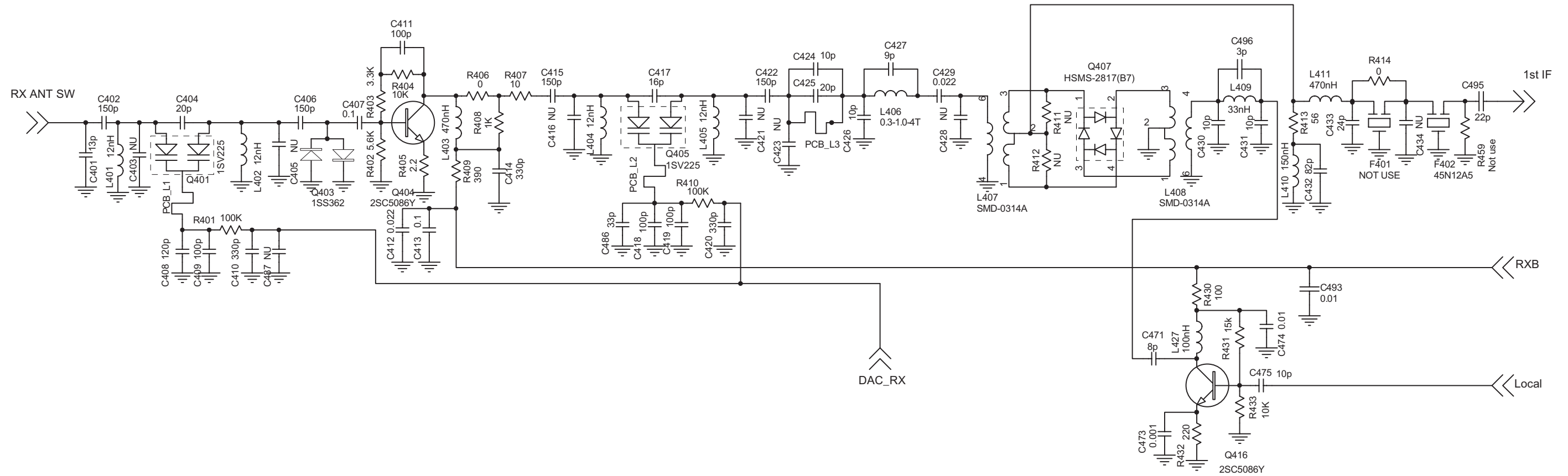


Figure 7-17. VHF 136-174 MHz Receiver Front End Schematic Diagram (K305E502-01)

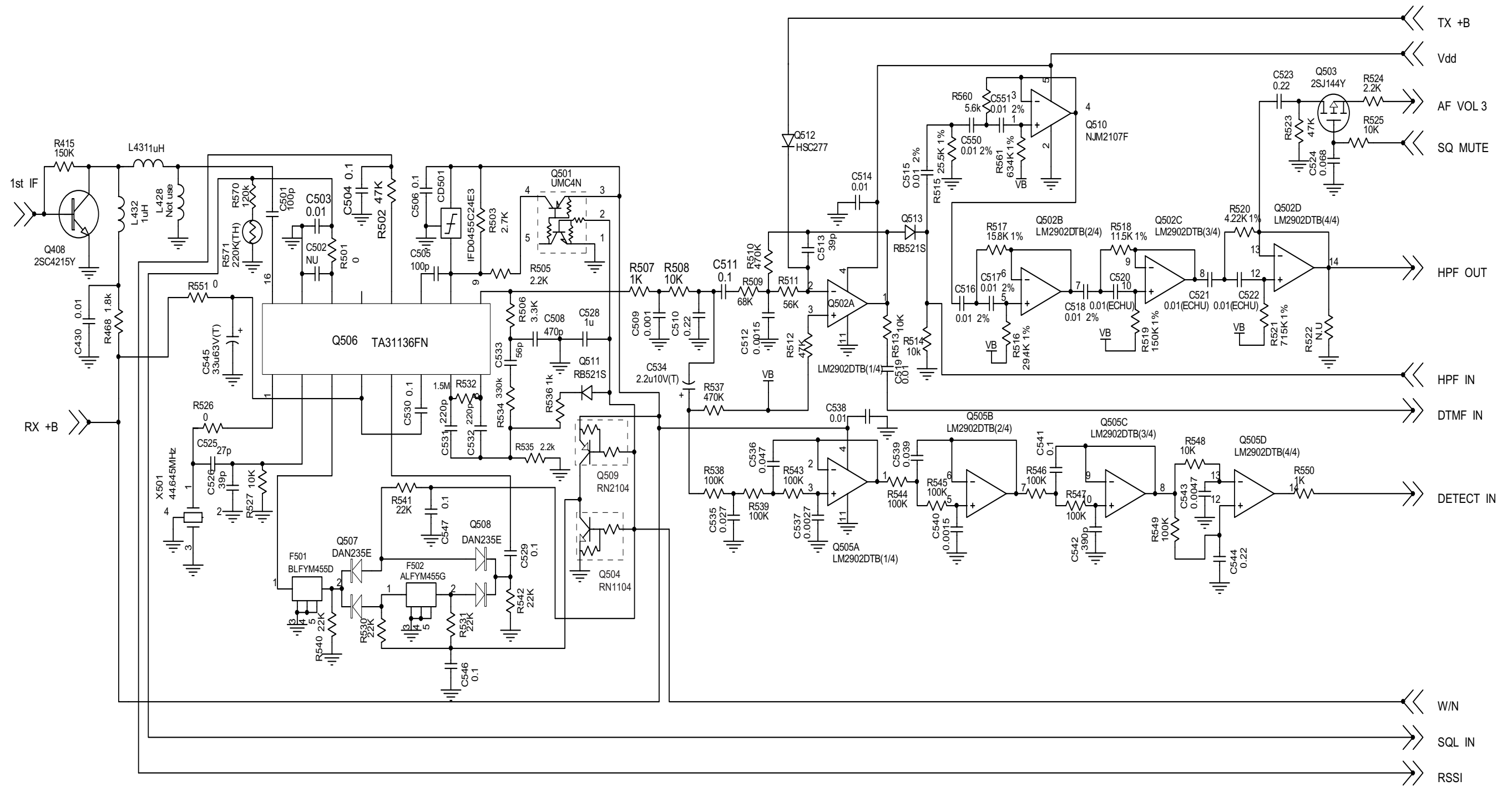


Figure 7-18. VHF 136-174 MHz Receiver Back End and Receiver Audio Schematic Diagram (K305E502-01)

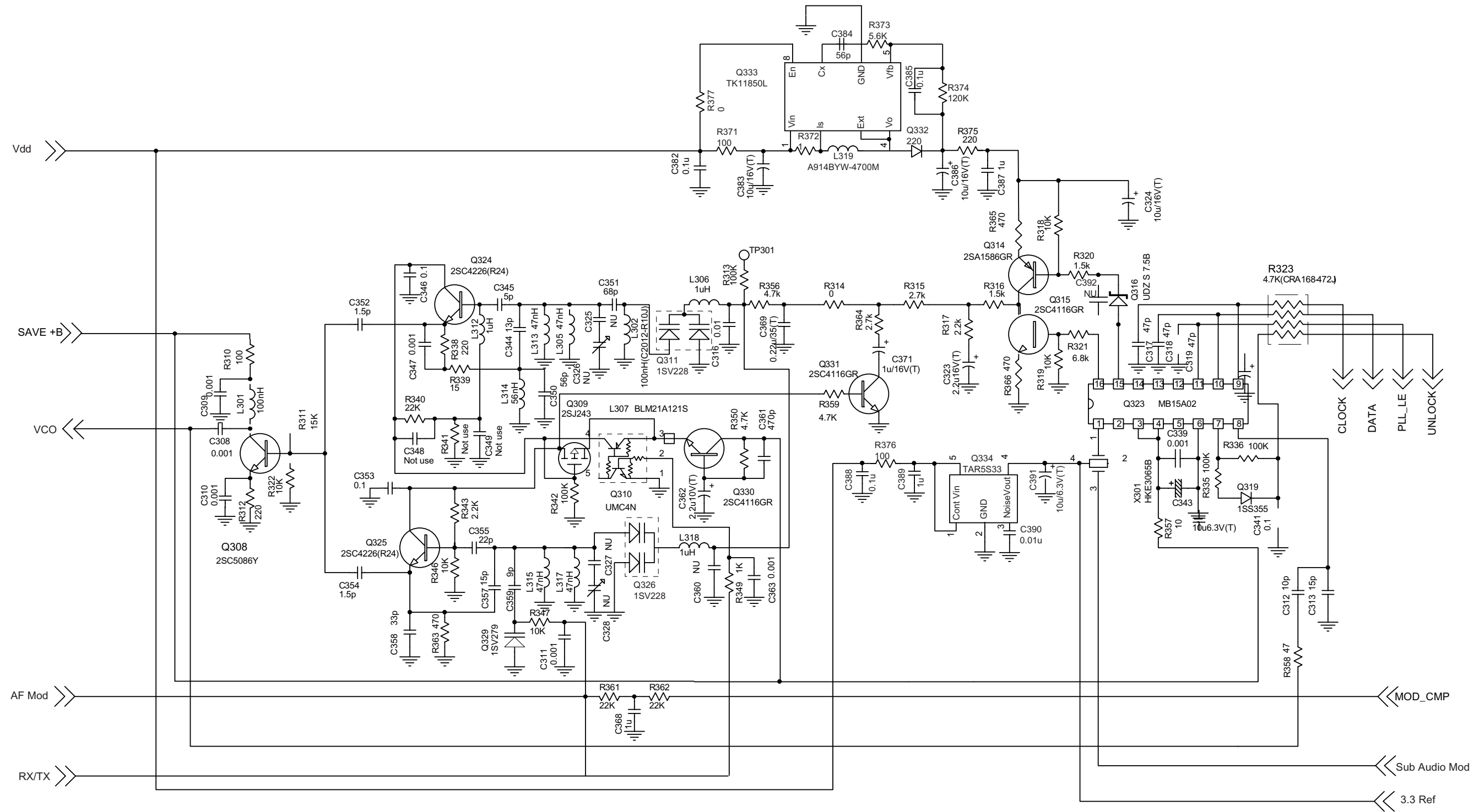


Figure 7-19. VHF 136-174 MHz Voltage Controlled Oscillator and Synthesizer Schematic Diagram (K305E502-01)

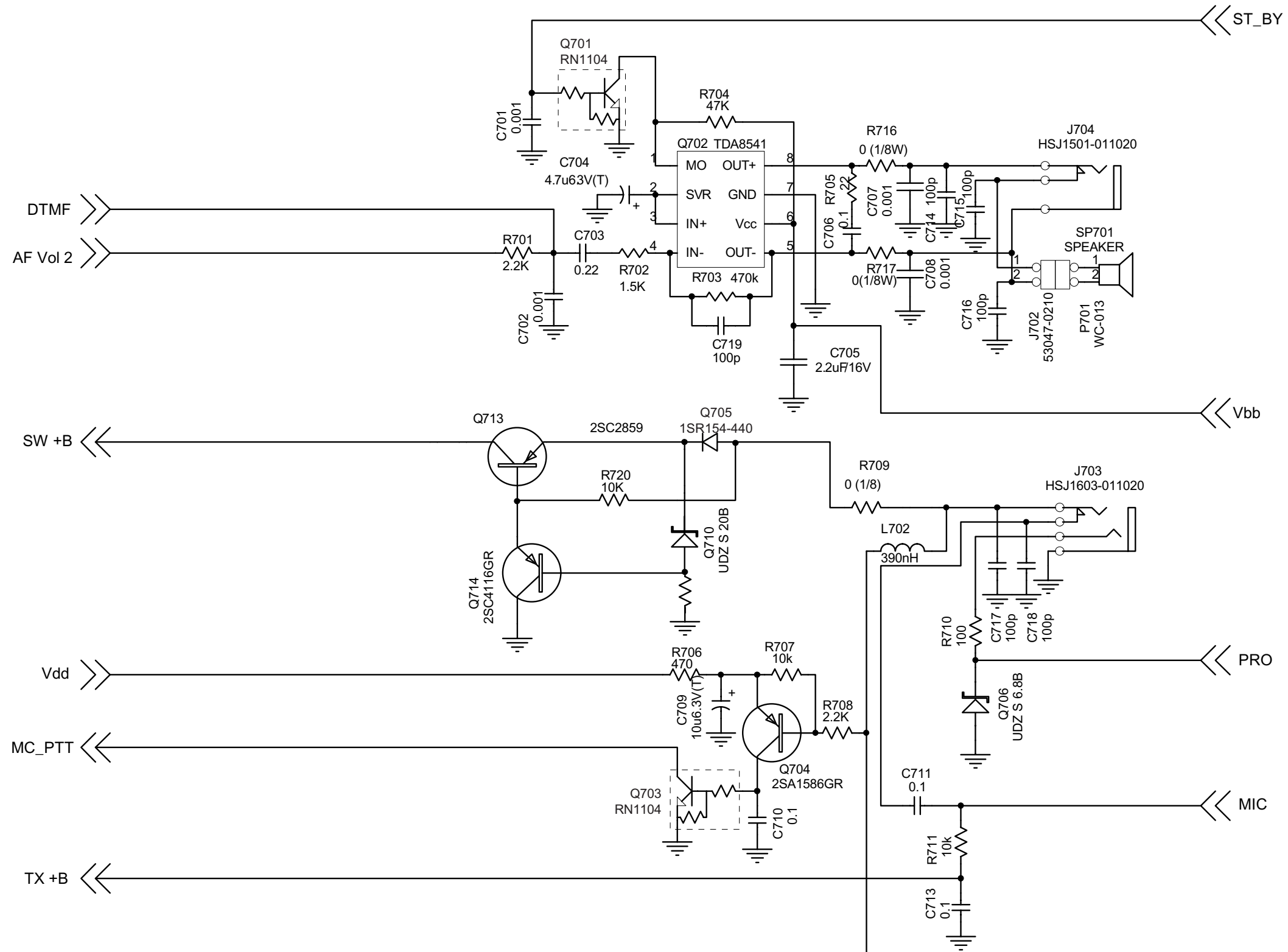


Figure 7-20. VHF 136-174 MHz Audio PA and External Audio Schematic Diagram (K305E502-01)

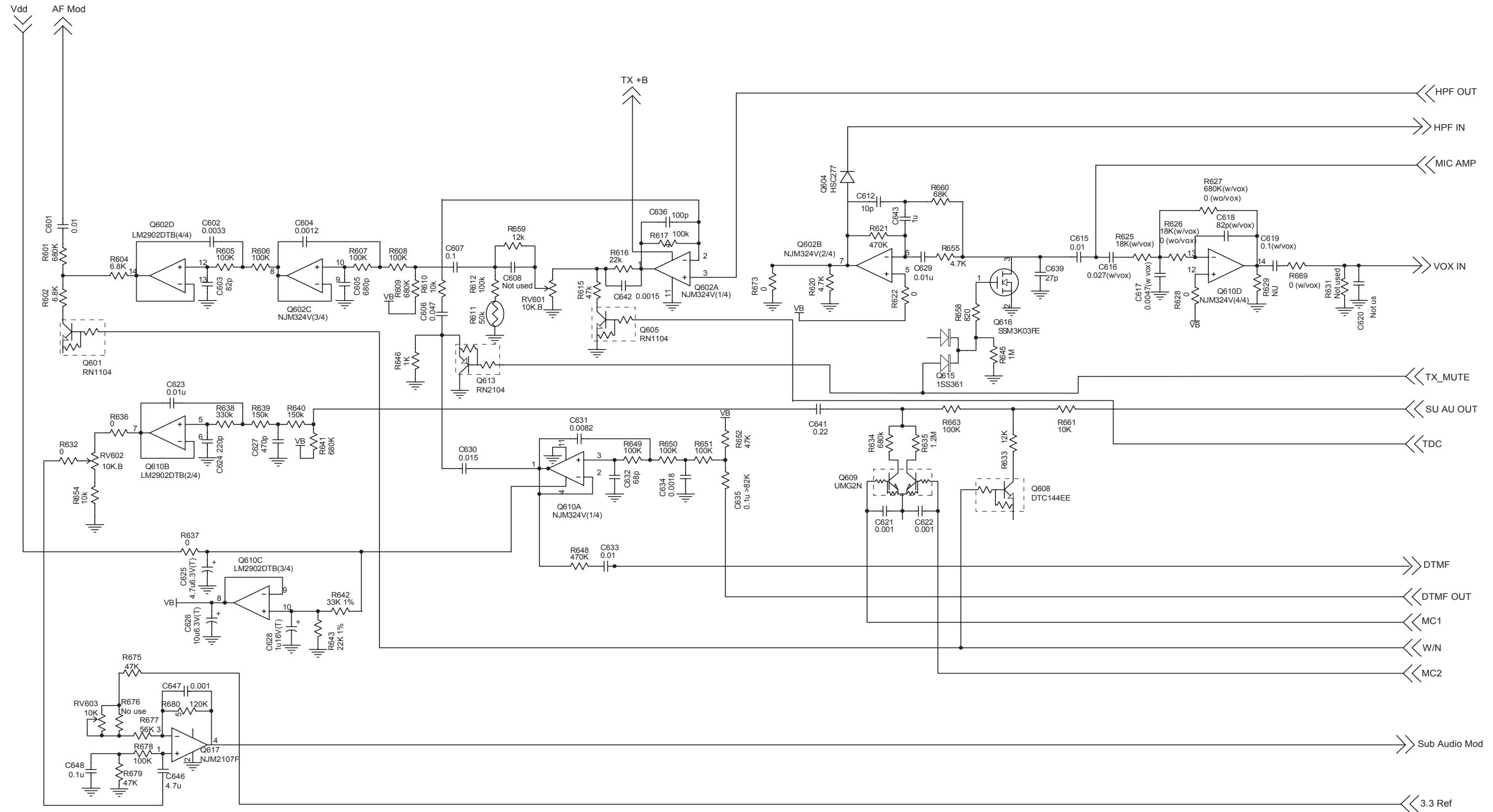


Figure 7-21. VHF 136-174 MHz Transmit Audio Schematic Diagram (K305E502-01)

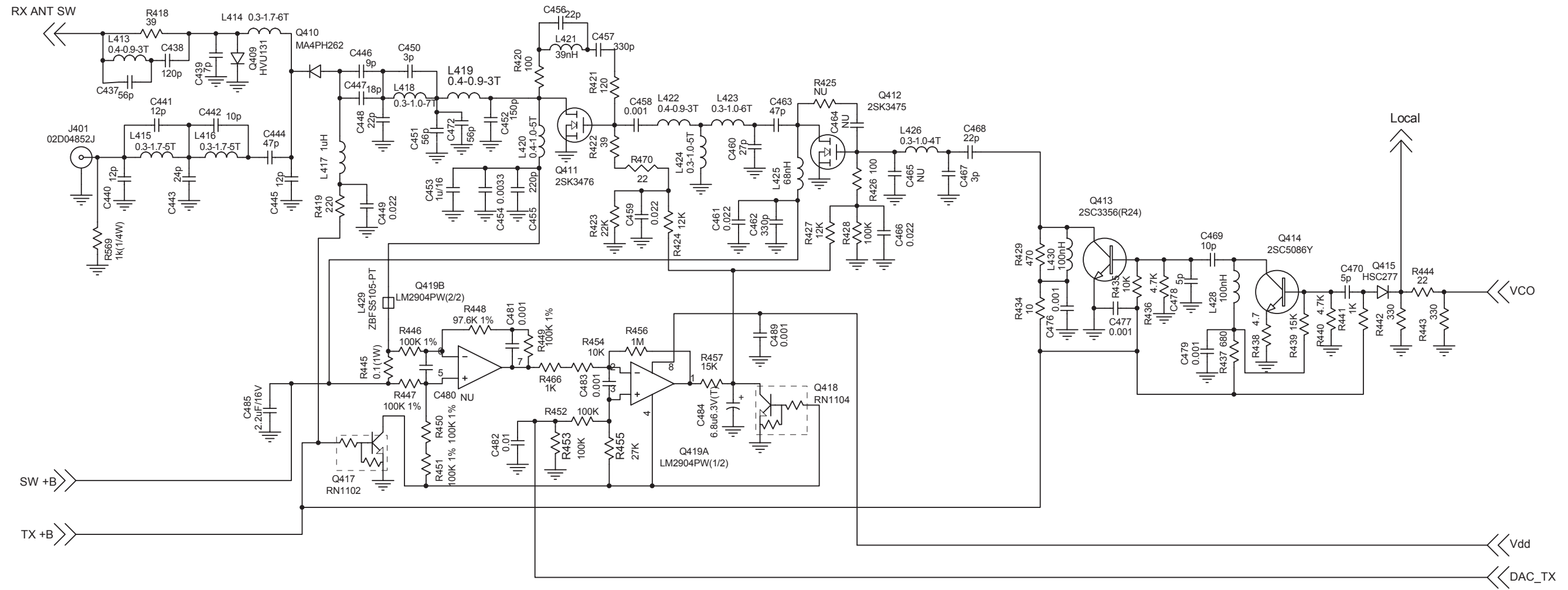


Figure 7-22. VHF 136-174 MHz Transmitter Schematic Diagram (K305E502-01)

VHF 136-174 MHz Radio Parts List (Controller Board) (K305E501-01)

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
C101	22pF; 50V; +-5%	MURATA	GRM39CH220J50PT	2113740F35
C102	NU			
C103	10pF; 50V; +- 0.5pF	MURATA	GRM39CH100J50PT	N/A
C104	100pF; 50V; +-5%	MURATA	GRM39CH101J50PT	2113740F51
C105	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C106	27pF; 50V; +-5%	MURATA	GRM39CH270J50PT	2113740F37
C107	0.01uF; 50V; +-10%	MURATA	GRM39B103K50PT	N/A
C108	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C109	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C110	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C111	47uF; 6.3V; +-20%	NI-CHEMI	6MCM476MB2TER	N/A
C112	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C113	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C114	47uF; 6.3V; +-20%	NI-CHEMI	6MCM476MB2TER	N/A
C115	47uF; 6.3V; +-20%	NI-CHEMI	6MCM476MB2TER	N/A
C116	47uF; 6.3V; +-20%	NI-CHEMI	6MCM476MB2TER	N/A
C120	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C129	0.01uF; 50V; +-10%	MURATA	GRM39B103K50PT	N/A
C131	33pF; 50V; +-5%	MURATA	GRM39CH330J50PT	2113740F39
C132	33pF; 50V; +-5%	MURATA	GRM39CH330J50PT	2113740F39
C135	2.2uF; 6.3V; +-10%	MURATA	GRM40B225K6.3PT	N/A
C137	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C138	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C139	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C140	0.22uF; 10V; +-10%	MURATA	GRM39B224K10PT	2113928G01
C141	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C142	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C143	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C144	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C145	47pF; 50V; +-5%	MURATA	GRM39CH470J50PT	2113740F43
C146	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C147	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C148	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C149	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C150	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C151	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C152	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C153	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C154	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C155	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C156	0.01uF; 50V; +-10%	MURATA	GRM39B103K50PT	N/A
C157	0.01uF; 50V; +-10%	MURATA	GRM39B103K50PT	N/A
C158	47pF; 50V; +-5%	MURATA	GRM39CH470J50PT	2113740F43
C159	47pF; 50V; +-5%	MURATA	GRM39CH470J50PT	2113740F43
C160	47pF; 50V; +-5%	MURATA	GRM39CH470J50PT	2113740F43
C161	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C162	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C164	0.01uF; 50V; +-10%	MURATA	GRM39B103K50PT	N/A
C165	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
C166	47pF; 50V; +-5%	MURATA	GRM39CH470J50PT	2113740F43
C167	47pF; 50V; +-5%	MURATA	GRM39CH470J50PT	2113740F43
C171	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C173	NU			
C174	1uF; 6.3V; +-10%	MURATA	GRM39B105K6.3PT	2113928P04
C176	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C181	0.22uF; 10V; +-10%	MURATA	GRM39B224K10PT	2113928G01
C182	0.22uF; 10V; +-10%	MURATA	GRM39B224K10PT	2113928G01
C183	470pF; 50V; +-5%	MURATA	GRM39CH471J50PT	N/A
C184		MURATA	GRM21BB31A475KA7 4_+A02	N/A
C185		MURATA	GRM21BB31A475KA7 4_+A02	N/A
C186	NU			
CN101		Matsushita	AXK5S40245J/P	DSCN097002
L112	10uH	Taiyo Yuden	LEM2520T100J	N/A
LC101		PICVUE	HT138ZAS	DSL170003
M101		BOSUNG	OB-22P44	DSMI505001
PB101			K305E501	N/A
Q101		Sanyo	LC87F72C8A	DSIC092009
Q102		Rohm	UMG2N TR	N/A
Q105		RICOH	RN5VD30CATR	DSIC076007
Q114		Seiko El.	S-24C16AFJ-01	DSIC510003
Q115		KOHA	HL002-Y11	N/A
Q116		KOHA	HL002-Y11	N/A
Q117		Rohm	DTC114EETL	N/A
Q118		Rohm	SML-020MLT T86NN	4804810T02
Q119		Rohm	UMH6N TR	4880439V02
Q121		Fujitsu	MB88347PFV	DSIC042002
Q123		Rohm	DTA144EETL	N/A
Q125		JRC	NJM2107F (TE1)	DSIC025016
Q126		Rohm	RB521S-30 TE61	4805656W22
Q127		Rohm	1SS355 TE-17	4870360C15
Q130		Toshiba	SSM3K03FE-TE85L	N/A
Q131		Rohm	1SS372-TE85L	N/A
Q133		Rohm	DAN222TL	N/A
Q134		Toshiba	2SC4116-GR TE85L	N/A
Q135		Rohm	DAN222TL	N/A
Q136		Rohm	1SS355 TE-17	N/A
Q137		Rohm	UMW1N TL	N/A
Q138		Rohm	1SS355 TE-17	N/A
R101	0 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 000	0662057B47
R102	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R103	NU			
R104	0 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 000	0662057B47
R105	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R106	0 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 000	0662057B47
R107	47 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 470	0662057A17
R108	330 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 331	0662057A37
R109	330 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 331	0662057A37
R110	51 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 513	0662057A90

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
R111	51 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 513	0662057A90
R112	13 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 133	0662057A76
R113	22 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 223	0662057A81
R114	43 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 433	0665027A88
R115	130 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 134	0662257B01
R116	18 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 183	0662057A79
R117	33 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 333	0662057A85
R118	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R119	0 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 000	0662057B47
R120	0 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 000	0662057B47
R121	NU			
R126	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R127	12.4 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 1242	0662057P69
R128	6.98 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 6981	0662057Y24
R129	1 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 102	0662057A49
R137	1 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 102	0662057A49
R138	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R141	20 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 203	0662057A80
R142	20 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 203	0662057A80
R143	20 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 203	0662057A80
R144	20 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 203	0662057A80
R145	20 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 203	0662057A80
R146	20 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 203	0662057A80
R147	20 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 203	0662057A80
R148	20 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 203	0662057A80
R150	2.2 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 222	0662057A57
R153	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R154	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R156	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R157	220 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 224	N/A
R158	470 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 474	0662057B14
R159	20 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 203	0662057A80
R160	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R161	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R162	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R163	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R164	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R165	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R166	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R167	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R168	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R169	330 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 331	0662057A37
R170	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R171	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R172	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R173	4.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 472	0662057A65
R174	4.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 472	0662057A65
R175	4.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 472	0662057A65
R176	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R180	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R182	0 ohm; 0.1W; +-5%	Rohm	MCR10 EZHJ 000	0662057B47

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
R183	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R184	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R187	220 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 224	N/A
R188	56 Kohm	Rohm	MCR03 EZHJ 563	N/A
R189	120 Kohm	Rohm	MCR03 EZHJ 124	N/A
R190	180 Kohm	Rohm	MCR03 EZHJ 184	N/A
R191	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R192	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R193	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
S101		Panasonic	EVQPUA02K	N/A
S102		Panasonic	EVQPUA02K	N/A
X101		CITIZEN	CSA-309(8.3886MHz)	DSXT182001

VHF 136-174 MHz Radio Parts List (RF Board) (K305E502-01)

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
C201	0.01uF; 50V; +-5%	MURATA	GRM39B103K50PT	2113931F49
C202	10uF; 6.3V; +-20%	NEC	TEMSVA0J106M8R	N/A
C203	1uF; 16V; +-20%	NEC	TESVA1C105M1-8R	N/A
C204	0.01uF; 50V; +-5%	MURATA	GRM39B103K50PT	2113931F49
C205	0.01uF; 50V; +-5%	MURATA	GRM39B103K50PT	2113931F49
C206	0.001uF; 50V; +-5%	MURATA	GRM39B102K50PT	2113931F25
C207	10uF; 6.3V; +-20%	NEC	TEMSVA0J106M8R	N/A
C208	0.01uF; 50V; +-5%	MURATA	GRM39B103K50PT	2113931F49
C211	0.001uF; 50V; +-5%	MURATA	GRM39B102K50PT	2113931F25
C212	0.001uF; 50V; +-5%	MURATA	GRM39B102K50PT	2113931F25
C213	10uF; 6.3V; +-20%	NEC	TEMSVA0J106M8R	N/A
C214	0.001uF; 50V; +-5%	MURATA	GRM39B102K50PT	2113931F25
C215	2.2uF; 16V; +-10%	MURATA	GRM40F225Z16PT	N/A
C217	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	2113743E20
C218	0.001uF; 50V; +-5%	MURATA	GRM39B102K50PT	2113931F25
C308	0.001uF; 50V; +-5%	MURATA	GRM39B102K50PT	2113931F25
C309	0.001uF; 50V; +-5%	MURATA	GRM39B102K50PT	2113931F25
C310	0.001uF; 50V; +-5%	MURATA	GRM39B102K50PT	2113931F25
C311	0.001uF; 50V; +-5%	MURATA	GRM39B102K50PT	2113931F25
C312	10pF; 50V; +-30%	MURATA	GRM39CH100D50PT	2113740F27
C313	15pF; 50V; +-30%	MURATA	GRM39CH150J50PT	2113740F31
C316	0.01uF; 50V; +-5%	MURATA	GRM39B103K50PT	2113931F49
C317	47pF; 50V; +-30%	MURATA	GRM39CH470J50PT	2113740F43
C318	47pF; 50V; +-30%	MURATA	GRM39CH470J50PT	2113740F43
C319	47pF; 50V; +-30%	MURATA	GRM39CH470J50PT	2113740F43
C323	2.2uF; 16V; +-20%	NEC	TEMSVA1C225M8R	N/A
C324	10uF; 16V; +-20%	NI-CHEMI	16MCM106MB2TER	N/A
C325	NU			
C326	NU			
C327	NU			
C328	NU			
C339	0.001uF; 50V; +-5%	MURATA	GRM39B102K50PT	2113931F25
C341	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	2113743E20

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
C343	10uF; 6.3V; +-20%	NEC	TEMSVA0J106M8R	N/A
C344	13pF; 50V; +-30%	MURATA	GRM39CH130J50PT	2113740F30
C345	5pF; 50V; +-0.25%	MURATA	GRM39CH050C50PT	N/A
C346	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	2113743E20
C347	0.001uF; 50V; +-5%	MURATA	GRM39B102K50PT	2113931F25
C348	NU			
C349	NU			
C350	56pF; 50V; +-30%	MURATA	GRM39CH560J50PT	2113740F45
C351	68pF; 50V; +-30%	MURATA	GRM39CH680J50PT	2113740F47
C352	1.5pF; 50V; +-0.25%	MURATA	GRM39CK1R5C50PT	N/A
C353	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	2113743E20
C354	1.5pF; 50V; +-0.25%	MURATA	GRM39CK1R5C50PT	N/A
C355	22pF; 50V; +-30%	MURATA	GRM39CH220J50PT	2113740F35
C357	15pF; 50V; +-30%	MURATA	GRM39CH150J50PT	2113740F31
C358	27pF; 50V; +-30%	MURATA	GRM39CH330J50PT	2113740F39
C359	9pF; 50V; +-0.5%	MURATA	GRM39CH090D50PT	N/A
C360	NU			
C361	470pF; 50V; +-10%	MURATA	GRM39B471K50PT	N/A
C362	2.2uF; 10V; +-20%	NEC	TESVA1A225M1-8R	N/A
C363	0.001uF; 50V; +-5%	MURATA	GRM39B102K50PT	2113931F25
C368	1uF; 6.3V; +-10%	MURATA	GRM39B105K6.3PT	2113928P04
C369	0.22uF; 35V; +-20%	NEC	TESVA1V224M8R	N/A
C371	1uF; 16V; +-20%	NEC	TESVA1C105M1-8R	N/A
C382	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	2113743E20
C383	10uF; 16V; +-20%	NI-CHEMI	16MCM106MB2TER	N/A
C384	56pF; 50V; +-30%	MURATA	GRM39CH560J50PT	2113740F45
C385	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	2113743E20
C386	10uF; 16V; +-20%	NI-CHEMI	16MCM106MB2TER	N/A
C387	1uF; 6.3V; +-20%	MURATA	GRM39B105K6.3PT	2113928P04
C388	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	2113743E20
C389	1uF; 6.3V; +-20%	MURATA	GRM39B105K6.3PT	2113928P04
C390	0.01uF; 50V; +-5%	MURATA	GRM39B103K50PT	2113931F49
C391	10uF; 6.3V; +-20%	NEC	TEMSVA0J106M8R	N/A
C392	NU			
C401	13pF; 50V; +-30%	MURATA	GRM39CH130J50PT	2113740F30
C402	150pF; 50V; +-30%	MURATA	GRM39CH151J50PT	2113740F55
C403	NU			
C404	20pF; 50V; +-30%	MURATA	GRM39CH200J50PT	2113740F34
C405	NU			
C406	150pF; 50V; +-30%	MURATA	GRM39CH151J50PT	2113740F55
C407	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	2113743E20
C408	120pF; 50V; +-30%	MURATA	GRM39CH121J50PT	2113740F53
C409	100pF; 50V; +-30%	MURATA	GRM39CH101J50PT	2113740F51
C410	330pF; 50V; +-10%	MURATA	GRM39B331K50PT	2155169M03
C411	100pF; 50V; +-30%	MURATA	GRM39CH101J50PT	2113740F51
C412	0.0022uF;50V; +-10%	MURATA	GRM39B223K25PT	N/A
C413	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	2113743E20
C414	330pF; 50V; +-10%	MURATA	GRM39B331K50PT	2155169M03
C415	150p; 50V; +-30%	MURATA	GRM39CH151J50PT	2113740F55
C416	NU			
C417	16pF; 50V; +-30%	MURATA	GRM39CH160J50PT	2113740F32

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
C418	100pF; 50V; +-30%	MURATA	GRM39CH101J50PT	2113740F51
C419	100pF; 50V; +-30%	MURATA	GRM39CH101J50PT	2113740F51
C420	330pF; 50V; +-10%	MURATA	GRM39B331K50PT	2155169M03
C421	NU			
C422	150pF; 50V; +-30%	MURATA	GRM39CH151J50PT	2113740F55
C423	NU			
C424	10pF; 50V; +-30%	MURATA	GRM39CH100D50PT	2113740F27
C425	20pF; 50V; +-30%	MURATA	GRM39CH200J50PT	2113740F34
C426	10pF; 50V; +-30%	MURATA	GRM39CH100D50PT	2113740F27
C427	9pF; 50V; +-0.5%	MURATA	GRM39CH090D50PT	N/A
C428	NU			
C429	0.022uF; 25V; +-10%	MURATA	GRM39B223K25PT	N/A
C430	10pF; 50V; +-30%	MURATA	GRM39CH100D50PT	2113740F27
C431	10pF; 50V; +-30%	MURATA	GRM39CH100D50PT	2113740F27
C432	82pF; 50V; +-30%	MURATA	GRM39CH820J50PT	2113740F49
C433	24pF; 50V; +-30%	MURATA	GRM39CH240J50PT	2113740F36
C434	NU			
C436	0.01uF; 50V; +-5%	MURATA	GRM39B103K50PT	2113931F49
C437	56pF; 50V; +-30%	MURATA	GRM39CH560J50PT	2113740F45
C438	120pF; 50V; +-30%	MURATA	GRM39CH121J50PT	2113740F53
C439	7pF; 50V; +-0.5%	MURATA	GRM39CH070D50PT	N/A
C440	12pF; 50V; +-30%	MURATA	GRM39CH120J50PT	2113740F29
C441	12pF; 50V; +-30%	MURATA	GRM39CH120J50PT	2113740F29
C442	10pF; 50V; +-30%	MURATA	GRM39CH100D50PT	2113740F27
C443	24pF; 50V; +-30%	MURATA	GRM39CH240J50PT	2113740F36
C444	47pF; 50V; +-30%	MURATA	GRM39CH470J50PT	2113740F43
C445	12pF; 50V; +-30%	MURATA	GRM39CH120J50PT	2113740F29
C446	9pF; 50V; +-0.5%	MURATA	GRM39CH090D50PT	N/A
C447	18pF; 50V; +-30%	MURATA	GRM39CH180J50PT	2113740F33
C448	22pF; 50V; +-30%	MURATA	GRM39CH220J50PT	2113740F35
C449	0.022uF; 25V; +-10%	MURATA	GRM39B223K25PT	N/A
C450	3pF; 50V; +-0.25%	MURATA	GRM39CH030C50PT	N/A
C451	56pF; 50V; +-30%	MURATA	GRM39CH560J50PT	2113740F45
C452	150pF; 50V; +-30%	MURATA	GRM39CH151J50PT	2113740F55
C453	1uF; 16V; +-10%	MURATA	GRM40B105K16PT	N/A
C454	0.0033uF;50V; +-10%	MURATA	GRM39B332K50PT	2155169M15
C455	220pF; 50V; +-10%	MURATA	GRM39B221K50PT	2155169M01
C456	22pF; 50V; +-30%	MURATA	GRM39CH220J50PT	2113740F35
C457	330pF; 50V; +-10%	MURATA	GRM39B331K50PT	2155169M03
C458	0.001uF; 50V; +-5%	MURATA	GRM39B102K50PT	2113931F25
C459	0.022uF; 25V; +-10%	MURATA	GRM39B223K25PT	N/A
C460	27pF; 50V; +-30%	MURATA	GRM39CH270J50PT	2113740F37
C461	0.022uF; 25V; +-10%	MURATA	GRM39B223K25PT	N/A
C462	330pF; 50V; +-10%	MURATA	GRM39B331K50PT	2155169M03
C463	47pF; 50V; +-30%	MURATA	GRM39CH470J50PT	2113740F43
C464	NU			
C465	NU			
C466	0.022uF; 25V; +-10%	MURATA	GRM39B223K25PT	N/A
C467	3pF; 50V; +-0.25%	MURATA	GRM39CH030C50PT	N/A
C468	22pF; 50V; +-30%	MURATA	GRM39CH220J50PT	2113740F35
C469	10pF; 50V; +-30%	MURATA	GRM39CH100D50PT	2113740F27

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
C470	5pF; 50V; +-0.25%	MURATA	GRM39CH050C50PT	N/A
C471	8pF; 50V; +-0.5%	MURATA	GRM39CH080D50PT	N/A
C472	56pF; 50V; +-30%	MURATA	GRM39CH560J50PT	2113740F45
C473	0.001uF; 50V; +-5%	MURATA	GRM39B102K50PT	2113931F25
C474	0.01uF; 50V; +-5%	MURATA	GRM39B103K50PT	2113931F49
C475	10pF; 50V; +-30%	MURATA	GRM39CH100D50PT	2113740F27
C476	0.001uF; 50V; +-5%	MURATA	GRM39B102K50PT	2113931F25
C477	0.001uF; 50V; +-5%	MURATA	GRM39B102K50PT	2113931F25
C478	5pF; 50V; +-0.25%	MURATA	GRM39CH050C50PT	N/A
C479	0.001uF; 50V; +-5%	MURATA	GRM39B102K50PT	2113931F25
C480	NU			
C481	0.001uF; 50V; +-5%	MURATA	GRM39B102K50PT	2113931F25
C482	0.01uF; 50V; +-5%	MURATA	GRM39B103K50PT	2113931F49
C483	0.001uF; 50V; +-5%	MURATA	GRM39B102K50PT	2113931F25
C484	6.8uF; 6.3V; +-20%	NEC	TEMSVA0J685M8R	N/A
C485	2.2uF; 16V; +-0%	MURATA	GRM40F225Z16PT	N/A
C486	33pF; 50V; +-30%	MURATA	GRM39CH330J50PT	2113740F39
C487	NU			
C489	0.001uF; 50V; +-5%	MURATA	GRM39B102K50PT	2113931F25
C490	100pF; 50V; +-30%	MURATA	GRM39CH101J50PT	2113740F51
C493	0.01uF; 50V; +-5%	MURATA	GRM39B103K50PT	2113931F49
C494	NU			
C495	3pF; 50V; +-0.25%	MURATA	GRM39CJ030C50PT	N/A
C496	22pF; 50V; +-30%	MURATA	GRM39CH220J50PT	2113740F35
C501	0.001uF; 50V; +-5%	MURATA	GRM39B102K50PT	2113931F25
C502	0.01uF; 50V; +-5%	MURATA	GRM39B103K50PT	2113931F49
C503	NU			
C504	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	2113743E20
C505	100pF; 50V; +-30%	MURATA	GRM39CH101J50PT	2113740F51
C506	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	2113743E20
C508	470pF; 50V; +-10%	MURATA	GRM39B471K50PT	N/A
C509	0.001uF; 50V; +-5%	MURATA	GRM39B102K50PT	2113931F25
C510	0.22uF; 10V; +-10%	MURATA	GRM39B224K10PT	N/A
C511	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	2113743E20
C512	0.0015uF; 50V; +-10%	MURATA	GRM39B152K50PT	2155169M11
C513	33pF; 50V; +-30%	MURATA	GRM39CH390J50PT	2113740F41
C514	0.01uF; 50V; +-5%	MURATA	GRM39B103K50PT	2113931F49
C515	0.01uF; 16V; +-2%	Panasonic	ECHU1C103GX5	DSCF097003
C516	0.01uF; 16V; +-2%	Panasonic	ECHU1C103GX5	DSCF097003
C517	0.01uF; 16V; +-2%	Panasonic	ECHU1C103GX5	DSCF097003
C518	0.01uF; 16V; +-2%	Panasonic	ECHU1C103GX5	DSCF097003
C519	0.01uF; 50V; +-5%	MURATA	GRM39B103K50PT	2113931F49
C520	0.01uF; 16V; +-2%	Panasonic	ECHU1C103GX5	DSCF097003
C521	0.01uF; 16V; +-2%	Panasonic	ECHU1C103GX5	DSCF097003
C522	0.01uF; 16V; +-2%	Panasonic	ECHU1C103GX5	DSCF097003
C523	0.22uF; 10V; +-10%	MURATA	GRM39B224K10PT	N/A
C524	0.068uF; 16V; +-10%	MURATA	GRM39B683K16PT	N/A
C525	27pF; 50V; +-30%	MURATA	GRM39CH270J50PT	2113740F37
C526	39pF; 50V; +-30%	MURATA	GRM39CH390J50PT	2113740F41
C528	1uF; 6.3V; +-20%	MURATA	GRM39B105K6.3PT	2113928P04
C529	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	2113743E20

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
C530	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	2113743E20
C531	220pF; 50V; +-10%	MURATA	GRM39B221K50PT	2155169M01
C532	220pF; 50V; +-10%	MURATA	GRM39B221K50PT	2155169M01
C533	22pF; 50V; +-30%	MURATA	GRM39CH220J50PT	2113740F35
C534	2.2uF; 10V; +-20%	NEC	TESVA1A225M1-8R	N/A
C535	0.027uF; 25V; +-10%	MURATA	GRM39B273K25PT	N/A
C536	0.047uF; 16V; +-10%	MURATA	GRM39B473K16PT	N/A
C537	0.0027uF; 50V; +-10%	MURATA	GRM39B272K50PT	N/A
C538	0.01uF; 50V; +-5%	MURATA	GRM39B103K50PT	2113931F49
C539	0.039uF; 16V; +-10%	MURATA	GRM39B393K16PT	2113743E11
C540	0.0015uF; 50V; +-10%	MURATA	GRM39B152K50PT	2155169M11
C541	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	2113743E20
C542	390pF; 50V; +-10%	MURATA	GRM39B391K50PT	2113741F15
C543	0.0047uF; 50V; +-10%	MURATA	GRM39B472K50PT	N/A
C544	0.22uF; 50V; +-10%	MURATA	GRM39B224K10PT	N/A
C545	33uF; 6.3V; +-20%	NEC	TEMSVB20J336M8R	N/A
C546	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	2113743E20
C547	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	2113743E20
C550	0.01uF; 16V; +-2%	Panasonic	ECHU1C103GX5	DSCF097003
C551	0.01uF; 16V; +-2%	Panasonic	ECHU1C103GX5	DSCF097003
C601	0.01uF; 50V; +-5%	MURATA	GRM39B103K50PT	2113931F49
C602	0.0033uF; 50V; +-10%	MURATA	GRM39B332K50PT	2155169M15
C603	82pF; 50V; +-30%	MURATA	GRM39CH820J50PT	2113740F49
C604	0.0012uF; 50V; +-10%	MURATA	GRM39B122K50PT	2155169M10
C605	680pF; 50V; +10%	MURATA	GRM39B681K50PT	N/A
C606	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	2113743E20
C607	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	2113743E20
C608	NU			
C612	10pF; 50V; +-30%	MURATA	GRM39CH100D50PT	2113740F27
C615	0.01uF; 50V; +-5%	MURATA	GRM39B103K50PT	2113931F49
C616	0.027uF; 25V; +-10%	MURATA	GRM39B273K25PT	N/A
C617	0.0047uF; 50V; +-10%	MURATA	GRM39B472K50PT	N/A
C618	82pF; 50V; +-30%	MURATA	GRM39CH820J50PT	2113740F49
C619	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	2113743E20
C620	NU			
C621	0.001uF; 50V; +-5%	MURATA	GRM39B102K50PT	2113931F25
C622	0.001uF; 50V; +-5%	MURATA	GRM39B102K50PT	2113931F25
C623	0.01uF; 50V; +-5%	MURATA	GRM39B103K50PT	2113931F49
C624	220pF; 50V; +-10%	MURATA	GRM39B221K50PT	2155169M01
C625	4.7uF; 6.3V; +-20%	NEC	TEMSVA0J475M8R	N/A
C626	10uF; 6.3V; +-20%	NEC	TEMSVA0J106M8R	N/A
C627	470pF; 50V; +-10%	MURATA	GRM39B471K50PT	N/A
C628	1uF; 16V; +-20%	NEC	TESVA1C105M1-8R	N/A
C629	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	2113743E20
C630	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	2113743E20
C631	0.0082uF; 50V; +-10%	MURATA	GRM39B822K50PT	N/A
C632	68pF; 50V; +-30%	MURATA	GRM39CH680J50PT	2113740F47
C633	0.01uF; 50V; +-5%	MURATA	GRM39B103K50PT	2113931F49
C634	0.0018uF; 50V; +-10%	MURATA	GRM39B182K50PT	2155169M12
C636	100pF; 50V; +-30%	MURATA	GRM39CH101J50PT	2113740F51
C639	27pF; 50V; +-30%	MURATA	GRM39CH270J50PT	2113740F37

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
C641	0.22uF; 10V; +-10%	MURATA	GRM39B224K10PT	N/A
C642	0.0015uF; 50V; +-10%	MURATA	GRM39B152K50PT	2155169M11
C643	1uF; 6.3V; +-20%	MURATA	GRM39B105K6.3PT	2113928P04
C646	4.7uF; 50V; +-10%	MURATA	GRM21BB31A475KA7 4_+A02	N/A
C647	0.001uF; 50V; +-5%	MURATA	GRM39B102K50PT	2113931F25
C648	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	2113743E20
C701	0.001uF; 50V; +-5%	MURATA	GRM39B102K50PT	2113931F25
C702	0.001uF; 50V; +-5%	MURATA	GRM39B102K50PT	2113931F25
C703	0.22uF; 10V; +-10%	MURATA	GRM39B224K10PT	N/A
C704	4.7uF; 6.3V; +-20%	NEC	TEMSVA0J475M8R	N/A
C705	2.2uF; 16V; +-0%	MURATA	GRM40F225Z16PT	N/A
C706	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	2113743E20
C707	0.001uF; 50V; +-5%	MURATA	GRM39B102K50PT	2113931F25
C708	0.001uF; 50V; +-5%	MURATA	GRM39B102K50PT	2113931F25
C709	10uF; 6.3V; +-20%	NEC	TEMSVA0J106M8R	N/A
C710	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	2113743E20
C711	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	2113743E20
C713	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	2113743E20
C714	100pF; 50V; +-30%	MURATA	GRM39CH101J50PT	2113740F51
C715	100pF; 50V; +-30%	MURATA	GRM39CH101J50PT	2113740F51
C716	100pF; 50V; +-30%	MURATA	GRM39CH101J50PT	2113740F51
C717	100pF; 50V; +-30%	MURATA	GRM39CH101J50PT	2113740F51
C718	100pF; 50V; +-30%	MURATA	GRM39CH101J50PT	2113740F51
C719	100pF; 50V; +-30%	MURATA	GRM39CH101J50PT	2113740F51
CD501	Discriminator	Samsung	IFD0455C24E03	DSFL506003
CN201	Connector Contact	Motorola	09D86237A	N/A
CN701	Connector	Matsushita Denko	AXK6S40545J/P	DSCN097003
F401	NU			
F402	Filter , 45.1 Mhz	HERTZ	45N12A5 (45.1MHz) UM-5J-SMD	DSXF137006
F501		TOKO	BLFYM455D	N/A
F502		TOKO	ALFYM455G	N/A
J401	Antenna Jack	Motorola	02D04852J	N/A
J702		Molex	53047-0210	DSCN075035
J703		Hoshiden	HSJ1603-011020	N/A
J704		Hoshiden	HSJ1501-011120	N/A
L301	100nH	TOKO	LL1608-FSR10J (100nH)	2413926N24
L302	100nH	Sagami Elec	C2012C-R10J	N/A
L305	47nH	Sagami Elec	C2012C-47NG	2413923B12
L306	1uH	Sagami Elec	C2520C-1R0J	2462587N68
L307	Chip Emifil	MURATA	BLM21A121SPT	2480067M02
L312	1uH	TOKO	FSLM2520-1R0J	2485601J13
L313	47nH	Sagami Elec	C2012C-47NG	2413923B12
L314	56nH	Sagami Elec	C2012C-56NG	2413923B18
L315	47nH	Sagami Elec	C2012C-47NG	2413923B12
L317	47nH	Sagami Elec	C2012C-47NG	2413923B12
L318	1uH	Sagami Elec	C2520C-1R0J	2462587N68
L319		TOKO	A914BYW-470M=P3	N/A

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
L401	12nH	Sagami Elec	C2012C-12NJ	2462587V23
L402	12nH	Sagami Elec	C2012C-12NJ	2462587V23
L403	470nH	TOKO	FSLM2520-R47K	2485602J33
L404	12nH	Sagami Elec	C2012C-12NJ	2462587V23
L405	12nH	Sagami Elec	C2012C-12NJ	2462587V23
L406	Airwound Coil	UCHIDA/LETEST	E2-0.30-1.0-4TL	N/A
L407	Coil	LATEST	SMD-0314A	N/A
L408	Coil	LATEST	SMD-0314A	N/A
L409	33nH	TOKO	LL2012-FH33NJ (33nH)	2413926K17
L410	150nH	Sagami Elec	C2012C-R15J	2462587V36
L411	470nH	TOKO	FSLM2520-R47K	2485602J33
L413	Airwound Coil	UCHIDA/LETEST	E2-0.40-0.9-3TL	N/A
L414	Airwound Coil	UCHIDA/LETEST	E2-0.30-1.7-6TL	N/A
L415	Airwound Coil	UCHIDA/LETEST	E2-0.30-1.7-5TL	N/A
L416	Airwound Coil	UCHIDA/LETEST	E2-0.30-1.7-5TL	N/A
L417	1uH	TOKO	FSLM2520-1R0J	2485601J13
L418	Airwound Coil	UCHIDA/LETEST	E2-0.30-1.0-7TL	N/A
L419	Airwound Coil	UCHIDA/LETEST	E2-0.40-0.9-3TL	N/A
L420	Airwound Coil	UCHIDA/LETEST	E2-0.40-1.0-5TL	N/A
L421	39nH	Sagami Elec	C2012C-39NJ	2462587V29
L422	Airwound Coil	UCHIDA/LETEST	E2-0.40-0.9-3TL	N/A
L423	Airwound Coil	UCHIDA/LETEST	E2-0.30-1.0-6TL	N/A
L424	Airwound Coil	UCHIDA/LETEST	E2-0.30-1.0-5TL	N/A
L425	68nH	Sagami Elec	C2012C-68NJ	2462587V32
L426	Airwound Coil	UCHIDA/LETEST	E2-0.30-1.0-4TL	N/A
L427	100nH	TOKO	LL1608-FSR10J (100nH)	2413926N24
L428	100nH	TOKO	LL1608-FSR10J (100nH)	2413926N24
L429	Chip Beads	TDK	ZBFS5105-PT	N/A
L430	100nH	TOKO	LL1608-FSR10J (100nH)	2413926N24
L431	2.2uH	TDK	MLF1608A2R2KT	N/A
L702	390nH	Sagami Elec	C2012C-R39J	2462587V41
P701	SP WIRE Assembly	EU-connector	WC-013	N/A
PB201			K305E502	N/A
Q201	PNP	NEC	2SB798-T1 DK	N/A
Q202	DUAL NPN	Rohm	UMW1N TL	N/A
Q203	Single	Rohm	1SR154-400 TE25	4842006M02
Q204	IC, Regulator	TOREX	XC62HR5002PR	DSIC510004
Q208		Toshiba	RN2102	N/A
Q209		Toshiba	RN1102	N/A
Q210	PNP	Toshiba	2SA1362-GR TE85L	N/A
Q211		Toshiba	RN2110	N/A
Q308	NPN	Toshiba	2SC5086-Y TE85L	N/A
Q309	FET	NEC	2SJ243-T1	N/A
Q310	DUAL PNP/NPN	Rohm	UMC4N TR	N/A
Q311	Dual Varactor	Toshiba	1SV228-TPH3	N/A
Q314	PNP	Toshiba	2SA1586-GR TE85L	N/A
Q315	NPN	Toshiba	2SC4116-GR TE85L	N/A

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
Q316	Zener ;7.6V	Rohm	UDZ S 7.5B TE-17	N/A
Q319	Single	Rohm	1SS355 TE-17	4870360C15
Q323		Fujitsu	MB15A02PFV1-ER	DSIC042003
Q324	NPN	NEC	2SC4226-T1 R24	N/A
Q325	NPN	NEC	2SC4226-T1 R24	N/A
Q326	Dual Varactor	Toshiba	1SV228-TPH3	N/A
Q329	Varactor	Toshiba	1SV279-TPH3	N/A
Q330	NPN	Toshiba	2SC4116-GR TE85L	N/A
Q331	NPN	Toshiba	2SC4116-GR TE85L	N/A
Q332	Single	Rohm	RB521S-30 TE61	N/A
Q333		TOKO	TK11850LTL	N/A
Q334		Toshiba	TAR5S33	N/A
Q401	Dual Varactor	Toshiba	1SV225-TPH3	N/A
Q403	Dual Varactor	Toshiba	1SS362-TE85L	N/A
Q404	NPN	Toshiba	2SC5086-Y TE85L	N/A
Q405	Dual Varactor	Toshiba	1SV225-TPH3	N/A
Q407	Diode	HP	HSMS-2817 (B7)	N/A
Q408	NPN	Toshiba	2SC4215-Y TE85L	N/A
Q409	Single	Hitachi	HVU131TRF	N/A
Q410		(MA/COM)	MA4PH262	N/A
Q411	FET	Toshiba	2SK3476	DSTR013027
Q412	FET	Toshiba	2SK3475	DSTR013026
Q413	NPN	NEC	2SC3356-T1B R24	N/A
Q414	NPN	Toshiba	2SC5086-Y TE85L	N/A
Q415	Single	Hitachi	HSC277TRF	N/A
Q416	NPN	Toshiba	2SC5086-Y TE85L	N/A
Q417		Toshiba	RN1102	N/A
Q418		Toshiba	RN1104	N/A
Q419		TI	LM2904PW	N/A
Q501	DUAL PNP/NPN	Rohm	UMC4N TR	N/A
Q502		TI	LM2902DTB	N/A
Q503	FET	Toshiba	2SJ144Y-TE85L	N/A
Q504		Toshiba	RN1104	N/A
Q505		TI	LM2902DTB	N/A
Q506	IF IC	Toshiba	TA31136FN-TP1	DSIC013007
Q507	Dual	Rohm	DAN235ETL	N/A
Q508	Dual	Rohm	DAN235ETL	N/A
Q509		Toshiba	RN2104	N/A
Q510	IC, Op-Amp	JRC	NJM2107F (TE1)	DSIC025016
Q511	Single	Rohm	RB521S-30 TE61	N/A
Q512	Single	Hitachi	HSC277TRF	N/A
Q513	Single	Rohm	RB521S-30 TE61	N/A
Q601		Toshiba	RN1104	N/A
Q602		TI	LM2902DTB	N/A
Q604	Single	Rohm	RB521S-30 TE61	N/A
Q605		Toshiba	RN1104	N/A
Q608		Toshiba	RN1104	N/A
Q609	DUAL NPN	Rohm	UMG2N TR	N/A
Q610		TI	LM2902DTB	N/A
Q613		Toshiba	RN2104	N/A
Q615		Toshiba	1SS361	N/A

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
Q616	FET	Toshiba	SSM3K03FE-TE85L	N/A
Q617	IC, Op-Amp	JRC	NJM2107F (TE1)	DSIC025016
Q701		Toshiba	RN1104	N/A
Q702	IC, Audio Amplifier	Philips	TDA8541T/N1	DSIC174004
Q703		Toshiba	RN1104	N/A
Q704	PNP	Toshiba	2SA1586-GR TE85L	N/A
Q705	Single	Rohm	1SR154-400 TE25	4842006M02
Q706	Zener;6.9V	Rohm	UDZ S 6.8B TE-17	4842006M03
Q713		Toshiba	2SC2859	N/A
Q714	NPN	Toshiba	2SC4116-GR TE85L	N/A
Q715	Zener;20.39V	Rohm	UDZ S 20B TE-17	N/A
R201	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R202	2.2 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 222	0662057A57
R203	4.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 472	0662057A65
R204	4.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 472	0662057A65
R205	Chip Thermister	Hokuriku	NSM3503J400J (50K ohm)	N/A
R209	10 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 100	0662057A01
R210	22 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 220	0662057A09
R211	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R212	100 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 101	0662057A25
R213	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R214	5.6 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 562	0662057A61
R310	100 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 101	0662057A25
R311	15 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 153	0662057A77
R312	220 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 221	0662057A33
R313	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R314	0 ohm; 0.1W; +-0.05 ohm	Rohm	MCR03 EZHJ 000	0662057B47
R315	2.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 272	0662057A59
R316	1.5 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 152	0662057A53
R317	2.2 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 222	0662057A57
R318	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R319	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R320	1.5 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 152	0662057A53
R321	6.8 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 682	0662057A69
R322	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R323	Chip Network Resistor	Hokuriku	CRA168-472J	DSRA508001
R335	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R336	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R338	220 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 221	0662057A33
R339	15 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 150	0662057A05
R340	22 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 223	0662057A81
R341	NU			
R342	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R343	2.2 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 222	0662057A57
R346	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R347	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R349	1 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 102	0662057A49
R350	4.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 472	0662057A65
R356	4.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 472	0662057A65

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
R357	10 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 100	0662057A01
R358	47 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 470	0662057A17
R359	4.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 472	0662057A65
R361	22 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 223	0662057A81
R362	22 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 223	0662057A81
R363	470 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 471	0662057A41
R364	2.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 272	0662057A59
R365	470 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 471	0662057A41
R366	470 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 471	0662057A41
R371	100 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 101	0662057A25
R372	1 ohm	Hokuriku	CR1/161R0JV	N/A
R373	5.6 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 562	0662057A61
R374	120 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 124	0662057A99
R375	220 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 221	0662057A33
R376	100 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 101	0662057A25
R377	0 ohm; 0.1W; +-0.05 ohm	Rohm	MCR03 EZHJ 000	0662057B47
R401	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R402	5.6 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 562	0662057A61
R403	3.3 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 332	0662057A61
R404	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R405	2.2 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 2R2	0662057W09
R406	0 ohm; 0.1W; +-0.05 ohm	Rohm	MCR03 EZHJ 000	0662057B47
R407	10 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 100	0662057A01
R408	1 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 102	0662057A49
R409	390 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 391	0662057A39
R410	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R411	NU			
R412	NU			
R413	56 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 560	0662057A19
R414	0 ohm; 0.1W; +-0.05 ohm	Rohm	MCR03 EZHJ 000	0662057B47
R415	150 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 154	0662057B02
R416	1.8Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 182	0662057A55
R418	39 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 390	0662057A15
R419	220 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 221	0662057A33
R420	100 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 101	0662057A25
R421	120 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 121	0662057A27
R422	39 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 390	0662057A15
R423	22 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 223	0662057A81
R424	12 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 123	0662057A75
R425	NU			
R426	100 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 101	0662057A25
R427	12 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 123	0662057A75
R428	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R429	470 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 471	0662057A41
R430	100 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 101	0662057A25
R431	15 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 153	0662057A77
R432	220 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 221	0662057A33
R433	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
R434	10 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 100	0662057A01
R435	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R436	4.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 472	0662057A65
R437	680 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 681	0662057A45
R438	4.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 4R7	0662057W17
R439	15 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 153	0662057A77
R440	4.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 472	0662057A65
R441	1 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 102	0662057A49
R442	330 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 331	0662057A37
R443	330 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 331	0662057A37
R444	22 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 220	0662057A09
R445		Hokuriku	LPR1R100FE (0.1ohm 1W)	N/A
R446	100 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 1003	0662057P95
R447	100 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 1003	0662057P95
R448	97.6K ohm 1%	Rohm	MCR03 EZHF 9762	0662057P81
R449	100 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 1003	0662057P95
R450	100 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 1003	0662057P95
R451	100 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 1003	0662057P95
R452	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R453	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R454	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R455	27 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 273	0662057A83
R456	1 Mohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 105	0662057B22
R457	15 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 153	0662057A77
R459	NU			
R466	1 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 102	0662057A49
R468	0 ohm; 0.1W; +-0.05 ohm	Rohm	MCR03 EZHJ 000	0662057B47
R469	NU			
R470	22 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 220	0662057A09
R501	0 ohm; 0.1W; +-0.05 ohm	Rohm	MCR03 EZHJ 000	0662057B47
R502	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R503	2.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 272	0662057A59
R505	2.2 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 222	0662057A57
R506	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R507	1 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 102	0662057A49
R508	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R509	68 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 683	0662057A93
R510	470 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 474	0662057B14
R511	56 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 563	0662057A91
R512	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R513	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R514	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R515	25.5 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 2552	0662057T92
R516	29.4 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 2942	0662057P29
R517	15.8 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 1582	0662057Z03
R518	11.5 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 1152	0662057Z35
R519	150 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 1503	0662057P97
R520	4.22 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 4221	N/A

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
R521	715 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 7153	0662057T99
R522	NU			
R523	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R524	2.2 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 222	0662057A57
R525	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R526	0 ohm; 0.1W; +-0.05 ohm	Rohm	MCR03 EZHJ 000	0662057B47
R527	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R530	22 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 223	0662057A81
R531	22 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 223	0662057A81
R532	1.5Mohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 155	0662057B26
R534	330 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 334	0662057B10
R535	2.2 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 222	0662057A57
R536	1 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 102	0662057A49
R537	470 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 474	0662057B14
R538	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R539	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R540	22 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 223	0662057A81
R541	22 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 223	0662057A81
R542	22 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 223	0662057A81
R543	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R544	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R545	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R546	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R547	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R548	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R549	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R550	1 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 102	0662057A49
R551	0 ohm; 0.1W; +-0.05 ohm	Rohm	MCR03 EZHJ 000	0662057B47
R560	5.6 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHF 562	0662057A67
R561	634 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 6343	N/A
R569	1 Kohm; 0.25W; +-5%	Rohm	CR1/4-102J	N/A
R570	120 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 124	0662057A99
R571	220K ohm	MURATA	NPC18WM224K03RB (220K ohm)	N/A
R601	680 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 684	0662057B18
R602	6.8 Kohm; 0.25W; +-5%	Rohm	MCR03 EZHJ 682	0662057A69
R604	6.8 Kohm; 0.25W; +-5%	Rohm	MCR03 EZHJ 682	0662057A69
R605	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R606	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R607	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R608	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R609	680 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 684	0662057B18
R610	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R611	Chip Thermistor	Hokuriku	NSM3503J400J (50K ohm)	N/A
R612	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R615	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R616	22 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 223	0662057A81
R617	120 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 124	0662057A99

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
R620	4.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 472	0662057A65
R621	270 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 274	0662057B08
R622	0 ohm; 0.1W; +-0.05 ohm	Rohm	MCR03 EZHJ 000	0662057B47
R625	18 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 183	0662057A79
R626	18 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 183	0662057A79
R627	680 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 684	0662057B18
R628	0 ohm; 0.1W; +-0.05 ohm	Rohm	MCR03 EZHJ 000	0662057B47
R629	NU			
R631	NU			
R632	0 ohm; 0.1W; +-0.05 ohm	Rohm	MCR03 EZHJ 000	0662057B47
R633	12 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 123	0662057A75
R634	680 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 684	0662057B18
R635	1.2 Mohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 125	0662057B24
R636	0 ohm; 0.1W; +-0.05 ohm	Rohm	MCR03 EZHJ 000	0662057B47
R637	0 ohm; 0.1W; +-0.05 ohm	Rohm	MCR03 EZHJ 000	0662057B47
R638	330 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 334	0662057B10
R639	150 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 154	0662057B02
R640	150 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 154	0662057B02
R641	680 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 684	0662057B18
R642	33 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 3302	N/A
R643	22 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 2202	N/A
R645	1 Mohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 105	0662057B22
R646	3.3 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 332	0662057A61
R648	68 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 683	0662057A93
R649	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R650	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R651	120 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 124	0662057A99
R652	33 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 333	0662057A85
R654	2.2 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 222	0662057A57
R655	4.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 472	0662057A65
R658	820 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 821	0662057A47
R659	12 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 123	0662057A75
R660	68 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 683	0662057A93
R661	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R663	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R669	0 ohm; 0.1W; +-0.05 ohm	Rohm	MCR03 EZHJ 000	0662057B47
R675	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R676	NU			
R677	56 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 563	0662057A91
R678	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R679	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R680	120 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 124	0662057A99
R681	220 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 224	0662057B06
R701	2.2 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 222	0662057A57
R702	1.5 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 152	0662057A53

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
R703	470 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 474	0662057B14
R704	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R705	22 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 220	0662057A09
R706	470 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 471	0662057A41
R707	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R708	2.2 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 222	0662057A57
R709	0 ohm; 0.1W; +-5%	Rohm	MCR10 EZHJ 000	0662057B47
R710	100 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 101	0662057A25
R711	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R716	0 ohm; 0.1W; +-5%	Rohm	MCR10 EZHJ 000	0662057B47
R717	0 ohm; 0.1W; +-5%	Rohm	MCR10 EZHJ 000	0662057B47
R720	220 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 221	0662057A33
R721	4.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 472	0662057A65
RV601		Hokuriku	VG025CHXTB103	N/A
RV602		Hokuriku	VG025CHXTB103	N/A
RV603		Hokuriku	VG025CHXTB103	N/A
SP701	SPEAKER	Orient Sound	K028NA (S09139)	N/A
SW201	Potentiometer	TOCOS	TP76N17N A10Kohm 10SK	N/A
X301		NDK	HKE3065B	N/A
X501		NDK	HU-816-106	N/A

Chapter 8 UHF (435-480 MHz) Band Information

8.1 Model Charts

Business Portable Radio, VHF 136-174 MHz			
Model		Description	
AAH49RCF8AA1A_		Business Portable, 435-480 MHz, 2-5W, 12.5/25 kHz, 16 Ch.	
	AAH49RCF8AA1A_	Business Portable, 435-480 MHz, 2-5W, 12.5/25 kHz, 4 Ch.	
	Item	Description	
X		PMUD1925_	Business Portable, 435-480 MHz, 2-5W, 12.5/25 kHz, 16 Ch.
	X	PMUD1922_	Business Portable, 435-480 MHz, 2-5W, 12.5/25 kHz, 4 Ch.
	X	DSAXRK210004	Front Housing Kit, Black CP125
X		DSAXRK210001	Front Housing Kit, Black BC120
X	X	DSAXRK210002	Front Housing Kit, Grey
X	X	PMDN4061_	Chassis Hardware Kit (1-Piece Audio Jack R2)
X	X	DS1M001120	Chassis Hardware Kit (2-Piece Audio Jack)
X	X	DSAXRA110001	Volume Knob Assembly
X	X	DSAXRK290001	LCD Kit
X	X	DSAXRA220001	Speaker Assembly
X	X	DSAXRM2B0001	Screw M2.6
X	X	DSAXRM2A0001	Battery Contact Gasket
X	X	DSAXRM250001	Main Gasket
X	X	DSAXRM120001	Volume Knob Gasket
X	X	DSAXRM2C0001	Gasket (Screw 26)
X	X	PMDN4063A	Back Chassis Kit (1-Piece Audio Jack)
X	X	DSM5190001	Back Chassis Kit (2-Piece Audio Jack)
X	X	DSAXRM140001	PTT Button
X	X	PMNN4063_R	Battery Std NiMH
X	X	PMAE4003_	UHF Helical 9cm Antenna, 403-470 MHz
X	X	PMAE4011_	UHF Helical 10cm Antenna, 435-480 MHz
X	X	NAE6483_	Standard UHF Whip Antenna, 403-520 MHz
X	X	PMTN4087_	Standard Rapid Rate Charger Kit, 120V

Business Portable Radio, VHF 136-174 MHz			
Model			Description
	X	3380384W23	CP125 Nameplate
X		DSAXRM160001	BC120 Nameplate
X	X	HLN9844_	2" Spring Belt Clip
X		6881096C35	Business Portable Radio User Guide (English)
	X	6881098C60	CP125 Radio User Guide (English/French)

X = indicates one of each is required.

8.2 Specifications

General

	UHF	
Frequency:	435-480 MHz	
Channel Capacity:	16, 4	
Power Supply:	7.5 Volts \pm 20%	
Dimensions with Standard High Capacity NiMH Battery:	115.5mm x 56mm x 35mm	
Weight: with Standard High Capacity NiMH Battery:	350 g	
Average Battery Life @ (5-5-90 Duty Cycle)	(Low Power) >11 hrs	(High Power) >8 hrs
Sealing:	Passes rain testing per IPX4 (EN60529=1991)	
Shock and Vibration:	Meets MIL STD 810C, D and E	
Dust:	Meets MIL STD 810C, D and E	
Humidity:	Weather resistant housing passes EIA RS-316B	

Transmitter

	UHF	
RF Output NiMH @ 7.5V:	Low 2 W	High 4 W
Channel Spacing	12.5/25 kHz	
Freq. Stability (-30°C to +60°C)	0.00025%	
Spurs/Harmonics:	-26 dBm	
Audio Response: (from 6 dB/oct. Pre-Emphasis, 300 to 3000Hz)	+1, -3 dB	
Audio Distortion: @ 1000 Hz, 60% Rated Max. Dev.	<5%	
FM Noise:	40 dB	

Receiver

	UHF 12.5kHz	UHF 25kHz
Sensitivity 12dB SINAD:	0.25 μ V	0.25 μ V
Adjacent Channel Selectivity EIA	60 dB	65 dB
Intermodulation	60 dB	65 dB
Spur Rejection:	60 dB	65 dB
Image Rejection:	60 dB	65 dB
Hum and Noise	40 dB	
Audio Distortion	< 5%	
Conducted Emmission	-57 dBm	
Audio Output @ <5% Distortion	500 mW	500 mW

8.3 Theory of Operation

8.3.1 General Information

Your radio has two printed circuit boards: the Controller board, and the Radio Frequency and Audio Frequency (RF) board. The Controller board contains the CPU/Control section. The RF board contains the VCO/Synthesizer section, Transmitter section, Receiver section, Transmitter Audio circuitry, Receiver Audio circuitry, and Battery section.

8.3.2 Power Distribution

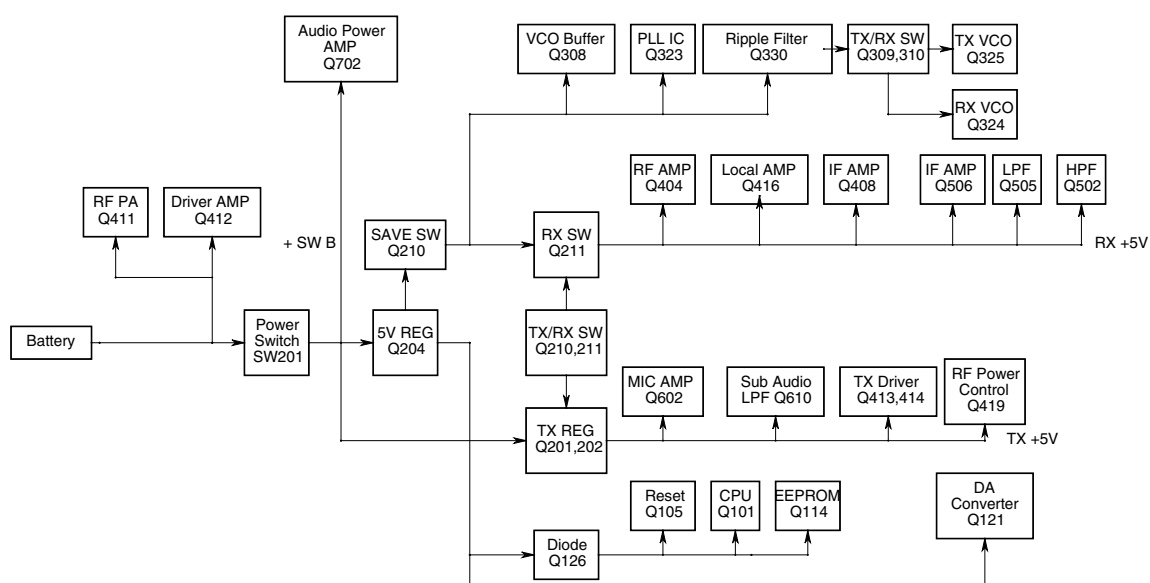


Figure 8-1.

The above figure illustrates the DC distribution throughout the radio board. A battery supplies power directly to the electronic on/off control. Radio power supply is triggered by the **Power Switch** (On/Off/Volume control) and **+SW B** is distributed as show in the figure. Regulator output 5V is supplied to the CPU. **+SW B** continues to support the Audio Power AMP, 5V Regulator, TX Regulator until the radio is turned off.

The radio can be turned off on two ways:

1. **Power Switch** turned-off
2. Low Battery

When a low battery level is detected by the CPU, it stores the radio personality data to EEPROM before turning off the radio.

8.3.3 Power up Sequence

1. Power supply is turned on by the On/Off/Volume Control (Power Switch).
2. Power from battery is supplied to the regulator through the switch.
3. Output (5V) from the regulator is directed to the CPU (**Q101**).
4. **Q105** resets the CPU (**Q101**).
5. The CPU loads radio personality data from EEPROM after the reset.
6. This personality data is used to initialize the radio.

7. The radio restores last power up state (i.e. state before the radio was turned-off).
8. Power is supplied to PLL circuitry.
9. Power is supplied to Rx and Rx VCO circuitry.
10. CPU sends data to PLL circuitry. If LOCK status is confirmed, radio continues the power-up sequence. Otherwise, PLL ERR is displayed.
11. Squelch level is checked.
12. If the Rx audio level is less than the pre-programmed squelch level, and other unmuting conditions are met, the radio will open squelch.

8.3.4 CPU / Control Section

When the radio is turned ON, the CPU (**Q101**) reads the radio status from the EEPROM **Q114**. It also monitors the keypad, the PTT line and other inputs such as the squelch detect, etc. continuously. When there is a channel change, the CPU sends the correct frequency information to the synthesizer via pins 2, 100, and 89. The CPU is clocked by the 8.388608MHz oscillator, which is composed of **X101**, **C101**, **C106**, and **R158**.

8.3.5 VCO / Synthesizer Section

This section consists of the Temperature-Compensated Crystal Oscillator (TCXO), Voltage Controlled Oscillator (VCO), Synthesizer and the Loop Filter. These circuits are found on the RF board.

8.3.5.1 Temperature-Compensated Crystal Oscillator (TCXO)

The reference oscillator is a temperature compensated crystal-controlled, Pierce type circuit. It utilizes a logic gate within **Q323** as a gain element. **C335** is used to adjust the oscillator on frequency (14.4 MHz) at room temperature (22°C). Temperature variations cause resistance changes in thermistor **R330** and **R567**, which is on the base of **Q320**, thus varying the voltage applied to varactor **Q322**. This changes the impedance across crystal **X301** in a manner complementary to the temperature drift characteristic of the crystal. In this way, the reference oscillator is held within the specified ± 2.5 PPM from -30 to +60°C.

8.3.5.2 Voltage-Controlled Oscillators

Only one of the VCOs runs at a time, which is controlled by **Q317** and **Q101**. The receive VCO consists of **C344-C351**, **L302-L305**, **Q302** and **Q311**. This VCO oscillates at 45.1 MHz above the programmed receive frequency. The VCO's oscillating frequency is tuned by the varactor **Q311**. The tuning voltage is supplied from the output of the Loop Filter. The output of the VCO is AC coupled (**C311**) to the synthesizer and the output buffer **Q308** respectively. The output of the VCO buffer **Q308** is AC coupled (**C312**, **C313**, **C463**, and **R439-R441**) to the synthesizer and the output buffer **Q416** respectively.

When the PTT is pressed, **Q101** pin36 goes low (approx. 0V) disabling the receive VCO by the **Q317** and biases on **Q916** to enable the transmitter VCO. The transmitter VCO consists of **C352**, **C935-C938**, **L307-L309**, **Q303**, **Q921**, and **Q922**. This VCO oscillates on the programmed transmit frequency. The VCO's oscillating frequency is tuned by the varactor **Q922**. The tuning voltage is directed from the output of the Loop Filter. The transmit voltage controlled oscillator is directly frequency-modulated and operates on the carrier frequency. In the receive mode, the transmit VCO is disabled and the receive VCO is enabled, producing the receive local oscillator signal at a frequency 45.1 MHz above the incoming receive frequency. The synthesizer is tuned in 5.00 kHz or 6.25 kHz steps.

8.3.5.3 Synthesizer

The frequency synthesizer is a large-scale monolithic synthesizer integrated circuit **Q323**. The synthesizer IC contains a dual modulus prescaler, programmable divide-by-N counter, prescale control (swallow) counter, reference oscillator, reference divider, phase detector, charge pump and lock detector. Also, included in **Q323** are shift registers and control circuits for frequency controls and general device control.

RF output from the active VCO is AC coupled to the synthesizer **Q323** prescaler input at Pin 8. The divide counter chain in **Q323**, consisting of the dual-modulus prescaler, swallow counter and programmable counter, divides the VCO signal down to a frequency very close to 5.00 kHz or 6.25 kHz which is applied to the phase detector. The phase comparator compares the phase with the 5.00 kHz or 6.25 kHz reference signal from the reference divider and drives the external charge pump (**Q314**, **Q315** and **Q301**). The synthesizer unlock detector circuit prevents the operation of the transmitter and receiver, when the phase lock loop (PLL) is unlocked. The following discussion assumes the unit has been placed in the transmit mode. **Q323** lock detector Pin 7 goes high when the PLL is locked. This high level is applied to Pin 25 of the CPU **Q101**. A software timing routing brings the RX/TX line low (Pin 36 of **Q101**). With the RX/TX line goes low, **Q209** is cut off and **Q208** is biased on passing **+5VTX-B** to **Q202**; it biases on **Q201** to pass switched **TX-B** to the transmitter amplifier string which enables transmission.

When the PLL is unlocked, the lock detector at **Q323** Pin 7 begins pulsing low. An RC circuit converts this low pulse to a low level for the CPU. The CPU then changes the RX/TX line to a high, thus signaling the other transistor switches to drive **Q201** into cutoff, which disables transmission. Therefore, the transmitter remains disabled while the loop remains out of lock, and "PLL ERR" is displayed.

8.3.5.4 Loop Filter

The Loop Filter, a passive lead-lag filter consisting of **R314-R317**, **R356**, **C323**, **C369**, and **C371** integrates the charge pump output to produce the DC tuning voltage for the VCO. One parasitic pole, consisting of RF chokes **L306** and **L310**, prevent modulation of the VCOs by the 5.00 kHz or 6.25 kHz reference energy remaining at the output of the loop filter. Direct FM is obtained for modulating frequencies outside the PLL bandwidth by applying the CTCSS/DCS signals and the pre-emphasized, limited microphone audio to the VCO modulation circuit. The modulation circuit consists of **R329** and **Q921**.

8.3.6 Transmitter Section

8.3.6.1 RF Power Amplifier

After the PTT is pressed, the **+5VTX-B** line switches to approximately 5V. **Q916** is turned on, enabling transmit VCO. The VCO buffer, pre-driver, driver and power amplifier are biased on by **Q201**. **Q201** is biased on by the **+5VTX-B** line switching to 5V. RF output from the transmit VCO (**Q303**) is applied to the VCO output buffer **Q308**. Output from **Q308** feeds the buffer **Q414**. The output signal from **Q414** feeds the pre-driver amplifier **Q413**, and feeds the driver amplifier **Q412**, whose output from the driver stage feeds the final RF power amplifier **Q411** to produce the rated output power of 5 watts. The final output is feed to a low-pass filter (**C435-437**, **C491-C493**, **L418**, and **L419**) and then to the transmit/receive switch **Q410**. RF power is then fed to the antenna via the output low-pass filter consisting of **C440-C445**, **L415**, and **L416**.

8.3.6.2 Antenna Switching

Switching of the antenna between the transmitter and the receiver is accomplished by the antenna transmit/receive switch consisting of diodes **Q409** and **Q410**. In the transmit mode, switched **TX B+** is applied through **R419** and RF choke **L417**, hard forward biasing the two diodes on **Q410**, thus permitting the flow of RF power from the output of the low-pass filter. **L414** and **C455** isolate the receiver circuit from the transmitter power input.

8.3.7 Power Control

Output power is controlled by the CPU (**Q101**), the D/A converter (**Q121**), the dual Op-Amp (**Q419**), which is used as a differential amplifier and comparator. Current is sensed by the voltage drop across **R445**. When the radio is in high power mode, this voltage is compared to the D/A converter voltage at 5-watt. When the radio is in low power mode, this voltage is compared to the D/A converter voltage at 1-watt. The power output is then reduced or increased by varying the applied voltage to the gate of the power amplifier **Q411** and **Q412**.

8.3.7.1 Transmitter Audio Circuits

The transmitter audio circuits consist of the audio processing circuits, the CTCSS circuits and the DCS circuits.

8.3.7.1.1 Audio Processing

Transmit speech audio is provided by either the internal electric microphone **M101** or the external microphone. The audio is pre-emphasized by 6 dB per octave by **C615** and **R655**, and then its signal is amplified. The microphone audio is directed to amplifier **Q602B**, **Q602A** and low-pass filter **Q602C** and **Q602D**. **Q602A** has limiting function. The modulation adjustment is done by potentiometer **RV601**, and directed to a four-pole active low-pass filter. The resulting signal is then limited, and is directed to a low pass filter (-18 dB per octave roll-off above 3 kHz). The audio is then directed through the 25 kHz/12.5 kHz channel spacing SW **Q601** to varactor diode **Q329** in transmit VCO. By varying the voltage on the varactor diode **Q329** at an audio rate, VCO output is frequency-modulated.

8.3.7.1.2 CTCSS Tone Encoder / Digital Code Squelch (DCS) Encoder

CTCSS signals and DCS signals are synthesized by CPU **Q101** and appear as pulse waveform on I/O line Pin 7. This I/O line is connected to a digital-to-analog converter network (consisting of **C136**, **C173**, **R150**, **R177**, and **R182**), which produces a pseudo-sine wave at its output. The waveform is smoothed by low pass filters **Q610B** to produce an acceptable sine wave output. The CTCSS tone signal is adjusted to the proper level by **RV602**.

8.3.8 Receiver Section

8.3.8.1 Receiver Front End

In the receive mode, the RF signal enters through the antenna, then through the low-pass filter **C439-C445**, and **L414-L416**. The diodes **Q409** and **Q410** are biased off, so that the output of the low-pass filter is coupled (C432, C433, and L418) to the first band-pass filter **C401-C407**, C408, C409, **L401**, **L402**, **Q401**, and **Q402** and to the Front End RF overload protection diode pair **Q403**. The signal from the band-pass filter is directed to the input of the RF amplifier **Q404**. The output of the RF amplifier is directed to three stages of band-pass filters, consisting of **C413-C417**, **C487**, **L404-L406**, **Q405**, **Q406**, **R408**, and **R410**. The output from the band-pass filter is directed to the mixer's **Q407** and **L408**.

8.3.8.2 Local Oscillator (LO)

The Receive VCO (**C314**, **C315**, **C913**, **C918**, **L302- L305**, **Q302**, and **Q311**) provides the LO signal. The VCO is running at 45.1 MHz above the desired receive frequency and is applied to output Buffer **Q308** and **Q416**. The output of the buffer is sent through the low-pass filter **C423** and **L410** and to the mixer **Q407** and **L409**.

8.3.8.3 Mixer

The mixer is a DBM type (**L407**, **L408**, **Q407**). The mixer LO frequency is 45.1 MHz above the desired receiver frequency. When the receiver frequency is present, the mixer output will be a 45.1 MHz signal. The mixer output is peaked for 45.1 MHz at **L410**, **C432** and **R413**, and the signal is filtered by crystal filter **F402** and amplified by **Q408** before being sent to the input of the IF IC **Q506**. The 45.1 MHz IF signal and LO frequency of 44.645 MHz (**X501**) are mixed in **Q506**. The 455 kHz ceramic filter **F501** or **F502** filters the second mixer's output. The resulting signal is the second IF signal. The mixer's output is then fed to the internal limiting amplifier, and consequently to the FM decoder.

8.3.8.4 FM Detector and Squelch

The FM detector output is used for squelch, decoding tones and audio output. The squelch amplifier is inside of **Q506**, and its output is fed to an internal rectifier and squelch detector. The output on **Q506** Pin 14 signals the CPU **Q101** with a low (~0 V) to unmute the radio. The audio is unmuted by the CPU **Q101** Pin 41 switching to a high (~5 V), thus biasing on **Q503**. The audio is then routed to the audio amplifier **Q702** via the volume control **SW201**.

8.3.8.5 Receiver Audio Circuit

The detector's audio output also is fed to the tone (CTCSS and DCS) low-pass filter **Q505A**. Then the output of the low-pass filter is routed to the second stage filter **Q505B**. The output of **Q505B** is passed to **Q505C**. The output of **Q505C** is directed to the squaring circuit **Q505D**, and finally to the CPU **Q101** Pin 22 for decoding.

The detector output feeds the audio high-pass filter **Q502**. The output of the audio high-pass filter feeds the Volume Control **SW201** (VOL). From the wiper arm on the Volume Control, the audio is routed to Pin 4, which is the input to the audio power amplifier **Q702**. The output of the audio power amplifier is routed through the earphone jack **J701** to the internal speaker **SP701**.

8.3.9 Battery Section

The battery connects to the contact (**CN201**). The positive terminal of the battery connects to the ON/OFF Volume control switch (**SW201**), and the negative terminal connects to PWB ground. Low battery is detected by **R127** and **R128** and voltage regulator **Q204**.

Battery voltage status is monitored by Pin 19 of the CPU **Q101** through **R127** and **R128**. When the battery voltage goes below the threshold voltage, "LOW BATT" is displayed on LCD **LC101**. When the radio is on a channel with no tone programmed, the BATTERY SAVER Mode is enabled when programmed. In the BATTERY SAVER Mode, the CPU **Q101** generates a square wave signal on Pin 37. The signal's duty cycle varies according to what the BATTERY SAVE TIMER is set. When the signal goes high (approximately 5 V), **Q210** is biased off, and **Q211** is cut off, thus turning the supply off to IF IC **Q506**.

8.4 Block Diagrams

8.4.1 Complete

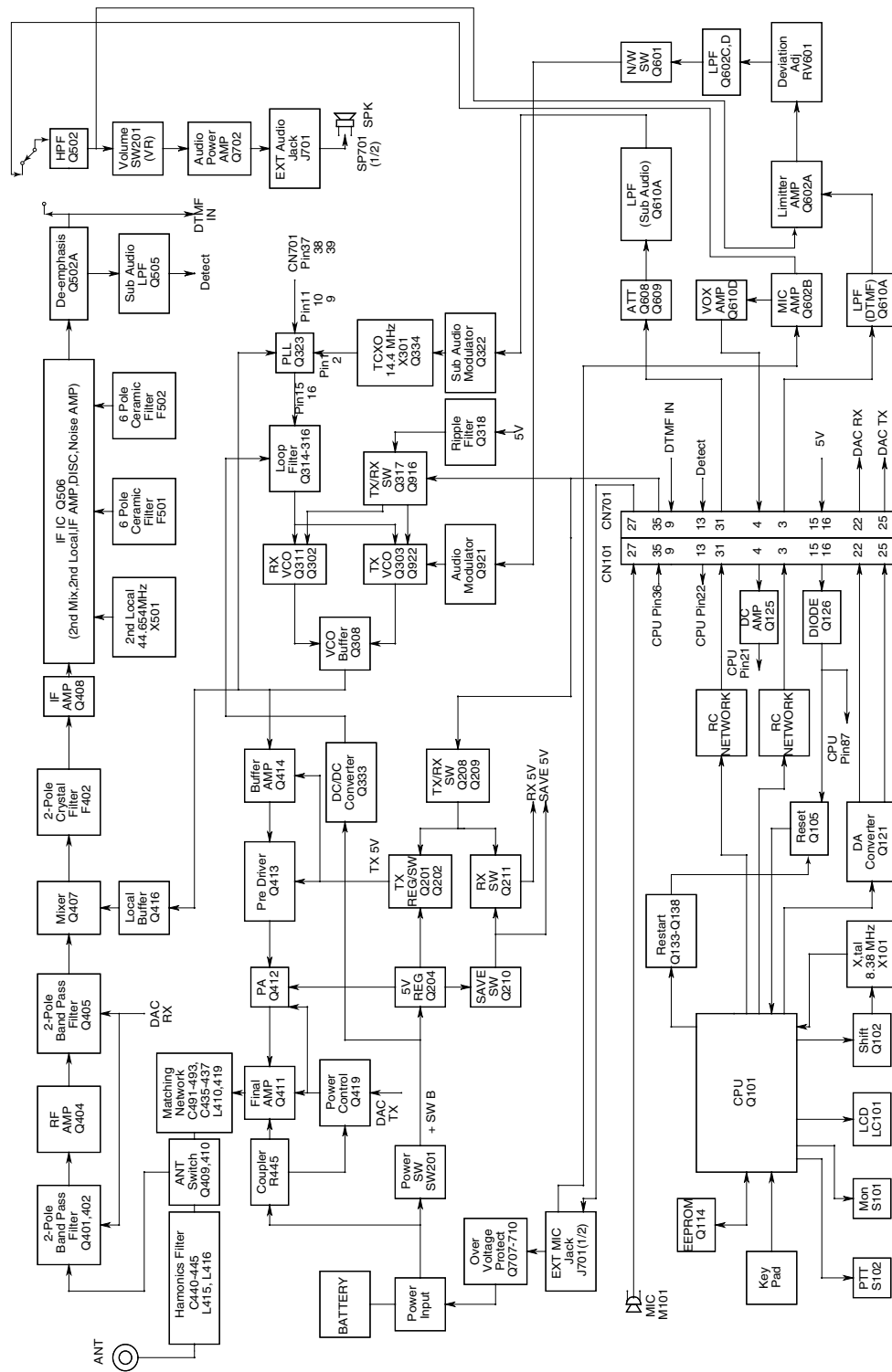


Figure 8-2.

8.4.2 Controller

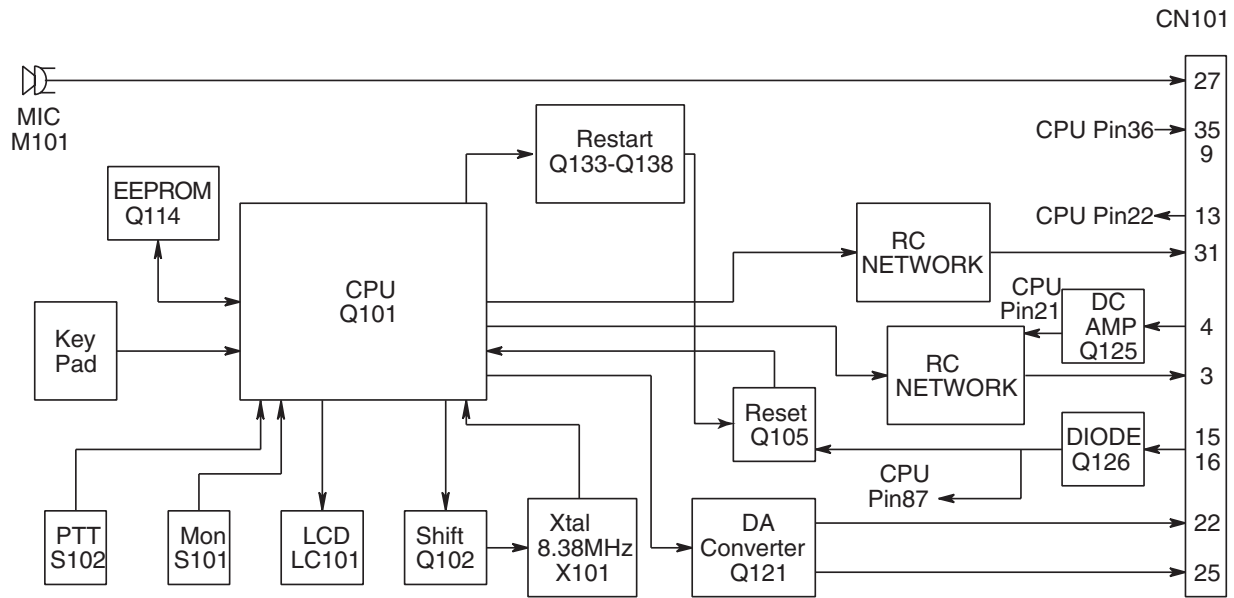


Figure 8-3.

8.4.3 VCO

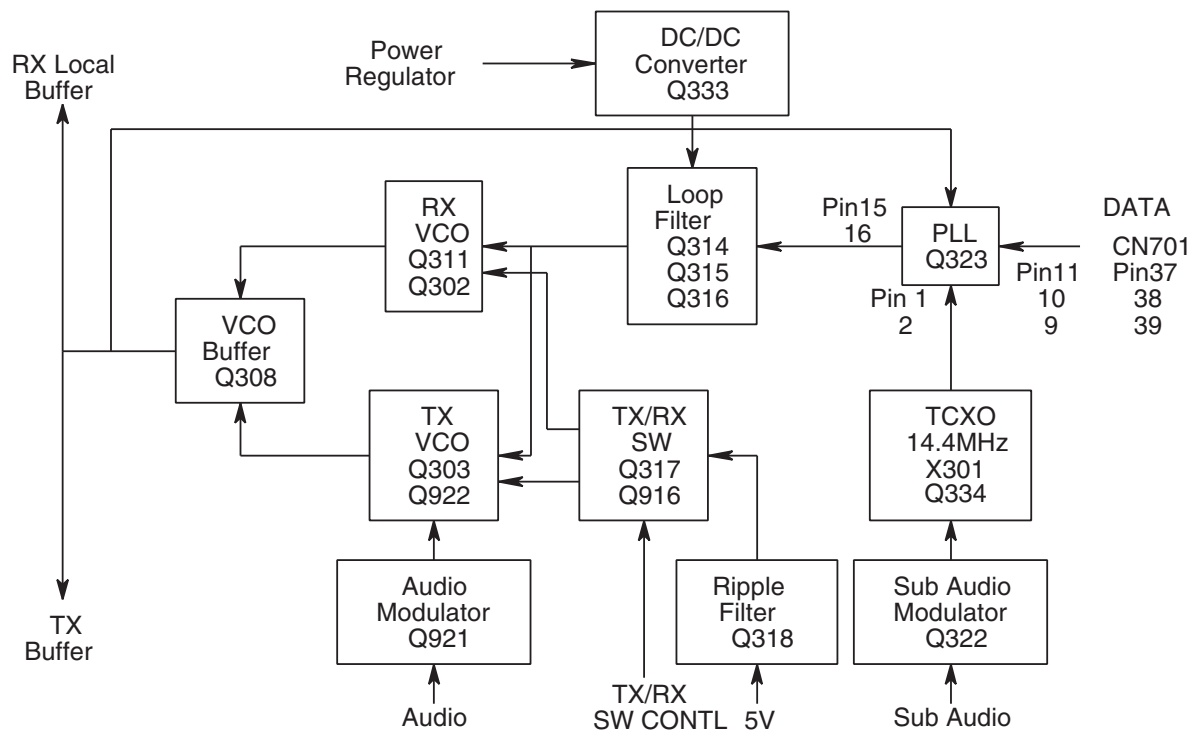


Figure 8-4.

8.4.4 Transmitter

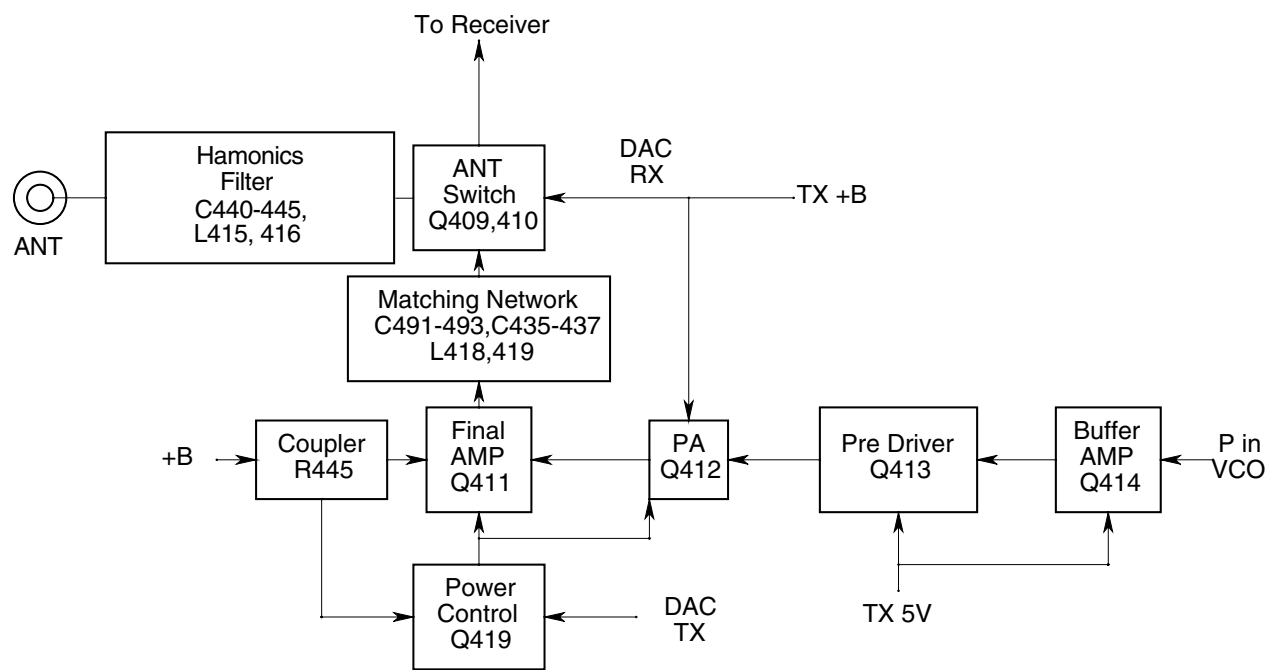


Figure 8-5.

8.4.5 Receiver

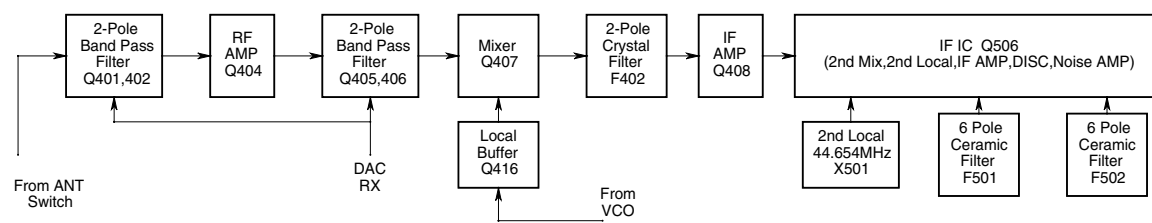
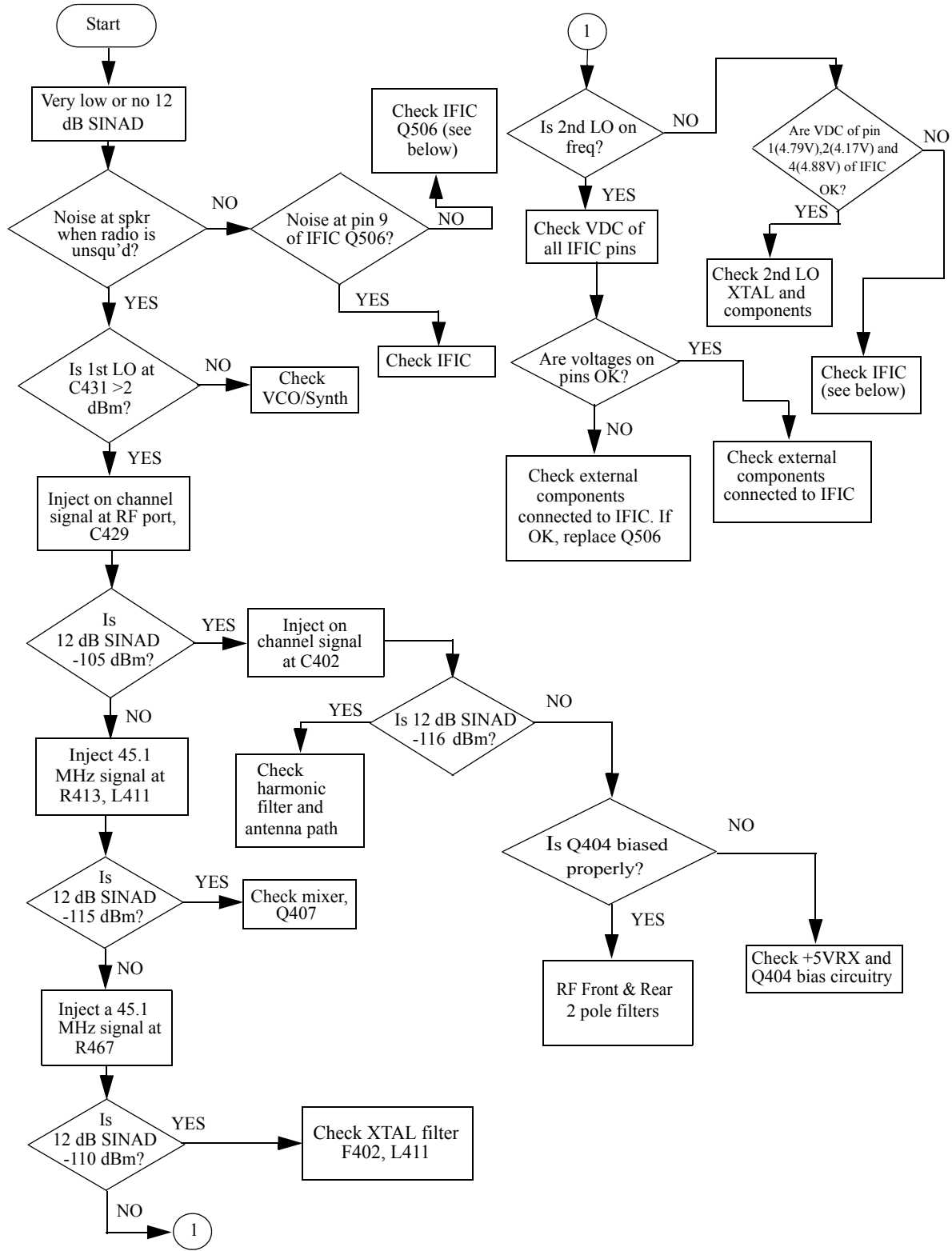


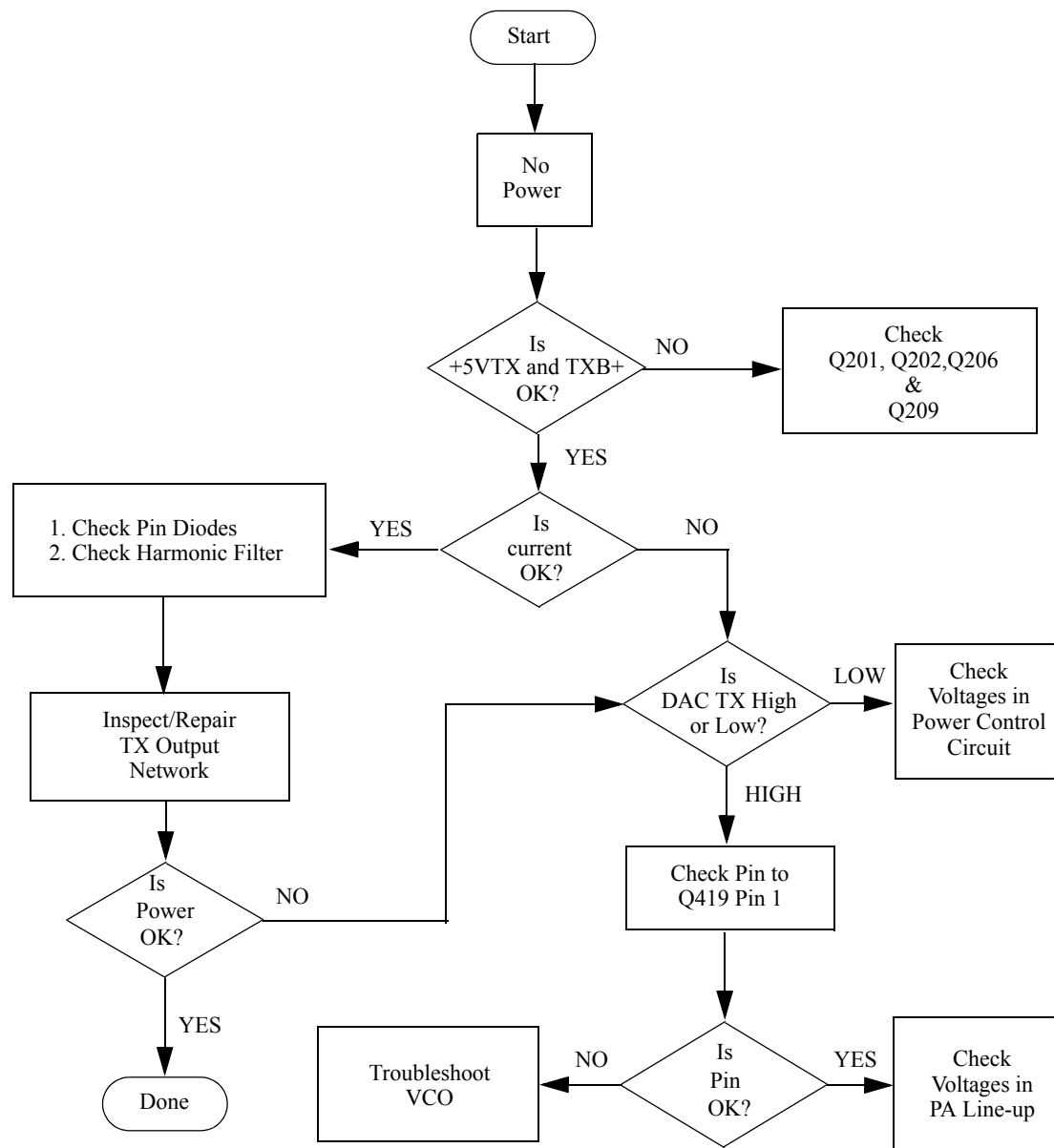
Figure 8-6.

8.5 Troubleshooting Charts



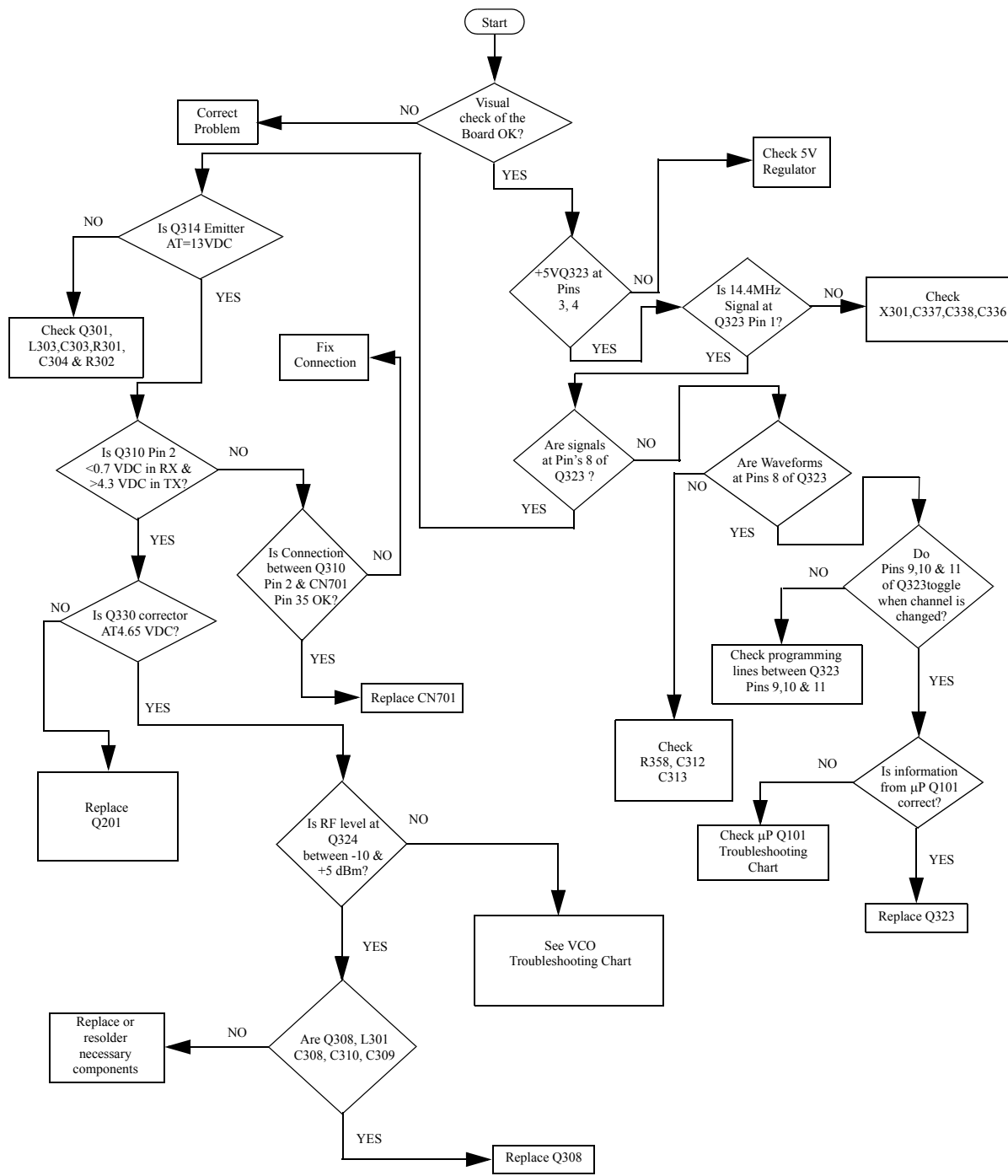
Troubleshooting Flow Chart for Receiver

Figure 8-7.



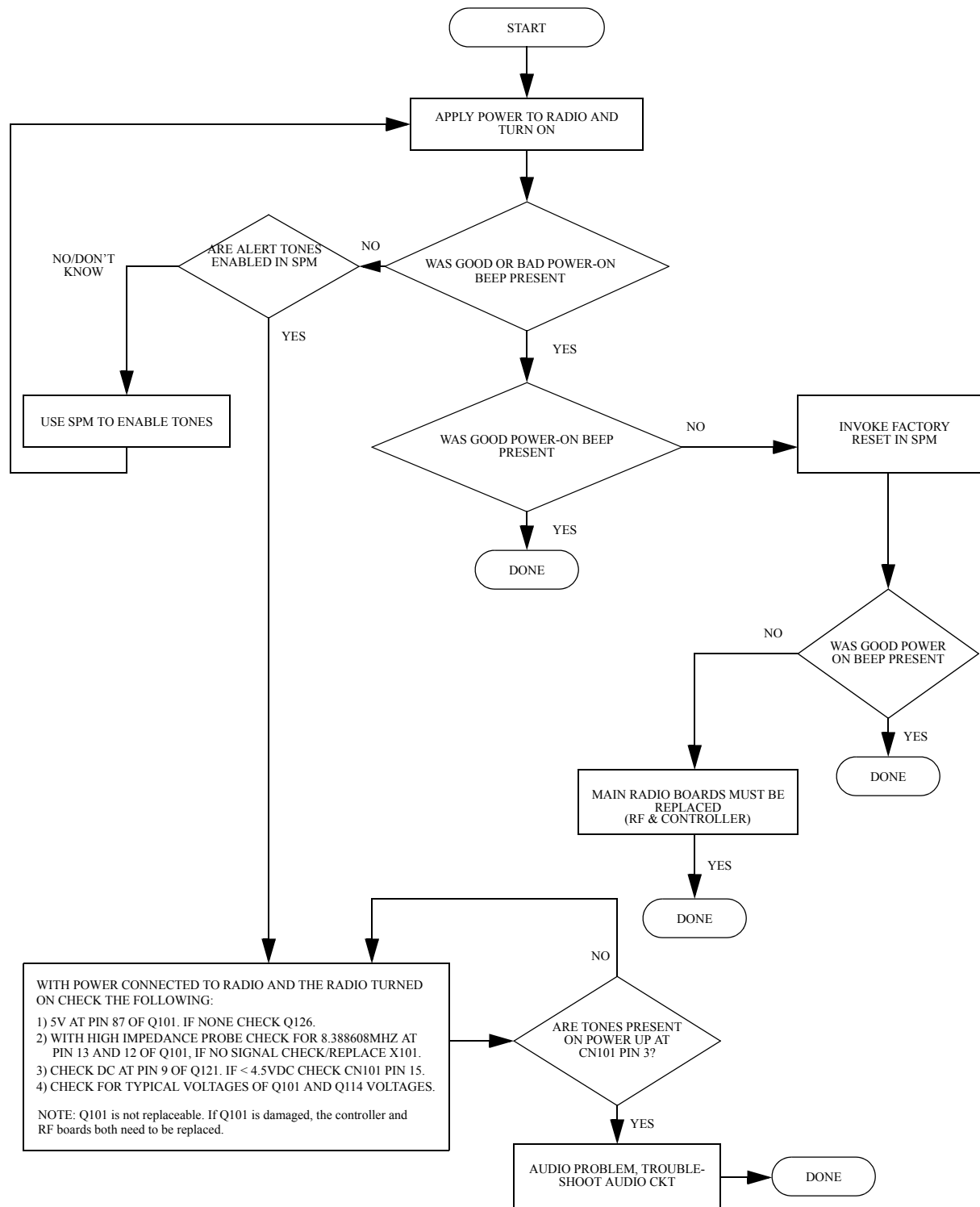
Troubleshooting Flow Chart for Transmitter

Figure 8-8.



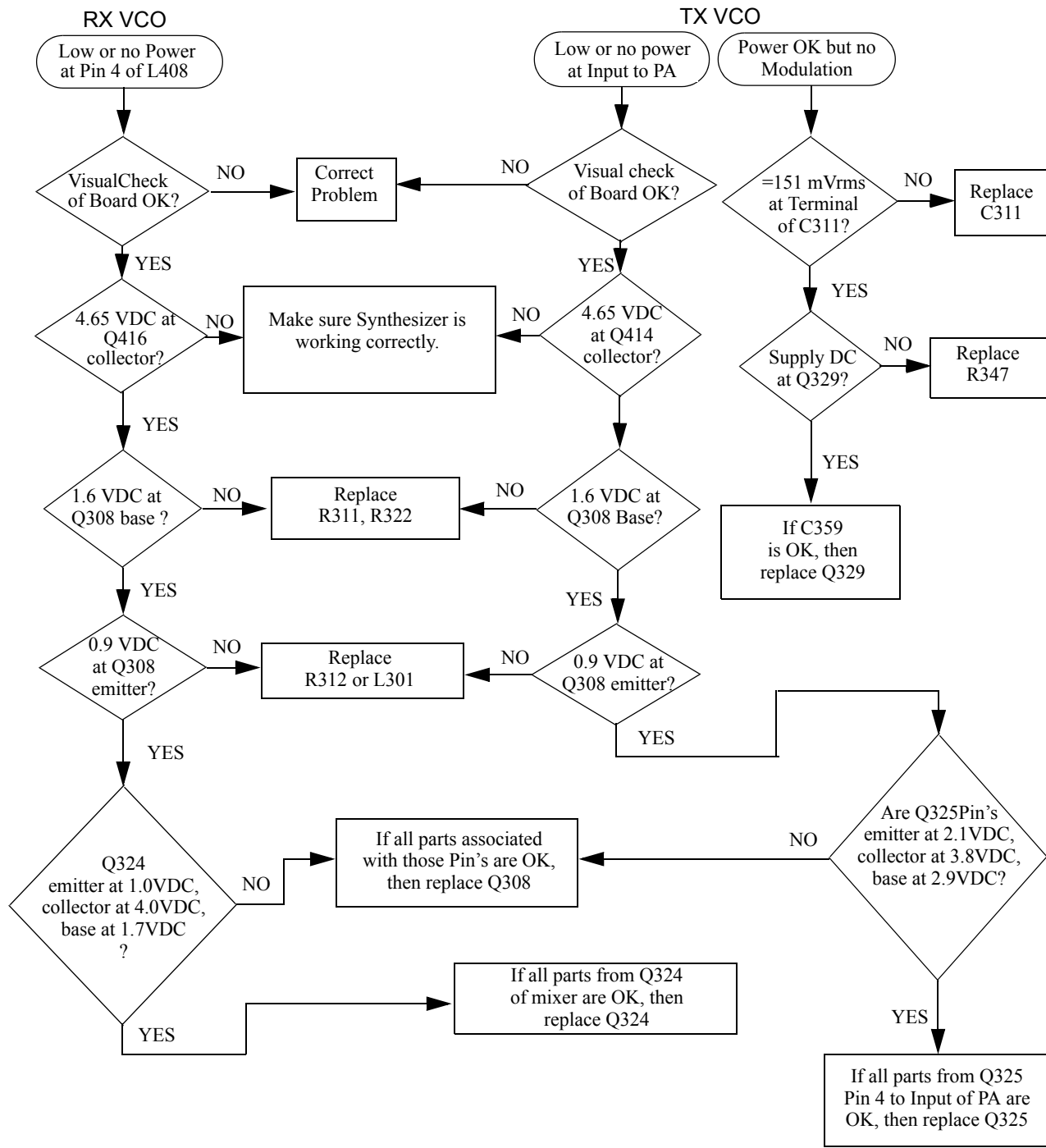
Troubleshooting Flow Chart for Synthesizer

Figure 8-9.



Troubleshooting Flow Chart for Microcontroller

Figure 8-10.

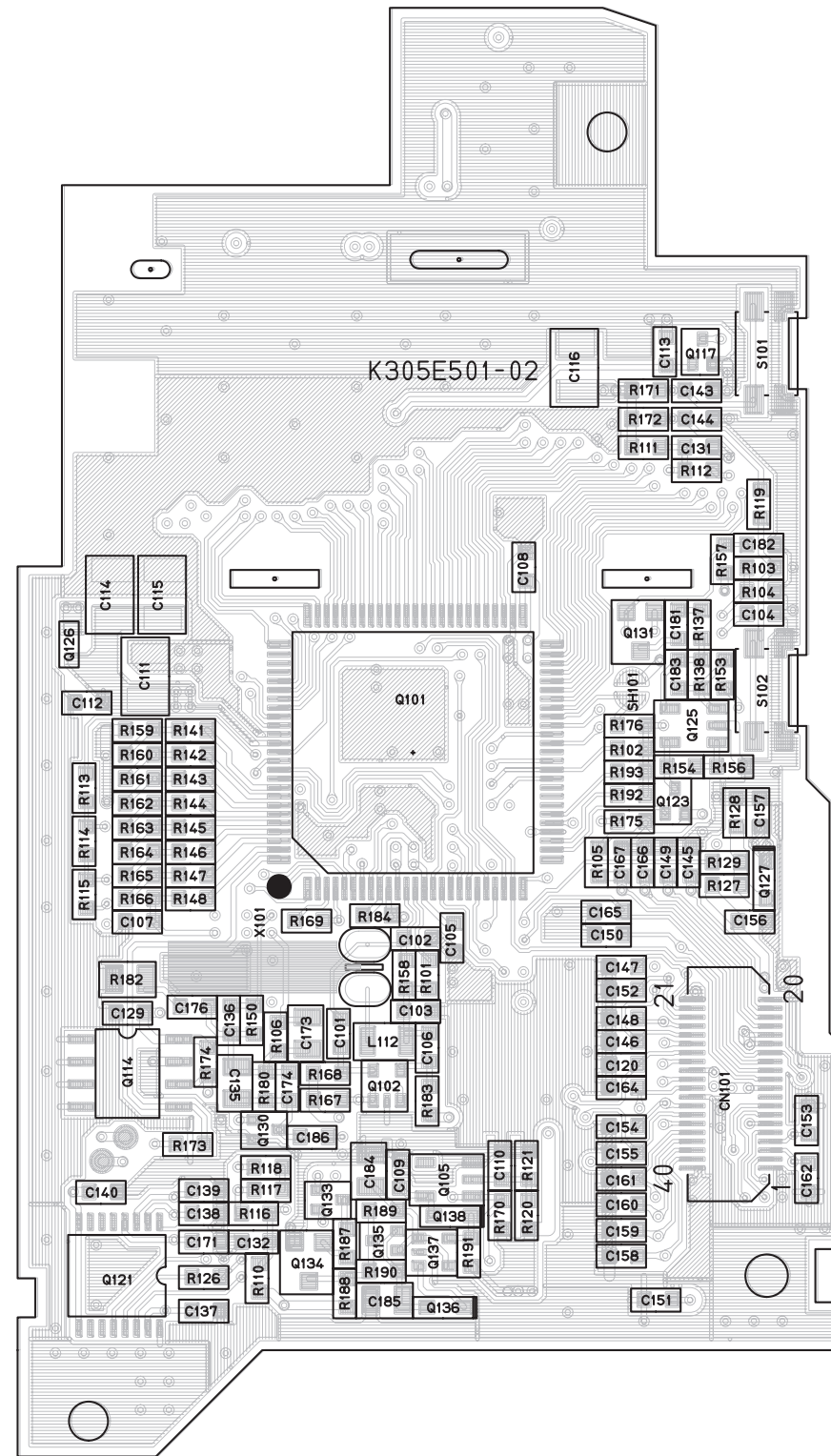


Note: Test Frequency 158MHz

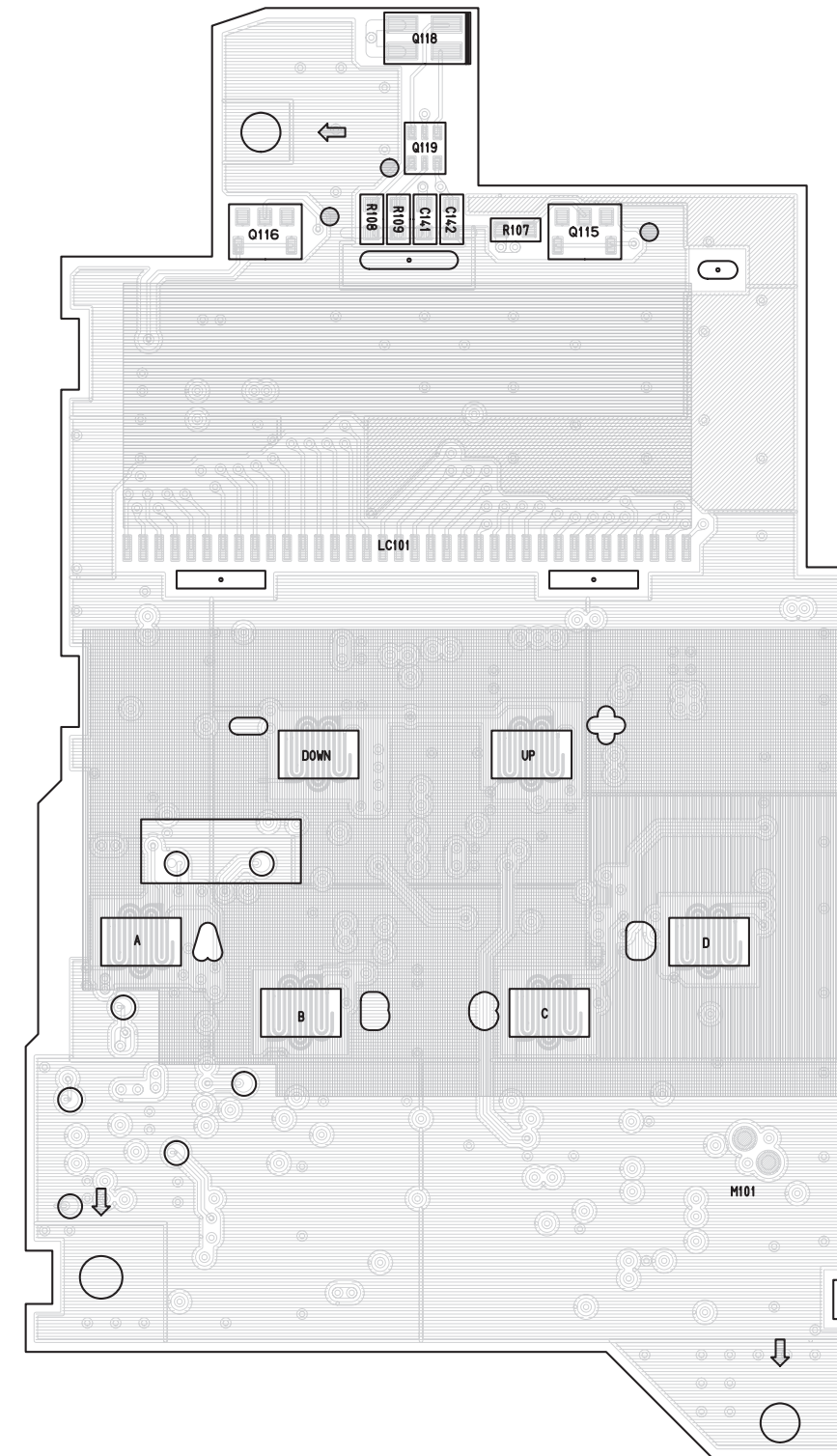
Troubleshooting Flow Chart for VCO

Figure 8-11.

8.6 UHF 435-480 MHz Circuit Board/Schematic Diagrams and Parts List



Top Side



Bottom Side

Figure 8-12. UHF 435-480 MHz Controller Board (K305E501-01)

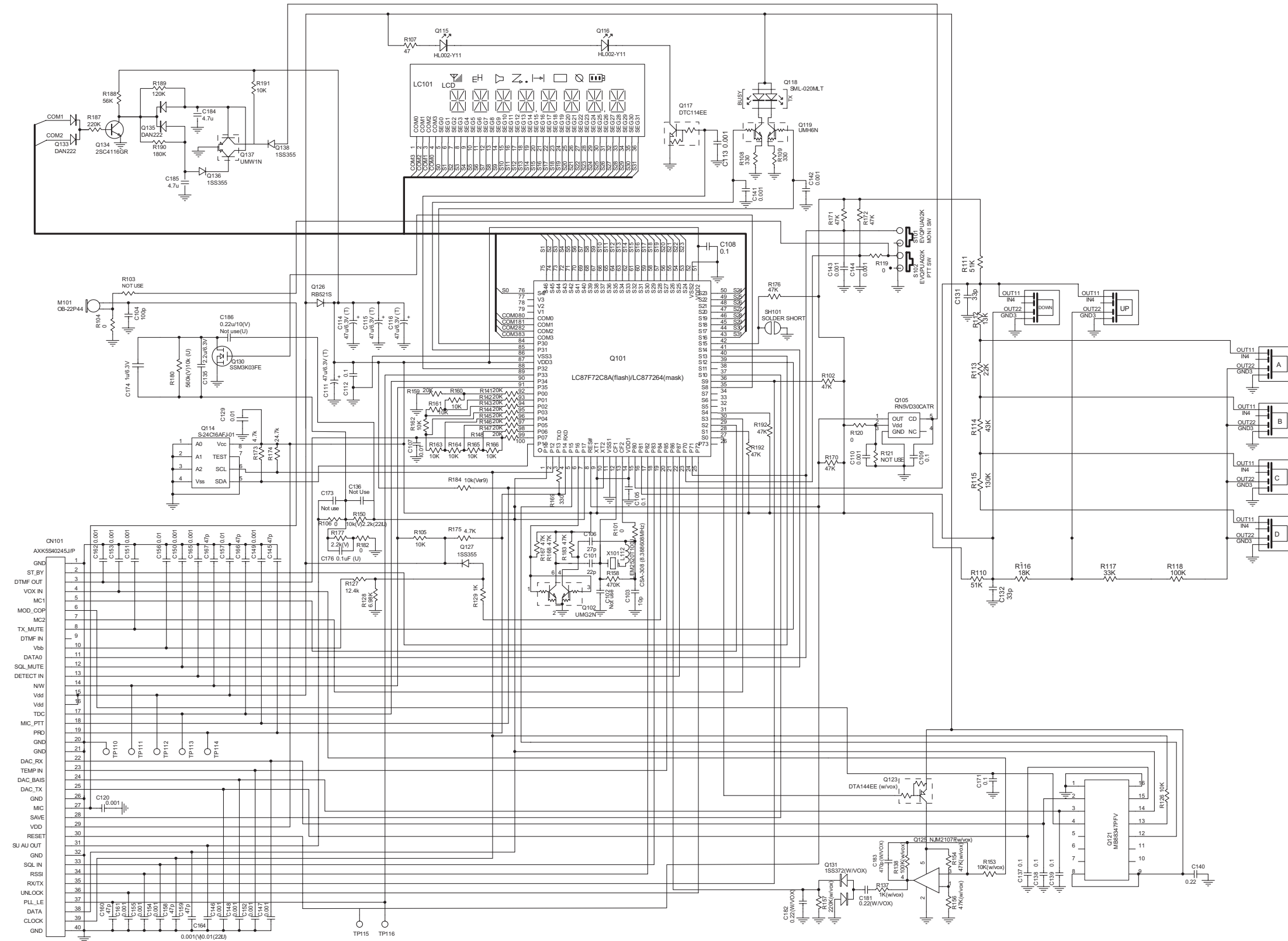


Figure 8-13. UHF 435-480 MHz Complete Controller Board Schematic Diagram (K305E501-01)

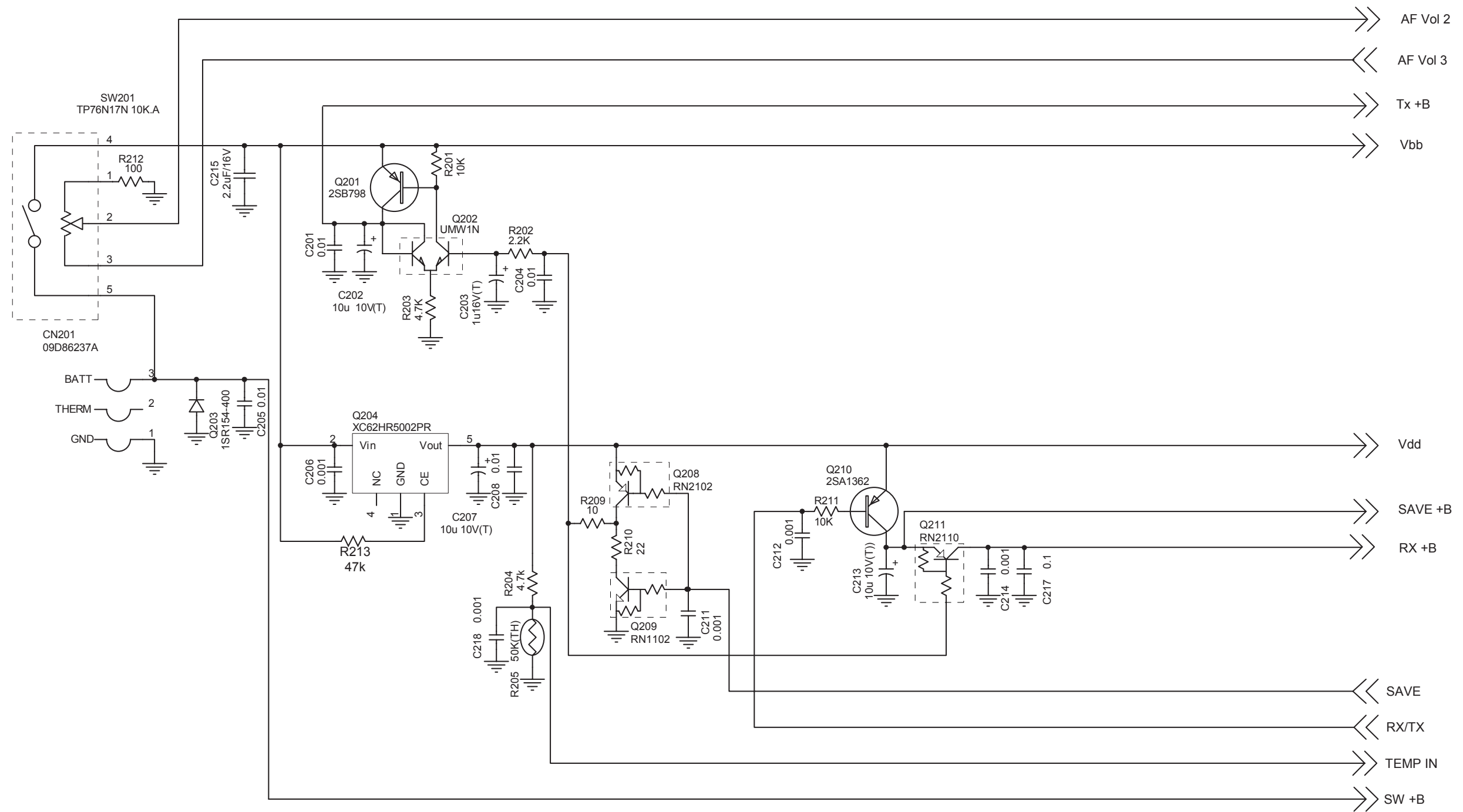


Figure 8-16. UHF 435-480 MHz Switches and Battery Schmeatic Diagram (K305E503-01)

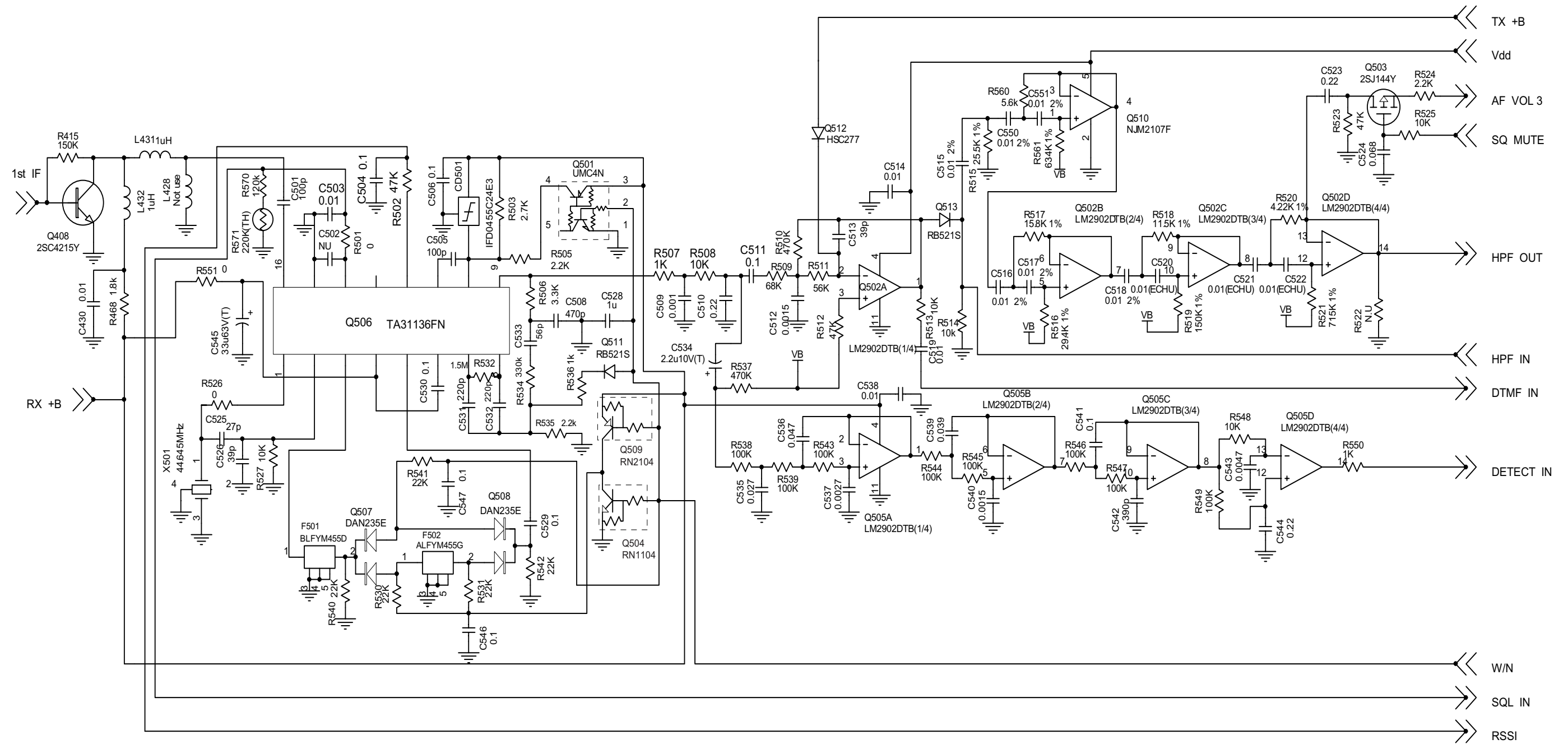


Figure 8-18. UHF 435-480 MHz Receiver Back End and Receiver Audio Schematic Diagram (K305E503-01)

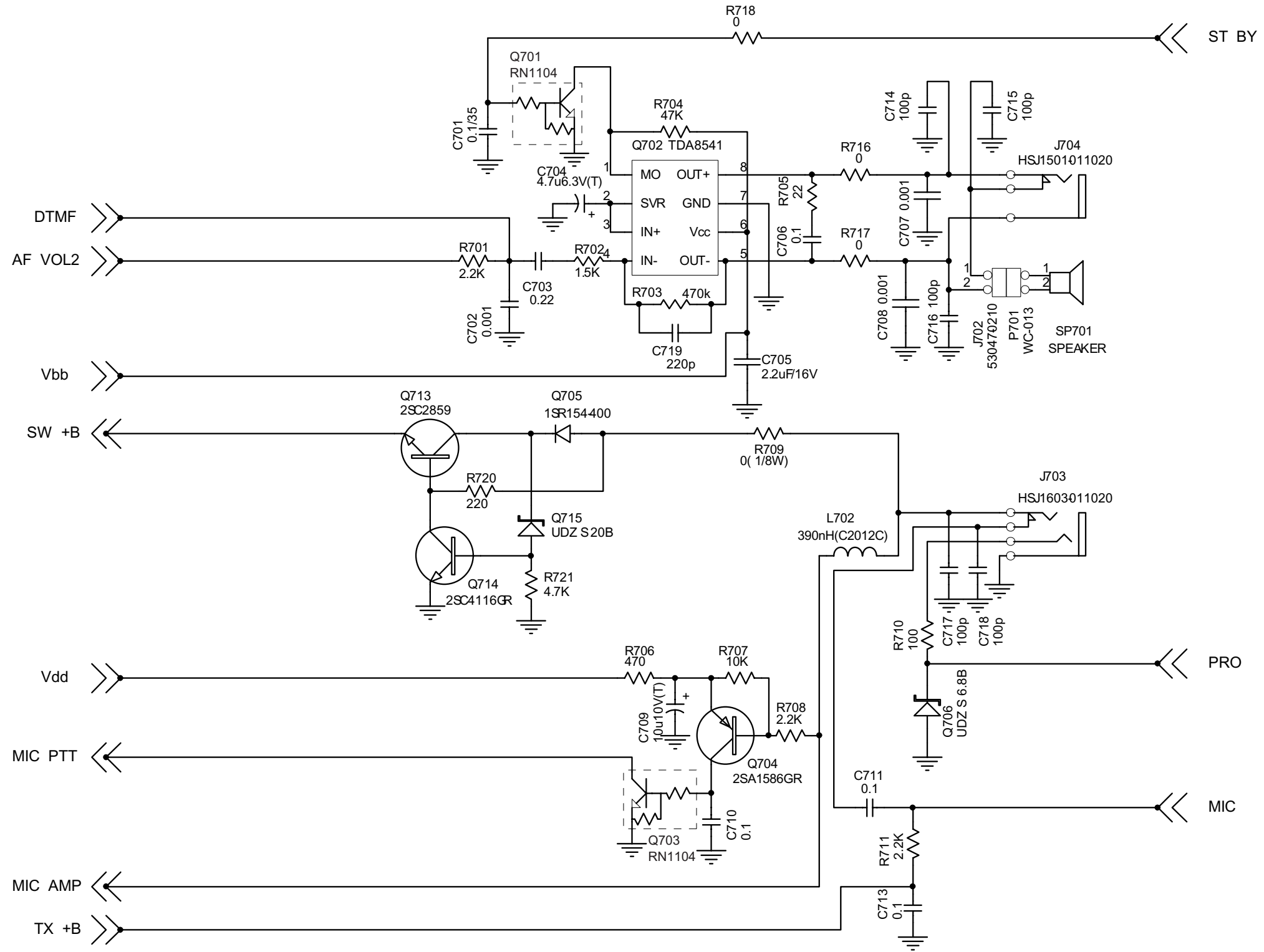


Figure 8-20. UHF 435-480 MHz Audio PA and External Audio Schematic Diagram (K305E503-01)

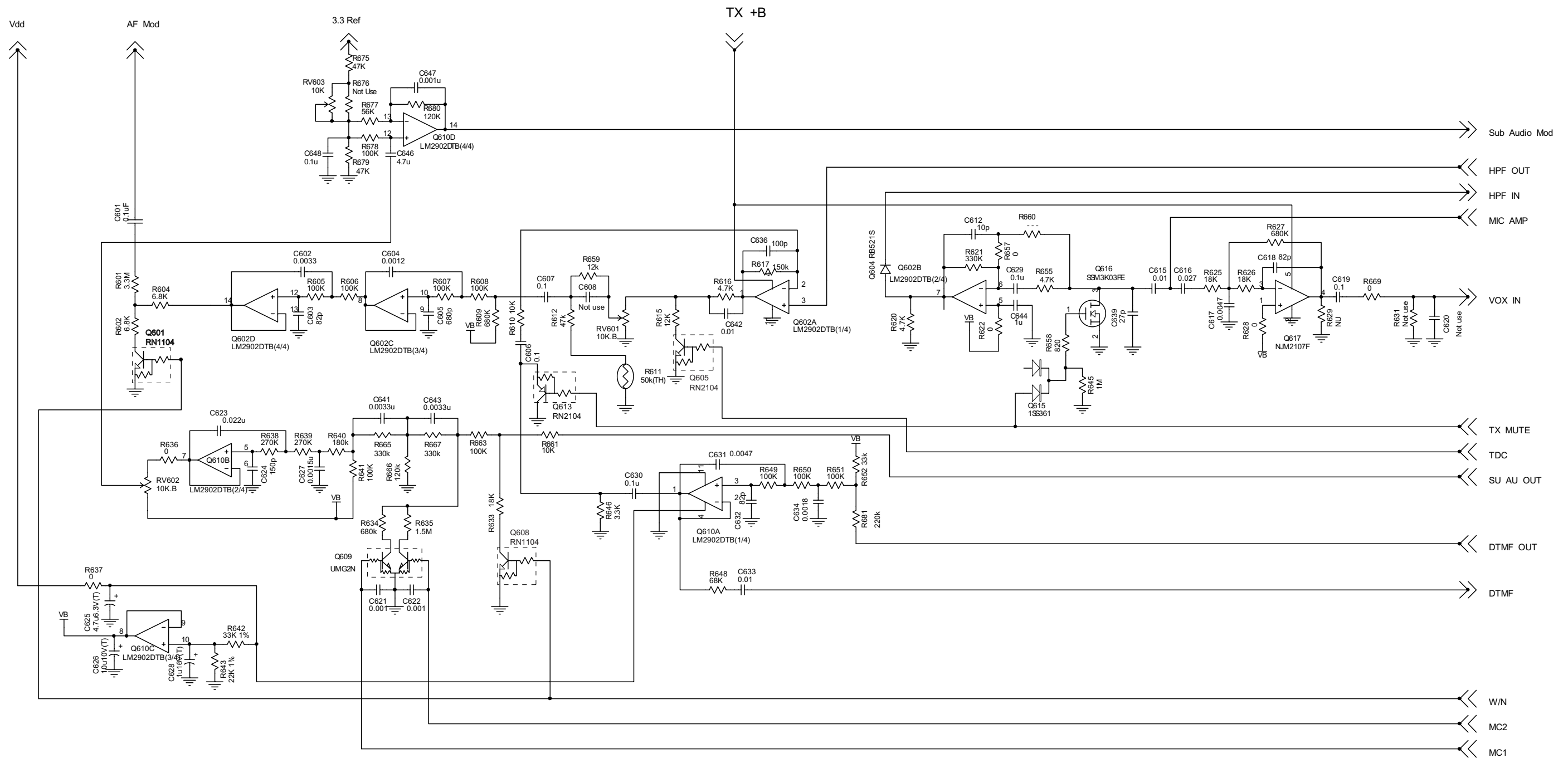


Figure 8-21. UHF 435-480 MHz Transmitter Audio Schematic Diagram (K305E503-01)

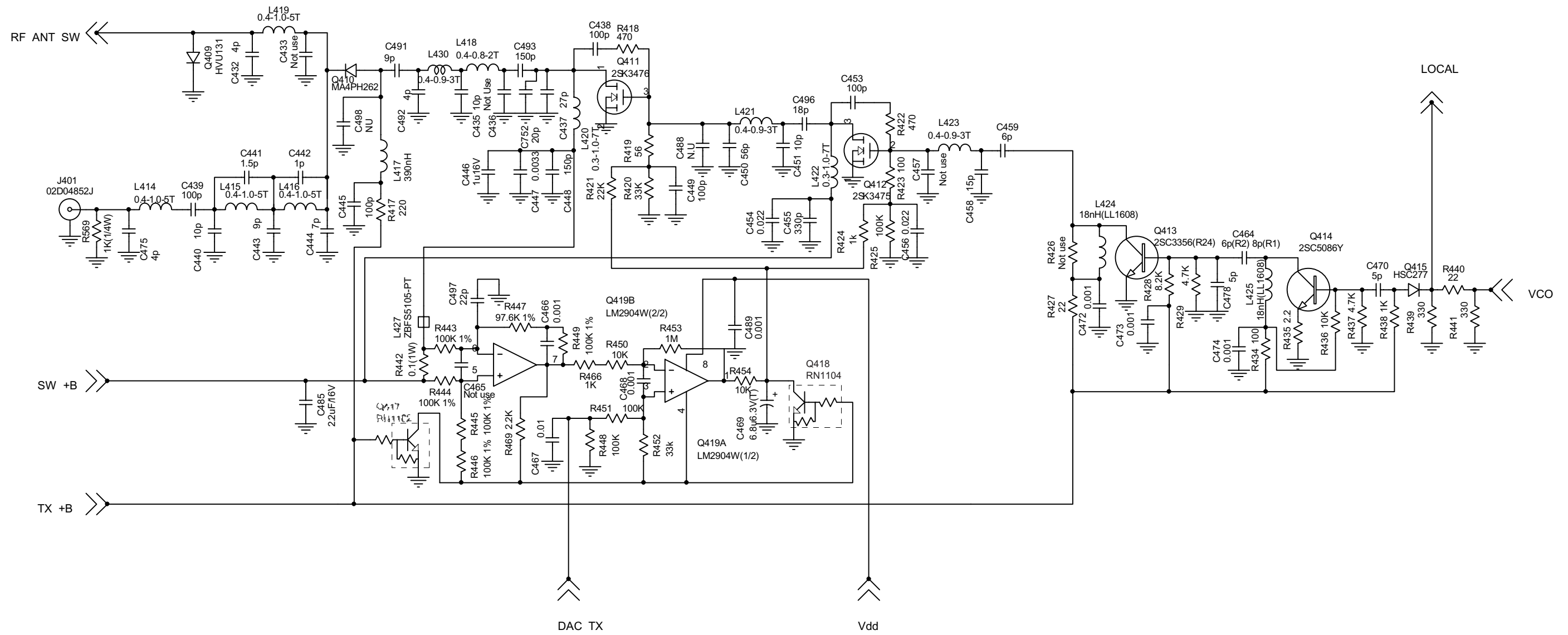


Figure 8-22. UHF 435-480 MHz Transmitter Schematic Diagram (K305E503-01)

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UHF 435-480 MHz Radio Parts List (Controller Board) (K305E501-01)

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
C101	22pF; 50V; +-5%	MURATA	GRM39CH220J50PT	2113740F35
C102	NU			
C103	10pF; 50V; +- 0.5pF	MURATA	GRM39CH100J50PT	N/A
C104	100pF; 50V; +-5%	MURATA	GRM39CH101J50PT	2113740F51
C105	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C106	27pF; 50V; +-5%	MURATA	GRM39CH270J50PT	2113740F37
C107	0.01uF; 50V; +-10%	MURATA	GRM39B103K50PT	N/A
C108	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C109	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C110	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C111	47uF; 6.3V; +-20%	NI-CHEMI	6MCM476MB2TER	N/A
C112	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C113	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C114	47uF; 6.3V; +-20%	NI-CHEMI	6MCM476MB2TER	N/A
C115	47uF; 6.3V; +-20%	NI-CHEMI	6MCM476MB2TER	N/A
C116	47uF; 6.3V; +-20%	NI-CHEMI	6MCM476MB2TER	N/A
C120	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C129	0.01uF; 50V; +-10%	MURATA	GRM39B103K50PT	N/A
C131	33pF; 50V; +-5%	MURATA	GRM39CH330J50PT	2113740F39
C132	33pF; 50V; +-5%	MURATA	GRM39CH330J50PT	2113740F39
C135	2.2uF; 6.3V; +-10%	MURATA	GRM40B225K6.3PT	N/A
C137	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C138	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C139	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C140	0.22uF; 10V; +-10%	MURATA	GRM39B224K10PT	2113928G01
C141	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C142	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C143	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C144	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C145	47pF; 50V; +-5%	MURATA	GRM39CH470J50PT	2113740F43
C146	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C147	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C148	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C149	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C150	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C151	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C152	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C153	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C154	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C155	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C156	0.01uF; 50V; +-10%	MURATA	GRM39B103K50PT	N/A
C157	0.01uF; 50V; +-10%	MURATA	GRM39B103K50PT	N/A
C158	47pF; 50V; +-5%	MURATA	GRM39CH470J50PT	2113740F43
C159	47pF; 50V; +-5%	MURATA	GRM39CH470J50PT	2113740F43
C160	47pF; 50V; +-5%	MURATA	GRM39CH470J50PT	2113740F43
C161	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C162	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C164	0.01uF; 50V; +-10%	MURATA	GRM39B103K50PT	N/A
C165	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
C166	47pF; 50V; +-5%	MURATA	GRM39CH470J50PT	2113740F43
C167	47pF; 50V; +-5%	MURATA	GRM39CH470J50PT	2113740F43
C171	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C173	NU			
C174	1uF; 6.3V; +-10%	MURATA	GRM39B105K6.3PT	2113928P04
C176	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C181	0.22uF; 10V; +-10%	MURATA	GRM39B224K10PT	2113928G01
C182	0.22uF; 10V; +-10%	MURATA	GRM39B224K10PT	2113928G01
C183	470pF; 50V; +-5%	MURATA	GRM39CH471J50PT	N/A
C184		MURATA	GRM21BB31A475KA7 4_+A02	N/A
C185		MURATA	GRM21BB31A475KA7 4_+A02	N/A
C186	NU			
CN101		Matsushita	AXK5S40245J/P	DSCN097002
L112	10uH	Taiyo Yuden	LEM2520T100J	N/A
LC101		PICVUE	HT138ZAS	DSL170003
M101		BOSUNG	OB-22P44	DSMI505001
PB101			K305E501	N/A
Q101		Sanyo	LC87F72C8A	DSIC092009
Q102		Rohm	UMG2N TR	N/A
Q105		RICOH	RN5VD30CATR	DSIC076007
Q114		Seiko El.	S-24C16AFJ-01	DSIC510003
Q115		KOHA	HL002-Y11	N/A
Q116		KOHA	HL002-Y11	N/A
Q117		Rohm	DTC114EETL	N/A
Q118		Rohm	SML-020MLT T86NN	4804810T02
Q119		Rohm	UMH6N TR	4880439V02
Q121		Fujitsu	MB88347PFV	DSIC042002
Q123		Rohm	DTA144EETL	N/A
Q125		JRC	NJM2107F (TE1)	DSIC025016
Q126		Rohm	RB521S-30 TE61	4805656W22
Q127		Rohm	1SS355 TE-17	4870360C15
Q130		Toshiba	SSM3K03FE-TE85L	N/A
Q131		Rohm	1SS372-TE85L	N/A
Q133		Rohm	DAN222TL	N/A
Q134		Toshiba	2SC4116-GR TE85L	N/A
Q135		Rohm	DAN222TL	N/A
Q136		Rohm	1SS355 TE-17	N/A
Q137		Rohm	UMW1N TL	N/A
Q138		Rohm	1SS355 TE-17	N/A
R101	0 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 000	0662057B47
R102	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R103	NU			
R104	0 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 000	0662057B47
R105	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R106	0 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 000	0662057B47
R107	47 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 470	0662057A17
R108	330 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 331	0662057A37
R109	330 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 331	0662057A37
R110	51 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 513	0662057A90

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
R111	51 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 513	0662057A90
R112	13 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 133	0662057A76
R113	22 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 223	0662057A81
R114	43 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 433	0665027A88
R115	130 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 134	0662257B01
R116	18 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 183	0662057A79
R117	33 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 333	0662057A85
R118	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R119	0 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 000	0662057B47
R120	0 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 000	0662057B47
R121	NU			
R126	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R127	12.4 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 1242	0662057P69
R128	6.98 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 6981	0662057Y24
R129	1 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 102	0662057A49
R137	1 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 102	0662057A49
R138	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R141	20 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 203	0662057A80
R142	20 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 203	0662057A80
R143	20 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 203	0662057A80
R144	20 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 203	0662057A80
R145	20 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 203	0662057A80
R146	20 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 203	0662057A80
R147	20 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 203	0662057A80
R148	20 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 203	0662057A80
R150	2.2 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 222	0662057A57
R153	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R154	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R156	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R157	220 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 224	N/A
R158	470 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 474	0662057B14
R159	20 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 203	0662057A80
R160	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R161	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R162	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R163	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R164	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R165	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R166	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R167	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R168	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R169	330 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 331	0662057A37
R170	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R171	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R172	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R173	4.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 472	0662057A65
R174	4.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 472	0662057A65
R175	4.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 472	0662057A65
R176	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R180	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R182	0 ohm; 0.1W; +-5%	Rohm	MCR10 EZHJ 000	0662057B47

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
R183	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R184	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R187	220 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 224	N/A
R188	56 Kohm	Rohm	MCR03 EZHJ 563	N/A
R189	120 Kohm	Rohm	MCR03 EZHJ 124	N/A
R190	180 Kohm	Rohm	MCR03 EZHJ 184	N/A
R191	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R192	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R193	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
S101		Panasonic	EVQPUA02K	N/A
S102		Panasonic	EVQPUA02K	N/A
X101		CITIZEN	CSA-309(8.3886MHz)	DSXT182001

UHF 435-480 MHz Radio Parts List (RF Board) (K305E503-01)

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
C201	0.01uF; 50V; +-10%	MURATA	GRM39B103K50PT	N/A
C202	10uF; 6.3V; +-20%	NI-CHEMI	10MCM106MATER	N/A
C203	2.2uF; 10V	NI-CHEMI	16MC105MATER	N/A
C204	0.01uF; 50V; +-10%	MURATA	GRM39B103K50PT	N/A
C205	0.01uF; 50V; +-10%	MURATA	GRM39B103K50PT	N/A
C206	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C207	10uF; 6.3V; +-20%	NI-CHEMI	10MCM106MATER	N/A
C208	0.01uF; 50V; +-10%	MURATA	GRM39B103K50PT	N/A
C211	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C212	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C213	10uF; 6.3V; +-20%	NI-CHEMI	10MCM106MATER	N/A
C214	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C215	2.2uF; 16V; +-10%	MURATA	GRM40F225Z16PT	2113743F18
C217	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C218	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	21SW973A115
C219	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C220	100pF; 50V; +-5%	MURATA	GRM39CH101J50PT	2113740F51
C308	6pF; 50V; +-0.25%	MURATA	GRM39CH060C50PT	N/A
C309	0.01uF; 50V; +-10%	MURATA	GRM39B103K50PT	N/A
C310	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C311	1pF; 50V; +-5%	MURATA	GRM39CK010C50PT	N/A
C312	10pF; 50V; +-0.5pF	MURATA	GRM39CH100D50PT	2113740F27
C313	NU			
C314	3pF; 50V; +-0.25%	MURATA	GRM39CH030C50PT	2103689A09
C315	6pF; 50V; +-0.25%	MURATA	GRM39CH060C50PT	N/A
C316	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C317	47pF; 50V; +-5%	MURATA	GRM39CH470J50PT	2113740F43
C318	47pF; 50V; +-5%	MURATA	GRM39CH470J50PT	2113740F43
C319	47pF; 50V; +-5%	MURATA	GRM39CH470J50PT	2113740F43
C320	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C323	1uF; 16V; +-20%	NI-CHEMI	16MC105MATER	N/A
C324	10uF; 16V; +-20%	NI-CHEMI	16MCM106MB2TER	N/A
C328	4.7uF 16V	NI-CHEMI	16MCM475MATER	N/A

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number	Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
C329	470pF; 50V; +-10%	MURATA	GRM39B471K50PT	N/A	C427	24pF; 50V; +-5%	MURATA	GRM39CH240J50PT	2113740F36
C339	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A	C428	NU			
C340	47pF; 50V; +-5%	MURATA	GRM39CH470J50PT	2113740F43	C429	NU			
C341	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A	C430	0.01uF; 50V; +-10%	MURATA	GRM39B103K50PT	N/A
C342	100pF; 50V; +-5%	MURATA	GRM39CH101J50PT	2113740F51	C432	4pF; 50V; +-0.25%	MURATA	GRM39CH040C50PT	N/A
C343	10uF; 6.3V; +-20%	NI-CHEMI	10MCM106MATER	N/A	C433	NU			
C345	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A	C435	10pF; 50V; +-0.5pF	MURATA	GRM39CH100D50PT	2113740F27
C346	NU				C436	NU			
C347	NU				C437	27pF; 50V; +-5%	MURATA	GRM39CH270J50PT	2113740F37
C350	0.0015uF;50V; +-10%	MURATA	GRM39B152K50PT	2155169M11	C438	100pF; 50V; +-5%	MURATA	GRM39CH101J50PT	2113740F51
C351	NU				C439	100pF; 50V; +-5%	MURATA	GRM39CH101J50PT	2113740F51
C352	2pF; 50V; +-5%	MURATA	GRM39CH020C50PT	N/A	C440	10pF; 50V; +-0.5pF	MURATA	GRM39CH100D50PT	2113740F27
C353	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A	C441	1.5pF; 50V; +-0.25%	MURATA	GRM39CK1R5C50PT	N/A
C368	1uF; 6.3V; +-10%	MURATA	GRM39B105K6.3PT	2113928P04	C442	1pF; 50V; +-5%	MURATA	GRM39CK010C50PT	N/A
C369	0.1uF; 35V	NI-CHEMI	35MC104MATER	N/A	C443	9pF; 50V; +-0.5%	MURATA	GRM39CH090D50PT	N/A
C371	1uF; 16V; +-20%	NI-CHEMI	16MC105MATER	N/A	C444	7pF; 50V; +-0.5%	MURATA	GRM39CH070D50PT	N/A
C382	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A	C445	100pF; 50V; +-5%	MURATA	GRM39CH101J50PT	2113740F51
C383	10uF; 16V; +-20%	NI-CHEMI	16MCM106MB2TER	N/A	C446	1uF; 16V; +-10%	MURATA	GRM40B105K16PT	2113743A31
C384	56pF; 50V; +-5%	MURATA	GRM39CH560J50PT	2113740F53	C447	0.0033uF; 50V; +-10%	MURATA	GRM39B332K50PT	2155169M15
C385	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A	C448	150pF; 50V; +-5%	MURATA	GRM39CH151J50PT	2113740F55
C386	10uF; 16V; +-20%	NI-CHEMI	16MCM106MB2TER	N/A	C449	100pF; 50V; +-5%	MURATA	GRM39CH101J50PT	2113740F51
C387	1uF; 6.3V; +-10%	MURATA	GRM39B105K6.3PT	2113928P04	C450	56pF; 50V; +-5%	MURATA	GRM39CH560J50PT	2113740F53
C388	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A	C451	10pF; 50V; +-0.5pF	MURATA	GRM39CH100D50PT	2113740F27
C389	1uF; 6.3V; +-10%	MURATA	GRM39B105K6.3PT	2113928P04	C453	100pF; 50V; +-5%	MURATA	GRM39CH101J50PT	2113740F51
C390	0.01uF; 50V; +-10%	MURATA	GRM39B103K50PT	N/A	C454	0.0022uF;50V; +-10%	MURATA	GRM39B223K25PT	N/A
C391	6.3V 10uF	NEC	TEMSVA0J106M8R	N/A	C455	330pF; 50V; +-10%	MURATA	GRM39B331K50PT	N/A
C401	8pF; 50V; +-0.5%	MURATA	GRM39CH080D50PT	N/A	C456	0.0022uF;50V; +-10%	MURATA	GRM39B223K25PT	N/A
C402	5pF; 50V; +-0.25pF	MURATA	GRM39CH050C50PT	N/A	C457	NU			
C403	NU				C458	15pF; 50V; +-5%	MURATA	GRM39CH150J50PT	2113740F31
C404	6pF; 50V; +-0.25%	MURATA	GRM39CH060C50PT	N/A	C459	6pF; 50V; +-0.25%	MURATA	GRM39CH060C50PT	N/A
C405	NU				C460	5pF; 50V; +-0.25pF	MURATA	GRM39CH050C50PT	N/A
C406	100pF; 50V; +-5%	MURATA	GRM39CH101J50PT	2113740F51	C461	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C407	2pF; 50V; +-5%	MURATA	GRM39CK020C50PT	N/A	C462	0.01uF; 50V; +-10%	MURATA	GRM39B103K50PT	N/A
C408	22pF; 50V; +-5%	MURATA	GRM39CH220J50PT	2113740F35	C463	5pF; 50V; +-0.25pF	MURATA	GRM39CH050C50PT	N/A
C409	0.01uF; 50V; +-10%	MURATA	GRM39B103K50PT	N/A	C464	6pF; 50V; +-0.25%	MURATA	GRM39CH060C50PT	N/A
C410	100pF; 50V; +-5%	MURATA	GRM39CH101J50PT	2113740F51	C465	NU			
C411	33pF; 50V; +-5%	MURATA	GRM39CH330J50PT	2113740F39	C466	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C412	0.01uF; 50V; +-10%	MURATA	GRM39B103K50PT	N/A	C467	0.01uF; 50V; +-10%	MURATA	GRM39B103K50PT	N/A
C413	0.01uF; 50V; +-10%	MURATA	GRM39B103K50PT	N/A	C468	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	21SW973A115
C414	7pF; 50V; +-0.5%	MURATA	GRM39CH070D50PT	N/A	C469	6.8uF; 6.3V	NI-CHEMI	6MCS685MATER	N/A
C415	6pF; 50V; +-0.25%	MURATA	GRM39CH060C50PT	N/A	C470	5pF; 50V; +-0.25pF	MURATA	GRM39CH050C50PT	N/A
C416	5pF; 50V; +-0.25pF	MURATA	GRM39CH050C50PT	N/A	C472	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C417	5pF; 50V; +-0.25pF	MURATA	GRM39CH050C50PT	N/A	C473	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C419	0.01uF; 50V; +-10%	MURATA	GRM39B103K50PT	N/A	C474	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C420	3pF; 50V; +-0.25%	MURATA	GRM39CH030C50PT	N/A	C475	4pF; 50V; +-0.25%	MURATA	GRM39CH040C50PT	N/A
C421	9pF; 50V; +-0.5%	MURATA	GRM39CH090D50PT	N/A	C478	5pF; 50V; +-0.25pF	MURATA	GRM39CH050C50PT	N/A
C422	7pF; 50V; +-0.5%	MURATA	GRM39CH070D50PT	N/A	C485	2.2uF; 16V; +-10%	MURATA	GRM40F225Z16PT	2113743F18
C423	3pF; 50V; +-0.25%	MURATA	GRM39CH030C50PT	2103689A09	C487	1pF; 50V; +-5%	MURATA	GRM39CK010C50PT	N/A
C424	NU				C488	NU			
C425	NU				C489	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C426	82pF; 50V; +-5%	MURATA	GRM39CH820J50PT	2113740F49	C491	9pF; 50V; +-0.5%	MURATA	GRM39CH090D50PT	N/A

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
C492	4pF; 50V; +-0.25%	MURATA	GRM39CH040C50PT	N/A
C493	150pF; 50V; +-5%	MURATA	GRM39CH151J50PT	2113740F55
C494	3pF; 50V; +-0.25%	MURATA	GRM39CH030C50PT	2103689A09
C495	22pF; 50V; +-5%	MURATA	GRM39CH220J50PT	2113740F35
C496	18pF; 50V; +-5%	MURATA	GRM39CH180J50PT	2113740F33
C497	22pF; 50V; +-5%	MURATA	GRM39CH220J50PT	2113740F35
C498	NU			
C499	NU			
C501	100pF; 50V; +-5%	MURATA	GRM39CH101J50PT	2113740F51
C502	NU			
C503	0.01uF; 50V; +-10%	MURATA	GRM39B103K50PT	N/A
C504	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C505	100pF; 50V; +-5%	MURATA	GRM39CH101J50PT	2113740F51
C506	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C508	470pF; 50V; +-10%	MURATA	GRM39B471K50PT	N/A
C509	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C510	0.22uF; 50V; +-10%	MURATA	GRM39B224K10PT	2113928G01
C511	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C512	0.0015uF;50V; +-10%	MURATA	GRM39B152K50PT	2155169M11
C513	39pF; 50V; +-5%	MURATA	GRM39CH390J50PT	2113740F41
C514	0.01uF; 50V; +-10%	MURATA	GRM39B103K50PT	N/A
C515	0.01uF; 16V; +-2%	Panasonic	ECHU1C103GX5	DSCF097003
C516	0.01uF; 16V; +-2%	Panasonic	ECHU1C103GX5	DSCF097003
C517	0.01uF; 16V; +-2%	Panasonic	ECHU1C103GX5	DSCF097003
C518	0.01uF; 16V; +-2%	Panasonic	ECHU1C103GX5	DSCF097003
C519	0.01uF; 50V; +-10%	MURATA	GRM39B103K50PT	N/A
C520	0.01uF; 16V; +-2%	Panasonic	ECHU1C103GX5	DSCF097003
C521	0.01uF; 16V; +-2%	Panasonic	ECHU1C103GX5	DSCF097003
C522	0.01uF; 16V; +-2%	Panasonic	ECHU1C103GX5	DSCF097003
C523	0.22uF; 50V; +-10%	MURATA	GRM39B224K10PT	2113928G01
C524	0.068uF;16V; +-10%	MURATA	GRM39B683K16PT	N/A
C525	27pF; 50V; +-5%	MURATA	GRM39CH270J50PT	2113740F37
C526	39pF; 50V; +-5%	MURATA	GRM39CH390J50PT	2113740F41
C528	1uF; 6.3V; +-10%	MURATA	GRM39B105K6.3PT	2113928P04
C529	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C530	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C531	220pF; 50V; +-10%	MURATA	GRM39B221K50PT	N/A
C532	220pF; 50V; +-5%	MURATA	GRM39CH221J50PT	N/A
C533	56pF; 50V; +-5%	MURATA	GRM39CH560J50PT	2113740F53
C534	10uF; 6.3V; +-20%	NI-CHEMI	10MCS225MATER	N/A
C535	0.0027uF;50V; +-10%	MURATA	GRM39B273K25PT	2155169N29
C536	0.0047uF;50V; +-10%	MURATA	GRM39B473K16PT	N/A
C537	0.0027uF;50V; +-10%	MURATA	GRM39B272K50PT	21SW973A115
C538	0.01uF; 50V; +-10%	MURATA	GRM39B103K50PT	N/A
C539	390pF; 50V; +-10%	MURATA	GRM39B393K16PT	N/A
C540	0.0015uF;50V; +-10%	MURATA	GRM39B152K50PT	2155169M11
C541	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C542	390pF; 50V; +-10%	MURATA	GRM39B391K50PT	2113741F15
C543	0.0047uF;50V; +-10%	MURATA	GRM39B472K50PT	N/A
C544	0.22uF; 50V; +-10%	MURATA	GRM39B224K10PT	2113928G01
C545	33uF; 6.3V; +-20%	NI-CHEMI	6MCM336MB2TER	N/A

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
C546	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C547	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C550	0.01uF; 16V; +-2%	Panasonic	ECHU1C103GX5	DSCF097003
C551	0.01uF; 16V; +-2%	Panasonic	ECHU1C103GX5	DSCF097003
C601	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C602	0.0033uF; 50V; +-10%	MURATA	GRM39B332K50PT	2155169M15
C603	82pF; 50V; +-5%	MURATA	GRM39CH820J50PT	2113740F49
C604	0.0012uF; 50V; +-10%	MURATA	GRM39B122K50PT	N/A
C605	0.0047uF;50V; +-10%	MURATA	GRM39B681K50PT	N/A
C606	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C607	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C608	NU			
C612	10pF; 50V; +-0.5pF	MURATA	GRM39CH100D50PT	2113740F27
C615	0.01uF; 50V; +-10%	MURATA	GRM39B103K50PT	N/A
C616	0.0027uF;50V; +-10%	MURATA	GRM39B273K25PT	2155169N29
C617	0.0047uF;50V; +-10%	MURATA	GRM39B472K50PT	N/A
C618	82pF; 50V; +-5%	MURATA	GRM39CH820J50PT	2113740F49
C619	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C620	NU			
C621	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C622	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C623	0.0022uF;50V; +-10%	MURATA	GRM39B223K25PT	N/A
C624	120pF; 50V; +-5%	MURATA	GRM39CH121J50PT	N/A
C625	4.7uF; 6.3V	NI-CHEMI	6MCS475MATER	N/A
C626	10uF; 6.3V; +-20%	NI-CHEMI	10MCM106MATER	N/A
C627	0.0015uF;50V; +-10%	MURATA	GRM39B152K50PT	2155169M11
C628	1uF; 16V; +-20%	NI-CHEMI	16MC105MATER	N/A
C629	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C630	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C631	0.0047uF;50V; +-10%	MURATA	GRM39B472K50PT	N/A
C632	82pF; 50V; +-5%	MURATA	GRM39CH820J50PT	2113740F49
C633	0.01uF; 50V; +-10%	MURATA	GRM39B103K50PT	N/A
C634	0.0018uF; 50V; +-10%	MURATA	GRM39B182K50PT	2155116E54
C636	100pF; 50V; +-5%	MURATA	GRM39CH101J50PT	2113740F51
C639	27pF; 50V; +-5%	MURATA	GRM39CH270J50PT	2113740F37
C641	0.0033uF; 50V; +-10%	MURATA	GRM39B332K50PT	2155169M15
C642	0.01uF; 50V; +-10%	MURATA	GRM39B103K50PT	N/A
C643	0.0033uF; 50V; +-10%	MURATA	GRM39B332K50PT	2155169M15
C644	1uF; 6.3V; +-10%	MURATA	GRM39B105K6.3PT	2113928P04
C646	4.7uF	MURATA	GRM21BB31A475KA7 4_+A02	N/A
C647	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C648	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C701	0.1uF; 35V	NI-CHEMI	35MC104MATER	N/A
C702	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	N/A
C703	0.22uF; 50V; +-10%	MURATA	GRM39B224K10PT	2113928G01
C704	4.7uF; 6.3V	NI-CHEMI	6MCS475MATER	N/A
C705	2.2uF; 16V; +-10%	MURATA	GRM40F225Z16PT	2113743F18
C706	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C707	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	21SW973A115
C708	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	21SW973A115

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
C709	10uF; 6.3V; +-20%	NI-CHEMI	10MCM106MATER	N/A
C710	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C711	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C713	0.1uF; 16V; +-10%	MURATA	GRM39B104K16PT	N/A
C714	100pF; 50V; +-5%	MURATA	GRM39CH101J50PT	2113740F51
C715	100pF; 50V; +-5%	MURATA	GRM39CH101J50PT	2113740F51
C716	100pF; 50V; +-5%	MURATA	GRM39CH101J50PT	2113740F51
C717	100pF; 50V; +-5%	MURATA	GRM39CH101J50PT	2113740F51
C718	100pF; 50V; +-5%	MURATA	GRM39CH101J50PT	2113740F51
C719	100pF; 50V; +-5%	MURATA	GRM39CH101J50PT	2113740F51
C721	0.001uF; 50V; +-10%	MURATA	GRM39B102K50PT	21SW973A115
C751	NU			
C752	20pF; 50V; +-5%	MURATA	GRM39CH200J50PT	2113740F34
C912	1pF; 50V; +-5%	MURATA	GRM39CK010C50PT	N/A
C913	3pF; 50V; +-0.25%	MURATA	GRM39CH030C50PT	2103689A09
C918	100pF; 50V; +-5%	MURATA	GRM39CH101J50PT	2113740F51
C919	0.0022uF;50V; +-10%	MURATA	GRM39B223K25PT	N/A
C935	4pF; 50V; +-0.25%	MURATA	GRM39CH040C50PT	N/A
C936	6pF; 50V; +-0.25%	MURATA	GRM39CH060C50PT	N/A
C937	6pF; 50V; +-0.25%	MURATA	GRM39CH060C50PT	N/A
C938	2pF; 50V; +-5%	MURATA	GRM39CH020C50PT	N/A
C940	NU			
CD501		Samsung	IFD0455C24E03	DSFL506003
CN201	Connector contact Battery	Motorola	09D86237A	N/A
CN701		Matsushita	AXK6S40545J/P	DSCN097003
F401	NU			
F402		HERTZ	45N12A5 (45.1MHz) UM-5J-SMD	DSXF137006
F501		TOKO	BLFYM455D	N/A
F502		TOKO	ALFYM455G	N/A
J401	Antenna Jack	Motorola	02D04852J	N/A
J702		Molex	53047-0210	N/A
J703		Hoshiden	HSJ1603-011020	N/A
J704		Hoshiden	HSJ1501-011120	N/A
L301	22nH	TOKO	LL1608-FS22NJ (22nH)	N/A
L302	390nH	Sagami Elec	C2012C-R39J (390nH)	2462587V41
L303	18nH	Sagami Elec	C2012C-18NG (18nH)	N/A
L304	390nH	Sagami Elec	C2012C-R39J (390nH)	2462587V41
L305	390nH	Sagami Elec	C2012C-R39J (390nH)	2462587V41
L306	390nH	Sagami Elec	C2012C-R39J (390nH)	2462587V41
L307	390nH	Sagami Elec	C2012C-R39J (390nH)	2462587V41
L308	390nH	Sagami Elec	C2012C-R39J (390nH)	2462587V41
L309	18nH	Sagami Elec	C2012C-18NG (18nH)	N/A
L310	390nH	Sagami Elec	C2012C-R39J (390nH)	2462587V41
L312		MURATA	BLM21A121SPT	2480067M02
L319		TOKO	A914BYW-470M=P3	N/A
L401		UCHIDA	E2-0.30-1.0-5TL	N/A
L402		UCHIDA	E2-0.30-1.0-5TL	N/A
L403	NU			
L404	180nH	Sagami Elec	C2012C-R18G (180nH)	N/A

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
L405		UCHIDA	E2-0.30-1.0-7TL	N/A
L406		UCHIDA	E2-0.30-1.0-5TL	N/A
L407		UCHIDA	E2-0.30-1.0-5TL	N/A
L408		LATEST	SMD-0314A	N/A
L409		LATEST	SMD-0314A	N/A
L410	15nH	TOKO	LL2012-FH15NJ (15nH)	N/A
L412	150nH	Sagami Elec	C2012C-R15J (150nH)	2462587V36
L413	470nH	TOKO	FSLM2520-R47K	N/A
L414		UCHIDA	E2-0.40-1.0-5TL	N/A
L415		UCHIDA	E2-0.40-1.0-5TL	N/A
L416		UCHIDA	E2-0.40-1.0-5TL	N/A
L417	390nH	Sagami Elec	C2012C-R39J (390nH)	2462587V41
L418		UCHIDA	E2-0.40-0.8-2TL	N/A
L419		UCHIDA	E2-0.40-1.0-5TL	N/A
L420		UCHIDA	E2-0.30-1.0-7TL	N/A
L421		UCHIDA	E2-0.40-0.9-3TL	N/A
L422		UCHIDA	E2-0.30-1.0-7TL	N/A
L423		UCHIDA	E2-0.40-0.9-3TL	N/A
L424	18nH	TOKO	LL1608-FS18NJ (18nH)	N/A
L425	18nH	TOKO	LL1608-FS18NJ (18nH)	N/A
L426	22nH	TOKO	LL1608-FS22NJ (22nH)	N/A
L427		TDK	ZBFS5105-PT	N/A
L428	NU			
L430		UCHIDA	E2-0.40-0.9-3TL	N/A
L431	1uH	TDK	MLF1608A1R0KT	N/A
L432	1uH	TDK	MLF1608A1R0KT	N/A
L702	390nH	Sagami Elec	C2012C-R39J (390nH)	2462587V41
P701		EU-Connector	WC-013	N/A
PB201			K305E503	N/A
Q201		NEC	2SB798-T1 DK	N/A
Q202		Rohm	UMW1N TL	N/A
Q203		Rohm	1SR154-400 TE25	4842006M02
Q204		TOREX	XC62HR5002PR	DSIC510004
Q208		Toshiba	RN2102	N/A
Q209		Toshiba	RN1102	N/A
Q210		Toshiba	2SA1362-GR TE85L	N/A
Q211		Toshiba	RN2110	N/A
Q302		NEC	2SK508-T1B K52	N/A
Q303		NEC	2SK508-T1B K52	N/A
Q308		Toshiba	2SC5086-Y TE85L	N/A
Q311		Toshiba	1SV228-TPH3	N/A
Q314		Toshiba	2SA1586-GR TE85L	N/A
Q315		Toshiba	2SC4116-GR TE85L	N/A
Q316		Rohm	UDZ S 7.5B TE-17	N/A
Q317		Rohm	UMC4N TR	N/A
Q318		Toshiba	2SC4116-GR TE85L	N/A
Q319		Rohm	1SS355 TE-17	4870360C15

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
Q323		Fujitsu	MB15A02PFV1-ER	DSIC042003
Q331		Toshiba	2SC4116-GR TE85L	N/A
Q332		Rohm	RB521S-30 TE61	N/A
Q333		TOKO	TK11850LTL	N/A
Q334		Toshiba	TAR5S33	N/A
Q401		Toshiba	1SV279-TPH3	N/A
Q402		Toshiba	1SV279-TPH3	N/A
Q403		Toshiba	1SS362-TE85L	N/A
Q404		Toshiba	2SC5086-Y TE85L	N/A
Q405		Toshiba	1SV279-TPH3	N/A
Q406		Toshiba	1SV279-TPH3	N/A
Q407		HP	HSMS-2817 (B7)	N/A
Q408		Toshiba	2SC4215-Y TE85L	N/A
Q409		Hitachi	HVU131TRF	N/A
Q410		MA/COM	MA4PH262	N/A
Q411		Toshiba	2SK3476	DSTR013027
Q412		Toshiba	2SK3475	DSTR013026
Q413		NEC	2SC3356-T1B R24	N/A
Q414		Toshiba	2SC5086-Y TE85L	N/A
Q415		Hitachi	HSC277TRF	N/A
Q416		Toshiba	2SC5086-Y TE85L	N/A
Q417		Toshiba	RN1102	N/A
Q418		Toshiba	RN1104	N/A
Q419		TI	LM2904PW	N/A
Q501		Rohm	UMC4N TR	N/A
Q502		TI	LM2902DTB	N/A
Q503		Toshiba	2SJ144Y-TE85L	N/A
Q504		Toshiba	RN1104	N/A
Q505		TI	LM2902DTB	N/A
Q506		Toshiba	TA31136FN-TP1	DSIC013007
Q507		Rohm	DAN235ETL	N/A
Q508		Rohm	DAN235ETL	N/A
Q509		Toshiba	RN2104	N/A
Q510		JRC	NJM2107F (TE1)	DSIC025016
Q511		Rohm	RB521S-30 TE61	N/A
Q512		Hitachi	HSC277TRF	N/A
Q513		Rohm	RB521S-30 TE61	N/A
Q601		Toshiba	RN1104	N/A
Q602		TI	LM2902DTB	N/A
Q604		Hitachi	RB521S-30 TE61	N/A
Q605		Toshiba	RN1104	N/A
Q608		Toshiba	RN1104	N/A
Q609		Rohm	UMG2N TR	N/A
Q610		TI	LM2902DTB	N/A
Q613		Toshiba	RN2104	N/A
Q615		Toshiba	1SS361	N/A
Q616		Toshiba	SSM3K03FE-TE85L	N/A
Q617		JRC	NJM2107F (TE1)	DSIC025016
Q701		Toshiba	RN1104	N/A
Q702		Philips	TDA8541T/N1	DSIC174004
Q703		Toshiba	RN1104	N/A

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
Q704		Toshiba	2SA1586-GR TE85L	N/A
Q705		Rohm	1SR154-400 TE25	4842006M02
Q706		Rohm	UDZ S 6.8B TE-17	4842006M03
Q713			2SC2859	N/A
Q714		Toshiba	2SC4116-GR TE85L	N/A
Q715		Rohm	UDZ S 20B TE-17	N/A
Q916		NEC	2SJ243-T1	N/A
Q921		Toshiba	JDV2S01E-TPH3	N/A
Q922		Toshiba	1SV270-TPH3	N/A
R201	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R202	220 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 222	0662057A57
R203	4.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 472	0662057A65
R204	4.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 472	0662057A65
R205	50K ohm	Hokuriku	NSM3503K400J3R	N/A
R209	10 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 100	0662057A01
R210	22 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 220	0662057A09
R211	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R212	100 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 101	0662057A25
R213	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R214	5.6 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHJ 562	0662057A67
R310	100 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 101	0662057A25
R311	15 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 153	0662057A77
R312	220 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 221	0662057A33
R313	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R314	0 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 000	0662057B47
R315	3.3 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 332	0662057A61
R316	2.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 272	0662057A59
R317	3.3 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 332	0662057A61
R318	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R319	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R320	6.8 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 682	0662057A69
R321	6.8 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 682	0662057A69
R323	4.7K ohm x 4	Hokuriku	CRA168-472J / MNR14 E0ABJ 472	DSRA508001
R335	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R336	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R356	4.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 472	0662057A65
R357	10 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 100	0662057A73
R358	47 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 470	0662057A17
R359	4.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 472	0662057A65
R361	22 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 223	0662057A81
R362	22 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 223	0662057A81
R364	6.8 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 682	0662057A69
R366	470 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 470	0662057A41
R367	470 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 470	0662057A41
R368	680 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 684	0662057B18
R371	100 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 101	0662057A25
R372	1 ohm	Hokuriku	CR1/161RV0JV	N/A
R373	5.6 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHJ 562	0662057A67
R374	12 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 124	N/A
R375	220 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 221	0662057A33

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
R376	100 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 101	0662057A97
R377	0 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 000	0662057B47
R401	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R402	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R403	12 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 123	0662057A51
R404	4.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 472	0662057A65
R405	6.8 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 682	0662057A69
R406	0 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 000	0662057B47
R407	470 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 470	0662057A41
R408	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R409	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R410	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R412	56 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 560	0662057A19
R413	0 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 000	0662057B47
R415	150 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 154	0662057B02
R417	220 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 221	0662057A33
R418	470 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 470	0662057A41
R419	56 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 560	0662057A19
R420	33 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 333	0662057A85
R421	22 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 223	0662057A81
R422	470 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 470	0662057A41
R423	100 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 101	0662057A25
R424	1 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 102	0662057A49
R425	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R426	NU			
R427	22 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 220	0662057A09
R428	8.2K ohm	Rohm	MCR03 EZHJ 822	N/A
R429	4.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 472	0662057A65
R430	100 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 101	0662057A97
R431	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R432	220 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 221	0662057A33
R433	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R434	100 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 101	0662057A97
R435	2.2 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 2R2	0662057W09
R436	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R437	4.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 472	0662057A65
R438	1 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 102	0662057A49
R439	330 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 331	0662057A37
R440	22 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 220	0662057A09
R441	330 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 331	0662057A37
R442	0.1ohm 1W	Hokuriku	LPR1R100FE(0.1ohm 1W)	N/A
R443	100 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 1003	0662057P95
R444	100 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 1003	0662057P95
R445	100 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 1003	0662057P95
R446	100 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 1003	0662057P95
R447	97.6 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 9762	N/A
R448	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R449	100 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 1003	0662057P95
R450	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R451	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
R452	33 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 333	0662057A85
R453	1 Mohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 105	0662057B22
R454	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R455	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R459	3.3 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 332	0662057A61
R466	1 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 102	0662057A49
R468	1.8 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 182	N/A
R469	220 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 222	0662057A57
R470	0 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 000	0662057B47
R501	0 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 000	0662057B47
R502	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R503	2.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 272	0662057A59
R505	220 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 222	0662057A57
R506	3.3 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 332	0662057A61
R507	1 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 102	0662057A49
R508	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R509	68 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 683	0662057A93
R510	470 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 474	0662057B14
R511	56 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 563	0662057A91
R512	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R513	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R514	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R515	25.5 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 2552	0662057T92
R516	29.4 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 2942	0662057P29
R517	15.8 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 1582	0662057Z03
R518	11.5 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 1152	0662057Z35
R519	150 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 1503	0662057P97
R520	4.22 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 4221	N/A
R521	715 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 7153	0662057T99
R522	NU			
R523	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R524	220 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 222	0662057A57
R525	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R526	0 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 000	0662057B47
R527	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R530	22 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 223	0662057A81
R531	22 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 223	0662057A81
R532	1.5 Mohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 155	N/A
R534	330 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 334	0662057B10
R535	220 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 222	0662057A57
R536	1 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 102	0662057A49
R537	470 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 474	0662057B14
R538	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R539	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R540	22 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 223	0662057A81
R541	22 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 223	0662057A81
R542	22 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 223	0662057A81
R543	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R544	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R545	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R546	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
R547	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R548	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R549	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R550	1 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 102	0662057A49
R551	0 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 000	0662057B47
R560	5.6 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 562	N/A
R561	634 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHF 6343	N/A
R569	1 Kohm; 0.25W; +-5%	Rohm	CR1/4-102J	N/A
R570	12 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 124	N/A
R571	220 Kohm	MURATA	NCP18WM224K03RB	N/A
R601	3.3M ohm	Rohm	MCR03 EZHJ 335	0662057B34
R602	6.8 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 682	0662057A69
R604	6.8 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 682	0662057A69
R605	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R606	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R607	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R608	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R609	680 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 684	0662057B18
R610	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R611	50K ohm	Hokuriku	NSM3503K400J3R	N/A
R612	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R615	12 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 123	0662057A51
R616	4.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 472	0662057A65
R617	150 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 154	0662057B02
R620	4.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 472	0662057A65
R621	270 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 274	N/A
R622	0 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 000	0662057B47
R625	18 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 183	0662057A79
R626	18 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 183	0662057A79
R627	680 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 684	0662057B18
R628	0 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 000	0662057B47
R629	NU			
R631	NU			
R633	18 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 183	0662057A79
R634	680 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 684	0662057B18
R635	1.5 Mohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 155	N/A
R636	0 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 000	0662057B47
R637	0 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 000	0662057B47
R638	270 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 274	N/A
R639	270 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 274	N/A
R640	180 Kohm	Rohm	MCR03 EZHJ 184	N/A
R641	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R642	33 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 3302	N/A
R643	15.8 Kohm; 0.1W; +-1%	Rohm	MCR03 EZHF 2202	N/A
R645	1 Mohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 105	0662057B22
R646	3.3 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 332	0662057A61
R648	68 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 683	0662057A93
R649	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R650	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R651	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R652	330 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 333	0662057A85

Circuit Ref	Description	Vendor	Vendor Part Number	Motorola Equivalent Part Number
R655	4.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 472	0662057A65
R657	0 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 000	0662057B47
R658	820 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 821	0662057A47
R659	12 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 123	0662057A51
R660	NU			
R661	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R663	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R665	330 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 334	0662057B10
R666	12 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 124	N/A
R667	330 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 334	0662057B10
R669	0 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 000	0662057B47
R675	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R676	NU			
R677	56 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 563	0662057A91
R678	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R679	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R680	12 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 124	N/A
R681		Rohm	MCR03 EZHJ 224	0662057B06
R701	220 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 222	0662057A57
R702	1.5 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 152	0662057A53
R703	470 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 474	0662057B14
R704	47 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 473	0662057A89
R705	22 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 220	0662057A09
R706	470 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 470	0662057A41
R707	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R708	220 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 222	0662057A57
R709	0 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 000	0662057B47
R710	100 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 101	0662057A97
R711	220 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 222	0662057A57
R716	0 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 000	0662057B47
R717	0 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 000	0662057B47
R718	0 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 000	0662057B47
R720	220 ohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 221	0662057A33
R721	4.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 472	0662057A65
R913	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R914	150 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 151	N/A
R928	150 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 151	N/A
R929	10 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 103	0662057A73
R930	100 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 104	0662057A97
R934	1 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 102	0662057A49
R935	4.7 Kohm; 0.1W; +-5%	Rohm	MCR03 EZHJ 472	0662057A65
RV601		Hokuriku	VG025CHXTB103	N/A
RV602		Hokuriku	VG025CHXTB103	N/A
RV603		Hokuriku	VG025CHXTB103	N/A
SP701		Orient sound	K028NA (S09139)	N/A
SW201		TOCOS	TP76N17N A10Kohm 10SK	DSVR010008
X301		NDK	HKE3065B	N/A
X501		NDK	HU-816-106	N/A

Glossary of Terms

Term	Definition
Active Scan State	The state when the radio is in Scan Mode, and when the radio is rapidly moving through the Scan List Member channels looking for eligible transmission activity.
Busy Channel Lockout (BCL)	If BCL is activated, the radio will check for channel activity before transmitting. If activity is detected, transmission is prohibited. For carrier squelch mode, radio will not transmit, if it is receiving carrier. For coded squelch mode, it will not transmit, if it is receiving carrier with different PL/DPL code.
Carrier	An electromagnetic signal that is transmitted on a selected frequency for the purpose of carrying voice or data transmissions along with it. Carrier can then be received by all radios listening on that frequency.
Carrier Squelch (CSQ)	When the carrier energy exceeds the carrier energy threshold, known as the Squelch Level, the radio unmutes.
CD	Compact Disk.
Channel	A single path separated by frequency or time divisions used for transmitting and/or receiving voice and/or data.
Channel Alias	Channel Aliases are radio-user descriptions for the radio's channels. Alphabets, numbers, spaces, "+", "-", and "/" can be used. Examples: EMT-001, 500, SECURITY.
Channel Bandwidth	The channel spacing when operating on the current channel.
Channel Enabled	When selected, the channel is enabled and accessible.
Coded Squelch	When the channel receives incoming message that contains the same PL or DPL code as its Rx PL/DPL code, the radio unmutes.
Codeplug	A solid-state chip inside a radio where the radio's personality data is stored.
Communications Port (COM Port)	A serial hardware interface connection at the back of a computer used to communicate with other hardware devices, such as radios, modems, and printers. Also known as a Serial Port. COM Ports are designated by slot positions such as Port1, Port2, Port3, Port4. When programming a radio, the computer is connected to the radio with a RIB cable via the COM port. The computer's CPS Com Port settings are independent of each other and apply to the Read and Write features.
CPS	Acronym for Customer Programming Software. Licensed Motorola software used to program two-way radios with a unique set of features.
CSQ	Carrier Squelch.
CTCSS	Acronym for <i>Continuous Tone Coded Squelch System</i> . A generic term for sub-audible tone/ code used to create communications groups. Also see <i>PL</i> .

Term	Definition
Digital Private Line (DPL)	DPL is a digital format transmitted along with the carrier. DPL allows for more use and privacy on a frequency. DPL is transmitted at a sub-audible (not able to be heard) frequency.
DPL	Digital Private-Line™
EEPROM	Electronically Erasable/Programmable Read-Only Memory: used by the radio to store its personality.
Firmware	Software, or a software/hardware combination of computer programs and data, with a fixed logic configuration stores in a read-only memory. Information cannot be altered or reprogrammed.
FGU	Frequency Generation Unit.
Frequency	(a) The location of the center of a channel of operation in the radio spectrum. Measured in Megahertz (MHz). (b) A computer speed. Measured in Megahertz (MHz).
Hard Pot	Hardware potentiometer for adjustment of parameter settings.
Home Channel	The channel where scan is started.
Landed Scan State	When the radio is in Scan Mode, and once Active Scan finds an eligible Scan List Member channel/call to receive or unmute to, the radio is then in Landed Scan State. Also, once both Transmit and Receive activity has ceased, and while the Scan Hang Timer is counting down, the radio is still in Landed Scan Mode.
Latest Codeplug Version	The most recent version number of codeplug information that was loaded into the radio. This is stored in the radio's codeplug.
LCD	Liquid Crystal Display: a module used to display the radio's current operating channel info or status message.
Long Press Function	Function that is invoked if the button is pressed and released after one second.
Lower Scan Frequency	The lower limit that VFO will scan.
Maximum Frequency	The highest frequency setting at which the radio is allowed to operate. The radio's frequency range is defined as being between, or equal to, the Minimum and Maximum frequencies. This information is stored in the radio's codeplug.
Minimum Frequency	The lowest frequency setting at which the radio is allowed to operate. The radio's frequency range is defined as being between, or equal to, the Minimum and Maximum frequencies. This information is stored in the radio's codeplug.
Model Number	The model number identifies the type of radio. This information is stored in the radio's codeplug.
Normal Scan	For Normal Scan, the radio assigns equal priority to all members in the Scan List selected for the current channel. When the radio is scanning a Scan List (Active Scan), all scan list members (including the Home Channel) will be allocated equal time to be scanned. For example, if the Home Channel is H1, and the Scan List Members are Nn, then the scanning sequence is: N1, N2, N3, ..., H1, N1, N2, ..., etc.

Term	Definition
Offset Frequency	If Tx Offset is set to Positive, this frequency will be added to the VFO Rx Frequency when radio is transmitting. It will be subtracted from the VFO Rx Frequency if Tx Offset is set to Negative.
Original Codeplug Version	The first version number of codeplug information that was loaded into the radio. This is stored in the radio's codeplug.
PC Board	Printed Circuit Board.
PL	Private-Line® tone squelch: a continuous sub-audible tone that is transmitted along with the carrier.
PLL	Phase-Locked Loop: a circuit in which an oscillator is kept in phase with a reference, usually after passing through a frequency divider.
Pretime	Selects the amount of time between PTT button press and the first digit of ID transmission. This time allows the receiving radio to stabilize before receiving data.
Priority Scan	For Priority Scan, the radio assigns the highest priority to the first member in the Scan List selected for the current channel. When the radio is scanning a Scan List (Active Scan), 50% of the scans are targeted at the Priority #1 Member channel. For example, if the Priority #1 Member is P1, and the non-priority Scan List Members are Nn, then the scanning sequence is: P1, N1, P1, N2, P1, N3, P1, N4, P1, N5, etc.
Priority #1 Scan List Member	The first member in the current Scan List. When the radio is scanning a Scan List (Active Scan), 50% of the scans are targeted at the Priority #1 Member channel. Example: If the Priority #1 Member is P1, and the non-priority Scan List Members are Nn, then the scanning sequence is: P1 N1, P1 N2, P1 N3, P1 N4, P1 N5, etc. Note: When the radio's speaker is unmuted to a non-priority call (Landed Scan mode), the radio continues to mute at a specific time interval (the Scan Interval Time), and scan for transmission activity on the Priority #1 Member channel. If the radio discovers a valid Priority #1 transmission, it drops the current transmission, and unmutes to the Priority #1 call. Priority Scan has to be enabled (per channel) for this feature to function.
Prime Channel Return Hang Time	The amount of time that the radio will stay idle in another channel before reverting back to the Prime Channel.
Private Line (PL)	A sub-audible tone/code used to create unique/private communication groups while operating in Conventional Dispatch mode. A generic term for Tone Private Line (TPL), or Digital Private Line (DPL).
Program	The transfer of CPS information from the computer's temporary memory (RAM) to the radio.
PTT	Push-To-Talk: the switch located on the left side of the radio which, when pressed, causes the radio to transmit.
Random Access Memory (RAM)	A temporary storage space used by a computer to operate a software program currently running. Anything stored in RAM is lost when the computer is turned off.
Registers	Short-term data-storage circuits within the microcontroller.

Term	Definition
Repeater	Remote transmit/receive facility that retransmits received signals to improve communications coverage.
RESET	Reset line: an input to the microcontroller that restarts execution.
RF PA	Radio Frequency Power Amplifier.
Radio Interface Box (RIB)	Used to connect a personal computer to a radio for the purpose of communication between the two. The RIB consists of level-shifting circuits that convert from the standard RS-232 voltage levels of the computer asynchronous serial interface (COM Port) to the single-ended voltage levels present on the Serial Bus contacts of the radio's connector. The RIB must have an appropriate RIB-to-radio and RIB-to-computer Radio Interface Cable for communication and radio programming to occur.
Receive Frequency	A designated frequency used when receiving carrier for the current channel.
Reverse Burst / Turn Off Code	Causes a Tone Private Line (TPL) or Digital Private Line (DPL) code to be transmitted at the end of a transmission - once PTT is released, and while operating on the current channel. This sub-audible tone causes the receiving radio to mute its speaker before loss of a carrier is detected. Muting the speaker eliminates unwanted noise (squelch tail) during loss of carrier detection.
ROM	Read Only Memory.
RSSI	Received Signal-Strength Indicator: a dc voltage proportional to the received RF signal strength.
RPT/TA	Repeater/Talk-Around.
Rx DPL Code	The specific code accepted when receiving Digital Private Line (DPL) encoding, while operating on the current channel.
Rx DPL Invert	Setting Rx DPL Invert causes Digital Private Line (DPL) signals to be inverted when they are received by the radio, while operating on the current channel. Inverted coding allows for more traffic/usage on frequencies.
Rx TPL Frequency	A designated frequency used when receiving Tone Private Line (TPL), while operating on the current channel. This frequency can directly correlate to the Rx TPL Code field; however, non standard code frequencies may also be selected.
Scan List	The Scan List determines which channels the radio scans, when operating in the Scan Mode, on the current channel.
Scan List Member	The Scan List allows you to select the grouping of channels that make up the current Scan List Member channel. This grouping of a Scan List Member channel can then be scanned for transmission activity - one at a time, when the radio is in Scan Mode. A Scan List can have a maximum of 16 Scan List Members. Scan List Member scanning priority is definable. A Scan List can be assigned to a channel. One Scan List is available.
Scan Mode	When the radio is in one of the two Scan States: Active Scan and Landed Scan. This mode is initiated when the programmable SCAN button is pressed.

Term	Definition
Scan Type	There are two types of scanning available on the current Conventional Personality: Normal Scan or Priority Scan.
Serial Number	Each radio has its own unique serial number. This information is stored in the radio's codeplug.
Short Press Function	Function that is invoked if the button is pressed and released within one second.
Softpot	Software Potentiometer: a computer-adjustable electronic attenuator.
Software	Computer programs, procedures, rules, documentation, and data pertaining to the operation of a system.
Squelch	Muting of audio circuits when received signal levels fall below a pre-determined value.
Squelch Level	The amount of carrier energy required to unmute the radio's speaker upon satisfying the selected Carrier Squelch threshold. Low level allows more transmissions with less clarity to unmute the radio's speaker. High level increases the squelch threshold causing a stronger carrier signal to be required before the radio's speaker will unmute. This helps to reduce unwanted noise.
Tone Private Line (TPL)	Transmitted when the receiving radio is to only receive calls from radios with specific TPL codes, this creates communications groups while operating in Conventional Dispatch mode. TPL allows for more use and privacy on a frequency. TPL is transmitted at a sub-audible (not able to be heard) frequency. Also known as CTCSS.
TOT	Time-Out Timer: a timer that limits the length of a transmission.
TPL	Tone Private-line.
Tx DPL Code	The Digital Private Line (DPL) code that transmits while operating on the current channel.
Tx DPL Invert	Setting Tx DPL Invert causes Digital Private Line (DPL) signals to be inverted before they are transmitted from the radio, while operating on the current channel. Inverted coding allows for more traffic/usage on frequencies.
Tx Frequency	A designated frequency used when transmitting carrier for the current channel.
Tx Offset	The offset that will be added to the VFO Rx Frequency when radio transmits in VFO mode. Available options are: None (transmits using Rx Frequency), Pos (transmits using Rx Frequency + Offset Frequency), Neg (transmits using Rx Frequency - Offset Frequency), User (transmits using the User Defined Tx Frequency).
Tx Power	The transmit power level while operating on the current channel. High: Used when a stronger signal is needed to extend transmission distances. Low: Used when communicating in close proximity, and to keep the radio from transmitting into other geographical groups operating on the same frequency.

Term	Definition
Tx TPL Frequency	A designated frequency used to transmit Tone Private Line (TPL) encoding, while operating on the current channel. This frequency can directly correlate to the Tx TPL Code field; however, non standard code frequencies may also be selected.
μ C	Microcontroller.
UHF	Ultra High Frequency.
Unmuting	A radio unmutes, when it opens its speaker to receive audio.
μ P	Microprocessor.
Upper Scan Frequency	The upper limit that VFO will scan.
User Defined PL Frequency	You can customize up to three non standard PL frequencies to provide more choices for PL.
VCO	Voltage-Controlled Oscillator: an oscillator whereby the frequency of oscillation can be varied by changing a control voltage.
VFO	Variable Frequency Operation. The radio user chooses frequencies instead of preprogrammed channels to operate the radio.
VFO Scan	Radio scans the preprogrammed frequency range defined by VFO Upper Scan Frequency and Lower Scan Frequency in the increment defined by Frequency Step Size.
VHF	Very High Frequency.
VSWR	Voltage Standing Wave Ratio.