Professional Digital Two-Way Radio System

MOTOTRBO™ Repeater

Detailed Service Manual

XPR™ 8300 Repeater

XPR™ 8400 Repeater

MOTOROLA







Foreword

This manual covers all models of the XPR™ 8300/XPR™ 8400 Repeater, unless otherwise specified. This manual provides sufficient information to enable qualified service technicians to troubleshoot and repair the XPR™ 8300/ XPR™ 8400 Repeater to the component level.

For details on radio operation or basic troubleshooting, refer to the applicable manuals available separately.



These servicing instructions are for use by qualified personnel only. To reduce the risk of electric shock, do not perform any servicing other than that contained in the Operating Instructions unless you are qualified to do so. Refer all servicing to qualified service personnel.

Product Safety and RF Exposure Compliance



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

ATTENTION!

This repeater 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 product (Motorola Publication part number 6881095C99) to ensure compliance with RF energy exposure limits.

For a list of Motorola-approved antennas, and other accessories, visit the following web site which lists approved accessories: http://www.motorola.com/governmentandenterprise

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Notes

Document History

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

Edition	Description	Date
6816811H01-A	Initial edition.	May 2007
6816811H01-B	Added VHF High Power Band Information	June 2007
6816811H01-C	Added UHF Low Power and VHF Low Power Band Information. Added issue C boards to all bands.	Nov. 2007
6816811H01-D	Added UHF2 Band Information.	June 2008
6816811H01-E	For UHF2 Band: changed four capacitors namely C0811, C0812, C0719 and C0746 in Power Amp schematic and parts list . Added section: Summary of Printed Circuit Boards and Bands available in manual.	June 2009
6816811H01-F	Added R6 Controller. Added Repeater Indicator Board PMLN5643_. Added Connector Board PMLN5644_. Added a new set of Printed Circuit Boards, Schematics and Parts Lists to: VHF (High & Low Power), UHF1 (High & Low Power), UHF2 (High Power) bands.	Sept. 2010

Notes

Commercial Warranty

Limited Warranty

MOTOROLA COMMUNICATION PRODUCTS

I. What This Warranty Covers And For How Long

MOTOROLA INC. (“MOTOROLA”) warrants the MOTOROLA manufactured Communication Products listed below (“Product”) against defects in material and workmanship under normal use and service for a period of time from the date of purchase as scheduled below:

Repeater	Two (2) Years
Product Accessories	One (1) Year

Motorola, at its option, will at no charge either repair the Product (with new or reconditioned parts), replace it (with a new or reconditioned Product), or refund the purchase price of the Product during the warranty period provided it is returned in accordance with the terms of this warranty. Replaced parts or boards are warranted for the balance of the original applicable warranty period. All replaced parts of Product shall become the property of MOTOROLA.

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You must provide proof of purchase (bearing the date of purchase and Product item serial number) in order to receive warranty service and, also, deliver or send the Product item, transportation and insurance prepaid, to an authorized warranty service location. Warranty service will be provided by Motorola through one of its authorized warranty service locations. If you first contact the company which sold you the Product, it can facilitate your obtaining warranty service. You can also call Motorola at 1-888-567-7347 US/Canada.

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B. Defects or damage from misuse, accident, water, or neglect.

C. Defects or damage from improper testing, operation, maintenance, installation, alteration, modification, or adjustment.

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G. Freight costs to the repair depot.

H. A Product which, due to illegal or unauthorized alteration of the software/firmware in the Product, does not function in accordance with MOTOROLA’s published specifications or the FCC type acceptance labeling in effect for the Product at the time the Product was initially distributed from MOTOROLA.

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J. Normal and customary wear and tear.

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B. that MOTOROLA will have sole control of the defense of such suit and all negotiations for its settlement or compromise; and

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VII. Governing Law

This Warranty is governed by the laws of the State of Illinois, USA.

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Detailed Service Manual

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Appendix B Motorola Service Centers

Glossary

September, 2010

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Summary of Printed Circuit Boards and Bands available:

Table below lists all the bands available in this manual and the revision of the Printed Circuit Boards used. For details, please refer to the respective chapters.

Chapter	Description	PC Board Part Number	Board Revision
2	Repeater Indicator Board (PMLN4814_)	8415470H02	B
2	Repeater Indicator Board (PMLN5269_)	8415470H04	D
2	Repeater Indicator Board (PMLN5643_)	84012135001	A
3	Connector Board (PMLN4815_)	8415472H01	A
3	Connector Board (PMLN5270_)	8415472H05	E
3	Connector Board (PMLN5644_)	8402133002	B
5	VHF Low Power 136–174 MHz, 1–25 W	8471495L01 8471495L03 8471495L04	A C D
6	VHF High Power 136–174 MHz, 25–45 W	8478023A12 8478023A16 8478023A17	P8 C D
7	UHF1 Low Power 403–470 MHz, 1–25 W	8471165L03 8471165L05 8471165L06	A C D
8	UHF1 High Power 403–470 MHz, 25–40 W	8486777Z12 8486777Z14 8486777Z15	A C D
9	UHF2 High Power 450–512 MHz, 1–40 W	8471696M01 8471696M02	A D

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XPR 8300/XPR8400 MOTOTRBO Repeater

Chapter 1

Service Maintainability

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Chapter 1 - Service Maintainability

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Section 1

INTRODUCTION

1.0 Notations Used in This Manual

Throughout the text in this publication, you will notice the use of note and caution notations. These notations are used to emphasize that safety hazards exist, and due care must be taken and observed.

NOTE: An operational procedure, practice, or condition that is essential to emphasize.



Caution

CAUTION indicates a potentially hazardous situation which, if not avoided, **might** result in equipment damage.

2.0 Repeater Description

The XPR 8300/XPR 8400 repeater is available in the following frequency ranges and power levels.

Table 1-1 Frequency Ranges and Power Levels

Freq. Band	Bandwidth	Power Level
VHF	136–174 MHz	1–25 Watts 25–45 Watts
UHF B1	403–470 MHz	1–25 Watts 25–40 Watts
UHF B2	450–512 MHz	1–40 Watts

This repeater is among the most sophisticated two-way repeaters available. It has a robust design for users who need high performance, quality, and reliability in their daily communications. This architecture provides the capability of supporting a multitude of legacy and advanced features resulting in a more cost-effective two-way repeater communications solution.

Notes

Section 2

MAINTENANCE

1.0 Introduction

This chapter provides details about the following:

- Preventive maintenance (inspection and cleaning).
- Safe handling of CMOS and LDMOS devices.
- Repair procedures and techniques.

2.0 Preventive Maintenance

Periodic visual inspection and cleaning is recommended.

2.1 Inspection

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

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 repeater. External surfaces include the top cover and repeater enclosure.

Periodically clean smudges and grime from exterior enclosure. Use a soft, non-abrasive cloth moistened in a mild soap and water solution Rinse the surface using a second cloth moistened in clean water, and clean any dirt or debris from the fan grill and louvers on the front side.

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

The only recommended agent for cleaning the external repeater surfaces is a 0.5% solution of a mild dishwashing detergent in water. The only factory recommended liquid for cleaning the printed circuit boards and their components is isopropyl alcohol (100% by volume).

Cleaning Internal Circuit Boards and Components

Isopropyl alcohol (100%) may be applied 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 repeater. 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. Once the cleaning process is complete, use a soft, absorbent, lintless cloth to dry the area. Do not brush or apply any isopropyl alcohol to the top cover and repeater enclosure.

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

3.0 Safe Handling of CMOS and LDMOS Devices

Complementary metal-oxide semiconductor (CMOS) devices are used in this family of repeaters, 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 repeater without first referring to the following CAUTION statement.



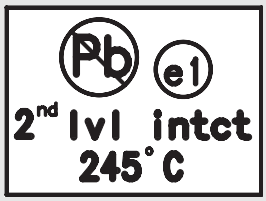
Caution

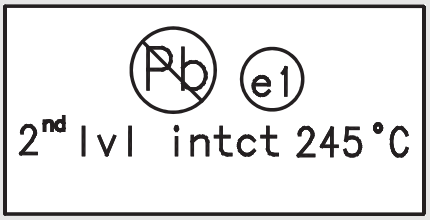
This repeater contains static-sensitive devices. Do not open the repeater unless you are properly grounded. Take the following precautions when working on this unit:

- 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 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 4280385A59).
- 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.

4.0 Repair Procedures and Techniques — General

NOTE Environmentally Preferred Products (EPP) (refer to the marking on the printed circuit boards — examples shown below) were developed and assembled using environmentally preferred components and solder assembly techniques to comply with the European Union's **Restriction of Hazardous Substances (ROHS) Directive 2002/95/EC** and **Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC**. To maintain product compliance and reliability, use only the Motorola specified parts in this manual.





Any rework or repair on Environmentally Preferred Products must be done using the appropriate lead-free solder wire and lead-free solder paste as stated in the following table:

Table 2-1 Lead Free Solder Wire Part Number List

Motorola Part Number	Alloy	Flux Type	Flux Content by Weight	Melting Point	Supplier Part number	Diameter	Weight
1088929Y01	95.5Sn/3.8Ag/0.7Cu	RMA Version	2.7-3.2%	217°C	52171	0.015"	1lb spool

Table 2-2 Lead Free Solder Paste Part Number List

Motorola Part Number	Manufacturer Part Number	Viscosity	Type	Composition & Percent Metal	Liquid Temperature
1085674C03	NC-SMQ230	900-1000KCPs Brookfield (5rpm)	Type 3 (-325/+500)	(95.5%Sn-3.8%Ag-0.7%Cu) 89.3%	217°C

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 Radio Products and Solutions Organization listed in Appendix A of this manual.

Rigid Circuit Boards

The repeater 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 a connector:

- 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.

Chip Components

Use the RLN4062 Hot-Air Repair Station for chip component replacement. Adjust the temperature control to 370°C (700°F), and adjust the airflow to a minimum setting. Airflow can vary due to component density.

- **To remove a chip component**:
  1. Use a hot-air hand piece and position the nozzle of the hand piece approximately 0.3 cm (1/8") above the component to be removed.
  2. Begin applying the hot air. Once the solder reflows, remove the component using a pair of tweezers.
  3. Using a 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**:
  1. Select the appropriate micro-tipped soldering iron and apply fresh solder to one of the solder pads.
  2. Using a pair of tweezers, position the new chip component in place while heating the fresh solder.
  3. Once solder wicks onto the new component, remove the heat from the solder.
  4. 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**:
  1. Use the hot-air hand piece and reflow the solder on the solder pads to smooth it.
  2. Apply a drop of solder paste flux to each pad.
  3. Using a pair of tweezers, position the new component in place.
  4. Position the hot-air hand piece approximately 0.3 cm (1/8") above the component and begin applying heat.
  5. Once the solder wicks to the component, remove the heat and inspect the repair. All joints should be smooth and shiny.

Shields

Removing and replacing shields is recommended to be done with an Air Blower, BOSCH GHG 600-3 or equivalent. The temperature should be set to approximately 400°C (752°F).

- **To remove the shield**:
  1. Place the circuit board in the circuit board holder.
  2. Add solder paste flux around the base of the shield.
  3. Position the heat-focus head onto the shield.
  4. Turn on the heater and wait until the shield lifts off the circuit board.
  5. Once the shield is off, turn off the heat, and grab the part with a pair of tweezers.
  6. Remove the circuit board from the circuit board holder.

- **To replace the shield:**
  1. Add solder to the shield if necessary, using a micro-tipped soldering iron.
  2. 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.
  3. Place the circuit board back in the circuit board holder.
  4. Place the shield on the circuit board using a pair of tweezers.
  5. Position the heat-focus head over the shield.
  6. Turn on the heater and wait for the solder to reflow.
  7. Once complete, turn off the heat, raise the heat-focus head and wait approximately one minute for the part to cool.
  8. Remove the circuit board and inspect the repair. No cleaning should be necessary.

Notes

Section 3

TEST EQUIPMENT AND SERVICE AIDS

1.0 Recommended Test Equipment

The list of equipment contained in Table 3-1 includes most of the standard test equipment required for servicing Motorola repeaters.

Table 3-1 Recommended Test Equipment

Equipment	Characteristic	Example	Application
Service Monitor	Can be used as a substitute for items marked with an asterisk (*)	Motorola R2670, or equivalent.	Frequency/deviation meter and signal generator for wide-range troubleshooting and alignment
Digital RMS Multimeter*	100 µV to 300 V 5 Hz to 1 MHz 10 Meg Ohm Impedance	Fluke 179 or equivalent (www.fluke.com)	AC/DC voltage and current measurements. Audio voltage measurements.
RF Signal Generator*	100 MHz to 1 GHz -130 dBM to +10 dBM FM Modulation 0 kHz to 10 kHz	Agilent N5181A (www.agilent.com), Ramsey RSG1000B (www.ramseyelectronics.com), or equivalent	Receiver measurements
Oscilloscope*	2 Channels 50 MHz Bandwidth 5 mV/div to 20 V/div	Leader LS8050 (www.leaderusa.com), Tektronix TDS1001b (www.tektronix.com), or equivalent	Waveform measurements
Power Meter and Sensor*	5% Accuracy 100 MHz to 500 MHz 50 Watts	Bird 43 Thruline Watt Meter (www.bird-electronic.com) or equivalent	Transmitter power output measurements
RF Millivolt Meter	100 mV to 3 V RF 10 kHz to 1 GHz	Boonton 92EA (www.boonton.com) or equivalent	RF level measurements

2.0 Service Aids

Table 3-2 lists the service aids recommended for working on the repeater. While all of these items are available from Motorola, most are standard workshop equipment items, and any equivalent item capable of the same performance may be substituted for the item listed.

Table 3-2 Service Aids

Motorola Part Number	Description	Application
RLN4460_	Test Set	Enables connection to audio/accessory jack. Allows switching for radio testing.
RVN5115_	Customer Programming Software on CD-ROM	Allows servicer to program repeater parameters, tune and troubleshoot repeaters.
PMKN4010_	Mobile & Repeater Rear Programming Cable	Connects the radio's rear connector to a USB port for radio programming and data applications.
PMKN4016_	Mobile & Repeater Rear Accessory Programming and Test Cable	Connects the radio's rear connector to a USB port for radio programming, data applications, testing and alignment.
PMKN4018_	Mobile & Repeater Rear Accessory Connector Universal Cable	Connects the radio's rear connector to accessory devices such as desk sets. Cable contains all 26 wires and is unterminated at the user end.

3.0 Programming Cables

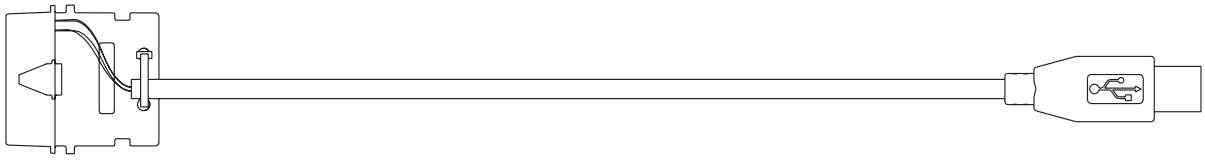
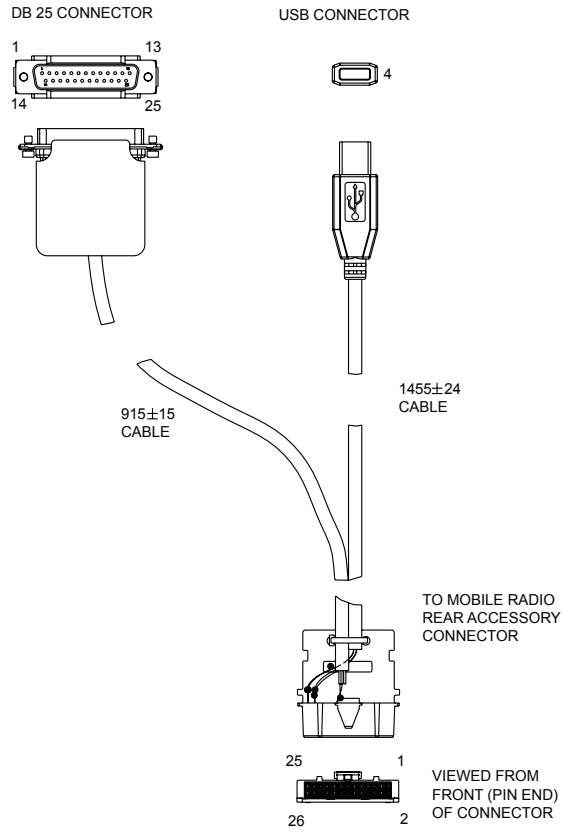


*Figure 3-1 Mobile & Repeater Rear Programming Cable PMKN4010_*



WIRE DIAGRAM			
REAR ACCESSORY CONNECTOR		USB	DB25P
PIN NO.	DESCRIPTION		
3	VCC (5 V)	1	
2	DATA -	2	
1	DATA +	3	
4	GND		
9	SPEAKER -		7
11	EXT MIC		17
17	DIGI IN 1 (EXT PTT)		20
16	GND		16
10	SPEAKER +		1

*Figure 3-2 Mobile & Repeater Rear Accessory Programming and Test Cable PMKN4016_*

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XPR 8300/XPR 8400 MOTOTRBO Repeater

Chapter 2

Repeater Indicator Board

Service Information

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4.1 Repeater Indicator Board Parts List PMLN5643_ 2-19

Notes

Section 1

THEORY OF OPERATION

1.0 Overview

This section provides a detailed theory of operation for the Repeater Indicator Board and its components.

2.0 Repeater Indicator Board

The Repeater Indicator board contains circuitry to drive the front panel indicator LEDs, an RTC battery for the RTC in the transmit radio, as well as an Ethernet controller.

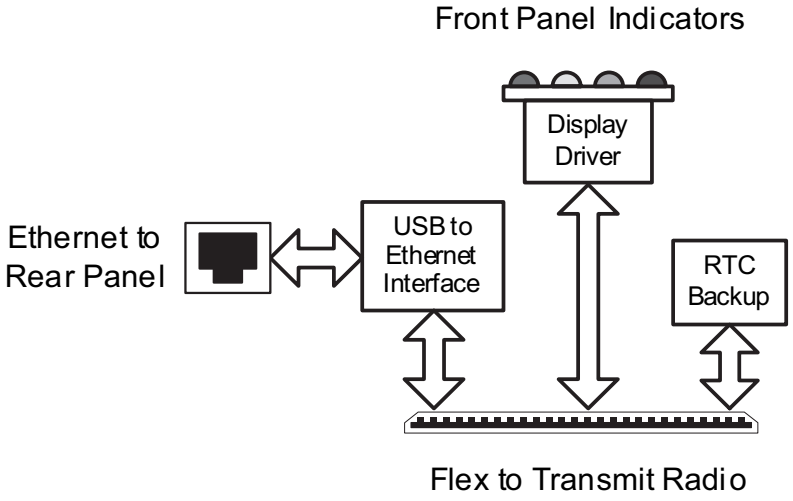


Figure 1-1 Repeater Indicator Board Block Diagram

All of the indicator LEDs that are on the front of the Repeater chassis reside on the Repeater Indicator board. Each is controlled by a shift register (U6) data out signal and a digital transistor. The shift register accepts serial data in from the transmit radio's OMAP processor via a SPI bus. A 74LVC07 buffer (U9) level shifts these signals from 3.3 V to 1.8 V.

The Repeater Disable LED is a dual-purpose LED that is hardware controlled initially at power-up. As soon as VBUS power is available on the Repeater Indicator board, the hardware circuitry for the Repeater Disable LED will cause it to blink periodically. When the software initialization is completed by the firmware, the blink circuitry will be disabled by the firmware. At that point, the Repeater Disable LED can be used for its intended purpose of displaying when the Repeater Disable function is turned on.

The power LED is the only LED that is not controlled by the software. This bi-color LED gets turned on green when the 13.8 V output from the power supply is valid. It turns on red when A/C power is lost, and the repeater's backup battery is used.

The Real Time Clock (RTC) battery (M1) is connected to the transmit radio through the Control Head Connector (J1, pin 30).

3.0 Ethernet Interface

The Repeater board uses an SMSC LAN9500 USB to 10/100 Ethernet controller (U8) to convert data from USB to Ethernet and vice-versa. An external 128 x 8 EEPROM (U2) is used to store the Ethernet MAC address and various USB configuration parameters. The transformer (T1) provides isolation between the Ethernet port and the Ethernet controller.

The LAN9500 controller integrates a 10/100 Ethernet MAC, 10/100 Ethernet PHY, USB 2.0 device controller, TAP controller, EEPROM controller, and a FIFO controller with 30 KB of internal packet buffering. The Ethernet controller supports auto-negotiation, auto-polarity correction, HP Auto-MDIX, and is compliant with the IEEE 802.3 and IEEE 802.3u standards. The internal EEPROM controller is used to load various USB configuration parameters and the device MAC address upon power-up. The USB portion of the LAN9500 integrates a High-speed USB 2.0 device controller and USB PHY. The USB device controller configures to Full-speed when communicating with the USB host controller on the TX transceiver board.

The LAN9500 integrates a 10/100 Ethernet MAC and an IEEE 802.3 PHY for twisted pair Ethernet applications. The PHY can be configured for 10Base-T (10 Mbps) or 100Base-TX (100 Mbps) and supports auto-negotiation, and full or half-duplex configurations. The controller also provides LED control signals for indicating Ethernet speed, link, and duplex configuration status. The Ethernet speed and Link LEDs reside on the Connector board's external Ethernet connector. The Link LED is the yellow LED and is lit solid when an Ethernet link is valid or blinking when there is transmit or receive activity. The speed LED is the green LED and indicates 100 Mbit operation when lit.

All of the Ethernet signals are transported to the Connector board through an Ethernet cable that connects the Repeater board to the Connector board. The LED signals are transported to the Connector board through an 8-pin cable that is also connected between the Repeater board and Connector board. (Applicable for VHF/UHF 32MB repeaters).

Section 2

REPEATER INDICATOR BOARDS / SCHEMATICS / PARTS LISTS

1.0 Allocation of Printed Circuit Boards, Schematics and Parts Lists

1.1 Repeater Indicator Board Circuits

This Chapter shows the Printed Circuit Boards (PCB), Schematics and Parts Lists for the Repeater Indicator Board circuits.

Table 2-1 Repeater Indicator Board Schematic Diagrams and Parts List

PCB :	
8415470H02 Repeater Indicator Board Top Side	Page 2-3
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Parts List	
Repeater Indicator Board, PMLN4814_	**Page 2-7**

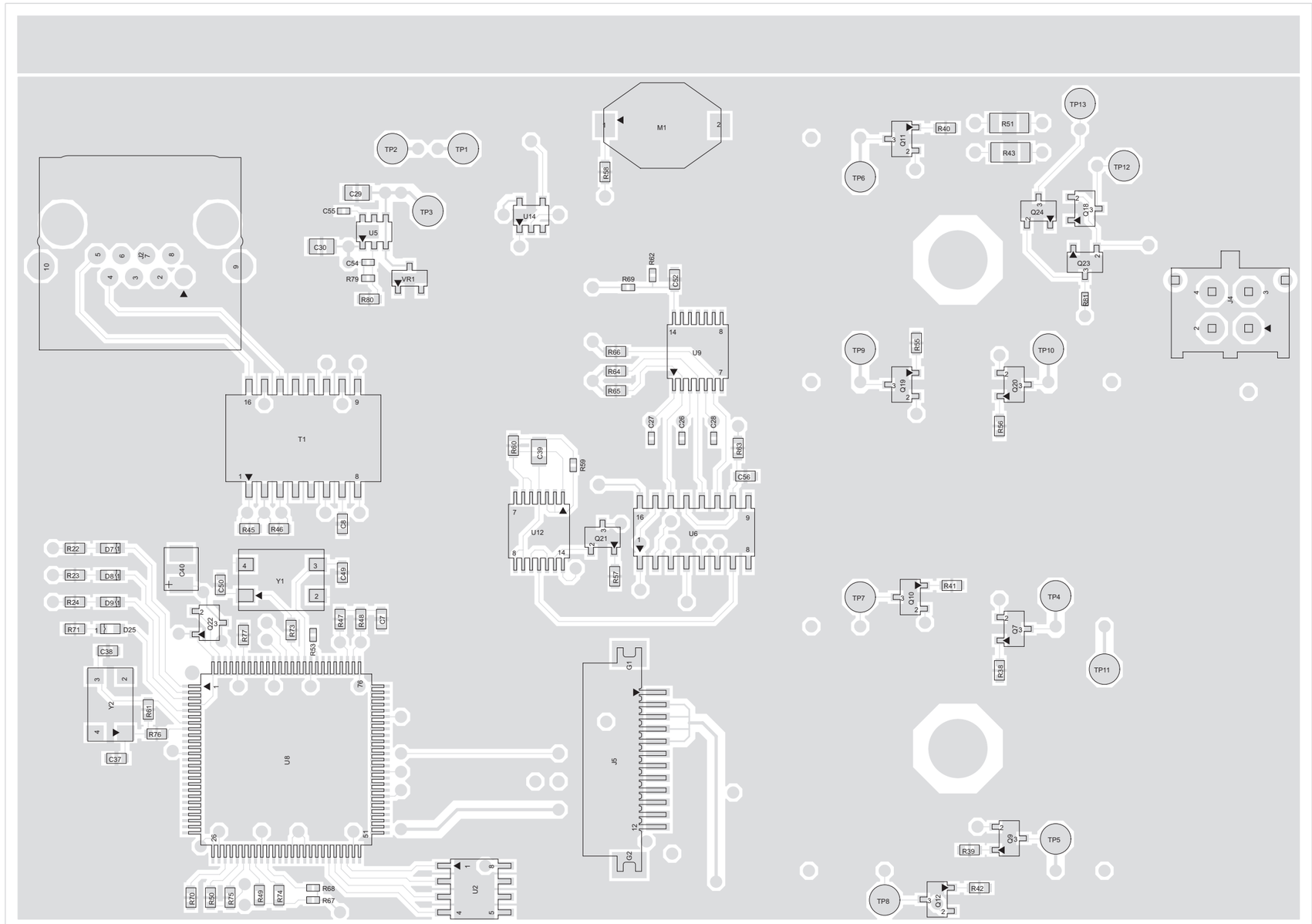
Table 2-2 Repeater Indicator Board Schematic Diagrams and Parts List

PCB :	
8415470H04 Repeater Indicator Board Top Side	Page 2-9
8415470H04 Repeater Indicator Board Bottom Side	Page 2-10
SCHEMATICS	
Repeater Indicator Board Schematic Diagram (Sheet 1 of 2)	**Page 2-11**
Repeater Indicator Board Schematic Diagram (Sheet 2 of 2)	**Page 2-12**
Parts List	
Repeater Indicator Board, PMLN5269_	**Page 2-13**

Table 2-3: Repeater Indicator Board Schematic Diagrams and Parts List

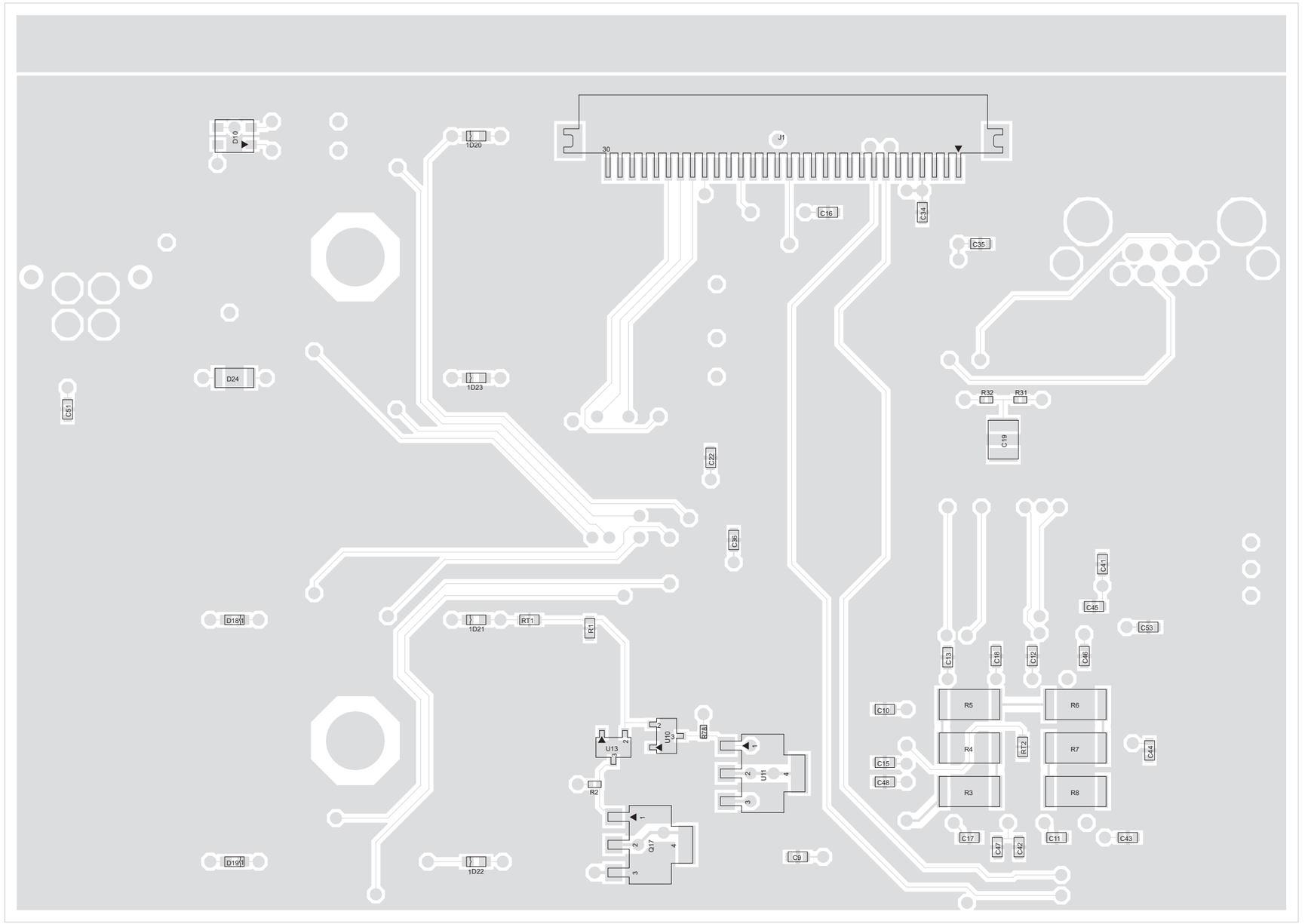
PCB :	
84012135001 Repeater Indicator Board Top Side	Page 2-15
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Parts List	
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2.0 Repeater Indicator Board (PMLN4814_) PCB/Schematics/Parts List



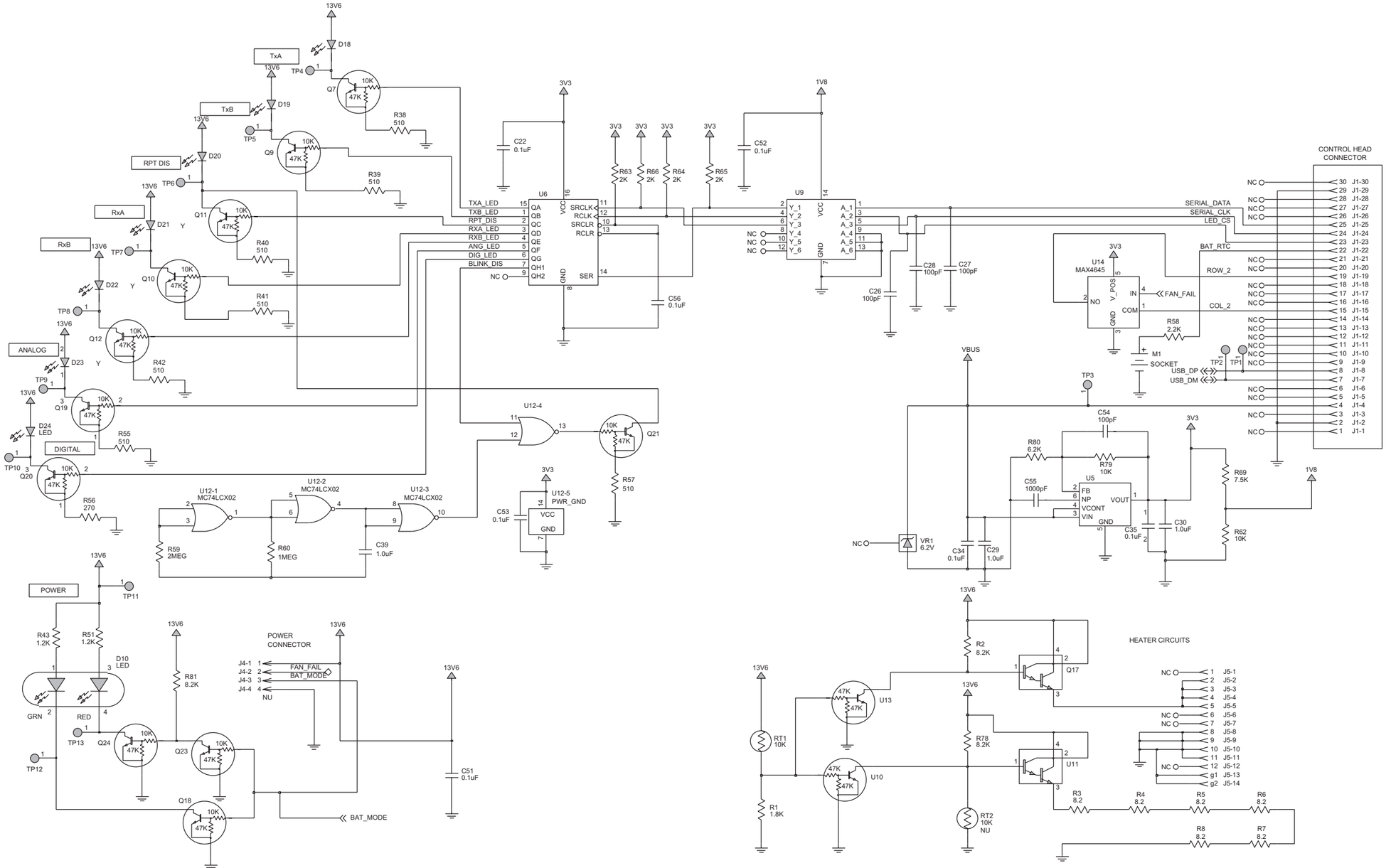
(For reference only - board is not field-repairable)

Repeater Indicator Board PCB 8415470H02 (Top Side)



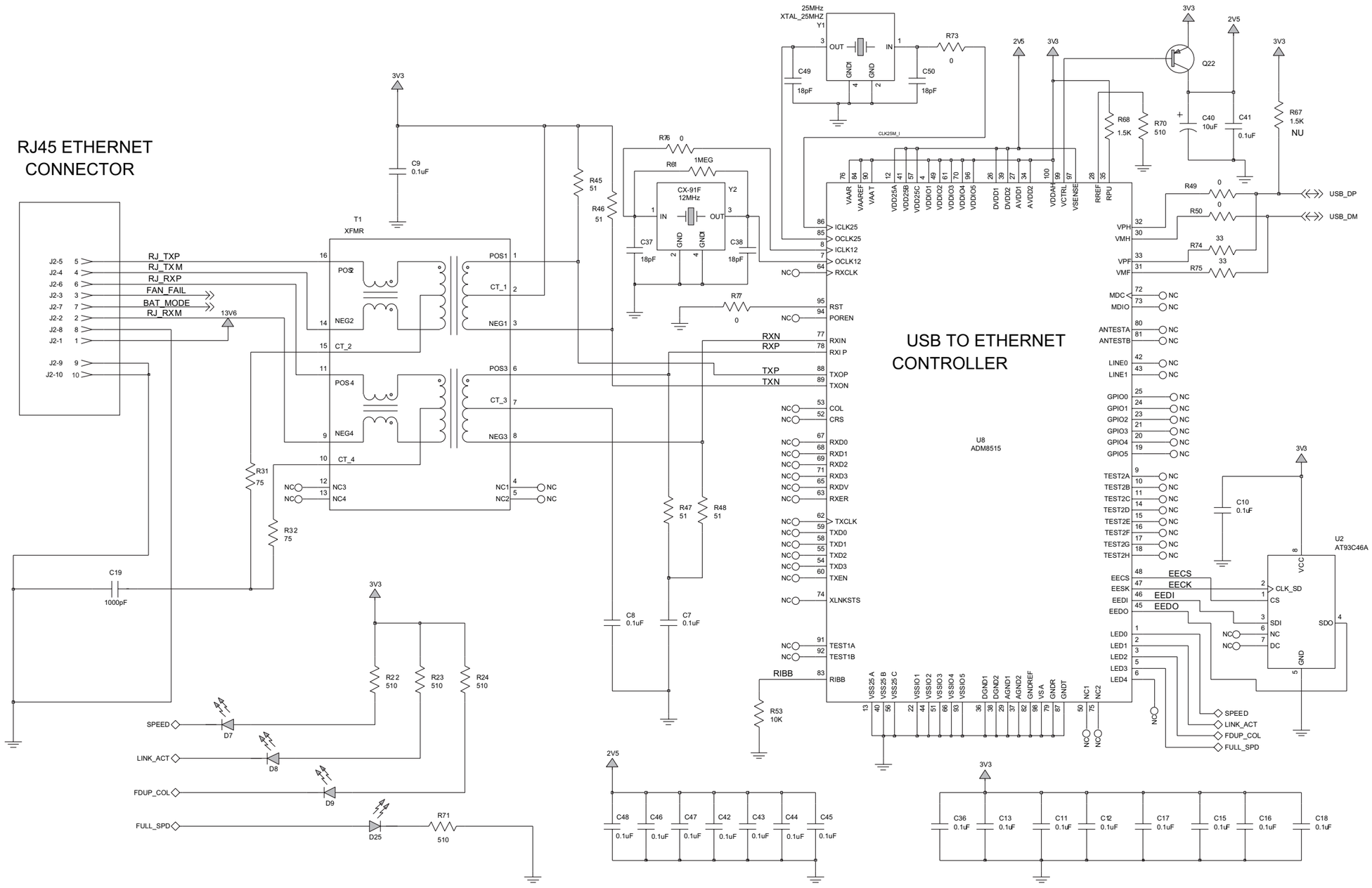
(For reference only - board is not field-repairable)

Repeater Indicator Board PCB 8415470H02 (Bottom Side)



(For reference only - board is not field-repairable)

Repeater Indicator Board Schematic Diagram (Sheet 1 of 2)



(For reference only - board is not field-repairable)

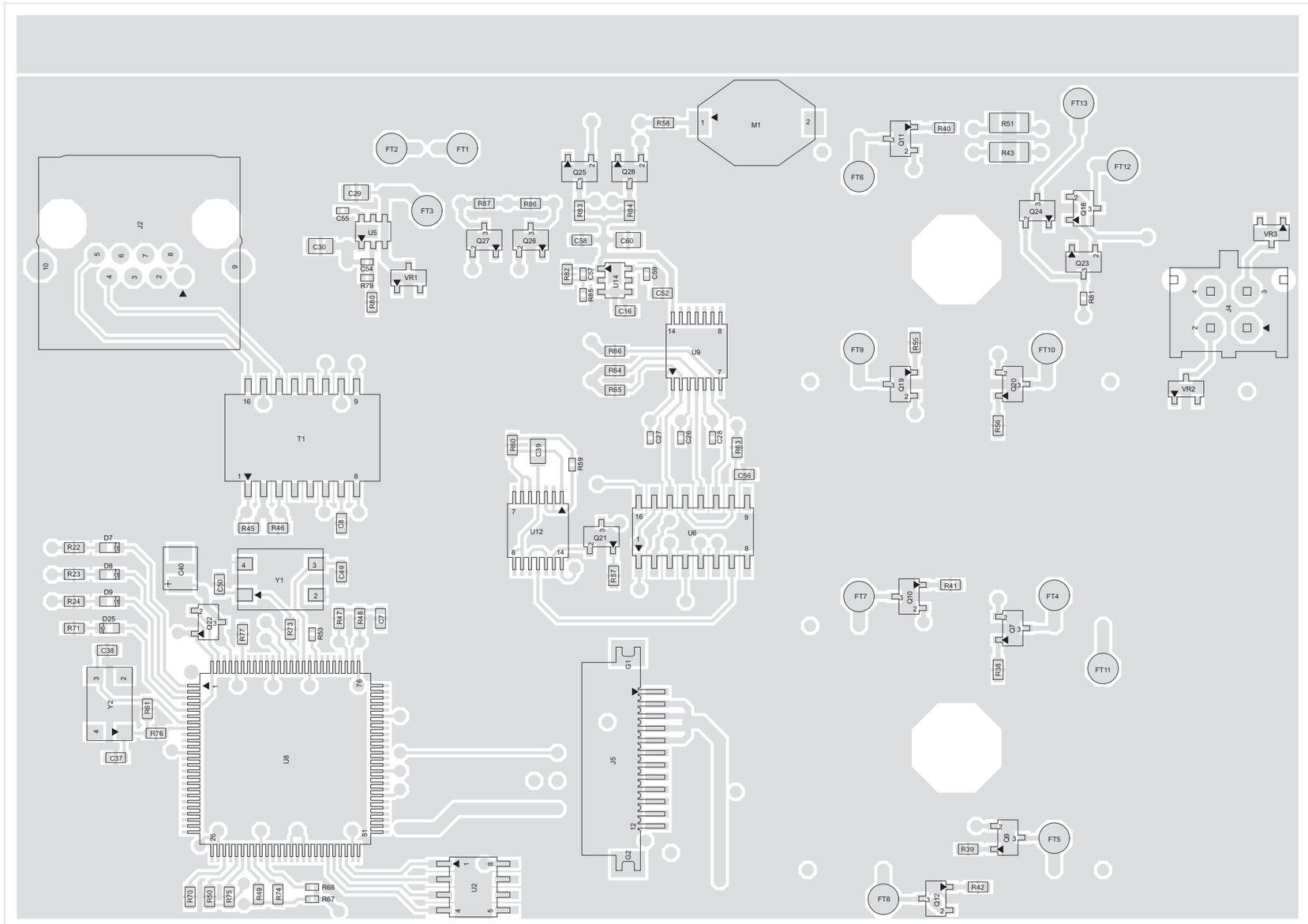
Repeater Indicator Board Schematic Diagram (Sheet 2 of 2)

2.1 Repeater Indicator Board Parts List PMLN4814_

Circuit Ref	Motorola Part No	Description
C07	2113945C31	CAP, 0.1uF
C08	2113945C31	CAP, 0.1uF
C09	2113945C31	CAP, 0.1uF
C10	2113945C31	CAP, 0.1uF
C11	2113945C31	CAP, 0.1uF
C12	2113945C31	CAP, 0.1uF
C13	2113945C31	CAP, 0.1uF
C15	2113945C31	CAP, 0.1uF
C16	2113945C31	CAP, 0.1uF
C17	2113945C31	CAP, 0.1uF
C18	2113945C31	CAP, 0.1uF
C19	2186154V01	CAP, 1000pF
C22	2113945C31	CAP, 0.1uF
C26	2113944A40	CAP, 100pF
C27	2113944A40	CAP, 100pF
C28	2113944A40	CAP, 100pF
C29	2113946E02	CAP, 1.0uF
C30	2113946E02	CAP, 1.0uF
C34	2113945C31	CAP, 0.1uF
C35	2113945C31	CAP, 0.1uF
C36	2113945C31	CAP, 0.1uF
C37	2113944C33	CAP, 18pF
C38	2113944C33	CAP, 18pF
C39	2113946E02	CAP, 1.0uF
C40	2313960D07	CAPP, 10uF
C41	2113945C31	CAP, 0.1uF
C42	2113945C31	CAP, 0.1uF
C43	2113945C31	CAP, 0.1uF
C44	2113945C31	CAP, 0.1uF
C45	2113945C31	CAP, 0.1uF
C46	2113945C31	CAP, 0.1uF
C47	2113945C31	CAP, 0.1uF
C48	2113945C31	CAP, 0.1uF
C49	2113944C33	CAP, 18pF
C50	2113944C33	CAP, 18pF
C51	2113945C31	CAP, 0.1uF
C52	2113945C31	CAP, 0.1uF
C53	2113945C31	CAP, 0.1uF
C54	2113944A40	CAP, 100pF
C55	2113945A09	CAP, 1000pF
C56	2113945C31	CAP, 0.1uF
D07	4815809H03	HT-S91UY
D08	4815809H01	HT-S91UYG
D09	4815809H02	HT-S91URO
D10	4887557T01	HSMF-C155
D18	4815809H01	HT-S91UYG
D19	4815809H01	HT-S91UYG
D20	4815809H02	HT-S91URO
D21	4815809H03	HT-S91UY
D22	4815809H03	HT-S91UY
D23	4815809H03	HT-S91UY
D24	4883288Y04	HSMB-C150
D25	4815809H03	HT-S91UY
J1	0915555H01	30 pin
J2	0915930H01	RJ45
J5	0971174L01	12 pin
M1	0985888K02	SOCKET
Q07	4815261H01	DTC114YKAF
Q09	4815261H01	DTC114YKAF
Q10	4815261H01	DTC114YKAF
Q11	4815261H01	DTC114YKAF
Q12	4815261H01	DTC114YKAF
Q17	4815867H01	PZTA14
Q18	4815261H01	DTC114YKAF
Q19	4815261H01	DTC114YKAF
Q20	4815261H01	DTC114YKAF
Q21	4815261H01	DTC114YKAF
Q22	4815700H01	2SB1197K
Q23	4815261H01	DTC114YKAF
Q24	4815261H01	DTC114YKAF
R01	0613952H79	RES, 1.8K
R02	0613952Q95	RES, 8.2K
R03	0613959Q23	RES, 8
R04	0613959Q23	RES, 8
R05	0613959Q23	RES, 8
R06	0613959Q23	RES, 8
R07	0613959Q23	RES, 8
R08	0613959Q23	RES, 8
R22	0613952H66	RES, 510
R23	0613952H66	RES, 510
R24	0613952H66	RES, 510
R31	0613952Q46	RES, 75
R32	0613952Q46	RES, 75
R38	0613952H66	RES, 510
R39	0613952H66	RES, 510
R40	0613952H66	RES, 510
R41	0613952H66	RES, 510
R42	0613952H66	RES, 510
R43	0613958S75	RES, 1.2K
R45	0613952H42	RES, 51
R46	0613952H42	RES, 51
R47	0613952H42	RES, 51
R48	0613952H42	RES, 51
R49	0613952H13	RES, 3.3
R50	0613952H13	RES, 3.3
R51	0613958S75	RES, 1.2K
R53	0613952N01	RES, 10K
R55	0613952H66	RES, 510
R56	0613952H59	RES, 270
R57	0613952H66	RES, 510
R58	0613952H81	RES, 2.2K
R59	0613952R56	RES, 2MEG
R60	0613952J49	RES, 1MEG
R61	0613952J49	RES, 1MEG
R62	0613952N01	RES, 10K
R63	0613952H80	RES, 2K
R64	0613952H80	RES, 2K
R65	0613952H80	RES, 2K
R66	0613952H80	RES, 2K
R68	0613952Q77	RES, 1.5K
R69	0613952Q94	RES, 7.5K
R70	0613952H66	RES, 510
R71	0613952H66	RES, 510
R73	0613952G67	RES, 0
R74	0613952H37	RES, 33
R75	0613952H37	RES, 33
R76	0613952G67	RES, 0
R77	0613952G67	RES, 0

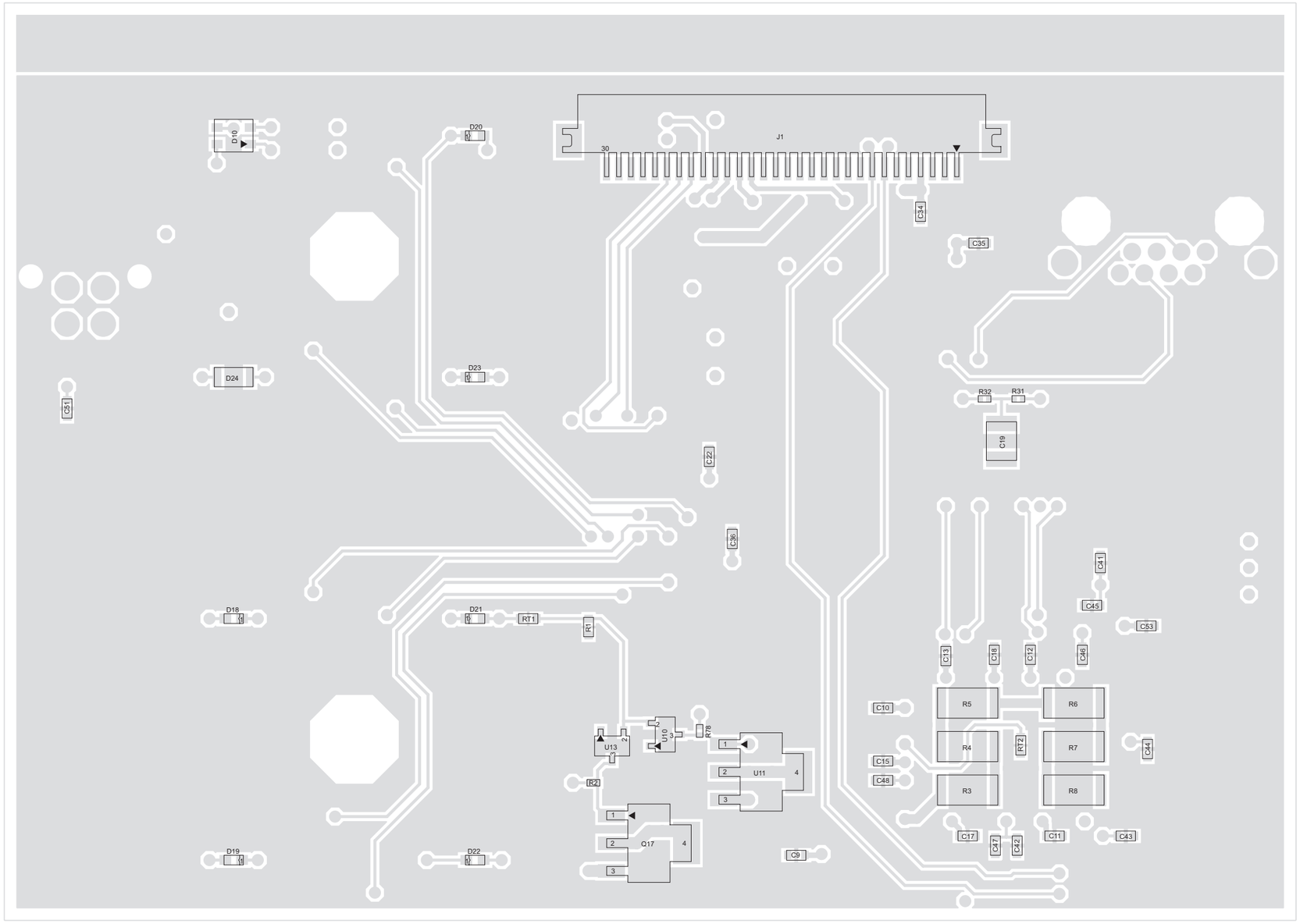
Circuit Ref	Motorola Part No	Description
R78	0613952Q95	RES, 8.2K
R79	0613952N01	RES, 10K
R80	0613952H92	RES, 6.2K
R81	0613952Q95	RES, 2K
RT1	0615471H01	THERM, 10K
T1	2515640H01	XFMR_H1260
U02	5171839H01	IC, AT93C46EN
U05	5115391H01	TK11100CSC
U06	5115476H01	SN74AHC594DR
U08	5171161L01	ADM8515
U09	5115502H01	SN74LVC07ADR
U10	4815263H01	DTC144EKAF
U11	4815867H01	PZTA14
U12	5114007A02	MC74LCX02
U13	4815263H01	DTC144EKAF
U14	5185229Y01	MAX4645EUK+T
VR1	4813977M13	6.2V Zener
Y1	4802582S71	XTAL_25MHz
Y2	4809612J45	CX-91F
PCB	8415470H02	

3.0 Repeater Indicator Board (PMLN5269_) PCB/Schematics/Parts List



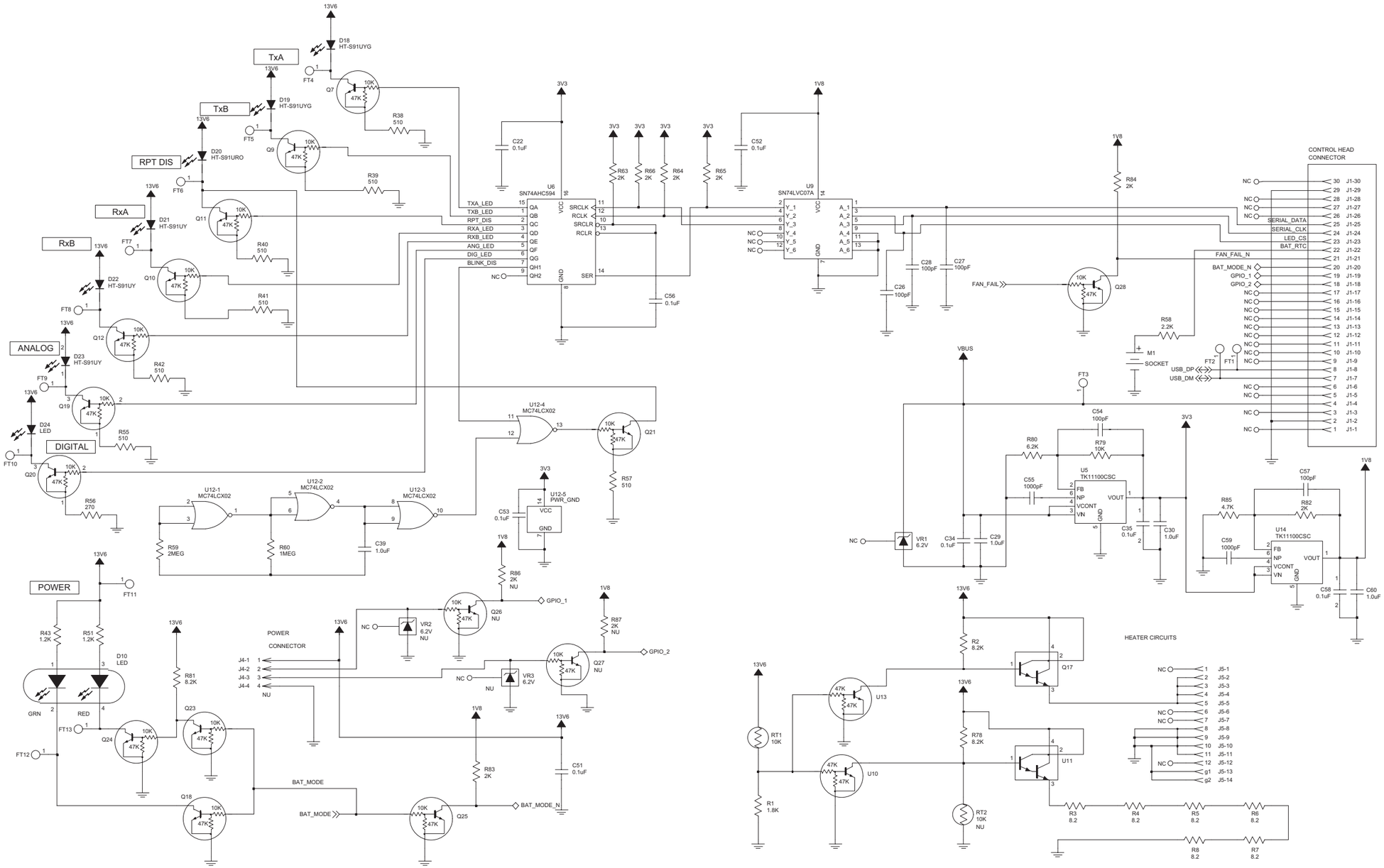
(For reference only - board is not field-repairable)

Repeater Indicator Board PCB 8415470H04 (Top Side)



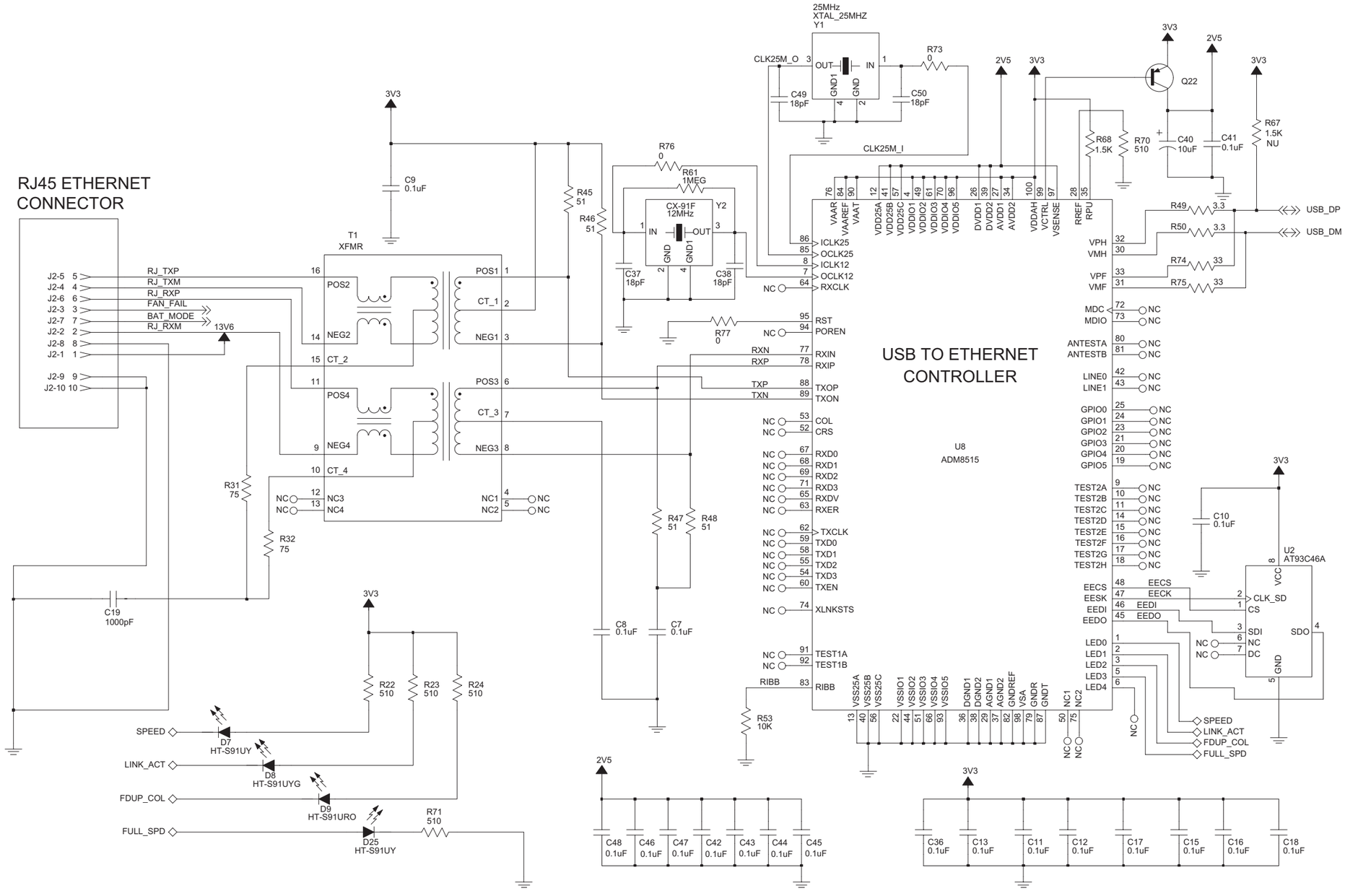
(For reference only - board is not field-repairable)

Repeater Indicator Board PCB 8415470H04 (Bottom Side)



(For reference only - board is not field-repairable)

Repeater Indicator Board Schematic Diagram (Sheet 1 of 2)



(For reference only - board is not field-repairable)

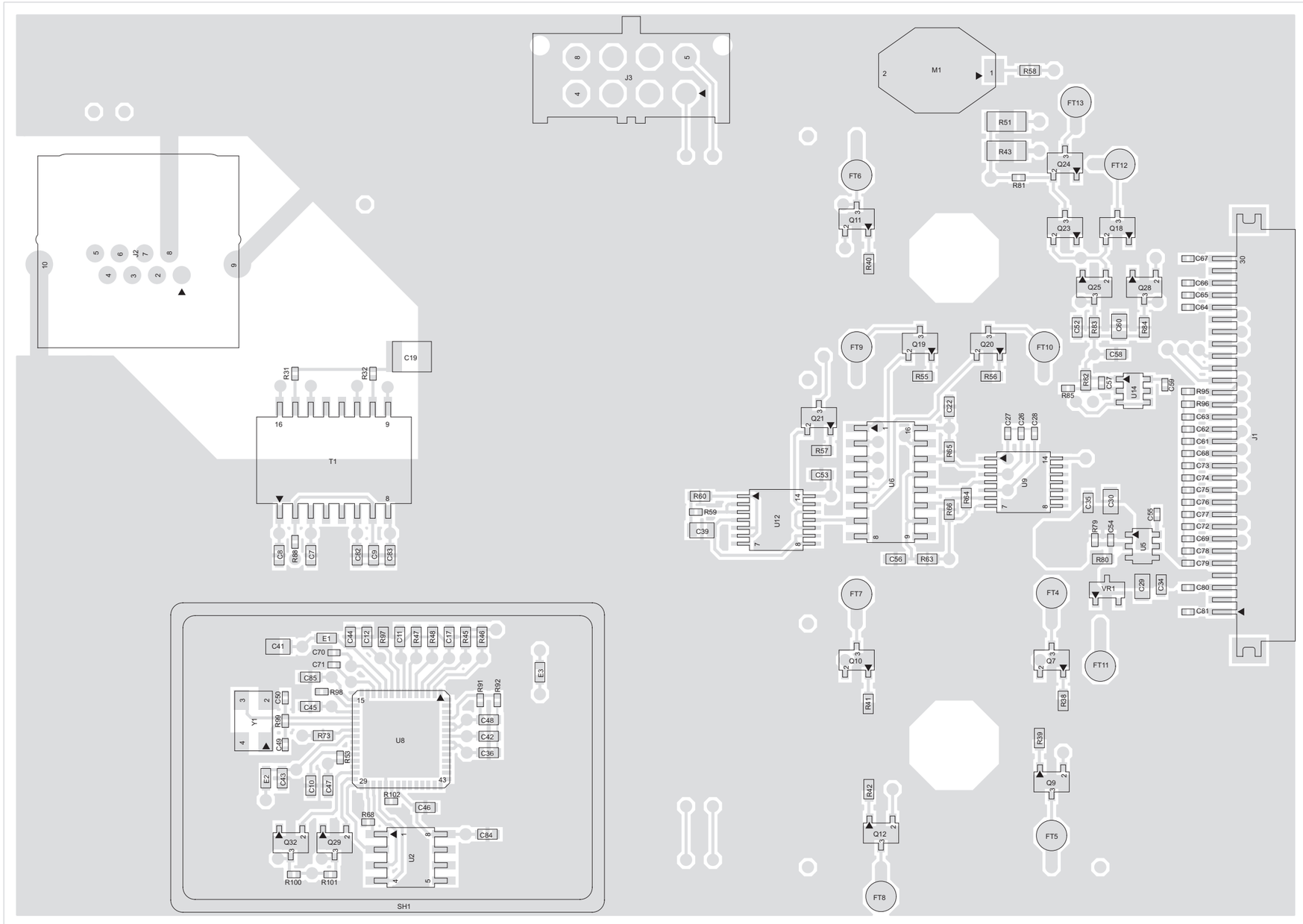
Repeater Indicator Board Schematic Diagram (Sheet 2 of 2)

3.1 Repeater Indicator Board Parts List PMLN5269_

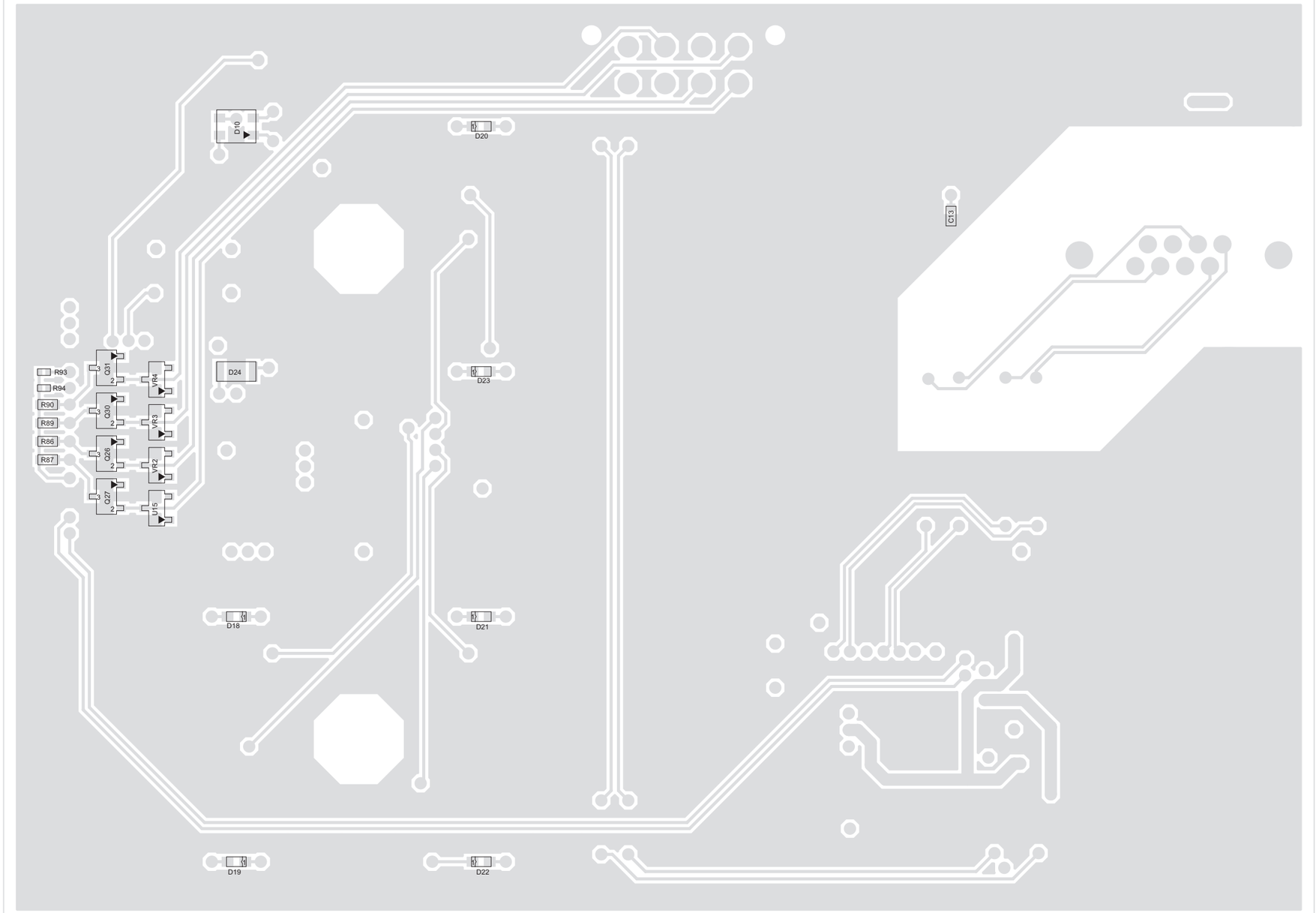
Circuit Ref	Motorola Part No	Description
C07	2113945C31	CAP, 0.1uF
C08	2113945C31	CAP, 0.1uF
C09	2113945C31	CAP, 0.1uF
C10	2113945C31	CAP, 0.1uF
C11	2113945C31	CAP, 0.1uF
C12	2113945C31	CAP, 0.1uF
C13	2113945C31	CAP, 0.1uF
C15	2113945C31	CAP, 0.1uF
C16	2113945C31	CAP, 0.1uF
C17	2113945C31	CAP, 0.1uF
C18	2113945C31	CAP, 0.1uF
C19	2186154V01	CAP, 1000pF
C22	2113945C31	CAP, 0.1uF
C26	2113944A40	CAP, 100pF
C27	2113944A40	CAP, 100pF
C28	2113944A40	CAP, 100pF
C29	2113946E02	CAP, 1.0uF
C30	2113946E02	CAP, 1.0uF
C34	2113945C31	CAP, 0.1uF
C35	2113945C31	CAP, 0.1uF
C36	2113945C31	CAP, 0.1uF
C37	2113944C33	CAP, 18pF
C38	2113944C33	CAP, 18pF
C39	2113946E02	CAP, 1.0uF
C40	2313960D07	CAPP, 10uF
C41	2113945C31	CAP, 0.1uF
C42	2113945C31	CAP, 0.1uF
C43	2113945C31	CAP, 0.1uF
C44	2113945C31	CAP, 0.1uF
C45	2113945C31	CAP, 0.1uF
C46	2113945C31	CAP, 0.1uF
C47	2113945C31	CAP, 0.1uF
C48	2113945C31	CAP, 0.1uF
C49	2113944C33	CAP, 18pF
C50	2113944C33	CAP, 18pF
C51	2113945C31	CAP, 0.1uF
C52	2113945C31	CAP, 0.1uF
C53	2113945C31	CAP, 0.1uF
C54	2113944A40	CAP, 100pF
C55	2113945A09	CAP, 1000pF
C56	2113945C31	CAP, 0.1uF
C57	2113944A40	CAP, 100pF
C58	2113945C31	CAP, 0.1uF
C59	2113945A09	CAP, 10000pF
C60	2113946E02	CAP, 1.0 uF
D07	4815809H03	HT-S91UY
D08	4815809H01	HT-S91UYG
D09	4815809H02	HT-S91URO
D10	4887557T01	HSMF-C155
D18	4815809H01	HT-S91UYG
D19	4815809H01	HT-S91UYG
D20	4815809H02	HT-S91URO
D21	4815809H03	HT-S91UY
D22	4815809H03	HT-S91UY
D23	4815809H03	HT-S91UY
D24	4883288Y04	HSMB-C150
D25	4815809H03	HT-S91UY
J1	0915555H01	30 pin
J2	0915930H01	RJ45
J5	0971174L01	12 pin
M1	0985888K02	SOCKET
Q07	4815261H01	DTC114YKAF
Q09	4815261H01	DTC114YKAF
Q10	4815261H01	DTC114YKAF
Q11	4815261H01	DTC114YKAF
Q12	4815261H01	DTC114YKAF
Q17	4815867H01	PZTA14
Q18	4815261H01	DTC114YKAF
Q19	4815261H01	DTC114YKAF
Q20	4815261H01	DTC114YKAF
Q21	4815261H01	DTC114YKAF
Q22	4815700H01	2SB1197K
Q23	4815261H01	DTC114YKAF
Q24	4815261H01	DTC114YKAF
Q25	4815261H01	DTC114YKAF
Q28	4815261H01	DTC114YKAF
R01	0613952H79	RES, 1.8K
R02	0613952Q95	RES, 8.2K
R03	0613959Q23	RES, 8
R04	0613959Q23	RES, 8
R05	0613959Q23	RES, 8
R06	0613959Q23	RES, 8
R07	0613959Q23	RES, 8
R08	0613959Q23	RES, 8
R22	0613952H66	RES, 510
R23	0613952H66	RES, 510
R24	0613952H66	RES, 510
R31	0613952Q46	RES, 75
R32	0613952Q46	RES, 75
R38	0613952H66	RES, 510
R39	0613952H66	RES, 510
R40	0613952H66	RES, 510
R41	0613952H66	RES, 510
R42	0613952H66	RES, 510
R43	0613958S75	RES, 1.2K
R45	0613952H42	RES, 51
R46	0613952H42	RES, 51
R47	0613952H42	RES, 51
R48	0613952H42	RES, 51
R49	0613952H13	RES, 3.3
R50	0613952H13	RES, 3.3
R51	0613958S75	RES, 1.2K
R53	0613952N01	RES, 10K
R55	0613952H66	RES, 510
R56	0613952H59	RES, 270
R57	0613952H66	RES, 510
R58	0613952H81	RES, 2.2K
R59	0613952R56	RES, 2MEG
R60	0613952J49	RES, 1MEG
R61	0613952J49	RES, 1MEG
R63	0613952H80	RES, 2K
R64	0613952H80	RES, 2K
R65	0613952H80	RES, 2K
R66	0613952H80	RES, 2K
R68	0613952Q77	RES, 1.5K
R70	0613952H66	RES, 510
R71	0613952H66	RES, 510
R73	0613952G67	RES, 0

Circuit Ref	Motorola Part No	Description
R74	0613952H37	RES, 33
R75	0613952H37	RES, 33
R76	0613952G67	RES, 0
R77	0613952G67	RES, 0
R78	0613952Q95	RES, 8.2K
R79	0613952N01	RES, 10K
R80	0613952H92	RES, 6.2K
R81	0613952Q95	RES, 8.2K
R82	0613952H80	RES, 2K
R83	0613952H80	RES, 2K
R84	0613952H80	RES, 2K
R85	0613952Q89	RES, 4.7K
RT1	0615471H01	THERM, 10K
T1	2515640H01	XFMR_H1260
U02	5171839H01	AT93C46A
U05	5115391H01	TK11100CSC
U06	5115476H01	SN74AHC594DR
U08	5171161L01	ADM8515
U09	5115502H01	SN74LVC07ADR
U10	4815263H01	DTC144EKAF
U11	4815867H01	PZTA14
U12	5114007A02	MC74LCX02
U13	4815263H01	DTC144EKAF
U14	5115391H01	TK11100CSC
VR1	4813977M13	6.2V Zener
Y1	4802582S71	XTAL_25MHZ
Y2	4809612J45	CX-91F
PCB	8415470H04	

4.0 Repeater Indicator Board (PMLN5643_) PCB/Schematics/Parts List

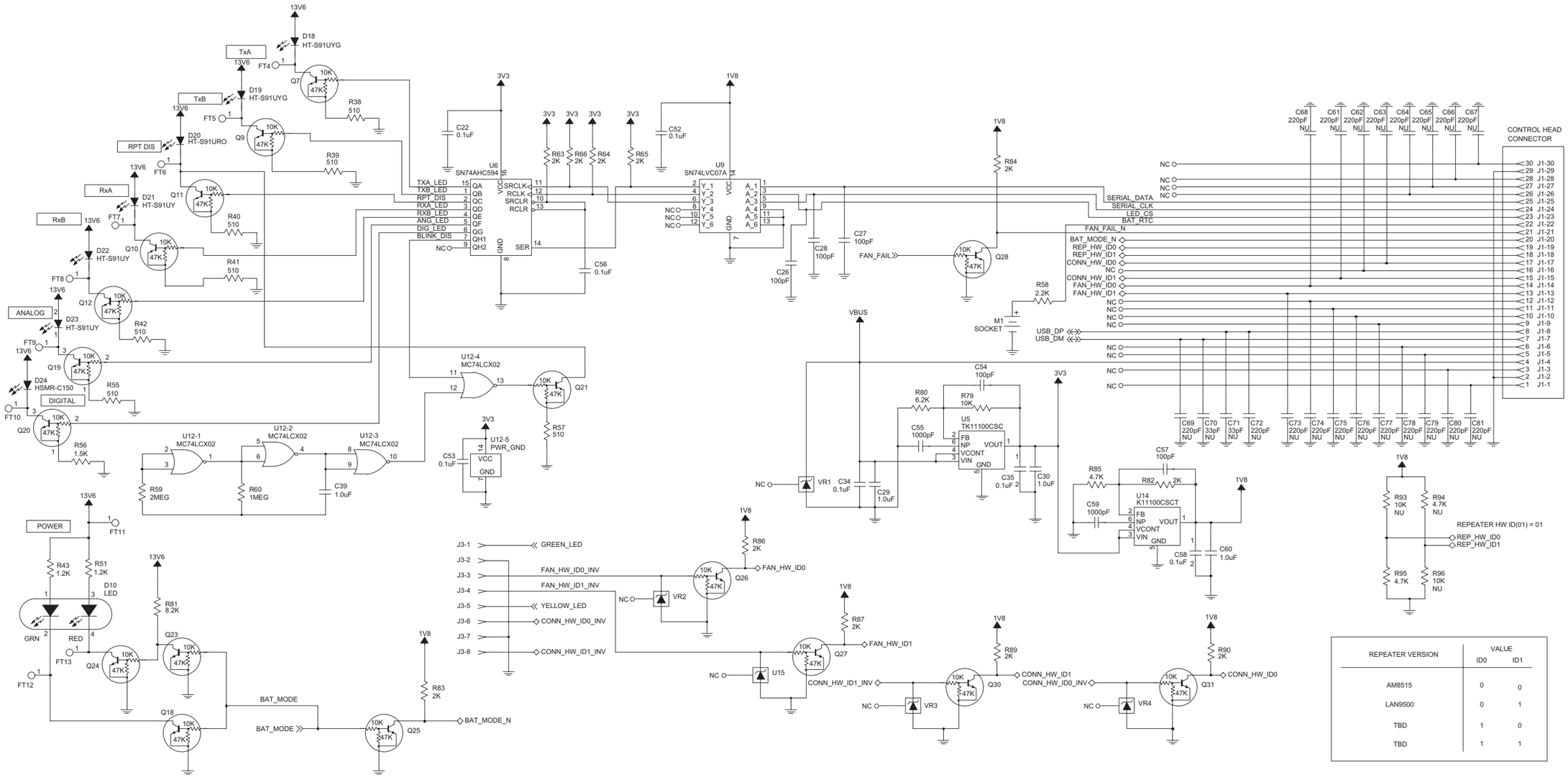


Repeater Indicator Board PCB 84012135001 (Top Side)



(For reference only - board is not field-repairable)

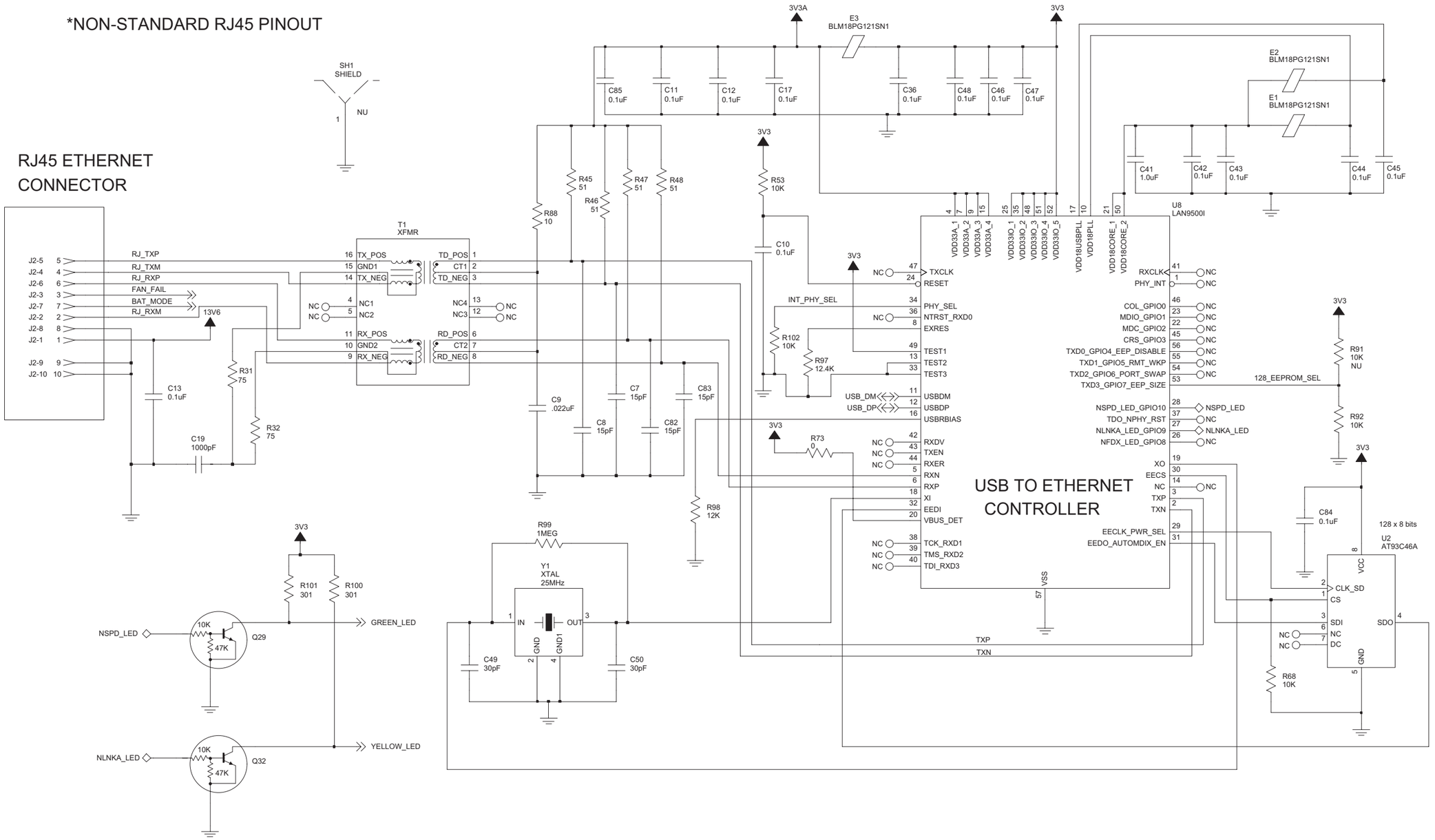
Repeater Indicator Board PCB 84012135001 (Bottom Side)



REPEATER VERSION	VALUE ID0	VALUE ID1
AM8515	0	0
LAN9500	0	1
TBD	1	0
TBD	1	1

(For reference only - board is not field-repairable)

Repeater Indicator Board Schematic Diagram (Sheet 1 of 2)



(For reference only - board is not field-repairable)

Repeater Indicator Board Schematic Diagram (Sheet 2 of 2)

4.1 Repeater Indicator Board Parts List PMLN5643_

Circuit Ref	Motorola Part No.	Description
C10	2113945C31	0.1 UF
C11	2113945C31	0.1 UF
C12	2113945C31	0.1 UF
C13	2113945C31	0.1 UF
C17	2113945C31	0.1 UF
C19	2186154V01	1 NF
C22	2113945C31	0.1 UF
C26	2113944A40	100 PF
C27	2113944A40	100 PF
C28	2113944A40	100 PF
C29	2113946E02	1.0 UF
C30	2113946E02	1.0 UF
C34	2113945C31	0.1 UF
C35	2113945C31	0.1 UF
C36	2113945C31	0.1 UF
C39	2113946E02	1.0 UF
C41	2113946E02	1.0 UF
C42	2113945C31	0.1 UF
C43	2113945C31	0.1 UF
C44	2113945C31	0.1 UF
C45	2113945C31	0.1 UF
C46	2113945C31	0.1 UF
C47	2113945C31	0.1 UF
C48	2113945C31	0.1 UF
C49	2115153H44	CAP, CERAMIC
C50	2115153H44	CAP, CERAMIC
C52	2113945C31	0.1 UF
C53	2113945C31	0.1 UF
C54	2113944A40	100 PF
C55	2113945A09	1000 PF
C56	2113945C31	0.1 UF
C57	2113944A40	100 PF
C58	2113945C31	0.1 UF
C59	2113945A09	1000 PF
C60	2113946E02	1.0 UF
C61	NOT PLACED	–
C62	NOT PLACED	–
C63	NOT PLACED	–
C64	NOT PLACED	–
C65	NOT PLACED	–
C66	NOT PLACED	–
C67	NOT PLACED	–
C68	NOT PLACED	–
C69	NOT PLACED	–
C7	2113944M22	15 PF
C70	NOT PLACED	–
C71	NOT PLACED	–
C72	NOT PLACED	–
C73	NOT PLACED	–
C74	NOT PLACED	–
C75	NOT PLACED	–
C76	NOT PLACED	–
C77	NOT PLACED	–
C78	NOT PLACED	–
C79	NOT PLACED	–
C8	2113944M22	15 PF
C80	NOT PLACED	–
C81	NOT PLACED	–
C82	2113944M22	15 PF
C83	2113944M22	15 PF
C84	2113945C31	0.1 UF
C85	2113945C31	0.1 UF
C9	2113945C04	22000 PF
D10	4887557T01	LED BI COLOR RED GREEN
D18	4815809H01	GREEN LED
D19	4815809H01	GREEN LED
D20	4815809H02	RED LED
D21	4815809H03	YELLOW LED
D22	4815809H03	YELLOW LED
D23	4815809H03	YELLOW LED
D24	48010088001	BLUE LED
E1	7686949J15	FLTR,FERR
E2	7686949J15	FLTR,FERR
E3	7686949J15	FLTR,FERR
J1	0915555H01	CONNECTOR, 30 POSITION
J2	0915930H01	RJ-45, CAT5 SHIELDED, ONE PORT
J3	9012030001	8 PIN CONNECTOR
M1	0985888K02	SKT RTC BTTY LEAP
PASTE	1085674C03	PASTE/NC-SMQ230
Q10	4815261H01	TRANSISTOR, NPN
Q11	4815261H01	TRANSISTOR, NPN
Q12	4815261H01	TRANSISTOR, NPN
Q18	4815261H01	TRANSISTOR, NPN
Q19	4815261H01	TRANSISTOR, NPN
Q20	4815261H01	TRANSISTOR, NPN
Q21	4815261H01	TRANSISTOR, NPN
Q23	4815261H01	TRANSISTOR, NPN
Q24	4815261H01	TRANSISTOR, NPN
Q25	4815261H01	TRANSISTOR, NPN
Q26	4815261H01	TRANSISTOR, NPN
Q27	4815261H01	TRANSISTOR, NPN
Q28	4815261H01	TRANSISTOR, NPN
Q29	4815261H01	TRANSISTOR, NPN
Q30	4815261H01	TRANSISTOR, NPN
Q31	4815261H01	TRANSISTOR, NPN
Q32	4815261H01	TRANSISTOR, NPN
Q7	4815261H01	TRANSISTOR, NPN
Q9	4815261H01	TRANSISTOR, NPN
R100	0613952L47	301
R101	0613952L47	301
R102	0613952N01	10.0K
R31	0613952Q46	75
R32	0613952Q46	75
R38	0613952H66	510
R39	0613952H66	510
R40	0613952H66	510
R41	0613952H66	510
R42	0613952H66	510
R43	0613958S75	1200
R45	0613952H42	51
R46	0613952H42	51
R47	0613952H42	51
R48	0613952H42	51
R51	0613958S75	1200
R53	0613952N01	10.0K
R55	0613952H66	510

Circuit Ref	Motorola Part No.	Description
R56	0613952H77	1500
R57	0613952H66	510
R58	0613952H81	2200
R59	0613952R56	2.0M
R60	0613952J49	1.0M
R63	0613952H80	2000
R64	0613952H80	2000
R65	0613952H80	2000
R66	0613952H80	2000
R68	0613952N01	10.0K
R73	0613952G67	0
R79	0613952N01	10.0K
R80	0613952H92	6200
R81	0613952Q95	8200
R82	0613952H80	2000
R83	0613952H80	2000
R84	0613952H80	2000
R85	0613952Q89	4700
R86	0613952H80	2000
R87	0613952H80	2000
R88	0613952Q25	10
R89	0613952H80	2000
R90	0613952H80	2000
R91	NOT PLACED	–
R92	0613952N01	10.0K
R93	NOT PLACED	–
R94	0613952Q89	4700
R95	0613952Q89	4700
R96	NOT PLACED	–
R97	0613952E10	12.4K

Circuit Ref	Motorola Part No.	Description
R98	0613952Z55	12K
R99	0613952R49	1.0M
T1	2489647C01	TRANSFORMER
U12	5114007A02	NOR GATE
U14	5115391H01	LINEAR REGULATOR IC
U15	4813977M13	DIODE
U2	51012124001	IC,SERIAL EEPROM
U5	5115391H01	LINEAR REGULATOR IC
U6	5115476H01	8-BIT SHIFT REGISTER
U8	51009265001	LAN9500
U9	5115502H01	SN74LVC07APWR
VR1	4813977M13	DIODE
VR2	4813977M13	DIODE
VR3	4813977M13	DIODE
VR4	4813977M13	DIODE
Y1	4884121Y01	XTAL, SMT 25MHZ, 50PPM
PCB	84012135001	

XPR 8300/XPR 8400 MOTOTRBO Repeater

Chapter 3

Connector Board

Service Information

Issue: September, 2010

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Chapter 3 - Connector Board Service Information

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Notes

Section 1

THEORY OF OPERATION

1.0 Overview

This section provides a detailed theory of operation for the Connector Board and its components.

2.0 Connector Board

The Connector board has two purposes: provide a place for the Repeater's MAP and Ethernet connectors to be mounted and a location for the Repeater's fan control circuitry.

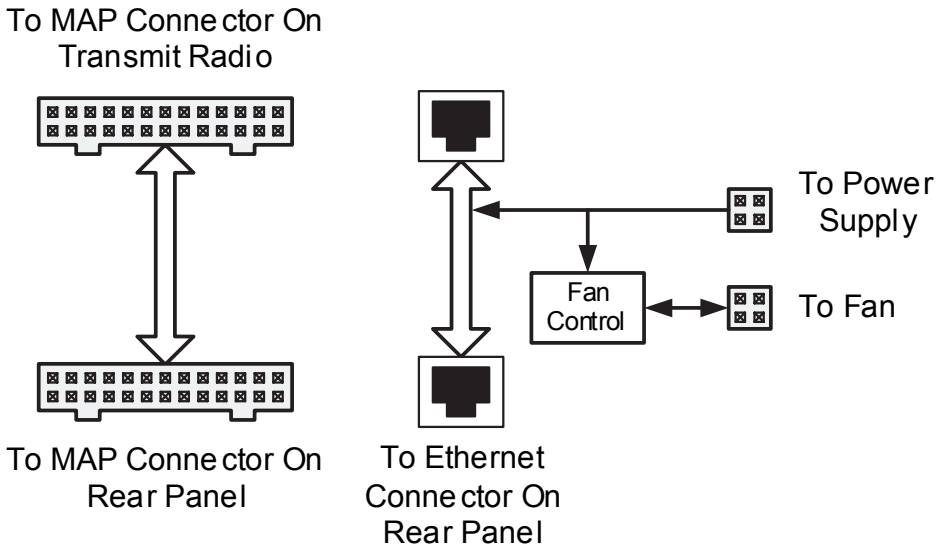


Figure 1-1 Connector Board Block Diagram

2.1 Fan

The fan control logic is provided by the fan controller IC (U51). This is a device from Cypress Semiconductor. There are basically two functions provided by the fan controller. First, it provides a PWM output based on a temperature input, and secondly, it provides detection of fan failure based on the fan tachometer reading.

The Repeater's internal chassis temperature is measured with an LM50 precision temperature sensor IC (U52). This IC outputs a voltage that is linearly proportional to temperature at 10 mV/°C, and with an offset of +500 mV. The output voltage of the LM50 ranges from +200 mV at -30°C to 1.1 V at +60°C.

The fan controller ID (U51) controls the speed of the fan by adjusting the PWM output (pin 1) from 0% to 100%. As long as the fan continues to work, pulses are output from the fan and input to the fan controller (pin 2).

Starting with the PMLN5644B Connector Board, a slide switch (S1) has been added to the board that allows the fan to be configured to a fixed full speed or variable speed operation. The factory default setting is full speed. For applications where full fan speed is not appropriate, the slide switch position can be moved from the default left (F) full speed, to the optional right (N) temperature regulated position. After the adjustment, the variable speed behavior will be as follows: the fan will idle low and be held constant from 10°C to 30°C. Between 30°C and 45°C, the fan will increase in speed and reach full speed at 46°C.

2.2 AC/DC Power Supply

The Repeater uses the PMPN4001A switch-mode, Power Supply Unit (PSU). It is capable of 200 W and designed for a 50 W UHF or VHF repeater system. This supply has UL, CE, and TUV regulatory approvals and is usable in all regions by using the correct line cord. The AC input is auto-ranging with no manual switch being specified to operate from 90 V-270 V and 47 Hz-63 Hz. It outputs a nominal voltage of 13.8 V with a voltage tolerance of +/- 5%.

It has Power Factor Correction circuitry and is rated at 15 A across the whole operating temperature range of -30°C to +60°C. It also has a built-in battery revert circuit with a float output available for maintaining the charge on a battery and has UL, CE, & TUV approvals. The battery revert connector is accessible in the back of the power supply.

The supply has over-load, over-voltage, and over-temperature protection. In an overload condition, the PSU goes into a hiccup mode where it recovers automatically after the fault condition is removed. During an over-voltage condition, the PSU shuts down and will have to be re-powered on to recover. In an over-temperature condition, the PSU also shuts down, but will recover after the temperature goes down.

The PSU is not designed to be field serviceable. If it is determined that the PSU is not functioning, the whole unit needs to be replaced.

2.3 Battery Backup Operation (Applicable for 32 MB repeaters only)

If AC power is removed or interrupted, the repeater will switch to its battery backup until AC is restored. The battery backup operation is controlled by a voltage sensing circuit on the connector board. During DC operation, the circuit monitors the DC voltage of the battery connected to the backup terminal on the PSU and enables or disables the unit accordingly to maintain reliable repeater operation.

When the battery voltage dips below approximately 7.5V, the repeater will disable itself until either AC is restored or the battery voltage recovers to above 10.5V. When heavy loading is present, the battery voltage may swing from 7.5V to 10.5V as soon as the unit disables and the loading is removed. Intermittent functionality may occur during this mode of operation, but it is normal and expected during low battery backup operation.

Section 2

CONNECTOR BOARDS / SCHEMATICS / PARTS LISTS

1.0 Allocation of Printed Circuit Boards, Schematics and Parts Lists

1.1 Connector Board Circuits

This Chapter shows the Printed Circuit Boards (PCB), Schematics and Parts Lists for the Connector Board circuits.

.

Table 2-1 Connector Board Schematic Diagrams and Parts List

PCB : **8415472H01** Connector Board	Page 2-3
SCHEMATICS **Connector Board Schematic Diagram (Sheet 1 of 2)** **Connector Board Schematic Diagram (Sheet 2 of 2)**	 **Page 2-4** **Page 2-5**
Parts List **Connector Board, PMLN4815_**	 **Page 2-6**

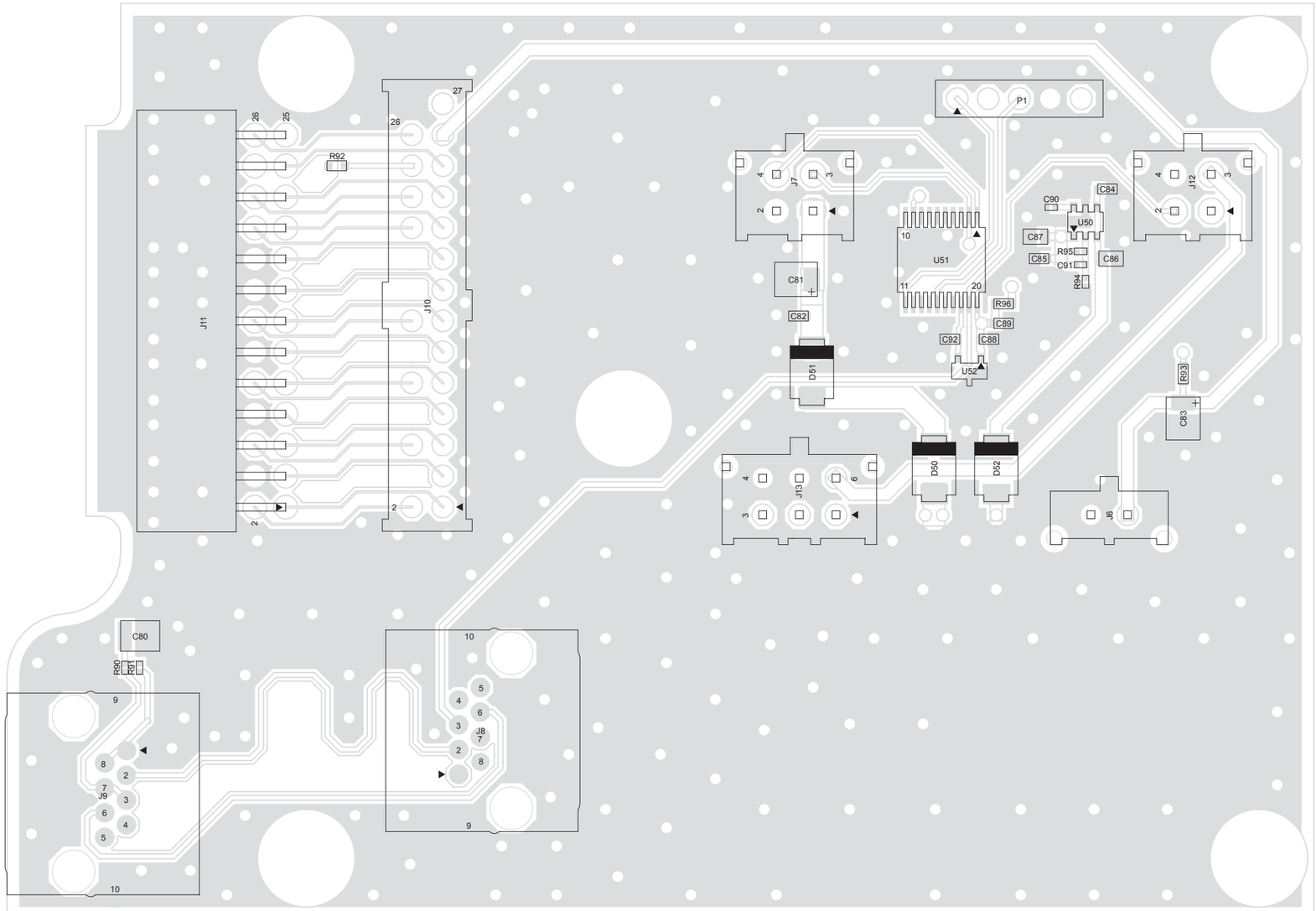
Table 2-2 Connector Board Schematic Diagrams and Parts List

PCB : **8415472H05** Connector Board	Page 2-7
SCHEMATICS **Connector Board Schematic Diagram (Sheet 1 of 2)** **Connector Board Schematic Diagram (Sheet 2 of 2)**	 **Page 2-8** **Page 2-9**
Parts List **Connector Board, PMLN5270_**	 **Page 2-10**

Table 2-3: Connector Board Schematic Diagrams and Parts List

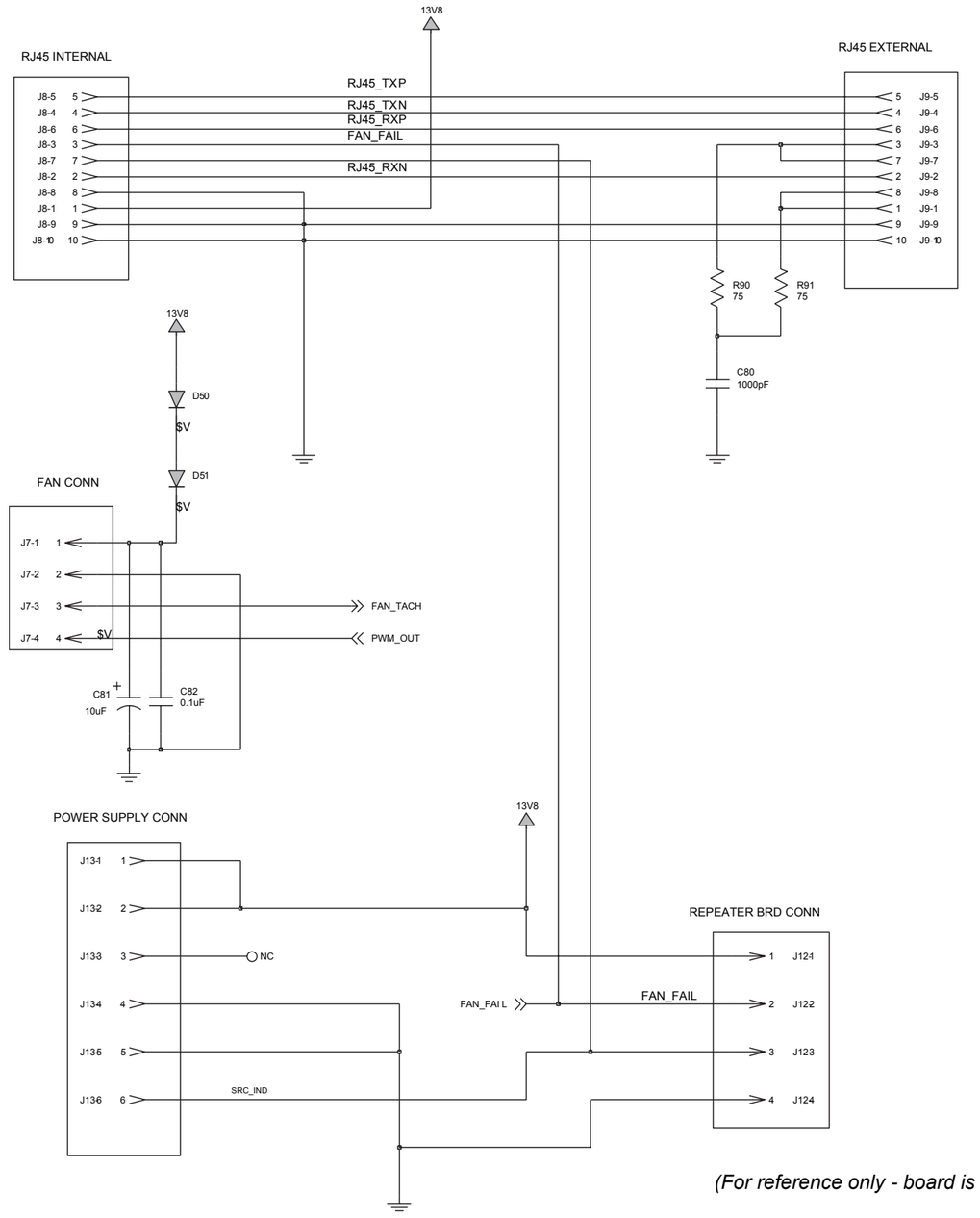
PCB : **84012133002** Connector Board	Page 2-11
SCHEMATICS **Connector Board Schematic Diagram (Sheet 1 of 2)** **Connector Board Schematic Diagram (Sheet 2 of 2)**	 **Page 2-12** **Page 2-13**
Parts List **Connector Board, PMLN5644_**	 **Page 2-14**

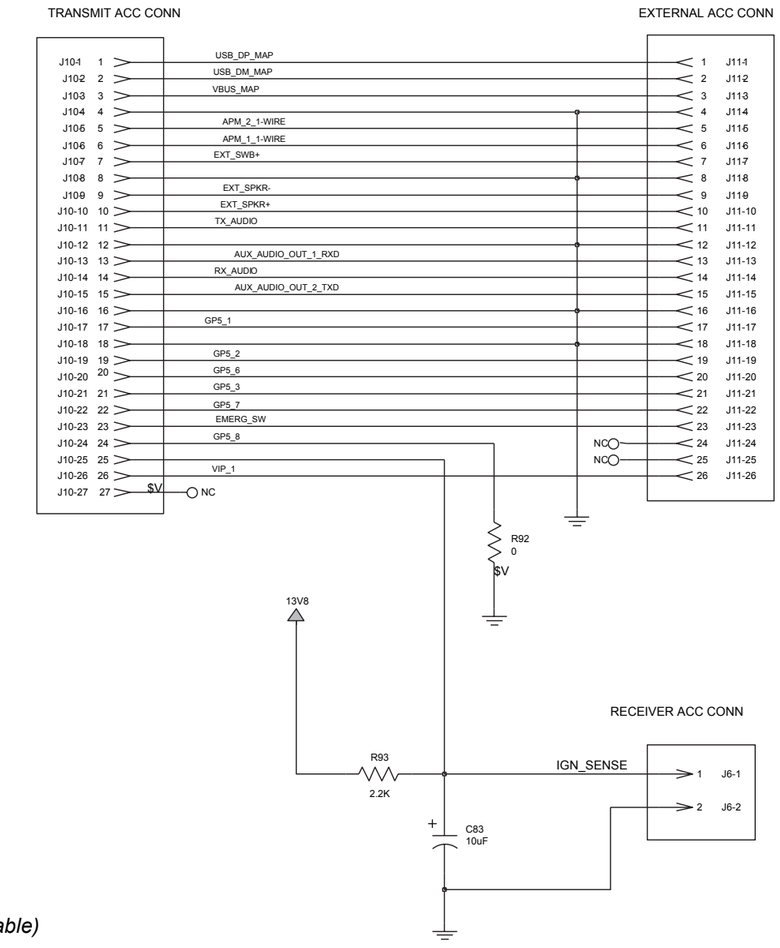
2.0 Connector Board (PMLN4815_) PCB/Schematics/Parts List



(For reference only - board is not field-repairable)

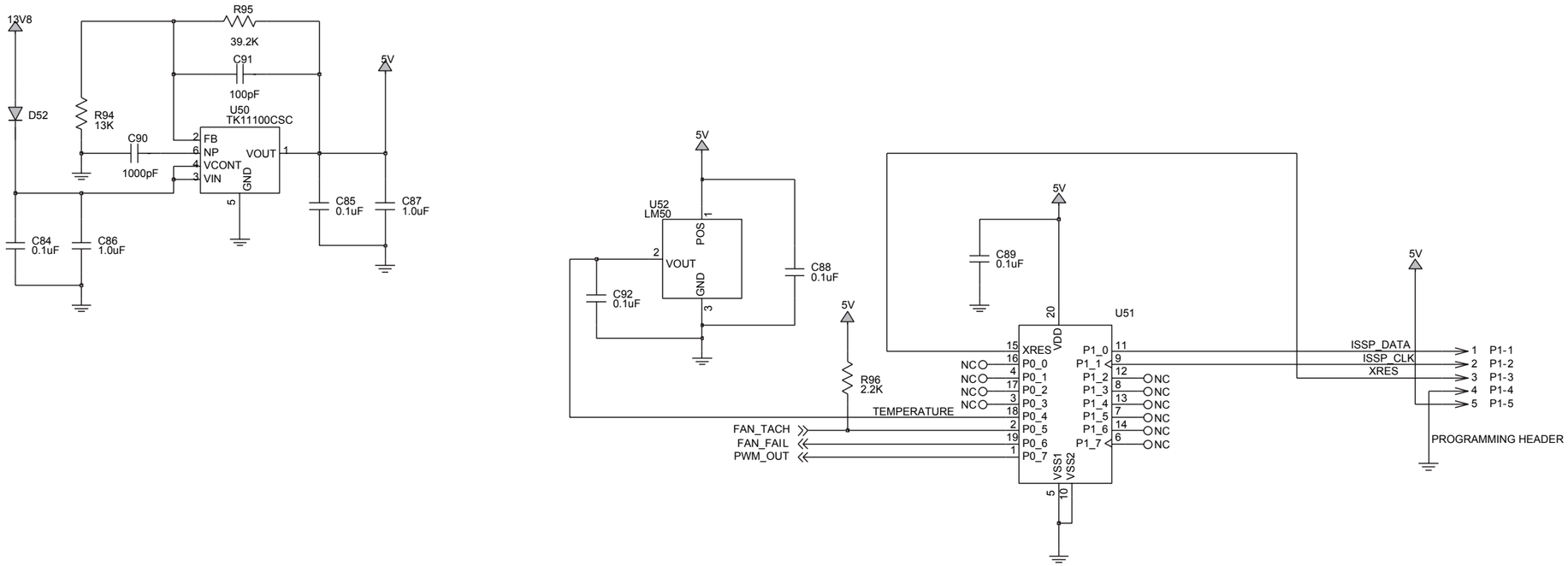
Connector Board PCB 8415472H01





(For reference only - board is not field-repairable)

Connector Board Schematic Diagram (Sheet 1 of 2)



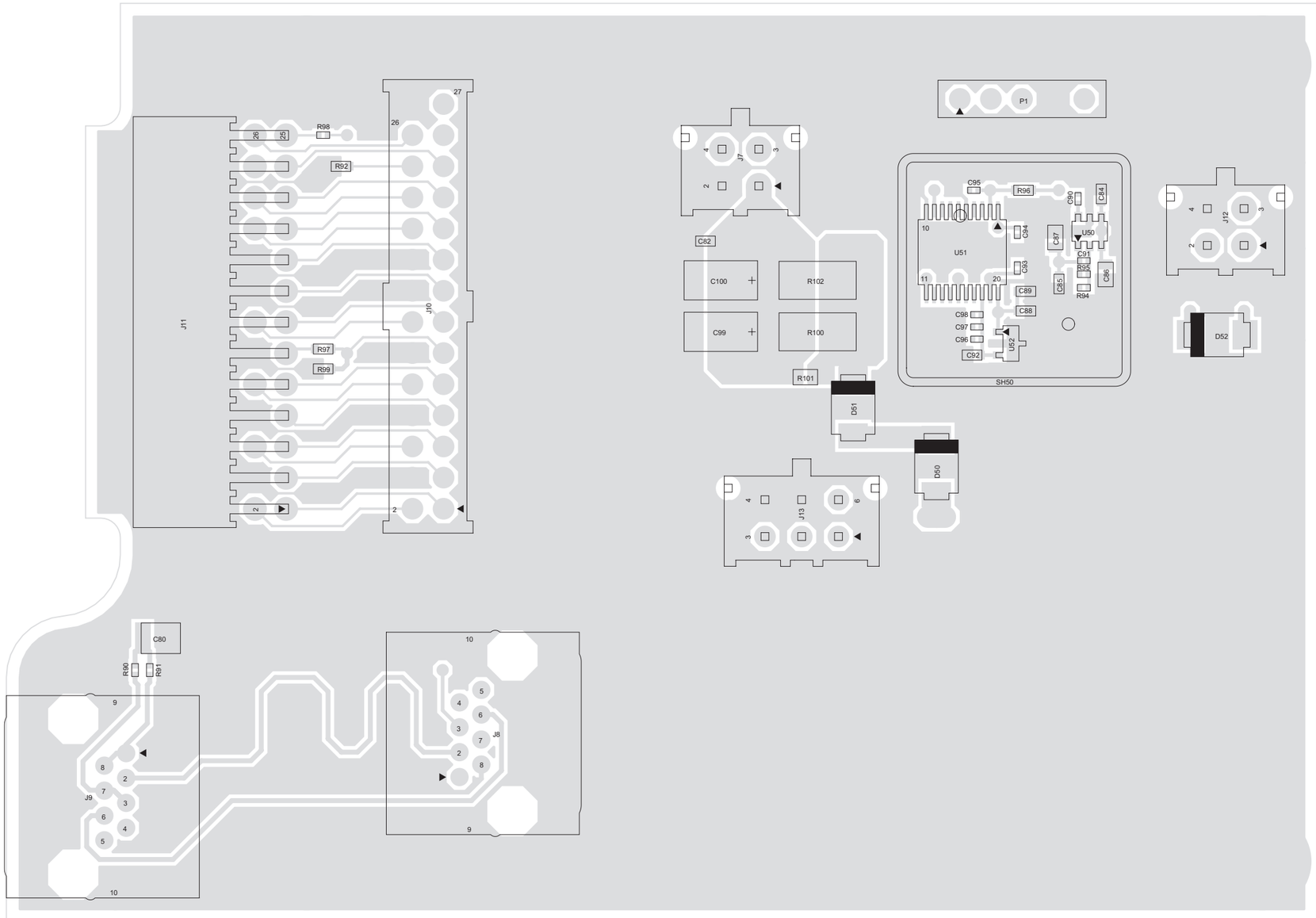
(For reference only - board is not field-repairable)

Connector Board Schematic Diagram (Sheet 2 of 2)

2.1 Connector Board Parts List PMLN4815_

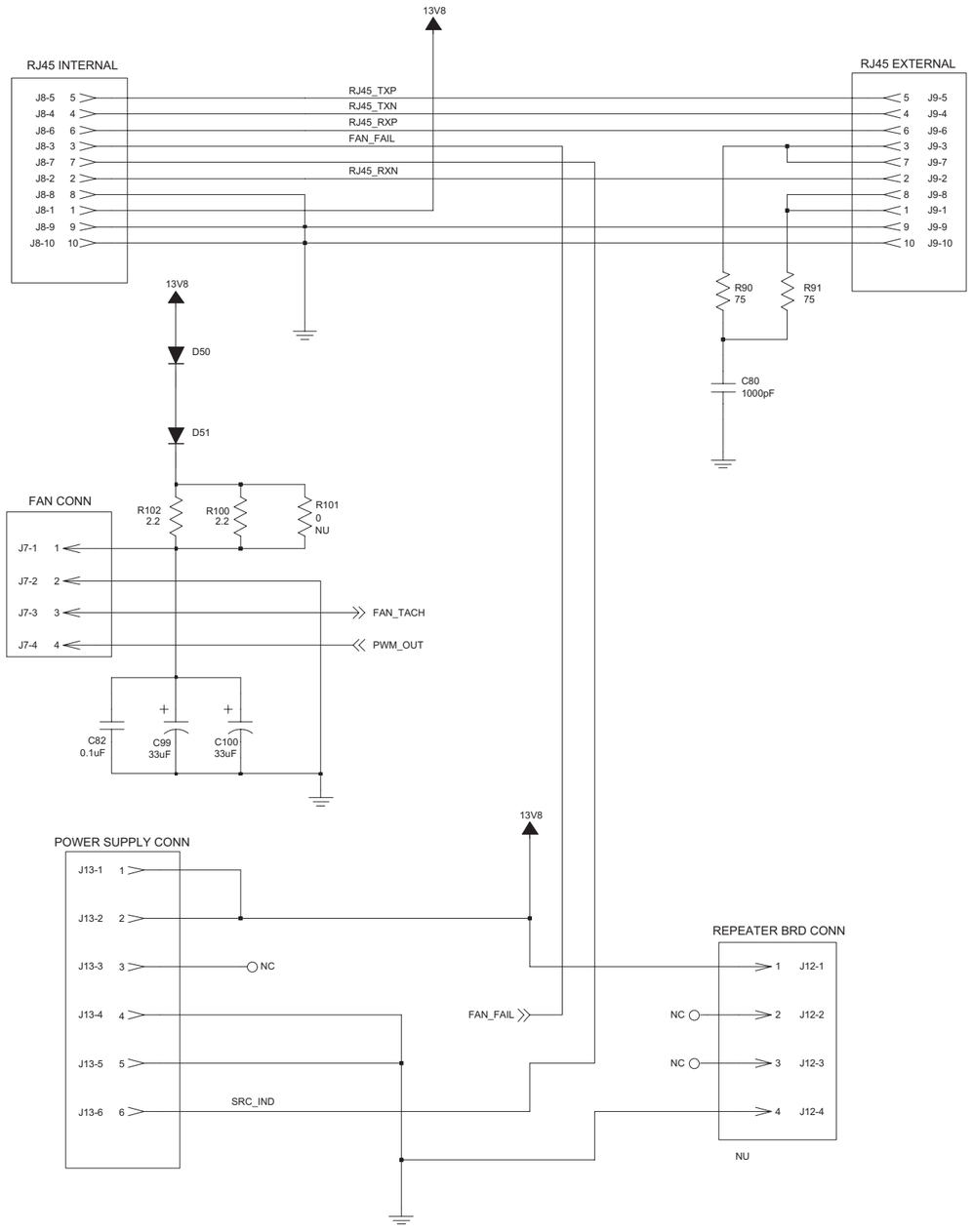
Circuit Ref	Motorola Part No	Description
C80	2186154V01	CAP, 1000pF
C81	2313960D07	CAPP, 10uF
C82	2113945C31	CAP, 0.1uF
C84	2113945C31	CAP, 0.1uF
C85	2113945C31	CAP, 0.1uF
C86	2113946E02	CAP, 1.0uF
C87	2113946E02	CAP, 1.0uF
C88	2113945C31	CAP, 0.1uF
C89	2113945C31	CAP, 0.1uF
C90	2113945A09	CAP, 1000pF
C91	2113944A40	CAP, 100pF
C92	2113945C31	CAP, 0.1uF
D50	4813978B01	Diode SMB 1A 40V
D51	4813978B01	Diode SMB 1A 40V
D52	4813978B01	Diode SMB 1A 40V
J7	2815631H01	Connector, 4 Pin
J8	0915930H01	Connector, 10 Pin
J9	0915930H01	Connector, 10 Pin
J10	2816476H01	Connector, 28 Pin
J11	0971878L01	Connector, 26 Pin
J13	2815632H01	Connector, 6 Pin
R90	0613952Q46	RES, 75
R91	0613952Q46	RES, 75
R92	0613952G67	RES, 0
R94	0613952N12	RES, 13
R95	0613952N58	RES, 39.2K
R96	0613952H81	RES, 2.2K
U50	5115391H01	TK11100CSC
U51	0104030J35	IC, Fan Controller
U52	5115022H01	IC Temperature Sensor
PCB	8415472H01	

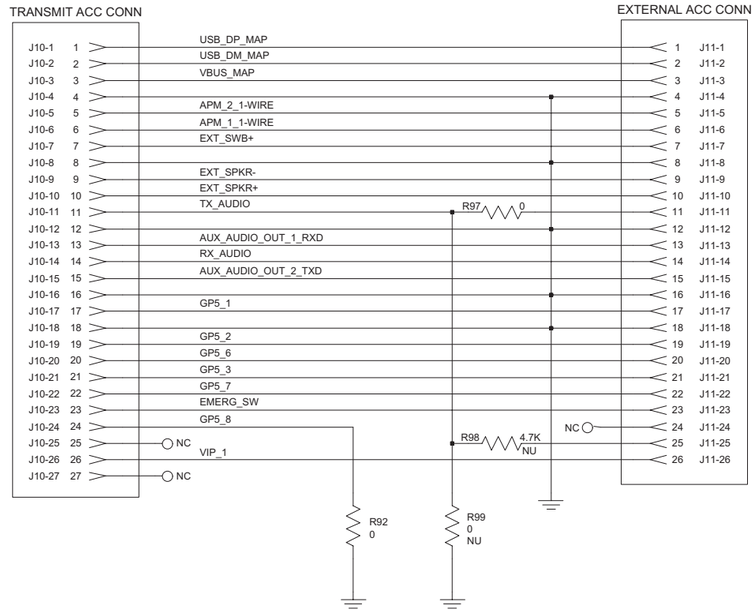
3.0 Connector Board (PMLN5270_) PCB/Schematics/Parts List



(For reference only - board is not field-repairable)

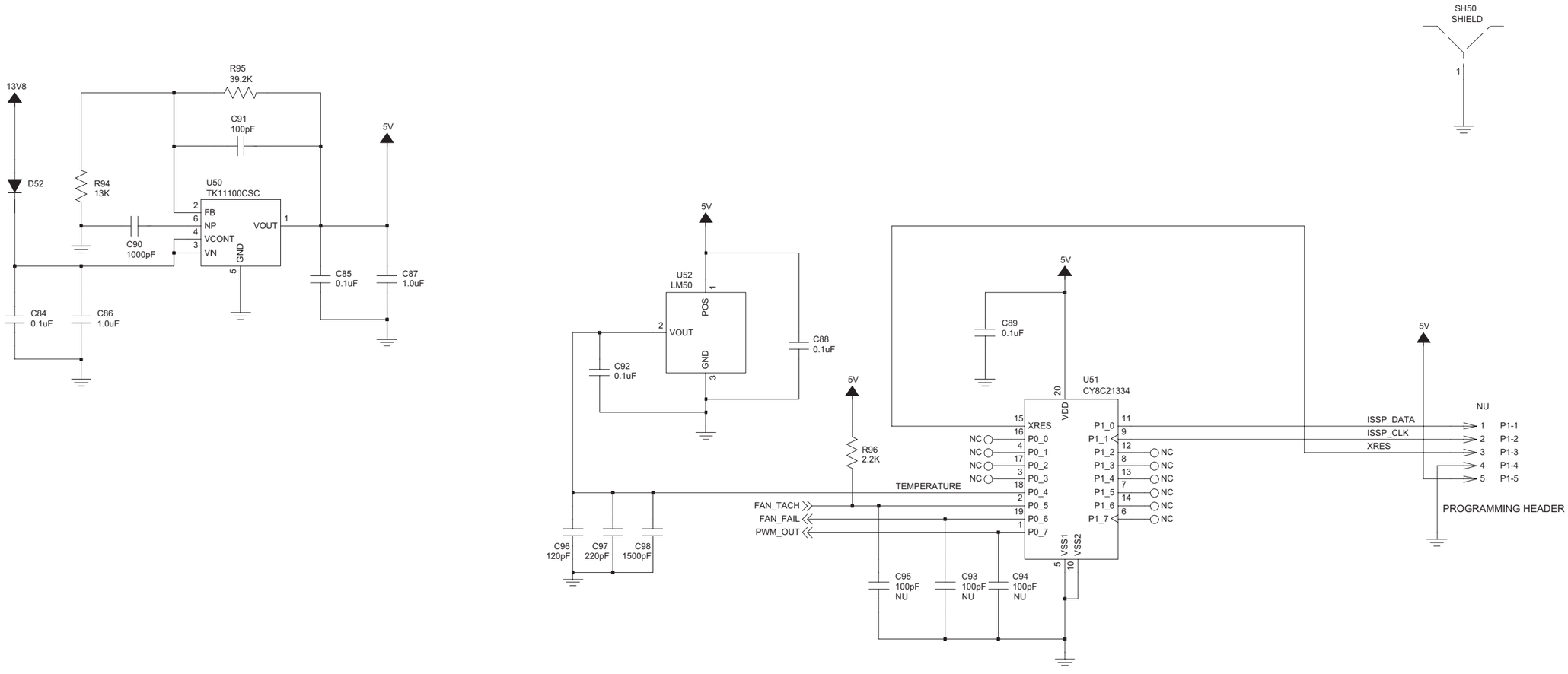
Connector Board PCB 8415472H05





(For reference only - board is not field-repairable)

Connector Board Schematic Diagram (Sheet 1 of 2)



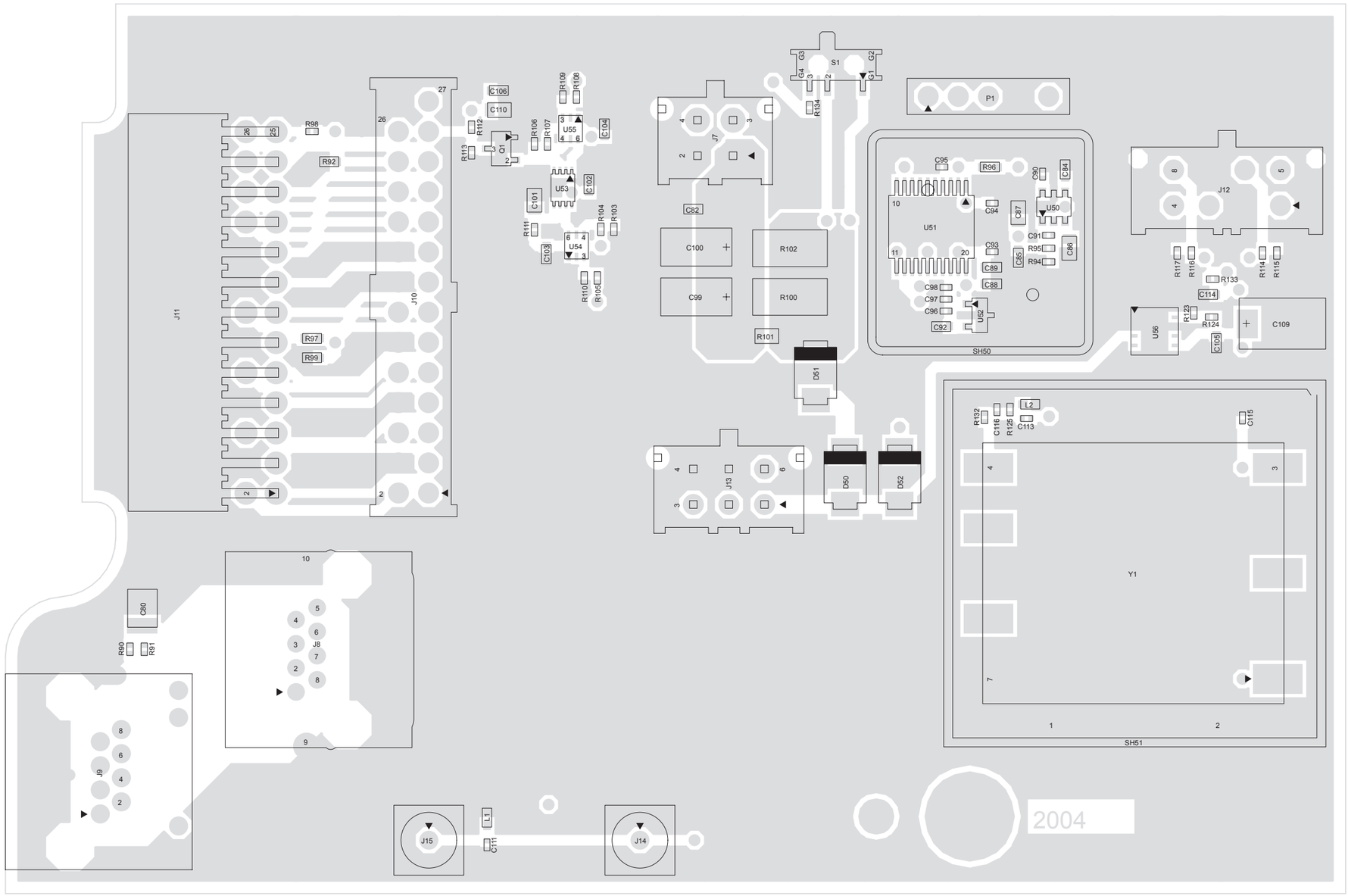
(For reference only - board is not field-repairable)

Connector Board Schematic Diagram (Sheet 2 of 2)

3.1 Connector Board Parts List PMLN5270_

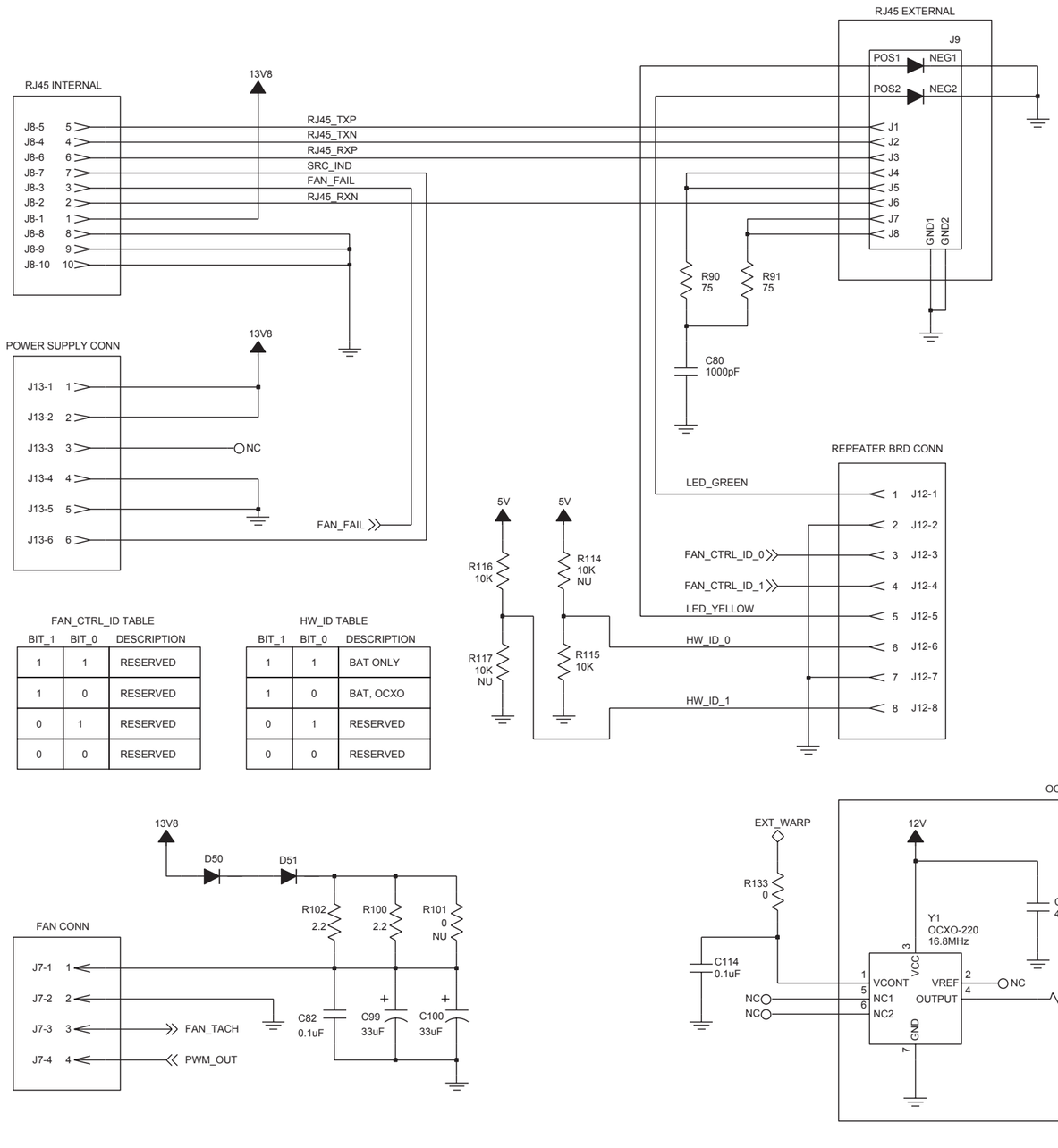
Circuit Ref	Motorola Part No	Description
C80	2186154V01	CAP, 1000pF
C82	2113945C31	CAP, 0.1uF
C84	2113945C31	CAP, 0.1uF
C85	2113945C31	CAP, 0.1uF
C86	2113946E02	CAP, 1.0uF
C87	2113946E02	CAP, 1.0uF
C88	2113945C31	CAP, 0.1uF
C89	2113945C31	CAP, 0.1uF
C90	2113945A09	CAP, 1000pF
C91	2113944A40	CAP, 100pF
C92	2113945C31	CAP, 0.1uF
C96	2113944A41	CAP, 120 pF
C97	2113944A44	CAP, 220 pF
C98	2113945A10	CAP, 1500 pF
C99	2314030E85	CAP, 33 uF
C100	2314030E85	CAP, 33 uF
D50	4813978B01	78B01
D51	4813978B01	78B01
D52	4813978B01	78B01
J7	2815631H01	CONN_P
J8	0915930H01	CONN_J
J9	0915930H01	CONN_J
J10	2816476H01	CONN_J
J11	0971878L01	CONN_P
J13	2815632H01	CONN_J
R90	0613952Q46	RES, 75
R91	0613952Q46	RES, 75
R92	0613952G67	RES, 0
R94	0613952N12	RES, 13K
R95	0613952N58	RES, 39.2K
R96	0613952H81	RES, 2.2K
R97	0613952G67	RES, 0
R100	0613959Y09	RES, 2.2
R102	0613959Y09	RES, 2.2
SH50	2686423Z02	SHIELD
U50	5115391H01	TK11100CSC
U51	0104030J35	CY8C21334
U52	5115022H01	LM50
PCB	8415472H05	

4.0 Connector Board (PMLN5644_) PCB/Schematics/Parts List

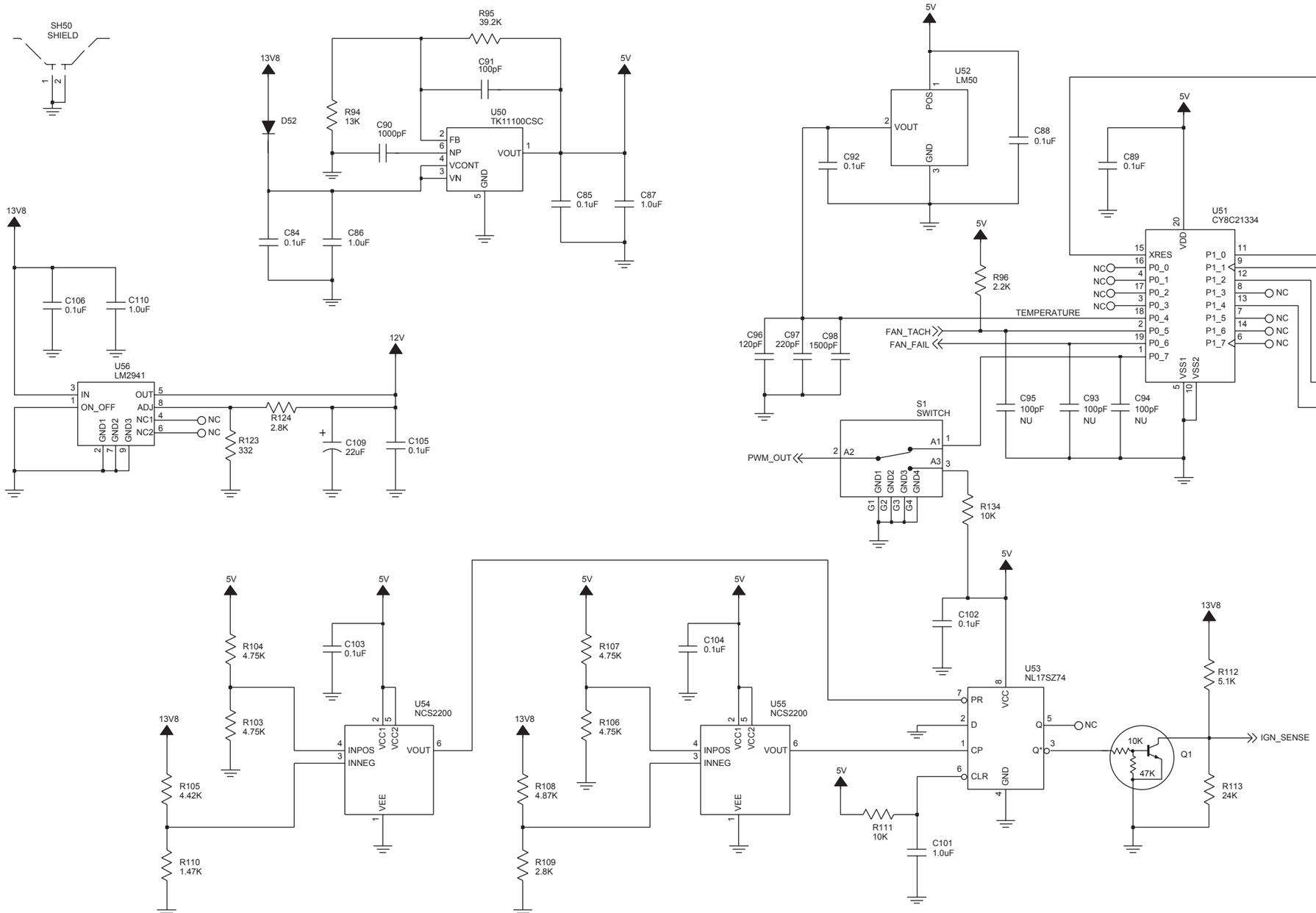


(For reference only - board is not field-repairable)

Connector Board PCB 84012133002



Connector Board Schematic Diagram (Sheet 1 of 2)



Connector Board Schematic Diagram (Sheet 2 of 2)

4.1 Connector Board Parts List PMLN5644_

Circuit Ref	Motorola Part No	Description
C80	2186154V01	1 NF
C82	2113945C31	0.1UF
C84	2113945C31	0.1UF
C85	2113945C31	0.1UF
C86	2113946E02	1.0 UF
C87	2113946E02	1.0 UF
C88	2113945C31	0.1UF
C89	2113945C31	0.1UF
C90	2113945A09	1000 PF
C91	2113944A40	100 PF
C92	2113945C31	0.1UF
C93	NOT PLACED	–
C94	NOT PLACED	–
C95	NOT PLACED	–
C96	2113944A41	120 PF
C97	2113944A44	220 PF
C98	2113945A10	1500 PF
C99	2314030E85	33 UF
C100	2314030E85	33 UF
C101	2113946E02	1.0 UF
C102	2113945C31	0.1UF
C103	2113945C31	0.1UF
C104	2113945C31	0.1UF
C105	NOT PLACED	–
C106	NOT PLACED	–
C109	NOT PLACED	–
C110	NOT PLACED	–
C111	NOT PLACED	–
C113	NOT PLACED	–
C114	NOT PLACED	–
C115	NOT PLACED	–
C116	NOT PLACED	–
D50	4813978B01	DIODE
D51	4813978B01	DIODE
D52	4813978B01	DIODE
J7	2815631H01	CONNECTOR, 4 POSITION, PCB
J8	0915930H01	RJ-45, CAT5 SHIELDED
J9	0985459Y01	JACK, RJ45, GRN & YELLOW LEDS
J10	2816476H01	CONNECTOR, 28 POSITION
J11	0971878L01	CONNECTOR, 26 POSITION
J12	9012030001	8 PIN CONNECTOR
J13	2815632H01	CONNECTOR, 6 POSITION
J14	NOT PLACED	–
J15	NOT PLACED	–
L1	NOT PLACED	–
L2	NOT PLACED	–
P1	NOT PLACED	–
Q1	4815261H01	TRANSISTOR
R90	0613952Q46	75
R91	0613952Q46	75
R92	0613952G67	0
R94	0613952N12	13.0K
R95	0613952N58	39.2K
R96	0613952H81	2200
R97	0613952G67	0
R98	NOT PLACED	–
R99	NOT PLACED	–
R100	0613959Y09	2.2
R101	NOT PLACED	–
R102	0613959Y09	2.2
R103	0613952M66	4750
R104	0613952M66	4750
R105	0613952M63	4420
R106	0613952M66	4750
R107	0613952M66	4750
R108	0613952M67	4870
R109	0613952M44	2800
R110	0613952M17	1470
R111	0613952R01	10K
R112	0613952Q90	5100
R113	0613952R10	24K
R114	0613952R01	10K
R115	NOT PLACED	–
R116	0613952R01	10K
R117	NOT PLACED	–
R123	NOT PLACED	–
R124	NOT PLACED	–
R125	NOT PLACED	–
R132	NOT PLACED	–
R133	NOT PLACED	–
R134	0613952R01	10K
S1	40012028001	SWITCH
SH50	2686423Z02	SHIELD, 19 X 19 X 3.03 MM
SH51	NOT PLACED	–
U50	5115391H01	LINEAR REGULATOR IC
U51	0104036J82	CY8C21334-24PVXIT
U52	5115022H01	IC TEMPERATURE SENSOR
U53	5114007M28	17SZ74 IC
U54	5109817F82	LOW VOLTAGE COMPARATOR
U55	5109817F82	LOW VOLTAGE COMPARATOR
U56	NOT PLACED	–
Y1	NOT PLACED	–
PASTE	1085674C03	PASTE/NC-SMQ230
PCB	84012133002	

XPR 8300/XPR 8400 MOTOTRBO Repeater

Chapter 4

Controller

Service Information

Issue: September, 2010

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Section 1

THEORY OF OPERATION

1.0 Controller

The Controller section consists of 4 main ICs. These are the Texas Instrument OMAP 1710 Host/ DSP Processor (U1000), Flash memory (U2000), SDRAM memory (U2001) and the MAKO Audio/ Power Management (U3200) chip.

Figure 1-1 shows how the Controller interfaces with the RF section, and peripherals in an XPR 8300/XPR 8400 repeater. The Controller, RF section, and Accessory interface are placed on a single Transceiver board.

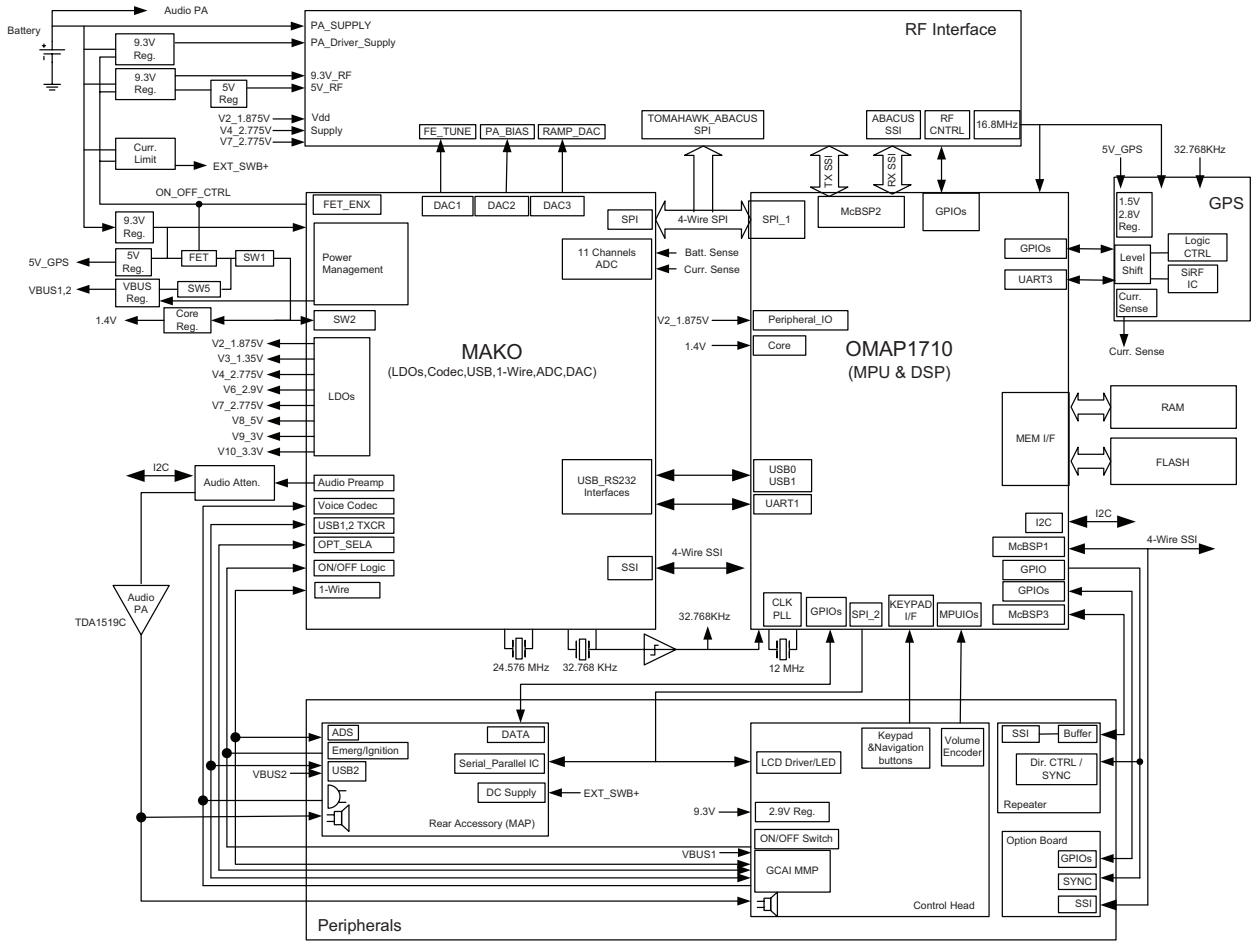


Figure 1-1 Controller Block Diagram

1.1 Radio Power Distribution

Figure 1-2 illustrates the controller DC power distribution throughout the transceiver board.

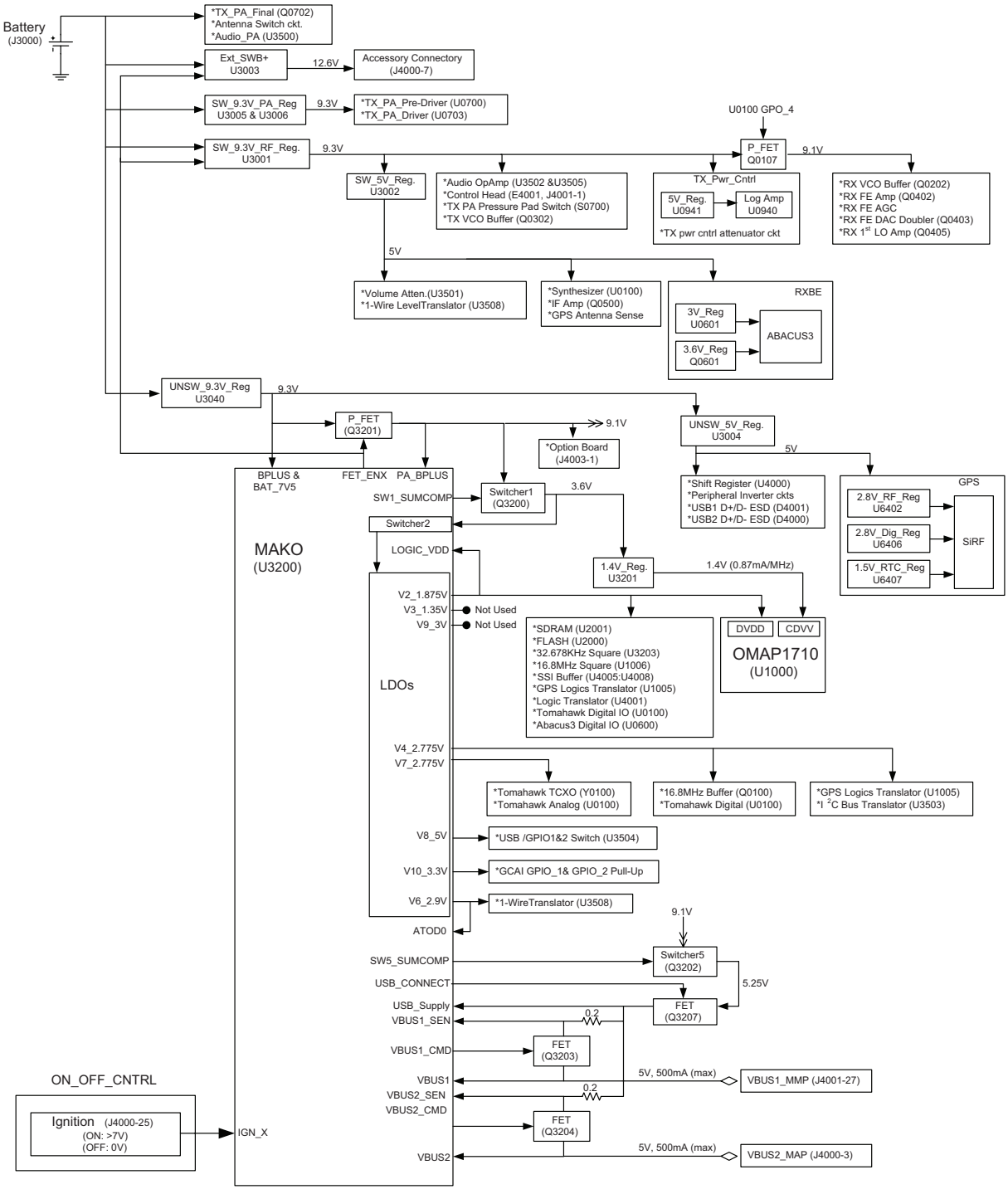


Figure 1-2 Radio DC Distribution

Voltage regulation is provided to the controller, GPS and RF sections by the following devices:

- +9.3V_PA: U3005, U3006, and U3030
- +9.3V_CNTRL: U3040 and U3030
- +9.3V_SW: U3001
- +12.6V_Ext SWB+: U3003
- +1.5V GPS RTC: U6407
- +1.4V OMAP Core: U3201
- Supplies for the Controller section: U3200 (MAKO)
- Supplies for the RF and GPS sections: U0601, U0941,U3002,U3004,U6402, and U6406

The 9V3_PA regulator uses Op Amp U3030-1 as a controlling element. The regulated output voltage is divided by R3039 and R3040 and compared with an accurate reference voltage (5.1V DC) determined by VR3040. The Op Amp's output voltage at pin 1 varies the amount of conduction in transistors Q3032, U3005 and U3006 as necessary to keep voltages equal on pins 2 and 3 of the Op Amp. A characteristic of the Op Amp which allows the regulator to start up is the fact the output is high when both inputs are low, which occurs momentarily at turn-on. Dual diode D3030 serves two purposes. Diode D3030 is used to protect transistors U3005 and U3006 if the 9.3V_PA line is grounded. When this happens Q3032's base can only be 0.7V DC and transistors U3005 and U3006 will be turned off. Diode D3030 also provides temperature compensation of the regulated output voltage. The 9V3_PA supply powers the low level and driver stages of the RF power amplifier.

The MAKO and GPS regulators are powered by the 9V3_CNTRL supply. Op amp U3030-2 functions as a controlling element for the 9V3_CNTRL regulator. The regulated output voltage is divided by R3045 and R3046 and compared with the reference voltage determined by VR3040. The Op Amp's output voltage at pin 7 varies the amount of conduction in transistors Q3040 and U3040 as necessary to keep equal voltages on pins 5 and 6 of the Op Amp. As is the case with the 9V3_PA regulator, the Op Amp characteristic allows the regulator to start up when both Op Amp inputs are momentarily low at turn-on. Dual diode D3040 serves two purposes. Diode D3040 is used to protect transistor U3040 if the 9.3V_CNTRL line is grounded. When this happens Q3040's base can only be 0.7V DC and transistor U3040 will be turned off. Diode D3030 also provides temperature compensation of the regulated output voltage.

Regulator U3001 generates the 9.3 V required by most RF, power control, and audio circuits. Input and output capacitors C3005, and C3006/C3007/C3046 are used to reduce high frequency noise. R3003 and R3004 resistor divider set the output voltage to 9.3 V. This regulator output is electronically enabled by 0 V signal at pin 2. MAKO (U3200) FET_ENX, Q3206, and Q3041 are used to control the on-off at U3001 pin 2.

Regulator U3003 generates the 12.6V required by external accessory device at connector J4000-7. Input and output capacitors C3012, and C3012 / C3013 are used to reduce high frequency noise. R3003 and R3004 resistor divider set the output voltage to 12.6V. This regulator output is electronically enabled by 0 V signal at pin 2. MAKO (U3200) FET_ENX, Q3206, and Q3041 are used to control the on-off at U3003 pin 2.

There are a total of eight other LDO regulators used to regulate the 9.3 V supply down to specific application voltages. U0941, U3002, and U3004 are set to supply 5 V output. U0601 is set to supply 3 V for the Abacus III IC. U6402 and U6406 generate 2.8V for GPS Digital IO and RF circuitry while U6407 regulator provides 1.5 V for the GPS RTC module. U3201 regulator, which is capable of handling up to 1 Amp, is set to 1.4 V for the OMAP core.

Switcher1 (Q3200) in conjunction with the MAKO power management IC (U3200) is a highly efficient dc-dc converter. In this application, it is configured as a synchronous buck dc-dc regulator. It generates an accurate 3.6 V output, which supplies directly to the MAKO internal Switcher2 circuit as well as the 1.4 V regulator for the OMAP Core (U3201). A pulse width modulated (PWM) signal is output from U3200 pin G14 to Q3200 pin 4 and controls the output voltage level. External components L3200 and C3203 are needed to filter out the dc-dc converter output. R3200 (0.1 ohm) is used for current sense and over-current circuit protection with 2 A threshold. MAKO Switcher2 output 2.3 V and supplies to the rest of MAKO internal LDOs.

Switcher5 (Q3202) circuitry is similar to Switcher1. It is also configured as a synchronous buck dc-dc regulator. It generates an accurate 5.2 V output, which supplies directly to both VBUS1 and VBUS2 supplies. External components L3202 and C3212 are needed to filter out the output. Q3208 and Q3207 prevent internal voltage leakage onto VBUS_SUPPLY (U3200 pin B13). When the radio is operated in the HOST mode, USB_CONNECT (U3200 pin L6) is toggled HIGH (3.3 V) turning on PMOS FET (Q3207) through Q3208 inverter, and thus provides 5.2 V to both Q3203 and Q3204 drains. Software will enable VBUS1_CMD and VBUS2_CMD either VBUS1 or VBUS2 port base on the detection mechanism. Note, only one of two VBUS ports can supply up to 500 mA (max) at one time. R3207 and R3208 (0.2 ohm) are used for current sense and over-current circuit protection with 800 mA threshold. In device mode, USB_CONNECT is toggled LOW to disable VBUS supply.

The MAKO power management IC (U3200) provides eight more LDOs. Some LDOs are programmable to meet the requirement for various ASIC devices. V2, V3, and V9 are programmable via SPI while V4, V5, V6, V8, and V10 are fixed. See Figure 1-2 for details.

1.2 Power On/Off

The repeater is switched on by asserting the ignition sense input high. On 8 MB repeaters, this signal is internally wired high, in both transmit and receive radios. On 32 MB repeaters, this signal is controlled by circuitry on the Connector board. It is driven high when the repeater’s power supply is switched on, or when the battery voltage is above 8.6 V in battery backup mode.

When the repeater’s power supply is switched on, Q4006 is driven into saturation which pulls its collector to ground and presents an active low to MAKO IGN_X input (U3200 pin B4). When there is no voltage at J4000 pin 25, Q4006 is turned off and its collector is internally pulled high by the MAKO Vsave supply. Because of the noisy nature of ignition signal, a long debounce period of 250ms is used before it will be recognized as a valid input.

1.2.1 Power-Up Sequence

Figure 1-3 details the typical power-up sequence on the mobile radio and the following events that occur sequentially.

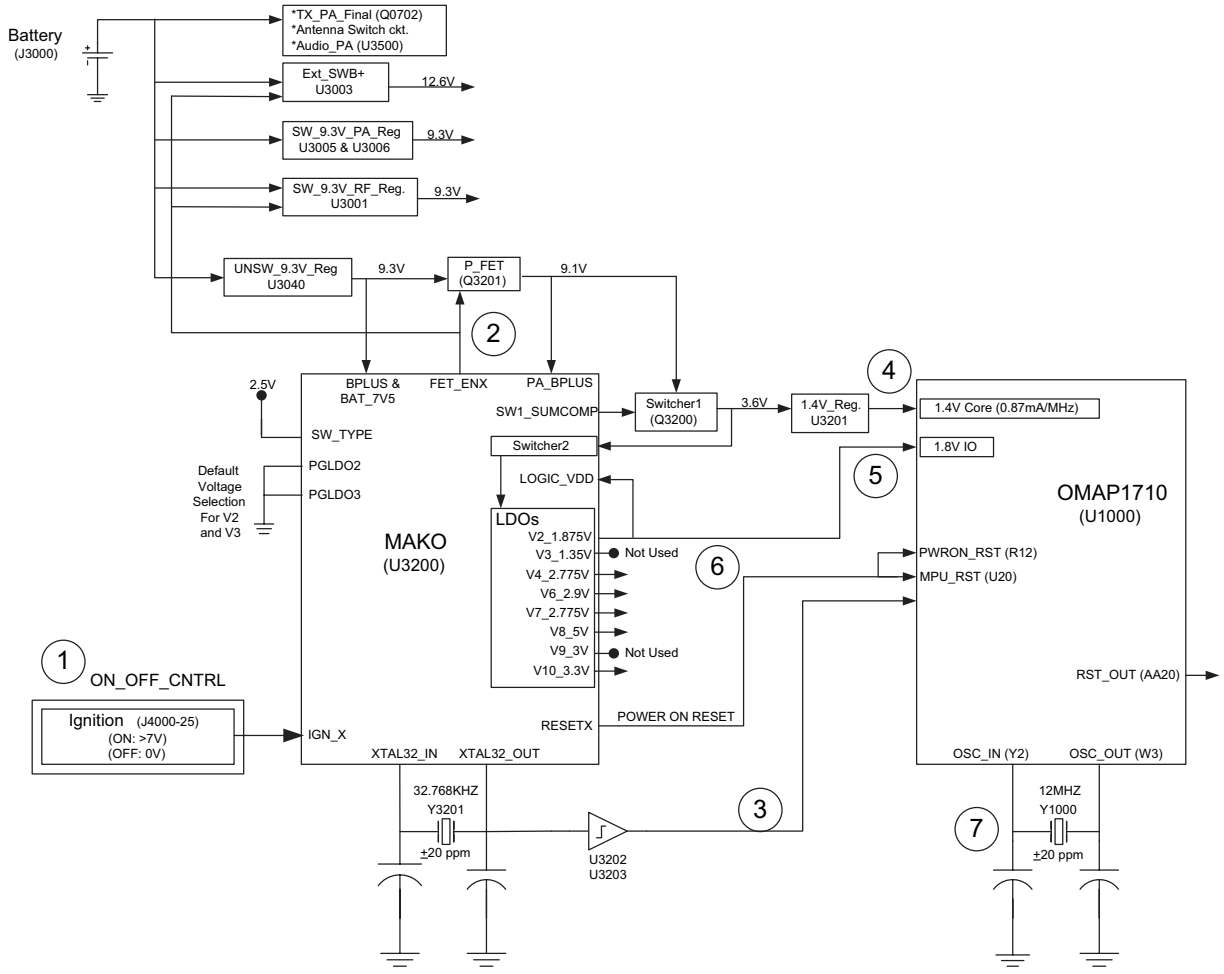


Figure 1-3 Power-Up Sequence

1. User switches on the power supply unit which initiates an ignition sense power on state.
2. The MAKO (U3200) generates an output low at FET_ENX (pin E2) once it detects a valid input at either Mech_SW (pin E4), Emerg_PB (pin F4), or IGN_X (pin B4). Q3206 dual PNP/NPN transistor acts as a double inverter between the MAKO and Q3201 power MOSFET switch as well as over voltage protection. This logic low at the gate of Q3201 results in switching 9.3 V to both Q3200 Switcher circuitry and 1.4 V regulator (U3201).
3. Next the MAKO (U3200) asserts the RESETX (pin C5) low to the OMAP for an additional 32mS after all the DC regulators are stable. It is then de-asserted, allowing the OMAP processor to start.

1.3 Clocks

Figure 1-4 illustrates the controller clocks used throughout the radio.

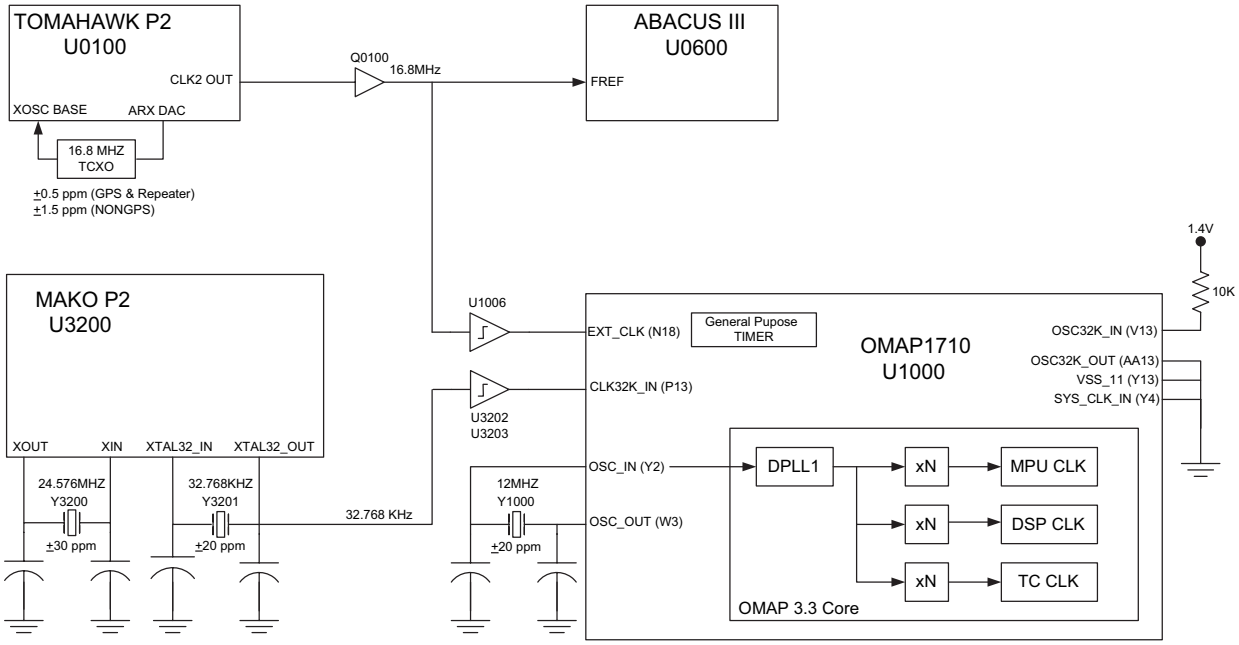


Figure 1-4 Clock Connections

The OMAP processor (U1000), which consists of an ARM and DSP core, needs three clocks for operation: a 32.768 kHz square-wave, a 12 MHz sine-wave, and a 16.8 MHz square-wave clock. The 16.8 MHz clock source is provided from the Tomahawk TCXO with its supporting circuitry Q0100 buffer amplifier, routes to squarer-circuit U1006, and feed to EXT_CLK (U1000 pin N18). The 32.768 kHz clock is generated by the MAKO crystal Y3201 oscillator; converted to a gated clock by U3202 and U3303 circuitry; then directly feed to OMAP CLK32_IN (U1000 pin P13) as well as GPS IC (U6400). The OMAP needs the 32.786 kHz to determine the input reference clock (12, 13, or 19.2 MHz) applied to OSC_IN (U1000 pin Y2). Without this 32 kHz clock, the OMAP will potentially program all the wrong dividers for USB and UART booting. The 12 MHz sine-wave is the main system reference clock for the OMAP which all the internal clocks are derived from. External pull-up on OSC32K_IN (U1000 pin V13) and grounding both OSC32K_OUT (pin AA1 and VSS_11 (pin Y13) indicating that an external 32 kHz clock is used. The 24.576 MHz crystal (Y3200) oscillator is the reference clock for MAKO CODEC and SSI clock.

1.4 Serial Peripheral Interface (SPI)

Figure 1-5 illustrates the controller SPI used throughout the radio.

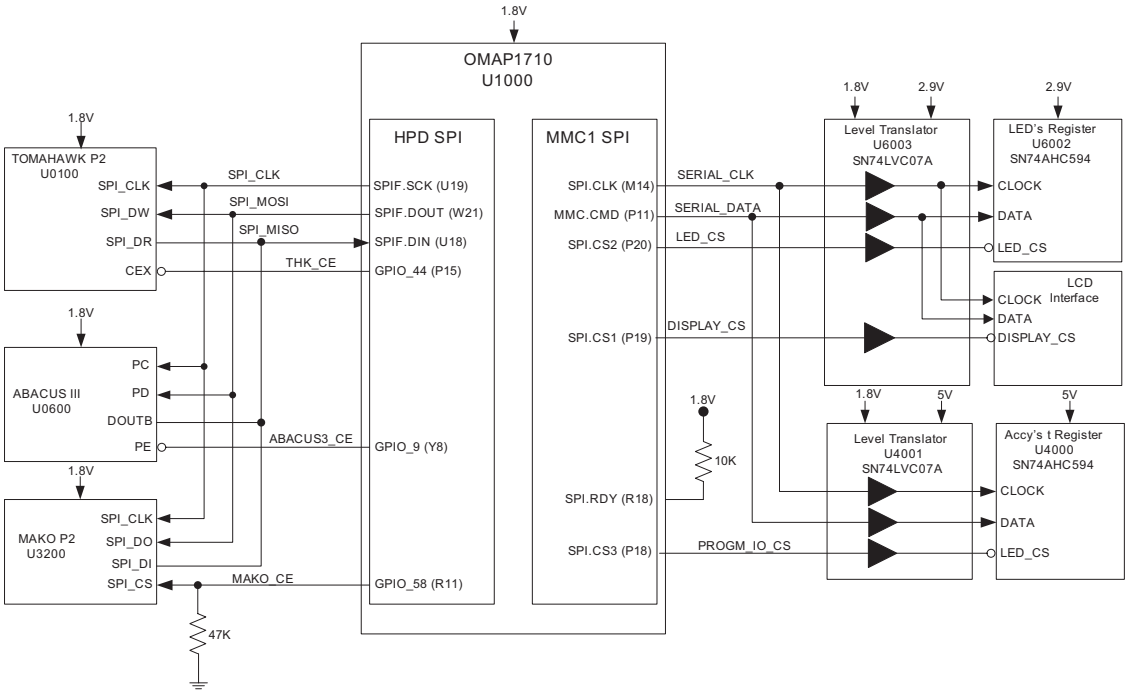


Figure 1-5 SPI Connections

The OMAP processor (U1000) has two SPI busses that it uses to communicate with the various peripheral IC's. The first is the High Performance Data (HPD) SPI bus and the second is the multi-media card (MMC) SPI.

The HPD SPI is a synchronous serial bus made up of four lines, SPI_CLK, SPI_MOSI, SPI_MISO, and chip select. The SPI_CLK line is used to control the speed of the data to/from the peripheral IC's and the OMAP processor. This clock can be adjusted to different speed based on the IC's specification.

HPD SPI module is used to interface to Tomahawk (U0100), Abacus III (U0600), and the MAKO (U3200). This interface operates at 1.8 V logic levels. SPI_MOSI, or commonly known as TRANSMIT Data, is a data string from the OMAP while SPI_MISO or RECEIVE Data is data string to the OMAP.

The MMC SPI is a 3-wire bus; consisting of SERIAL_CLK, SERIAL_DATA, and chip select. This SPI bus is used to interface to accessory Serial-Parallel IC (U4000), the repeater board LED's and LCD driver. For accessory Serial-Parallel IC, the logic level out of the processor is level shifted from 1.8 V to 5 V through U4001 and pull-up resistors R4100, R4101, and R4103.

1.5 Serial Synchronous Interface (SSI)

Figure 1-6 illustrates the controller SSI used on XPR series radios controller design.

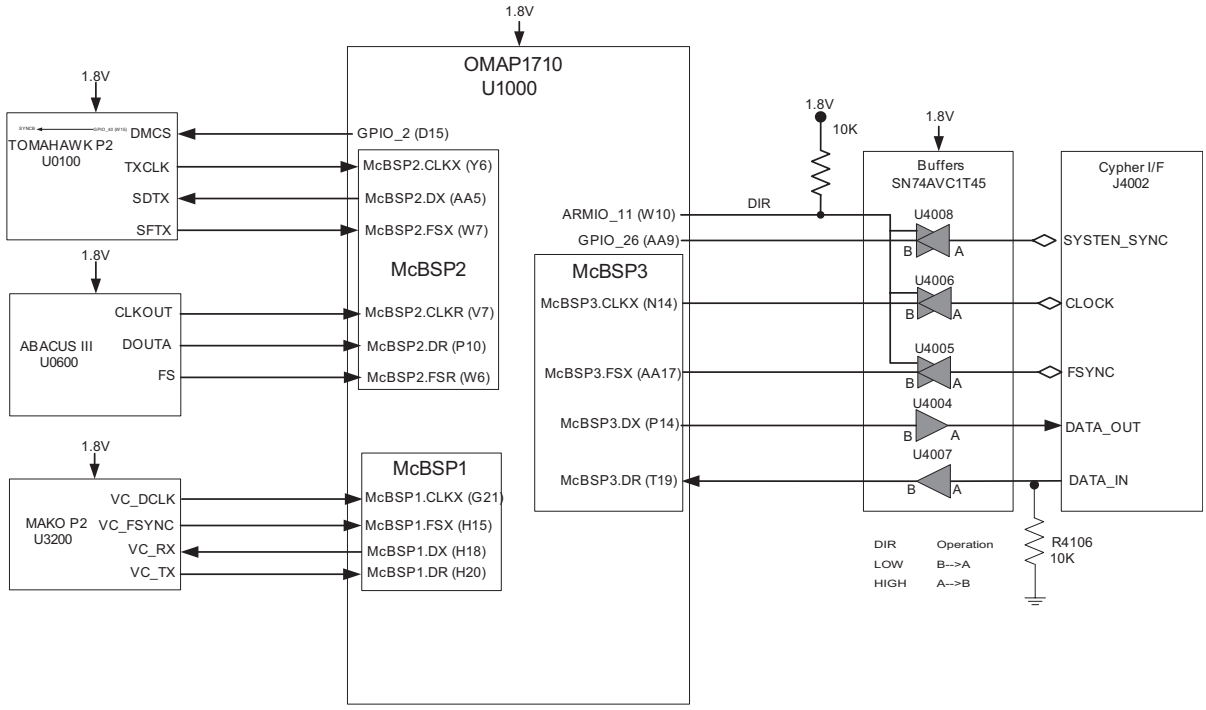


Figure 1-6 SSI Connections

The OMAP processor (U1000) has a total of three SSI or multi-channel buffer serial ports (McBSP) modules that are used to directly interface to the CODECs in the Tomahawk, Abacus, and MAKO and between Tx and Rx radios within a Repeater.

As shown in Figure 1-6, McBSP1 is a 4-wire bus and interface to the MAKO CODEC. McBSP2 is 6-wire bus; 3-wire dedicated to the Tomahawk Tx audio and the other 3-wire to Abacus Rx audio. McBSP3 is a 4-wire bus, and used primarily to interface between Tx and Rx radios within a Repeater.

1.6 ACC_ID Interface

Smart accessories use the Accessory ID (ACC_ID) Interface to help the repeater determine which smart accessory, if any, are attached to the repeater. Figure 1-7 illustrates the ACC_ID connections used within the radio.

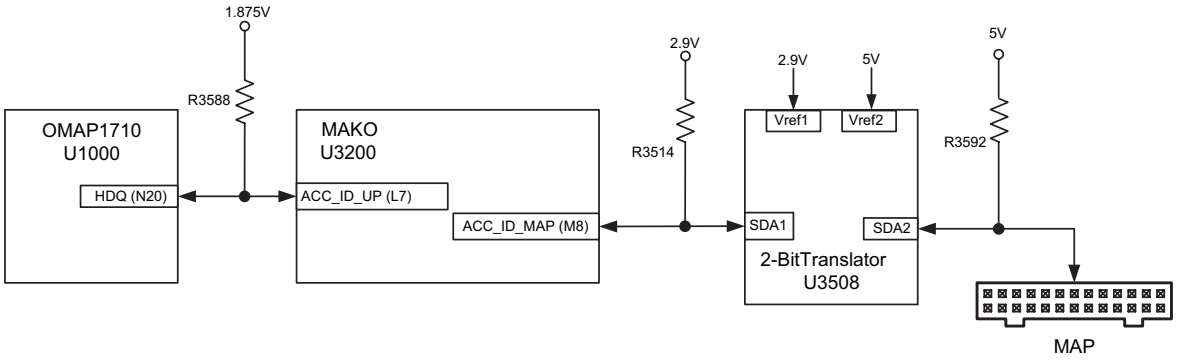


Figure 1-7 ACC_ID Interface Connections

The MAKO (U3200) serves as a driver between the OMAP ACC_ID bus and the device. Level translator (U3508) is required to level shift between 2.9 V to 5 V.

1.7 USB Interface

The OMAP processor (U1000) supports two USB ports. The radio makes use of these USB ports to communicate with smart accessories, and connection to a host computer for radio programming via CPS and tuning via the Tuner Tool. Only one of these ports is available (via the MAP connector), the other is dedicated to the Ethernet controller.

Note: The USB ports are designed to support Motorola accessories and approved applications only and will not support third party "Plug-n-Play" USB devices.

Figure 1-8 shows the details of the HSSI connections within the radio.

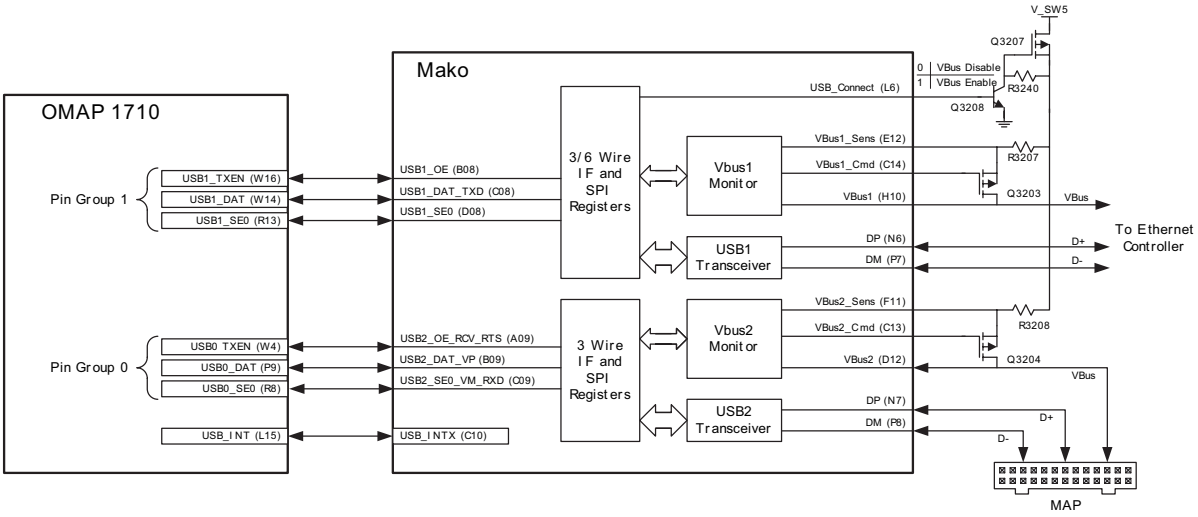


Figure 1-8 USB Interface Connections

The OMAP processor USB host controller communicates with accessories at either 1.5 Mbps or 12 Mbps data rates depending on the accessory. Either port can be used as a host or a device, the only limitation is that both ports cannot be used as a device at the same time.

The MAKO (U3200) incorporates two USB transceivers that provide the physical layer signaling for the two ports. Each transceiver generates and receives the DP and DM differential signals of the USB port. The transceiver interfaces to the OMAP processor through a three-wire interface consisting of two bi-directional signals (SE0 and DAT), and one uni-directional signal (TXEN). The MAKO also includes two bus monitors that sense the connection or removal of a device and determine whether or not to supply current to that device via Q3203 or Q3204 up to a maximum of 500 mA per port.

1.8 Mobile Accessory Port (MAP)

The Mobile Accessory Port (MAP) is a newly defined Motorola accessory port that contains audio, programmable digital I/O, serial interfaces, and accessory supply lines; and is similar in function to Motorola's legacy products accessory connectors.

Table 1-1 Mobile Accessory Port Functions

MAP Pin Number	MAP Pin Name	MAKO Pin
1	USB_D+	USB for programming or Smart Accessory
2	USB_D-	
3	V_Bus	
4	USB_Ground	
5	ACC_MAP_ID_2	Accessory Identifier
6	ACC_MAP_ID_1	
7	Ext_SWB+	Switched Battery Voltage
8	Power Ground	Ground
9	Ext_Spkr-	External Speaker
10	Ext_Spkr+	
11	Tx_Audio	Tx Audio Input
12	Audio Ground	Ground
13	Aux_Audio_Out_1	Auxiliary Audio Output (not supported in the repeater)
14	Rx_Audio	Rx Audio Output (not supported in the repeater)
15	Aux_Audio_Out_2	Auxiliary Audio Output (not supported in the repeater)
16	Ground	Ground
17	Prgm_In_1_(PTT)	Programmable Input with prescribed function of PTT
18	Ground	Ground
19	Prgm_IO_2 (Monitor)	Programmable Input/Output with prescribed function Monitor
20	Prgm_IO_6	Programmable Input/Output
21	Prgm_IO_3 (Chan_Act)	Programmable Input/Output with prescribed function Channel Activity
22	Prgm_IO_7	Programmable Input/Output

Table 1-1 Mobile Accessory Port Functions

MAP Pin Number	MAP Pin Name	MAKO Pin
23	Prgm_In_4 (Emergency)	Programmable Input with dedicated function for Emergency Switch
24	Prgm_IO_8	Programmable Input/Output (not supported in the repeater)
25	Prgm_1_5 (Ign_Sense)	Not Used
26	Prgm_Out_9 (Ext_Alarm)	Programmable Output with prescribed function of External Alarm

1.8.1 MAP Programmable I/Os

The MAP contains 7 general purpose I/Os. One is specifically an output, 1 is specifically an input, and the remaining 5 can be either input or output. The MAP also contains 2 dedicated inputs. All input signals map directly to OMAP (U1000) GPIOs, while all outputs are controlled from the OMAP through a SPI connected shift register (U4000) referred here as the Acc_Shift_Reg. While 7 of the 9 I/Os are general purpose and designed to be programmable through the CPS, several have recommended functions that will be detailed below.

All of the programmable I/Os, except the dedicated inputs, use inverted logic, IE: a 1 on the connector as an input will be seen by the OMAP as a 0 and visa versa. Also, a 1 output by the OMAP through the Acc_Shift_Reg will be seen as a 0 output on the connector.

- Prgm_In_1 (PTT): Programmable input that has the recommended function of Push-To-Talk (PTT). This signal connects to the OMAP GPIO_7 (U1000 pin M15) as an input.
- Prgm_IO_2 (Monitor): Programmable input/output that has the recommended function of Monitor. This signal connects to the OMAP GPIO_32 (U1000 pin B17) as an input. The output for this signal is driven from Acc_Shift_Reg bit 0 (U4000 pin 15).
- Prgm_IO_3 (Chan_Act): Programmable input/output that has the recommended function of Channel Activity (Chan_Act). This signal connects to the OMAP GPIO_33 (U1000 pin J14) as an input. The output for this signal is driven from Acc_Shift_Reg bit 1(U4000 pin 1).
- Prgm_I_4 (Emergency): Dedicated input that is having the function of Emergency (Emerg_Sw). This signal connects to the MAKO EMERG_PB (U3200 pin F4) as an input.
- Prgm_IO_6: Programmable input/output. This signal connects to the OMAP ARMIO_15 (U1000 pin E19) as an input. The output for this signal is driven from Acc_Shift_Reg bit 2 (U4000 pin 2).
- Prgm_IO_7: Programmable input/output. This signal connects to the OMAP ARMIO_3 (U1000 pin V8) as an input. The output for this signal is driven from Acc_Shift_Reg bit 3 (U4000 pin 3).
- Prgm_IO_8: Programmable input/output. This signal connects to the OMAP GPIO_24 (U1000 pin V5) as an input. The output for this signal is driven from Acc_Shift_Reg bit 4 (U4000 pin 4). This IO is not supported in the repeater.
- Prgm_Out_9 (Ext_Alarm): Programmable output that has the recommended function of External Alarm (Ext_Alarm). The output for this signal is driven from Acc_Shift_Reg bit 5 (U4000 pin 5).

1.8.2 MAP Serial Interfaces

The MAP includes 2 serial interfaces: an USB port and an ACC_ID interface. The USB port can be used as either a device (radio is device) or as a host (radio is host). When configured as a device, the radio can be programmed or tuned using MOTOTRBO CPS or Tuner software. When configured as a host, various smart accessories can be used with the radio. See section 1.7 on page 1-10 for more information on the USB interface.

The ACC_ID interface is used by accessories to provide the radio with information needed to configure the interface for that accessory. See section 1.6 on page 1-9 for more information on the ACC_ID interface.

Note: The USB ports are designed to support Motorola accessories and appoved applications only and will not support third party "Plug-n-Play" USB devices.

1.8.3 MAP Audio Signals

The MAP has Speaker and Tx audio input. Speaker audio is a differential output from the radio's audio PA (U3500). The speaker output available for monitor functions only. Tx audio is a mic/line level input audio for transmit, it is available in test mode only.

1.9 Repeater Interconnections Interface

The Repeater's architecture uses two mobiles, one for transmit, one for receive to form a repeater. The Repeater Interconnection Interface is used to communicate between the Tx and Rx radios within the Repeater. This is accomplished by using one of the SSI ports from the OMAP (U1000) and level shifters/drivers (U4004, U4005, U4006, and U4007). Both data and commands/responses can be passed via this interface. The interface consists of two separate serial paths, one from the Rx radio to the Tx radio; and one from the Tx radio to the Rx radio. The Tx radio is considered the master while the Rx radio is the slave, meaning that the Tx radio generates the sync and clock for both communication paths. Figure 1-9 shows the basic block diagram of this interconnection.

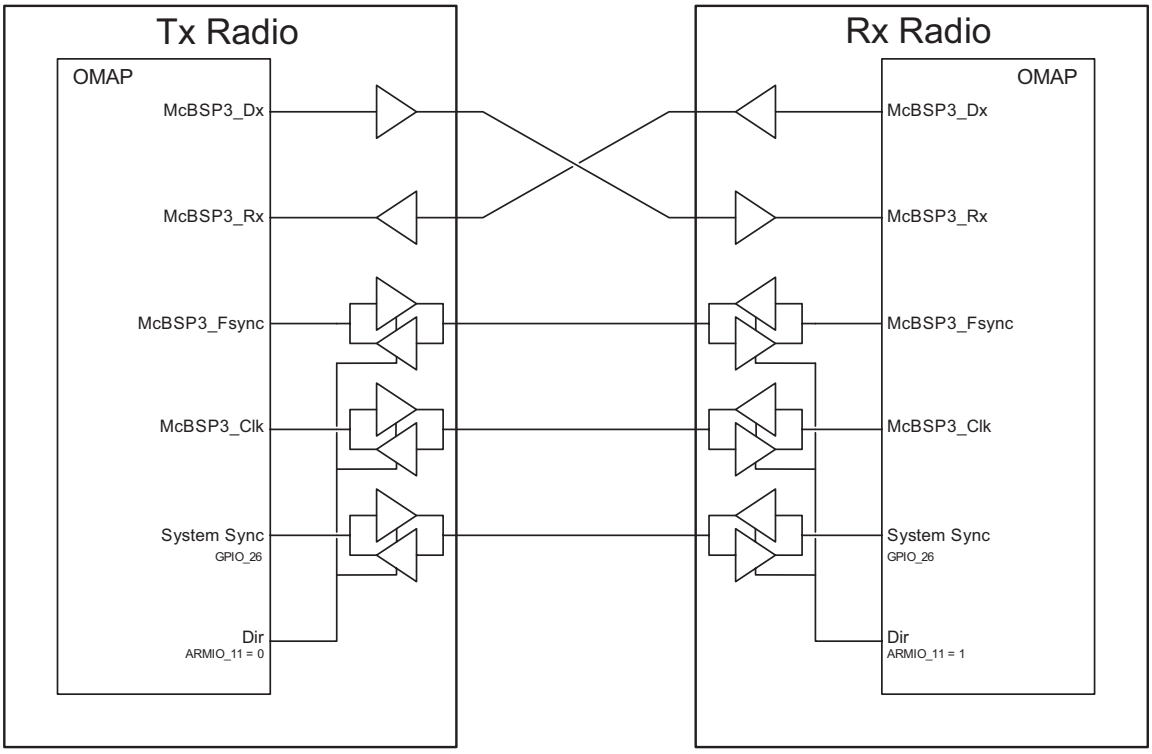
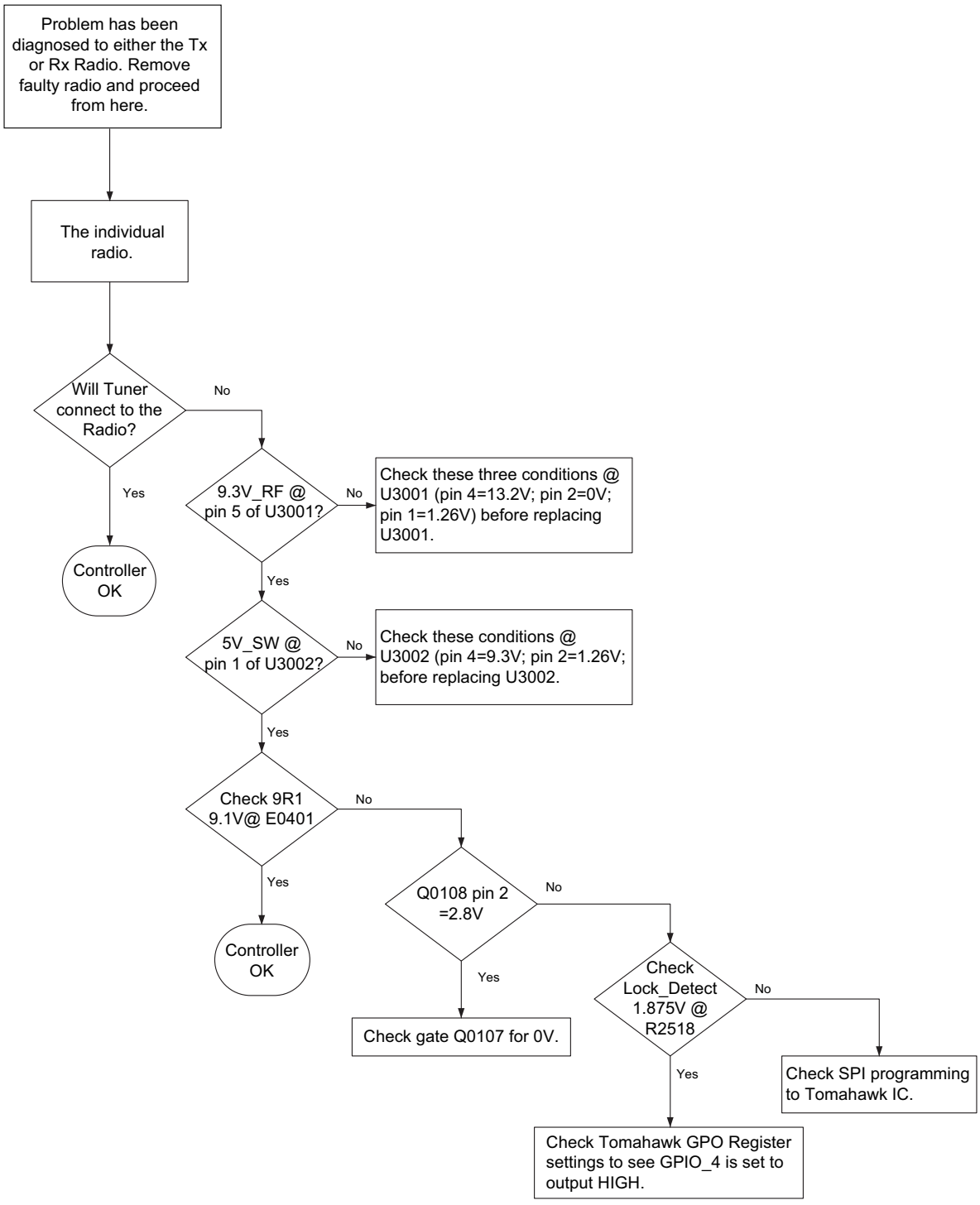


Figure 1-9 Repeater Interconnection Interface

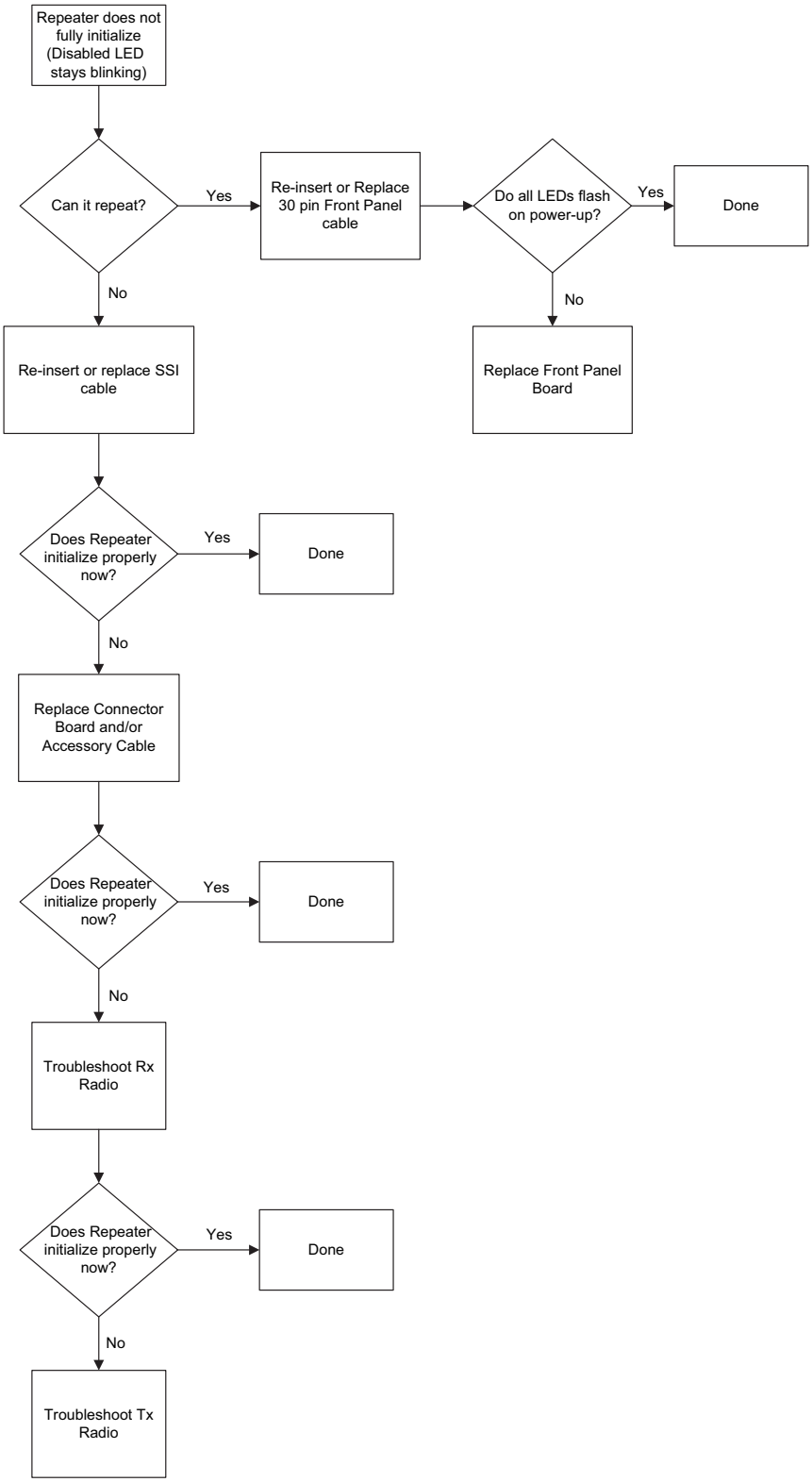
Section 2

TROUBLESHOOTING CHARTS

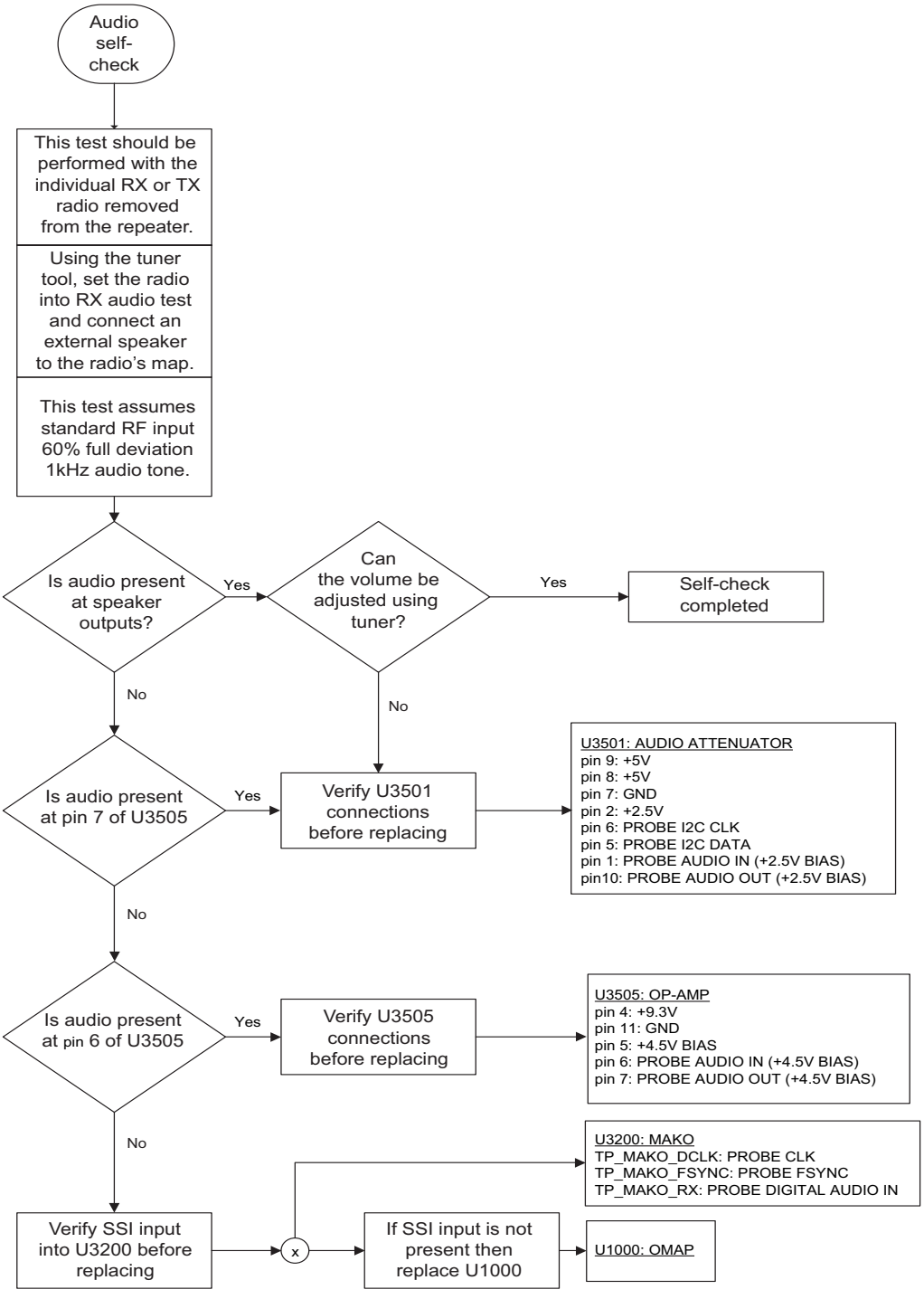
1.0 Controller Troubleshooting Chart



2.0 Power-Up Troubleshooting Chart



3.0 Audio Troubleshooting Chart



Notes

Section 3

CONTROLLER SCHEMATICS / PARTS LISTS

1.0 Allocation of Schematics and Parts List

1.1 Controller Circuits

This Chapter shows the Schematics and the Parts Lists for the Controller circuits.

Table 3-1 Controller GPS R1 Schematic Diagrams and Parts List

Controller R1 used on PCB: **8471165L03_A UHF (403–470 MHz), 1–25 W** **8486777Z12_A UHF (403–470 MHz), 25–40 W**	
SCHEMATICS **Controller GPS** **DC Supply** **DC Distribution** **Peripheral (sheet 1 of 2)** **Peripheral (sheet 2 of 2)** **Microprocessor** **Memories** **Audio and USB**	 **Page 3-5** **Page 3-6** **Page 3-7** **Page 3-8** **Page 3-9** **Page 3-10** **Page 3-11** **Page 3-12**
Parts List **Controller**	 **Page 3-13**

Table 3-2 Controller GPS R2 Schematic Diagrams and Parts List

Controller R2 used on PCB: **8471495L01_A VHF (136–174 MHz), 1–25 W** **8478023A12_A VHF (136–174 MHz), 25–45 W**	
SCHEMATICS **Controller GPS** **DC Supply** **DC Distribution** **Peripheral (sheet 1 of 2)** **Peripheral (sheet 2 of 2)** **Microprocessor** **Memories** **Audio and USB**	 **Page 3-19** **Page 3-20** **Page 3-21** **Page 3-22** **Page 3-23** **Page 3-24** **Page 3-25** **Page 3-26**
Parts List **Controller**	 **Page 3-27**

Table 3-3 Controller GPS R4 Schematic Diagrams and Parts List

Controller R4 used on PCB: **8471495L03_C VHF (136–174 MHz), 1–25 W** **8478023A16_C VHF (136–174 MHz), 25–45 W** **8471165L05_C UHF (403–470 MHz), 1–25 W** **8486777Z14_C UHF (403–470 MHz), 25–40 W**	
SCHEMATICS	
Controller GPS	**Page 3-33**
DC Supply	**Page 3-34**
DC Distribution	**Page 3-35**
Peripheral (sheet 1 of 2)	**Page 3-36**
Peripheral (sheet 2 of 2)	**Page 3-37**
Microprocessor	**Page 3-38**
Memories	**Page 3-39**
Audio and USB	**Page 3-40**
Parts List	
Controller	**Page 3-41**

Table 3-4 Controller GPS R5 Schematic Diagrams and Parts List

Controller R5 used on PCB: **8471696M01_A UHF2 (450–512 MHz), 1–40 W**	
SCHEMATICS	
Controller GPS	**Page 3-47**
DC Supply	**Page 3-48**
DC Distribution	**Page 3-49**
Peripheral (sheet 1 of 2)	**Page 3-50**
Peripheral (sheet 2 of 2)	**Page 3-51**
Microprocessor	**Page 3-52**
Memories	**Page 3-53**
Audio and USB	**Page 3-54**
Parts List	
Controller	**Page 3-55**

Table 3-5 Controller GPS R6 Schematic Diagrams and Parts List

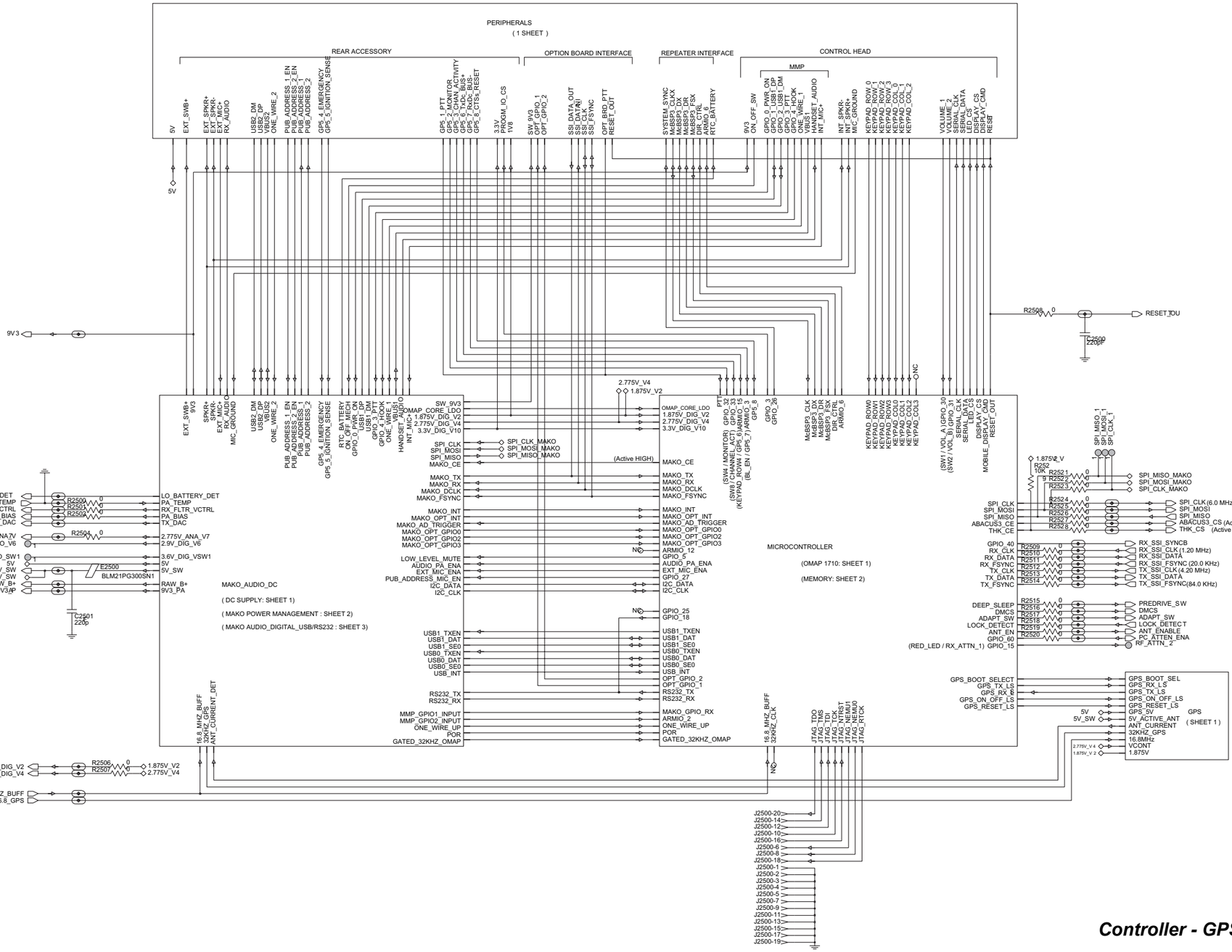
Controller R6 used on PCB: **8471495L04_D VHF (136–174 MHz), 1–25 W** **8478023A17_D VHF (136–174 MHz), 25–45 W** **8471165L06_D UHF (403–470 MHz), 1–25 W** **8486777Z15_D UHF (403–470 MHz), 25–40 W** **8471696M02_D UHF (450–512 MHz), 25–45 W**	
SCHEMATICS **Controller GPS** **DC Supply** **DC Distribution** **Peripheral (sheet 1 of 2)** **Peripheral (sheet 2 of 2)** **Microprocessor** **Memories** **Audio and USB**	 **Page 3-61** **Page 3-62** **Page 3-63** **Page 3-64** **Page 3-65** **Page 3-66** **Page 3-67** **Page 3-68**
Parts List **Controller**	 **Page 3-69**

Table 3-6 Hardware ID Table R6 Controller

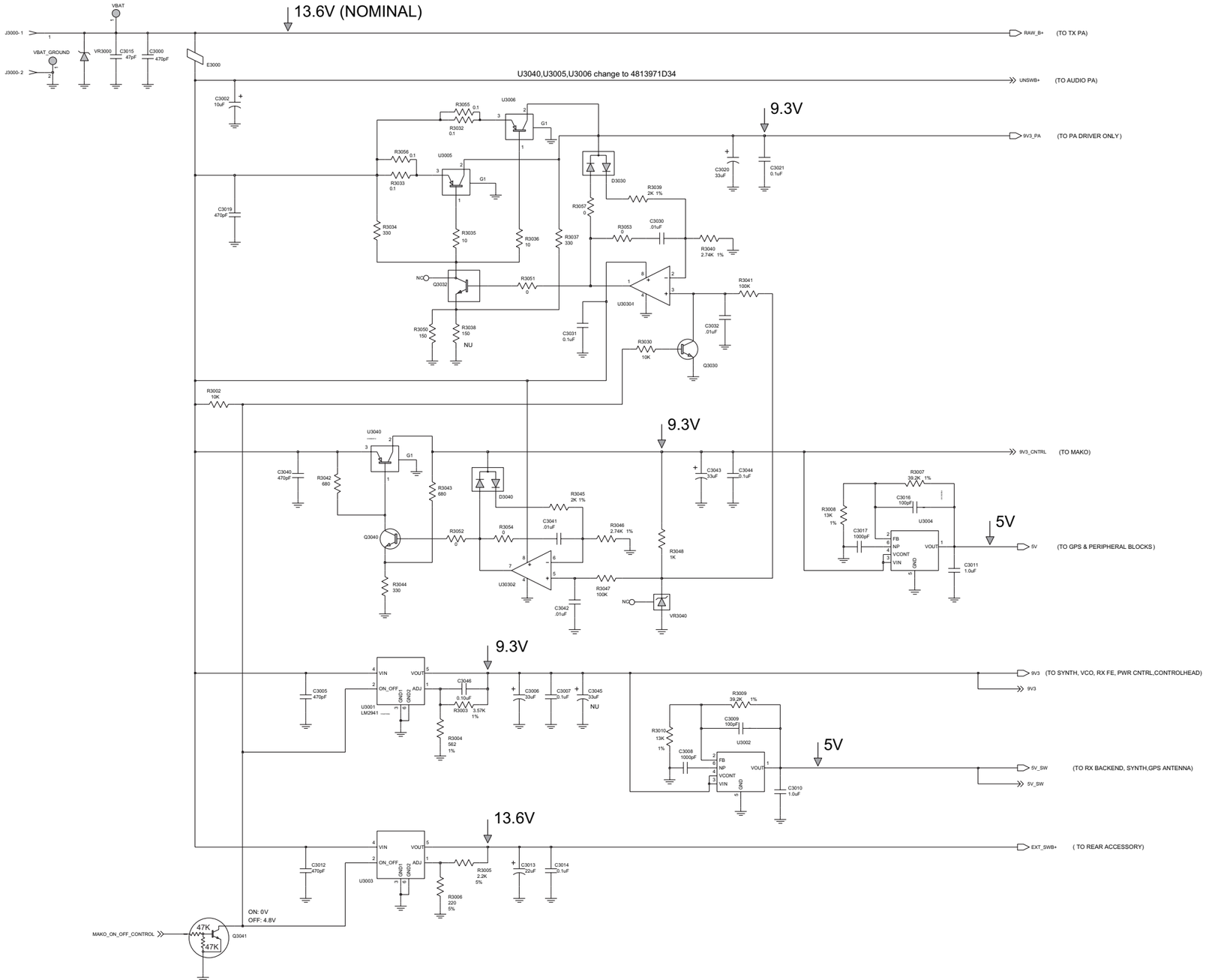
Circuit Ref	VHF		UHF B1		UHF B2	
	Motorola Part No.	Desc.	Motorola Part No.	Desc.	Motorola Part No.	Desc.
R3503	0613952R07	18K	0613952R07	18K	0613952R07	18K
R3504	0613952N15	14K 1%	0613952N15	14K 1%	0613952N15	14K 1%
R3505	0613952N01	10K	0613952Z52	6.8K 1%	0613952Z48	4.7K
R3507	0613952R11	27K	0613952R11	27K	0613952R11	27K
R3508	0613952M01	1K 1%	0613952M01	1K 1%	0613952M01	1K 1%
R3509	0613952M30	2K	0613952Z48	4.7K	0613952Z48	4.7K

Notes

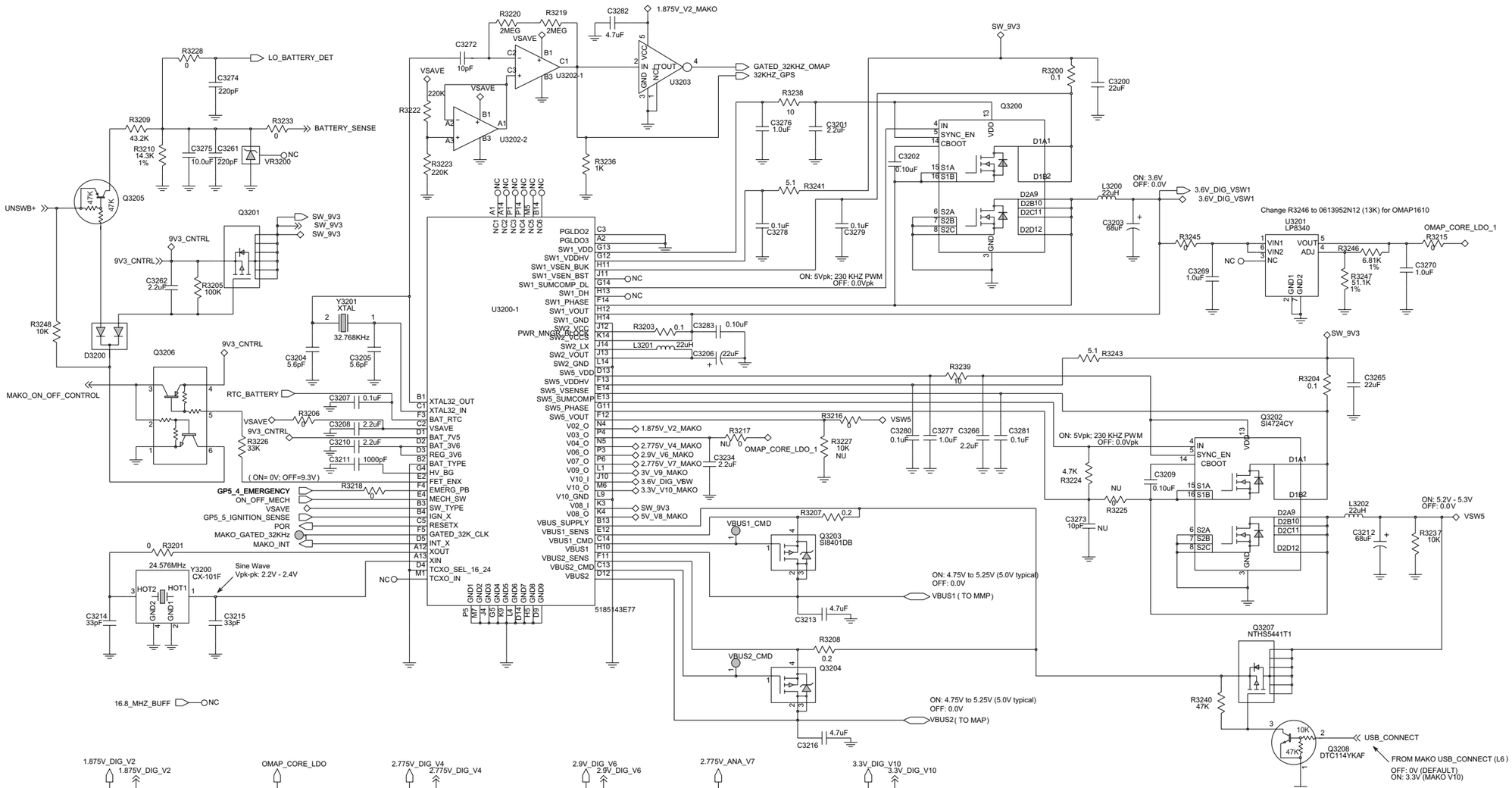
2.0 Controller R1 Schematic Diagrams



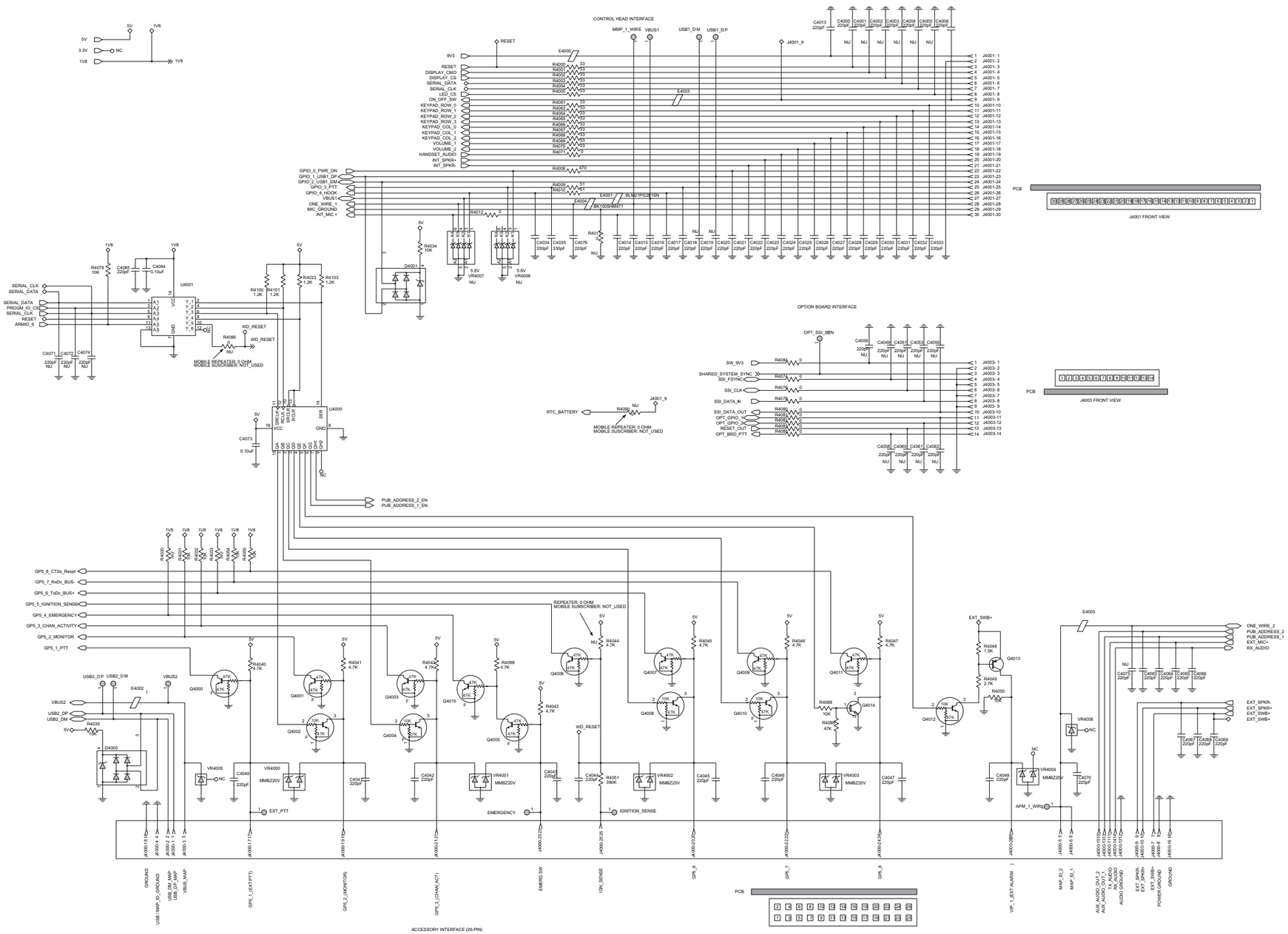
Controller - GPS Schematic Diagram



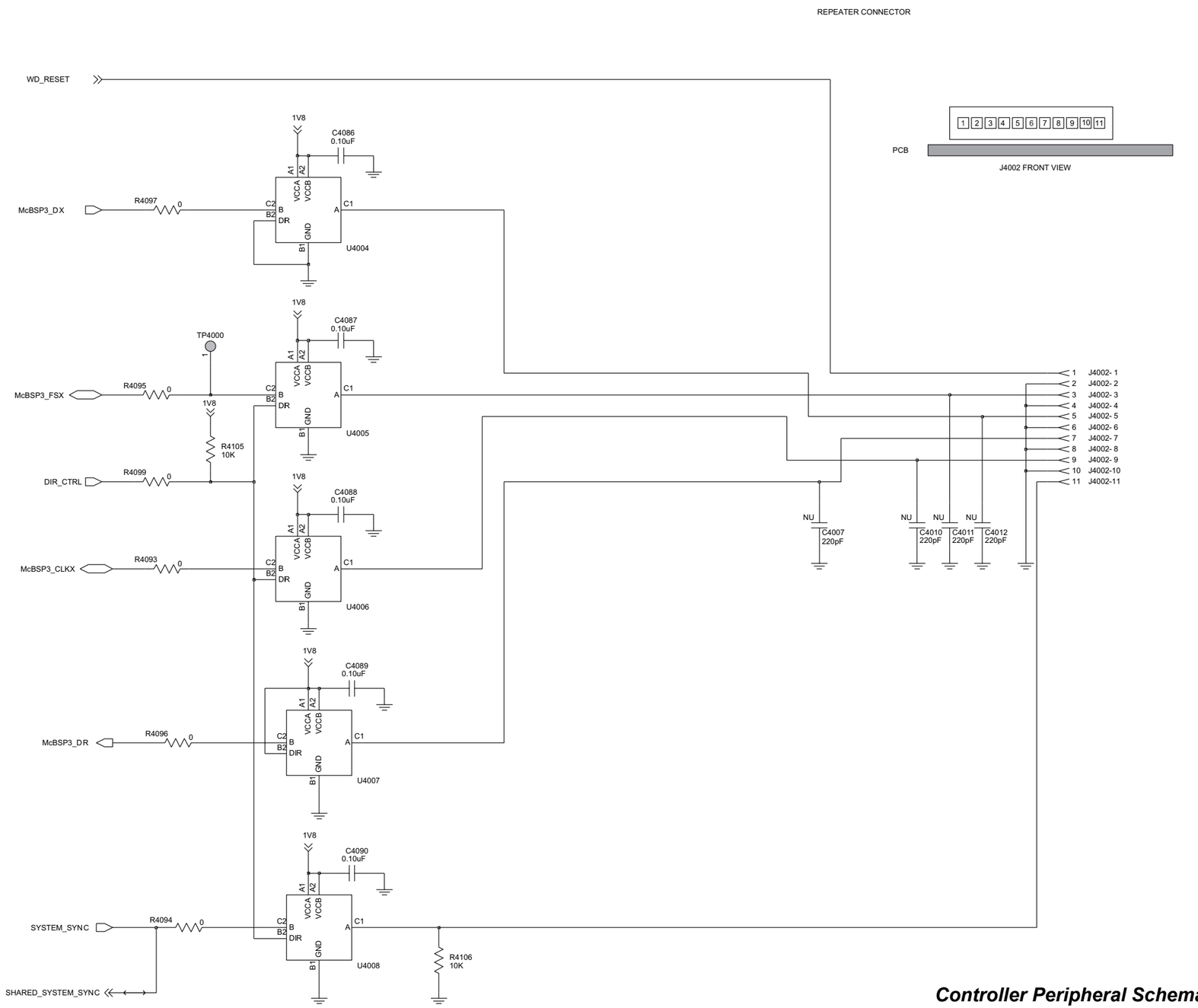
Controller DC Supply Schematic Diagram



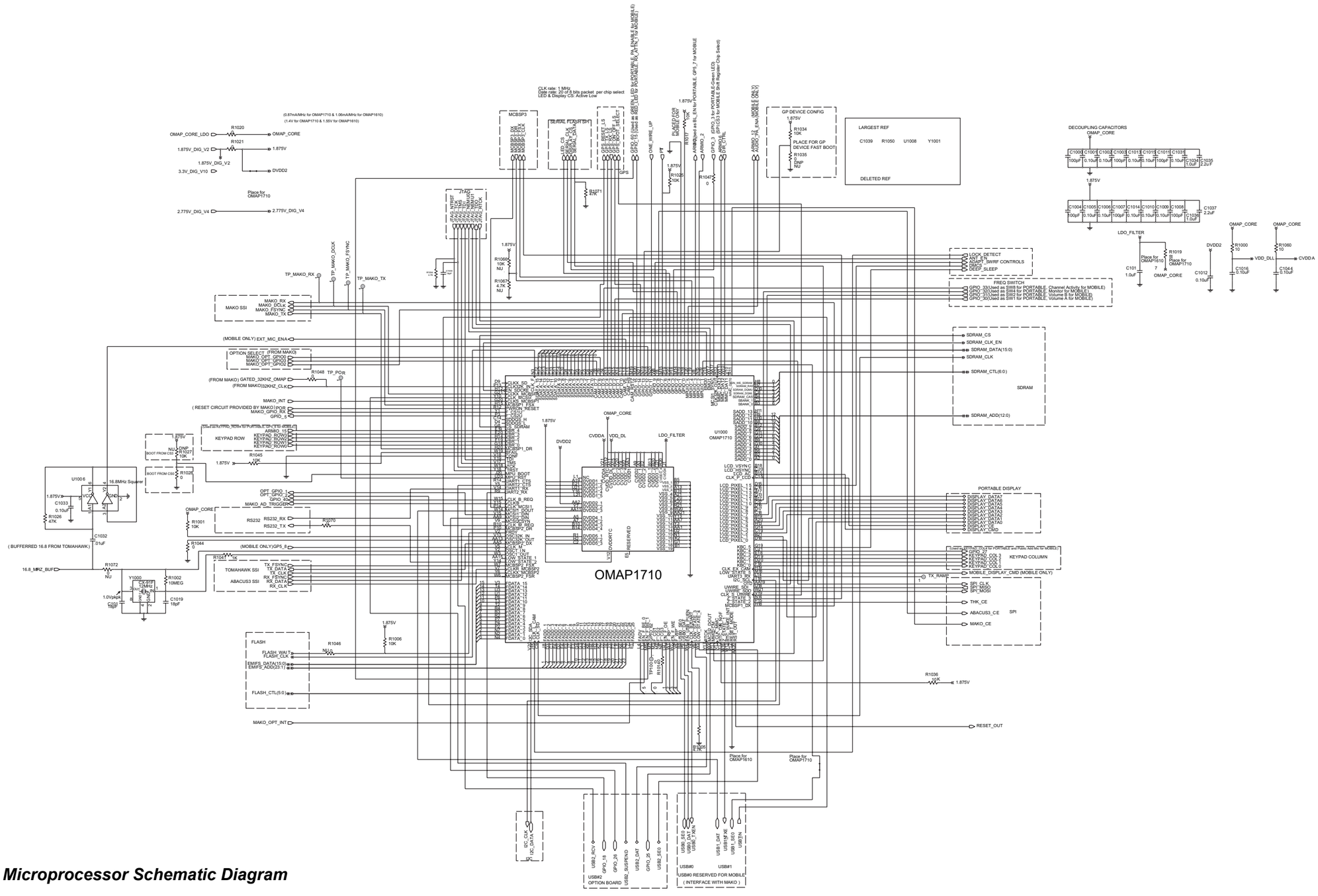
Controller DC Distribution Schematic Diagram



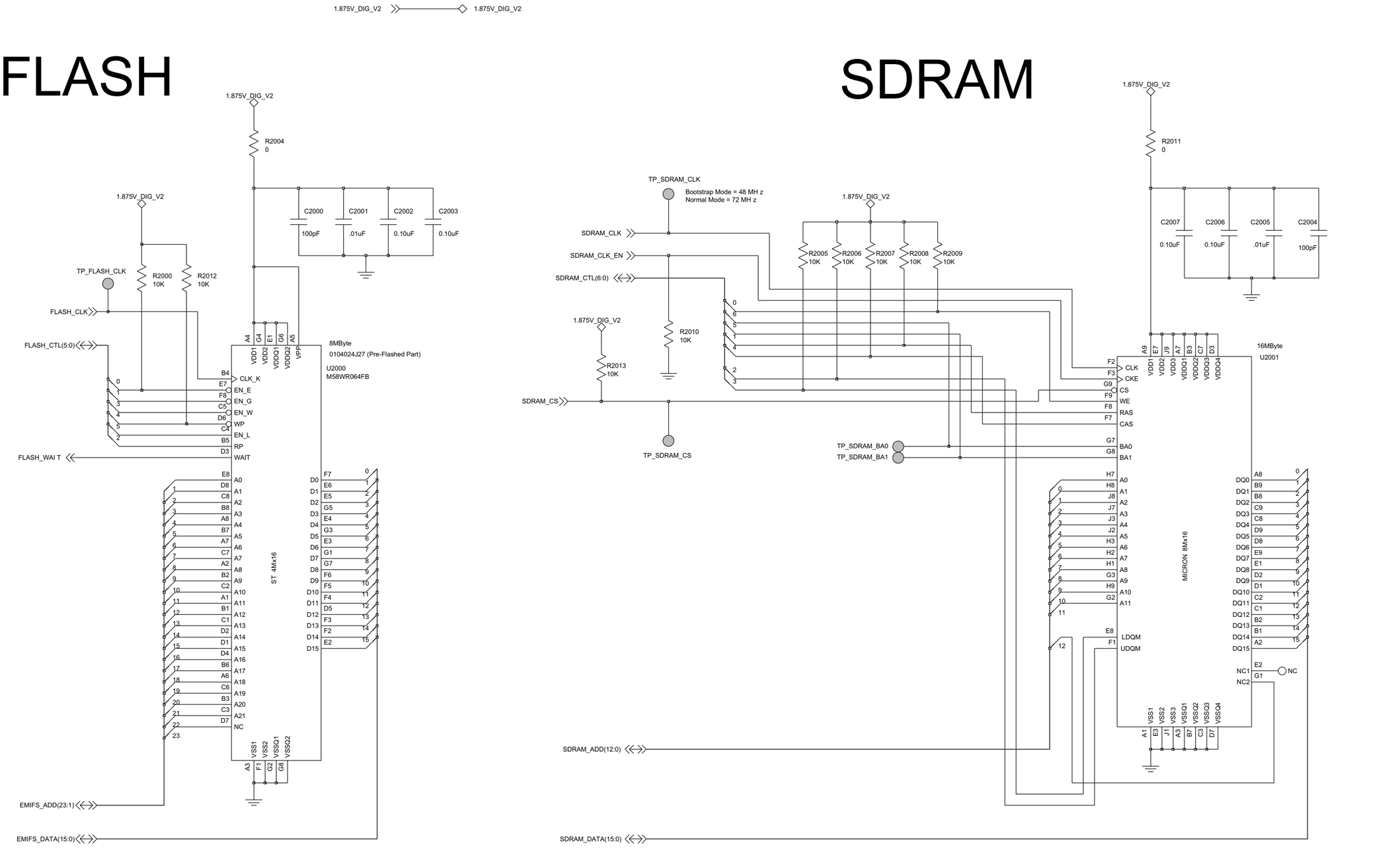
Controller Peripheral Schematic Diagram (sheet 1 of 2)



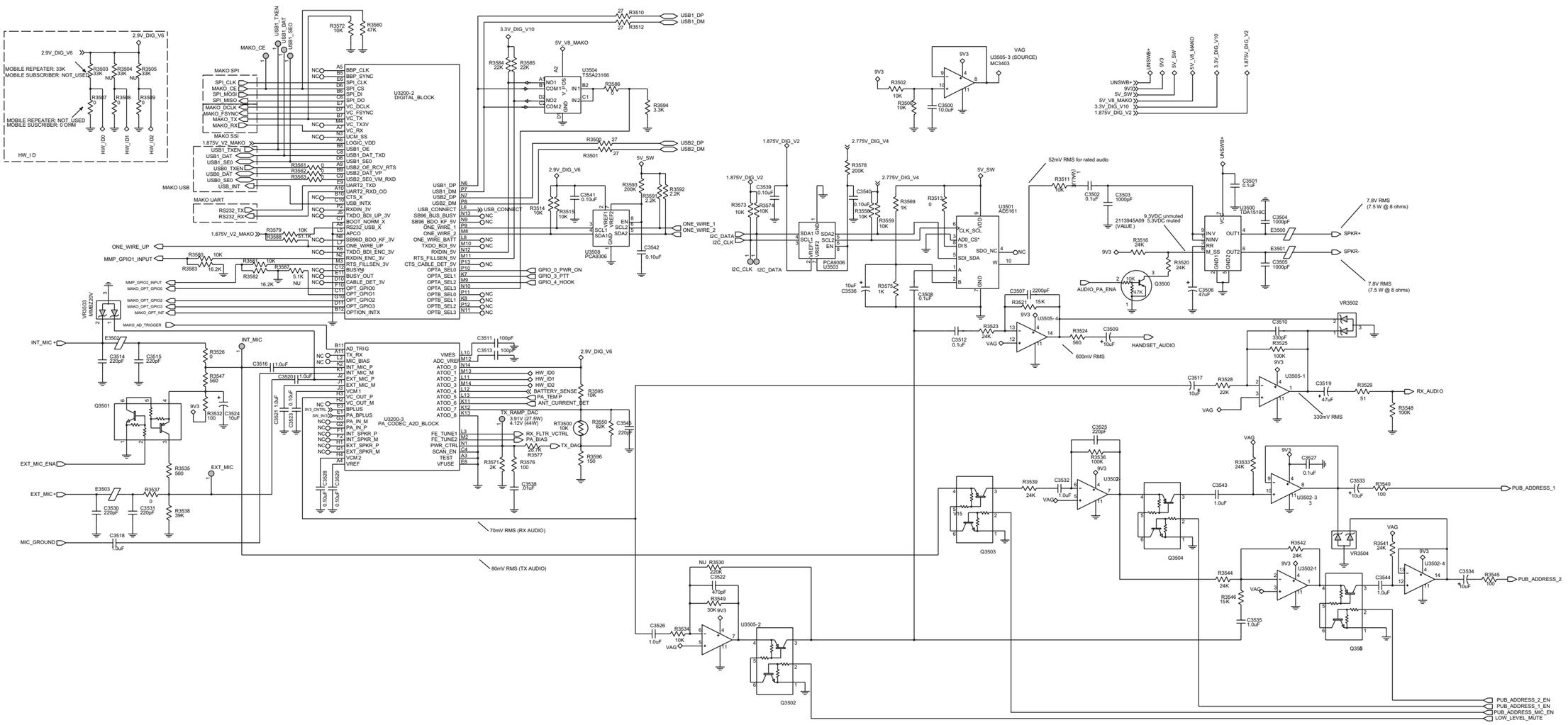
Controller Peripheral Schematic Diagram (sheet 2 of 2)



Controller Microprocessor Schematic Diagram



Controller Memories Schematic Diagram



Controller Audio and USB Schematic Diagram

2.1 Controller R1 Parts List

Circuit Ref	Motorola Part No	Description
C1000	2113944A40	100pF
C1001	2113945Y02	0.10uF
C1002	2113945Y02	0.10uF
C1003	2113944A40	100pF
C1004	2113944A40	100pF
C1005	2113945Y02	0.10uF
C1006	2113945Y02	0.10uF
C1007	2113944A40	100pF
C1008	2113944A40	100pF
C1009	2113945Y02	0.10uF
C1010	2113945Y02	0.10uF
C1011	2113944A40	100pF
C1012	2113945Y02	0.10uF
C1013	2113945Y02	0.10uF
C1014	2113945Y02	0.10uF
C1015	2113945Y02	0.10uF
C1016	2113945Y02	0.10uF
C1017	2113946E02	1.0uF
C1018	2113944A28	18pF
C1019	2113944A28	18pF
C1030	2113944A28	18pF
C1031	2113945Y02	0.10uF
C1032	2113945B02	.01uF
C1033	2113945Y02	0.10uF
C1034	2113946S35	1.0uF
C1035	2113946D05	2.2uF
C1036	2113946S35	1.0uF
C1037	2113946D05	2.2uF
C1044	2113945Y02	0.10uF

Circuit Ref	Motorola Part No	Description
C2000	2113944A40	100pF
C2001	2113945B02	.01uF
C2002	2113945Y02	0.10uF
C2003	2113945Y02	0.10uF
C2004	2113944A40	100pF
C2005	2113945B02	.01uF
C2006	2113945Y02	0.10uF
C2007	2113945Y02	0.10uF
C2500	2113944A44	220pF
C2501	2113944A44	220pF
C3000	2113944C06	470pF
C3002	2371403L02	10uF
C3005	2113944C06	470pF
C3006	2314030E85	33uF
C3007	2113945C31	0.1uF
C3008	2113945A09	1000pF
C3009	2113944A40	100pF
C3010	2113946S35	1.0uF
C3011	2113946S35	1.0uF
C3012	2113944C06	470pF
C3013	2314030J28	22uF
C3014	2113945C31	0.1uF
C3015	2113944C38	47pF
C3016	2113944A40	100pF
C3017	2113945A09	1000pF
C3018	2389289U01	10uF
C3019	2113944C06	470pF
C3020	2314030E85	33uF
C3021	2113945C31	0.1uF
C3030	2113945C02	.01uF

Circuit Ref	Motorola Part No	Description
C3031	2113945C31	0.1uF
C3032	2113945B02	.01uF
C3040	2113944C06	470pF
C3041	2113945C02	.01uF
C3042	2113945B02	.01uF
C3043	2314030E85	33uF
C3044	2113945C31	0.1uF
C3045	NOT PLACED	–
C3046	2113945Y02	0.10uF
C3200	2113946J04	22uF
C3201	2113946D05	2.2uF
C3202	2113945Y02	0.10uF
C3203	2316410H02	68uF
C3204	2115153H21	5.6pF
C3205	2115153H21	5.6pF
C3206	2316410H01	22uF
C3207	2113945C31	0.1uF
C3208	2113946D05	2.2uF
C3209	2113945Y02	0.10uF
C3210	2113946D05	2.2uF
C3211	2113945A09	1000pF
C3212	2316410H02	68uF
C3213	2113946F03	4.7uF
C3214	2115153H45	33pF
C3215	2115153H45	33pF
C3216	2113946F03	4.7uF
C3217	2113944A44	220pF
C3218	2113945Y02	0.10uF
C3219	2113944A44	220pF
C3220	2113945Y02	0.10uF

Circuit Ref	Motorola Part No	Description
C3221	2113944A44	220pF
C3222	2113945Y02	0.10uF
C3225	2113944A44	220pF
C3226	2113945Y02	0.10uF
C3227	2113944A44	220pF
C3228	2113945Y02	0.10uF
C3229	2113944A44	220pF
C3231	2113944A44	220pF
C3232	2113945Y02	0.10uF
C3233	2113944A44	220pF
C3234	2113946D05	2.2uF
C3237	2113946D05	2.2uF
C3238	2113946H02	10uF
C3239	2113946D05	2.2uF
C3240	2113944C45	100pF
C3243	2113946S35	1.0uF
C3247	2113946H02	10uF
C3248	2113946S35	1.0uF
C3249	2113944C45	100pF
C3252	2113946S35	1.0uF
C3254	2113946D05	2.2uF
C3257	2113946S35	1.0uF
C3260	2113946S35	1.0uF
C3261	2113944A44	220pF
C3262	2113946N03	2.2uF
C3265	2113946J04	22uF
C3266	2113946D05	2.2uF
C3269	2113946S35	1.0uF
C3270	2113946S35	1.0uF
C3272	2115153H27	10pF

Circuit Ref	Motorola Part No	Description
C3273	NOT PLACED	–
C3274	2113944A44	220pF
C3275	2113946J03	10.0uF
C3276	2113946S35	1.0uF
C3277	2113946S35	1.0uF
C3278	2113945C31	0.1uF
C3279	2113945C31	0.1uF
C3280	2113945C31	0.1uF
C3281	2113945C31	0.1uF
C3282	2113946F03	4.7uF
C3283	2113945Y02	0.10uF
C3500	2113946J03	10.0uF
C3501	2113945G91	0.1uF
C3502	2113945C31	0.1uF
C3503	2113945A09	1000pF
C3504	2113945A09	1000pF
C3505	2113945A09	1000pF
C3506	2314030F30	47uF
C3507	2113945A11	2200pF
C3508	2113945C31	0.1uF
C3509	2313960D07	10uF
C3510	2113945A03	330pF
C3511	2113944A40	100pF
C3512	2113945C31	0.1uF
C3513	2113944A40	100pF
C3514	2113944A44	220pF
C3515	2113944A44	220pF
C3516	2113946S35	1.0uF
C3517	2314030M51	10uF
C3518	2113946S35	1.0uF
C3519	2314030F30	47uF
C3520	2113946S35	1.0uF
C3521	2113946S35	1.0uF
C3522	2113945A05	470pF
C3523	2113945Y02	0.10uF
C3524	2313960D07	10uF
C3525	2113944A44	220pF
C3526	2113946S35	1.0uF
C3527	2113945C31	0.1uF
C3528	2113945Y02	0.10uF
C3529	2113945Y02	0.10uF
C3530	2113944A44	220pF
C3531	2113944A44	220pF
C3532	2113946S35	1.0uF
C3533	2313960D07	10uF
C3534	2313960D07	10uF
C3535	2113946S35	1.0uF
C3536	2314030M51	10uF
C3538	2113945B02	.01uF
C3539	2113945Y02	0.10uF
C3540	2113945Y02	0.10uF
C3541	2113945Y02	0.10uF
C3542	2113945Y02	0.10uF
C3543	2113946S35	1.0uF
C3544	2113946S35	1.0uF
C3545	2113944A44	220pF
C4000	NOT PLACED	–
C4001	NOT PLACED	–
C4002	NOT PLACED	–
C4003	NOT PLACED	–
C4004	NOT PLACED	–
C4005	NOT PLACED	–
C4006	2113944A44	220pF
C4007	NOT PLACED	–
C4010	NOT PLACED	–
C4011	NOT PLACED	–
C4012	NOT PLACED	–
C4013	2113944A44	220pF
C4014	2113944A44	220pF
C4015	2113944A44	220pF
C4016	2113944A44	220pF
C4017	2113944A44	220pF
C4018	2113944A44	220pF
C4019	NOT PLACED	–
C4020	NOT PLACED	–
C4021	2113944A44	220pF
C4022	2113944A44	220pF
C4023	2113944A44	220pF
C4024	2113944A44	220pF
C4025	2113944A44	220pF
C4026	2113944A44	220pF
C4027	2113944A44	220pF
C4028	2113944A44	220pF
C4029	2113944A44	220pF
C4030	2113944A44	220pF
C4031	2113944A44	220pF
C4032	2113944A44	220pF
C4033	2113944A44	220pF
C4034	2113945A03	330pF
C4035	2113945A03	330pF
C4040	2113944A44	220pF
C4041	2113944A44	220pF
C4042	2113944A44	220pF
C4043	2113944A44	220pF
C4044	2113944A44	220pF
C4045	2113944A44	220pF
C4046	2113944A44	220pF
C4047	2113944A44	220pF
C4048	2113944A44	220pF
C4049	NOT PLACED	–
C4051	NOT PLACED	–
C4053	NOT PLACED	–
C4055	NOT PLACED	–
C4058	NOT PLACED	–
C4059	NOT PLACED	–
C4060	NOT PLACED	–
C4061	NOT PLACED	–
C4062	NOT PLACED	–
C4063	2113944A44	220pF
C4064	2113944A44	220pF
C4065	2113944A44	220pF
C4066	2113944A44	220pF
C4067	2113944A44	220pF
C4068	2113944A44	220pF
C4069	2113944A44	220pF
C4070	2113944A44	220pF
C4071	NOT PLACED	–
C4072	NOT PLACED	–
C4073	2113945Y02	0.10uF
C4074	NOT PLACED	–

Circuit Ref	Motorola Part No	Description
C4075	NOT PLACED	–
C4076	NOT PLACED	–
C4084	2113945Y02	0.10uF
C4085	2113944A44	220pF
C4086	2113945Y02	0.10uF
C4087	2113945Y02	0.10uF
C4088	2113945Y02	0.10uF
C4089	2113945Y02	0.10uF
C4090	2113945Y02	0.10uF
D3030	4813978P07	DIODE, SWITCHING
D3040	4813978P07	DIODE, SWITCHING
D3200	4813978C02	DIODE, SWITCHING
D4000	4866544A01	DIODE, DUAL
D4001	4866544A01	DIODE, DUAL
E2500	2480675U01	FERRITE BEAD
E3000	2485011Y01	FERRITE BEAD
E3201	2480675U01	FERRITE BEAD
E3202	2480675U01	FERRITE BEAD
E3203	2480675U01	FERRITE BEAD
E3205	2480675U01	FERRITE BEAD
E3206	2480675U01	FERRITE BEAD
E3208	2480675U01	FERRITE BEAD
E3500	2485011Y01	FERRITE BEAD
E3501	2485011Y01	FERRITE BEAD
E3502	2485011Y01	FERRITE BEAD
E3503	2485011Y01	FERRITE BEAD
E4000	2485011Y01	FERRITE BEAD
E4001	7686949J14	FERRITE BEAD
E4002	7686949J14	FERRITE BEAD
E4003	NOT PLACED	–

Circuit Ref	Motorola Part No	Description
E4004	2409134J25	FERRITE BEAD
E4005	2409134J25	FERRITE BEAD
J2500	0905505Y02	22-PIN JTAG CONNECTOR
J3000	0905902V09	DC POWER CONNECTOR
J4000	0916017H01	26-PIN ACCESSORY CONNECTOR
J4001	0915555H01	30-PIN CONTROL HEAD CONNECTOR
J4002	0915558H01	11-PIN REPEATER CONNECTOR
J4003	0915556H01	14-PIN OPT BRD CONNECTOR
L3200	2415005H02	22uH
L3201	2415005H02	22uH
L3202	2415005H02	22uH
Q3030	4813973M07	NPN
Q3032	4813973B01	NPN
Q3040	4813973M07	NPN
Q3041	4815263H01	ANALOG SWITCH
Q3200	5185956E76	N-CHANNEL SYNCHRONOUS MOSFET
Q3201	4813970A62	P-CHANNEL MOSFET
Q3202	5185956E76	N-CHANNEL SYNCHRONOUS MOSFET
Q3203	4805585Q23	PMOS FET
Q3204	4805585Q23	PMOS FET
Q3205	4815262H01	ANALOG SWITCH
Q3206	4815272H01	ANALOG SWITCH
Q3207	4813970A62	P-CHANNEL MOSFET
Q3208	4815261H01	ANALOG SWITCH
Q3500	4815261H01	ANALOG SWITCH

Circuit Ref	Motorola Part No	Description
Q3501	4815272H01	ANALOG SWITCH
Q3502	4815272H01	ANALOG SWITCH
Q3503	4815272H01	ANALOG SWITCH
Q3504	4815272H01	ANALOG SWITCH
Q3505	4815272H01	ANALOG SWITCH
Q4000	4815263H01	ANALOG SWITCH
Q4001	4815263H01	ANALOG SWITCH
Q4002	4815261H01	ANALOG SWITCH
Q4003	4815263H01	ANALOG SWITCH
Q4004	4815261H01	ANALOG SWITCH
Q4005	4815263H01	ANALOG SWITCH
Q4006	4815263H01	ANALOG SWITCH
Q4007	4815263H01	ANALOG SWITCH
Q4008	4815261H01	ANALOG SWITCH
Q4009	4815263H01	ANALOG SWITCH
Q4010	4815261H01	ANALOG SWITCH
Q4011	4815263H01	ANALOG SWITCH
Q4012	4815261H01	ANALOG SWITCH
Q4013	4816023H01	PNP
Q4014	4813973A06	NPN
Q4015	4815263H01	ANALOG SWITCH
R1000	0613952Q25	10
R1001	0613952R01	10K
R1002	0613952J73	10MEG
R1005	0613952Q89	4.7K
R1006	0613952R01	10K
R1014	0613952R66	0
R1017	0613952R01	10K
R1019	0613952Q18	5.1
R1020	0613952R66	0

Circuit Ref	Motorola Part No	Description
R1021	0613952R66	0
R1025	0613952R01	10K
R1026	0613952R17	47K
R1027	NOT PLACED	–
R1028	0613952R66	0
R1034	0613952R01	10K
R1035	NOT PLACED	–
R1036	0613952R01	10K
R1041	0613952Q73	1K
R1044	0613952R66	0
R1045	0613952R01	10K
R1046	NOT PLACED	–
R1047	0613952R66	0
R1048	0613952R66	0
R1054	0613952Q89	4.7K
R1060	0613952Q25	10
R1066	NOT PLACED	–
R1067	NOT PLACED	–
R1070	0613952R66	0
R1071	0613952R17	47K
R1072	NOT PLACED	–
R2000	0613952R01	10K
R2004	0613952R66	0
R2005	0613952R01	10K
R2006	0613952R01	10K
R2007	0613952R01	10K
R2008	0613952R01	10K
R2009	0613952R01	10K
R2010	0613952R01	10K
R2011	0613952R66	0

Circuit Ref	Motorola Part No	Description
R2012	0613952R01	10K
R2013	0613952R01	10K
R2500	0613952R66	0
R2501	0613952R66	0
R2502	0613952R66	0
R2504	0613952R66	0
R2506	0613952R66	0
R2507	0613952R66	0
R2508	0613952R66	0
R2509	0613952R66	0
R2510	0613952R66	0
R2511	0613952R66	0
R2512	0613952R66	0
R2513	0613952R66	0
R2514	0613952R66	0
R2515	0613952R66	0
R2516	0613952R66	0
R2517	0613952R66	0
R2518	0613952R66	0
R2519	0613952R66	0
R2520	0613952R66	0
R2521	0613952R66	0
R2522	0613952R66	0
R2523	0613952R66	0
R2524	0613952R66	0
R2525	0613952R66	0
R2526	0613952R66	0
R2527	0613952R66	0
R2528	0613952R66	0
R2529	0613952R01	10K

Circuit Ref	Motorola Part No	Description
R3002	0613952R01	10K
R3003	0613952M54	3.57K
R3004	0613952L73	562
R3005	0613952Q81	2.2K
R3006	0613952Q57	220
R3007	0613952N58	39.2K
R3008	0613952N12	13K
R3009	0613952N58	39.2K
R3010	0613952N12	13K
R3030	0613952R01	10K
R3032	0615871H01	0.1
R3033	0615871H01	0.1
R3034	0613952H61	330
R3035	0613952H25	10
R3036	0613952H25	10
R3037	0613959G61	330
R3038	NOT PLACED	–
R3039	0613952M30	2K
R3040	0613952M43	2.74K
R3041	0613952R25	100K
R3042	0613952H69	680
R3043	0613952H69	680
R3044	0613958S61	330
R3045	0613952M30	2K
R3046	0613952M43	2.74K
R3047	0613952R25	100K
R3048	0613952Q73	1K
R3050	0613959Q53	150
R3051	0613952G67	0
R3052	0613952G67	0

Circuit Ref	Motorola Part No	Description
R3053	0613952R66	0
R3054	0613952R66	0
R3055	0615871H01	0.1
R3056	0615871H01	0.1
R3057	0613952R66	0
R3200	0615871H01	0.1
R3201	0613952R66	0
R3203	0615871H01	0.1
R3204	0615871H01	0.1
R3205	0613952R25	100K
R3206	0613952R66	0
R3207	0686135Z02	0.2
R3208	0686135Z02	0.2
R3209	0613952N62	43.2K
R3210	0613952N16	14.3K
R3215	0613952G67	0
R3216	0613952G67	0
R3217	NOT PLACED	–
R3218	0613952R66	0
R3219	0613952R56	2MEG
R3220	0613952R56	2MEG
R3222	0613952R33	220K
R3223	0613952R33	220K
R3224	0613952Q89	4.7K
R3225	NOT PLACED	–
R3226	0613952R13	33K
R3227	NOT PLACED	–
R3228	0613952G67	0
R3233	0613952R66	0
R3236	0613952Q73	1K

Circuit Ref	Motorola Part No	Description
R3237	0613952R01	10K
R3238	0613952H25	10
R3239	0613952H25	10
R3240	0613952R17	47K
R3241	0613952Q18	5.1
R3243	0613952Q18	5.1
R3245	0613952G67	0
R3246	0613952M81	6.81K
R3247	0613952N69	51.1K
R3248	0613952R01	10K
R3500	0613952Q35	27
R3501	0613952Q35	27
R3502	0613952R01	10K
R3503	0613952R13	33K
R3504	NOT PLACED	–
R3505	NOT PLACED	–
R3506	0613952R01	10K
R3507	NOTPLACED	–
R3508	0613952R66	0
R3509	0613952R66	0
R3510	0613952Q35	27
R3511	0613952R01	10K
R3512	0613952Q35	27
R3513	0613952R66	0
R3514	0613952R01	10K
R3515	0613952R01	10K
R3516	0613952R10	24K
R3520	0613952R10	24K
R3521	0613952R05	15K
R3523	0613952R10	24K

Circuit Ref	Motorola Part No	Description
R3524	0613952Q67	560
R3525	0613952R25	100K
R3526	0613952R66	0
R3528	0613952R09	22K
R3529	0613952Q42	51
R3530	NOT PLACED	–
R3532	0613952Q49	100
R3533	0613952R10	24K
R3534	0613952R01	10K
R3535	0613952Q67	560
R3536	0613952R25	100K
R3537	0613952R66	0
R3538	0613952R15	39K
R3539	0613952R10	24K
R3540	0613952Q49	100
R3541	0613952R10	24K
R3542	0613952R10	24K
R3544	0613952R10	24K
R3545	0613952Q49	100
R3546	0613952R05	15K
R3547	0613952Q67	560
R3548	0613952J25	100K
R3549	0613952R12	30K
R3550	0613952R23	82K
R3558	0613952R01	10K
R3559	0613952R01	10K
R3560	0613952R17	47K
R3561	0613952R66	0
R3562	0613952R66	0
R3563	0613952R66	0

Circuit Ref	Motorola Part No	Description
R3569	0613952Q73	1K
R3571	0613952Q80	2K
R3572	0613952R01	10K
R3573	0613952R01	10K
R3574	0613952R01	10K
R3575	0613952Q73	1K
R3576	0613952Q49	100
R3577	0613952N42	26.7K
R3578	0613952R32	200K
R3579	0613952R01	10K
R3580	0613952R01	10K
R3581	0613952R01	10K
R3582	0613952N21	16.2K
R3583	0613952N21	16.2K
R3584	0613952R09	22K
R3585	0613952R09	22K
R3586	0613952R66	0
R3587	NOT PLACED	–
R3588	0613952N69	51.1K
R3591	0613952Q81	2.2K
R3592	0613952Q81	2.2K
R3593	0613952R32	200K
R3594	0613952Q85	3.3K
R3595	0613952R01	10K
R3596	0613952H53	150
R4000	0613952Q37	33
R4001	0613952Q37	33
R4002	0613952Q37	33
R4003	0613952Q37	33
R4004	0613952Q37	33

Circuit Ref	Motorola Part No	Description
R4005	0613952Q37	33
R4006	0613952Q65	470
R4009	0613952Q42	51
R4010	0613952Q42	51
R4011	0613952R66	0
R4012	0613952R66	0
R4023	0613952Q75	1.2K
R4030	NOT PLACED	–
R4031	0613952R01	10K
R4032	0613952R01	10K
R4033	NOT PLACED	–
R4034	0613952R01	10K
R4035	0613952R01	10K
R4040	0613952Q89	4.7K
R4041	0613952Q89	4.7K
R4042	0613952Q89	4.7K
R4043	0613952Q89	4.7K
R4044	0613952Q89	4.7K
R4045	0613952Q89	4.7K
R4046	0613952Q89	4.7K
R4047	0613952Q89	4.7K
R4048	0613952Q77	1.5K
R4049	0613958H83	2.7K
R4050	0613952R01	10K
R4051	0613952Q89	4.7K
R4054	0613952R01	10K
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R4061	0613952Q37	33
R4063	0613952Q37	33
R4064	0613952Q37	33

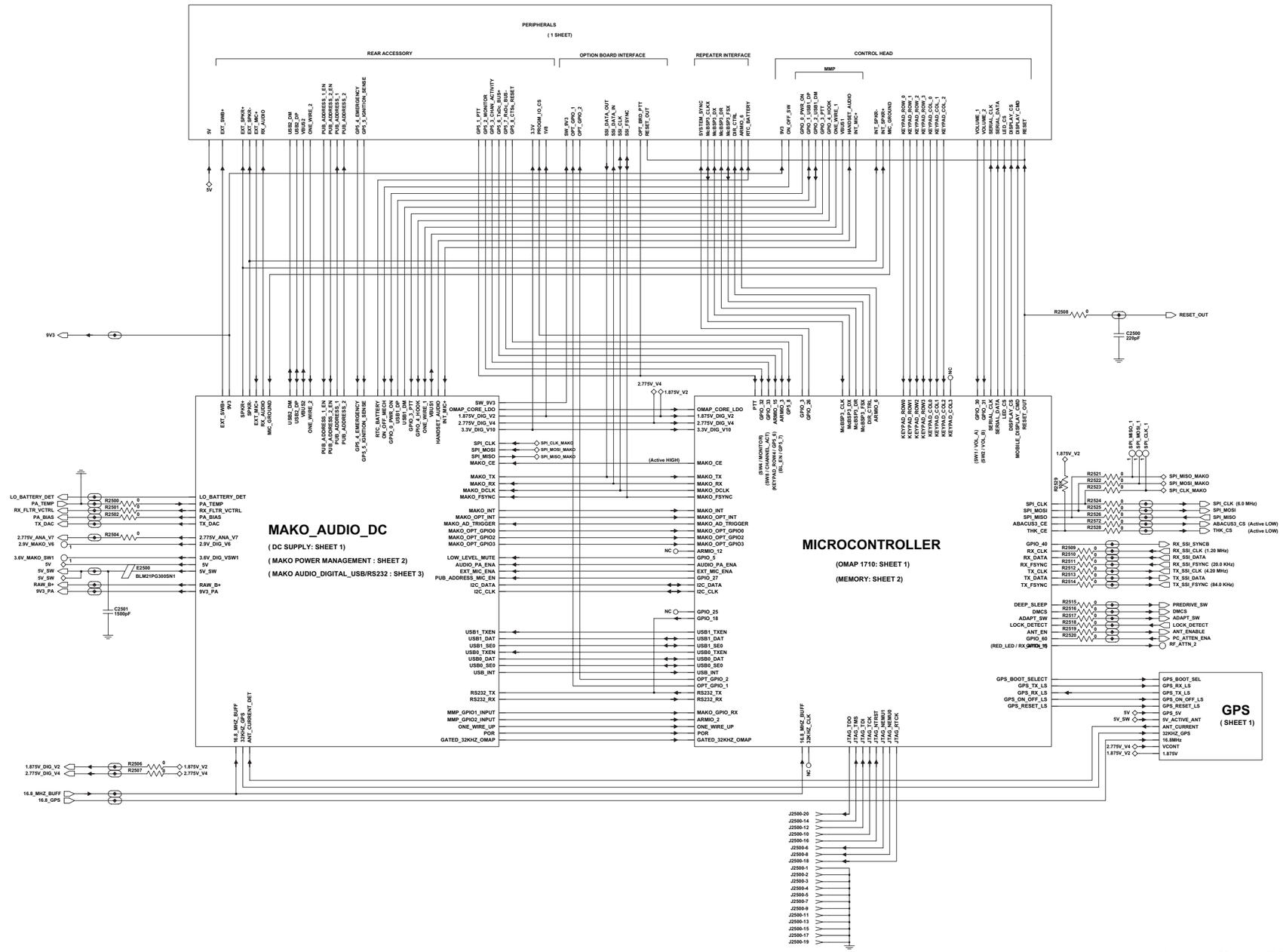
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R4065	0613952Q37	33
R4066	0613952Q37	33
R4067	0613952Q37	33
R4068	0613952Q37	33
R4069	0613952Q37	33
R4070	0613952Q37	33
R4071	0613952R66	0
R4074	0613952R66	0
R4076	0613952R66	0
R4078	0613952R66	0
R4079	0613952R01	10K
R4080	0613952R66	0
R4081	0613952R66	0
R4082	0613952R66	0
R4083	0613952R66	0
R4084	0613952R66	0
R4085	0613952R66	0
R4086	0613952R66	0
R4088	0613952R01	10K
R4089	0613952R17	47K
R4090	0613952R66	0
R4093	0613952R66	0
R4094	0613952R66	0
R4095	0613952R66	0
R4096	0613952R66	0
R4097	0613952R66	0
R4098	0613952Q89	4.7K
R4099	0613952R66	0
R4100	0613952Q75	1.2K
R4101	0613952Q75	1.2K

Circuit Ref	Motorola Part No	Description
R4103	0613952Q75	1.2K
R4105	0613952R01	10K
R4106	0613952R01	10K
RT3500	0615471H01	THERMISTOR, 10K
U1000	5102495J13	MICROPROCESSOR
U1006	5115001H02	IC, DUAL UNBUF-FERED INVERTER
U2000	0104024J27	IC, 8MB FLASH
U2001	5171614M01	IC, 16MB SDRAM
U3001	5164015H94	VOLTAGE REGULATOR
U3002	5115391H01	VOLTAGE REGULATOR
U3003	5164015H94	VOLTAGE REGULATOR
U3004	5115391H01	VOLTAGE REGULATOR
U3005	0105959T72	PNP
U3006	0105959T72	PNP
U3030	5116525H01	DUAL OPAMP
U3040	0105959T72	PNP
U3200	5185143E77	IC, POWER MANAGEMENT
U3201	5115616H01	VOLTAGE REGULATOR
U3202	5115453H01	DUAL OPAMP
U3203	5114007A43	IC, SCHMITT TRIGGER
U3500	5102463J95	AUDIO PA
U3501	5115368H01	DIGITAL ATTENUATOR
U3502	5114016A18	QUAD OPAMP
U3503	5164852H47	IC, LEVEL TRANSLATOR
U3504	5171395L01	IC, CMOS SWITCH
U3505	5114016A18	QUAD OPAMP
U3508	5164852H47	IC, LEVEL TRANSLATOR

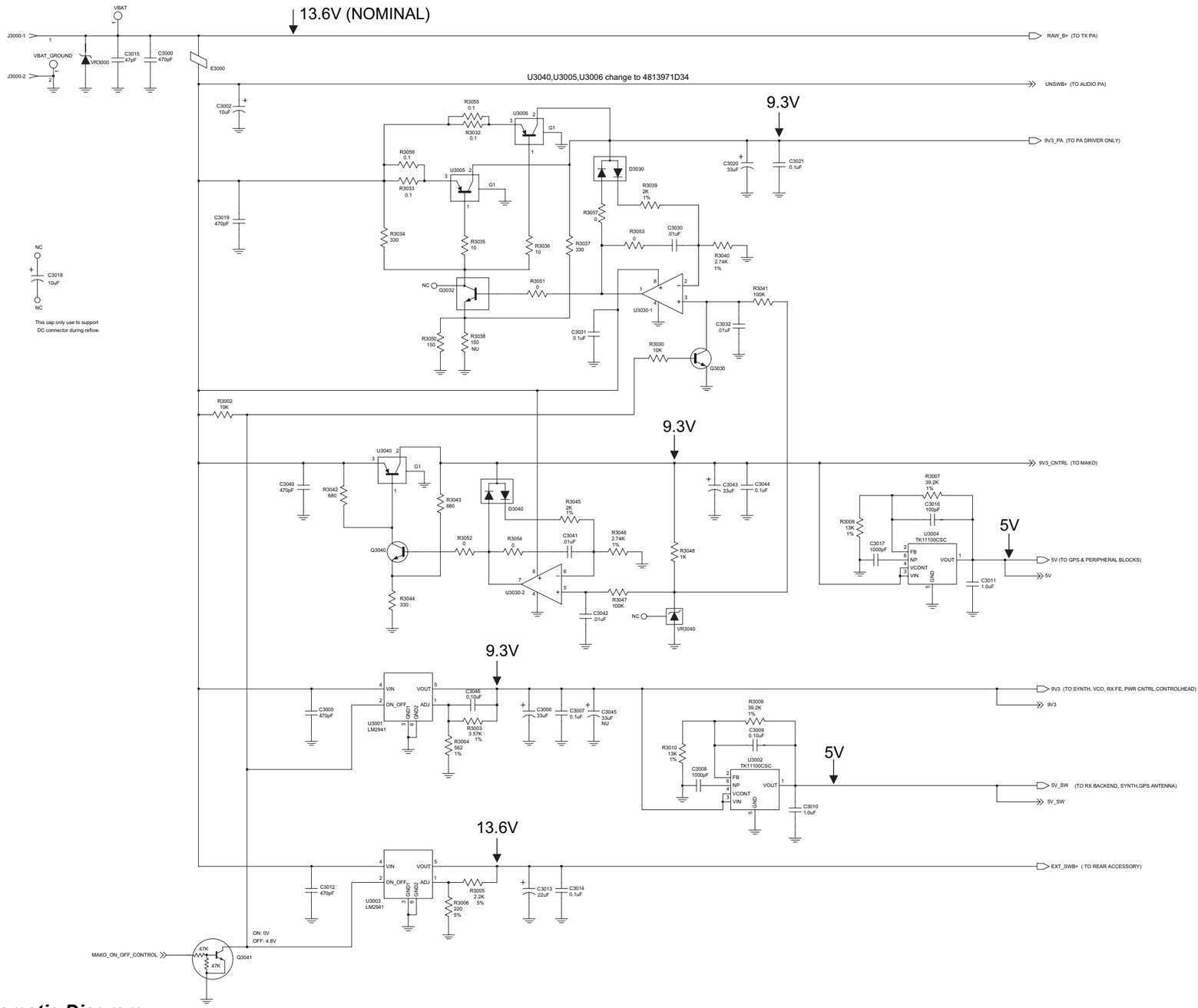
Circuit Ref	Motorola Part No	Description
U4000	5115476H01	IC, SERIAL-TO-PARAL-LEL CONVERTER
U4001	5115502H01	LOGIC TRANSLATOR
U4004	5115865H01	IC, BUFFER
U4005	5115865H01	IC, BUFFER
U4006	5115865H01	IC, BUFFER
U4007	5115865H01	IC, BUFFER
U4008	5115865H01	IC, BUFFER
VR3000	4813979C17	TRANSIENT SUPPRESSOR
VR3040	4813977M10	DIODE, 5.1V ZENER
VR3200	4813977M10	DIODE, 5.1V ZENER
VR3201	4813977M05	DIODE, 3.3V ZENER
VR3202	4813977M05	DIODE, 3.3V ZENER
VR3203	4813977M05	DIODE, 3.3V ZENER
VR3204	4813977M13	DIODE, 6.2V ZENER
VR3205	4813977M05	DIODE, 3.3V ZENER
VR3206	4813977M13	DIODE, 6.2V ZENER
VR3207	4813977M13	DIODE, 6.2V ZENER
VR3208	4813977M13	DIODE, 6.2V ZENER
VR3502	4813977A48	DIODE, 20V ZENER
VR3503	4813977A48	DIODE, 20V ZENER
VR3504	4813977A48	DIODE, 20V ZENER
VR4000	4813977A48	DIODE, 20V ZENER
VR4001	4813977A48	DIODE, 20V ZENER
VR4002	4813977A48	DIODE, 20V ZENER
VR4003	4813977A48	DIODE, 20V ZENER
VR4004	4813977A48	DIODE, 20V ZENER
VR4005	4813977M13	DIODE, 6.2V ZENER
VR4006	4813977M13	DIODE, 6.2V ZENER
VR4007	NOT PLACED	–

Circuit Ref	Motorola Part No	Description
VR4008	NOT PLACED	–
Y1000	4809612J45	12MHZ CRYSTAL
Y3200	4815028H01	24.576MHZ CRYSTAL
Y3201	4802582S80	32KHZ CRYSTAL

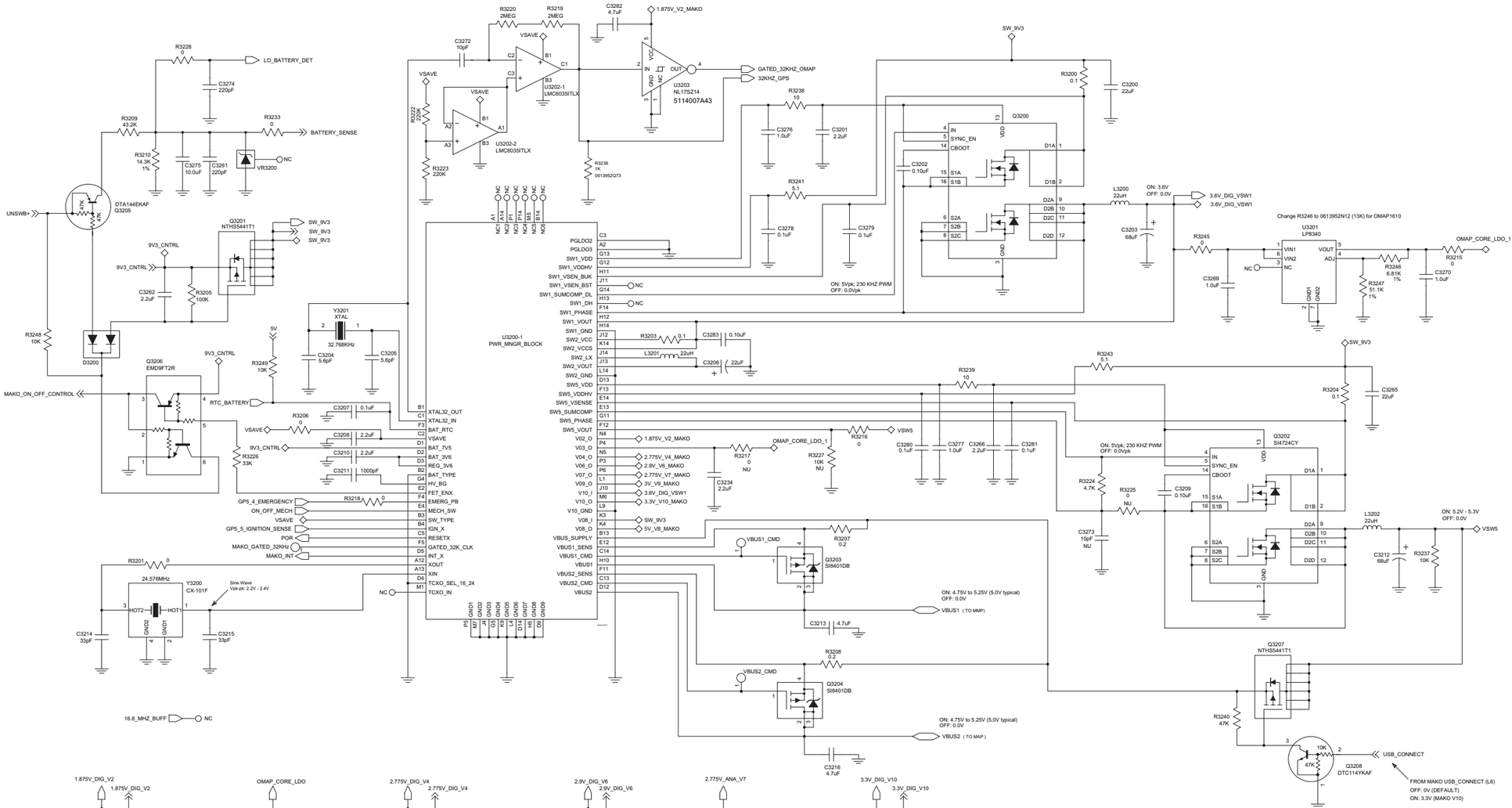
3.0 Controller R2 Schematic Diagrams



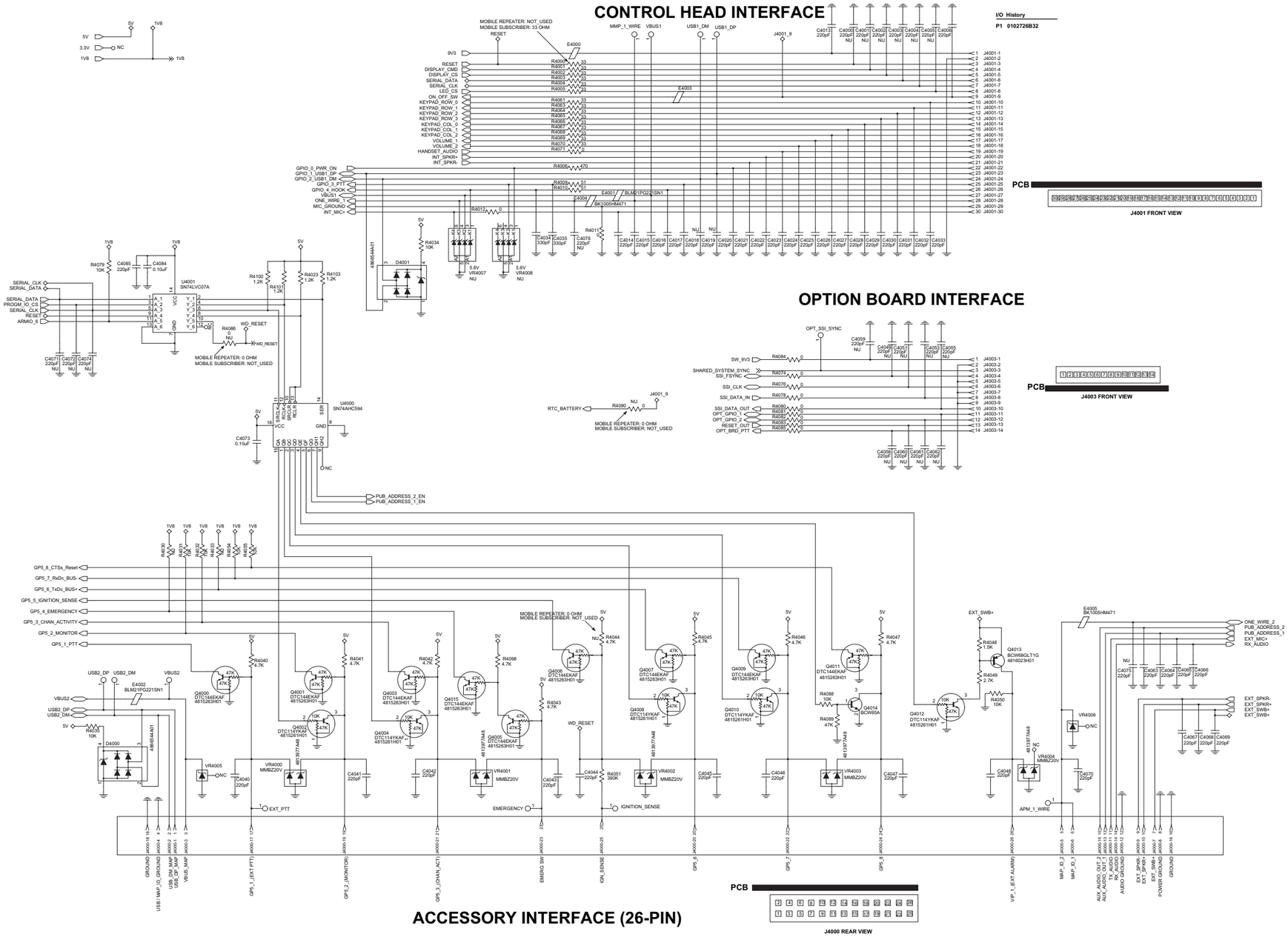
Controller - GPS Schematic Diagram



Controller DC Supply Schematic Diagram

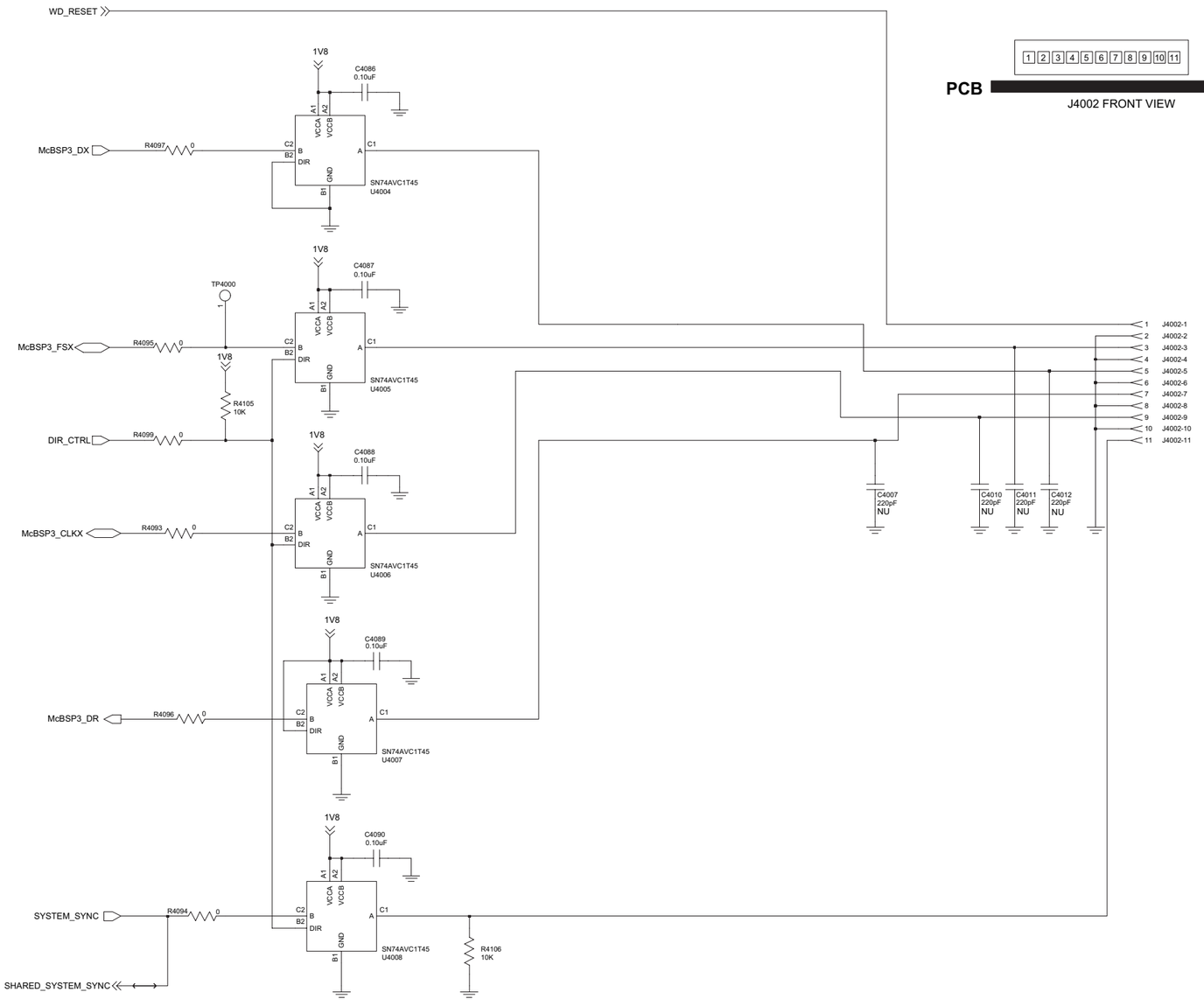


Controller DC Distribution Schematic Diagram

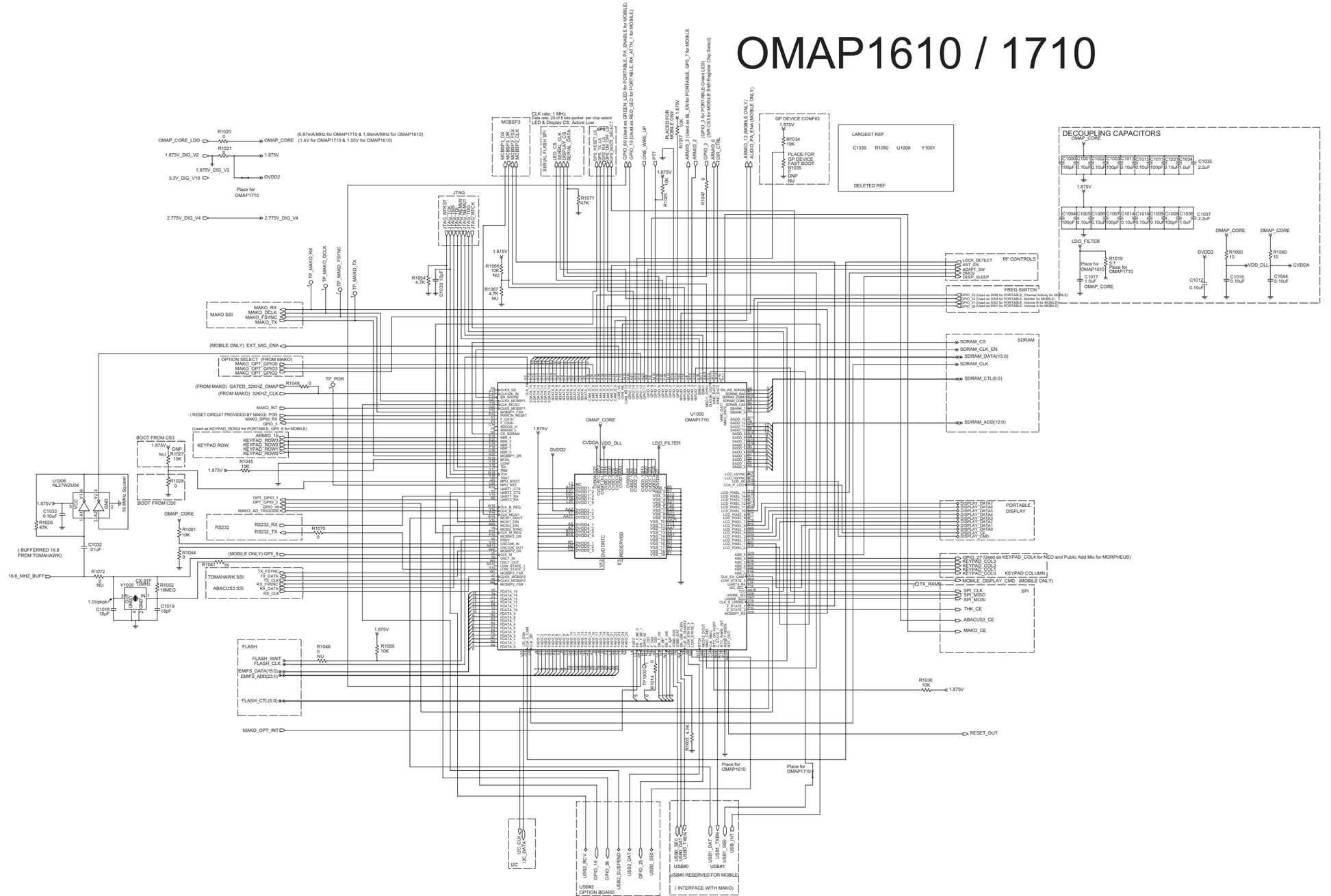


Controller Peripheral Schematic Diagram (sheet 1 of 2)

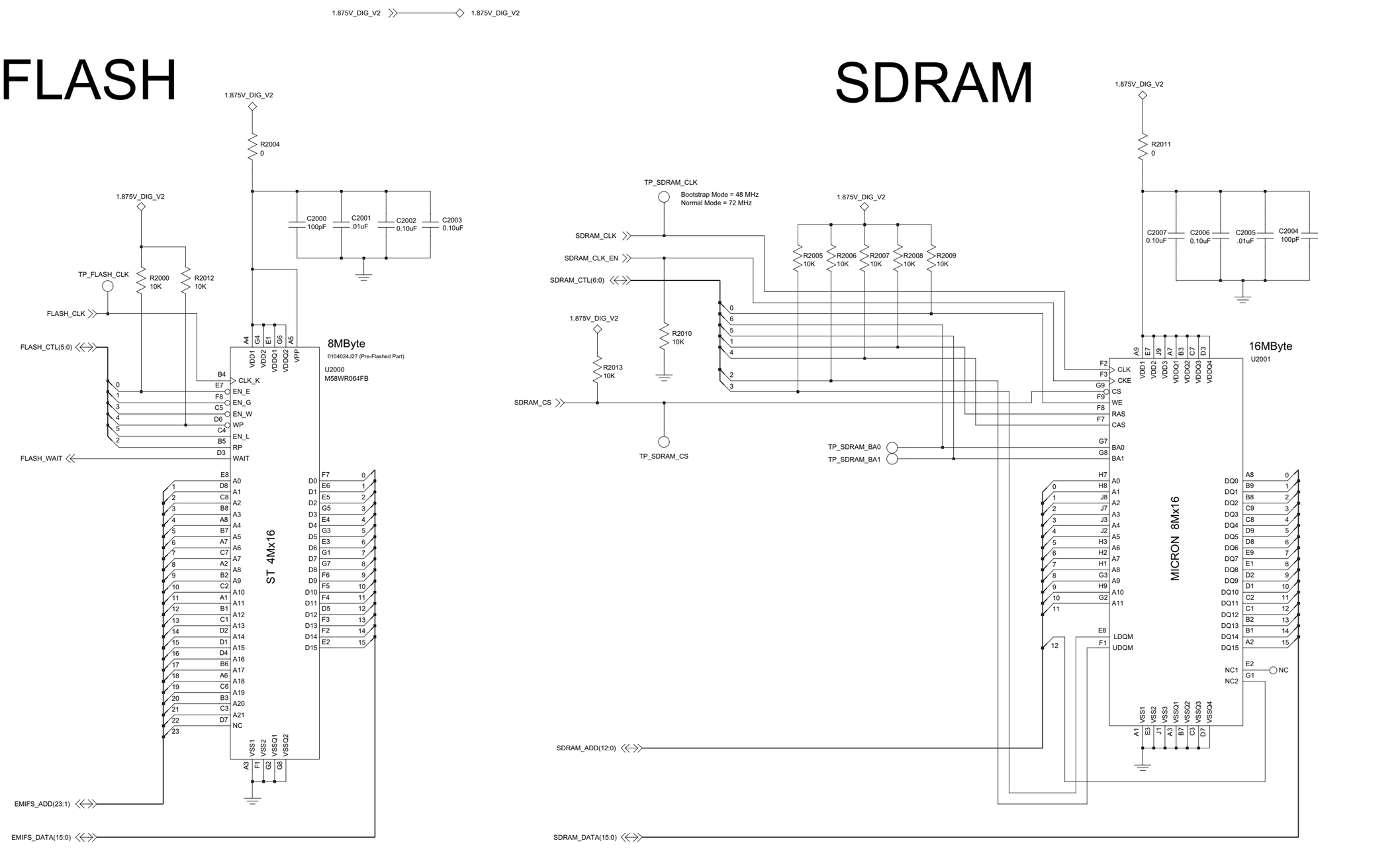
REPEATER CONNECTOR



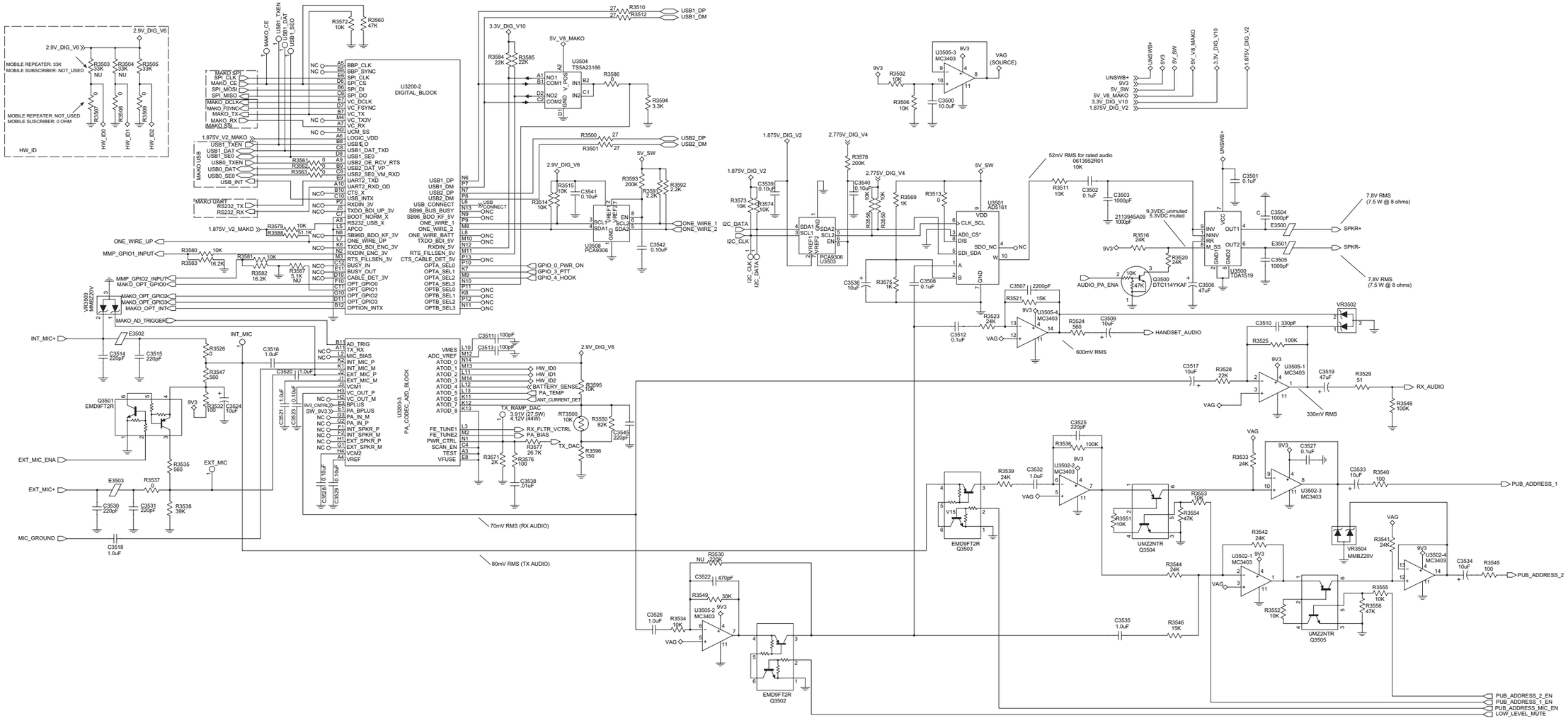
Controller Peripheral Schematic Diagram (sheet 2 of 2)



Controller Microprocessor Schematic Diagram



Controller Memories Schematic Diagram



Controller Audio and USB Schematic Diagram

3.1 Controller R2 Parts List

Circuit Ref	Motorola Part No	Description
C1000	2113944A40	100pF
C1001	2113945Y02	0.10uF
C1002	2113945Y02	0.10uF
C1003	2113944A40	100pF
C1004	2113944A40	100pF
C1005	2113945Y02	0.10uF
C1006	2113945Y02	0.10uF
C1007	2113944A40	100pF
C1008	2113944A40	100pF
C1009	2113945Y02	0.10uF
C1010	2113945Y02	0.10uF
C1011	2113944A40	100pF
C1012	2113945Y02	0.10uF
C1013	2113945Y02	0.10uF
C1014	2113945Y02	0.10uF
C1015	2113945Y02	0.10uF
C1016	2113945Y02	0.10uF
C1017	2113946E02	1.0uF
C1018	2113944A28	18pF
C1019	2113944A28	18pF
C1030	2113944A28	18pF
C1031	2113945Y02	0.10uF
C1032	2113945B02	.01uF
C1033	2113945Y02	0.10uF
C1034	2113946S35	1.0uF
C1035	2113946D05	2.2uF
C1036	2113946S35	1.0uF
C1037	2113946D05	2.2uF
C1044	2113945Y02	0.10uF

Circuit Ref	Motorola Part No	Description
C2000	2113944A40	100pF
C2001	2113945B02	.01uF
C2002	2113945Y02	0.10uF
C2003	2113945Y02	0.10uF
C2004	2113944A40	100pF
C2005	2113945B02	.01uF
C2006	2113945Y02	0.10uF
C2007	2113945Y02	0.10uF
C2500	2113944A44	220pF
C2501	2113945A10	1500pF
C3000	2113944C06	470pF
C3002	2371403L02	10uF
C3005	2113944C06	470pF
C3006	2314030E85	33uF
C3007	2113945C31	0.1uF
C3008	2113945A09	1000pF
C3009	2113945Y02	0.10uF
C3010	2113946S35	1.0uF
C3011	2113946S35	1.0uF
C3012	2113944C06	470pF
C3013	2314030J28	22uF
C3014	2113945C31	0.1uF
C3015	2113944C38	47pF
C3016	2113944A40	100pF
C3017	2113945A09	1000pF
C3018	2389289U01	10uF
C3019	2113944C06	470pF
C3020	2314030E85	33uF
C3021	2113945C31	0.1uF
C3030	2113945C02	.01uF

Circuit Ref	Motorola Part No	Description
C3031	2113945C31	0.1uF
C3032	2113945B02	.01uF
C3040	2113944C06	470pF
C3041	2113945C02	.01uF
C3042	2113945B02	.01uF
C3043	2314030E85	33uF
C3044	2113945C31	0.1uF
C3045	NOT PLACED	–
C3046	2113945Y02	0.10uF
C3200	2113946J04	22uF
C3201	2113946D05	2.2uF
C3202	2113945Y02	0.10uF
C3203	2316410H02	68uF
C3204	2115153H21	5.6pF
C3205	2115153H21	5.6pF
C3206	2316410H01	22uF
C3207	2113945C31	0.1uF
C3208	2113946D05	2.2uF
C3209	2113945Y02	0.10uF
C3210	2113946D05	2.2uF
C3211	2113945A09	1000pF
C3212	2316410H02	68uF
C3213	2113946F03	4.7uF
C3214	2115153H45	33pF
C3215	2115153H45	33pF
C3216	2113946F03	4.7uF
C3217	2113944A44	220pF
C3218	2113945Y02	0.10uF
C3219	2113944A44	220pF
C3220	2113945Y02	0.10uF

Circuit Ref	Motorola Part No	Description
C3221	2113944A44	220pF
C3222	2113945Y02	0.10uF
C3225	2113944A44	220pF
C3226	2113945Y02	0.10uF
C3227	2113944A44	220pF
C3228	2113945Y02	0.10uF
C3229	2113944A44	220pF
C3231	2113944A44	220pF
C3232	2113945Y02	0.10uF
C3233	2113944A44	220pF
C3234	2113946D05	2.2uF
C3237	2113946D05	2.2uF
C3238	2113946H02	10uF
C3239	2113946D05	2.2uF
C3240	2113944C45	100pF
C3243	2113946S35	1.0uF
C3247	2113946H02	10uF
C3248	2113946S35	1.0uF
C3249	2113944C45	100pF
C3252	2113946S35	1.0uF
C3254	2113946D05	2.2uF
C3257	2113946S35	1.0uF
C3260	2113946S35	1.0uF
C3261	2113944A44	220pF
C3262	2113946N03	2.2uF
C3265	2113946J04	22uF
C3266	2113946D05	2.2uF
C3269	2113946S35	1.0uF
C3270	2113946S35	1.0uF
C3272	2115153H27	10pF

Circuit Ref	Motorola Part No	Description
C3273	NOT PLACED	–
C3274	2113944A44	220pF
C3275	2113946J03	10.0uF
C3276	2113946S35	1.0uF
C3277	2113946S35	1.0uF
C3278	2113945C31	0.1uF
C3279	2113945C31	0.1uF
C3280	2113945C31	0.1uF
C3281	2113945C31	0.1uF
C3282	2113946F03	4.7uF
C3283	2113945Y02	0.10uF
C3500	2113946J03	10.0uF
C3501	2113945G91	0.1uF
C3502	2113945C31	0.1uF
C3503	2113945A09	1000pF
C3504	2113945A09	1000pF
C3505	2113945A09	1000pF
C3506	2314030F30	47uF
C3507	2113945A11	2200pF
C3508	2113945C31	0.1uF
C3509	2313960D07	10uF
C3510	2113945A03	330pF
C3511	2113944A40	100pF
C3512	2113945C31	0.1uF
C3513	2113944A40	100pF
C3514	2113944A44	220pF
C3515	2113944A44	220pF
C3516	2113946S35	1.0uF
C3517	2314030M51	10uF
C3518	2113946S35	1.0uF
C3519	2314030F30	47uF
C3520	2113946S35	1.0uF
C3521	2113946S35	1.0uF
C3522	2113945A05	470pF
C3523	2113945Y02	0.10uF
C3524	2313960D07	10uF
C3525	2113944A44	220pF
C3526	2113946S35	1.0uF
C3527	2113945C31	0.1uF
C3528	2113945Y02	0.10uF
C3529	2113945Y02	0.10uF
C3530	2113944A44	220pF
C3531	2113944A44	220pF
C3532	2113946S35	1.0uF
C3533	2313960D07	10uF
C3534	2313960D07	10uF
C3535	2113946S35	1.0uF
C3536	2314030M51	10uF
C3538	2113945B02	.01uF
C3539	2113945Y02	0.10uF
C3540	2113945Y02	0.10uF
C3541	2113945Y02	0.10uF
C3542	2113945Y02	0.10uF
C3545	2113944A44	220pF
C4000	NOT PLACED	–
C4001	NOT PLACED	–
C4002	NOT PLACED	–
C4003	NOT PLACED	–
C4004	NOT PLACED	–
C4005	NOT PLACED	–
C4006	2113944A44	220pF
C4007	NOT PLACED	–
C4010	NOT PLACED	–
C4011	NOT PLACED	–
C4012	NOT PLACED	–
C4013	2113944A44	220pF
C4014	2113944A44	220pF
C4015	2113944A44	220pF
C4016	2113944A44	220pF
C4017	2113944A44	220pF
C4018	2113944A44	220pF
C4019	NOT PLACED	–
C4020	NOT PLACED	–
C4021	2113944A44	220pF
C4022	2113944A44	220pF
C4023	2113944A44	220pF
C4024	2113944A44	220pF
C4025	2113944A44	220pF
C4026	2113944A44	220pF
C4027	2113944A44	220pF
C4028	2113944A44	220pF
C4029	2113944A44	220pF
C4030	2113944A44	220pF
C4031	2113944A44	220pF
C4032	2113944A44	220pF
C4033	2113944A44	220pF
C4034	2113945A03	330pF
C4035	2113945A03	330pF
C4040	2113944A44	220pF
C4041	2113944A44	220pF
C4042	2113944A44	220pF
C4043	2113944A44	220pF
C4044	2113944A44	220pF
C4045	2113944A44	220pF
C4046	2113944A44	220pF
C4047	2113944A44	220pF
C4048	2113944A44	220pF
C4049	NOT PLACED	–
C4051	NOT PLACED	–
C4053	NOT PLACED	–
C4055	NOT PLACED	–
C4058	NOT PLACED	–
C4059	NOT PLACED	–
C4060	NOT PLACED	–
C4061	NOT PLACED	–
C4062	NOT PLACED	–
C4063	2113944A44	220pF
C4064	2113944A44	220pF
C4065	2113944A44	220pF
C4066	2113944A44	220pF
C4067	2113944A44	220pF
C4068	2113944A44	220pF
C4069	2113944A44	220pF
C4070	2113944A44	220pF
C4071	NOT PLACED	–
C4072	NOT PLACED	–
C4073	2113945Y02	0.10uF
C4074	NOT PLACED	–
C4075	NOT PLACED	–
C4076	NOT PLACED	–

Circuit Ref	Motorola Part No	Description
C4084	2113945Y02	0.10uF
C4085	2113944A44	220pF
C4086	2113945Y02	0.10uF
C4087	2113945Y02	0.10uF
C4088	2113945Y02	0.10uF
C4089	2113945Y02	0.10uF
C4090	2113945Y02	0.10uF
D3030	4813978P07	DIODE, SWITCHING
D3040	4813978P07	DIODE, SWITCHING
D3200	4813978C02	DIODE, SWITCHING
D4000	4866544A01	DIODE, DUAL
D4001	4866544A01	DIODE, DUAL
E2500	2480675U01	FERRITE BEAD
E3000	2485011Y01	FERRITE BEAD
E3201	2480675U01	FERRITE BEAD
E3202	2480675U01	FERRITE BEAD
E3203	2480675U01	FERRITE BEAD
E3205	2480675U01	FERRITE BEAD
E3206	2480675U01	FERRITE BEAD
E3208	2480675U01	FERRITE BEAD
E3500	2485011Y01	FERRITE BEAD
E3501	2485011Y01	FERRITE BEAD
E3502	2485011Y01	FERRITE BEAD
E3503	2485011Y01	FERRITE BEAD
E4000	2485011Y01	FERRITE BEAD
E4001	7686949J14	FERRITE BEAD
E4002	7686949J14	FERRITE BEAD
E4003	NOTPLACED	
E4004	2409134J25	FERRITE BEAD
E4005	2409134J25	FERRITE BEAD

Circuit Ref	Motorola Part No	Description
J2500	0905505Y02	22-PIN JTAG CONNECTOR
J3000	0905902V09	DC POWER CONNECTOR
J4000	0916017H01	26-PIN ACCESSORY CONNECTOR
J4001	0915555H01	30-PIN CONTROL HEAD CONNECTOR
J4002	0915558H01	11-PIN REPEATER CONNECTOR
J4003	0915556H01	14-PIN OPT BRD CONNECTOR
L3200	2415005H02	22uH
L3201	2415005H02	22uH
L3202	2415005H02	22uH
Q3030	4813973M07	NPN
Q3032	4813973B01	NPN
Q3040	4813973M07	NPN
Q3041	4815263H01	ANALOG SWITCH
Q3200	5185956E76	N-CHANNEL SYN-CHRONOUS MOSFET
Q3201	4813970A62	P-CHANNEL MOSFET
Q3202	5185956E76	N-CHANNEL SYN-CHRONOUS MOSFET
Q3203	4805585Q23	PMOS FET
Q3204	4805585Q23	PMOS FET
Q3205	4815262H01	ANALOG SWITCH
Q3206	4815272H01	ANALOG SWITCH
Q3207	4813970A62	P-CHANNEL MOSFET
Q3208	4815261H01	ANALOG SWITCH
Q3500	4815261H01	ANALOG SWITCH
Q3501	4815272H01	ANALOG SWITCH
Q3502	4815272H01	ANALOG SWITCH

Circuit Ref	Motorola Part No	Description
Q3503	4815272H01	ANALOG SWITCH
Q3504	4815270H01	ANALOG SWITCH
Q3505	4815270H01	ANALOG SWITCH
Q4000	4815263H01	ANALOG SWITCH
Q4001	4815263H01	ANALOG SWITCH
Q4002	4815261H01	ANALOG SWITCH
Q4003	4815263H01	ANALOG SWITCH
Q4004	4815261H01	ANALOG SWITCH
Q4005	4815263H01	ANALOG SWITCH
Q4006	4815263H01	ANALOG SWITCH
Q4007	4815263H01	ANALOG SWITCH
Q4008	4815261H01	ANALOG SWITCH
Q4009	4815263H01	ANALOG SWITCH
Q4010	4815261H01	ANALOG SWITCH
Q4011	4815263H01	ANALOG SWITCH
Q4012	4815261H01	ANALOG SWITCH
Q4013	4816023H01	PNP
Q4014	4813973A06	NPN
Q4015	4815263H01	ANALOG SWITCH
R1000	0613952Q25	10
R1001	0613952R01	10K
R1002	0613952J73	10MEG
R1005	0613952Q89	4.7K
R1006	0613952R01	10K
R1014	0613952R66	0
R1017	0613952R01	10K
R1019	0613952Q18	5.1
R1020	0613952R66	0
R1021	0613952R66	0
R1025	0613952R01	10K

Circuit Ref	Motorola Part No	Description
R1026	0613952R17	47K
R1027	NOT PLACED	–
R1028	0613952R66	0
R1034	0613952R01	10K
R1035	NOT PLACED	–
R1036	0613952R01	10K
R1041	0613952Q73	1K
R1044	0613952R66	0
R1045	0613952R01	10K
R1046	NOT PLACED	–
R1047	0613952R66	0
R1048	0613952R66	0
R1054	0613952Q89	4.7K
R1060	0613952Q25	10
R1066	NOT PLACED	–
R1067	NOT PLACED	–
R1070	0613952R66	0
R1071	0613952R17	47K
R1072	NOT PLACED	–
R2000	0613952R01	10K
R2004	0613952R66	0
R2005	0613952R01	10K
R2006	0613952R01	10K
R2007	0613952R01	10K
R2008	0613952R01	10K
R2009	0613952R01	10K
R2010	0613952R01	10K
R2011	0613952R66	0
R2012	0613952R01	10K
R2013	0613952R01	10K

Circuit Ref	Motorola Part No	Description
R2500	0613952R66	0
R2501	0613952R66	0
R2502	0613952R66	0
R2504	0613952R66	0
R2506	0613952R66	0
R2507	0613952R66	0
R2508	0613952R66	0
R2509	0613952R66	0
R2510	0613952R66	0
R2511	0613952R66	0
R2512	0613952R66	0
R2513	0613952R66	0
R2514	0613952R66	0
R2515	0613952R66	0
R2516	0613952R66	0
R2517	0613952R66	0
R2518	0613952R66	0
R2519	0613952R66	0
R2520	0613952R66	0
R2521	0613952R66	0
R2522	0613952R66	0
R2523	0613952R66	0
R2524	0613952R66	0
R2525	0613952R66	0
R2526	0613952R66	0
R2527	0613952R66	0
R2528	0613952R66	0
R2529	0613952R01	10K
R3002	0613952R01	10K
R3003	0613952M54	3.57K

Circuit Ref	Motorola Part No	Description
R3004	0613952L73	562
R3005	0613952Q81	2.2K
R3006	0613952Q57	220
R3007	0613952N58	39.2K
R3008	0613952N12	13K
R3009	0613952N58	39.2K
R3010	0613952N12	13K
R3030	0613952R01	10K
R3032	0615871H01	0.1
R3033	0615871H01	0.1
R3034	0613952H61	330
R3035	0613952H25	10
R3036	0613952H25	10
R3037	0613959G61	330
R3038	NOT PLACED	–
R3039	0613952M30	2K
R3040	0613952M43	2.74K
R3041	0613952R25	100K
R3042	0613952H69	680
R3043	0613952H69	680
R3044	0613958S61	330
R3045	0613952M30	2K
R3046	0613952M43	2.74K
R3047	0613952R25	100K
R3048	0613952Q73	1K
R3050	0613959Q53	150
R3051	0613952G67	0
R3052	0613952G67	0
R3053	0613952R66	0
R3054	0613952R66	0

Circuit Ref	Motorola Part No	Description
R3055	0615871H01	0.1
R3056	0615871H01	0.1
R3057	0613952R66	0
R3200	0615871H01	0.1
R3201	0613952R66	0
R3203	0615871H01	0.1
R3204	0615871H01	0.1
R3205	0613952R25	100K
R3206	0613952R66	0
R3207	0686135Z02	0.2
R3208	0686135Z02	0.2
R3209	0613952N62	43.2K
R3210	0613952N16	14.3K
R3215	0613952G67	0
R3216	0613952G67	0
R3217	NOT PLACED	–
R3218	0613952R66	0
R3219	0613952R56	2MEG
R3220	0613952R56	2MEG
R3222	0613952R33	220K
R3223	0613952R33	220K
R3224	0613952Q89	4.7K
R3225	NOT PLACED	–
R3226	0613952R13	33K
R3227	NOT PLACED	–
R3228	0613952G67	0
R3233	0613952R66	0
R3236	0613952Q73	1K
R3237	0613952R01	10K
R3238	0613952H25	10

Circuit Ref	Motorola Part No	Description
R3239	0613952H25	10
R3240	0613952R17	47K
R3241	0613952Q18	5.1
R3243	0613952Q18	5.1
R3245	0613952G67	0
R3246	0613952M81	6.81K
R3247	0613952N69	51.1K
R3248	0613952R01	10K
R3249	NOTPLACED	
R3500	0613952Q35	27
R3501	0613952Q35	27
R3502	0613952R01	10K
R3503	0613952R13	33K
R3504	NOT PLACED	–
R3505	NOT PLACED	–
R3506	0613952R01	10K
R3507	NOTPLACED	
R3508	0613952R66	0
R3509	0613952R66	0
R3510	0613952Q35	27
R3511	0613952R01	10K
R3512	0613952Q35	27
R3513	0613952R66	0
R3514	0613952R01	10K
R3515	0613952R01	10K
R3516	0613952R10	24K
R3520	0613952R10	24K
R3521	0613952R05	15K
R3523	0613952R10	24K
R3524	0613952Q67	560

Circuit Ref	Motorola Part No	Description
R3525	0613952R25	100K
R3526	0613952R66	0
R3528	0613952R09	22K
R3529	0613952Q42	51
R3530	NOT PLACED	–
R3532	0613952Q49	100
R3533	0613952R10	24K
R3534	0613952R01	10K
R3535	0613952Q67	560
R3536	0613952R25	100K
R3537	0613952R66	0
R3538	0613952R15	39K
R3539	0613952R10	24K
R3540	0613952Q49	100
R3541	0613952R10	24K
R3542	0613952R10	24K
R3544	0613952R10	24K
R3545	0613952Q49	100
R3546	0613952R05	15K
R3547	0613952Q67	560
R3548	0613952J25	100K
R3549	0613952R12	30K
R3550	0613952R23	82K
R3551	0613952R01	RES, 10K
R3552	0613952R01	RES, 10K
R3553	0613952R01	RES, 10K
R3554	0613952R17	RES, 47K
R3555	0613952R01	RES, 10K
R3556	0613952R17	RES, 47K
R3558	0613952R01	10K

Circuit Ref	Motorola Part No	Description
R3559	0613952R01	10K
R3560	0613952R17	47K
R3561	0613952R66	0
R3562	0613952R66	0
R3563	0613952R66	0
R3569	0613952Q73	1K
R3571	0613952Q80	2K
R3572	0613952R01	10K
R3573	0613952R01	10K
R3574	0613952R01	10K
R3575	0613952Q73	1K
R3576	0613952Q49	100
R3577	0613952N42	26.7K
R3578	0613952R32	200K
R3579	0613952R01	10K
R3580	0613952R01	10K
R3581	0613952R01	10K
R3582	0613952N21	16.2K
R3583	0613952N21	16.2K
R3584	0613952R09	22K
R3585	0613952R09	22K
R3586	0613952R66	0
R3587	NOT PLACED	–
R3588	0613952N69	51.1K
R3591	0613952Q81	2.2K
R3592	0613952Q81	2.2K
R3593	0613952R32	200K
R3594	0613952Q85	3.3K
R3595	0613952R01	10K
R3596	0613952H53	150

Circuit Ref	Motorola Part No	Description
R4000	NOTPLACED	
R4001	0613952Q37	33
R4002	0613952Q37	33
R4003	0613952Q37	33
R4004	0613952Q37	33
R4005	0613952Q37	33
R4006	0613952Q65	470
R4009	0613952Q42	51
R4010	0613952Q42	51
R4011	0613952R66	0
R4012	0613952R66	0
R4023	0613952Q75	1.2K
R4030	NOT PLACED	–
R4031	0613952R01	10K
R4032	0613952R01	10K
R4033	NOT PLACED	–
R4034	0613952R01	10K
R4035	0613952R01	10K
R4040	0613952Q89	4.7K
R4041	0613952Q89	4.7K
R4042	0613952Q89	4.7K
R4043	0613952Q89	4.7K
R4044	0613952Q89	4.7K
R4045	0613952Q89	4.7K
R4046	0613952Q89	4.7K
R4047	0613952Q89	4.7K
R4048	0613952Q77	1.5K
R4049	0613958H83	2.7K
R4050	0613952R01	10K
R4051	0613952Q89	4.7K

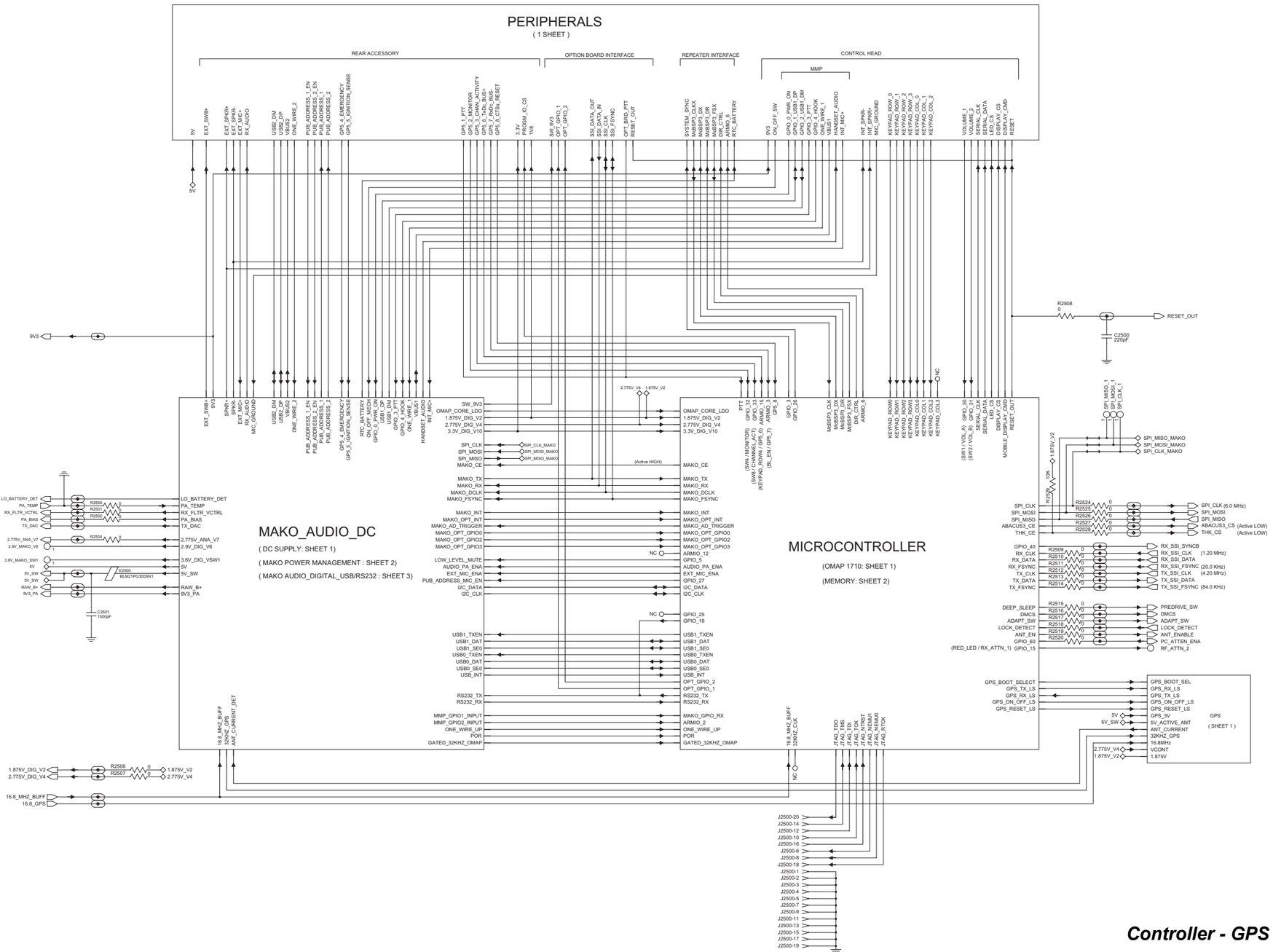
Circuit Ref	Motorola Part No	Description
R4054	0613952R01	10K
R4055	0613952R01	10K
R4061	0613952Q37	33
R4063	0613952Q37	33
R4064	0613952Q37	33
R4065	0613952Q37	33
R4066	0613952Q37	33
R4067	0613952Q37	33
R4068	0613952Q37	33
R4069	0613952Q37	33
R4070	0613952Q37	33
R4071	0613952R66	0
R4074	0613952R66	0
R4076	0613952R66	0
R4078	0613952R66	0
R4079	0613952R01	10K
R4080	0613952R66	0
R4081	0613952R66	0
R4082	0613952R66	0
R4083	0613952R66	0
R4084	0613952R66	0
R4085	0613952R66	0
R4086	0613952R66	0
R4088	0613952R01	10K
R4089	0613952R17	47K
R4090	0613952R66	0
R4093	0613952R66	0
R4094	0613952R66	0
R4095	0613952R66	0
R4096	0613952R66	0

Circuit Ref	Motorola Part No	Description
R4097	0613952R66	0
R4098	0613952Q89	4.7K
R4099	0613952R66	0
R4100	0613952Q75	1.2K
R4101	0613952Q75	1.2K
R4103	0613952Q75	1.2K
R4105	0613952R01	10K
R4106	0613952R01	10K
RT3500	0615471H01	THERMISTOR, 10K
U1000	5102495J13	MICROPROCESSOR
U1006	5115001H02	IC, DUAL UNBUF-FERED INVERTER
U2000	0104024J27	IC, 8MB FLASH
U2001	5171614M01	IC, 16MB SDRAM
U3001	5164015H94	VOLTAGE REGULATOR
U3002	5115391H01	VOLTAGE REGULATOR
U3003	5164015H94	VOLTAGE REGULATOR
U3004	5115391H01	VOLTAGE REGULATOR
U3005	0105959T72	PNP
U3006	0105959T72	PNP
U3030	5116525H01	DUAL OPAMP
U3040	0105959T72	PNP
U3200	5185143E77	IC, POWER MANAGEMENT
U3201	5115616H01	VOLTAGE REGULATOR
U3202	5115453H01	DUAL OPAMP
U3203	5114007A43	IC, SCHMITT TRIGGER
U3500	5102463J95	AUDIO PA
U3501	5115368H01	DIGITAL ATTENUATOR
U3502	5114016A18	QUAD OPAMP

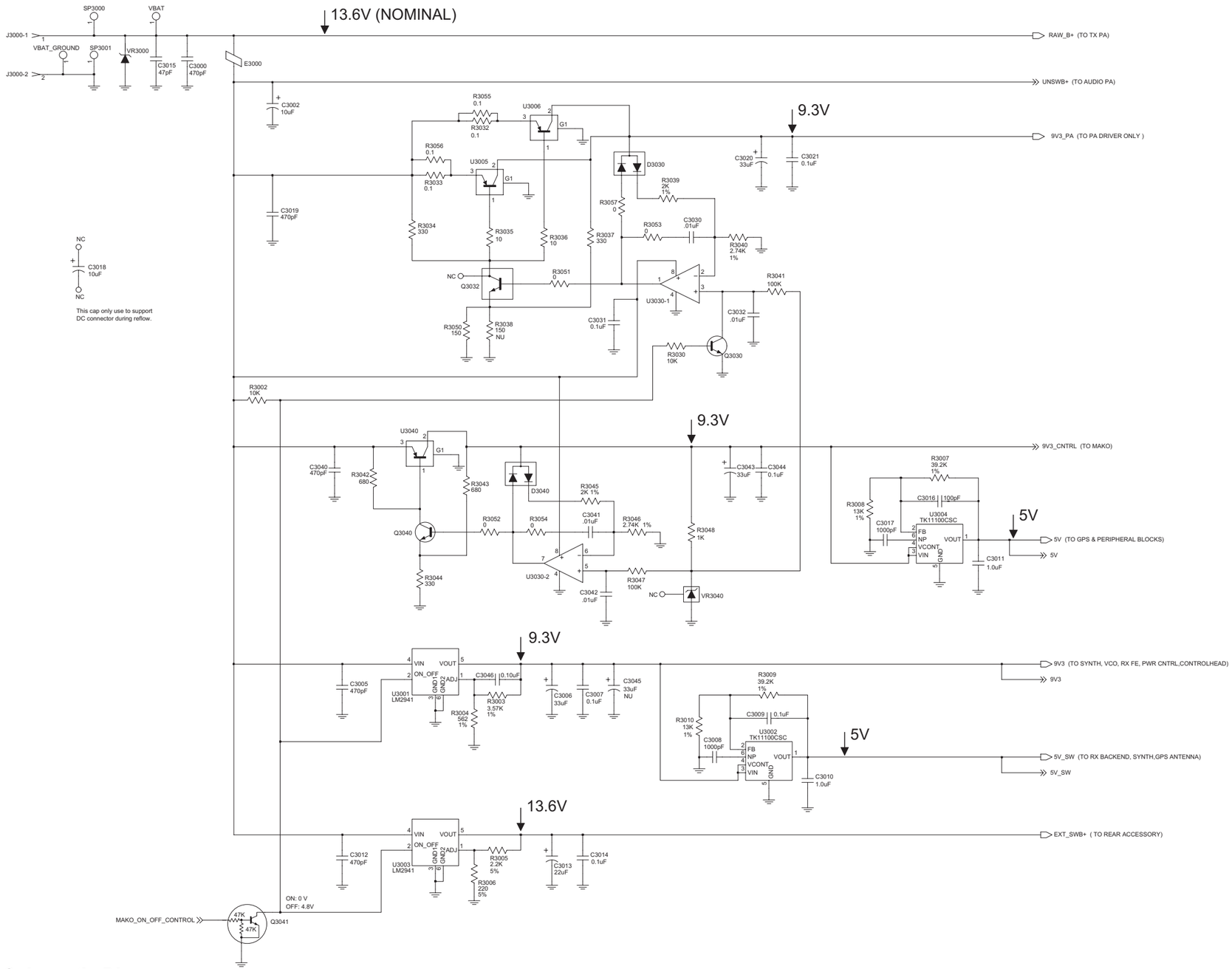
Circuit Ref	Motorola Part No	Description
U3503	5164852H47	IC, LEVEL TRANSLATOR
U3504	5171395L01	IC, CMOS SWITCH
U3505	5114016A18	QUAD OPAMP
U3508	5164852H47	IC, LEVEL TRANSLATOR
U4000	5115476H01	IC, SERIAL-TO-PARAL-LEL CONVERTER
U4001	5115502H01	LOGIC TRANSLATOR
U4004	5115865H01	IC, BUFFER
U4005	5115865H01	IC, BUFFER
U4006	5115865H01	IC, BUFFER
U4007	5115865H01	IC, BUFFER
U4008	5115865H01	IC, BUFFER
VR3000	4813979C17	TRANSIENT SUPPRESSOR
VR3040	4813977M10	DIODE, 5.1V ZENER
VR3200	4813977M10	DIODE, 5.1V ZENER
VR3201	4813977M05	DIODE, 3.3V ZENER
VR3202	4813977M05	DIODE, 3.3V ZENER
VR3203	4813977M05	DIODE, 3.3V ZENER
VR3204	4813977M13	DIODE, 6.2V ZENER
VR3205	4813977M05	DIODE, 3.3V ZENER
VR3206	4813977M13	DIODE, 6.2V ZENER
VR3207	4813977M13	DIODE, 6.2V ZENER
VR3208	4813977M13	DIODE, 6.2V ZENER
VR3502	4813977A48	DIODE, 20V ZENER
VR3503	4813977A48	DIODE, 20V ZENER
VR3504	4813977A48	DIODE, 20V ZENER
VR4000	4813977A48	DIODE, 20V ZENER
VR4001	4813977A48	DIODE, 20V ZENER
VR4002	4813977A48	DIODE, 20V ZENER

Circuit Ref	Motorola Part No	Description
VR4003	4813977A48	DIODE, 20V ZENER
VR4004	4813977A48	DIODE, 20V ZENER
VR4005	4813977M13	DIODE, 6.2V ZENER
VR4006	4813977M13	DIODE, 6.2V ZENER
VR4007	NOT PLACED	–
VR4008	NOT PLACED	–
Y1000	4809612J45	12MHZ CRYSTAL
Y3200	4815028H01	24.576MHZ CRYSTAL
Y3201	4802582S80	32KHZ CRYSTAL

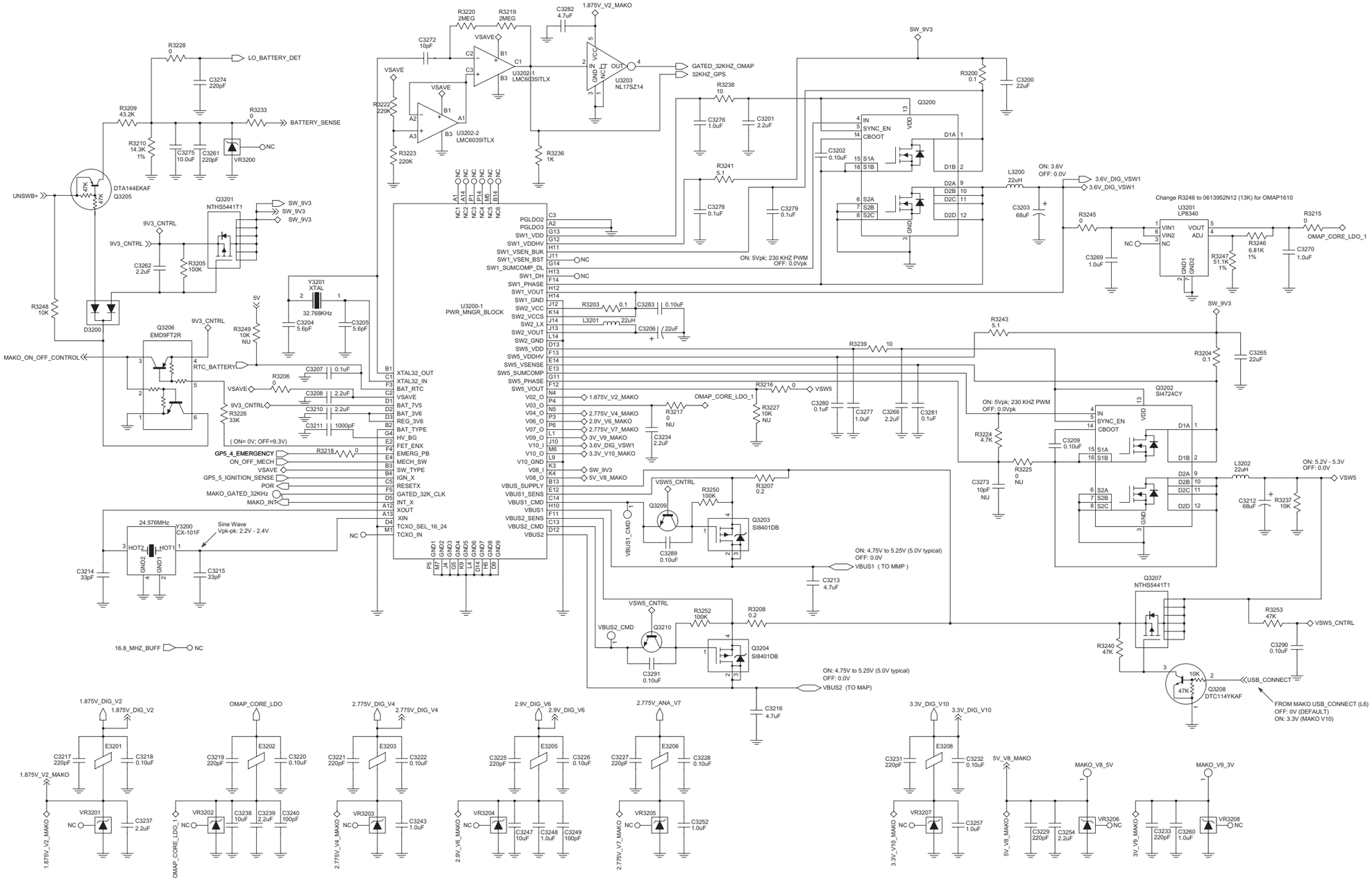
4.0 Controller R4 Schematic Diagrams



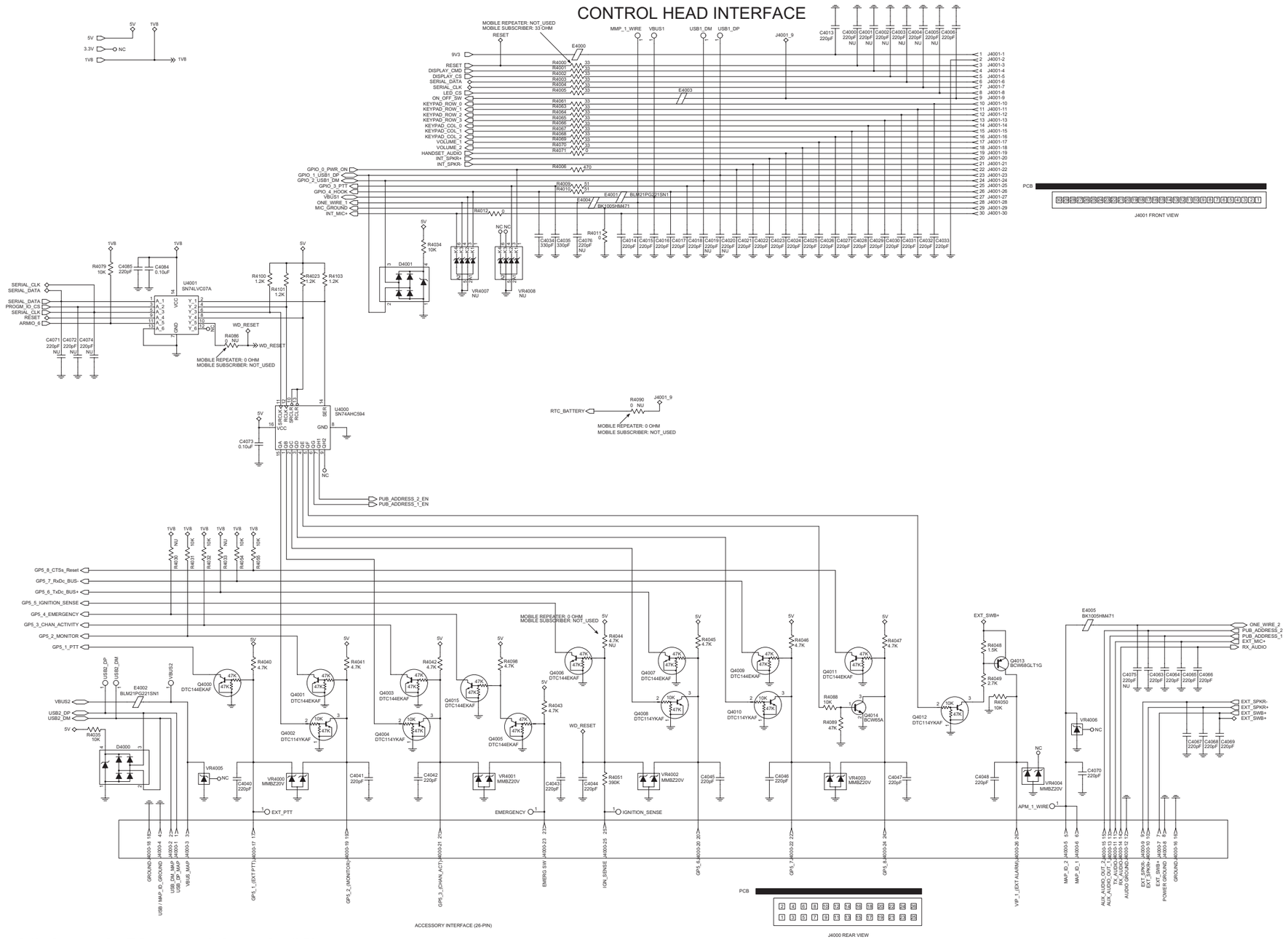
Controller - GPS Schematic Diagram



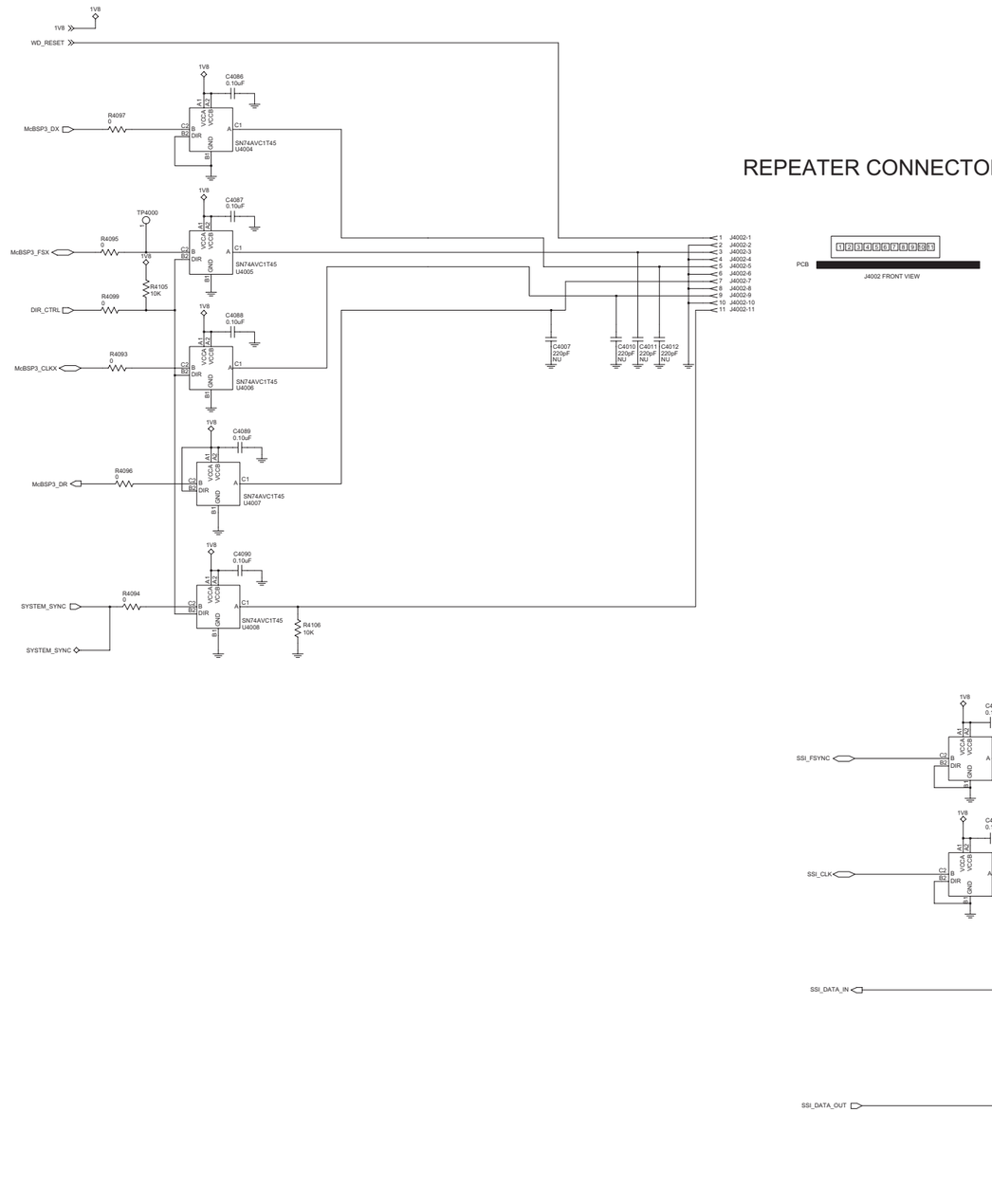
Controller DC Supply Schematic Diagram



Controller DC Distribution Schematic Diagram

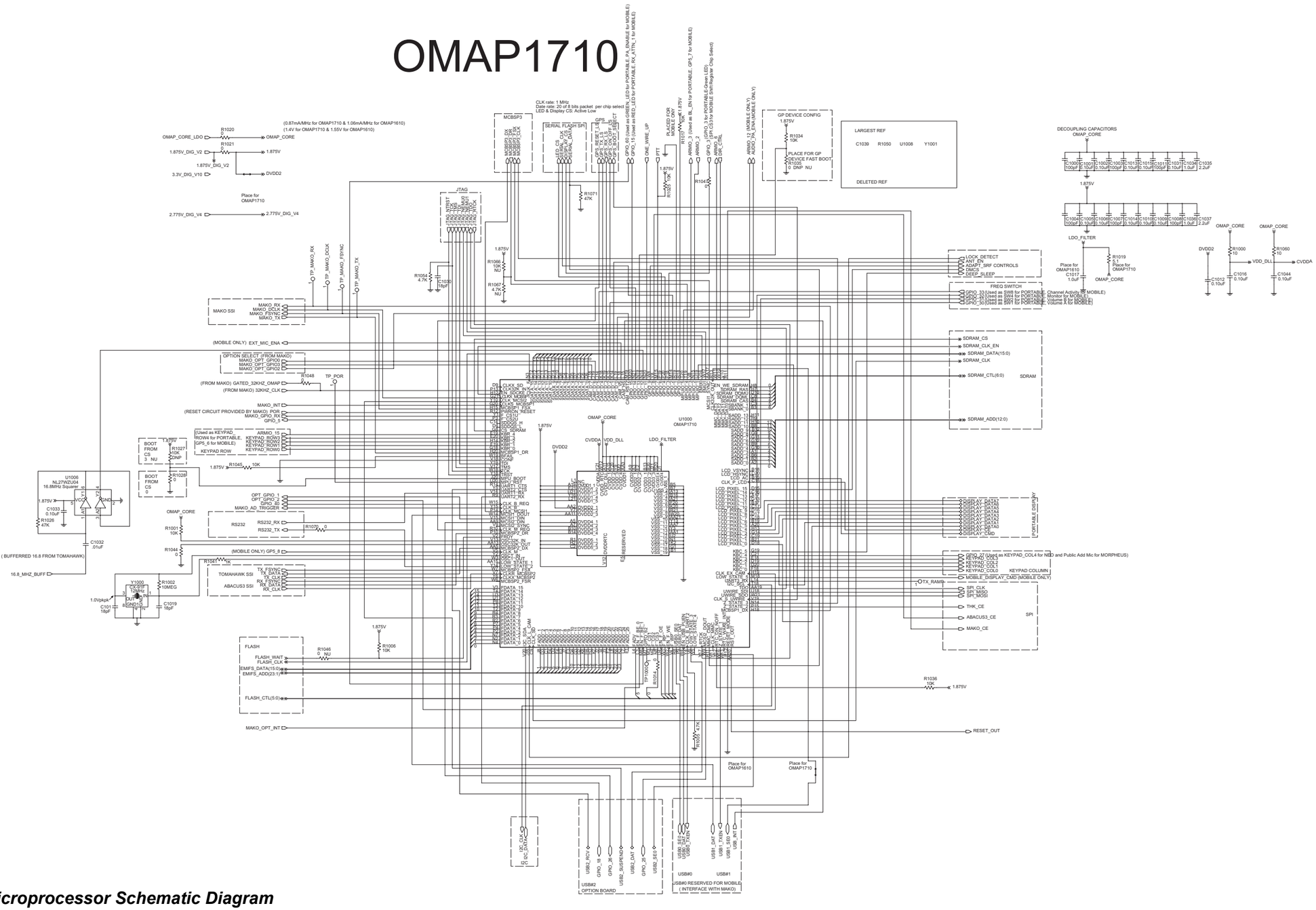


Controller Peripheral Schematic Diagram (sheet 1 of 2)



DIR	OPERATION
LOW	B ---->A
HIGH	B <----A

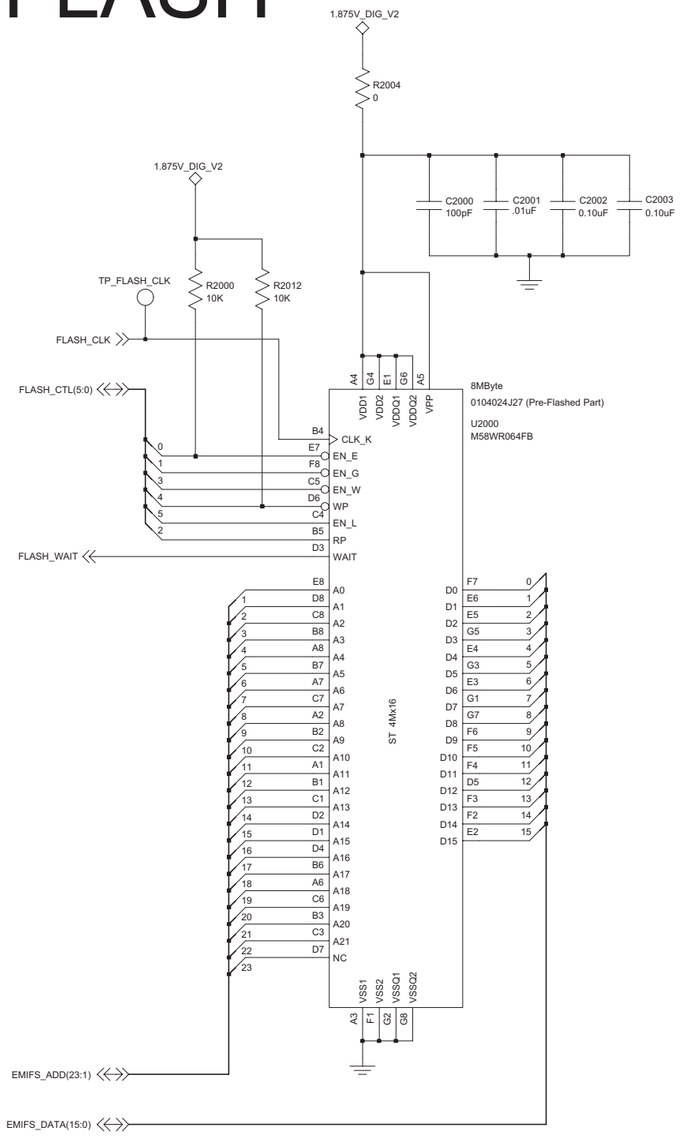
Controller Peripheral Schematic Diagram (sheet 2 of 2)



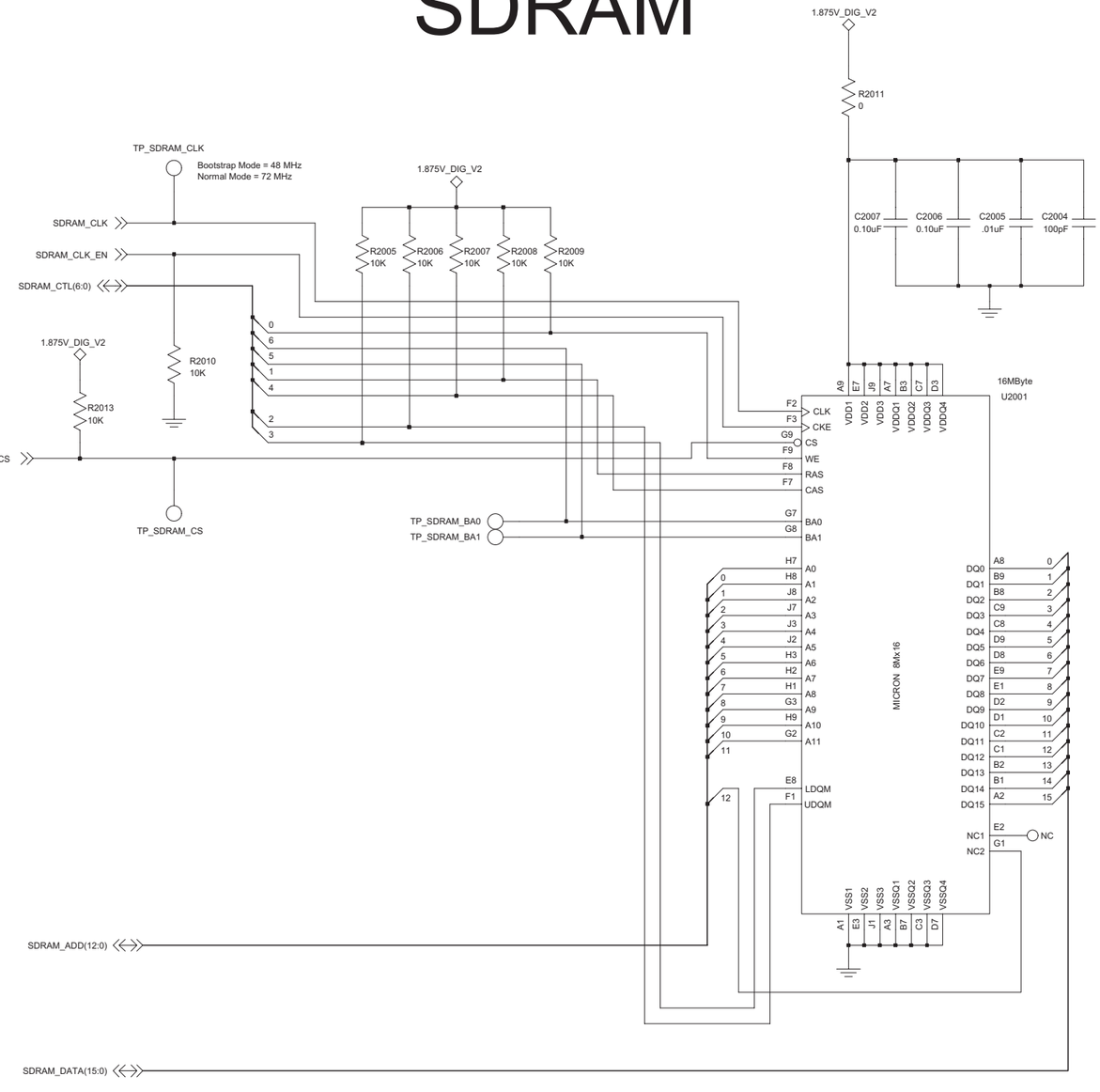
Controller Microprocessor Schematic Diagram

1.875V_DIG_V2 1.875V_DIG_V2

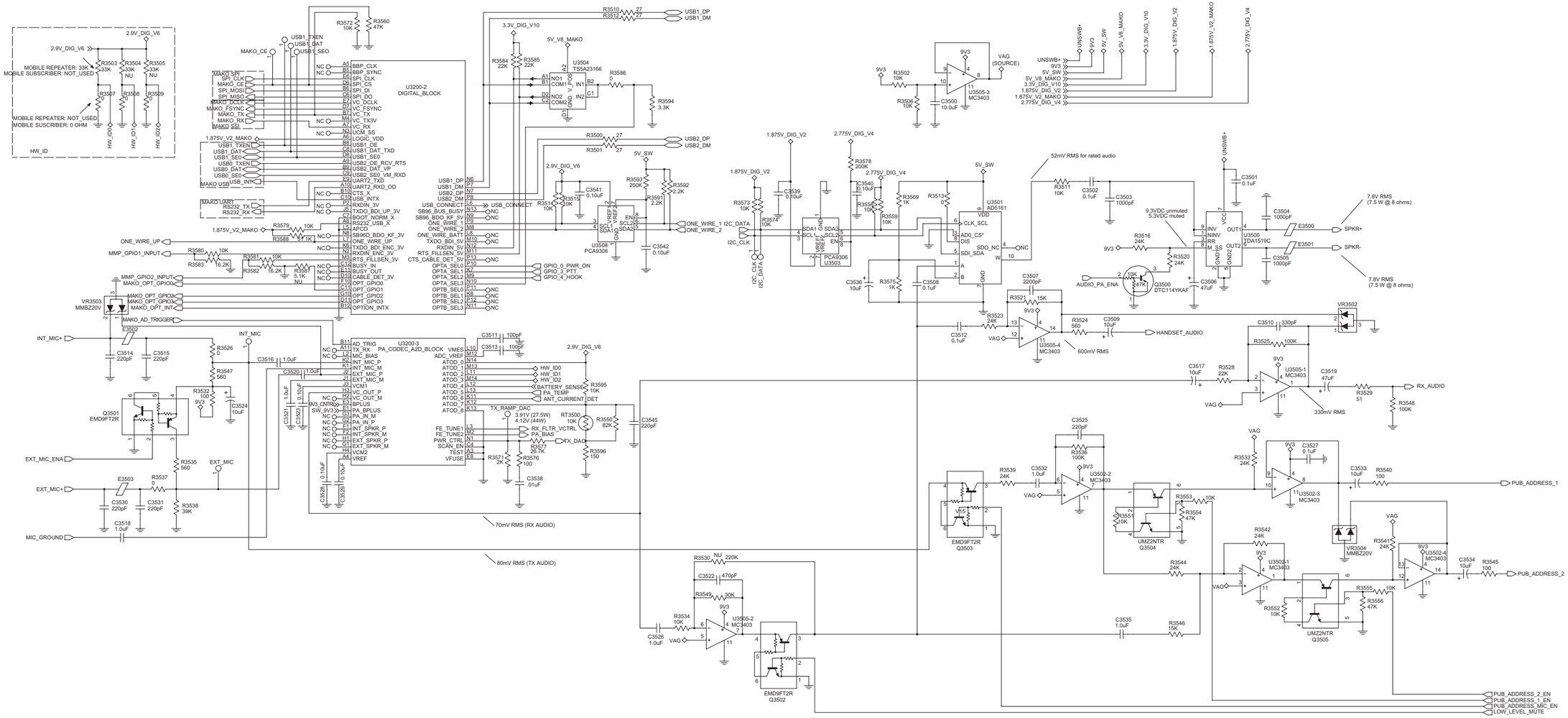
FLASH



SDRAM



Controller Memories Schematic Diagram



Controller Audio and USB Schematic Diagram

4.1 Controller R4 Parts List

Circuit Ref	Motorola Part No	Description
C1000	2113944A40	100pF
C1001	2113945Y02	0.10uF
C1002	2113945Y02	0.10uF
C1003	2113944A40	100pF
C1004	2113944A40	100pF
C1005	2113945Y02	0.10uF
C1006	2113945Y02	0.10uF
C1007	2113944A40	100pF
C1008	2113944A40	100pF
C1009	2113945Y02	0.10uF
C1010	2113945Y02	0.10uF
C1011	2113944A40	100pF
C1012	2113945Y02	0.10uF
C1013	2113945Y02	0.10uF
C1014	2113945Y02	0.10uF
C1015	2113945Y02	0.10uF
C1016	2113945Y02	0.10uF
C1017	2113946E02	1.0uF
C1018	2113944A28	18pF
C1019	2113944A28	18pF
C1030	2113944A28	18pF
C1031	2113945Y02	0.10uF
C1032	2113945B02	0.01uF
C1033	2113945Y02	0.10uF
C1034	2113946S35	1.0uF
C1035	2113946D05	2.2uF
C1036	2113946S35	1.0uF
C1037	2113946D05	2.2uF
C1044	2113945Y02	0.10uF

Circuit Ref	Motorola Part No	Description
C2000	2113944A40	100pF
C2001	2113945B02	0.01uF
C2002	2113945Y02	0.10uF
C2003	2113945Y02	0.10uF
C2004	2113944A40	100pF
C2005	2113945B02	0.01uF
C2006	2113945Y02	0.10uF
C2007	2113945Y02	0.10uF
C2500	2113944A44	220pF
C2501	2113945A10	1500pF
C3000	2113944C06	470pF
C3002	2371403L02	10uF
C3005	2113944C06	470pF
C3006	2314030E85	33uF
C3007	2113945C31	0.1uF
C3008	2113945A09	1000pF
C3009	2113945Y02	0.1uF
C3010	2113946S35	1.0uF
C3011	2113946S35	1.0uF
C3012	2113944C06	470pF
C3013	2314030J28	22uF
C3014	2113945C31	0.1uF
C3015	2113944C38	47pF
C3016	2113944A40	100pF
C3017	2113945A09	1000pF
C3018	2389289U01	10uF
C3019	2113944C06	470pF
C3020	2314030E85	33uF
C3021	2113945C31	0.1uF
C3030	2113945C02	0.01uF

Circuit Ref	Motorola Part No	Description
C3031	2113945C31	0.1uF
C3032	2113945B02	0.01uF
C3040	2113944C06	470pF
C3041	2113945C02	0.01uF
C3042	2113945B02	0.01uF
C3043	2314030E85	33uF
C3044	2113945C31	0.1uF
C3045	NOT PLACED	–
C3046	2113945Y02	0.10uF
C3200	2113946J04	22uF
C3201	2113946D05	2.2uF
C3202	2113945Y02	0.10uF
C3203	2316410H02	68uF
C3204	2115153H21	5.6pF
C3205	2115153H21	5.6pF
C3206	2316410H01	22uF
C3207	2113945C31	0.1uF
C3208	2113946D05	2.2uF
C3209	2113945Y02	0.10uF
C3210	2113946D05	2.2uF
C3211	2113945A09	1000pF
C3212	2316410H02	68uF
C3213	2113946F03	4.7uF
C3214	2115153H45	33pF
C3215	2115153H45	33pF
C3216	2113946F03	4.7uF
C3217	2113944A44	220pF
C3218	2113945Y02	0.10uF
C3219	2113944A44	220pF
C3220	2113945Y02	0.10uF

Circuit Ref	Motorola Part No	Description
C3221	2113944A44	220pF
C3222	2113945Y02	0.10uF
C3225	2113944A44	220pF
C3226	2113945Y02	0.10uF
C3227	2113944A44	220pF
C3228	2113945Y02	0.10uF
C3229	2113944A44	220pF
C3231	2113944A44	220pF
C3232	2113945Y02	0.10uF
C3233	2113944A44	220pF
C3234	2113946D05	2.2uF
C3237	2113946D05	2.2uF
C3238	2113946H02	10uF
C3239	2113946D05	2.2uF
C3240	2113944C45	100pF
C3243	2113946S35	1.0uF
C3247	2113946H02	10uF
C3248	2113946S35	1.0uF
C3249	2113944C45	100pF
C3252	2113946S35	1.0uF
C3254	2113946D05	2.2uF
C3257	2113946S35	1.0uF
C3260	2113946S35	1.0uF
C3261	2113944A44	220pF
C3262	2113946N03	2.2uF
C3265	2113946J04	22uF
C3266	2113946D05	2.2uF
C3269	2113946S35	1.0uF
C3270	2113946S35	1.0uF
C3272	2115153H27	10pF

Circuit Ref	Motorola Part No	Description
C3273	NOT PLACED	–
C3274	2113944A44	220pF
C3275	2113946J03	10.0uF
C3276	2113946S35	1.0uF
C3277	2113946S35	1.0uF
C3278	2113945C31	0.1uF
C3279	2113945C31	0.1uF
C3280	2113945C31	0.1uF
C3281	2113945C31	0.1uF
C3282	2113946F03	4.7uF
C3283	2113945Y02	0.10uF
C3289	2113945Y02	0.10uF
C3290	2113945Y02	0.10uF
C3291	2113945Y02	0.10uF
C3500	2113946J03	10.0uF
C3501	2113945G91	0.1uF
C3502	2113945C31	0.1uF
C3503	2113945A09	1000pF
C3504	2113945A09	1000pF
C3505	2113945A09	1000pF
C3506	2314030F30	47uF
C3507	2113945A11	2200pF
C3508	2113945C31	0.1uF
C3509	2313960D07	10uF
C3510	2113945A03	330pF
C3511	2113944A40	100pF
C3512	2113945C31	0.1uF
C3513	2113944A40	100pF
C3514	2113944A44	220pF
C3515	2113944A44	220pF

Circuit Ref	Motorola Part No	Description
C3516	2113946S35	1.0uF
C3517	2314030M51	10uF
C3518	2113946S35	1.0uF
C3519	2314030F30	47uF
C3520	2113946S35	1.0uF
C3521	2113946S35	1.0uF
C3522	2113945A05	470pF
C3523	2113945Y02	0.10uF
C3524	2313960D07	10uF
C3525	2113944A44	220pF
C3526	2113946S35	1.0uF
C3527	2113945C31	0.1uF
C3528	2113945Y02	0.10uF
C3529	2113945Y02	0.10uF
C3530	2113944A44	220pF
C3531	2113944A44	220pF
C3532	2113946S35	1.0uF
C3533	2313960D07	10uF
C3534	2313960D07	10uF
C3535	2113946S35	1.0uF
C3536	2314030M51	10uF
C3538	2113945B02	0.01uF
C3539	2113945Y02	0.10uF
C3540	2113945Y02	0.10uF
C3541	2113945Y02	0.10uF
C3542	2113945Y02	0.10uF
C3545	2113944A44	220pF
C4000	NOT PLACED	–
C4001	NOT PLACED	–
C4002	NOT PLACED	–

Circuit Ref	Motorola Part No	Description
C4003	NOT PLACED	–
C4004	NOT PLACED	–
C4005	NOT PLACED	–
C4006	2113944A44	220pF
C4007	NOT PLACED	–
C4010	NOT PLACED	–
C4011	NOT PLACED	–
C4012	NOT PLACED	–
C4013	2113944A44	220pF
C4014	2113944A44	220pF
C4015	2113944A44	220pF
C4016	2113944A44	220pF
C4017	2113944A44	220pF
C4018	2113944A44	220pF
C4019	NOT PLACED	–
C4020	NOT PLACED	–
C4021	2113944A44	220pF
C4022	2113944A44	220pF
C4023	2113944A44	220pF
C4024	2113944A44	220pF
C4025	2113944A44	220pF
C4026	2113944A44	220pF
C4027	2113944A44	220pF
C4028	2113944A44	220pF
C4029	2113944A44	220pF
C4030	2113944A44	220pF
C4031	2113944A44	220pF
C4032	2113944A44	220pF
C4033	2113944A44	220pF
C4034	2113945A03	330pF

Circuit Ref	Motorola Part No	Description
C4035	2113945A03	330pF
C4040	2113944A44	220pF
C4041	2113944A44	220pF
C4042	2113944A44	220pF
C4043	2113944A44	220pF
C4044	2113944A44	220pF
C4045	2113944A44	220pF
C4046	2113944A44	220pF
C4047	2113944A44	220pF
C4048	2113944A44	220pF
C4049	NOT PLACED	–
C4051	NOT PLACED	–
C4053	NOT PLACED	–
C4055	NOT PLACED	–
C4058	NOT PLACED	–
C4059	NOT PLACED	–
C4060	NOT PLACED	–
C4061	NOT PLACED	–
C4062	NOT PLACED	–
C4063	2113944A44	220pF
C4064	2113944A44	220pF
C4065	2113944A44	220pF
C4066	2113944A44	220pF
C4067	2113944A44	220pF
C4068	2113944A44	220pF
C4069	2113944A44	220pF
C4070	2113944A44	220pF
C4071	NOT PLACED	–
C4072	NOT PLACED	–
C4073	2113945Y02	0.10uF

Circuit Ref	Motorola Part No	Description
C4074	NOT PLACED	–
C4075	NOT PLACED	–
C4076	NOT PLACED	–
C4084	2113945Y02	0.10uF
C4085	2113944A44	220pF
C4086	2113945Y02	0.10uF
C4087	2113945Y02	0.10uF
C4088	2113945Y02	0.10uF
C4089	2113945Y02	0.10uF
C4090	2113945Y02	0.10uF
C4091	2113945Y02	0.10uF
C4092	2113945Y02	0.10uF
C4093	NOT PLACED	–
C4094	NOT PLACED	–
D3030	4813978P07	DIODE, SWITCHING
D3040	4813978P07	DIODE, SWITCHING
D3200	4813978C02	DIODE, SWITCHING
D4000	4866544A01	DIODE, DUAL
D4001	4866544A01	DIODE, DUAL
E2500	2480675U01	FERRITE BEAD
E3000	2485011Y01	FERRITE BEAD
E3201	2480675U01	FERRITE BEAD
E3202	2480675U01	FERRITE BEAD
E3203	2480675U01	FERRITE BEAD
E3205	2480675U01	FERRITE BEAD
E3206	2480675U01	FERRITE BEAD
E3208	2480675U01	FERRITE BEAD
E3500	2485011Y01	FERRITE BEAD
E3501	2485011Y01	FERRITE BEAD
E3502	2485011Y01	FERRITE BEAD

Circuit Ref	Motorola Part No	Description
E3503	2485011Y01	FERRITE BEAD
E4000	2485011Y01	FERRITE BEAD
E4001	7686949J14	FERRITE BEAD
E4002	7686949J14	FERRITE BEAD
E4003	NOT PLACED	–
E4004	2409134J25	FERRITE BEAD
E4005	2409134J25	FERRITE BEAD
E4006	2409134J25	FERRITE BEAD
J2500	0905505Y02	22-PIN JTAG CONNECTOR
J3000	0905902V09	DC POWER CONNECTOR
J4000	0916017H01	26-PIN ACCESSORY CONNECTOR
J4001	0915555H01	30-PIN CONTROL HEAD CONNECTOR
J4002	0915558H01	CONN_J
J4003	0915556H01	14-PIN OPT BRD CONNECTOR
L3200	2415005H02	22uH
L3201	2415005H02	22uH
L3202	2415005H02	22uH
Q3030	4813973M07	NPN
Q3032	4813973B01	NPN
Q3040	4813973M07	NPN
Q3041	4815263H01	ANALOG SWITCH
Q3200	5185956E76	N-CHANNEL SYNCHRONOUS MOSFET
Q3201	4813970A62	P-CHANNEL MOSFET
Q3202	5185956E76	N-CHANNEL SYNCHRONOUS MOSFET
Q3203	4805585Q23	PMOS FET

Circuit Ref	Motorola Part No	Description
Q3204	4805585Q23	PMOS FET
Q3205	4815262H01	ANALOG SWITCH
Q3206	4815272H01	ANALOG SWITCH
Q3207	4813970A62	P-CHANNEL MOSFET
Q3208	4815261H01	ANALOG SWITCH
Q3209	4813973M07	ANALOG SWITCH
Q3210	4813973M07	ANALOG SWITCH
Q3500	4815261H01	ANALOG SWITCH
Q3501	4815272H01	ANALOG SWITCH
Q3502	4815272H01	ANALOG SWITCH
Q3503	4815272H01	ANALOG SWITCH
Q3504	4815270H01	ANALOG SWITCH
Q3505	4815270H01	ANALOG SWITCH
Q4000	4815263H01	ANALOG SWITCH
Q4001	4815263H01	ANALOG SWITCH
Q4002	4815261H01	ANALOG SWITCH
Q4003	4815263H01	ANALOG SWITCH
Q4004	4815261H01	ANALOG SWITCH
Q4005	4815263H01	ANALOG SWITCH
Q4006	4815263H01	ANALOG SWITCH
Q4007	4815263H01	ANALOG SWITCH
Q4008	4815261H01	ANALOG SWITCH
Q4009	4815263H01	ANALOG SWITCH
Q4010	4815261H01	ANALOG SWITCH
Q4011	4815263H01	ANALOG SWITCH
Q4012	4815261H01	ANALOG SWITCH
Q4013	4816023H01	PNP
Q4014	4813973A06	NPN
Q4015	4815263H01	ANALOG SWITCH
R1000	0613952Q25	10

Circuit Ref	Motorola Part No	Description
R1001	0613952R01	10K
R1002	0613952J73	10MEG
R1005	0613952Q89	4.7K
R1006	0613952R01	10K
R1014	0613952R66	0
R1017	0613952R01	10K
R1019	0613952Q18	5.1
R1020	0613952R66	0
R1021	0613952R66	0
R1025	0613952R01	10K
R1026	0613952R17	47K
R1027	NOT PLACED	–
R1028	0613952R66	0
R1034	0613952R01	10K
R1035	NOT PLACED	–
R1036	0613952R01	10K
R1041	0613952Q73	1K
R1044	0613952R66	0
R1045	0613952R01	10K
R1046	NOT PLACED	–
R1047	0613952R66	0
R1048	0613952R66	0
R1054	0613952Q89	4.7K
R1060	0613952Q25	10
R1066	NOT PLACED	–
R1067	NOT PLACED	–
R1070	0613952R66	0
R1071	0613952R17	47K
R2000	0613952R01	10K
R2004	0613952R66	0

Circuit Ref	Motorola Part No	Description
R2005	0613952R01	10K
R2006	0613952R01	10K
R2007	0613952R01	10K
R2008	0613952R01	10K
R2009	0613952R01	10K
R2010	0613952R01	10K
R2011	0613952R66	0
R2012	0613952R01	10K
R2013	0613952R01	10K
R2500	0613952R66	0
R2501	0613952R66	0
R2502	0613952R66	0
R2504	0613952R66	0
R2506	0613952R66	0
R2507	0613952R66	0
R2508	0613952R66	0
R2509	0613952R66	0
R2510	0613952R66	0
R2511	0613952R66	0
R2512	0613952R66	0
R2513	0613952R66	0
R2514	0613952R66	0
R2515	0613952R66	0
R2516	0613952R66	0
R2517	0613952R66	0
R2518	0613952R66	0
R2519	0613952R66	0
R2520	0613952R66	0
R2524	0613952R66	0
R2525	0613952R66	0

Circuit Ref	Motorola Part No	Description
R2526	0613952R66	0
R2527	0613952R66	0
R2528	0613952R66	0
R2529	0613952R01	10K
R3002	0613952R01	10K
R3003	0613952M54	3.57K
R3004	0613952L73	562
R3005	0613952Q81	2.2K
R3006	0613952Q57	220
R3007	0613952N58	39.2K
R3008	0613952N12	13K
R3009	0613952N58	39.2K
R3010	0613952N12	13K
R3030	0613952R01	10K
R3032	0615871H01	0.1
R3033	0615871H01	0.1
R3034	0613952H61	330
R3035	0613952H25	10
R3036	0613952H25	10
R3037	0613959G61	330
R3038	NOT PLACED	–
R3039	0613952M30	2K
R3040	0613952M43	2.74K
R3041	0613952R25	100K
R3042	0613952H69	680
R3043	0613952H69	680
R3044	0613958S61	330
R3045	0613952M30	2K
R3046	0613952M43	2.74K
R3047	0613952R25	100K

Circuit Ref	Motorola Part No	Description
R3048	0613952Q73	1K
R3050	0613959Q53	150
R3051	0613952G67	0
R3052	0613952G67	0
R3053	0613952R66	0
R3054	0613952R66	0
R3055	0615871H01	0.1
R3056	0615871H01	0.1
R3057	0613952R66	0
R3200	0615871H01	0.1
R3203	0615871H01	0.1
R3204	0615871H01	0.1
R3205	0613952R25	100K
R3206	0613952R66	0
R3207	0686135Z02	0.2
R3208	0686135Z02	0.2
R3209	0613952N62	43.2K
R3210	0613952N16	14.3K
R3215	0613952G67	0
R3216	0613952G67	0
R3217	NOT PLACED	–
R3218	0613952R66	0
R3219	0613952R56	2MEG
R3220	0613952R56	2MEG
R3222	0613952R33	220K
R3223	0613952R33	220K
R3224	0613952Q89	4.7K
R3225	NOT PLACED	–
R3226	0613952R13	33K
R3227	NOT PLACED	–

Circuit Ref	Motorola Part No	Description
R3228	0613952G67	0
R3233	0613952R66	0
R3236	0613952Q73	1K
R3237	0613952R01	10K
R3238	0613952H25	10
R3239	0613952H25	10
R3240	0613952R17	47K
R3241	0613952Q18	5.1
R3243	0613952Q18	5.1
R3245	0613952G67	0
R3246	0613952M81	6.81K
R3247	0613952N69	51.1K
R3248	0613952R01	10K
R3249	NOT PLACED	–
R3250	0613952R25	100K
R3252	0613952R25	100K
R3253	0613952R17	47K
R3500	0613952Q35	27
R3501	0613952Q35	27
R3502	0613952R01	10K
R3503	0613952R13	33K
R3504	NOT PLACED	–
R3505	NOT PLACED	–
R3506	0613952R01	10K
R3507	NOT PLACED	–
R3508	0613952R66	0
R3509	0613952R66	0
R3510	0613952Q35	27
R3511	0613952R01	10K
R3512	0613952Q35	27

Circuit Ref	Motorola Part No	Description
R3513	0613952R66	0
R3514	0613952R01	10K
R3515	0613952R01	10K
R3516	0613952R10	24K
R3520	0613952R10	24K
R3521	0613952R05	15K
R3523	0613952R10	24K
R3524	0613952Q67	560
R3525	0613952R25	100K
R3526	0613952R66	0
R3528	0613952R09	22K
R3529	0613952Q42	51
R3530	NOT PLACED	–
R3532	0613952Q49	100
R3533	0613952R10	24K
R3534	0613952R01	10K
R3535	0613952Q67	560
R3536	0613952R25	100K
R3537	0613952R66	0
R3538	0613952R15	39K
R3539	0613952R10	24K
R3540	0613952Q49	100
R3541	0613952R10	24K
R3542	0613952R10	24K
R3544	0613952R10	24K
R3545	0613952Q49	100
R3546	0613952R05	15K
R3547	0613952Q67	560
R3548	0613952J25	100K
R3549	0613952R12	30K

Circuit Ref	Motorola Part No	Description
R3550	0613952R23	82K
R3551	0613952R01	10K
R3552	0613952R01	10K
R3553	0613952R01	10K
R3554	0613952R17	47K
R3555	0613952R01	10K
R3556	0613952R17	47K
R3558	0613952R01	10K
R3559	0613952R01	10K
R3560	0613952R17	47K
R3569	0613952Q73	1K
R3571	0613952Q80	2K
R3572	0613952R01	10K
R3573	0613952R01	10K
R3574	0613952R01	10K
R3575	0613952Q73	1K
R3576	0613952Q49	100
R3577	0613952N42	26.7K
R3578	0613952R32	200K
R3579	0613952R01	10K
R3580	0613952R01	10K
R3581	0613952R01	10K
R3582	0613952N21	16.2K
R3583	0613952N21	16.2K
R3584	0613952R09	22K
R3585	0613952R09	22K
R3586	0613952R66	0
R3587	NOT PLACED	–
R3588	0613952N69	51.1K
R3591	0613952Q81	2.2K

Circuit Ref	Motorola Part No	Description
R3592	0613952Q81	2.2K
R3593	0613952R32	200K
R3594	0613952Q85	3.3K
R3595	0613952R01	10K
R3596	0613952H53	150
R4000	NOT PLACED	–
R4001	0613952Q37	33
R4002	0613952Q37	33
R4003	0613952Q37	33
R4004	0613952Q37	33
R4005	0613952Q37	33
R4006	0613952Q65	470
R4009	0613952Q42	51
R4010	0613952Q42	51
R4011	0613952R66	0
R4012	0613952R66	0
R4023	0613952Q75	1.2K
R4030	NOT PLACED	–
R4031	0613952R01	10K
R4032	0613952R01	10K
R4033	NOT PLACED	–
R4034	0613952R01	10K
R4035	0613952R01	10K
R4040	0613952Q89	4.7K
R4041	0613952Q89	4.7K
R4042	0613952Q89	4.7K
R4043	0613952Q89	4.7K
R4044	0613952Q89	4.7K
R4045	0613952Q89	4.7K
R4046	0613952Q89	4.7K

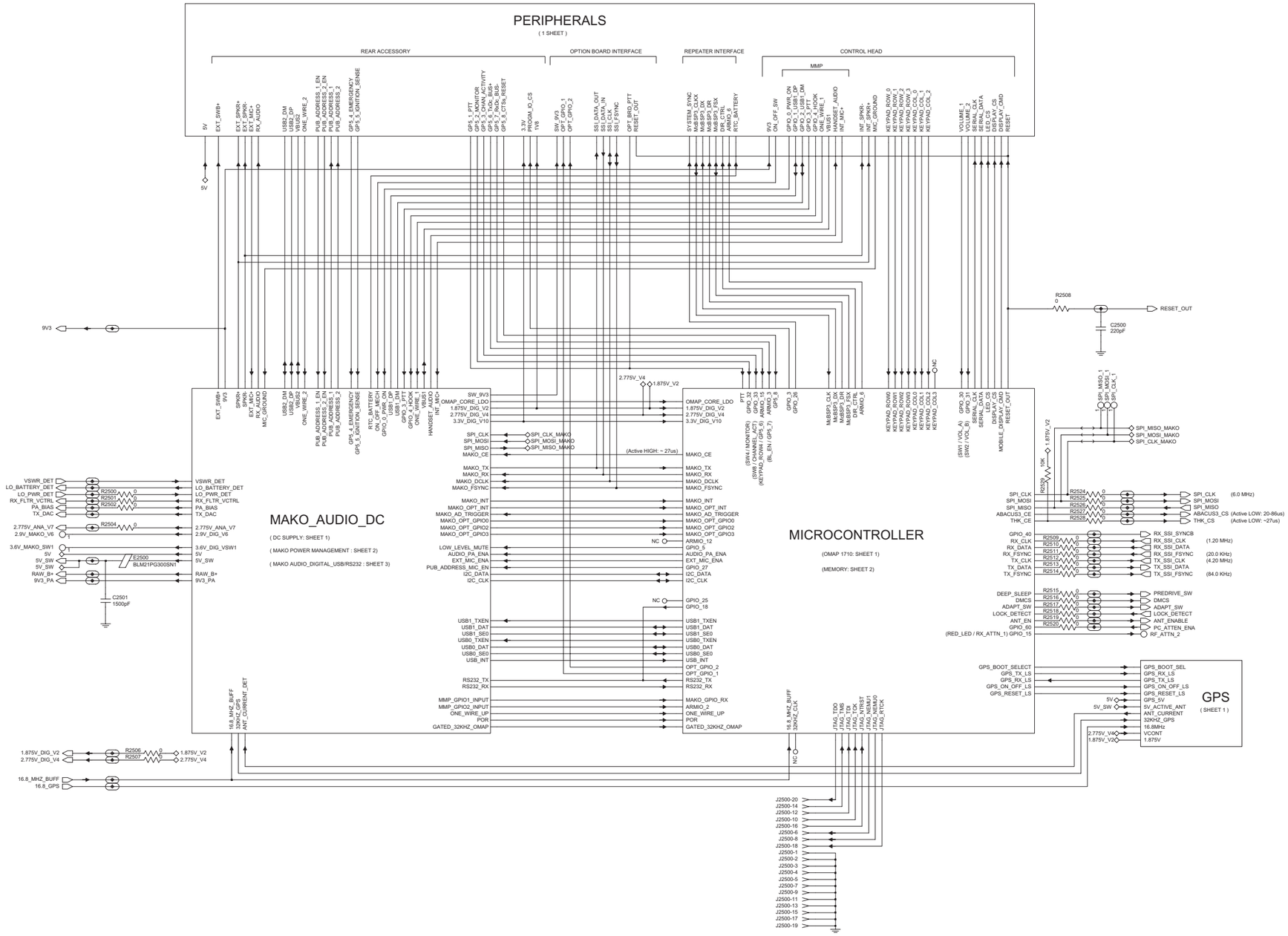
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R4047	0613952Q89	4.7K
R4048	0613952Q77	1.5K
R4049	0613958H83	2.7K
R4050	0613952R01	10K
R4051	0613952R39	390K
R4054	0613952R01	10K
R4055	0613952R01	10K
R4061	0613952Q37	33
R4063	0613952Q37	33
R4064	0613952Q37	33
R4065	0613952Q37	33
R4066	0613952Q37	33
R4067	0613952Q37	33
R4068	0613952Q37	33
R4069	0613952Q37	33
R4070	0613952Q37	33
R4071	0613952R66	0
R4074	0613952R66	0
R4076	0613952R66	0
R4078	0613952R66	0
R4079	0613952R01	10K
R4080	0613952R66	0
R4081	0613952R66	0
R4082	0613952R66	0
R4083	0613952R66	0
R4085	0613952R66	0
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R4088	0613952R01	10K
R4089	0613952R17	47K
R4090	0613952R66	0

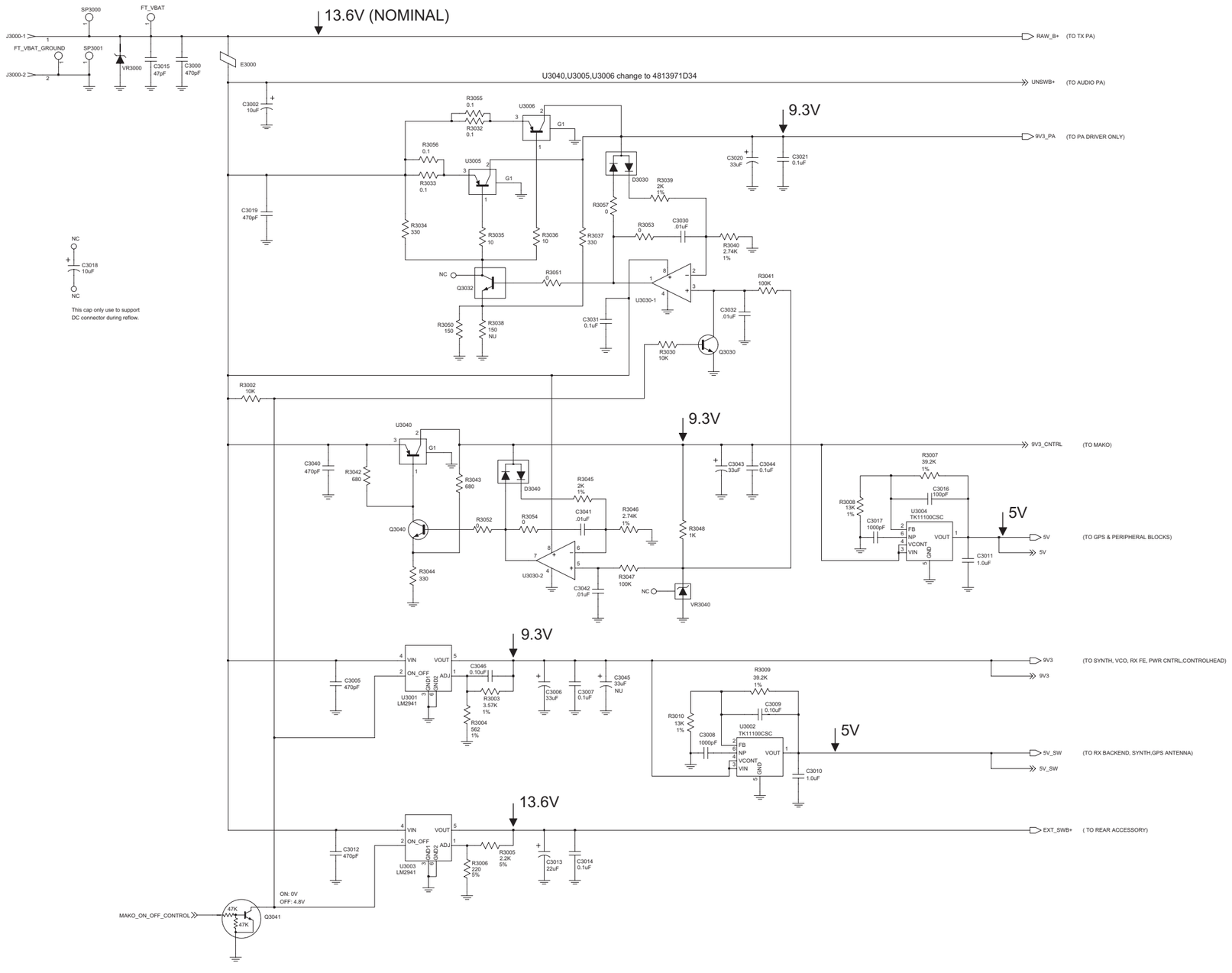
Circuit Ref	Motorola Part No	Description
R4093	0613952R66	0
R4094	0613952R66	0
R4095	0613952R66	0
R4096	0613952R66	0
R4097	0613952R66	0
R4098	0613952Q89	4.7K
R4099	0613952R66	0
R4100	0613952Q75	1.2K
R4101	0613952Q75	1.2K
R4103	0613952Q75	1.2K
R4105	0613952R01	10K
R4106	0613952R01	10K
RT3500	0615471H01	THERMISTOR, 10K
SP3000	1015349H03	SOLDER_PREFORM
SP3001	1015349H03	SOLDER_PREFORM
U1000	5102495J13	MICROPROCESSOR
U1006	5115001H02	IC, DUAL UNBUFFERED INVERTER
U2000	0104024J27	IC, 8MB FLASH
U2001	5171614M01	IC, 16MB SDRAM
U3001	5164015H94	VOLTAGE REGULATOR
U3002	5115391H01	VOLTAGE REGULATOR
U3003	5164015H94	VOLTAGE REGULATOR
U3004	5115391H01	VOLTAGE REGULATOR
U3005	0105959T72	PNP
U3006	0105959T72	PNP
U3030	5116525H01	DUAL OPAMP
U3040	0105959T72	PNP
U3200	5185143E77	IC, POWER MANAGEMENT

Circuit Ref	Motorola Part No	Description
U3201	5115616H01	VOLTAGE REGULATOR
U3202	5115453H01	DUAL OPAMP
U3203	5114007A43	IC, SCHMITT TRIGGER
U3500	5102463J95	AUDIO PA
U3501	5115368H01	DIGITAL ATTENUATOR
U3502	5114016A18	QUAD OPAMP
U3503	5164852H47	IC, LEVEL TRANSLATOR
U3504	5171395L01	IC, CMOS SWITCH
U3505	5114016A18	QUAD OPAMP
U3508	5164852H47	IC, LEVEL TRANSLATOR
U4000	5115476H01	IC, SERIAL-TO-PARALLEL CONVERTER
U4001	5115502H01	LOGIC TRANSLATOR
U4004	5115865H01	IC, BUFFER
U4005	5115865H01	IC, BUFFER
U4006	5115865H01	IC, BUFFER
U4007	5115865H01	IC, BUFFER
U4008	5115865H01	IC, BUFFER
U4009	5115865H01	IC, BUFFER
U4010	5115865H01	IC, BUFFER
VR3000	4813979C17	TRANSIENT SUPPRESSOR
VR3040	4813977M10	DIODE, 5.1V ZENER
VR3200	4813977M10	DIODE, 5.1V ZENER
VR3201	4813977M05	DIODE, 3.3V ZENER
VR3202	4813977M05	DIODE, 3.3V ZENER
VR3203	4813977M05	DIODE, 3.3V ZENER
VR3204	4813977M13	DIODE, 6.2V ZENER
VR3205	4813977M05	DIODE, 3.3V ZENER

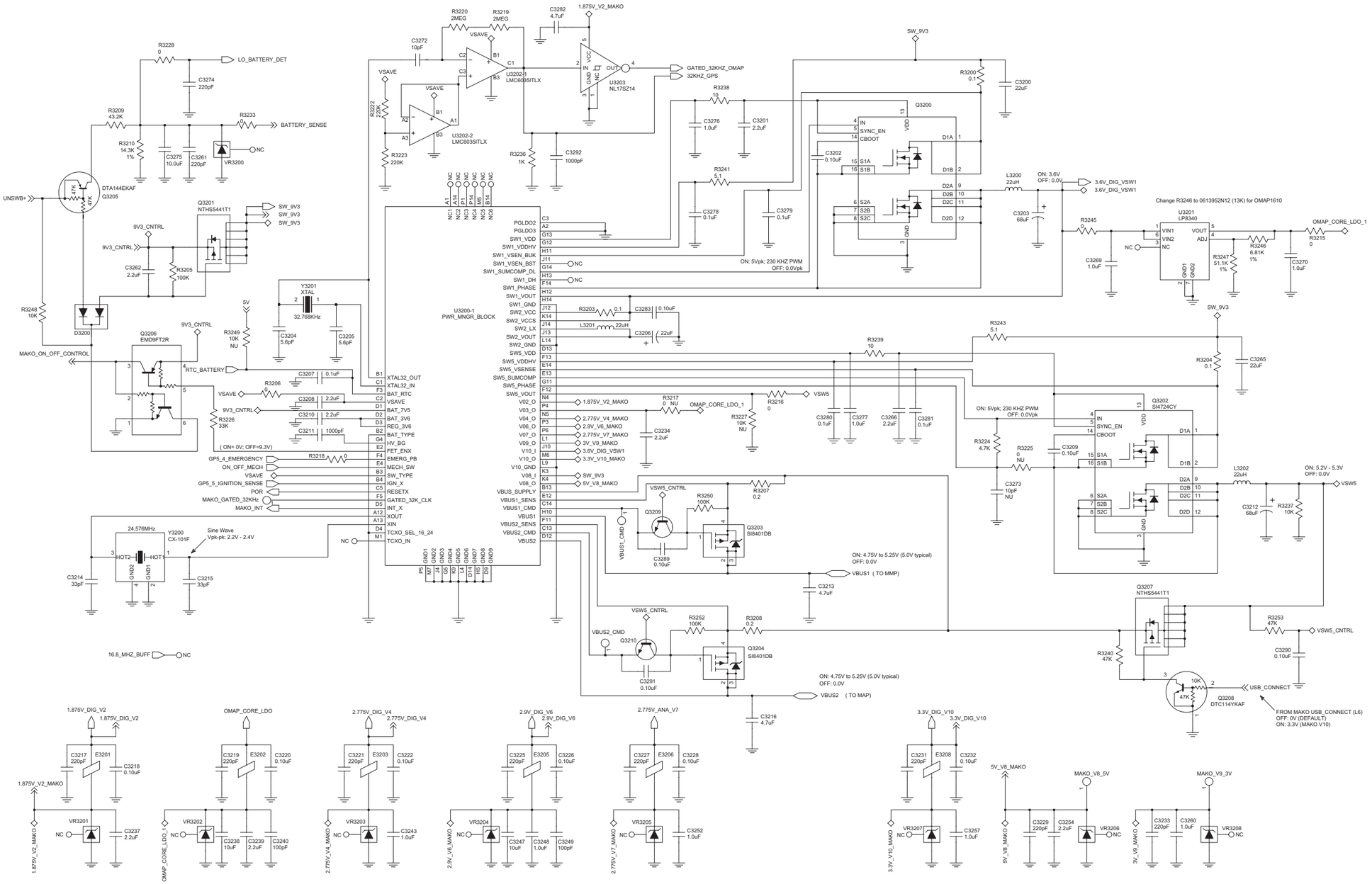
Circuit Ref	Motorola Part No	Description
VR3206	4813977M13	DIODE, 6.2V ZENER
VR3207	4813977M13	DIODE, 6.2V ZENER
VR3208	4813977M13	DIODE, 6.2V ZENER
VR3502	4813977A48	DIODE, 20V ZENER
VR3503	4813977A48	DIODE, 20V ZENER
VR3504	4813977A48	DIODE, 20V ZENER
VR4000	4813977A48	DIODE, 20V ZENER
VR4001	4813977A48	DIODE, 20V ZENER
VR4002	4813977A48	DIODE, 20V ZENER
VR4003	4813977A48	DIODE, 20V ZENER
VR4004	4813977A48	DIODE, 20V ZENER
VR4005	4813977M13	DIODE, 6.2V ZENER
VR4006	4813977M13	DIODE, 6.2V ZENER
VR4007	NOT PLACED	–
VR4008	NOT PLACED	–
Y1000	4809612J45	12 MHZ CRYSTAL
Y3200	4815028H01	24.576 MHZ CRYSTAL
Y3201	4802582S80	32 KHZ CRYSTAL

5.0 Controller R5 Schematic Diagrams

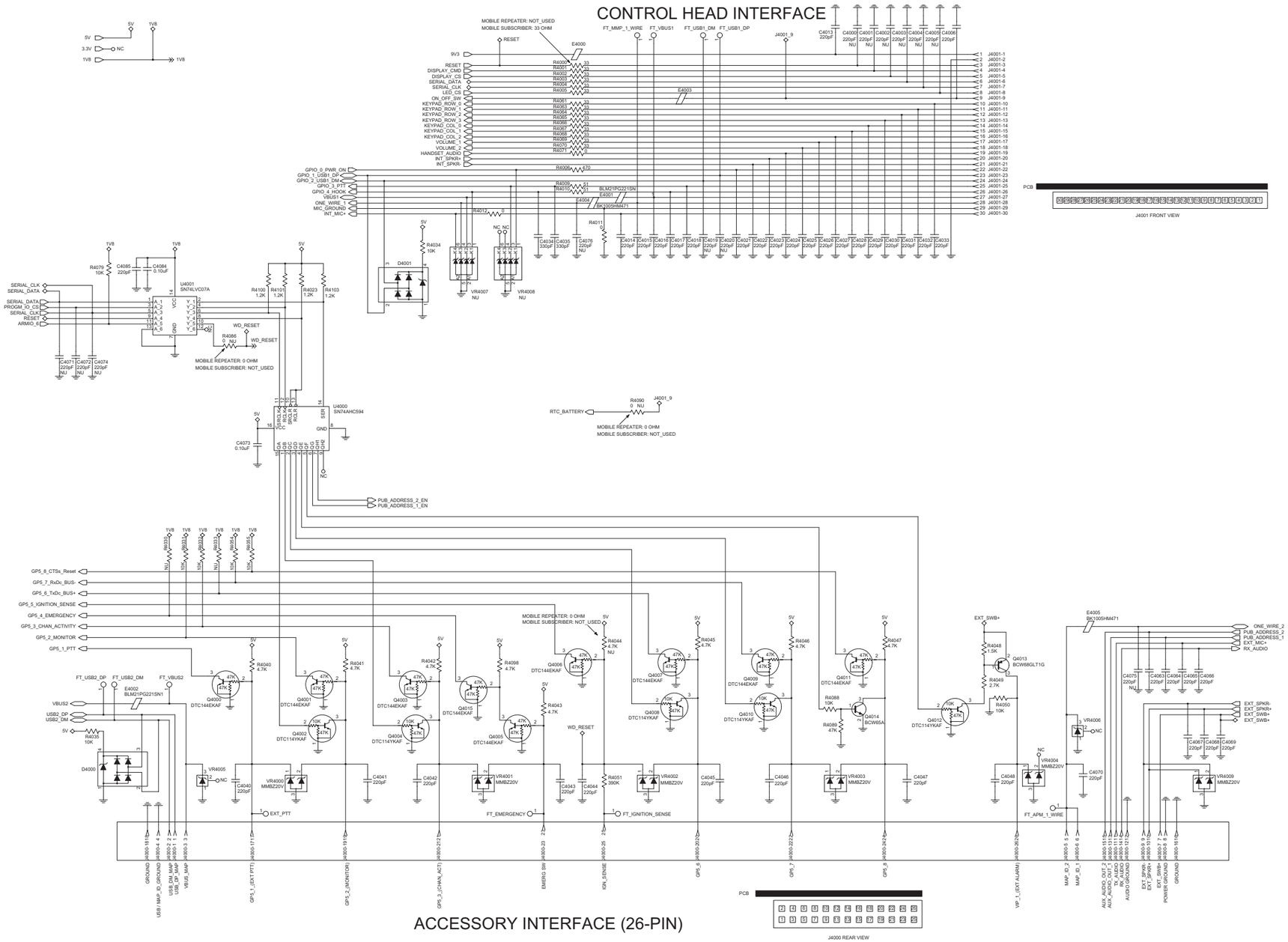




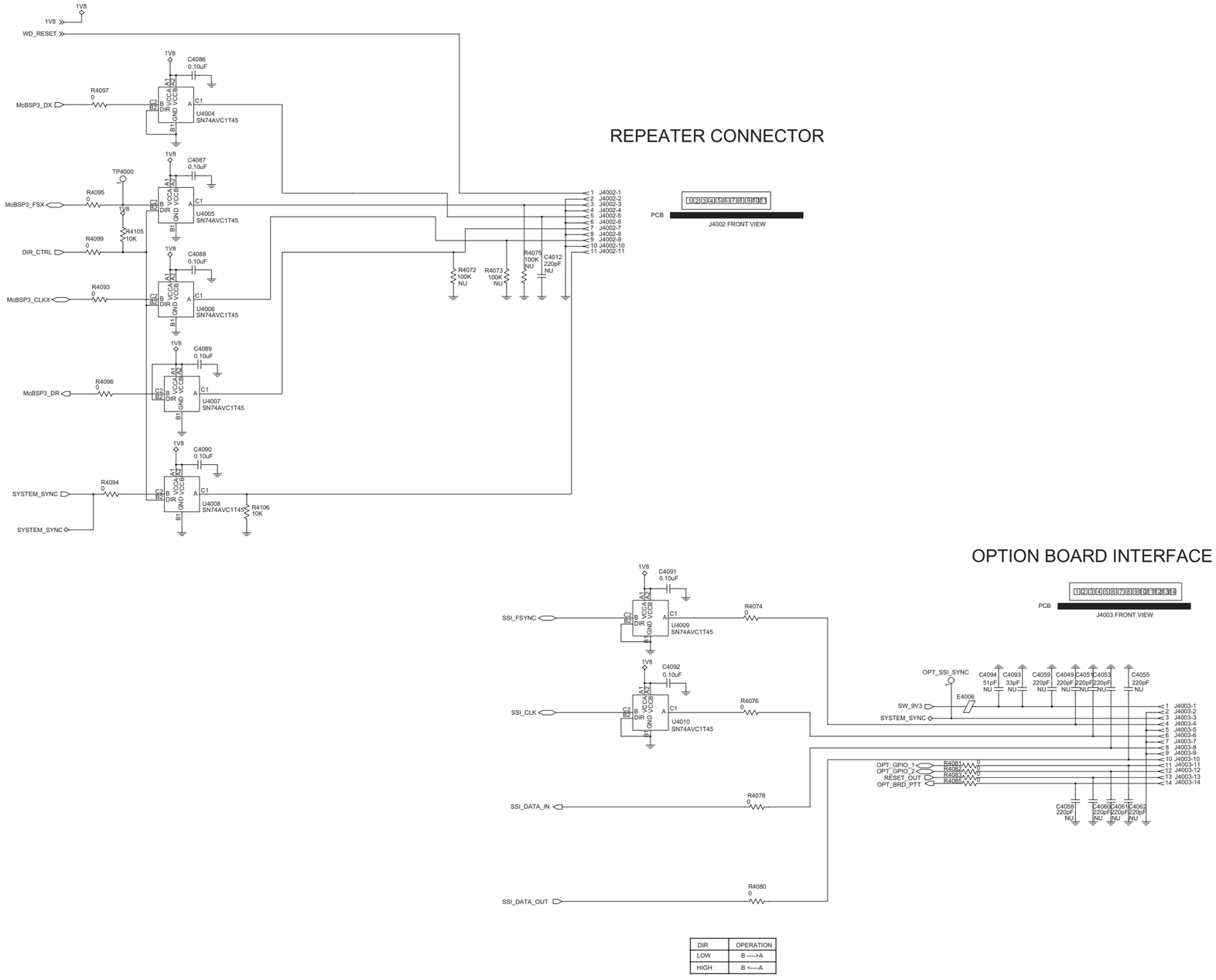
Controller DC Supply Schematic Diagram



Controller DC Distribution Schematic Diagram

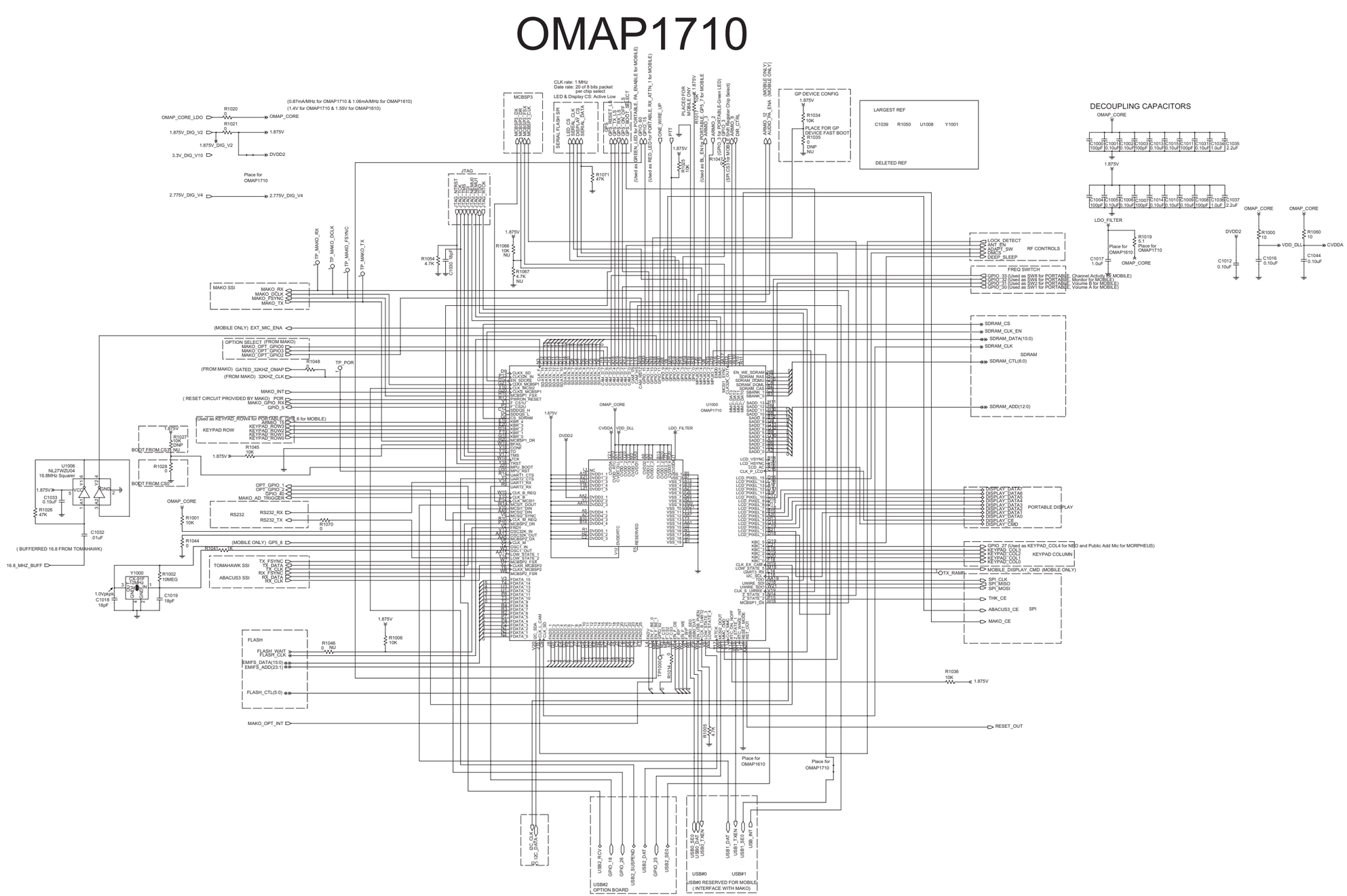


Controller Peripheral Schematic Diagram (sheet 1 of 2)

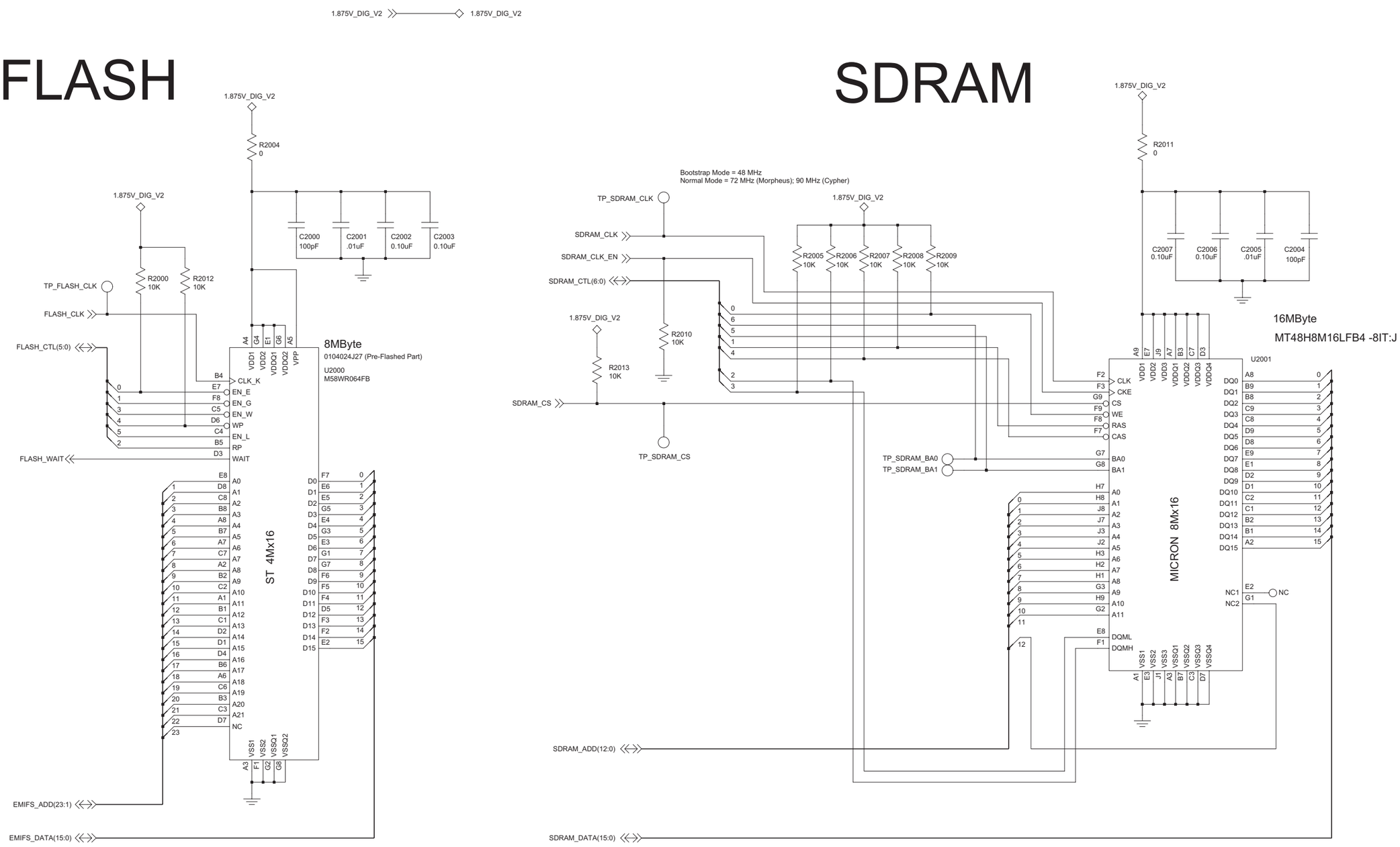


DIR	OPERATION
LOW	B ----->A
HIGH	B <-----A

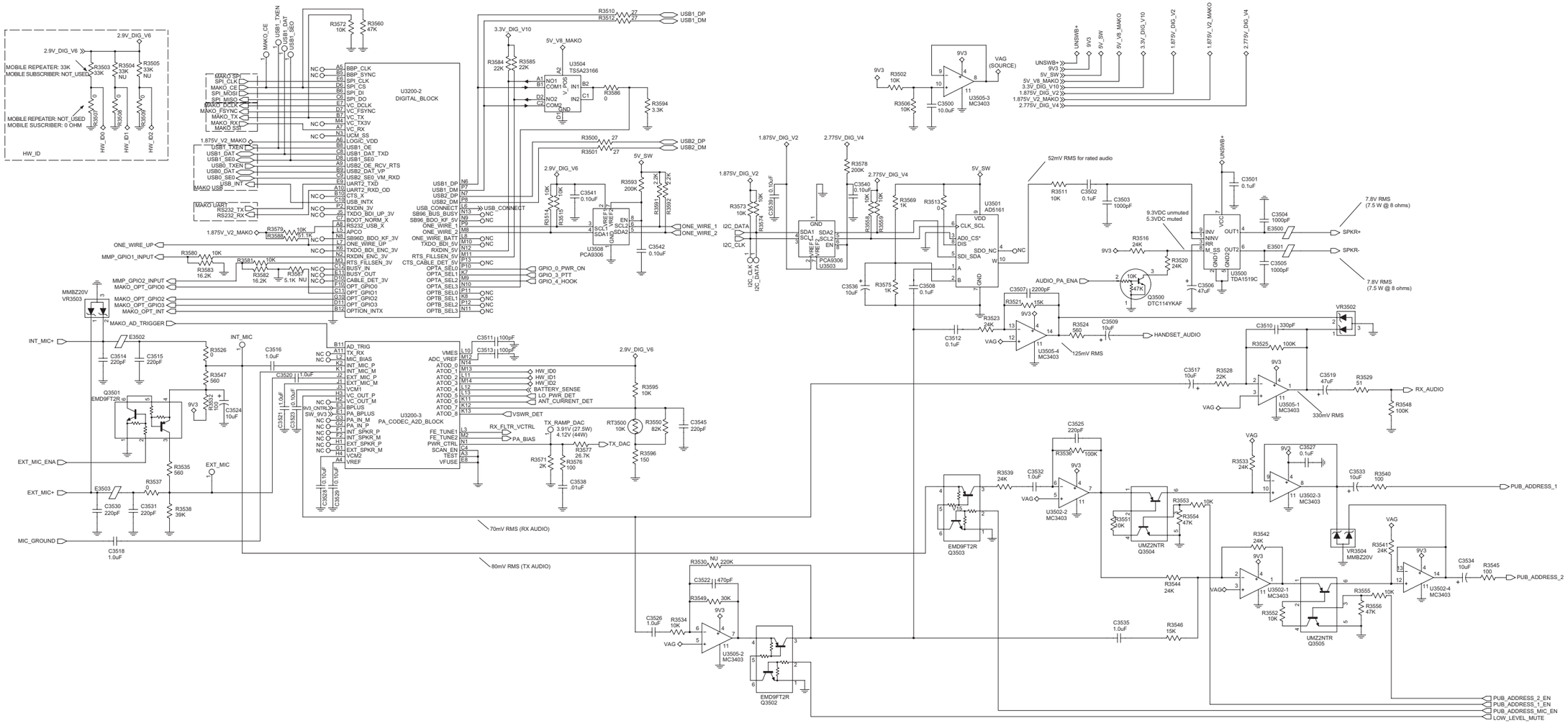
Controller Peripheral Schematic Diagram (sheet 2 of 2)



Controller Microprocessor Schematic Diagram



Controller Memories Schematic Diagram



Controller Audio and USB Schematic Diagram

5.1 Controller R5 Parts List

Circuit Ref	Motorola Part No	Description
C1000	2113944A40	100pF
C1001	2113945Y02	0.10uF
C1002	2113945Y02	0.10uF
C1003	2113944A40	100pF
C1004	2113944A40	100pF
C1005	2113945Y02	0.10uF
C1006	2113945Y02	0.10uF
C1007	2113944A40	100pF
C1008	2113944A40	100pF
C1009	2113945Y02	0.10uF
C1010	2113945Y02	0.10uF
C1011	2113944A40	100pF
C1012	2113945Y02	0.10uF
C1013	2113945Y02	0.10uF
C1014	2113945Y02	0.10uF
C1015	2113945Y02	0.10uF
C1016	2113945Y02	0.10uF
C1017	2113946E02	1.0uF
C1018	2113944A28	18pF
C1019	2113944A28	18pF
C1030	2113944A28	18pF
C1031	2113945Y02	0.10uF
C1032	2113945B02	.01uF
C1033	2113945Y02	0.10uF
C1034	2113946S35	1.0uF
C1035	2113946D05	2.2uF
C1036	2113946S35	1.0uF
C1037	2113946D05	2.2uF
C1044	2113945Y02	0.10uF

Circuit Ref	Motorola Part No	Description
C2000	2113944A40	100pF
C2001	2113945B02	.01uF
C2002	2113945Y02	0.10uF
C2003	2113945Y02	0.10uF
C2004	2113944A40	100pF
C2005	2113945B02	.01uF
C2006	2113945Y02	0.10uF
C2007	2113945Y02	0.10uF
C2500	2113944A44	220pF
C2501	2113945A10	1500pF
C3000	2113944C06	470pF
C3002	2371403L02	10uF
C3005	2113944C06	470pF
C3006	2314030E85	33uF
C3007	2113945C31	0.1uF
C3008	2113945A09	1000pF
C3009	2113945Y02	0.10uF
C3010	2113946S35	1.0uF
C3011	2113946S35	1.0uF
C3012	2113944C06	470pF
C3013	2314030J28	22uF
C3014	2113945C31	0.1uF
C3015	2113944C38	47pF
C3016	2113944A40	100pF
C3017	2113945A09	1000pF
C3018	2389289U01	10uF
C3019	2113944C06	470pF
C3020	2314030E85	33uF
C3021	2113945C31	0.1uF
C3030	2113945C02	.01uF

Circuit Ref	Motorola Part No	Description
C3031	2113945C31	0.1uF
C3032	2113945B02	.01uF
C3040	2113944C06	470pF
C3041	2113945C02	.01uF
C3042	2113945B02	.01uF
C3043	2314030E85	33uF
C3044	2113945C31	0.1uF
C3045	NOT PLACED	–
C3046	2113945Y02	0.10uF
C3200	2113946J04	22uF
C3201	2113946D05	2.2uF
C3202	2113945Y02	0.10uF
C3203	2316410H02	68uF
C3204	2115153H21	5.6pF
C3205	2115153H21	5.6pF
C3206	2316410H01	22uF
C3207	2113945C31	0.1uF
C3208	2113946D05	2.2uF
C3209	2113945Y02	0.10uF
C3210	2113946D05	2.2uF
C3211	2113945A09	1000pF
C3212	2316410H02	68uF
C3213	2113946F03	4.7uF
C3214	2115153H45	33pF
C3215	2115153H45	33pF
C3216	2113946F03	4.7uF
C3217	2113944A44	220pF
C3218	2113945Y02	0.10uF
C3219	2113944A44	220pF
C3220	2113945Y02	0.10uF

Circuit Ref	Motorola Part No	Description
C3221	2113944A44	220pF
C3222	2113945Y02	0.10uF
C3225	2113944A44	220pF
C3226	2113945Y02	0.10uF
C3227	2113944A44	220pF
C3228	2113945Y02	0.10uF
C3229	2113944A44	220pF
C3231	2113944A44	220pF
C3232	2113945Y02	0.10uF
C3233	2113944A44	220pF
C3234	2113946D05	2.2uF
C3237	2113946D05	2.2uF
C3238	2113946H02	10uF
C3239	2113946D05	2.2uF
C3240	2113944C45	100pF
C3243	2113946S35	1.0uF
C3247	2113946H02	10uF
C3248	2113946S35	1.0uF
C3249	2113944C45	100pF
C3252	2113946S35	1.0uF
C3254	2113946D05	2.2uF
C3257	2113946S35	1.0uF
C3260	2113946S35	1.0uF
C3261	2113944A44	220pF
C3262	2113946N03	2.2uF
C3265	2113946J04	22uF
C3266	2113946D05	2.2uF
C3269	2113946S35	1.0uF
C3270	2113946S35	1.0uF
C3272	2115153H27	10pF

Circuit Ref	Motorola Part No	Description
C3273	NOT PLACED	–
C3274	2113944A44	220pF
C3275	2113946J03	10.0uF
C3276	2113946S35	1.0uF
C3277	2113946S35	1.0uF
C3278	2113945C31	0.1uF
C3279	2113945C31	0.1uF
C3280	2113945C31	0.1uF
C3281	2113945C31	0.1uF
C3282	2113946F03	4.7uF
C3283	2113945Y02	0.10uF
C3289	2113945Y02	0.10uF
C3290	2113945Y02	0.10uF
C3291	2113945Y02	0.10uF
C3292	2113945A09	1000pF
C3500	2113946J03	10.0uF
C3501	2113945G91	0.1uF
C3502	2113945C31	0.1uF
C3503	2113945A09	1000pF
C3504	2113945A09	1000pF
C3505	2113945A09	1000pF
C3506	2314030F30	47uF
C3507	2113945A11	2200pF
C3508	2113945C31	0.1uF
C3509	2313960D07	10uF
C3510	2113945A03	330pF
C3511	2113944A40	100pF
C3512	2113945C31	0.1uF
C3513	2113944A40	100pF
C3514	2113944A44	220pF

Circuit Ref	Motorola Part No	Description
C3515	2113944A44	220pF
C3516	2113946S35	1.0uF
C3517	2314030M51	10uF
C3518	2113946S35	1.0uF
C3519	2314030F30	47uF
C3520	2113946S35	1.0uF
C3521	2113946S35	1.0uF
C3522	2113945A05	470pF
C3523	2113945Y02	0.10uF
C3524	2313960D07	10uF
C3525	2113944A44	220pF
C3526	2113946S35	1.0uF
C3527	2113945C31	0.1uF
C3528	2113945Y02	0.10uF
C3529	2113945Y02	0.10uF
C3530	2113944A44	220pF
C3531	2113944A44	220pF
C3532	2113946S35	1.0uF
C3533	2313960D07	10uF
C3534	2313960D07	10uF
C3535	2113946S35	1.0uF
C3536	2314030M51	10uF
C3538	2113945B02	.01uF
C3539	2113945Y02	0.10uF
C3540	2113945Y02	0.10uF
C3541	2113945Y02	0.10uF
C3542	2113945Y02	0.10uF
C3545	2113944A44	220pF
C4000	NOT PLACED	–
C4001	NOT PLACED	–

Circuit Ref	Motorola Part No	Description
C4002	NOT PLACED	–
C4003	NOT PLACED	–
C4004	NOT PLACED	–
C4005	NOT PLACED	–
C4006	2113944A44	220pF
C4012	NOT PLACED	–
C4013	2113944A44	220pF
C4014	2113944A44	220pF
C4015	2113944A44	220pF
C4016	2113944A44	220pF
C4017	2113944A44	220pF
C4018	2113944A44	220pF
C4019	NOT PLACED	–
C4020	NOT PLACED	–
C4021	2113944A44	220pF
C4022	2113944A44	220pF
C4023	2113944A44	220pF
C4024	2113944A44	220pF
C4025	2113944A44	220pF
C4026	2113944A44	220pF
C4027	2113944A44	220pF
C4028	2113944A44	220pF
C4029	2113944A44	220pF
C4030	2113944A44	220pF
C4031	2113944A44	220pF
C4032	2113944A44	220pF
C4033	2113944A44	220pF
C4034	2113945A03	330pF
C4035	2113945A03	330pF
C4040	2113944A44	220pF

Circuit Ref	Motorola Part No	Description
C4041	2113944A44	220pF
C4042	2113944A44	220pF
C4043	2113944A44	220pF
C4044	2113944A44	220pF
C4045	2113944A44	220pF
C4046	2113944A44	220pF
C4047	2113944A44	220pF
C4048	2113944A44	220pF
C4049	NOT PLACED	–
C4051	NOT PLACED	–
C4053	NOT PLACED	–
C4055	NOT PLACED	–
C4058	NOT PLACED	–
C4059	NOT PLACED	–
C4060	NOT PLACED	–
C4061	NOT PLACED	–
C4062	NOT PLACED	–
C4063	2113944A44	220pF
C4064	2113944A44	220pF
C4065	2113944A44	220pF
C4066	2113944A44	220pF
C4067	2113944A44	220pF
C4068	2113944A44	220pF
C4069	2113944A44	220pF
C4070	2113944A44	220pF
C4071	NOT PLACED	–
C4072	NOT PLACED	–
C4073	2113945Y02	0.10uF
C4074	NOT PLACED	–
C4075	NOT PLACED	–

Circuit Ref	Motorola Part No	Description
C4076	NOT PLACED	–
C4084	2113945Y02	0.10uF
C4085	2113944A44	220pF
C4086	2113945Y02	0.10uF
C4087	2113945Y02	0.10uF
C4088	2113945Y02	0.10uF
C4089	2113945Y02	0.10uF
C4090	2113945Y02	0.10uF
C4091	2113945Y02	0.10uF
C4092	2113945Y02	0.10uF
C4093	NOT PLACED	–
C4094	NOT PLACED	–
D3030	4813978P07	DIODE, SWITCHING
D3040	4813978P07	DIODE, SWITCHING
D3200	4813978C02	DIODE, SWITCHING
D4000	4866544A01	DIODE, DUAL
D4001	4866544A01	DIODE, DUAL
E2500	2480675U01	FERRITE BEAD
E3000	2485011Y01	FERRITE BEAD
E3201	2480675U01	FERRITE BEAD
E3202	2480675U01	FERRITE BEAD
E3203	2480675U01	FERRITE BEAD
E3205	2480675U01	FERRITE BEAD
E3206	2480675U01	FERRITE BEAD
E3208	2480675U01	FERRITE BEAD
E3500	2485011Y01	FERRITE BEAD
E3501	2485011Y01	FERRITE BEAD
E3502	2485011Y01	FERRITE BEAD
E3503	2485011Y01	FERRITE BEAD
E4000	2485011Y01	FERRITE BEAD

Circuit Ref	Motorola Part No	Description
E4001	7686949J14	FERRITE BEAD
E4002	7686949J14	FERRITE BEAD
E4003	NOT PLACED	–
E4004	2409134J25	FERRITE BEAD
E4005	2409134J25	FERRITE BEAD
E4006	2409134J25	FERRITE BEAD
J2500	NOT PLACED	–
J3000	0905902V09	DC POWER CONNECTOR
J4000	0916017H01	26-PIN ACCESSORY CONNECTOR
J4001	0915555H01	30-PIN CONTROL HEAD CONNECTOR
J4002	0915558H01	11-PIN REPEATER CONNECTOR
J4003	0915556H01	14-PIN OPT BRD CONNECTOR
L3200	2415005H02	22uH
L3201	2415005H02	22uH
L3202	2415005H02	22uH
Q3030	4813973M07	NPN
Q3032	4813973B01	NPN
Q3040	4813973M07	NPN
Q3041	4815263H01	ANALOG SWITCH
Q3200	5185956E76	N-CHANNEL SYN-CHRONOUS MOSFET
Q3201	4813970A62	P-CHANNEL MOSFET
Q3202	5185956E76	N-CHANNEL SYN-CHRONOUS MOSFET
Q3203	4805585Q23	PMOS FET
Q3204	4805585Q23	PMOS FET
Q3205	4815262H01	ANALOG SWITCH
Q3206	4815272H01	ANALOG SWITCH

Circuit Ref	Motorola Part No	Description
Q3207	4813970A62	P-CHANNEL MOSFET
Q3208	4815261H01	ANALOG SWITCH
Q3209	4813973M07	NPN
Q3210	4813973M07	NPN
Q3500	4815261H01	ANALOG SWITCH
Q3501	4815272H01	ANALOG SWITCH
Q3502	4815272H01	ANALOG SWITCH
Q3503	4815272H01	ANALOG SWITCH
Q3504	4815270H01	ANALOG SWITCH
Q3505	4815270H01	ANALOG SWITCH
Q4000	4815263H01	ANALOG SWITCH
Q4001	4815263H01	ANALOG SWITCH
Q4002	4815261H01	ANALOG SWITCH
Q4003	4815263H01	ANALOG SWITCH
Q4004	4815261H01	ANALOG SWITCH
Q4005	4815263H01	ANALOG SWITCH
Q4006	4815263H01	ANALOG SWITCH
Q4007	4815263H01	ANALOG SWITCH
Q4008	4815261H01	ANALOG SWITCH
Q4009	4815263H01	ANALOG SWITCH
Q4010	4815261H01	ANALOG SWITCH
Q4011	4815263H01	ANALOG SWITCH
Q4012	4815261H01	ANALOG SWITCH
Q4013	4816023H01	PNP
Q4014	4813973A06	NPN
Q4015	4815263H01	ANALOG SWITCH
R1000	0613952Q25	10
R1001	0613952R01	10K
R1002	0613952J73	10MEG
R1005	0613952Q89	4.7K

Circuit Ref	Motorola Part No	Description
R1006	0613952R01	10K
R1014	0613952R66	0
R1017	0613952R01	10K
R1019	0613952Q18	5.1
R1020	0613952R66	0
R1021	0613952R66	0
R1025	0613952R01	10K
R1026	0613952R17	47K
R1027	NOT PLACED	–
R1028	0613952R66	0
R1034	0613952R01	10K
R1035	NOT PLACED	–
R1036	0613952R01	10K
R1041	0613952Q73	1K
R1044	0613952R66	0
R1045	0613952R01	10K
R1046	NOT PLACED	
R1047	0613952R66	0
R1048	0613952R66	0
R1054	0613952Q89	4.7K
R1060	0613952Q25	10
R1066	NOT PLACED	–
R1067	NOT PLACED	–
R1070	0613952R66	0
R1071	0613952R17	47K
R2000	0613952R01	10K
R2004	0613952R66	0
R2005	0613952R01	10K
R2006	0613952R01	10K
R2007	0613952R01	10K

Circuit Ref	Motorola Part No	Description
R2008	0613952R01	10K
R2009	0613952R01	10K
R2010	0613952R01	10K
R2011	0613952R66	0
R2012	0613952R01	10K
R2013	0613952R01	10K
R2500	0613952R66	0
R2501	0613952R66	0
R2502	0613952R66	0
R2504	0613952R66	0
R2506	0613952R66	0
R2507	0613952R66	0
R2508	0613952R66	0
R2509	0613952R66	0
R2510	0613952R66	0
R2511	0613952R66	0
R2512	0613952R66	0
R2513	0613952R66	0
R2514	0613952R66	0
R2515	0613952R66	0
R2516	0613952R66	0
R2517	0613952R66	0
R2518	0613952R66	0
R2519	0613952R66	0
R2520	0613952R66	0
R2524	0613952R66	0
R2525	0613952R66	0
R2526	0613952R66	0
R2527	0613952R66	0
R2528	0613952R66	0

Circuit Ref	Motorola Part No	Description
R2529	0613952R01	10K
R3002	0613952R01	10K
R3003	0613952M54	3.57K
R3004	0613952L73	562
R3005	0613952Q81	2.2K
R3006	0613952Q57	220
R3007	0613952N58	39.2K
R3008	0613952N12	13K
R3009	0613952N58	39.2K
R3010	0613952N12	13K
R3030	0613952R01	10K
R3032	0615871H01	0.1
R3033	0615871H01	0.1
R3034	0613952H61	330
R3035	0613952H25	10
R3036	0613952H25	10
R3037	0613959G61	330
R3038	NOT PLACED	–
R3039	0613952M30	2K
R3040	0613952M43	2.74K
R3041	0613952R25	100K
R3042	0613952H69	680
R3043	0613952H69	680
R3044	0613958S61	330
R3045	0613952M30	2K
R3046	0613952M43	2.74K
R3047	0613952R25	100K
R3048	0613952Q73	1K
R3050	0613959Q53	150
R3051	0613952G67	0

Circuit Ref	Motorola Part No	Description
R3052	0613952G67	0
R3053	0613952R66	0
R3054	0613952R66	0
R3055	0615871H01	0.1
R3056	0615871H01	0.1
R3057	0613952R66	0
R3200	0615871H01	0.1
R3203	0615871H01	0.1
R3204	0615871H01	0.1
R3205	0613952R25	100K
R3206	0613952R66	0
R3207	0686135Z02	0.2
R3208	0686135Z02	0.2
R3209	0613952N62	43.2K
R3210	0613952N16	14.3K
R3215	0613952G67	0
R3216	0613952G67	0
R3217	NOT PLACED	–
R3218	0613952R66	0
R3219	0613952R56	2MEG
R3220	0613952R56	2MEG
R3222	0613952R33	220K
R3223	0613952R33	220K
R3224	0613952Q89	4.7K
R3225	NOT PLACED	–
R3226	0613952R13	33K
R3227	NOT PLACED	–
R3228	0613952G67	0
R3233	0613952R66	0
R3236	0613952Q73	1K

Circuit Ref	Motorola Part No	Description
R3237	0613952R01	10K
R3238	0613952H25	10
R3239	0613952H25	10
R3240	0613952R17	47K
R3241	0613952Q18	5.1
R3243	0613952Q18	5.1
R3245	0613952G67	0
R3246	0613952M81	6.81K
R3247	0613952N69	51.1K
R3248	0613952R01	10K
R3249	NOT PLACED	–
R3250	0613952R25	100K
R3252	0613952R25	100K
R3253	0613952R17	47K
R3500	0613952Q35	27
R3501	0613952Q35	27
R3502	0613952R01	10K
R3503	0613952R13	33K
R3504	NOT PLACED	–
R3505	NOT PLACED	–
R3506	0613952R01	10K
R3507	NOT PLACED	–
R3508	0613952R66	0
R3509	0613952R66	0
R3510	0613952Q35	27
R3511	0613952R01	10K
R3512	0613952Q35	27
R3513	0613952R66	0
R3514	0613952R01	10K
R3515	0613952R01	10K

Circuit Ref	Motorola Part No	Description
R3516	0613952R10	24K
R3520	0613952R10	24K
R3521	0613952R05	15K
R3523	0613952R10	24K
R3524	0613952Q67	560
R3525	0613952R25	100K
R3526	0613952R66	0
R3528	0613952R09	22K
R3529	0613952Q42	51
R3530	NOT PLACED	–
R3532	0613952Q49	100
R3533	0613952R10	24K
R3534	0613952R01	10K
R3535	0613952Q67	560
R3536	0613952R25	100K
R3537	0613952R66	0
R3538	0613952R15	39K
R3539	0613952R10	24K
R3540	0613952Q49	100
R3541	0613952R10	24K
R3542	0613952R10	24K
R3544	0613952R10	24K
R3545	0613952Q49	100
R3546	0613952R05	15K
R3547	0613952Q67	560
R3548	0613952J25	100K
R3549	0613952R12	30K
R3550	0613952R23	82K
R3551	0613952R01	10K
R3552	0613952R01	10K

Circuit Ref	Motorola Part No	Description
R3553	0613952R01	10K
R3554	0613952R17	47K
R3555	0613952R01	10K
R3556	0613952R17	47K
R3558	0613952R01	10K
R3559	0613952R01	10K
R3560	0613952R17	47K
R3569	0613952Q73	1K
R3571	0613952Q80	2K
R3572	0613952R01	10K
R3573	0613952R01	10K
R3574	0613952R01	10K
R3575	0613952Q73	1K
R3576	0613952Q49	100
R3577	0613952N42	26.7K
R3578	0613952R32	200K
R3579	0613952R01	10K
R3580	0613952R01	10K
R3581	0613952R01	10K
R3582	0613952N21	16.2K
R3583	0613952N21	16.2K
R3584	0613952R09	22K
R3585	0613952R09	22K
R3586	0613952R66	0
R3587	NOT PLACED	–
R3588	0613952N69	51.1K
R3591	0613952Q81	2.2K
R3592	0613952Q81	2.2K
R3593	0613952R32	200K
R3594	0613952Q85	3.3K

Circuit Ref	Motorola Part No	Description
R3595	0613952R01	10K
R3596	0613952H53	150
R4000	NOT PLACED	–
R4001	0613952Q37	33
R4002	0613952Q37	33
R4003	0613952Q37	33
R4004	0613952Q37	33
R4005	0613952Q37	33
R4006	0613952Q65	470
R4009	0613952Q42	51
R4010	0613952Q42	51
R4011	0613952R66	0
R4012	0613952R66	0
R4023	0613952Q75	1.2K
R4030	NOT PLACED	–
R4031	0613952R01	10K
R4032	0613952R01	10K
R4033	NOT PLACED	–
R4034	0613952R01	10K
R4035	0613952R01	10K
R4040	0613952Q89	4.7K
R4041	0613952Q89	4.7K
R4042	0613952Q89	4.7K
R4043	0613952Q89	4.7K
R4044	0613952Q89	4.7K
R4045	0613952Q89	4.7K
R4046	0613952Q89	4.7K
R4047	0613952Q89	4.7K
R4048	0613952Q77	1.5K
R4049	0613958H83	2.7K

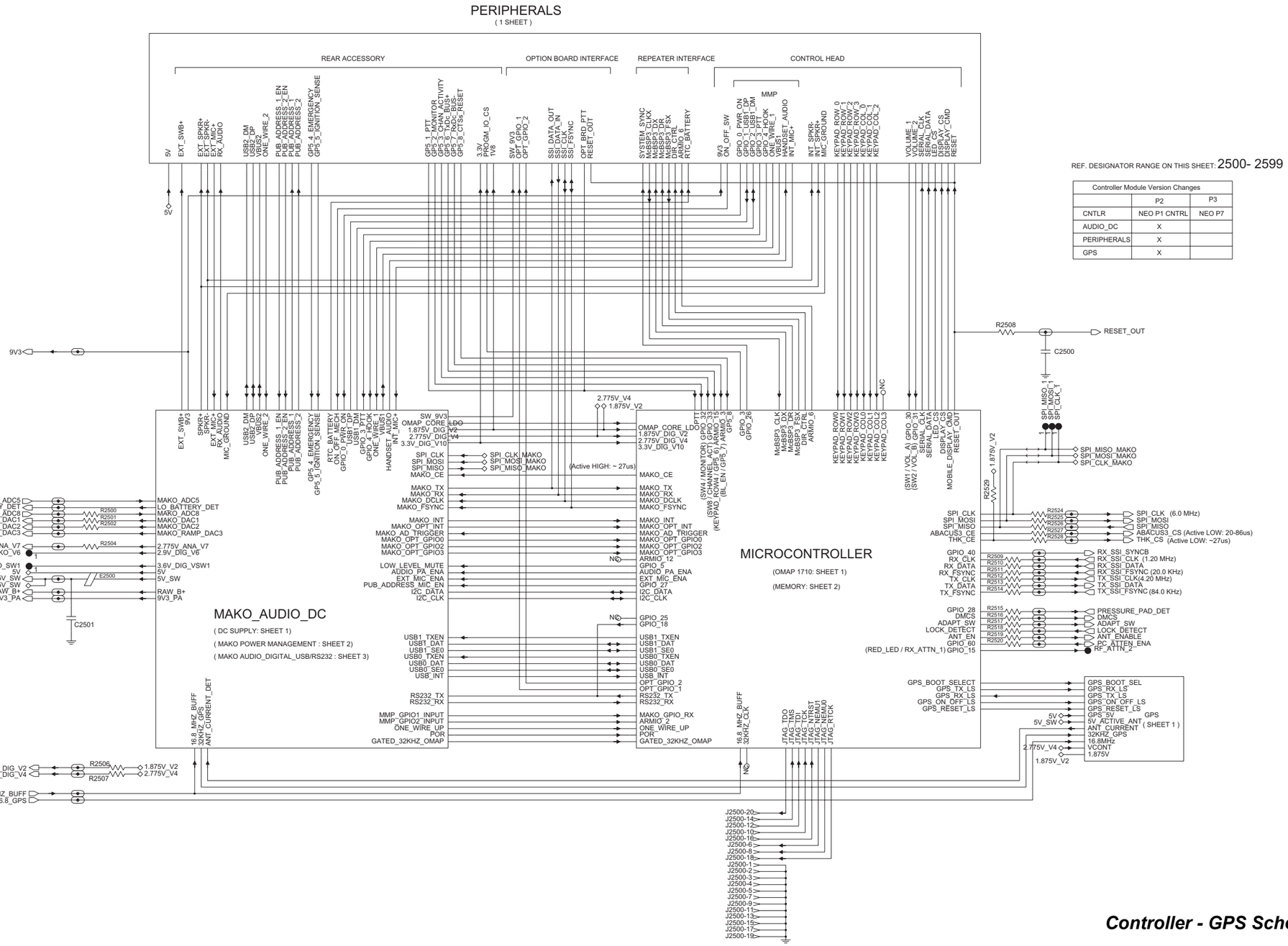
Circuit Ref	Motorola Part No	Description
R4050	0613952R01	10K
R4051	0613952R39	390K
R4054	0613952R01	10K
R4055	0613952R01	10K
R4061	0613952Q37	33
R4063	0613952Q37	33
R4064	0613952Q37	33
R4065	0613952Q37	33
R4066	0613952Q37	33
R4067	0613952Q37	33
R4068	0613952Q37	33
R4069	0613952Q37	33
R4070	0613952Q37	33
R4071	0613952R66	0
R4072	NOT PLACED	–
R4073	NOT PLACED	–
R4074	0613952R66	0
R4075	NOT PLACED	–
R4076	0613952R66	0
R4078	0613952R66	0
R4079	0613952R01	10K
R4080	0613952R66	0
R4081	0613952R66	0
R4082	0613952R66	0
R4083	0613952R66	0
R4085	0613952R66	0
R4086	0613952R66	0
R4088	0613952R01	10K
R4089	0613952R17	47K
R4090	0613952R66	0

Circuit Ref	Motorola Part No	Description
R4093	0613952R66	0
R4094	0613952R66	0
R4095	0613952R66	0
R4096	0613952R66	0
R4097	0613952R66	0
R4098	0613952Q89	4.7K
R4099	0613952R66	0
R4100	0613952Q75	1.2K
R4101	0613952Q75	1.2K
R4103	0613952Q75	1.2K
R4105	0613952R01	10K
R4106	0613952R01	10K
RT3500	0615471H01	THERMISTOR, 10K
SP3000	1015349H03	SOLDER PREFORM
SP3001	1015349H03	SOLDER PREFORM
U1000	5102495J13	MICROPROCESSOR
U1006	5115001H02	IC, DUAL UNBUF-FERED INVERTER
U2000	0104024J27	IC, 8MB FLASH
U2001	5171614M01	IC, 16MB SDRAM
U3001	5164015H94	VOLTAGE REGULATOR
U3002	5115391H01	VOLTAGE REGULATOR
U3003	5164015H94	VOLTAGE REGULATOR
U3004	5115391H01	VOLTAGE REGULATOR
U3005	0105959T72	PNP
U3006	0105959T72	PNP
U3030	5116525H01	DUAL OPAMP
U3040	0105959T72	PNP

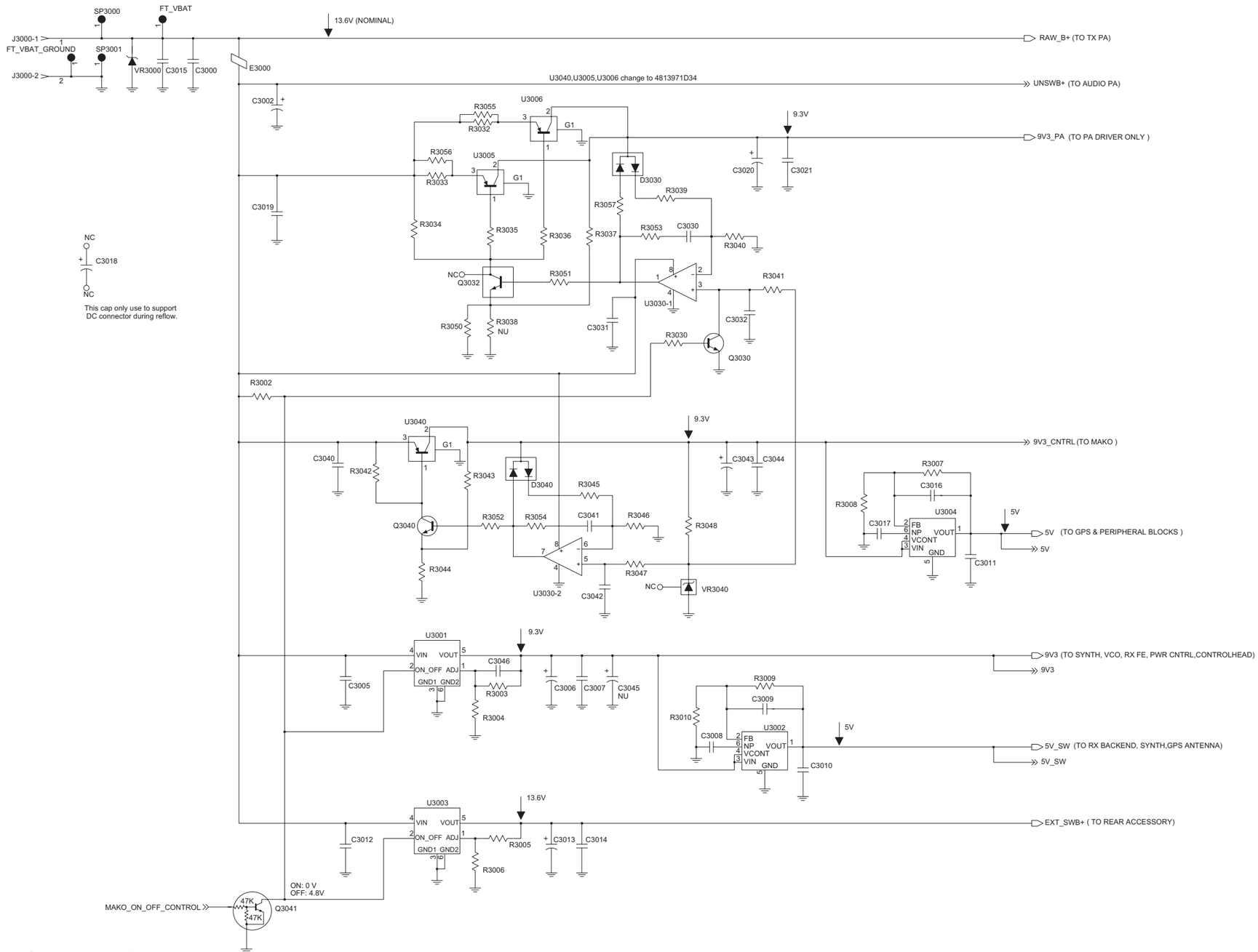
Circuit Ref	Motorola Part No	Description
U3200	5185143E77	IC, POWER MANAGEMENT
U3201	5115616H01	VOLTAGE REGULATOR
U3202	5115453H01	DUAL OPAMP
U3203	5114007A43	IC, SCHMITT TRIGGER
U3500	5102463J95	AUDIO PA
U3501	5115368H01	DIGITAL ATTENUATOR
U3502	5114016A18	QUAD OPAMP
U3503	5164852H47	IC, LEVEL TRANSLATOR
U3504	5171395L01	IC, CMOS SWITCH
U3505	5114016A18	QUAD OPAMP
U3508	5164852H47	IC, LEVEL TRANSLATOR
U4000	5115476H01	IC, SERIAL-TO-PARAL-LEL CONVERTER
U4001	5115502H01	LOGIC TRANSLATOR
U4004	5115865H01	IC, BUFFER
U4005	5115865H01	IC, BUFFER
U4006	5115865H01	IC, BUFFER
U4007	5115865H01	IC, BUFFER
U4008	5115865H01	IC, BUFFER
U4009	5115865H01	IC, BUFFER
U4010	5115865H01	IC, BUFFER
VR3000	4813979C17	TRANSIENT SUPPRESSOR
VR3040	4813977M10	DIODE, 5.1V ZENER
VR3200	4813977M10	DIODE, 5.1V ZENER
VR3201	4813977M05	DIODE, 3.3V ZENER
VR3202	4813977M05	DIODE, 3.3V ZENER
VR3203	4813977M05	DIODE, 3.3V ZENER
VR3204	4813977M13	DIODE, 6.2V ZENER

Circuit Ref	Motorola Part No	Description
VR3205	4813977M05	DIODE, 3.3V ZENER
VR3206	4813977M13	DIODE, 6.2V ZENER
VR3207	4813977M13	DIODE, 6.2V ZENER
VR3208	4813977M13	DIODE, 6.2V ZENER
VR3502	4813977A48	DIODE, 20V ZENER
VR3503	4813977A48	DIODE, 20V ZENER
VR3504	4813977A48	DIODE, 20V ZENER
VR4000	4813977A48	DIODE, 20V ZENER
VR4001	4813977A48	DIODE, 20V ZENER
VR4002	4813977A48	DIODE, 20V ZENER
VR4003	4813977A48	DIODE, 20V ZENER
VR4004	4813977A48	DIODE, 20V ZENER
VR4005	4813977M13	DIODE, 6.2V ZENER
VR4006	4813977M13	DIODE, 6.2V ZENER
VR4007	NOT PLACED	–
VR4008	NOT PLACED	–
VR4009	4813977A48	DIODE, 20V ZENER
Y1000	4809612J45	12MHZ CRYSTAL
Y3200	4815028H01	24.576MHZ CRYSTAL
Y3201	4802582S80	32KHZ CRYSTAL

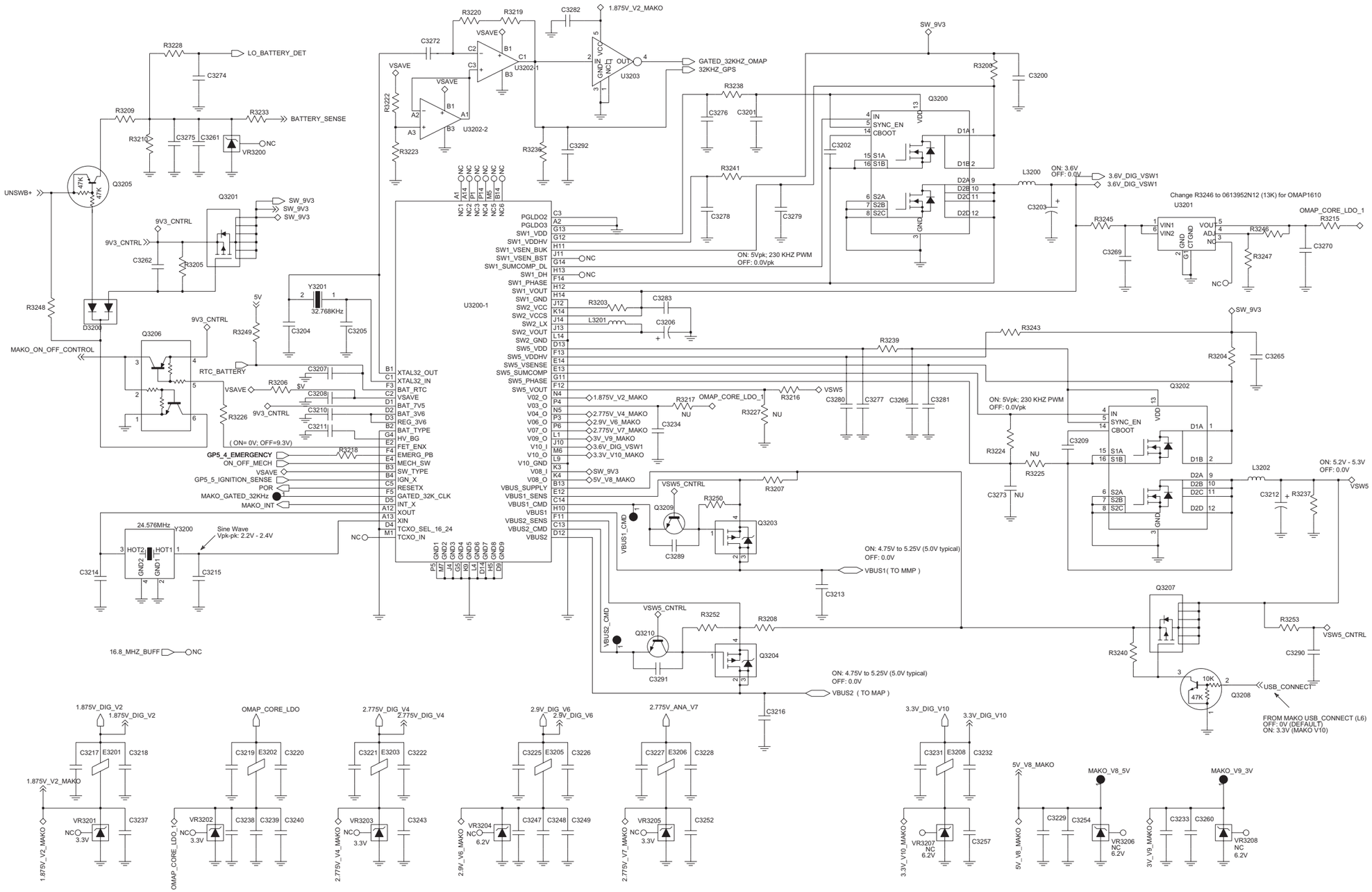
6.0 Controller R6 Schematic Diagrams



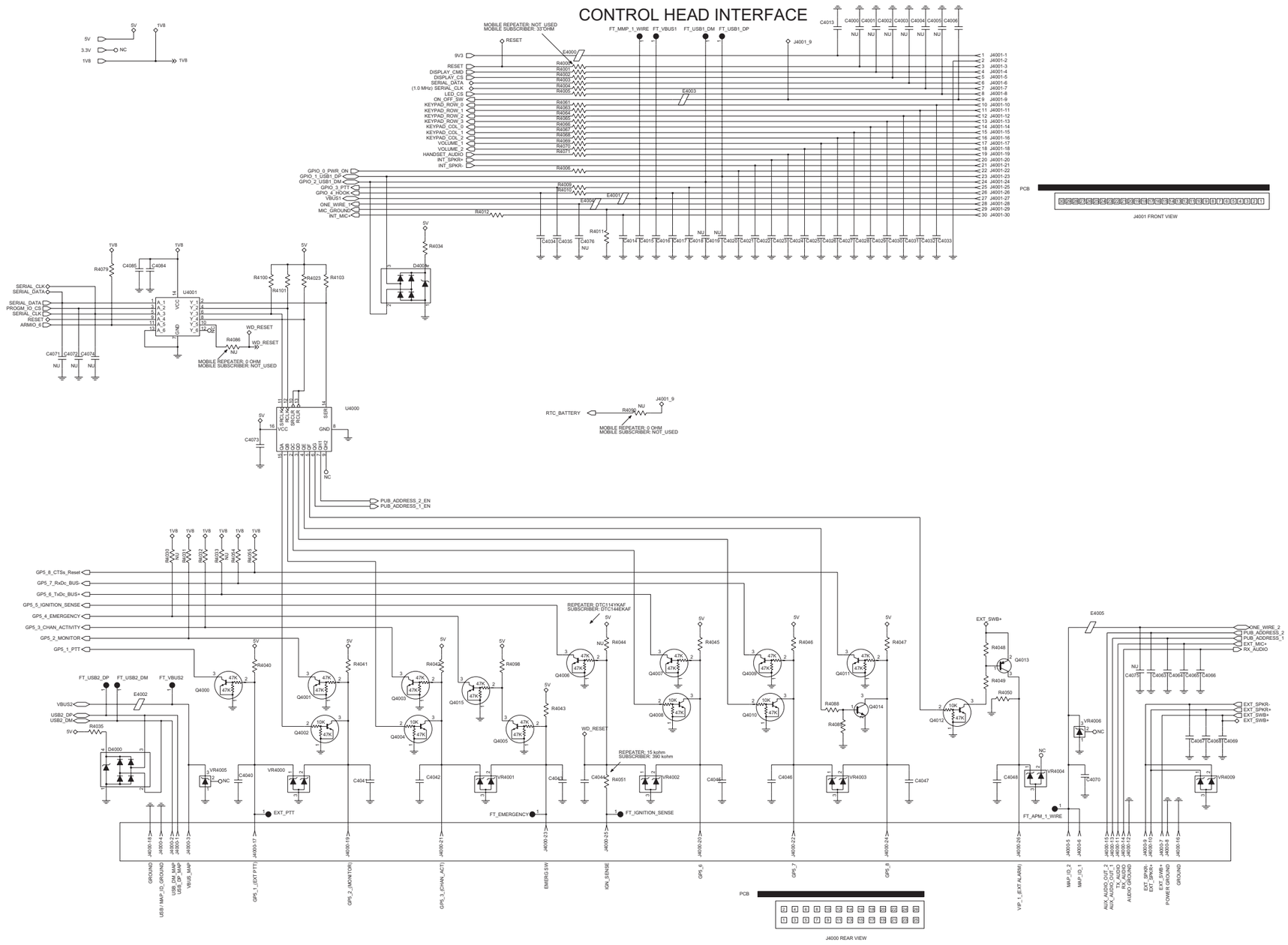
Controller - GPS Schematic Diagram



Controller DC Supply Schematic Diagram

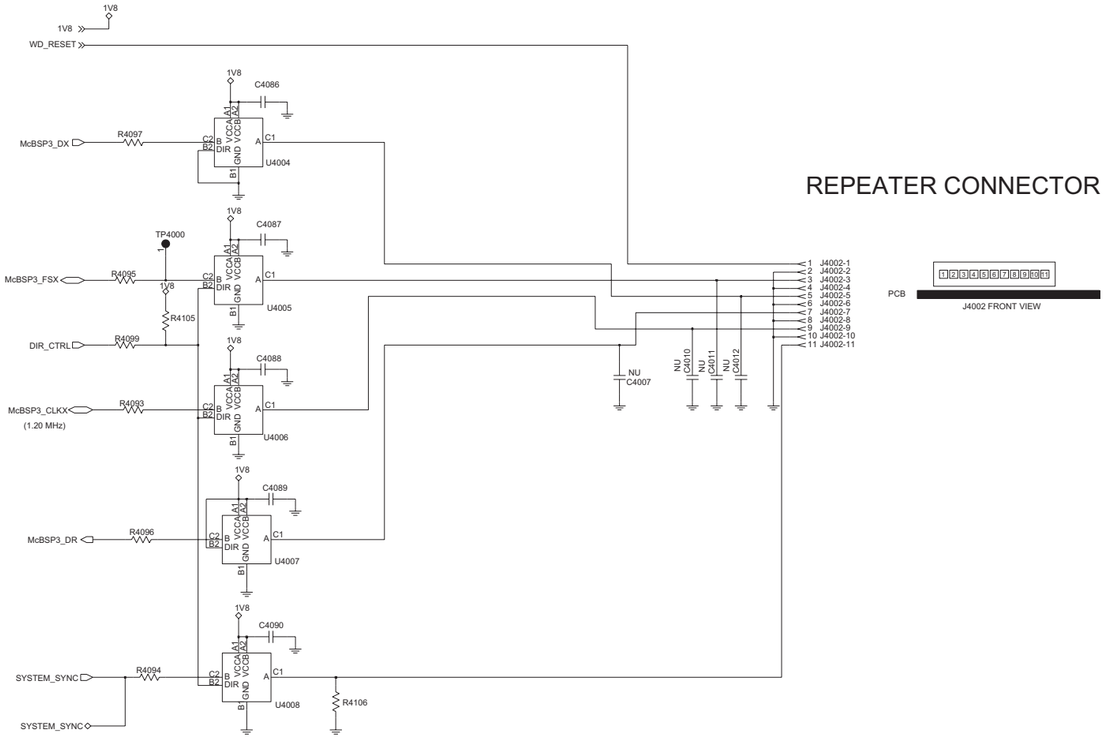


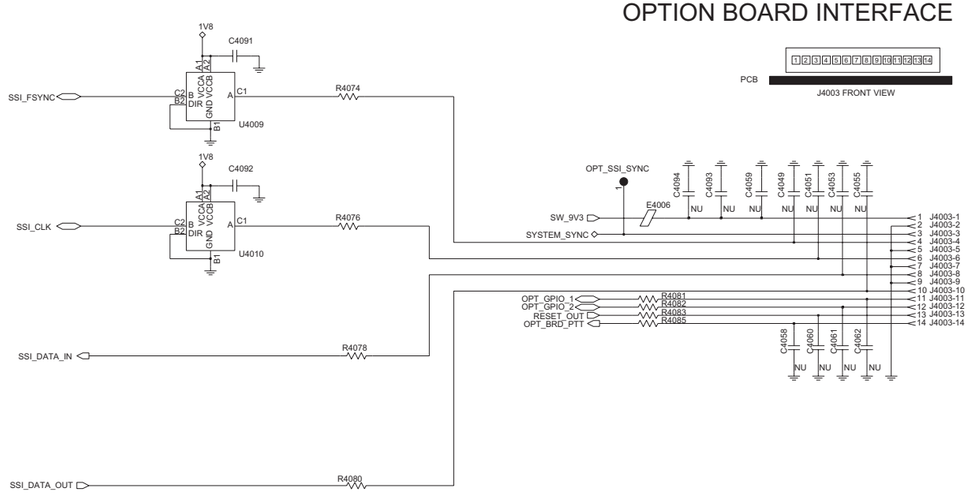
Controller DC Distribution Schematic Diagram



Controller Peripheral Schematic Diagram (sheet 1 of 2)

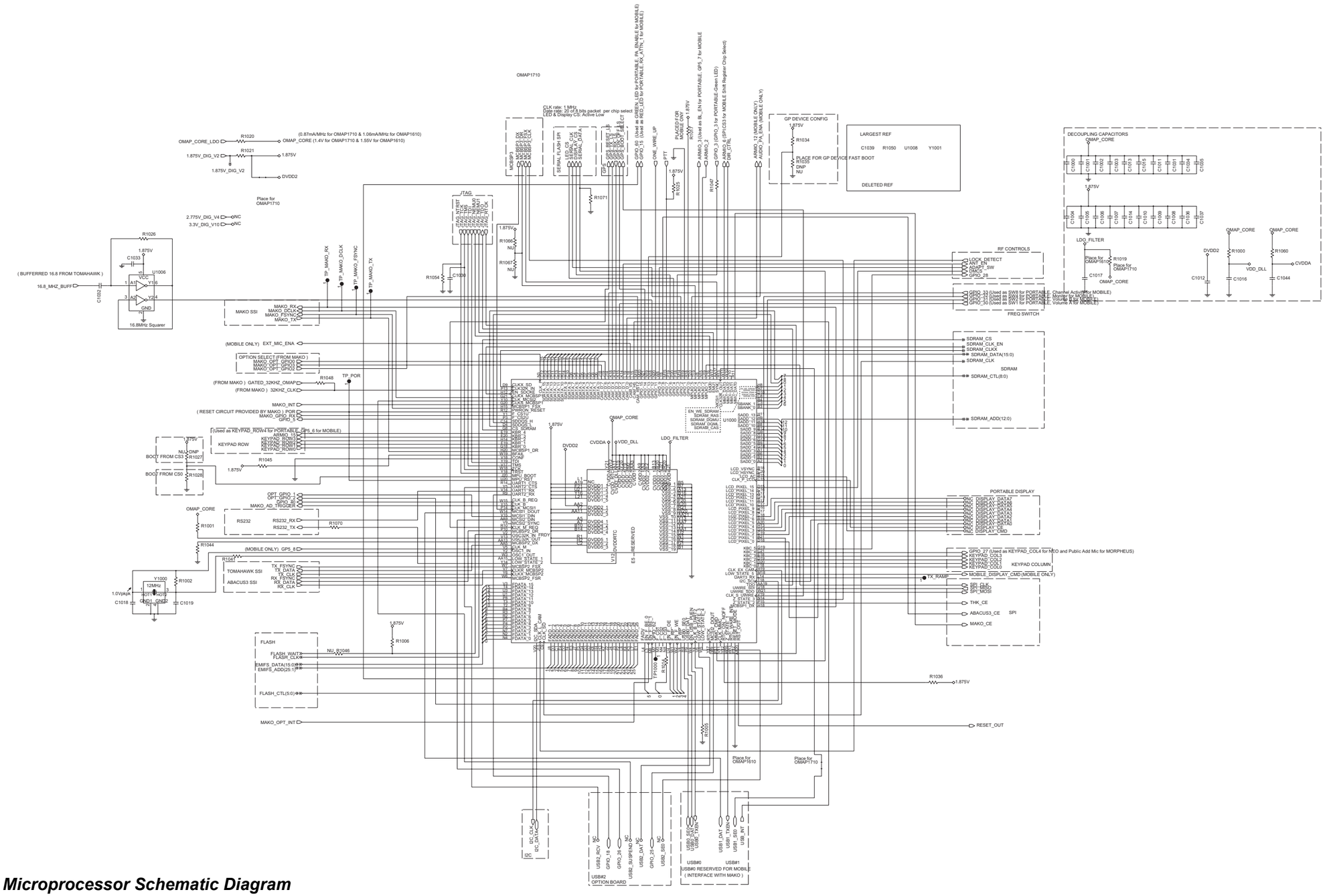
ACCESSORY INTERFACE (26-PIN)



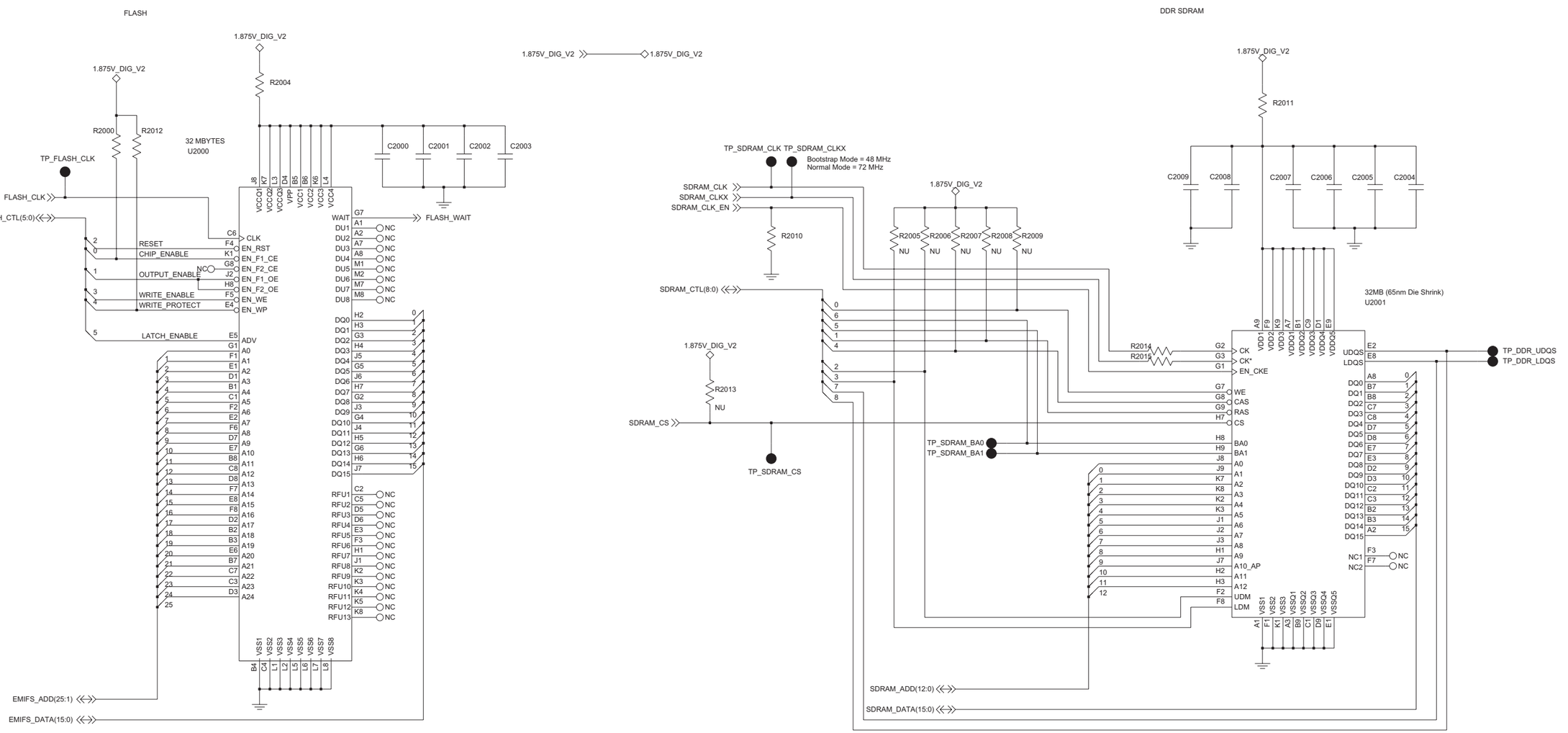


DIR	OPERATION
LOW	B ---->A
HIGH	B <----A

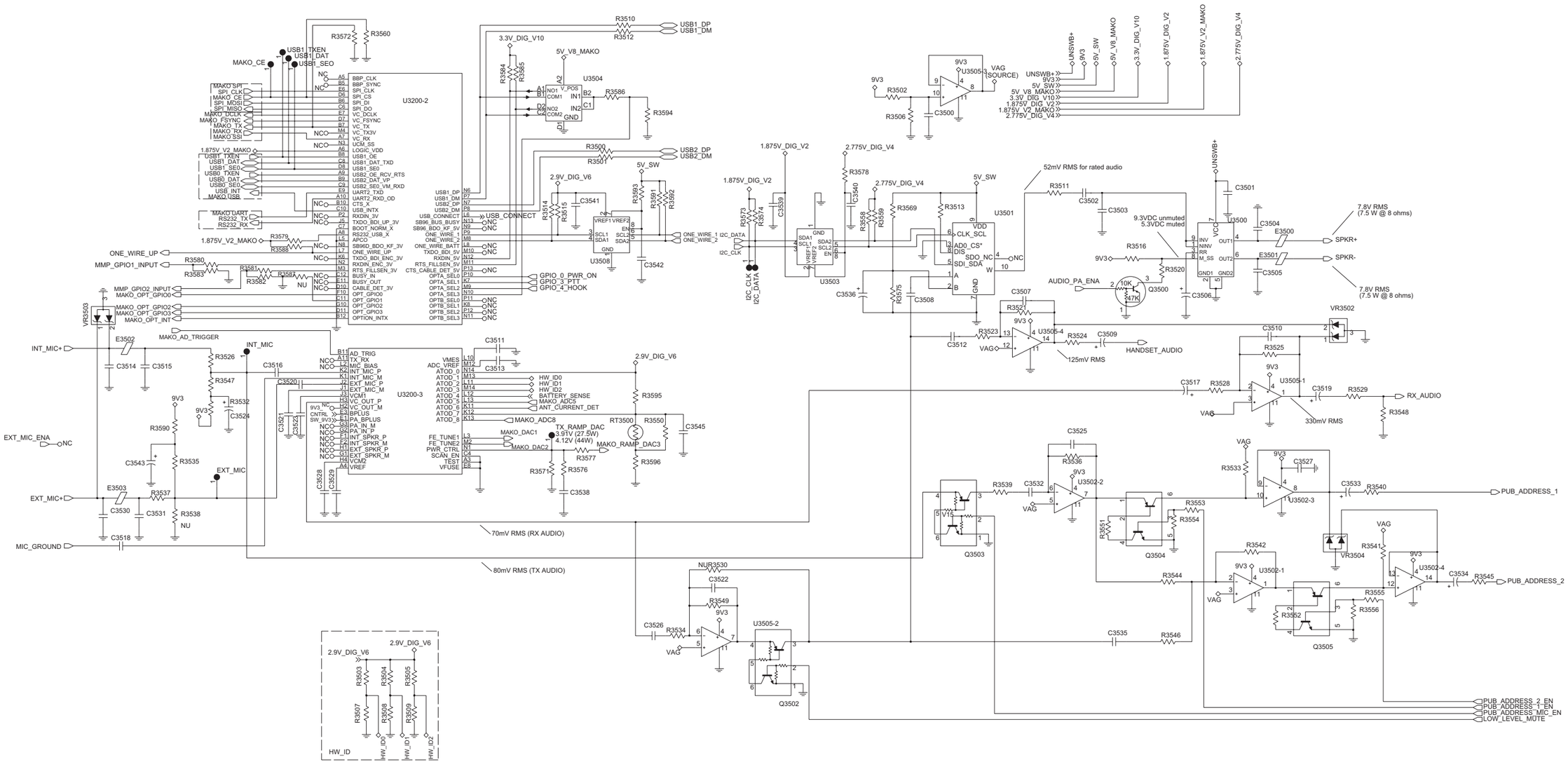
Controller Peripheral Schematic Diagram (sheet 2 of 2)



Controller Microprocessor Schematic Diagram



Controller Memories Schematic Diagram



Controller Audio and USB Schematic Diagram

6.1 Controller R6 Parts List

Circuit Ref	Motorola Part No	Description
C1000	2113944A40	CAP, 100pF
C1001	2113945Y02	CAP, 0.10uF
C1002	2113945Y02	CAP, 0.10uF
C1003	2113944A40	CAP, 100pF
C1004	2113944A40	CAP, 100pF
C1005	2113945Y02	CAP, 0.10uF
C1006	2113945Y02	CAP, 0.10uF
C1007	2113944A40	CAP, 100pF
C1008	2113944A40	CAP, 100pF
C1009	2113945Y02	CAP, 0.10uF
C1010	2113945Y02	CAP, 0.10uF
C1011	2113944A40	CAP, 100pF
C1012	2113945Y02	CAP, 0.10uF
C1013	2113945Y02	CAP, 0.10uF
C1014	2113945Y02	CAP, 0.10uF
C1015	2113945Y02	CAP, 0.10uF
C1016	2113945Y02	CAP, 0.10uF
C1017	2113946E02	CAP, 1.0uF
C1018	2113944A28	CAP, 18pF
C1019	2113944A28	CAP, 18pF
C1030	2113944A28	CAP, 18pF
C1031	2113945Y02	CAP, 0.10uF
C1032	2113945B02	CAP, .01uF
C1033	2113945Y02	CAP, 0.10uF
C1034	2113946S35	CAP, 1.0uF
C1035	2113946D05	CAP, 2.2uF
C1036	2113946S35	CAP, 1.0uF
C1037	2113946D05	CAP, 2.2uF
C1044	2113945Y02	CAP, 0.10uF
C2000	2113944A40	CAP, 100pF
C2001	2113945B02	CAP, .01uF
C2002	2113945Y02	CAP, 0.10uF
C2003	2113945Y02	CAP, 0.10uF
C2004	2113944A40	CAP, 100pF
C2005	2113945B02	CAP, .01uF
C2006	2113945Y02	CAP, 0.10uF
C2007	2113945Y02	CAP, 0.10uF
C2008	2113946D05	CAP, 2.2uF
C2009	2113946D05	CAP, 2.2uF
C2500	2113944A44	CAP, 220pF
C2501	2113945A10	CAP, 1500pF
C3000	2113944C06	CAP, 470pF
C3002	2371403L02	CAPP, 10uF
C3005	2113944C06	CAP, 470pF
C3006	2314030E85	CAPP, 33uF
C3007	2113945C31	CAP, 0.1uF
C3008	2113945A09	CAP, 1000pF
C3009	2113945Y02	CAP, 0.10uF
C3010	2113946S35	CAP, 1.0uF
C3011	2113946S35	CAP, 1.0uF
C3012	2113944C06	CAP, 470pF
C3013	2314030J28	CAPP, 22uF
C3014	2113945C31	CAP, 0.1uF
C3015	2113944C38	CAP, 47pF
C3016	2113944A40	CAP, 100pF
C3017	2113945A09	CAP, 1000pF
C3018	2389289U01	CAPP, 10uF
C3019	2113944C06	CAP, 470pF
C3020	2314030E85	CAPP, 33uF
C3021	2113945C31	CAP, 0.1uF
C3030	2113945C02	CAP, .01uF
C3031	2113945C31	CAP, 0.1uF
C3032	2113945B02	CAP, .01uF
C3040	2113944C06	CAP, 470pF
C3041	2113945C02	CAP, .01uF
C3042	2113945B02	CAP, .01uF
C3043	2314030E85	CAPP, 33uF
C3044	2113945C31	CAP, 0.1uF
C3045	NOT PLACED	–
C3046	2113945Y02	CAP, 0.10uF
C3200	2113946J04	CAP, 22uF
C3201	2113946D05	CAP, 2.2uF
C3202	2113945Y02	CAP, 0.10uF
C3203	2316410H02	CAPP, 68uF
C3204	2115153H21	CAP, 5.6pF
C3205	2115153H21	CAP, 5.6pF
C3206	2316410H01	CAPP, 22uF
C3207	2113945C31	CAP, 0.1uF
C3208	2113946D05	CAP, 2.2uF
C3209	2113945Y02	CAP, 0.10uF
C3210	2113946D05	CAP, 2.2uF
C3211	2113945A09	CAP, 1000pF
C3212	2316410H02	CAPP, 68uF
C3213	2113946F03	CAP, 4.7uF
C3214	2115153H45	CAP, 33pF
C3215	2115153H45	CAP, 33pF
C3216	2113946F03	CAP, 4.7uF
C3217	2113944A44	CAP, 220pF
C3218	2113945Y02	CAP, 0.10uF
C3219	2113944A44	CAP, 220pF
C3220	2113945Y02	CAP, 0.10uF
C3221	2113944A44	CAP, 220pF
C3222	2113945Y02	CAP, 0.10uF
C3225	2113944A44	CAP, 220pF
C3226	2113945Y02	CAP, 0.10uF
C3227	2113944A44	CAP, 220pF
C3228	2113945Y02	CAP, 0.10uF
C3229	2113944A44	CAP, 220pF
C3231	2113944A44	CAP, 220pF
C3232	2113945Y02	CAP, 0.10uF
C3233	2113944A44	CAP, 220pF
C3234	2113946D05	CAP, 2.2uF
C3237	2113946D05	CAP, 2.2uF
C3238	2113946H02	CAP, 10uF
C3239	2113946D05	CAP, 2.2uF
C3240	2113944C45	CAP, 100pF
C3243	2113946S35	CAP, 1.0uF
C3247	2113946H02	CAP, 10uF
C3248	2113946S35	CAP, 1.0uF
C3249	2113944C45	CAP, 100pF
C3252	2113946S35	CAP, 1.0uF
C3254	2113946D05	CAP, 2.2uF
C3257	2113946S35	CAP, 1.0uF
C3260	2113946S35	CAP, 1.0uF
C3261	2113944A44	CAP, 220pF
C3262	2113946N03	CAP, 2.2uF
C3265	2113946J04	CAP, 22uF
C3266	2113946D05	CAP, 2.2uF
C3269	2113946S35	CAP, 1.0uF

Circuit Ref	Motorola Part No	Description
C3270	2113946S35	CAP, 1.0uF
C3272	2115153H27	CAP, 10pF
C3273	NOT PLACED	–
C3274	2113944A44	CAP, 220pF
C3275	2113946J03	CAP, 10.0uF
C3276	2113946S35	CAP, 1.0uF
C3277	2113946S35	CAP, 1.0uF
C3278	2113945C31	CAP, 0.1uF
C3279	2113945C31	CAP, 0.1uF
C3280	2113945C31	CAP, 0.1uF
C3281	2113945C31	CAP, 0.1uF
C3282	2113946F03	CAP, 4.7uF
C3283	2113945Y02	CAP, 0.10uF
C3289	2113945Y02	CAP, 0.10uF
C3290	2113945Y02	CAP, 0.10uF
C3291	2113945Y02	CAP, 0.10uF
C3292	2113945A09	CAP, 1000pF
C3500	2113946J03	CAP, 10.0uF
C3501	2113945G91	CAP, 0.1uF
C3502	2113945C31	CAP, 0.1uF
C3503	2113945A09	CAP, 1000pF
C3504	2113945A09	CAP, 1000pF
C3505	2113945A09	CAP, 1000pF
C3506	2314030F30	CAPP, 47uF
C3507	2113945A11	CAP, 2200pF
C3508	2113945C31	CAP, 0.1uF
C3509	2313960D07	CAPP, 10uF
C3510	2113945A03	CAP, 330pF
C3511	2113944A40	CAP, 100pF
C3512	2113945C31	CAP, 0.1uF
C3513	2113944A40	CAP, 100pF
C3514	2113944A44	CAP, 220pF
C3515	2113944A44	CAP, 220pF
C3516	2113946S35	CAP, 1.0uF
C3517	2314030M51	CAPP, 10uF
C3518	2113946S35	CAP, 1.0uF
C3519	2314030F30	CAPP, 47uF
C3520	2113946S35	CAP, 1.0uF
C3521	2113946S35	CAP, 1.0uF
C3522	2113945A05	CAP, 470pF
C3523	2113945Y02	CAP, 0.10uF
C3524	2313960D07	CAPP, 10uF
C3525	2113944A44	CAP, 220pF
C3526	2113946S35	CAP, 1.0uF
C3527	2113945C31	CAP, 0.1uF
C3528	2113945Y02	CAP, 0.10uF
C3529	2113945Y02	CAP, 0.10uF
C3530	2113944A44	CAP, 220pF
C3531	2113944A44	CAP, 220pF
C3532	2113946S35	CAP, 1.0uF
C3533	2313960D07	CAPP, 10uF
C3534	2313960D07	CAPP, 10uF
C3535	2113946S35	CAP, 1.0uF
C3536	2314030M51	CAPP, 10uF
C3538	2113945B02	CAP, .01uF
C3539	2113945Y02	CAP, 0.10uF
C3540	2113945Y02	CAP, 0.10uF
C3541	2113945Y02	CAP, 0.10uF
C3542	2113945Y02	CAP, 0.10uF
C3543	2313960D07	CAPP, 10uF
C3545	2113944A44	CAP, 220pF
C4000	NOT PLACED	–
C4001	NOT PLACED	–
C4002	NOT PLACED	–
C4003	NOT PLACED	–
C4004	NOT PLACED	–
C4005	NOT PLACED	–
C4006	2113944A44	CAP, 220pF
C4007	NOT PLACED	–
C4010	NOT PLACED	–
C4011	NOT PLACED	–
C4012	NOT PLACED	–
C4013	2113944A44	CAP, 220pF
C4014	2113944A44	CAP, 220pF
C4015	2113944A44	CAP, 220pF
C4016	2113944A44	CAP, 220pF
C4017	2113944A44	CAP, 220pF
C4018	2113944A44	CAP, 220pF
C4019	NOT PLACED	–
C4020	NOT PLACED	–
C4021	2113944A44	CAP, 220pF
C4022	2113944A44	CAP, 220pF
C4023	2113944A44	CAP, 220pF
C4024	2113944A44	CAP, 220pF
C4025	2113944A44	CAP, 220pF
C4026	2113944A44	CAP, 220pF
C4027	2113944A44	CAP, 220pF
C4028	2113944A44	CAP, 220pF
C4029	2113944A44	CAP, 220pF
C4030	2113944A44	CAP, 220pF
C4031	2113944A44	CAP, 220pF
C4032	2113944A44	CAP, 220pF
C4033	2113944A44	CAP, 220pF
C4034	2113945A03	CAP, 330pF
C4035	2113945A03	CAP, 330pF
C4040	2113944A44	CAP, 220pF
C4041	2113944A44	CAP, 220pF
C4042	2113944A44	CAP, 220pF
C4043	2113944A44	CAP, 220pF
C4044	2113944A44	CAP, 220pF
C4045	2113944A44	CAP, 220pF
C4046	2113944A44	CAP, 220pF
C4047	2113944A44	CAP, 220pF
C4048	2113944A44	CAP, 220pF
C4049	NOT PLACED	–
C4051	NOT PLACED	–
C4053	NOT PLACED	–
C4055	NOT PLACED	–
C4058	NOT PLACED	–
C4059	NOT PLACED	–
C4060	NOT PLACED	–
C4061	NOT PLACED	–
C4062	NOT PLACED	–
C4063	2113944A44	CAP, 220pF
C4064	2113944A44	CAP, 220pF
C4065	2113944A44	CAP, 220pF
C4066	2113944A44	CAP, 220pF
C4067	2113944A44	CAP, 220pF
C4068	2113944A44	CAP, 220pF
C4069	2113944A44	CAP, 220pF

Circuit Ref	Motorola Part No	Description
C4070	2113944A44	CAP, 220pF
C4071	NOT PLACED	–
C4072	NOT PLACED	–
C4073	2113945Y02	CAP, 0.10uF
C4074	NOT PLACED	–
C4075	NOT PLACED	–
C4076	NOT PLACED	–
C4084	2113945Y02	CAP, 0.10uF
C4085	2113944A44	CAP, 220pF
C4086	2113945Y02	CAP, 0.10uF
C4087	2113945Y02	CAP, 0.10uF
C4088	2113945Y02	CAP, 0.10uF
C4089	2113945Y02	CAP, 0.10uF
C4090	2113945Y02	CAP, 0.10uF
C4091	2113945Y02	CAP, 0.10uF
C4092	2113945Y02	CAP, 0.10uF
C4093	NOT PLACED	–
C4094	NOT PLACED	–
D3030	4813978P07	DIODE, SWITCHING
D3040	4813978P07	DIODE, SWITCHING
D3200	4813978C02	DIODE, SWITCHING
D4000	4866544A01	DIODE, DUAL
D4001	4866544A01	DIODE, DUAL
E2500	2480675U01	FERRITE BEAD
E3000	2485011Y01	FERRITE BEAD
E3201	2480675U01	FERRITE BEAD
E3202	2480675U01	FERRITE BEAD
E3203	2480675U01	FERRITE BEAD
E3205	2480675U01	FERRITE BEAD
E3206	2480675U01	FERRITE BEAD

Circuit Ref	Motorola Part No	Description
E3208	2480675U01	FERRITE BEAD
E3500	2485011Y01	FERRITE BEAD
E3501	2485011Y01	FERRITE BEAD
E3502	2485011Y01	FERRITE BEAD
E3503	2485011Y01	FERRITE BEAD
E4000	2485011Y01	FERRITE BEAD
E4001	7686949J14	FERRITE BEAD
E4002	7686949J14	FERRITE BEAD
E4003	NOT PLACED	–
E4004	2409134J25	FERRITE BEAD
E4005	2409134J25	FERRITE BEAD
E4006	2409134J25	FERRITE BEAD
J2500	0915064H02	CONN_J
J3000	0905902V09	DC POWER CONNECTOR
J4000	0916017H01	26-PIN ACCESSORY CONNECTOR
J4001	0915555H01	30-PIN CONTROL HEAD CONNECTOR
J4002	0915558H01	CONN_J
J4003	0915556H01	14-PIN OPT BOARD CONNECTOR
L3200	2415005H02	IDCTR, 22uH
L3201	2415005H02	IDCTR, 22uH
L3202	2415005H02	IDCTR, 22uH
Q3030	4813973M07	NPN
Q3032	4813973B01	NPN
Q3040	4813973M07	NPN
Q3041	4815263H01	ANALOG SWITCH
Q3200	5185956E76	N-CHANNEL SYN-CHRONOUS MOSFET
Q3201	4813970A62	P-CHANNEL MOSFET

Circuit Ref	Motorola Part No	Description
Q3202	5185956E76	N-CHANNEL SYN-CHRONOUS MOSFET
Q3203	4805585Q23	PMOSFET
Q3204	4805585Q23	PMOSFET
Q3205	4815262H01	ANALOG SWITCH
Q3206	4815272H01	ANALOG SWITCH
Q3207	4813970A62	P-CHANNEL MOSFET
Q3208	4815261H01	ANALOG SWITCH
Q3209	4813973M07	NPN
Q3210	4813973M07	NPN
Q3500	4815261H01	ANALOG SWITCH
Q3502	4815272H01	ANALOG SWITCH
Q3503	4815272H01	ANALOG SWITCH
Q3504	4815270H01	ANALOG SWITCH
Q3505	4815270H01	ANALOG SWITCH
Q4000	4815263H01	ANALOG SWITCH
Q4001	4815263H01	ANALOG SWITCH
Q4002	4815261H01	ANALOG SWITCH
Q4003	4815263H01	ANALOG SWITCH
Q4004	4815261H01	ANALOG SWITCH
Q4005	4815263H01	ANALOG SWITCH
Q4006	4815261H01	ANALOG SWITCH
Q4007	4815263H01	ANALOG SWITCH
Q4008	4815261H01	ANALOG SWITCH
Q4009	4815263H01	ANALOG SWITCH
Q4010	4815261H01	ANALOG SWITCH
Q4011	4815263H01	ANALOG SWITCH
Q4012	4815261H01	ANALOG SWITCH
Q4013	4816023H01	PNP
Q4014	4813973A06	NPN
Q4015	4815263H01	ANALOG SWITCH

Circuit Ref	Motorola Part No	Description
R1000	0613952Q25	RES, 10
R1001	0613952R01	RES, 10K
R1002	0613952J73	RES, 10MEG
R1005	0613952Q89	RES, 4.7K
R1006	0613952R01	RES, 10K
R1014	0613952R66	RES, 0
R1017	0613952R01	RES, 10K
R1019	0613952Q18	RES, 5.1
R1020	0613952R66	RES, 0
R1021	0613952R66	RES, 0
R1025	0613952R01	RES, 10K
R1026	0613952R17	RES, 47K
R1027	NOT PLACED	–
R1028	0613952R66	RES, 0
R1034	0613952R01	RES, 10K
R1035	NOT PLACED	–
R1036	0613952R01	RES, 10K
R1041	0613952Q73	RES, 1K
R1044	0613952R66	RES, 0
R1045	0613952R01	RES, 10K
R1046	NOT PLACED	–
R1047	0613952R66	RES, 0
R1048	0613952R66	RES, 0
R1054	0613952Q89	RES, 4.7K
R1060	0613952Q25	RES, 10
R1066	NOT PLACED	–
R1067	NOT PLACED	–
R1070	0613952R66	RES, 0
R1071	0613952R17	RES, 47K
R2000	0613952R01	RES, 10K

Circuit Ref	Motorola Part No	Description
R2004	0613952R66	RES, 0
R2005	NOT PLACED	–
R2006	NOT PLACED	–
R2007	NOT PLACED	–
R2008	NOT PLACED	–
R2009	NOT PLACED	–
R2010	0613952R01	RES, 10K
R2011	0613952R66	RES, 0
R2012	0613952R01	RES, 10K
R2013	NOT PLACED	–
R2014	0613952Q37	RES, 33
R2015	0613952Q37	RES, 33
R2500	0613952R66	RES, 0
R2501	0613952R66	RES, 0
R2502	0613952R66	RES, 0
R2504	0613952R66	RES, 0
R2506	0613952R66	RES, 0
R2507	0613952R66	RES, 0
R2508	0613952R66	RES, 0
R2509	0613952R66	RES, 0
R2510	0613952R66	RES, 0
R2511	0613952R66	RES, 0
R2512	0613952R66	RES, 0
R2513	0613952R66	RES, 0
R2514	0613952R66	RES, 0
R2515	0613952R66	RES, 0
R2516	0613952R66	RES, 0
R2517	0613952R66	RES, 0
R2518	0613952R66	RES, 0
R2519	0613952R66	RES, 0

Circuit Ref	Motorola Part No	Description
R2520	0613952R66	RES, 0
R2524	0613952R66	RES, 0
R2525	0613952R66	RES, 0
R2526	0613952R66	RES, 0
R2527	0613952R66	RES, 0
R2528	0613952R66	RES, 0
R2529	0613952R01	RES, 10K
R3002	0613952R01	RES, 10K
R3003	0613952M54	RES, 3.57K
R3004	0613952L73	RES, 562
R3005	0613952Q81	RES, 2.2K
R3006	0613952Q57	RES, 220
R3007	0613952N58	RES, 39.2K
R3008	0613952N12	RES, 13K
R3009	0613952N58	RES, 39.2K
R3010	0613952N12	RES, 13K
R3030	0613952R01	RES, 10K
R3032	0615871H01	RES, 0.1
R3033	0615871H01	RES, 0.1
R3034	0613952H61	RES, 330
R3035	0613952H25	RES, 10
R3036	0613952H25	RES, 10
R3037	0613959G61	RES, 330
R3038	NOT PLACED	–
R3039	0613952M30	RES, 2K
R3040	0613952M43	RES, 2.74K
R3041	0613952R25	RES, 100K
R3042	0613952H69	RES, 680
R3043	0613952H69	RES, 680
R3044	0613958S61	RES, 330

Circuit Ref	Motorola Part No	Description
R3045	0613952M30	RES, 2K
R3046	0613952M43	RES, 2.74K
R3047	0613952R25	RES, 100K
R3048	0613952Q73	RES, 1K
R3050	0613959Q53	RES, 150
R3051	0613952G67	RES, 0
R3052	0613952G67	RES, 0
R3053	0613952R66	RES, 0
R3054	0613952R66	RES, 0
R3055	0615871H01	RES, 0.1
R3056	0615871H01	RES, 0.1
R3057	0613952R66	RES, 0
R3200	0615871H01	RES, 0.1
R3203	0615871H01	RES, 0.1
R3204	0615871H01	RES, 0.1
R3205	0613952R25	RES, 100K
R3206	0613952R66	RES, 0
R3207	0686135Z02	RES, 0.2
R3208	0686135Z02	RES, 0.2
R3209	0613952N62	RES, 43.2K
R3210	0613952N16	RES, 14.3K
R3215	0613952G67	RES, 0
R3216	0613952G67	RES, 0
R3217	NOT PLACED	–
R3218	0613952R66	RES, 0
R3219	0613952R56	RES, 2MEG
R3220	0613952R56	RES, 2MEG
R3222	0613952R33	RES, 220K
R3223	0613952R33	RES, 220K
R3224	0613952Q89	RES, 4.7K

Circuit Ref	Motorola Part No	Description
R3225	NOT PLACED	–
R3226	0613952R13	RES, 33K
R3227	NOT PLACED	–
R3228	0613952G67	RES, 0
R3233	0613952R66	RES, 0
R3236	0613952Q73	RES, 1K
R3237	0613952R01	RES, 10K
R3238	0613952H25	RES, 10
R3239	0613952H25	RES, 10
R3240	0613952R17	RES, 47K
R3241	0613952Q18	RES, 5.1
R3243	0613952Q18	RES, 5.1
R3245	0613952G67	RES, 0
R3246	0613952M81	RES, 6.81K
R3247	0613952N69	RES, 51.1K
R3248	0613952R01	RES, 10K
R3249	NOT PLACED	–
R3250	0613952R25	RES, 100K
R3252	0613952R25	RES, 100K
R3253	0613952R17	RES, 47K
R3500	0613952Q35	RES, 27
R3501	0613952Q35	RES, 27
R3502	0613952R01	RES, 10K
R3503	Refer to Table 3-6 on page 3-3	
R3504	Refer to Table 3-6 on page 3-3	
R3505	Refer to Table 3-6 on page 3-3	
R3506	0613952R01	10K
R3507	Refer to Table 3-6 on page 3-3	
R3508	Refer to Table 3-6 on page 3-3	
R3509	Refer to Table 3-6 on page 3-3	

Circuit Ref	Motorola Part No	Description
R3510	0613952Q35	RES, 27
R3511	0613952R01	RES, 10K
R3512	0613952Q35	RES, 27
R3513	0613952R66	RES, 0
R3514	0613952R01	RES, 10K
R3515	0613952R01	RES, 10K
R3516	0613952R10	RES, 24K
R3520	0613952R10	RES, 24K
R3521	0613952R05	RES, 15K
R3523	0613952R10	RES, 24K
R3524	0613952Q67	RES, 560
R3525	0613952R25	RES, 100K
R3526	0613952R66	RES, 0
R3528	0613952R09	RES, 22K
R3529	0613952Q42	RES, 51
R3530	NOT PLACED	–
R3532	0613952Q49	RES, 100
R3533	0613952R10	RES, 24K
R3534	0613952R01	RES, 10K
R3535	0613952Q67	RES, 560
R3536	0613952R25	RES, 100K
R3537	0613952R66	RES, 0
R3538	NOT PLACED	–
R3539	0613952R10	RES, 24K
R3540	0613952Q49	RES, 100
R3541	0613952R10	RES, 24K
R3542	0613952R10	RES, 24K
R3544	0613952R10	RES, 24K
R3545	0613952Q49	RES, 100
R3546	0613952R05	RES, 15K

Circuit Ref	Motorola Part No	Description
R3547	0613952Q67	RES, 560
R3548	0613952J25	RES, 100K
R3549	0613952R12	RES, 30K
R3550	0613952R23	RES, 82K
R3551	0613952R01	RES, 10K
R3552	0613952R01	RES, 10K
R3553	0613952R01	RES, 10K
R3554	0613952R17	RES, 47K
R3555	0613952R01	RES, 10K
R3556	0613952R17	RES, 47K
R3558	0613952R01	RES, 10K
R3559	0613952R01	RES, 10K
R3560	0613952R17	RES, 47K
R3569	0613952Q73	RES, 1K
R3571	0613952Q80	RES, 2K
R3572	0613952R01	RES, 10K
R3573	0613952R01	RES, 10K
R3574	0613952R01	RES, 10K
R3575	0613952Q73	RES, 1K
R3576	0613952Q49	RES, 100
R3577	0613952N42	RES, 26.7K
R3578	0613952R32	RES, 200K
R3579	0613952R01	RES, 10K
R3580	0613952R01	RES, 10K
R3581	0613952R01	RES, 10K
R3582	0613952N21	RES, 16.2K
R3583	0613952N21	RES, 16.2K
R3584	0613952R09	RES, 22K
R3585	0613952R09	RES, 22K
R3586	0613952R66	RES, 0

Circuit Ref	Motorola Part No	Description
R3587	NOT PLACED	–
R3588	0613952N69	RES, 51.1K
R3590	0613952Q49	RES, 100
R3591	0613952Q81	RES, 2.2K
R3592	0613952Q81	RES, 2.2K
R3593	0613952R32	RES, 200K
R3594	0613952Q85	RES, 3.3K
R3595	0613952R01	RES, 10K
R3596	0613952H53	RES, 150
R4000	NOT PLACED	–
R4001	0613952Q37	RES, 33
R4002	0613952Q37	RES, 33
R4003	0613952Q37	RES, 33
R4004	0613952Q37	RES, 33
R4005	0613952Q37	RES, 33
R4006	0613952Q65	RES, 470
R4009	0613952Q42	RES, 51
R4010	0613952Q42	RES, 51
R4011	0613952R66	RES, 0
R4012	0613952R66	RES, 0
R4023	0613952Q75	RES, 1.2K
R4030	NOT PLACED	–
R4031	0613952R01	RES, 10K
R4032	0613952R01	RES, 10K
R4033	NOT PLACED	–
R4034	0613952R01	RES, 10K
R4035	0613952R01	RES, 10K
R4040	0613952Q89	RES, 4.7K
R4041	0613952Q89	RES, 4.7K
R4042	0613952Q89	RES, 4.7K

Circuit Ref	Motorola Part No	Description
R4043	0613952Q89	RES, 4.7K
R4044	NOT PLACED	–
R4045	0613952Q89	RES, 4.7K
R4046	0613952Q89	RES, 4.7K
R4047	0613952Q89	RES, 4.7K
R4048	0613952Q77	RES, 1.5K
R4049	0613958H83	RES, 2.7K
R4050	0613952R01	RES, 10K
R4051	0613952R05	RES, 15K
R4054	0613952R01	RES, 10K
R4055	0613952R01	RES, 10K
R4061	0613952Q37	RES, 33
R4063	0613952Q37	RES, 33
R4064	0613952Q37	RES, 33
R4065	0613952Q37	RES, 33
R4066	0613952Q37	RES, 33
R4067	0613952Q37	RES, 33
R4068	0613952Q37	RES, 33
R4069	0613952Q37	RES, 33
R4070	0613952Q37	RES, 33
R4071	0613952R66	RES, 0
R4074	0613952R66	RES, 0
R4076	0613952R66	RES, 0
R4078	0613952R66	RES, 0
R4079	0613952R01	RES, 10K
R4080	0613952R66	RES, 0
R4081	0613952R66	RES, 0
R4082	0613952R66	RES, 0
R4083	0613952R66	RES, 0
R4085	0613952R66	RES, 0

Circuit Ref	Motorola Part No	Description
R4086	0613952R66	RES, 0
R4088	0613952R01	RES, 10K
R4089	0613952R17	RES, 47K
R4090	0613952R66	RES, 0
R4093	0613952R66	RES, 0
R4094	0613952R66	RES, 0
R4095	0613952R66	RES, 0
R4096	0613952R66	RES, 0
R4097	0613952R66	RES, 0
R4098	0613952Q89	RES, 4.7K
R4099	0613952R66	RES, 0
R4100	0613952Q75	RES, 1.2K
R4101	0613952Q75	RES, 1.2K
R4103	0613952Q75	RES, 1.2K
R4105	0613952R01	RES, 10K
R4106	0613952R01	RES, 10K
RT3500	0615471H01	THERM, 10K
SP3000	1015349H03	SOLDER_PREFORM
SP3001	1015349H03	SOLDER_PREFORM
U1000	5102495J13	MICROPROCESSOR
U1006	5115001H02	IC, DUAL UNBUF-FERED INVERTER
U2000	0104034J63	IC, 32MB FLASH
U2001	51012031001	IC, 32MB SDRAM
U3001	5164015H94	VOLTAGE REGULATOR
U3002	5115391H01	VOLTAGE REGULATOR
U3003	5164015H94	VOLTAGE REGULATOR
U3004	5115391H01	VOLTAGE REGULATOR

Circuit Ref	Motorola Part No	Description
U3005	0105959T72	PNP
U3006	0105959T72	PNP
U3030	5116525H01	DUAL OPAMP
U3040	0105959T72	PNP
U3200	5185143E77	PWR_MNGR_BLOCK
U3201	5189680C06	VOLTAGE REGULATOR
U3202	5115453H01	DUAL OPAMP
U3203	5114007A43	IC SCHMITTTRIGGER
U3500	5102463J95	AUDIO PA
U3501	5115368H01	DIGITAL ATTENUATOR
U3502	5114016A18	QUAD OPAMP
U3503	5164852H47	IC, LEVEL TRANSLATOR
U3504	5171395L01	IC, CMOS SWITCH
U3505	5114016A18	QUAD OPAMP
U3508	5164852H47	IC, LEVEL TRANSLATOR
U4000	5115476H01	IC, SERIAL-TO-PARAL-LEL CONVERTER
U4001	5115502H01	LOGIC TRANSLATOR
U4004	5178395A01	IC, BUFFER
U4005	5178395A01	IC, BUFFER
U4006	5178395A01	IC, BUFFER
U4007	5178395A01	IC, BUFFER
U4008	5178395A01	IC, BUFFER
U4009	5178395A01	IC, BUFFER
U4010	5178395A01	IC, BUFFER
VR3000	48012043001	TRANSORB DC 28V
VR3040	4813977M10	DIODE, 5.1V ZENER
VR3200	4813977M10	DIODE, 5.1V ZENER
VR3201	4813977M05	DIODE, 3.3V ZENER

Circuit Ref	Motorola Part No	Description
VR3202	4813977M05	DIODE, 3.3V ZENER
VR3203	4813977M05	DIODE, 3.3V ZENER
VR3204	4813977M13	DIODE, 6.2V ZENER
VR3205	4813977M05	DIODE, 3.3V ZENER
VR3206	4813977M13	DIODE, 6.2V ZENER
VR3207	4813977M13	DIODE, 6.2V ZENER
VR3208	4813977M13	DIODE, 6.2V ZENER
VR3502	4813977A48	DIODE, 20V ZENER
VR3503	4813977A48	DIODE, 20V ZENER
VR3504	4813977A48	DIODE, 20V ZENER
VR4000	4813977A48	DIODE, 20V ZENER
VR4001	4813977A48	DIODE, 20V ZENER
VR4002	4813977A48	DIODE, 20V ZENER
VR4003	4813977A48	DIODE, 20V ZENER
VR4004	4813977A48	DIODE, 20V ZENER
VR4005	4813977M13	DIODE, 6.2V ZENER
VR4006	4813977M13	DIODE, 6.2V ZENER
VR4009	4813977A48	DIODE, 20V ZENER
Y1000	93012000001	12 MHZ CRYSTAL
Y3200	4815028H01	24.576 MHZ CRYSTAL
Y3201	4802582S80	32 KHZ CRYSTAL

XPR 8300/XPR 8400 MOTOTRBO Repeater

Chapter 5

VHF (136–174 MHz)

1–25W

Service Information

Issue: September, 2010

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Chapter 5 - VHF Low Power Service Information

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Section 1

THEORY OF OPERATION

1.0 Introduction

The MOTOTRBO repeater consists of two MOTOTRBO mobile radios; one to act as a receiver, and one to act as a transmitter and controller. Both of these radios contain specialized software that allows them to function together as a repeater. The Repeater also contains a Repeater Indicator board and a Connector board. A block diagram of the repeater is shown in Figure 1-1. The Repeater Indicator board contains the Front-Panel LED circuitry as well as an Ethernet interface. The Connector board is a multifunctional board that is primarily used to pass signals to and from modules inside the chassis to the outside of the chassis.

The Repeater contains the following assemblies and sections:

- Receiver
- Transmitter
- Repeater Indicator Board
- Connector Board
- Fan
- AC/DC PSU

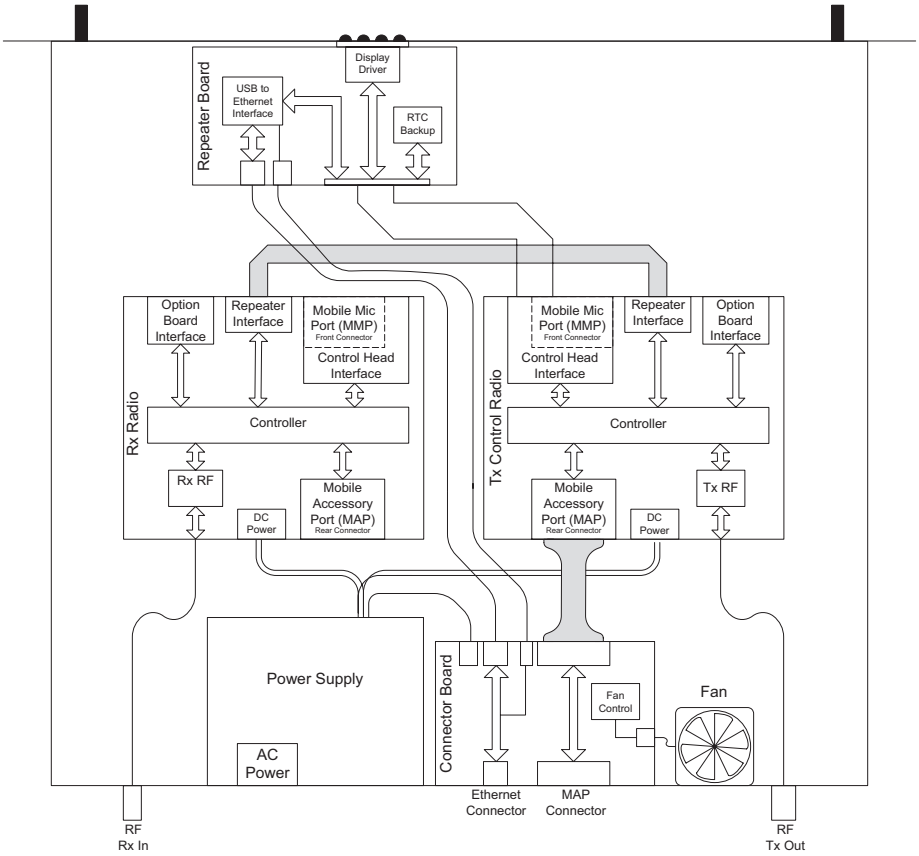


Figure 1-1 Repeater Block Diagram

1.1 Receiver

The receiver uses a transceiver board which is based on the mobile radio's transceiver board. The board uses the same PCB as the mobile radio board, but is populated differently to work in the Repeater application. Only the receiver related functions of the board are utilized in this application, even though the circuitry for transmit also exists on the board.

The Repeater receiver is identical in functionality to the mobile radio's receiver differing only in the audio path. On the mobile radio, the decoded audio is sent to a DAC, and then to the speaker. In the Repeater, this audio information is sent out through the SSI link to the transmit radio to be processed. Details of the receiver theory of operation can be found in Section 3.1.

1.2 Transmitter

The transmitter consists of a transceiver board which is based on the mobile radio's transceiver board housed in a transmit chassis. The transmit radio is identical to the receive board from a hardware standpoint. The difference between the two is the software that is running on them, how they are connected within the Repeater, and an additional heat sink that is mounted to the chassis. The added heatsink and the Repeater fan allow the transmitter to be cooled sufficiently when operating in a 60°C, full-duty cycle environment.

The transmit radio acts as the master controller for the Repeater. It handles all controller related tasks for the Repeater, including management of the receive radio. The transmit radio is responsible for processing the audio sent from the receive radio and repeating it out at the Tx frequency. Details of the transmitter theory of operation can be found in Section 3.2.

1.3 Repeater Indicator Board

The Repeater Indicator board contains circuitry to drive the front panel indicator LEDs, an RTC battery for the RTC in the transmit radio, as well as an Ethernet controller.

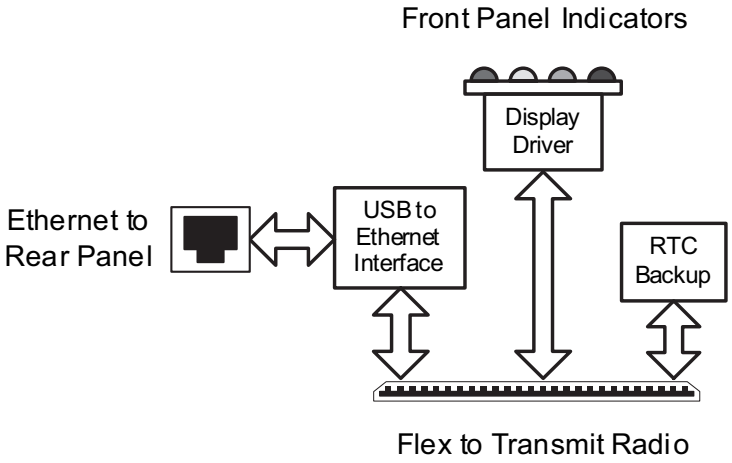


Figure 1-2 Repeater Indicator Board Block Diagram

All of the indicator LEDs that are on the front of the Repeater chassis reside on the Repeater Indicator board. Each is controlled by a shift register (U6) data out signal and a digital transistor. The shift register accepts serial data in from the transmit radio's OMAP processor via a SPI bus. A 74LVC07 buffer (U9) level shifts these signals from 3.3 V to 1.8 V.

The Repeater Disable LED is a dual-purpose LED that is hardware controlled initially at power-up. As soon as VBUS power is available on the Repeater Indicator board, the hardware circuitry for the Repeater Disable LED will cause it to blink periodically. When the software initialization is completed by the firmware, the blink circuitry will get disabled by the firmware. At that point, the Repeater Disable LED can be used for its intended purpose of displaying when the Repeater Disable function is turned on.

The power LED is the only LED that is not controlled by the software. This bi-color LED gets turned on green when the 13.8 V output from the power supply is valid. It turns on red when A/C power is lost, and the repeater's backup battery is used.

The Real Time Clock (RTC) battery (M1) is connected to the transmit radio through the Control Head (J1, pin 30).

Details of the Ethernet Controller can be found in Chapter 2.

1.4 Connector Board

The Connector board has two purposes: provide a place for the Repeater's MAP and Ethernet connectors to be mounted and a location for the Repeater's fan control circuitry.

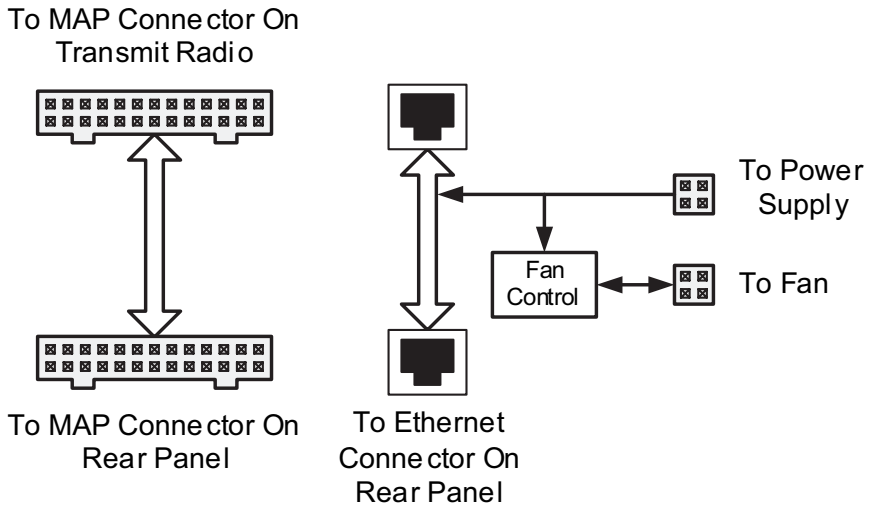


Figure 1-3 Connector Board Block Diagram

1.5 Fan

The fan control logic is provided by the fan controller IC (U51). This is a device from Cypress Semiconductor. There are basically two functions provided by the fan controller. First, it provides a PWM output based on a temperature input, and secondly, it provides detection of fan failure based on the fan tachometer reading.

The Repeater's internal chassis temperature is measured with an LM50 precision temperature sensor IC (U52). This IC outputs a voltage that is linearly proportional to temperature at 10 mV/°C, and with an offset of +500 mV. The output voltage of the LM50 ranges from +200 mV at -30°C to 1.1 V at +60°C.

The fan controller IC (U51) controls the speed of the fan by adjusting the PWM output (pin 1) from 0% to 100%. As long as the fan continues to work, pulses are output from the fan and input to the fan controller (pin 2).

1.6 AC/DC Power Supply

The Repeater uses the PMPN4001A switch-mode, Power Supply Unit (PSU). It is capable of 200 W and designed for a 50 W UHF or VHF repeater system. This supply has UL, CE, and TUV regulatory approvals and is usable in all regions by using the correct line cord. The AC input is auto-ranging with no manual switch being specified to operate from 90 V-270 V and 47 Hz-63 Hz. It outputs a nominal voltage of 13.8 V with a voltage tolerance of +/- 5%.

It has Power Factor Correction circuitry and is rated at 15 A across the whole operating temperature range of -30°C to +60°C. It also has a built-in battery revert circuit with a float output available for maintaining the charge on a battery and has UL, CE, & TUV approvals. The battery revert connector is accessible in the back of the power supply.

The supply has over-load, over-voltage, and over-temperature protection. In an overload condition, the PSU goes into a hiccup mode where it recovers automatically after the fault condition is removed. During an over-voltage condition, the PSU shuts down and will have to be re-powered on to recover. In an over-temperature condition, the PSU also shuts down, but will recover after the temperature goes down.

The PSU is not designed to be field serviceable. If it is determined that the PSU is not functioning, the whole unit needs to be replaced.

2.0 Repeater Interconnections and Cables

Figure 1-4 shows the Cable interconnections inside the Repeater.

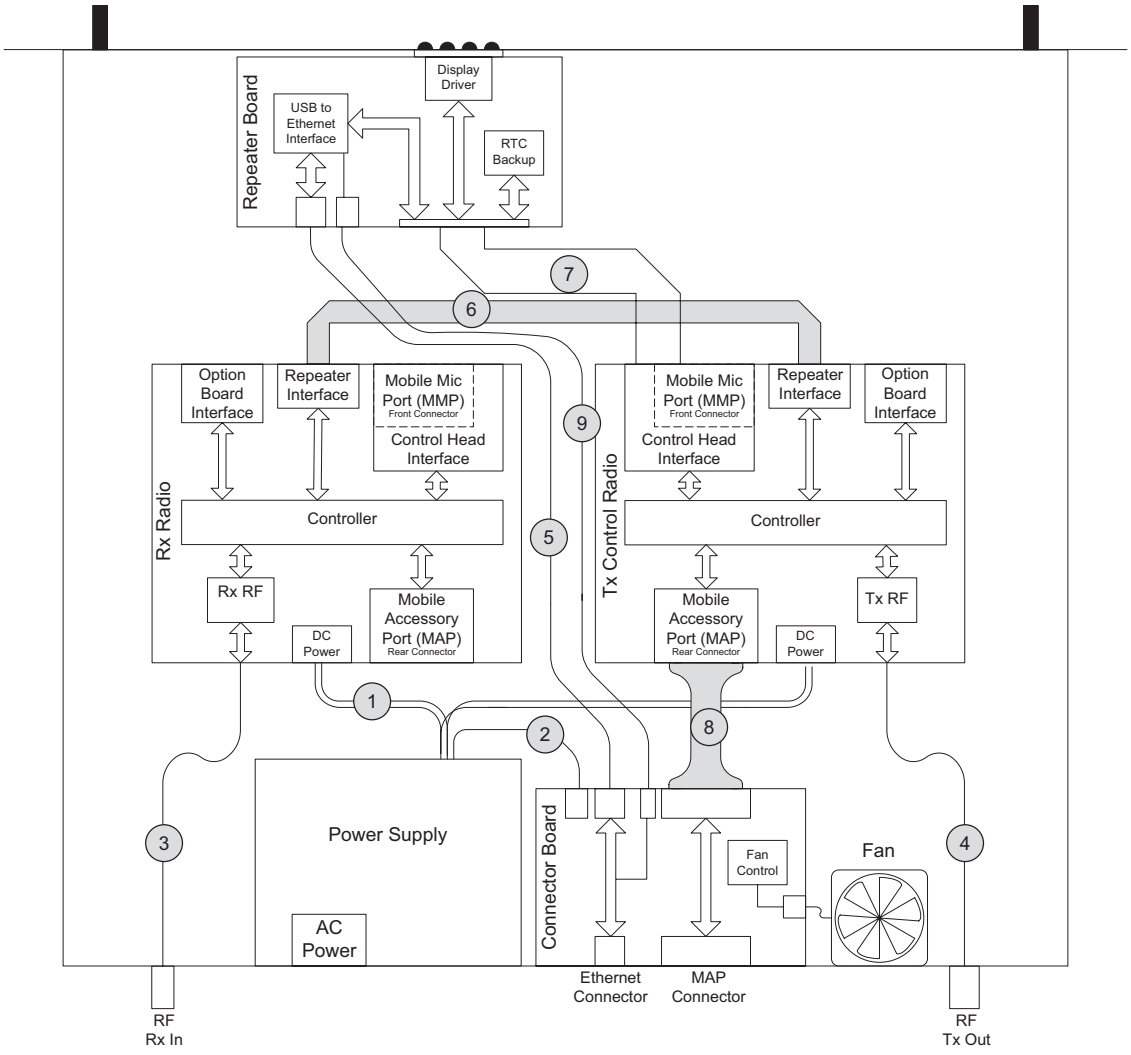


Figure 1-4 Repeater Cabling Diagram

The details of each of these cables/interconnections are as follows:

1. Two conductor DC power cables to the transmit and receive radios.
2. Six conductor DC power cable to the connector Board. Supplies power for the fan and Repeater Indicator board via cable 6.
3. RF Coax to connect the receive radio to the back of the Repeater. This cable has a BNC connector on the Repeater's rear panel.
4. RF Coax to connect the transmit radio to the back of the Repeater. This cable has an N type connector on the Repeater's rear panel.
5. CAT5 cable with RJ45 style connectors on both ends. This cable connects the Ethernet controller on the Repeater Indicator board to the Repeater's back panel and provides power from the Connector Board to the Repeater Indicator board for the LED indicators.

6. Eleven conductor flex cable. Provides the SSI connection between the transmit and receive radios. Refer to Section 1.5 for more details on this interface.
7. Thirty conductor flex cable. Provides the connection from the transmit radio to the Repeater Indicator board and includes SPI signals to drive the LED indicators, RTC backup supply, and the interface to the Ethernet controller.
8. Twenty six conductor cable. Provides the connection from the transmit radio's MAP to the MAP located on the Repeater's rear panel.
9. Eight pin conductor cable. Provides Ethernet LED signals from Repeater Board and HWID signals from Connector Board (Applicable for 32 MB repeaters only).

3.0 Mobile Radio's Theory of Operation

The sections that follow provide a detailed theory of operation for the VHF circuits in the two MOTOTRBO mobile radios. For details of the theory of operation and troubleshooting for the associated Controller circuits, refer to the Controller Section of this manual.

3.1 VHF (136–174 MHz) Receiver Circuitry

The receiver is configured as a dual-conversion superheterodyne receiver, capable of both FM and 4-level FSK demodulation. The major blocks are the front-end, the mixer, Xtal filter, and the Abacus III back-end IC. The overall block diagram is shown in Figure 1-5.

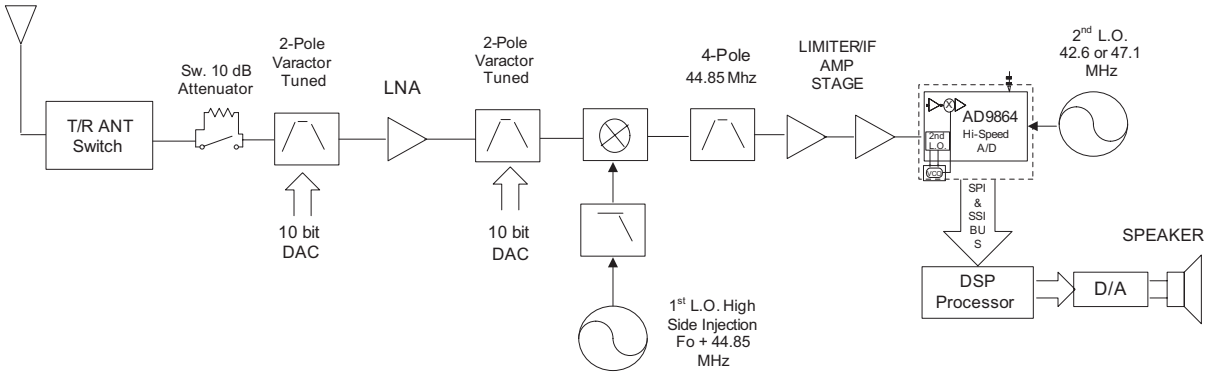


Figure 1-5 Receiver Block Diagram

3.1.1 Receiver Front-End

The front-end consists of a 2-pole varactor-tuned pre-selector filter, an LNA, a 2-pole varactor-tuned post-selector filter, and a passive double-balanced mixer. The received signal applied to the antenna is routed through the harmonic filter and PIN diode controlled antenna switch (D0702). A logic high level on ANT_ENABLE configures the antenna switch for Tx operation while a logic low places the switch in Rx mode. The insertion loss of the harmonic filter and antenna switch combined is approximately 0.8 dB max in Rx mode with slightly more loss at the upper end of the band. From this point, the Rx signal is routed to the Local Distance Switch (D0400/R0407), which biases on a diode in normal operation to minimize any insertion loss. Under strong signal conditions and for improved intermodulation protection from interfering signals, the switch can be turned on by the signal RF_ATTEN_1, which introduces approximately 10 dB of additional path loss. Activation of the switch can be accomplished manually by the user or left in the default setting.

The signal next reaches the pre-selector filter, which is a 2-pole varactor-tuned filter with 5 zeros that are optimized to provide image frequency rejection. This filter, and the similarly designed post-selector filter, provide over 75 dB of image response rejection. The 3 dB bandwidth for both filters varies across the band with a minimum of 32 MHz at 136 MHz and a maximum of 38 MHz around 174 MHz. Half-IF rejection from the filters is also frequency dependent with a minimum of approximately 7.5 dB achieved at the worst-case frequency of 174 MHz. Both filters have variable center frequencies that are adjusted by the FE_TUNE signal, which is derived from the output of a 10-bit DAC internal to the MAKO IC (U3200). The voltage is scaled up by a voltage doubler (Q0403) in order to provide the required linearity for the filters. Both filters are matched to the LNA (Q0402) to optimize the amplifier's noise figure (2.0 dB) and to provide an LNA gain of 16 dB to the signal. The combined gain of the filters and LNA is about 14 dB. Active bias transistor Q0401 maintains the collector current of Q0402 constant at 25 mA. The LNA, active bias circuit, Local Distance Switch, and voltage doubler are all supplied by 9R1_FILT, which is derived from 9R1 after filtering.

Following the post-selector filter is the Class 2, double-balanced mixer. It is comprised of baluns T0400 and T0401 and diode ring mixer D0405. Injection amplifier Q0405 provides 15 dB of gain to the Rx VCO injection signal. Another amplifier, Q0202, located in the VCO block, also provides gain for the LO signal and isolation from high RF signals entering the mixer. The signal applied to the LO port of the mixer is +16 dBm minimum after passing through the 3-pole/1-zero, low-pass injection filter. The LO injection is high-side and mixes the signal down to an IF frequency of 44.85 MHz. The output of the mixer is connected to a diplexer network, which terminates out-of-band frequencies into 51 ohms (R0427) while appearing as high impedance to the 44.85 MHz IF signal.

3.1.2 Receiver Back-End

The signal entering the back-end is matched to 4-pole crystal filter, FL0500, by C0507 and L0503. The filter is centered at 44.85 MHz with a 3 dB bandwidth of 13.4 kHz. IF amplifiers Q0500 and Q0501 follow the crystal filter and provide both amplification and limiting to the signal. An overall gain of 24 dB is available from the composite IF amplifier to lower-level IF signals. As the signal level increases, Q0501 begins to limit and eventually saturates out at approximately –16 dBm. The purpose of the limiting is to provide protection to the AD9864 Abacus III back-end IC (U0600). An internal 16 dB attenuator is also engaged to provide attenuation to the Abacus's input signal, working with the external amplifier to limit the signal below the ADC clip point. The block diagram for the AD9864 is shown in Figure 1-6 below. At IF levels exceeding –26 dBm into U0600, the 2nd LO synthesizer internal to U0600 can be pulled, causing corruption of the I/Q data being delivered to the DSP.

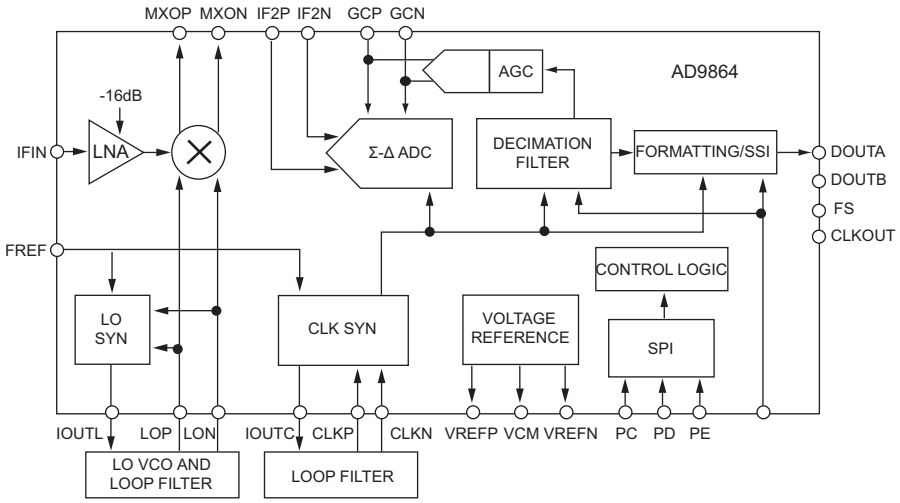


Figure 1-6 AD9864 Block Diagram

The Abacus III accepts the 44.85 MHz signal, processes it, and sends out baseband I/Q data in 16-bit format to the DSP at a 20 kHz rate. Internal to the Abacus III is an LNA and 16 dB FE attenuator, an internal integer-N synthesizer used to control the external 2nd LO VCO, a Sigma-Delta ADC and decimation filter, and control and formatting logic for outputting the baseband I/Q data. External to U0600 is the 2nd LO VCO with active device Q0600 and its associated circuitry including the loop filter consisting of C0613, C0618, and R0603. The 2nd LO mixes the 44.85 MHz IF signal down to 2.25 MHz before being input to the ADC where it is sampled. The tank circuit (L0608, C0605, C0642, R0617) and varactor (D0601) for the internal clock synthesizer, work with the loop filter (R0618, C0643, C0646) to provide the 18 MHz clocking signal to the internal ADC, decimation filter, and SSI formatting circuitry. A 3 Volt regulator (U0601) provides a clean 3 Volt supply to U0600. Transistor Q0601 is configured as a super filter to provide the 2nd LO transistor with a low noise supply. The reference clock for U0600 is 16.8_REF, which is a buffered (Q0100) 16.8 MHz clock from the synthesizer block.

Shown below in Figure 1-7, is the block diagram of the signal flow through the receiver back-end. All the blocks within the dotted box represent the DSP software algorithms internal to U1000.

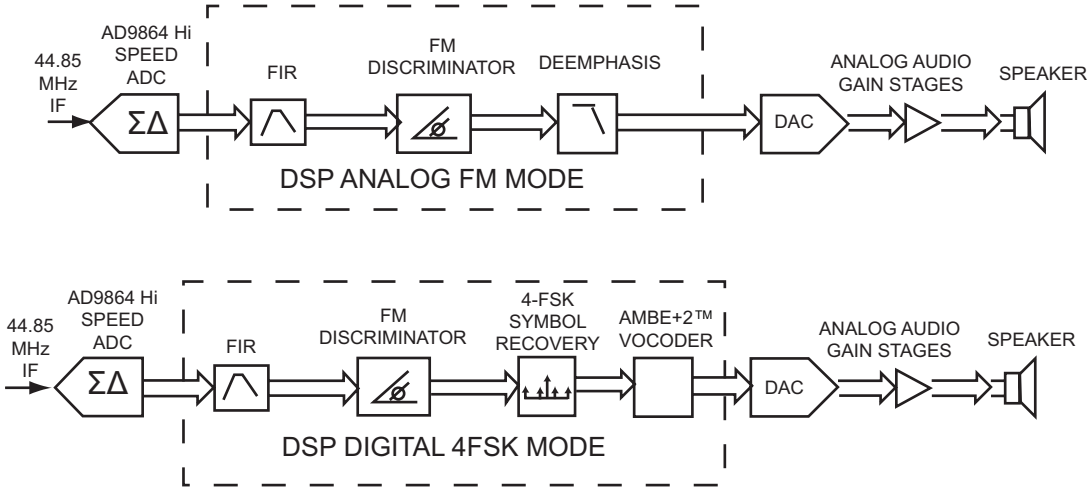


Figure 1-7 Signal Flow through Receiver Back-End

The DSP takes the incoming 20 kHz data-stream and passes the information through an FIR (Finite Impulse Response) filter, which provides rejection from any in-band adjacent channel interference. The remaining filter data is then sent through a decimation process further reducing its frequency to 8 kHz.

Depending on whether the repeater is in Analog or Digital mode determines the kind of signal processing used. If the radio is in Analog mode, the remaining 8 kHz data is sent through the FM Discriminator and De-emphasis subroutines in the DSP code. If the repeater is in Digital mode, the remaining 8 kHz data is still sent through the FM Discriminator but an additional "Symbol Recovery" routine is applied along with a standard AMBE+2™ Vocoder process. The resultant audio (still represented by high-speed data) is sent to a DAC (U3200), which drives several gain stages. These gain stages consist of an I2C audio attenuator (U3501) and a high-power audio PA (U3500) providing the user with at least 3 Watts of power through the internal speaker.

3.2 VHF (136–174 MHz) Transmitter Circuitry - 25 Watt

The Transmitter consists of the power amplifier circuitry and the power control circuitry. The power amplifier is responsible for delivering a faithful replica of the VCO output amplified up to the desired output power level, free from distortion. The power control circuitry is responsible for ensuring that the desired output power level is maintained in both analog and digital modes, as well as protecting the power amplifier from damage due to heat, antenna mismatch, out-of-range battery voltage, or mis-assembly.

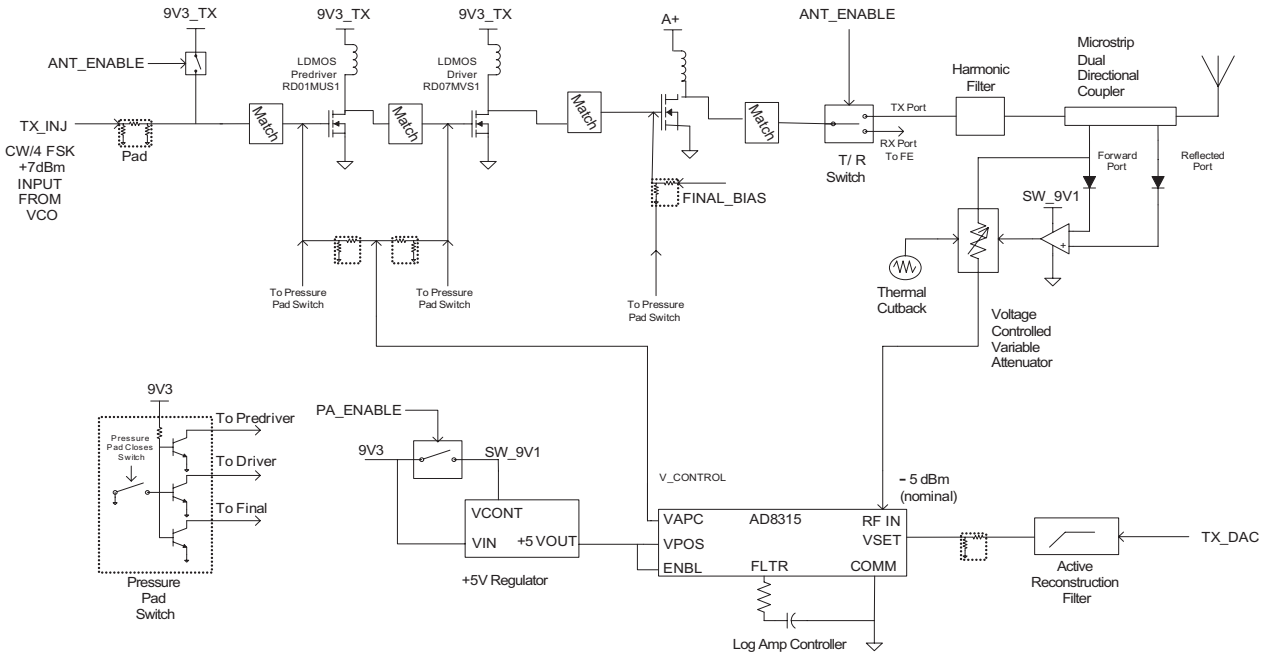


Figure 1-8 VHF 25 Watt Low-Power Transmitter Detailed Block Diagram

3.2.1 Power Amplifier

The radio's 25 Watt power amplifier (PA) is a 3-stage amplifier, which amplifies the output of the VCO to the required transmit power level. The first stage is an adjustable gain LDMOS pre-driver (RD01MUS1, Q0705), followed by an adjustable gain LDMOS driver (RD07MVS1, Q0703), and the fixed-gain LDMOS final device (MRF1535, Q0702). A transmit/receive (T/R) switch and a harmonic filter complete the transmit lineup.

3.2.2 Pre-Driver Stage

Pre-driver is a low power LDMOS device (RD01MUS1, Q0705), which delivers up to +27 dBm power to the driver stage. Its gain is controlled by varying the gate bias voltage and varies from low gain up to approximately 14 dB power gain. The gate bias voltage is controlled with the V_cont signal and is controlled in parallel with the driver stage gain.

The input match to this stage is a high-pass topology comprised of L0716, L0718, and C0795. (High-pass matches are used where appropriate to minimize the chances of low frequency regeneration within the amplifier.) The inter-stage match between the pre-driver and driver stages is comprised of C0790, C0786, C0791, C0792, L0717, and L0719 arranged in a high-pass topology.

Additional footprints are provided on the printed circuit board to allow for possible engineering optimizations to this match. These are non-populated parts C0793, C0794, C0817, C0820, and C0821.

3.2.3 Driver Stage

The next stage is a medium-power LDMOS device (RD07MVS1, Q0703), which delivers up to +38 dBm to the final device. Its gain is controlled by varying the gate bias voltage and varies from low gain up to approximately 10 dB power gain. The gate bias voltage is controlled with the V_cont signal and is controlled in parallel with the pre-driver stage gain.

R0718, R0720, R0754, and R0755 are required to improve the bandwidth of the driver stage. The inter-stage match between the driver and final device is comprised of C0819, C0746, C0754, C0745, and associated micro-strips on the PCB. Additional footprints are provided on the printed circuit board to allow for possible engineering optimizations to this match. These are non-populated parts C0753, C0755 and C0752.

3.2.4 Final Stage

The final stage is a high-power LDMOS device (MRF1535, Q0702). The package is mounted to a copper carrier to improve thermal conductivity to the chassis and also to more tightly control the RF load, allowing higher and more consistent maximum output power. This stage is biased at a quiescent current of 100 mA and operates with a fixed-gain of approximately 14 dB, allowing the radio to be set to a maximum output power of 35 Watts. The quiescent current is set by adjusting the Final_Bias signal.

The output match consists of C0719, C0720, C0721, C0726, C0727, C0741, C0724, C0725 and L0714 and the associated microstrip line on the PCB. The output matching circuitry of this stage has extremely critical part location requirements. Any repairs must be done with care to ensure the replaced components are placed accurately and properly soldered. Of particular concern are the output matching capacitors, C0719, C0720, C0721, C0726, and C0727. The resistor networks at the input of each of the final elements are required to improve the bandwidth of the circuit. These resistors are R0712, R0716, R0717, R0719, R0721, R0726, R0732, R0733, R0734, R0736, R0737, and R0739.

Additional footprints are provided on the printed circuit board to allow for possible engineering optimizations to this match. These are non-populated parts C0722, C0729, and C0730. If the final device is replaced, the bias voltage must be re-tuned using the Customer Programming Software (CPS). Care must be taken not to damage the device by exceeding the maximum allowed quiescent current. The maximum allowable current is 500 mA, but the design is optimized for 100 mA as noted earlier. The device can tolerate up to 5 Amps for brief periods of time without damage.

3.2.5 Antenna Switch

The Antenna Switch (T/R switch) has two modes of operation, transmit and receive.

Transmit mode:
The antenna switch utilizes the existing dc feed (A+) to the final stage device (Q0702). Both PIN diodes, D0700 and D0702, are turned on during key-up by forward biasing them. Forward biasing is achieved by pulling down the voltage at the cathode end of D0702 to around 12.2 Volts (0.7 Volt drop across each diode). Q0704 is configured as a current sink that maintains the current through the antenna switch diodes at 100 mA, as set by VR0700 and R0738.

The current sink is enabled during transmit mode by ANT_ENABLE asserting thru Q0706 and associated circuitry. When the PIN diodes are conducting, an RF ground is formed at the anode of the lower PIN diode D0702, which places the series L0710 and L0724 in parallel with C0803. The values of L0710, L0724, and C0803 are chosen so that they are in parallel resonance at the center of the transmit band, making them appear as an open-circuit so that a 50 ohm power path is maintained thru the top PIN diode to the harmonic filter. To further attenuate the Tx signal from getting to the Rx front-end, a PIN diode pair (D0703) is placed in the Rx path separated from the D0702 short by a quarter wave inductor (L0730 & L0731). This diode pair shorts to ground in transmit mode so that the receiver sees as little transmitter power as possible.

Receive mode:
The DC current thru the PIN diodes is interrupted by turning off the current sink. The RF path now flows from the Harmonic Filter thru the matching circuit formed by C0803, L0710, and L0724, then to pi network C0766, L0730, L0731, and C0772. The additional shunt diodes (D0703) will be high impedance since no bias current is flowing from the switched Tx power line.

3.2.6 Harmonic Filter

Inductors L0720, L0721, L0706, L0707, L0708, L0709, L0722, and L0723, and capacitors C0742, C0739, C0740, C0735, and C0750, form a harmonic filter which is a 7th order low-pass filter with two notches; this is used to attenuate harmonic energy from the transmitter before it reaches the antenna. The harmonic filter also prevents high-level RF signals above the receiver passband from reaching the receiver circuits, improving spurious response rejection. R0713 and L0728 are used to drain any electrostatic charges that might otherwise build up on the antenna.

3.2.7 Directional Coupler

The dual directional microstrip coupler is implemented at the harmonic filter output to sample both forward and reverse directed transmitter power. RF power from the transmitter PA passes through the microstrip coupler before reaching the antenna. Forward RF power is coupled to the U0940 log detector / controller via the voltage controlled attenuator (VCA) stage consisting of pin diodes D0901, D0902, and D0903. The log detector/controller regulates the gain of PA stages Q0703 and Q0705 (via V_cont) as necessary, thus ensuring that the forward power out of the radio is held to a constant value.

The directional coupler functions not only as part of the transmitter power regulation circuit but also as part of the VSWR load detection circuitry. Its physical location close to the antenna connector allows accurate VSWR sense at the transmitter output. Forward and reverse coupled signals are rectified by D0904 and D0905, respectively. Resulting DC voltage FWD_DETECTED is proportional to RF power while REV_DETECTED is proportional to reflected RF power. The detected voltages are fed to the respective inputs of difference amplifier U0901. The difference amplifier output is applied to variable attenuator control stage U0900-1.

An abnormally high reflected power level, such as may be caused by a damaged antenna, also causes an increase in the difference amplifier output voltage. An increased difference amplifier output causes a reduction in attenuation by the VCA. As a result, the increased RF signal applied to the log detector/controller causes the controller to reduce the gain of PA stages Q0703 and Q0705. Transmitter power is thus reduced to prevent damage to the final device due to an improper load.

3.2.8 Power Control

The transmitter uses PA controller IC, U0940, to control the power output of the radio. A portion of the forward RF power from the transmitter is sampled by the directional coupler and delivered via the VCA to the RFIN port of the PA controller IC (pin 1). The PA controller, a log detector type, provides temperature-stable, high accuracy control over a typical 50 dB dynamic range.

The MAKO IC contains a digital-to-analog converter (DAC), which provides a reference voltage (TX_DAC) at the input of reconstruction filter stage U0900-2. The filtered reference voltage at the output of U0900-2 is divided by the combination of R0942 and R0946 before reaching the VSET input of the PA controller IC (pin 3). Thermistor RT0953 is used in combination with R0954 to compensate reference voltage drift at operating temperature extremes. Reference voltage level is programmable through the SPI lines of the MAKO. This reference voltage is proportional to the desired power setting of the transmitter, and is factory programmed at several points across the frequency range of the transmitter to offset frequency response variations of the transmitter's coupled power circuits.

The PA controller IC provides a DC output voltage at pin 7 (VAPC), which is divided to provide gate bias for PA pre-driver and driver stages. The 0 to 5 VDC range at U0940 pin 7, is applied as V_CONTROL to power-adjust the transmitter by controlling the gate bias of stages Q0703 and Q0705. Voltage divider combination R0727 and R0728 provide gate bias to Q0703 while divider combination R0750 and R0751 provide gate bias to Q0705. This adjusts the transmitter power output to the intended value. The ratios of each of these resistor dividers are chosen to ensure that Q0703 and Q0705 are both running at their nominal design condition at rated output power. Variations in sampled forward transmitter power cause the PA controller IC to adjust the control voltage above or below its nominal value to raise or lower output power in order to maintain transmitter output power relative to the reference voltage applied to VSET.

A power control attenuator circuit was added to the 25 Watt transmitter circuitry in order to extend the range of the RF detection in the RF detector at low-power levels. This enables the power control loop to close at lower relative power levels and is needed because of the greater relative power-set range (1-25 Watt, 14 dB). The PC_ATTEN_ENA activation threshold is set in software for operation at lower power levels, typically 1-5 Watt. When the PC_ATTEN_ENA is activated, the VCA is driven to its minimum attenuation level, which increases the RF level at the AD8315 (U0940) for a given transmitter power level. The radio software adjusts the K&M tuning accordingly such that proper power-set is maintained at operating powers both above and below the activation threshold point.

3.2.9 Power Ramp Profile Control

In order to limit transient adjacent channel power at the transmitter's output, the ramped power should follow a raised-cosine profile. The PA controller IC has a linear slope function when scaled in dB/V. To achieve the desired raised-cosine profile of the output power, the ramped reference voltage provided by the MAKO DAC follows a raised-cosine approximation. The MAKO DAC reference output is low-pass filtered by the DAC reconstruction filter before it is applied to the VSET input of the PA controller IC. Reconstruction filtering reduces spurious emissions in the RF spectrum as a result of the finite steps of the DAC. Loop filter capacitor C0926, in conjunction with resistor R0950 and the integrator within the PA controller IC, control the loop dynamics. Loop dynamics have been optimized to achieve sufficient speed to follow the required ramping profiles while meeting switching transient requirements over varied power levels. Accurate control of the power-rise (ramp-up) and power-decay (ramp-down) characteristics minimizes splatter into adjacent channels.

3.2.10 Load Dump Protection

In order to protect the transmitter line-up in the case where extremely high voltage spike occurs, a simple load dump protection circuit is implemented. This circuit is placed at the gate of PA stage Q0703 and consists of resistors R0980, R0981, R0982 and transistor Q0710. When high voltage spike (>29.9 V_) is sensed at power supply (A+), the base-to-emitter voltage VBE of this transistor will be above threshold voltage and this will cause the transistor to turn on. The VBE is controlled by a combination of R0980 and R0981 which form a voltage divider circuit. When Q0710 is turned on, it will drain the current from PA stage Q0703 via R0982 and thus preventing the transmission of power and keep the transmitter line-up from any damage.

3.2.11 Thermal Protection

Thermistor RT0908 and R0902 form a voltage divider with the output proportional to the sensed circuit board temperature in the vicinity of the transmitter driver and final devices. The voltage divider output is routed to operational amplifier U0901-2, which provides a dc voltage via diode junction D0900 to control the attenuation level of the VCA stage. For the condition that the temperature threshold set by resistive divider combination R0901 and R0909 is reached, the VCA is driven to increase the RFIN signal at the PA controller IC (pin 1). This increase will cause the PA controller IC to adjust the PA control voltage below its nominal value to decrease transmitter output power. The temperature will be reduced by lowering transmitter output power relative to the reference voltage applied to VSET.

3.2.12 Out-of-Range Battery Protection

Transmitter power cutback, under extended battery supply voltage operation, is provided for by monitoring the battery supply in the controller circuit of the radio in order to change the VSET input of the PA controller IC (pin 3) for reduced transmitter output. This cutback starts when the battery voltage at the connector is 15.3 Volts or greater and has a 2 dB/V slope. In addition, a second low battery detect circuit is implemented in hardware. This hardware cutback forces a 1.2 dB drop in RF power level when the battery voltage drops below 12 Volts.

3.2.13 Pressure Pad Switch

The power control circuitry includes a safety switch (S0700) that consists of a conductive portion of the rubber pad which pushes the RF final transistor Q0702 against the chassis. When the chassis cover and rubber pad are properly assembled, the conductive portion of the pad contacts a pattern on the circuit board, electrically closing switch S0700. If the cover and pad are not in place, switch S0700 is open-circuited and the power control circuit is disabled, turning off the gate bias to Q0702, Q0703, and Q0705. This prevents thermal damage of the RF transistors which might occur if the transmitter is operated without adequate heat sinking.

3.3 Frequency Generation Circuitry

The synthesizer subsystem consists of the reference oscillator (Y0100), the fractional-N Synthesizer IC (Tomahawk II, U0100), and the Voltage Controlled Oscillator VCO.

3.3.1 Reference Oscillator

The reference oscillator (Y0100) contains a temperature compensated crystal oscillator with a frequency of 16.8 MHz. A digital-to-analog (DAC) converter internal to U0100 (Tomahawk) and controlled by the microprocessor via serial interface (SPI), sets the voltage at the AUX_DAC output of U0100 (pin H6) to set the frequency of the oscillator. The output of the oscillator (pin 3 of Y0100) is applied to pin K5 (XOSC_BASE) of U0100.

3.3.2 Fractional-N Synthesizer

The Tomahawk II Synthesizer IC (U0100) consists of a pre-scaler, a programmable divider and divider control logic, phase detector, charge pump, a D/A converter in the high frequency analog modulation path, an attenuator to balance the high and low frequency modulation paths, a serial interface for control (SPI), a serial interface for modulation (SSI), and a super filter for the regulated 2.45 Volts.

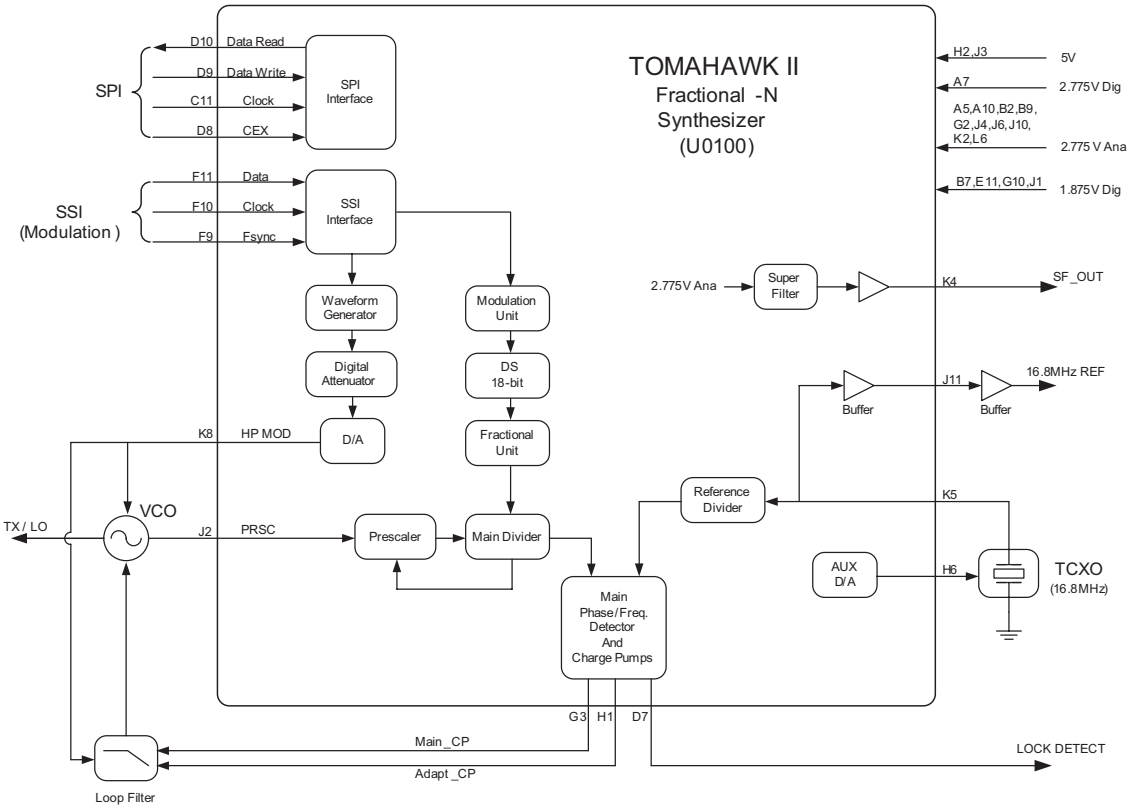


Figure 1-9 VHF Synthesizer Block Diagram

A voltage of 2.775 Volts applied to the super filter input (U0100 pin J4) supplies an output voltage of 2.45 VDC (SF_OUT) at pin K4. This supplies the VCO and the VCO modulation bias circuit (via R0321). The super filter supply voltage is provided by the 2.775 Volt regulator within U3200. The synthesizer is also supplied by the 5 Volt regulator, U3002, another 2.775 Volt regulator within U3200, and a 1.875 Volt regulator within U3200.

The output signal LOCK (U0100-D7) provides information about the lock status of the synthesizer loop. A high level at this output indicates a stable loop. A discrete buffer amplifier (Q0100) provides a buffered 16.8 MHz reference frequency to other parts of the radio.

The serial programming interface (SPI) is connected to the microprocessor via the data lines SPI_DW (U0100-D9) and SPI_DR (U0100-D10), clock line SPI_CLK (U0100-C11), and chip enable line CEX (U0100-D8). The serial modulation interface (SSI) is connected to the DSP via the data line SDTX (U0100-F11), clock line TXCLK (U0100-F10), and frame sync line SFTX (U0100-F9).

3.3.3 Voltage Controlled Oscillator (VCO)

The Voltage Controlled Oscillator (VCO) subsystem consists of three Colpitts oscillators (two Rx and one Tx), a single-stage Tx buffer amplifier, a single-stage Rx buffer amplifier, oscillator bias control switches, and the modulation circuitry.

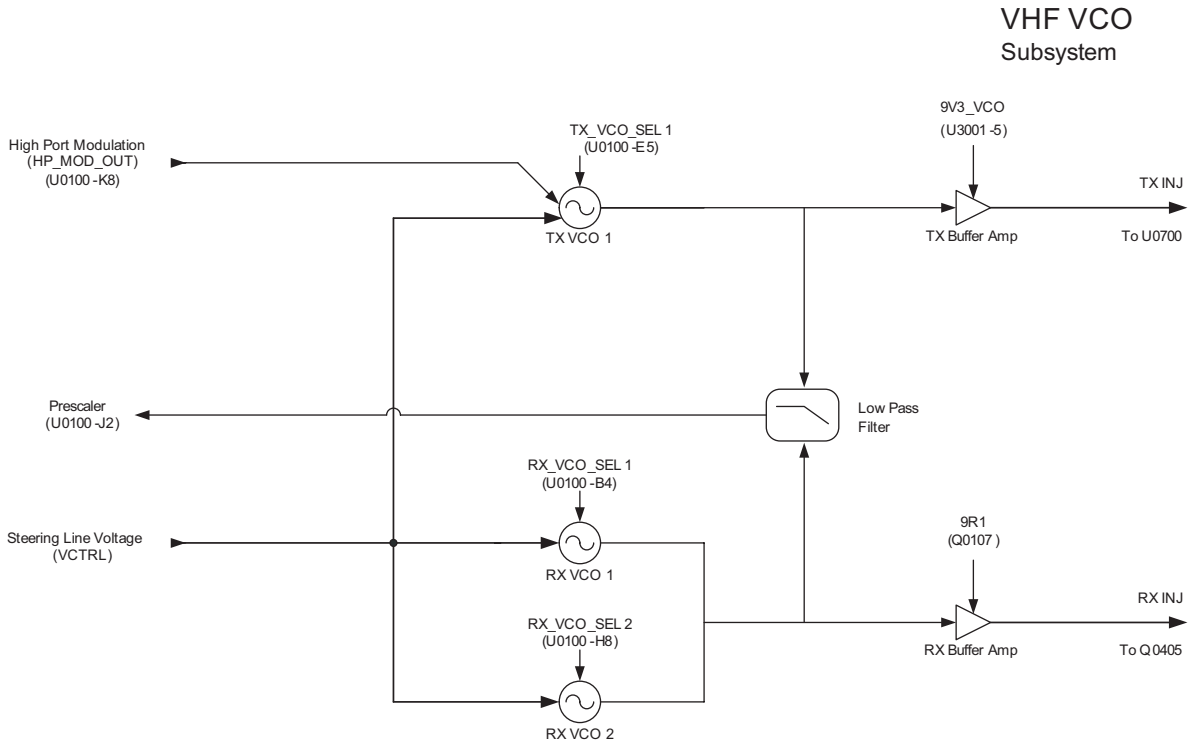


Figure 1-10 VHF VCO Block Diagram

The VHF Rx VCO design incorporates two varactor-tunable Colpitts oscillators. Each Rx oscillator has a tuning range of 19 MHz, sufficient to cover the Rx frequency range of 180.85 MHz to 218.85 MHz. A single Tx oscillator covers the frequency range of 136 MHz to 174 MHz. The oscillators resonate at fundamental operating frequencies. Three (active-low logic) general purpose output lines (GPO1, GPO3, and GPO6) from the Tomahawk IC (U0100-B4, E5, and H8) provide the control for independent bias selection to each oscillator (VCO_SEL) via the PNP transistor switches U0304 and U0201. The 2.45 Volt super filtered output, SF_OUT, of the Tomahawk IC (U0100-K4) supplies the bias to the oscillators. A portion of the VCO output signal is lightly coupled through coupling capacitors C0331 and C0231, routed through a low-pass filter (formed by L0221, C0235, L0230, C0265, and C0233), and fed back to the M_PRSC input of the Tomahawk IC (U0100-J2).

High-port modulation is scaled through a voltage divider (comprised of R0319, R0320, and R0321) and applied to the Tx modulation varactor diode CR0300. The Tx VCO frequency is modulated via coupling capacitor C0310.

A discrete single-stage Tx buffer amplifier (comprised of the NPN transistor Q0302 and surrounding components) amplifies the signal from the Tx oscillator to the level required by the first stage of the Transmitter Power Amplifier (U0700). The Tx buffer amplifier also provides sufficient isolation from any undesired load-pulling from the Transmitter Power Amplifier. The bias for Q0302 is provided by the 9.3 Volt regulator U3001.

A discrete single-stage Rx buffer amplifier (comprised of the NPN transistor Q0202 and surrounding components) amplifies the signal from the Rx oscillator to the level required by the LO injection amplifier (Q0405). The Rx buffer amplifier also provides sufficient isolation from any undesired load-pulling from high input levels in the receiver front-end. GPO4 from the Tomahawk IC (U0100-D4) controls the transistor switch (comprised of Q0108 and Q0107), that enables the 9.1 Volt bias to Q0202 (via the 9.3 Volt regulator U3001).

3.3.4 Synthesizer Operation

The complete synthesizer subsystem is comprised mainly of the Tomahawk Synthesizer IC, Reference Oscillator (crystal oscillator with temperature compensation), loop filter circuitry, VCO, and DC supplies. The VCO feedback signal, PRSC, is fed to pin J2 of U0100 (M_PRSC) via a low-pass filter (L0221, C0235, L0230, C0265 and C0233) which attenuates harmonics and provides the correct level to close the phase-locked loop.

The prescaler in the Synthesizer IC (U0100) is a four-level prescaler capable of dividing by 4, 5, 6, and 7**.** The main loop N divider is configured to be an 8-bit divider. The divide-by-N portion of the main loop is set via the SPI. The fractional portion of the divider is realized using a 3-accumulator, 24-bit fractional divider. The SPI is used to set the desired divide ratio.

The output of the prescaler is applied to the main loop divider. The output of the main divider is sent to the phase/frequency detector, which compares the main divider's output signal with the reference signal. The reference signal is generated by dividing down the signal of the reference oscillator (Y0100). The output signal of the phase/frequency detector is a pulsed signal which is routed to the charge pumps. The main charge pump current is programmable through the SPI with its output at pin G3 of U0100 (MN_CP). The loop filter transforms this current into a steering voltage that is applied to the VCO.

To reduce lock time when new frequency data has been loaded into the synthesizer, an adapt charge pump, providing much greater current than the main charge pump, is turned on for a finite amount of time to quickly charge or discharge the loop filter capacitors to steer the VCO to the desired frequency. The output of the adapt charge pump passes to the loop filter via pin H1 of U0100 (MN_ADAPT_CP). When the synthesizer is within the lock range and the adapt timer runs out, the adapt charge pump is powered down and the main charge pump takes over. A settled synthesizer loop is indicated by a high level at signal LOCK (U0100-D7), which is routed to the microprocessor. Q0102 is configured as a current source to provide a steady 1.5 mA during the adapt period. U0101 is an analog switch that opens the adapt path slightly before the end of the adapt period to prevent the current from the current source from pushing the VCO off frequency.

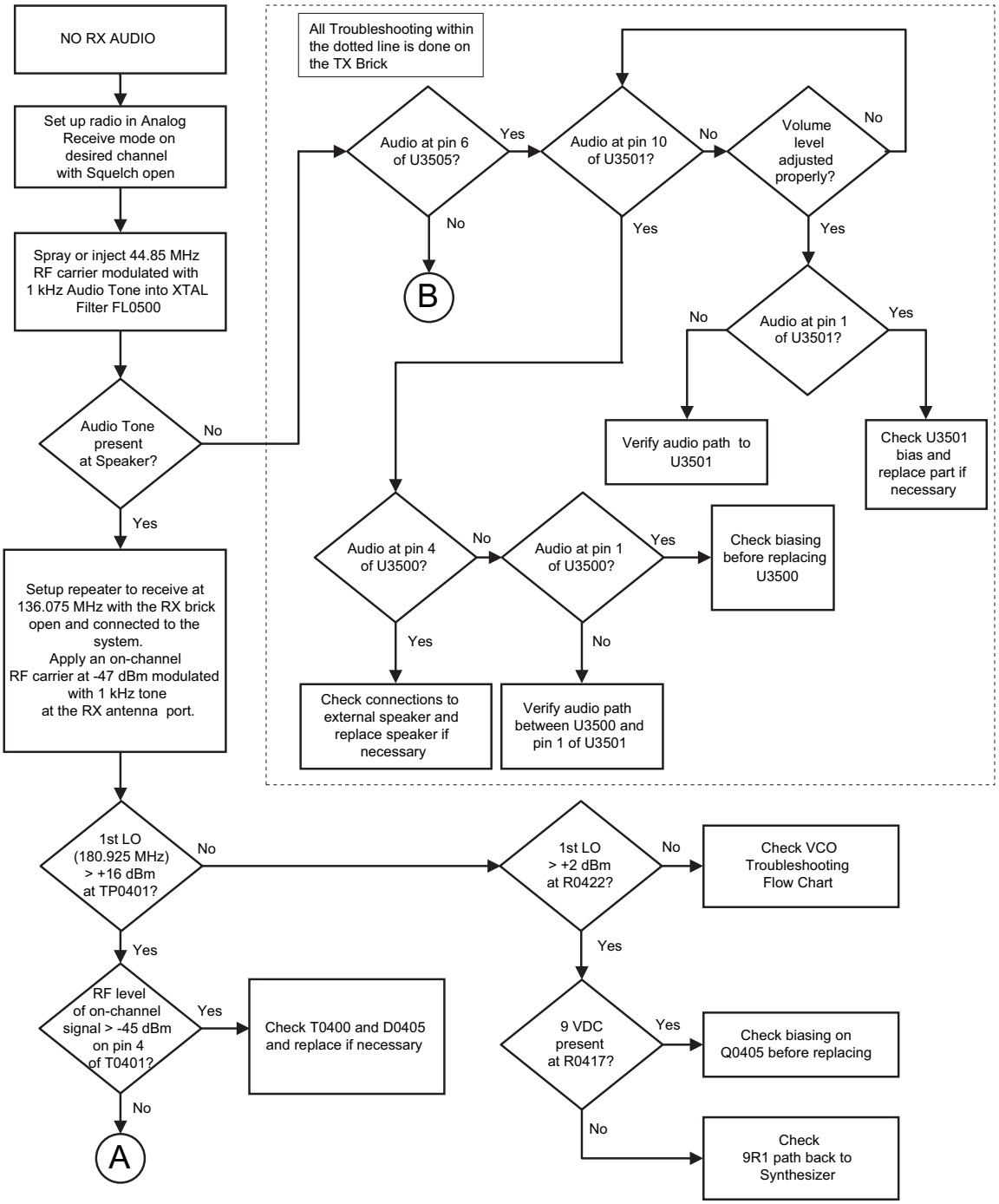
Modulation is performed by applying a digital data stream via the SSI bus from the DSP (U1000) to the synthesizer (U0100). In order to meet spurious and phase noise requirements, the PLL bandwidth was designed to be narrower than the full modulation bandwidth, therefore requiring the use of dual-port modulation. Internal to the synthesizer (U0100), low-port modulation is added to the fractional-N division numerator to trace out the modulation versus time while the high-port data stream passes through an interpolating waveform generator, a digital attenuator (for modulation balancing), and then is converted to an analog signal through a 10-bit DAC before modulating the VCO. This high-port analog modulation output (HP_MOD_OUT, U0100-K8) is connected to the VCO modulation varactor diode (CR0300) via C0360 and R0319.

Notes

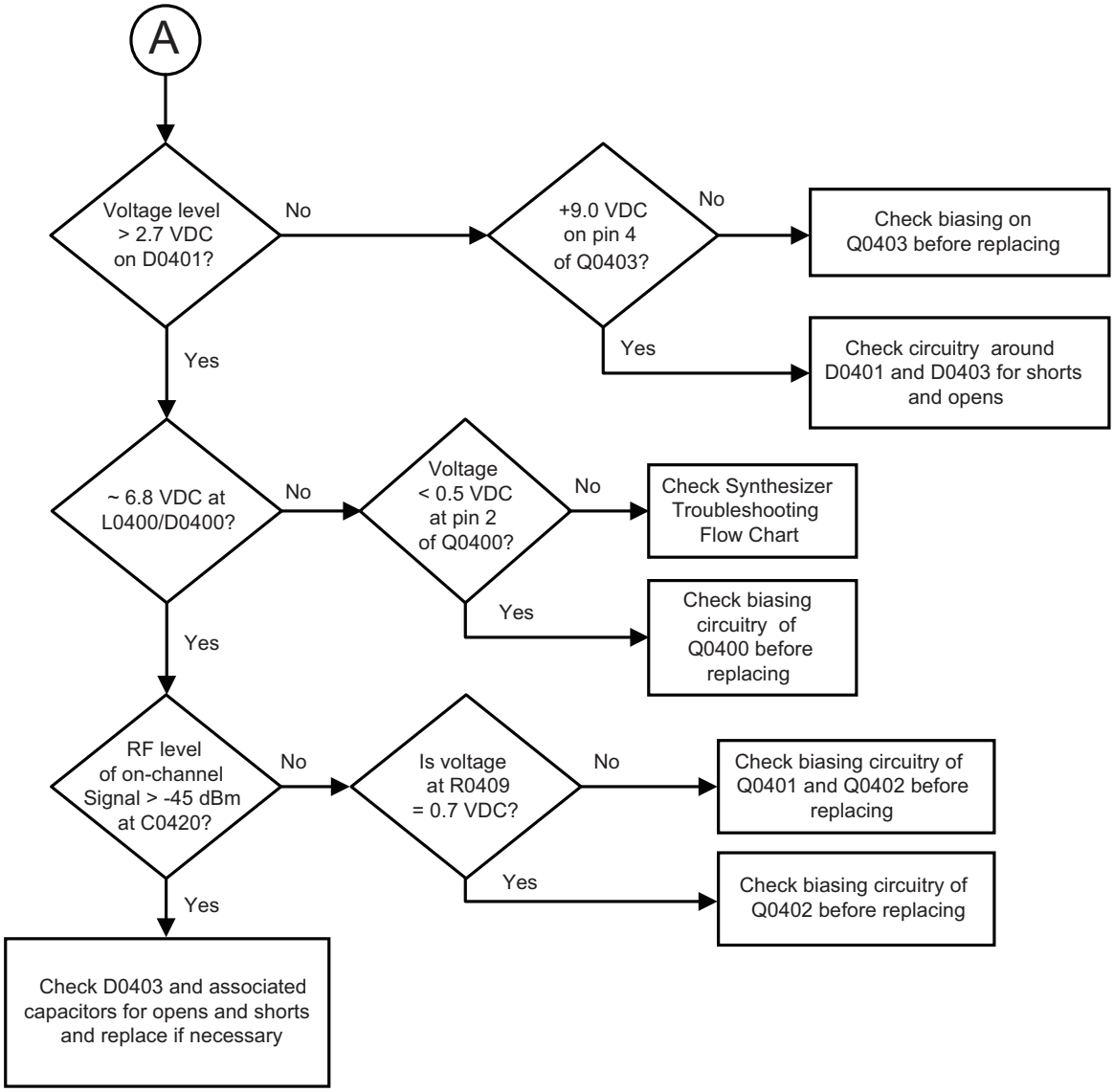
Section 2

TROUBLESHOOTING CHARTS

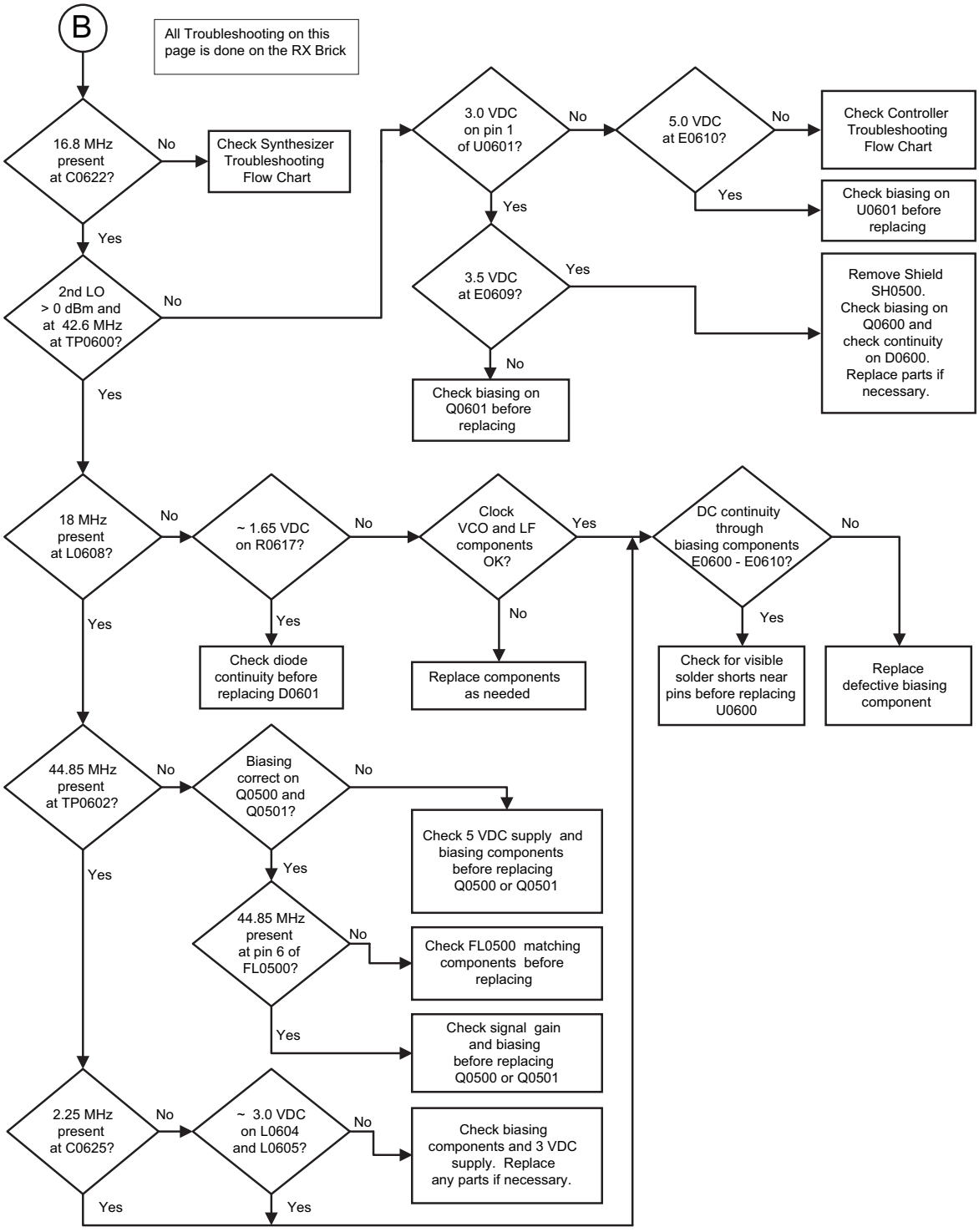
1.0 Troubleshooting Flow Chart for Receiver (Sheet 1 of 3)



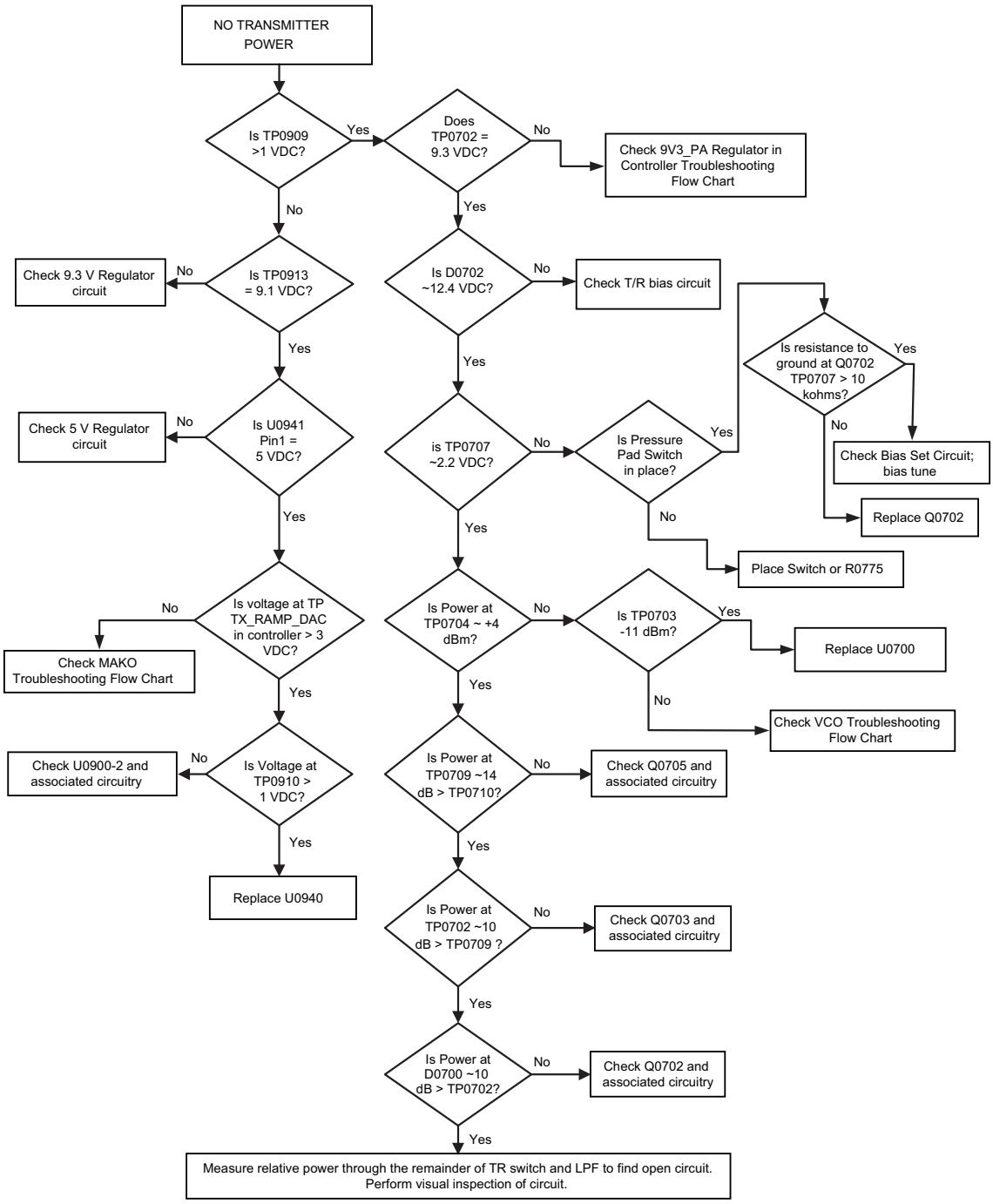
1.1 Troubleshooting Flow Chart for Receiver (Sheet 2 of 3)



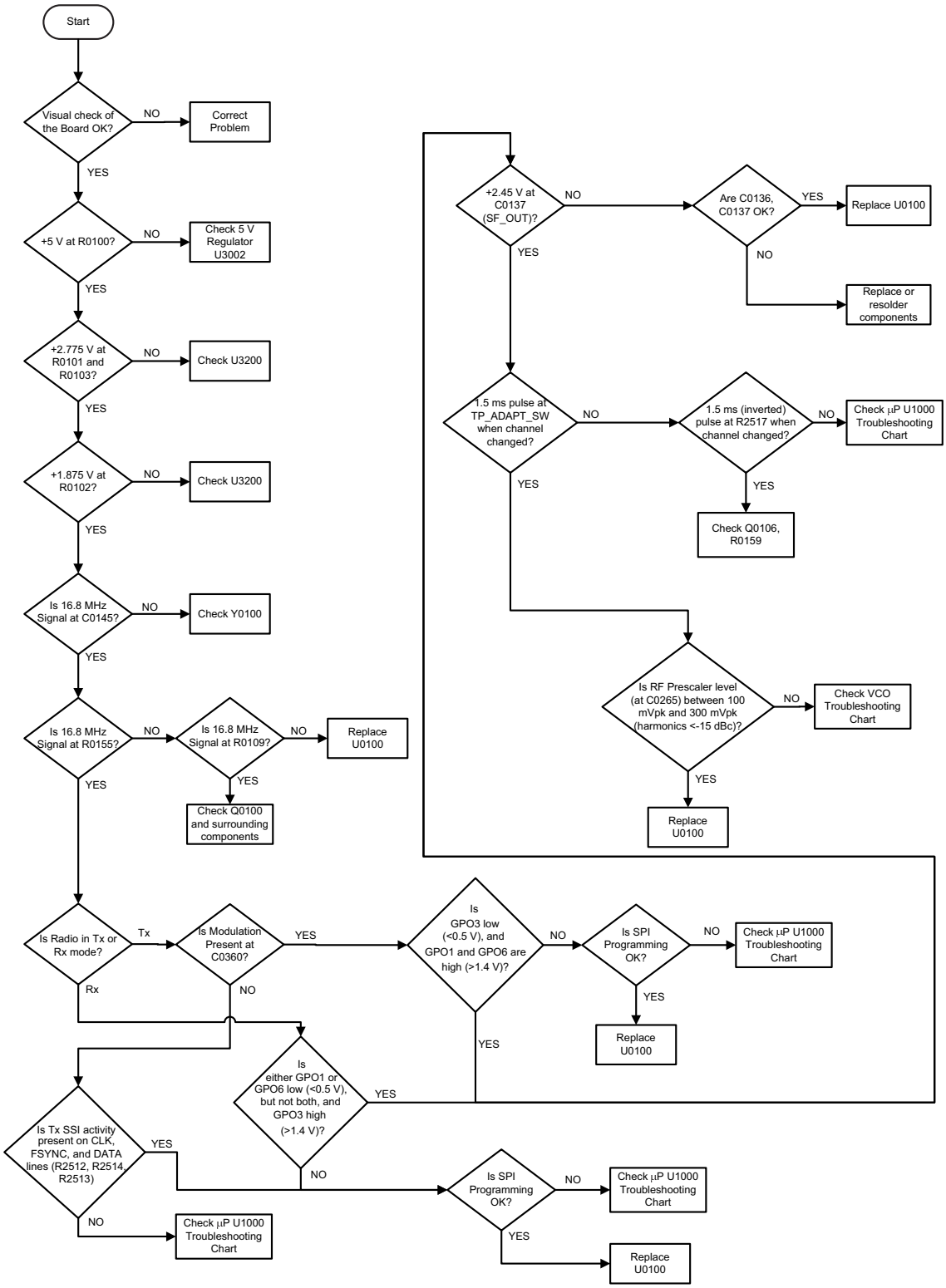
1.2 Troubleshooting Flow Chart for Receiver (Sheet 3 of 3)



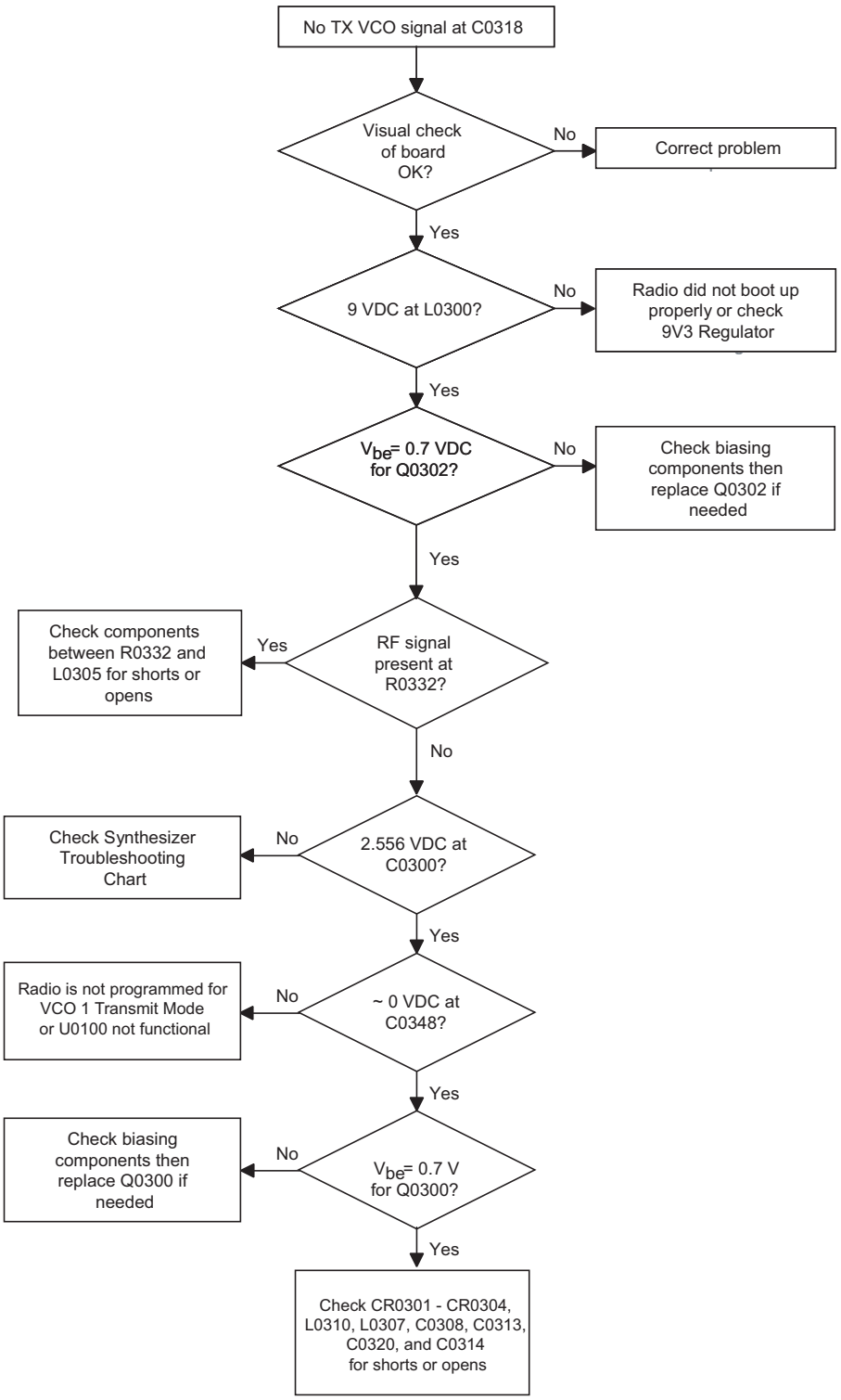
2.0 Troubleshooting Flow Chart for 25W Transmitter



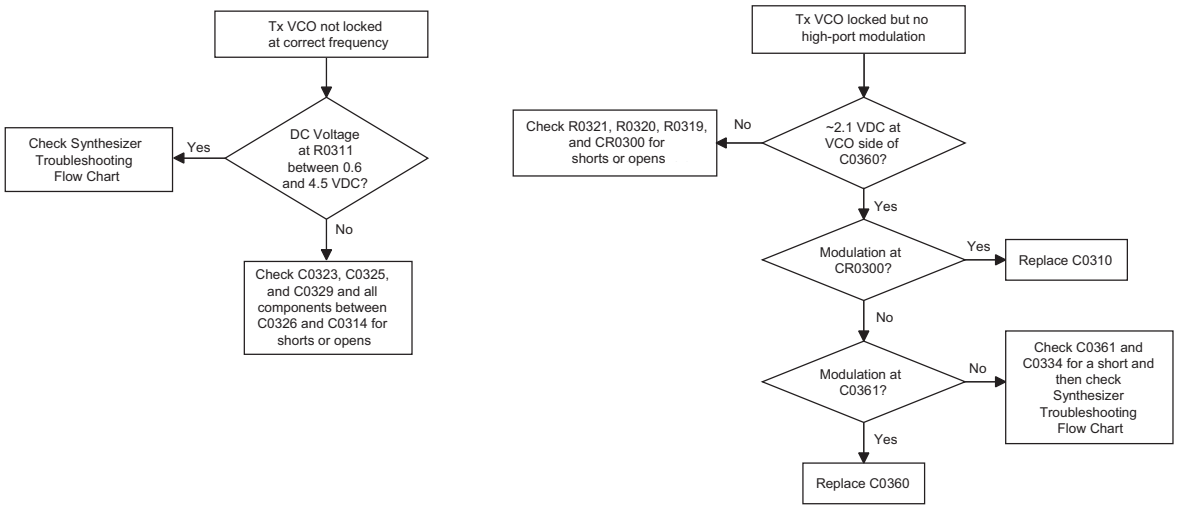
3.0 Troubleshooting Flow Chart for Synthesizer



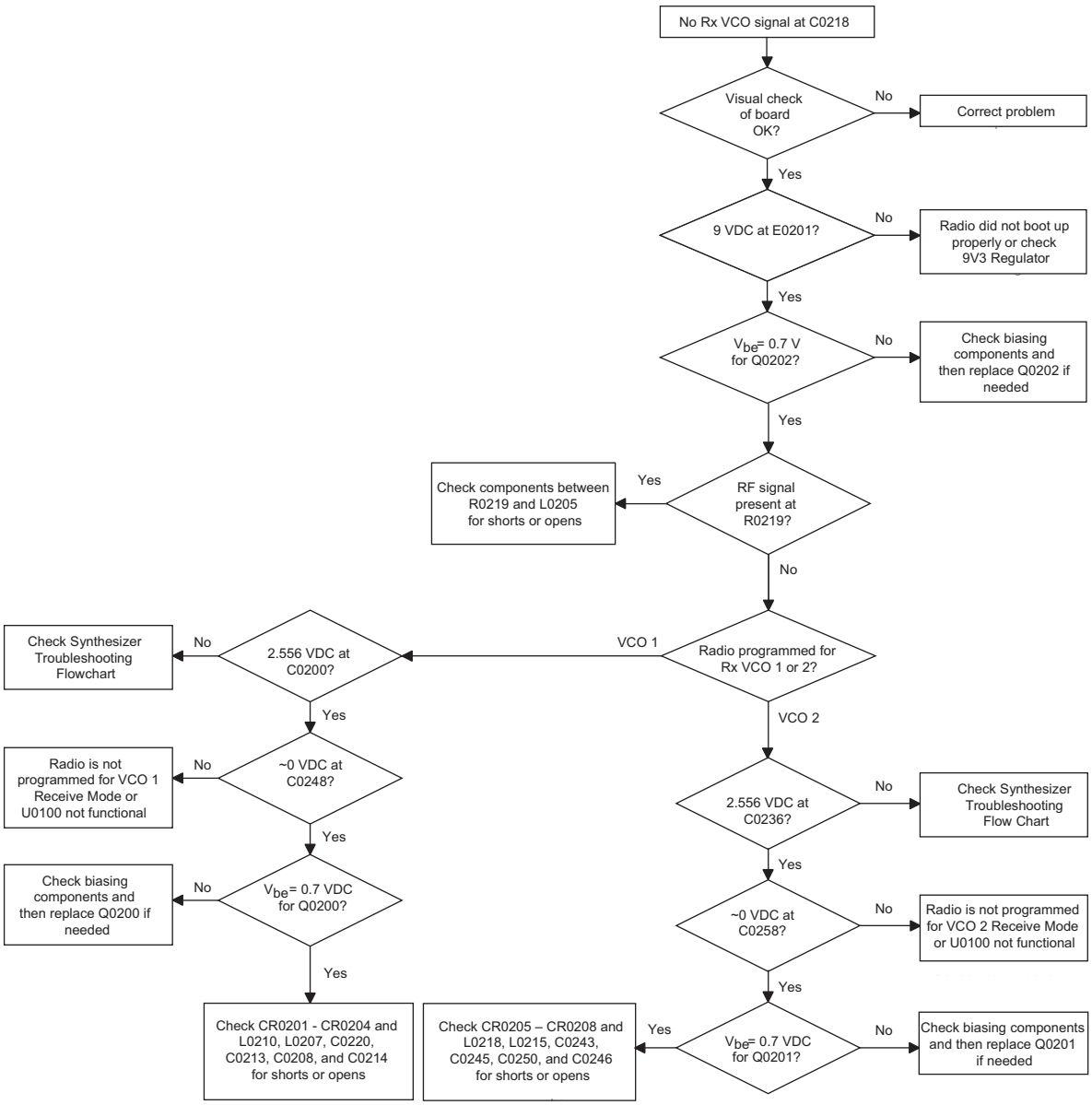
4.0 Troubleshooting Flow Chart for Tx VCO (Sheet 1 of 2)



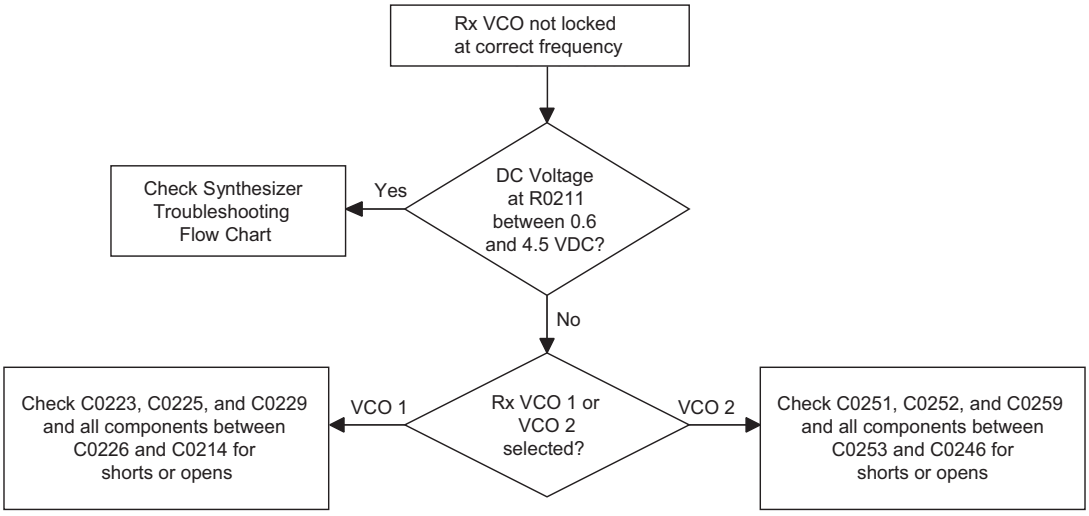
4.1 Troubleshooting Flow Chart for Tx VCO (Sheet 2 of 2)



5.0 Troubleshooting Flow Chart for Rx VCO (Sheet 1 of 2)



5.1 Troubleshooting Flow Chart for Rx VCO (Sheet 2 of 2)



Notes

Section 3

VHF PCB / SCHEMATICS / PARTS LIST

1.0 Allocation of Schematics and Circuit Boards

1.1 Controller Circuits

The VHF circuits are contained on the Printed Circuit Board (PCB) which also contains the Controller circuits. This Chapter shows the schematics for the VHF circuits only, refer to the Controller section for details of the related Controller circuits. The PCB component layouts in this Chapter show both the Controller and VHF circuit components. The VHF schematics and the related PCB and parts list are shown in the table below.

NOTE: The VHF Schematics and parts lists are the same for 8471495L01 and 8471495L03. Only the Controller circuits are different between the two PCBs.

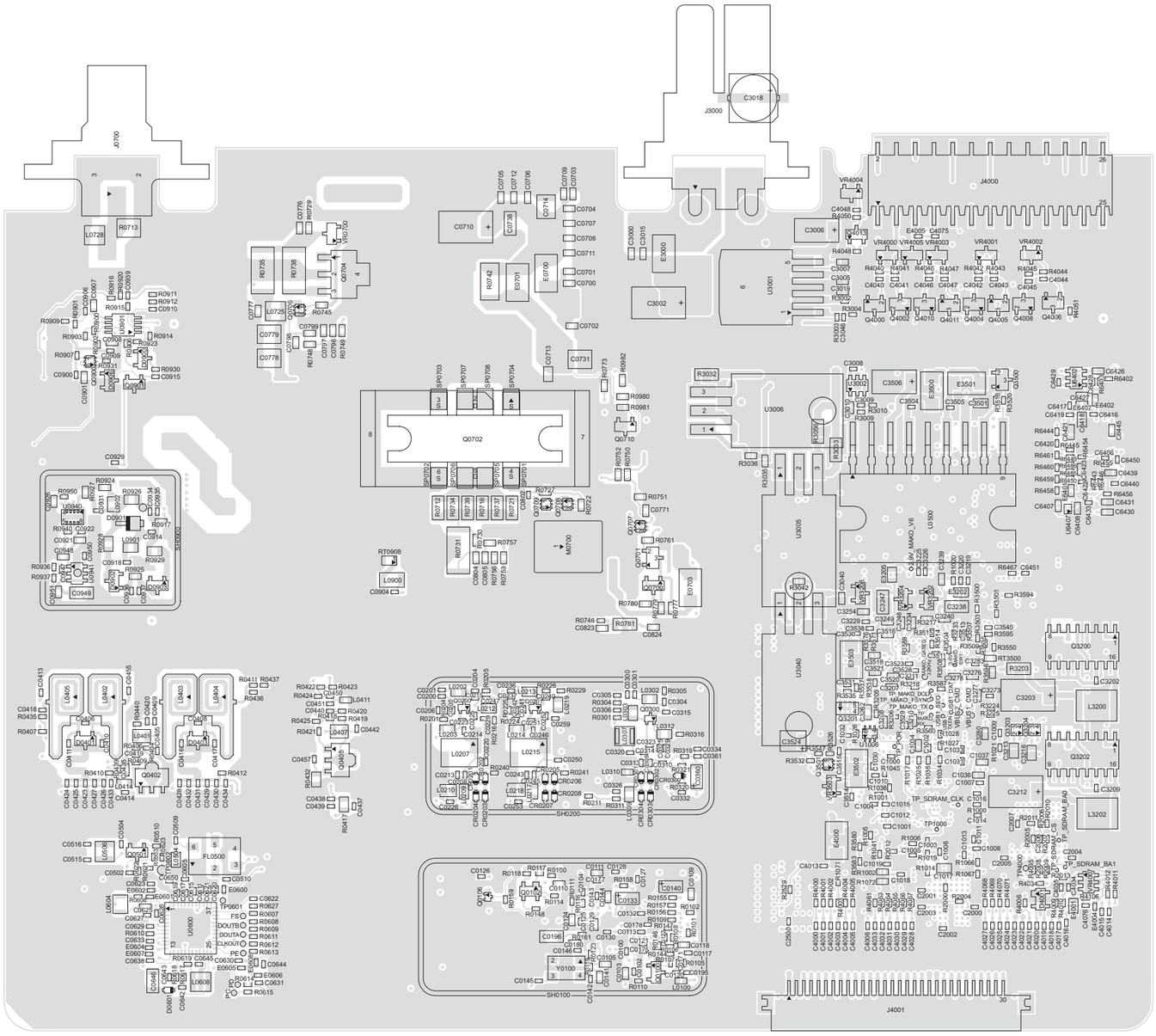
Table 3-1 VHF 1–25W Diagrams and Parts List

PCB:	
8471495L01 Main Board Top Side	Page 3-3
8471495L01 Main Board Bottom Side	Page 3-4
8471495L03 Main Board Top Side	Page 3-5
8471495L03 Main Board Bottom Side	Page 3-6
SCHEMATICS	
Overall	**Page 3-7**
Receiver Front-End	**Page 3-8**
Receiver IF Amp	**Page 3-9**
Receiver Back-End	**Page 3-10**
Power Amplifier	**Page 3-11**
Power Control	**Page 3-12**
Synthesizer	**Page 3-13**
Receiver VCO	**Page 3-14**
Transmit VCO	**Page 3-15**
Parts List	
8471495L01 and 8471495L03	**Page 3-16**

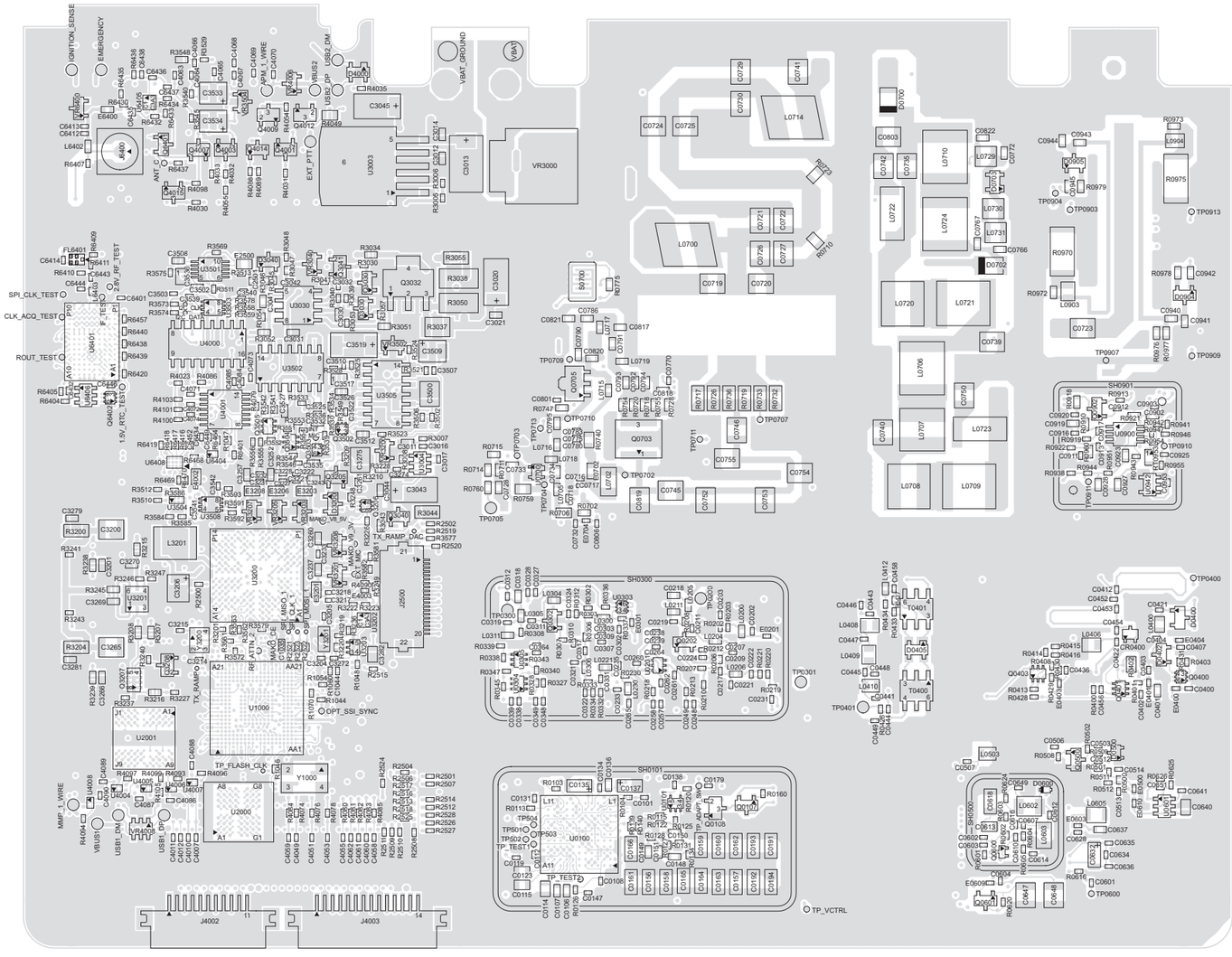
Table 3-2: VHF 1–25W Diagrams and Parts List

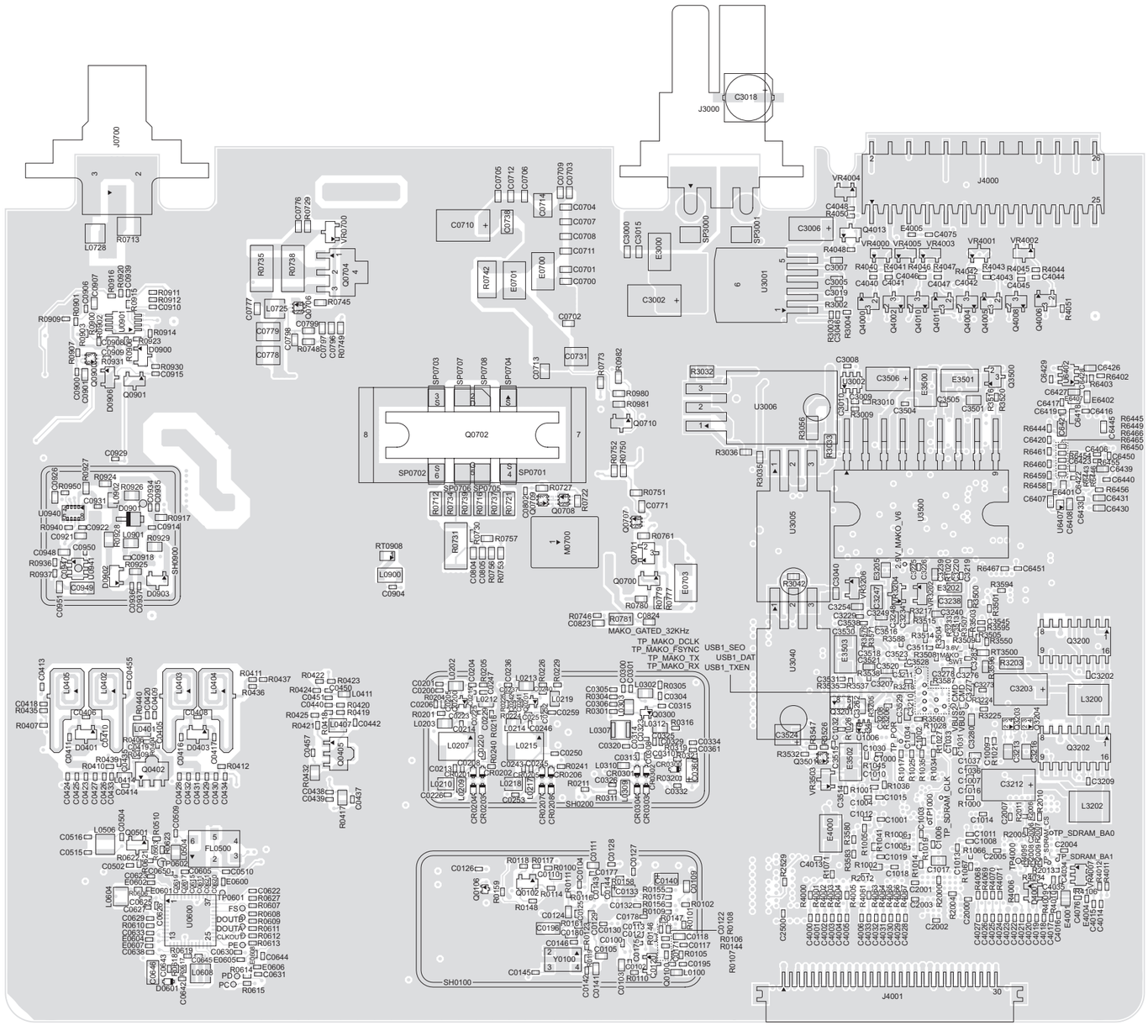
PCB:	
8471495L04 Main Board Top Side	Page 3-21
8471495L04 Main Board Bottom Side	Page 3-22
SCHEMATICS	
Overall	**Page 3-23**
Receiver Front-End	**Page 3-24**
Receiver IF Amp	**Page 3-25**
Receiver Back-End	**Page 3-26**
Power Amplifier	**Page 3-27**
Power Control	**Page 3-28**
Synthesizer	**Page 3-29**
Receiver VCO	**Page 3-30**
Transmit VCO	**Page 3-31**
Parts List	
8471495L04	**Page 3-32**

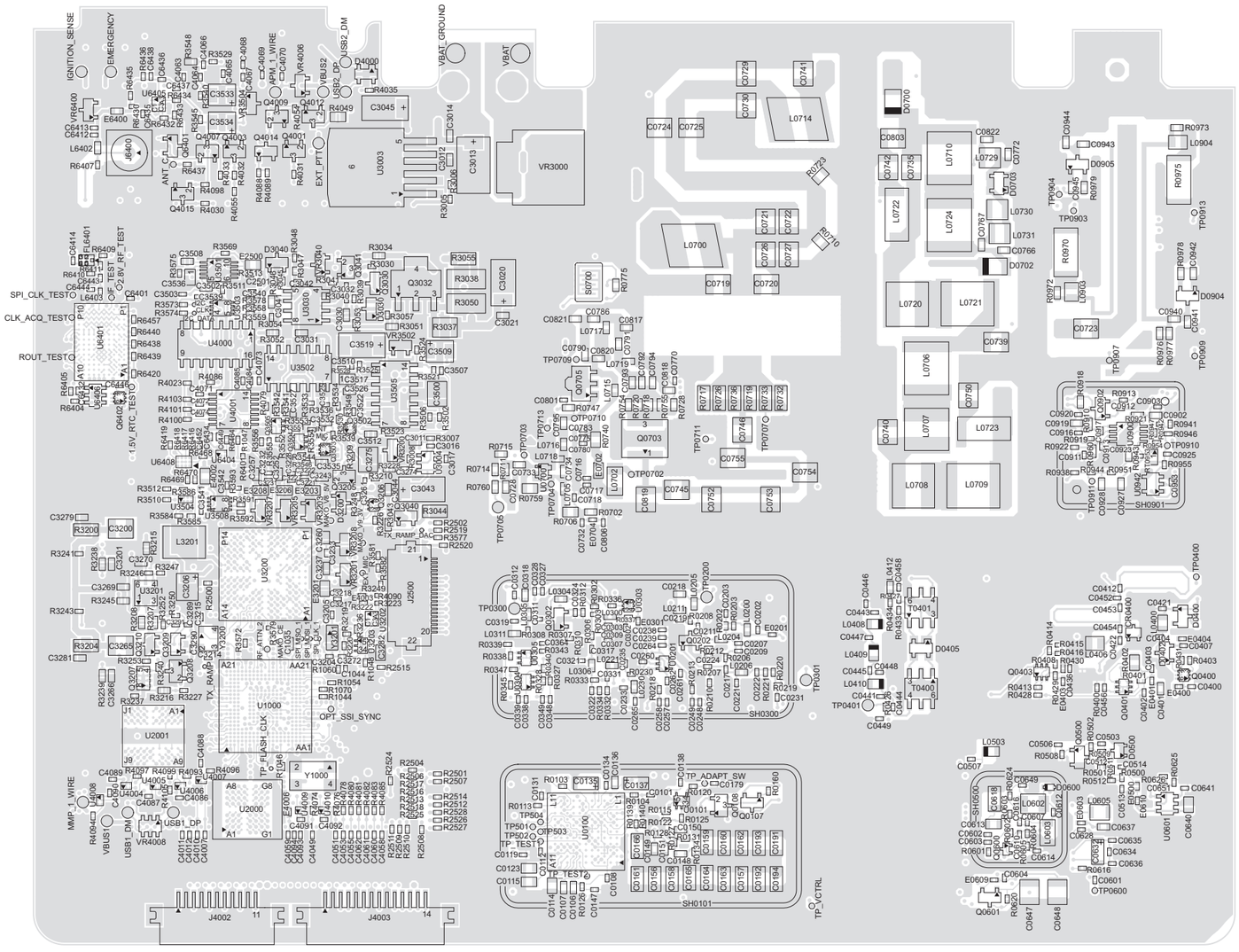
2.0 VHF (136–174 MHz) 1–25W PCB / Schematics / Parts List



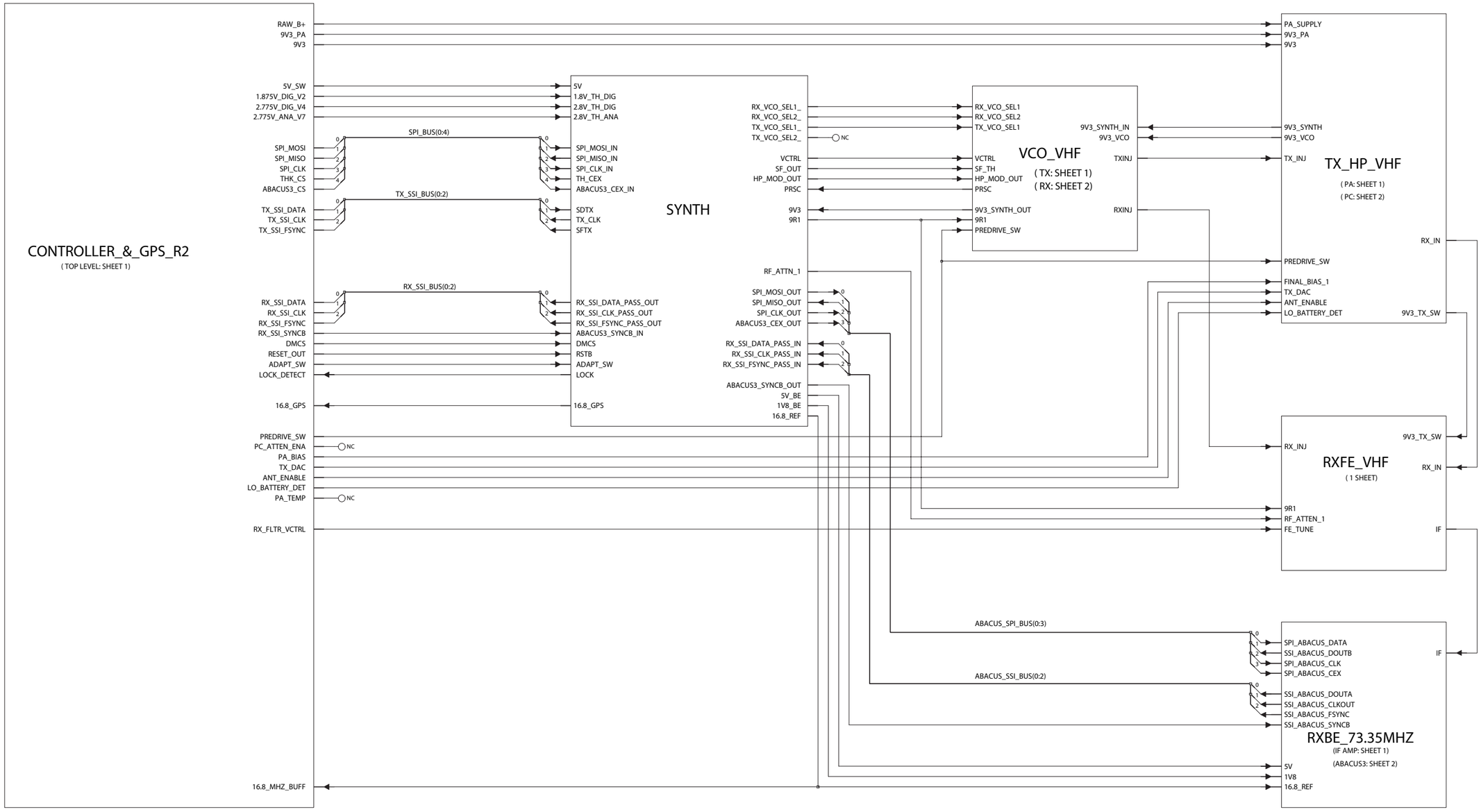
VHF (136–174 MHz) 1–25W 8471495L01 Top Side


IGNITION_SENSE
EMERGENCY
VBAT_GROUND
VBAT
EXT_PTT
KPM_1_WIRE
USB2_DM
USB2_DP
VBUS2
VR3000
U3003
U1000
U2001
U2000
U3000
U3502
U4000
U3030
U3501
U3505
U3503
U3504
U3506
U4001
U4005
U4007
U4008
U4009
U4010
U4011
U4012
U4013
U4014
U4015
U4016
U4017
U4018
U4019
U4020
U4021
U4022
U4023
U4024
U4025
U4026
U4027
U4028
U4029
U4030
U4031
U4032
U4033
U4034
U4035
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U4040
U4041
U4042
U4043
U4044
U4045
U4046

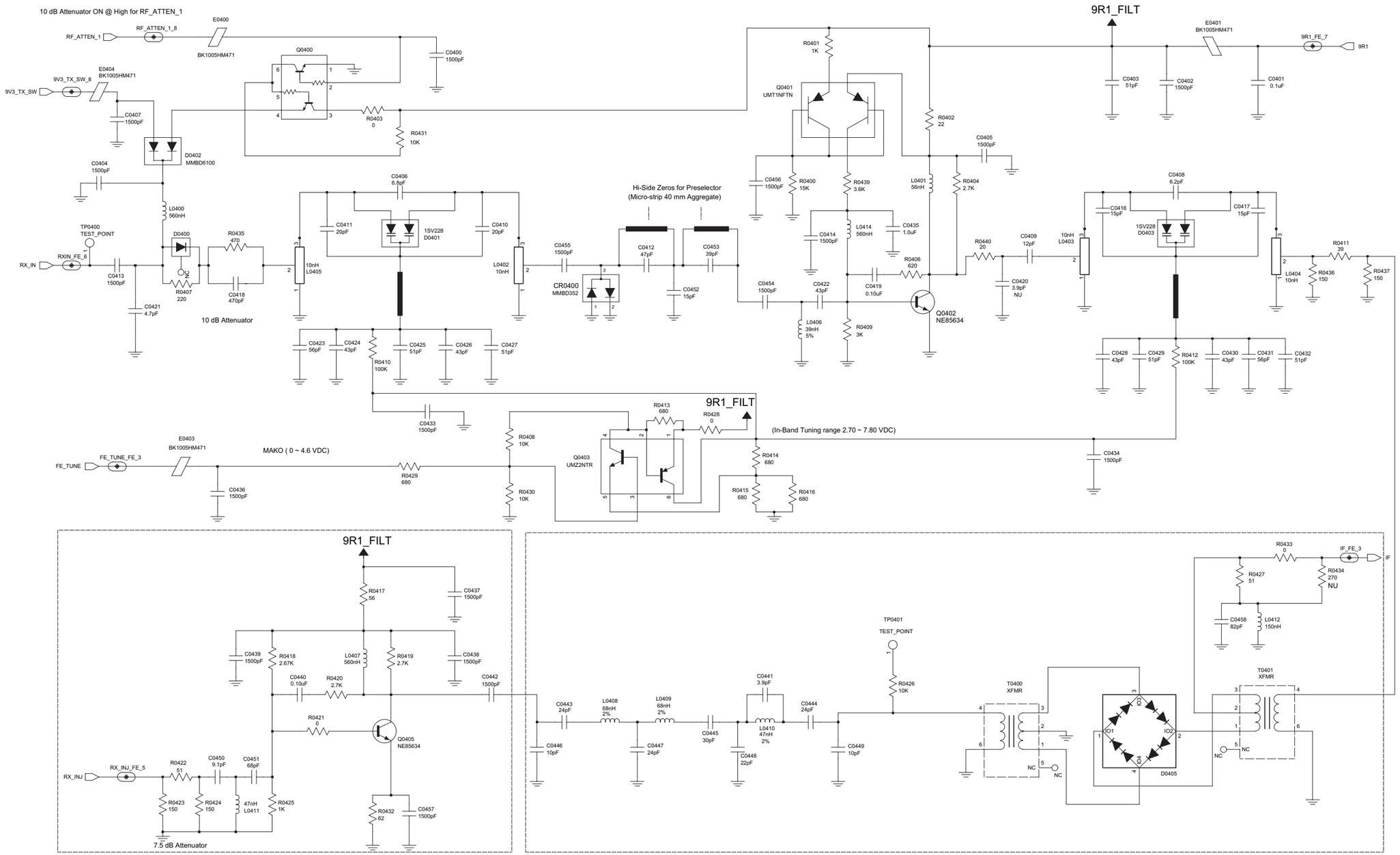

J0700
J3000
C3018
J4000
VR4004
VR4000
VR4005
VR4003
VR4001
VR4002
C3006
Q4013
E4005
C4075
C3007
C3005
C3019
R3002
R3004
C4040
C4041
C4046
C4047
C4042
C4043
C4045
C4044
C4051
C3000
C3015
E3000
SP3000
SP3001
U3001
C3002
C0710
C0738
C0714
C0705
C0712
C0706
C0709
C0703
C0704
C0707
C0708
C0711
C0701
C0700
E0701
E0700
R0742
C0702
C0731
R0773
R0982
R0980
R0981
Q0710
R0752
R0750
R0751
C0771
R0761
R0757
M0700
Q0707
Q0701
Q0700
R0779
R0777
E0703
R0746
R0781
C0824
C0823
MAKO_GATED_32KHz
TP_MAKO_DCLK
TP_MAKO_FSYNC
TP_MAKO_TX
TP_MAKO_RX
USB1_SEO
USB1_DAT
USB1_TXEN
SP0703
SP0707
SP0708
SP0704
Q0702
SP0702
SP0701
SP0706
SP0705
R0712
R0734
R0739
R0716
R0737
R0721
R0727
R0722
Q0706
C0802
C0709
C0708
C0804
C0806
R0736
R0750
R0731
R0730
RT0908
L0900
C0904
R0735
R0738
C0776
R0729
VR0700
Q0704
C0777
L0725
Q0706
R0745
C0779
C0759
C0798
R0748
C0797
C0796
R0749
C0778
C0929
C0926
R0927
R0924
R0950
R0926
C0934
C0935
C0931
C0901
R0917
U0940
R0940
C0922
C0914
C0921
L0901
R0929
C0950
C0948
R0928
R0936
R0937
C0949
C0951
D0902
D0903
C0938
C0937
SH0900
R0916
R0920
C0838
C0907
C0906
R0915
R0911
R0912
C0910
R0909
R0901
R0903
R0902
U0901
R0914
C0908
R0923
C0909
R0913
D0900
R0907
R0931
R0930
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C0901
C0904
Q0904
D0906
Q0901
C0413
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C0418
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C0404
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L0404
C0406
C0408
C0409
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R0437
R0436
R0422
R0423
R0424
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C0451
C0440
L0411
R0420
R0419
R0425
R0421
L0407
C0442
C0405
C0457
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R0417
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C0412
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C0422
C0423
C0424
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C0426
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C0428
C0429
C0430
C0431
C0432
C0433
C0434
R0440
R0439
R0410
Q0402
C0414
D0403
C0416
C0417
R0412
L0501
L0506
C0504
C0516
C0515
Q0501
R0510
R0623
R0622
C0502
C0650
C0651
C0652
C0653
C0654
C0655
C0656
C0657
C0658
C0659
TP0602
FL0500
C0605
C0510
E0600
E0602
E0601
C0623
C0627
C0629
C0610
C0633
C0607
C0638
L0604
U0600
FSO
DOUTI
DOUTA
CLKOUT
PE
C0630
E0609
E0605
C0644
R0619
C0643
C0646
C0645
L0608
D0601
C0647
R0614
PD
PC
C0606
E0606
C0631
R0615
R0627
R0607
R0608
R0609
R0611
R0612
R0613
C0622
C0126
Q0106
R0159
R0118
R0117
R0100
C0111
C0104
C0177
C0128
C0127
C0140
C0099
R0102
R0148
Q0102
R0114
R0116
R0115
R0158
C0133
R0155
R0157
R0156
R0109
R0147
C0132
C0178
C0124
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C0196
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C0100
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Y0100
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C0101
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R0110
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C0175
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C0177
C0174
C0117
R0105
C0195
L0100
SH0100
R0122
R0108
R0107
R0106
R0144
R3032
U3006
R3036
R3035
R3056
R3363
C3008
C3506
E3506
E3501
C3509
R3010
C3504
C3505
C3501
R3510
R3520
Q3500
C6429
C6426
R6402
R6403
C6427
C6417
C6419
E6402
C6416
R6444
R6420
R6461
R6460
R6459
R6458
C6407
R6445
R6449
R6466
R6465
R6450
C6406
C6450
C6439
C6440
R6456
C6431
C6430
U3305
U3500
2.6V_MAKO_V6
R6467
C6451
C3040
VR3206
E3205
C3254
C3229
C3249
C3247
C3217
C3240
C3238
E3202
R3500
R3594
C3530
C3531
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C3568
C3569



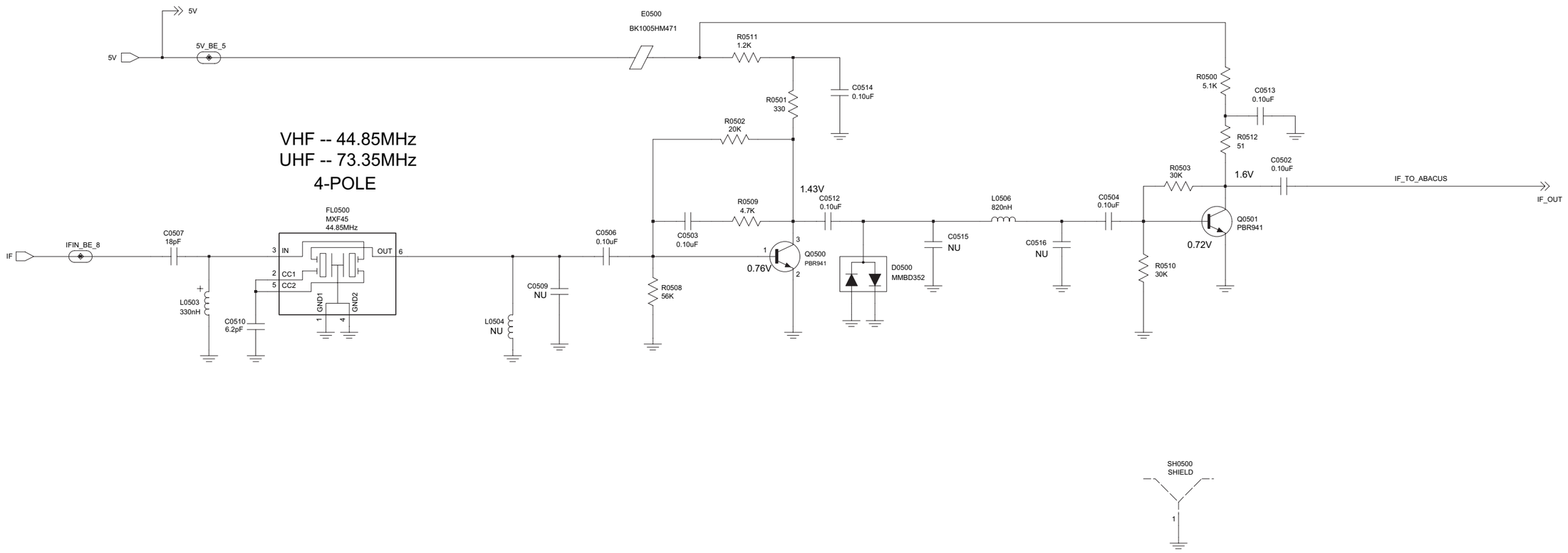
VHF (136–174 MHz) 1–25W 8471495L03 Bottom side



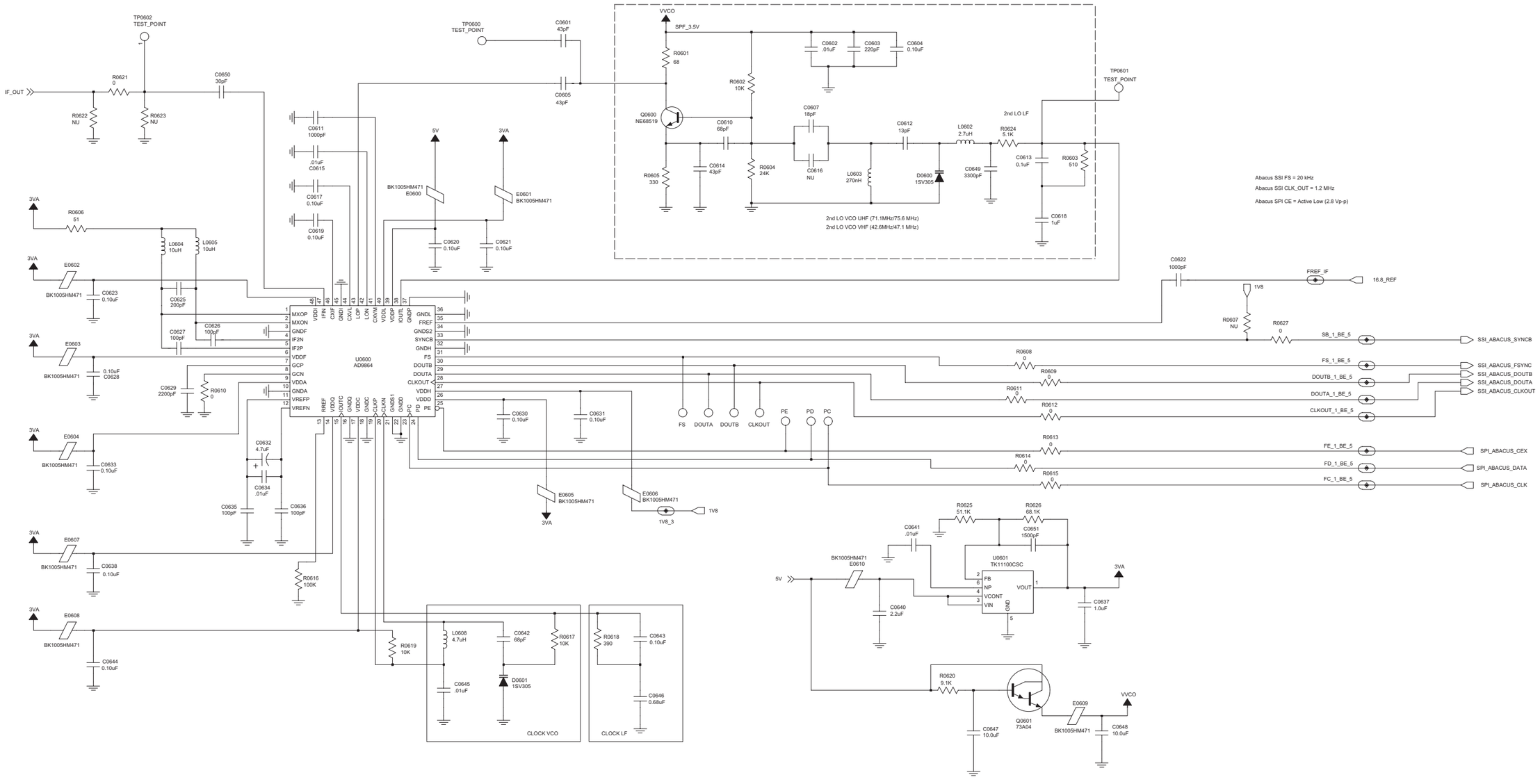
VHF (136–174 MHz) 1–25W Overall Schematic Diagram



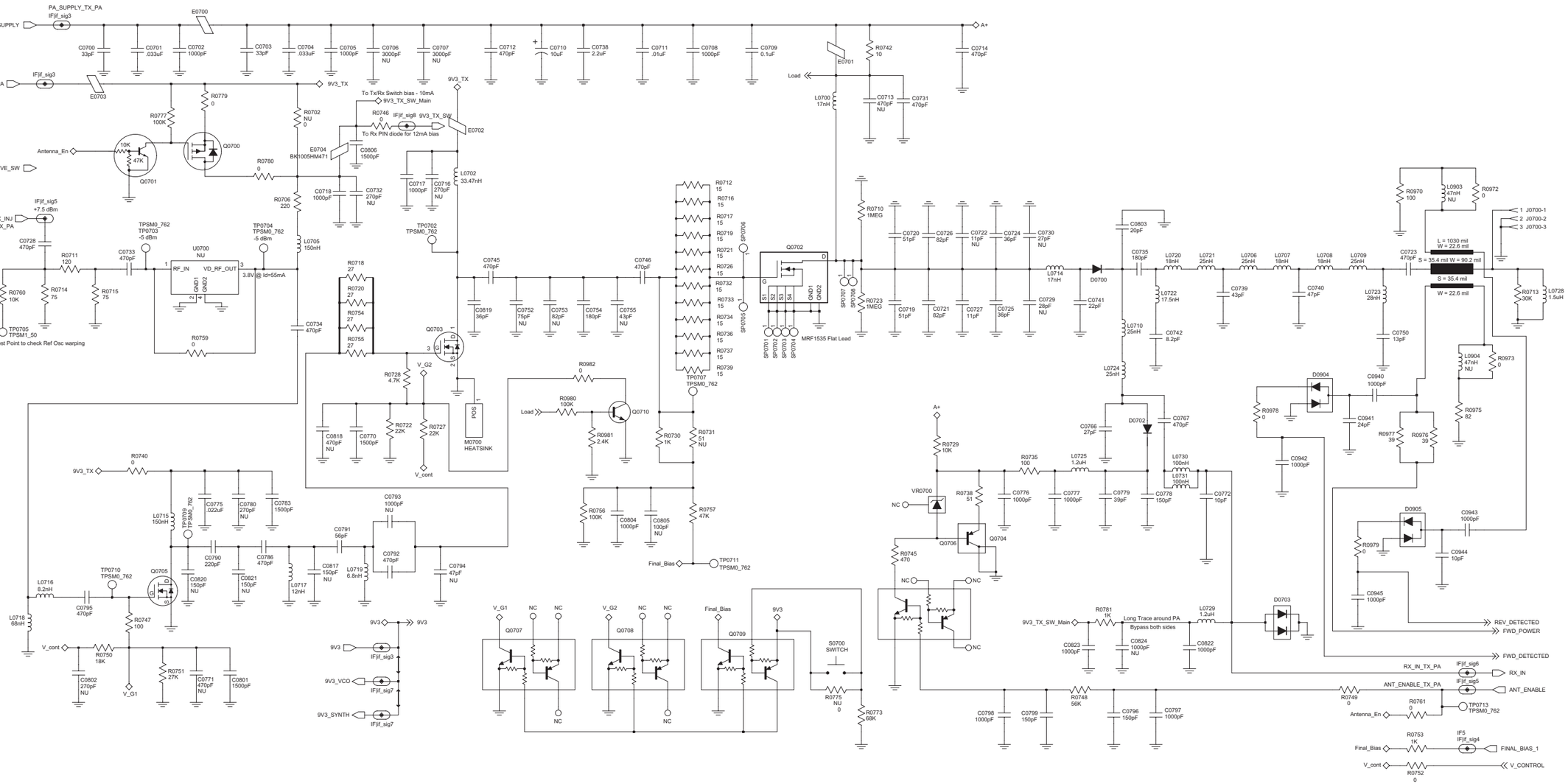
VHF (136–174 MHz) 1–25W Receiver Front-End Schematic Diagram



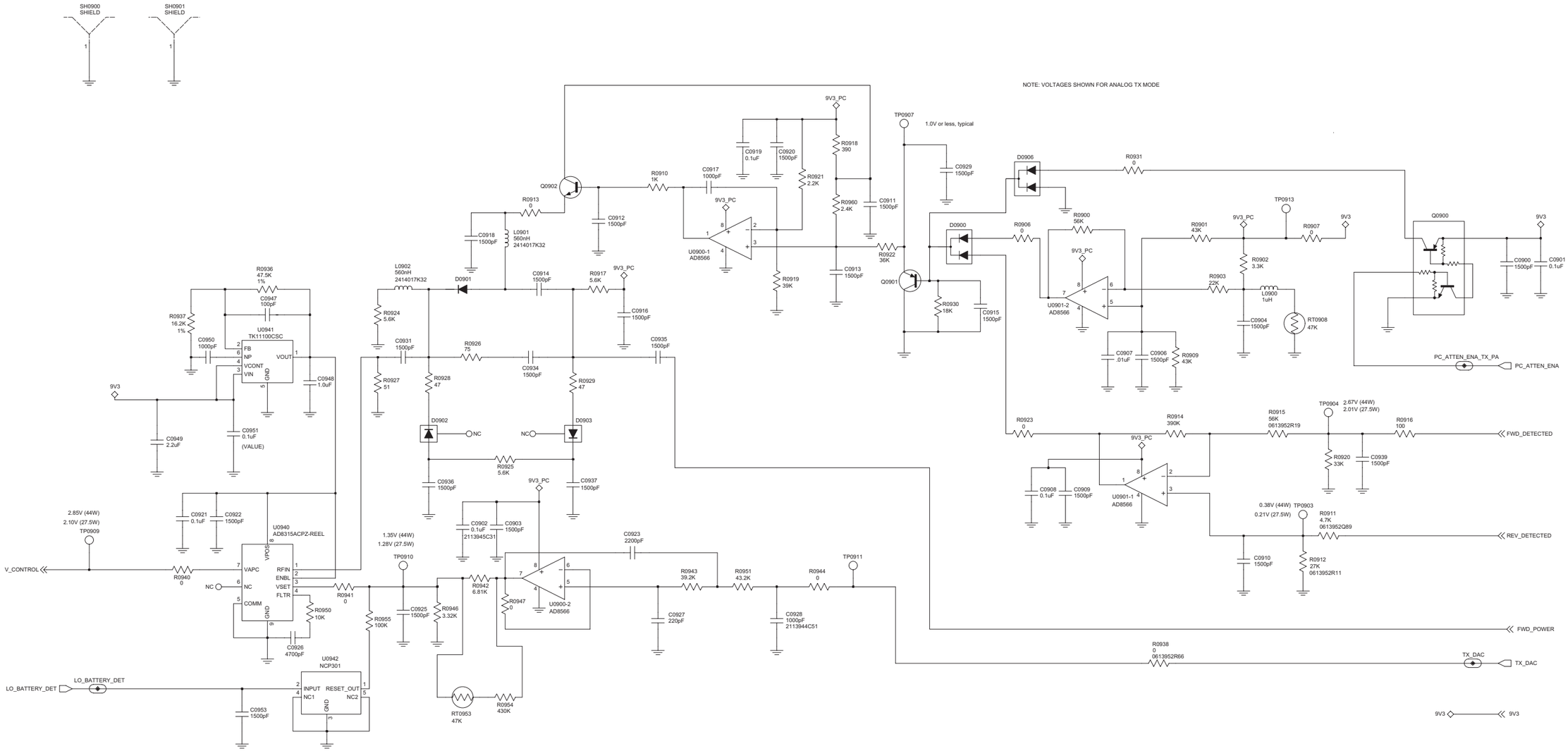
VHF (136–174 MHz) 1–25W Receiver IF Amp Schematic Diagram



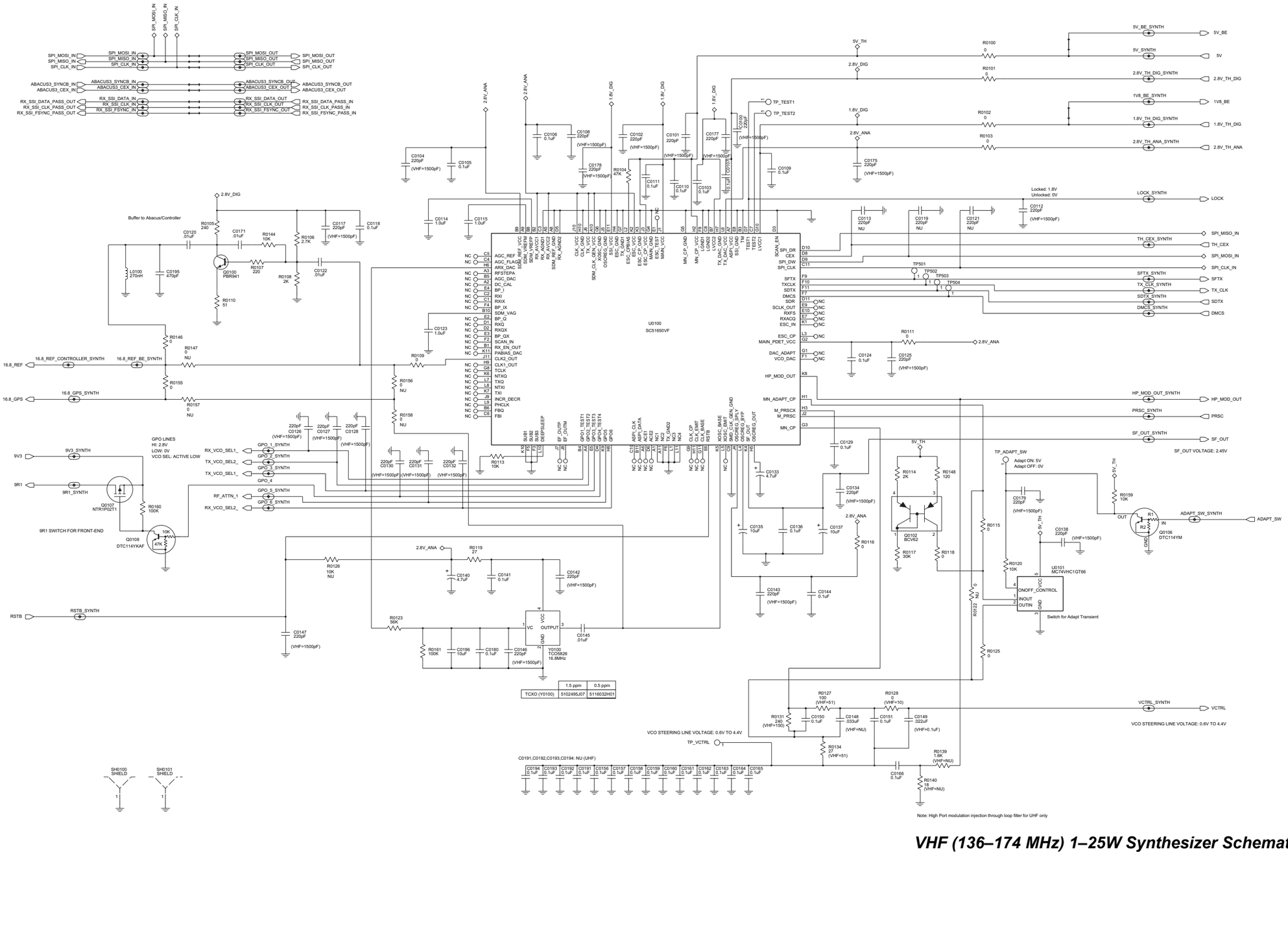
VHF (136–174 MHz) 1–25W Receiver Back-End Schematic Diagram



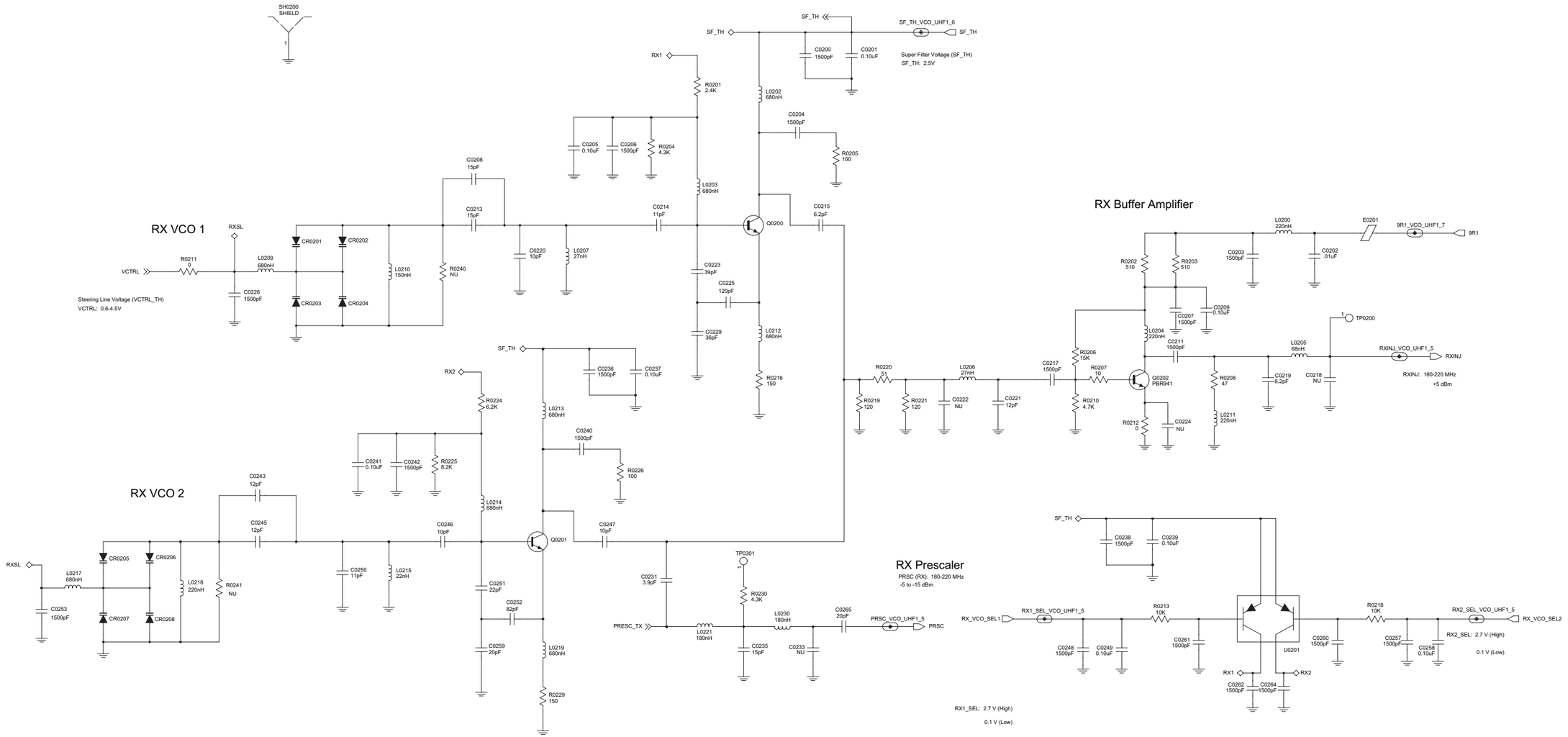
VHF (136–174 MHz) 1–25W Power Amplifier Schematic Diagram



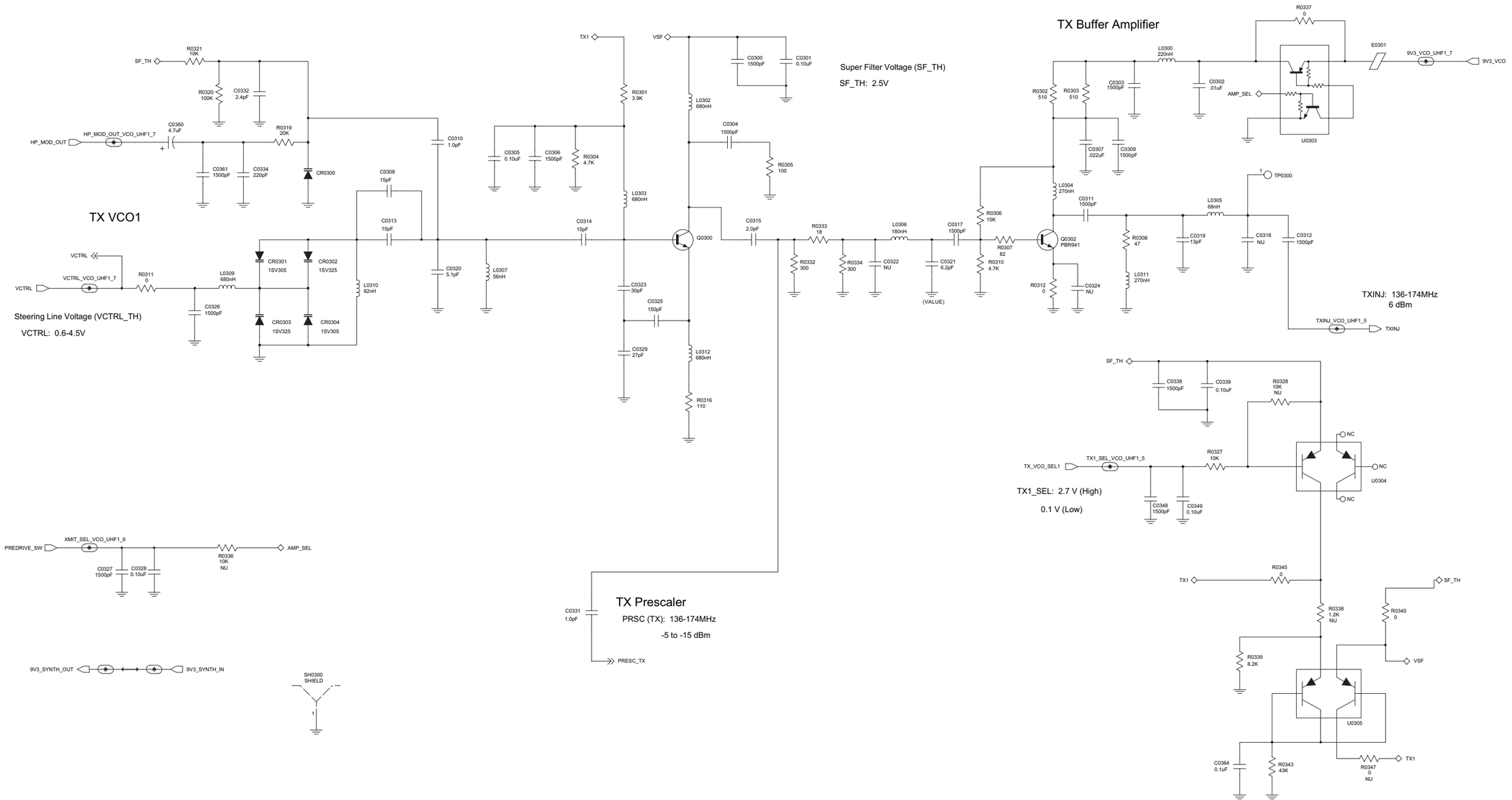
VHF (136–174 MHz) 1–25W Power Control Schematic Diagram



VHF (136–174 MHz) 1–25W Synthesizer Schematic Diagram



VHF (136–174 MHz) 1–25W Receiver VCO Schematic Diagram



VHF (136–174 MHz) 1–25W Transmit VCO Schematic Diagram

VHF PCB 8471495L01 and 8471495L03 Parts List 1–25W

Circuit Ref	Motorola Part No.	Description
C0100	2113945A10	1500pF
C0101	2113945A10	1500pF
C0102	2113945A10	1500pF
C0103	2113945C31	0.1uF
C0104	2113945A10	1500pF
C0105	2113945C31	0.1uF
C0106	2113945C31	0.1uF
C0107	2113945C31	0.1uF
C0108	2113945A10	1500pF
C0109	2113945C31	0.1uF
C0110	2113945C31	0.1uF
C0111	2113945C31	0.1uF
C0112	2113945A10	1500pF
C0113	NOT PLACED	–
C0114	2113946E02	1.0uF
C0115	2113946E02	1.0uF
C0117	2113945A10	1500pF
C0118	2113945C31	0.1uF
C0119	NOT PLACED	–
C0120	2113945B02	.01uF
C0121	NOT PLACED	–
C0122	2113945B02	.01uF
C0123	2113946E02	1.0uF
C0124	2113945C31	0.1uF
C0125	2113945A10	1500pF
C0126	2113945A10	1500pF
C0127	2113945A10	1500pF
C0128	2113945A10	1500pF
C0129	2113945C31	0.1uF
C0130	2113945A10	1500pF
C0131	2113945A10	1500pF
C0132	2113945A10	1500pF
C0133	2313960B30	4.7uF
C0134	2113945A10	1500pF
C0135	2313960B32	10uF
C0136	2113945C31	0.1uF
C0137	2313960B32	10uF
C0138	2113945A10	1500pF
C0140	2313960B30	4.7uF
C0141	2113945C31	0.1uF
C0142	2113945A10	1500pF
C0143	2113945A10	1500pF
C0144	2113945C31	0.1uF
C0145	2113945B02	.01uF
C0146	2113945A10	1500pF
C0147	2113945A10	1500pF
C0148	NOT PLACED	–
C0149	2113945C31	0.1uF
C0150	2113945C31	0.1uF
C0151	2113945C31	0.1uF
C0156	2185419D06	0.1uF
C0157	2185419D06	0.1uF
C0158	2185419D06	0.1uF
C0159	2185419D06	0.1uF
C0160	2185419D06	0.1uF
C0161	2185419D06	0.1uF
C0162	2185419D06	0.1uF
C0163	2185419D06	0.1uF
C0164	2185419D06	0.1uF
C0165	2185419D06	0.1uF
C0166	2185419D06	0.1uF
C0171	2113945B02	.01uF
C0175	2113945A10	1500pF
C0177	2113945A10	1500pF
C0178	2113945A10	1500pF
C0179	2113945A10	1500pF
C0180	2113945C31	0.1uF
C0191	2185419D06	0.1uF
C0192	2185419D06	0.1uF
C0193	2185419D06	0.1uF
C0194	2185419D06	0.1uF
C0195	2113945A05	470pF
C0196	2113946H02	10uF
C0200	2113945A10	1500pF
C0201	2113945Y02	0.10uF
C0202	2113945B02	.01uF
C0203	2113945A10	1500pF
C0204	2113945A10	1500pF
C0205	2113945Y02	0.10uF
C0206	2113945A10	1500pF
C0207	2113945A10	1500pF
C0208	2115153H37	15pF
C0209	2113945Y02	0.10uF
C0211	2113945A10	1500pF
C0213	2115153H37	15pF
C0214	2115153H34	11pF
C0215	2115153H22	6.2pF
C0217	2113945A10	1500pF
C0218	NOT PLACED	–
C0219	2115153H25	8.2pF
C0220	2115153H27	10pF
C0221	2115153H35	12pF
C0222	NOT PLACED	–
C0223	2115153H47	39pF
C0224	NOT PLACED	–
C0225	2115153H59	120pF
C0226	2113945A10	1500pF
C0229	2115153H46	36pF
C0231	2115153H17	3.9pF
C0233	NOT PLACED	–
C0235	2115153H37	15pF
C0236	2113945A10	1500pF
C0237	2113945Y02	0.10uF
C0238	2113945A10	1500pF
C0239	2113945Y02	0.10uF
C0240	2113945A10	1500pF
C0241	2113945Y02	0.10uF
C0242	2113945A10	1500pF
C0243	2115153H35	12pF
C0245	2115153H35	12pF
C0246	2115153H27	10pF
C0247	2115153H27	10pF
C0248	2113945A10	1500pF
C0249	2113945Y02	0.10uF
C0250	2115153H34	11pF
C0251	2115153H41	22pF
C0252	2115153H55	82pF
C0253	2113945A10	1500pF
C0257	2113945A10	1500pF
C0258	2113945Y02	0.10uF
C0259	2115153H40	20pF
C0260	2113945A10	1500pF
C0261	2113945A10	1500pF
C0262	2113945A10	1500pF
C0264	2113945A10	1500pF
C0265	2115153H40	20pF
C0300	2113945A10	1500pF
C0301	2113945Y02	0.10uF
C0302	2113945B02	.01uF
C0303	2113945A10	1500pF
C0304	2113945A10	1500pF
C0305	2113945Y02	0.10uF
C0306	2113945A10	1500pF
C0307	2113945B04	.022uF
C0308	2115153H37	15pF
C0309	2113945A10	1500pF
C0310	2115153H03	1.0pF
C0311	2113945A10	1500pF
C0312	2113945A10	1500pF
C0313	2115153H37	15pF
C0314	2115153H37	15pF
C0315	2115153H10	2.0pF
C0317	2113945A10	1500pF
C0318	NOT PLACED	–
C0319	2115153H36	13pF
C0320	2115153H20	5.1pF
C0321	2115153H22	6.2pF
C0322	NOT PLACED	–
C0323	2115153H44	30pF
C0324	NOT PLACED	–
C0325	2113944A42	150pF
C0326	2113945A10	1500pF
C0327	2113945A10	1500pF
C0328	2113945Y02	0.10uF
C0329	2115153H43	27pF
C0331	2115153H03	1.0pF
C0332	2115153H12	2.4pF
C0334	2113944A44	220pF
C0338	2113945A10	1500pF
C0339	2113945Y02	0.10uF
C0348	2113945A10	1500pF
C0349	2113945Y02	0.10uF
C0360	2313960B30	4.7uF
C0361	2113945A10	1500pF
C0364	2113946B04	0.1uF
C0400	2113945A10	1500pF
C0401	2113945C31	0.1uF
C0402	2113945A10	1500pF
C0403	2115153H50	51pF
C0404	2113945A10	1500pF
C0405	2113945A10	1500pF
C0406	2115153H23	6.8pF
C0407	2113945A10	1500pF
C0408	2115153H22	6.2pF
C0409	2115153H35	12pF
C0410	2115153H40	20pF
C0411	2115153H40	20pF
C0412	2115153H49	47pF
C0413	2113945A10	1500pF
C0414	2113945A10	1500pF
C0416	2115153H37	15pF
C0417	2115153H37	15pF
C0418	2113945A05	470pF
C0419	2113945Y02	0.10uF
C0420	NOT PLACED	–
C0421	2115153H19	4.7pF
C0422	2115153H48	43pF
C0423	2115153H51	56pF
C0424	2115153H48	43pF
C0425	2115153H50	51pF
C0426	2115153H48	43pF
C0427	2115153H50	51pF
C0428	2115153H48	43pF
C0429	2115153H50	51pF
C0430	2115153H48	43pF
C0431	2115153H51	56pF
C0432	2115153H50	51pF
C0433	2113945A10	1500pF
C0434	2113945A10	1500pF
C0435	2113946S35	1.0uF
C0436	2113945A10	1500pF
C0437	2113945A10	1500pF

Circuit Ref	Motorola Part No.	Description
C0438	2113945A10	1500pF
C0439	2113945A10	1500pF
C0440	2113945Y02	0.10uF
C0441	2115153H17	3.9pF
C0442	2113945A10	1500pF
C0443	2115153H42	24pF
C0444	2115153H42	24pF
C0445	2115153H44	30pF
C0446	2115153H27	10pF
C0447	2115153H42	24pF
C0448	2115153H41	22pF
C0449	2115153H27	10pF
C0450	2115153H26	9.1pF
C0451	2115153H53	68pF
C0452	2115153H37	15pF
C0453	2115153H47	39pF
C0454	2113945A10	1500pF
C0455	2113945A10	1500pF
C0456	2113945A10	1500pF
C0457	2113945A10	1500pF
C0458	2115153H55	82pF
C0502	2113945Y02	0.10uF
C0503	2113945Y02	0.10uF
C0504	2113945Y02	0.10uF
C0506	2115153H35	12pF
C0507	2115153H38	18pF
C0509	NOT PLACED	–
C0510	2115153H24	7.5pF
C0512	2113945Y02	0.10uF
C0513	2113945Y02	0.10uF
C0514	2113945Y02	0.10uF
C0515	NOT PLACED	–
C0516	NOT PLACED	–
C0601	2115153H48	43pF
C0602	2113945B02	.01uF
C0603	2113944A44	220pF
C0604	2113945Y02	0.10uF
C0605	2115153H48	43pF
C0607	2115153H37	15pF
C0610	2115153H51	56pF
C0611	2113945A09	1000pF
C0612	2115153H39	18pF
C0613	2113945G91	0.1uF
C0614	2115153H41	22pF
C0615	2113945B02	.01uF
C0616	NOT PLACED	–
C0617	2113945Y02	0.10uF
C0618	2115358H25	1uF
C0619	2113945Y02	0.10uF
C0620	2113945Y02	0.10uF
C0621	2113945Y02	0.10uF

Circuit Ref	Motorola Part No.	Description
C0622	2113945A09	1000pF
C0623	2113945Y02	0.10uF
C0625	2113944C89	200pF
C0626	2113944A40	100pF
C0627	2113944A40	100pF
C0628	2113945Y02	0.10uF
C0629	2113945A11	2200pF
C0630	2113945Y02	0.10uF
C0631	2113945Y02	0.10uF
C0632	2313960B30	4.7uF
C0633	2113945Y02	0.10uF
C0634	2113945B02	.01uF
C0635	2113944A40	100pF
C0636	2113944A40	100pF
C0637	2113946S35	1.0uF
C0638	2113945Y02	0.10uF
C0640	2113946N03	2.2uF
C0641	2113945B02	.01uF
C0642	2115153H53	68pF
C0643	2113945Y02	0.10uF
C0644	2113945Y02	0.10uF
C0645	2113945B02	.01uF
C0646	2113946G04	0.68uF
C0647	2113946J03	10.0uF
C0648	2113946J03	10.0uF
C0649	2113945A12	3300pF
C0650	2115153H44	30pF
C0651	2113945A10	1500pF
C0700	2113944C36	33pF
C0701	2113945C25	.033uF
C0702	2113944C51	1000pF
C0703	2113944C36	33pF
C0704	2113945C25	.033uF
C0705	2113944C51	1000pF
C0706	NOT PLACED	–
C0707	NOT PLACED	–
C0708	2113944C51	1000pF
C0709	2113945C31	0.1uF
C0710	2371403L02	10uF
C0711	2113945L49	.01uF
C0712	2113944C06	470pF
C0713	NOT PLACED	–
C0714	2111078B59	470pF
C0716	NOT PLACED	–
C0717	2113945A09	1000pF
C0718	2113945A09	1000pF
C0719	2111078B35	51pF
C0720	2111078B35	51pF
C0721	2111078B40	82pF
C0722	NOT PLACED	–
C0723	2111078B59	470pF

Circuit Ref	Motorola Part No.	Description
C0724	2111078B31	36pF
C0725	2111078B31	36pF
C0726	2111078B40	82pF
C0727	2111078B14	11pF
C0728	2113944C06	470pF
C0729	NOT PLACED	–
C0730	NOT PLACED	–
C0731	2111078B59	470pF
C0732	NOT PLACED	–
C0733	2113944C06	470pF
C0734	2113944C06	470pF
C0735	2111078B49	180pF
C0738	2113955D13	2.2uF
C0739	2111078B33	43pF
C0740	2111078B34	47pF
C0741	2111078B22	22pF
C0742	2111078B11	8.2pF
C0745	2111078B59	470pF
C0746	2111078B59	470pF
C0750	2111078B16	13pF
C0752	NOT PLACED	–
C0753	NOT PLACED	–
C0754	2111078B47	180pF
C0755	NOT PLACED	–
C0766	2113944C35	27pF
C0767	2113944C06	470pF
C0770	2113945A10	1500pF
C0771	NOT PLACED	–
C0772	2113944C30	10pF
C0775	NOT PLACED	–
C0776	2113944C51	1000pF
C0777	2113944C51	1000pF
C0778	2111078B47	150pF
C0779	2111078B32	39pF
C0780	NOT PLACED	–
C0783	2113945A10	1500pF
C0786	2113944C06	470pF
C0790	2113944C02	220pF
C0791	2113944C39	56pF
C0792	2113944C06	470pF
C0793	NOT PLACED	–
C0794	NOT PLACED	–
C0795	2113944C06	470pF
C0796	2113944C47	150pF
C0797	2113944C51	1000pF
C0798	2113944C51	1000pF
C0799	2113944C47	150pF
C0801	2113945A10	1500pF
C0802	NOT PLACED	–
C0803	2111078B21	20pF
C0804	2113944C51	1000pF

Circuit Ref	Motorola Part No.	Description
C0805	NOT PLACED	–
C0806	2113945A10	1500pF
C0817	NOT PLACED	–
C0818	NOT PLACED	
C0819	2111078B31	36pF
C0820	NOT PLACED	–
C0821	NOT PLACED	–
C0822	2113944C51	1000pF
C0823	2113944C51	1000pF
C0824	NOT PLACED	–
C0900	2113945A10	1500pF
C0901	2113945C31	0.1uF
C0902	2113945C31	0.1uF
C0903	2113945A10	1500pF
C0904	2113945A10	1500pF
C0906	2113945A10	1500pF
C0907	2113945C02	.01uF
C0908	2113945C31	0.1uF
C0909	2113945A10	1500pF
C0910	2113945A10	1500pF
C0911	2113945A10	1500pF
C0912	2113945A10	1500pF
C0913	2113945A10	1500pF
C0914	2113945A10	1500pF
C0915	2113945A10	1500pF
C0916	2113945A10	1500pF
C0917	2113945A09	1000pF
C0918	2113945A10	1500pF
C0919	2113945C31	0.1uF
C0920	2113945A10	1500pF
C0921	2113945C31	0.1uF
C0922	2113945A10	1500pF
C0923	2113944C55	2200pF
C0925	2113945A10	1500pF
C0926	2113945L41	4700pF
C0927	2113944C02	220pF
C0928	2113944C51	1000pF
C0929	2113945A10	1500pF
C0931	2113945A10	1500pF
C0934	2113945A10	1500pF
C0935	2113945A10	1500pF
C0936	2113945A10	1500pF
C0937	2113945A10	1500pF
C0939	2113945A10	1500pF
C0940	2113944C51	1000pF
C0941	2113944M27	24pF
C0942	2113944C51	1000pF
C0943	2113944C51	1000pF
C0944	2113944M18	10pF
C0945	2113944C51	1000pF
C0947	2113944A40	100pF

Circuit Ref	Motorola Part No.	Description
C0948	2113946S35	1.0uF
C0949	2113946G01	2.2uF
C0950	2113945A09	1000pF
C0951	2113945C31	0.1uF
C0953	2113945A10	1500pF
R0980	0613952J25	100K
R0981	0613952H82	2.4K
R0982	0613952G67	0
CR0201	4815096H01	DIODE VARACTOR 1SV305
CR0202	4815096H01	DIODE VARACTOR 1SV305
CR0203	4815096H01	DIODE VARACTOR 1SV305
CR0204	4815096H01	DIODE VARACTOR 1SV305
CR0205	4815096H01	DIODE VARACTOR 1SV305
CR0206	4815096H01	DIODE VARACTOR 1SV305
CR0207	4815096H01	DIODE VARACTOR 1SV305
CR0208	4815096H01	DIODE VARACTOR 1SV305
CR0300	4815096H01	DIODE VARACTOR 1SV305
CR0301	4815096H01	DIODE VARACTOR 1SV305
CR0302	4815059H01	DIODE VARACTOR 1SV325
CR0303	4815059H01	DIODE VARACTOR 1SV325
CR0304	4815096H01	DIODE VARACTOR 1SV305
CR0400	4813974A19	DIODE, SCHOTTKY
D0400	4813974A06	DIODE, PIN
D0401	4885094Y01	DIODE VARACTOR 1SV228
D0402	4813978C02	DIODE, PIN
D0403	4885094Y01	DIODE VARACTOR 1SV228
D0405	4815090H01	DIODE, MIXER
D0500	4813974A19	DIODE, SCHOTTKY
D0600	4815096H01	DIODE VARACTOR 1SV305
D0601	4815096H01	DIODE VARACTOR 1SV305
D0700	4802482J02	DIODE, PIN
D0702	4802482J02	DIODE, PIN
D0703	4886622Y06	DIODE, PIN
D0900	4813978C02	DIODE, SWITCHING
D0901	4815897H01	DIODE, PIN
D0902	4815024H01	DIODE, PIN
D0903	4815024H01	DIODE, PIN
D0904	4813974A21	DIODE, SCHOTTKY
D0905	4813974A21	DIODE, SCHOTTKY
E0201	2480640Z01	FERRITE BEAD
E0301	2480640Z01	FERRITE BEAD
E0400	2409134J25	FERRITE BEAD
E0401	2409134J25	FERRITE BEAD
E0403	2409134J25	FERRITE BEAD
E0404	2409134J25	FERRITE BEAD
E0500	2409134J25	FERRITE BEAD
E0600	2409134J25	FERRITE BEAD
E0601	2409134J25	FERRITE BEAD
E0602	2409134J25	FERRITE BEAD
E0603	2409134J25	FERRITE BEAD
E0604	2409134J25	FERRITE BEAD

Circuit Ref	Motorola Part No.	Description
E0605	2409134J25	FERRITE BEAD
E0606	2409134J25	FERRITE BEAD
E0607	2409134J25	FERRITE BEAD
E0608	2409134J25	FERRITE BEAD
E0609	2409134J25	FERRITE BEAD
E0610	2480640Z01	FERRITE BEAD
E0700	2485011Y01	FERRITE BEAD
E0701	2485011Y01	FERRITE BEAD
E0702	7671656M01	FERRITE BEAD
E0703	2485011Y01	FERRITE BEAD
E0704	2409134J25	FERRITE BEAD
FL0500	9180022M11	73.35MHZ CRYSTAL FILTER
J0700	0905901V11	MINI-U RF CONNECTOR
L0100	2414017N29	270nH
L0200	2414017N28	220nH
L0202	2414017K33	680nH
L0203	2414017K33	680nH
L0204	2414017N28	220nH
L0205	2414017N22	68nH
L0206	2414017N17	27nH
L0207	2416077H12	27nH
L0209	2414017K33	680nH
L0210	2414015B06	150nH
L0211	2414017N28	220nH
L0212	2414017K33	680nH
L0213	2414017K33	680nH
L0214	2414017K33	680nH
L0215	2416077H11	22nH
L0217	2414017K33	680nH
L0218	2414015B08	220nH
L0219	2414017K33	680nH
L0221	2414017N27	180nH
L0230	2414017N27	180nH
L0300	2414017N28	220nH
L0302	2414017K33	680nH
L0303	2414017K33	680nH
L0304	2414017N29	270nH
L0305	2414017N22	68nH
L0306	2414017N27	180nH
L0307	2414015C08	56nH
L0309	2414017K33	680nH
L0310	2414017N23	82nH
L0311	2414017N29	270nH
L0312	2414017K33	680nH
L0400	2414017K32	560nH
L0401	2414032F31	56nH
L0402	NOT PLACED	–
L0403	NOT PLACED	–
L0404	NOT PLACED	–
L0405	NOT PLACED	–
L0406	2414032F29	39nH

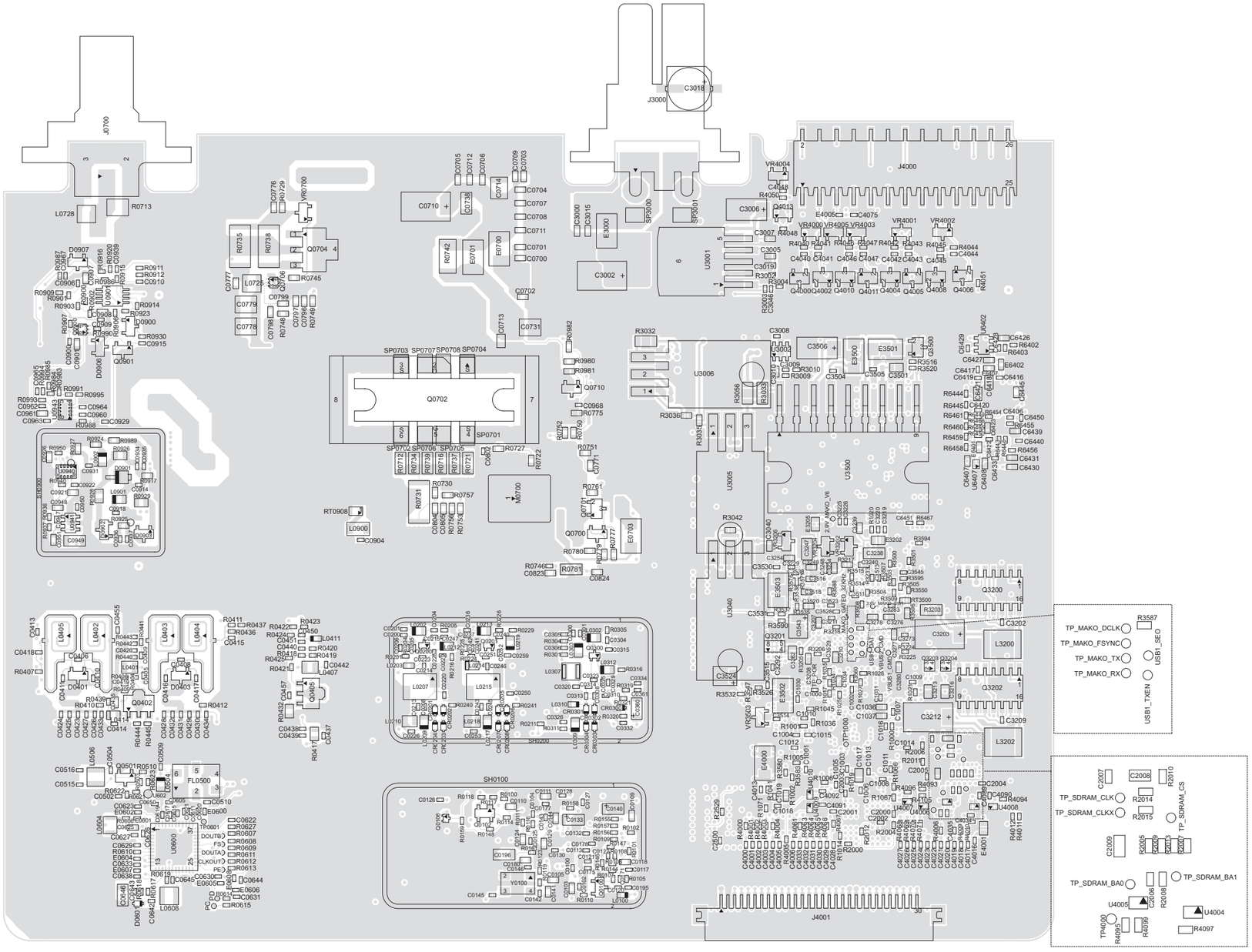
Circuit Ref	Motorola Part No.	Description
L0407	2414032F74	560nH
L0408	2414015B02	68nH
L0409	2414015B02	68nH
L0410	2414015B12	47nH
L0411	2414017N20	47nH
L0412	2414017N26	150nH
L0414	2414017K32	560nH
L0503	2414015B32	330nH
L0504	NOT PLACED	–
L0506	2414032B70	1.5uH
L0602	2414032K29	8.2uH
L0603	2414032D28	820nH
L0604	2466505A01	10uH
L0605	2466505A01	10uH
L0608	2414032B76	4.7uH
L0700	2460592A01	17nH
L0702	2479990G01	33.47nH
L0705	2414017N26	150nH
L0706	2485873L02	25nH
L0707	2485873L01	18nH
L0708	2485873L01	18nH
L0709	2485873L02	25nH
L0710	2485873L02	25nH
L0714	2460592A01	17nH
L0715	2414017N26	150nH
L0716	2414017N11	8.2nH
L0717	2414017N13	12nH
L0718	2414017N22	68nH
L0719	2414017N10	6.8nH
L0720	2485873L01	18nH
L0721	2485873L02	25nH
L0722	2415385H04	17.5nH
L0723	2415385H06	28nH
L0724	2485873L02	25nH
L0725	2414032B69	1.2uH
L0728	2414032B70	1.5uH
L0729	2414032B69	1.2uH
L0730	2414032B53	100nH
L0731	2414032B53	100nH
L0745	2460591A01	4.22nH
L0900	2414032D30	1uH
L0901	2414017K32	560nH
L0902	2414017K32	560nH
L0903	NOT PLACED	–
L0904	NOT PLACED	–
M0700	2686201B02	HEATSINK
Q0100	4802197J95	NPN RF TRANSISTOR
Q0102	4815359H01	DUAL PNP
Q0106	4816134H01	ANALOG SWITCH
Q0107	4813970A59	P-CHANNEL MOSFET
Q0108	4815261H01	ANALOG SWITCH

Circuit Ref	Motorola Part No.	Description
Q0200	4805793Y10	NPN RF TRANSISTOR
Q0201	4805793Y10	NPN RF TRANSISTOR
Q0202	4802197J95	NPN RF TRANSISTOR
Q0300	4805793Y10	NPN RF TRANSISTOR
Q0302	4802197J95	NPN RF TRANSISTOR
Q0400	4815271H01	ANALOG SWITCH
Q0401	4815267H01	DUAL PNP
Q0402	4871127H01	NPN RF TRANSISTOR
Q0403	4815270H01	DUAL NPN/PNP
Q0405	4871127H01	NPN RF TRANSISTOR
Q0500	4802197J95	NPN RF TRANSISTOR
Q0501	4802197J95	NPN RF TRANSISTOR
Q0600	4805793Y10	NPN RF TRANSISTOR
Q0601	4813973A04	NPN DARLINGTON
Q0700	4813970A59	P-CHANNEL MOSFET
Q0701	4815261H01	ANALOG SWITCH
Q0702	0104025J50	MRF1535PA ASSEMBLY
Q0703	4816548H01	N-CHANNEL LDMOS DRIVER
Q0704	4813973B02	PNP
Q0705	4816547H01	N-CHANNEL LDMOS PRE-DRIVER
Q0706	4815272H01	ANALOG SWITCH
Q0707	4815272H01	ANALOG SWITCH
Q0708	4815272H01	ANALOG SWITCH
Q0709	4815272H01	ANALOG SWITCH
Q0710	4813973M01	ANALOG SWITCH
Q0900	4815272H01	ANALOG SWITCH
Q0901	4813973A13	PNP
Q0902	4813973M07	NPN
R0100	0613952R66	0
R0101	0613952R66	0
R0102	0613952R66	0
R0103	0613952R66	0
R0104	0613952R17	47K
R0105	0613952Q58	240
R0106	0613952Q83	2.7K
R0107	0613952Q57	220
R0108	0613952Q80	2K
R0109	0613952R66	0
R0110	0613952Q42	51
R0111	0613952R66	0
R0113	0613952R01	10K
R0114	0613952Q80	2K
R0115	0613952R66	0
R0116	0613952R66	0
R0117	0613952R12	30K
R0118	0613952R66	0
R0119	0613952Q35	27
R0120	0613952R01	10K
R0122	NOT PLACED	–
R0123	0613952R19	56K

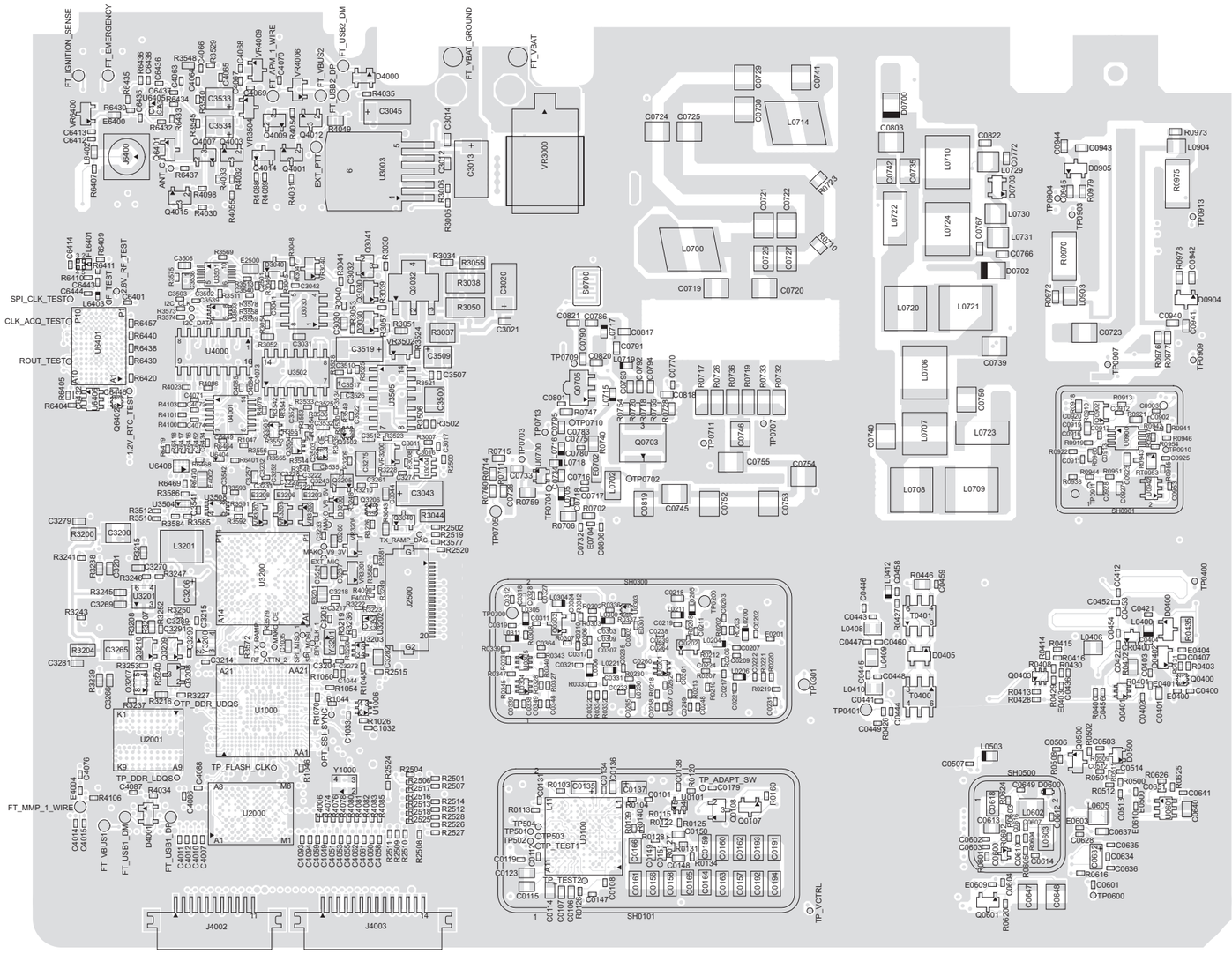
Circuit Ref	Motorola Part No.	Description
R0125	0613952R66	0
R0126	NOT PLACED	–
R0127	0613952Q42	51
R0128	0613952Q25	10
R0131	0613952Q53	150
R0134	0613952Q42	51
R0139	NOT PLACED	–
R0140	NOT PLACED	–
R0144	0613952R01	10K
R0146	0613952R66	0
R0147	NOT PLACED	–
R0148	0613952Q51	120
R0155	0613952R66	0
R0156	NOT PLACED	–
R0157	NOT PLACED	–
R0158	NOT PLACED	–
R0159	0613952R01	10K
R0160	0613952R25	100K
R0161	0613952R25	100K
R0201	0613952Q82	2.4K
R0202	0613952Q66	510
R0203	0613952Q66	510
R0204	0613952Q88	4.3K
R0205	0613952Q49	100
R0206	0613952R05	15K
R0207	0613952Q25	10
R0208	0613952Q41	47
R0210	0613952Q89	4.7K
R0211	0613952R66	0
R0212	0613952R66	0
R0213	0613952R01	10K
R0216	0613952Q53	150
R0218	0613952R01	10K
R0219	0613952Q51	120
R0220	0613952Q42	51
R0221	0613952Q51	120
R0224	0613952Q92	6.2K
R0225	0613952Q95	8.2K
R0226	0613952Q49	100
R0229	0613952Q53	150
R0230	0613952Q88	4.3K
R0240	NOT PLACED	–
R0241	NOT PLACED	–
R0301	0613952Q87	3.9K
R0302	0613952Q66	510
R0303	0613952Q66	510
R0304	0613952Q89	4.7K
R0305	0613952Q49	100
R0306	0613952R05	15K
R0307	0613952Q47	82
R0308	0613952Q41	47
R0310	0613952Q89	4.7K
R0311	0613952R66	0
R0312	0613952R66	0
R0316	0613952Q50	110
R0319	0613952R08	20K
R0320	0613952R25	100K
R0321	0613952R01	10K
R0327	0613952R01	10K
R0328	NOT PLACED	–
R0332	0613952Q60	300
R0333	0613952Q31	18
R0334	0613952Q60	300
R0336	NOT PLACED	–
R0337	0613952R66	0
R0338	NOT PLACED	–
R0339	0613952Q95	8.2K
R0340	0613952R66	0
R0343	0613952R16	43K
R0345	0613952R66	0
R0347	NOT PLACED	–
R0400	0613952R05	15K
R0401	0613952Q73	1K
R0402	0613958H33	22
R0403	0613952R66	0
R0404	0613952Q83	2.7K
R0406	0613952Q68	620
R0407	0613952Q57	220
R0408	0613952R01	10K
R0409	0613952Z43	3K
R0410	0613952R25	100K
R0411	0613952Q39	39
R0412	0613952R25	100K
R0413	0613952Q69	680
R0414	0613952Q69	680
R0415	0613952Q69	680
R0416	0613952Q69	680
R0417	0613958H43	56
R0418	0613952M42	2.67K
R0419	0613952Q83	2.7K
R0420	0613952Q83	2.7K
R0421	0613952R66	0
R0422	0613952Q42	51
R0423	0613952Q53	150
R0424	0613952Q53	150
R0425	0613952M01	1K
R0426	0613952R01	10K
R0427	0613952Q42	51
R0428	0613952R66	0
R0429	0613952Q69	680
R0430	0613952R01	10K
R0431	0613952R01	10K
R0432	0613958H44	62
R0433	0613952R66	0
R0434	NOT PLACED	–
R0435	0613952Q65	470
R0436	0613952Q53	150
R0437	0613952Q53	150
R0439	0613952Z45	3.6K
R0440	0613952Q32	20
R0500	0613952Q90	5.1K
R0501	0613952Q61	330
R0502	0613952R08	20K
R0503	0613952R12	30K
R0508	0613952R19	56K
R0509	0613952Q89	4.7K
R0510	0613952R12	30K
R0511	0613952Q75	1.2K
R0512	0613952Q42	51
R0601	0613952Q51	120
R0602	0613952R01	10K
R0603	0613952Q66	510
R0604	0613952R10	24K
R0605	0613952Q61	330
R0606	0613952Q42	51
R0607	NOT PLACED	–
R0608	0613952R66	0
R0609	0613952R66	0
R0610	0613952R66	0
R0611	0613952R66	0
R0612	0613952R66	0
R0613	0613952R66	0
R0614	0613952R66	0
R0615	0613952R66	0
R0616	0613952R25	100K
R0617	0613952R01	10K
R0618	0613952Q63	390
R0619	0613952R01	10K
R0620	0613952Q96	9.1K
R0621	0613952R66	0
R0622	NOT PLACED	–
R0623	NOT PLACED	–
R0624	0613952Q90	5.1K
R0625	0613952N69	51.1K
R0626	0613952N81	68.1K
R0627	0613952R66	0
R0702	NOT PLACED	–
R0706	0613958H57	220
R0710	0613958J49	1MEG
R0711	0613952H51	120
R0712	0613958S29	15
R0713	0613959H12	30K
R0714	0613952H46	75
R0715	0613952H46	75
R0716	0613958S29	15
R0717	0613958S29	15
R0718	0613952H35	27
R0719	0613958S29	15
R0720	0613952H35	27
R0721	0613958S29	15
R0722	0613952J07	18K
R0723	0613958J49	1MEG
R0726	0613958S29	15
R0727	0613952J05	15K
R0728	0613952H89	4.7K
R0729	0613952J01	10K
R0730	0613952H73	1K
R0731	NOT PLACED	–
R0732	0613958S29	15
R0733	0613958S29	15
R0734	0613958S29	15
R0735	0613959Y49	100
R0736	0613958S29	15
R0737	0613958S29	15
R0738	0613959Y42	51
R0739	0613958S29	15
R0740	0613958J74	0
R0742	0613959Q25	10
R0745	0613952H65	470
R0746	0613952R66	0
R0747	0613952H49	100
R0748	0613952J19	56K
R0749	0613952G67	0
R0750	0613952J07	18K
R0751	0613952J11	27K
R0752	0613952G67	0
R0753	0613952H73	1K
R0754	0613952H35	27
R0755	0613952H35	27
R0756	0613952J25	100K
R0757	0613952J17	47K
R0759	0613958J74	0
R0760	0613952J01	10K
R0761	0613952G67	0
R0773	0613952J21	68K
R0775	NOT PLACED	–
R0777	0613952J25	100K
R0779	0613952G67	0
R0780	0613952G67	0
R0781	0613958S73	1K
R0900	0613952R19	56K
R0901	0613952R16	43K
R0902	0613952Q88	4.3K
R0903	0613952R09	22K

Circuit Ref	Motorola Part No.	Description
R0906	0613952R66	0
R0907	0613952R66	0
R0909	0613952R16	43K
R0910	0613952H73	1K
R0911	0613952Q89	4.7K
R0912	0613952R11	27K
R0913	0613952R66	0
R0914	0613952R39	390K
R0915	0613952R19	56K
R0916	0613952Q49	100
R0917	0613952H91	5.6K
R0918	0613952H63	390
R0919	0613952R15	39K
R0920	0613952R13	33K
R0921	0613952H81	2.2K
R0922	0613952R14	36K
R0923	0613952R66	0
R0924	0613952H91	5.6K
R0925	0613952H91	5.6K
R0926	0613958H46	75
R0927	0613952H42	51
R0928	0613958H41	47
R0929	0613958H41	47
R0930	0613952R07	18K
R0931	0613952R66	0
R0936	0613952N66	47.5K
R0937	0613952N21	16.2K
R0938	0613952R66	0
R0940	0613952R66	0
R0941	0613952R66	0
R0942	0613952M81	6.81K
R0943	0613952N58	39.2K
R0944	0613952R66	0
R0946	0613952M51	3.32K
R0947	0613952R66	0
R0950	0613952N01	10K
R0951	0613952N62	43.2K
R0954	0613952R40	430K
R0955	0613952P01	100K
R0960	0613952H82	2.4K
R0970	0613959Y49	100
R0972	0613952G67	0
R0973	0613952G67	0
R0975	0613959Y47	82
R0976	0613952H39	39
R0977	0613952H39	39
R0978	0613952G67	0
R0979	0613952G67	0
RT0908	0615585H01	THERMISTOR, 47K
RT0953	0615585H01	THERMISTOR, 47K
SH0100	2615362H01	SHIELD
SH0101	2615362H01	SHIELD
SH0200	2615362H01	SHIELD
SH0300	2615362H01	SHIELD
SH0500	2615576H01	SHIELD
SH0900	2686423Z02	SHIELD
SH0901	2686425Z02	SHIELD
SP0701	1015349H01	SOLDER_PREFORM
SP0702	1015349H01	SOLDER_PREFORM
SP0703	1015349H01	SOLDER_PREFORM
SP0704	1015349H01	SOLDER_PREFORM
SP0705	1015349H01	SOLDER_PREFORM
SP0706	1015349H01	SOLDER_PREFORM
SP0707	1015349H01	SOLDER_PREFORM
SP0708	1015349H01	SOLDER_PREFORM
T0400	2515121H01	BALUN XFMR
T0401	2515121H01	BALUN XFMR
U0100	5104932K08	IC, FRACN SYNTHESIZER
U0101	5114000B59	ANALOG SWITCH
U0201	4815267H01	DUAL PNP
U0303	4815272H01	ANALOG SWITCH
U0304	4815267H01	DUAL PNP
U0305	4815267H01	DUAL PNP
U0600	5102495J14	IC, RF ASIC
U0601	5115391H01	VOLTAGE REGULATOR
U0700	NOT PLACED	–
U0900	5115147H01	DUAL OPAMP
U0901	5115147H01	DUAL OPAMP
U0940	5180390L83	IC, PA CONTROLLER
U0941	5115391H01	VOLTAGE REGULATOR
U0942	5114004A35	VOLTAGE DETECTOR
VR0700	4813977M11	DIODE, 5.6V ZENER
Y0100	5116032H01	0.5PPM 16.8MHZ TCXO (GPS Models only)

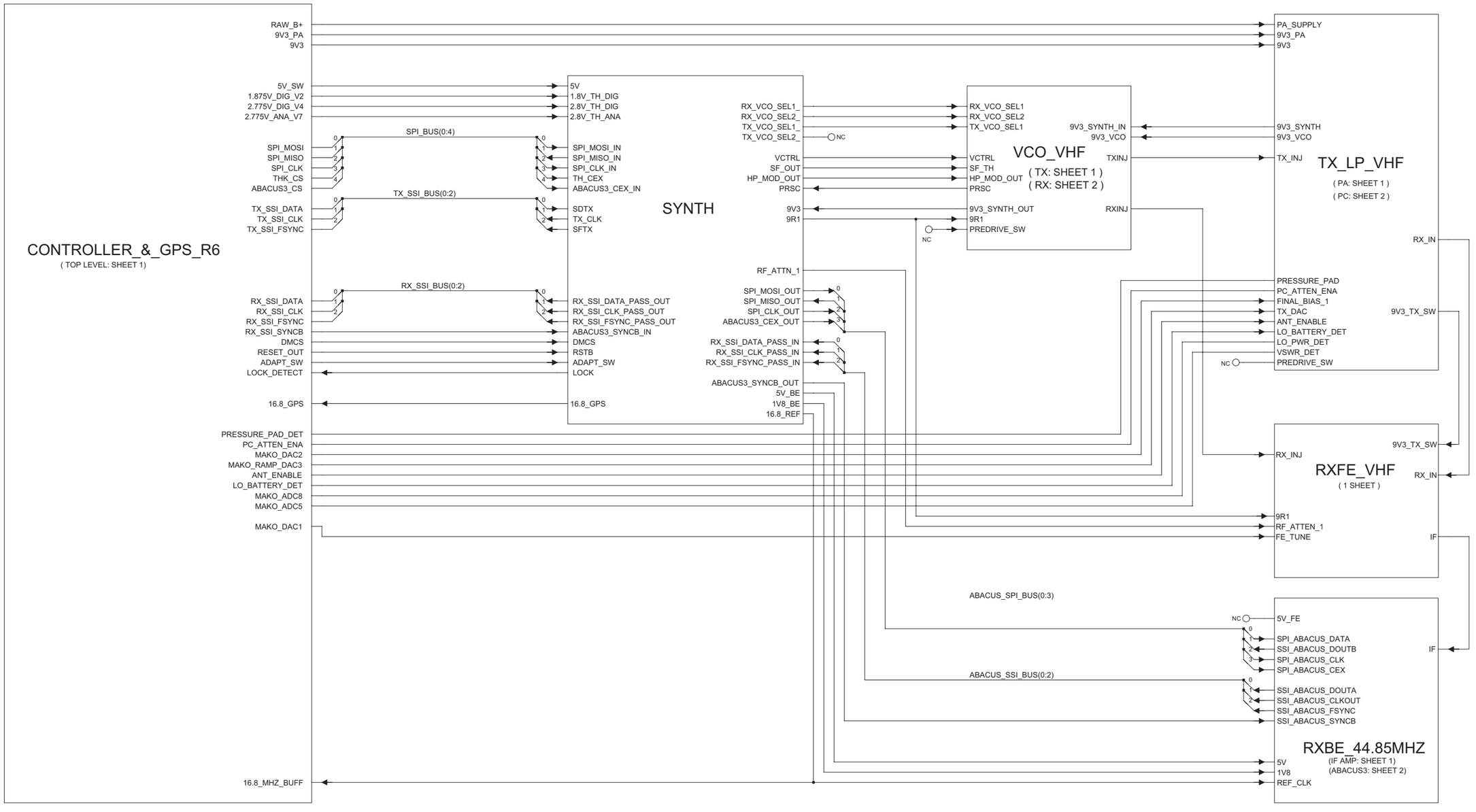
3.0 VHF (136–174 MHz) 1–25W PCB / Schematics / Parts List



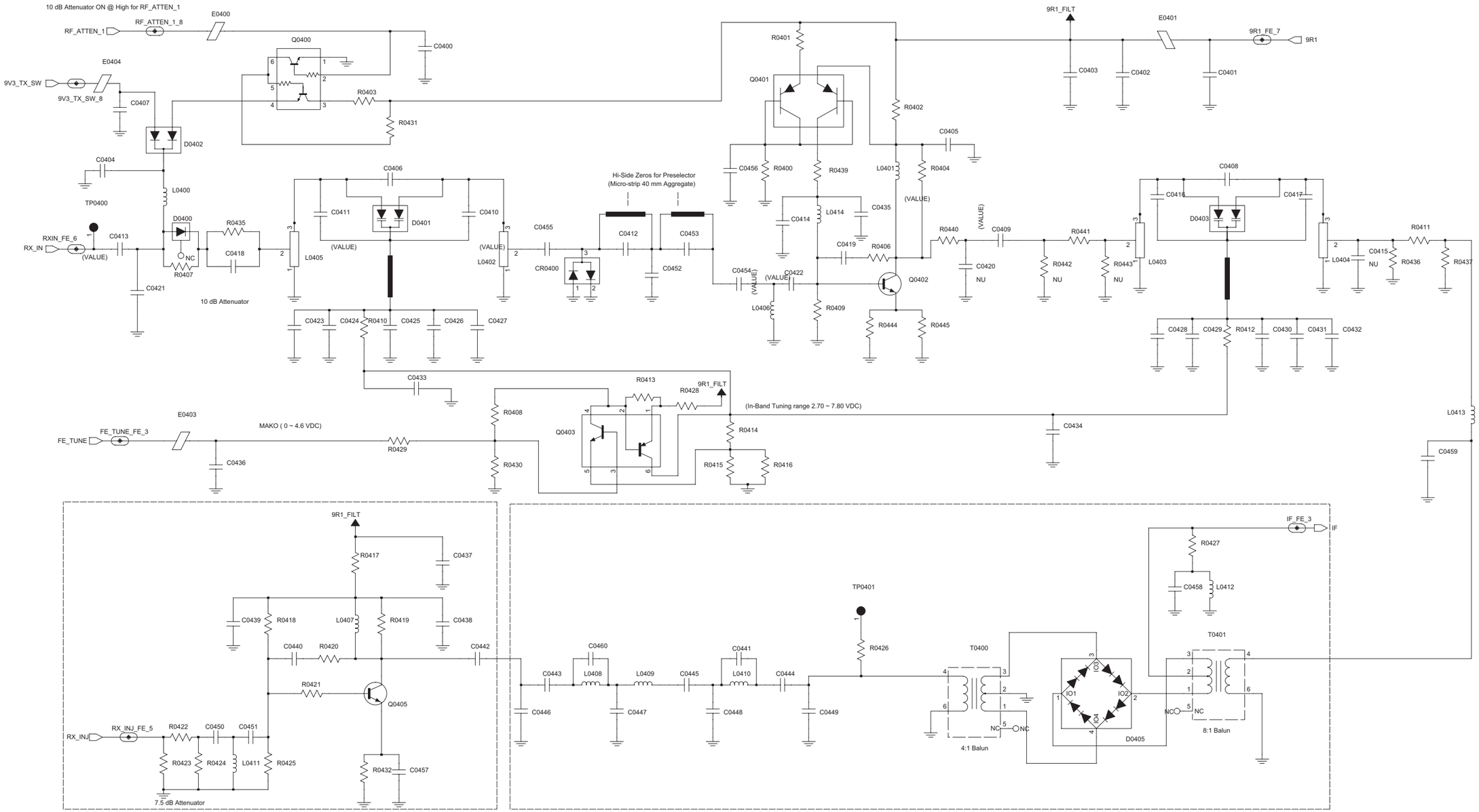
VHF (136–174 MHz) 1–25W 8471495L04 Top Side



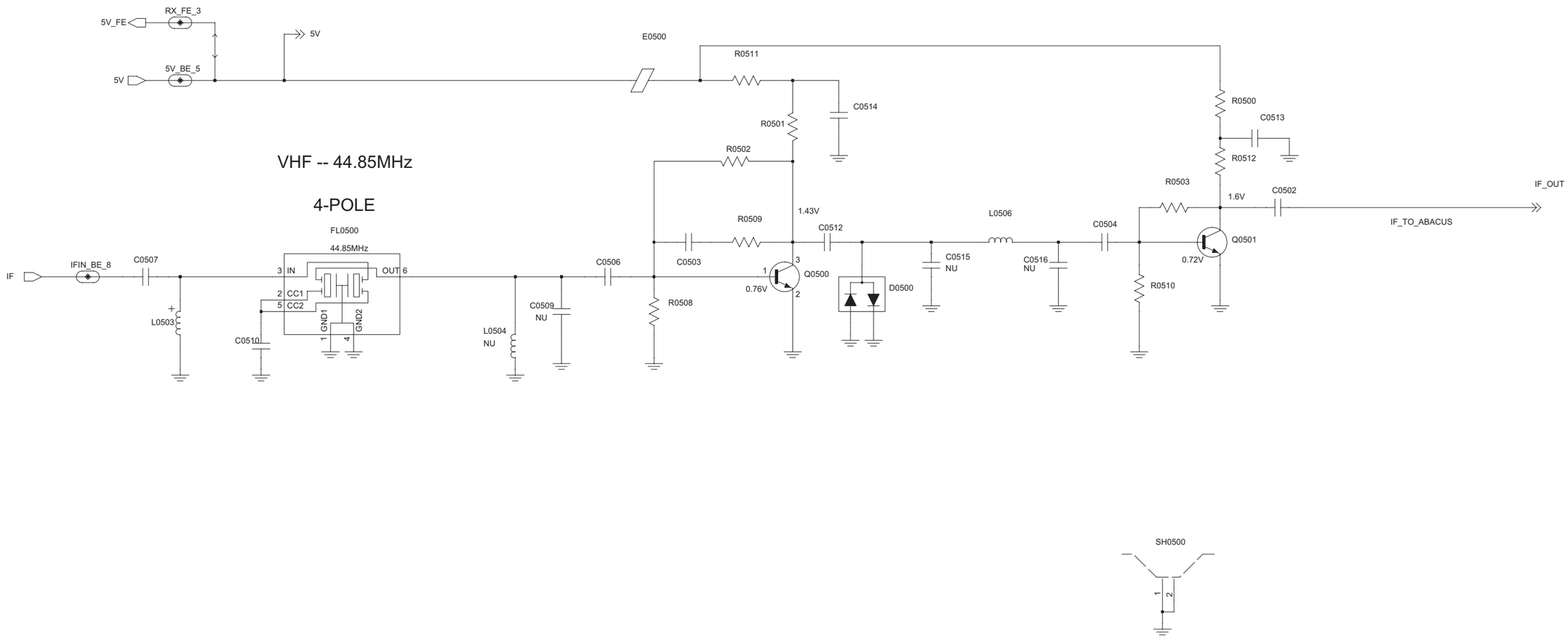
VHF (136–174 MHz) 1–25W 8471495L04 Bottom Side



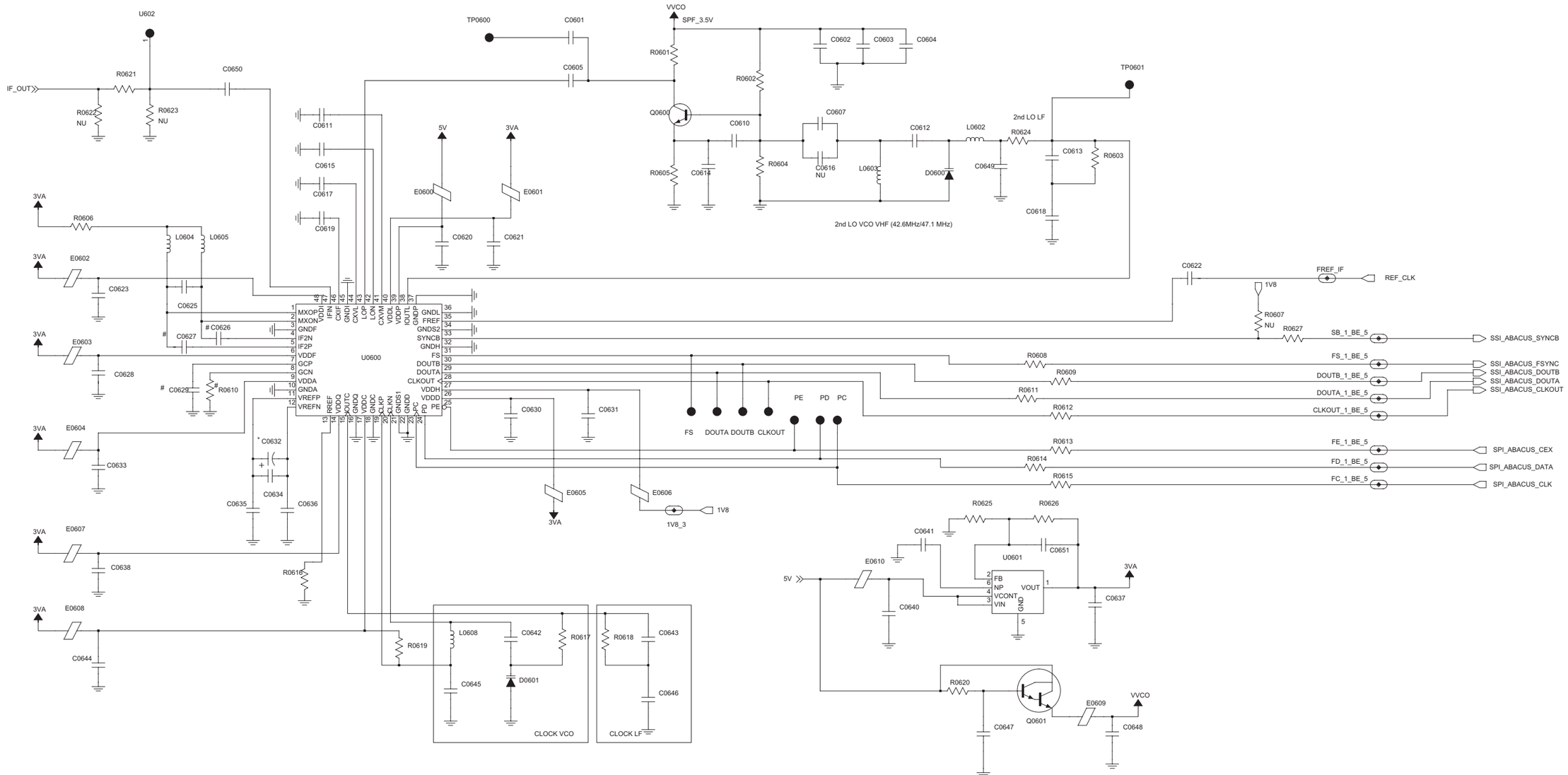
VHF (136–174 MHz) 1–25W Overall Schematic Diagram



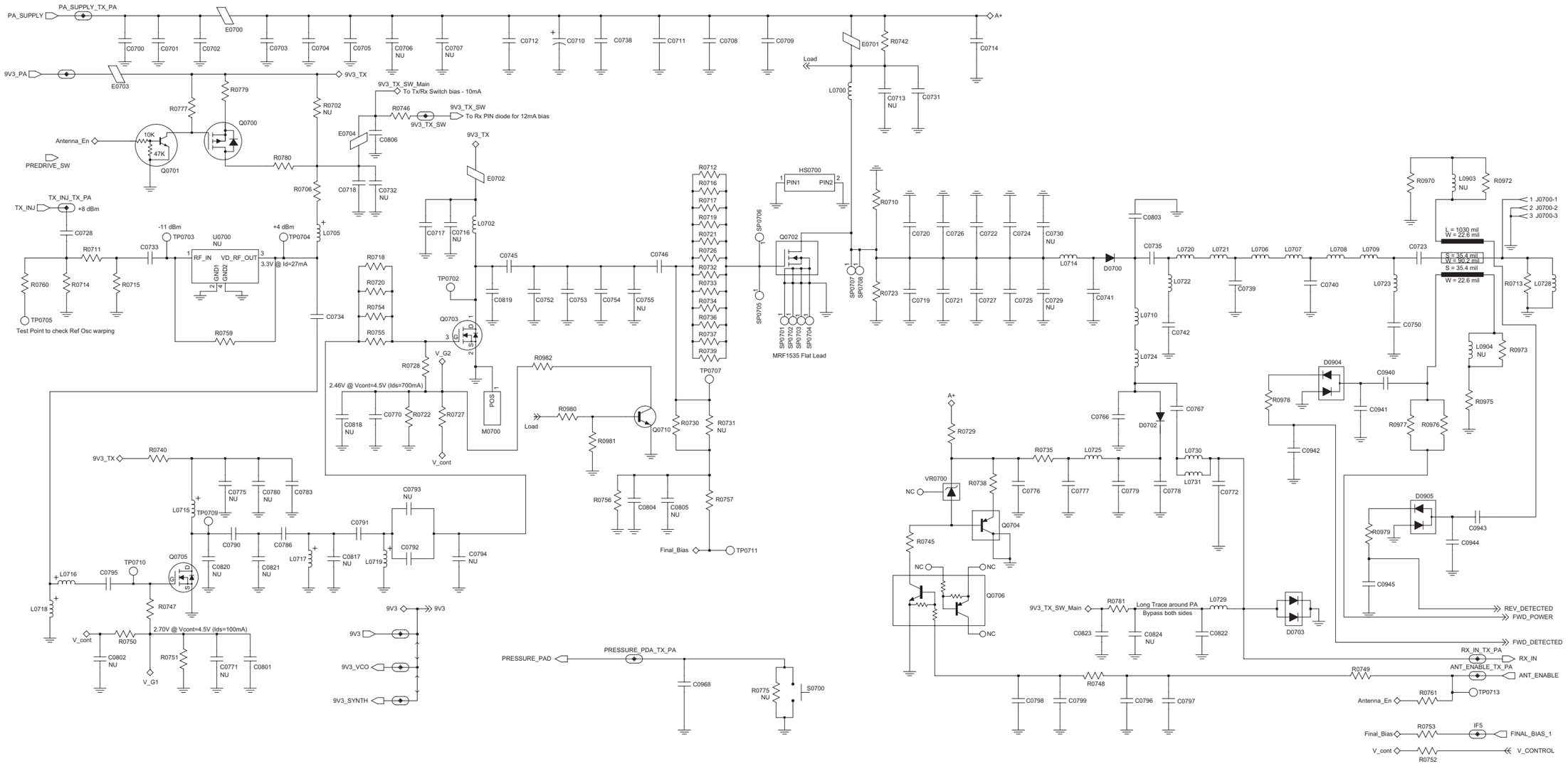
VHF (136–174 MHz) 1–25W Receiver Front-End Schematic Diagram



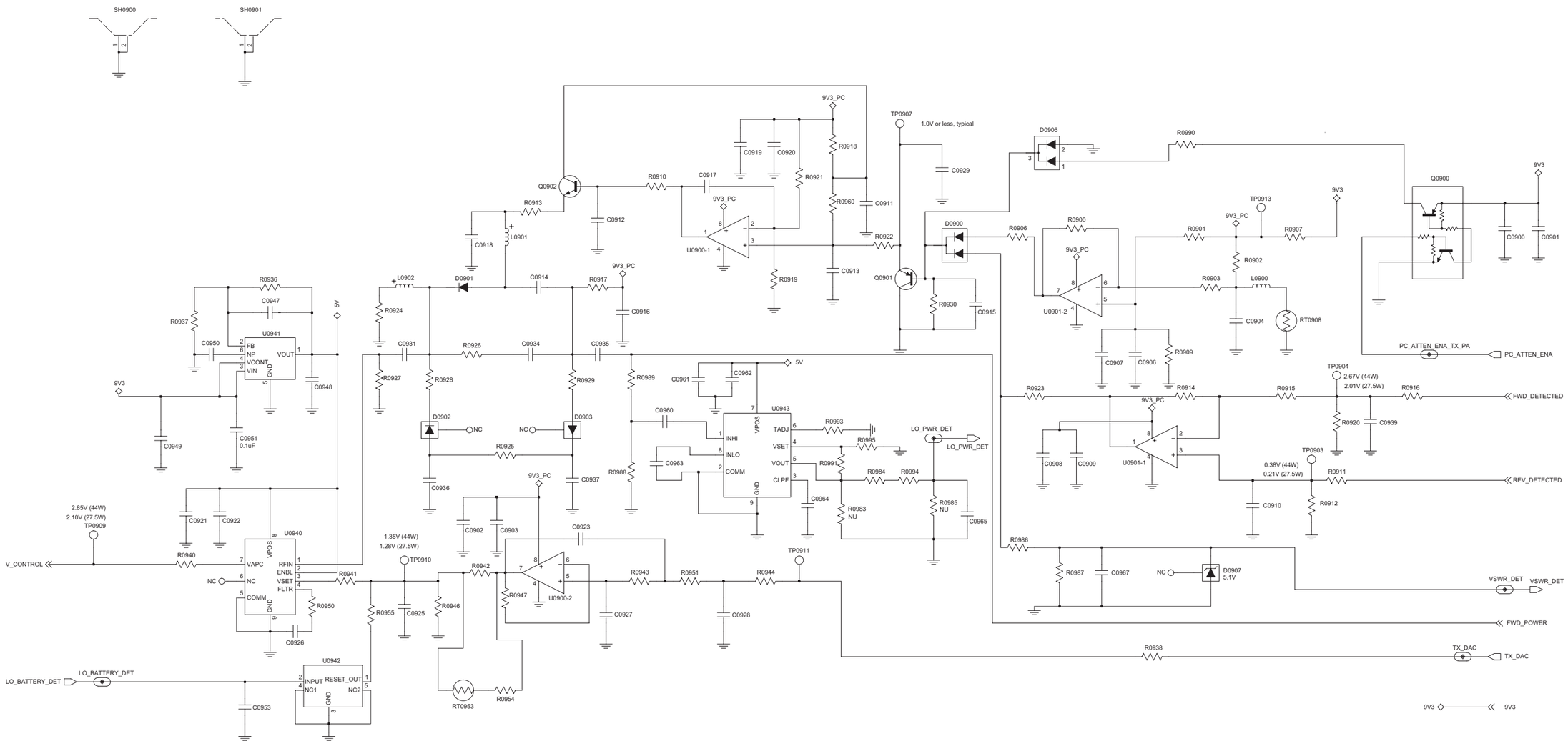
VHF (136–174 MHz) 1–25W Receiver IF Amp Schematic Diagram



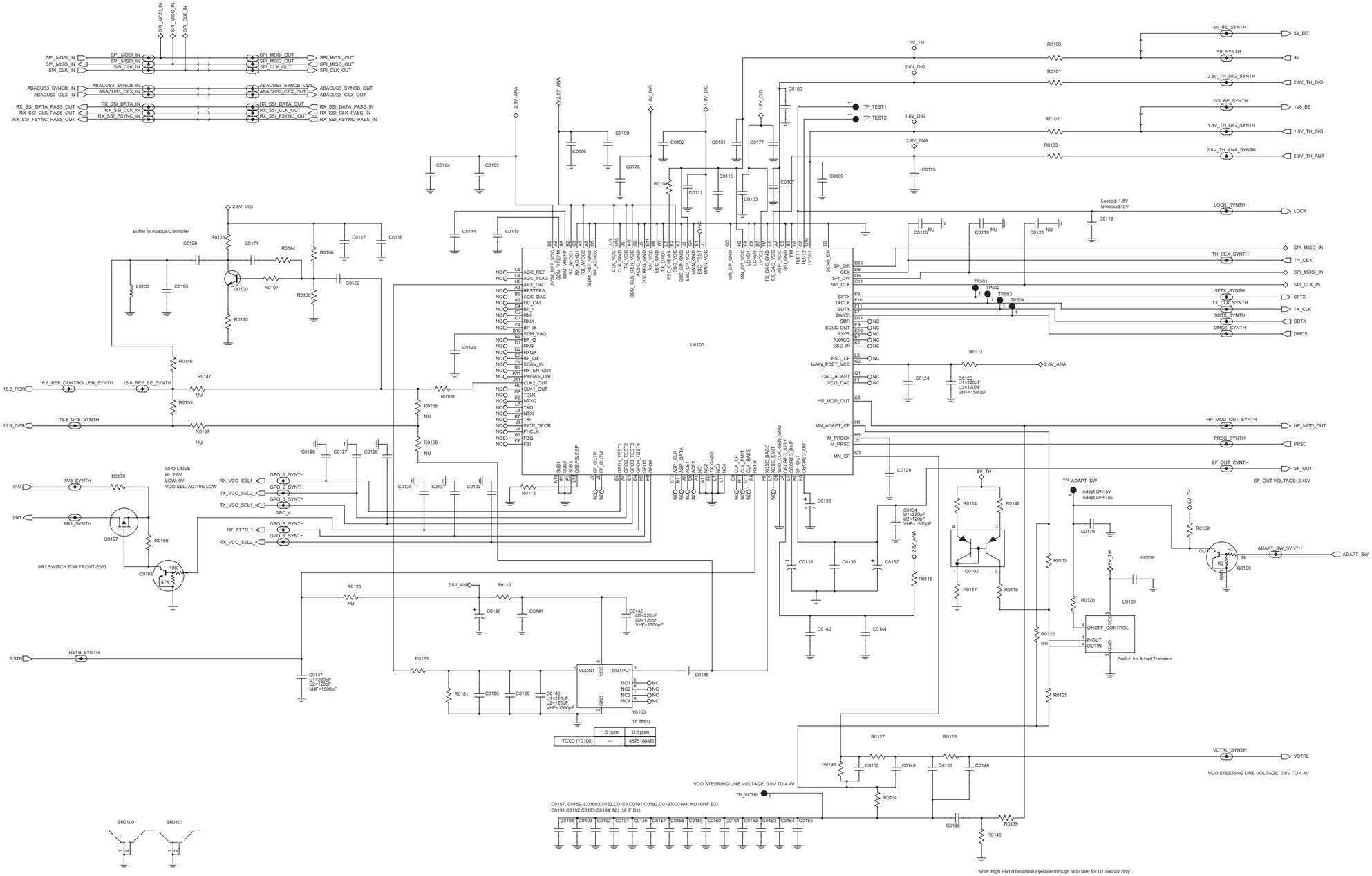
VHF (136–174 MHz) 1–25W Receiver Back-End Schematic Diagram



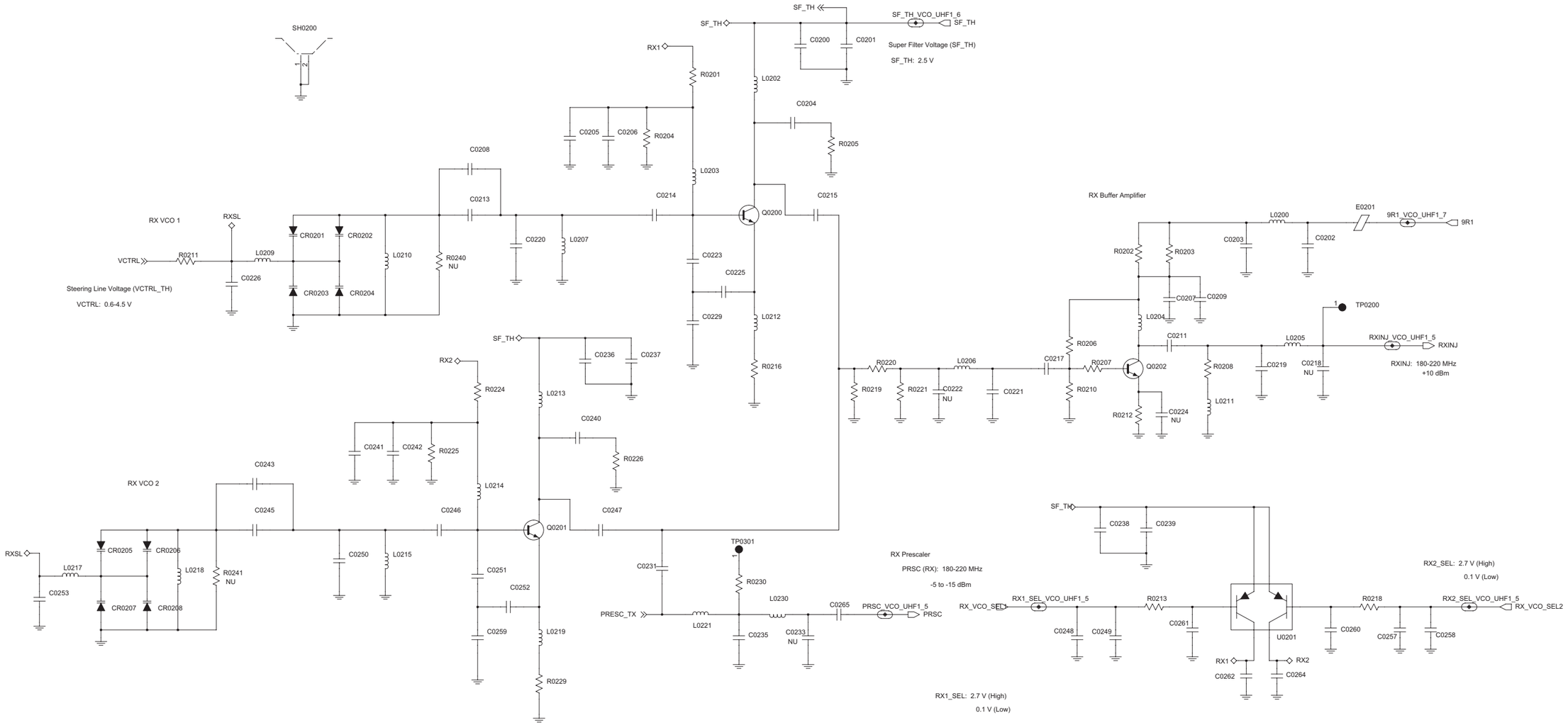
VHF (136–174 MHz) 1–25W Power Amplifier Schematic Diagram



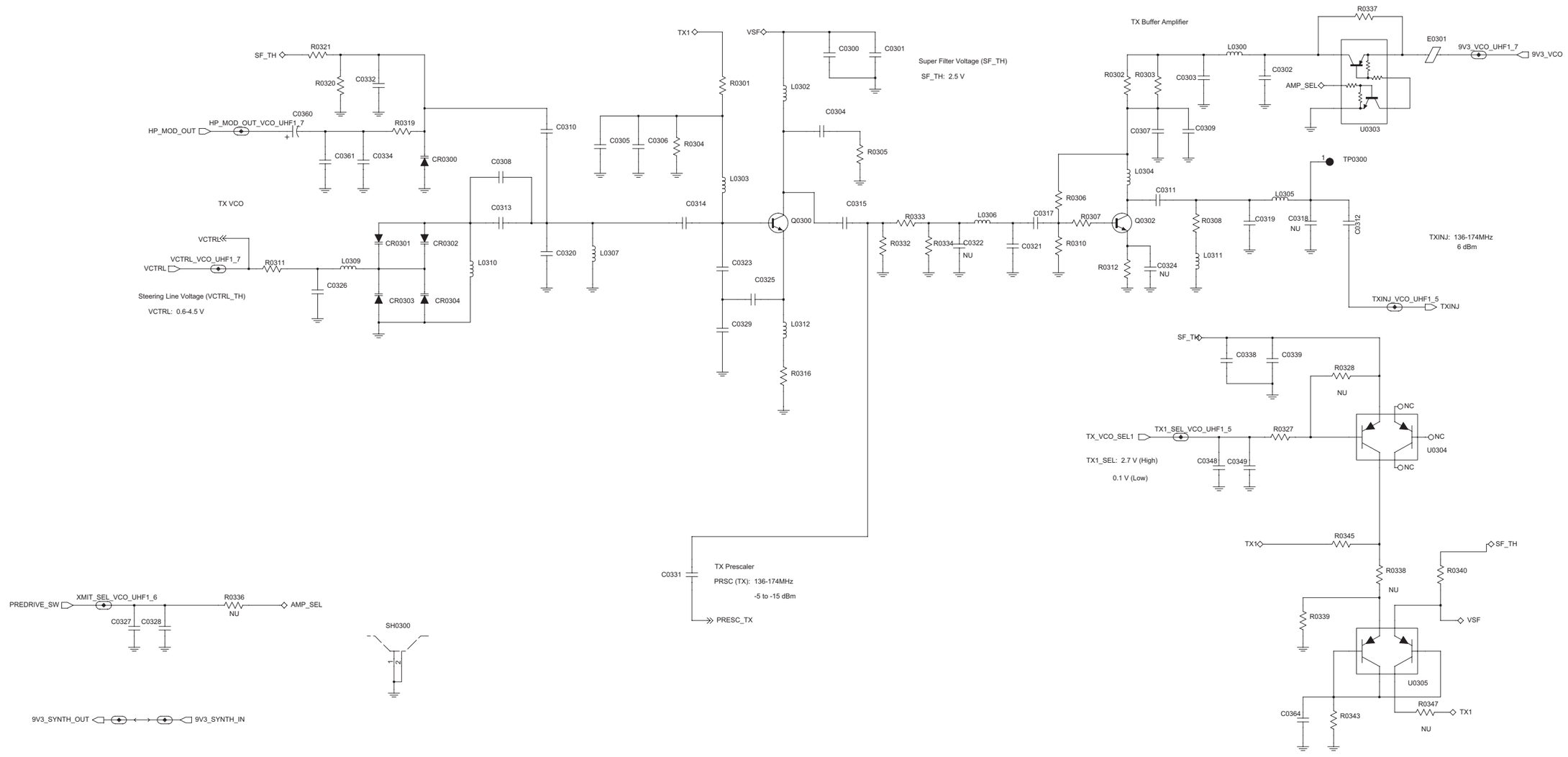
VHF (136–174 MHz) 1–25W Power Control Schematic Diagram



VHF (136–174 MHz) 1–25W Synthesizer Schematic Diagram



VHF (136–174 MHz) 1–25W Receiver VCO Schematic Diagram



VHF (136–174 MHz) 1–25W Transmit VCO Schematic Diagram

VHF PCB 8471495L04 Parts List 1–25W

Circuit Ref	Motorola Part No.	Description
C0100	2113944A44	220pF
C0101	2113944A44	220pF
C0102	2113944A44	220pF
C0103	2113945C31	0.1uF
C0104	2113944A44	220pF
C0105	2113945C31	0.1uF
C0106	2113945C31	0.1uF
C0107	2113945C31	0.1uF
C0108	2113944A44	220pF
C0109	2113945C31	0.1uF
C0110	2113945C31	0.1uF
C0111	2113945C31	0.1uF
C0112	2113944A44	220pF
C0113	NOT PLACED	–
C0114	2113946E02	1.0uF
C0115	2113946E02	1.0uF
C0117	2113944A44	220pF
C0118	2113945C31	0.1uF
C0119	NOT PLACED	–
C0120	2113945B02	.01uF
C0121	NOT PLACED	–
C0122	2113945B02	.01uF
C0123	2113946E02	1.0uF
C0124	2113945C31	0.1uF
C0125	2113944A44	220pF
C0126	2113944A44	220pF
C0127	2113944A44	220pF
C0128	2113944A44	220pF
C0129	2113945C31	0.1uF
C0130	2113944A44	220pF
C0131	2113944A44	220pF
C0132	2113944A44	220pF
C0133	2313960B30	4.7uF
C0134	2113944A44	220pF
C0135	2313960B32	10uF
C0136	2113945C31	0.1uF
C0137	2313960B32	10uF
C0138	2113944A44	220pF
C0140	2313960B30	4.7uF
C0141	2113945C31	0.1uF
C0142	2113944A44	220pF
C0143	2113944A44	220pF
C0144	2113945C31	0.1uF
C0145	2113945B02	.01uF
C0146	2113944A44	220pF
C0147	2113944A44	220pF
C0148	2113945D01	.033uF
C0149	2113945C04	.022uF
C0150	2113945C31	0.1uF
C0151	2113945C31	0.1uF
C0156	2185419D06	0.1uF
C0157	2185419D06	0.1uF
C0158	2185419D06	0.1uF
C0159	2185419D06	0.1uF
C0160	2185419D06	0.1uF
C0161	2185419D06	0.1uF
C0162	2185419D06	0.1uF
C0163	2185419D06	0.1uF
C0164	2185419D06	0.1uF
C0165	2185419D06	0.1uF
C0166	2185419D06	0.1uF
C0171	2113945B02	.01uF
C0175	2113944A44	220pF
C0177	2113944A44	220pF
C0178	2113944A44	220pF
C0179	2113944A44	220pF
C0180	2113945C31	0.1uF
C0191	NOT PLACED	–
C0192	NOT PLACED	–
C0193	NOT PLACED	–
C0194	NOT PLACED	–
C0195	2113945A05	470pF
C0196	2113946H02	10uF
C0200	2113944A44	220pF
C0201	2113945Y02	0.10uF
C0202	2113945C02	.01uF
C0203	2113944A44	220pF
C0204	2113944A44	220pF
C0205	2113945Y02	0.10uF
C0206	2113944A44	220pF
C0207	2113945C04	.022uF
C0208	2115153H18	4.3pF
C0209	2113944A44	220pF
C0211	2113944A44	220pF
C0213	2115153H17	3.9pF
C0214	2115153H34	11pF
C0215	2115153H20	5.1pF
C0217	2113944A44	220pF
C0218	NOT PLACED	–
C0219	NOT PLACED	–
C0220	2115153H17	3.9pF
C0221	2115153H14	3.0pF
C0222	NOT PLACED	–
C0223	2115153H46	36pF
C0224	NOT PLACED	–
C0225	2115153H51	56pF
C0226	2113944A44	220pF
C0229	2115153H42	24pF
C0230	2113944C47	150pF
C0231	2115153H14	3.0pF
C0233	NOT PLACED	–
C0235	2115153H22	6.2pF
C0236	2113944A44	220pF
C0237	2113945Y02	0.10uF
C0238	2113944A44	220pF
C0239	2113945Y02	0.10uF
C0240	2113944A44	220pF
C0241	2113945Y02	0.10uF
C0242	2113944A44	220pF
C0243	2115153H13	2.7pF
C0245	2115153H14	3.0pF
C0246	2115153H27	10pF
C0247	2115153H20	5.1pF
C0248	2113944A44	220pF
C0249	2113945Y02	0.10uF
C0250	2115153H16	3.6pF
C0251	2115153H40	20pF
C0252	2115153H48	43pF
C0253	2113944A44	220pF
C0257	2113944A44	220pF
C0258	2113945Y02	0.10uF
C0259	2115153H35	12pF
C0300	2113944A44	220pF
C0301	2113945Y02	0.10uF
C0302	2113945C02	.01uF
C0303	2113944A44	220pF
C0304	2113944A44	220pF
C0305	2113945Y02	0.10uF
C0306	2113944A44	220pF
C0307	2113945C04	.022uF
C0308	2115153H15	3.3pF
C0309	2113944A44	220pF
C0310	2115153H01	0.5pF
C0311	2113944A44	220pF
C0313	2115153H15	3.3pF
C0314	2115153H35	12pF
C0315	2115153H20	5.1pF
C0316	2313960B32	10uF
C0317	2113944A44	220pF
C0318	2115153H15	3.3pF
C0319	NOT PLACED	–
C0320	2115153H20	5.1pF
C0321	2115153H24	7.5pF
C0322	NOT PLACED	–
C0323	2115153H43	27pF
C0324	NOT PLACED	–
C0325	2115153H51	56pF
C0326	2113944A44	220pF
C0327	NOT PLACED	–
C0328	NOT PLACED	–
C0329	2115153H38	16pF
C0331	2115153H14	3.0pF
C0334	2113944A44	220pF
C0336	2113944A44	220pF
C0337	2113945Y02	0.10uF
C0340	2113944A44	220pF
C0341	2113945Y02	0.10uF
C0342	2113944A44	220pF
C0343	2115153H15	3.3pF
C0344	2115153H01	0.5pF
C0345	2115153H15	3.3pF
C0346	2115153H24	7.5pF
C0347	2115153H20	5.1pF
C0348	2113944A44	220pF
C0349	2113945Y02	0.10uF
C0350	2115153H18	4.3pF
C0351	2115153H42	24pF
C0352	2115153H50	51pF
C0353	2113944A44	220pF
C0357	2113944A44	220pF
C0358	2113945Y02	0.10uF
C0359	2115153H38	16pF
C0360	2313960B30	4.7uF
C0361	2113944C51	1000pF
C0362	2113944A44	220pF
C0363	2113945Y02	0.10uF
C0400	NOT PLACED	–
C0401	2113945C31	0.1uF
C0402	2113944A44	220pF
C0403	2115153H49	47pF
C0404	NOT PLACED	–
C0405	2113944A44	220pF
C0406	2115153H27	10pF
C0407	2115153H13	2.7pF
C0408	2115153H27	10pF
C0409	2115153H13	2.7pF
C0410	2115153H22	6.2pF
C0411	2115153H22	6.2pF
C0412	2115153H14	3.0pF
C0413	2115153H57	100pF
C0414	2113944A44	220pF
C0415	2115153H21	5.6pF
C0416	2115153H22	6.2pF
C0417	2115153H22	6.2pF
C0419	2113945Y02	0.10uF
C0420	2115153H03	1.0pF
C0421	2115153H13	2.7pF
C0422	2115153H26	9.1pF
C0423	2113944A44	220pF
C0424	2113944A44	220pF
C0425	2113944A44	220pF
C0426	2113944A44	220pF
C0427	2113944A44	220pF

Circuit Ref	Motorola Part No.	Description
C0428	2113944A44	220pF
C0429	2113944A44	220pF
C0430	2113944A44	220pF
C0431	2113944A44	220pF
C0432	2113944A44	220pF
C0433	NOT PLACED	–
C0434	2113944A44	220pF
C0435	NOT PLACED	–
C0436	2113944A44	220pF
C0437	2113944A44	220pF
C0438	2113944A44	220pF
C0439	NOT PLACED	–
C0440	2113944A44	220pF
C0441	2115153H11	2.2pF
C0442	2115153H25	8.2pF
C0443	2115153H41	22pF
C0444	2115153H41	22pF
C0445	2115153H37	15pF
C0446	2115153H20	5.1pF
C0447	2115153H27	10pF
C0448	2115153H26	9.1pF
C0449	2115153H20	5.1pF
C0451	2115153H41	22pF
C0452	2115153H26	9.1pF
C0453	2115153H20	5.1pF
C0454	2115153H26	9.1pF
C0455	2113945C31	0.1uF
C0456	2113944A40	100pF
C0457	2113945C31	0.1uF
C0458	2115153H40	20pF
C0459	2115153H40	20pF
C0460	2113946F05	10uF
C0461	2115153H40	20pF
C0462	2115153H40	20pF
C0463	2115153H06	1.3pF
C0464	2115153H06	1.3pF
C0502	2113945Y02	0.10uF
C0503	2113945Y02	0.10uF
C0504	2113945Y02	0.10uF
C0506	2113945Y02	0.10uF
C0507	2115153H39	18pF
C0509	NOT PLACED	–
C0510	2115153H22	6.2pF
C0512	2113945Y02	0.10uF
C0513	2113945Y02	0.10uF
C0514	2113945Y02	0.10uF
C0515	NOT PLACED	–
C0516	NOT PLACED	–
C0601	2115153H48	43pF
C0602	2113945B02	.01uF
C0603	2113944A44	220pF

Circuit Ref	Motorola Part No.	Description
C0604	2113945Y02	0.10uF
C0605	2115153H48	43pF
C0607	2115153H39	18pF
C0610	2115153H53	68pF
C0611	2113945A09	1000pF
C0612	2115153H34	11pF
C0613	2185419D03	0.01uF
C0614	2115153H48	43pF
C0615	2113945B02	.01uF
C0616	NOT PLACED	–
C0617	2113945Y02	0.10uF
C0618	2185419D06	0.1uF
C0619	2113945Y02	0.10uF
C0620	2113945Y02	0.10uF
C0621	2113945Y02	0.10uF
C0622	2113945A09	1000pF
C0623	2113945Y02	0.10uF
C0625	2113944C89	200pF
C0626	2113944A40	100pF
C0627	2113944A40	100pF
C0628	2113945Y02	0.10uF
C0629	2113945A11	2200pF
C0630	2113945Y02	0.10uF
C0631	2113945Y02	0.10uF
C0632	2313960B30	4.7uF
C0633	2113945Y02	0.10uF
C0634	2113945B02	.01uF
C0635	2113944A40	100pF
C0636	2113944A40	100pF
C0637	2113946S35	1.0uF
C0638	2113945Y02	0.10uF
C0640	2113946N03	2.2uF
C0641	2113945B02	.01uF
C0642	2115153H53	68pF
C0643	2113945Y02	0.10uF
C0644	2113945Y02	0.10uF
C0645	2113945B02	.01uF
C0646	2113946G04	0.68uF
C0647	2113946J03	10.0uF
C0648	2113946J03	10.0uF
C0649	2113945A12	3300pF
C0650	2115153H44	30pF
C0651	2115153H57	100pF
C0700	2113944C82	30pF
C0701	2113945C04	.022uF
C0702	2113944C55	2200pF
C0703	2113944C82	30pF
C0704	2113945C04	.022uF
C0705	2113944C51	1000pF
C0706	NOT PLACED	–
C0707	NOT PLACED	–

Circuit Ref	Motorola Part No.	Description
C0708	2113944C51	1000pF
C0709	2113945C31	0.1uF
C0710	2371403L02	10uF
C0711	NOT PLACED	–
C0712	2113944C51	1000pF
C0713	2111078B42	100pF
C0714	2111078B42	100pF
C0715	NOT PLACED	–
C0716	2113944A41	120pF
C0717	2113945A09	1000pF
C0718	2113945A09	1000pF
C0719	2111078B25	27pF
C0720	NOT PLACED	–
C0721	NOT PLACED	–
C0722	NOT PLACED	–
C0723	2111078B39	75pF
C0724	2113944A41	120pF
C0725	2113944A41	120pF
C0726	2111078B20	18pF
C0727	NOT PLACED	–
C0728	2113944C42	75pF
C0729	NOT PLACED	–
C0730	NOT PLACED	–
C0731	NOT PLACED	–
C0732	2113951B41	24pF
C0733	2113944C42	75pF
C0734	2113944C84	43pF
C0735	2111078B39	75pF
C0736	2113944A41	120pF
C0737	NOT PLACED	–
C0738	2111078B07	5.6pF
C0739	2185400Y36	12pF
C0740	2185400Y36	12pF
C0741	NOT PLACED	–
C0742	2111078B07	5.6pF
C0743	2113944C37	39pF
C0744	2113944C38	47pF
C0745	2113944F44	12pF
C0746	2111078B25	27pF
C0747	NOT PLACED	–
C0748	2111078B11	8.2pF
C0749	NOT PLACED	–
C0751	NOT PLACED	–
C0752	2113944A41	120pF
C0753	2111078B39	75pF
C0754	NOT PLACED	–
C0755	NOT PLACED	–
C0756	2113944F44	12pF
C0757	2113944C42	75pF
C0758	NOT PLACED	–
C0759	2113944C42	75pF

Circuit Ref	Motorola Part No.	Description
C0760	NOT PLACED	–
C0761	2113951B41	24pF
C0763	2113944A41	120pF
C0764	NOT PLACED	–
C0765	NOT PLACED	–
C0766	NOT PLACED	–
C0767	2113944C42	75pF
C0768	2113944A41	120pF
C0769	2113944F51	24pF
C0770	2113944A41	120pF
C0771	NOT PLACED	–
C0772	2113944C16	2.7pF
C0774	2113944F51	24pF
C0775	2113945C04	.022uF
C0776	2113944C42	75pF
C0777	2113944C47	150pF
C0778	2111078B30	34pF
C0779	2111078B29	33pF
C0780	2113944A41	120pF
C0781	2113944C42	75pF
C0782	2113944C51	1000pF
C0783	2113944A41	120pF
C0785	2113944C42	75pF
C0786	2113944C84	43pF
C0787	2113944C84	43pF
C0788	NOT PLACED	–
C0789	NOT PLACED	–
C0790	NOT PLACED	–
C0791	2113944A80	20pF
C0792	2113944A28	18pF
C0793	2113944A25	10pF
C0794	NOT PLACED	–
C0795	2113944C75	8.2pF
C0796	2113944C42	75pF
C0797	2113944C51	1000pF
C0798	2113944C51	1000pF
C0799	2113944C42	75pF
C0800	NOT PLACED	–
C0801	2113944A41	120pF
C0802	2113944A41	120pF
C0803	2111078B01	3.3pF
C0804	2113944C42	75pF
C0805	2113944C51	1000pF
C0806	NOT PLACED	–
C0807	NOT PLACED	–
C0808	NOT PLACED	–
C0809	2113944C30	10pF
C0810	2113944C42	75pF
C0811	NOT PLACED	–
C0812	NOT PLACED	–
C0813	NOT PLACED	–

Circuit Ref	Motorola Part No.	Description
C0814	2113944C46	120pF
C0815	2113944C41	68pF
C0817	2113951A31	7.50pF
C0818	2113944F54	33pF
C0819	2113944F54	33pF
C0828	2113944F54	33pF
C0829	2113944F54	33pF
C0832	2113951B41	24pF
C0845	2113944F44	12pF
C0856	2113944F44	12pF
C0861	2113951B41	24pF
C0869	2113944F51	24pF
C0874	2113944F51	24pF
C0900	2113944A41	120pF
C0901	2113945C31	0.1uF
C0902	2113945C31	0.1uF
C0903	2113944A41	120pF
C0904	2113944A41	120pF
C0906	2113944A41	120pF
C0907	2113945C02	.01uF
C0908	2113945C31	0.1uF
C0909	2113944A41	120pF
C0910	2113944A41	120pF
C0911	2113944A41	120pF
C0912	2113944A41	120pF
C0913	2113944A41	120pF
C0914	2113944A41	120pF
C0915	2113944A41	120pF
C0916	2113944A41	120pF
C0917	2113945A09	1000pF
C0918	2113944A41	120pF
C0919	2113945C31	0.1uF
C0920	2113944A41	120pF
C0921	2113945C31	0.1uF
C0922	2113944A41	120pF
C0923	2113944C55	2200pF
C0925	2113944A41	120pF
C0926	2113945L41	4700pF
C0927	2113944C02	220pF
C0928	2113944C53	1500pF
C0929	2113944A41	120pF
C0931	2113944A41	120pF
C0934	2113944A41	120pF
C0935	2113944A41	120pF
C0936	2113944A41	120pF
C0937	2113944A41	120pF
C0939	2113944A41	120pF
C0940	2113944C46	120pF
C0941	2113944M17	9.1pF
C0942	2113944C42	75pF
C0943	2113944C42	75pF

Circuit Ref	Motorola Part No.	Description
C0944	2113944M06	3.3pF
C0945	2113944C42	75pF
C0947	2113944A40	100pF
C0948	2113946S35	1.0uF
C0949	2113946G01	2.2uF
C0950	2113945A09	1000pF
C0951	2113945C31	0.1uF
C0953	2113944A41	120pF
C0960	2113944A52	1000pF
C0961	2113945C31	0.1uF
C0962	2113944A40	100pF
C0963	2113944A52	1000pF
C0964	2113944A23	8.2pF
C0965	2113944A40	100pF
C0966	2113944A41	120pF
C0967	2113944A41	120pF
CR0201	4815096H01	DIODE VARACTOR 1SV305
CR0202	4815096H01	DIODE VARACTOR 1SV305
CR0203	4815096H01	DIODE VARACTOR 1SV305
CR0204	4815096H01	DIODE VARACTOR 1SV305
CR0205	4815096H01	DIODE VARACTOR 1SV305
CR0206	4815096H01	DIODE VARACTOR 1SV305
CR0207	4815096H01	DIODE VARACTOR 1SV305
CR0208	4815096H01	DIODE VARACTOR 1SV305
CR0300	4815096H01	DIODE VARACTOR 1SV305
CR0301	4815096H01	DIODE VARACTOR 1SV305
CR0302	4815096H01	DIODE VARACTOR 1SV305
CR0303	4815096H01	DIODE VARACTOR 1SV305
CR0304	4815096H01	DIODE VARACTOR 1SV305
CR0305	4815096H01	DIODE VARACTOR 1SV305
CR0306	4815096H01	DIODE VARACTOR 1SV305
CR0307	4815096H01	DIODE VARACTOR 1SV305
CR0308	4815096H01	DIODE VARACTOR 1SV305
CR0400	4813974A19	DIODE, SCHOTTKY
D0400	NOT PLACED	–
D0401	4885055Y01	DIODE VARACTOR 1SV229
D0402	4885055Y01	DIODE VARACTOR 1SV229
D0403	4885055Y01	DIODE VARACTOR 1SV229
D0404	4885055Y01	DIODE VARACTOR 1SV229
D0405	4815090H01	DIODE, MIXER
D0406	4885055Y01	DIODE VARACTOR 1SV229
D0407	4885055Y01	DIODE VARACTOR 1SV229
D0408	4885055Y01	DIODE VARACTOR 1SV229
D0409	4885055Y01	DIODE VARACTOR 1SV229
D0500	4813974A19	DIODE, SCHOTTKY
D0600	4815096H01	DIODE VARACTOR 1SV305
D0601	4815096H01	DIODE VARACTOR 1SV305
D0700	4802482J02	DIODE, PIN
D0702	4802482J02	DIODE, PIN
D0703	4875430M01	DIODE, PIN
D0704	4813974A06	DIODE, PIN

Circuit Ref	Motorola Part No.	Description
D0900	4813978C02	DIODE, SWITCHING
D0901	4815023H01	DIODE, PIN
D0902	4815024H01	DIODE, PIN
D0903	4815024H01	DIODE, PIN
D0904	4813974A21	DIODE, SCHOTTKY
D0905	4813974A21	DIODE, SCHOTTKY
D0906	4813978C02	DIODE, SWITCHING
D0907	4813977M10	DIODE, 5.1V ZENER
E0201	2409134J25	FERRITE BEAD
E0301	2409134J25	FERRITE BEAD
E0302	NOT PLACED	–
E0400	NOT PLACED	–
E0401	2409134J25	FERRITE BEAD
E0403	2409134J25	FERRITE BEAD
E0500	2409134J25	FERRITE BEAD
E0600	2409134J25	FERRITE BEAD
E0601	2409134J25	FERRITE BEAD
E0602	2409134J25	FERRITE BEAD
E0603	2409134J25	FERRITE BEAD
E0604	2409134J25	FERRITE BEAD
E0605	2409134J25	FERRITE BEAD
E0606	2409134J25	FERRITE BEAD
E0607	2409134J25	FERRITE BEAD
E0608	2409134J25	FERRITE BEAD
E0609	2409134J25	FERRITE BEAD
E0610	2480640Z01	FERRITE BEAD
E0700	2485011Y01	FERRITE BEAD
E0701	2485011Y01	FERRITE BEAD
E0702	7671656M01	FERRITE BEAD
E0703	2485011Y01	FERRITE BEAD
E0704	2409134J25	FERRITE BEAD
FL0500	9116854H02	73.35 MHZ CRYSTAL FILTER
HS0700	0104038J81	HEATSINK
J0700	0905901V11	MINI-U RF CONNECTOR
L0100	2414017N29	270nH
L0200	2414017N28	220nH
L0202	2414032F42	470nH
L0203	2414032F42	470nH
L0204	2414017N28	220nH
L0205	2414017N20	47nH
L0206	2414017N14	15nH
L0207	2415385H02	12.5nH
L0209	2414032F42	470nH
L0210	2414015A21	27nH
L0211	2414017N28	220nH
L0212	2414032F42	470nH
L0213	2414032F42	470nH
L0214	2414032F42	470nH
L0215	2415385H02	12.5nH
L0217	2414032F42	470nH
L0218	2414015A20	22nH

Circuit Ref	Motorola Part No.	Description
L0219	2414032F42	470nH
L0221	2414017N19	39nH
L0300	2414017N28	220nH
L0302	2414032F42	470nH
L0303	2414032F42	470nH
L0304	2414017N28	220nH
L0305	2414017N19	39nH
L0306	2414017N12	10nH
L0307	2415385H01	8nH
L0309	2414032F42	470nH
L0310	2414015A32	18nH
L0311	2414017N28	220nH
L0312	2414032F42	470nH
L0313	2414032F42	470nH
L0314	2414032F42	470nH
L0315	2415385H01	8nH
L0317	2414032F42	470nH
L0318	2414015A32	18nH
L0319	2414032F42	470nH
L0401	2414015B24	15nH
L0402	NOT PLACED	–
L0403	NOT PLACED	–
L0404	NOT PLACED	–
L0405	NOT PLACED	–
L0406	2414015B29	10nH
L0407	2414015B16	27nH
L0408	2414015B15	22nH
L0409	2414015B15	22nH
L0410	2414015B15	22nH
L0411	2414015B15	22nH
L0412	2414017N20	47nH
L0413	2414017N28	220nH
L0414	2414015B23	12nH
L0503	2414015B27	390nH
L0504	NOT PLACED	–
L0506	2414032B66	820nH
L0602	2414032K23	2.7uH
L0603	2414032D20	270nH
L0604	2466505A01	10uH
L0605	2466505A01	10uH
L0608	2414032B76	4.7uH
L0700	2460592A01	17nH
L0702	2479990G01	33.47nH
L0705	2414017N26	150nH
L0706	2460592A01	17nH
L0707	2460592A01	17nH
L0708	2460592A01	17nH
L0709	2414017N26	150nH
L0710	2460592A02	12.5nH
L0711	2414017N26	150nH
L0712	NOT PLACED	–

Circuit Ref	Motorola Part No.	Description
L0714	2479990N01	43.67nH
L0715	2414017N26	150nH
L0716	2414017N27	180nH
L0717	2414017N06	3.3nH
L0718	NOT PLACED	–
L0719	2414017N22	68nH
L0720	2414017N06	3.3nH
L0721	2414017N11	8.2nH
L0722	2414032B60	390nH
L0723	NOT PLACED	–
L0900	2414032D30	1uH
L0901	2414032F42	470nH
L0902	2414032F42	470nH
L0903	2414032F23	12nH
L0904	2414032F22	8.2nH
L0905	2414017N24	100nH
M0700	2686201B02	HEATSINK
Q0100	4802197J95	NPN RF TRANSISTOR
Q0102	4815359H01	DUAL PNP
Q0106	4816134H01	ANALOG SWITCH
Q0107	4813970A59	P-CHANNEL MOSFET
Q0108	4815261H01	ANALOG SWITCH
Q0200	4885061Y01	NPN RF TRANSISTOR
Q0201	4885061Y01	NPN RF TRANSISTOR
Q0202	4802197J95	NPN RF TRANSISTOR
Q0300	4885061Y01	NPN RF TRANSISTOR
Q0301	4885061Y01	NPN RF TRANSISTOR
Q0302	4802197J95	NPN RF TRANSISTOR
Q0400	NOT PLACED	–
Q0401	4815267H01	DUAL PNP
Q0402	4885593U03	NPN RF TRANSISTOR
Q0403	4815270H01	ANALOG SWITCH
Q0405	4885593U03	NPN RF TRANSISTOR
Q0500	4802197J95	NPN RF TRANSISTOR
Q0501	4802197J95	NPN RF TRANSISTOR
Q0600	4805793Y10	NPN RF TRANSISTOR
Q0601	4813973A04	NPN DARLINGTON
Q0701	4816013H01	DUAL NPN/PNP
Q0702	48012048002	RF POWER AMPLIFIER, LDMOS
Q0703	4816548H01	N_CHANNEL LDMOS DRIVER
Q0704	4813973B02	PNP
Q0705	4816547H01	N-CHANNEL LDMOS PRE-DRIVER
Q0706	4815272H01	ANALOG SWITCH
Q0711	4815271H01	ANALOG SWITCH
Q0900	4815272H01	ANALOG SWITCH
Q0901	4813973A13	PNP
Q0902	4813973M07	NPN
R0100	0613952R66	0
R0101	0613952R66	0
R0102	0613952R66	0
R0103	0613952R66	0
R0104	0613952R17	47K
R0105	0613952Q58	240
R0106	0613952Q83	2.7K
R0107	0613952Q57	220
R0108	0613952Q80	2K
R0109	0613952R66	0
R0110	0613952Q42	51
R0111	0613952R66	0
R0113	0613952R01	10K
R0114	0613952Q80	2K
R0115	0613952R66	0
R0116	0613952R66	0
R0117	0613952R12	30K
R0118	0613952R66	0
R0119	0613952Q35	27
R0120	0613952R01	10K
R0122	NOT PLACED	–
R0123	0613952R19	56K
R0125	0613952R66	0
R0126	NOT PLACED	–
R0127	0613952Q49	100
R0128	0613952R66	0
R0131	0613952Q58	240
R0134	0613952Q35	27
R0139	0613952Q78	1.6K
R0140	0613952Q31	18
R0144	0613952R01	10K
R0146	0613952R66	0
R0147	NOT PLACED	–
R0148	0613952Q60	300
R0155	0613952R66	0
R0156	NOT PLACED	–
R0157	NOT PLACED	–
R0158	NOT PLACED	–
R0159	0613952R01	10K
R0160	0613952R25	100K
R0161	0613952R25	100K
R0170	0613952R66	0
R0201	0613952Q85	3.3K
R0202	0613952Q75	1.2K
R0203	0613952Q75	1.2K
R0204	0613952Q95	8.2K
R0205	0613952Q49	100
R0206	0613952R05	15K
R0207	0613952Q25	10
R0208	0613952Q42	51
R0210	0613952Q89	4.7K
R0211	0613952R66	0
R0212	0613952R66	0
R0213	0613952R01	10K
R0216	0613952Q51	120
R0218	0613952R01	10K
R0219	0613952Q66	510
R0220	0613952Q25	10
R0221	0613952Q66	510
R0224	0613952Q92	6.2K
R0225	0613952Q94	7.5K
R0226	0613952Q49	100
R0229	0613952Q54	160
R0230	0613952Q89	4.7K
R0301	0613952Q85	3.3K
R0302	0613952Q66	510
R0303	0613952Q66	510
R0304	0613952Q95	8.2K
R0305	0613952Q49	100
R0306	0613952R05	15K
R0307	0613952Q25	10
R0308	0613952Q42	51
R0310	0613952Q89	4.7K
R0311	0613952R66	0
R0312	0613952R66	0
R0316	0613952Q46	75
R0319	0613952R32	200K
R0320	0613952R05	15K
R0321	0613952Q83	2.7K
R0324	0613952Q80	2K
R0325	0613952Q95	8.2K
R0326	0613952Q49	100
R0327	0613952R01	10K
R0329	0613952Q50	110
R0331	0613952R01	10K
R0332	0613952Q56	200
R0333	0613952Q35	27
R0334	0613952Q56	200
R0337	0613952R66	0
R0400	0613952R05	15K
R0401	0613952Q91	5.6K
R0402	0613958H55	180
R0403	NOT PLACED	–
R0404	0613952Q57	220
R0405	0613952Q91	5.6K
R0406	0613952Q83	2.7K
R0407	0613952G67	0
R0409	0613952Q75	1.2K
R0410	0613952R25	100K
R0411	0613958H55	180
R0412	0613952R25	100K
R0413	0613952Q69	680
R0414	0613952Q69	680
R0415	0613952Q69	680
R0416	0613952Q69	680
R0417	0613958H25	10
R0418	0613952Q77	1.5K
R0419	0613952Q83	2.7K
R0420	0613952Q83	2.7K
R0421	0613958H25	10
R0422	0613952K25	17.8
R0423	0613952L46	294
R0424	0613952L46	294
R0425	0613952Q75	1.2K
R0426	0613952Q83	2.7K
R0427	0613952Q25	10
R0428	0613952R01	10K
R0429	0613952Q69	680
R0430	0613952R01	10K
R0431	NOT PLACED	–
R0432	NOT PLACED	–
R0433	0613952R66	0
R0434	0613958H49	100
R0435	0613952R66	0
R0436	0613952Q67	560
R0437	0613952R66	0
R0438	0613952Q67	560
R0440	0613952R25	100K
R0441	0613952R25	100K
R0443	0613952R25	100K
R0444	0613952R25	100K
R0500	0613952Q90	5.1K
R0501	0613952Q61	330
R0502	0613952R08	20K
R0503	0613952R12	30K
R0508	0613952R19	56K
R0509	0613952Q89	4.7K
R0510	0613952R12	30K
R0511	0613952Q75	1.2K
R0512	0613952Q42	51
R0601	0613952Q45	68
R0602	0613952R01	10K
R0603	0613952Q80	2K
R0604	0613952R10	24K
R0605	0613952Q61	330
R0606	0613952Q42	51
R0607	NOT PLACED	–
R0608	0613952R66	0
R0609	0613952R66	0
R0610	0613952R66	0
R0611	0613952R66	0
R0612	0613952R66	0
R0613	0613952R66	0
R0614	0613952R66	0
R0615	0613952R66	0

Circuit Ref	Motorola Part No.	Description
R0616	0613952R25	100K
R0617	0613952R01	10K
R0618	0613952Q63	390
R0619	0613952R01	10K
R0620	0613952Q96	9.1K
R0621	0613952R66	0
R0622	NOT PLACED	–
R0623	NOT PLACED	–
R0624	0613952Q90	5.1K
R0625	0613952N69	51.1K
R0626	0613952N81	68.1K
R0627	0613952R66	0
R0700	0613958H44	62
R0701	0613958J74	0
R0702	NOT PLACED	–
R0706	0613958S51	120
R0709	0613959Q60	300
R0711	0613952H57	220
R0712	0613952H48	91
R0713	0613959H12	30K
R0714	0613952H46	75
R0715	0613952H46	75
R0718	0613952H25	10
R0719	0613959Q25	10
R0720	0613952H25	10
R0722	0613952H89	4.7K
R0724	0613952H79	1.8K
R0725	0613952Q59	270
R0726	0613952N01	10K
R0727	0613952H95	8.2K
R0728	0613952J01	10K
R0729	0613952J01	10K
R0730	0613952H73	1K
R0732	0613952H73	1K
R0734	0613952G67	0
R0735	0613959Y49	100
R0738	0613959Y42	51
R0739	NOT PLACED	–
R0740	0613952J25	100K
R0741	0613952J17	47K
R0742	0613959Q25	10
R0743	0613958S73	1K
R0744	NOT PLACED	–
R0745	0613952H65	470
R0747	0613952H89	4.7K
R0748	0613952J19	56K
R0749	0613952G67	0
R0750	0613952J07	18K
R0751	0613952J08	20K
R0752	0613952G67	0
R0753	0613952H73	1K

Circuit Ref	Motorola Part No.	Description
R0754	0613952H25	10
R0755	0613952H25	10
R0756	0613952J25	100K
R0757	0613952J17	47K
R0759	0613952H25	10
R0760	0613952Q83	2.7K
R0761	0613952G67	0
R0762	0613958S29	15
R0763	0613958S29	15
R0764	0613958S29	15
R0765	0613958S29	15
R0766	0613958S29	15
R0768	0613958S29	15
R0769	0613958S29	15
R0770	0613958S29	15
R0771	0613958S29	15
R0773	0613958S29	15
R0775	0613952G67	0
R0777	0613952H25	10
R0900	0613952N73	56.2K
R0901	0613952N62	43.2K
R0902	0613952M50	3.24K
R0903	0613952N34	22.1K
R0906	0613952R66	0
R0907	0613952R66	0
R0909	0613952N62	43.2K
R0910	0613952H73	1K
R0911	0613952N01	10K
R0912	0613952N30	20K
R0913	0613952R66	0
R0914	0613952P26	182K
R0915	0613952N81	68.1K
R0916	0613952M59	4.02K
R0917	0613952H91	5.6K
R0918	0613952H63	390
R0919	0613952R15	39K
R0920	0613952N42	26.7K
R0921	0613952H81	2.2K
R0922	0613952R14	36K
R0923	0613952R66	0
R0924	0613952H91	5.6K
R0925	0613952H91	5.6K
R0926	0613958H53	150
R0927	0613952H42	51
R0928	0613958H39	39
R0929	0613958H39	39
R0930	0613952R07	18K
R0931	0613952R66	0
R0936	0613952N66	47.5K
R0937	0613952N21	16.2K
R0938	0613952R66	0

Circuit Ref	Motorola Part No.	Description
R0940	0613952R66	0
R0941	0613952R66	0
R0942	0613952M81	6.81K
R0943	0613952N58	39.2K
R0944	0613952R66	0
R0946	0613952M51	3.32K
R0947	0613952R66	0
R0950	0613952N01	10K
R0951	0613952N62	43.2K
R0954	0613952R40	430K
R0955	0613952P01	100K
R0960	0613952H82	2.4K
R0970	0613958H56	200
R0971	0613958H55	180
R0973	NOT PLACED	–
R0974	0613958H55	180
R0975	0613958H56	200
R0976	0613952H53	150
R0977	0613952H53	150
R0978	0613952G67	0
R0979	0613952G67	0
R0981	0613952R07	18K
R0982	0613952R01	10K
R0983	0613952R01	10K
R0984	NOT PLACED	–
R0985	0613952N81	68.1K
R0986	0613952N81	68.1K
R0987	0613952N81	68.1K
R0988	0613952Q42	51
R0989	NOT PLACED	–
R0994	NOT PLACED	–
R0995	NOT PLACED	–
RT0908	0615585H01	47K
RT0953	0615585H01	47K
SH0100	2615362H01	SHIELD
SH0101	2615362H01	SHIELD
SH0300	2615362H01	SHIELD
SH0301	2615362H01	SHIELD
SH0500	2615576H01	SHIELD
SH0900	2686423Z02	SHIELD
SH0901	2686425Z02	SHIELD
T0400	2515121H01	BALUN XFMR
T0401	2515121H01	BALUN XFMR
U0100	5104932K08	IC, FRACN SYNTHESIZER
U0101	5114000B59	ANALOG SWITCH
U0201	4815267H01	DUAL PNP
U0303	NOT PLACED	–
U0304	4815267H01	DUAL PNP
U0600	5102495J14	IC, RF ASIC
U0601	5115391H01	VOLTAGE REGULATOR
U0700	4802246J29	PA PRE-DRIVER

Circuit Ref	Motorola Part No.	Description
U0900	5115147H01	DUAL OPAMP
U0901	5115147H01	DUAL OPAMP
U0940	5180390L83	IC, PA CONTROLLER
U0941	5115391H01	VOLTAGE REGULATOR
U0942	5114004A35	VOLTAGE DETECTOR
U0943	5178286A01	IC, VOLTAGE DETECTOR
VR0700	4813977M11	DIODE, 5.6V ZENER
Y0100	5116032H01	0.5 PPM 16.8 MHZ TCXO (GPS Models Only)

XPR 8300/XPR 8400 MOTOTRBO Repeater

Chapter 6

VHF (136–174 MHz)

25–45W

Service Information

Issue: September, 2010

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Chapter 6 - VHF High Power Service Information

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Section 1

THEORY OF OPERATION

1.0 Introduction

The MOTOTRBO repeater consists of two MOTOTRBO mobile radios; one to act as a receiver, and one to act as a transmitter and controller. Both of these radios contain specialized software that allows them to function together as a repeater. The Repeater also contains a Repeater Indicator board and a Connector board. A block diagram of the repeater is shown in Figure 1-1. The Repeater Indicator board contains the Front-Panel LED circuitry as well as an Ethernet interface. The Connector board is a multifunctional board that is primarily used to pass signals to and from modules inside the chassis to the outside of the chassis.

The Repeater contains the following assemblies and sections:

- Receiver
- Transmitter
- Repeater Indicator Board
- Connector Board
- Fan
- AC/DC PSU

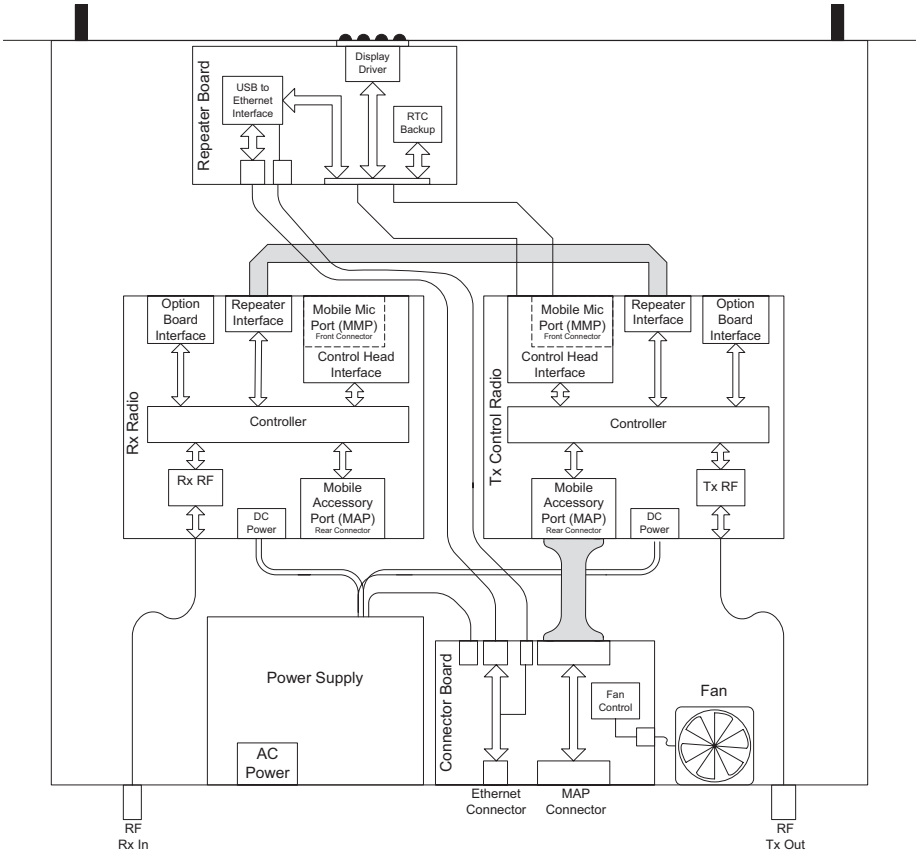


Figure 1-1 Repeater Block Diagram

1.1 Receiver

The receiver uses a transceiver board which is based on the mobile radio's transceiver board. The board uses the same PCB as the mobile radio board, but is populated differently to work in the Repeater application. Only the receiver related functions of the board are utilized in this application, even though the circuitry for transmit also exists on the board.

The Repeater receiver is identical in functionality to the mobile radio's receiver differing only in the audio path. On the mobile radio, the decoded audio is sent to a DAC, and then to the speaker. In the Repeater, this audio information is sent out through the SSI link to the transmit radio to be processed. Details of the receiver theory of operation can be found in Section 3.1.

1.2 Transmitter

The transmitter consists of a transceiver board which is based on the mobile radio's transceiver board housed in a transmit chassis. The transmit radio is identical to the receive board from a hardware standpoint. The difference between the two is the software that is running on them, how they are connected within the Repeater, and an additional heat sink that is mounted to the chassis. The added heatsink and the Repeater fan allow the transmitter to be cooled sufficiently when operating in a 60°C, full-duty cycle environment.

The transmit radio acts as the master controller for the Repeater. It handles all controller related tasks for the Repeater, including management of the receive radio. The transmit radio is responsible for processing the audio sent from the receive radio and repeating it out at the Tx frequency. Details of the transmitter theory of operation can be found in Section 3.2.

1.3 Repeater Indicator Board

The Repeater Indicator board contains circuitry to drive the front panel indicator LEDs, an RTC battery for the RTC in the transmit radio, as well as an Ethernet controller.

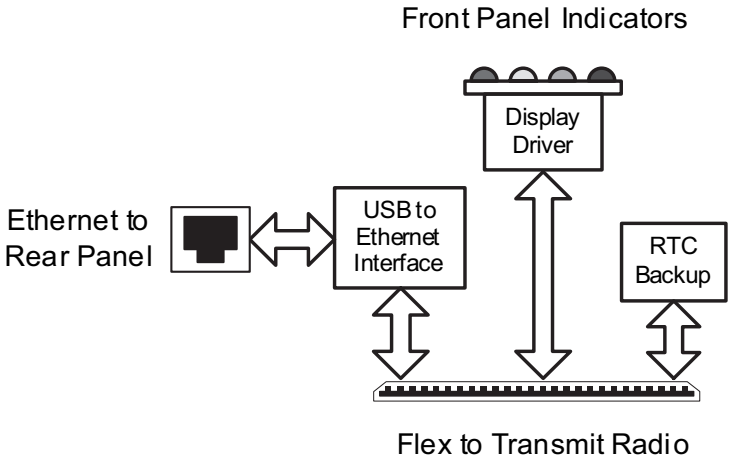


Figure 1-2 Repeater Indicator Board Block Diagram

All of the indicator LEDs that are on the front of the Repeater chassis reside on the Repeater Indicator board. Each is controlled by a shift register (U6) data out signal and a digital transistor. The shift register accepts serial data in from the transmit radio's OMAP processor via a SPI bus. A 74LVC07 buffer (U9) level shifts these signals from 3.3 V to 1.8 V.

The Repeater Disable LED is a dual-purpose LED that is hardware controlled initially at power-up. As soon as VBUS power is available on the Repeater Indicator board, the hardware circuitry for the Repeater Disable LED will cause it to blink periodically. When the software initialization is completed by the firmware, the blink circuitry will get disabled by the firmware. At that point, the Repeater Disable LED can be used for its intended purpose of displaying when the Repeater Disable function is turned on.

The power LED is the only LED that is not controlled by the software. This bi-color LED gets turned on green when the 13.8 V output from the power supply is valid. It turns on red when A/C power is lost, and the repeater's backup battery is used.

The Real Time Clock (RTC) battery (M1) is connected to the transmit radio through the Control Head (J1, pin 30).

Details of the Ethernet Controller can be found in Chapter 2.

1.4 Connector Board

The Connector board has two purposes: provide a place for the Repeater's MAP and Ethernet connectors to be mounted and a location for the Repeater's fan control circuitry.

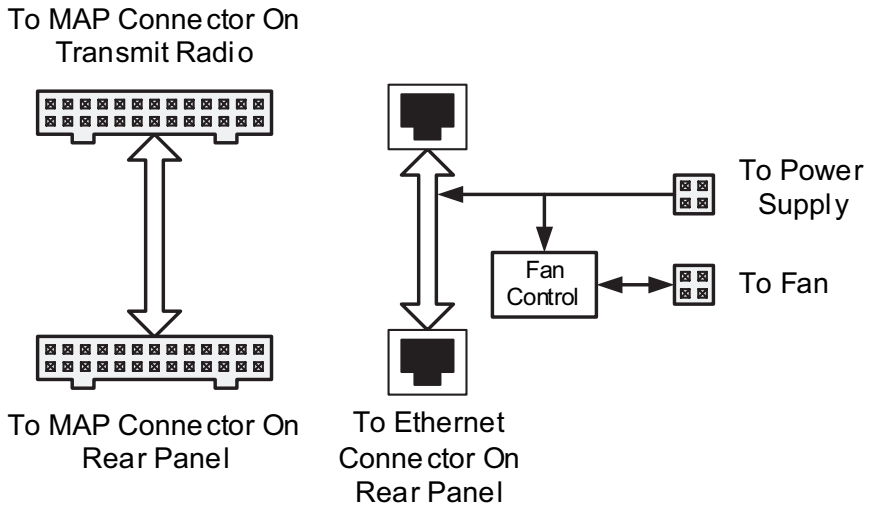


Figure 1-3 Connector Board Block Diagram

1.5 Fan

The fan control logic is provided by the fan controller IC (U51). This is a device from Cypress Semiconductor. There are basically two functions provided by the fan controller. First, it provides a PWM output based on a temperature input, and secondly, it provides detection of fan failure based on the fan tachometer reading.

The Repeater's internal chassis temperature is measured with an LM50 precision temperature sensor IC (U52). This IC outputs a voltage that is linearly proportional to temperature at 10 mV/°C, and with an offset of +500 mV. The output voltage of the LM50 ranges from +200 mV at -30°C to 1.1 V at +60°C.

The fan controller IC (U51) controls the speed of the fan by adjusting the PWM output (pin 1) from 0% to 100%. As long as the fan continues to work, pulses are output from the fan and input to the fan controller (pin 2).

1.6 AC/DC Power Supply

The Repeater uses the PMPN4001A switch-mode, Power Supply Unit (PSU). It is capable of 200 W and designed for a 50 W UHF or VHF repeater system. This supply has UL, CE, and TUV regulatory approvals and is usable in all regions by using the correct line cord. The AC input is auto-ranging with no manual switch being specified to operate from 90 V-270 V and 47 Hz-63 Hz. It outputs a nominal voltage of 13.8 V with a voltage tolerance of +/- 5%.

It has Power Factor Correction circuitry and is rated at 15 A across the whole operating temperature range of -30°C to +60°C. It also has a built-in battery revert circuit with a float output available for maintaining the charge on a battery and has UL, CE, & TUV approvals. The battery revert connector is accessible in the back of the power supply.

The supply has over-load, over-voltage, and over-temperature protection. In an overload condition, the PSU goes into a hiccup mode where it recovers automatically after the fault condition is removed. During an over-voltage condition, the PSU shuts down, and will have to be re-powered on to recover. In an over-temperature condition, the PSU also shuts down but will recover after the temperature goes down.

The PSU is not designed to be field serviceable. If it is determined that the PSU is not functioning, the whole unit needs to be replaced.

2.0 Repeater Interconnections and Cables

Figure 1-4 shows the Cable interconnections inside the Repeater.

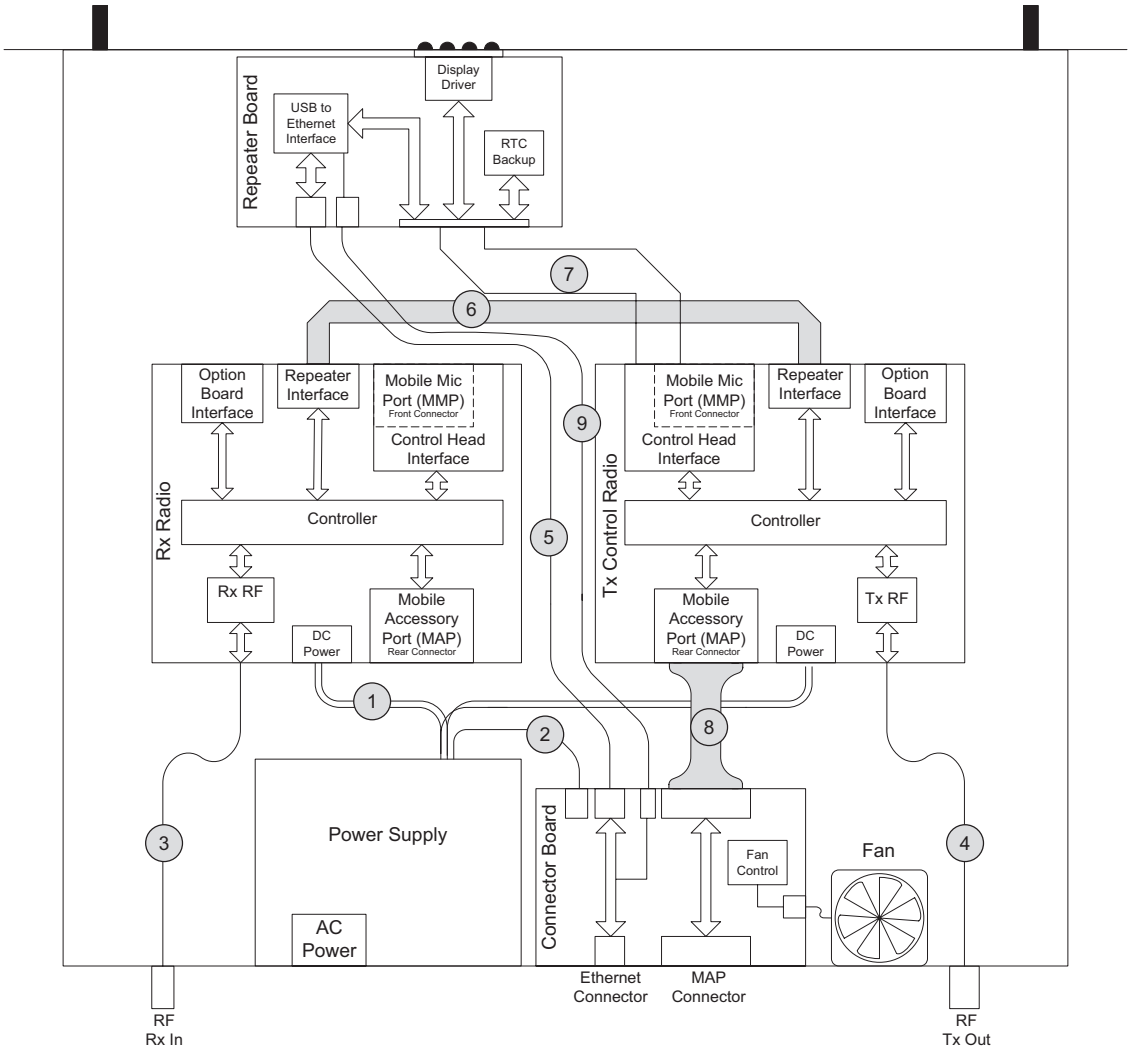


Figure 1-4 Repeater Cabling Diagram

The details of each of these cables/interconnections are as follows:

1. Two conductor DC power cables to the transmit and receive radios.
2. Six conductor DC power cable to the connector Board. Supplies power for the fan and Repeater Indicator board via cable 6.
3. RF Coax to connect the receive radio to the back of the Repeater. This cable has a BNC connector on the Repeater's rear panel.
4. RF Coax to connect the transmit radio to the back of the Repeater. This cable has an N type connector on the Repeater's rear panel.
5. CAT5 cable with RJ45 style connectors on both ends. This cable connects the Ethernet controller on the Repeater Indicator board to the Repeater's back panel and provides power from the Connector Board to the Repeater Indicator board for the LED indicators.

6. Eleven conductor flex cable. Provides the SSI connection between the transmit and receive radios. Refer to Section 1.5 for more details on this interface.
7. Thirty conductor flex cable. Provides the connection from the transmit radio to the Repeater Indicator board and includes SPI signals to drive the LED indicators, RTC backup supply, and the interface to the Ethernet controller.
8. Twenty six conductor cable. Provides the connection from the transmit radio's MAP to the MAP located on the Repeater's rear panel.
9. Eight pin conductor cable. Provides Ethernet LED signals from Repeater Board and HWID signals from Connector Board (Applicable for 32 MB repeaters only).

3.0 Mobile Radio's Theory of Operation

The sections that follow provide a detailed theory of operation for the VHF circuits in the two MOTOTRBO mobile radios. For details of the theory of operation and troubleshooting for the associated Controller circuits, refer to the Controller Section of this manual.

3.1 VHF (136–174 MHz) Receiver Circuitry

The receiver is configured as a dual-conversion superheterodyne receiver, capable of both FM and 4-level FSK demodulation. The major blocks are the front-end, the mixer, Xtal filter, and the Abacus III back-end IC. The overall block diagram is shown in Figure 1-5.

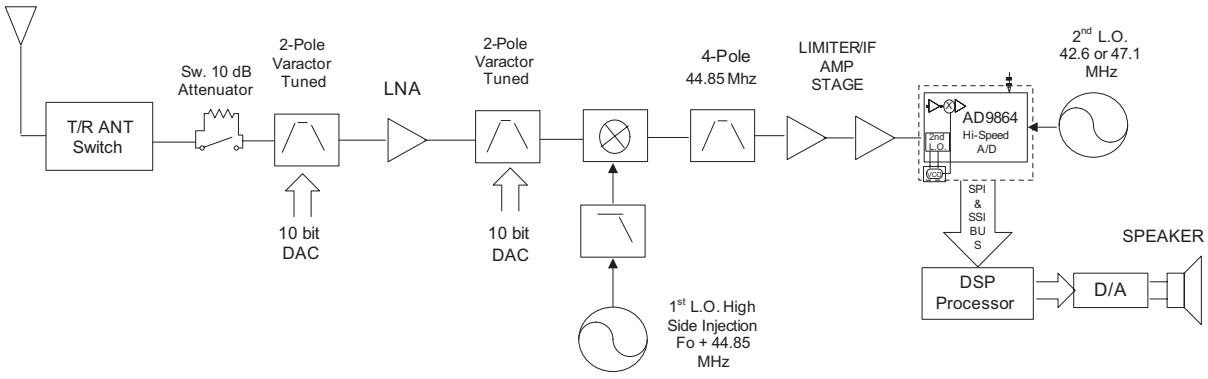


Figure 1-5 Receiver Block Diagram

3.1.1 Receiver Front-End

The front-end consists of a 2-pole varactor-tuned pre-selector filter, an LNA, a 2-pole varactor-tuned post-selector filter, and a passive double-balanced mixer. The received signal applied to the antenna is routed through the harmonic filter and PIN diode controlled antenna switch (D0702). A logic high level on ANT_ENABLE configures the antenna switch for Tx operation while a logic low places the switch in Rx mode. The insertion loss of the harmonic filter and antenna switch combined is approximately 0.8 dB max in Rx mode with slightly more loss at the upper end of the band. From this point, the Rx signal is routed to the Local Distance Switch (D0400/R0407), which biases on a diode in normal operation to minimize any insertion loss. Under strong signal conditions and for improved intermodulation protection from interfering signals, the switch can be turned on by the signal RF_ATTEN_1, which introduces approximately 10 dB of additional path loss. Activation of the switch can be accomplished manually by the user or left in the default setting.

The signal next reaches the pre-selector filter, which is a 2-pole varactor-tuned filter with 5 zeros that are optimized to provide image frequency rejection. This filter, and the similarly designed post-selector filter, provide over 75 dB of image response rejection. The 3 dB bandwidth for both filters varies across the band with a minimum of 32 MHz at 136 MHz and a maximum of 38 MHz around 174 MHz. Half-IF rejection from the filters is also frequency dependent with a minimum of approximately 7.5 dB achieved at the worst-case frequency of 174 MHz. Both filters have variable center frequencies that are adjusted by the FE_TUNE signal, which is derived from the output of a 10-bit DAC internal to the MAKO IC (U3200). The voltage is scaled up by a voltage doubler (Q0403) in order to provide the required linearity for the filters. Both filters are matched to the LNA (Q0402) to optimize the amplifier's noise figure (2.0 dB) and to provide an LNA gain of 16 dB to the signal. The combined gain of the filters and LNA is about 14 dB. Active bias transistor Q0401 maintains the collector current of Q0402 constant at 25 mA. The LNA, active bias circuit, Local Distance Switch, and voltage doubler are all supplied by 9R1_FILT, which is derived from 9R1 after filtering.

Following the post-selector filter is the Class 2, double-balanced mixer. It is comprised of baluns T0400 and T0401 and diode ring mixer D0405. Injection amplifier Q0405 provides 15 dB of gain to the Rx VCO injection signal. Another amplifier, Q0202, located in the VCO block, also provides gain for the LO signal and isolation from high RF signals entering the mixer. The signal applied to the LO port of the mixer is +16 dBm minimum after passing through the 3-pole/1-zero, low-pass injection filter. The LO injection is high-side and mixes the signal down to an IF frequency of 44.85 MHz. The output of the mixer is connected to a diplexer network, which terminates out-of-band frequencies into 51 ohms (R0427) while appearing as high impedance to the 44.85 MHz IF signal.

3.1.2 Receiver Back-End

The signal entering the back-end is matched to 4-pole crystal filter, FL0500, by C0507 and L0503. The filter is centered at 44.85 MHz with a 3 dB bandwidth of 13.4 kHz. IF amplifiers Q0500 and Q0501 follow the crystal filter and provide both amplification and limiting to the signal. An overall gain of 24 dB is available from the composite IF amplifier to lower-level IF signals. As the signal level increases, Q0501 begins to limit and eventually saturates out at approximately –16 dBm. The purpose of the limiting is to provide protection to the AD9864 Abacus III back-end IC (U0600). An internal 16 dB attenuator is also engaged to provide attenuation to the Abacus's input signal, working with the external amplifier to limit the signal below the ADC clip point. The block diagram for the AD9864 is shown in Figure 1-6 below. At IF levels exceeding –26 dBm into U0600, the 2nd LO synthesizer internal to U0600 can be pulled, causing corruption of the I/Q data being delivered to the DSP.

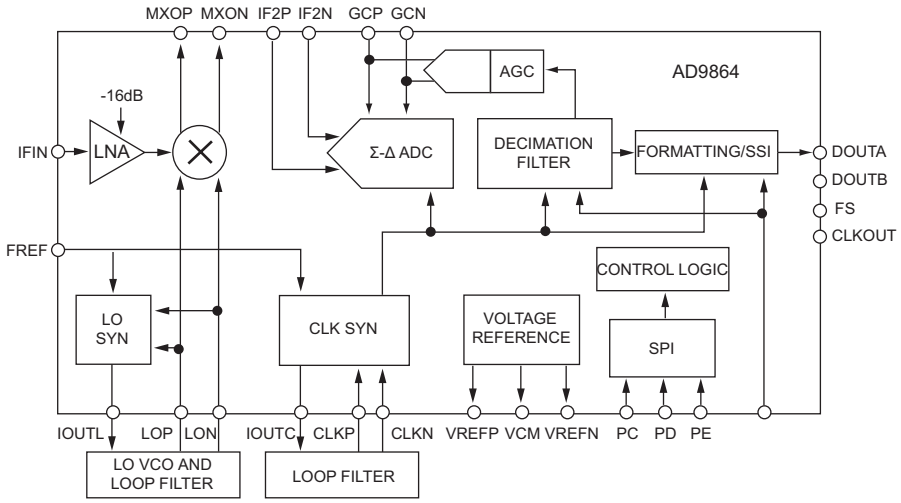


Figure 1-6 AD9864 Block Diagram

The Abacus III accepts the 44.85 MHz signal, processes it, and sends out baseband I/Q data in 16-bit format to the DSP at a 20 kHz rate. Internal to the Abacus III is an LNA and 16 dB FE attenuator, an internal integer-N synthesizer used to control the external 2nd LO VCO, a Sigma-Delta ADC and decimation filter, and control and formatting logic for outputting the baseband I/Q data. External to U0600 is the 2nd LO VCO with active device Q0600 and its associated circuitry including the loop filter consisting of C0613, C0618, and R0603. The 2nd LO mixes the 44.85 MHz IF signal down to 2.25 MHz before being input to the ADC where it is sampled. The tank circuit (L0608, C0605, C0642, R0617) and varactor (D0601) for the internal clock synthesizer, work with the loop filter (R0618, C0643, C0646) to provide the 18 MHz clocking signal to the internal ADC, decimation filter, and SSI formatting circuitry. A 3 Volt regulator (U0601) provides a clean 3 Volt supply to U0600. Transistor Q0601 is configured as a super filter to provide the 2nd LO transistor with a low noise supply. The reference clock for U0600 is 16.8_REF, which is a buffered (Q0100) 16.8 MHz clock from the synthesizer block.

Shown below in Figure 1-7, is the block diagram of the signal flow through the receiver back-end. All the blocks within the dotted box represent the DSP software algorithms internal to U1000.

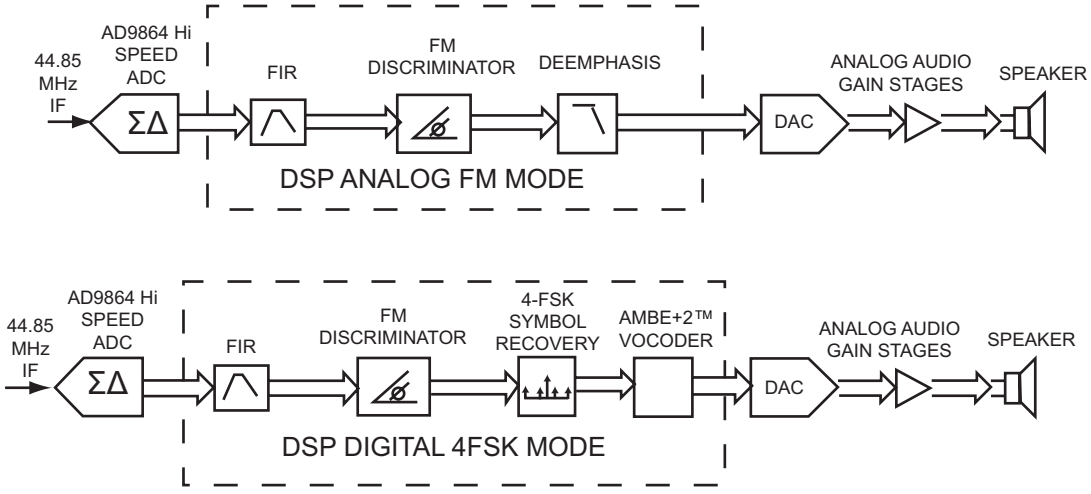


Figure 1-7 Signal Flow through Receiver Back-End

The DSP takes the incoming 20 kHz data-stream and passes the information through an FIR (Finite Impulse Response) filter, which provides rejection from any in-band adjacent channel interference. The remaining filter data is then sent through a decimation process further reducing its frequency to 8 kHz.

Depending on whether the repeater is in Analog or Digital mode determines the kind of signal processing used. If the radio is in Analog mode, the remaining 8 kHz data is sent through the FM Discriminator and De-emphasis subroutines in the DSP code. If the repeater is in Digital mode, the remaining 8 kHz data is still sent through the FM Discriminator but an additional "Symbol Recovery" routine is applied along with a standard AMBE+2™ Vocoder process. The resultant audio (still represented by high-speed data) is sent to a DAC (U3200), which drives several gain stages. These gain stages consist of an I2C audio attenuator (U3501) and a high-power audio PA (U3500) providing the user with at least 3 Watts of power through the internal speaker.

3.2 VHF (136–174 MHz) Transmitter Circuitry - 45 Watt

The Transmitter consists of the power amplifier circuitry and the power control circuitry. The power amplifier is responsible for delivering a faithful replica of the VCO output amplified up to the desired output power level, free from distortion. The power control circuitry is responsible for ensuring that the desired output power level is maintained in both analog and digital modes, as well as protecting the power amplifier from damage due to heat, antenna mismatch, out-of-range battery voltage, or mis-assembly.

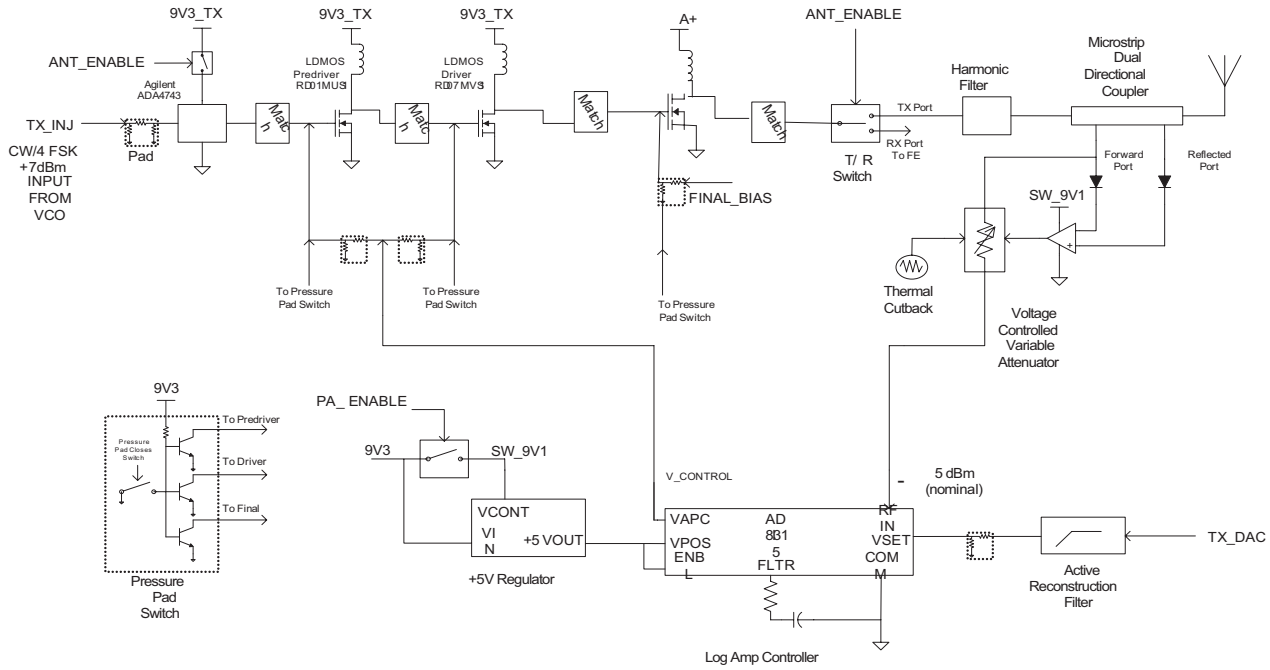


Figure 1-8 VHF 45 Watt High-Power Transmitter Detailed Block Diagram

3.2.1 Power Amplifier

The radio's 45 Watt power amplifier (PA) is a 4-stage amplifier, which amplifies the output of the VCO to the required transmit power level. The first stage is an LDMOS (Lateral Diffuse MOS) 50 ohm fixed-gain block (ADA-4743, U0700), followed by the adjustable gain LDMOS pre-driver (RD01MUS1, Q0705), an adjustable gain LDMOS driver (RD07MVS1, Q0703), and the fixed-gain LDMOS final device (MRF1550, Q0702). A transmit/receive (T/R) switch and a harmonic filter complete the transmit lineup.

3.2.2 Input Stage (50 Ohm Fixed-Gain Block)

The first stage (ADA-4743, U0700) is an integrated circuit with internally matched 50 ohm input and output stages providing approximately 16.5 dB power gain. Its purpose is to provide reverse isolation between the PA and the VCO to lessen the risk of VCO load pull and to provide appropriate power to the pre-driver stage. The ADA-4743 is biased at 27 mA during transmit by R0706, which is switched to 9V3 during Tx by Q0701 (controlled by Antenna_En). The ADA-4743 is preceded by a 19 dB resistive pad to further improve reverse isolation.

3.2.3 Pre-Driver Stage

The next stage is a low power LDMOS device (RD01MUS1, Q0705), which delivers up to +27 dBm power to the driver stage. Its gain is controlled by varying the gate bias voltage and varies from low gain up to approximately 14 dB power gain. The gate bias voltage is controlled with the V_cont signal and is controlled in parallel with the driver stage gain.

The input match to this stage is a high-pass topology comprised of L0716, L0718, and C0795. (High-pass matches are used where appropriate to minimize the chances of low frequency regeneration within the amplifier.) The inter-stage match between the pre-driver and driver stages is comprised of C0790, C0786, C0791, C0792, L0717, and L0719 arranged in a high-pass topology. Additional footprints are provided on the printed circuit board to allow for possible engineering optimizations to this match. These are non-populated parts C0793, C0794, C0817, C0820, and C0821.

3.2.4 Driver Stage

The next stage is a medium-power LDMOS device (RD07MVS1, Q0703), which delivers up to +38 dBm to the final device. Its gain is controlled by varying the gate bias voltage and varies from low gain up to approximately 10 dB power gain. The gate bias voltage is controlled with the V_cont signal and is controlled in parallel with the pre-driver stage gain.

R0718, R0720, R0754, and R0755 are required to improve the bandwidth of the driver stage. The inter-stage match between the driver and final device is comprised of C0819, C0746, C0752, C0754, L0745, and associated micro-strips on the PCB. Additional footprints are provided on the printed circuit board to allow for possible engineering optimizations to this match. These are non-populated parts C0753 and C0755.

3.2.5 Final Stage

The final stage is a high-power LDMOS device (MRF1550, Q0702). The package is mounted to a copper carrier to improve thermal conductivity to the chassis and also to more tightly control the RF load, allowing higher and more consistent maximum output power. This stage is biased at a quiescent current of 500 mA and operates with a fixed gain of approximately 14 dB, allowing the radio to be set to a maximum output power of 54 Watts. The quiescent current is set by adjusting the Final_Bias signal.

The output match consists of C0719, C0720, C0721,C0722, C0726, C0727, C0729, C0741, and L0714 and the associated microstrip line on the PCB. The output matching circuitry of this stage has extremely critical part location requirements. Any repairs must be done with care to ensure the replaced components are placed accurately and properly soldered. Of particular concern are the output matching capacitors, C0719, C0720, C0721, C0722, C0726, C0727, and C0729. The resistor networks at the input of each of the final elements are required to improve the bandwidth of the circuit. These resistors are R0712, R0716, R0717, R0719, R0721, R0726, R0732, R0733, R0734, R0736, R0737, and R0739.

Additional footprints are provided on the printed circuit board to allow for possible engineering optimizations to this match. These are non-populated parts C0724, C0725, and C0730. If the final device is replaced, the bias voltage must be re-tuned using the Customer Programming Software (CPS). Care must be taken not to damage the device by exceeding the maximum allowed quiescent current. The maximum allowable current is 750 mA, but the design is optimized for 500 mA as noted earlier. The device can tolerate up to 5 Amps for brief periods of time without damage.

3.2.6 Antenna Switch

The Antenna Switch (T/R switch) has two modes of operation, transmit and receive.

Transmit mode:
The antenna switch utilizes the existing dc feed (A+) to the final stage device (Q0702). Both PIN diodes, D0700 and D0702, are turned on during key-up by forward biasing them. Forward biasing is achieved by pulling down the voltage at the cathode end of D0702 to around 12.2 Volts (0.7 Volt drop across each diode). Q0704 is configured as a current sink that maintains the current through the antenna switch diodes at 100 mA, as set by VR0700 and R0738. The current sink is enabled during transmit mode by ANT_ENABLE asserting thru Q0706 and associated circuitry. When the PIN diodes are conducting, an RF ground is formed at the anode of the lower PIN diode D0702, which places the series L0710 and L0724 in parallel with C0803. The values of L0710, L0724, and C0803 are chosen so that they are in parallel resonance at the center of the transmit band, making them appear as an open-circuit so that a 50 ohm power path is maintained thru the top PIN diode to the harmonic filter. To further attenuate the Tx signal from getting to the Rx front-end, a PIN diode pair (D0703) is placed in the Rx path separated from the D0702 short by a quarter wave inductor (L0730 & L0731). This diode pair shorts to ground in transmit mode so that the receiver sees as little transmitter power as possible.

Receive mode:
The DC current thru the PIN diodes is interrupted by turning off the current sink. The RF path now flows from the Harmonic Filter thru the matching circuit formed by C0803, L0710, and L0724, then to pi network C0766, L0730, L0731, and C0772. The additional shunt diodes (D0703) will be high impedance since no bias current is flowing from the switched Tx power line.

3.2.7 Harmonic Filter

Inductors L0720, L0721, L0706, L0707, L0708, L0709, L0722, and L0723, and capacitors C0742, C0739, C0740, C0735, and C0750, form a harmonic filter which is a 7th order low-pass filter with two notches; this is used to attenuate harmonic energy from the transmitter before it reaches the antenna. The harmonic filter also prevents high-level RF signals above the receiver passband from reaching the receiver circuits, improving spurious response rejection. R0713 and L0728 are used to drain any electrostatic charges that might otherwise build up on the antenna.

3.2.8 Directional Coupler

The dual directional microstrip coupler is implemented at the harmonic filter output to sample both forward and reverse directed transmitter power. RF power from the transmitter PA passes through the microstrip coupler before reaching the antenna. Forward RF power is coupled to the U0940 log detector / controller via the voltage controlled attenuator (VCA) stage consisting of pin diodes D0901, D0902, and D0903. The log detector/controller regulates the gain of PA stages Q0703 and Q0705 (via V_cont) as necessary, thus ensuring that the forward power out of the radio is held to a constant value.

The directional coupler functions not only as part of the transmitter power regulation circuit but also as part of the VSWR load detection circuitry. Its physical location close to the antenna connector allows accurate VSWR sense at the transmitter output. Forward and reverse coupled signals are rectified by D0904 and D0905, respectively. Resulting DC voltage FWD_DETECTED is proportional to RF power while REV_DETECTED is proportional to reflected RF power. The detected voltages are fed to the respective inputs of difference amplifier U0901. The difference amplifier output is applied to variable attenuator control stage U0900-1.

An abnormally high reflected power level, such as may be caused by a damaged antenna, also causes an increase in the difference amplifier output voltage. An increased difference amplifier output causes a reduction in attenuation by the VCA. As a result, the increased RF signal applied to the log detector/controller causes the controller to reduce the gain of PA stages Q0703 and Q0705. Transmitter power is thus reduced to prevent damage to the final device due to an improper load.

3.2.9 Power Control

The transmitter uses PA controller IC, U0940, to control the power output of the radio. A portion of the forward RF power from the transmitter is sampled by the directional coupler and delivered via the VCA to the RFIN port of the PA controller IC (pin 1). The PA controller, a log detector type, provides temperature-stable, high accuracy control over a typical 50 dB dynamic range.

The MAKO IC contains a digital-to-analog converter (DAC), which provides a reference voltage (TX_DAC) at the input of reconstruction filter stage U0900-2. The filtered reference voltage at the output of U0900-2 is divided by the combination of R0942 and R0946 before reaching the VSET input of the PA controller IC (pin 3). Thermistor RT0953 is used in combination with R0954 to compensate reference voltage drift at operating temperature extremes. Reference voltage level is programmable through the SPI lines of the MAKO. This reference voltage is proportional to the desired power setting of the transmitter, and is factory programmed at several points across the frequency range of the transmitter to offset frequency response variations of the transmitter's coupled power circuits.

The PA controller IC provides a DC output voltage at pin 7 (VAPC), which is divided to provide gate bias for PA pre-driver and driver stages. The 0 to 5 VDC range at U0940 pin 7, is applied as V_CONTROL to power-adjust the transmitter by controlling the gate bias of stages Q0703 and Q0705. Voltage divider combination R0727 and R0728 provide gate bias to Q0703 while divider combination R0750 and R0751 provide gate bias to Q0705. This adjusts the transmitter power output to the intended value. The ratios of each of these resistor dividers are chosen to ensure that Q0703 and Q0705 are both running at their nominal design condition at rated output power. Variations in sampled forward transmitter power cause the PA controller IC to adjust the control voltage above or below its nominal value to raise or lower output power in order to maintain transmitter output power relative to the reference voltage applied to VSET.

3.2.10 Power Ramp Profile Control

In order to limit transient adjacent channel power at the transmitter's output, the ramped power should follow a raised-cosine profile. The PA controller IC has a linear slope function when scaled in dB/V. To achieve the desired raised-cosine profile of the output power, the ramped reference voltage provided by the MAKO DAC follows a raised-cosine approximation. The MAKO DAC reference output is low-pass filtered by the DAC reconstruction filter before it is applied to the VSET input of the PA controller IC. Reconstruction filtering reduces spurious emissions in the RF spectrum as a result of the finite steps of the DAC. Loop filter capacitor C0926, in conjunction with resistor R0950 and the integrator within the PA controller IC, control the loop dynamics. Loop dynamics have been optimized to achieve sufficient speed to follow the required ramping profiles while meeting switching transient requirements over varied power levels. Accurate control of the power-rise (ramp-up) and power-decay (ramp-down) characteristics minimizes splatter into adjacent channels.

3.2.11 Thermal Protection

Thermistor RT0908 and R0902 form a voltage divider with the output proportional to the sensed circuit board temperature in the vicinity of the transmitter driver and final devices. The voltage divider output is routed to operational amplifier U0901-2, which provides a dc voltage via diode junction D0900 to control the attenuation level of the VCA stage. For the condition that the temperature threshold set by resistive divider combination R0901 and R0909 is reached, the VCA is driven to increase the RFIN signal at the PA controller IC (pin 1). This increase will cause the PA controller IC to adjust the PA control voltage below its nominal value to decrease transmitter output power. The temperature will be reduced by lowering transmitter output power relative to the reference voltage applied to VSET.

3.2.12 Out-of-Range Battery Protection

Transmitter power cutback, under extended battery supply voltage operation, is provided for by monitoring the battery supply in the controller circuit of the radio in order to change the VSET input of the PA controller IC (pin 3) for reduced transmitter output. This cutback starts when the battery voltage at the connector is 15.3 Volts or greater and has a 2 dB/V slope. In addition, a second low battery detect circuit is implemented in hardware. This hardware cutback forces a 1.2 dB drop in RF power level when the battery voltage drops below 11.6 Volts and exhibits about 0.6 Volts of hysteresis before returning to normal power.

3.2.13 Pressure Pad Switch

The power control circuitry includes a safety switch (S0700) that consists of a conductive portion of the rubber pad which pushes the RF final transistor Q0702 against the chassis. When the chassis cover and rubber pad are properly assembled, the conductive portion of the pad contacts a pattern on the circuit board, electrically closing switch S0700. If the cover and pad are not in place, switch S0700 is open-circuited and the power control circuit is disabled, turning off the gate bias to Q0702, Q0703, and Q0705. This prevents thermal damage of the RF transistors which might occur if the transmitter is operated without adequate heat sinking.

3.3 Frequency Generation Circuitry

The synthesizer subsystem consists of the reference oscillator (Y0100), the fractional-N Synthesizer IC (Tomahawk II, U0100), and the Voltage Controlled Oscillator VCO.

3.3.1 Reference Oscillator

The reference oscillator (Y0100) contains a temperature compensated crystal oscillator with a frequency of 16.8 MHz. A digital-to-analog (DAC) converter internal to U0100 (Tomahawk) and controlled by the microprocessor via serial interface (SPI), sets the voltage at the AUX_DAC output of U0100 (pin H6) to set the frequency of the oscillator. The output of the oscillator (pin 3 of Y0100) is applied to pin K5 (XOSC_BASE) of U0100.

3.3.2 Fractional-N Synthesizer

The Tomahawk II Synthesizer IC (U0100) consists of a pre-scaler, a programmable divider and divider control logic, phase detector, charge pump, a D/A converter in the high frequency analog modulation path, an attenuator to balance the high and low frequency modulation paths, a serial interface for control (SPI), a serial interface for modulation (SSI), and a super filter for the regulated 2.45 Volts.

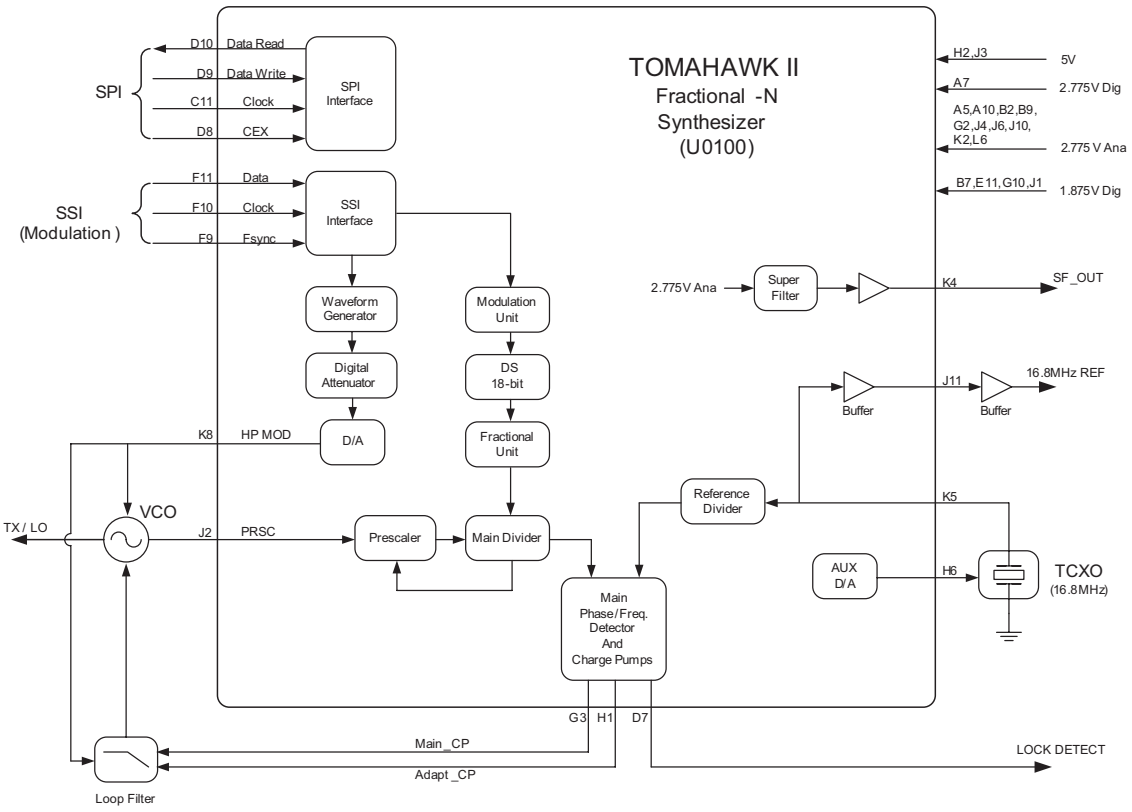


Figure 1-9 VHF Synthesizer Block Diagram

A voltage of 2.775 Volts applied to the super filter input (U0100 pin J4) supplies an output voltage of 2.45 VDC (SF_OUT) at pin K4. This supplies the VCO and the VCO modulation bias circuit (via R0321). The super filter supply voltage is provided by the 2.775 Volt regulator within U3200. The synthesizer is also supplied by the 5 Volt regulator, U3002, another 2.775 Volt regulator within U3200, and a 1.875 Volt regulator within U3200.

The output signal LOCK (U0100-D7) provides information about the lock status of the synthesizer loop. A high level at this output indicates a stable loop. A discrete buffer amplifier (Q0100) provides a buffered 16.8 MHz reference frequency to other parts of the radio.

The serial programming interface (SPI) is connected to the microprocessor via the data lines SPI_DW (U0100-D9) and SPI_DR (U0100-D10), clock line SPI_CLK (U0100-C11), and chip enable line CEX (U0100-D8). The serial modulation interface (SSI) is connected to the DSP via the data line SDTX (U0100-F11), clock line TXCLK (U0100-F10), and frame sync line SFTX (U0100-F9).

3.3.3 Voltage Controlled Oscillator (VCO)

The Voltage Controlled Oscillator (VCO) subsystem consists of three Colpitts oscillators (two Rx and one Tx), a single-stage Tx buffer amplifier, a single-stage Rx buffer amplifier, oscillator bias control switches, and the modulation circuitry.

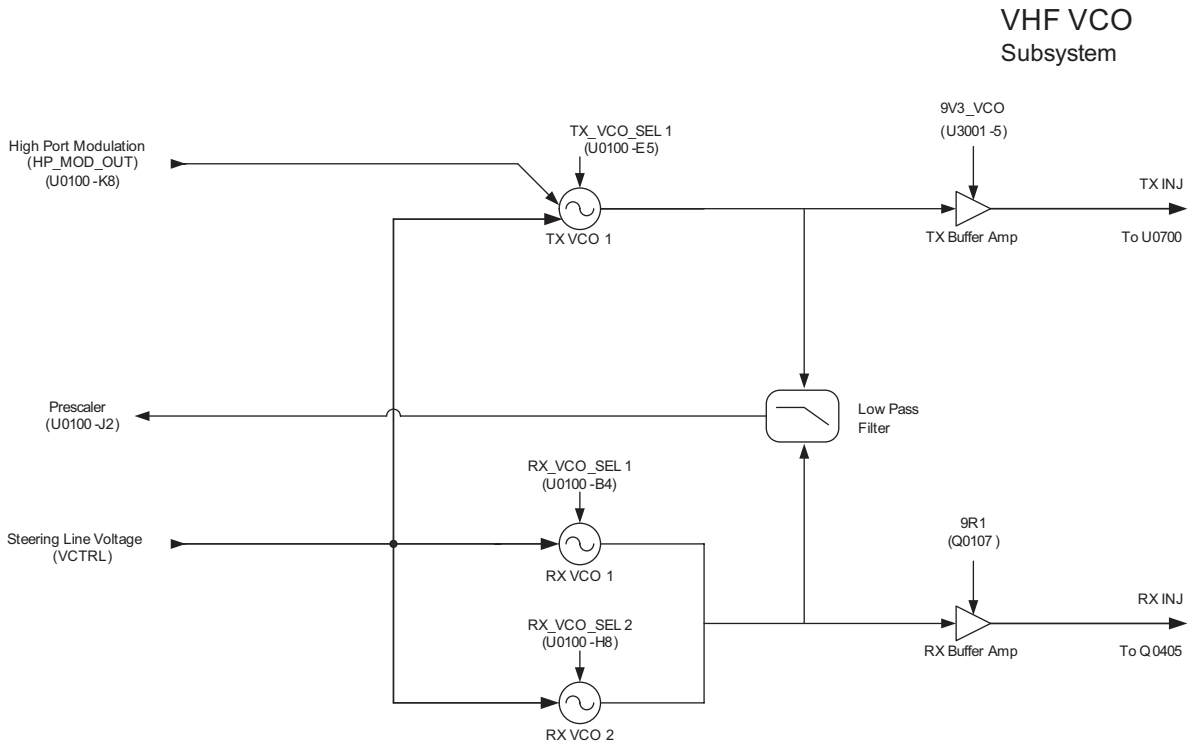


Figure 1-10 VHF VCO Block Diagram

The VHF Rx VCO design incorporates two varactor-tunable Colpitts oscillators. Each Rx oscillator has a tuning range of 19 MHz, sufficient to cover the Rx frequency range of 180.85 MHz to 218.85 MHz. A single Tx oscillator covers the frequency range of 136 MHz to 174 MHz. The oscillators resonate at fundamental operating frequencies. Three (active-low logic) general purpose output lines (GPO1, GPO3, and GPO6) from the Tomahawk IC (U0100-B4, E5, and H8) provide the control for independent bias selection to each oscillator (VCO_SEL) via the PNP transistor switches U0304 and U0201. The 2.45 Volt super filtered output, SF_OUT of the Tomahawk IC (U0100-K4), supplies the bias to the oscillators. A portion of the VCO output signal is lightly coupled through coupling capacitors C0331 and C0231, routed through a low-pass filter (formed by L0221, C0235, L0230, C0265, and C0233), and fed back to the M_PRSC input of the Tomahawk IC (U0100-J2).

High-port modulation is scaled through a voltage divider (comprised of R0319, R0320, and R0321) and applied to the Tx modulation varactor diode CR0300. The Tx VCO frequency is modulated via coupling capacitor C0310.

A discrete single-stage Tx buffer amplifier (comprised of the NPN transistor Q0302 and surrounding components) amplifies the signal from the Tx oscillator to the level required by the first stage of the Transmitter Power Amplifier (U0700). The Tx buffer amplifier also provides sufficient isolation from any undesired load-pulling from the Transmitter Power Amplifier. The bias for Q0302 is provided by the 9.3 Volt regulator U3001.

A discrete single-stage Rx buffer amplifier (comprised of the NPN transistor Q0202 and surrounding components) amplifies the signal from the Rx oscillator to the level required by the LO injection amplifier (Q0405). The Rx buffer amplifier also provides sufficient isolation from any undesired load-pulling from high input levels in the receiver front-end. GPO4 from the Tomahawk IC (U0100-D4) controls the transistor switch (comprised of Q0108 and Q0107), that enables the 9.1 Volt bias to Q0202 (via the 9.3 Volt regulator U3001).

3.3.4 Synthesizer Operation

The complete synthesizer subsystem is comprised mainly of the Tomahawk Synthesizer IC, Reference Oscillator (crystal oscillator with temperature compensation), loop filter circuitry, VCO, and DC supplies. The VCO feedback signal, PRSC, is fed to pin J2 of U0100 (M_PRSC) via a low-pass filter (L0221, C0235, L0230, C0265 and C0233) which attenuates harmonics and provides the correct level to close the phase-locked loop.

The prescaler in the Synthesizer IC (U0100) is a four-level prescaler capable of dividing by 4, 5, 6, and 7**.** The main loop N divider is configured to be an 8-bit divider. The divide-by-N portion of the main loop is set via the SPI. The fractional portion of the divider is realized using a 3-accumulator, 24-bit fractional divider. The SPI is used to set the desired divide ratio.

The output of the prescaler is applied to the main loop divider. The output of the main divider is sent to the phase/frequency detector, which compares the main divider's output signal with the reference signal. The reference signal is generated by dividing down the signal of the reference oscillator (Y0100). The output signal of the phase/frequency detector is a pulsed signal which is routed to the charge pumps. The main charge pump current is programmable through the SPI with its output at pin G3 of U0100 (MN_CP). The loop filter transforms this current into a steering voltage that is applied to the VCO.

To reduce lock time when new frequency data has been loaded into the synthesizer, an adapt charge pump, providing much greater current than the main charge pump, is turned on for a finite amount of time to quickly charge or discharge the loop filter capacitors to steer the VCO to the desired frequency. The output of the adapt charge pump passes to the loop filter via pin H1 of U0100 (MN_ADAPT_CP). When the synthesizer is within the lock range and the adapt timer runs out, the adapt charge pump is powered down and the main charge pump takes over. A settled synthesizer loop is indicated by a high level at signal LOCK (U0100-D7), which is routed to the microprocessor. Q0102 is configured as a current source to provide a steady 1.5 mA during the adapt period. U0101 is an analog switch that opens the adapt path slightly before the end of the adapt period to prevent the current from the current source from pushing the VCO off frequency.

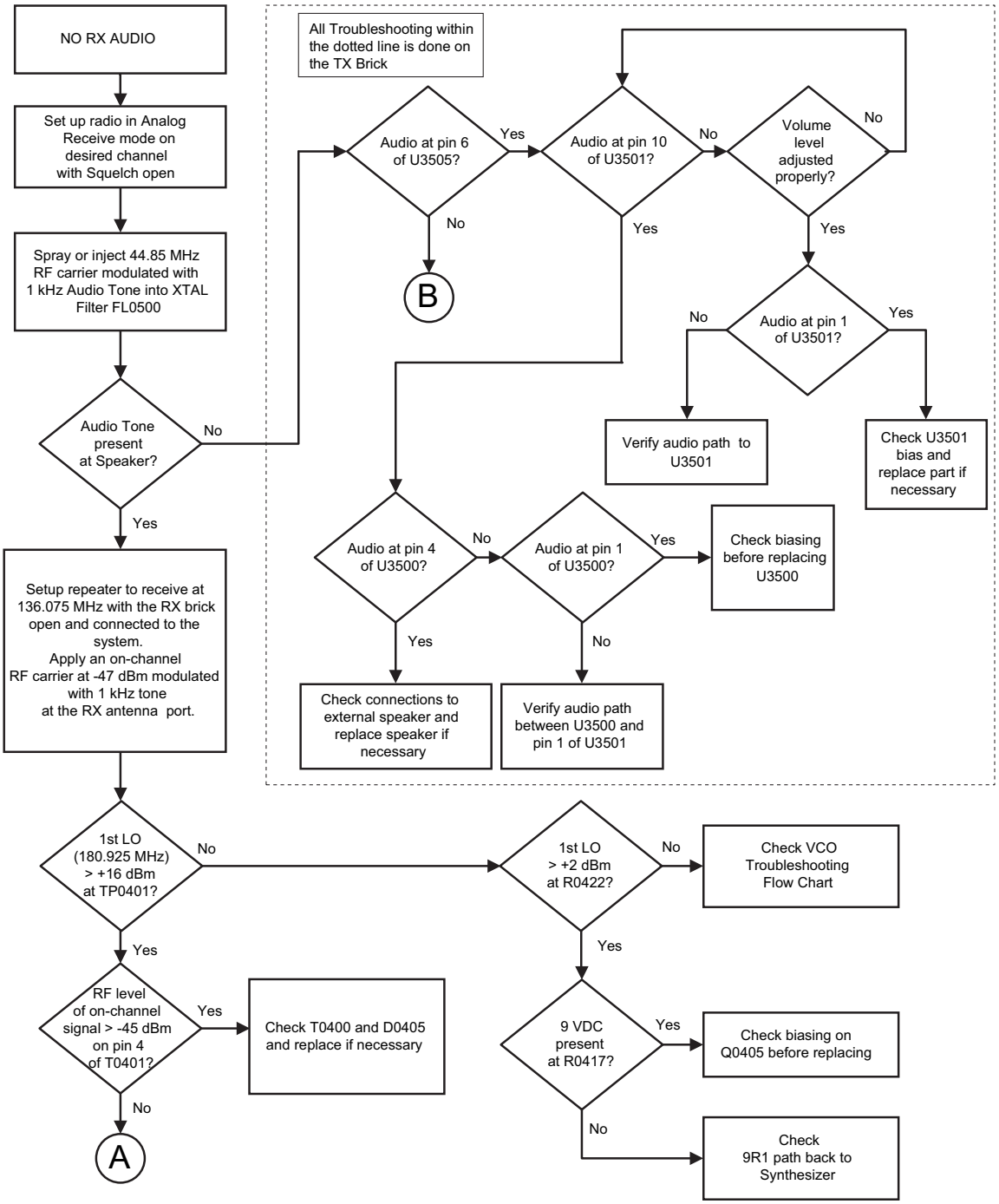
Modulation is performed by applying a digital data stream via the SSI bus from the DSP (U1000) to the synthesizer (U0100). In order to meet spurious and phase noise requirements, the PLL bandwidth was designed to be narrower than the full modulation bandwidth, therefore requiring the use of dual-port modulation. Internal to the synthesizer (U0100), low-port modulation is added to the fractional-N division numerator to trace out the modulation versus time while the high-port data stream passes through an interpolating waveform generator, a digital attenuator (for modulation balancing), and then is converted to an analog signal through a 10-bit DAC before modulating the VCO. This high-port analog modulation output (HP_MOD_OUT, U0100-K8) is connected to the VCO modulation varactor diode (CR0300) via C0360 and R0319.

Notes

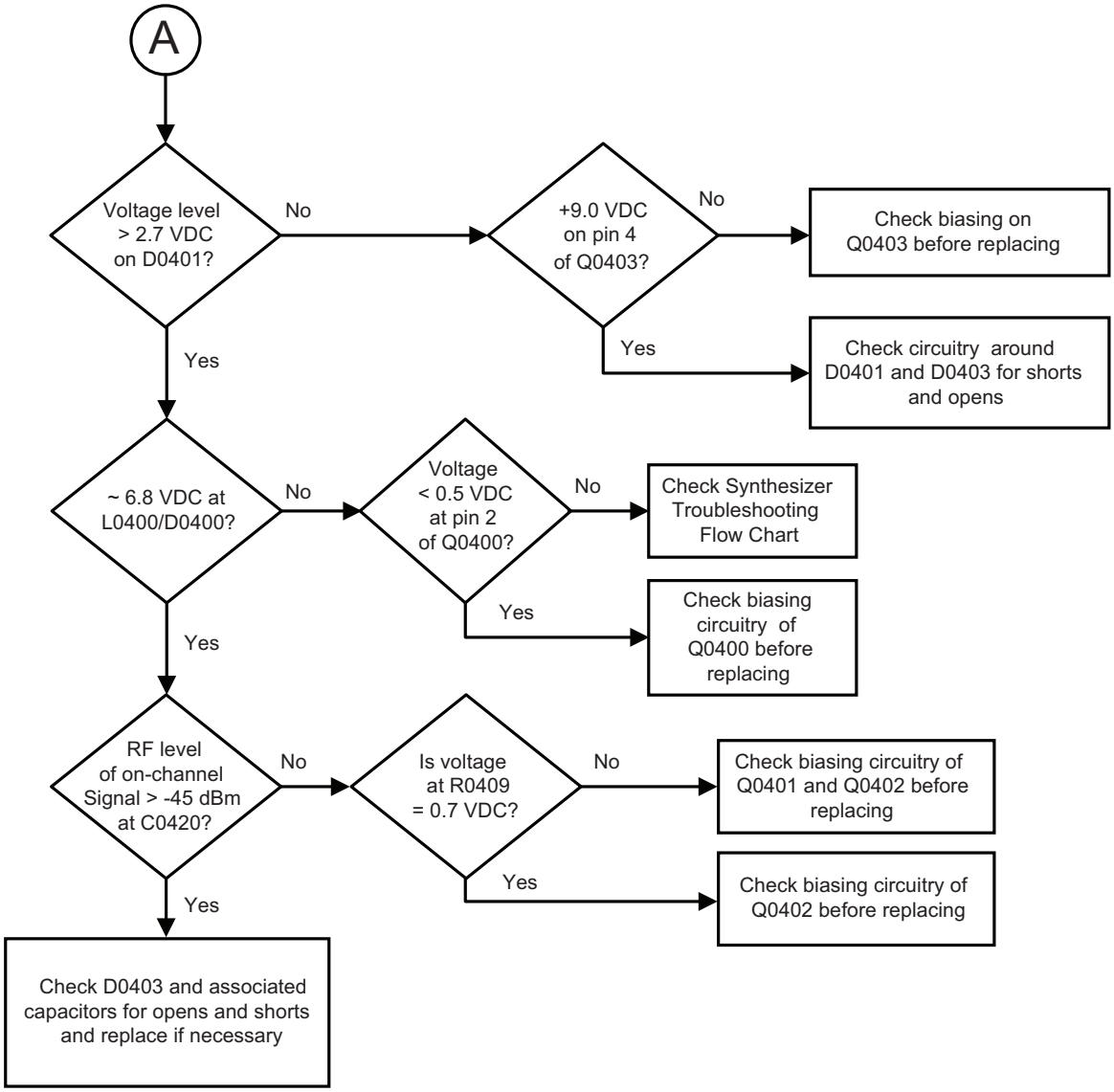
Section 2

TROUBLESHOOTING CHARTS

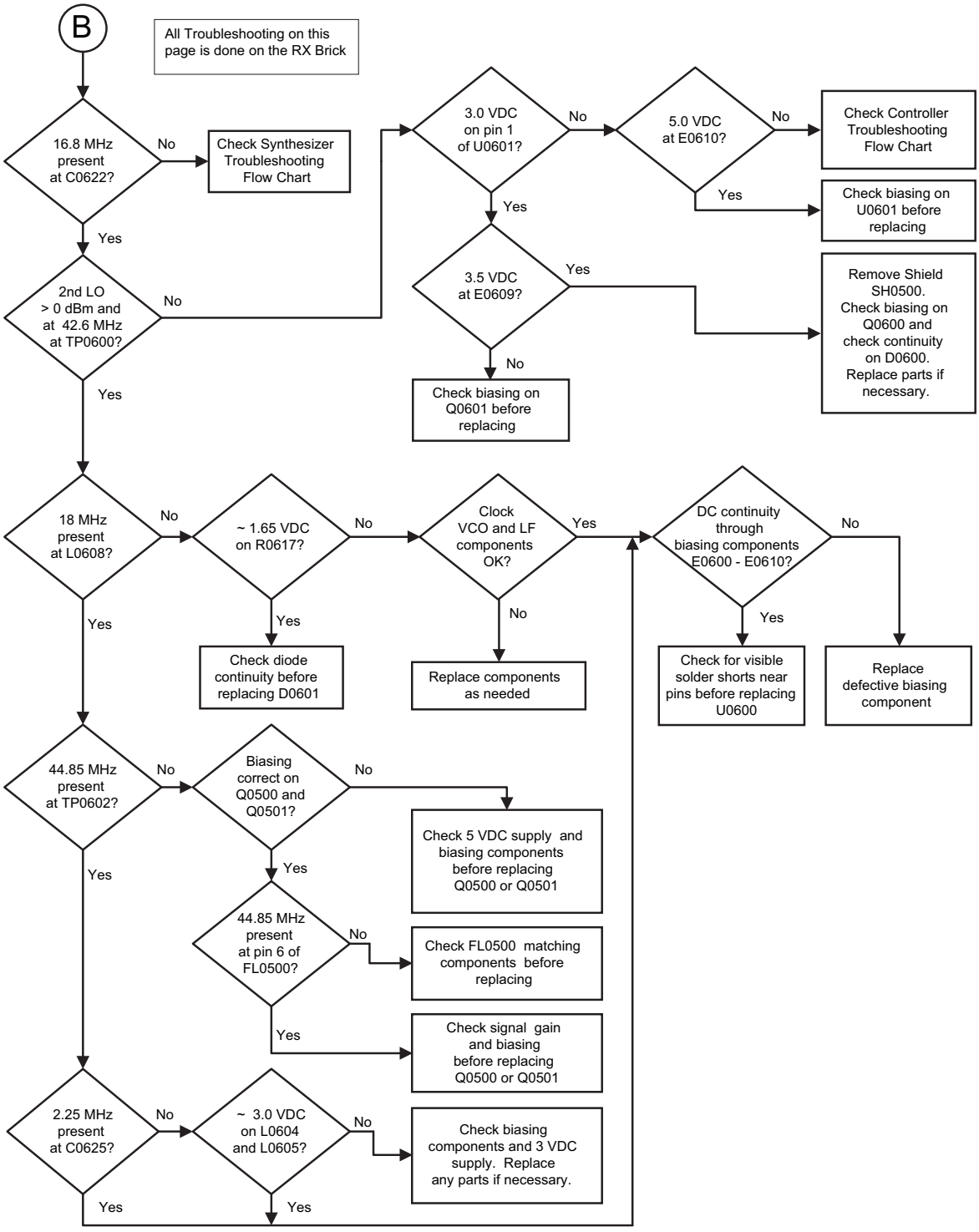
1.0 Troubleshooting Flow Chart for Receiver (Sheet 1 of 3)



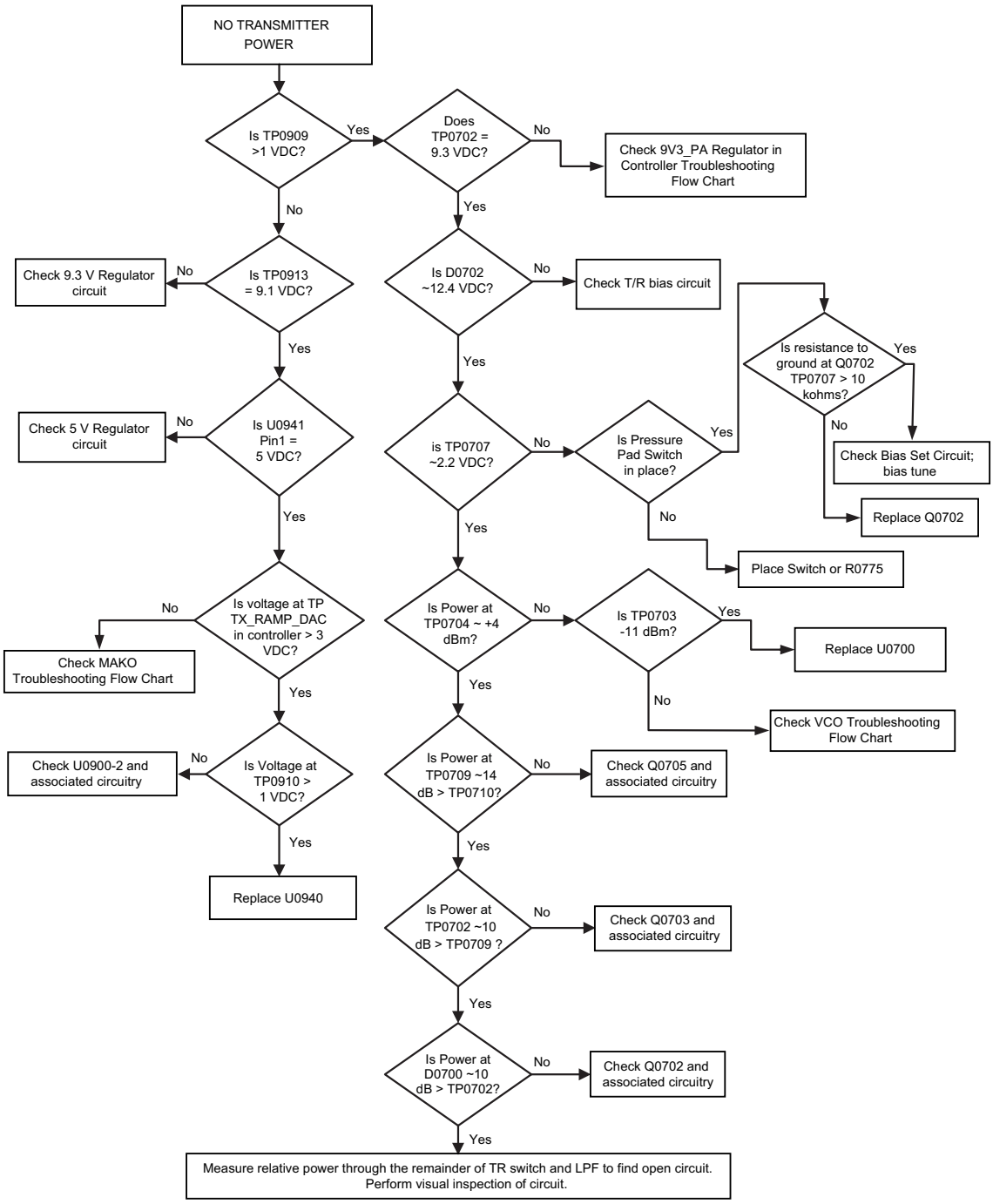
1.1 Troubleshooting Flow Chart for Receiver (Sheet 2 of 3)



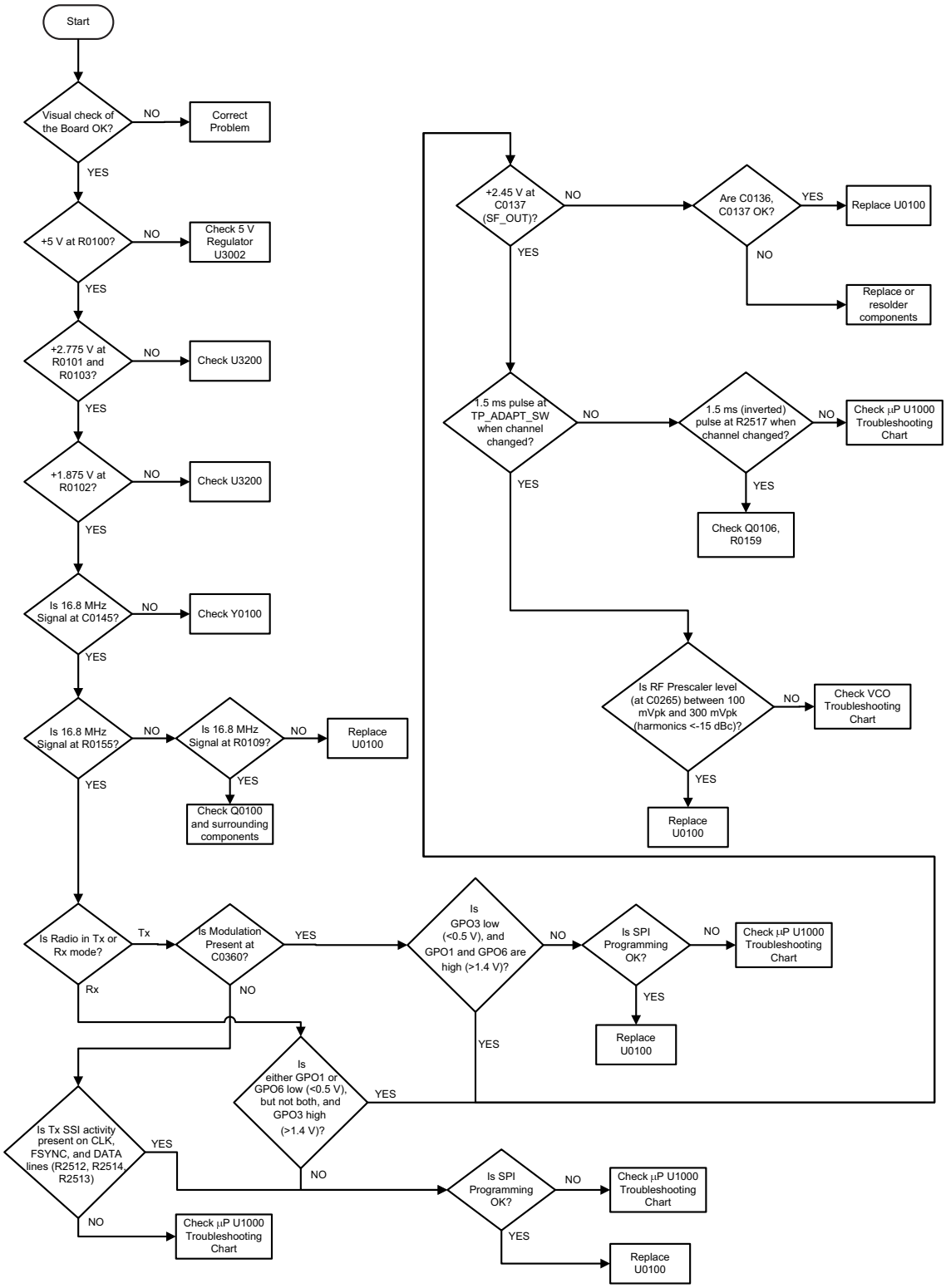
1.2 Troubleshooting Flow Chart for Receiver (Sheet 3 of 3)



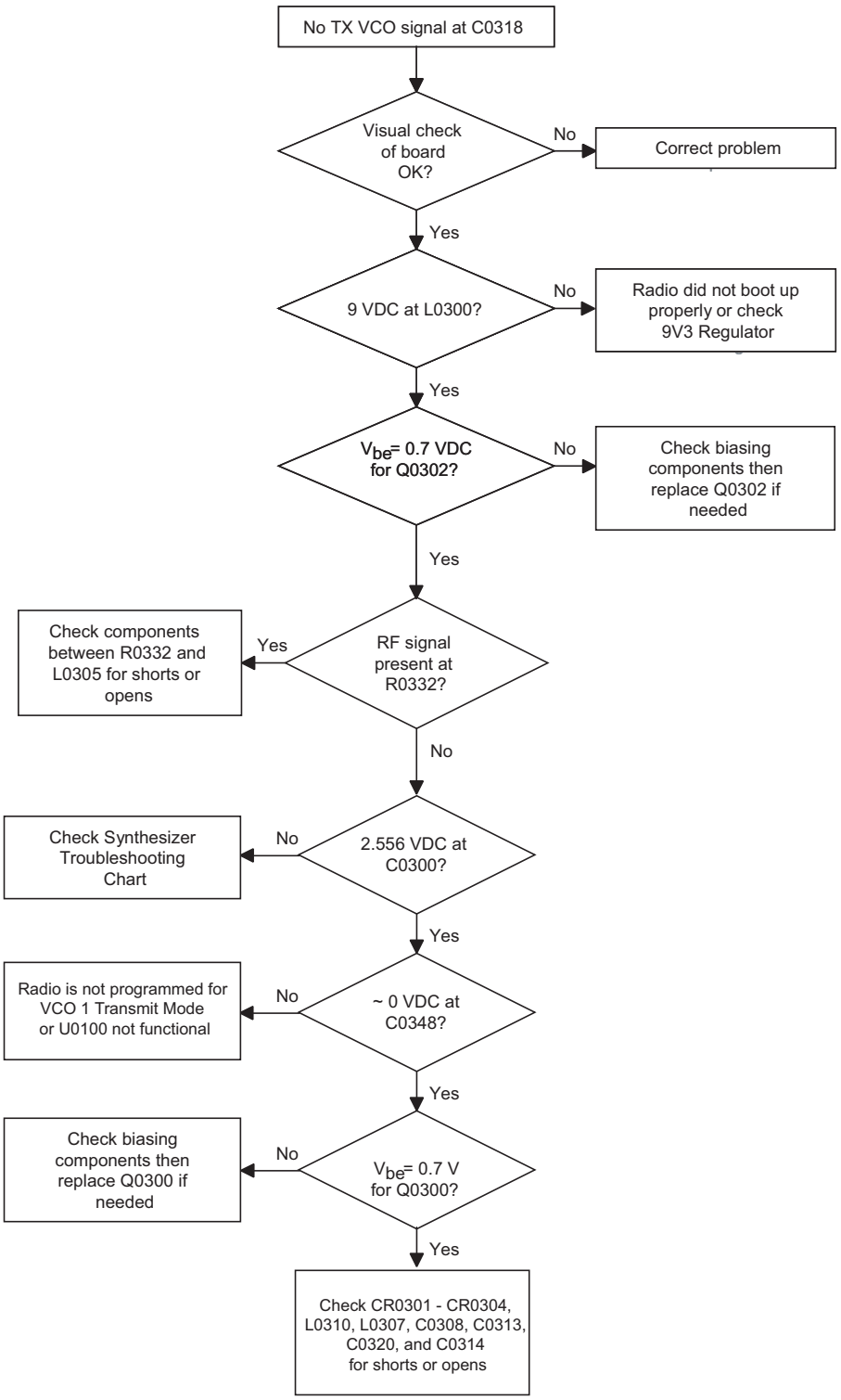
2.0 Troubleshooting Flow Chart for 45W Transmitter



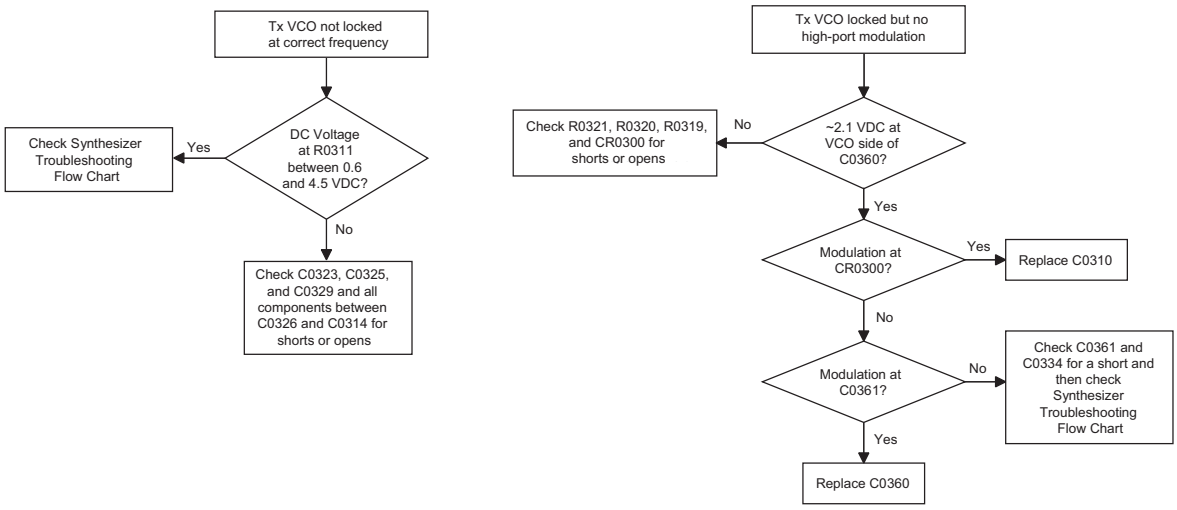
3.0 Troubleshooting Flow Chart for Synthesizer



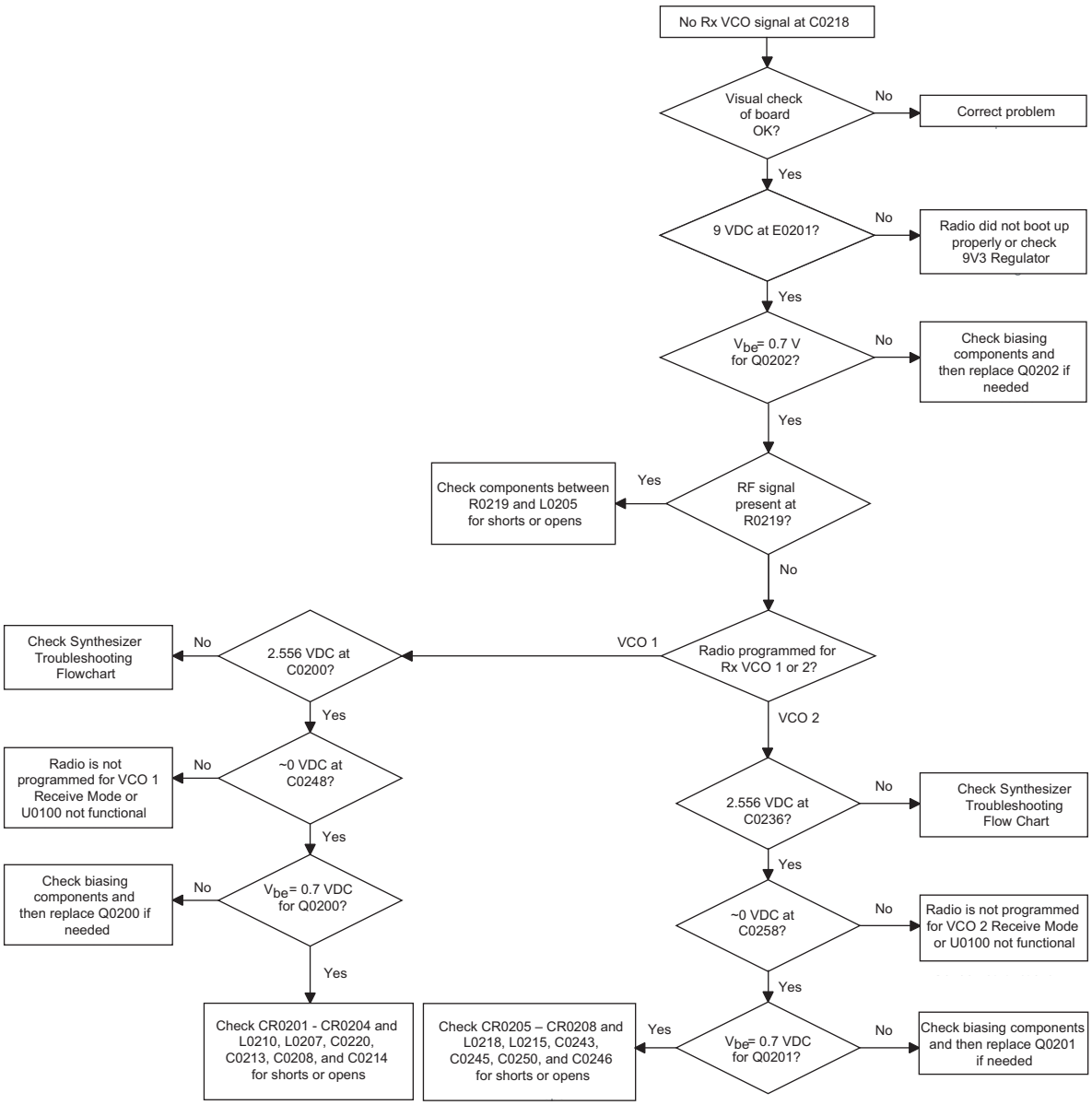
4.0 Troubleshooting Flow Chart for Tx VCO (Sheet 1 of 2)



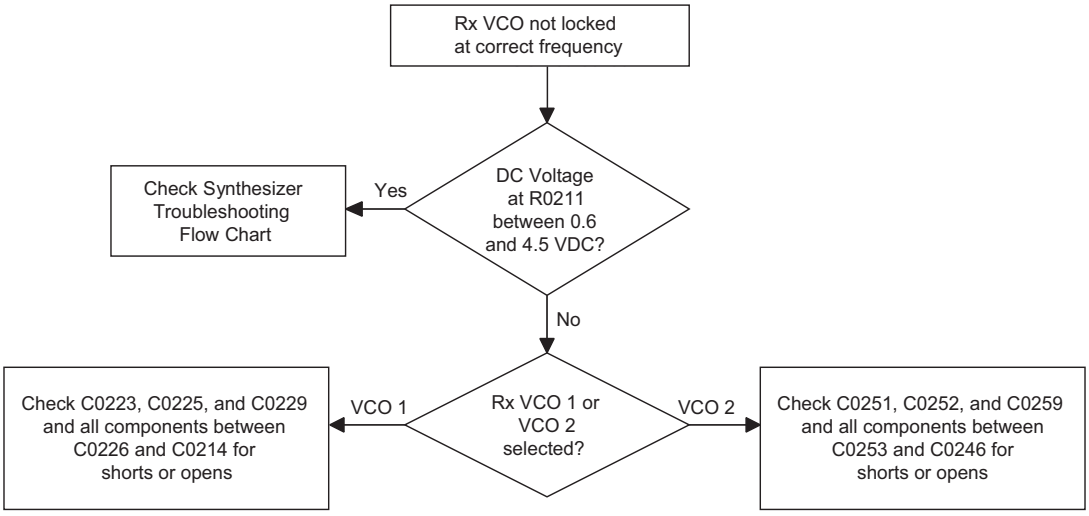
4.1 Troubleshooting Flow Chart for Tx VCO (Sheet 2 of 2)



5.0 Troubleshooting Flow Chart for Rx VCO (Sheet 1 of 2)



5.1 Troubleshooting Flow Chart for Rx VCO (Sheet 2 of 2)



Notes

Section 3

VHF PCB / SCHEMATICS / PARTS LIST

1.0 Allocation of Schematics and Circuit Boards

1.1 Controller Circuits

The VHF circuits are contained on the Printed Circuit Board (PCB) which also contains the Controller circuits. This Chapter shows the schematics for the VHF circuits only, refer to the Controller section for details of the related Controller circuits. The PCB component layouts in this Chapter show both the Controller and VHF circuit components. The VHF schematics and the related PCB and parts list are shown in the table below.

NOTE: The VHF Schematics and parts lists are the same for 8478023A12 and 8478023A16. Only the Controller circuits are different between the two PCBs.

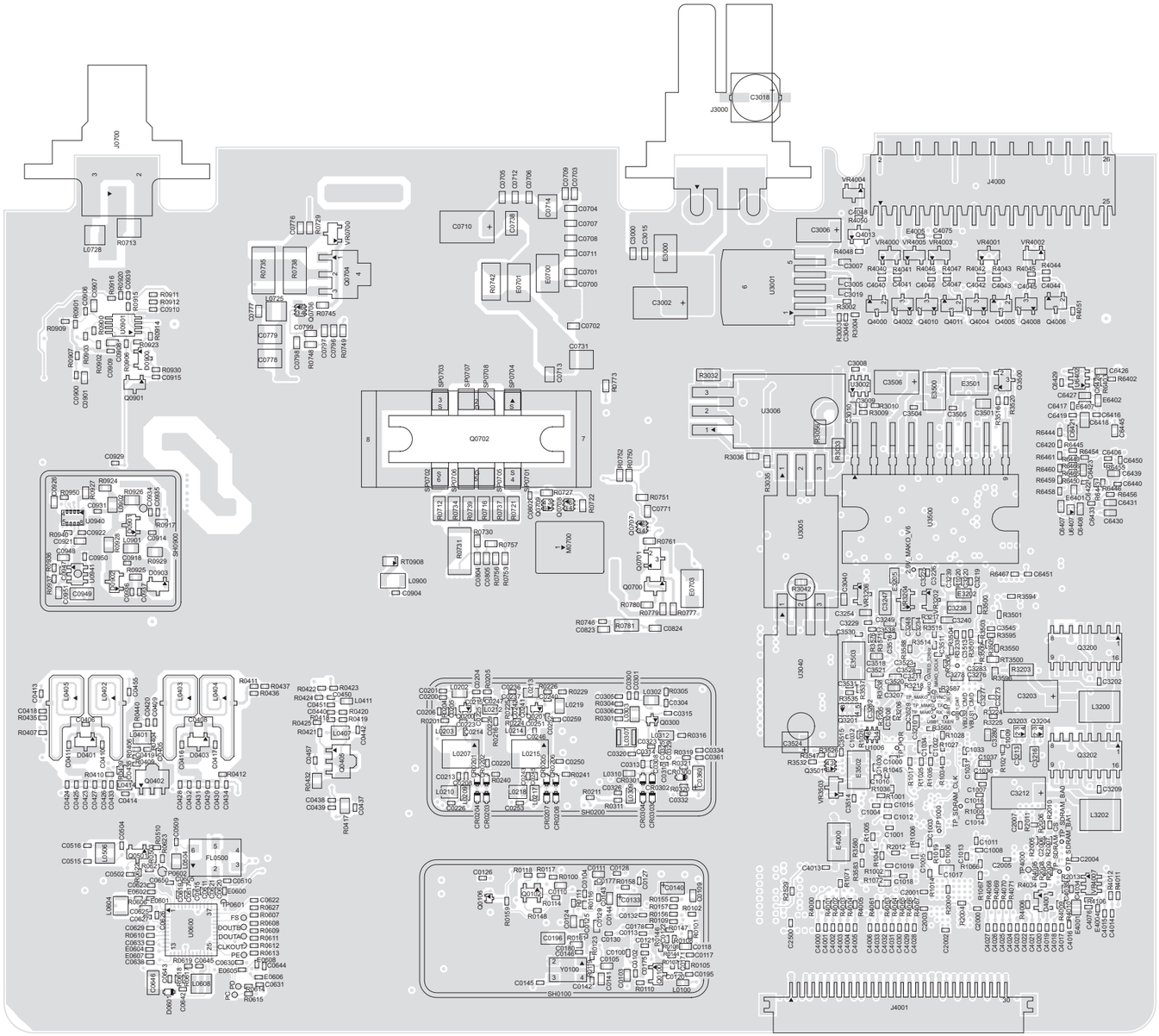
Table 3-1 VHF 25–45W Diagrams and Parts List

PCB:	
8478023A12 Main Board Top Side	Page 3-3
8478023A12 Main Board Bottom Side	Page 3-4
8478023A16 Main Board Top Side	Page 3-5
8478023A16 Main Board Bottom Side	Page 3-6
SCHEMATICS	
Overall	**Page 3-7**
Receiver Front-End	**Page 3-8**
Receiver IF Amp	**Page 3-9**
Receiver Back-End	**Page 3-10**
Power Amplifier	**Page 3-11**
Power Control	**Page 3-12**
Synthesizer	**Page 3-13**
Receiver VCO	**Page 3-14**
Transmit VCO	**Page 3-15**
Parts List	
8478023A12 and 8478023A16	**Page 3-16**

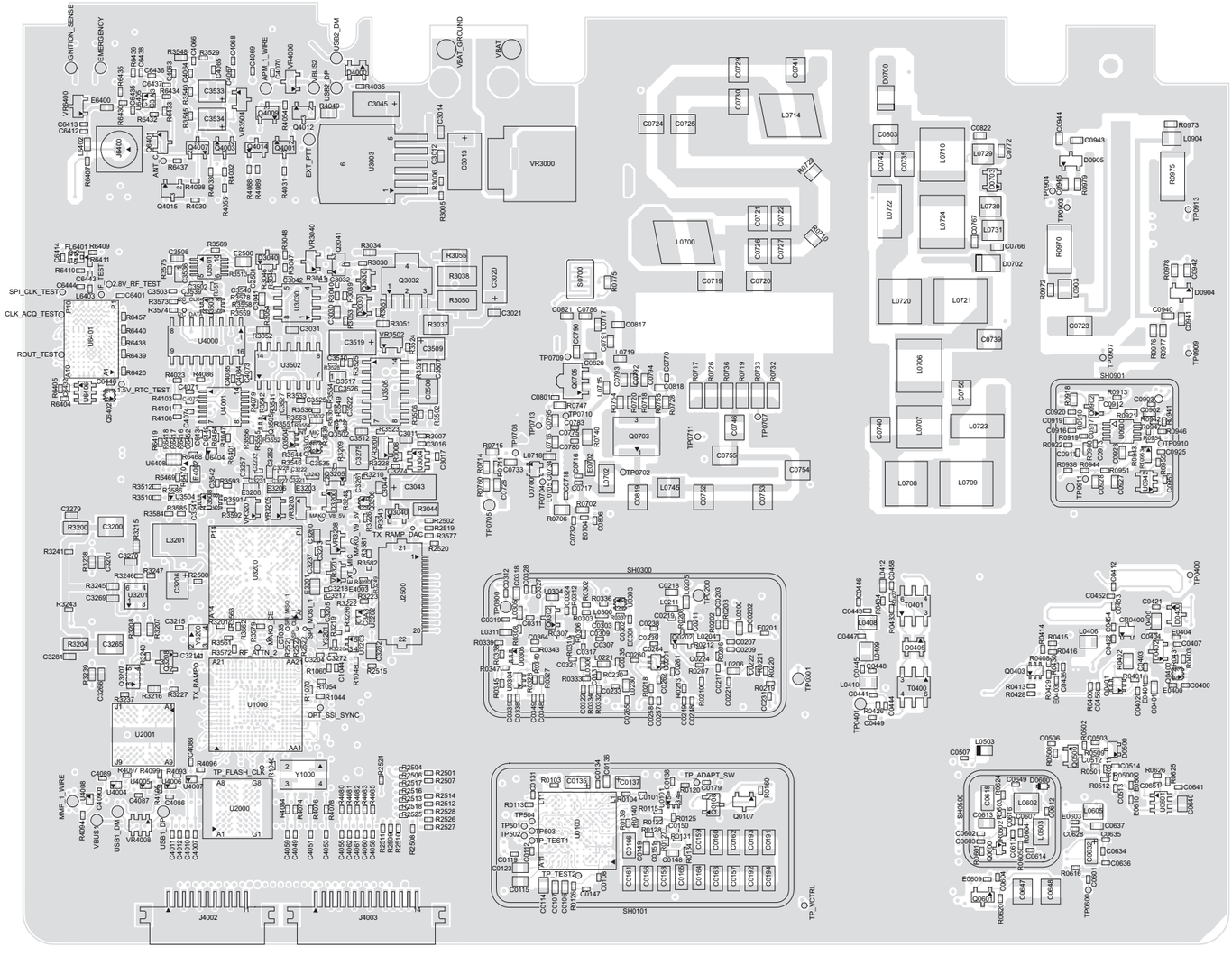
Table 3-2: VHF 25–45W Diagrams and Parts List

PCB:	
8478023A17 Main Board Top Side	Page 3-21
8478023A17 Main Board Bottom Side	Page 3-22
SCHEMATICS	
Overall	**Page 3-23**
Receiver Front-End	**Page 3-24**
Receiver IF Amp	**Page 3-25**
Receiver Back-End	**Page 3-26**
Power Amplifier	**Page 3-27**
Power Control	**Page 3-28**
Synthesizer	**Page 3-29**
Receiver VCO	**Page 3-30**
Transmit VCO	**Page 3-31**
Parts List	
8478023A17	**Page 3-32**

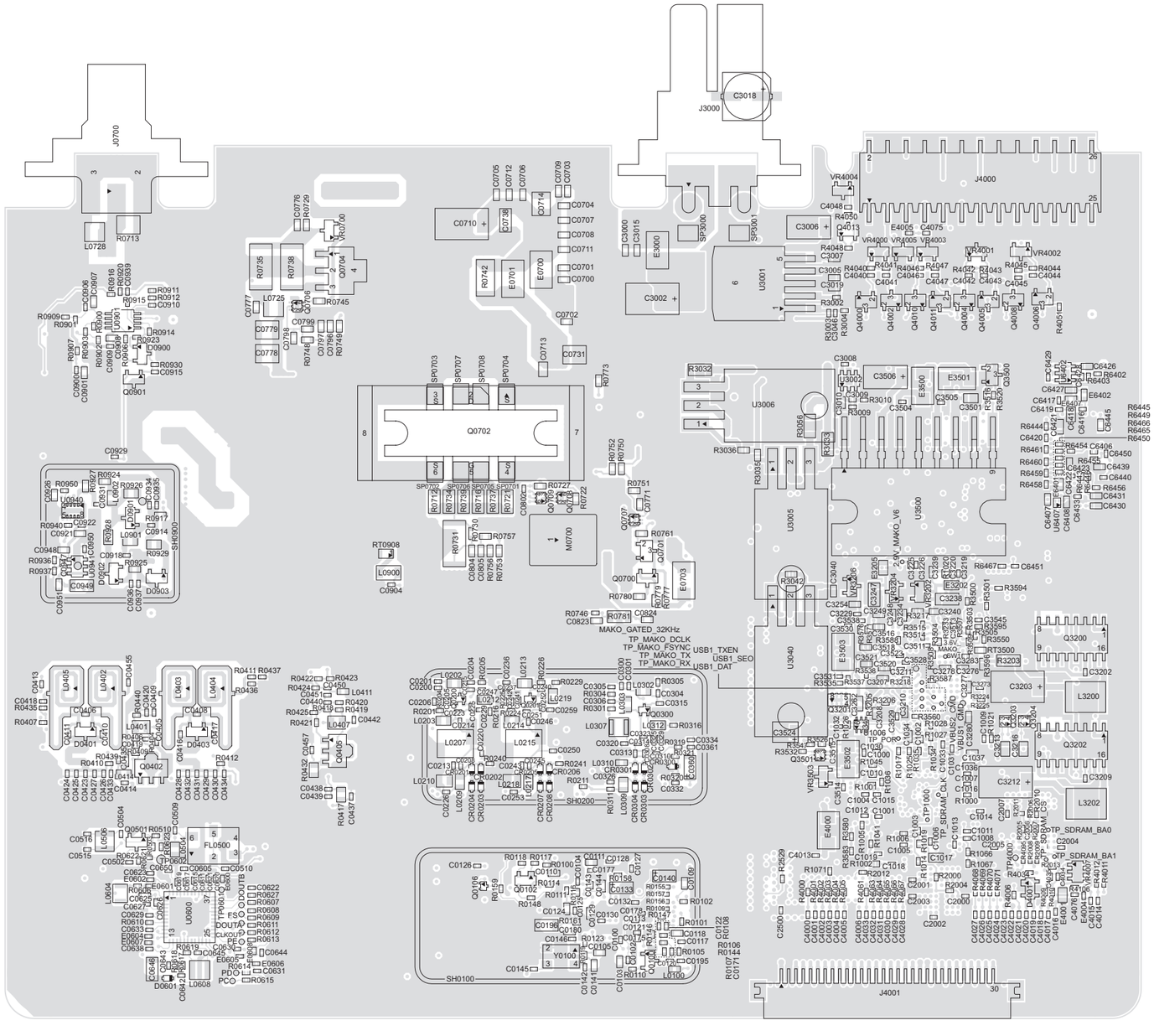
2.0 VHF (136–174 MHz) 25–45W PCB / Schematics / Parts List



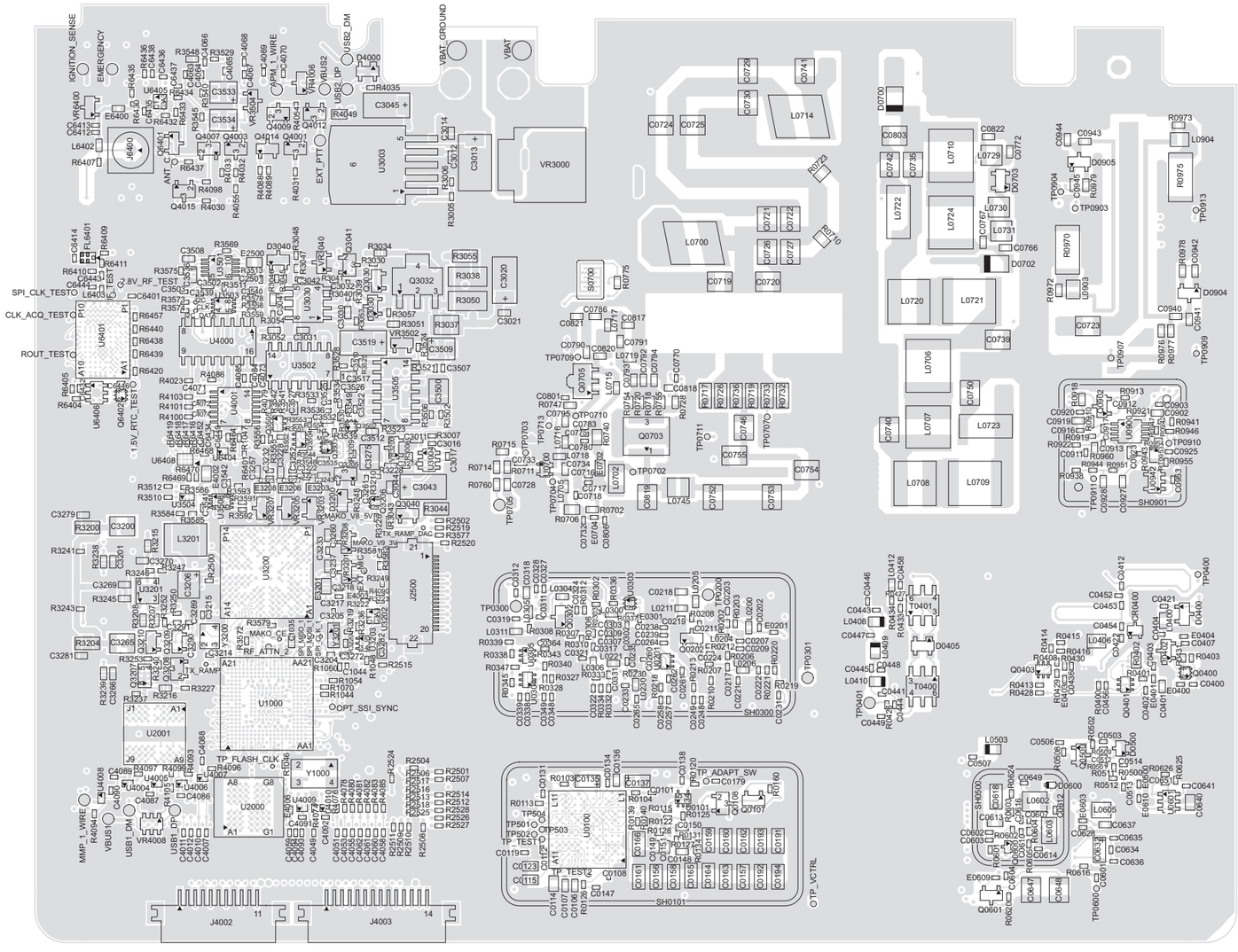
VHF (136–174 MHz) 25–45W 8478023A12 Top Side

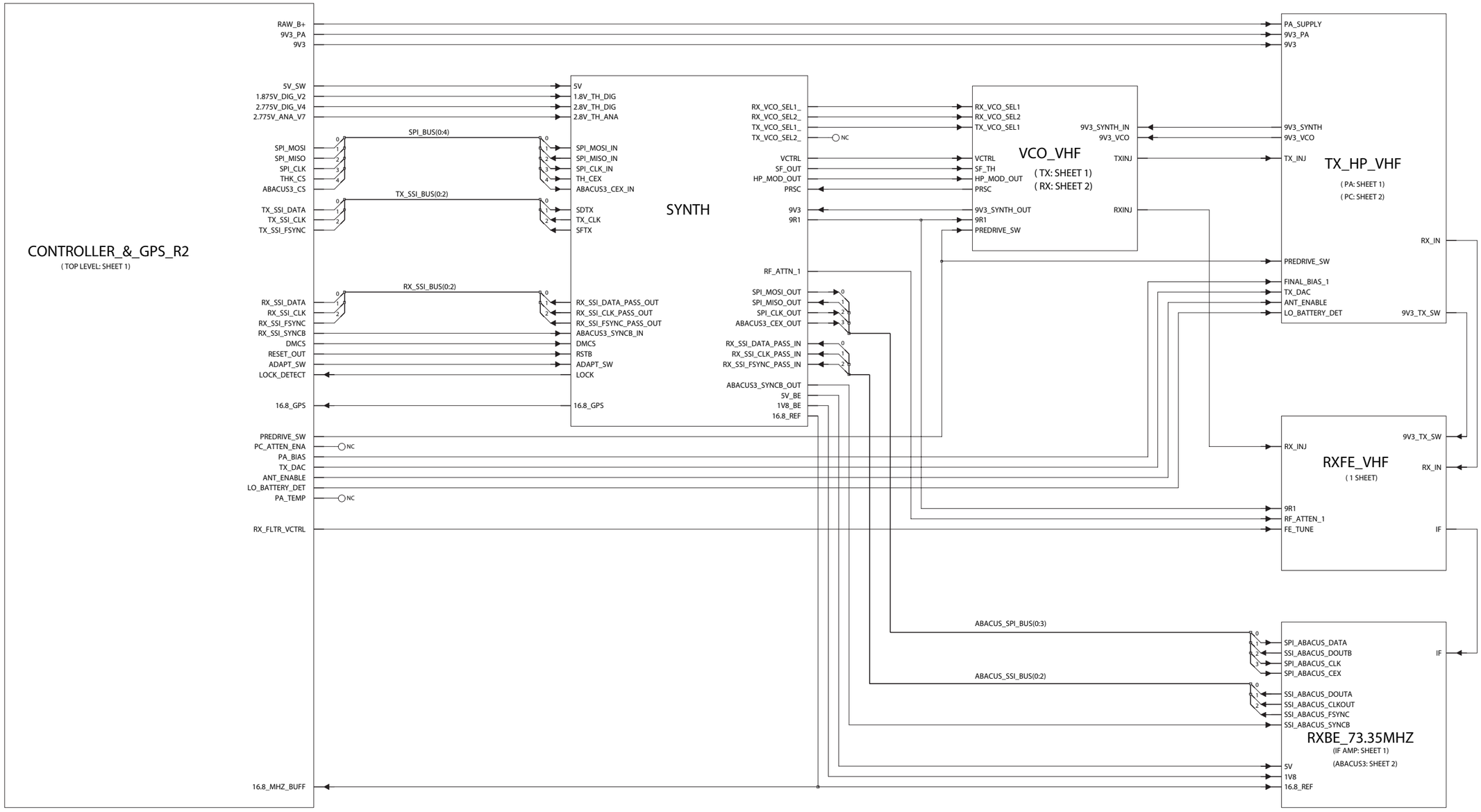


VHF (136–174 MHz) 25–45W 8478023A12 Bottom Side

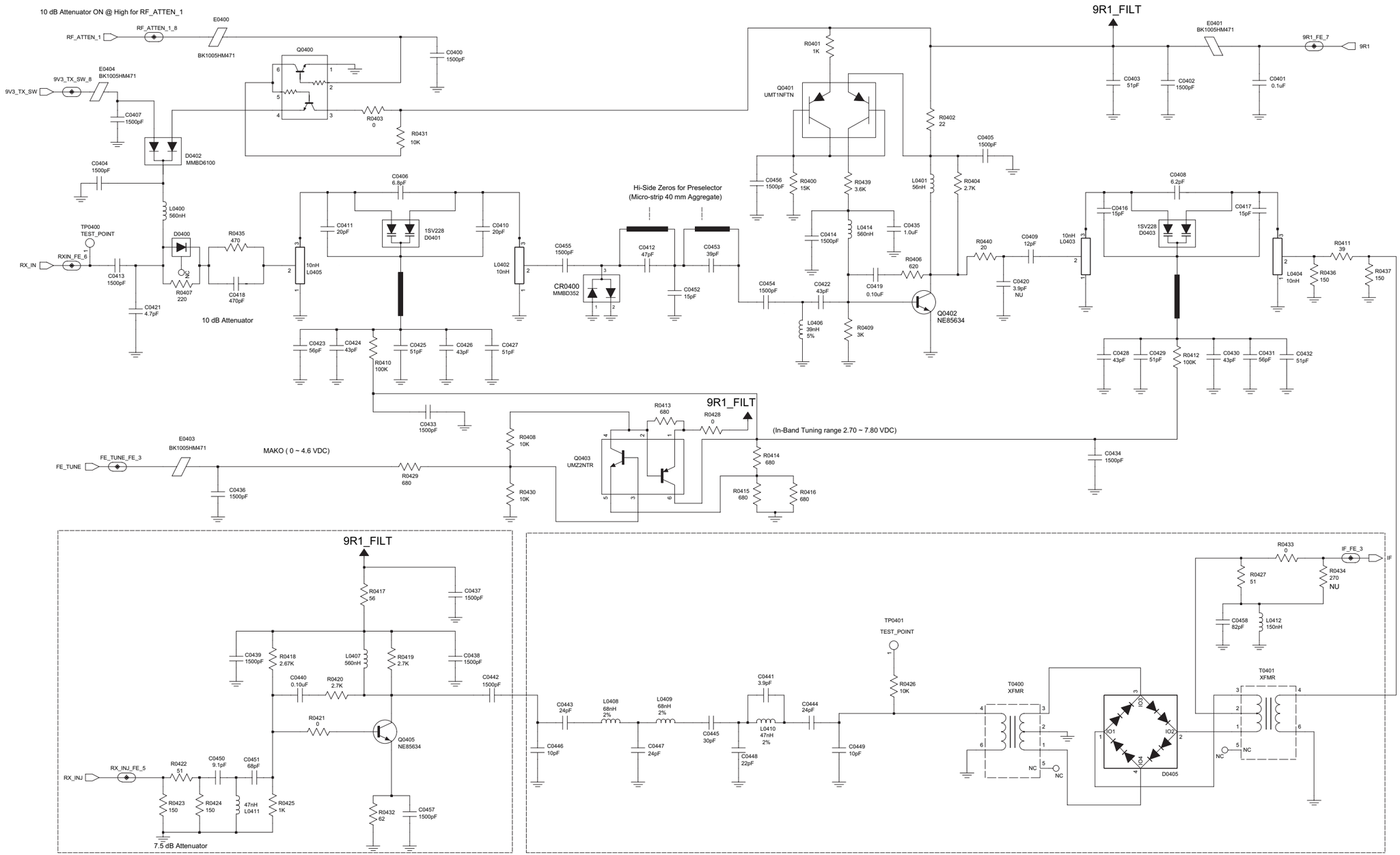


VHF (136–174 MHz) 25–45W 8478023A16 Top Side

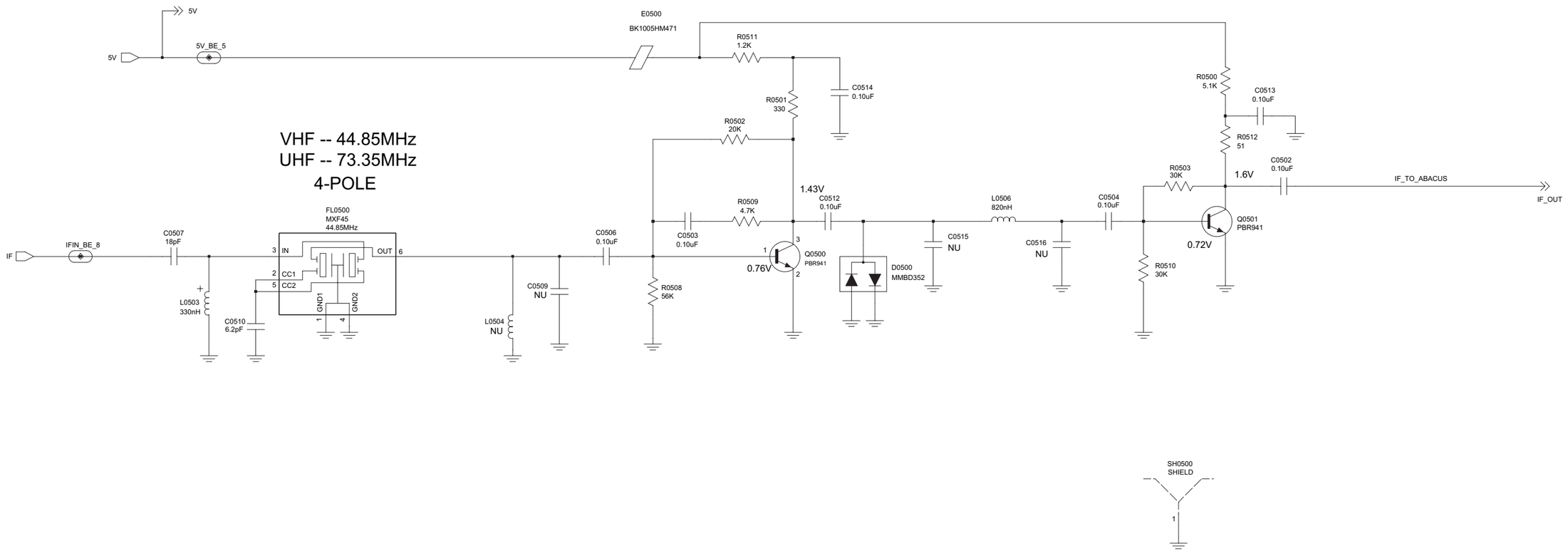

IGNITION_SENSE
EMERGENCY
VBAT_GROUND
VBAT
EXT_PTT
VR3000
U3303
U6800
U6401
U4000
U3502
U3505
U2001
U2000
U1000
U3201
U2200
U0100
U0303
U0305
U0401
U0412
U0458
U0501
U0502
U0503
U0504
U0505
U0506
U0507
U0508
U0509
U0510
U0511
U0512
U0513
U0514
U0515
U0516
U0517
U0518
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U0538
U0539
U0540



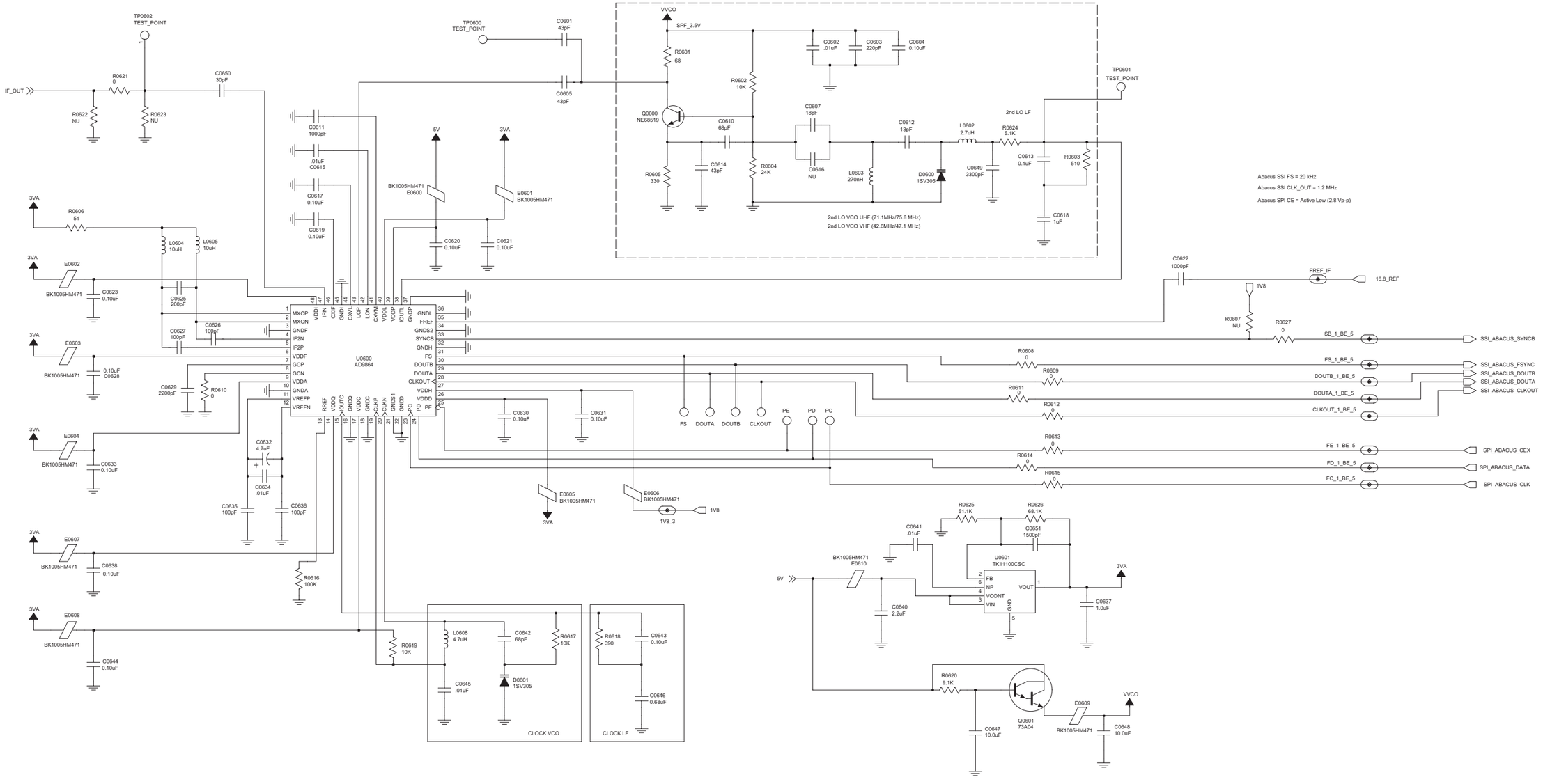
VHF (136–174 MHz) 25–45W Overall Schematic Diagram



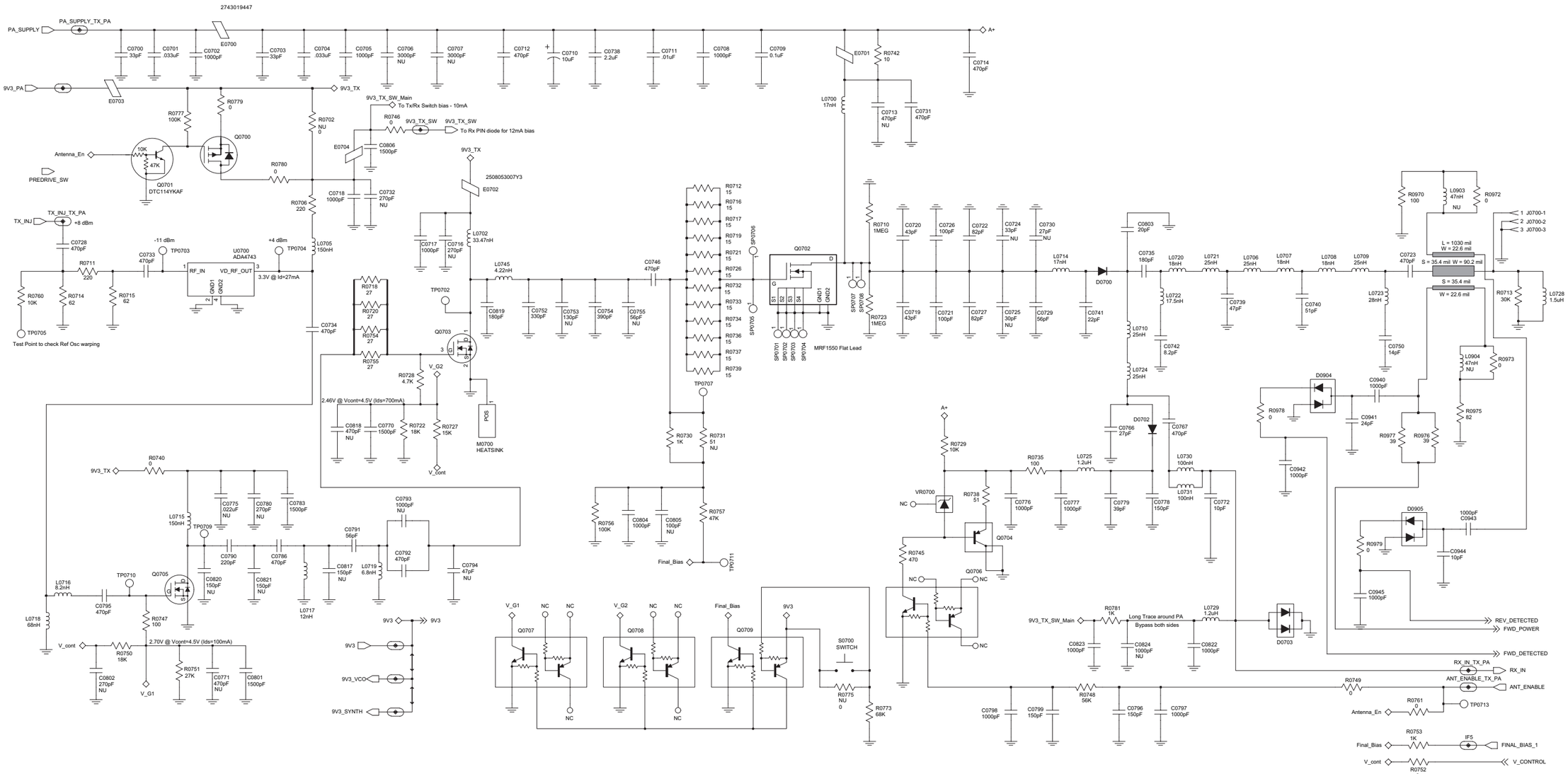
VHF (136–174 MHz) 25–45W Receiver Front-End Schematic Diagram



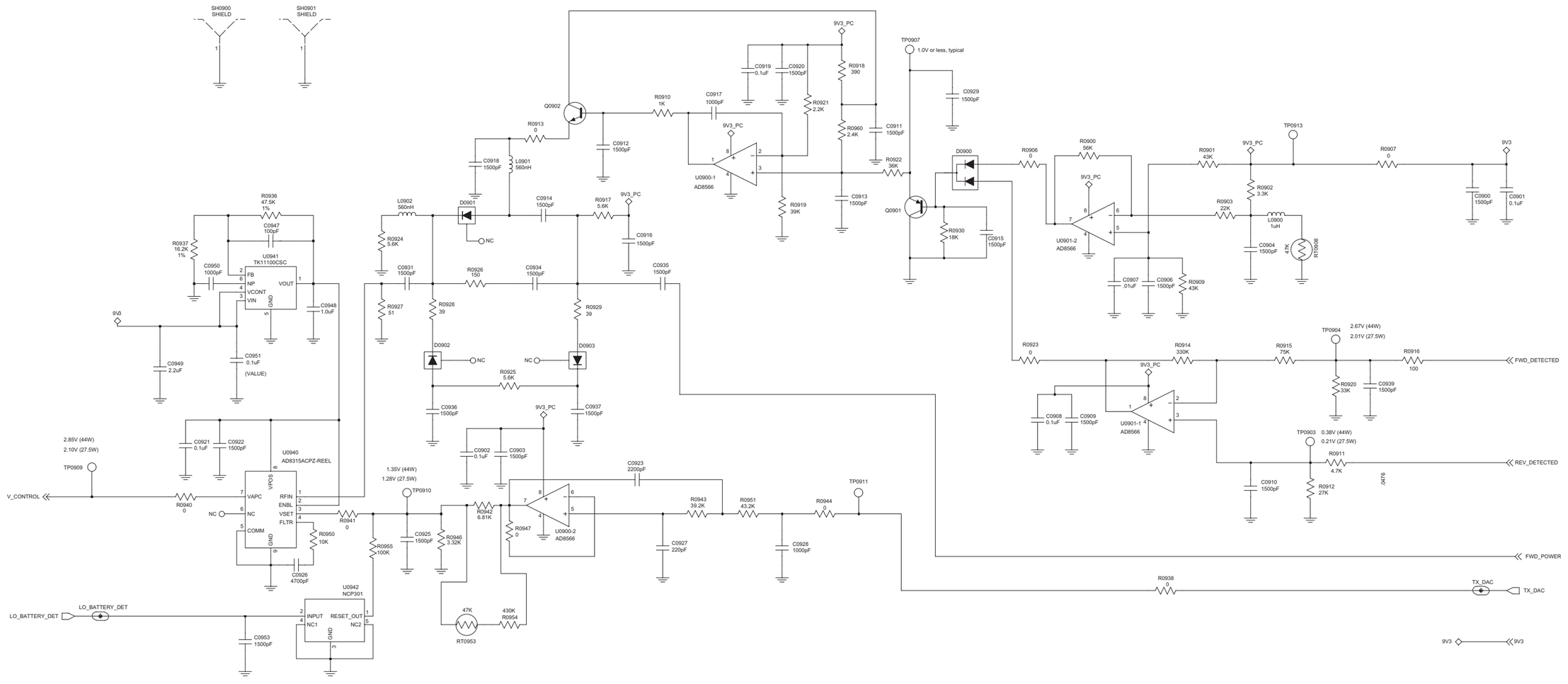
VHF (136–174 MHz) 25–45W Receiver IF Amp Schematic Diagram



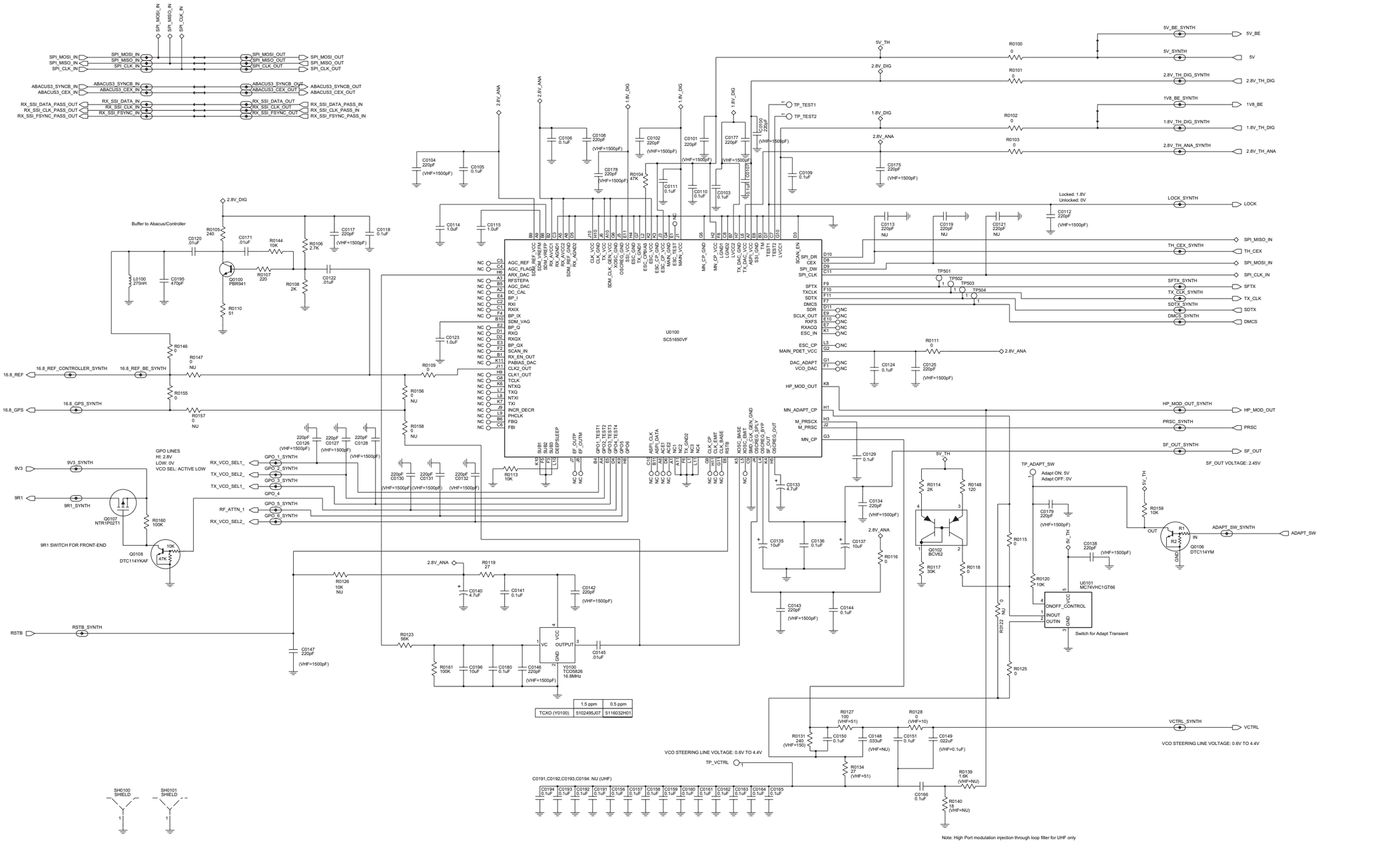
VHF (136–174 MHz) 25–45W Receiver Back-End Schematic Diagram



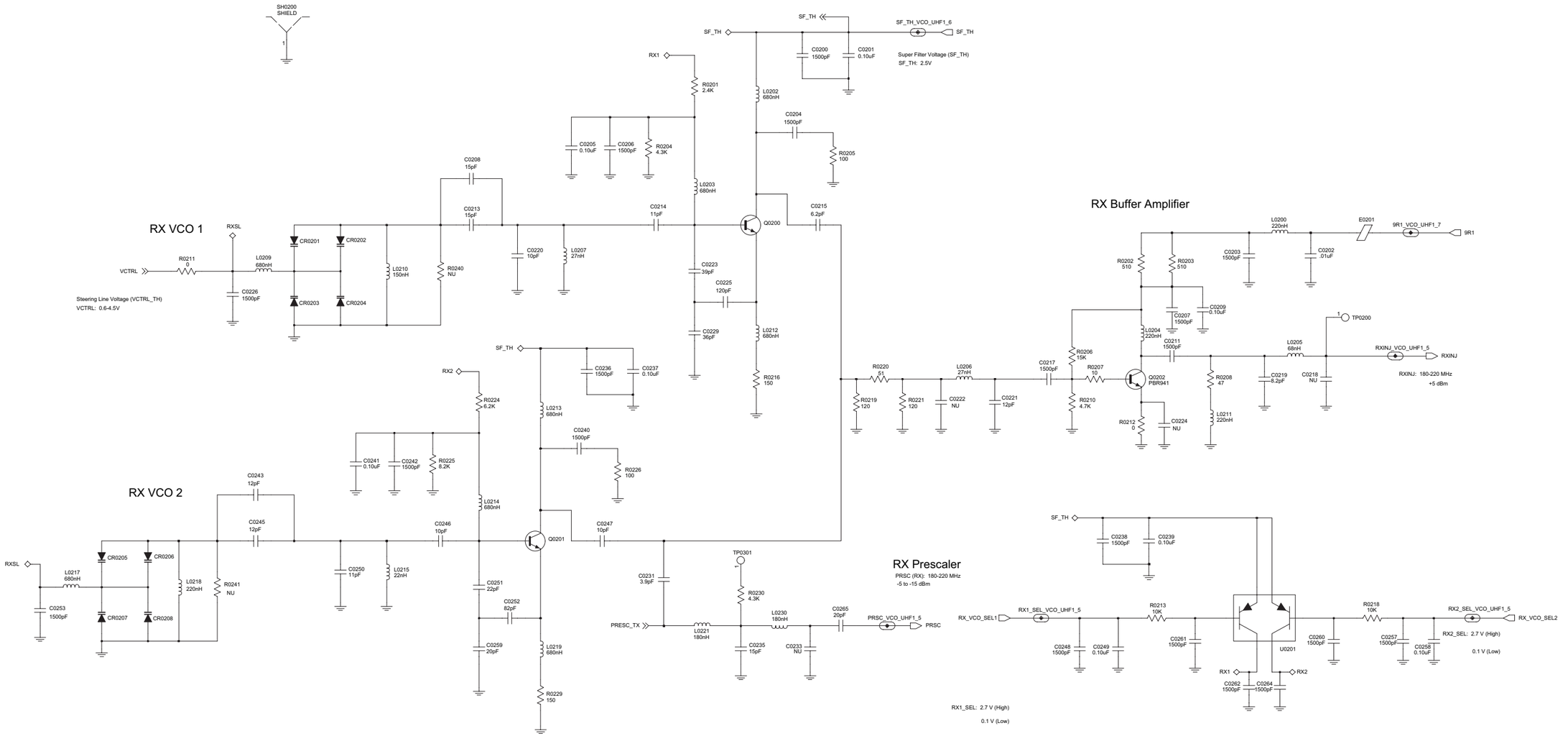
VHF (136–174 MHz) 25–45W Power Amplifier Schematic Diagram



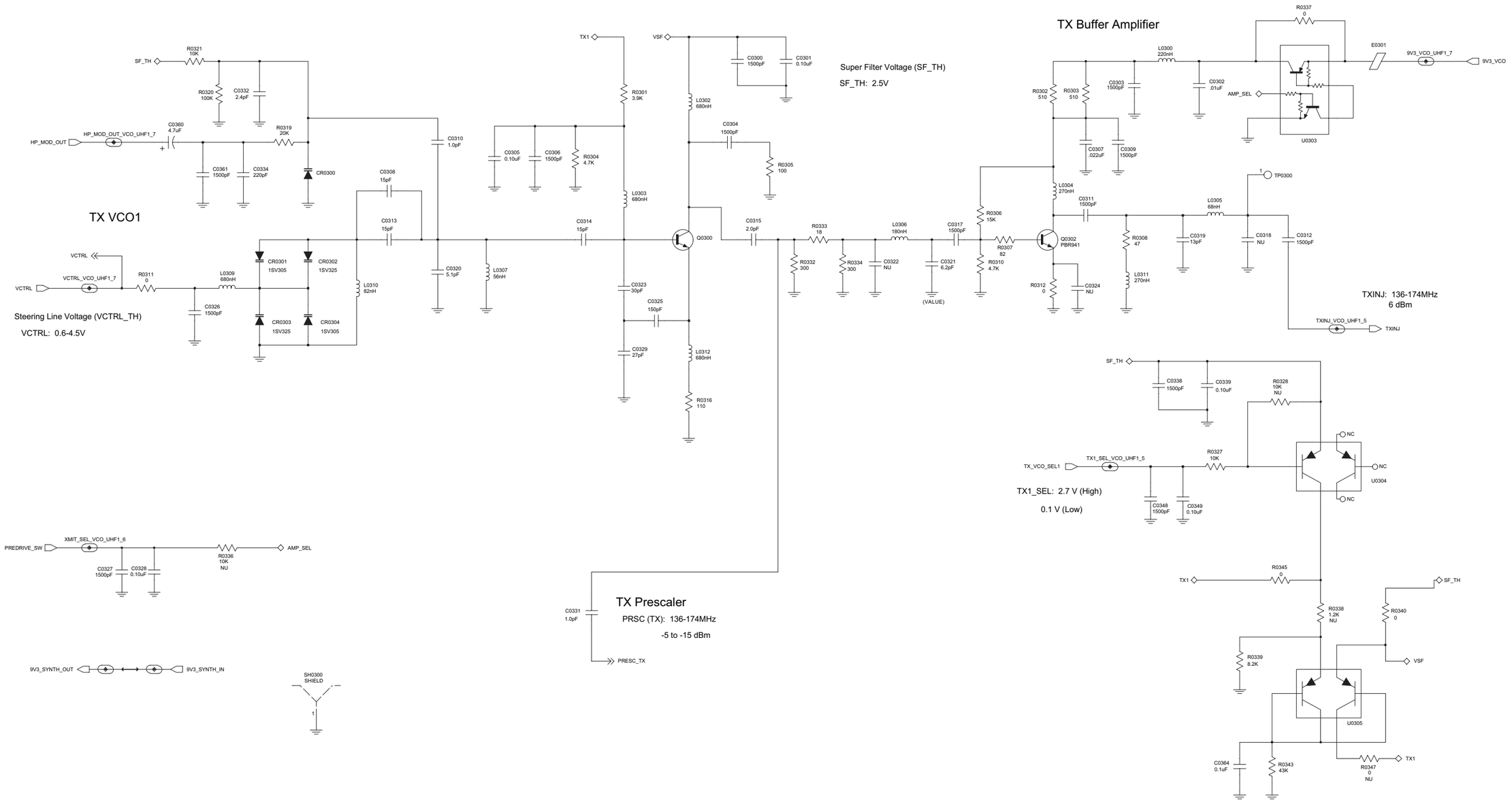
VHF (136–174 MHz) 25–45W Power Control Schematic Diagram



VHF (136–174 MHz) 25–45W Synthesizer Schematic Diagram



VHF (136–174 MHz) 25–45W Receiver VCO Schematic Diagram



VHF (136–174 MHz) 25–45W Transmit VCO Schematic Diagram

VHF PCB 8478023A12 and 8478023A16 Parts List 25–45W

Circuit Ref	Motorola Part No.	Description
C0100	2113945A10	1500pF
C0101	2113945A10	1500pF
C0102	2113945A10	1500pF
C0103	2113945C31	0.1uF
C0104	2113945A10	1500pF
C0105	2113945C31	0.1uF
C0106	2113945C31	0.1uF
C0107	2113945C31	0.1uF
C0108	2113945A10	1500pF
C0109	2113945C31	0.1uF
C0110	2113945C31	0.1uF
C0111	2113945C31	0.1uF
C0112	2113945A10	1500pF
C0113	NOT PLACED	–
C0114	2113946E02	1.0uF
C0115	2113946E02	1.0uF
C0117	2113945A10	1500pF
C0118	2113945C31	0.1uF
C0119	NOT PLACED	–
C0120	2113945B02	.01uF
C0121	NOT PLACED	–
C0122	2113945B02	.01uF
C0123	2113946E02	1.0uF
C0124	2113945C31	0.1uF
C0125	2113945A10	1500pF
C0126	2113945A10	1500pF
C0127	2113945A10	1500pF
C0128	2113945A10	1500pF
C0129	2113945C31	0.1uF
C0130	2113945A10	1500pF
C0131	2113945A10	1500pF
C0132	2113945A10	1500pF
C0133	2313960B30	4.7uF
C0134	2113945A10	1500pF
C0135	2313960B32	10uF
C0136	2113945C31	0.1uF
C0137	2313960B32	10uF
C0138	2113945A10	1500pF
C0140	2313960B30	4.7uF
C0141	2113945C31	0.1uF
C0142	2113945A10	1500pF
C0143	2113945A10	1500pF
C0144	2113945C31	0.1uF
C0145	2113945B02	.01uF
C0146	2113945A10	1500pF
C0147	2113945A10	1500pF
C0148	NOT PLACED	–
C0149	2113945C31	0.1uF
C0150	2113945C31	0.1uF
C0151	2113945C31	0.1uF
C0156	2185419D06	0.1uF
C0157	2185419D06	0.1uF
C0158	2185419D06	0.1uF
C0159	2185419D06	0.1uF
C0160	2185419D06	0.1uF
C0161	2185419D06	0.1uF
C0162	2185419D06	0.1uF
C0163	2185419D06	0.1uF
C0164	2185419D06	0.1uF
C0165	2185419D06	0.1uF
C0166	2185419D06	0.1uF
C0171	2113945B02	.01uF
C0175	2113945A10	1500pF
C0177	2113945A10	1500pF
C0178	2113945A10	1500pF
C0179	2113945A10	1500pF
C0180	2113945C31	0.1uF
C0191	2185419D06	0.1uF
C0192	2185419D06	0.1uF
C0193	2185419D06	0.1uF
C0194	2185419D06	0.1uF
C0195	2113945A05	470pF
C0196	2113946H02	10uF
C0200	2113945A10	1500pF
C0201	2113945Y02	0.10uF
C0202	2113945B02	.01uF
C0203	2113945A10	1500pF
C0204	2113945A10	1500pF
C0205	2113945Y02	0.10uF
C0206	2113945A10	1500pF
C0207	2113945A10	1500pF
C0208	2115153H37	15pF
C0209	2113945Y02	0.10uF
C0211	2113945A10	1500pF
C0213	2115153H37	15pF
C0214	2115153H34	11pF
C0215	2115153H22	6.2pF
C0217	2113945A10	1500pF
C0218	NOT PLACED	–
C0219	2115153H25	8.2pF
C0220	2115153H27	10pF
C0221	2115153H35	12pF
C0222	NOT PLACED	–
C0223	2115153H47	39pF
C0224	NOT PLACED	–
C0225	2115153H59	120pF
C0226	2113945A10	1500pF
C0229	2115153H46	36pF
C0231	2115153H17	3.9pF
C0233	NOT PLACED	–
C0235	2115153H37	15pF
C0236	2113945A10	1500pF
C0237	2113945Y02	0.10uF
C0238	2113945A10	1500pF
C0239	2113945Y02	0.10uF
C0240	2113945A10	1500pF
C0241	2113945Y02	0.10uF
C0242	2113945A10	1500pF
C0243	2115153H35	12pF
C0245	2115153H35	12pF
C0246	2115153H27	10pF
C0247	2115153H27	10pF
C0248	2113945A10	1500pF
C0249	2113945Y02	0.10uF
C0250	2115153H34	11pF
C0251	2115153H41	22pF
C0252	2115153H55	82pF
C0253	2113945A10	1500pF
C0257	2113945A10	1500pF
C0258	2113945Y02	0.10uF
C0259	2115153H40	20pF
C0260	2113945A10	1500pF
C0261	2113945A10	1500pF
C0262	2113945A10	1500pF
C0264	2113945A10	1500pF
C0265	2115153H40	20pF
C0300	2113945A10	1500pF
C0301	2113945Y02	0.10uF
C0302	2113945B02	.01uF
C0303	2113945A10	1500pF
C0304	2113945A10	1500pF
C0305	2113945Y02	0.10uF
C0306	2113945A10	1500pF
C0307	2113945B04	.022uF
C0308	2115153H37	15pF
C0309	2113945A10	1500pF
C0310	2115153H03	1.0pF
C0311	2113945A10	1500pF
C0312	2113945A10	1500pF
C0313	2115153H37	15pF
C0314	2115153H37	15pF
C0315	2115153H10	2.0pF
C0317	2113945A10	1500pF
C0318	NOT PLACED	–
C0319	2115153H36	13pF
C0320	2115153H20	5.1pF
C0321	2115153H22	6.2pF
C0322	NOT PLACED	–
C0323	2115153H44	30pF
C0324	NOT PLACED	–
C0325	2113944A42	150pF
C0326	2113945A10	1500pF
C0327	2113945A10	1500pF
C0328	2113945Y02	0.10uF
C0329	2115153H43	27pF
C0331	2115153H03	1.0pF
C0332	2115153H12	2.4pF
C0334	2113944A44	220pF
C0338	2113945A10	1500pF
C0339	2113945Y02	0.10uF
C0348	2113945A10	1500pF
C0349	2113945Y02	0.10uF
C0360	2313960B30	4.7uF
C0361	2113945A10	1500pF
C0364	2113946B04	0.1uF
C0400	2113945A10	1500pF
C0401	2113945C31	0.1uF
C0402	2113945A10	1500pF
C0403	2115153H50	51pF
C0404	2113945A10	1500pF
C0405	2113945A10	1500pF
C0406	2115153H23	6.8pF
C0407	2113945A10	1500pF
C0408	2115153H22	6.2pF
C0409	2115153H35	12pF
C0410	2115153H40	20pF
C0411	2115153H40	20pF
C0412	2115153H49	47pF
C0413	2113945A10	1500pF
C0414	2113945A10	1500pF
C0416	2115153H37	15pF
C0417	2115153H37	15pF
C0418	2113945A05	470pF
C0419	2113945Y02	0.10uF
C0420	NOT PLACED	–
C0421	2115153H19	4.7pF
C0422	2115153H48	43pF
C0423	2115153H51	56pF
C0424	2115153H48	43pF
C0425	2115153H50	51pF
C0426	2115153H48	43pF
C0427	2115153H50	51pF
C0428	2115153H48	43pF
C0429	2115153H50	51pF
C0430	2115153H48	43pF
C0431	2115153H51	56pF
C0432	2115153H50	51pF
C0433	2113945A10	1500pF
C0434	2113945A10	1500pF
C0435	2113946S35	1.0uF
C0436	2113945A10	1500pF
C0437	2113945A10	1500pF

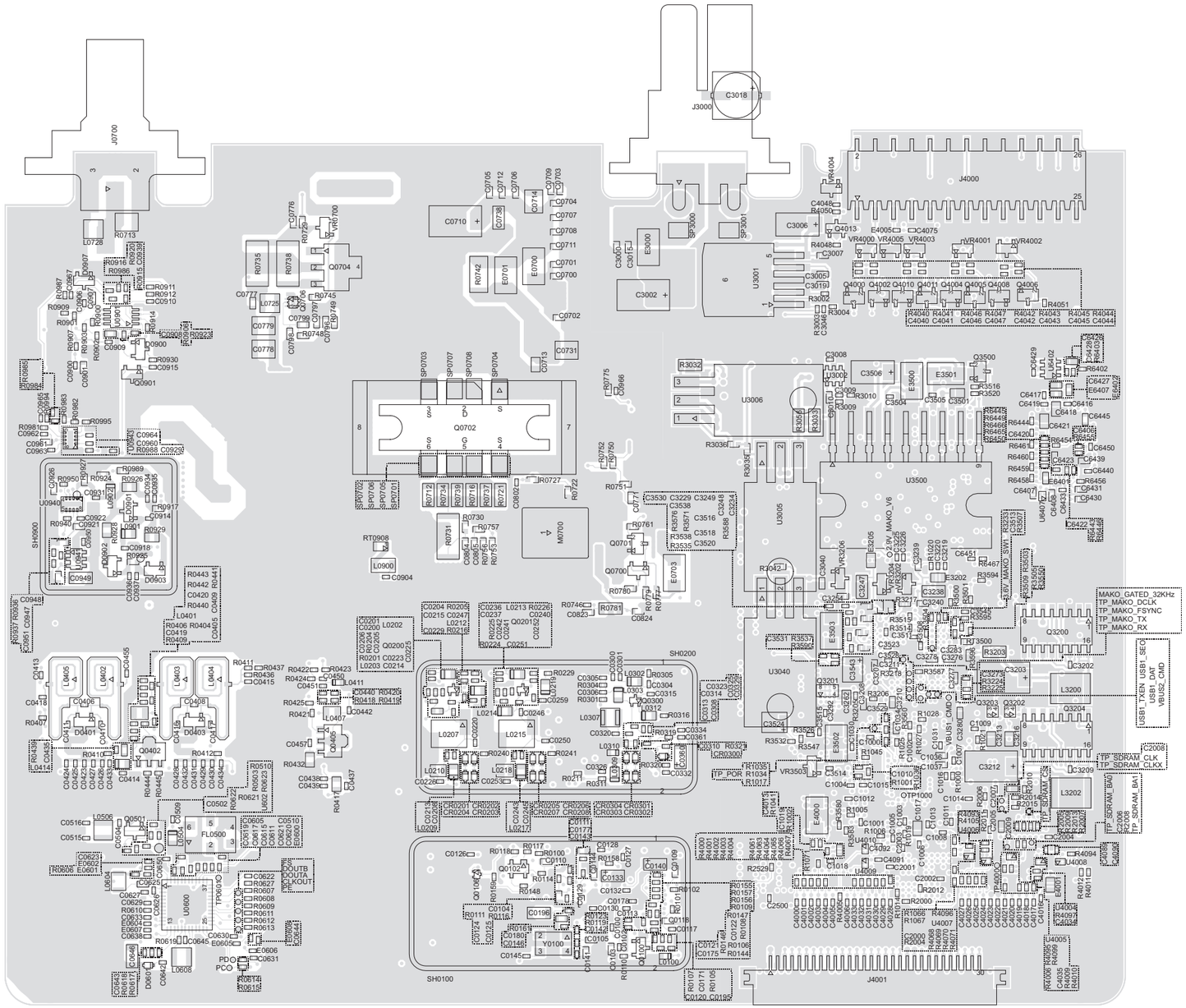
Circuit Ref	Motorola Part No.	Description
C0438	2113945A10	1500pF
C0439	2113945A10	1500pF
C0440	2113945Y02	0.10uF
C0441	2115153H17	3.9pF
C0442	2113945A10	1500pF
C0443	2115153H42	24pF
C0444	2115153H42	24pF
C0445	2115153H44	30pF
C0446	2115153H27	10pF
C0447	2115153H42	24pF
C0448	2115153H41	22pF
C0449	2115153H27	10pF
C0450	2115153H26	9.1pF
C0451	2115153H53	68pF
C0452	2115153H37	15pF
C0453	2115153H47	39pF
C0454	2113945A10	1500pF
C0455	2113945A10	1500pF
C0456	2113945A10	1500pF
C0457	2113945A10	1500pF
C0458	2115153H55	82pF
C0502	2113945Y02	0.10uF
C0503	2113945Y02	0.10uF
C0504	2113945Y02	0.10uF
C0506	2115153H35	12pF
C0507	2115153H38	18pF
C0509	NOT PLACED	–
C0510	2115153H24	7.5pF
C0512	2113945Y02	0.10uF
C0513	2113945Y02	0.10uF
C0514	2113945Y02	0.10uF
C0515	NOT PLACED	–
C0516	NOT PLACED	–
C0601	2115153H48	43pF
C0602	2113945B02	.01uF
C0603	2113944A44	220pF
C0604	2113945Y02	0.10uF
C0605	2115153H48	43pF
C0607	2115153H37	15pF
C0610	2115153H51	56pF
C0611	2113945A09	1000pF
C0612	2115153H39	18pF
C0613	2113945G91	0.1uF
C0614	2115153H41	22pF
C0615	2113945B02	.01uF
C0616	NOT PLACED	–
C0617	2113945Y02	0.10uF
C0618	2115358H25	1uF
C0619	2113945Y02	0.10uF
C0620	2113945Y02	0.10uF
C0621	2113945Y02	0.10uF
C0622	2113945A09	1000pF
C0623	2113945Y02	0.10uF
C0625	2113944C89	200pF
C0626	2113944A40	100pF
C0627	2113944A40	100pF
C0628	2113945Y02	0.10uF
C0629	2113945A11	2200pF
C0630	2113945Y02	0.10uF
C0631	2113945Y02	0.10uF
C0632	2313960B30	4.7uF
C0633	2113945Y02	0.10uF
C0634	2113945B02	.01uF
C0635	2113944A40	100pF
C0636	2113944A40	100pF
C0637	2113946S35	1.0uF
C0638	2113945Y02	0.10uF
C0640	2113946N03	2.2uF
C0641	2113945B02	.01uF
C0642	2115153H53	68pF
C0643	2113945Y02	0.10uF
C0644	2113945Y02	0.10uF
C0645	2113945B02	.01uF
C0646	2113946G04	0.68uF
C0647	2113946J03	10.0uF
C0648	2113946J03	10.0uF
C0649	2113945A12	3300pF
C0650	2115153H44	30pF
C0651	2113945A10	1500pF
C0700	2113944C36	33pF
C0701	2113945C25	.033uF
C0702	2113944C51	1000pF
C0703	2113944C36	33pF
C0704	2113945C25	.033uF
C0705	2113944C51	1000pF
C0706	NOT PLACED	–
C0707	NOT PLACED	–
C0708	2113944C51	1000pF
C0709	2113945C31	0.1uF
C0710	2371403L02	10uF
C0711	2113945L49	.01uF
C0712	2113944C06	470pF
C0713	NOT PLACED	–
C0714	2111078B59	470pF
C0716	NOT PLACED	–
C0717	2113945A09	1000pF
C0718	2113945A09	1000pF
C0719	2111078B33	43pF
C0720	2111078B33	43pF
C0721	2111078B42	100pF
C0722	2111078B40	82pF
C0723	2111078B59	470pF
C0724	NOT PLACED	–
C0725	NOT PLACED	–
C0726	2111078B42	100pF
C0727	2111078B40	82pF
C0728	2113944C06	470pF
C0729	2111078B36	56pF
C0730	NOT PLACED	–
C0731	2111078B59	470pF
C0732	NOT PLACED	–
C0733	2113944C06	470pF
C0734	2113944C06	470pF
C0735	2111078B49	180pF
C0738	2113955D13	2.2uF
C0739	2111078B34	47pF
C0740	2111078B35	51pF
C0741	2111078B22	22pF
C0742	2111078B11	8.2pF
C0746	2111078B59	470pF
C0750	2111078B17	14pF
C0752	2111078B55	330pF
C0753	NOT PLACED	–
C0754	2111078B57	390pF
C0755	NOT PLACED	–
C0766	2113944C35	27pF
C0767	2113944C06	470pF
C0770	2113945A10	1500pF
C0771	NOT PLACED	–
C0772	2113944C30	10pF
C0775	NOT PLACED	–
C0776	2113944C51	1000pF
C0777	2113944C51	1000pF
C0778	2111078B47	150pF
C0779	2111078B32	39pF
C0780	NOT PLACED	–
C0783	2113945A10	1500pF
C0786	2113944C06	470pF
C0790	2113944C02	220pF
C0791	2113944C39	56pF
C0792	2113944C06	470pF
C0793	NOT PLACED	–
C0794	NOT PLACED	–
C0795	2113944C06	470pF
C0796	2113944C47	150pF
C0797	2113944C51	1000pF
C0798	2113944C51	1000pF
C0799	2113944C47	150pF
C0801	2113945A10	1500pF
C0802	NOT PLACED	–
C0803	2111078B21	20pF
C0804	2113944C51	1000pF
C0805	NOT PLACED	–
C0806	2113945A10	1500pF
C0817	NOT PLACED	–
C0818	NOT PLACED	–
C0819	2111078B49	180pF
C0820	NOT PLACED	–
C0821	NOT PLACED	–
C0822	2113944C51	1000pF
C0823	2113944C51	1000pF
C0824	NOT PLACED	–
C0900	2113945A10	1500pF
C0901	2113945C31	0.1uF
C0902	2113945C31	0.1uF
C0903	2113945A10	1500pF
C0904	2113945A10	1500pF
C0906	2113945A10	1500pF
C0907	2113945C02	.01uF
C0908	2113945C31	0.1uF
C0909	2113945A10	1500pF
C0910	2113945A10	1500pF
C0911	2113945A10	1500pF
C0912	2113945A10	1500pF
C0913	2113945A10	1500pF
C0914	2113945A10	1500pF
C0915	2113945A10	1500pF
C0916	2113945A10	1500pF
C0917	2113945A09	1000pF
C0918	2113945A10	1500pF
C0919	2113945C31	0.1uF
C0920	2113945A10	1500pF
C0921	2113945C31	0.1uF
C0922	2113945A10	1500pF
C0923	2113944C55	2200pF
C0925	2113945A10	1500pF
C0926	2113945L41	4700pF
C0927	2113944C02	220pF
C0928	2113944C51	1000pF
C0929	2113945A10	1500pF
C0931	2113945A10	1500pF
C0934	2113945A10	1500pF
C0935	2113945A10	1500pF
C0936	2113945A10	1500pF
C0937	2113945A10	1500pF
C0939	2113945A10	1500pF
C0940	2113944C51	1000pF
C0941	2113944M27	24pF
C0942	2113944C51	1000pF
C0943	2113944C51	1000pF
C0944	2113944M18	10pF
C0945	2113944C51	1000pF
C0947	2113944A40	100pF
C0948	2113946S35	1.0uF

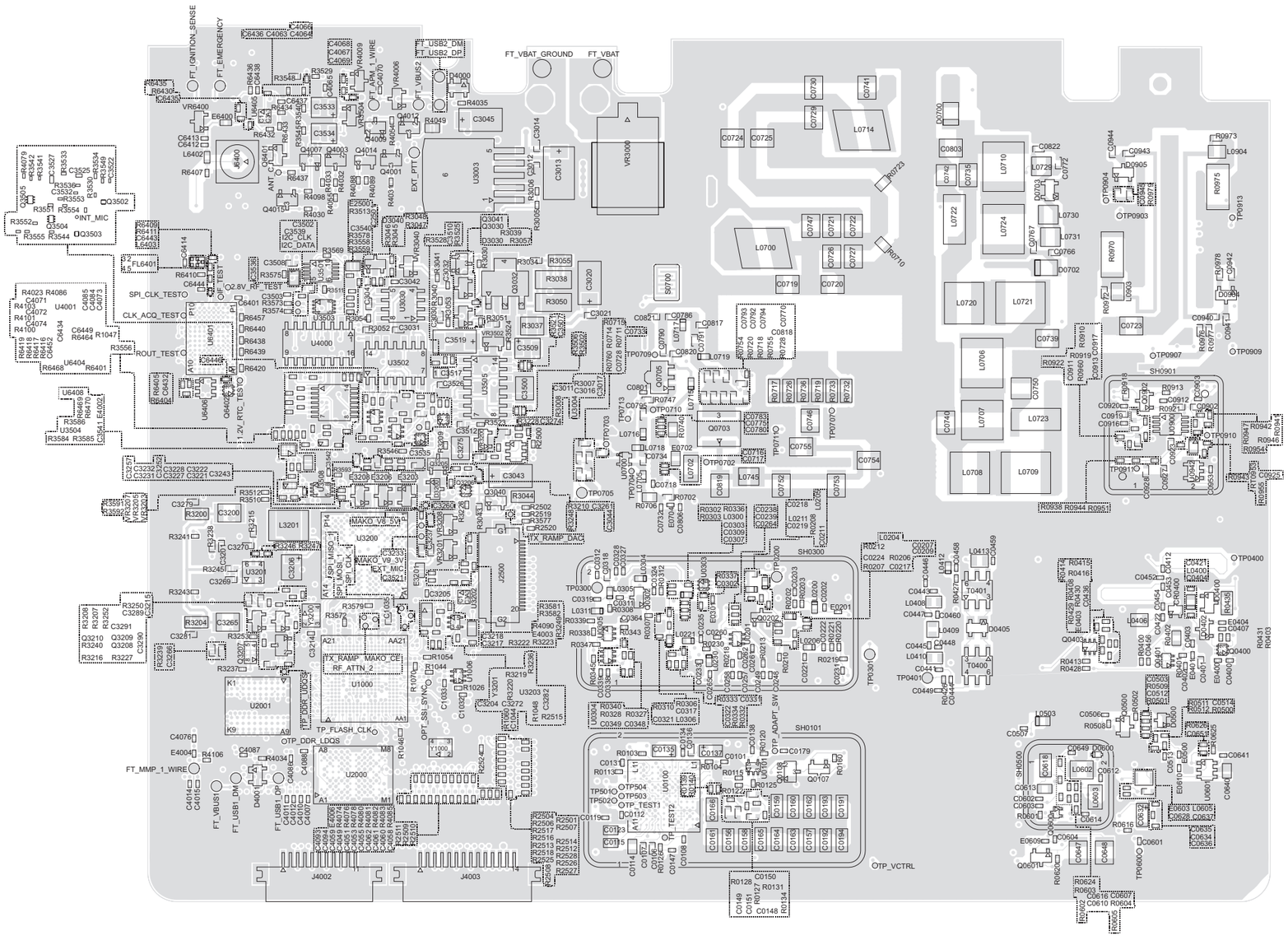
Circuit Ref	Motorola Part No.	Description
C0949	2113946G01	2.2uF
C0950	2113945A09	1000pF
C0951	2113945C31	0.1uF
C0953	2113945A10	1500pF
CR0201	4815096H01	DIODE VARACTOR 1SV305
CR0202	4815096H01	DIODE VARACTOR 1SV305
CR0203	4815096H01	DIODE VARACTOR 1SV305
CR0204	4815096H01	DIODE VARACTOR 1SV305
CR0205	4815096H01	DIODE VARACTOR 1SV305
CR0206	4815096H01	DIODE VARACTOR 1SV305
CR0207	4815096H01	DIODE VARACTOR 1SV305
CR0208	4815096H01	DIODE VARACTOR 1SV305
CR0300	4815096H01	DIODE VARACTOR 1SV305
CR0301	4815096H01	DIODE VARACTOR 1SV305
CR0302	4815059H01	DIODE VARACTOR 1SV325
CR0303	4815059H01	DIODE VARACTOR 1SV325
CR0304	4815096H01	DIODE VARACTOR 1SV305
CR0400	4813974A19	DIODE, SCHOTTKY
D0400	4813974A06	DIODE, PIN
D0401	4885094Y01	DIODE VARACTOR 1SV228
D0402	4813978C02	DIODE, PIN
D0403	4885094Y01	DIODE VARACTOR 1SV228
D0405	4815090H01	DIODE, MIXER
D0500	4813974A19	DIODE, SCHOTTKY
D0600	4815096H01	DIODE VARACTOR 1SV305
D0601	4815096H01	DIODE VARACTOR 1SV305
D0700	4802482J02	DIODE, PIN
D0702	4802482J02	DIODE, PIN
D0703	4886622Y06	DIODE, PIN
D0900	4813978C02	DIODE, SWITCHING
D0901	4815023H01	DIODE, PIN
D0902	4815024H01	DIODE, PIN
D0903	4815024H01	DIODE, PIN
D0904	4813974A21	DIODE, SCHOTTKY
D0905	4813974A21	DIODE, SCHOTTKY
E0201	2480640Z01	FERRITE BEAD
E0301	2480640Z01	FERRITE BEAD
E0400	2409134J25	FERRITE BEAD
E0401	2409134J25	FERRITE BEAD
E0403	2409134J25	FERRITE BEAD
E0404	2409134J25	FERRITE BEAD
E0500	2409134J25	FERRITE BEAD
E0600	2409134J25	FERRITE BEAD
E0601	2409134J25	FERRITE BEAD
E0602	2409134J25	FERRITE BEAD
E0603	2409134J25	FERRITE BEAD
E0604	2409134J25	FERRITE BEAD
E0605	2409134J25	FERRITE BEAD
E0606	2409134J25	FERRITE BEAD
E0607	2409134J25	FERRITE BEAD
E0608	2409134J25	FERRITE BEAD
E0609	2409134J25	FERRITE BEAD
E0610	2480640Z01	FERRITE BEAD
E0700	2485011Y01	FERRITE BEAD
E0701	2485011Y01	FERRITE BEAD
E0702	7671656M01	FERRITE BEAD
E0703	2485011Y01	FERRITE BEAD
E0704	2409134J25	FERRITE BEAD
FL0500	9180022M11	73.35MHZ CRYSTAL FILTER
J0700	0905901V11	MINI-U RF CONNECTOR
L0100	2414017N29	270nH
L0200	2414017N28	220nH
L0202	2414017K33	680nH
L0203	2414017K33	680nH
L0204	2414017N28	220nH
L0205	2414017N22	68nH
L0206	2414017N17	27nH
L0207	2416077H12	27nH
L0209	2414017K33	680nH
L0210	2414015B06	150nH
L0211	2414017N28	220nH
L0212	2414017K33	680nH
L0213	2414017K33	680nH
L0214	2414017K33	680nH
L0215	2416077H11	22nH
L0217	2414017K33	680nH
L0218	2414015B08	220nH
L0219	2414017K33	680nH
L0221	2414017N27	180nH
L0230	2414017N27	180nH
L0300	2414017N28	220nH
L0302	2414017K33	680nH
L0303	2414017K33	680nH
L0304	2414017N29	270nH
L0305	2414017N22	68nH
L0306	2414017N27	180nH
L0307	2414015C08	56nH
L0309	2414017K33	680nH
L0310	2414017N23	82nH
L0311	2414017N29	270nH
L0312	2414017K33	680nH
L0400	2414017K32	560nH
L0401	2414032F31	56nH
L0402	NOT PLACED	–
L0403	NOT PLACED	–
L0404	NOT PLACED	–
L0405	NOT PLACED	–
L0406	2414032F29	39nH
L0407	2414032F74	560nH
L0408	2414015B02	68nH
L0409	2414015B02	68nH
L0410	2414015B12	47nH
L0411	2414017N20	47nH
L0412	2414017N26	150nH
L0414	2414017K32	560nH
L0503	2414015B32	330nH
L0504	NOT PLACED	–
L0506	2414032B70	1.5uH
L0602	2414032K29	8.2uH
L0603	2414032D28	820nH
L0604	2466505A01	10uH
L0605	2466505A01	10uH
L0608	2414032B76	4.7uH
L0700	2460592A01	17nH
L0702	2479990G01	33.47nH
L0705	2414017N26	150nH
L0706	2485873L02	25nH
L0707	2485873L01	18nH
L0708	2485873L01	18nH
L0709	2485873L02	25nH
L0710	2485873L02	25nH
L0714	2460592A01	17nH
L0715	2414017N26	150nH
L0716	2414017N11	8.2nH
L0717	2414017N13	12nH
L0718	2414017N22	68nH
L0719	2414017N10	6.8nH
L0720	2485873L01	18nH
L0721	2485873L02	25nH
L0722	2415385H04	17.5nH
L0723	2415385H06	28nH
L0724	2485873L02	25nH
L0725	2414032B69	1.2uH
L0728	2414032B70	1.5uH
L0729	2414032B69	1.2uH
L0730	2414032B53	100nH
L0731	2414032B53	100nH
L0745	2460591A01	4.22nH
L0900	2414032D30	1uH
L0901	2414017K32	560nH
L0902	2414017K32	560nH
L0903	NOT PLACED	–
L0904	NOT PLACED	–
M0700	2686201B02	HEATSINK
Q0100	4802197J95	NPN RF TRANSISTOR
Q0102	4815359H01	DUAL PNP
Q0106	4816134H01	ANALOG SWITCH
Q0107	4813970A59	P-CHANNEL MOSFET
Q0108	4815261H01	ANALOG SWITCH
Q0200	4805793Y10	NPN RF TRANSISTOR
Q0201	4805793Y10	NPN RF TRANSISTOR
Q0202	4802197J95	NPN RF TRANSISTOR
Q0300	4805793Y10	NPN RF TRANSISTOR
Q0302	4802197J95	NPN RF TRANSISTOR
Q0400	4815271H01	ANALOG SWITCH
Q0401	4815267H01	DUAL PNP
Q0402	4871127H01	NPN RF TRANSISTOR
Q0403	4815270H01	DUAL NPN/PNP
Q0405	4871127H01	NPN RF TRANSISTOR
Q0500	4802197J95	NPN RF TRANSISTOR
Q0501	4802197J95	NPN RF TRANSISTOR
Q0600	4805793Y10	NPN RF TRANSISTOR
Q0601	4813973A04	NPN DARLINGTON
Q0700	4813970A59	P-CHANNEL MOSFET
Q0701	4815261H01	ANALOG SWITCH
Q0702	0105958T74	MRF1550PA ASSEMBLY
Q0703	4816548H01	N-CHANNEL LDMOS DRIVER
Q0704	4813973B02	PNP
Q0705	4816547H01	N-CHANNEL LDMOS PRE-DRIVER
Q0706	4815272H01	ANALOG SWITCH
Q0707	4815272H01	ANALOG SWITCH
Q0708	4815272H01	ANALOG SWITCH
Q0709	4815272H01	ANALOG SWITCH
Q0901	4813973A13	PNP
Q0902	4813973M07	NPN
R0100	0613952R66	0
R0101	0613952R66	0
R0102	0613952R66	0
R0103	0613952R66	0
R0104	0613952R17	47K
R0105	0613952Q58	240
R0106	0613952Q83	2.7K
R0107	0613952Q57	220
R0108	0613952Q80	2K
R0109	0613952R66	0
R0110	0613952Q42	51
R0111	0613952R66	0
R0113	0613952R01	10K
R0114	0613952Q80	2K
R0115	0613952R66	0
R0116	0613952R66	0
R0117	0613952R12	30K
R0118	0613952R66	0
R0119	0613952Q35	27
R0120	0613952R01	10K
R0122	NOT PLACED	–
R0123	0613952R19	56K
R0125	0613952R66	0
R0126	NOT PLACED	–
R0127	0613952Q42	51
R0128	0613952Q25	10
R0131	0613952Q53	150
R0134	0613952Q42	51

Circuit Ref	Motorola Part No.	Description
R0139	NOT PLACED	–
R0140	NOT PLACED	–
R0144	0613952R01	10K
R0146	0613952R66	0
R0147	NOT PLACED	–
R0148	0613952Q51	120
R0155	0613952R66	0
R0156	NOT PLACED	–
R0157	NOT PLACED	–
R0158	NOT PLACED	–
R0159	0613952R01	10K
R0160	0613952R25	100K
R0161	0613952R25	100K
R0201	0613952Q82	2.4K
R0202	0613952Q66	510
R0203	0613952Q66	510
R0204	0613952Q88	4.3K
R0205	0613952Q49	100
R0206	0613952R05	15K
R0207	0613952Q25	10
R0208	0613952Q41	47
R0210	0613952Q89	4.7K
R0211	0613952R66	0
R0212	0613952R66	0
R0213	0613952R01	10K
R0216	0613952Q53	150
R0218	0613952R01	10K
R0219	0613952Q51	120
R0220	0613952Q42	51
R0221	0613952Q51	120
R0224	0613952Q92	6.2K
R0225	0613952Q95	8.2K
R0226	0613952Q49	100
R0229	0613952Q53	150
R0230	0613952Q88	4.3K
R0240	NOT PLACED	–
R0241	NOT PLACED	–
R0301	0613952Q87	3.9K
R0302	0613952Q66	510
R0303	0613952Q66	510
R0304	0613952Q89	4.7K
R0305	0613952Q49	100
R0306	0613952R05	15K
R0307	0613952Q47	82
R0308	0613952Q41	47
R0310	0613952Q89	4.7K
R0311	0613952R66	0
R0312	0613952R66	0
R0316	0613952Q50	110
R0319	0613952R08	20K
R0320	0613952R25	100K
R0321	0613952R01	10K
R0327	0613952R01	10K
R0328	NOT PLACED	–
R0332	0613952Q60	300
R0333	0613952Q31	18
R0334	0613952Q60	300
R0336	NOT PLACED	–
R0337	0613952R66	0
R0338	NOT PLACED	–
R0339	0613952Q95	8.2K
R0340	0613952R66	0
R0343	0613952R16	43K
R0345	0613952R66	0
R0347	NOT PLACED	–
R0400	0613952R05	15K
R0401	0613952Q73	1K
R0402	0613958H33	22
R0403	0613952R66	0
R0404	0613952Q83	2.7K
R0406	0613952Q68	620
R0407	0613952Q57	220
R0408	0613952R01	10K
R0409	0613952Z43	3K
R0410	0613952R25	100K
R0411	0613952Q39	39
R0412	0613952R25	100K
R0413	0613952Q69	680
R0414	0613952Q69	680
R0415	0613952Q69	680
R0416	0613952Q69	680
R0417	0613958H43	56
R0418	0613952M42	2.67K
R0419	0613952Q83	2.7K
R0420	0613952Q83	2.7K
R0421	0613952R66	0
R0422	0613952Q42	51
R0423	0613952Q53	150
R0424	0613952Q53	150
R0425	0613952M01	1K
R0426	0613952R01	10K
R0427	0613952Q42	51
R0428	0613952R66	0
R0429	0613952Q69	680
R0430	0613952R01	10K
R0431	0613952R01	10K
R0432	0613958H44	62
R0433	0613952R66	0
R0434	NOT PLACED	–
R0435	0613952Q65	470
R0436	0613952Q53	150
R0437	0613952Q53	150
R0439	0613952Z45	3.6K
R0440	0613952Q32	20
R0500	0613952Q90	5.1K
R0501	0613952Q61	330
R0502	0613952R08	20K
R0503	0613952R12	30K
R0508	0613952R19	56K
R0509	0613952Q89	4.7K
R0510	0613952R12	30K
R0511	0613952Q75	1.2K
R0512	0613952Q42	51
R0601	0613952Q51	120
R0602	0613952R01	10K
R0603	0613952Q66	510
R0604	0613952R10	24K
R0605	0613952Q61	330
R0606	0613952Q42	51
R0607	NOT PLACED	–
R0608	0613952R66	0
R0609	0613952R66	0
R0610	0613952R66	0
R0611	0613952R66	0
R0612	0613952R66	0
R0613	0613952R66	0
R0614	0613952R66	0
R0615	0613952R66	0
R0616	0613952R25	100K
R0617	0613952R01	10K
R0618	0613952Q63	390
R0619	0613952R01	10K
R0620	0613952Q96	9.1K
R0621	0613952R66	0
R0622	NOT PLACED	–
R0623	NOT PLACED	–
R0624	0613952Q90	5.1K
R0625	0613952N69	51.1K
R0626	0613952N81	68.1K
R0627	0613952R66	0
R0702	NOT PLACED	–
R0706	0613958H57	220
R0710	0613958J49	1MEG
R0711	0613952H57	220
R0712	0613958S29	15
R0713	0613959H12	30K
R0714	0613952H44	62
R0715	0613952H44	62
R0716	0613958S29	15
R0717	0613958S29	15
R0718	0613952H35	27
R0719	0613958S29	15
R0720	0613952H35	27
R0721	0613958S29	15
R0722	0613952J07	18K
R0723	0613958J49	1MEG
R0726	0613958S29	15
R0727	0613952J05	15K
R0728	0613952H89	4.7K
R0729	0613952J01	10K
R0730	0613952H73	1K
R0731	NOT PLACED	–
R0732	0613958S29	15
R0733	0613958S29	15
R0734	0613958S29	15
R0735	0613959Y49	100
R0736	0613958S29	15
R0737	0613958S29	15
R0738	0613959Y42	51
R0739	0613958S29	15
R0740	0613958J74	0
R0742	0613959Q25	10
R0745	0613952H65	470
R0746	0613952R66	0
R0747	0613952H49	100
R0748	0613952J19	56K
R0749	0613952G67	0
R0750	0613952J07	18K
R0751	0613952J11	27K
R0752	0613952G67	0
R0753	0613952H73	1K
R0754	0613952H35	27
R0755	0613952H35	27
R0756	0613952J25	100K
R0757	0613952J17	47K
R0760	0613952J01	10K
R0761	0613952G67	0
R0773	0613952J21	68K
R0775	NOT PLACED	–
R0777	0613952J25	100K
R0779	0613952G67	0
R0780	0613952G67	0
R0781	0613958S73	1K
R0900	0613952R19	56K
R0901	0613952R16	43K
R0902	0613952Q88	4.3K
R0903	0613952R09	22K
R0906	0613952R66	0
R0907	0613952R66	0
R0909	0613952R16	43K
R0910	0613952H73	1K
R0911	0613952Q89	4.7K
R0912	0613952R11	27K
R0913	0613952R66	0

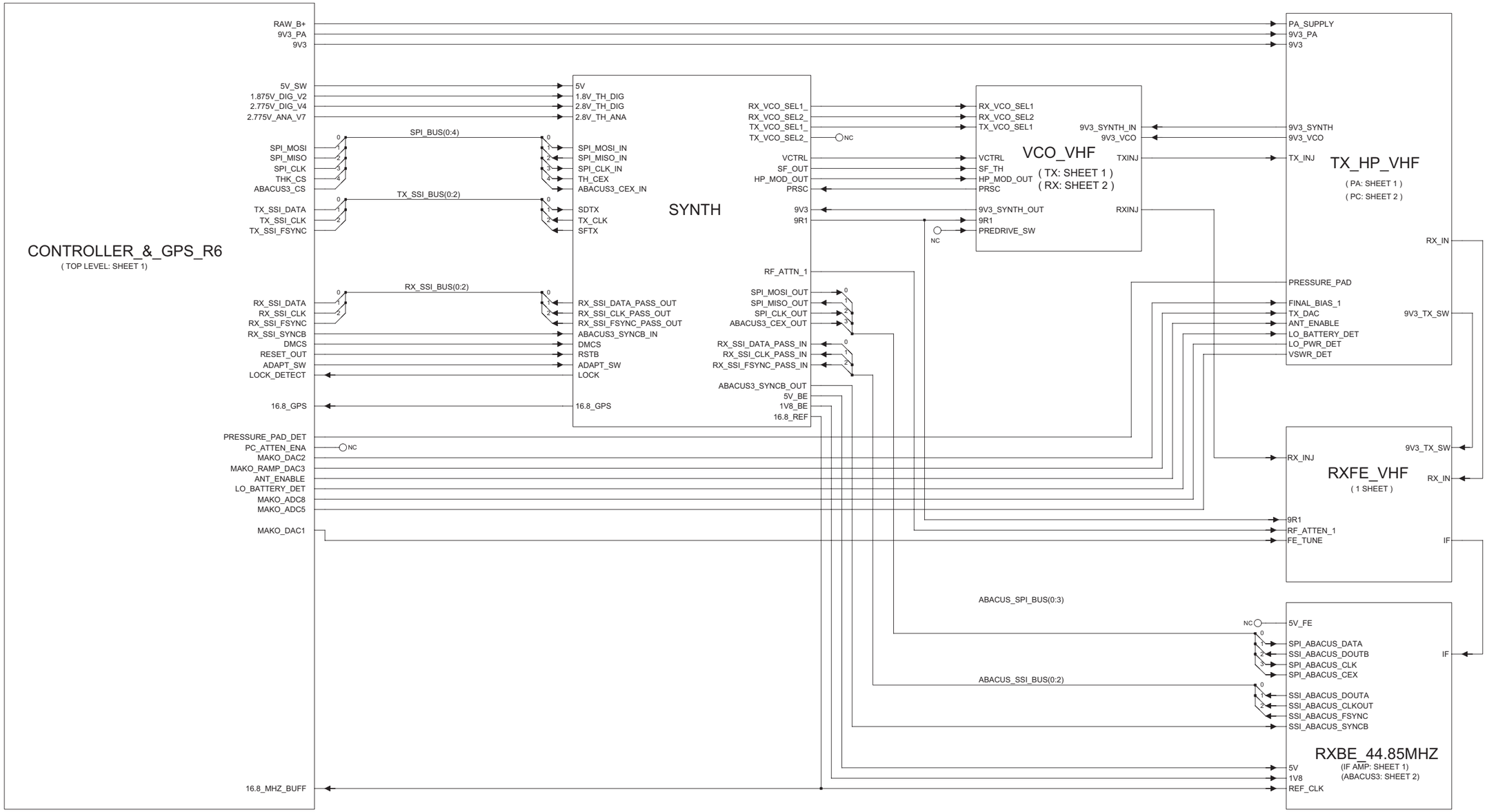
Circuit Ref	Motorola Part No.	Description
R0914	0613952R37	330K
R0915	0613952R22	75K
R0916	0613952Q49	100
R0917	0613952H91	5.6K
R0918	0613952H63	390
R0919	0613952R15	39K
R0920	0613952R13	33K
R0921	0613952H81	2.2K
R0922	0613952R14	36K
R0923	0613952R66	0
R0924	0613952H91	5.6K
R0925	0613952H91	5.6K
R0926	0613958H53	150
R0927	0613952H42	51
R0928	0613958H39	39
R0929	0613958H39	39
R0930	0613952R07	18K
R0936	0613952N66	47.5K
R0937	0613952N21	16.2K
R0938	0613952R66	0
R0940	0613952R66	0
R0941	0613952R66	0
R0942	0613952M81	6.81K
R0943	0613952N58	39.2K
R0944	0613952R66	0
R0946	0613952M51	3.32K
R0947	0613952R66	0
R0950	0613952N01	10K
R0951	0613952N62	43.2K
R0954	0613952R40	430K
R0955	0613952P01	100K
R0960	0613952H82	2.4K
R0970	0613959Y49	100
R0972	0613952G67	0
R0973	0613952G67	0
R0975	0613959Y47	82
R0976	0613952H39	39
R0977	0613952H39	39
R0978	0613952G67	0
R0979	0613952G67	0
RT0908	0615585H01	THERMISTOR, 47K
RT0953	0615585H01	THERMISTOR, 47K
SH0100	2615362H01	SHIELD
SH0101	2615362H01	SHIELD
SH0200	2615362H01	SHIELD
SH0300	2615362H01	SHIELD
SH0500	2615576H01	SHIELD
SH0900	2686423Z02	SHIELD
SH0901	2686425Z02	SHIELD
SP0701	1015349H01	SOLDER_PREFORM
SP0702	1015349H01	SOLDER_PREFORM
SP0703	1015349H01	SOLDER_PREFORM
SP0704	1015349H01	SOLDER_PREFORM
SP0705	1015349H01	SOLDER_PREFORM
SP0706	1015349H01	SOLDER_PREFORM
SP0707	1015349H01	SOLDER_PREFORM
SP0708	1015349H01	SOLDER_PREFORM
T0400	2515121H01	BALUN XFMR
T0401	2515121H01	BALUN XFMR
U0100	5104932K08	IC, FRACN SYNTHESIZER
U0101	5114000B59	ANALOG SWITCH
U0201	4815267H01	DUAL PNP
U0303	4815272H01	ANALOG SWITCH
U0304	4815267H01	DUAL PNP
U0305	4815267H01	DUAL PNP
U0600	5102495J14	IC, RF ASIC
U0601	5115391H01	VOLTAGE REGULATOR
U0700	4802246J29	PA PRE-DRIVER
U0900	5115147H01	DUAL OPAMP
U0901	5115147H01	DUAL OPAMP
U0940	5180390L83	IC, PA CONTROLLER
U0941	5115391H01	VOLTAGE REGULATOR
U0942	5114004A35	VOLTAGE DETECTOR
VR0700	4813977M11	DIODE, 5.6V ZENER
Y0100	5116032H01	0.5PPM 16.8MHZ TCXO (GPS Models only)

3.0 VHF (136–174 MHz) 25–45W PCB / Schematics / Parts List

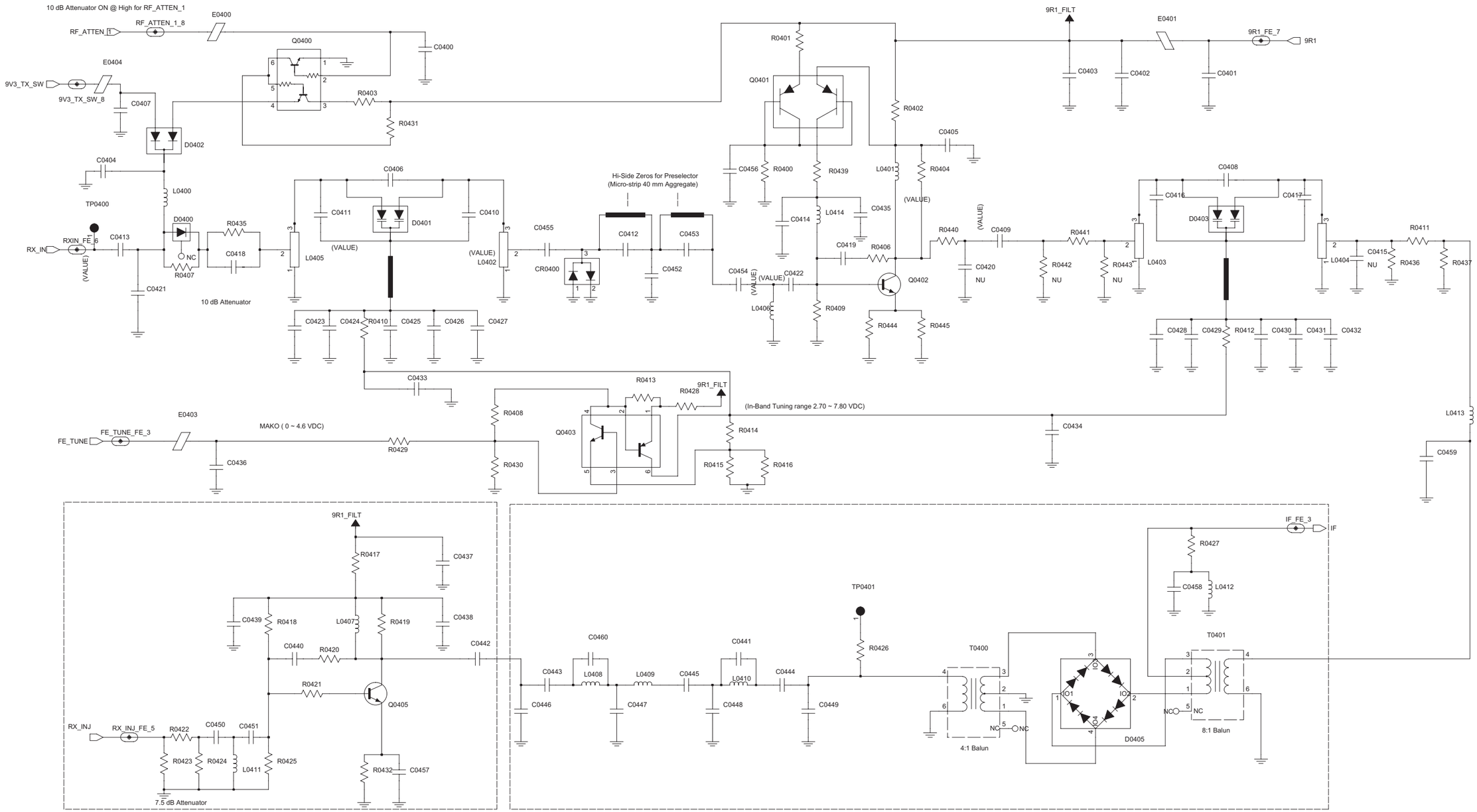




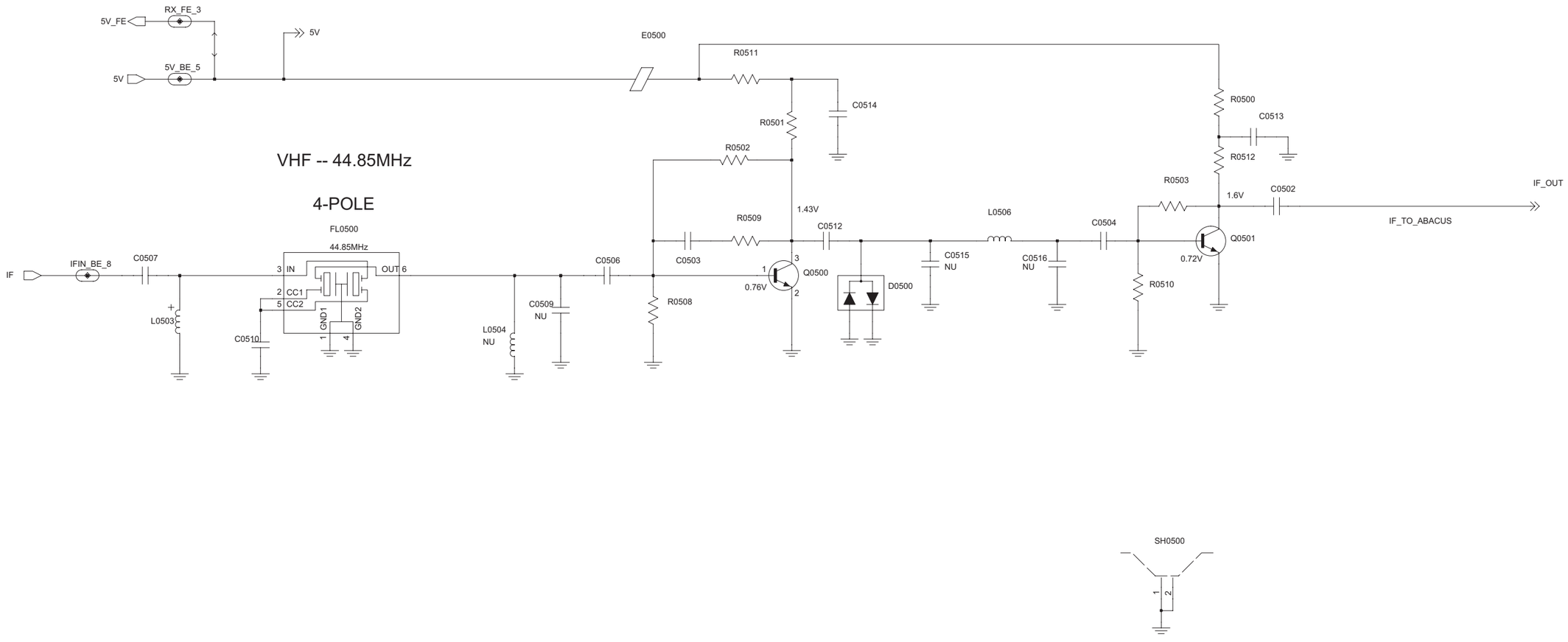
VHF (136–174 MHz) 25–45W 8478023A17 Bottom Side



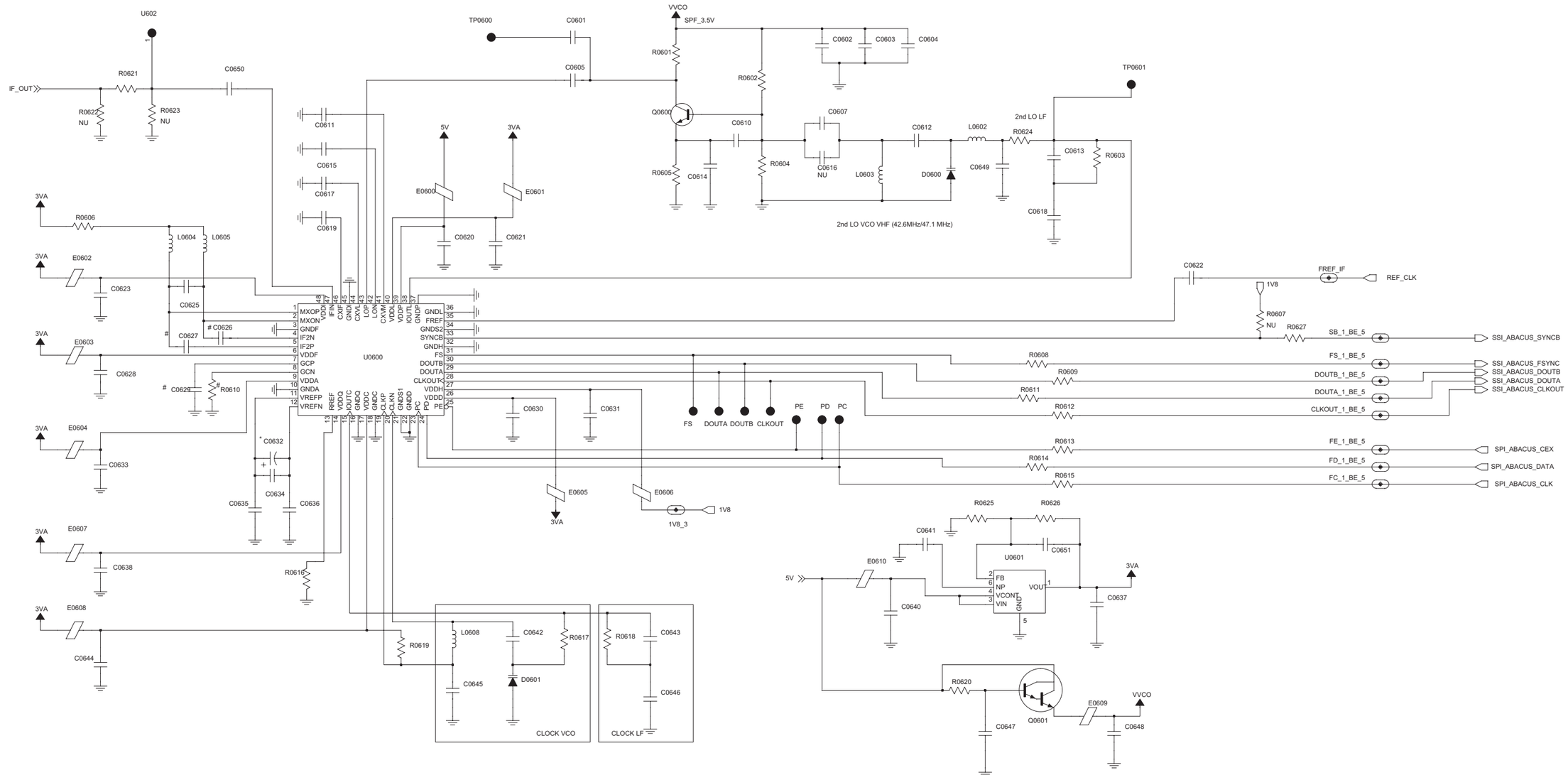
VHF (136–174 MHz) 25–45W Overall Schematic Diagram



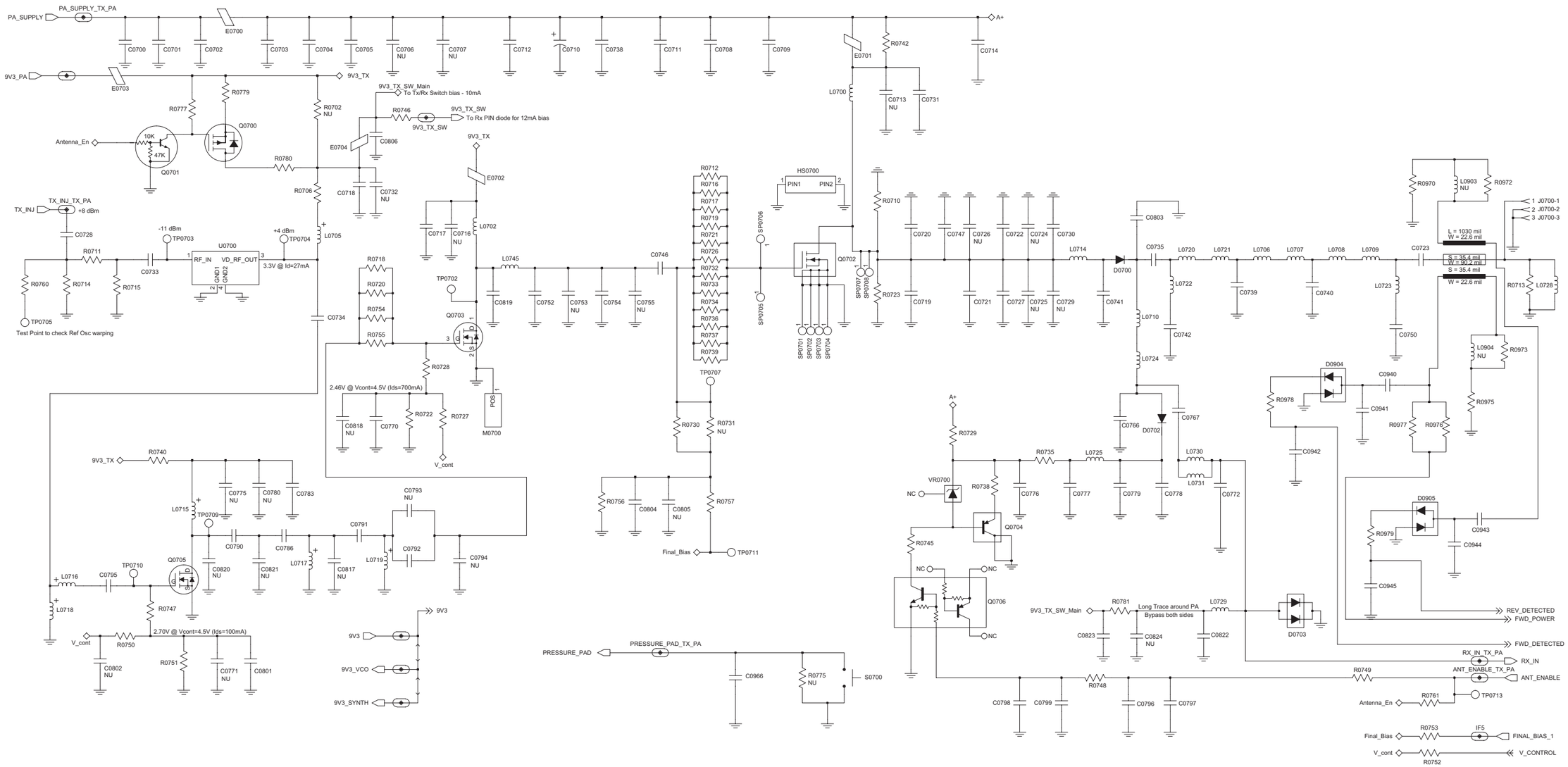
VHF (136–174 MHz) 25–45W Receiver Front-End Schematic Diagram



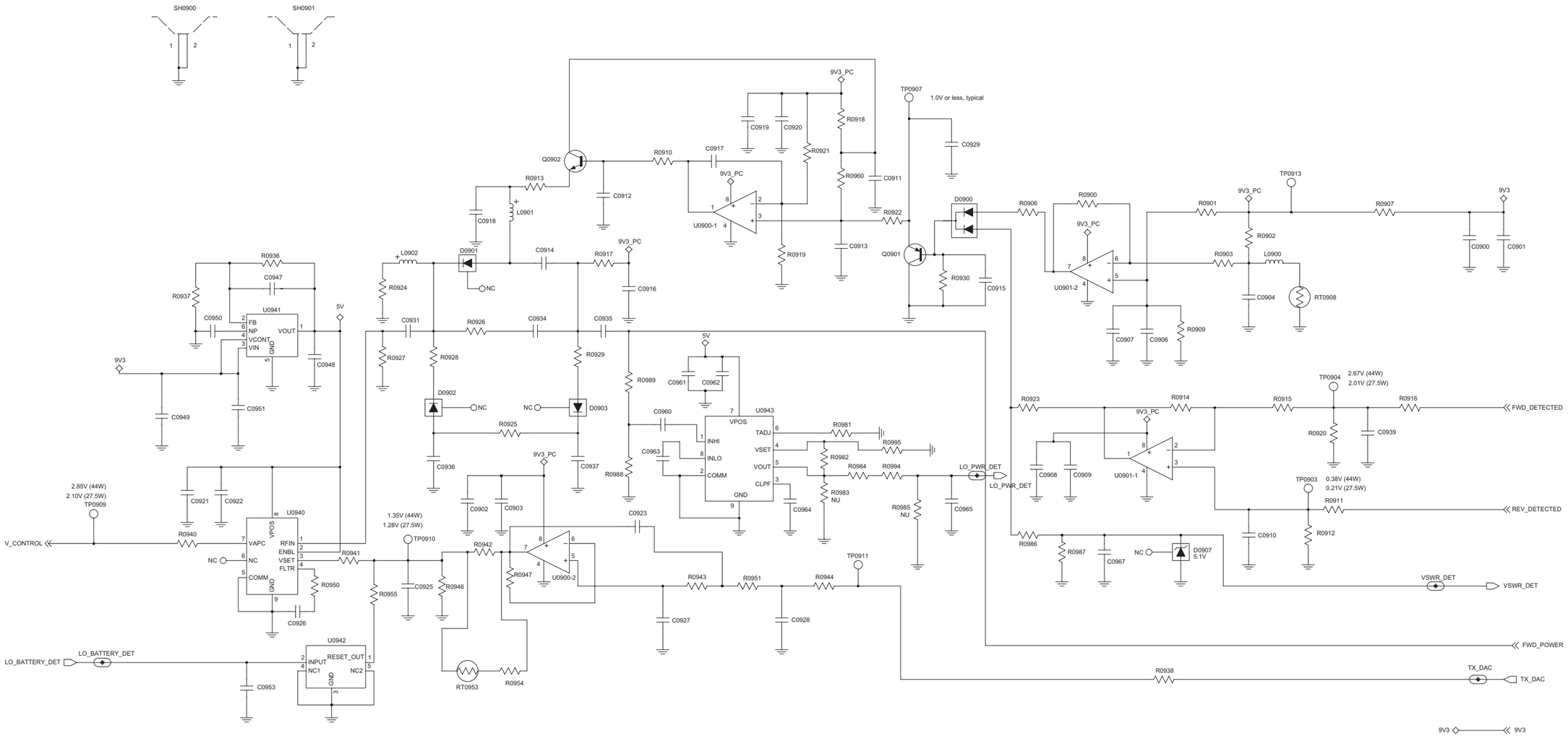
VHF (136–174 MHz) 25–45W Receiver IF Amp Schematic Diagram



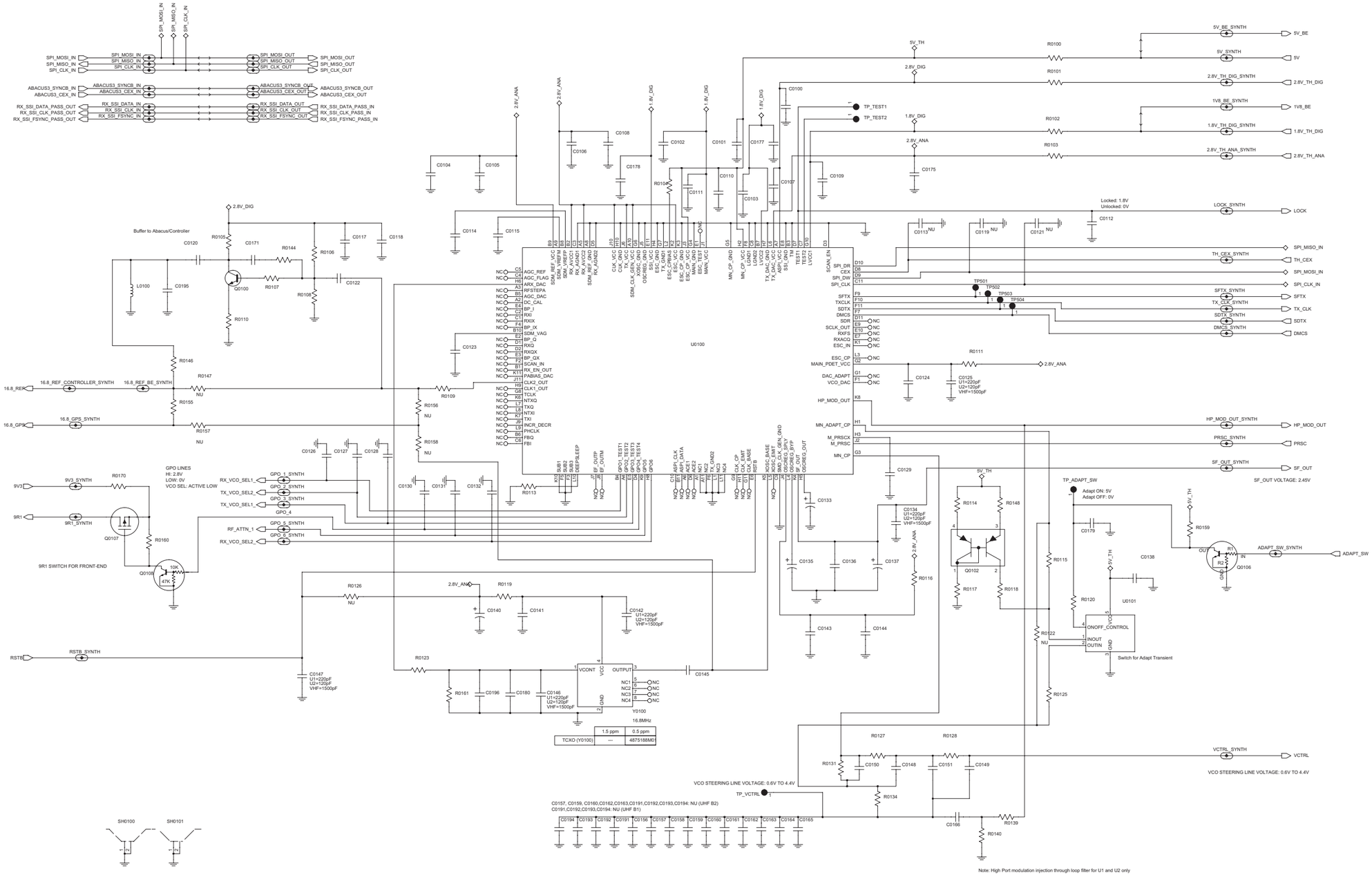
VHF (136–174 MHz) 25–45W Receiver Back-End Schematic Diagram



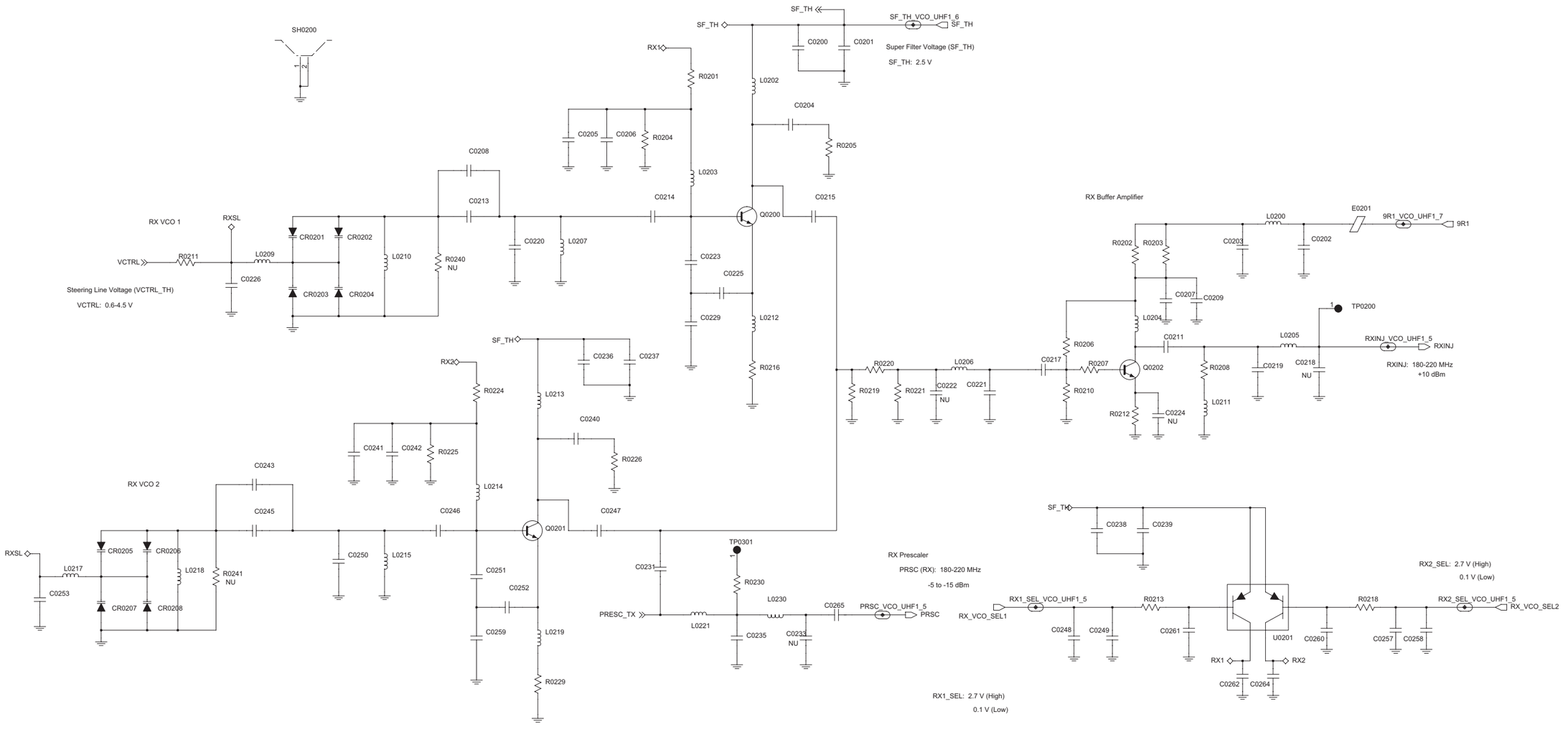
VHF (136–174 MHz) 25–45W Power Amplifier Schematic Diagram



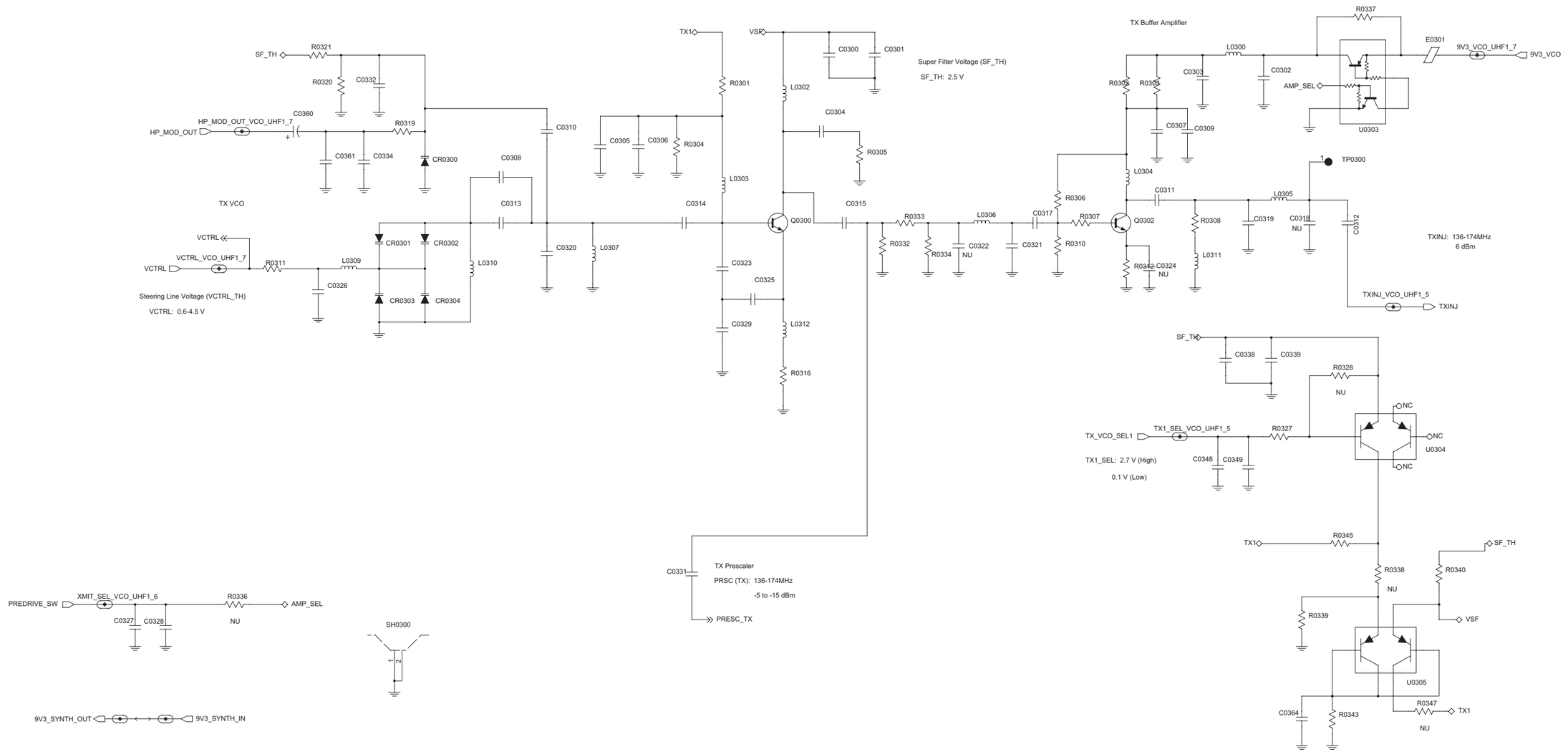
VHF (136–174 MHz) 25–45W Power Control Schematic Diagram



VHF (136–174 MHz) 25–45W Synthesizer Schematic Diagram



VHF (136–174 MHz) 25–45W Receiver VCO Schematic Diagram



VHF (136–174 MHz) 25–45W Transmit VCO Schematic Diagram

VHF PCB 8478023A17 Parts List 25–45W

Circuit Ref	Motorola Part No.	Description
C0100	2113945A10	1500pF
C0101	2113945A10	1500pF
C0102	2113945A10	1500pF
C0103	2113945C31	0.1uF
C0104	2113945A10	1500pF
C0105	2113945C31	0.1uF
C0106	2113945C31	0.1uF
C0107	2113945C31	0.1uF
C0108	2113945A10	1500pF
C0109	2113945C31	0.1uF
C0110	2113945C31	0.1uF
C0111	2113945C31	0.1uF
C0112	2113945A10	1500pF
C0113	NOT PLACED	–
C0114	2113946E02	1.0uF
C0115	2113946E02	1.0uF
C0117	2113945A10	1500pF
C0118	2113945C31	0.1uF
C0119	NOT PLACED	–
C0120	2113945B02	.01uF
C0121	NOT PLACED	–
C0122	2113945B02	.01uF
C0123	2113946E02	1.0uF
C0124	2113945C31	0.1uF
C0125	2113945A10	1500pF
C0126	2113945A10	1500pF
C0127	2113945A10	1500pF
C0128	2113945A10	1500pF
C0129	2113945C31	0.1uF
C0130	2113945A10	1500pF
C0131	2113945A10	1500pF
C0132	2113945A10	1500pF
C0133	2313960B30	4.7uF
C0134	2113945A10	1500pF
C0135	2313960B32	10uF
C0136	2113945C31	0.1uF
C0137	2313960B32	10uF
C0138	2113945A10	1500pF
C0140	2313960B30	4.7uF
C0141	2113945C31	0.1uF
C0142	2113945A10	1500pF
C0143	2113945A10	1500pF
C0144	2113945C31	0.1uF
C0145	2113945B02	.01uF
C0146	2113945A10	1500pF
C0147	2113945A10	1500pF
C0148	NOT PLACED	–
C0149	2113945C31	0.1uF
C0150	2113945C31	0.1uF
C0151	2113945C31	0.1uF
C0156	2185419D06	0.1uF
C0157	2185419D06	0.1uF
C0158	2185419D06	0.1uF
C0159	2185419D06	0.1uF
C0160	2185419D06	0.1uF
C0161	2185419D06	0.1uF
C0162	2185419D06	0.1uF
C0163	2185419D06	0.1uF
C0164	2185419D06	0.1uF
C0165	2185419D06	0.1uF
C0166	2185419D06	0.1uF
C0171	2113945B02	.01uF
C0175	2113945A10	1500pF
C0177	2113945A10	1500pF
C0178	2113945A10	1500pF
C0179	2113945A10	1500pF
C0180	2113945C31	0.1uF
C0191	2185419D06	0.1uF
C0192	2185419D06	0.1uF
C0193	2185419D06	0.1uF
C0194	2185419D06	0.1uF
C0195	2113945A05	470pF
C0196	2113946H02	10uF
C0200	2113945A10	1500pF
C0201	2113945Y02	0.10uF
C0202	2113945B02	.01uF
C0203	2113945A10	1500pF
C0204	2113945A10	1500pF
C0205	2113945Y02	0.10uF
C0206	2113945A10	1500pF
C0207	2113945A10	1500pF
C0208	2115153H37	15pF
C0209	2113945Y02	0.10uF
C0211	2113945A10	1500pF
C0213	2115153H37	15pF
C0214	2115153H34	11pF
C0215	2115153H22	6.2pF
C0217	2113945A10	1500pF
C0218	NOT PLACED	–
C0219	2115153H25	8.2pF
C0220	2115153H27	10pF
C0221	2115153H35	12pF
C0222	NOT PLACED	–
C0223	2115153H47	39pF
C0224	NOT PLACED	–
C0225	2115153H59	120pF
C0226	2113945A10	1500pF
C0229	2115153H46	36pF
C0231	2115153H17	3.9pF
C0233	NOT PLACED	–
C0235	2115153H37	15pF
C0236	2113945A10	1500pF
C0237	2113945Y02	0.10uF
C0238	2113945A10	1500pF
C0239	2113945Y02	0.10uF
C0240	2113945A10	1500pF
C0241	2113945Y02	0.10uF
C0242	2113945A10	1500pF
C0243	2115153H35	12pF
C0245	2115153H35	12pF
C0246	2115153H27	10pF
C0247	2115153H27	10pF
C0248	2113945A10	1500pF
C0249	2113945Y02	0.10uF
C0250	2115153H34	11pF
C0251	2115153H41	22pF
C0252	2115153H55	82pF
C0253	2113945A10	1500pF
C0257	2113945A10	1500pF
C0258	2113945Y02	0.10uF
C0259	2115153H40	20pF
C0260	2113945A10	1500pF
C0261	2113945A10	1500pF
C0262	2113945A10	1500pF
C0264	2113945A10	1500pF
C0265	2115153H40	20pF
C0300	2113945A10	1500pF
C0301	2113945Y02	0.10uF
C0302	2113945B02	.01uF
C0303	2113945A10	1500pF
C0304	2113945A10	1500pF
C0305	2113945Y02	0.10uF
C0306	2113945A10	1500pF
C0307	2113945B04	.022uF
C0308	2115153H37	15pF
C0309	2113945A10	1500pF
C0310	2115153H03	1.0pF
C0311	2113945A10	1500pF
C0312	2113945A10	1500pF
C0313	2115153H37	15pF
C0314	2115153H37	15pF
C0315	2115153H10	2.0pF
C0317	2113945A10	1500pF
C0318	NOT PLACED	–
C0319	2115153H36	4.3pF
C0320	2115153H20	5.1pF
C0321	2115153H22	6.2pF
C0322	NOT PLACED	–
C0323	2115153H44	30pF
C0324	NOT PLACED	–
C0325	2113944A42	150pF
C0326	2113945A10	1500pF
C0327	2113945A10	1500pF
C0328	2113945Y02	0.10uF
C0329	2115153H43	27pF
C0331	2115153H03	1.0pF
C0332	2115153H12	2.4pF
C0334	2113944A44	220pF
C0338	2113945A10	1500pF
C0339	2113945Y02	0.10uF
C0348	2113945A10	1500pF
C0349	2113945Y02	0.10uF
C0360	2313960B30	4.7uF
C0361	2113945A10	1500pF
C0364	2113946B04	0.1uF
C0400	NOT PLACED	–
C0401	2113945C31	0.1uF
C0402	2113945A10	1500pF
C0403	2115153H50	51pF
C0404	NOT PLACED	–
C0405	2113945A10	1500pF
C0406	2115153H23	6.8pF
C0407	NOT PLACED	–
C0408	2115153H22	6.2pF
C0409	2115153H35	12pF
C0410	2115153H40	20pF
C0411	2115153H40	20pF
C0412	2115153H49	47pF
C0413	2113944A44	220pF
C0414	2113945A10	1500pF
C0415	NOT PLACED	–
C0416	2115153H37	15pF
C0417	2115153H37	15pF
C0418	NOT PLACED	–
C0419	2113945Y02	0.10uF
C0420	NOT PLACED	–
C0421	NOT PLACED	–
C0422	2115153H48	43pF
C0423	2115153H51	56pF
C0424	2115153H48	43pF
C0425	2115153H50	51pF
C0426	2115153H48	43pF
C0427	2115153H50	51pF
C0428	2115153H48	43pF
C0429	2115153H50	51pF
C0430	2115153H48	43pF
C0431	2115153H51	56pF
C0432	2115153H50	51pF
C0433	2113945A10	1500pF
C0434	2113945A10	1500pF
C0435	2113946S35	1.0uF
C0436	2113945A10	1500pF
C0437	2113945A10	1500pF

Circuit Ref	Motorola Part No.	Description
C0438	2113945A10	1500pF
C0439	2113945A10	1500pF
C0440	2113945Y02	0.10uF
C0441	2115153H17	3.9pF
C0442	2115153H39	18pF
C0443	2115153H42	24pF
C0444	2115153H42	24pF
C0445	2115153H44	30pF
C0446	2115153H27	10pF
C0447	2115153H42	24pF
C0448	2115153H41	22pF
C0449	2115153H27	10pF
C0450	2115153H42	24pF
C0451	2115153H50	51pF
C0452	2115153H37	15pF
C0453	2115153H47	39pF
C0454	2113944A84	43pF
C0455	2113944A36	68pF
C0456	2113945A10	1500pF
C0457	2113945A10	1500pF
C0458	2115153H55	82pF
C0459	NOT PLACED	–
C0460	NOT PLACED	–
C0502	2113945Y02	0.10uF
C0503	2113945Y02	0.10uF
C0504	2113945Y02	0.10uF
C0506	2115153H35	12pF
C0507	2115153H40	20pF
C0509	NOT PLACED	–
C0510	2115153H24	7.5pF
C0512	2113945Y02	0.10uF
C0513	2113945Y02	0.10uF
C0514	2113945Y02	0.10uF
C0515	NOT PLACED	–
C0516	NOT PLACED	–
C0601	2115153H48	43pF
C0602	2113945B02	.01uF
C0603	2113944A44	220pF
C0604	2113945Y02	0.10uF
C0605	2115153H48	43pF
C0607	2115153H37	15pF
C0610	2115153H51	56pF
C0611	2113945A09	1000pF
C0612	2115153H39	18pF
C0613	2185419D03	0.01uF
C0614	2115153H41	22pF
C0615	2113945B02	.01uF
C0616	NOT PLACED	–
C0617	2113945Y02	0.10uF
C0618	2115358H25	0.1uF
C0619	2113945Y02	0.10uF
C0620	2113945Y02	0.10uF
C0621	2113945Y02	0.10uF
C0622	2113945A09	1000pF
C0623	2113945Y02	0.10uF
C0625	2113944C89	200pF
C0626	2113944A40	100pF
C0627	2113944A40	100pF
C0628	2113945Y02	0.10uF
C0629	2113945A11	2200pF
C0630	2113945Y02	0.10uF
C0631	2113945Y02	0.10uF
C0632	2313960B30	4.7uF
C0633	2113945Y02	0.10uF
C0634	2113945B02	.01uF
C0635	2113944A40	100pF
C0636	2113944A40	100pF
C0637	2113946S35	1.0uF
C0638	2113945Y02	0.10uF
C0640	2113946N03	2.2uF
C0641	2113945B02	.01uF
C0642	2115153H53	68pF
C0643	2113945Y02	0.10uF
C0644	2113945Y02	0.10uF
C0645	2113945B02	.01uF
C0646	2113946G04	0.68uF
C0647	2113946J03	10.0uF
C0648	2113946J03	10.0uF
C0649	2113945A12	3300pF
C0650	2115153H44	30pF
C0651	2115153H57	100pF
C0700	2113944C36	33pF
C0701	2113945C25	.033uF
C0702	2113944C51	1000pF
C0703	2113944C36	33pF
C0704	2113945C25	.033uF
C0705	2113944C51	1000pF
C0706	NOT PLACED	–
C0707	NOT PLACED	–
C0708	2113944C51	1000pF
C0709	2113945C31	0.1uF
C0710	2371403L02	10uF
C0711	2113945L49	.01uF
C0712	2113944C06	470pF
C0713	NOT PLACED	–
C0714	2111078B59	470pF
C0716	NOT PLACED	–
C0717	2113945A09	1000pF
C0718	2113945A09	1000pF
C0719	2111078B32	39pF
C0720	2111078B32	39pF
C0721	2111078B40	82pF
C0722	2111078B41	91pF
C0723	2111078B59	470pF
C0724	NOT PLACED	–
C0725	NOT PLACED	–
C0726	NOT PLACED	–
C0727	2111078B40	82pF
C0728	2113944C06	470pF
C0729	NOT PLACED	–
C0730	2111078B35	51pF
C0731	2111078B59	470pF
C0732	NOT PLACED	–
C0733	2113944C06	470pF
C0734	2113944C06	470pF
C0735	2111078B46	140pF
C0738	2113955D13	2.2uF
C0739	2111078B34	47pF
C0740	2111078B34	47pF
C0741	2111078B22	22pF
C0742	2185400Y36	12pF
C0746	2111078B59	470pF
C0747	2111078B41	91pF
C0750	2185400Y32	8.2pF
C0752	2111078B55	330pF
C0753	NOT PLACED	–
C0754	2111078B57	390pF
C0755	NOT PLACED	–
C0766	2113944C35	27pF
C0767	2113944C06	470pF
C0770	2113945A10	1500pF
C0771	NOT PLACED	–
C0772	2113944C30	10pF
C0775	NOT PLACED	–
C0776	2113944C51	1000pF
C0777	2113944C51	1000pF
C0778	2111078B47	150pF
C0779	2111078B27	30pF
C0780	NOT PLACED	–
C0783	2113945A10	1500pF
C0786	2113944C06	470pF
C0790	2113944C02	220pF
C0791	2113944C39	56pF
C0792	2113944C06	470pF
C0793	NOT PLACED	–
C0794	NOT PLACED	–
C0795	2113944C06	470pF
C0796	2113944C47	150pF
C0797	2113944C51	1000pF
C0798	2113944C51	1000pF
C0799	2113944C47	150pF
C0801	2113945A10	1500pF
C0802	NOT PLACED	–
C0803	2111078B19	16pF
C0804	2113944C51	1000pF
C0805	NOT PLACED	–
C0806	2113945A10	1500pF
C0817	NOT PLACED	–
C0818	NOT PLACED	–
C0819	2111078B49	180pF
C0820	NOT PLACED	–
C0821	NOT PLACED	–
C0822	2113944C51	1000pF
C0823	2113944C51	1000pF
C0824	NOT PLACED	–
C0900	2113945A10	1500pF
C0901	2113945C31	0.1uF
C0902	2113945C31	0.1uF
C0903	2113945A10	1500pF
C0904	2113945A10	1500pF
C0906	2113945A10	1500pF
C0907	2113945C02	.01uF
C0908	2113945C31	0.1uF
C0909	2113945A10	1500pF
C0910	2113945A10	1500pF
C0911	2113945A10	1500pF
C0912	2113945A10	1500pF
C0913	2113945A10	1500pF
C0914	2113945A10	1500pF
C0915	2113945A10	1500pF
C0916	2113945A10	1500pF
C0917	2113945A09	1000pF
C0918	2113945A10	1500pF
C0919	2113945C31	0.1uF
C0920	2113945A10	1500pF
C0921	2113945C31	0.1uF
C0922	2113945A10	1500pF
C0923	2113944C55	2200pF
C0925	2113945A10	1500pF
C0926	2113945L41	4700pF
C0927	2113944C02	220pF
C0928	2113944C51	1000pF
C0929	2113945A10	1500pF
C0931	2113945A10	1500pF
C0934	2113945A10	1500pF
C0935	2113945A10	1500pF
C0936	2113945A10	1500pF
C0937	2113945A10	1500pF
C0939	2113945A10	1500pF
C0940	2113944C51	1000pF
C0941	2113944M27	24pF
C0942	2113944C51	1000pF
C0943	2113944C51	1000pF
C0944	2113944M19	11pF

Circuit Ref	Motorola Part No.	Description
C0945	2113944C51	1000pF
C0947	2113944A40	100pF
C0948	2113946S35	1.0uF
C0949	2113946G01	2.2uF
C0950	2113945A09	1000pF
C0951	2113945C31	0.1uF
C0953	2113945A10	1500pF
C0960	2113945A14	4700pF
C0961	2113945C31	0.1uF
C0962	2113945A10	1500pF
C0963	2113945A14	4700pF
C0964	2113945A14	4700pF
C0965	2113945A10	1500pF
C0966	2113945A10	1500pF
C0967	2113945A10	1500pF
CR0201	4815096H01	DIODE VARACTOR 1SV305
CR0202	4815096H01	DIODE VARACTOR 1SV305
CR0203	4815096H01	DIODE VARACTOR 1SV305
CR0204	4815096H01	DIODE VARACTOR 1SV305
CR0205	4815096H01	DIODE VARACTOR 1SV305
CR0206	4815096H01	DIODE VARACTOR 1SV305
CR0207	4815096H01	DIODE VARACTOR 1SV305
CR0208	4815096H01	DIODE VARACTOR 1SV305
CR0300	4815096H01	DIODE VARACTOR 1SV305
CR0301	4815096H01	DIODE VARACTOR 1SV305
CR0302	4815059H01	DIODE VARACTOR 1SV325
CR0303	4815059H01	DIODE VARACTOR 1SV325
CR0304	4815096H01	DIODE VARACTOR 1SV305
CR0400	4813974A19	DIODE, SCHOTTKY
D0400	NOT PLACED	–
D0401	4885094Y01	DIODE VARACTOR 1SV228
D0402	NOT PLACED	–
D0403	4885094Y01	DIODE VARACTOR 1SV228
D0405	4815090H01	DIODE, MIXER
D0500	4813974A19	DIODE, SCHOTTKY
D0600	4815096H01	DIODE VARACTOR 1SV305
D0601	4815096H01	DIODE VARACTOR 1SV305
D0700	4802482J02	DIODE, PIN
D0702	4802482J02	DIODE, PIN
D0703	4886622Y06	DIODE, PIN
D0900	4813978C02	DIODE, SWITCHING
D0901	4815023H01	DIODE, PIN
D0902	4815024H01	DIODE, PIN
D0903	4815024H01	DIODE, PIN
D0904	4813974A21	DIODE, SCHOTTKY
D0905	4813974A21	DIODE, SCHOTTKY
D0907	4813977M10	DIODE, 5.1V ZENER
E0201	2480640Z01	FERRITE BEAD
E0301	2480640Z01	FERRITE BEAD
E0400	NOT PLACED	–
E0401	2409134J25	FERRITE BEAD
E0403	2409134J25	FERRITE BEAD
E0404	NOT PLACED	–
E0500	2409134J25	FERRITE BEAD
E0600	2409134J25	FERRITE BEAD
E0601	2409134J25	FERRITE BEAD
E0602	2409134J25	FERRITE BEAD
E0603	2409134J25	FERRITE BEAD
E0604	2409134J25	FERRITE BEAD
E0605	2409134J25	FERRITE BEAD
E0606	2409134J25	FERRITE BEAD
E0607	2409134J25	FERRITE BEAD
E0608	2409134J25	FERRITE BEAD
E0609	2409134J25	FERRITE BEAD
E0610	2480640Z01	FERRITE BEAD
E0700	2485011Y01	FERRITE BEAD
E0701	2485011Y01	FERRITE BEAD
E0702	7671656M01	FERRITE BEAD
E0703	2485011Y01	FERRITE BEAD
E0704	2409134J25	FERRITE BEAD
FL0500	9180022M11	44.85 MHZ CRYSTAL FILTER
HS0700	0104038J81	HEATSINK
J0700	0905901V11	MINI-U RF CONNECTOR
L0100	2414017N29	270nH
L0200	2414017N28	220nH
L0202	2414017K33	680nH
L0203	2415347H01	1000nH
L0204	2414017N28	220nH
L0205	2414017N22	68nH
L0206	2414017N17	27nH
L0207	2416077H12	27nH
L0209	2414017K33	680nH
L0210	2414015B06	150nH
L0211	2414017N28	220nH
L0212	2414017K33	680nH
L0213	2414017K33	680nH
L0214	2414017K33	680nH
L0215	2416077H11	22nH
L0217	2414017K33	680nH
L0218	2414015B08	220nH
L0219	2414017K33	680nH
L0221	2414017N27	180nH
L0230	2414017N27	180nH
L0300	2414017N28	220nH
L0302	2414017K33	680nH
L0303	2414017K33	680nH
L0304	2414017N29	270nH
L0305	2414017N22	68nH
L0306	2414017N27	180nH
L0307	2414015C08	56nH
L0309	2414017K33	680nH
L0310	2414017N23	82nH
L0311	2414017N29	270nH
L0312	2414017K33	680nH
L0400	NOT PLACED	–
L0401	2414032F31	56nH
L0402	NOT PLACED	–
L0403	NOT PLACED	–
L0404	NOT PLACED	–
L0405	NOT PLACED	–
L0406	2414032F29	39nH
L0407	2414032F30	47nH
L0408	2414015B02	68nH
L0409	2414015B02	68nH
L0410	2414015B12	47nH
L0411	2414017N20	47nH
L0412	2414017N26	150nH
L0413	0613958J74	0
L0414	2414017K32	560nH
L0503	2414017K33	680nH
L0504	NOT PLACED	–
L0506	2414032B70	1.5uH
L0602	2414032K29	2.7uH
L0603	2414032D28	270nH
L0604	2466505A01	10uH
L0605	2466505A01	10uH
L0608	2414032B76	4.7uH
L0700	2460592A01	17nH
L0702	2479990G01	33.47nH
L0705	2414017N26	150nH
L0706	2485873L02	25nH
L0707	2485873L01	18nH
L0708	2485873L01	18nH
L0709	2485873L02	25nH
L0710	2485873L02	25nH
L0714	2460592A01	17nH
L0715	2414017N26	150nH
L0716	2414017N11	8.2nH
L0717	2414017N13	12nH
L0718	2414017N22	68nH
L0719	2414017N10	6.8nH
L0720	2485873L01	18nH
L0721	2485873L02	25nH
L0722	2415385H04	17.5nH
L0723	2415385H08	43nH
L0724	2485873L02	25nH
L0725	2414032B69	1.2uH
L0728	2414032B70	1.5uH
L0729	2414032B69	1.2uH
L0730	2414032B53	100nH
L0731	2414032B53	100nH
L0745	2460591A01	4.22nH
L0900	2414032D30	1uH
L0901	2414017K32	560nH
L0902	2414017K32	560nH
L0903	NOT PLACED	–
L0904	NOT PLACED	–
M0700	2686201B02	HEATSINK
Q0100	4802197J95	NPN RF TRANSISTOR
Q0102	4815359H01	DUAL PNP
Q0106	4816134H01	ANALOG SWITCH
Q0107	4813970A59	P-CHANNEL MOSFET
Q0108	4815261H01	ANALOG SWITCH
Q0200	4885061Y01	NPN RF TRANSISTOR
Q0201	4885061Y01	NPN RF TRANSISTOR
Q0202	4802197J95	NPN RF TRANSISTOR
Q0300	4885061Y01	NPN RF TRANSISTOR
Q0302	4802197J95	NPN RF TRANSISTOR
Q0400	NOT PLACED	–
Q0401	4815267H01	DUAL PNP
Q0402	4871127H01	NPN RF TRANSISTOR
Q0403	4815270H01	ANALOG SWITCH
Q0405	4871127H01	NPN RF TRANSISTOR
Q0500	4802197J95	NPN RF TRANSISTOR
Q0501	4802197J95	NPN RF TRANSISTOR
Q0600	4805793Y10	NPN RF TRANSISTOR
Q0601	4813973A04	NPN DARLINGTON
Q0700	4813970A59	P-CHANNEL MOSFET
Q0701	4815261H01	ANALOG SWITCH
Q0702	48012048003	RF POWER AMPLIFIER, LDMOS
Q0703	4816548H01	N_CHANNEL LDMOS DRIVER
Q0704	4813973B02	PNP
Q0705	4816547H01	N-CHANNEL LDMOS PRE-DRIVER
Q0706	4815272H01	ANALOG SWITCH
Q0901	4813973A13	PNP
Q0902	4813973M07	NPN
R0100	0613952R66	0
R0101	0613952R66	0
R0102	0613952R66	0
R0103	0613952R66	0
R0104	0613952R17	47K
R0105	0613952Q58	240
R0106	0613952Q83	2.7K
R0107	0613952Q57	220
R0108	0613952Q80	2K
R0109	0613952R66	0
R0110	0613952Q42	51
R0111	0613952R66	0
R0113	0613952R01	10K
R0114	0613952Q80	2K
R0115	0613952R66	0
R0116	0613952R66	0

Circuit Ref	Motorola Part No.	Description
R0117	0613952R12	30K
R0118	0613952R66	0
R0119	0613952Q35	27
R0120	0613952R01	10K
R0122	NOT PLACED	–
R0123	0613952R19	56K
R0125	0613952R66	0
R0126	NOT PLACED	–
R0127	0613952Q42	51
R0128	0613952Q25	10
R0131	0613952Q53	150
R0134	0613952Q42	51
R0139	NOT PLACED	–
R0140	NOT PLACED	–
R0144	0613952R01	10K
R0146	0613952R66	0
R0147	NOT PLACED	–
R0148	0613952Q60	300
R0155	0613952R66	0
R0156	NOT PLACED	–
R0157	NOT PLACED	–
R0158	NOT PLACED	–
R0159	0613952R01	10K
R0160	0613952R25	100K
R0161	0613952R25	100K
R0170	0613952R66	0
R0201	0613952Q82	2.4K
R0202	0613952Q66	510
R0203	0613952Q66	510
R0204	0613952Q88	4.3K
R0205	0613952Q49	100
R0206	0613952R05	15K
R0207	0613952Q25	10
R0208	0613952Q41	47
R0210	0613952Q89	4.7K
R0211	0613952R66	0
R0212	0613952R66	0
R0213	0613952R01	10K
R0216	0613952Q53	150
R0218	0613952R01	10K
R0219	0613952Q51	120
R0220	0613952Q42	51
R0221	0613952Q51	120
R0224	0613952Q92	6.2K
R0225	0613952Q95	8.2K
R0226	0613952Q49	100
R0229	0613952Q53	150
R0230	0613952Q88	4.3K
R0240	NOT PLACED	–
R0241	NOT PLACED	–
R0301	0613952Q87	3.9K
R0302	0613952Q66	510
R0303	0613952Q66	510
R0304	0613952Q89	4.7K
R0305	0613952Q49	100
R0306	0613952R05	15K
R0307	0613952Q47	82
R0308	0613952Q41	47
R0310	0613952Q89	4.7K
R0311	0613952R66	0
R0312	0613952R66	0
R0316	0613952Q50	110
R0319	0613952R08	20K
R0320	0613952R25	100K
R0321	0613952R01	10K
R0327	0613952R01	10K
R0328	NOT PLACED	–
R0332	0613952Q60	300
R0333	0613952Q31	18
R0334	0613952Q60	300
R0336	NOT PLACED	–
R0337	0613952R66	0
R0338	NOT PLACED	–
R0339	0613952Q95	8.2K
R0340	0613952R66	0
R0343	0613952R16	43K
R0345	0613952R66	0
R0347	NOT PLACED	–
R0400	0613952R05	15K
R0401	0613952Q73	1K
R0402	0613958H33	22
R0403	NOT PLACED	–
R0404	0613952Q83	2.7K
R0406	0613952Q68	620
R0407	0613952R66	0
R0408	0613952R01	10K
R0409	0613952Z43	3K
R0410	0613952R25	100K
R0411	0613952Q28	13
R0412	0613952R25	100K
R0413	0613952Q69	680
R0414	0613952Q69	680
R0415	0613952Q69	680
R0416	0613952Q69	680
R0417	0613958H25	10
R0418	0613952Q80	2K
R0419	0613952Q83	2.7K
R0420	0613952Q83	2.7K
R0421	0613952R66	0
R0422	0613952Q31	18
R0423	0613952Q60	300
R0424	0613952Q60	300
R0425	0613952Q75	1.2K
R0426	0613952R01	10K
R0427	0613952Q42	51
R0428	0613952R66	0
R0429	0613952Q69	680
R0430	0613952R01	10K
R0431	NOT PLACED	–
R0432	0613958H49	100
R0435	0613958T74	0
R0436	0613952Q53	150
R0437	0613952Q53	150
R0439	0613952Z45	3.6K
R0440	0613952Q32	20
R0441	0613952R66	0
R0442	NOT PLACED	–
R0443	NOT PLACED	–
R0444	0613952Q20	6.2
R0445	0613952Q20	6.2
R0500	0613952Q90	5.1K
R0501	0613952Q61	330
R0502	0613952R08	20K
R0503	0613952R12	30K
R0508	0613952R19	56K
R0509	0613952Q89	4.7K
R0510	0613952R12	30K
R0511	0613952Q75	1.2K
R0512	0613952Q42	51
R0601	0613952Q51	120
R0602	0613952R01	10K
R0603	0613952Q80	2K
R0604	0613952R10	24K
R0605	0613952Q61	330
R0606	0613952Q42	51
R0607	NOT PLACED	–
R0608	0613952R66	0
R0609	0613952R66	0
R0610	0613952R66	0
R0611	0613952R66	0
R0612	0613952R66	0
R0613	0613952R66	0
R0614	0613952R66	0
R0615	0613952R66	0
R0616	0613952R25	100K
R0617	0613952R01	10K
R0618	0613952Q63	390
R0619	0613952R01	10K
R0620	0613952Q96	9.1K
R0621	0613952R66	0
R0622	NOT PLACED	–
R0623	NOT PLACED	–
R0624	0613952Q90	5.1K
R0625	0613952N69	51.1K
R0626	0613952N81	68.1K
R0627	0613952R66	0
R0702	NOT PLACED	–
R0706	0613958H53	150
R0710	0613958J49	1MEG
R0711	0613952H57	220
R0712	0613958S29	15
R0713	0613959H12	30K
R0714	0613952H44	62
R0715	0613952H44	62
R0716	0613958S29	15
R0717	0613958S29	15
R0718	0613952H35	27
R0719	0613958S29	15
R0720	0613952H35	27
R0721	0613958S29	15
R0722	0613952J07	18K
R0723	0613958J49	1MEG
R0726	0613958S29	15
R0727	0613952J05	15K
R0728	0613952H89	4.7K
R0729	0613952J01	10K
R0730	0613952H73	1K
R0731	NOT PLACED	–
R0732	0613958S29	15
R0733	0613958S29	15
R0734	0613958S29	15
R0735	0613959Y49	100
R0736	0613958S29	15
R0737	0613958S29	15
R0738	0613959Y42	51
R0739	0613958S29	15
R0740	0613958J74	0
R0742	0613959Q25	10
R0745	0613952H65	470
R0746	0613952R66	0
R0747	0613952H49	100
R0748	0613952J19	56K
R0749	0613952G67	0
R0750	0613952J07	18K
R0751	0613952J11	27K
R0752	0613952G67	0
R0753	0613952H73	1K
R0754	0613952H35	27
R0755	0613952H35	27
R0756	0613952J25	100K
R0757	0613952J17	47K
R0760	0613952J01	10K
R0761	0613952G67	0
R0775	0613952G67	0

Circuit Ref	Motorola Part No.	Description
R0777	0613952J25	100K
R0779	0613952H37	33
R0780	0613952H37	33
R0781	0613958S73	1K
R0900	0613952R19	56K
R0901	0613952R16	43K
R0902	0613952Q87	3.9K
R0903	0613952R09	22K
R0906	0613952R66	0
R0907	0613952R66	0
R0909	0613952R16	43K
R0910	0613952H73	1K
R0911	0613952Q87	3.9K
R0912	0613952R11	27K
R0913	0613952R66	0
R0914	0613952R37	330K
R0915	0613952R22	75K
R0916	0613952Q49	100
R0917	0613952H91	5.6K
R0918	0613952H63	390
R0919	0613952R15	39K
R0920	0613952R13	33K
R0921	0613952H81	2.2K
R0922	0613952R14	36K
R0923	0613952R66	0
R0924	0613952H91	5.6K
R0925	0613952H91	5.6K
R0926	0613958H53	150
R0927	0613952H42	51
R0928	0613958H39	39
R0929	0613958H39	39
R0930	0613952R07	18K
R0936	0613952N66	47.5K
R0937	0613952N21	16.2K
R0938	0613952R66	0
R0940	0613952R66	0
R0941	0613952R66	0
R0942	0613952M81	6.81K
R0943	0613952N58	39.2K
R0944	0613952R66	0
R0946	0613952M51	3.32K
R0947	0613952R66	0
R0950	0613952N01	10K
R0951	0613952N62	43.2K
R0954	0613952R40	430K
R0955	0613952P01	100K
R0960	0613952H82	2.4K
R0970	0613959Y47	82
R0972	0613952H25	10
R0973	0613952G67	0
R0975	0613959Y47	82
R0976	0613952H39	39
R0977	0613952H39	39
R0978	0613952G67	0
R0979	0613952G67	0
R0981	0613952R07	18K
R0982	0613952N24	17.4K
R0983	NOT PLACED	–
R0984	0613952M01	1K 1%
R0985	NOT PLACED	–
R0986	0613952N93	90.9K
R0987	0613952N64	45.3K
R0988	0613952K68	49.9
R0989	0613952H60	300
R0994	0613952R66	0
R0995	0613952N02	10.2K
RT0908	0615585H01	47K
RT0953	0615585H01	47K
SH0100	2615362H01	SHIELD
SH0101	2615362H01	SHIELD
SH0200	2615362H01	SHIELD
SH0300	2615362H01	SHIELD
SH0500	2615576H01	SHIELD
SH0900	2686423Z02	SHIELD
SH0901	2686425Z02	SHIELD
SP0701	1015349H01	SOLDER_PREFORM
SP0702	1015349H01	SOLDER_PREFORM
SP0703	1015349H01	SOLDER_PREFORM
SP0704	1015349H01	SOLDER_PREFORM
SP0705	1015349H01	SOLDER_PREFORM
SP0706	1015349H01	SOLDER_PREFORM
SP0707	1015349H01	SOLDER_PREFORM
SP0708	1015349H01	SOLDER_PREFORM
T0400	2515121H01	BALUN XFMR
T0401	2515121H01	BALUN XFMR
U0100	5104932K08	IC, FRACN SYNTHESIZER
U0101	5114000B59	ANALOG SWITCH
U0201	4815267H01	DUAL PNP
U0303	4815272H01	ANALOG SWITCH
U0304	4815267H01	DUAL PNP
U0305	4815267H01	DUAL PNP
U0600	5102495J14	IC, RF ASIC
U0601	5115391H01	VOLTAGE REGULATOR
U0700	4802246J29	PA PRE-DRIVER
U0900	5115147H01	DUAL OPAMP
U0901	5115147H01	DUAL OPAMP
U0940	5180390L83	IC, PA CONTROLLER
U0941	5115391H01	VOLTAGE REGULATOR
U0942	5114004A35	VOLTAGE DETECTOR
U0943	5178286A01	IC, VOLTAGE DETECTOR
VR0700	4813977M11	DIODE, 5.6V ZENER
Y0100	5116032H01	0.5 PPM 16.8 MHZ TCXO (GPS Models Only)

XPR 8300/XPR 8400 MOTOTRBO Repeater

Chapter 7

UHF1 (403–470 MHz)

1–25W

Service Information

Issue: September, 2010

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Chapter 7 - UHF1 Low Power Service Information

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Section 1

THEORY OF OPERATION

1.0 Introduction

The MOTOTRBO repeater consists of two MOTOTRBO mobile radios; one to act as a receiver, and one to act as a transmitter and controller. Both of these radios contain specialized software that allows them to function together as a repeater. The Repeater also contains a Repeater Indicator board and a Connector board. A block diagram of the repeater is shown in Figure 1-1. The Repeater Indicator board contains the Front-Panel LED circuitry as well as an Ethernet interface. The Connector board is a multifunctional board that is primarily used to pass signals to and from modules inside the chassis to the outside of the chassis.

The Repeater contains the following assemblies and sections:

- Receiver
- Transmitter
- Repeater Indicator Board
- Connector Board
- Fan
- AC/DC PSU

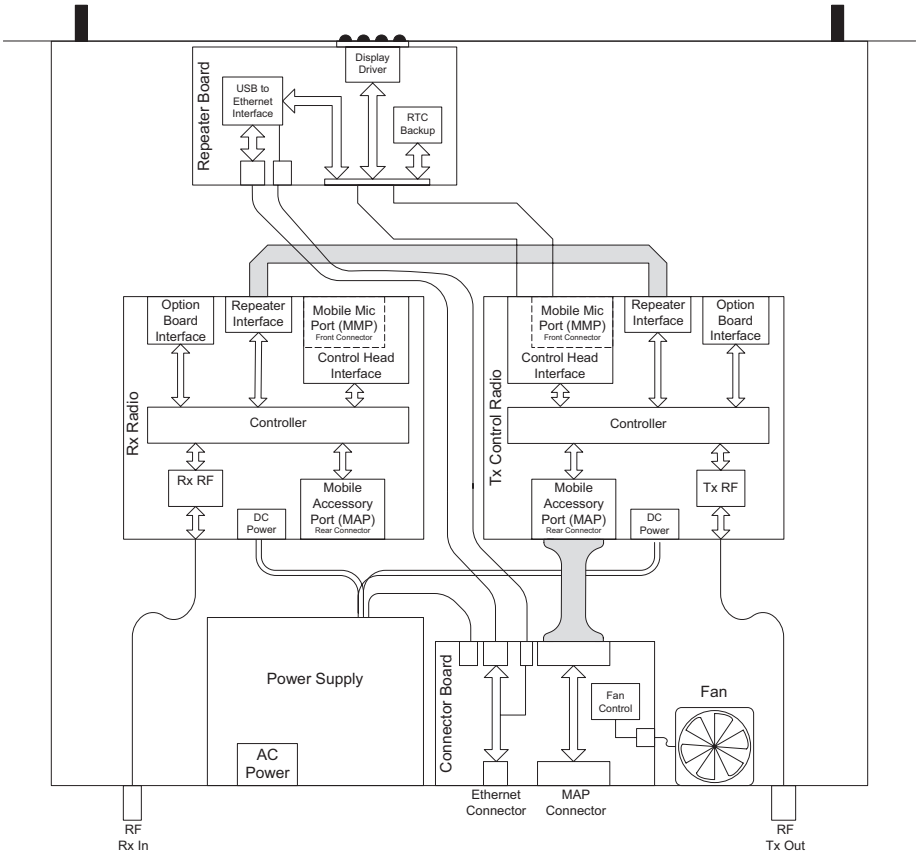


Figure 1-1 Repeater Block Diagram

1.1 Receiver

The receiver uses a transceiver board which is based on the mobile radio's transceiver board. The board uses the same PCB as the mobile radio board, but is populated differently to work in the Repeater application. Only the receiver related functions of the board are utilized in this application, even though the circuitry for transmit also exists on the board.

The Repeater receiver is identical in functionality to the mobile radio's receiver differing only in the audio path. On the mobile radio, the decoded audio is sent to a DAC, and then to the speaker. In the Repeater, this audio information is sent out through the SSI link to the transmit radio to be processed. Details of the receiver theory of operation can be found in Section 3.1.

1.2 Transmitter

The transmitter consists of a transceiver board which is based on the mobile radio's transceiver board housed in a transmit chassis. The transmit radio is identical to the receive board from a hardware standpoint. The difference between the two is the software that is running on them, how they are connected within the Repeater, and an additional heat sink that is mounted to the chassis. The added heatsink and the Repeater fan allow the transmitter to be cooled sufficiently when operating in a 60°C, full-duty cycle environment.

The transmit radio acts as the master controller for the Repeater. It handles all controller related tasks for the Repeater, including management of the receive radio. The transmit radio is responsible for processing the audio sent from the receive radio and repeating it out at the Tx frequency. Details of the transmitter theory of operation can be found in Section 3.2.

1.3 Repeater Indicator Board

The Repeater Indicator board contains circuitry to drive the front panel indicator LEDs, an RTC battery for the RTC in the transmit radio, as well as an Ethernet controller.

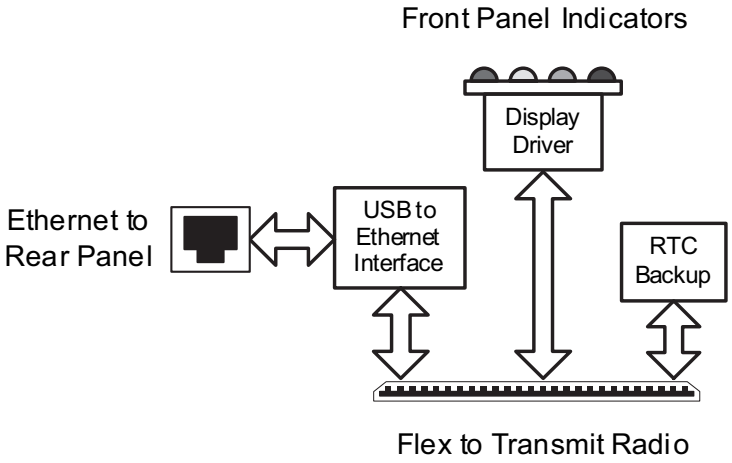


Figure 1-2 Repeater Indicator Board Block Diagram

All of the indicator LEDs that are on the front of the Repeater chassis reside on the Repeater Indicator board. Each is controlled by a shift register (U6) data out signal and a digital transistor. The shift register accepts serial data in from the transmit radio's OMAP processor via a SPI bus. A 74LVC07 buffer (U9) level shifts these signals from 3.3 V to 1.8 V.

The Repeater Disable LED is a dual-purpose LED that is hardware controlled initially at power-up. As soon as VBUS power is available on the Repeater Indicator board, the hardware circuitry for the Repeater Disable LED will cause it to blink periodically. When the software initialization is completed by the firmware, the blink circuitry will get disabled by the firmware. At that point, the Repeater Disable LED can be used for its intended purpose of displaying when the Repeater Disable function is turned on.

The power LED is the only LED that is not controlled by the software. This bi-color LED gets turned on green when the 13.8 V output from the power supply is valid. It turns on red when A/C power is lost, and the repeater's backup battery is used.

The Real Time Clock (RTC) battery (M1) is connected to the transmit radio through the Control Head (J1, pin 30).

Details of the Ethernet Controller can be found in Chapter 2.

1.4 Connector Board

The Connector board has two purposes: provide a place for the Repeater's MAP and Ethernet connectors to be mounted and a location for the Repeater's fan control circuitry.

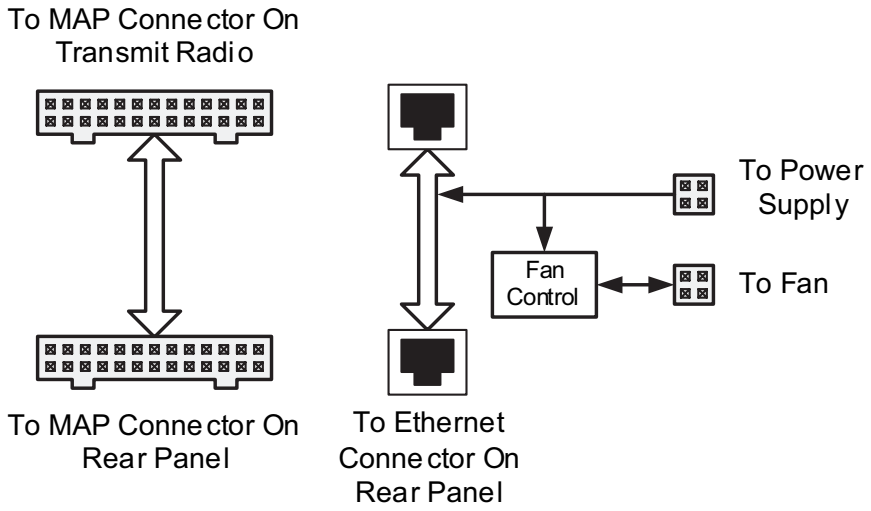


Figure 1-3 Connector Board Block Diagram

1.5 Fan

The fan control logic is provided by the fan controller IC (U51). This is a device from Cypress Semiconductor. There are basically two functions provided by the fan controller. First, it provides a PWM output based on a temperature input, and secondly, it provides detection of fan failure based on the fan tachometer reading.

The Repeater's internal chassis temperature is measured with an LM50 precision temperature sensor IC (U52). This IC outputs a voltage that is linearly proportional to temperature at 10 mV/°C, and with an offset of +500 mV. The output voltage of the LM50 ranges from +200 mV at -30°C to 1.1 V at +60°C.

The fan controller IC (U51) controls the speed of the fan by adjusting the PWM output (pin 1) from 0% to 100%. As long as the fan continues to work, pulses are output from the fan and input to the fan controller (pin 2).

1.6 AC/DC Power Supply

The Repeater uses the PMPN4001A switch-mode, Power Supply Unit (PSU). It is capable of 200 W and designed for a 50 W UHF or VHF repeater system. This supply has UL, CE, and TUV regulatory approvals and is usable in all regions by using the correct line cord. The AC input is auto-ranging with no manual switch being specified to operate from 90 V-270 V and 47 Hz-63 Hz. It outputs a nominal voltage of 13.8 V with a voltage tolerance of +/- 5%.

It has Power Factor Correction circuitry and is rated at 15 A across the whole operating temperature range of -30°C to +60°C. It also has a built-in battery revert circuit with a float output available for maintaining the charge on a battery and has UL, CE, & TUV approvals. The battery revert connector is accessible in the back of the power supply.

The supply has over-load, over-voltage, and over-temperature protection. In an overload condition, the PSU goes into a hiccup mode where it recovers automatically after the fault condition is removed. During an over-voltage condition, the PSU shuts down, and will have to be re-powered on to recover. In an over-temperature condition, the PSU also shuts down but will recover after the temperature goes down.

The PSU is not designed to be field serviceable. If it is determined that the PSU is not functioning, the whole unit needs to be replaced.

2.0 Repeater Interconnections and Cables

Figure 1-4 shows the Cable interconnections inside the Repeater.

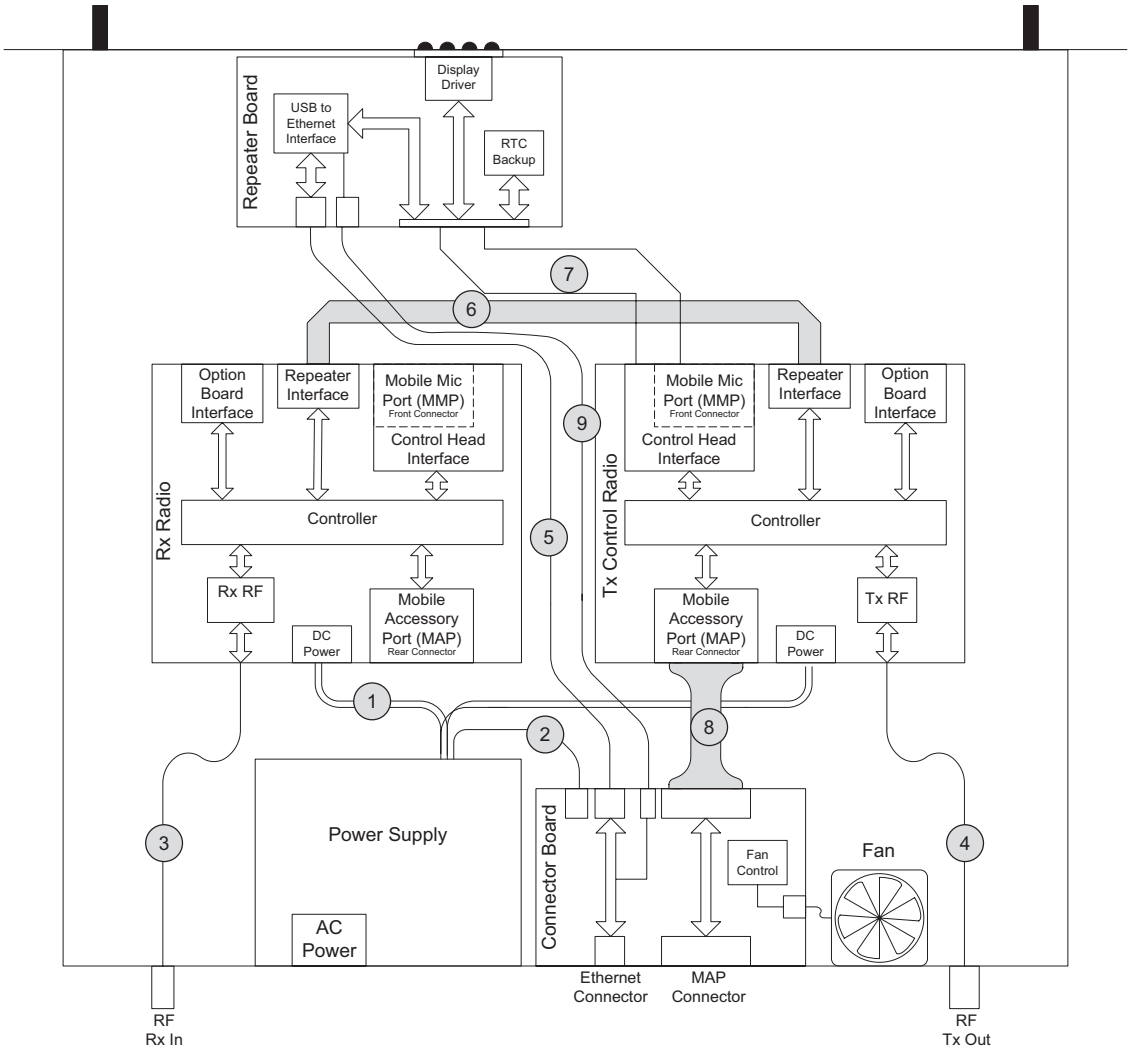


Figure 1-4 Repeater Cabling Diagram

The details of each of these cables/interconnections are as follows:

1. Two conductor DC power cables to the transmit and receive radios.
2. Six conductor DC power cable to the connector Board. Supplies power for the fan and Repeater Indicator board via cable 6.
3. RF Coax to connect the receive radio to the back of the Repeater. This cable has a BNC connector on the Repeater's rear panel.
4. RF Coax to connect the transmit radio to the back of the Repeater. This cable has an N type connector on the Repeater's rear panel.
5. CAT5 cable with RJ45 style connectors on both ends. This cable connects the Ethernet controller on the Repeater Indicator board to the Repeater's back panel and provides power from the Connector Board to the Repeater Indicator board for the LED indicators.

6. Eleven conductor flex cable. Provides the SSI connection between the transmit and receive radios. Refer to Section 1.5 for more details on this interface.
7. Thirty conductor flex cable. Provides the connection from the transmit radio to the Repeater Indicator board and includes SPI signals to drive the LED indicators, RTC backup supply, and the interface to the Ethernet controller.
8. Twenty six conductor cable. Provides the connection from the transmit radio's MAP to the MAP located on the Repeater's rear panel.
9. Eight pin conductor cable. Provides Ethernet LED signals from Repeater Board and HWID signals from Connector Board (Applicable for 32 MB repeaters only).

3.0 Mobile Radio's Theory of Operation

The sections that follow provide a detailed theory of operation for the UHF circuits in the two MOTOTRBO mobile radios. For details of the theory of operation and troubleshooting for the associated Controller circuits, refer to the Controller Section of this manual.

3.1 UHF1 (403–470 MHz) Receiver Circuitry

The receiver is configured as a dual-conversion superheterodyne receiver, capable of both FM and 4-level FSK demodulation. The major blocks are the front-end, the mixer, Xtal filter, and the Abacus III back-end IC. The overall block diagram is shown in Figure 1-5.

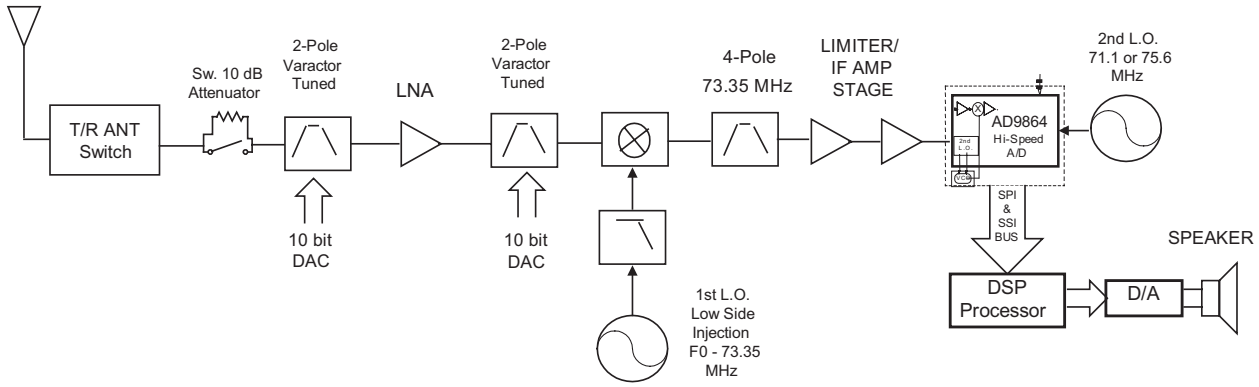


Figure 1-5 Receiver Block Diagram

3.1.1 Receiver Front-End

The front-end consists of a 2-pole varactor-tuned pre-selector filter, an LNA, a 2-pole varactor-tuned post-selector filter, and a passive double-balanced mixer. The received signal applied to the antenna is routed through the harmonic filter and PIN diode controlled antenna switch (D0702). A logic high level on ANT_ENABLE configures the antenna switch for Tx operation while a logic low places the switch in Rx mode. The insertion loss of the harmonic filter and antenna switch combined is approximately 0.5 dB max in Rx mode. From this point, the Rx signal is routed to the Local Distance switch (D0400/R0407), which biases on a diode in normal operation to minimize any insertion loss. Under strong signal conditions and for improved intermodulation protection from interfering signals, the switch can be turned on by the signal RF_ATTEN_1 which introduces approximately 10 dB of additional path loss. Activation of the switch can be accomplished manually by the user or left in the default setting.

The signal next reaches the pre-selector filter, which is a 2-pole, varactor-tuned filter with 5 zeros that are optimized to provide image frequency rejection. This filter, along with the similarly designed post-selector filter, provides over 75 dB of image response rejection. The 3 dB bandwidth for both filters varies across the band with a minimum of 19 MHz at 403 MHz and a maximum of 40 MHz around 436 MHz. Half-IF rejection from the filters is also frequency dependent with a minimum of approximately 10 dB achieved at the worst-case frequency of 436 MHz. Both filters have variable center frequencies that are adjusted by the FE_TUNE signal, which is derived from the output of a 10-bit DAC internal to the MAKO IC (U3200). The voltage is scaled up by a voltage doubler (Q0403) in order to provide the required linearity for the filters. Both filters are matched to the LNA (Q0402) to optimize the amplifier's noise figure (2.0 dB) and to provide an LNA gain of 15 dB to the signal. The combined gain of the filters and LNA is about 13 dB. Current source Q0401 maintains the collector current of Q0402 constant at 20 mA. The LNA, current source, Local Distance switch, and voltage doubler are all supplied by 9R1_FILT, which is derived from 9R1 after filtering.

Following the post-selector filter is the Class 2, double-balanced mixer. It is comprised of baluns T0400 and T0401 and diode ring mixer D0405. Injection amplifier Q0405 provides 10 dB of gain to the Rx VCO injection signal. Another amplifier, Q0202, located in the VCO block, also provides gain for the LO signal and isolation from high RF signals entering the mixer. The signal applied to the LO port of the mixer is +16 dBm minimum after passing through the 3-pole/1-zero, low-pass injection filter. The LO injection is low-side and mixes the signal down to an IF frequency of 73.35 MHz. The output of the mixer is connected to a diplexer network, which terminates out-of-band frequencies in 51 ohms (R0427) while appearing as high impedance to the 73.35 MHz IF signal.

3.1.2 Receiver Back-End

The signal entering the back-end is matched to 4-pole crystal filter, FL0500, by C0507 and L0503. The filter is centered at 73.35 MHz with a 3 dB bandwidth of 12 kHz. IF amplifiers Q0500 and Q0501 follow the crystal filter and provide both amplification and limiting to the signal. An overall gain of 25 dB is available from the composite IF amplifier to lower-level IF signals. As the signal level increases, Q0501 begins to limit and eventually saturates out at approximately –16 dBm. The purpose of the limiting is to provide protection to the AD9864 Abacus III back-end IC (U0600). At IF levels exceeding –32 dBm into U0600, the 2nd LO synthesizer internal to U0600 can be pulled, causing corruption of the I/Q data being delivered to the DSP. The block diagram for the AD9864 is shown in Figure 1-6 below.

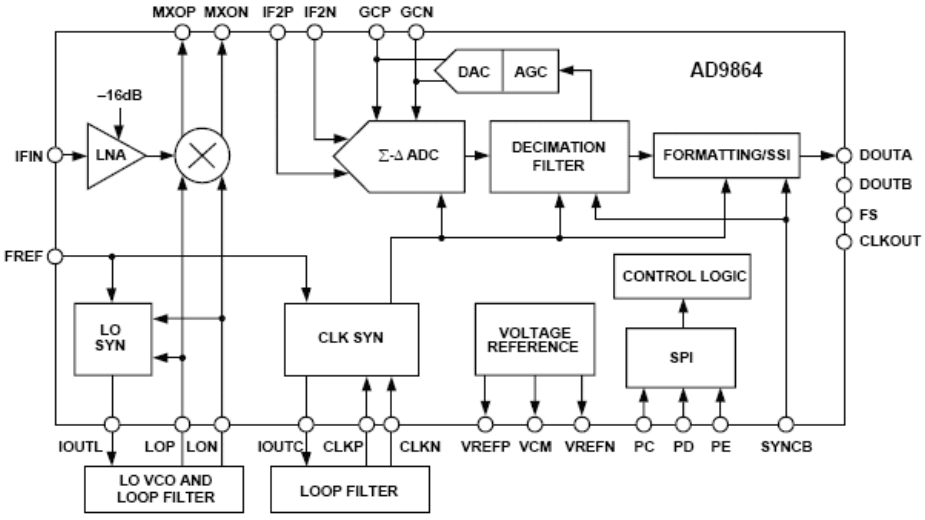


Figure 1-6 AD9864 Block Diagram

The Abacus III accepts the 73.35 MHz signal, processes it, and sends out I/Q data in 16-bit format to the DSP at a 20 kHz rate. Internal to the Abacus III is an LNA and 16 dB FE attenuator, an internal integer-N synthesizer used to control the external 2nd LO VCO, a Sigma-Delta ADC and decimation filter, and control and formatting logic for outputting the baseband I/Q data. External to U0600 is the 2nd LO VCO with active device Q0600 and its associated circuitry including the loop filter consisting of C0613, C0618, and R0603. The 2nd LO mixes the 73.35 MHz IF signal down to 2.25 MHz before being input to the ADC where it is sampled. The tank circuit (L0608, C0605, C0642, R0617) and varactor (D0601) for the internal clock synthesizer, work with the loop filter (R0618, C0643, C0646) to provide the 18 MHz clocking signal to the internal ADC, decimation filter, and SSI formatting circuitry. A 3 Volt regulator (U0601) provides a clean supply to U0600. Transistor Q0601 is configured as a super filter to provide the 2nd LO transistor with a low-noise supply. The reference clock for U0600 is 16.8_REF, which is a buffered (Q0100) 16.8 MHz clock from the synthesizer block.

Shown below in Figure 1-7 is a simplified block diagram of the signal flow through the receiver back-end and the DSP processor portion of the OMAP (U1000). All of the blocks within the dotted box represent the DSP software algorithms internal to the DSP.

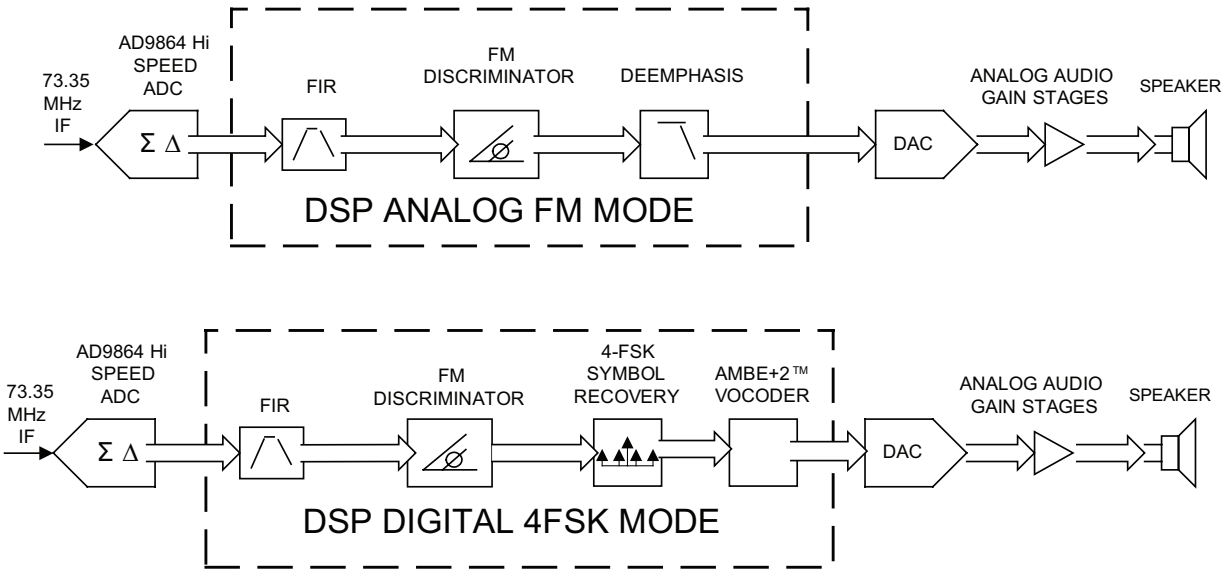


Figure 1-7 Signal Flow through Receiver Back-End

The DSP takes the incoming 20 kHz data stream and passes the information through an FIR (Finite Impulse Response) filter, which provides rejection from any in-band adjacent channel interference. The remaining filter data is then sent through a decimation process further reducing its frequency to 8 kHz.

Depending on whether the repeater is in Analog or Digital mode determines the type of signal processing used. If in Analog mode, the remaining 8 kHz data is sent through the FM Discriminator and De-emphasis subroutines in the DSP code. If the repeater is in Digital mode, the 8 kHz data is again passed through the FM Discriminator but an additional Symbol Recovery routine is applied along with a standard AMBE+2™ Vocoder process. The data is sent to the MAKO (U3200), which provides digital to analog conversion and drives the audio gain stages. Detailed information regarding this can be found in the Audio Section of the Controller Theory of Operation.

3.2 UHF1 (403–470 MHz) Transmitter Circuitry - 25 Watt

The Transmitter consists of the power amplifier (PA) circuitry and the power control circuitry. The power amplifier provides amplification of the signal from the VCO up to the desired output power. The power control block is responsible for ensuring the desired output power level is maintained in both analog and digital modes, as well as protecting the power amplifier from damage due to heat, antenna mismatch, out-of-range battery voltage, and poor assembly.

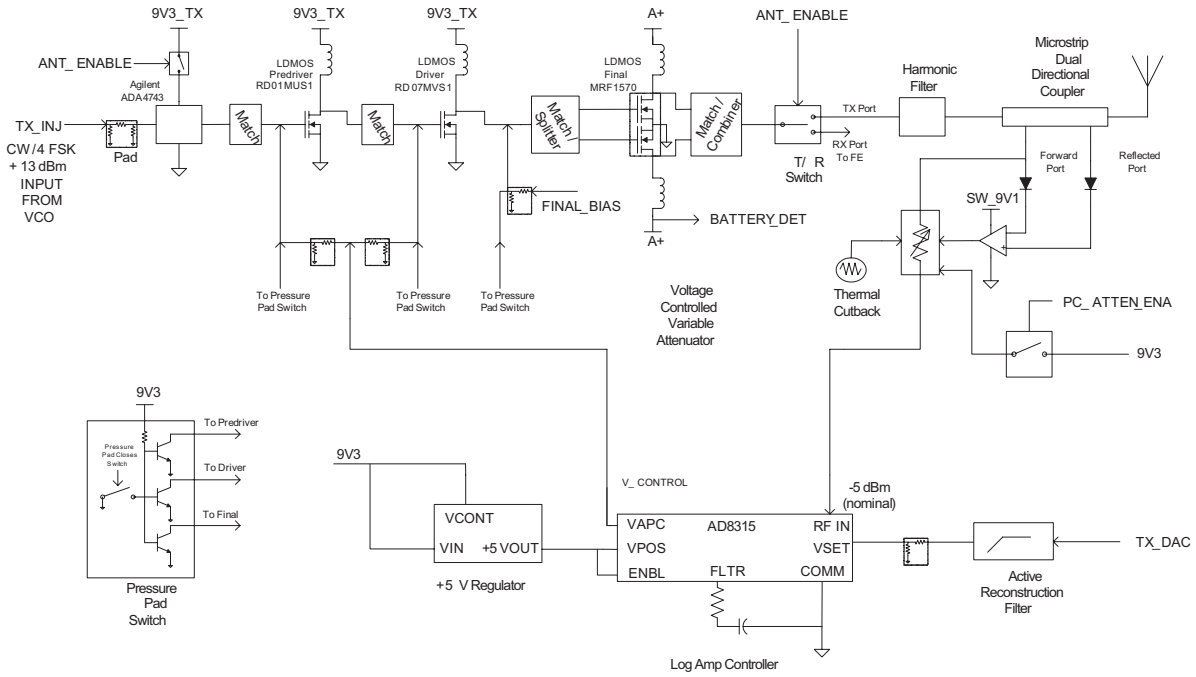


Figure 1-8 UHF 25 Watt Low-Power Transmitter Detailed Block Diagram

3.2.1 Power Amplifier

The radio's 25 Watt power amplifier (PA) is a 4-stage amplifier which amplifies the output of the VCO to the required transmit power level. The first stage is an LDMOS (Lateral Double Diffuse MOS) 50 ohm fixed-gain block (ADA-4743, U0700) followed by the adjustable gain LDMOS pre-driver (RD01MUS1, Q0705), an adjustable gain LDMOS driver (RD07MVS1, Q0703), and the fixed-gain LDMOS final device (MRF1570, Q0702). A transmit/receive (T/R) switch and a harmonic filter complete the transmit lineup.

3.2.2 Input Stage (50 Ohm Fixed-Gain Block)

The first stage (ADA-4743, U0700) is an integrated circuit with internally matched 50 ohm input and output stages providing approximately 16.5 dB power gain. It provides reverse isolation between the PA and the VCO to lessen the risk of VCO load-pull and it also supplies appropriate power to the pre-driver stage. The ADA-4743 is biased at 60 mA during transmit by R0706, which is switched to 9V3_TX during TX operation by Q0701 (controlled by Antenna_En). The ADA-4743 is preceded by an 16 dB resistive pad to further improve reverse isolation.

3.2.3 Pre-Driver Stage

The next stage is a low-power, LDMOS device (RD01MUS1, Q0705), which delivers up to +27 dBm to the driver stage. Its gain is controlled by varying the gate bias voltage and varies from low gain up to approximately 14 dB power gain. The gate bias voltage is controlled in parallel with the driver stage by the V_cont signal.

The input match to this stage is a high-pass topology comprising of L0718, C0817, and L0721. High-pass matches are used where appropriate to minimize the chances of low frequency regeneration within the amplifier. R0759 and R0777 are required to improve the bandwidth of this circuit. The inter-stage match between the pre-driver and driver stages is comprised of L0720, C0786, and C0791 arranged in a high-pass topology. Additional pads are provided on the transceiver board to allow for possible engineering optimizations to this match. These are non-populated parts C0789, C0792, C0793, and C0794.

3.2.4 Driver Stage

The third stage is a medium-power, LDMOS device (RD07MVS1, Q0703), which delivers up to +38 dBm to the final device. Its gain is controlled by varying the gate bias voltage and varies from low gain up to approximately 11 dB of power gain. The gate bias voltage is controlled with the V_cont signal and is controlled in parallel with the pre-driver stage gain.

R0718, R0720, R0754, and R0755 are required to improve the bandwidth of the driver stage. The inter-stage match (as well as the power splitter) between the driver and final device is comprised of C0753, C0813, C0818, C0819, C0732, C0743, C0744, and C0761, and associated micro-strips on the PCB. Additional pads are provided on the printed circuit board to allow for possible engineering optimizations to this match. These are non-populated parts C0754, C0755, C0729, C0730, C0731, C0808, C0764, C0760, and C0765.

3.2.5 Final Stage

The final stage is a high-power, LDMOS device (MRF1570, Q0702) consisting of two parallel, high-power devices within 1 plastic package. The package is mounted to a copper carrier to improve thermal conductivity to the chassis and also to more tightly control the RF load, allowing higher and more consistent maximum output power. This stage is biased at a quiescent current of 750 mA and operates with a fixed-gain of approximately 10 dB, allowing the radio to be set to a maximum output power of 30 Watts. The quiescent current is set by adjusting the Final_Bias signal. Both elements of this transistor are fabricated on the same semiconductor die and are well matched, allowing control via a single voltage.

Both the input and output matching circuits of this stage have extremely critical part location requirements. Any repairs must be done with care to ensure the replaced components are placed accurately and properly soldered. Of particular concern are input matching capacitors C0732 and C0761 and output matching capacitors C0811 and C0812. The resistor networks at the input of each of the final elements are required to improve the bandwidth of the circuit. These resistors are R0762 through R0773.

The output matching circuit and power combiner is comprised of C0811, C0719, C0812, C0746, C0726, and C0737 and associated microstrips fabricated on the printed circuit board. Additional pads are provided on the pc board to allow for possible engineering optimizations to this match. These are non-populated parts C0720, C0721, C0747, C0748, C0727, and C0741. R0719 is added as a preventative measure against half-carrier regeneration.

If the final device fails and has to be replaced, R0719 should be carefully inspected to ensure against any damage caused by the final device. Replacement of the final device requires that the bias voltage be re-tuned using the Customer Programming Software (CPS). Care must be taken not to damage the device by exceeding the maximum allowed quiescent current which is 1 Amp. The device can tolerate up to 5 Amps for brief periods of time without damage.

3.2.6 Antenna Switch

The antenna switch (T/R switch) routes the signal between either the transmitter or receiver and the antenna. In transmit mode, it utilizes the existing dc feed (A+) to the final stage device (Q0702). Both PIN diodes D0700 and D0702 are turned on during key-up through forward biasing. This is achieved by pulling down the voltage at the cathode end of D0702 to approximately 12.2 Volts (0.7 Volt drop across each diode). Q0704 is configured as a current sink that maintains the current through the antenna switch diodes at 100 mA, as set by VR0700 and R0738. The current sink is enabled during transmit mode by ANT_ENABLE, which is asserted through Q0706 and associated circuitry. When the PIN diodes are conducting, an RF ground is formed at the anode of the lower PIN diode, D0702, which places L0710 and C0803 in parallel. The values of L0710 and C0803 are chosen so as to be parallel resonant at the center of the transmit band, making them appear as an open-circuit so that a 50 ohm power path is maintained through the top PIN diode to the harmonic filter.

In receive mode, DC current through the PIN diodes is interrupted by turning off the current sink. The RF path now flows from the harmonic filter, through the matching circuit formed by L0710, C0803, and the capacitive divider formed by C0767 and C0772. C0766, currently unplaced, is provided for possible future engineering optimizations to this match. The purpose of L0719 is to form a parallel resonant tank with the reverse capacitance of D0700, improving the receive path return loss at the receive input of the T/R switch.

3.2.7 Harmonic Filter

Inductors L0706, L0707, L0708, and capacitors C0742, C0739, C0740, and C0738 form a 7-element low-pass filter to attenuate harmonic energy from the transmitter. R0713 is used to drain any electrostatic charges that might otherwise build up on the antenna. The harmonic filter also prevents high-level RF signals above the receiver pass-band from reaching the receiver circuits, improving spurious response rejection.

3.2.8 Directional Coupler

The dual-directional microstrip coupler is implemented at the harmonic filter output to sample both forward and reverse directed transmitter power. RF power from the transmitter PA passes through the microstrip coupler before reaching the antenna. Forward RF power is coupled to the U0940 log detector/controller via the voltage-controlled attenuator (VCA) stage consisting of pin diodes D0901, D0902, and D0903. The log detector/controller regulates the gain of PA stages Q0703 and Q0705 (via V_cont), thus ensuring that the forward power out of the radio is held to a constant value.

The directional coupler functions not only as part of the transmitter power regulation circuit but also as part of the VSWR load-detection circuitry. Its physical location close to the antenna connector allows accurate VSWR sense at the transmitter output. Forward and reverse coupled signals are rectified by D0904 and D0905, respectively. DC voltage FWD_DETECTED is proportional to RF power while REV_DETECTED is proportional to reflected RF power. The detected voltages are fed to the respective inputs of difference amplifier U0901. The difference amplifier output is applied to the variable attenuator control stage, U0900-1. An abnormally high reflected power level, i.e., a damaged antenna, also causes an increase in the difference amplifier output voltage.

This causes a reduction in attenuation by the VCA. As a result, the greater RF signal applied to the log detector/controller causes the controller to reduce the gain of PA stages Q0703 and Q0705. Transmitter power is thus reduced to prevent damage to the final device due to an improper load.

3.2.9 Power Control

The transmitter uses PA controller IC, U0940 to control the power output of the radio. A portion of the forward RF power from the transmitter is sampled by the directional coupler and delivered via the VCA to the RFIN port of the PA controller IC (pin 1). The PA controller, a log detector type, provides temperature-stable, high-accuracy control over a typical 50 dB dynamic range.

The MAKO IC contains a digital-to-analog converter (DAC), which provides a reference voltage (TX_DAC) at the input of reconstruction filter stage U0900-2. The filtered reference voltage at the output of U0900-2 is divided by the combination of R0942 and R0946 before reaching the VSET input of the PA controller IC (pin 3). Thermistor RT0953 is used in combination with R0954 to compensate reference voltage drift at operating temperature extremes. Reference voltage level is programmable through the SPI lines of the MAKO. This reference voltage is proportional to the desired power setting of the transmitter and is factory programmed at several points across the frequency range of the transmitter to offset frequency response variations of the transmitter's coupled power circuits.

The PA controller IC provides a dc output voltage at pin 7 (VAPC), which is divided to provide gate bias for PA pre-driver and driver stages. The 0 Volts to 5 Volts range at U0940, pin 7, is applied as V_CONTROL to power-adjust the transmitter by controlling the gate bias of stages Q0703 and Q0705. Voltage divider combination R0727 and R0728 provides gate bias to Q0703 while divider combination R0750 and R0751 provides gate bias to Q0705. This adjusts the transmitter power output to the intended value. The ratio of each of these resistive dividers is chosen to ensure that Q0703 and Q0705 are both running at their nominal design condition at rated output power. Variations in sampled forward transmitter power cause the PA controller IC to adjust the control voltage above or below its nominal value to raise or lower output power in order to maintain transmitter output power relative to the reference voltage applied to VSET.

A power control attenuator circuit was added to the 25 Watt transmitter circuitry in order to extend the range of the RF detection in the RF detector at low-power levels. This enables the power control loop to close at lower relative power levels and is needed because of the greater relative power-set range (1-25 Watt, 14 dB). The PC_ATTEN_ENA activation threshold is set in software for operation at lower power levels, typically 1-5 Watt. When the PC_ATTEN_ENA is activated, the VCA is driven to its minimum attenuation level, which increases the RF level at the AD8315 (U0940) for a given transmitter power level. The radio software adjusts the K&M tuning accordingly such that proper power-set is maintained at operating powers both above and below the activation threshold point.

3.2.10 Power Ramp Profile Control

In order to minimize the transient adjacent channel power at the transmitter's output, the ramped power follows a raised-cosine profile. The PA controller IC has a linear slope function when scaled in dB/V. To achieve the desired raised-cosine profile of the output power, the ramped reference voltage provided by the MAKO DAC follows a raised-cosine approximation. The MAKO DAC reference output is low-pass filtered by the DAC reconstruction filter before it is applied to the VSET input of the PA controller IC.

Reconstruction filtering reduces spurious emissions in the RF spectrum as a result of the finite steps of the DAC. Loop filter capacitor C0926 in conjunction with resistor R0950 and the integrator within the PA controller IC, set the loop dynamics. The loop response has been optimized to achieve sufficient speed to follow the required ramping profiles while meeting switching transient requirements over varied power levels. Accurate control of the power-rise (ramp-up) and power-decay (ramp-down) characteristics minimizes splatter into adjacent channels.

3.2.11 Thermal Protection

Thermistor RT0908 in combination with R0902, form a voltage divider with the output proportional to the sensed transceiver board temperature in the vicinity of the transmitter driver and final devices. The voltage divider output is routed to an operational amplifier U0901-2, which provides a dc voltage via diode junction D0900 to control the attenuation level of the VCA stage. For the condition that the temperature threshold set by resistive divider combination R0901 and R0909 is reached, the VCA is driven to increase the RFIN signal at the PA controller IC (pin 1). This increase will cause the controller IC to adjust the PA control voltage below its nominal value to decrease transmitter output power. Temperature will be reduced by lowering transmitter output power relative to the reference voltage applied to VSET.

3.2.12 Out-of-Range Battery Protection

Transmitter power cutback under extended battery supply voltage operation is provided for by monitoring the battery supply in the controller circuit of the radio in order to change the VSET input of the PA controller IC (pin 3) for reduced transmitter output. This feature allows transmitter PA dissipation to be limited at high-line battery supply operating conditions while limiting transmitter PA overdrive conditions at low-line battery supply operating conditions.

3.2.13 Pressure Pad Switch

The power control circuitry includes a safety switch (S0700) that consists of a conductive portion of the rubber pad which pushes the RF final transistor Q0702 against the chassis. When the chassis cover and rubber pad are properly assembled, the conductive portion of the pad contacts a pattern on the transceiver board, electrically closing switch S0700. If the cover and pad are not in place, switch S0700 is open-circuited and the power control circuit is disabled, turning off the gate bias to Q0702, Q0703, and Q0705. This prevents thermal damage of the RF transistors which could occur if the transmitter is operated without adequate heat sinking.

3.3 Frequency Generation Circuitry

The synthesizer subsystem consists of the reference oscillator (Y0100), the fractional-N synthesizer IC (Tomahawk II, U0100), and the Voltage Controlled Oscillator VCO.

3.3.1 Reference Oscillator

The reference oscillator (Y0100) contains a temperature compensated crystal oscillator with a frequency of 16.8 MHz. A digital-to-analog (DAC) converter internal to U0100 (Tomahawk) and controlled by the microprocessor via serial interface (SPI), sets the voltage at the AUX_DAC output of U0100 (pin H6) to set the frequency of the oscillator. The output of the oscillator (pin 3 of Y0100) is applied to pin K5 (XOSC_BASE) of U0100.

3.3.2 Fractional-N Synthesizer

The Tomahawk II synthesizer IC (U0100) consists of a pre-scaler, a programmable divider and divider control logic, phase detector, charge pump, a D/A converter in the high frequency analog modulation path, an attenuator to balance the high and low frequency modulation paths, a serial interface for control (SPI), a serial interface for modulation (SSI), and a super filter for the regulated 2.45 Volts.

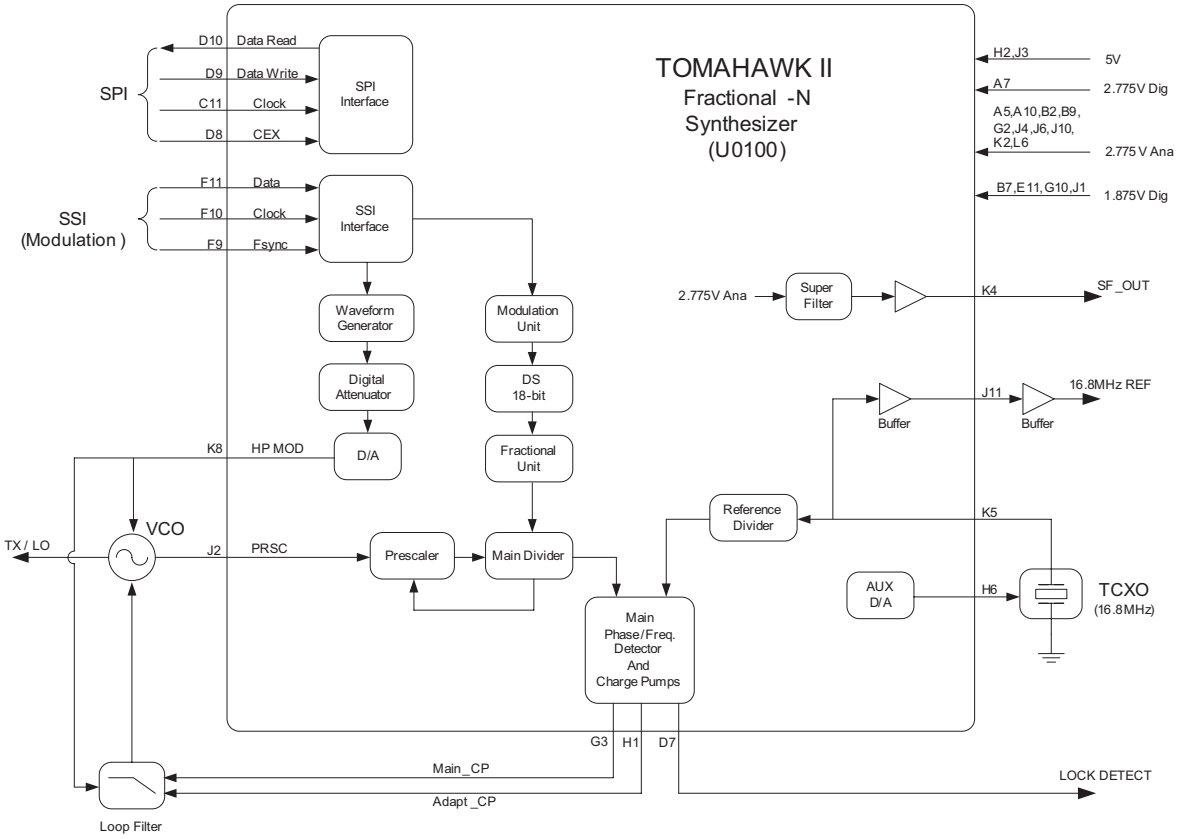


Figure 1-9 UHF Synthesizer Block Diagram

A voltage of 2.775 Volts applied to the super filter input (U0100 pin J4) supplies an output voltage of 2.45 Vdc (SF_OUT) at pin K4. This supplies the VCO and the VCO modulation bias circuit (via R0321). The super filter supply voltage is provided by the 2.775 Volt regulator within U3200. The synthesizer is also supplied by the 5 Volt regulator, U3002, another 2.775 Volt regulator within U3200, and a 1.875 Volt regulator within U3200.

The output signal LOCK (U0100-D7) provides information about the lock status of the synthesizer loop. A high level at this output indicates a stable loop. A discrete buffer amplifier (Q0100) provides a buffered 16.8 MHz reference frequency to other parts of the radio.

The serial programming interface (SPI) is connected to the microprocessor via the data lines SPI_DW (U0100-D9) and SPI_DR (U0100-D10), clock line SPI_CLK (U0100-C11), and chip enable line CEX (U0100-D8). The serial modulation interface (SSI) is connected to the DSP via the data line SDTX (U0100-F11), clock line TXCLK (U0100-F10), and frame sync line SFTX (U0100-F9).

3.3.3 Voltage Controlled Oscillator (VCO)

The Voltage Controlled Oscillator (VCO) subsystem consists of four Colpitts oscillators (two each for Tx and Rx), a single-stage Tx buffer amplifier, a single-stage Rx buffer amplifier, oscillator bias control switches, and the modulation circuitry.

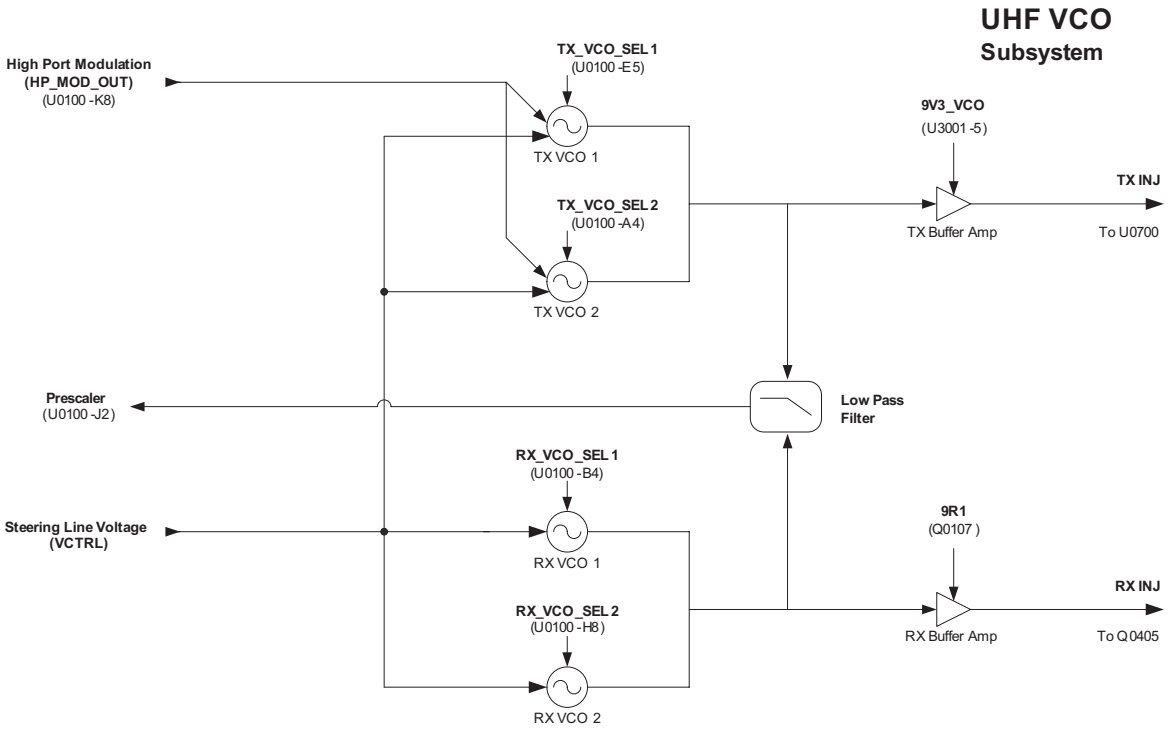


Figure 1-10 UHF VCO Block Diagram

The UHF VCO design incorporates a total of four oscillators; two varactor-tunable Colpitts oscillators each for Tx and Rx. Each oscillator has a tuning range of 33.5 MHz, sufficient to cover the Rx and Tx frequency ranges of 326.65 MHz to 396.65 MHz and 403 MHz to 470 MHz, respectively. The oscillators resonate at fundamental operating frequencies. Four (active-low logic) general purpose output lines (GPO1, GPO2, GPO3, and GPO6) from the Tomahawk IC (U0100-B4, A4, E5, and H8) provide the control for independent bias selection to each oscillator (VCO_SEL) via the PNP transistor switches U0304 and U0201. The 2.45 Volt super filtered output, SF_OUT, of the Tomahawk IC (U0100-K4) supplies the bias to the oscillators. A portion of the VCO output signal is lightly coupled through coupling capacitors C0331 and C0231, routed through a low-pass filter (formed by L0221, C0235, C0230, and C0233), and fed back to the M_PRSC input of the Tomahawk IC (U0100-J2).

High-port modulation is scaled through a voltage divider (comprised of R0319, R0320, and R0321) and applied to the Tx modulation varactor diode CR0300. The TX VCO frequency is modulated via coupling capacitors C0310 and C0344. High-port modulation is also applied to the VCO steering line (through R0139, R0140 and C0166) which modulates the main VCO tuning varactors.

A discrete single-stage Tx buffer amplifier (comprised of the NPN transistor Q0302 and surrounding components) amplifies the signal from the Tx oscillator to the level required by the first stage of the Transmitter Power Amplifier (U0700). The TX buffer amplifier also provides sufficient isolation from any undesired load-pulling from the Transmitter Power Amplifier. The bias for Q0302 is provided by the 9.3 Volt regulator U3001.

A discrete single-stage Rx buffer amplifier (comprised of the NPN transistor Q0202 and surrounding components) amplifies the signal from the Rx oscillator to the level required by the LO injection amplifier (Q0405). The Rx buffer amplifier also provides sufficient isolation from any undesired load-pulling from high input levels in the receiver front-end. GPO4 from the Tomahawk IC (U0100-D4) controls the transistor switch (comprised of Q0108 and Q0107), that enables the 9.1 Volt bias to Q0202 (via the 9.3 Volt regulator U3001).

3.3.4 Synthesizer Operation

The complete synthesizer subsystem is comprised mainly of the Tomahawk synthesizer IC, Reference Oscillator (crystal oscillator with temperature compensation), loop filter circuitry, VCO, and DC supplies. The VCO feedback signal, PRSC, is fed to pin J2 of U0100 (M_PRSC) via a low-pass filter (L0221, C0235, C0230, and C0233) which attenuates harmonics and provides the correct level to close the phase-locked loop.

The prescaler in the synthesizer IC (U0100) is a four-level prescaler capable of dividing by 4, 5, 6, and 7**.** The main loop N divider is configured to be an 8-bit divider. The divide-by-N portion of the main loop is set via the SPI. The fractional portion of the divider is realized using a 3-accumulator, 24-bit fractional divider. The SPI is used to set the desired divide ratio.

The output of the prescaler is applied to the main loop divider. The output of the main divider is sent to the phase/frequency detector, which compares the main divider's output signal with the reference signal. The reference signal is generated by dividing down the signal of the reference oscillator (Y0100). The output signal of the phase/frequency detector is a pulsed signal which is routed to the charge pumps. The main charge pump current is programmable through the SPI with its output at pin G3 of U0100 (MN_CP). The loop filter transforms this current into a steering voltage that is applied to the VCO.

To reduce lock time when new frequency data has been loaded into the synthesizer, an adapt charge pump providing much greater current than the main charge pump is turned on for a finite amount of time to quickly charge or discharge the loop filter capacitors to steer the VCO to the desired frequency. The output of the adapt charge pump passes to the loop filter via pin H1 of U0100 (MN_ADAPT_CP). When the synthesizer is within the lock range and the adapt timer runs out, the adapt charge pump is powered down and the main charge pump takes over. A settled synthesizer loop is indicated by a high level at signal LOCK (U0100-D7), which is routed to the microprocessor. Q0102 is configured as a current source to provide a steady 1.5 mA during the adapt period. U0101 is an analog switch that opens the adapt path slightly before the end of the adapt period to prevent the current from the current source from pushing the VCO off frequency.

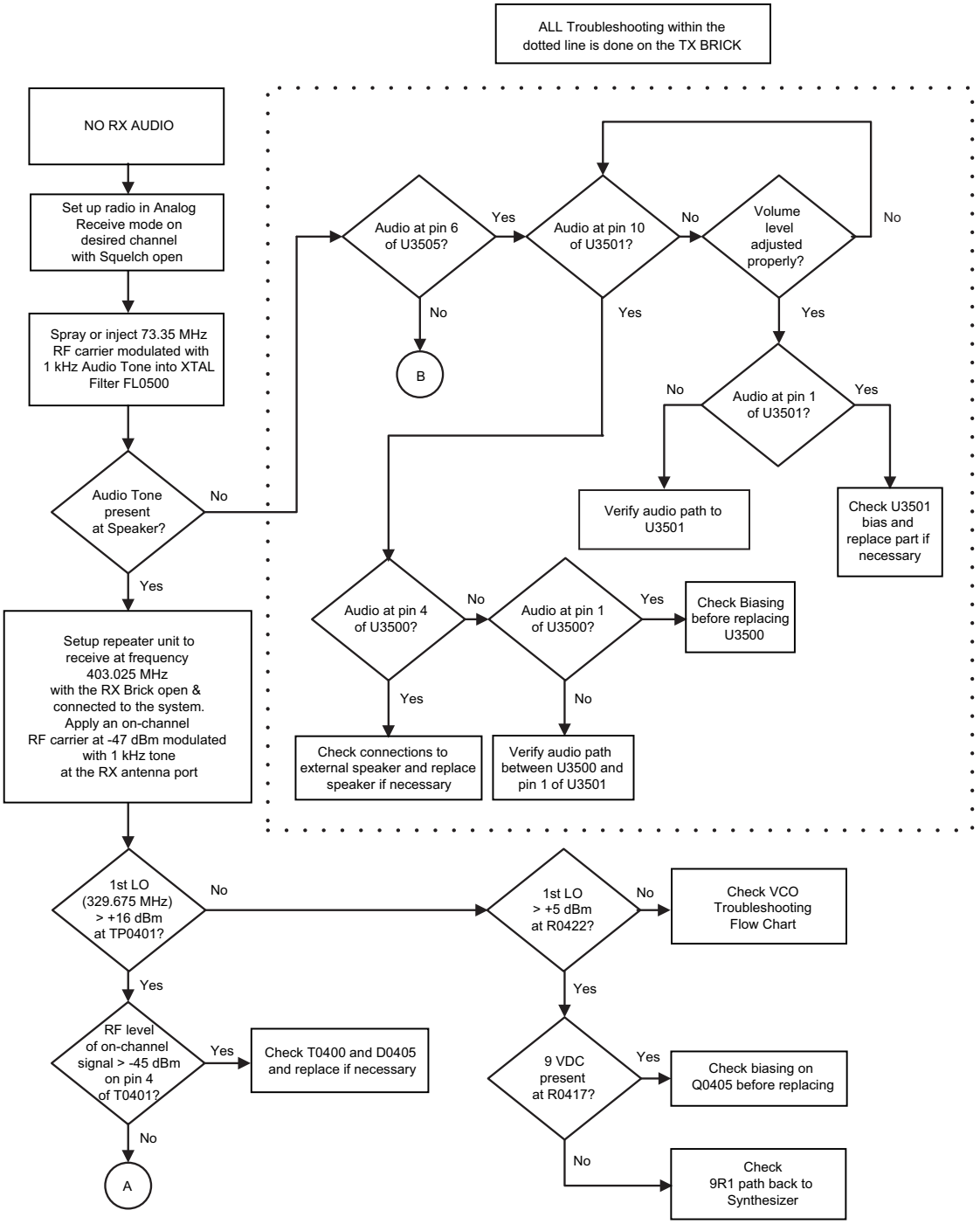
Modulation is performed by applying a digital data stream via the SSI bus from the DSP (U1000) to the synthesizer (U0100). In order to meet spurious and phase noise requirements, the PLL bandwidth was designed to be narrower than the full modulation bandwidth, therefore requiring the use of dual-port modulation. Internal to the synthesizer (U0100), low-port modulation is added to the fractional-N division numerator to trace out the modulation versus time while the high-port data stream passes through an interpolating waveform generator, a digital attenuator (for modulation balancing), and then gets converted to an analog signal through a 10-bit DAC before modulating the VCO. This high-port analog modulation output (HP_MOD_OUT, U0100-K8) is connected to the VCO modulation varactor diode (CR0300) via C0360 and R0319, and to the loop filter via R0139, R0140, and C0166.

Notes

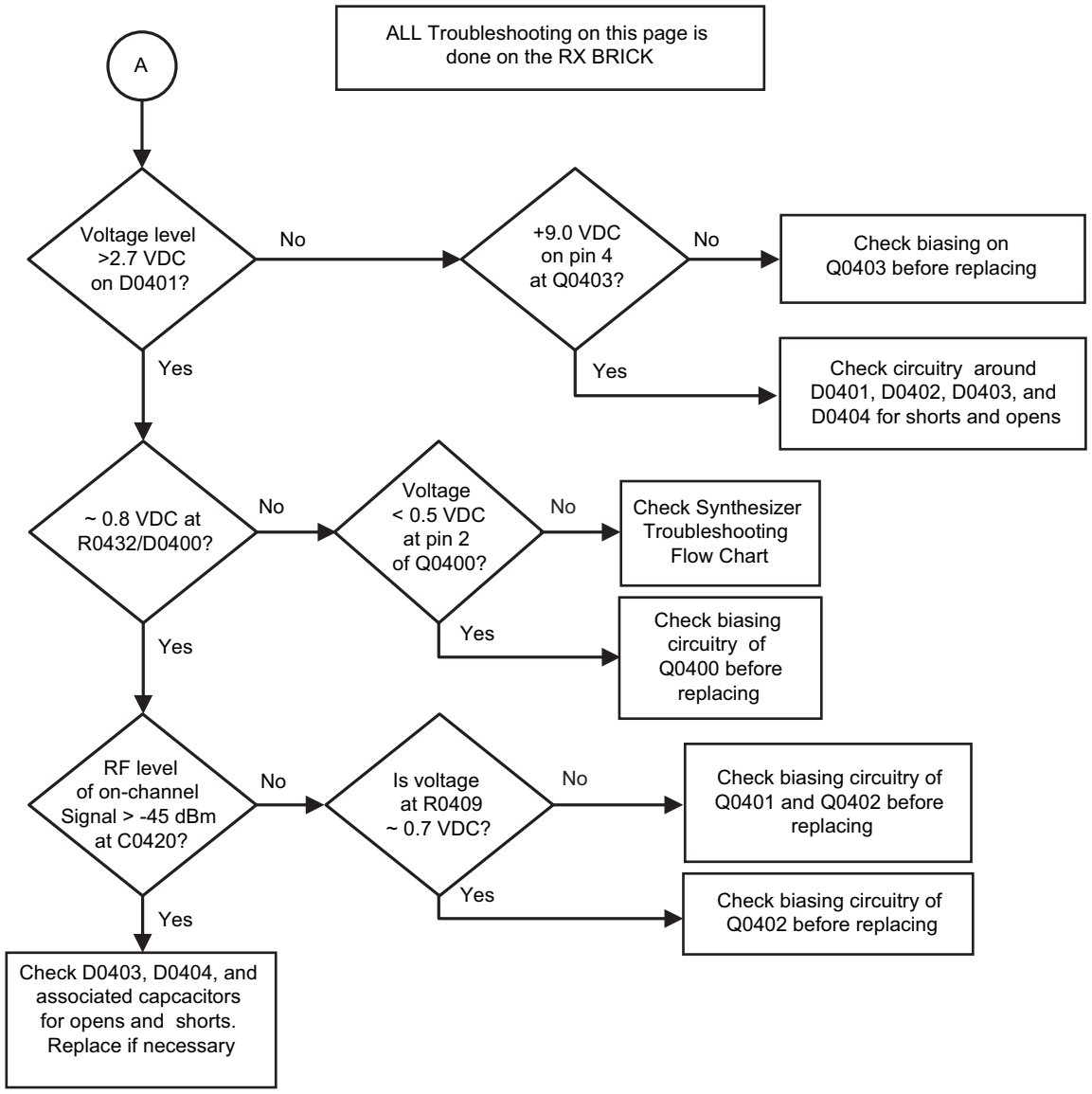
Section 2

TROUBLESHOOTING CHARTS

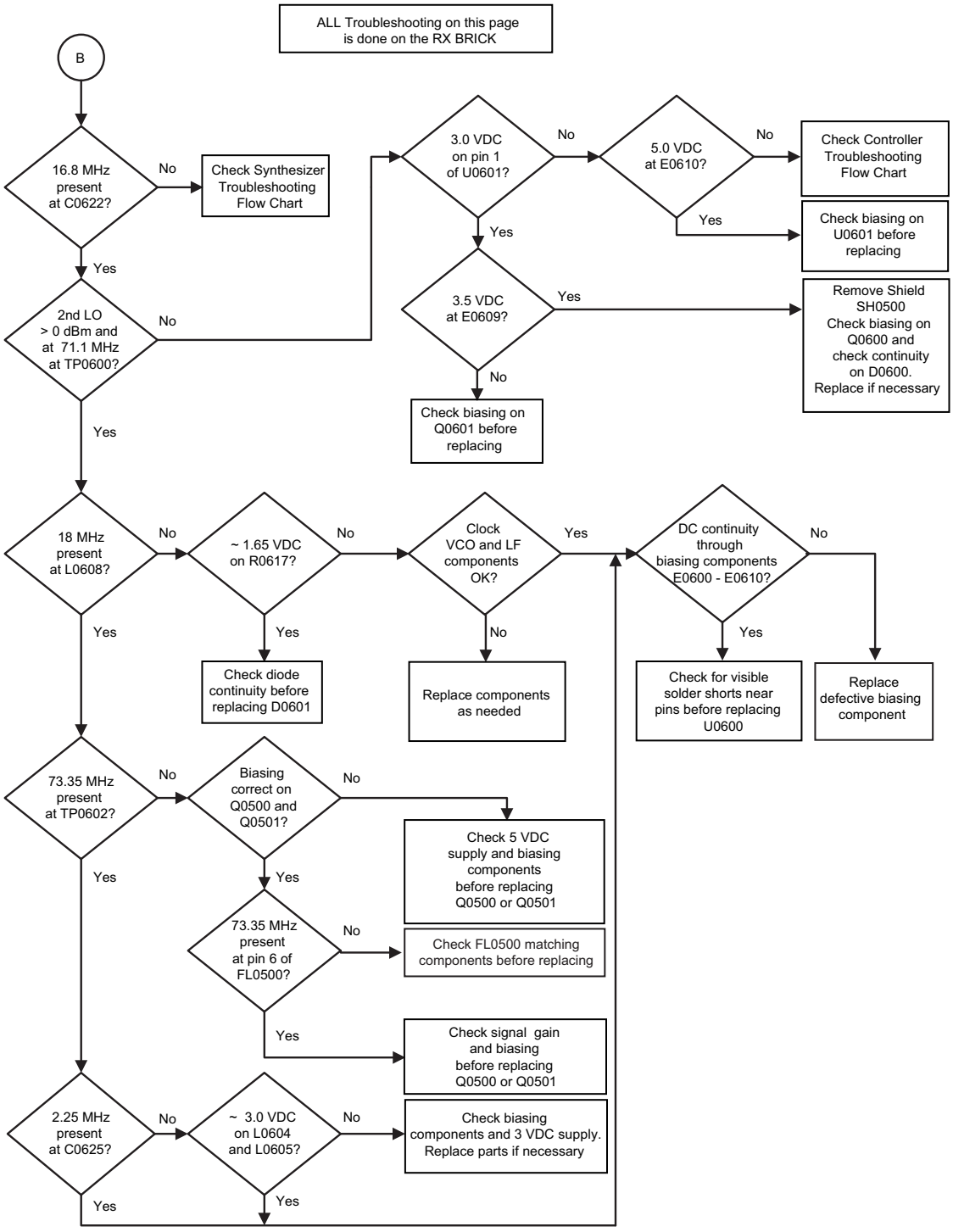
1.0 Troubleshooting Flow Chart for Receiver (Sheet 1 of 3)



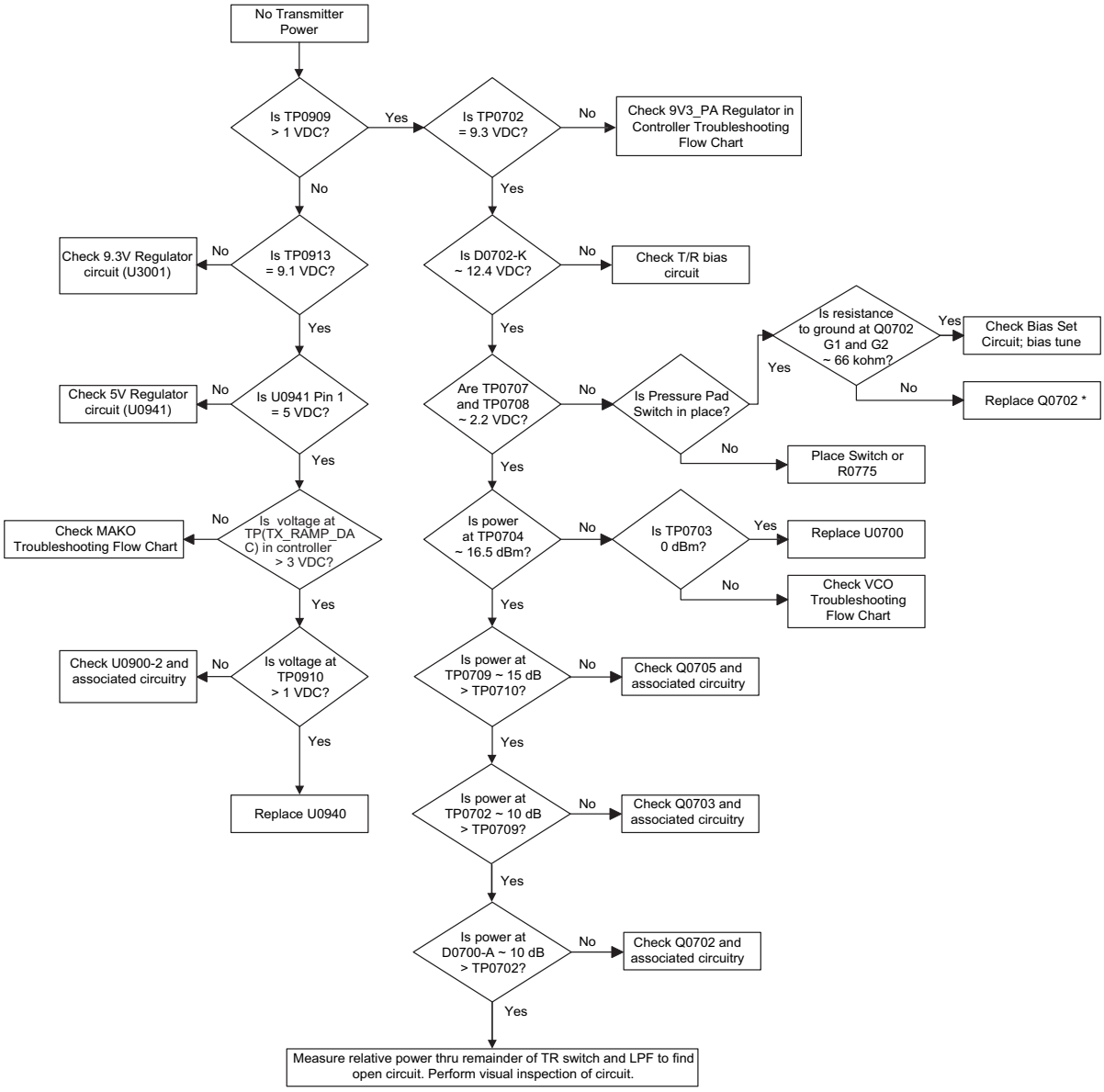
1.1 Troubleshooting Flow Chart for Receiver (Sheet 2 of 3)



1.2 Troubleshooting Flow Chart for Receiver (Sheet 3 of 3)



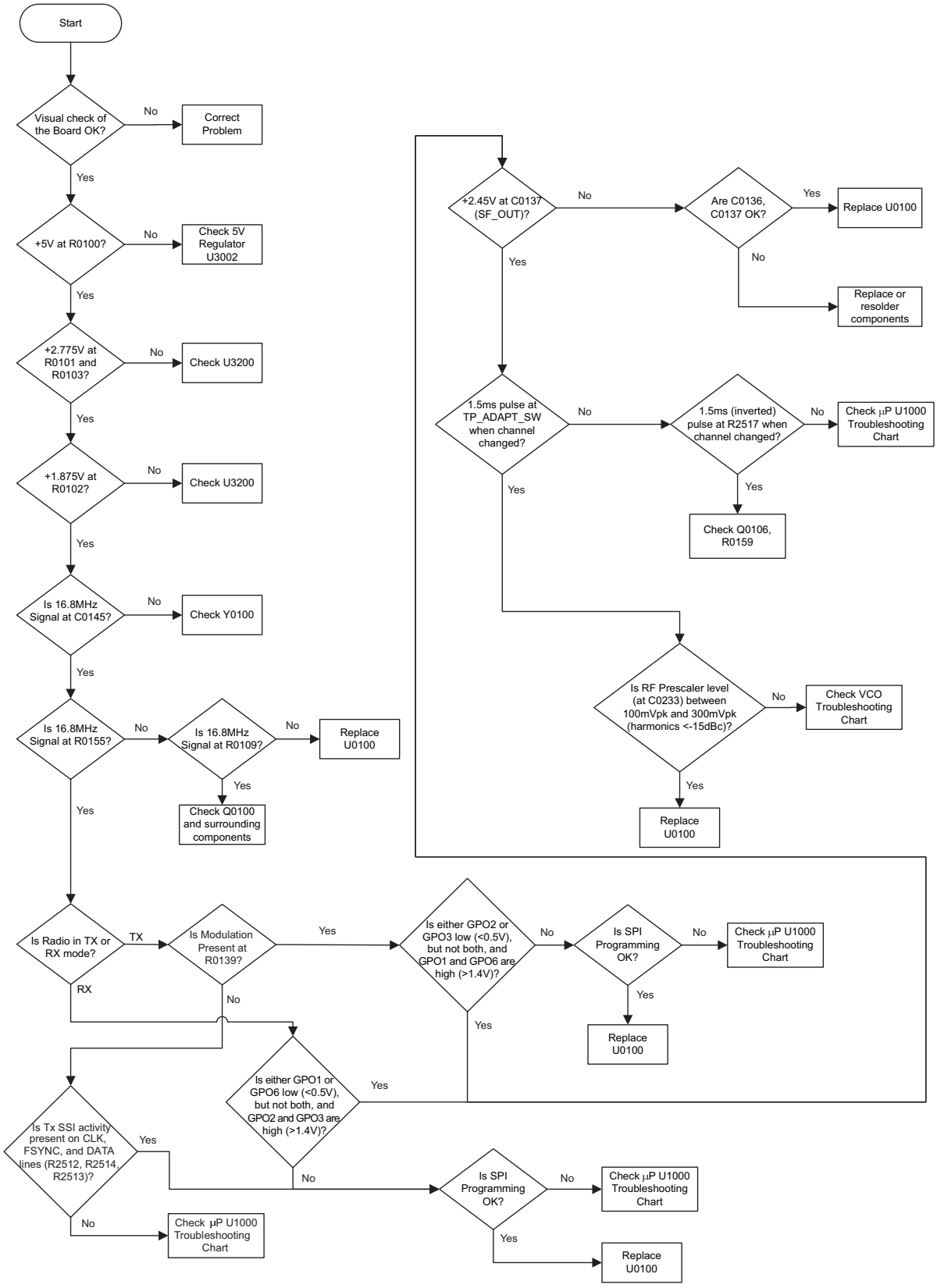
2.0 Troubleshooting Flow Chart for 25W Transmitter



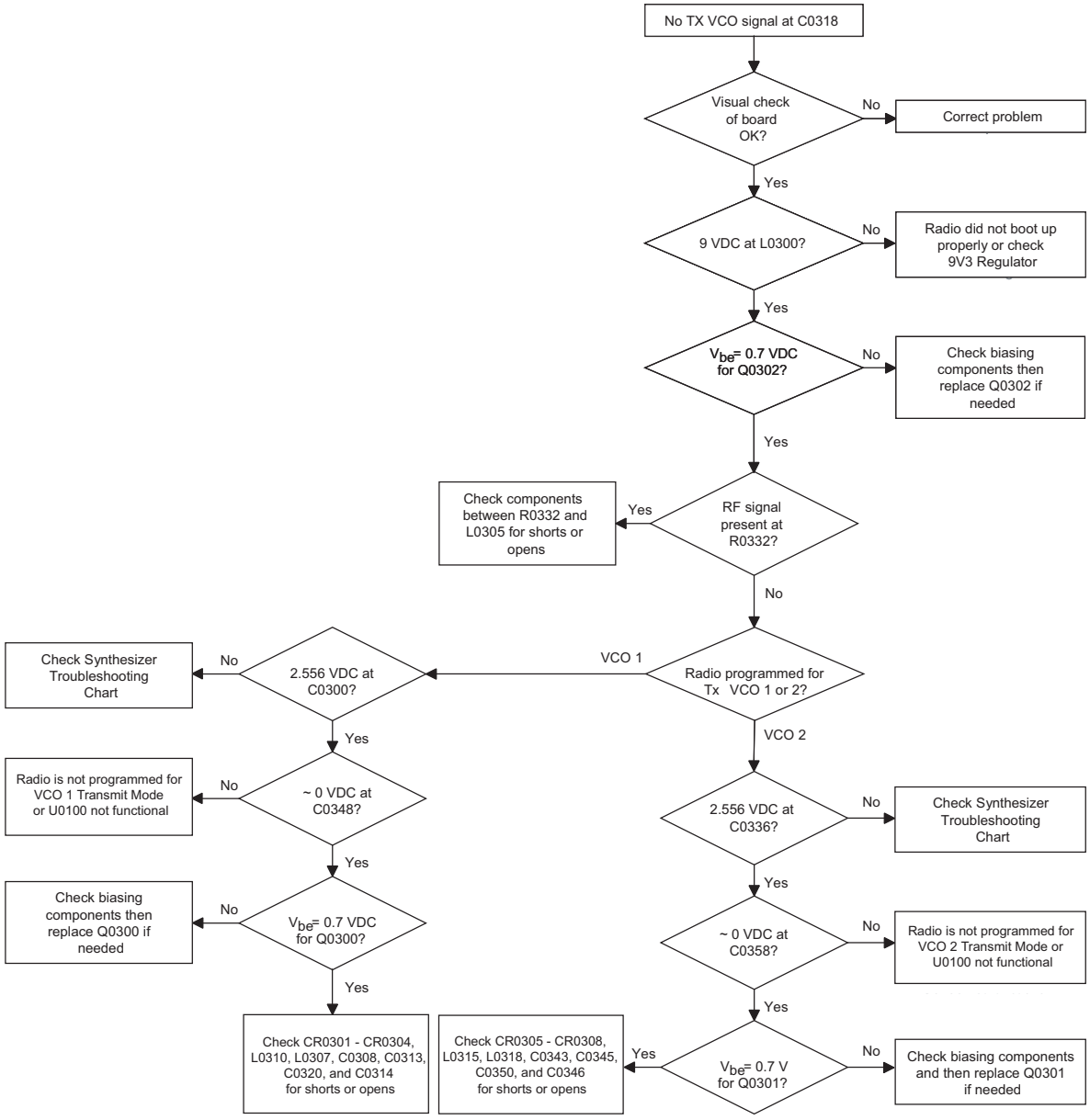
* Note: If Q0702 is replaced radio must be bias set and power set.

1) Levels are during Transmit Mode (analog), 13.6V at battery connector, 50 ohm termination on transmitter.
2) Make sure PCB is screwed into chassis during these tests to avoid final device damage.
3) When making measurements within the transmitter using an RF power probe, be careful that the rating of the probe is not exceeded. The “relative” measurements listed in the flow chart should be made with a scope probe connected to a spectrum analyzer or similar instrument to avoid damaging sensitive power probes.

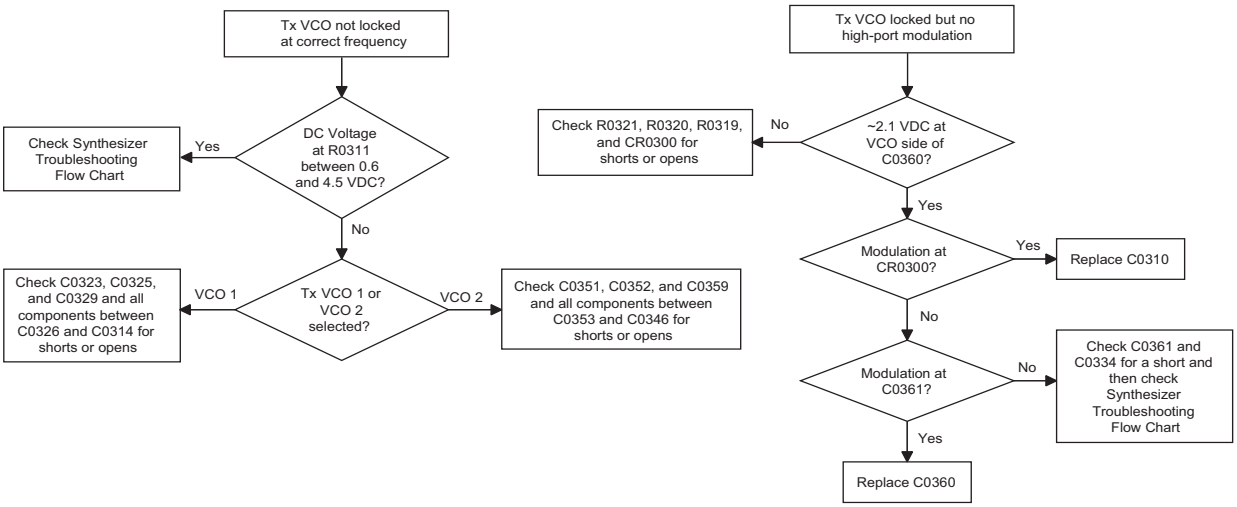
3.0 Troubleshooting Flow Chart for Synthesizer



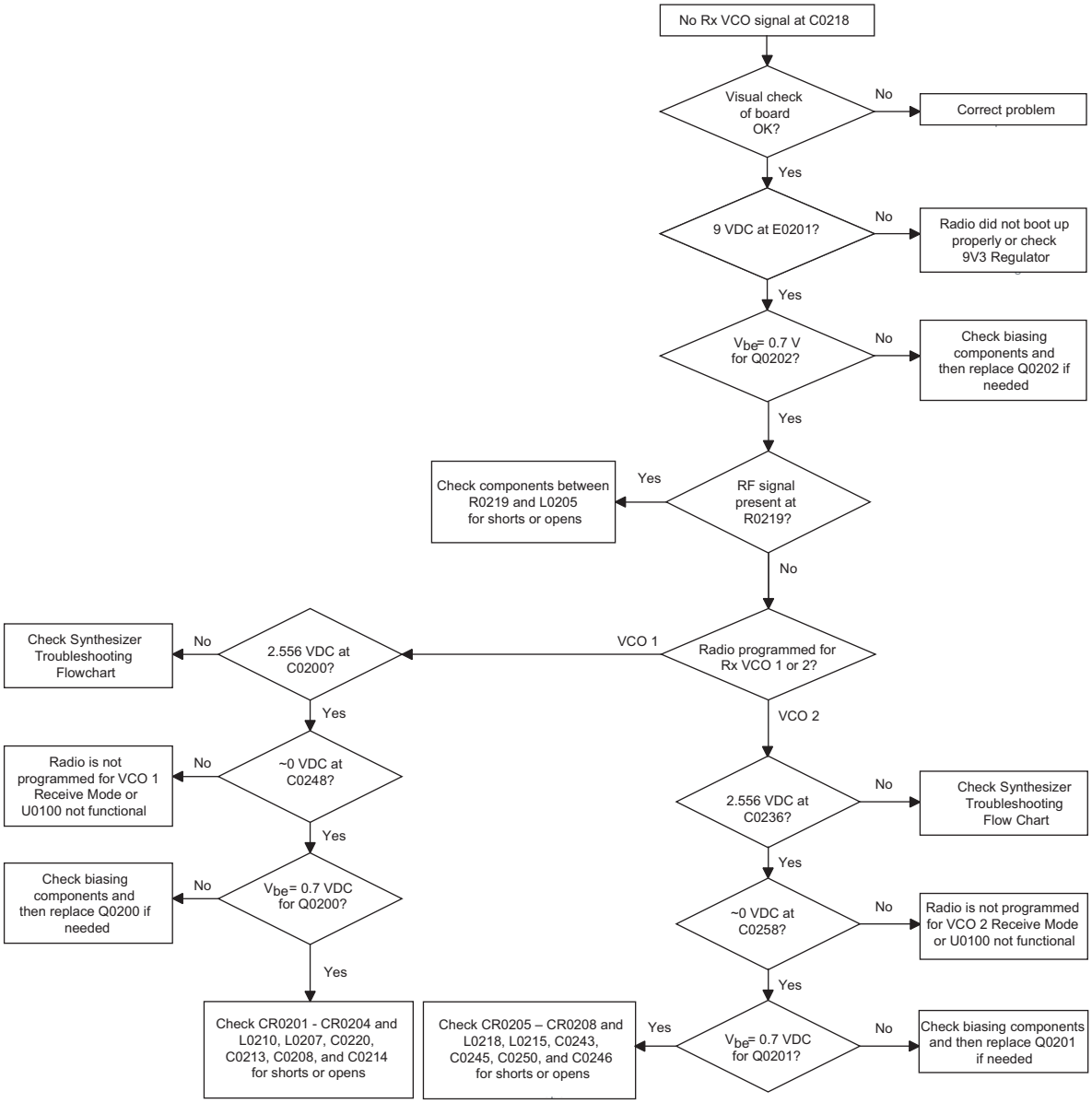
4.0 Troubleshooting Flow Chart for Tx VCO (Sheet 1 of 2)



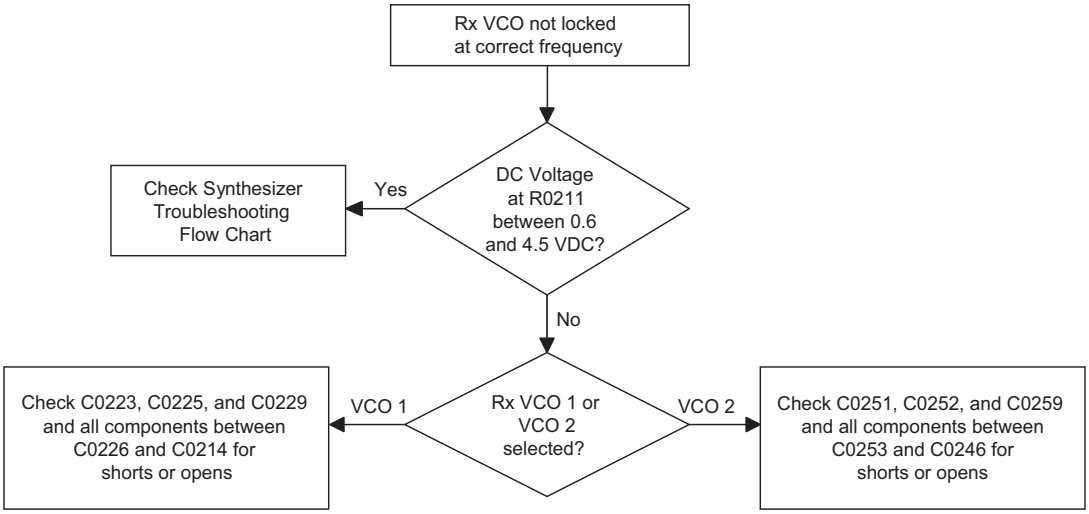
4.1 Troubleshooting Flow Chart for Tx VCO (Sheet 2 of 2)



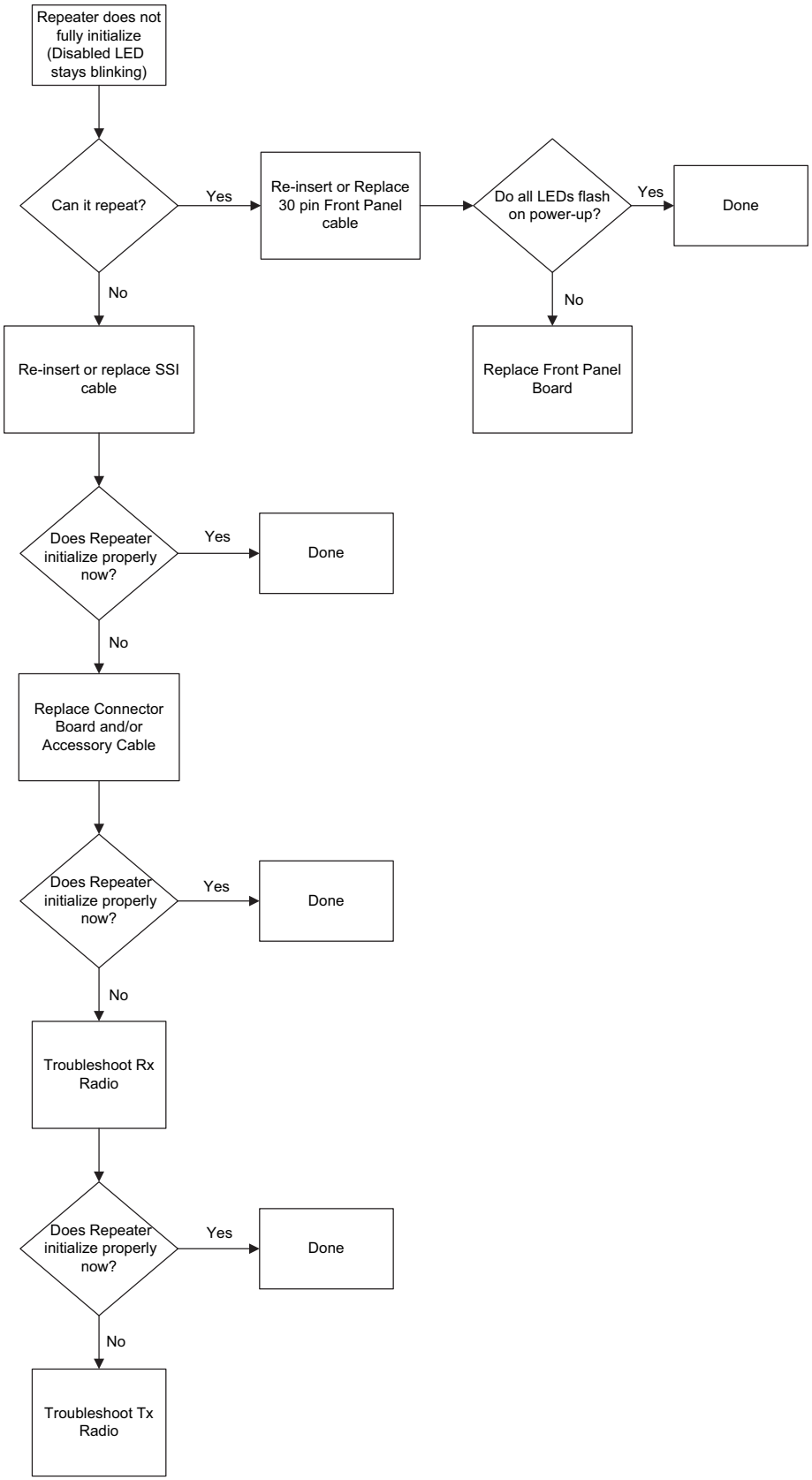
5.0 Troubleshooting Flow Chart for Rx VCO (Sheet 1 of 2)



5.1 Troubleshooting Flow Chart for Rx VCO (Sheet 2 of 2)



6.0 Troubleshooting Flow Chart for Repeater



Section 3

UHF1 PCB / SCHEMATICS / PARTS LIST

1.0 Allocation of Schematics and Circuit Boards

1.1 Controller Circuits

The UHF circuits are contained on the Printed Circuit Board (PCB) which also contains the Controller circuits. This Chapter shows the schematics for the UHF circuits only, refer to the Controller section for details of the related Controller circuits. The PCB component layouts and the Parts Lists in this Chapter show both the Controller and UHF circuit components. The UHF schematics and the related PCB and parts list are shown in the table below.

NOTE: The UHF Schematics and parts lists are the same for 8471165L03 and 8471165L05. Only the Controller circuits are different between the two PCBs.

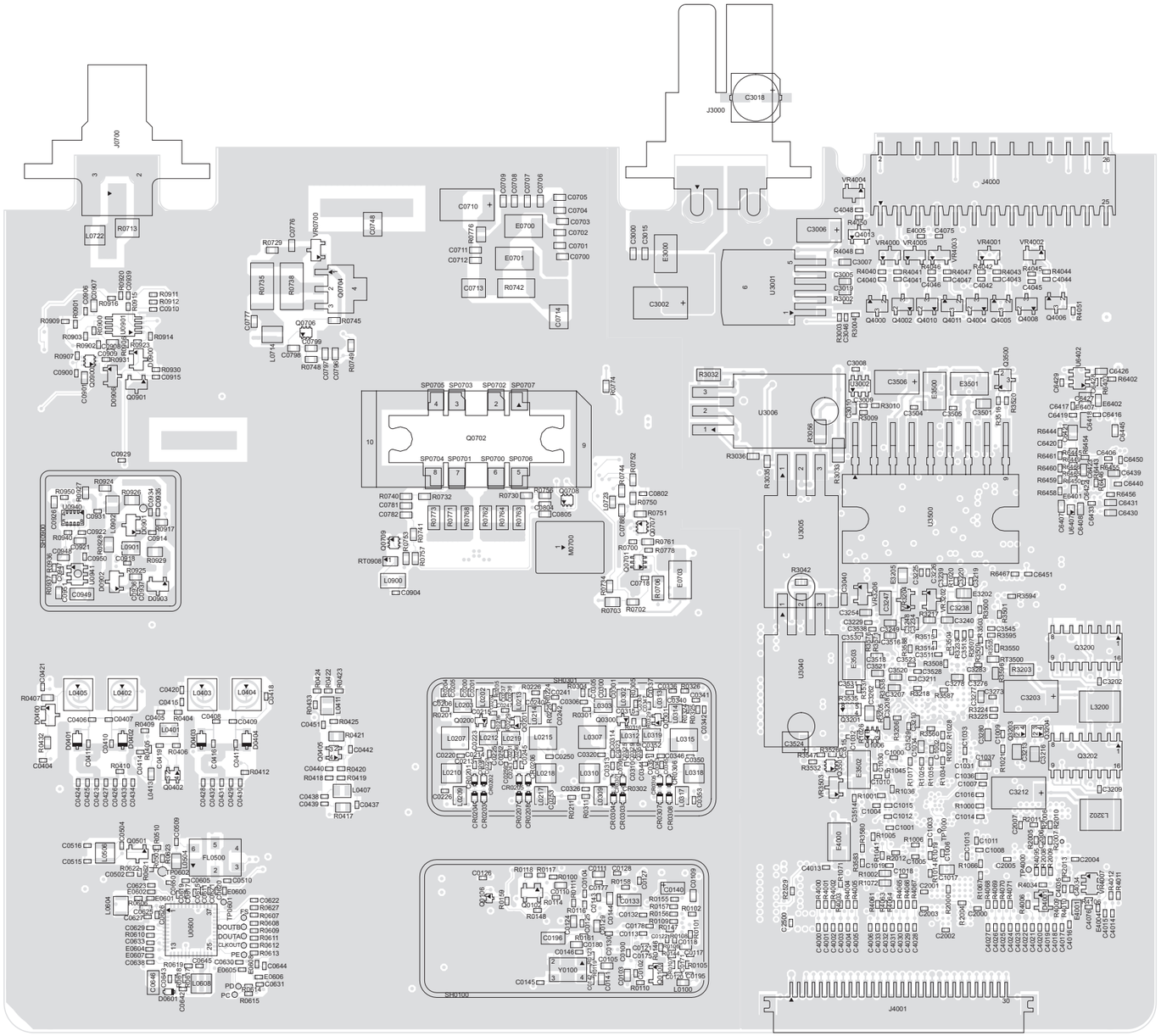
Table 3-1 UHF1 1–25W Diagrams and Parts List

PCB :	
8471165L03 Main Board Top Side	Page 3-3
8471165L03 Main Board Bottom Side	Page 3-4
8471165L05 Main Board Top Side	Page 3-5
8471165L05 Main Board Bottom Side	Page 3-6
SCHEMATICS	
Overall	**Page 3-7**
Receiver Front- End	**Page 3-8**
Receiver IF Amp	**Page 3-9**
Receiver Back-End	**Page 3-10**
Power Amplifier	**Page 3-11**
Power Control	**Page 3-12**
Synthesizer	**Page 3-13**
Receiver VCO	**Page 3-14**
Transmit VCO	**Page 3-15**
Parts List	
8471165L03 and 8471165L05	**Page 3-16**

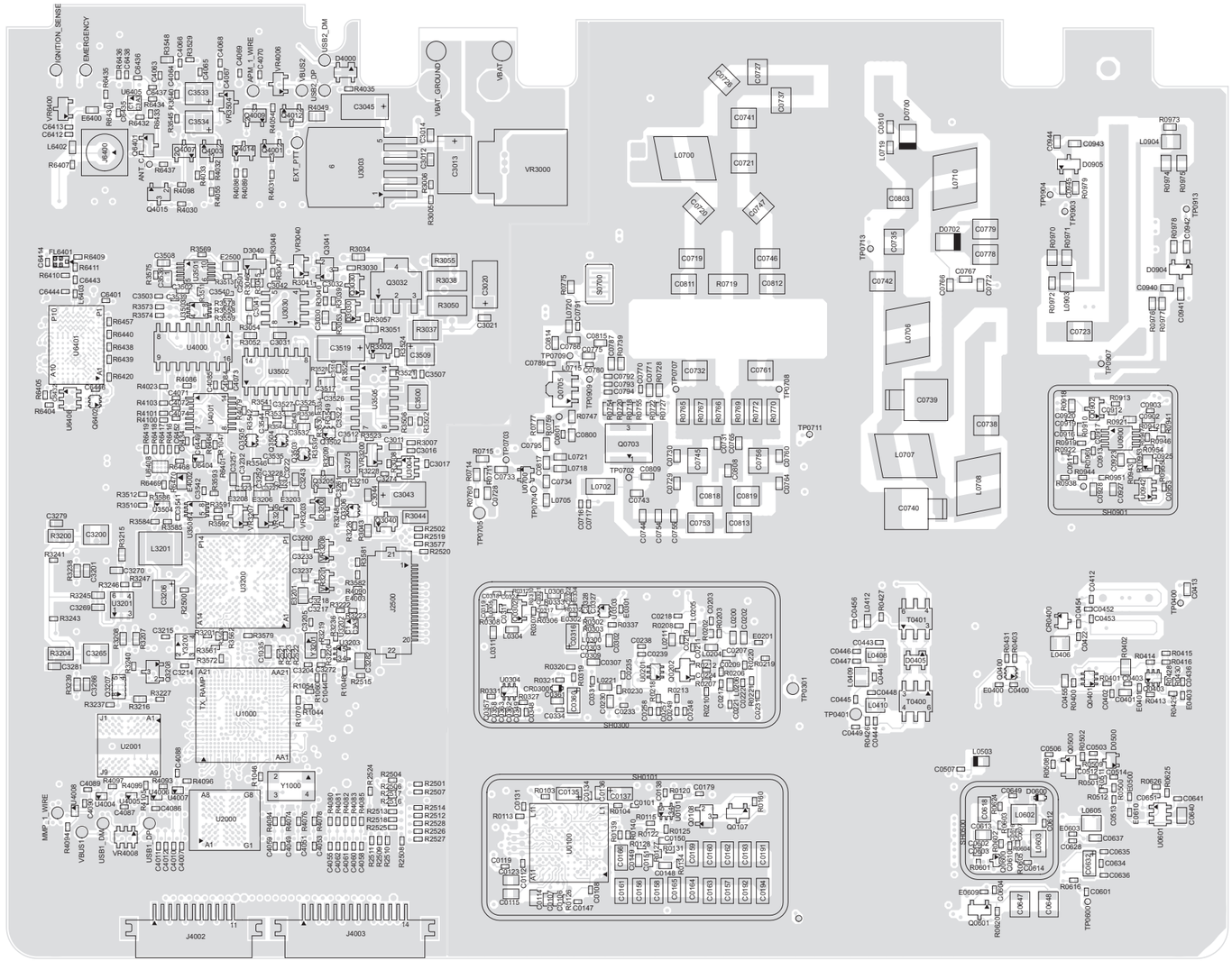
Table 3-2: UHF1 1–25W Diagrams and Parts List

PCB :	
8471165L06 Main Board Top Side	Page 3-21
8471165L06 Main Board Bottom Side	Page 3-22
SCHEMATICS	
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Power Amplifier	**Page 3-27**
Power Control	**Page 3-28**
Synthesizer	**Page 3-29**
Receiver VCO	**Page 3-30**
Transmit VCO	**Page 3-31**
Parts List	
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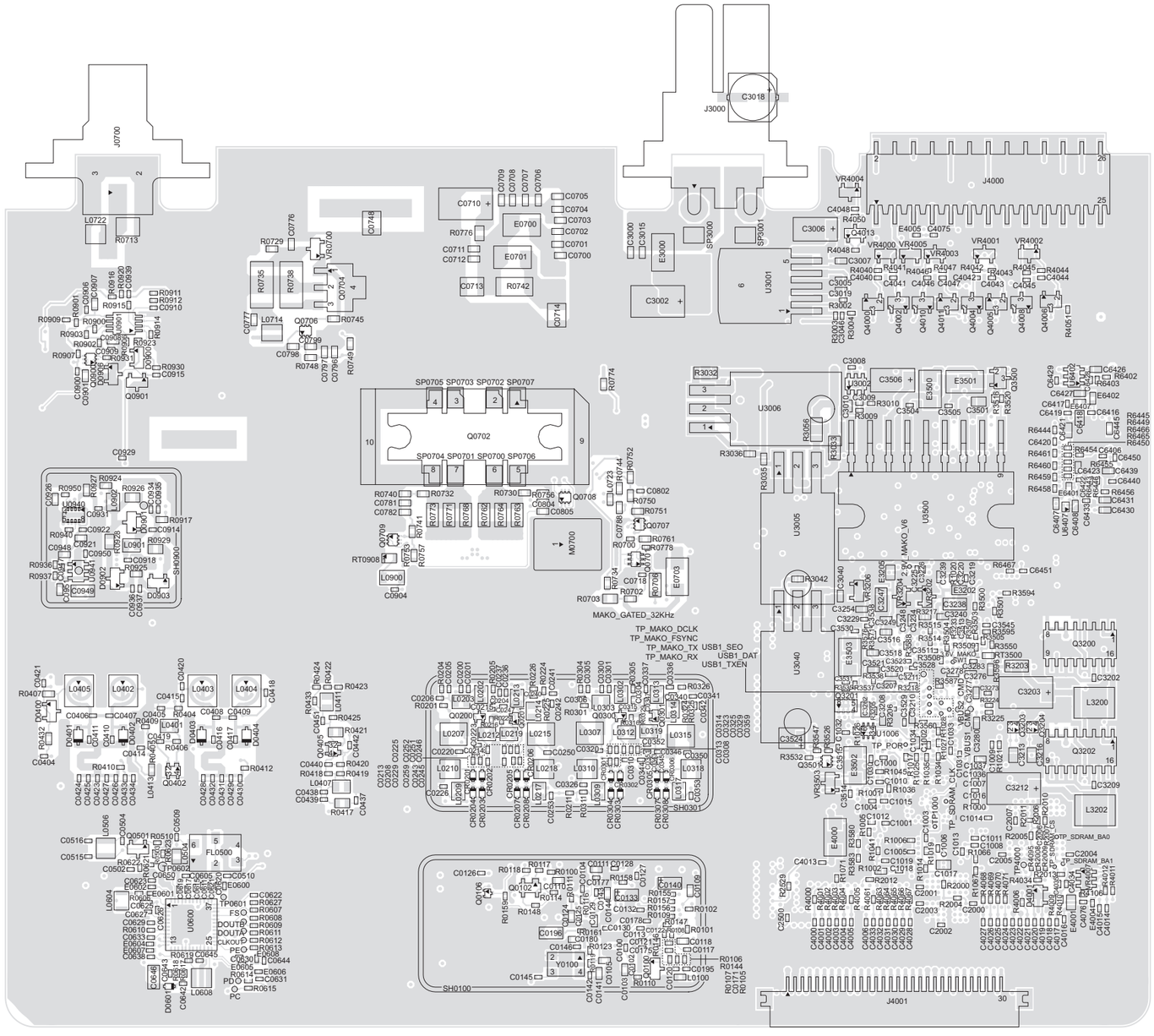
2.0 UHF1 (403–470 MHz) 1–25W PCB / Schematics / Parts List

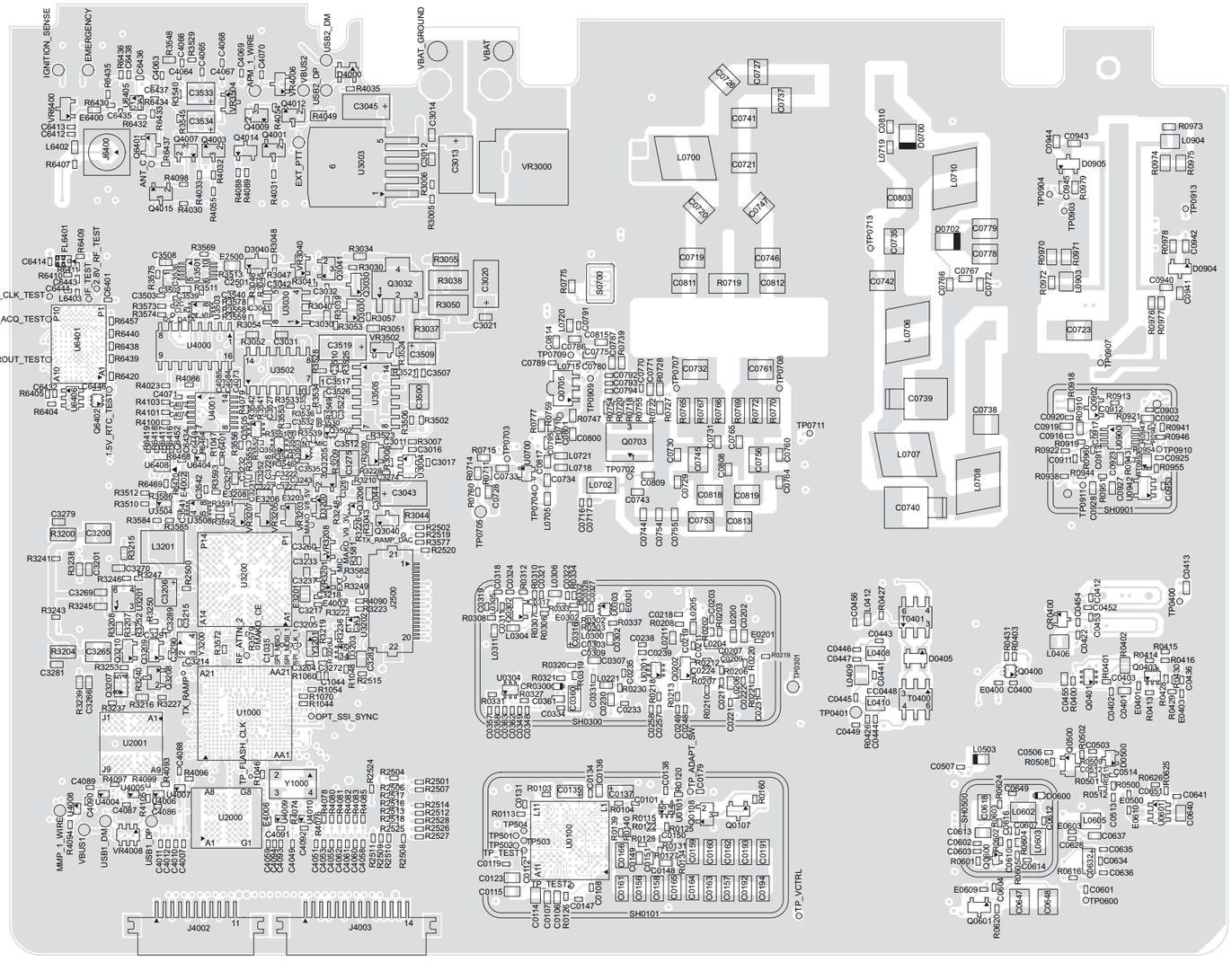


UHF1 (403–470 MHz) 1–25W 8471165L03 Top Side

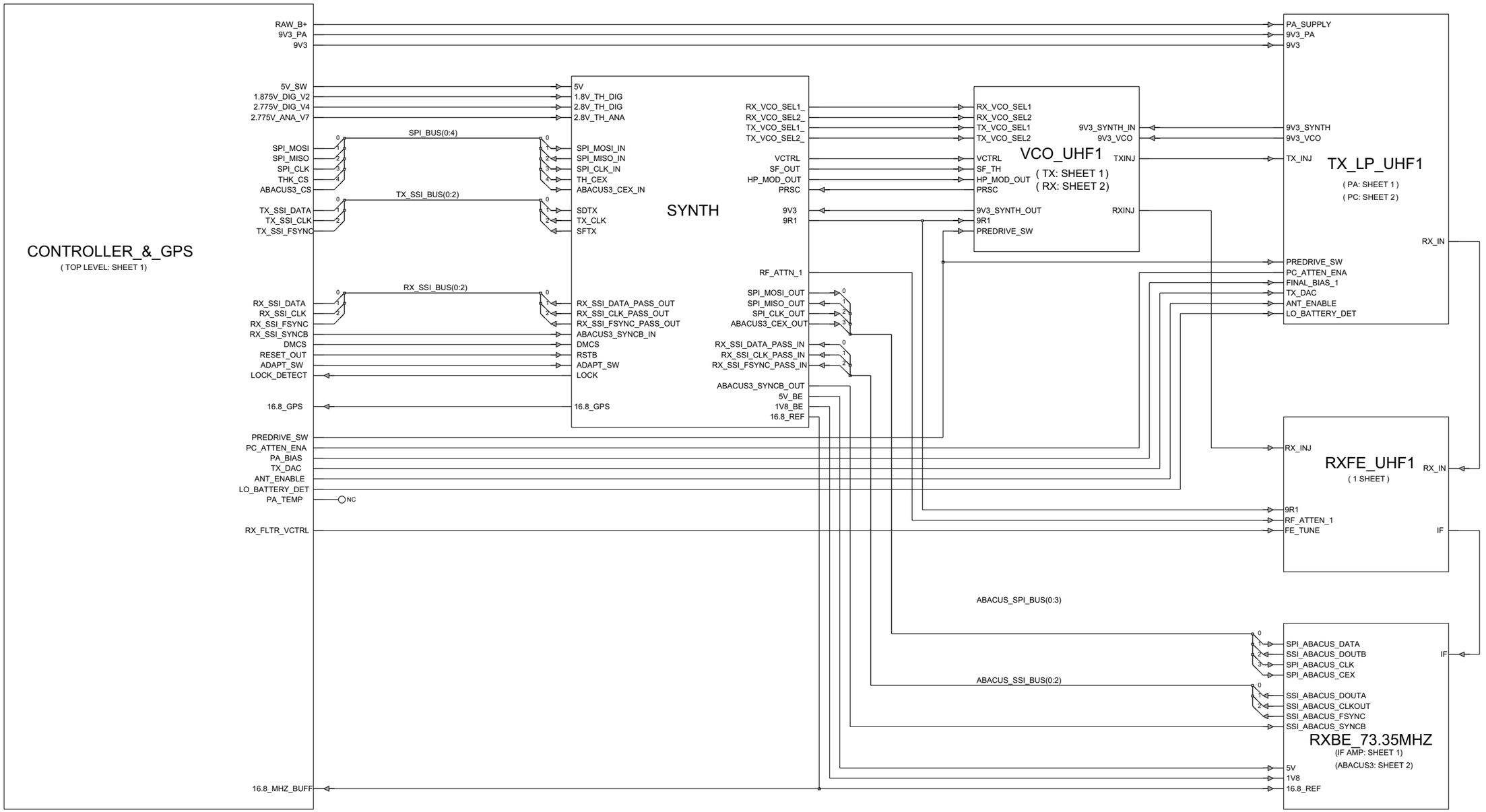


UHF1 (403–470 MHz) 1–25W 8471165L03 Bottom Side

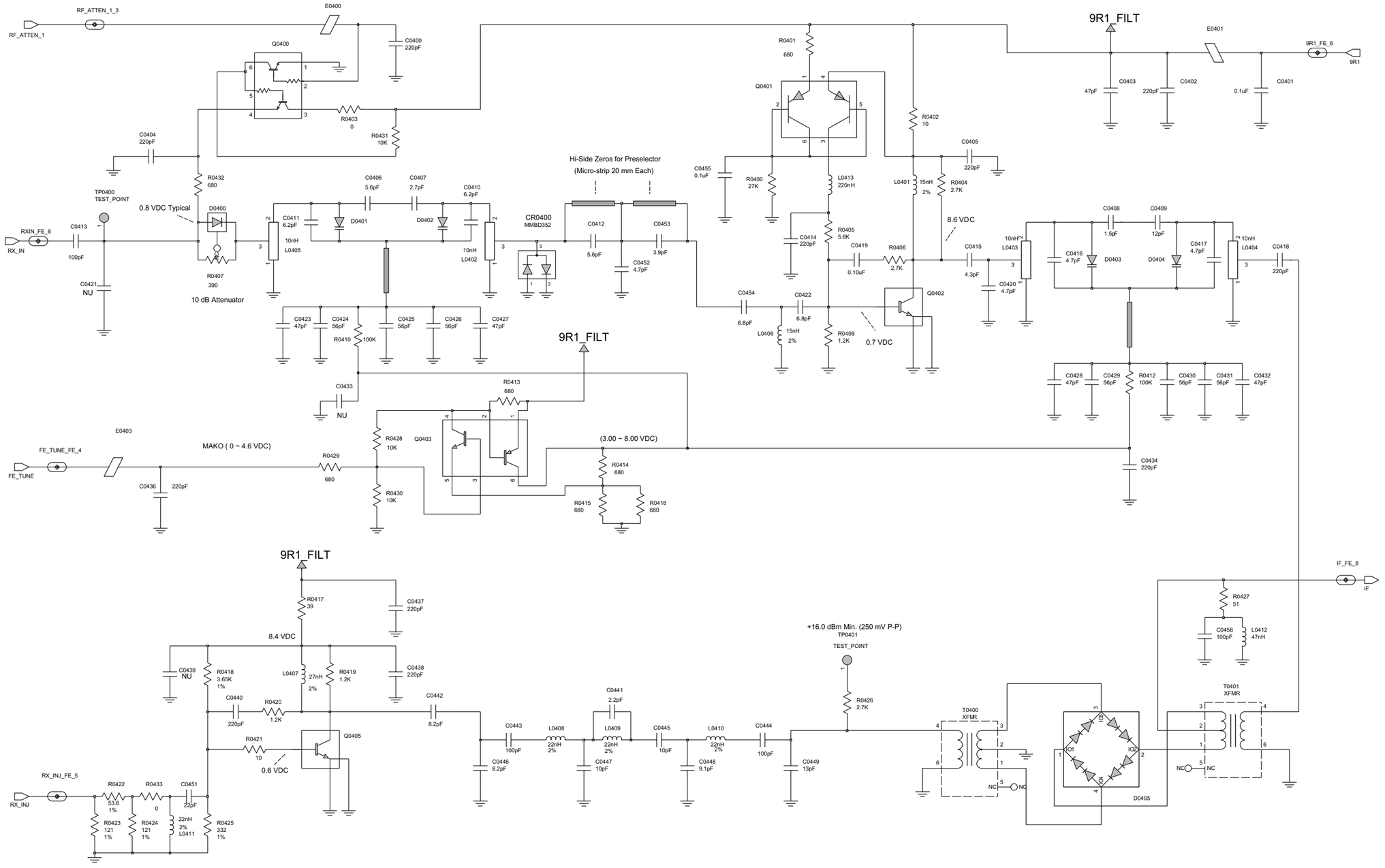

J0700
L0722
R0713
J3000
C3018
C0710
C0705
C0704
C0703
C0702
C0701
C0700
E0700
E0701
R0742
C0713
C0711
C0712
R0776
C0714
Q0748
R0729
C0776
VR0700
Q0704
R0735
R0738
C0777
L0714
Q0706
R0745
C0798
C0799
R0748
C0797
C0796
R0749
SP0705 SP0703 SP0702 SP0707
Q0702
SP0704 SP0701 SP0700 SP0706
R0774
R0740
C0781
C0782
R0732
R0730
R0756
Q0708
C0804
C0805
C0802
R0750
R0751
Q0707
R0761
R0778
R0752
L0723
R0744
C0788
R0700
M0700
Q0709
R0741
R0753
R0757
RT0908
L0900
C0904
C0718
R0734
R0702
R0703
E0703
R0708
MAKO_GATED_32KHz
TP_MAKO_DCLK
TP_MAKO_FSYNC
TP_MAKO_TX
TP_MAKO_RX
USB1_SEO
USB1_DAT
USB1_TXEN
C3000
C3015
E3000
SP3000
SP3001
C3002
U3001
J4000
VR4004
C4048
R4050
C4013
C3006
E4005
C4075
R4048
C3007
VR4000
VR4005
VR4003
VR4001
VR4002
R4040
C4040
R4041
C4041
R4046
C4046
R4047
C4047
R4042
C4042
R4043
C4043
R4045
C4045
R4044
C4044
C3005
C3019
R3002
C4000
R3004
C4004
C4006
R4051
C0929
C0926
R0950
R0927
R0924
R0926
C0934
C0935
C0933
L0902
R0917
R0947
C0922
C0914
C0948
C0921
C0950
L0901
R0929
R0928
C0918
R0936
R0937
C0949
R0925
C0937
C0936
C0903
SH0900
C0901
C0902
U0941
R0922
C0938
C0939
C0940
C0941
C0942
C0943
C0944
C0945
C0946
C0947
C0948
C0949
C0950
C0951
C0952
C0953
C0954
C0955
C0956
C0957
C0958
C0959
C0960
C0961
C0962
C0963
C0964
C0965
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C0975
C0976
C0977



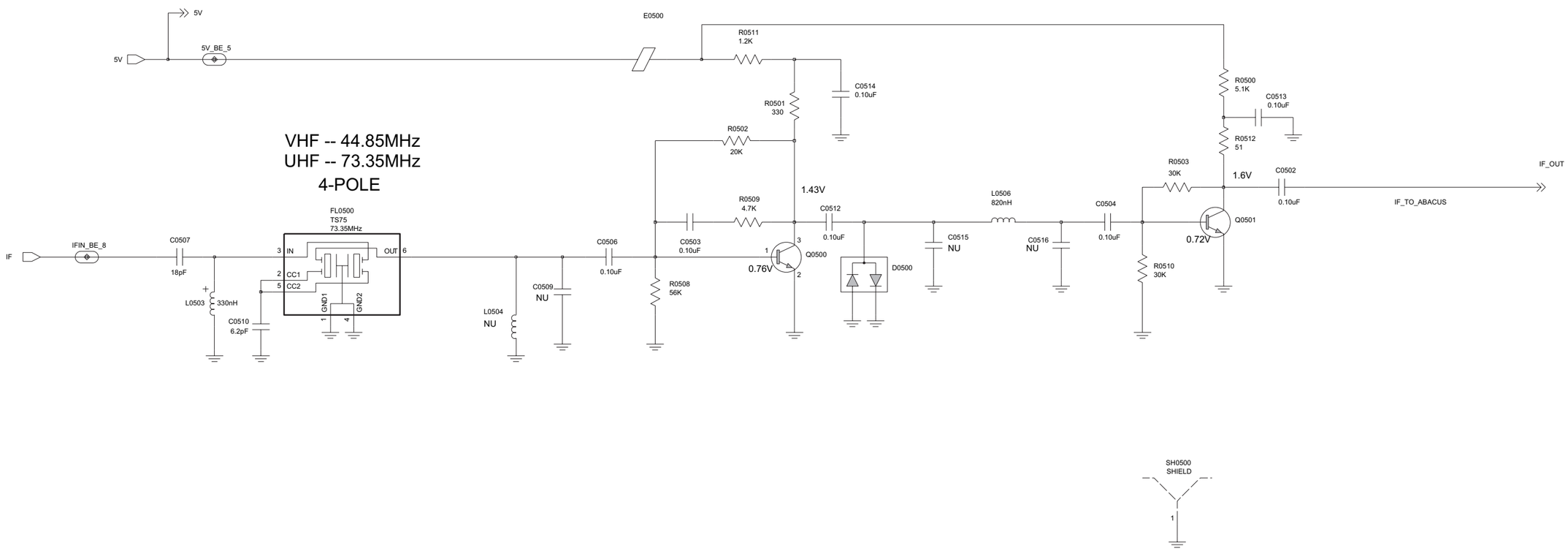
UHF1 (403–470 MHz) 1–25W 8471165L05 Bottom side



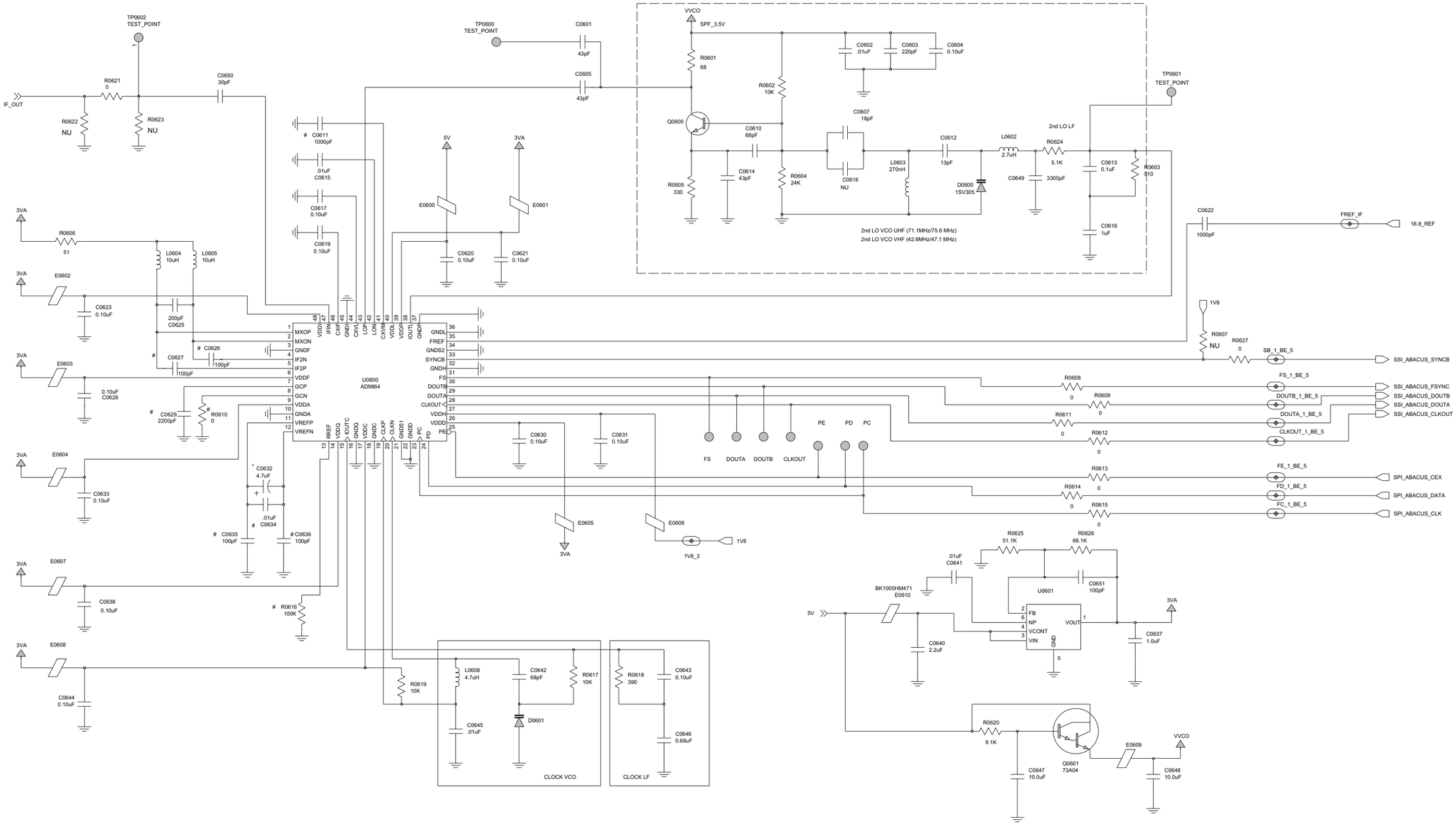
UHF1 (403–470 MHz) 1–25W Overall Schematic Diagram



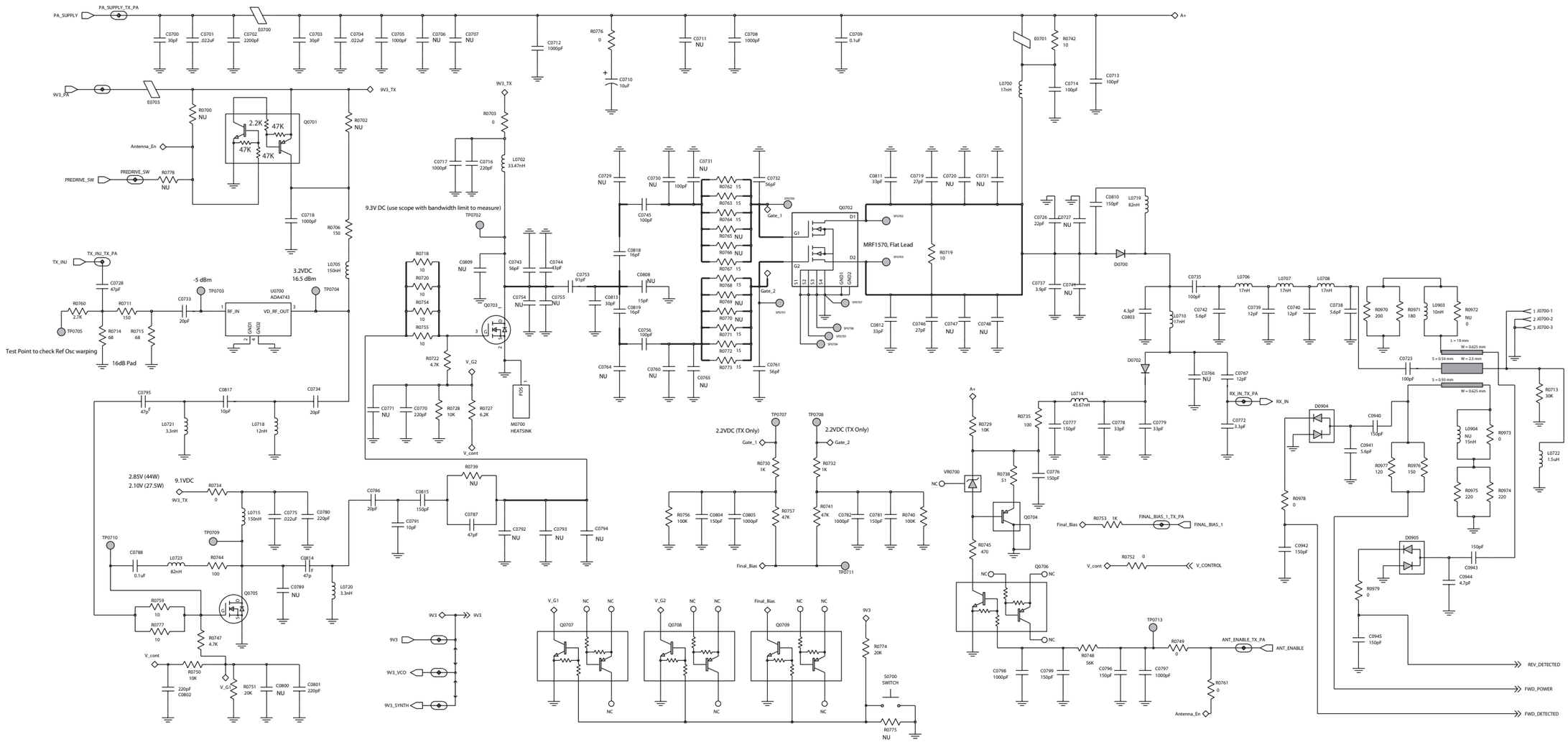
UHF1 (403–470 MHz) 1–25W Receiver Front-End Schematic Diagram

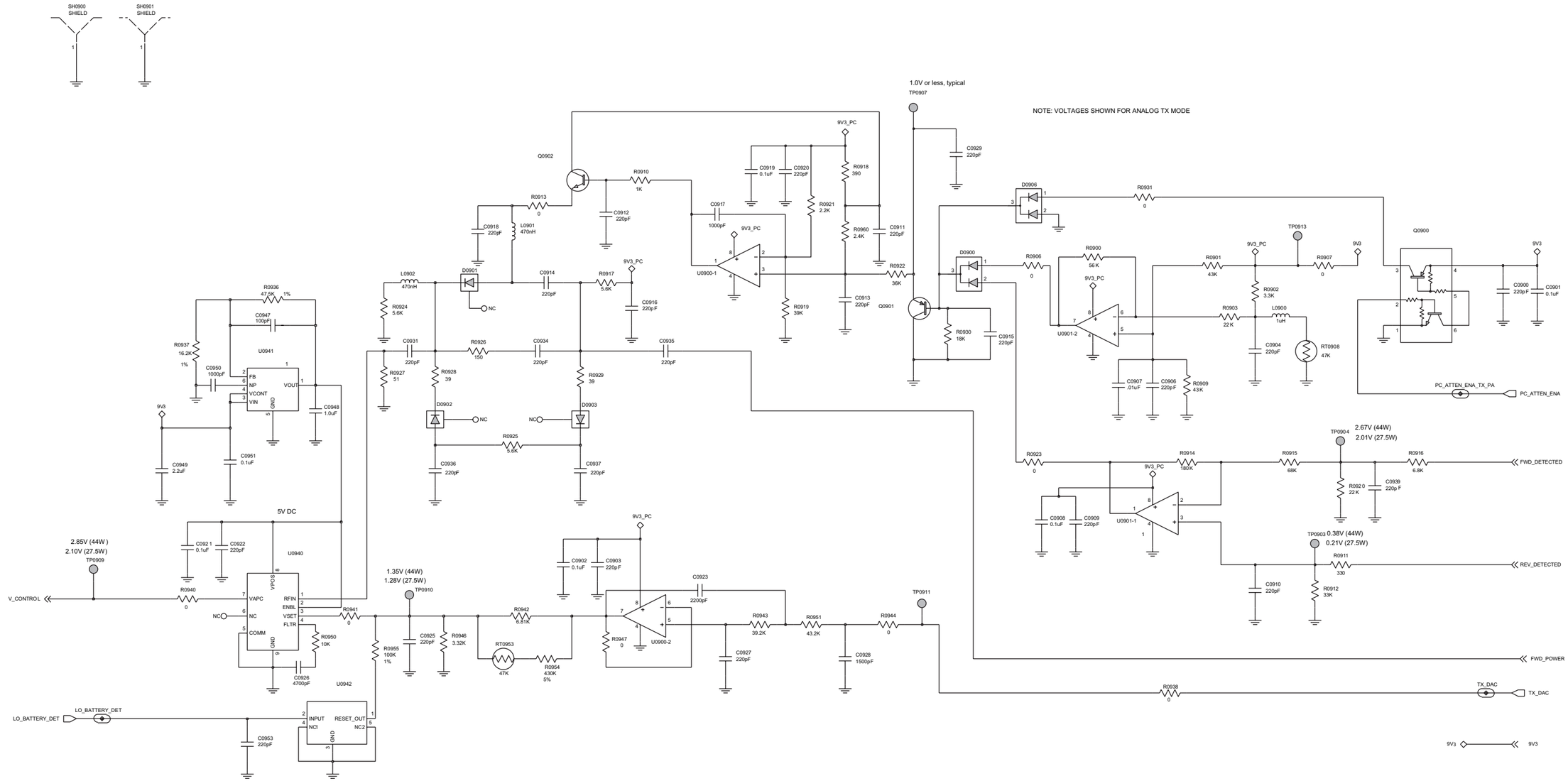


UHF1 (403–470 MHz) 1–25W Receiver IF Amp Schematic Diagram

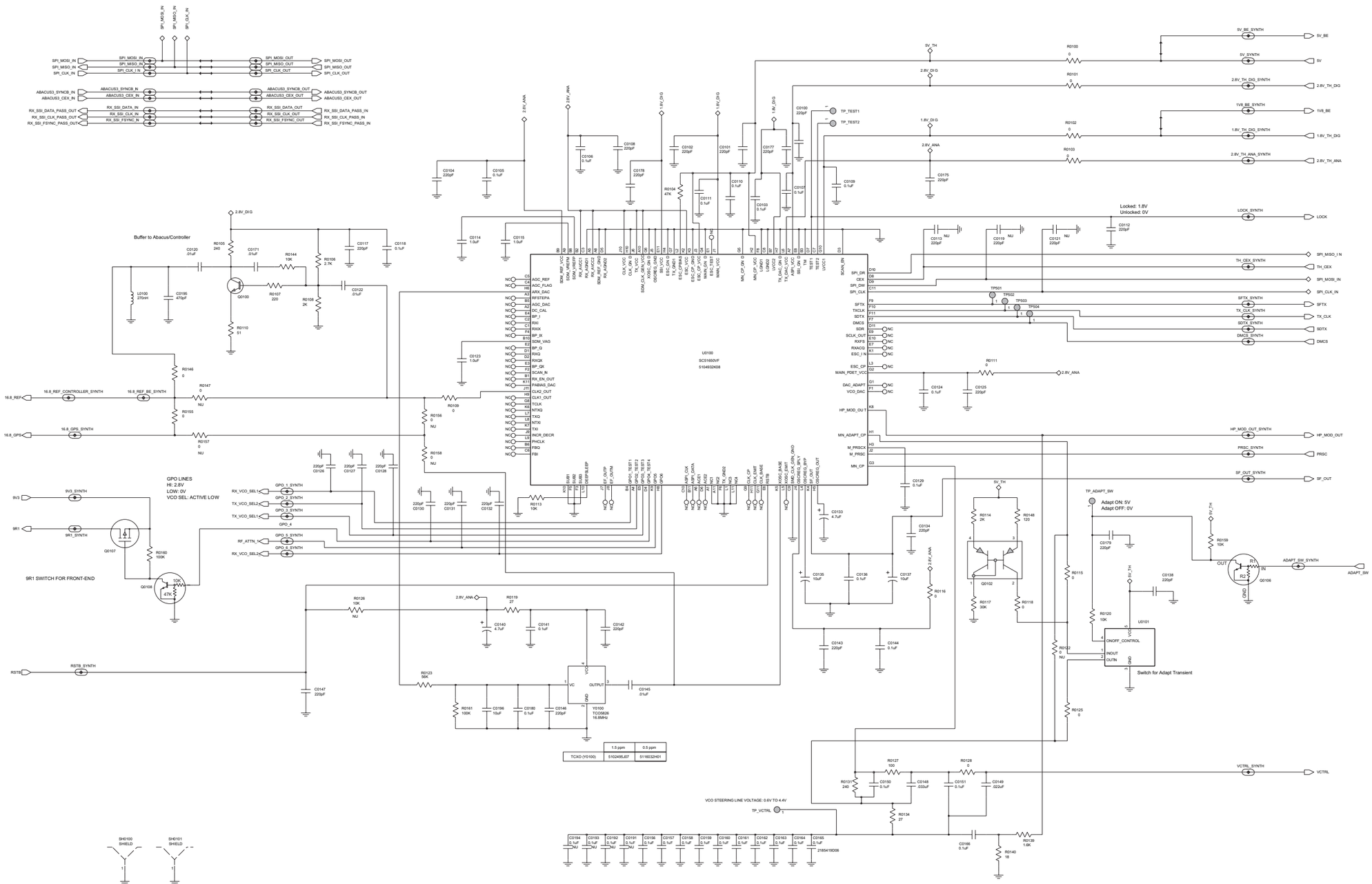


UHF1 (403–470 MHz) 1–25W Receiver Back-End Schematic Diagram

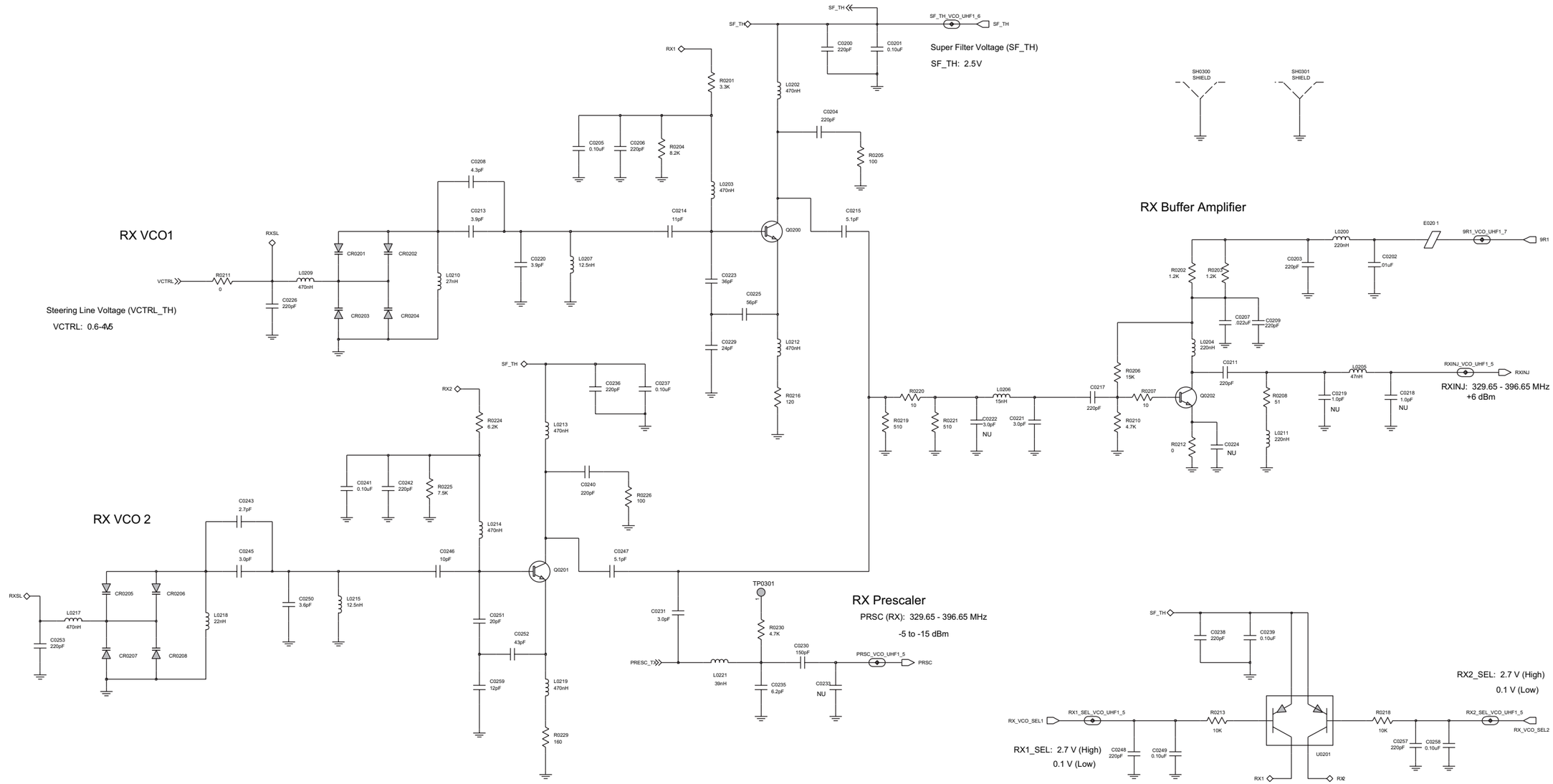

PA_SUPPLY
PA_SUPPLY_TX_PA
9V3_PA
9V3_TX
Antenna_En
PREDRIVE_SW
TX_INJ
TX_INJ_TX_PA
-5 dBm
3.2VDC
16.5 dBm
Test Point to check Ref Osc warping
16dB Pad
9.3V DC (use scope with bandwidth limit to measure)
MRF1570, Flat Lead
2.2VDC (TX Only)
2.2VDC (TX Only)
2.85V (44W)
2.10V (27.5W)
9.1VDC
V_cont
V_G1
V_G2
Final_Bias
RX_IN_TX_PA
RX_IN
ANT_ENABLE_TX_PA
ANT_ENABLE
FINAL_BIAS_1_TX_PA
FINAL_BIAS_1
V_CONTROL
REV_DETECTED
FWD_POWER
FWD_DETECTED
A+
HEATSINK
SWITCH
ADA4743
U0700
Q0701
Q0702
Q0703
Q0704
Q0705
Q0706
Q0707
Q0708
Q0709
VR0700
D0700
D0702
D0904
D0905
E0700
E0701
E0703
M0700
S0700
S0701
S0702
S0703
S0704
S0705
S0706
S0707
TP0702
TP0703
TP0704
TP0705
TP0707
TP0708
TP0709
TP0710
TP0711
TP0713
L0700 17nH
L0702 33.47nH
L0705 150nH
L0706 17nH
L0707 17nH
L0708 17nH
L0710 17nH
L0712 1000pF
L0714 43.67nH
L0715 150nH
L0718 12nH
L0719 82nH
L0720 3.3nH
L0721 3.3nH
L0722 1.5uH
L0723 82nH
L0900 NU 15nH
L0903 10nH
C0700 30pF
C0701 .022uF
C0702 2200pF
C0703 30pF
C0704 .022uF
C0705 1000pF
C0706 NU
C0707 NU
C0708 1000pF
C0709 0.1uF
C0710 10uF
C0711 NU
C0713 100pF
C0714 100pF
C0716 220pF
C0717 1000pF
C0718 1000pF
C0720 NU
C0721 NU
C0723 100pF
C0726 22pF
C0727 NU
C0728 47pF
C0729 NU
C0730 NU
C0731 NU
C0732 56pF
C0733 20pF
C0734 20pF
C0735 100pF
C0737 3.9pF
C0738 5.6pF
C0739 12pF
C0740 12pF
C0741 100pF
C0742 5.6pF
C0743 56pF
C0744 43pF
C0745 100pF
C0746 27pF
C0747 NU
C0748 NU
C0749 NU
C0750 220pF
C0752 0
C0753 91pF
C0754 NU
C0755 NU
C0756 100pF
C0760 NU
C0761 56pF
C0764 NU
C0765 NU
C0766 NU
C0767 12pF
C0770 220pF
C0771 NU
C0772 3.3pF
C0775 .022uF
C0776 150pF
C0777 150pF
C0778 33pF
C0779 33pF
C0780 220pF
C0781 150pF
C0782 1000pF
C0786 20pF
C0787 47pF
C0788 0.1uF
C0789 NU
C0791 10pF
C0792 NU
C0793 NU
C0794 NU
C0795 47pF
C0796 150pF
C0797 1000pF
C0798 1000pF
C0799 150pF
C0800 NU
C0801 220pF
C0802 220pF
C0803 4.3pF
C0804 150pF
C0805 1000pF
C0808 NU
C0809 NU
C0810 150pF
C0811 33pF
C0812 33pF
C0813 30pF
C0814 47p
C0817 10pF
C0818 16pF
C0819 16pF
C0940 150pF
C0941 5.6pF
C0942 150pF
C0943 150pF
C0944 4.7pF
C0945 150pF
R0700 NU
R0702 NU
R0703 0
R0706 150
R0707 NU
R0708 NU
R0709 NU
R0710 NU
R0711 150
R0712 NU
R0713 30K
R0714 68
R0715 68
R0718 10
R0719 10
R0720 10
R0721 NU
R0722 4.7K
R0723 NU
R0724 NU
R0725 NU
R0726 NU
R0727 6.2K
R0728 10K
R0729 10K
R0730 1K
R0731 NU
R0732 1K
R0733 NU
R0734 0
R0735 100
R0738 51
R0739 NU
R0740 100K
R0741 47K
R0742 10
R0743 NU
R0744 100
R0745 470
R0746 NU
R0747 4.7K
R0748 56K
R0749 0
R0750 10K
R0751 20K
R0752 0
R0753 1K
R0754 10
R0755 10
R0756 100K
R0757 47K
R0759 10
R0760 2.7K
R0761 0
R0762 15
R0763 15
R0764 15
R0765 NU
R0766 NU
R0767 15
R0768 15
R0769 NU
R0770 NU
R0771 15
R0772 15
R0773 15
R0774 20K
R0775 NU
R0776 0
R0777 10
R0778 NU
R0903 10nH
R0904 NU
R0905 NU
R0970 200
R0971 180
R0972 NU 0
R0973 0
R0974 220
R0975 220
R0976 150
R0977 120
R0978 0
R0979 0
R0980 NU
R0981 NU
R0982 NU
R0983 NU
R0984 NU
R0985 NU
R0986 NU
R0987 NU
R0988 NU
R0989 NU
R0990 NU
R0991 NU
R0992 NU
R0993 NU
R0994 NU
R0995 NU
R0996 NU
R0997 NU
R0998 NU
R0999 NU



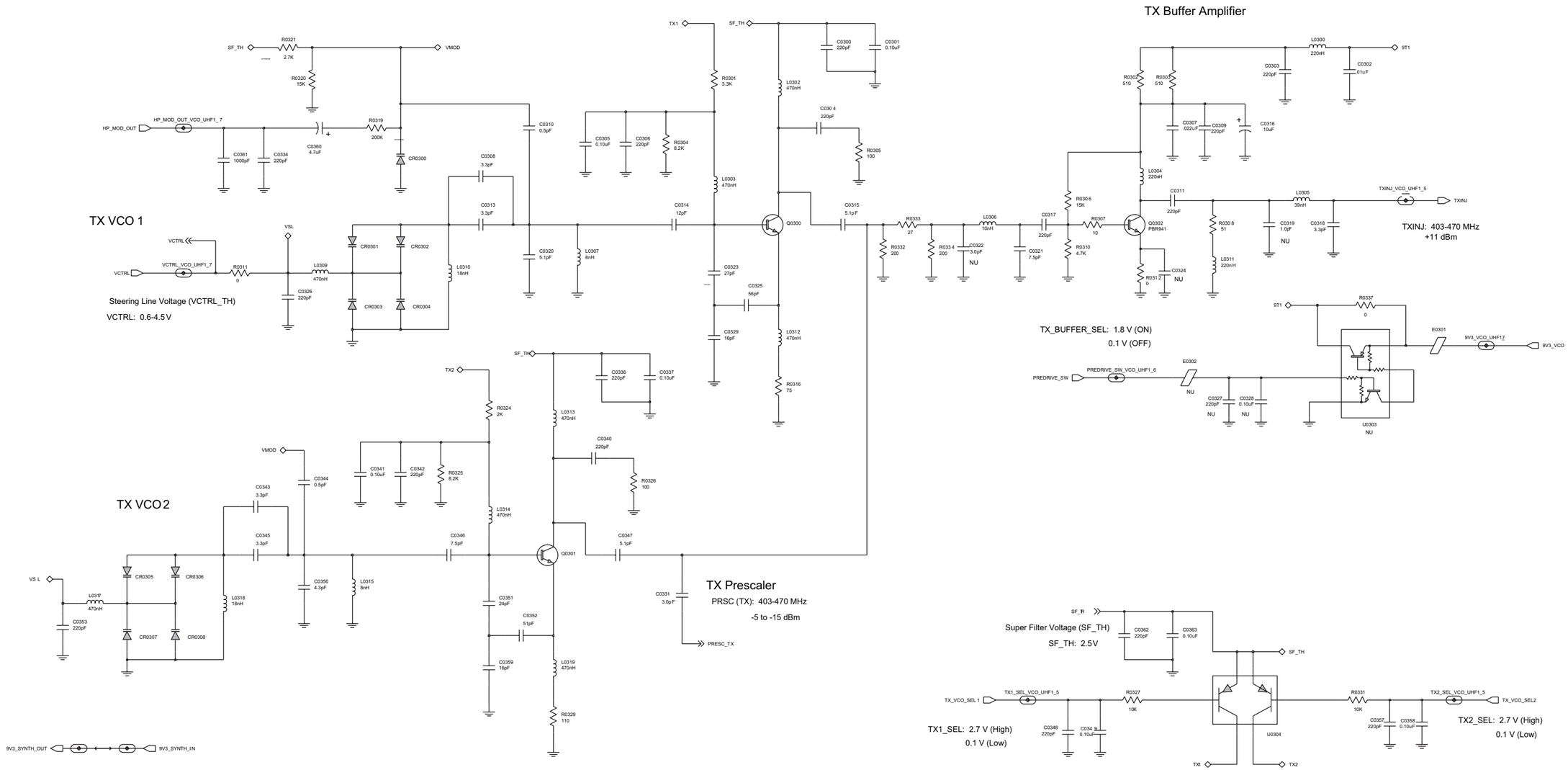
UHF1 (403–470 MHz) 1–25W Power Control Schematic Diagram



UHF1 (403–470 MHz) 1–25W Synthesizer Schematic Diagram



UHF1 (403–470 MHz) 1–25W Receiver VCO Schematic Diagram



UHF1 (403–470 MHz) 1–25W Transmit VCO Schematic Diagram

UHF1 PCB 8471165L03 and 8471165L05 Parts List 1–25W

Circuit Ref	Motorola Part No.	Description
C0100	2113944A44	220pF
C0101	2113944A44	220pF
C0102	2113944A44	220pF
C0103	2113945C31	0.1uF
C0104	2113944A44	220pF
C0105	2113945C31	0.1uF
C0106	2113945C31	0.1uF
C0107	2113945C31	0.1uF
C0108	2113944A44	220pF
C0109	2113945C31	0.1uF
C0110	2113945C31	0.1uF
C0111	2113945C31	0.1uF
C0112	2113944A44	220pF
C0113	NOT PLACED	–
C0114	2113946E02	1.0uF
C0115	2113946E02	1.0uF
C0117	2113944A44	220pF
C0118	2113945C31	0.1uF
C0119	NOT PLACED	–
C0120	2113945B02	.01uF
C0121	NOT PLACED	–
C0122	2113945B02	.01uF
C0123	2113946E02	1.0uF
C0124	2113945C31	0.1uF
C0125	2113944A44	220pF
C0126	2113944A44	220pF
C0127	2113944A44	220pF
C0128	2113944A44	220pF
C0129	2113945C31	0.1uF
C0130	2113944A44	220pF
C0131	2113944A44	220pF
C0132	2113944A44	220pF
C0133	2313960B30	4.7uF
C0134	2113944A44	220pF
C0135	2313960B32	10uF
C0136	2113945C31	0.1uF
C0137	2313960B32	10uF
C0138	2113944A44	220pF
C0140	2313960B30	4.7uF
C0141	2113945C31	0.1uF
C0142	2113944A44	220pF
C0143	2113944A44	220pF
C0144	2113945C31	0.1uF
C0145	2113945B02	.01uF
C0146	2113944A44	220pF
C0147	2113944A44	220pF
C0148	2113945D01	.033uF
C0149	2113945C04	.022uF
C0150	2113945C31	0.1uF
C0151	2113945C31	0.1uF
C0156	2185419D06	0.1uF
C0157	2185419D06	0.1uF
C0158	2185419D06	0.1uF
C0159	2185419D06	0.1uF
C0160	2185419D06	0.1uF
C0161	2185419D06	0.1uF
C0162	2185419D06	0.1uF
C0163	2185419D06	0.1uF
C0164	2185419D06	0.1uF
C0165	2185419D06	0.1uF
C0166	2185419D06	0.1uF
C0171	2113945B02	.01uF
C0175	2113944A44	220pF
C0177	2113944A44	220pF
C0178	2113944A44	220pF
C0179	2113944A44	220pF
C0180	2113945C31	0.1uF
C0191	NOT PLACED	–
C0192	NOT PLACED	–
C0193	NOT PLACED	–
C0194	NOT PLACED	–
C0195	2113945A05	470pF
C0196	2113946H02	10uF
C0200	2113944A44	220pF
C0201	2113945Y02	0.10uF
C0202	2113945C02	.01uF
C0203	2113944A44	220pF
C0204	2113944A44	220pF
C0205	2113945Y02	0.10uF
C0206	2113944A44	220pF
C0207	2113945C04	.022uF
C0208	2115153H18	4.3pF
C0209	2113944A44	220pF
C0211	2113944A44	220pF
C0213	2115153H17	3.9pF
C0214	2115153H34	11pF
C0215	2115153H20	5.1pF
C0217	2113944A44	220pF
C0218	NOT PLACED	–
C0219	NOT PLACED	–
C0220	2115153H17	3.9pF
C0221	2115153H14	3.0pF
C0222	NOT PLACED	–
C0223	2115153H46	36pF
C0224	NOT PLACED	–
C0225	2115153H51	56pF
C0226	2113944A44	220pF
C0229	2115153H42	24pF
C0230	2113944C47	150pF
C0231	2115153H14	3.0pF
C0233	NOT PLACED	–
C0235	2115153H22	6.2pF
C0236	2113944A44	220pF
C0237	2113945Y02	0.10uF
C0238	2113944A44	220pF
C0239	2113945Y02	0.10uF
C0240	2113944A44	220pF
C0241	2113945Y02	0.10uF
C0242	2113944A44	220pF
C0243	2115153H13	2.7pF
C0245	2115153H14	3.0pF
C0246	2115153H27	10pF
C0247	2115153H20	5.1pF
C0248	2113944A44	220pF
C0249	2113945Y02	0.10uF
C0250	2115153H16	3.6pF
C0251	2115153H40	20pF
C0252	2115153H48	43pF
C0253	2113944A44	220pF
C0257	2113944A44	220pF
C0258	2113945Y02	0.10uF
C0259	2115153H35	12pF
C0300	2113944A44	220pF
C0301	2113945Y02	0.10uF
C0302	2113945C02	.01uF
C0303	2113944A44	220pF
C0304	2113944A44	220pF
C0305	2113945Y02	0.10uF
C0306	2113944A44	220pF
C0307	2113945C04	.022uF
C0308	2115153H15	3.3pF
C0309	2113944A44	220pF
C0310	2115153H01	0.5pF
C0311	2113944A44	220pF
C0313	2115153H15	3.3pF
C0314	2115153H35	12pF
C0315	2115153H20	5.1pF
C0316	2313960B32	10uF
C0317	2113944A44	220pF
C0318	2115153H15	3.3pF
C0319	NOT PLACED	–
C0320	2115153H20	5.1pF
C0321	2115153H24	7.5pF
C0322	NOT PLACED	–
C0323	2115153H43	27pF
C0324	NOT PLACED	–
C0325	2115153H51	56pF
C0326	2113944A44	220pF
C0327	NOT PLACED	–
C0328	NOT PLACED	–
C0329	2115153H38	16pF
C0331	2115153H14	3.0pF
C0334	2113944A44	220pF
C0336	2113944A44	220pF
C0337	2113945Y02	0.10uF
C0340	2113944A44	220pF
C0341	2113945Y02	0.10uF
C0342	2113944A44	220pF
C0343	2115153H15	3.3pF
C0344	2115153H01	0.5pF
C0345	2115153H15	3.3pF
C0346	2115153H24	7.5pF
C0347	2115153H20	5.1pF
C0348	2113944A44	220pF
C0349	2113945Y02	0.10uF
C0350	2115153H18	4.3pF
C0351	2115153H42	24pF
C0352	2115153H50	51pF
C0353	2113944A44	220pF
C0357	2113944A44	220pF
C0358	2113945Y02	0.10uF
C0359	2115153H38	16pF
C0360	2313960B30	4.7uF
C0361	2113944C51	1000pF
C0362	2113944A44	220pF
C0363	2113945Y02	0.10uF
C0400	2113944A44	220pF
C0401	2113945C31	0.1uF
C0402	2113944A44	220pF
C0403	2115153H49	47pF
C0404	2113944A44	220pF
C0405	2113944A44	220pF
C0406	2115153H21	5.6pF
C0407	2115153H13	2.7pF
C0408	2115153H08	1.5pF
C0409	2115153H35	12pF
C0410	2115153H22	6.2pF
C0411	2115153H22	6.2pF
C0412	2115153H21	5.6pF
C0413	2113944C45	100pF
C0414	2113944A44	220pF
C0415	2115153H18	4.3pF
C0416	2115153H19	4.7pF
C0417	2115153H19	4.7pF
C0418	2113944A44	220pF
C0419	2113945Y02	0.10uF
C0420	2115153H19	4.7pF
C0421	NOT PLACED	–
C0422	2115153H23	6.8pF
C0423	2115153H49	47pF
C0424	2115153H51	56pF
C0425	2115153H51	56pF

Circuit Ref	Motorola Part No.	Description
C0426	2115153H51	56pF
C0427	2115153H49	47pF
C0428	2115153H49	47pF
C0429	2115153H51	56pF
C0430	2115153H51	56pF
C0431	2115153H51	56pF
C0432	2115153H49	47pF
C0433	NOT PLACED	–
C0434	2113944A44	220pF
C0436	2113944A44	220pF
C0437	2113944A44	220pF
C0438	2113944A44	220pF
C0439	NOT PLACED	–
C0440	2113944A44	220pF
C0441	2115153H11	2.2pF
C0442	2115153H25	8.2pF
C0443	2115153H57	100pF
C0444	2115153H57	100pF
C0445	2115153H27	10pF
C0446	2115153H25	8.2pF
C0447	2115153H27	10pF
C0448	2115153H26	9.1pF
C0449	2115153H36	13pF
C0451	2115153H41	22pF
C0452	2115153H19	4.7pF
C0453	2115153H17	3.9pF
C0454	2115153H23	6.8pF
C0455	2113945C31	0.1uF
C0456	2113944A40	100pF
C0502	2113945Y02	0.10uF
C0503	2113945Y02	0.10uF
C0504	2113945Y02	0.10uF
C0506	2113945Y02	0.10uF
C0507	2115153H39	18pF
C0509	NOT PLACED	–
C0510	2115153H22	6.2pF
C0512	2113945Y02	0.10uF
C0513	2113945Y02	0.10uF
C0514	2113945Y02	0.10uF
C0515	NOT PLACED	–
C0516	NOT PLACED	–
C0601	2115153H48	43pF
C0602	2113945B02	.01uF
C0603	2113944A44	220pF
C0604	2113945Y02	0.10uF
C0605	2115153H48	43pF
C0607	2115153H39	18pF
C0610	2115153H53	68pF
C0611	2113945A09	1000pF
C0612	2115153H36	13pF
C0613	2113945G91	0.1uF
C0614	2115153H48	43pF
C0615	2113945B02	.01uF
C0616	NOT PLACED	–
C0617	2113945Y02	0.10uF
C0618	2115358H25	1uF
C0619	2113945Y02	0.10uF
C0620	2113945Y02	0.10uF
C0621	2113945Y02	0.10uF
C0622	2113945A09	1000pF
C0623	2113945Y02	0.10uF
C0625	2113944C89	200pF
C0626	2113944A40	100pF
C0627	2113944A40	100pF
C0628	2113945Y02	0.10uF
C0629	2113945A11	2200pF
C0630	2113945Y02	0.10uF
C0631	2113945Y02	0.10uF
C0632	2313960B30	4.7uF
C0633	2113945Y02	0.10uF
C0634	2113945B02	.01uF
C0635	2113944A40	100pF
C0636	2113944A40	100pF
C0637	2113946S35	1.0uF
C0638	2113945Y02	0.10uF
C0640	2113946N03	2.2uF
C0641	2113945B02	.01uF
C0642	2115153H53	68pF
C0643	2113945Y02	0.10uF
C0644	2113945Y02	0.10uF
C0645	2113945B02	.01uF
C0646	2113946G04	0.68uF
C0647	2113946J03	10.0uF
C0648	2113946J03	10.0uF
C0649	2113945A12	3300pF
C0650	2115153H44	30pF
C0651	2115153H57	100pF
C0700	2113944C82	30pF
C0701	2113945C04	.022uF
C0702	2113944C55	2200pF
C0703	2113944C82	30pF
C0704	2113945C04	.022uF
C0705	2113944C51	1000pF
C0706	NOT PLACED	–
C0707	NOT PLACED	–
C0708	2113944C51	1000pF
C0709	2113945C31	0.1uF
C0710	2371403L02	10uF
C0711	NOT PLACED	–
C0712	2113944C51	1000pF
C0713	2111078B42	100pF
C0714	2111078B42	100pF
C0716	2113944A44	220pF
C0717	2113945A09	1000pF
C0718	2113945A09	1000pF
C0719	2111078B25	27pF
C0720	NOT PLACED	–
C0721	NOT PLACED	–
C0723	2111078B42	100pF
C0726	2111078B22	22pF
C0727	NOT PLACED	–
C0728	2113944C38	47pF
C0729	NOT PLACED	–
C0730	NOT PLACED	–
C0731	NOT PLACED	–
C0732	2111078B36	56pF
C0733	2113944C80	20pF
C0734	2113944C80	20pF
C0735	2111078B42	100pF
C0737	2111078B03	3.9pF
C0738	2111078B07	5.6pF
C0739	2171388L01	12pF
C0740	2171388L01	12pF
C0741	NOT PLACED	–
C0742	2111078B07	5.6pF
C0743	2113944C39	56pF
C0744	2113944C84	43pF
C0745	2111078B42	100pF
C0746	2111078B25	27pF
C0747	NOT PLACED	–
C0748	NOT PLACED	–
C0753	2111078B41	91pF
C0754	NOT PLACED	–
C0755	NOT PLACED	–
C0756	2111078B42	100pF
C0760	NOT PLACED	–
C0761	2111078B36	56pF
C0764	NOT PLACED	–
C0765	NOT PLACED	–
C0766	NOT PLACED	–
C0767	2113944C31	12pF
C0770	2113944A44	220pF
C0771	NOT PLACED	–
C0772	2113944C18	3.3pF
C0775	2113945C04	.022uF
C0776	2113944C47	150pF
C0777	2113944C47	150pF
C0778	2111078B29	33pF
C0779	2111078B29	33pF
C0780	2113944A44	220pF
C0781	2113944C47	150pF
C0782	2113944C51	1000pF
C0786	2113944C80	20pF
C0787	2113944C38	47pF
C0788	NOT PLACED	–
C0789	NOT PLACED	–
C0791	2113944A25	10pF
C0792	NOT PLACED	–
C0793	NOT PLACED	–
C0794	NOT PLACED	–
C0795	2113944C38	47pF
C0796	2113944C47	150pF
C0797	2113944C51	1000pF
C0798	2113944C51	1000pF
C0799	2113944C47	150pF
C0800	NOT PLACED	–
C0801	2113944A44	220pF
C0802	2113944A44	220pF
C0803	2111078B04	4.3pF
C0804	2113944C47	150pF
C0805	2113944C51	1000pF
C0808	NOT PLACED	–
C0809	NOT PLACED	–
C0810	2113944C47	150pF
C0811	2111078B29	33pF
C0812	2111078B29	33pF
C0813	2111078B27	30pF
C0814	2113944C38	47pF
C0815	2113944C47	150pF
C0817	2113944C30	10pF
C0818	2111078B19	16pF
C0819	2111078B19	16pF
C0900	2113944A44	220pF
C0901	2113945C31	0.1uF
C0902	2113945C31	0.1uF
C0903	2113944A44	220pF
C0904	2113944A44	220pF
C0906	2113944A44	220pF
C0907	2113945C02	.01uF
C0908	2113945C31	0.1uF
C0909	2113944A44	220pF
C0910	2113944A44	220pF
C0911	2113944A44	220pF
C0912	2113944A44	220pF
C0913	2113944A44	220pF
C0914	2113944A44	220pF
C0915	2113944A44	220pF
C0916	2113944A44	220pF
C0917	2113945A09	1000pF
C0918	2113944A44	220pF
C0919	2113945C31	0.1uF
C0920	2113944A44	220pF
C0921	2113945C31	0.1uF
C0922	2113944A44	220pF

Circuit Ref	Motorola Part No.	Description
C0923	2113944C55	2200pF
C0925	2113944A44	220pF
C0926	2113945L41	4700pF
C0927	2113944C02	220pF
C0928	2113944C53	1500pF
C0929	2113944A44	220pF
C0931	2113944A44	220pF
C0934	2113944A44	220pF
C0935	2113944A44	220pF
C0936	2113944A44	220pF
C0937	2113944A44	220pF
C0939	2113944A44	220pF
C0940	2113944C47	150pF
C0941	2113944M12	5.6pF
C0942	2113944C47	150pF
C0943	2113944C47	150pF
C0944	2113944M10	4.7pF
C0945	2113944C47	150pF
C0947	2113944A40	100pF
C0948	2113946S35	1.0uF
C0949	2113946G01	2.2uF
C0950	2113945A09	1000pF
C0951	2113945C31	0.1uF
C0953	2113944A44	220pF
CR0201	4815096H01	DIODE VARACTOR 1SV305
CR0202	4815096H01	DIODE VARACTOR 1SV305
CR0203	4815096H01	DIODE VARACTOR 1SV305
CR0204	4815096H01	DIODE VARACTOR 1SV305
CR0205	4815096H01	DIODE VARACTOR 1SV305
CR0206	4815096H01	DIODE VARACTOR 1SV305
CR0207	4815096H01	DIODE VARACTOR 1SV305
CR0208	4815096H01	DIODE VARACTOR 1SV305
CR0300	4815096H01	DIODE VARACTOR 1SV305
CR0301	4815096H01	DIODE VARACTOR 1SV305
CR0302	4815096H01	DIODE VARACTOR 1SV305
CR0303	4815096H01	DIODE VARACTOR 1SV305
CR0304	4815096H01	DIODE VARACTOR 1SV305
CR0305	4815096H01	DIODE VARACTOR 1SV305
CR0306	4815096H01	DIODE VARACTOR 1SV305
CR0307	4815096H01	DIODE VARACTOR 1SV305
CR0308	4815096H01	DIODE VARACTOR 1SV305
CR0400	4813974A19	DIODE, SCHOTTKY
D0400	4813974A06	DIODE, PIN
D0401	4885055Y01	DIODE VARACTOR 1SV229
D0402	4885055Y01	DIODE VARACTOR 1SV229
D0403	4885055Y01	DIODE VARACTOR 1SV229
D0404	4885055Y01	DIODE VARACTOR 1SV229
D0405	4815090H01	DIODE, MIXER
D0500	4813974A19	DIODE, SCHOTTKY
D0600	4815096H01	DIODE VARACTOR 1SV305
D0601	4815096H01	DIODE VARACTOR 1SV305

Circuit Ref	Motorola Part No.	Description
D0700	4802482J02	DIODE, PIN
D0702	4802482J02	DIODE, PIN
D0900	4813978C02	DIODE, SWITCHING
D0901	4815023H01	DIODE, PIN
D0902	4815024H01	DIODE, PIN
D0903	4815024H01	DIODE, PIN
D0904	4813974A21	DIODE, SCHOTTKY
D0905	4813974A21	DIODE, SCHOTTKY
D0906	4813978C02	DIODE, SWITCHING
E0201	2409134J25	FERRITE BEAD
E0301	2409134J25	FERRITE BEAD
E0302	NOT PLACED	–
E0400	2409134J25	FERRITE BEAD
E0401	2409134J25	FERRITE BEAD
E0403	2409134J25	FERRITE BEAD
E0500	2409134J25	FERRITE BEAD
E0600	2409134J25	FERRITE BEAD
E0601	2409134J25	FERRITE BEAD
E0602	2409134J25	FERRITE BEAD
E0603	2409134J25	FERRITE BEAD
E0604	2409134J25	FERRITE BEAD
E0605	2409134J25	FERRITE BEAD
E0606	2409134J25	FERRITE BEAD
E0607	2409134J25	FERRITE BEAD
E0608	2409134J25	FERRITE BEAD
E0609	2409134J25	FERRITE BEAD
E0610	2480640Z01	FERRITE BEAD
E0700	2485011Y01	FERRITE BEAD
E0701	2485011Y01	FERRITE BEAD
E0703	2485011Y01	FERRITE BEAD
FL0500	9116854H01	73.35MHZ CRYSTAL FILTER
J0700	0905901V11	MINI-U RF CONNECTOR
L0100	2414017N29	270nH
L0200	2414017N28	220nH
L0202	2414032F42	470nH
L0203	2414032F42	470nH
L0204	2414017N28	220nH
L0205	2414017N20	47nH
L0206	2414017N14	15nH
L0207	2415385H02	12.5nH
L0209	2414032F42	470nH
L0210	2414015A21	27nH
L0211	2414017N28	220nH
L0212	2414032F42	470nH
L0213	2414032F42	470nH
L0214	2414032F42	470nH
L0215	2415385H02	12.5nH
L0217	2414032F42	470nH
L0218	2414015A20	22nH
L0219	2414032F42	470nH
L0221	2414017N19	39nH

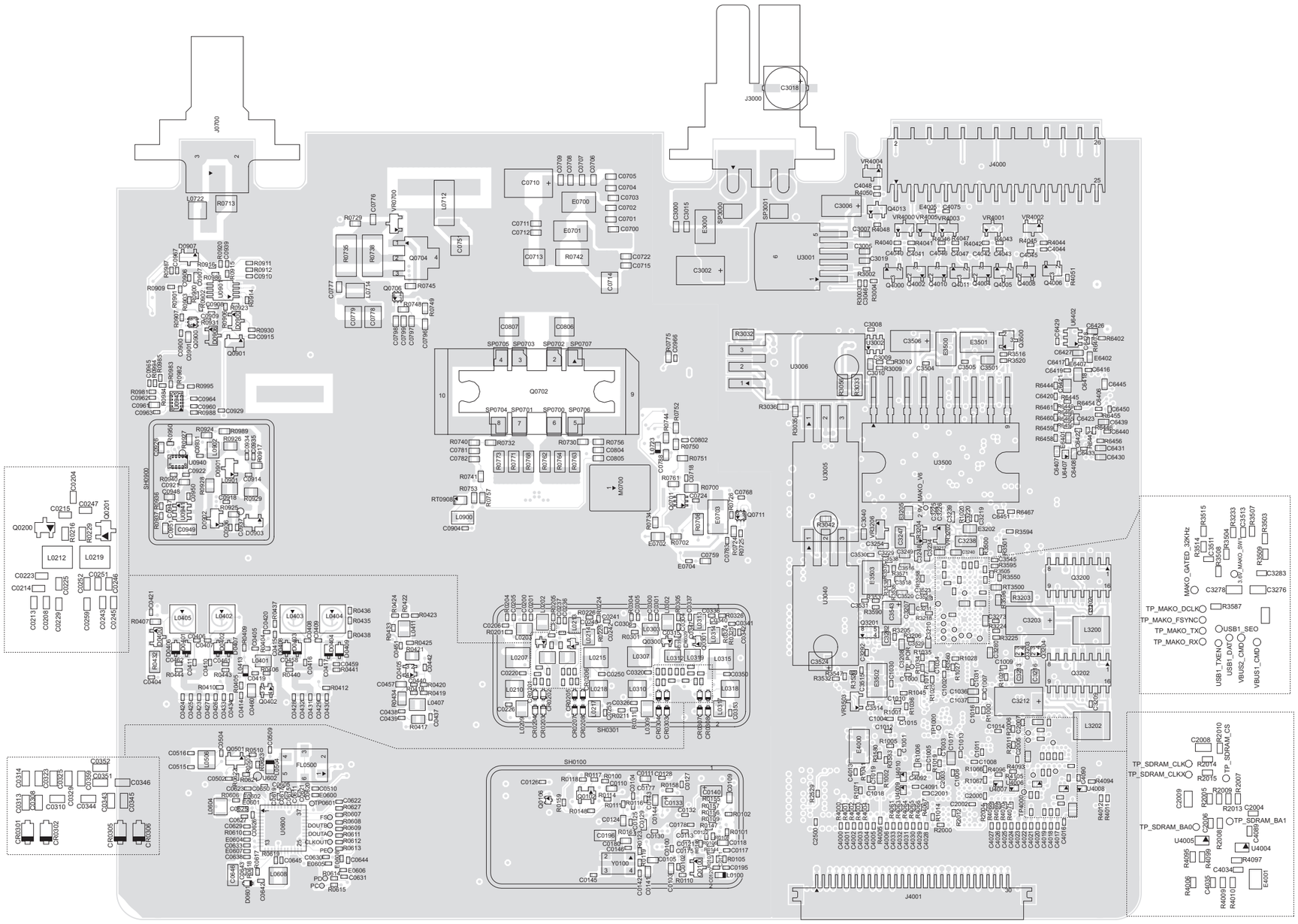
Circuit Ref	Motorola Part No.	Description
L0300	2414017N28	220nH
L0302	2414032F42	470nH
L0303	2414032F42	470nH
L0304	2414017N28	220nH
L0305	2414017N19	39nH
L0306	2414017N12	10nH
L0307	2415385H01	8nH
L0309	2414032F42	470nH
L0310	2414015A32	18nH
L0311	2414017N28	220nH
L0312	2414032F42	470nH
L0313	2414032F42	470nH
L0314	2414032F42	470nH
L0315	2415385H01	8nH
L0317	2414032F42	470nH
L0318	2414015A32	18nH
L0319	2414032F42	470nH
L0401	2414015B24	15nH
L0402	NOT PLACED	–
L0403	NOT PLACED	–
L0404	NOT PLACED	–
L0405	NOT PLACED	–
L0406	2414015B24	15nH
L0407	2414015B16	27nH
L0408	2414015B15	22nH
L0409	2414015B15	22nH
L0410	2414015B15	22nH
L0411	2414015B15	22nH
L0412	2414017N20	47nH
L0413	2414017N28	220nH
L0503	2414017K29	330nH
L0504	NOT PLACED	–
L0506	2414032B66	820nH
L0602	2414032K23	2.7uH
L0603	2414032D20	270nH
L0604	2466505A01	10uH
L0605	2466505A01	10uH
L0608	2414032B76	4.7uH
L0700	2460592A01	17nH
L0702	2479990G01	33.47nH
L0705	2414017N26	150nH
L0706	2460592A01	17nH
L0707	2460592A01	17nH
L0708	2460592A01	17nH
L0710	2460592A01	17nH
L0714	2479990N01	43.67nH
L0715	2414017N26	150nH
L0718	2414017N13	12nH
L0719	2414017N23	82nH
L0720	2414017N06	3.3nH
L0721	2414017N06	3.3nH

Circuit Ref	Motorola Part No.	Description
L0722	2414032B70	1.5uH
L0723	NOT PLACED	–
L0900	2414032D30	1uH
L0901	2414032F42	470nH
L0902	2414032F42	470nH
L0903	2414032F66	10nH
L0904	NOT PLACED	–
M0700	2686201B02	HEATSINK
Q0100	4802197J95	NPN RF TRANSISTOR
Q0102	4815359H01	DUAL PNP
Q0106	4816134H01	ANALOG SWITCH
Q0107	4813970A59	P-CHANNEL MOSFET
Q0108	4815261H01	ANALOG SWITCH
Q0200	4805793Y10	NPN RF TRANSISTOR
Q0201	4805793Y10	NPN RF TRANSISTOR
Q0202	4802197J95	NPN RF TRANSISTOR
Q0300	4805793Y10	NPN RF TRANSISTOR
Q0301	4805793Y10	NPN RF TRANSISTOR
Q0302	4802197J95	NPN RF TRANSISTOR
Q0400	4815271H01	ANALOG SWITCH
Q0401	4815267H01	DUAL PNP
Q0402	4885593U03	NPN RF TRANSISTOR
Q0403	4815270H01	DUAL NPN/PNP
Q0405	4885593U03	NPN RF TRANSISTOR
Q0500	4802197J95	NPN RF TRANSISTOR
Q0501	4802197J95	NPN RF TRANSISTOR
Q0600	4805793Y10	NPN RF TRANSISTOR
Q0601	4813973A04	NPN DARLINGTON
Q0701	4816013H01	DUAL NPN/PNP
Q0702	0105958T75	MRF1570 PA ASSEMBLY
Q0703	4816548H01	N-CHANNEL LDMOS DRIVER
Q0704	4813973B02	PNP
Q0705	4816547H01	N-CHANNEL LDMOS PRE-DRIVER
Q0706	4815272H01	ANALOG SWITCH
Q0707	4815272H01	ANALOG SWITCH
Q0708	4815272H01	ANALOG SWITCH
Q0709	4815272H01	ANALOG SWITCH
Q0900	4815272H01	ANALOG SWITCH
Q0901	4813973A13	PNP
Q0902	4813973M07	NPN
R0100	0613952R66	0
R0101	0613952R66	0
R0102	0613952R66	0
R0103	0613952R66	0
R0104	0613952R17	47K
R0105	0613952Q58	240
R0106	0613952Q83	2.7K
R0107	0613952Q57	220
R0108	0613952Q80	2K
R0109	0613952R66	0

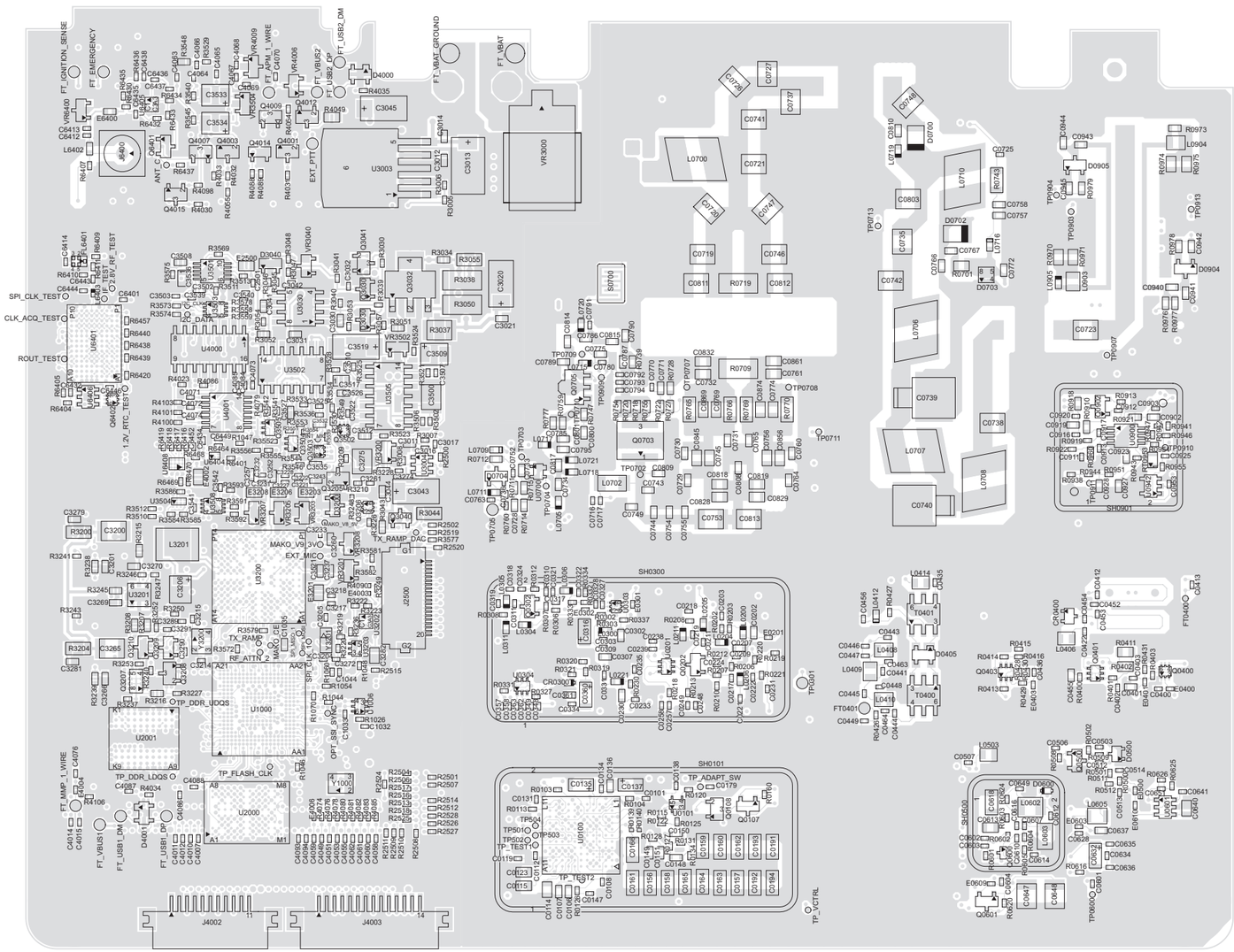
Circuit Ref	Motorola Part No.	Description
R0110	0613952Q42	51
R0111	0613952R66	0
R0113	0613952R01	10K
R0114	0613952Q80	2K
R0115	0613952R66	0
R0116	0613952R66	0
R0117	0613952R12	30K
R0118	0613952R66	0
R0119	0613952Q35	27
R0120	0613952R01	10K
R0122	NOT PLACED	–
R0123	0613952R19	56K
R0125	0613952R66	0
R0126	NOT PLACED	–
R0127	0613952Q49	100
R0128	0613952R66	0
R0131	0613952Q58	240
R0134	0613952Q35	27
R0139	0613952Q78	1.6K
R0140	0613952Q31	18
R0144	0613952R01	10K
R0146	0613952R66	0
R0147	NOT PLACED	–
R0148	0613952Q51	120
R0155	0613952R66	0
R0156	NOT PLACED	–
R0157	NOT PLACED	–
R0158	NOT PLACED	–
R0159	0613952R01	10K
R0160	0613952R25	100K
R0161	0613952R25	100K
R0201	0613952Q85	3.3K
R0202	0613952Q75	1.2K
R0203	0613952Q75	1.2K
R0204	0613952Q95	8.2K
R0205	0613952Q49	100
R0206	0613952R05	15K
R0207	0613952Q25	10
R0208	0613952Q42	51
R0210	0613952Q89	4.7K
R0211	0613952R66	0
R0212	0613952R66	0
R0213	0613952R01	10K
R0216	0613952Q51	120
R0218	0613952R01	10K
R0219	0613952Q66	510
R0220	0613952Q25	10
R0221	0613952Q66	510
R0224	0613952Q92	6.2K
R0225	0613952Q94	7.5K
R0226	0613952Q49	100
R0229	0613952Q54	160
R0230	0613952Q89	4.7K
R0301	0613952Q85	3.3K
R0302	0613952Q66	510
R0303	0613952Q66	510
R0304	0613952Q95	8.2K
R0305	0613952Q49	100
R0306	0613952R05	15K
R0307	0613952Q25	10
R0308	0613952Q42	51
R0310	0613952Q89	4.7K
R0311	0613952R66	0
R0312	0613952R66	0
R0316	0613952Q46	75
R0319	0613952R32	200K
R0320	0613952R05	15K
R0321	0613952Q83	2.7K
R0324	0613952Q80	2K
R0325	0613952Q95	8.2K
R0326	0613952Q49	100
R0327	0613952R01	10K
R0329	0613952Q50	110
R0331	0613952R01	10K
R0332	0613952Q56	200
R0333	0613952Q35	27
R0334	0613952Q56	200
R0337	0613952R66	0
R0400	0613952R11	27K
R0401	0613952Q69	680
R0402	0613958H25	10
R0403	0613952R66	0
R0404	0613952Q83	2.7K
R0405	0613952Q91	5.6K
R0406	0613952Q83	2.7K
R0407	0613952H63	390
R0409	0613952Q75	1.2K
R0410	0613952R25	100K
R0412	0613952R25	100K
R0413	0613952Q69	680
R0414	0613952Q69	680
R0415	0613952Q69	680
R0416	0613952Q69	680
R0417	0613958H39	39
R0418	0613952M55	3.65K
R0419	0613952Q75	1.2K
R0420	0613952Q75	1.2K
R0421	0613958H25	10
R0422	0613952K71	53.6
R0423	0613952L09	121
R0424	0613952L09	121
R0425	0613952L51	332
R0426	0613952Q83	2.7K
R0427	0613952Q42	51
R0428	0613952R01	10K
R0429	0613952Q69	680
R0430	0613952R01	10K
R0431	0613952R01	10K
R0432	0613952H69	680
R0433	0613952R66	0
R0500	0613952Q90	5.1K
R0501	0613952Q61	330
R0502	0613952R08	20K
R0503	0613952R12	30K
R0508	0613952R19	56K
R0509	0613952Q89	4.7K
R0510	0613952R12	30K
R0511	0613952Q75	1.2K
R0512	0613952Q42	51
R0601	0613952Q45	68
R0602	0613952R01	10K
R0603	0613952Q66	510
R0604	0613952R10	24K
R0605	0613952Q61	330
R0606	0613952Q42	51
R0607	NOT PLACED	–
R0608	0613952R66	0
R0609	0613952R66	0
R0610	0613952R66	0
R0611	0613952R66	0
R0612	0613952R66	0
R0613	0613952R66	0
R0614	0613952R66	0
R0615	0613952R66	0
R0616	0613952R25	100K
R0617	0613952R01	10K
R0618	0613952Q63	390
R0619	0613952R01	10K
R0620	0613952Q96	9.1K
R0621	0613952R66	0
R0622	NOT PLACED	–
R0623	NOT PLACED	–
R0624	0613952Q90	5.1K
R0625	0613952N69	51.1K
R0626	0613952N81	68.1K
R0627	0613952R66	0
R0700	NOT PLACED	–
R0702	NOT PLACED	–
R0703	0613958J74	0
R0706	0613958S53	150
R0711	0613952H53	150
R0713	0613959H12	30K
R0714	0613952H45	68
R0715	0613952H45	68
R0718	0613952H25	10
R0719	0613959Q25	10
R0720	0613952H25	10
R0722	0613952H89	4.7K
R0727	0613952H92	6.2K
R0728	0613952J01	10K
R0729	0613952J01	10K
R0730	0613952H73	1K
R0732	0613952H73	1K
R0734	0613952G67	0
R0735	0613959Y49	100
R0738	0613959Y42	51
R0739	NOT PLACED	–
R0740	0613952J25	100K
R0741	0613952J17	47K
R0742	0613959Q25	10
R0744	NOT PLACED	–
R0745	0613952H65	470
R0747	0613952H89	4.7K
R0748	0613952J19	56K
R0749	0613952G67	0
R0750	0613952J01	10K
R0751	0613952J08	20K
R0752	0613952G67	0
R0753	0613952H73	1K
R0754	0613952H25	10
R0755	0613952H25	10
R0756	0613952J25	100K
R0757	0613952J17	47K
R0759	0613952H25	10
R0760	0613952Q83	2.7K
R0761	0613952G67	0
R0762	0613958S29	15
R0763	0613958S29	15
R0764	0613958S29	15
R0765	NOT PLACED	–
R0766	NOT PLACED	–
R0767	0613958S29	15
R0768	0613958S29	15
R0769	NOT PLACED	–
R0770	NOT PLACED	–
R0771	0613958S29	15
R0772	0613958S29	15
R0773	0613958S29	15
R0774	0613952J08	20K
R0775	NOT PLACED	–
R0776	0613958J74	0
R0777	0613952H25	10
R0778	NOT PLACED	–
R0900	0613952R19	56K

Circuit Ref	Motorola Part No.	Description
R0901	0613952R16	43K
R0902	0613952Q88	4.3K
R0903	0613952R09	22K
R0906	0613952R66	0
R0907	0613952R66	0
R0909	0613952R16	43K
R0910	0613952H73	1K
R0911	0613952Q61	330
R0912	0613952R13	33K
R0913	0613952R66	0
R0914	0613952R31	180K
R0915	0613952R21	68K
R0916	0613952Q93	6.8K
R0917	0613952H91	5.6K
R0918	0613952H63	390
R0919	0613952R15	39K
R0920	0613952R09	22K
R0921	0613952H81	2.2K
R0922	0613952R14	36K
R0923	0613952R66	0
R0924	0613952H91	5.6K
R0925	0613952H91	5.6K
R0926	0613958H53	150
R0927	0613952H42	51
R0928	0613958H39	39
R0929	0613958H39	39
R0930	0613952R07	18K
R0931	0613952R66	0
R0936	0613952N66	47.5K
R0937	0613952N21	16.2K
R0938	0613952R66	0
R0940	0613952R66	0
R0941	0613952R66	0
R0942	0613952M81	6.81K
R0943	0613952N58	39.2K
R0944	0613952R66	0
R0946	0613952M51	3.32K
R0947	0613952R66	0
R0950	0613952N01	10K
R0951	0613952N62	43.2K
R0954	0613952R40	430K
R0955	0613952P01	100K
R0960	0613952H82	2.4K
R0970	0613958H56	200
R0971	0613958H55	180
R0972	NOT PLACED	–
R0973	0613952G67	0
R0974	0613958H57	220
R0975	0613958H57	220
R0976	0613952H53	150
R0977	0613952H51	120
R0978	0613952G67	0
R0979	0613952G67	0
RT0908	0615585H01	THERMISTOR, 47K
RT0953	0615585H01	THERMISTOR, 47K
SH0100	2615362H01	SHIELD
SH0101	2615362H01	SHIELD
SH0300	2615362H01	SHIELD
SH0301	2615362H01	SHIELD
SH0500	2615576H01	SHIELD
SH0900	2686423Z02	SHIELD
SH0901	2686425Z02	SHIELD
SP0700	1015349H01	SOLDER PREFORM
SP0701	1015349H01	SOLDER PREFORM
SP0702	1015349H01	SOLDER PREFORM
SP0703	1015349H01	SOLDER PREFORM
SP0704	1015349H01	SOLDER PREFORM
SP0705	1015349H01	SOLDER PREFORM
SP0706	1015349H01	SOLDER PREFORM
SP0707	1015349H01	SOLDER PREFORM
T0400	2515121H01	BALUN XFMR
T0401	2515121H01	BALUN XFMR
U0100	5104932K08	IC, FRACN SYNTHESIZER
U0101	5114000B59	ANALOG SWITCH
U0201	4815267H01	DUAL PNP
U0303	NOT PLACED	–
U0304	4815267H01	DUAL PNP
U0600	5102495J14	IC, RF ASIC
U0601	5115391H01	VOLTAGE REGULATOR
U0700	4802246J29	PA PRE-DRIVER
U0900	5115147H01	DUAL OPAMP
U0901	5115147H01	DUAL OPAMP
U0940	5180390L83	IC, PA CONTROLLER
U0941	5115391H01	VOLTAGE REGULATOR
U0942	5114004A35	VOLTAGE DETECTOR
VR0700	4813977M11	DIODE, 5.6V ZENER
Y0100	5116032H01	0.5PPM 16.8MHZ TCXO (GPS Models only)

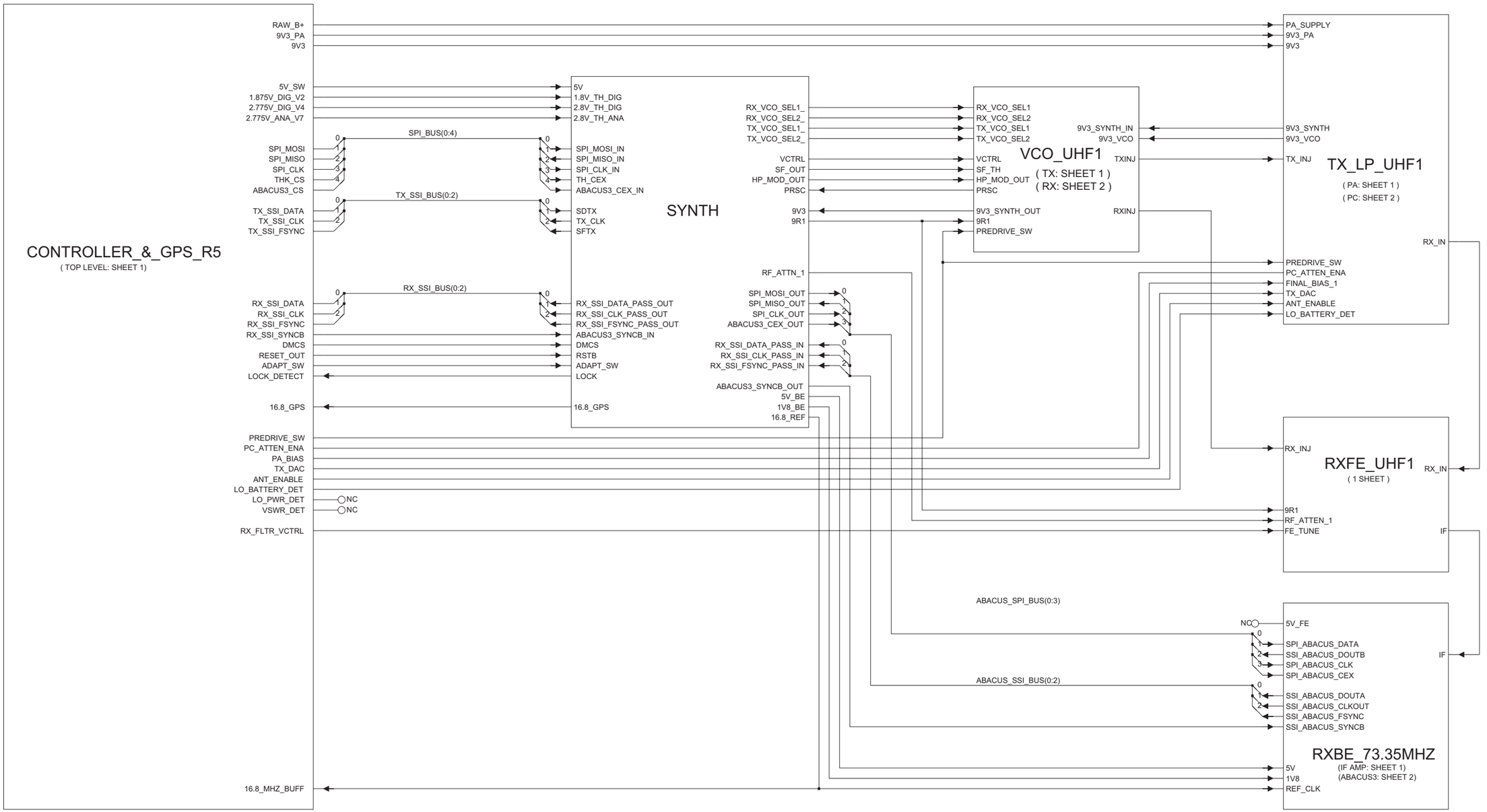
3.0 UHF1 (403–470 MHz) 1–25W PCB / Schematics / Parts List



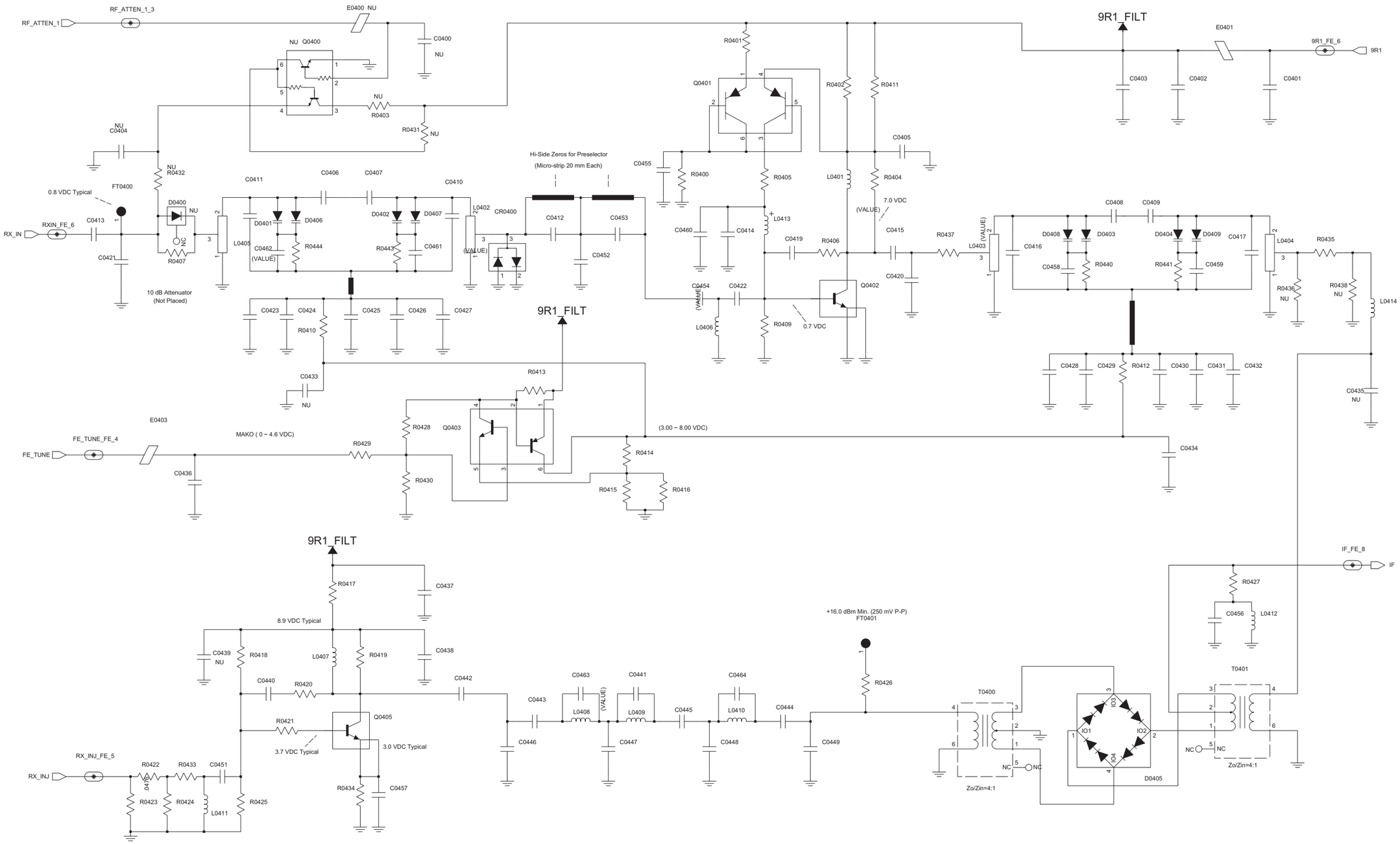
UHF1 (403–470 MHz) 1–25W 8471165L06 Top Side



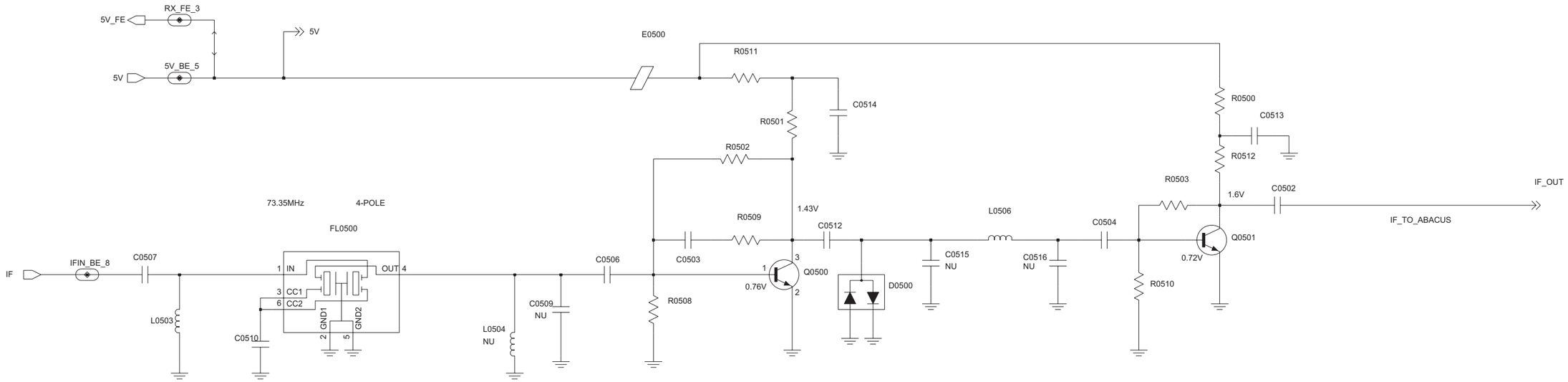
UHF1 (403–470 MHz) 1–25W 8471165L06 Bottom Side

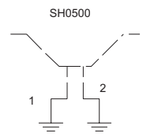


UHF1 (403–470 MHz) 1–25W Overall Schematic Diagram

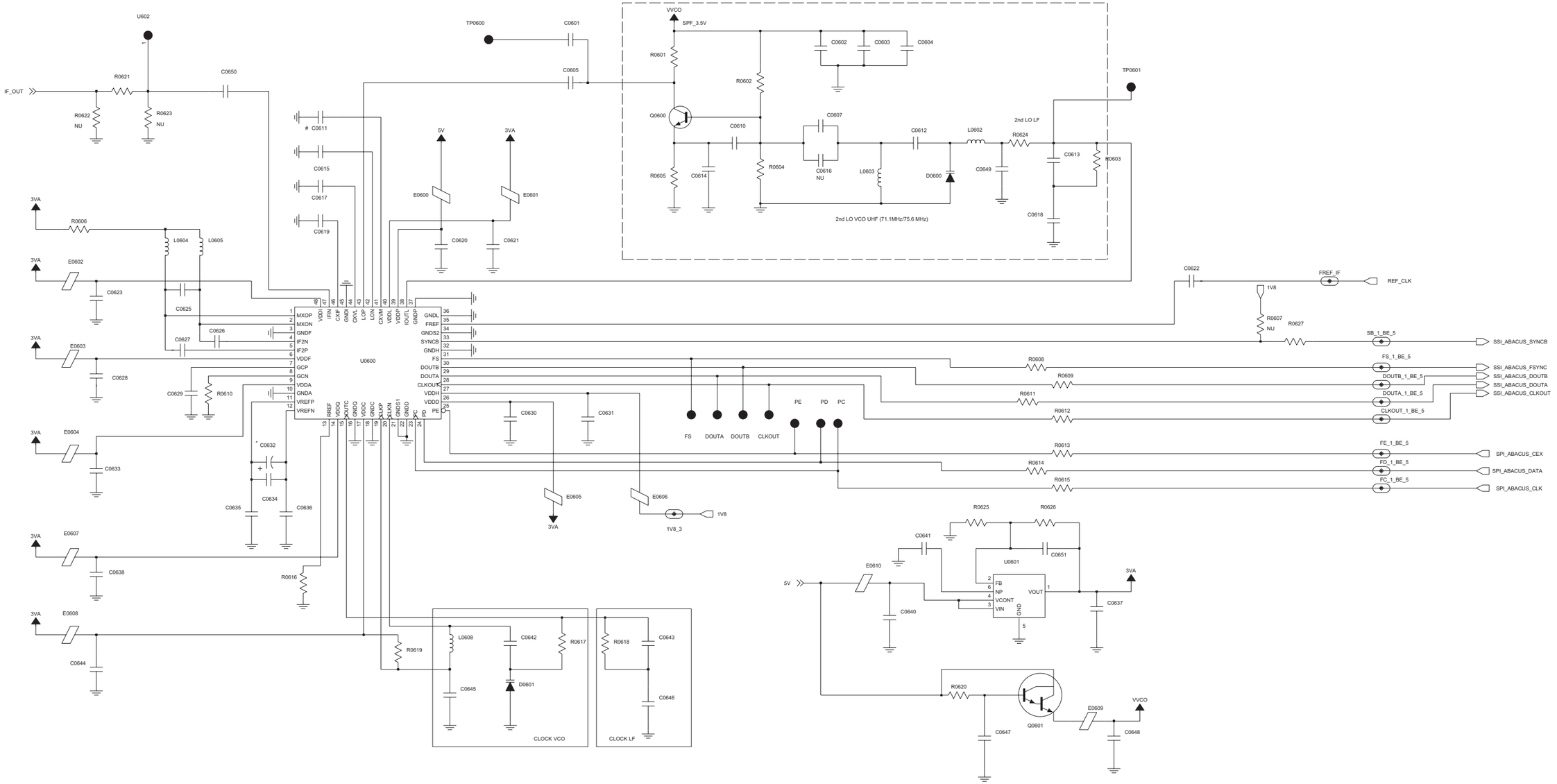


UHF1 (403–470 MHz) 1–25W Receiver Front-End Schematic Diagram

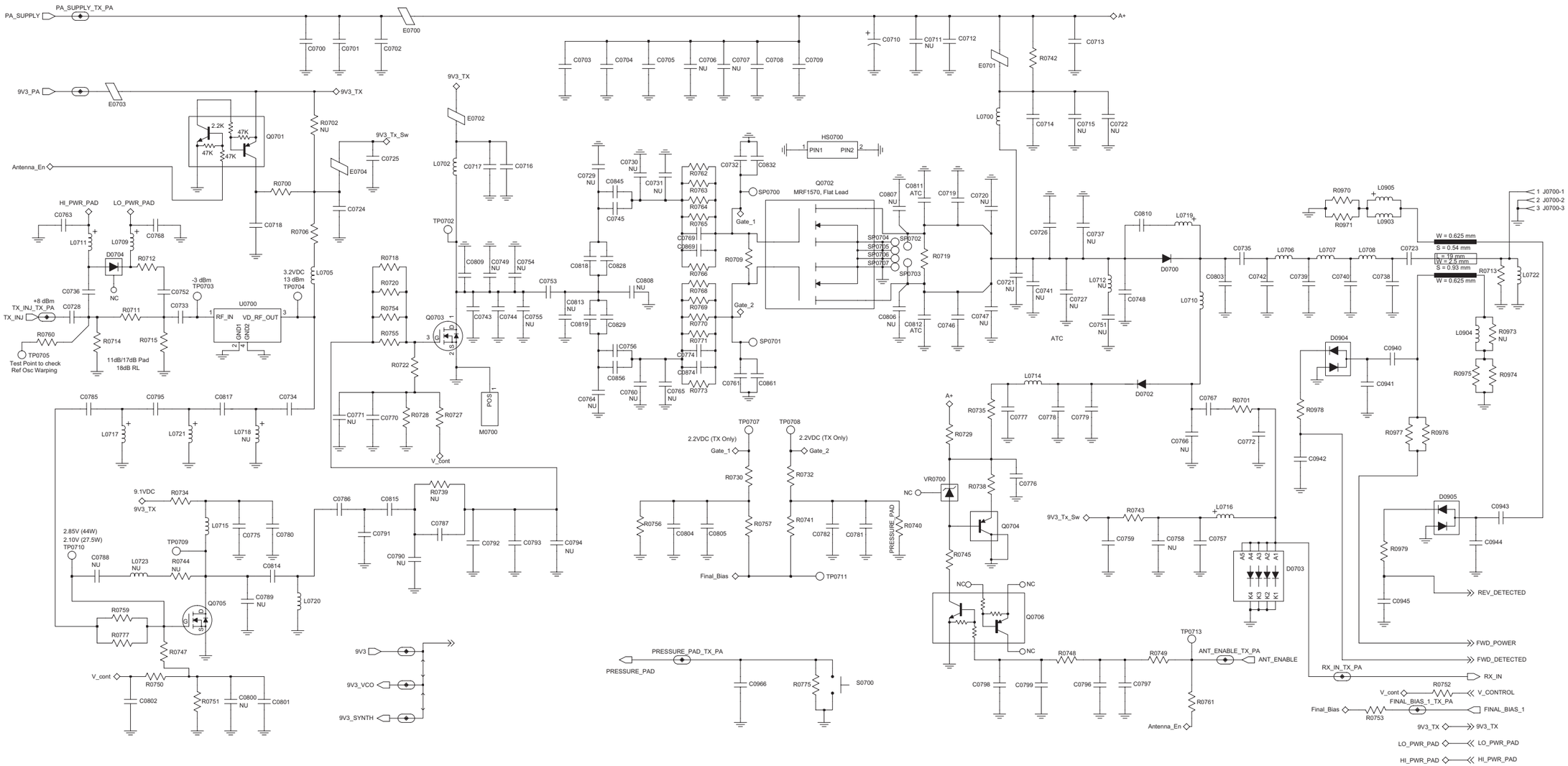




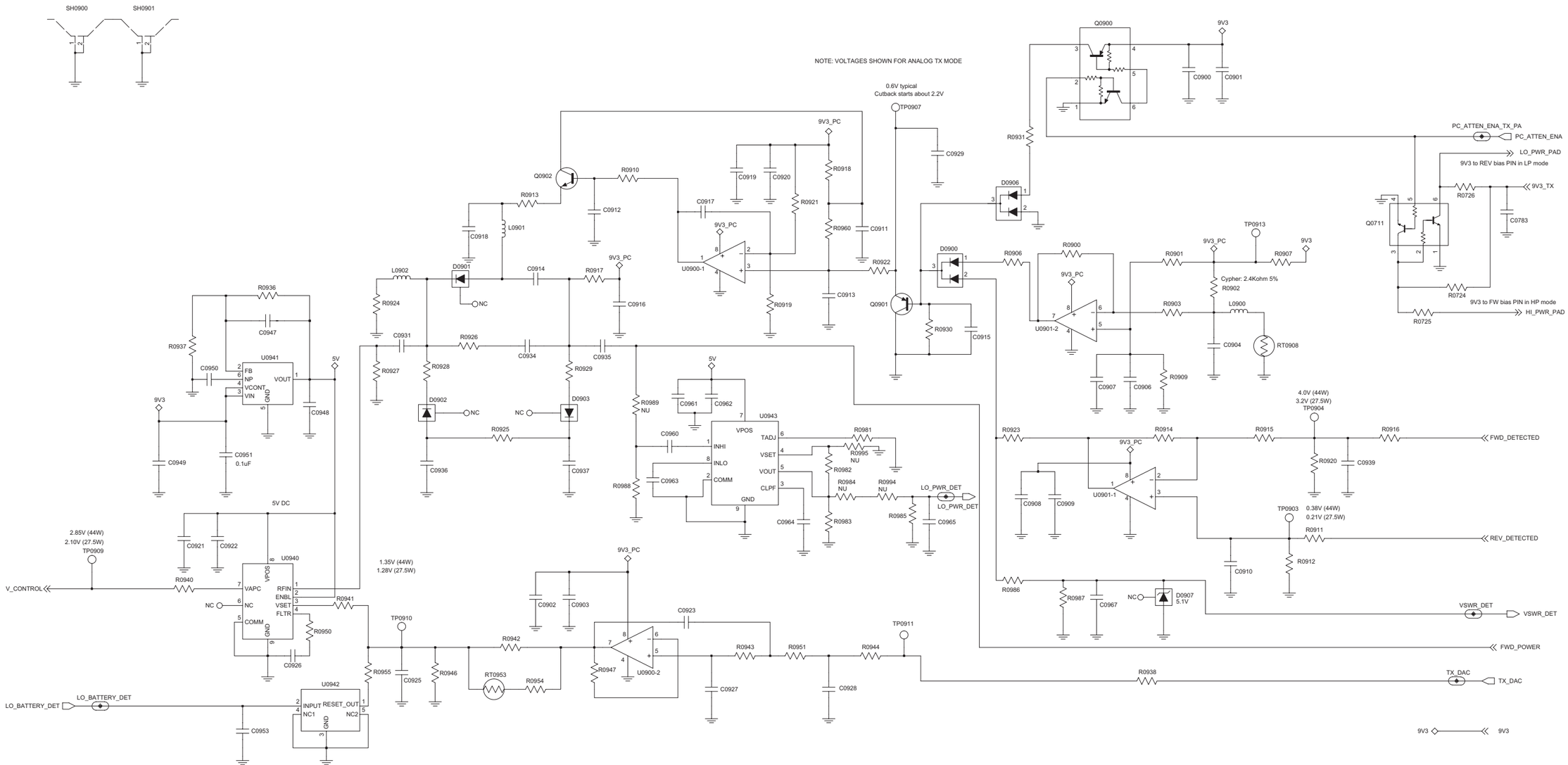
UHF1 (403–470 MHz) 1–25W Receiver IF Amp Schematic Diagram



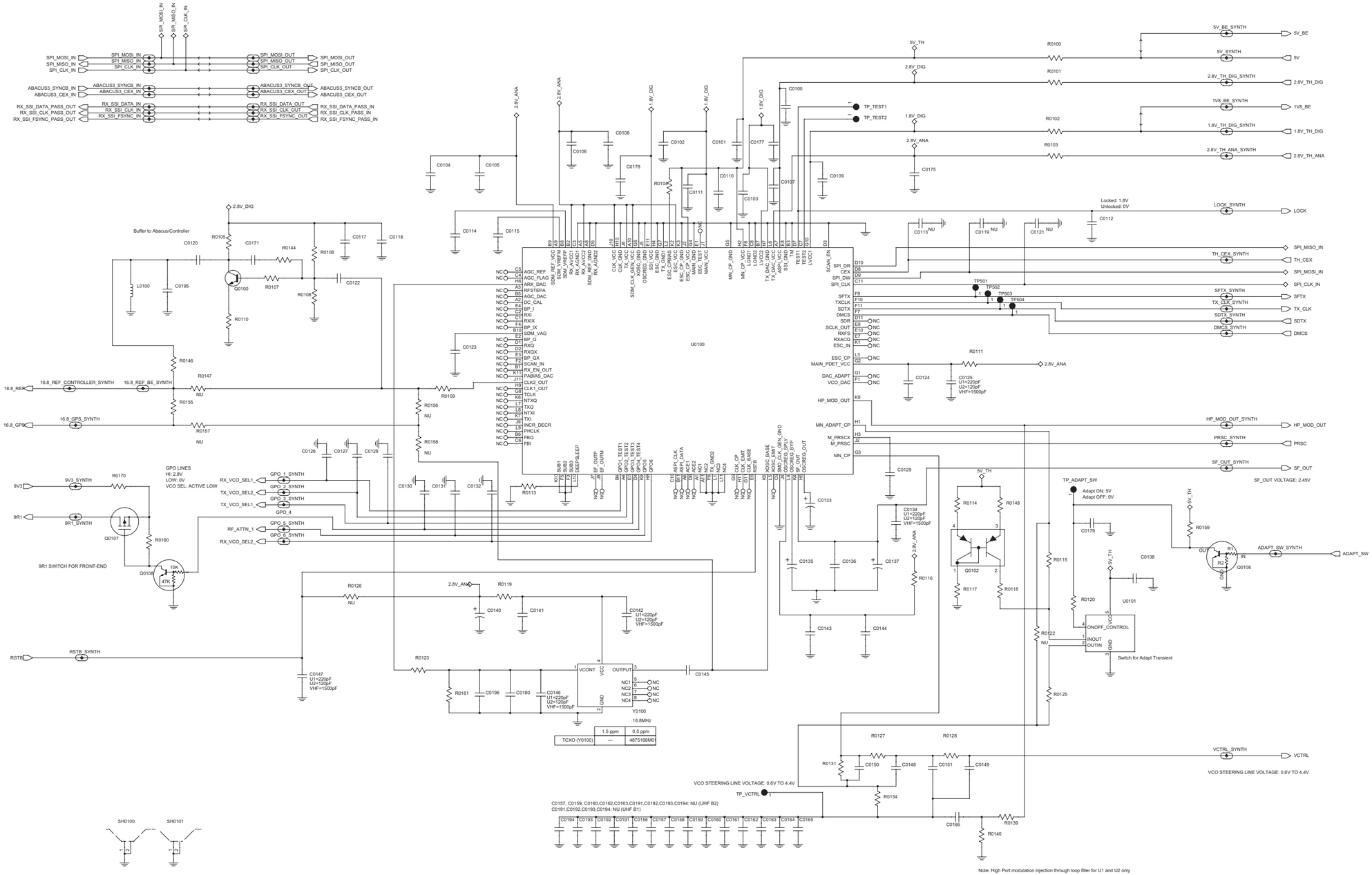
UHF1 (403–470 MHz) 1–25W Receiver Back-End Schematic Diagram



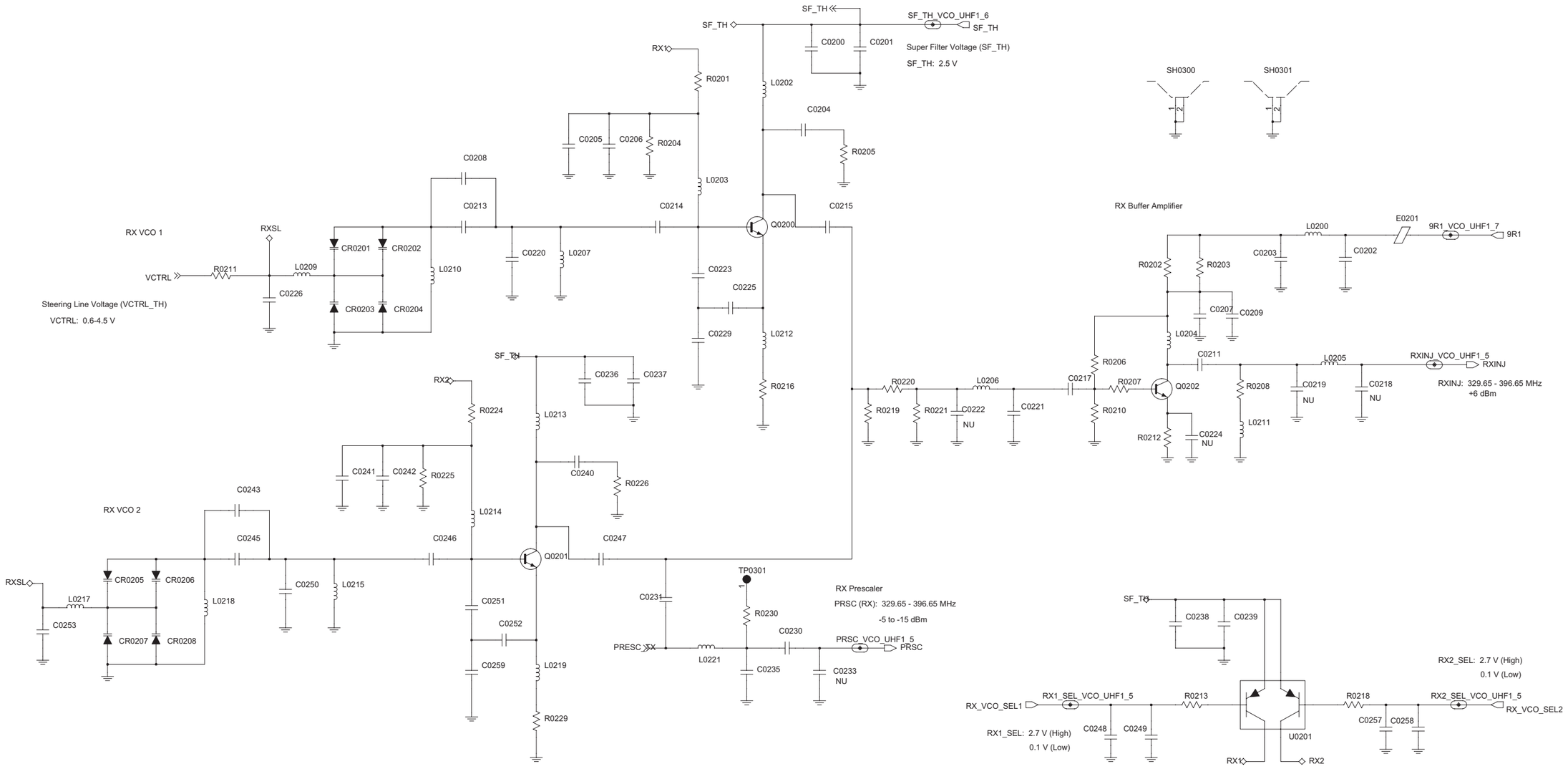
UHF1 (403–470 MHz) 1–25W Power Amplifier Schematic Diagram



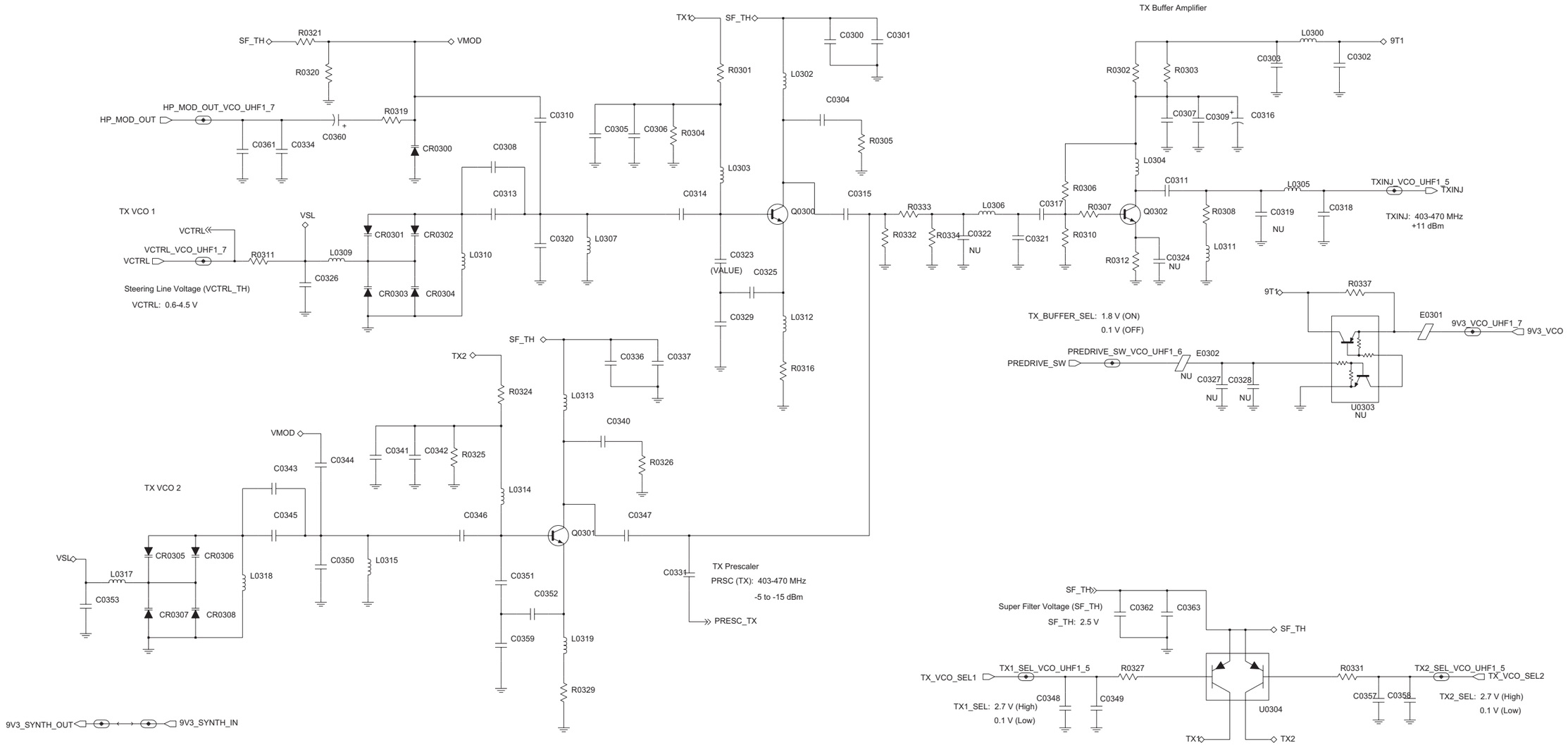
UHF1 (403–470 MHz) 1–25W Power Control Schematic Diagram



UHF1 (403–470 MHz) 1–25W Synthesizer Schematic Diagram



UHF1 (403–470 MHz) 1–25W Receiver VCO Schematic Diagram



UHF1 (403–470 MHz) 1–25W Transmit VCO Schematic Diagram

UHF1 PCB 8471165L06 Parts List 1–25W

Circuit Ref	Motorola Part No.	Description
C0100	2113944A44	220pF
C0101	2113944A44	220pF
C0102	2113944A44	220pF
C0103	2113945C31	0.1uF
C0104	2113944A44	220pF
C0105	2113945C31	0.1uF
C0106	2113945C31	0.1uF
C0107	2113945C31	0.1uF
C0108	2113944A44	220pF
C0109	2113945C31	0.1uF
C0110	2113945C31	0.1uF
C0111	2113945C31	0.1uF
C0112	2113944A44	220pF
C0113	NOT PLACED	–
C0114	2113946E02	1.0uF
C0115	2113946E02	1.0uF
C0117	2113944A44	220pF
C0118	2113945C31	0.1uF
C0119	NOT PLACED	–
C0120	2113945B02	.01uF
C0121	NOT PLACED	–
C0122	2113945B02	.01uF
C0123	2113946E02	1.0uF
C0124	2113945C31	0.1uF
C0125	2113944A44	220pF
C0126	2113944A44	220pF
C0127	2113944A44	220pF
C0128	2113944A44	220pF
C0129	2113945C31	0.1uF
C0130	2113944A44	220pF
C0131	2113944A44	220pF
C0132	2113944A44	220pF
C0133	2313960B30	4.7uF
C0134	2113944A44	220pF
C0135	2313960B32	10uF
C0136	2113945C31	0.1uF
C0137	2313960B32	10uF
C0138	2113944A44	220pF
C0140	2313960B30	4.7uF
C0141	2113945C31	0.1uF
C0142	2113944A44	220pF
C0143	2113944A44	220pF
C0144	2113945C31	0.1uF
C0145	2113945B02	.01uF
C0146	2113944A44	220pF
C0147	2113944A44	220pF
C0148	2113945D01	.033uF
C0149	2113945C04	.022uF
C0150	2113945C31	0.1uF
C0151	2113945C31	0.1uF
C0156	2185419D06	0.1uF
C0157	2185419D06	0.1uF
C0158	2185419D06	0.1uF
C0159	2185419D06	0.1uF
C0160	2185419D06	0.1uF
C0161	2185419D06	0.1uF
C0162	2185419D06	0.1uF
C0163	2185419D06	0.1uF
C0164	2185419D06	0.1uF
C0165	2185419D06	0.1uF
C0166	2185419D06	0.1uF
C0171	2113945B02	.01uF
C0175	2113944A44	220pF
C0177	2113944A44	220pF
C0178	2113944A44	220pF
C0179	2113944A44	220pF
C0180	2113945C31	0.1uF
C0191	NOT PLACED	–
C0192	NOT PLACED	–
C0193	NOT PLACED	–
C0194	NOT PLACED	–
C0195	2113945A05	470pF
C0196	2113946H02	10uF
C0200	2113944A44	220pF
C0201	2113945Y02	0.10uF
C0202	2113945C02	.01uF
C0203	2113944A44	220pF
C0204	2113944A44	220pF
C0205	2113945Y02	0.10uF
C0206	2113944A44	220pF
C0207	2113945C04	.022uF
C0208	2115153H18	4.3pF
C0209	2113944A44	220pF
C0211	2113944A44	220pF
C0213	2115153H17	3.9pF
C0214	2115153H34	11pF
C0215	2115153H20	5.1pF
C0217	2113944A44	220pF
C0218	NOT PLACED	–
C0219	NOT PLACED	–
C0220	2115153H17	3.9pF
C0221	2115153H14	3.0pF
C0222	NOT PLACED	–
C0223	2115153H46	36pF
C0224	NOT PLACED	–
C0225	2115153H51	56pF
C0226	2113944A44	220pF
C0229	2115153H42	24pF
C0230	2113944C47	150pF
C0231	2115153H14	3.0pF
C0233	NOT PLACED	–
C0235	2115153H22	6.2pF
C0236	2113944A44	220pF
C0237	2113945Y02	0.10uF
C0238	2113944A44	220pF
C0239	2113945Y02	0.10uF
C0240	2113944A44	220pF
C0241	2113945Y02	0.10uF
C0242	2113944A44	220pF
C0243	2115153H13	2.7pF
C0245	2115153H14	3.0pF
C0246	2115153H27	10pF
C0247	2115153H20	5.1pF
C0248	2113944A44	220pF
C0249	2113945Y02	0.10uF
C0250	2115153H16	3.6pF
C0251	2115153H40	20pF
C0252	2115153H48	43pF
C0253	2113944A44	220pF
C0257	2113944A44	220pF
C0258	2113945Y02	0.10uF
C0259	2115153H35	12pF
C0300	2113944A44	220pF
C0301	2113945Y02	0.10uF
C0302	2113945C02	.01uF
C0303	2113944A44	220pF
C0304	2113944A44	220pF
C0305	2113945Y02	0.10uF
C0306	2113944A44	220pF
C0307	2113945C04	.022uF
C0308	2115153H15	3.3pF
C0309	2113944A44	220pF
C0310	2115153H01	0.5pF
C0311	2113944A44	220pF
C0313	2115153H15	3.3pF
C0314	2115153H35	12pF
C0315	2115153H20	5.1pF
C0316	2313960B32	10uF
C0317	2113944A44	220pF
C0318	2115153H15	3.3pF
C0319	NOT PLACED	–
C0320	2115153H20	5.1pF
C0321	2115153H24	7.5pF
C0322	NOT PLACED	–
C0323	2115153H43	27pF
C0324	NOT PLACED	–
C0325	2115153H51	56pF
C0326	2113944A44	220pF
C0327	NOT PLACED	–
C0328	NOT PLACED	–
C0329	2115153H38	16pF
C0331	2115153H14	3.0pF
C0334	2113944A44	220pF
C0336	2113944A44	220pF
C0337	2113945Y02	0.10uF
C0340	2113944A44	220pF
C0341	2113945Y02	0.10uF
C0342	2113944A44	220pF
C0343	2115153H15	3.3pF
C0344	2115153H01	0.5pF
C0345	2115153H15	3.3pF
C0346	2115153H24	7.5pF
C0347	2115153H20	5.1pF
C0348	2113944A44	220pF
C0349	2113945Y02	0.10uF
C0350	2115153H18	4.3pF
C0351	2115153H42	24pF
C0352	2115153H50	51pF
C0353	2113944A44	220pF
C0357	2113944A44	220pF
C0358	2113945Y02	0.10uF
C0359	2115153H38	16pF
C0360	2313960B30	4.7uF
C0361	2113944C51	1000pF
C0362	2113944A44	220pF
C0363	2113945Y02	0.10uF
C0400	NOT PLACED	–
C0401	2113945C31	0.1uF
C0402	2113944A44	220pF
C0403	2115153H49	47pF
C0404	NOT PLACED	–
C0405	2113944A44	220pF
C0406	2115153H27	10pF
C0407	2115153H13	2.7pF
C0408	2115153H27	10pF
C0409	2115153H13	2.7pF
C0410	2115153H22	6.2pF
C0411	2115153H22	6.2pF
C0412	2115153H20	5.1pF
C0413	2115153H57	100pF
C0414	2113944A44	220pF
C0415	2115153H21	5.6pF
C0416	2115153H22	6.2pF
C0417	2115153H22	6.2pF
C0419	2113945Y02	0.10uF
C0420	2115153H03	1.0pF
C0421	2115153H13	2.7pF
C0422	2115153H26	9.1pF
C0423	2113944A44	220pF
C0424	2113944A44	220pF
C0425	2113944A44	220pF
C0426	2113944A44	220pF
C0427	2113944A44	220pF

Circuit Ref	Motorola Part No.	Description
C0428	2113944A44	220pF
C0429	2113944A44	220pF
C0430	2113944A44	220pF
C0431	2113944A44	220pF
C0432	2113944A44	220pF
C0433	NOT PLACED	–
C0434	2113944A44	220pF
C0435	2115153H17	3.9pF
C0436	2113944A44	220pF
C0437	2113944A44	220pF
C0438	2113944A44	220pF
C0439	NOT PLACED	–
C0440	2113944A44	220pF
C0441	2115153H11	2.2pF
C0442	2115153H25	8.2pF
C0443	2115153H41	22pF
C0444	2115153H41	22pF
C0445	2115153H37	15pF
C0446	2115153H20	5.1pF
C0447	2115153H27	10pF
C0448	2115153H26	9.1pF
C0449	2115153H20	5.1pF
C0451	2115153H41	22pF
C0452	2115153H26	9.1pF
C0453	2115153H20	5.1pF
C0454	2115153H26	9.1pF
C0455	2113945C31	0.1uF
C0456	2113944A40	100pF
C0457	2113945C31	0.1uF
C0458	2115153H40	20pF
C0459	2115153H40	20pF
C0460	2113946F05	10uF
C0461	2115153H40	20pF
C0462	2115153H40	20pF
C0463	2115153H06	1.3pF
C0464	2115153H06	1.3pF
C0502	2113945Y02	0.10uF
C0503	2113945Y02	0.10uF
C0504	2113945Y02	0.10uF
C0506	2113945Y02	0.10uF
C0507	2115153H39	18pF
C0509	NOT PLACED	–
C0510	2115153H22	6.2pF
C0512	2113945Y02	0.10uF
C0513	2113945Y02	0.10uF
C0514	2113945Y02	0.10uF
C0515	NOT PLACED	–
C0516	NOT PLACED	–
C0601	2115153H48	43pF
C0602	2113945B02	.01uF
C0603	2113944A44	220pF

Circuit Ref	Motorola Part No.	Description
C0604	2113945Y02	0.10uF
C0605	2115153H48	43pF
C0607	2115153H39	18pF
C0610	2115153H53	68pF
C0611	2113945A09	1000pF
C0612	2115153H34	11pF
C0613	2185419D03	0.01uF
C0614	2115153H48	43pF
C0615	2113945B02	.01uF
C0616	NOT PLACED	–
C0617	2113945Y02	0.10uF
C0618	2185419D06	0.1uF
C0619	2113945Y02	0.10uF
C0620	2113945Y02	0.10uF
C0621	2113945Y02	0.10uF
C0622	2113945A09	1000pF
C0623	2113945Y02	0.10uF
C0625	2113944C89	200pF
C0626	2113944A40	100pF
C0627	2113944A40	100pF
C0628	2113945Y02	0.10uF
C0629	2113945A11	2200pF
C0630	2113945Y02	0.10uF
C0631	2113945Y02	0.10uF
C0632	2313960B30	4.7uF
C0633	2113945Y02	0.10uF
C0634	2113945B02	.01uF
C0635	2113944A40	100pF
C0636	2113944A40	100pF
C0637	2113946S35	1.0uF
C0638	2113945Y02	0.10uF
C0640	2113946N03	2.2uF
C0641	2113945B02	.01uF
C0642	2115153H53	68pF
C0643	2113945Y02	0.10uF
C0644	2113945Y02	0.10uF
C0645	2113945B02	.01uF
C0646	2113946G04	0.68uF
C0647	2113946J03	10.0uF
C0648	2113946J03	10.0uF
C0649	2113945A12	3300pF
C0650	2115153H44	30pF
C0651	2115153H57	100pF
C0700	2113944C82	30pF
C0701	2113945C04	.022uF
C0702	2113944C55	2200pF
C0703	2113944C82	30pF
C0704	2113945C04	.022uF
C0705	2113944C51	1000pF
C0706	NOT PLACED	–
C0707	NOT PLACED	–

Circuit Ref	Motorola Part No.	Description
C0708	2113944C51	1000pF
C0709	2113945C31	0.1uF
C0710	2371403L02	10uF
C0711	NOT PLACED	–
C0712	2113944C51	1000pF
C0713	2111078B42	100pF
C0714	2111078B42	100pF
C0715	NOT PLACED	–
C0716	2113944A41	120pF
C0717	2113945A09	1000pF
C0718	2113945A09	1000pF
C0719	2111078B25	27pF
C0720	NOT PLACED	–
C0721	NOT PLACED	–
C0722	NOT PLACED	–
C0723	2111078B39	75pF
C0724	2113944A41	120pF
C0725	2113944A41	120pF
C0726	2111078B20	18pF
C0727	NOT PLACED	–
C0728	2113944C42	75pF
C0729	NOT PLACED	–
C0730	NOT PLACED	–
C0731	NOT PLACED	–
C0732	2113951B41	24pF
C0733	2113944C42	75pF
C0734	2113944C84	43pF
C0735	2111078B39	75pF
C0736	2113944A41	120pF
C0737	NOT PLACED	–
C0738	2111078B07	5.6pF
C0739	2185400Y36	12pF
C0740	2185400Y36	12pF
C0741	NOT PLACED	–
C0742	2111078B07	5.6pF
C0743	2113944C37	39pF
C0744	2113944C38	47pF
C0745	2113944F44	12pF
C0746	2111078B25	27pF
C0747	NOT PLACED	–
C0748	2111078B11	8.2pF
C0749	NOT PLACED	–
C0751	NOT PLACED	–
C0752	2113944A41	120pF
C0753	2111078B39	75pF
C0754	NOT PLACED	–
C0755	NOT PLACED	–
C0756	2113944F44	12pF
C0757	2113944C42	75pF
C0758	NOT PLACED	–
C0759	2113944C42	75pF

Circuit Ref	Motorola Part No.	Description
C0760	NOT PLACED	–
C0761	2113951B41	24pF
C0763	2113944A41	120pF
C0764	NOT PLACED	–
C0765	NOT PLACED	–
C0766	NOT PLACED	–
C0767	2113944C42	75pF
C0768	2113944A41	120pF
C0769	2113944F51	24pF
C0770	2113944A41	120pF
C0771	NOT PLACED	–
C0772	2113944C16	2.7pF
C0774	2113944F51	24pF
C0775	2113945C04	.022uF
C0776	2113944C42	75pF
C0777	2113944C47	150pF
C0778	2111078B30	34pF
C0779	2111078B29	33pF
C0780	2113944A41	120pF
C0781	2113944C42	75pF
C0782	2113944C51	1000pF
C0783	2113944A41	120pF
C0785	2113944C42	75pF
C0786	2113944C84	43pF
C0787	2113944C84	43pF
C0788	NOT PLACED	–
C0789	NOT PLACED	–
C0790	NOT PLACED	–
C0791	2113944A80	20pF
C0792	2113944A28	18pF
C0793	2113944A25	10pF
C0794	NOT PLACED	–
C0795	2113944C75	8.2pF
C0796	2113944C42	75pF
C0797	2113944C51	1000pF
C0798	2113944C51	1000pF
C0799	2113944C42	75pF
C0800	NOT PLACED	–
C0801	2113944A41	120pF
C0802	2113944A41	120pF
C0803	2111078B01	3.3pF
C0804	2113944C42	75pF
C0805	2113944C51	1000pF
C0806	NOT PLACED	–
C0807	NOT PLACED	–
C0808	NOT PLACED	–
C0809	2113944C30	10pF
C0810	2113944C42	75pF
C0811	NOT PLACED	–
C0812	NOT PLACED	–
C0813	NOT PLACED	–

Circuit Ref	Motorola Part No.	Description
C0814	2113944C46	120pF
C0815	2113944C41	68pF
C0817	2113951A31	7.50pF
C0818	2113944F54	33pF
C0819	2113944F54	33pF
C0828	2113944F54	33pF
C0829	2113944F54	33pF
C0832	2113951B41	24pF
C0845	2113944F44	12pF
C0856	2113944F44	12pF
C0861	2113951B41	24pF
C0869	2113944F51	24pF
C0874	2113944F51	24pF
C0900	2113944A41	120pF
C0901	2113945C31	0.1uF
C0902	2113945C31	0.1uF
C0903	2113944A41	120pF
C0904	2113944A41	120pF
C0906	2113944A41	120pF
C0907	2113945C02	.01uF
C0908	2113945C31	0.1uF
C0909	2113944A41	120pF
C0910	2113944A41	120pF
C0911	2113944A41	120pF
C0912	2113944A41	120pF
C0913	2113944A41	120pF
C0914	2113944A41	120pF
C0915	2113944A41	120pF
C0916	2113944A41	120pF
C0917	2113945A09	1000pF
C0918	2113944A41	120pF
C0919	2113945C31	0.1uF
C0920	2113944A41	120pF
C0921	2113945C31	0.1uF
C0922	2113944A41	120pF
C0923	2113944C55	2200pF
C0925	2113944A41	120pF
C0926	2113945L41	4700pF
C0927	2113944C02	220pF
C0928	2113944C53	1500pF
C0929	2113944A41	120pF
C0931	2113944A41	120pF
C0934	2113944A41	120pF
C0935	2113944A41	120pF
C0936	2113944A41	120pF
C0937	2113944A41	120pF
C0939	2113944A41	120pF
C0940	2113944C46	120pF
C0941	2113944M17	9.1pF
C0942	2113944C42	75pF
C0943	2113944C42	75pF

Circuit Ref	Motorola Part No.	Description
C0944	2113944M06	3.3pF
C0945	2113944C42	75pF
C0947	2113944A40	100pF
C0948	2113946S35	1.0uF
C0949	2113946G01	2.2uF
C0950	2113945A09	1000pF
C0951	2113945C31	0.1uF
C0953	2113944A41	120pF
C0960	2113944A52	1000pF
C0961	2113945C31	0.1uF
C0962	2113944A40	100pF
C0963	2113944A52	1000pF
C0964	2113944A23	8.2pF
C0965	2113944A40	100pF
C0966	2113944A41	120pF
C0967	2113944A41	120pF
CR0201	4815096H01	DIODE VARACTOR 1SV305
CR0202	4815096H01	DIODE VARACTOR 1SV305
CR0203	4815096H01	DIODE VARACTOR 1SV305
CR0204	4815096H01	DIODE VARACTOR 1SV305
CR0205	4815096H01	DIODE VARACTOR 1SV305
CR0206	4815096H01	DIODE VARACTOR 1SV305
CR0207	4815096H01	DIODE VARACTOR 1SV305
CR0208	4815096H01	DIODE VARACTOR 1SV305
CR0300	4815096H01	DIODE VARACTOR 1SV305
CR0301	4815096H01	DIODE VARACTOR 1SV305
CR0302	4815096H01	DIODE VARACTOR 1SV305
CR0303	4815096H01	DIODE VARACTOR 1SV305
CR0304	4815096H01	DIODE VARACTOR 1SV305
CR0305	4815096H01	DIODE VARACTOR 1SV305
CR0306	4815096H01	DIODE VARACTOR 1SV305
CR0307	4815096H01	DIODE VARACTOR 1SV305
CR0308	4815096H01	DIODE VARACTOR 1SV305
CR0400	4813974A19	DIODE, SCHOTTKY
D0400	NOT PLACED	–
D0401	4885055Y01	DIODE VARACTOR 1SV229
D0402	4885055Y01	DIODE VARACTOR 1SV229
D0403	4885055Y01	DIODE VARACTOR 1SV229
D0404	4885055Y01	DIODE VARACTOR 1SV229
D0405	4815090H01	DIODE, MIXER
D0406	4885055Y01	DIODE VARACTOR 1SV229
D0407	4885055Y01	DIODE VARACTOR 1SV229
D0408	4885055Y01	DIODE VARACTOR 1SV229
D0409	4885055Y01	DIODE VARACTOR 1SV229
D0500	4813974A19	DIODE, SCHOTTKY
D0600	4815096H01	DIODE VARACTOR 1SV305
D0601	4815096H01	DIODE VARACTOR 1SV305
D0700	4802482J02	DIODE, PIN
D0702	4802482J02	DIODE, PIN
D0703	4875430M01	DIODE, PIN
D0704	4813974A06	DIODE, PIN

Circuit Ref	Motorola Part No.	Description
D0900	4813978C02	DIODE, SWITCHING
D0901	4815023H01	DIODE, PIN
D0902	4815024H01	DIODE, PIN
D0903	4815024H01	DIODE, PIN
D0904	4813974A21	DIODE, SCHOTTKY
D0905	4813974A21	DIODE, SCHOTTKY
D0906	4813978C02	DIODE, SWITCHING
D0907	4813977M10	DIODE, 5.1V ZENER
E0201	2409134J25	FERRITE BEAD
E0301	2409134J25	FERRITE BEAD
E0302	NOT PLACED	–
E0400	NOT PLACED	–
E0401	2409134J25	FERRITE BEAD
E0403	2409134J25	FERRITE BEAD
E0500	2409134J25	FERRITE BEAD
E0600	2409134J25	FERRITE BEAD
E0601	2409134J25	FERRITE BEAD
E0602	2409134J25	FERRITE BEAD
E0603	2409134J25	FERRITE BEAD
E0604	2409134J25	FERRITE BEAD
E0605	2409134J25	FERRITE BEAD
E0606	2409134J25	FERRITE BEAD
E0607	2409134J25	FERRITE BEAD
E0608	2409134J25	FERRITE BEAD
E0609	2409134J25	FERRITE BEAD
E0610	2480640Z01	FERRITE BEAD
E0700	2485011Y01	FERRITE BEAD
E0701	2485011Y01	FERRITE BEAD
E0702	7671656M01	FERRITE BEAD
E0703	2485011Y01	FERRITE BEAD
E0704	2409134J25	FERRITE BEAD
FL0500	9116854H02	73.35 MHZ CRYSTAL FILTER
HS0700	0104038J81	HEATSINK
J0700	0905901V11	MINI-U RF CONNECTOR
L0100	2414017N29	270nH
L0200	2414017N28	220nH
L0202	2414032F42	470nH
L0203	2414032F42	470nH
L0204	2414017N28	220nH
L0205	2414017N20	47nH
L0206	2414017N14	15nH
L0207	2415385H02	12.5nH
L0209	2414032F42	470nH
L0210	2414015A21	27nH
L0211	2414017N28	220nH
L0212	2414032F42	470nH
L0213	2414032F42	470nH
L0214	2414032F42	470nH
L0215	2415385H02	12.5nH
L0217	2414032F42	470nH
L0218	2414015A20	22nH

Circuit Ref	Motorola Part No.	Description
L0219	2414032F42	470nH
L0221	2414017N19	39nH
L0300	2414017N28	220nH
L0302	2414032F42	470nH
L0303	2414032F42	470nH
L0304	2414017N28	220nH
L0305	2414017N19	39nH
L0306	2414017N12	10nH
L0307	2415385H01	8nH
L0309	2414032F42	470nH
L0310	2414015A32	18nH
L0311	2414017N28	220nH
L0312	2414032F42	470nH
L0313	2414032F42	470nH
L0314	2414032F42	470nH
L0315	2415385H01	8nH
L0317	2414032F42	470nH
L0318	2414015A32	18nH
L0319	2414032F42	470nH
L0401	2414015B24	15nH
L0402	NOT PLACED	–
L0403	NOT PLACED	–
L0404	NOT PLACED	–
L0405	NOT PLACED	–
L0406	2414015B29	10nH
L0407	2414015B16	27nH
L0408	2414015B15	22nH
L0409	2414015B15	22nH
L0410	2414015B15	22nH
L0411	2414015B15	22nH
L0412	2414017N20	47nH
L0413	2414017N28	220nH
L0414	2414015B17	18nH
L0503	2414015B27	390nH
L0504	NOT PLACED	–
L0506	2414032B66	820nH
L0602	2414032K23	2.7uH
L0603	2414032D20	270nH
L0604	2466505A01	10uH
L0605	2466505A01	10uH
L0608	2414032B76	4.7uH
L0700	2460592A01	17nH
L0702	2479990G01	33.47nH
L0705	2414017N26	150nH
L0706	2460592A01	17nH
L0707	2460592A01	17nH
L0708	2460592A01	17nH
L0709	2414017N26	150nH
L0710	2460592A02	12.5nH
L0711	2414017N26	150nH
L0712	NOT PLACED	–

Circuit Ref	Motorola Part No.	Description
L0714	2479990N01	43.67nH
L0715	2414017N26	150nH
L0716	2414017N27	180nH
L0717	2414017N06	3.3nH
L0718	NOT PLACED	–
L0719	2414017N22	68nH
L0720	2414017N06	3.3nH
L0721	2414017N11	8.2nH
L0722	2414032B60	390nH
L0723	NOT PLACED	–
L0900	2414032D30	1uH
L0901	2414032F42	470nH
L0902	2414032F42	470nH
L0903	2414032F23	12nH
L0904	2414032F22	8.2nH
L0905	2414017N24	100nH
M0700	2686201B02	HEATSINK
Q0100	4802197J95	NPN RF TRANSISTOR
Q0102	4815359H01	DUAL PNP
Q0106	4816134H01	ANALOG SWITCH
Q0107	4813970A59	P-CHANNEL MOSFET
Q0108	4815261H01	ANALOG SWITCH
Q0200	4885061Y01	NPN RF TRANSISTOR
Q0201	4885061Y01	NPN RF TRANSISTOR
Q0202	4802197J95	NPN RF TRANSISTOR
Q0300	4885061Y01	NPN RF TRANSISTOR
Q0301	4885061Y01	NPN RF TRANSISTOR
Q0302	4802197J95	NPN RF TRANSISTOR
Q0400	NOT PLACED	–
Q0401	4815267H01	DUAL PNP
Q0402	4885593U03	NPN RF TRANSISTOR
Q0403	4815270H01	ANALOG SWITCH
Q0405	4885593U03	NPN RF TRANSISTOR
Q0500	4802197J95	NPN RF TRANSISTOR
Q0501	4802197J95	NPN RF TRANSISTOR
Q0600	4805793Y10	NPN RF TRANSISTOR
Q0601	4813973A04	NPN DARLINGTON
Q0701	4816013H01	DUAL NPN/PNP
Q0702	48012048002	RF POWER AMPLIFIER, LDMOS
Q0703	4816548H01	N_CHANNEL LDMOS DRIVER
Q0704	4813973B02	PNP
Q0705	4816547H01	N-CHANNEL LDMOS PRE-DRIVER
Q0706	4815272H01	ANALOG SWITCH
Q0711	4815271H01	ANALOG SWITCH
Q0900	4815272H01	ANALOG SWITCH
Q0901	4813973A13	PNP
Q0902	4813973M07	NPN
R0100	0613952R66	0
R0101	0613952R66	0
R0102	0613952R66	0
R0103	0613952R66	0
R0104	0613952R17	47K
R0105	0613952Q58	240
R0106	0613952Q83	2.7K
R0107	0613952Q57	220
R0108	0613952Q80	2K
R0109	0613952R66	0
R0110	0613952Q42	51
R0111	0613952R66	0
R0113	0613952R01	10K
R0114	0613952Q80	2K
R0115	0613952R66	0
R0116	0613952R66	0
R0117	0613952R12	30K
R0118	0613952R66	0
R0119	0613952Q35	27
R0120	0613952R01	10K
R0122	NOT PLACED	–
R0123	0613952R19	56K
R0125	0613952R66	0
R0126	NOT PLACED	–
R0127	0613952Q49	100
R0128	0613952R66	0
R0131	0613952Q58	240
R0134	0613952Q35	27
R0139	0613952Q78	1.6K
R0140	0613952Q31	18
R0144	0613952R01	10K
R0146	0613952R66	0
R0147	NOT PLACED	–
R0148	0613952Q60	300
R0155	0613952R66	0
R0156	NOT PLACED	–
R0157	NOT PLACED	–
R0158	NOT PLACED	–
R0159	0613952R01	10K
R0160	0613952R25	100K
R0161	0613952R25	100K
R0170	0613952R66	0
R0201	0613952Q85	3.3K
R0202	0613952Q75	1.2K
R0203	0613952Q75	1.2K
R0204	0613952Q95	8.2K
R0205	0613952Q49	100
R0206	0613952R05	15K
R0207	0613952Q25	10
R0208	0613952Q42	51
R0210	0613952Q89	4.7K
R0211	0613952R66	0
R0212	0613952R66	0
R0213	0613952R01	10K
R0216	0613952Q51	120
R0218	0613952R01	10K
R0219	0613952Q66	510
R0220	0613952Q25	10
R0221	0613952Q66	510
R0224	0613952Q92	6.2K
R0225	0613952Q94	7.5K
R0226	0613952Q49	100
R0229	0613952Q54	160
R0230	0613952Q89	4.7K
R0301	0613952Q85	3.3K
R0302	0613952Q66	510
R0303	0613952Q66	510
R0304	0613952Q95	8.2K
R0305	0613952Q49	100
R0306	0613952R05	15K
R0307	0613952Q33	22
R0308	0613952Q42	51
R0310	0613952Q89	4.7K
R0311	0613952R66	0
R0312	0613952R66	0
R0316	0613952Q46	75
R0319	0613952R32	200K
R0320	0613952R05	15K
R0321	0613952Q83	2.7K
R0324	0613952Q80	2K
R0325	0613952Q95	8.2K
R0326	0613952Q49	100
R0327	0613952R01	10K
R0329	0613952Q50	110
R0331	0613952R01	10K
R0332	0613952Q56	200
R0333	0613952Q35	27
R0334	0613952Q56	200
R0337	0613952R66	0
R0400	0613952R05	15K
R0401	0613952Q91	5.6K
R0402	0613958H55	180
R0403	NOT PLACED	–
R0404	0613952Q57	220
R0405	0613952Q91	5.6K
R0406	0613952Q83	2.7K
R0407	0613952G67	0
R0409	0613952Q75	1.2K
R0410	0613952R25	100K
R0411	0613958H55	180
R0412	0613952R25	100K
R0413	0613952Q69	680
R0414	0613952Q69	680
R0415	0613952Q69	680
R0416	0613952Q69	680
R0417	0613958H25	10
R0418	0613952Q77	1.5K
R0419	0613952Q83	2.7K
R0420	0613952Q83	2.7K
R0421	0613958H25	10
R0422	0613952K25	17.8
R0423	0613952L46	294
R0424	0613952L46	294
R0425	0613952Q75	1.2K
R0426	0613952Q83	2.7K
R0427	0613952Q25	10
R0428	0613952R01	10K
R0429	0613952Q69	680
R0430	0613952R01	10K
R0431	NOT PLACED	–
R0432	NOT PLACED	–
R0433	0613952R66	0
R0434	0613958H49	100
R0435	0613952R66	0
R0436	0613952Q67	560
R0437	0613952R66	0
R0438	0613952Q67	560
R0440	0613952R25	100K
R0441	0613952R25	100K
R0443	0613952R25	100K
R0444	0613952R25	100K
R0500	0613952Q90	5.1K
R0501	0613952Q61	330
R0502	0613952R08	20K
R0503	0613952R12	30K
R0508	0613952R19	56K
R0509	0613952Q89	4.7K
R0510	0613952R12	30K
R0511	0613952Q75	1.2K
R0512	0613952Q42	51
R0601	0613952Q45	68
R0602	0613952R01	10K
R0603	0613952Q80	2K
R0604	0613952R10	24K
R0605	0613952Q61	330
R0606	0613952Q42	51
R0607	NOT PLACED	–
R0608	0613952R66	0
R0609	0613952R66	0
R0610	0613952R66	0
R0611	0613952R66	0
R0612	0613952R66	0
R0613	0613952R66	0
R0614	0613952R66	0
R0615	0613952R66	0

Circuit Ref	Motorola Part No.	Description
R0616	0613952R25	100K
R0617	0613952R01	10K
R0618	0613952Q63	390
R0619	0613952R01	10K
R0620	0613952Q96	9.1K
R0621	0613952R66	0
R0622	NOT PLACED	–
R0623	NOT PLACED	–
R0624	0613952Q90	5.1K
R0625	0613952N69	51.1K
R0626	0613952N81	68.1K
R0627	0613952R66	0
R0700	0613958H44	62
R0701	0613958J74	0
R0702	NOT PLACED	–
R0706	0613958S51	120
R0709	0613959Q60	300
R0711	0613952H57	220
R0712	0613952H48	91
R0713	0613959H12	30K
R0714	0613952H46	75
R0715	0613952H46	75
R0718	0613952H25	10
R0719	0613959Q25	10
R0720	0613952H25	10
R0722	0613952H89	4.7K
R0724	0613952H79	1.8K
R0725	0613952Q59	270
R0726	0613952N01	10K
R0727	0613952H95	8.2K
R0728	0613952J01	10K
R0729	0613952J01	10K
R0730	0613952H73	1K
R0732	0613952H73	1K
R0734	0613952G67	0
R0735	0613959Y49	100
R0738	0613959Y42	51
R0739	NOT PLACED	–
R0740	0613952J25	100K
R0741	0613952J17	47K
R0742	0613959Q25	10
R0743	0613958S73	1K
R0744	NOT PLACED	–
R0745	0613952H65	470
R0747	0613952H89	4.7K
R0748	0613952J19	56K
R0749	0613952G67	0
R0750	0613952J07	18K
R0751	0613952J08	20K
R0752	0613952G67	0
R0753	0613952H73	1K

Circuit Ref	Motorola Part No.	Description
R0754	0613952H25	10
R0755	0613952H25	10
R0756	0613952J25	100K
R0757	0613952J17	47K
R0759	0613952H25	10
R0760	0613952Q83	2.7K
R0761	0613952G67	0
R0762	0613958S29	15
R0763	0613958S29	15
R0764	0613958S29	15
R0765	0613958S29	15
R0766	0613958S29	15
R0768	0613958S29	15
R0769	0613958S29	15
R0770	0613958S29	15
R0771	0613958S29	15
R0773	0613958S29	15
R0775	0613952G67	0
R0777	0613952H25	10
R0900	0613952N73	56.2K
R0901	0613952N62	43.2K
R0902	0613952M50	3.24K
R0903	0613952N34	22.1K
R0906	0613952R66	0
R0907	0613952R66	0
R0909	0613952N62	43.2K
R0910	0613952H73	1K
R0911	0613952N01	10K
R0912	0613952N30	20K
R0913	0613952R66	0
R0914	0613952P26	182K
R0915	0613952N81	68.1K
R0916	0613952M59	4.02K
R0917	0613952H91	5.6K
R0918	0613952H63	390
R0919	0613952R15	39K
R0920	0613952N42	26.7K
R0921	0613952H81	2.2K
R0922	0613952R14	36K
R0923	0613952R66	0
R0924	0613952H91	5.6K
R0925	0613952H91	5.6K
R0926	0613958H53	150
R0927	0613952H42	51
R0928	0613958H39	39
R0929	0613958H39	39
R0930	0613952R07	18K
R0931	0613952R66	0
R0936	0613952N66	47.5K
R0937	0613952N21	16.2K
R0938	0613952R66	0

Circuit Ref	Motorola Part No.	Description
R0940	0613952R66	0
R0941	0613952R66	0
R0942	0613952M81	6.81K
R0943	0613952N58	39.2K
R0944	0613952R66	0
R0946	0613952M51	3.32K
R0947	0613952R66	0
R0950	0613952N01	10K
R0951	0613952N62	43.2K
R0954	0613952R40	430K
R0955	0613952P01	100K
R0960	0613952H82	2.4K
R0970	0613958H56	200
R0971	0613958H55	180
R0973	NOT PLACED	–
R0974	0613958H55	180
R0975	0613958H56	200
R0976	0613952H53	150
R0977	0613952H53	150
R0978	0613952G67	0
R0979	0613952G67	0
R0981	0613952R07	18K
R0982	0613952R01	10K
R0983	0613952R01	10K
R0984	NOT PLACED	–
R0985	0613952N81	68.1K
R0986	0613952N81	68.1K
R0987	0613952N81	68.1K
R0988	0613952Q42	51
R0989	NOT PLACED	–
R0994	NOT PLACED	–
R0995	NOT PLACED	–
RT0908	0615585H01	47K
RT0953	0615585H01	47K
SH0100	2615362H01	SHIELD
SH0101	2615362H01	SHIELD
SH0300	2615362H01	SHIELD
SH0301	2615362H01	SHIELD
SH0500	2615576H01	SHIELD
SH0900	2686423Z02	SHIELD
SH0901	2686425Z02	SHIELD
T0400	2515121H01	BALUN XFMR
T0401	2515121H01	BALUN XFMR
U0100	5104932K08	IC, FRACN SYNTHESIZER
U0101	5114000B59	ANALOG SWITCH
U0201	4815267H01	DUAL PNP
U0303	NOT PLACED	–
U0304	4815267H01	DUAL PNP
U0600	5102495J14	IC, RF ASIC
U0601	5115391H01	VOLTAGE REGULATOR
U0700	4802246J29	PA PRE-DRIVER

Circuit Ref	Motorola Part No.	Description
U0900	5115147H01	DUAL OPAMP
U0901	5115147H01	DUAL OPAMP
U0940	5180390L83	IC, PA CONTROLLER
U0941	5115391H01	VOLTAGE REGULATOR
U0942	5114004A35	VOLTAGE DETECTOR
U0943	5178286A01	IC, VOLTAGE DETECTOR
VR0700	4813977M11	DIODE, 5.6V ZENER
Y0100	5116032H01	0.5 PPM 16.8 MHZ TCXO (GPS Models Only)

XPR 8300/XPR 8400 MOTOTRBO Repeater

Chapter 8

UHF1 (403–470 MHz)

25–40W

Service Information

Issue: September, 2010

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Section 1

THEORY OF OPERATION

1.0 Introduction

The MOTOTRBO repeater consists of two MOTOTRBO mobile radios; one to act as a receiver, and one to act as a transmitter and controller. Both of these radios contain specialized software that allows them to function together as a repeater. The Repeater also contains a Repeater Indicator board and a Connector board. A block diagram of the repeater is shown in Figure 1-1. The Repeater Indicator board contains the Front-Panel LED circuitry as well as an Ethernet interface. The Connector board is a multifunctional board that is primarily used to pass signals to and from modules inside the chassis to the outside of the chassis.

The Repeater contains the following assemblies and sections:

- Receiver
- Transmitter
- Repeater Indicator Board
- Connector Board
- Fan
- AC/DC PSU

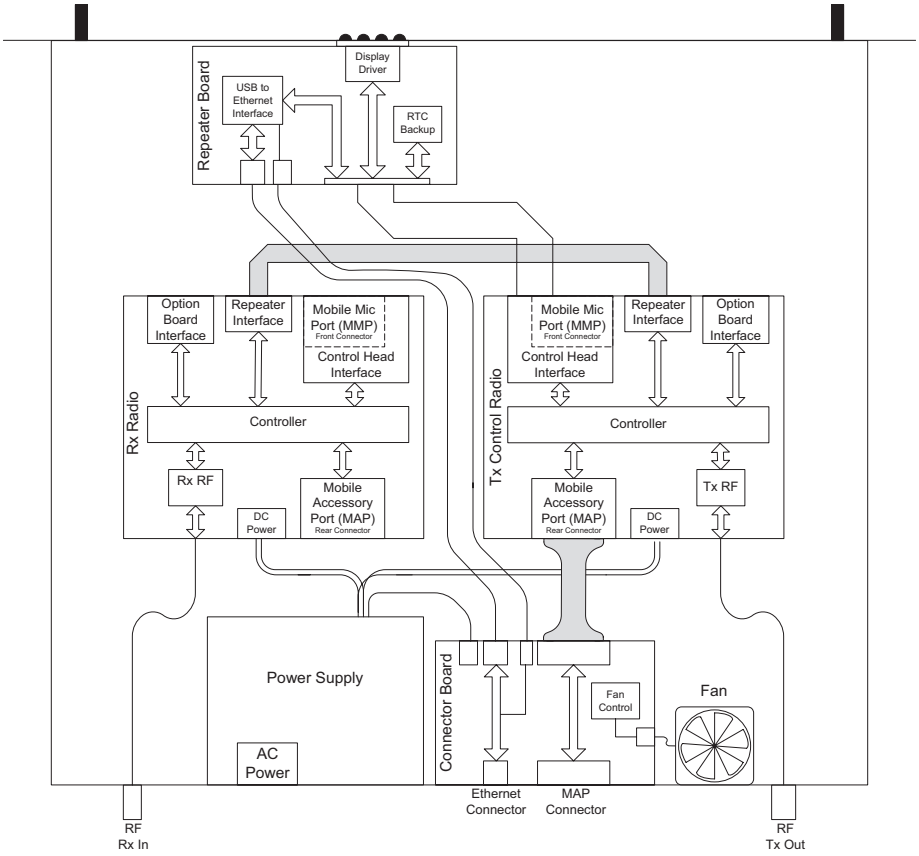


Figure 1-1 Repeater Block Diagram

1.1 Receiver

The receiver uses a transceiver board which is based on the mobile radio's transceiver board. The board uses the same PCB as the mobile radio board, but is populated differently to work in the Repeater application. Only the receiver related functions of the board are utilized in this application, even though the circuitry for transmit also exists on the board.

The Repeater receiver is identical in functionality to the mobile radio's receiver differing only in the audio path. On the mobile radio, the decoded audio is sent to a DAC, and then to the speaker. In the Repeater, this audio information is sent out through the SSI link to the transmit radio to be processed. Details of the receiver theory of operation can be found in Section 3.1.

1.2 Transmitter

The transmitter consists of a transceiver board which is based on the mobile radio's transceiver board housed in a transmit chassis. The transmit radio is identical to the receive board from a hardware standpoint. The difference between the two is the software that is running on them, how they are connected within the Repeater, and an additional heat sink that is mounted to the chassis. The added heatsink and the Repeater fan allow the transmitter to be cooled sufficiently when operating in a 60°C, full-duty cycle environment.

The transmit radio acts as the master controller for the Repeater. It handles all controller related tasks for the Repeater, including management of the receive radio. The transmit radio is responsible for processing the audio sent from the receive radio and repeating it out at the Tx frequency. Details of the transmitter theory of operation can be found in Section 3.2.

1.3 Repeater Indicator Board

The Repeater Indicator board contains circuitry to drive the front panel indicator LEDs, an RTC battery for the RTC in the transmit radio, as well as an Ethernet controller.

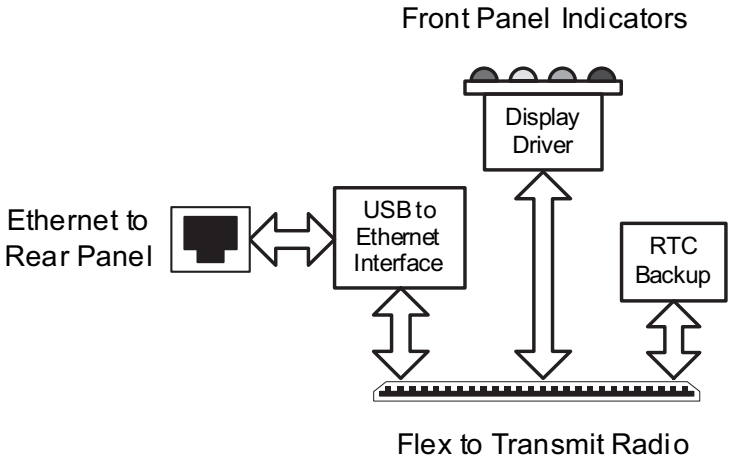


Figure 1-2 Repeater Indicator Board Block Diagram

All of the indicator LEDs that are on the front of the Repeater chassis reside on the Repeater Indicator board. Each is controlled by a shift register (U6) data out signal and a digital transistor. The shift register accepts serial data in from the transmit radio's OMAP processor via a SPI bus. A 74LVC07 buffer (U9) level shifts these signals from 3.3 V to 1.8 V.

The Repeater Disable LED is a dual-purpose LED that is hardware controlled initially at power-up. As soon as VBUS power is available on the Repeater Indicator board, the hardware circuitry for the Repeater Disable LED will cause it to blink periodically. When the software initialization is completed by the firmware, the blink circuitry will get disabled by the firmware. At that point, the Repeater Disable LED can be used for its intended purpose of displaying when the Repeater Disable function is turned on.

The power LED is the only LED that is not controlled by the software. This bi-color LED gets turned on green when the 13.8 V output from the power supply is valid. It turns on red when A/C power is lost, and the repeater's backup battery is used.

The Real Time Clock (RTC) battery (M1) is connected to the transmit radio through the Control Head (J1, pin 30).

Details of the Ethernet Controller can be found in Chapter 2.

1.4 Connector Board

The Connector board has two purposes: provide a place for the Repeater's MAP and Ethernet connectors to be mounted and a location for the Repeater's fan control circuitry.

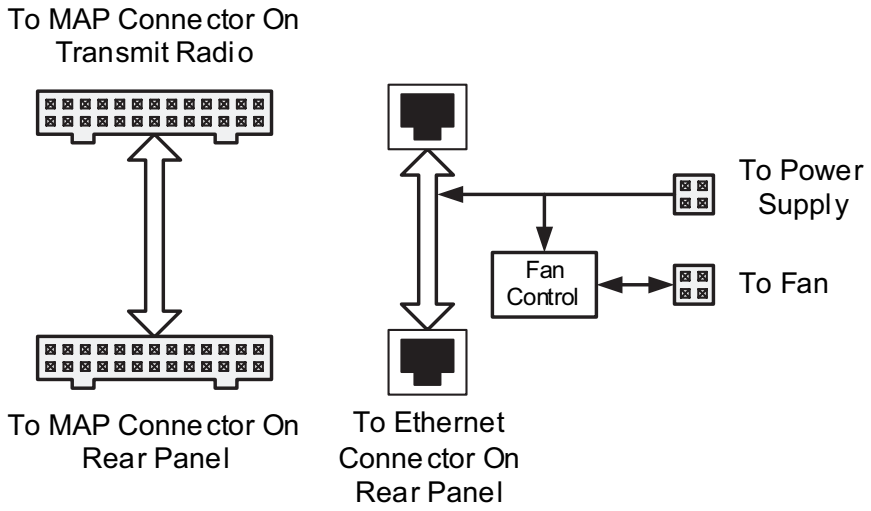


Figure 1-3 Connector Board Block Diagram

1.5 Fan

The fan control logic is provided by the fan controller IC (U51). This is a device from Cypress Semiconductor. There are basically two functions provided by the fan controller. First, it provides a PWM output based on a temperature input, and secondly, it provides detection of fan failure based on the fan tachometer reading.

The Repeater's internal chassis temperature is measured with an LM50 precision temperature sensor IC (U52). This IC outputs a voltage that is linearly proportional to temperature at 10 mV/°C, and with an offset of +500 mV. The output voltage of the LM50 ranges from +200 mV at -30°C to 1.1 V at +60°C.

The fan controller IC (U51) controls the speed of the fan by adjusting the PWM output (pin 1) from 0% to 100%. As long as the fan continues to work, pulses are output from the fan and input to the fan controller (pin 2).

1.6 AC/DC Power Supply

The Repeater uses the PMPN4001A switch-mode, Power Supply Unit (PSU). It is capable of 200 W and designed for a 50 W UHF or VHF repeater system. This supply has UL, CE, and TUV regulatory approvals and is usable in all regions by using the correct line cord. The AC input is auto-ranging with no manual switch being specified to operate from 90 V-270 V and 47 Hz-63 Hz. It outputs a nominal voltage of 13.8 V with a voltage tolerance of +/- 5%.

It has Power Factor Correction circuitry and is rated at 15 A across the whole operating temperature range of -30°C to +60°C. It also has a built-in battery revert circuit with a float output available for maintaining the charge on a battery and has UL, CE, & TUV approvals. The battery revert connector is accessible in the back of the power supply.

The supply has over-load, over-voltage, and over-temperature protection. In an overload condition, the PSU goes into a hiccup mode where it recovers automatically after the fault condition is removed. During an over-voltage condition, the PSU shuts down, and will have to be re-powered on to recover. In an over-temperature condition, the PSU also shuts down but will recover after the temperature goes down.

The PSU is not designed to be field serviceable. If it is determined that the PSU is not functioning, the whole unit needs to be replaced.

2.0 Repeater Interconnections and Cables

Figure 1-4 shows the Cable interconnections inside the Repeater.

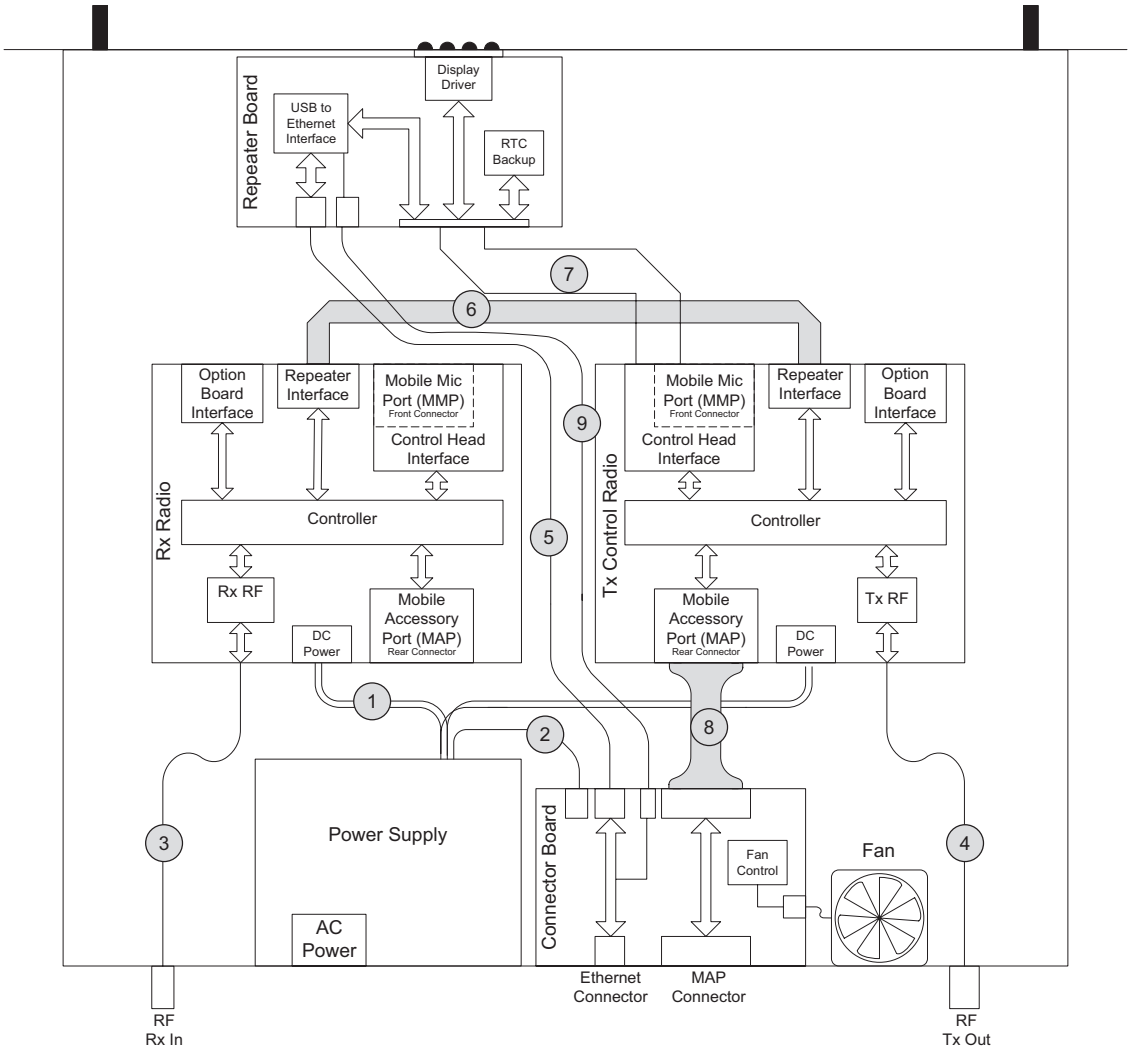


Figure 1-4 Repeater Cabling Diagram

The details of each of these cables/interconnections are as follows:

1. Two conductor DC power cables to the transmit and receive radios.
2. Six conductor DC power cable to the connector Board. Supplies power for the fan and Repeater Indicator board via cable 6.
3. RF Coax to connect the receive radio to the back of the Repeater. This cable has a BNC connector on the Repeater's rear panel.
4. RF Coax to connect the transmit radio to the back of the Repeater. This cable has an N type connector on the Repeater's rear panel.
5. CAT5 cable with RJ45 style connectors on both ends. This cable connects the Ethernet controller on the Repeater Indicator board to the Repeater's back panel and provides power from the Connector Board to the Repeater Indicator board for the LED indicators.

6. Eleven conductor flex cable. Provides the SSI connection between the transmit and receive radios. Refer to Section 1.5 for more details on this interface.
7. Thirty conductor flex cable. Provides the connection from the transmit radio to the Repeater Indicator board and includes SPI signals to drive the LED indicators, RTC backup supply, and the interface to the Ethernet controller.
8. Twenty six conductor cable. Provides the connection from the transmit radio's MAP to the MAP located on the Repeater's rear panel.
9. Eight pin conductor cable. Provides Ethernet LED signals from Repeater Board and HWID signals from Connector Board (Applicable for 32 MB repeaters only).

3.0 Mobile Radio's Theory of Operation

The sections that follow provide a detailed theory of operation for the UHF circuits in the two MOTOTRBO mobile radios. For details of the theory of operation and troubleshooting for the associated Controller circuits, refer to the Controller Section of this manual.

3.1 UHF (403–470 MHz) Receiver Circuitry

The receiver is configured as a dual-conversion superheterodyne receiver, capable of both FM and 4-level FSK demodulation. The major blocks are the front-end, the mixer, Xtal filter, and the Abacus III back-end IC. The overall block diagram is shown in Figure 1-5.

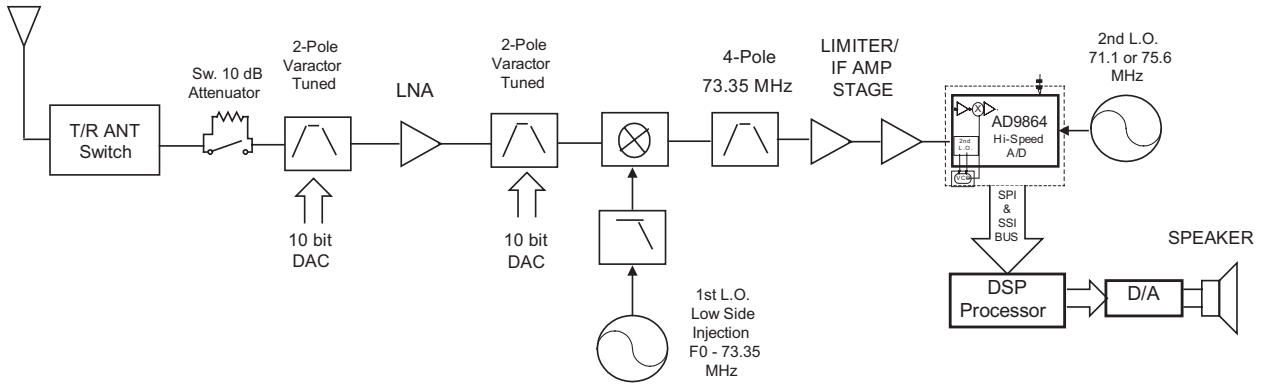


Figure 1-5 Receiver Block Diagram

3.1.1 Receiver Front-End

The front-end consists of a 2-pole varactor-tuned pre-selector filter, an LNA, a 2-pole varactor-tuned post-selector filter, and a passive double-balanced mixer. The received signal applied to the antenna is routed through the harmonic filter and PIN diode controlled antenna switch (D0702). A logic high level on ANT_ENABLE configures the antenna switch for Tx operation while a logic low places the switch in Rx mode. The insertion loss of the harmonic filter and antenna switch combined is approximately 0.5 dB max in Rx mode. From this point, the Rx signal is routed to the Local Distance switch (D0400/R0407), which biases on a diode in normal operation to minimize any insertion loss. In the repeater, the diode is always biased on with the potential intermodulation improvement through use of the resistive attenuation not accessible.

The signal next reaches the pre-selector filter, which is a 2-pole varactor-tuned filter with 5 zeros that are optimized to provide image frequency rejection. This filter, along with the similarly designed post-selector filter, provides over 75 dB of image response rejection. The 3 dB bandwidth for both filters varies across the band with a minimum of 19 MHz at 403 MHz and a maximum of 40 MHz around 436 MHz. Half-IF rejection from the filters is also frequency dependent with a minimum of approximately 10 dB achieved at the worst-case frequency of 436 MHz. Both filters have variable center frequencies that are adjusted by the FE_TUNE signal, which is derived from the output of a 10-bit DAC internal to the MAKO IC (U3200). The voltage is scaled up by a voltage doubler (Q0403) in order to provide the required linearity for the filters. Both filters are matched to the LNA (Q0402) to optimize the amplifier's noise figure (2.0 dB) and to provide an LNA gain of 15 dB to the signal. The combined gain of the filters and LNA is about 13 dB. Current source Q0401 maintains the collector current of Q0402 constant at 20 mA. The LNA, current source, Local Distance switch, and voltage doubler are all supplied by 9R1_FILT, which is derived from 9R1 after filtering.

Following the post-selector filter is the Class 2, double-balanced mixer. It is comprised of baluns T0400 and T0401 and diode ring mixer D0405. Injection amplifier Q0405 provides 10 dB of gain to the Rx VCO injection signal. Another amplifier, Q0202, located in the VCO block, also provides gain for the LO signal and isolation from high RF signals entering the mixer. The signal applied to the LO port of the mixer is +16 dBm minimum after passing through the 3-pole/1-zero, low-pass injection filter. The LO injection is low-side and mixes the signal down to an IF frequency of 73.35 MHz. The output of the mixer is connected to a diplexer network, which terminates out-of-band frequencies in 51 ohms (R0427) while appearing as high impedance to the 73.35 MHz IF signal.

3.1.2 Receiver Back-End

The signal entering the back-end is matched to 4-pole crystal filter, FL0500, by C0507 and L0503. The filter is centered at 73.35 MHz with a 3 dB bandwidth of 12 kHz. IF amplifiers Q0500 and Q0501 follow the crystal filter and provide both amplification and limiting to the signal. An overall gain of 25 dB is available from the composite IF amplifier to lower-level IF signals. As the signal level increases, Q0501 begins to limit and eventually saturates out at approximately –16 dBm. The purpose of the limiting is to provide protection to the AD9864 Abacus III back-end IC (U0600). At IF levels exceeding –32 dBm into U0600, the 2nd LO synthesizer internal to U0600 can be pulled, causing corruption of the I/Q data being delivered to the DSP. The block diagram for the AD9864 is shown in Figure 1-6 below.

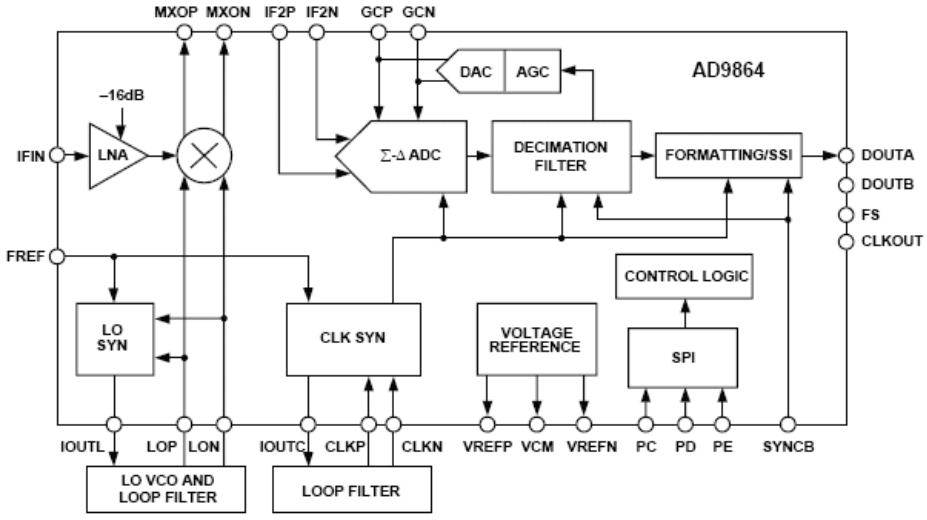


Figure 1-6 AD9864 Block Diagram

The Abacus III accepts the 73.35 MHz signal, processes it, and sends out I/Q data in 16-bit format to the DSP at a 20 kHz rate. Internal to the Abacus III is an LNA and 16 dB FE attenuator, an internal integer-N synthesizer used to control the external 2nd LO VCO, a Sigma-Delta ADC and decimation filter, and control and formatting logic for outputting the baseband I/Q data. External to U0600 is the 2nd LO VCO with active device Q0600 and its associated circuitry including the loop filter consisting of C0613, C0618, and R0603. The 2nd LO mixes the 73.35 MHz IF signal down to 2.25 MHz before being input to the ADC where it is sampled. The tank circuit (L0608, C0605, C0642, R0617) and varactor (D0601) for the internal clock synthesizer, work with the loop filter (R0618, C0643, C0646) to provide the 18 MHz clocking signal to the internal ADC, decimation filter, and SSI formatting circuitry. A 3 Volt regulator (U0601) provides a clean supply to U0600. Transistor Q0601 is configured as a super filter to provide the 2nd LO transistor with a low-noise supply. The reference clock for U0600 is 16.8_REF, which is a buffered (Q0100) 16.8 MHz clock from the synthesizer block.

Shown below in Figure 1-7, is a simplified block diagram of the signal flow through the receiver back-end and the DSP processor portion of the OMAP (U1000). All of the blocks within the dotted box represent the DSP software algorithms internal to the DSP.

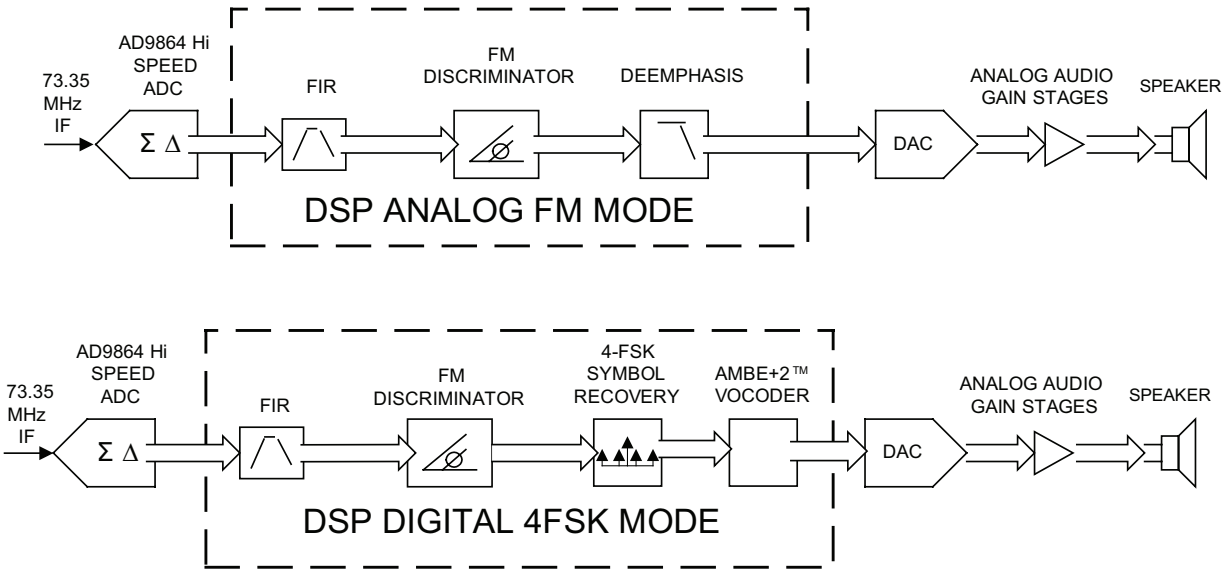


Figure 1-7 Signal Flow through Receiver Back-End

The DSP takes the incoming 20 kHz data stream and passes the information through an FIR (Finite Impulse Response) filter, which provides rejection from any in-band adjacent channel interference. The remaining filter data is then sent through a decimation process further reducing its frequency to 8 kHz.

Depending on whether the repeater is in Analog or Digital mode determines the type of signal processing used. If in Analog mode, the remaining 8 kHz data is sent through the FM Discriminator and De-emphasis subroutines in the DSP code. If the repeater is in Digital mode, the 8 kHz data is again passed through the FM Discriminator but an additional Symbol Recovery routine is applied along with a standard AMBE+2™ Vocoder process. The data is sent to the MAKO (U3200), which provides digital to analog conversion and drives the audio gain stages. Detailed information regarding this can be found in the Audio Section of the Controller Theory of Operation.

3.2 UHF (403–470 MHz) Transmitter Circuitry - 40 Watt

The Transmitter consists of the power amplifier (PA) circuitry and the power control circuitry. The power amplifier provides amplification of the signal from the VCO up to the desired output power. The power control block is responsible for ensuring the desired output power level is maintained in both analog and digital modes, as well as protecting the power amplifier from damage due to heat, antenna mismatch, out-of-range battery voltage, and poor assembly.

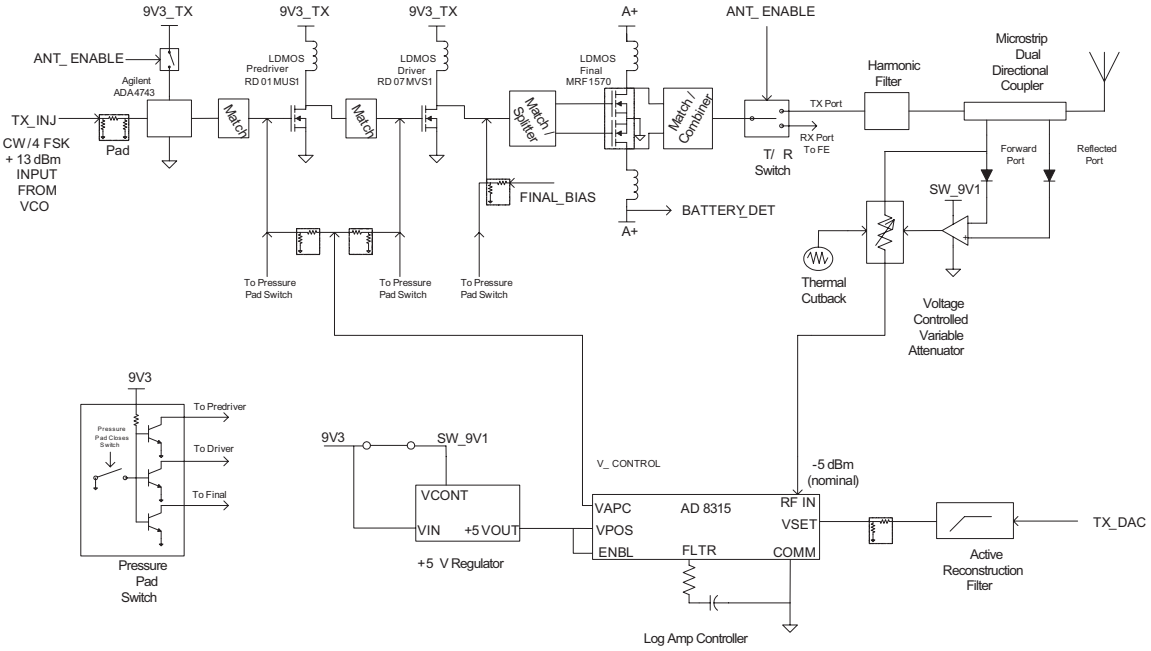


Figure 1-8 UHF 40 Watt High-Power Transmitter Detailed Block Diagram

3.2.1 Power Amplifier

The radio's 40 Watt power amplifier (PA) is a 4-stage amplifier which amplifies the output of the VCO to the required transmit power level. The first stage is an LDMOS (Lateral Double Diffuse MOS) 50 ohm fixed-gain block (ADA-4743, U0700) followed by the adjustable gain LDMOS pre-driver (RD01MUS1, Q0705), an adjustable gain LDMOS driver (RD07MVS1, Q0703), and the fixed-gain LDMOS final device (MRF1570, Q0702). A transmit/receive (T/R) switch and a harmonic filter complete the transmit lineup.

3.2.2 Input Stage (50 Ohm Fixed-Gain Block)

The first stage (ADA-4743, U0700) is an integrated circuit with internally matched 50 ohm input and output stages providing approximately 16.5 dB power gain. It provides reverse isolation between the PA and the VCO to lessen the risk of VCO load-pull and it also supplies appropriate power to the pre-driver stage. The ADA-4743 is biased at 60 mA during transmit by R0706, which is switched to 9V3_TX during TX by Q0701 (controlled by Antenna_En). The ADA-4743 is preceded by an 11 dB resistive pad to further improve reverse isolation.

3.2.3 Pre-Driver Stage

The next stage is a low-power, LDMOS device (RD01MUS1, Q0705), which delivers up to +27 dBm to the driver stage. Its gain is controlled by varying the gate bias voltage and varies from low gain up to approximately 14 dB power gain. The gate bias voltage is controlled in parallel with the driver stage by the V_cont signal.

The input match to this stage is a high-pass topology comprised of L0718, C0817, and L0721. High-pass matches are used where appropriate to minimize the chances of low frequency regeneration within the amplifier. R0759 and R0777 are required to improve the bandwidth of this circuit. The inter-stage match between the pre-driver and driver stages is comprised of L0720, C0786, and C0791 arranged in a high-pass topology. Additional pads are provided on the transceiver board to allow for possible engineering optimizations to this match. These are non-populated parts C0789, C0792, C0793, and C0794.

3.2.4 Driver Stage

The third stage is a medium-power, LDMOS device (RD07MVS1, Q0703), which delivers up to +38 dBm to the final device. Its gain is controlled by varying the gate bias voltage and varies from low gain up to approximately 11 dB of power gain. The gate bias voltage is controlled with the V_cont signal and is controlled in parallel with the pre-driver stage gain.

R0718, R0720, R0754, and R0755 are required to improve the bandwidth of the driver stage. The inter-stage match (as well as the power splitter) between the driver and final device is comprised of C0753, C0813, C0818, C0819, C0732, C0743, C0744 and C0761, and associated micro-strips on the PCB. Additional pads are provided on the printed circuit board to allow for possible engineering optimizations to this match. These are non-populated parts C0754, C0755, C0729, C0730, C0731, C0808, C0764, C0760, and C0765.

3.2.5 Final Stage

The final stage is a high-power, LDMOS device (MRF1570, Q0702) consisting of two parallel, high-power devices within 1 plastic package. The package is mounted to a copper carrier to improve thermal conductivity to the chassis and also to more tightly control the RF load, allowing higher and more consistent maximum output power. This stage is biased at a quiescent current of 750 mA and operates with a fixed-gain of approximately 10 dB, allowing the radio to be set to a maximum output power of 48 Watts. The quiescent current is set by adjusting the Final_Bias signal. Both elements of this transistor are fabricated on the same semiconductor die and are well matched, allowing control via a single voltage.

Both the input and output matching circuits of this stage have extremely critical part location requirements. Any repair must be done with care to ensure the replaced components are placed accurately and properly soldered. Of particular concern are input matching capacitors C0732 and C0761 and output matching capacitors C0811 and C0812. The resistor networks at the input of each of the final elements are required to improve the bandwidth of the circuit. These resistors are R0762 through R0773.

The output matching circuit and power combiner is comprised of C0811, C0719, C0812, C0746, C0726, and C0737 and associated microstrips fabricated on the printed circuit board. Additional pads are provided on the PC board to allow for possible engineering optimizations to this match. These are non-populated parts C0720, C0721, C0747, C0748, C0727, and C0741. R0719 is added as a preventative measure against half-carrier regeneration. If the final device fails and has to be replaced, R0719 should be carefully inspected to ensure against any damage caused by the final device. Replacement of the final device requires that the bias voltage be re-tuned using the Customer Programming Software (CPS). Care must be taken not to damage the device by exceeding the maximum allowed quiescent current which is 1 Amp. The device can tolerate up to 5 Amps for brief periods of time without damage.

3.2.6 Antenna Switch

The antenna switch (T/R switch) routes the signal between either the transmitter or receiver and the antenna. In transmit mode, it utilizes the existing dc feed (A+) to the final stage device (Q0702). Both PIN diodes D0700 and D0702 are turned on during key-up through forward biasing. This is achieved by pulling down the voltage at the cathode end of D0702 to approximately 12.2 Volts (0.7 Volt drop across each diode). Q0704 is configured as a current sink that maintains the current through the antenna switch diodes at 100 mA, as set by VR0700 and R0738. The current sink is enabled during transmit mode by ANT_ENABLE, which is asserted through Q0706 and associated circuitry. When the PIN diodes are conducting, an RF ground is formed at the anode of the lower PIN diode, D0702, which places L0710 and C0803 in parallel. The values of L0710 and C0803 are chosen so as to be parallel resonant at the center of the transmit band, making them appear as an open-circuit so that a 50 ohm power path is maintained through the top PIN diode to the harmonic filter.

In receive mode, DC current through the PIN diodes is interrupted by turning off the current sink. The RF path now flows from the harmonic filter, through the matching circuit formed by L0710, C0803, and the capacitive divider formed by C0767 and C0772. C0766, currently unplaced, is provided for possible future engineering optimizations to this match. The purpose of L0719 is to form a parallel resonant tank with the reverse capacitance of D0700, improving the receive path return loss at the receive input of the T/R switch.

3.2.7 Harmonic Filter

Inductors L0706, L0707, L0708, and capacitors C0742, C0739, C0740, and C0738 form a 7-element low-pass filter to attenuate harmonic energy from the transmitter. R0713 is used to drain any electrostatic charges that might otherwise build up on the antenna. The harmonic filter also prevents high-level RF signals above the receiver pass-band from reaching the receiver circuits, improving spurious response rejection.

3.2.8 Directional Coupler

The dual-directional microstrip coupler is implemented at the harmonic filter output to sample both forward and reverse directed transmitter power. RF power from the transmitter PA passes through the microstrip coupler before reaching the antenna. Forward RF power is coupled to the U0940 log detector/controller via the voltage-controlled attenuator (VCA) stage consisting of pin diodes D0901, D0902, and D0903. The log detector/controller regulates the gain of PA stages Q0703 and Q0705 (via V_cont), thus ensuring that the forward power out of the radio is held to a constant value.

The directional coupler functions not only as part of the transmitter power regulation circuit but also as part of the VSWR load-detection circuitry. Its physical location close to the antenna connector allows accurate VSWR sense at the transmitter output. Forward and reverse coupled signals are rectified by D0904 and D0905, respectively. DC voltage FWD_DETECTED is proportional to RF power while REV_DETECTED is proportional to reflected RF power. The detected voltages are fed to the respective inputs of difference amplifier U0901. The difference amplifier output is applied to the variable attenuator control stage, U0900-1. An abnormally high reflected power level, i.e., a damaged antenna, also causes an increase in the difference amplifier output voltage. This causes a reduction in attenuation by the VCA. As a result, the greater RF signal applied to the log detector/ controller causes the controller to reduce the gain of PA stages Q0703 and Q0705. Transmitter power is thus reduced to prevent damage to the final device due to an improper load.

3.2.9 Power Control

The transmitter uses PA controller IC, U0940 to control the power output of the radio. A portion of the forward RF power from the transmitter is sampled by the directional coupler and delivered via the VCA to the RFIN port of the PA controller IC (pin 1). The PA controller, a log detector type, provides temperature-stable, high-accuracy control over a typical 50 dB dynamic range.

The MAKO IC contains a digital-to-analog converter (DAC), which provides a reference voltage (TX_DAC) at the input of reconstruction filter stage U0900-2. The filtered reference voltage at the output of U0900-2 is divided by the combination of R0942 and R0946 before reaching the VSET input of the PA controller IC (pin 3). Thermistor RT0953 is used in combination with R0954 to compensate reference voltage drift at operating temperature extremes. Reference voltage level is programmable through the SPI lines of the MAKO. This reference voltage is proportional to the desired power setting of the transmitter and is factory programmed at several points across the frequency range of the transmitter to offset frequency response variations of the transmitter's coupled power circuits.

The PA controller IC provides a dc output voltage at pin 7 (VAPC), which is divided to provide gate bias for PA pre-driver and driver stages. The 0 Volts to 5 Volts range at U0940, pin 7, is applied as V_CONTROL to power-adjust the transmitter by controlling the gate bias of stages Q0703 and Q0705. Voltage divider combination R0727 and R0728 provides gate bias to Q0703 while divider combination R0750 and R0751 provides gate bias to Q0705. This adjusts the transmitter power output to the intended value. The ratio of each of these resistive dividers is chosen to ensure that Q0703 and Q0705 are both running at their nominal design condition at rated output power. Variations in sampled forward transmitter power cause the PA controller IC to adjust the control voltage above or below its nominal value to raise or lower output power in order to maintain transmitter output power relative to the reference voltage applied to VSET.

3.2.10 Power Ramp Profile Control

In order to minimize the transient adjacent channel power at the transmitter's output, the ramped power follows a raised-cosine profile. The PA controller IC has a linear slope function when scaled in dB/V. To achieve the desired raised-cosine profile of the output power, the ramped reference voltage provided by the MAKO DAC follows a raised-cosine approximation. The MAKO DAC reference output is low-pass filtered by the DAC reconstruction filter before it is applied to the VSET input of the PA controller IC.

Reconstruction filtering reduces spurious emissions in the RF spectrum as a result of the finite steps of the DAC. Loop filter capacitor C0926 in conjunction with resistor R0950 and the integrator within the PA controller IC, set the loop dynamics. The loop response has been optimized to achieve sufficient speed to follow the required ramping profiles while meeting switching transient requirements over varied power levels. Accurate control of the power-rise (ramp-up) and power-decay (ramp-down) characteristics minimizes splatter into adjacent channels.

3.2.11 Thermal Protection

Thermistor RT0908 in combination with R0902, form a voltage divider with the output proportional to the sensed transceiver board temperature in the vicinity of the transmitter driver and final devices. The voltage divider output is routed to an operational amplifier U0901-2, which provides a dc voltage via diode junction D0900 to control the attenuation level of the VCA stage. For the condition that the temperature threshold set by resistive divider combination R0901 and R0909 is reached, the VCA is driven to increase the RFIN signal at the PA controller IC (pin 1). This increase will cause the controller IC to adjust the PA control voltage below its nominal value to decrease transmitter output power. Temperature will be reduced by lowering transmitter output power relative to the reference voltage applied to VSET.

The extruded heat sink on the transmitter chassis helps to get the heat away from the transmit circuitry more efficiently. Because the heat transfer is better than the mobile chassis due to the fan and heat sink, there are some component values in this area that are different from those in the MOTOTRBO mobile chassis.

3.2.12 Out-of-Range Battery Protection

Transmitter power cutback under extended battery supply voltage operation is provided for by monitoring the battery supply in the controller circuit of the radio in order to change the VSET input of the PA controller IC (pin 3) for reduced transmitter output. This feature allows transmitter PA dissipation to be limited at high-line battery supply operating conditions while limiting transmitter PA overdrive conditions at low-line battery supply operating conditions.

3.2.13 Pressure Pad Switch

The power control circuitry includes a safety switch (S0700) that consists of a conductive portion of the rubber pad which pushes the RF final transistor Q0702 against the chassis. When the chassis cover and rubber pad are properly assembled, the conductive portion of the pad contacts a pattern on the transceiver board, electrically closing switch S0700. If the cover and pad are not in place, switch S0700 is open-circuited and the power control circuit is disabled, turning off the gate bias to Q0702, Q0703, and Q0705. This prevents thermal damage of the RF transistors which could occur if the transmitter is operated without adequate heat sinking.

3.3 Frequency Generation Circuitry

The synthesizer subsystem consists of the reference oscillator (Y0100), the fractional-N synthesizer IC (Tomahawk II, U0100), and the Voltage Controlled Oscillator VCO.

3.3.1 Reference Oscillator

The reference oscillator (Y0100) contains a temperature compensated crystal oscillator with a frequency of 16.8 MHz. A digital-to-analog (DAC) converter internal to U0100 (Tomahawk) and controlled by the mP via serial interface (SPI), sets the voltage at the AUX_DAC output of U0100 (pin H6) to set the frequency of the oscillator. The output of the oscillator (pin 3 of Y0100) is applied to pin K5 (XOSC_BASE) of U0100.

3.3.2 Fractional-N Synthesizer

The Tomahawk II synthesizer IC (U0100) consists of a pre-scaler, a programmable divider and divider control logic, phase detector, charge pump, a D/A converter in the high frequency analog modulation path, an attenuator to balance the high and low frequency modulation paths, a serial interface for control (SPI), a serial interface for modulation (SSI), and a super filter for the regulated 2.45 Volts.

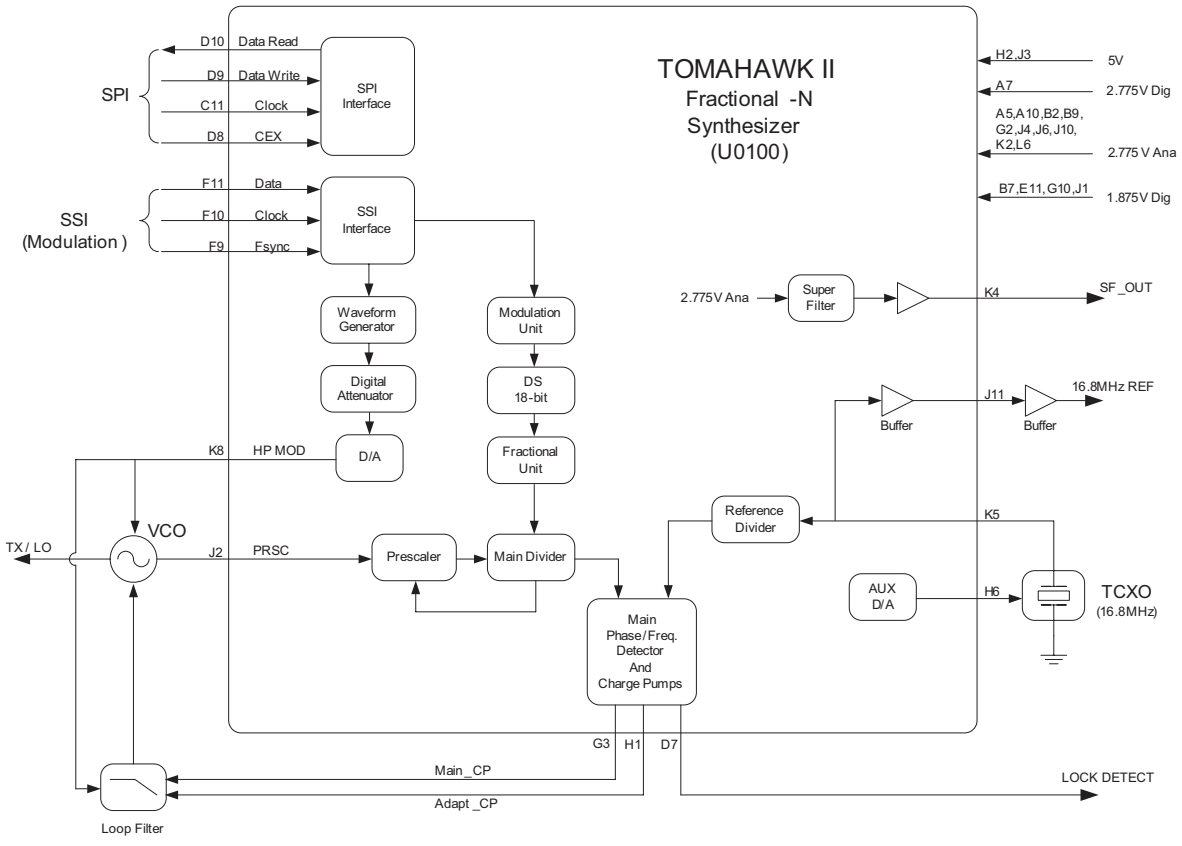


Figure 1-9 UHF Synthesizer Block Diagram

A voltage of 2.775 Volts applied to the super filter input (U0100 pin J4) supplies an output voltage of 2.45 Vdc (SF_OUT) at pin K4. This supplies the VCO and the VCO modulation bias circuit (via R0321). The super filter supply voltage is provided by the 2.775 Volt regulator within U3200. The synthesizer is also supplied by the 5 Volt regulator, U3002, another 2.775 Volt regulator within U3200, and a 1.875 Volt regulator within U3200.

The output signal LOCK (U0100-D7) provides information about the lock status of the synthesizer loop. A high level at this output indicates a stable loop. A discrete buffer amplifier (Q0100) provides a buffered 16.8 MHz reference frequency to other parts of the radio.

The serial programming interface (SPI) is connected to the microprocessor via the data lines SPI_DW (U0100-D9) and SPI_DR (U0100-D10), clock line SPI_CLK (U0100-C11), and chip enable line CEX (U0100-D8). The serial modulation interface (SSI) is connected to the DSP via the data line SDTX (U0100-F11), clock line TXCLK (U0100-F10), and frame sync line SFTX (U0100-F9).

3.3.3 Voltage Controlled Oscillator (VCO)

The Voltage Controlled Oscillator (VCO) subsystem consists of four Colpitts oscillators (two each for Tx and Rx), a single-stage Tx buffer amplifier, a single-stage Rx buffer amplifier, oscillator bias control switches, and the modulation circuitry.

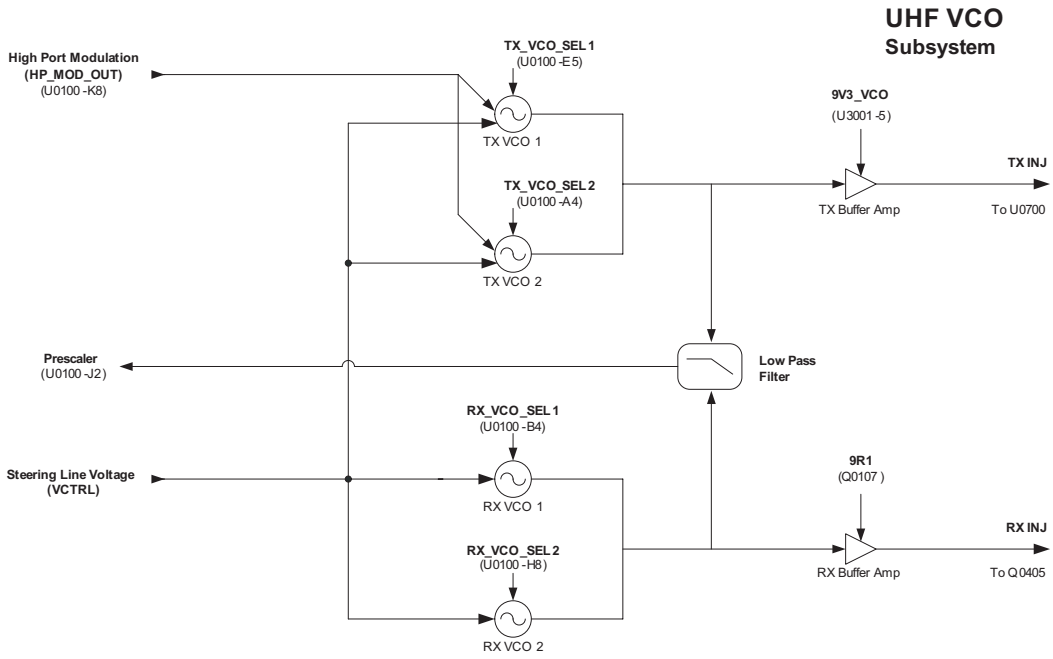


Figure 1-10 UHF VCO Block Diagram

The UHF VCO design incorporates a total of four oscillators; two varactor-tunable Colpitts oscillators each for Tx and Rx. Each oscillator has a tuning range of 33.5 MHz, sufficient to cover the Rx and Tx frequency ranges of 326.65 MHz to 396.65 MHz and 403 MHz to 470 MHz, respectively. The oscillators resonate at fundamental operating frequencies. Four (active-low logic) general purpose output lines (GPO1, GPO2, GPO3, and GPO6) from the Tomahawk IC (U0100-B4, A4, E5, and H8) provide the control for independent bias selection to each oscillator (VCO_SEL) via the PNP transistor switches U0304 and U0201.

The 2.45 Volt super filtered output, SF_OUT, of the Tomahawk IC (U0100-K4) supplies the bias to the oscillators. A portion of the VCO output signal is lightly coupled through coupling capacitors C0331 and C0231, routed through a low-pass filter (formed by L0221, C0235, C0230, and C0233), and fed back to the M_PRSC input of the Tomahawk IC (U0100-J2).

High-port modulation is scaled through a voltage divider (comprised of R0319, R0320, and R0321) and applied to the Tx modulation varactor diode CR0300. The TX VCO frequency is modulated via coupling capacitors C0310 and C0344. High-port modulation is also applied to the VCO steering line (through R0139, R0140 and C0166) which modulates the main VCO tuning varactors.

A discrete single-stage Tx buffer amplifier (comprised of the NPN transistor Q0302 and surrounding components) amplifies the signal from the Tx oscillator to the level required by the first stage of the Transmitter Power Amplifier (U0700). The TX buffer amplifier also provides sufficient isolation from any undesired load-pulling from the Transmitter Power Amplifier. The bias for Q0302 is provided by the 9.3 Volt regulator U3001.

A discrete single-stage Rx buffer amplifier (comprised of the NPN transistor Q0202 and surrounding components) amplifies the signal from the Rx oscillator to the level required by the LO injection amplifier (Q0405). The Rx buffer amplifier also provides sufficient isolation from any undesired load-pulling from high input levels in the receiver front-end. GPO4 from the Tomahawk IC (U0100-D4) controls the transistor switch (comprised of Q0108 and Q0107), that enables the 9.1 Volt bias to Q0202 (via the 9.3 Volt regulator U3001).

3.3.4 Synthesizer Operation

The complete synthesizer subsystem is comprised mainly of the Tomahawk synthesizer IC, Reference Oscillator (crystal oscillator with temperature compensation), loop filter circuitry, VCO, and DC supplies. The VCO feedback signal, PRSC, is fed to pin J2 of U0100 (M_PRSC) via a low-pass filter (L0221, C0235, C0230, and C0233) which attenuates harmonics and provides the correct level to close the phase-locked loop.

The prescaler in the synthesizer IC (U0100) is a four-level prescaler capable of dividing by 4, 5, 6, and 7. The main loop N divider is configured to be an 8-bit divider. The divide-by-N portion of the main loop is set via the SPI. The fractional portion of the divider is realized using a 3-accumulator, 24-bit fractional divider. The SPI is used to set the desired divide ratio.

The output of the prescaler is applied to the main loop divider. The output of the main divider is sent to the phase/frequency detector, which compares the main divider's output signal with the reference signal. The reference signal is generated by dividing down the signal of the reference oscillator (Y0100). The output signal of the phase/frequency detector is a pulsed signal which is routed to the charge pumps. The main charge pump current is programmable through the SPI with its output at pin G3 of U0100 (MN_CP). The loop filter transforms this current into a steering voltage that is applied to the VCO.

To reduce lock time when new frequency data has been loaded into the synthesizer, an adapt charge pump providing much greater current than the main charge pump is turned on for a finite amount of time to quickly charge or discharge the loop filter capacitors to steer the VCO to the desired frequency. The output of the adapt charge pump passes to the loop filter via pin H1 of U0100 (MN_ADAPT_CP). When the synthesizer is within the lock range and the adapt timer runs out, the adapt charge pump is powered down and the main charge pump takes over. A settled synthesizer loop is indicated by a high level at signal LOCK (U0100-D7), which is routed to the microprocessor. Q0102 is configured as a current source to provide a steady 1.5 mA during the adapt period. U0101 is an analog switch that opens the adapt path slightly before the end of the adapt period to prevent the current from the current source from pushing the VCO off frequency.

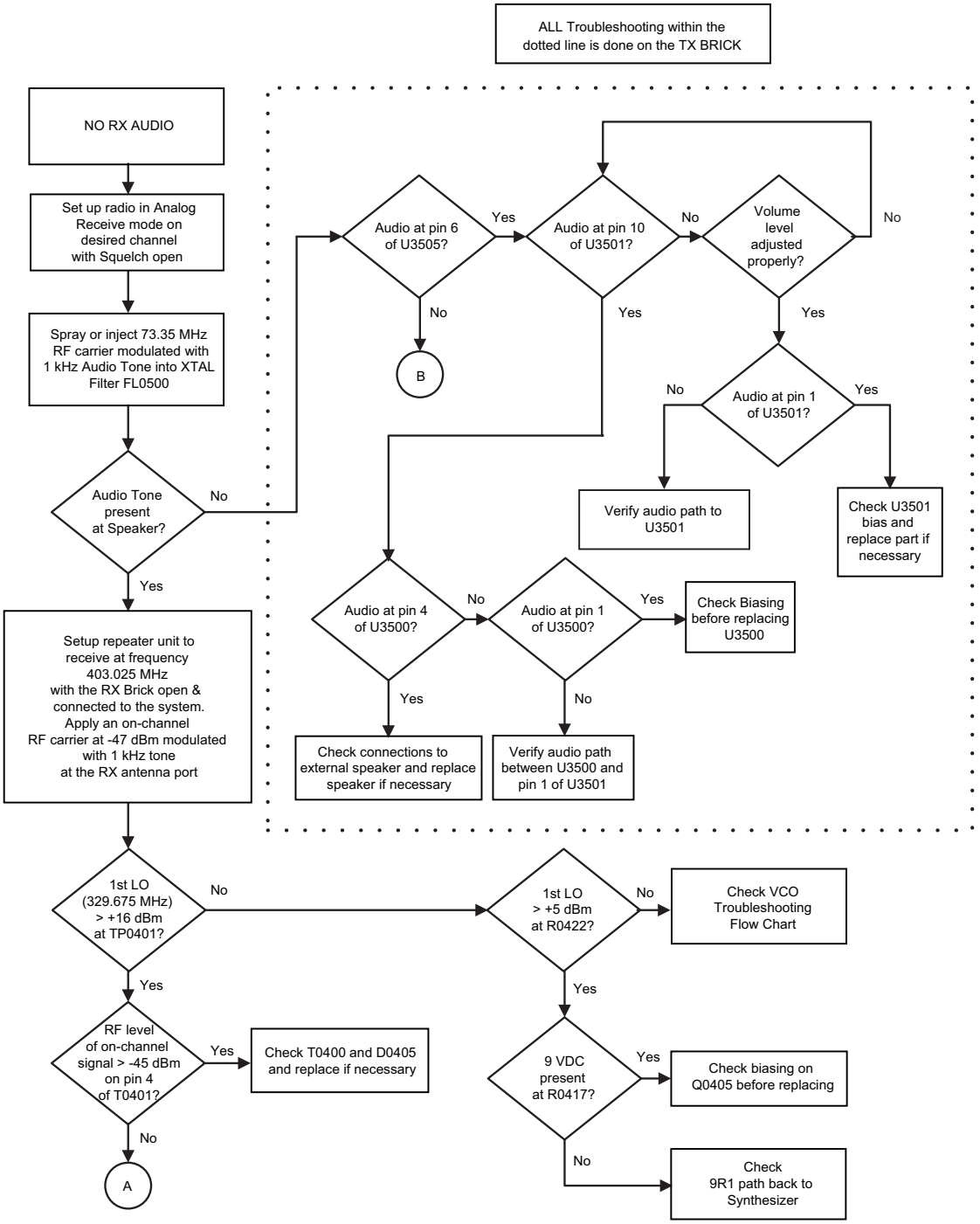
Modulation is performed by applying a digital data stream via the SSI bus from the DSP (U1000) to the synthesizer (U0100). In order to meet spurious and phase noise requirements, the PLL bandwidth was designed to be narrower than the full modulation bandwidth, therefore requiring the use of dual-port modulation. Internal to the synthesizer (U0100), low-port modulation is added to the fractional-N division numerator to trace out the modulation versus time while the high-port data stream passes through an interpolating waveform generator, a digital attenuator (for modulation balancing), and then gets converted to an analog signal through a 10-bit DAC before modulating the VCO. This high-port analog modulation output (HP_MOD_OUT, U0100-K8) is connected to the VCO modulation varactor diode (CR0300) via C0360 and R0319, and to the loop filter via R0139, R0140, and C0166.

Notes

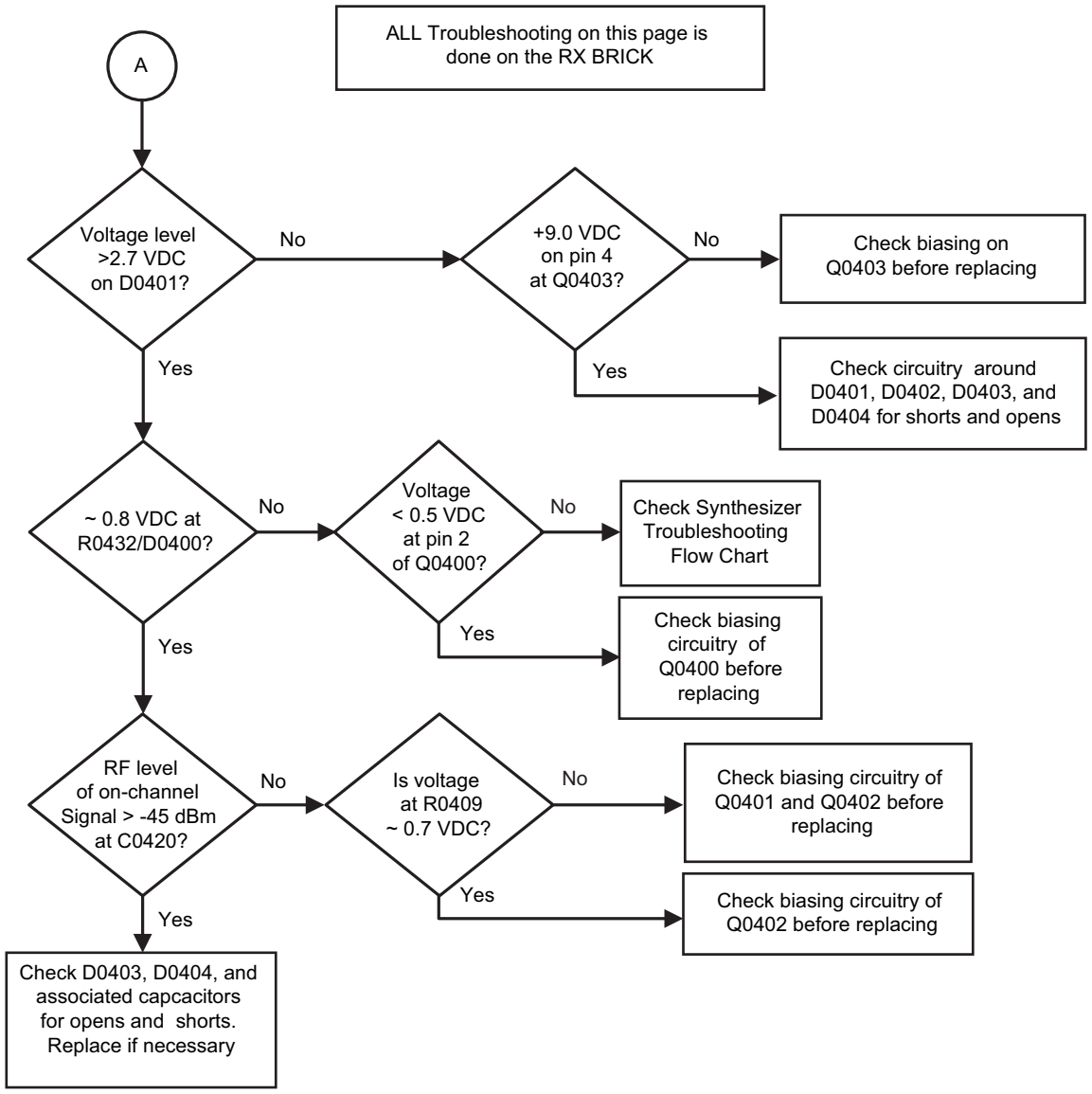
Section 2

TROUBLESHOOTING CHARTS

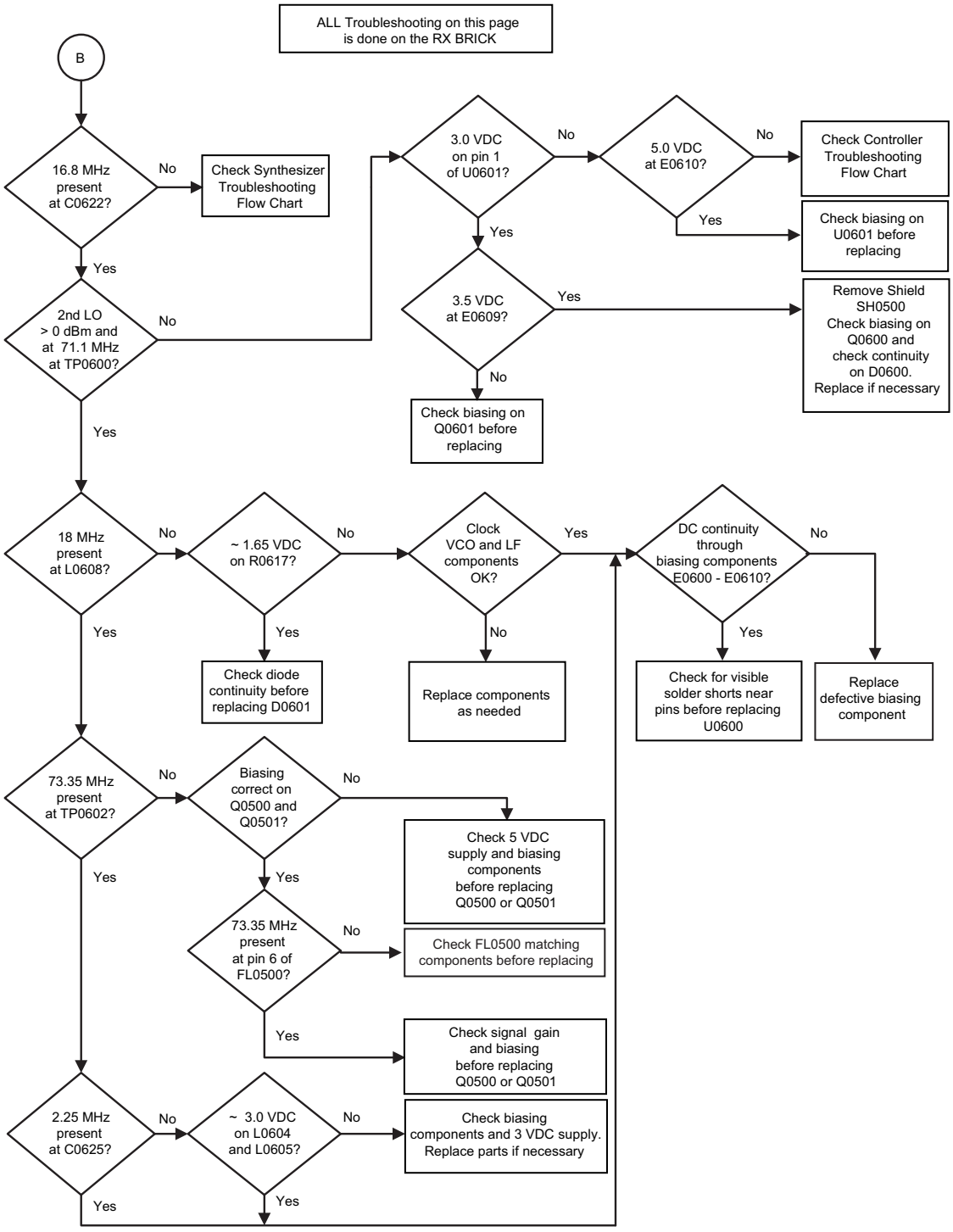
1.0 Troubleshooting Flow Chart for Receiver (Sheet 1 of 3)



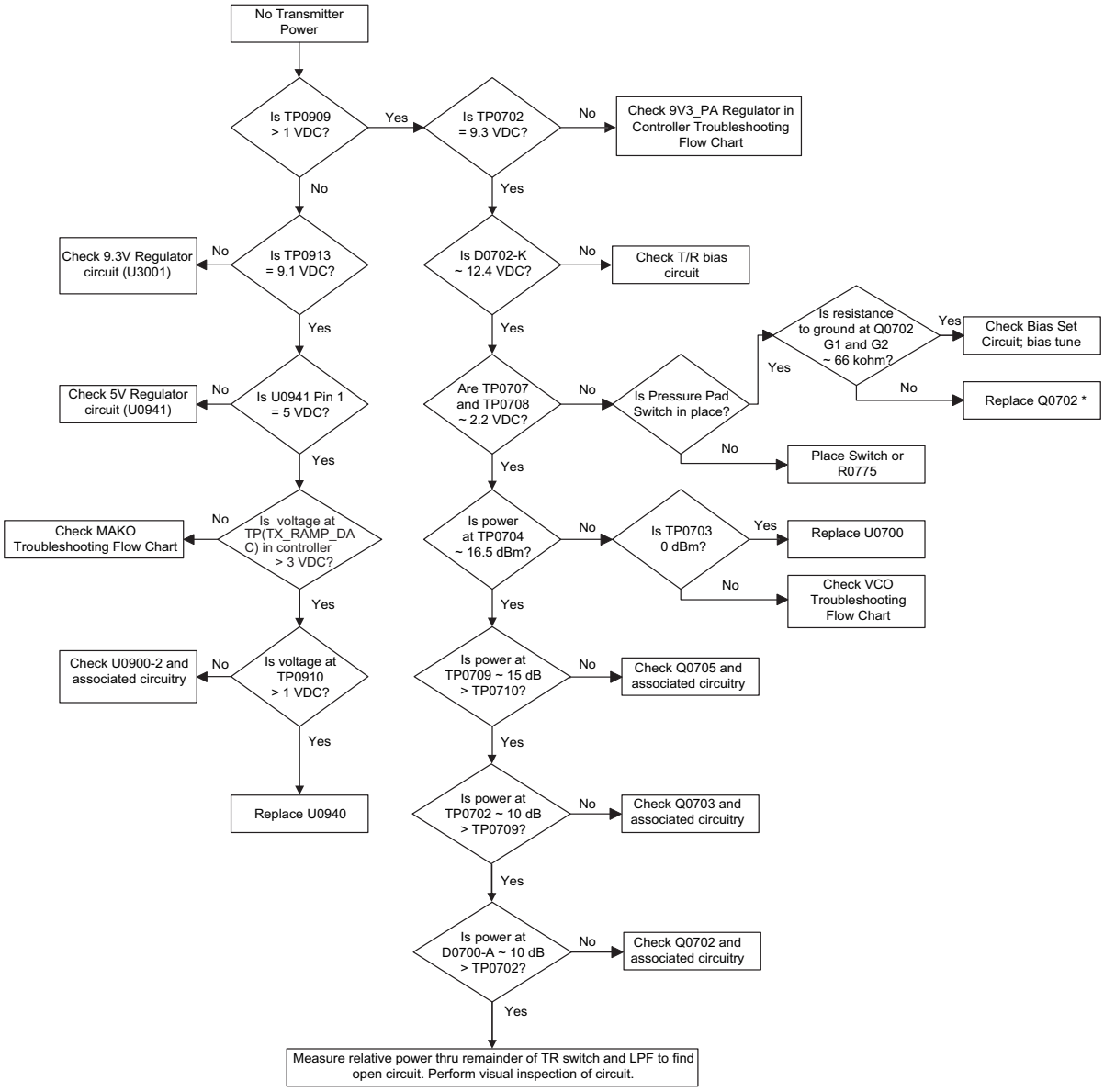
1.1 Troubleshooting Flow Chart for Receiver (Sheet 2 of 3)



1.2 Troubleshooting Flow Chart for Receiver (Sheet 3 of 3)



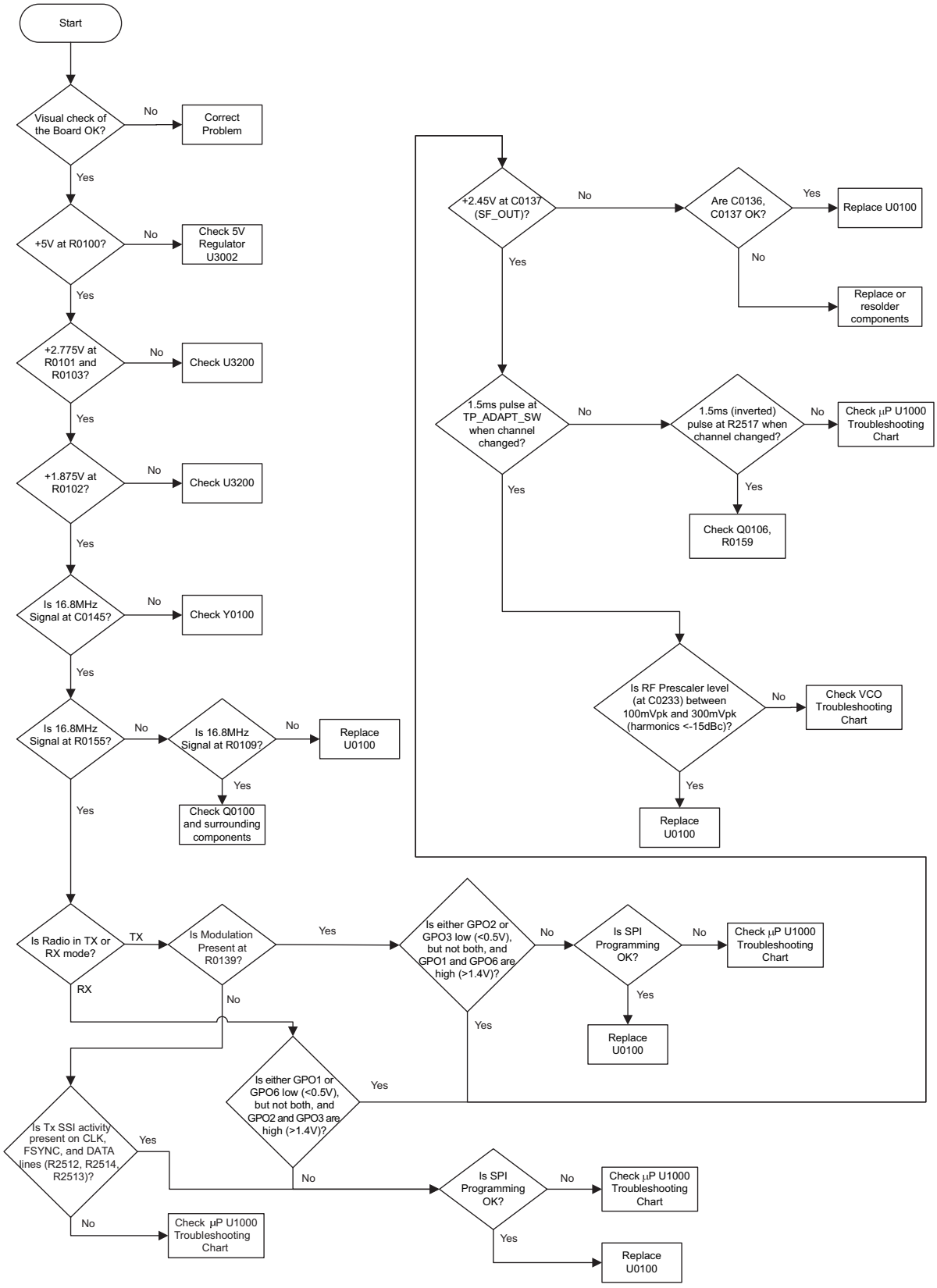
2.0 Troubleshooting Flow Chart for 40W Transmitter



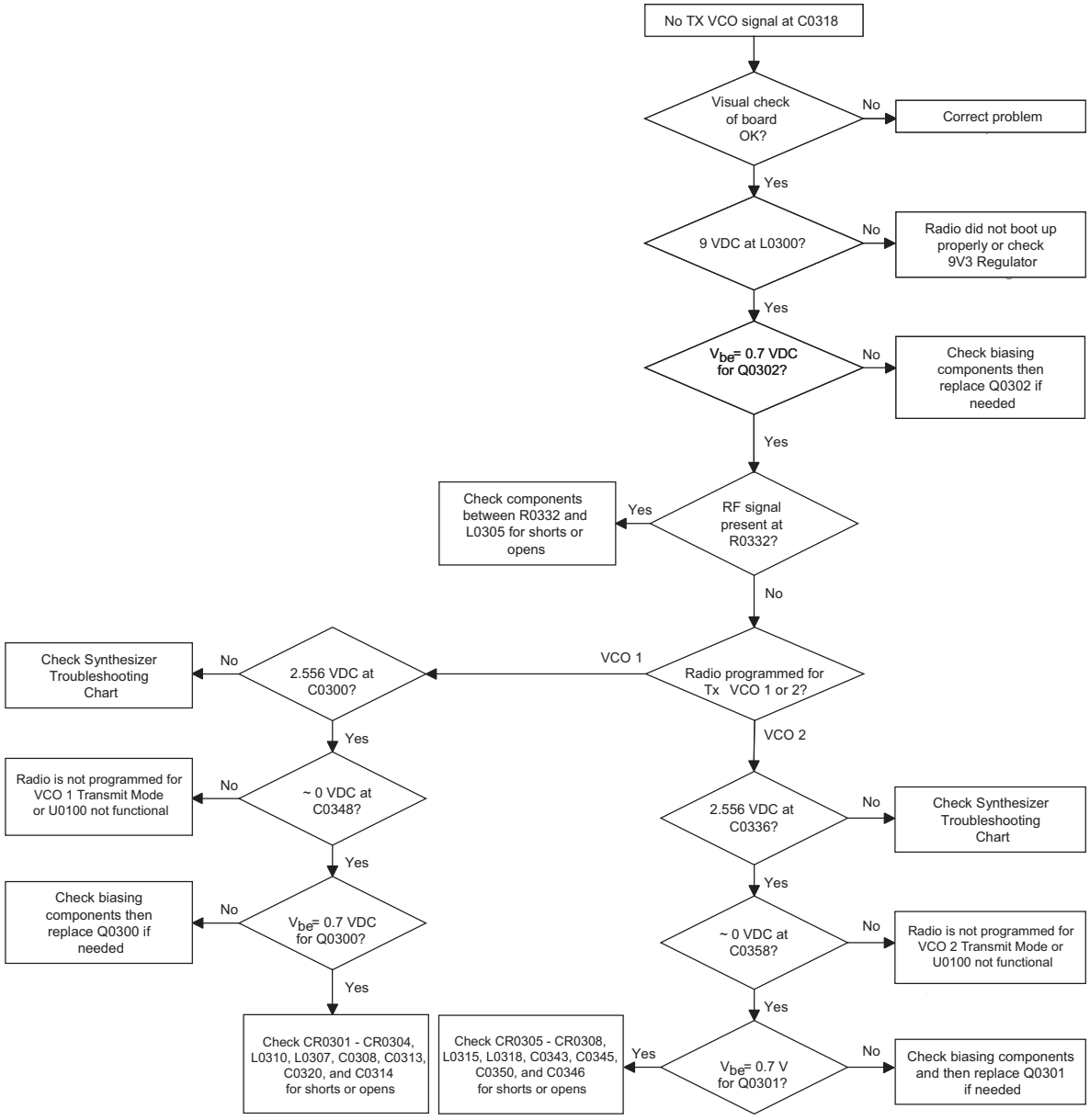
* Note: If Q0702 is replaced radio must be bias set and power set.

1) Levels are during Transmit Mode (analog), 13.6V at battery connector, 50 ohm termination on transmitter.
2) Make sure PCB is screwed into chassis during these tests to avoid final device damage.
3) When making measurements within the transmitter using an RF power probe, be careful that the rating of the probe is not exceeded. The “relative” measurements listed in the flow chart should be made with a scope probe connected to a spectrum analyzer or similar instrument to avoid damaging sensitive power probes.

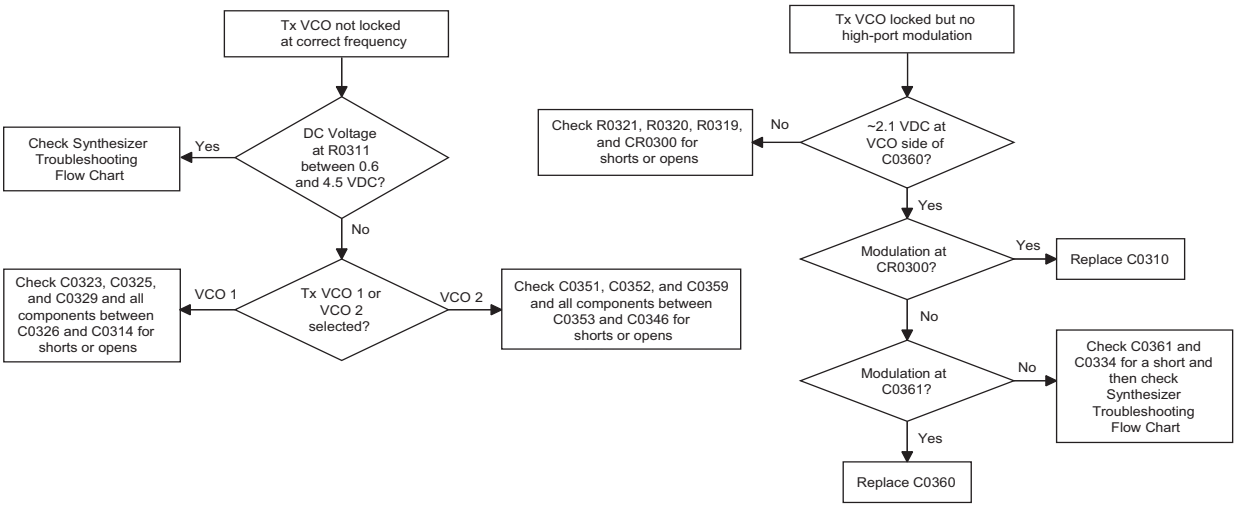
3.0 Troubleshooting Flow Chart for Synthesizer



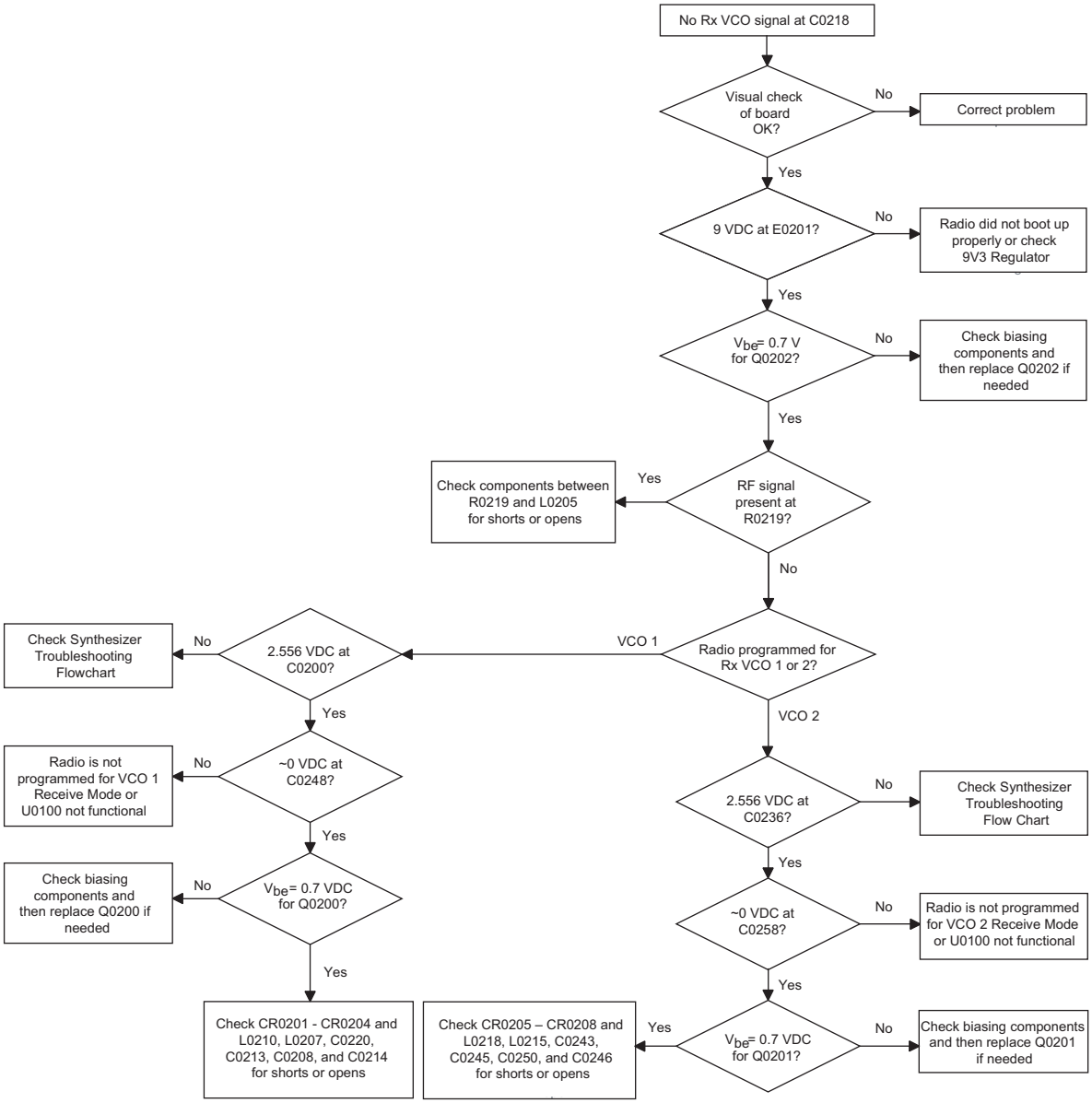
4.0 Troubleshooting Flow Chart for Tx VCO (Sheet 1 of 2)



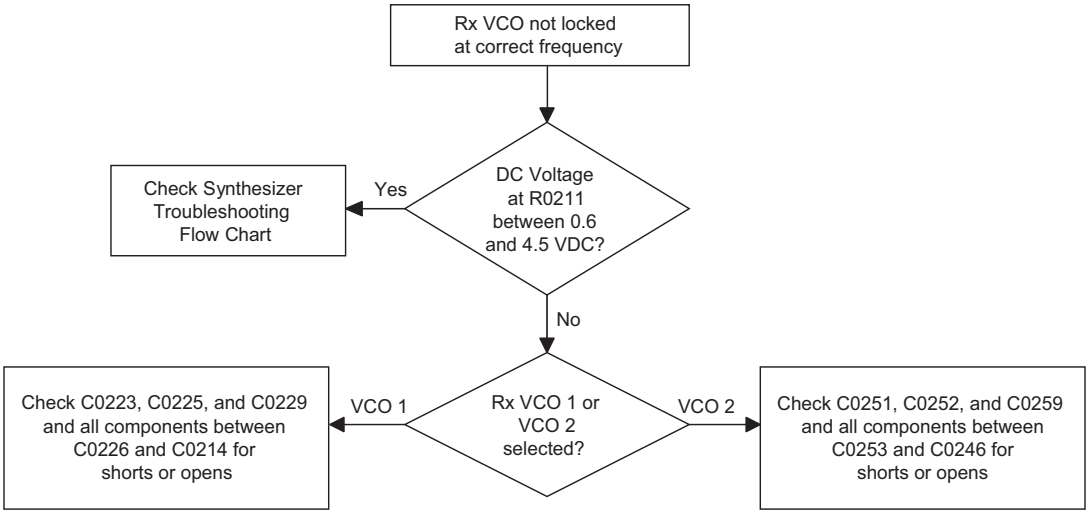
4.1 Troubleshooting Flow Chart for Tx VCO (Sheet 2 of 2)



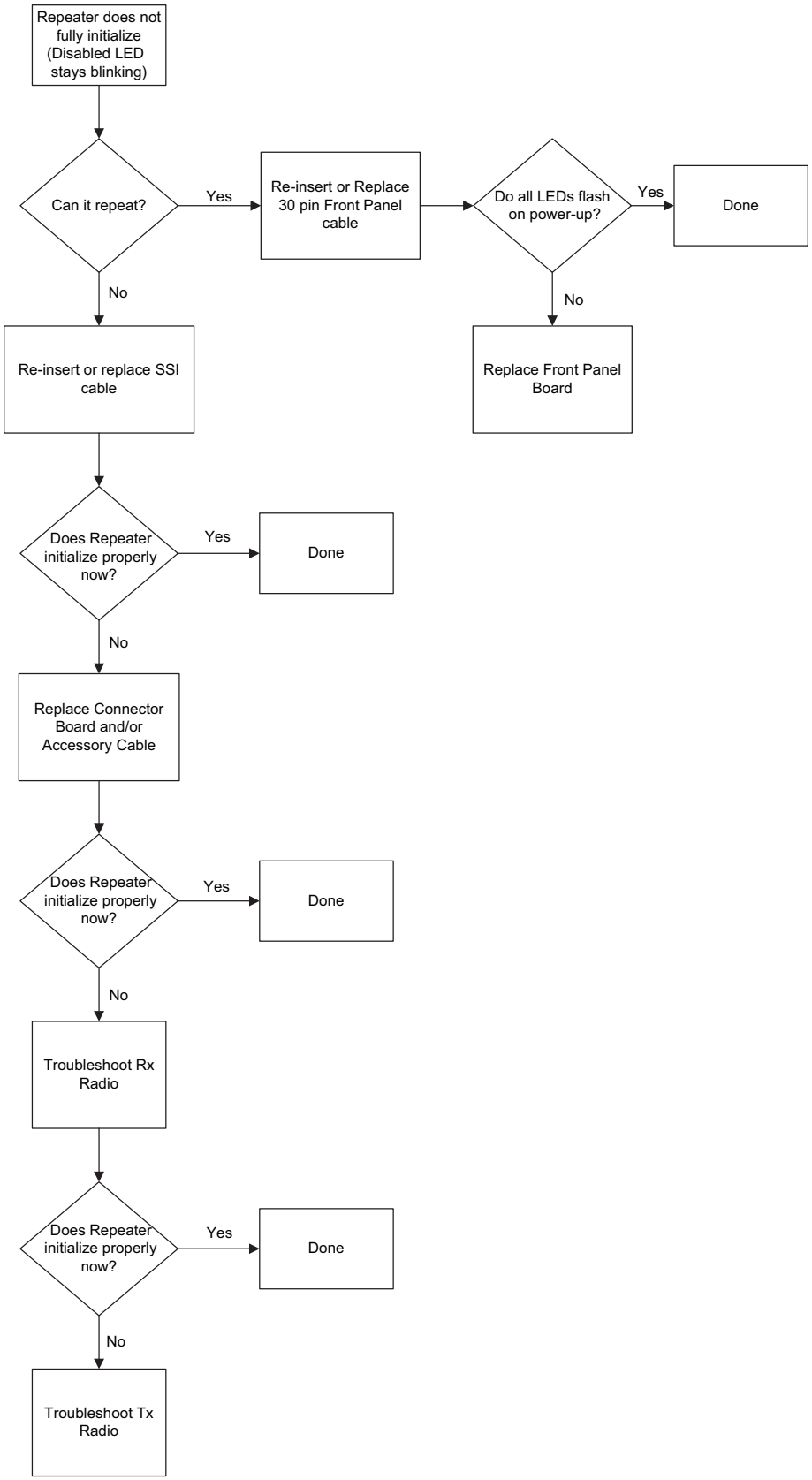
5.0 Troubleshooting Flow Chart for Rx VCO (Sheet 1 of 2)



5.1 Troubleshooting Flow Chart for Rx VCO (Sheet 2 of 2)



6.0 Troubleshooting Flow Chart for Repeater



Section 3

UHF1 PCB / SCHEMATICS / PARTS LISTS

1.0 Allocation of Schematics and Circuit Boards

1.1 Controller Circuits

The UHF1 circuits are contained on the Printed Circuit Board (PCB) which also contains the Controller circuits. This Chapter shows the schematics for the UHF1 circuits only, refer to the Controller section for details of the related Controller circuits. The PCB component layouts in this Chapter show both the Controller and UHF1 circuit components. The UHF1 schematics and the related PCB and parts list are shown in the tables below.

NOTE: The UHF Schematics and parts lists are the same for 8486777Z12 and 8486777Z14. Only the Controller circuits are different between the two PCBs.

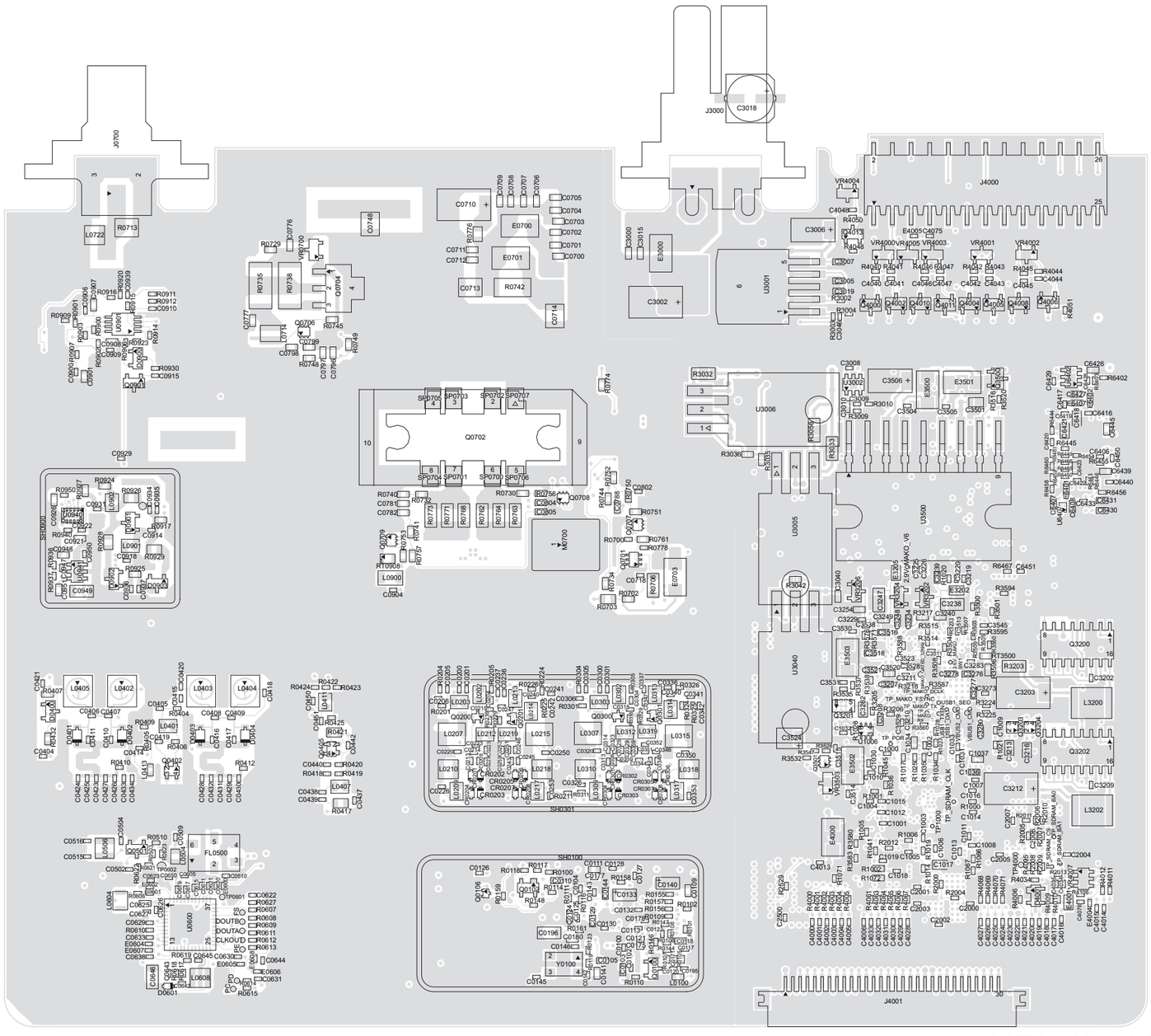
Table 3-1 UHF1 25–40W Diagrams and Parts List

PCB :	
8486777Z12 Main Board Top Side	Page 3-3
8486777Z12 Main Board Bottom Side	Page 3-4
8486777Z14 Main Board Top Side	Page 3-5
8486777Z14 Main Board Bottom Side	Page 3-6
SCHEMATICS	
Overall	**Page 3-7**
Receiver Front-End	**Page 3-8**
Receiver IF Amp	**Page 3-9**
Receiver Back-End	**Page 3-10**
Power Amplifier	**Page 3-11**
Power Control	**Page 3-12**
Synthesizer	**Page 3-13**
Receiver VCO	**Page 3-14**
Transmit VCO	**Page 3-15**
Parts List	
8486777Z12 and 8486777Z14	**Page 3-16**

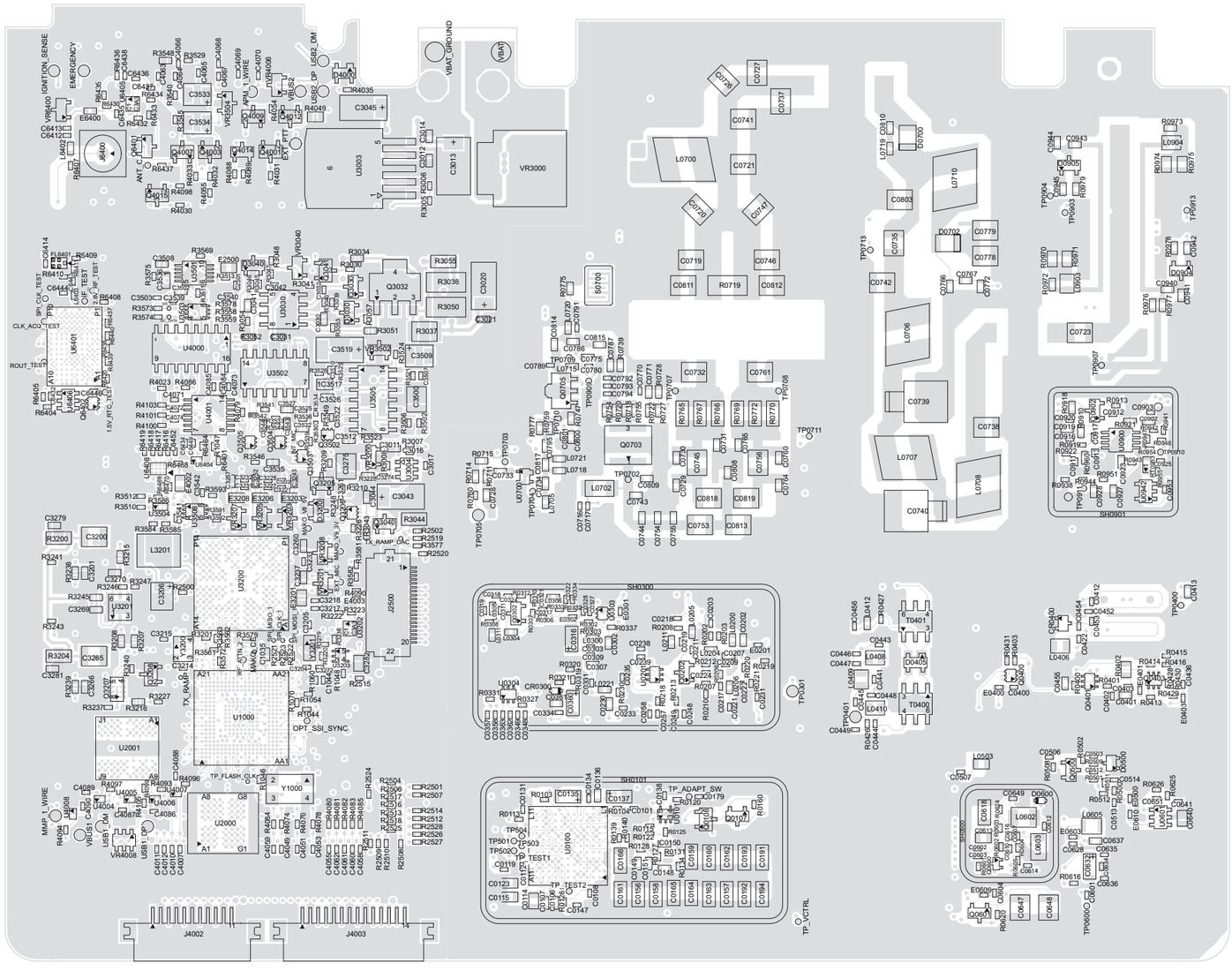
Table 3-2: UHF1 25-40W Diagrams and Parts List

PCB:	
8486777Z15 Main Board Top Side	Page 3-21
8486777Z15 Main Board Bottom Side	Page 3-22
SCHEMATICS	
Overall	**Page 3-23**
Receiver Front-End	**Page 3-24**
Receiver IF Amp	**Page 3-25**
Receiver Back-End	**Page 3-26**
Power Amplifier	**Page 3-27**
Power Control	**Page 3-28**
Synthesizer	**Page 3-29**
Receiver VCO	**Page 3-30**
Transmit VCO	**Page 3-31**
Parts List	
8486777Z15	**Page 3-32**

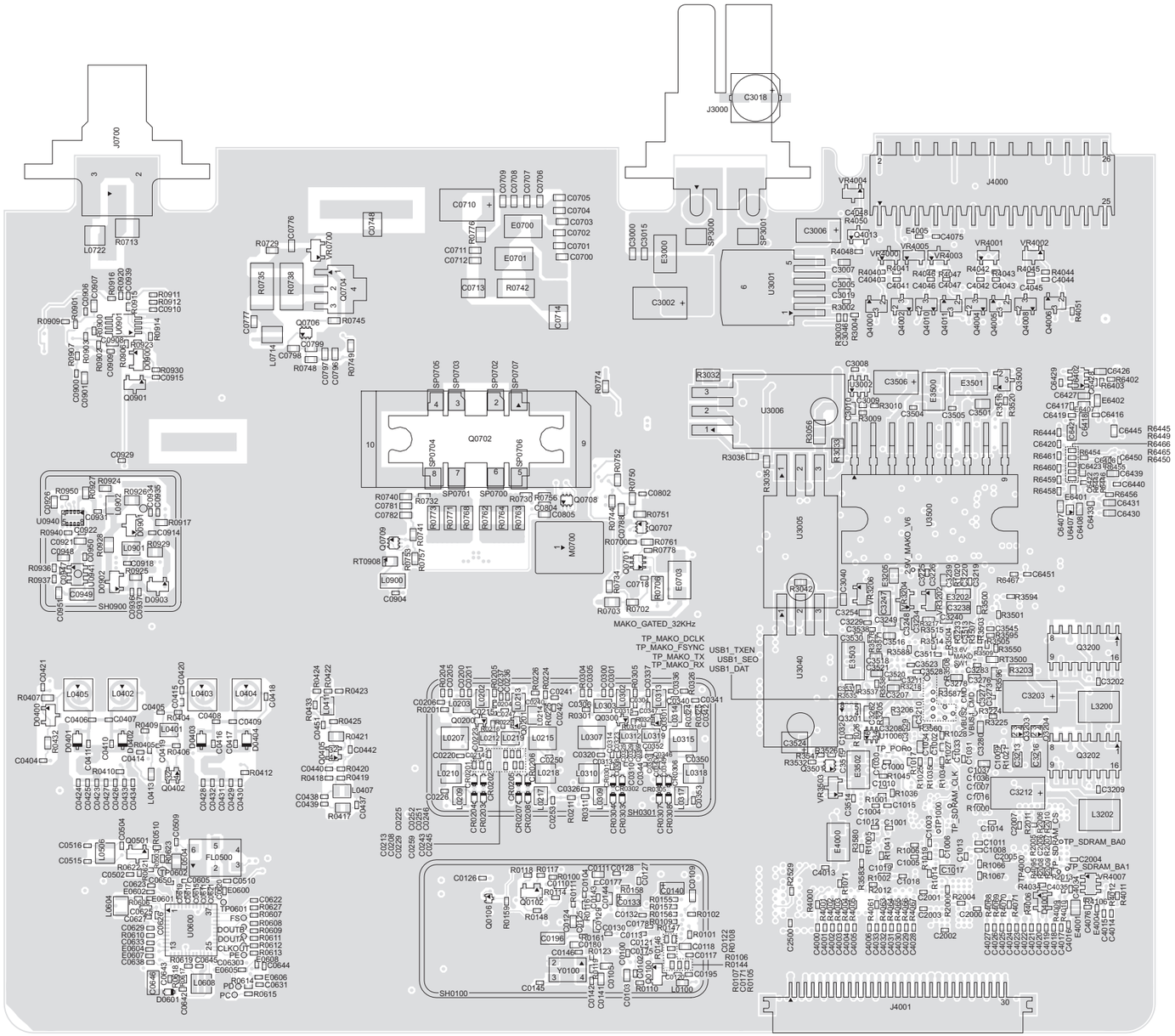
2.0 UHF1 (403–470 MHz) 25–40W PCB / Schematics / Parts List

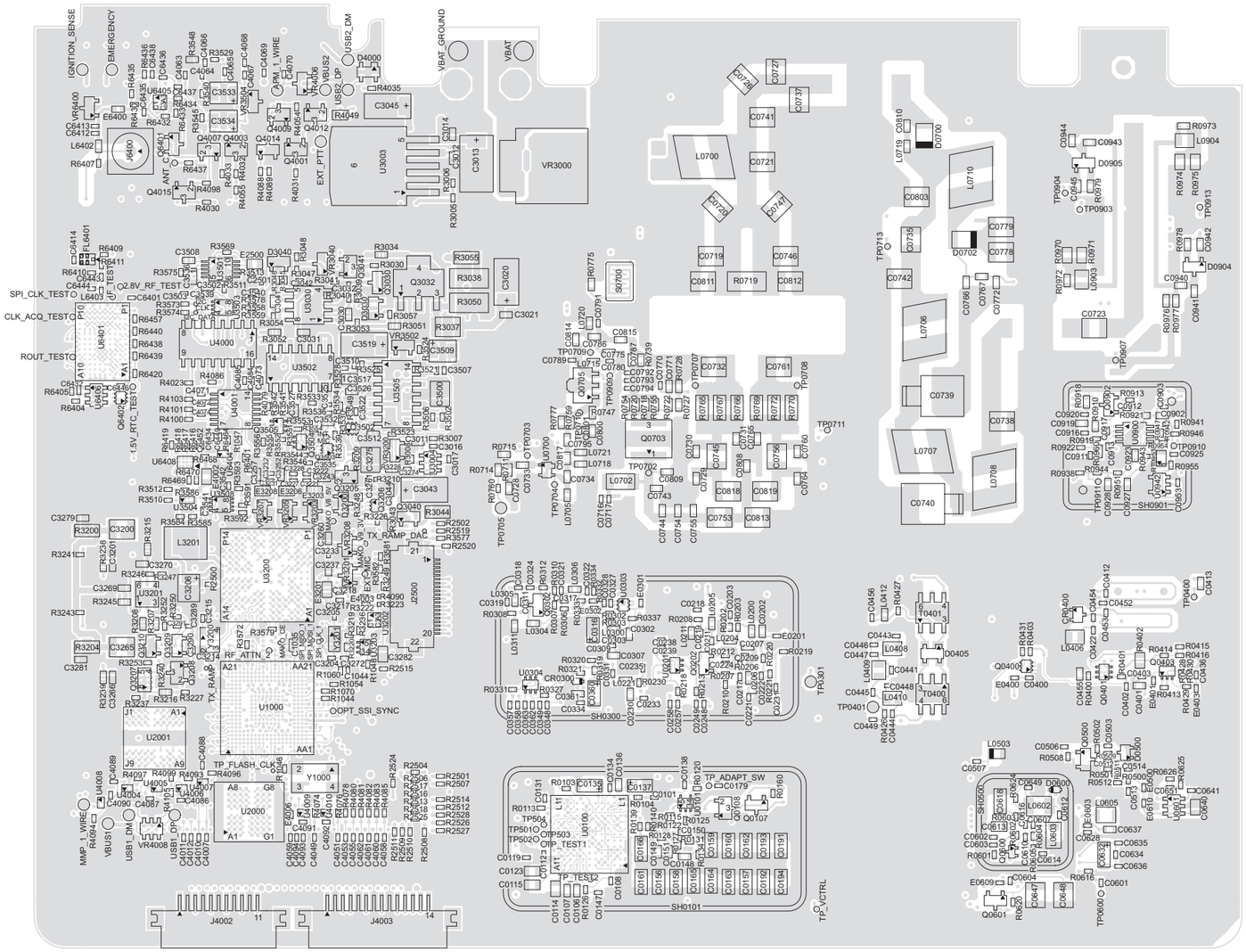


UHF1 (403–470 MHz) 25–40W 8486777Z12 Top Side

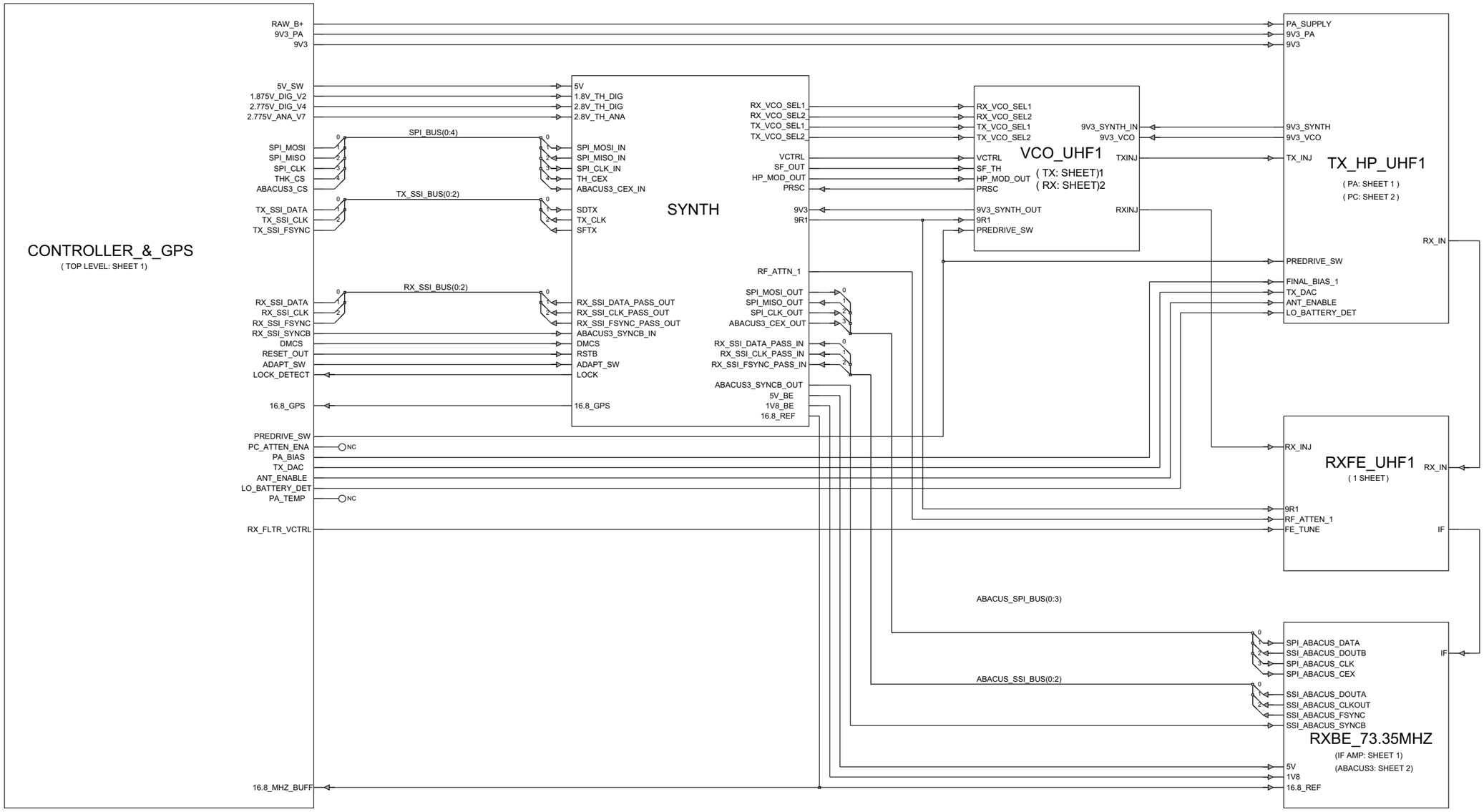


UHF1 (403–470 MHz) 25–40W 8486777Z12 Bottom Side

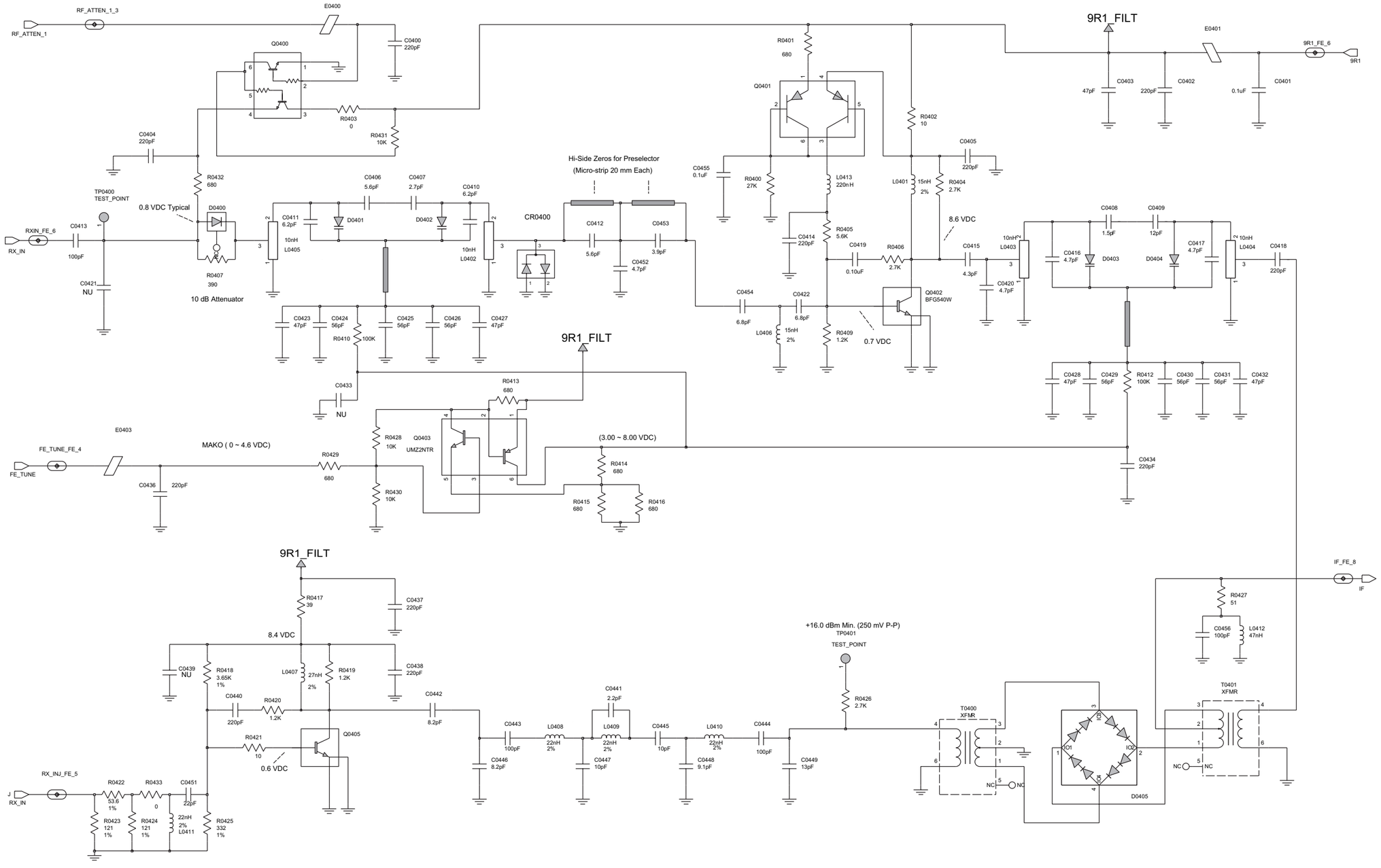

J0700
L0722
R0713
J3000
C3018
J4000
VR4004
VR4005
VR4003
VR4001
VR4002
C3006
C4013
E4005
C4075
C3000
C3015
E3000
SP3000
SP3001
C3002
U3001
C3007
C3005
C3019
R3002
R3004
R4048
R4050
R4051
C0710
E0700
E0701
R0742
C0711
C0712
C0713
C0714
R0776
C0709
C0708
C0707
C0706
C0705
C0704
C0703
C0702
C0701
C0700
R0723
C0776
VR0700
C0748
R0735
R0738
Q0704
Q0706
R0745
C0777
C0798
C0799
C0797
C0796
L0714
R0748
R0749
Q0702
SP0705
SP0703
SP0702
SP0707
SP0704
SP0706
SP0701
SP0700
R0774
R0740
C0781
C0782
R0732
R0773
R0771
R0768
R0762
R0764
R0763
R0730
R0756
C0804
C0805
Q0708
R0752
C0802
R0751
Q0707
R0761
R0778
R0700
C0784
R0734
Q0701
C0711
R0708
E0703
R0703
R0702
MAKO_GATED_32KHz
M0700
Q0709
RT0908
R0733
R0757
R0741
L0900
C0904
R3032
U3006
C3008
C3506
E3500
E3501
C3504
C3505
C3501
C3009
R3010
R3009
R3036
R3035
R3033
R3056
U3005
U3500
C6429
C6426
C6402
C6403
C6427
C6417
C6419
C6416
C6445
R6445
R6449
R6466
R6465
R6450
C6450
C6439
C6440
C6456
C6431
C6430
R6444
C6420
R6461
R6460
R6459
R6458
E6401
C6407
C6408
C6433
R6467
C6451
R3594
R3501
R3500
R3503
R3505
R3550
RT3500
R3203
C3203
L3200
Q3200
C3202
Q3202
C3212
L3202
C3209
R3042
C3040
C3254
C3225
C3536
C3530
C3516
C3518
C3521
C3520
C3523
C3526
C3527
C3514
C3515
C3511
R3514
R3515
R3588
R3587
R3560
R3206
R3224
R3225
C3574
R3532
Q3501
R3502
E3502
VR3500
C3502
C3503
C3504
C3505
C3506
C3507
C3508
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C3511
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C3541



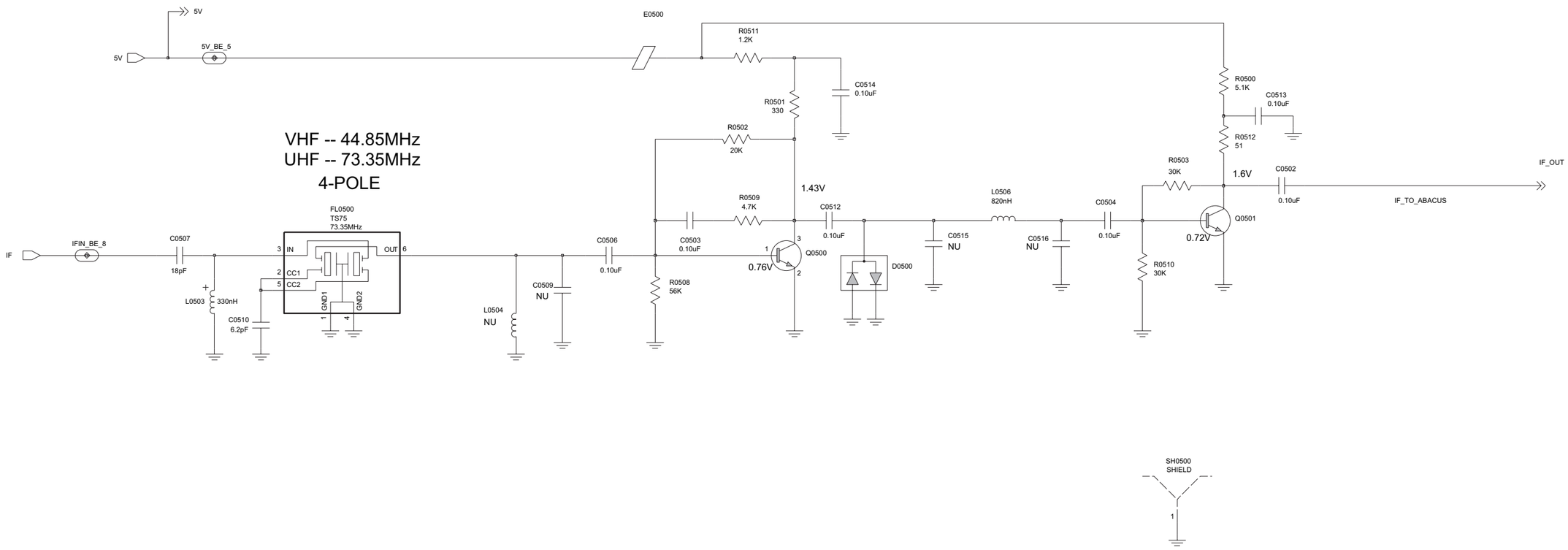
UHF1 (403–470 MHz) 25–40W 8486777Z14 Bottom side



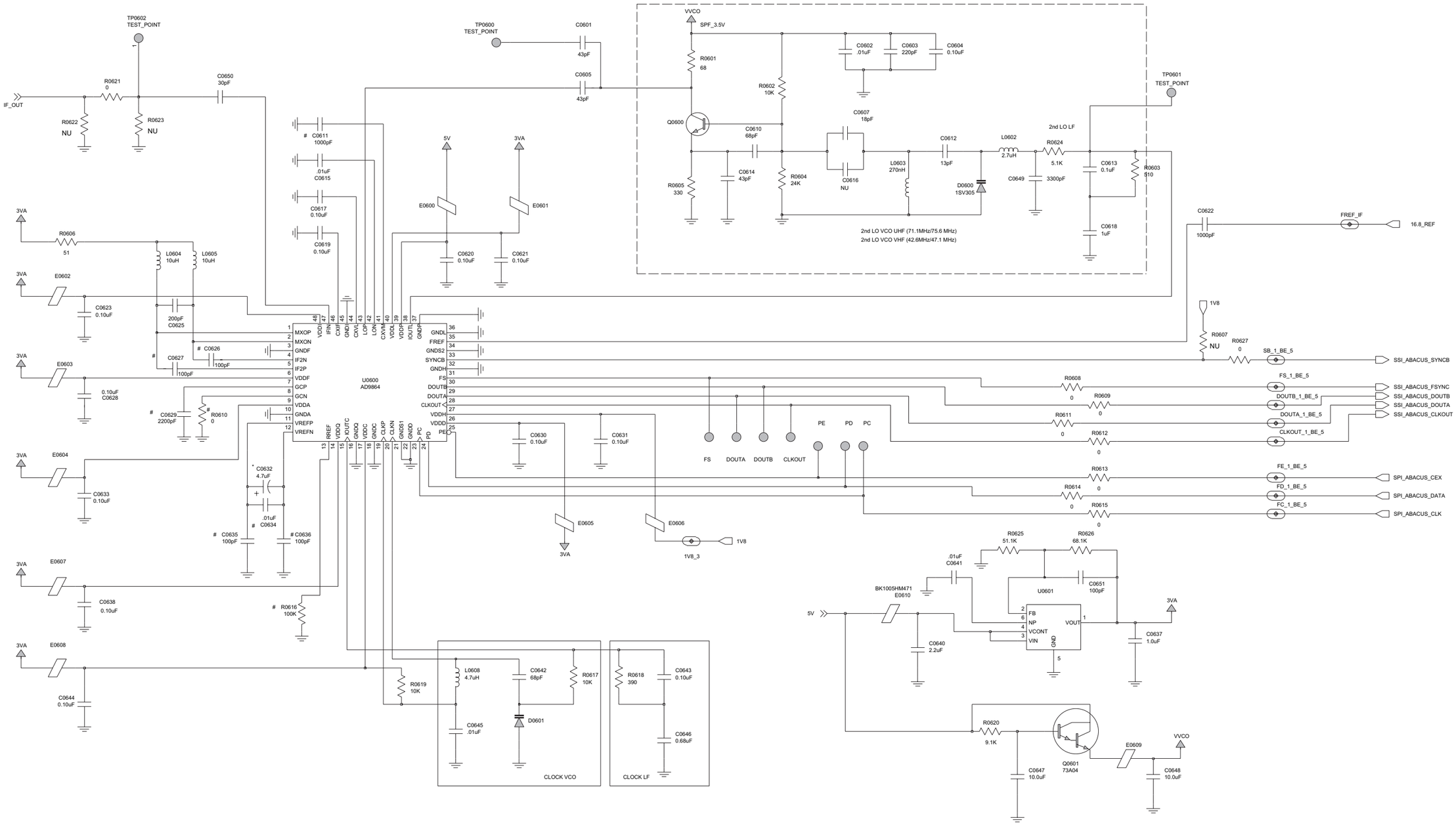
UHF1 (403–470 MHz) 25–40W Overall Schematic Diagram



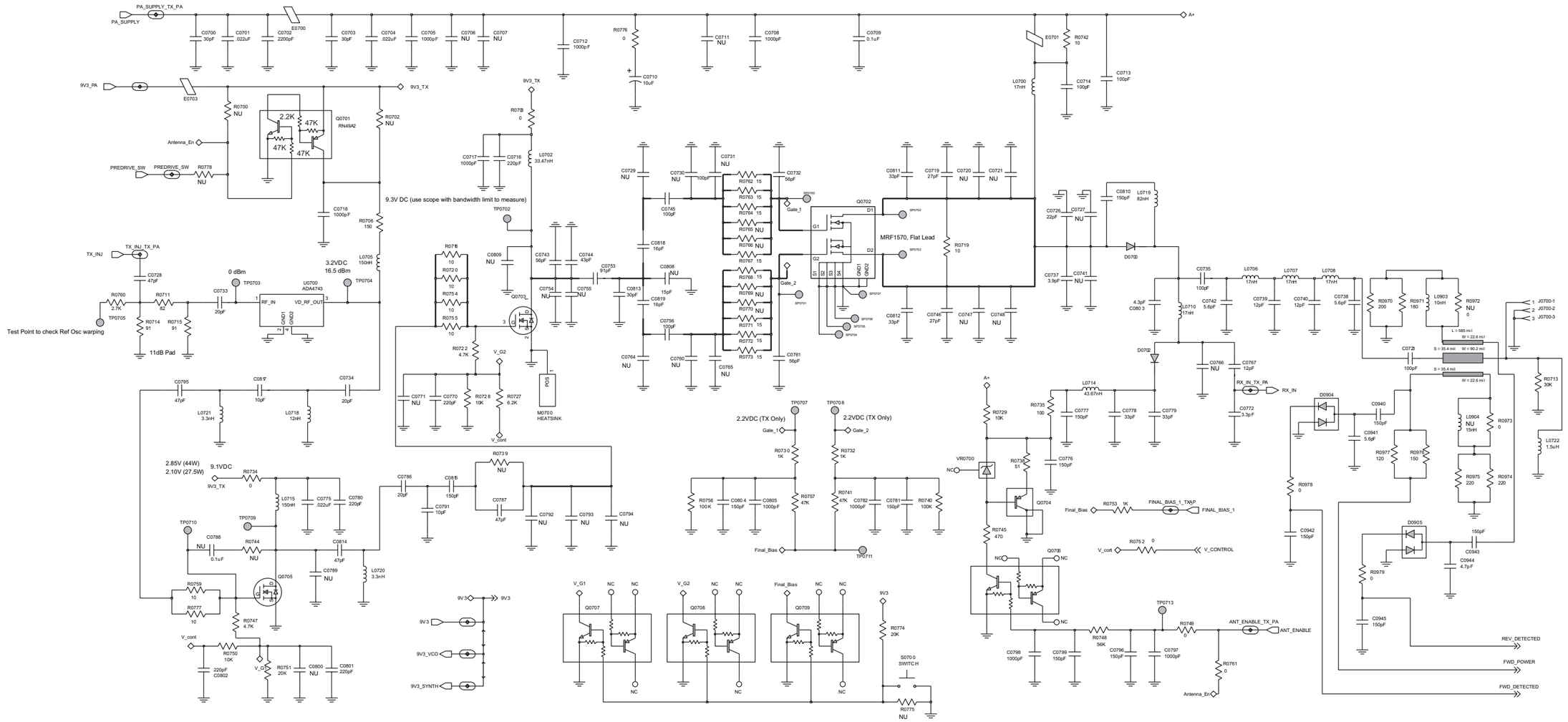
UHF1 (403–470 MHz) 25–40W Receiver Front-End Schematic Diagram



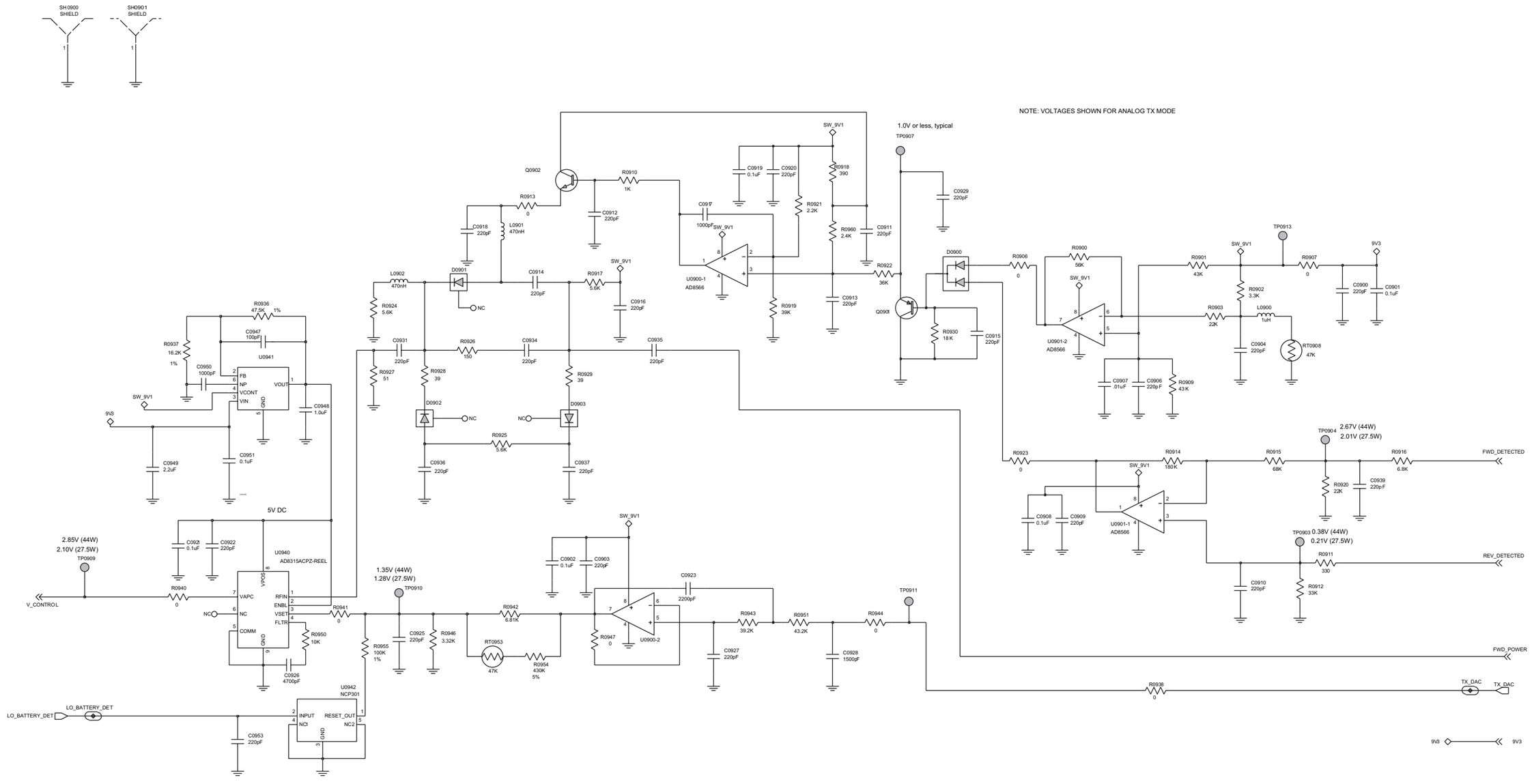
UHF1 (403–470 MHz) 25–40W Receiver IF Amp Schematic Diagram



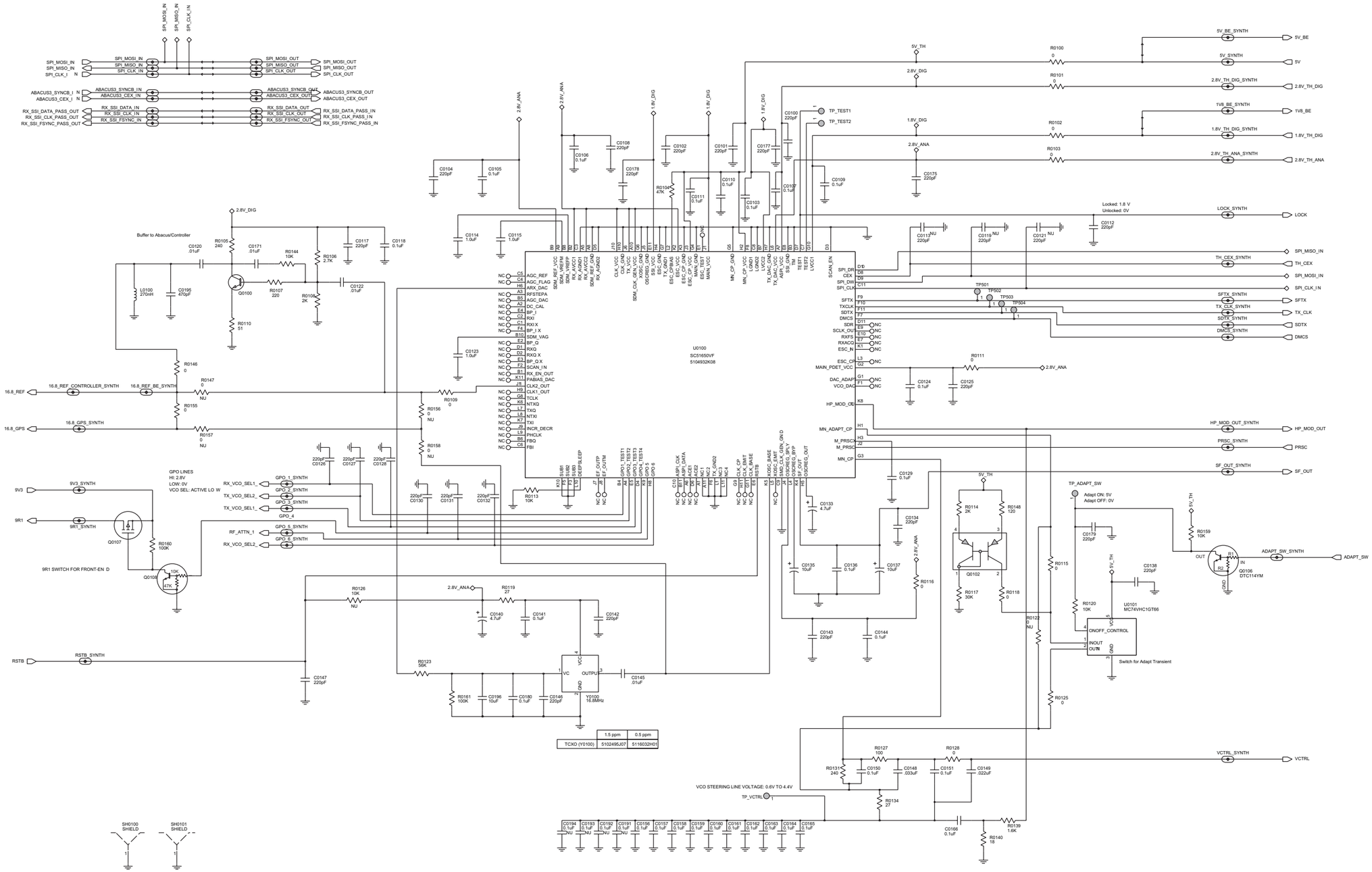
UHF1 (403–470 MHz) 25–40W Receiver Back-End Schematic Diagram



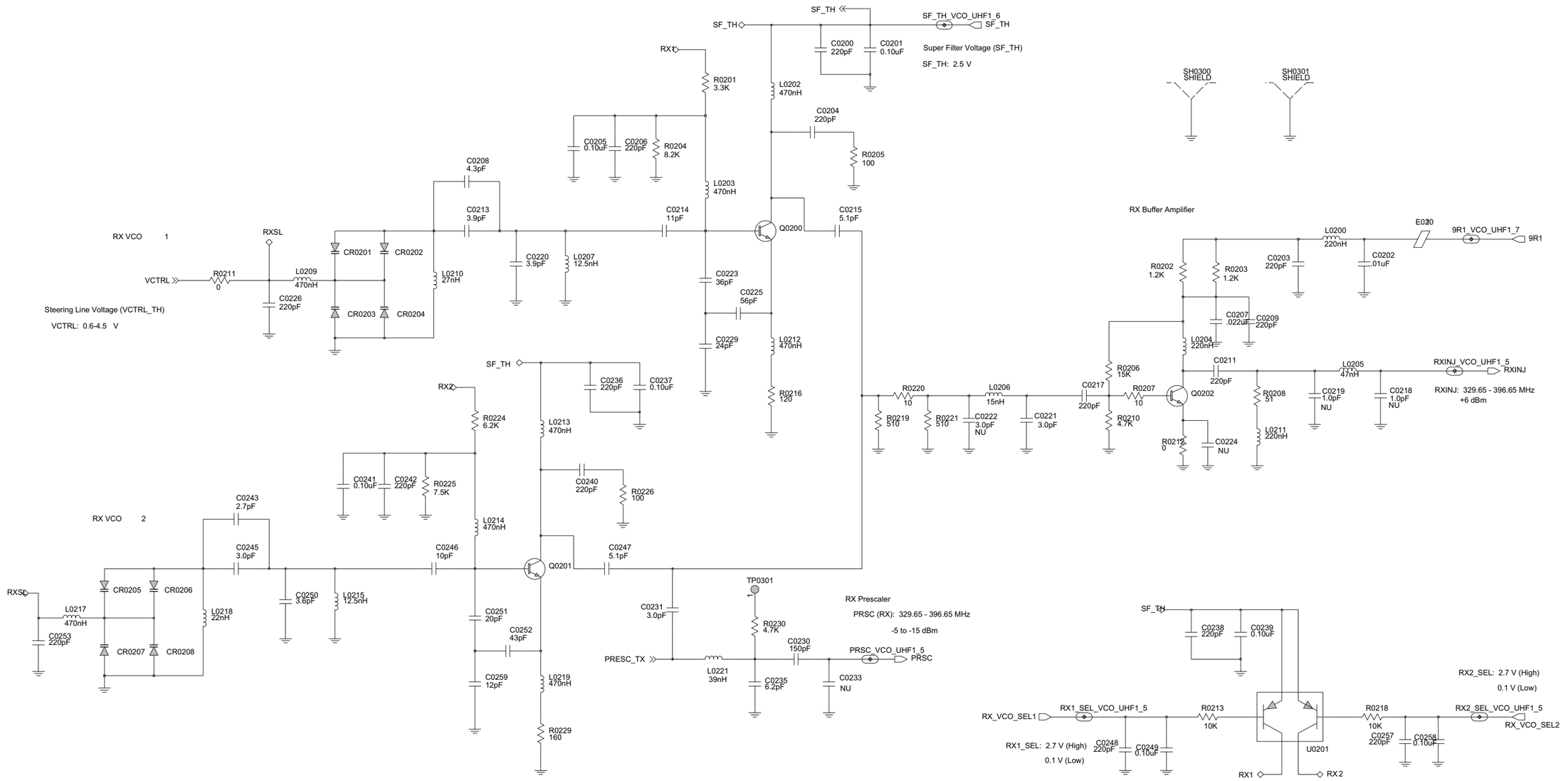
UHF1 (403–470 MHz) 25–40W Power Amplifier Schematic Diagram



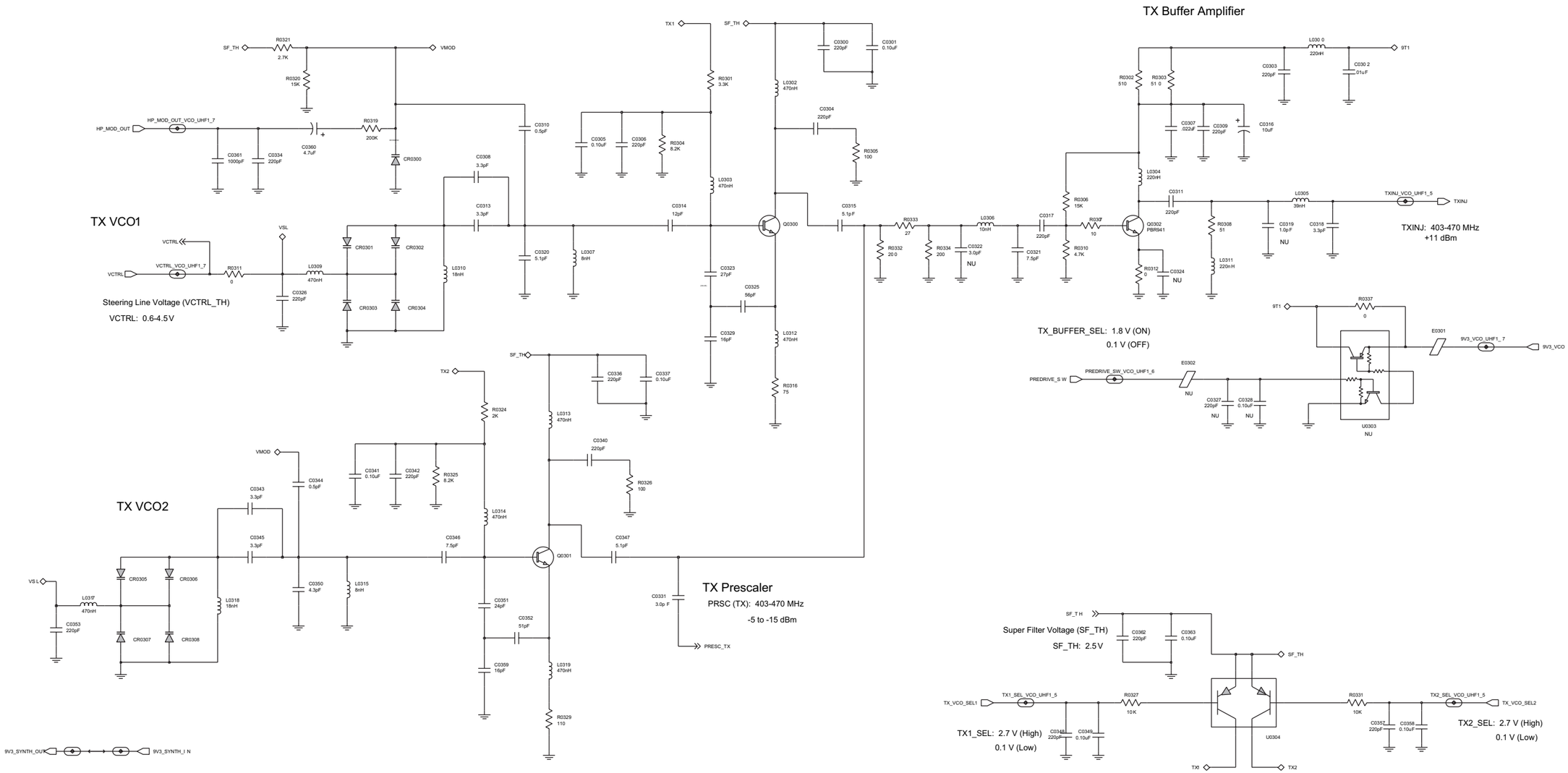
UHF1 (403–470 MHz) 25–40W Power Control Schematic Diagram



UHF1 (403–470 MHz) 25–40W Synthesizer Schematic Diagram



UHF1 (403–470 MHz) 25–40W Receiver VCO Schematic Diagram



UHF1 (403–470 MHz) 25–40W Transmit VCO Schematic Diagram

UHF1 PCB 8486777Z12 and 8486777Z14 Parts List 25–40W

Circuit Ref	Motorola Part No.	Description
C0100	2113944A44	220pF
C0101	2113944A44	220pF
C0102	2113944A44	220pF
C0103	2113945C31	0.1uF
C0104	2113944A44	220pF
C0105	2113945C31	0.1uF
C0106	2113945C31	0.1uF
C0107	2113945C31	0.1uF
C0108	2113944A44	220pF
C0109	2113945C31	0.1uF
C0110	2113945C31	0.1uF
C0111	2113945C31	0.1uF
C0112	2113944A44	220pF
C0113	NOT PLACED	–
C0114	2113946E02	1.0uF
C0115	2113946E02	1.0uF
C0117	2113944A44	220pF
C0118	2113945C31	0.1uF
C0119	NOT PLACED	–
C0120	2113945B02	.01uF
C0121	NOT PLACED	–
C0122	2113945B02	.01uF
C0123	2113946E02	1.0uF
C0124	2113945C31	0.1uF
C0125	2113944A44	220pF
C0126	2113944A44	220pF
C0127	2113944A44	220pF
C0128	2113944A44	220pF
C0129	2113945C31	0.1uF
C0130	2113944A44	220pF
C0131	2113944A44	220pF
C0132	2113944A44	220pF
C0133	2313960B30	4.7uF
C0134	2113944A44	220pF
C0135	2313960B32	10uF
C0136	2113945C31	0.1uF
C0137	2313960B32	10uF
C0138	2113944A44	220pF
C0140	2313960B30	4.7uF
C0141	2113945C31	0.1uF
C0142	2113944A44	220pF
C0143	2113944A44	220pF
C0144	2113945C31	0.1uF
C0145	2113945B02	.01uF
C0146	2113944A44	220pF
C0147	2113944A44	220pF
C0148	2113945D01	.033uF
C0149	2113945C04	.022uF
C0150	2113945C31	0.1uF
C0151	2113945C31	0.1uF
C0156	2185419D06	0.1uF
C0157	2185419D06	0.1uF
C0158	2185419D06	0.1uF
C0159	2185419D06	0.1uF
C0160	2185419D06	0.1uF
C0161	2185419D06	0.1uF
C0162	2185419D06	0.1uF
C0163	2185419D06	0.1uF
C0164	2185419D06	0.1uF
C0165	2185419D06	0.1uF
C0166	2185419D06	0.1uF
C0171	2113945B02	.01uF
C0175	2113944A44	220pF
C0177	2113944A44	220pF
C0178	2113944A44	220pF
C0179	2113944A44	220pF
C0180	2113945C31	0.1uF
C0191	NOT PLACED	–
C0192	NOT PLACED	–
C0193	NOT PLACED	–
C0194	NOT PLACED	–
C0195	2113945A05	470pF
C0196	2113946H02	10uF
C0200	2113944A44	220pF
C0201	2113945Y02	0.10uF
C0202	2113945C02	.01uF
C0203	2113944A44	220pF
C0204	2113944A44	220pF
C0205	2113945Y02	0.10uF
C0206	2113944A44	220pF
C0207	2113945C04	.022uF
C0208	2115153H18	4.3pF
C0209	2113944A44	220pF
C0211	2113944A44	220pF
C0213	2115153H17	3.9pF
C0214	2115153H34	11pF
C0215	2115153H20	5.1pF
C0217	2113944A44	220pF
C0218	NOT PLACED	–
C0219	NOT PLACED	–
C0220	2115153H17	3.9pF
C0221	2115153H14	3.0pF
C0222	NOT PLACED	–
C0223	2115153H46	36pF
C0224	NOT PLACED	–
C0225	2115153H51	56pF
C0226	2113944A44	220pF
C0229	2115153H42	24pF
C0230	2113944C47	150pF
C0231	2115153H14	3.0pF
C0233	NOT PLACED	–
C0235	2115153H22	6.2pF
C0236	2113944A44	220pF
C0237	2113945Y02	0.10uF
C0238	2113944A44	220pF
C0239	2113945Y02	0.10uF
C0240	2113944A44	220pF
C0241	2113945Y02	0.10uF
C0242	2113944A44	220pF
C0243	2115153H13	2.7pF
C0245	2115153H14	3.0pF
C0246	2115153H27	10pF
C0247	2115153H20	5.1pF
C0248	2113944A44	220pF
C0249	2113945Y02	0.10uF
C0250	2115153H16	3.6pF
C0251	2115153H40	20pF
C0252	2115153H48	43pF
C0253	2113944A44	220pF
C0257	2113944A44	220pF
C0258	2113945Y02	0.10uF
C0259	2115153H35	12pF
C0300	2113944A44	220pF
C0301	2113945Y02	0.10uF
C0302	2113945C02	.01uF
C0303	2113944A44	220pF
C0304	2113944A44	220pF
C0305	2113945Y02	0.10uF
C0306	2113944A44	220pF
C0307	2113945C04	.022uF
C0308	2115153H15	3.3pF
C0309	2113944A44	220pF
C0310	2115153H01	0.5pF
C0311	2113944A44	220pF
C0313	2115153H15	3.3pF
C0314	2115153H35	12pF
C0315	2115153H20	5.1pF
C0316	2313960B32	10uF
C0317	2113944A44	220pF
C0318	2115153H15	3.3pF
C0319	NOT PLACED	–
C0320	2115153H20	5.1pF
C0321	2115153H24	7.5pF
C0322	NOT PLACED	–
C0323	2115153H43	27pF
C0324	NOT PLACED	–
C0325	2115153H51	56pF
C0326	2113944A44	220pF
C0327	NOT PLACED	–
C0328	NOT PLACED	–
C0329	2115153H38	16pF
C0331	2115153H14	3.0pF
C0334	2113944A44	220pF
C0336	2113944A44	220pF
C0337	2113945Y02	0.10uF
C0340	2113944A44	220pF
C0341	2113945Y02	0.10uF
C0342	2113944A44	220pF
C0343	2115153H15	3.3pF
C0344	2115153H01	0.5pF
C0345	2115153H15	3.3pF
C0346	2115153H24	7.5pF
C0347	2115153H20	5.1pF
C0348	2113944A44	220pF
C0349	2113945Y02	0.10uF
C0350	2115153H18	4.3pF
C0351	2115153H42	24pF
C0352	2115153H50	51pF
C0353	2113944A44	220pF
C0357	2113944A44	220pF
C0358	2113945Y02	0.10uF
C0359	2115153H38	16pF
C0360	2313960B30	4.7uF
C0361	2113944C51	1000pF
C0362	2113944A44	220pF
C0363	2113945Y02	0.10uF
C0400	2113944A44	220pF
C0401	2113945C31	0.1uF
C0402	2113944A44	220pF
C0403	2115153H49	47pF
C0404	2113944A44	220pF
C0405	2113944A44	220pF
C0406	2115153H21	5.6pF
C0407	2115153H13	2.7pF
C0408	2115153H08	1.5pF
C0409	2115153H35	12pF
C0410	2115153H22	6.2pF
C0411	2115153H22	6.2pF
C0412	2115153H21	5.6pF
C0413	2113944C45	100pF
C0414	2113944A44	220pF
C0415	2115153H18	4.3pF
C0416	2115153H19	4.7pF
C0417	2115153H19	4.7pF
C0418	2113944A44	220pF
C0419	2113945Y02	0.10uF
C0420	2115153H19	4.7pF
C0421	NOT PLACED	–
C0422	2115153H23	6.8pF
C0423	2115153H49	47pF
C0424	2115153H51	56pF
C0425	2115153H51	56pF

Circuit Ref	Motorola Part No.	Description
C0426	2115153H51	56pF
C0427	2115153H49	47pF
C0428	2115153H49	47pF
C0429	2115153H51	56pF
C0430	2115153H51	56pF
C0431	2115153H51	56pF
C0432	2115153H49	47pF
C0433	NOT PLACED	–
C0434	2113944A44	220pF
C0436	2113944A44	220pF
C0437	2113944A44	220pF
C0438	2113944A44	220pF
C0439	NOT PLACED	–
C0440	2113944A44	220pF
C0441	2115153H11	2.2pF
C0442	2115153H25	8.2pF
C0443	2115153H57	100pF
C0444	2115153H57	100pF
C0445	2115153H27	10pF
C0446	2115153H25	8.2pF
C0447	2115153H27	10pF
C0448	2115153H26	9.1pF
C0449	2115153H36	13pF
C0451	2115153H41	22pF
C0452	2115153H19	4.7pF
C0453	2115153H17	3.9pF
C0454	2115153H23	6.8pF
C0455	2113945C31	0.1uF
C0456	2113944A40	100pF
C0502	2113945Y02	0.10uF
C0503	2113945Y02	0.10uF
C0504	2113945Y02	0.10uF
C0506	2113945Y02	0.10uF
C0507	2115153H39	18pF
C0509	NOT PLACED	–
C0510	2115153H22	6.2pF
C0512	2113945Y02	0.10uF
C0513	2113945Y02	0.10uF
C0514	2113945Y02	0.10uF
C0515	NOT PLACED	–
C0516	NOT PLACED	–
C0601	2115153H48	43pF
C0602	2113945B02	.01uF
C0603	2113944A44	220pF
C0604	2113945Y02	0.10uF
C0605	2115153H48	43pF
C0607	2115153H39	18pF
C0610	2115153H53	68pF
C0611	2113945A09	1000pF
C0612	2115153H36	13pF
C0613	2113945G91	0.1uF
C0614	2115153H48	43pF
C0615	2113945B02	.01uF
C0616	NOT PLACED	–
C0617	2113945Y02	0.10uF
C0618	2115358H25	1uF
C0619	2113945Y02	0.10uF
C0620	2113945Y02	0.10uF
C0621	2113945Y02	0.10uF
C0622	2113945A09	1000pF
C0623	2113945Y02	0.10uF
C0625	2113944C89	200pF
C0626	2113944A40	100pF
C0627	2113944A40	100pF
C0628	2113945Y02	0.10uF
C0629	2113945A11	2200pF
C0630	2113945Y02	0.10uF
C0631	2113945Y02	0.10uF
C0632	2313960B30	4.7uF
C0633	2113945Y02	0.10uF
C0634	2113945B02	.01uF
C0635	2113944A40	100pF
C0636	2113944A40	100pF
C0637	2113946S35	1.0uF
C0638	2113945Y02	0.10uF
C0640	2113946N03	2.2uF
C0641	2113945B02	.01uF
C0642	2115153H53	68pF
C0643	2113945Y02	0.10uF
C0644	2113945Y02	0.10uF
C0645	2113945B02	.01uF
C0646	2113946G04	0.68uF
C0647	2113946J03	10.0uF
C0648	2113946J03	10.0uF
C0649	2113945A12	3300pF
C0650	2115153H44	30pF
C0651	2115153H57	100pF
C0700	2113944C82	30pF
C0701	2113945C04	.022uF
C0702	2113944C55	2200pF
C0703	2113944C82	30pF
C0704	2113945C04	.022uF
C0705	2113944C51	1000pF
C0706	NOT PLACED	–
C0707	NOT PLACED	–
C0708	2113944C51	1000pF
C0709	2113945C31	0.1uF
C0710	2371403L02	10uF
C0711	NOT PLACED	–
C0712	2113944C51	1000pF
C0713	2111078B42	100pF
C0714	2111078B42	100pF
C0716	2113944A44	220pF
C0717	2113945A09	1000pF
C0718	2113945A09	1000pF
C0719	2111078B25	27pF
C0720	NOT PLACED	–
C0721	NOT PLACED	–
C0723	2111078B42	100pF
C0726	2111078B22	22pF
C0727	NOT PLACED	–
C0728	2113944C38	47pF
C0729	NOT PLACED	–
C0730	NOT PLACED	–
C0731	NOT PLACED	–
C0732	2111078B36	56pF
C0733	2113944C80	20pF
C0734	2113944C80	20pF
C0735	2111078B42	100pF
C0737	2111078B03	3.9pF
C0738	2111078B07	5.6pF
C0739	2171388L01	12pF
C0740	2171388L01	12pF
C0741	NOT PLACED	–
C0742	2111078B07	5.6pF
C0743	2113944C39	56pF
C0744	2113944C84	43pF
C0745	2111078B42	100pF
C0746	2111078B25	27pF
C0747	NOT PLACED	–
C0748	NOT PLACED	–
C0753	2111078B41	91pF
C0754	NOT PLACED	–
C0755	NOT PLACED	–
C0756	2111078B42	100pF
C0760	NOT PLACED	–
C0761	2111078B36	56pF
C0764	NOT PLACED	–
C0765	NOT PLACED	–
C0766	NOT PLACED	–
C0767	2113944C31	12pF
C0770	2113944A44	220pF
C0771	NOT PLACED	–
C0772	2113944C18	3.3pF
C0775	2113945C04	.022uF
C0776	2113944C47	150pF
C0777	2113944C47	150pF
C0778	2111078B29	33pF
C0779	2111078B29	33pF
C0780	2113944A44	220pF
C0781	2113944C47	150pF
C0782	2113944C51	1000pF
C0786	2113944C80	20pF
C0787	2113944C38	47pF
C0788	NOT PLACED	–
C0789	NOT PLACED	–
C0791	2113944A25	10pF
C0792	NOT PLACED	–
C0793	NOT PLACED	–
C0794	NOT PLACED	–
C0795	2113944C38	47pF
C0796	2113944C47	150pF
C0797	2113944C51	1000pF
C0798	2113944C51	1000pF
C0799	2113944C47	150pF
C0800	NOT PLACED	–
C0801	2113944A44	220pF
C0802	2113944A44	220pF
C0803	2111078B04	4.3pF
C0804	2113944C47	150pF
C0805	2113944C51	1000pF
C0808	NOT PLACED	–
C0809	NOT PLACED	–
C0810	2113944C47	150pF
C0811	2111078B29	33pF
C0812	2111078B29	33pF
C0813	2111078B27	30pF
C0814	2113944C38	47pF
C0815	2113944C47	150pF
C0817	2113944C30	10pF
C0818	2111078B19	16pF
C0819	2111078B19	16pF
C0900	2113944A44	220pF
C0901	2113945C31	0.1uF
C0902	2113945C31	0.1uF
C0903	2113944A44	220pF
C0904	2113944A44	220pF
C0906	2113944A44	220pF
C0907	2113945C02	.01uF
C0908	2113945C31	0.1uF
C0909	2113944A44	220pF
C0910	2113944A44	220pF
C0911	2113944A44	220pF
C0912	2113944A44	220pF
C0913	2113944A44	220pF
C0914	2113944A44	220pF
C0915	2113944A44	220pF
C0916	2113944A44	220pF
C0917	2113945A09	1000pF
C0918	2113944A44	220pF
C0919	2113945C31	0.1uF
C0920	2113944A44	220pF
C0921	2113945C31	0.1uF
C0922	2113944A44	220pF

Circuit Ref	Motorola Part No.	Description
C0923	2113944C55	2200pF
C0925	2113944A44	220pF
C0926	2113945L41	4700pF
C0927	2113944C02	220pF
C0928	2113944C53	1500pF
C0929	2113944A44	220pF
C0931	2113944A44	220pF
C0934	2113944A44	220pF
C0935	2113944A44	220pF
C0936	2113944A44	220pF
C0937	2113944A44	220pF
C0939	2113944A44	220pF
C0940	2113944C47	150pF
C0941	2113944M12	5.6pF
C0942	2113944C47	150pF
C0943	2113944C47	150pF
C0944	2113944M10	4.7pF
C0945	2113944C47	150pF
C0947	2113944A40	100pF
C0948	2113946S35	1.0uF
C0949	2113946G01	2.2uF
C0950	2113945A09	1000pF
C0951	2113945C31	0.1uF
C0953	2113944A44	220pF
CR0201	4815096H01	DIODE VARACTOR 1SV305
CR0202	4815096H01	DIODE VARACTOR 1SV305
CR0203	4815096H01	DIODE VARACTOR 1SV305
CR0204	4815096H01	DIODE VARACTOR 1SV305
CR0205	4815096H01	DIODE VARACTOR 1SV305
CR0206	4815096H01	DIODE VARACTOR 1SV305
CR0207	4815096H01	DIODE VARACTOR 1SV305
CR0208	4815096H01	DIODE VARACTOR 1SV305
CR0300	4815096H01	DIODE VARACTOR 1SV305
CR0301	4815096H01	DIODE VARACTOR 1SV305
CR0302	4815096H01	DIODE VARACTOR 1SV305
CR0303	4815096H01	DIODE VARACTOR 1SV305
CR0304	4815096H01	DIODE VARACTOR 1SV305
CR0305	4815096H01	DIODE VARACTOR 1SV305
CR0306	4815096H01	DIODE VARACTOR 1SV305
CR0307	4815096H01	DIODE VARACTOR 1SV305
CR0308	4815096H01	DIODE VARACTOR 1SV305
CR0400	4813974A19	DIODE, SCHOTTKY
D0400	4813974A06	DIODE, PIN
D0401	4885055Y01	DIODE VARACTOR 1SV229
D0402	4885055Y01	DIODE VARACTOR 1SV229
D0403	4885055Y01	DIODE VARACTOR 1SV229
D0404	4885055Y01	DIODE VARACTOR 1SV229
D0405	4815090H01	DIODE, MIXER
D0500	4813974A19	DIODE, SCHOTTKY
D0600	4815096H01	DIODE VARACTOR 1SV305
D0601	4815096H01	DIODE VARACTOR 1SV305

Circuit Ref	Motorola Part No.	Description
D0700	4802482J02	DIODE, PIN
D0702	4802482J02	DIODE, PIN
D0900	4813978C02	DIODE, SWITCHING
D0901	4815023H01	DIODE, PIN
D0902	4815024H01	DIODE, PIN
D0903	4815024H01	DIODE, PIN
D0904	4813974A21	DIODE, SCHOTTKY
D0905	4813974A21	DIODE, SCHOTTKY
E0201	2409134J25	FERRITE BEAD
E0301	2409134J25	FERRITE BEAD
E0302	NOT PLACED	–
E0400	2409134J25	FERRITE BEAD
E0401	2409134J25	FERRITE BEAD
E0403	2409134J25	FERRITE BEAD
E0500	2409134J25	FERRITE BEAD
E0600	2409134J25	FERRITE BEAD
E0601	2409134J25	FERRITE BEAD
E0602	2409134J25	FERRITE BEAD
E0603	2409134J25	FERRITE BEAD
E0604	2409134J25	FERRITE BEAD
E0605	2409134J25	FERRITE BEAD
E0606	2409134J25	FERRITE BEAD
E0607	2409134J25	FERRITE BEAD
E0608	2409134J25	FERRITE BEAD
E0609	2409134J25	FERRITE BEAD
E0610	2480640Z01	FERRITE BEAD
E0700	2485011Y01	FERRITE BEAD
E0701	2485011Y01	FERRITE BEAD
E0703	2485011Y01	FERRITE BEAD
FL0500	9116854H01	73.35 MHz CRYSTAL FILTER
J0700	0905901V11	MINI-U RF CONNECTOR
L0100	2414017N29	270nH
L0200	2414017N28	220nH
L0202	2414032F42	470nH
L0203	2414032F42	470nH
L0204	2414017N28	220nH
L0205	2414017N20	47nH
L0206	2414017N14	15nH
L0207	2415385H02	12.5nH
L0209	2414032F42	470nH
L0210	2414015A21	27nH
L0211	2414017N28	220nH
L0212	2414032F42	470nH
L0213	2414032F42	470nH
L0214	2414032F42	470nH
L0215	2415385H02	12.5nH
L0217	2414032F42	470nH
L0218	2414015A20	22nH
L0219	2414032F42	470nH
L0221	2414017N19	39nH
L0300	2414017N28	220nH

Circuit Ref	Motorola Part No.	Description
L0302	2414032F42	470nH
L0303	2414032F42	470nH
L0304	2414017N28	220nH
L0305	2414017N19	39nH
L0306	2414017N12	10nH
L0307	2415385H01	8nH
L0309	2414032F42	470nH
L0310	2414015A32	18nH
L0311	2414017N28	220nH
L0312	2414032F42	470nH
L0313	2414032F42	470nH
L0314	2414032F42	470nH
L0315	2415385H01	8nH
L0317	2414032F42	470nH
L0318	2414015A32	18nH
L0319	2414032F42	470nH
L0401	2414015B24	15nH
L0402	NOT PLACED	–
L0403	NOT PLACED	–
L0404	NOT PLACED	–
L0405	NOT PLACED	–
L0406	2414015B24	15nH
L0407	2414015B16	27nH
L0408	2414015B15	22nH
L0409	2414015B15	22nH
L0410	2414015B15	22nH
L0411	2414015B15	22nH
L0412	2414017N20	47nH
L0413	2414017N28	220nH
L0503	2414017K29	330nH
L0504	NOT PLACED	–
L0506	2414032B66	820nH
L0602	2414032K23	2.7uH
L0603	2414032D20	270nH
L0604	2466505A01	10uH
L0605	2466505A01	10uH
L0608	2414032B76	4.7uH
L0700	2460592A01	17nH
L0702	2479990G01	33.47nH
L0705	2414017N26	150nH
L0706	2460592A01	17nH
L0707	2460592A01	17nH
L0708	2460592A01	17nH
L0710	2460592A01	17nH
L0714	2479990N01	43.67nH
L0715	2414017N26	150nH
L0718	2414017N13	12nH
L0719	2414017N23	82nH
L0720	2414017N06	3.3nH
L0721	2414017N06	3.3nH
L0722	2414032B70	1.5uH

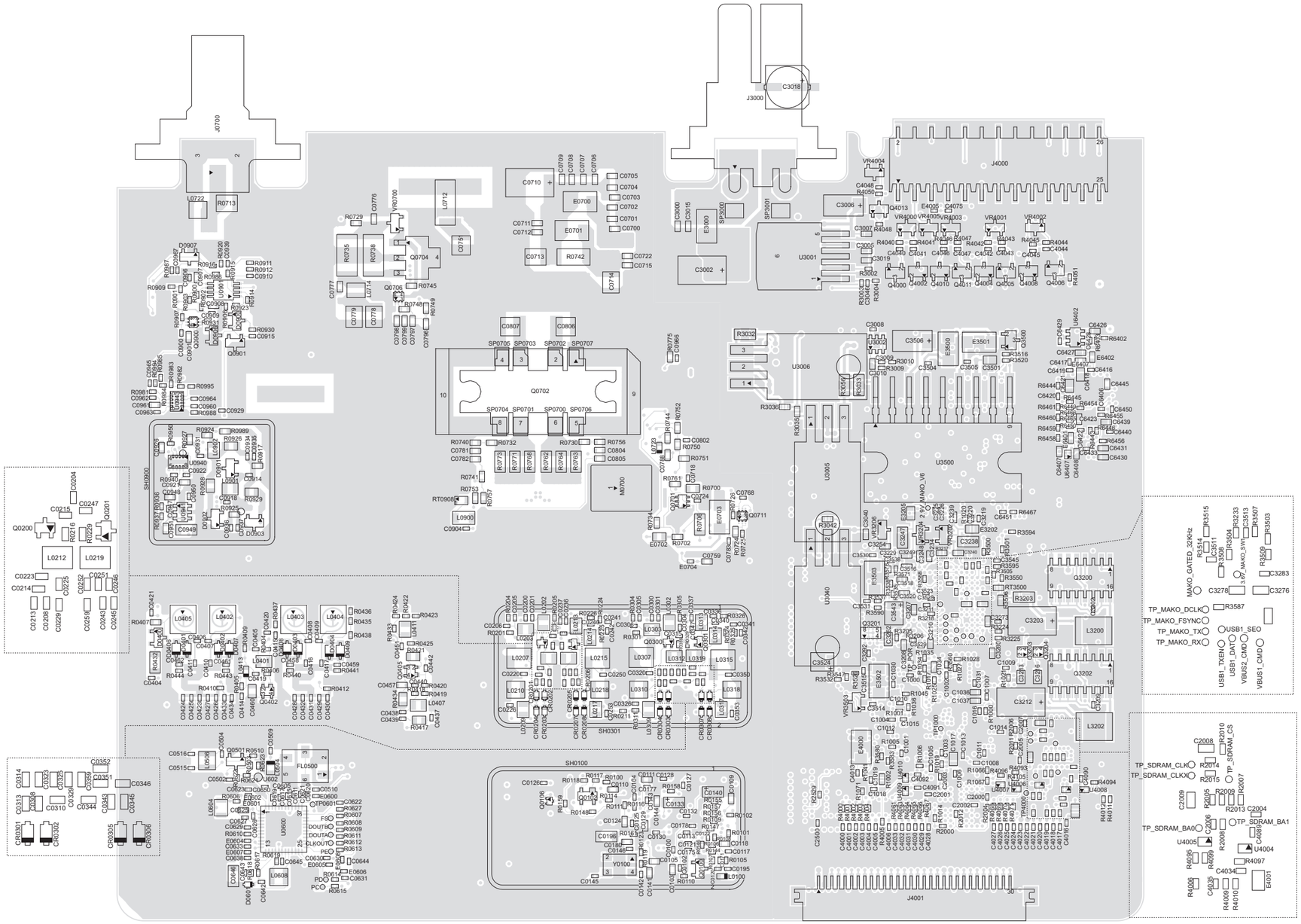
Circuit Ref	Motorola Part No.	Description
L0900	2414032D30	1uH
L0901	2414032F42	470nH
L0902	2414032F42	470nH
L0903	2414032F66	10nH
L0904	NOT PLACED	–
M0700	2686201B02	HEATSINK
Q0100	4802197J95	NPN RF TRANSISTOR
Q0102	4815359H01	DUAL PNP
Q0106	4816134H01	ANALOG SWITCH
Q0107	4813970A59	P-CHANNEL MOSFET
Q0108	4815261H01	ANALOG SWITCH
Q0200	4805793Y10	NPN RF TRANSISTOR
Q0201	4805793Y10	NPN RF TRANSISTOR
Q0202	4802197J95	NPN RF TRANSISTOR
Q0300	4805793Y10	NPN RF TRANSISTOR
Q0301	4805793Y10	NPN RF TRANSISTOR
Q0302	4802197J95	NPN RF TRANSISTOR
Q0400	4815271H01	ANALOG SWITCH
Q0401	4815267H01	DUAL PNP
Q0402	4885593U03	NPN RF TRANSISTOR
Q0403	4815270H01	DUAL NPN/PNP
Q0405	4885593U03	NPN RF TRANSISTOR
Q0500	4802197J95	NPN RF TRANSISTOR
Q0501	4802197J95	NPN RF TRANSISTOR
Q0600	4805793Y10	NPN RF TRANSISTOR
Q0601	4813973A04	NPN DARLINGTON
Q0701	4816013H01	DUAL NPN/PNP
Q0702	0105958T75	MRF1570 PA ASSEMBLY
Q0703	4816548H01	N-CHANNEL LDMOS DRIVER
Q0704	4813973B02	PNP
Q0705	4816547H01	N-CHANNEL LDMOS PRE-DRIVER
Q0706	4815272H01	ANALOG SWITCH
Q0707	4815272H01	ANALOG SWITCH
Q0708	4815272H01	ANALOG SWITCH
Q0709	4815272H01	ANALOG SWITCH
Q0901	4813973A13	PNP
Q0902	4813973M07	NPN
R0100	0613952R66	0
R0101	0613952R66	0
R0102	0613952R66	0
R0103	0613952R66	0
R0104	0613952R17	47K
R0105	0613952Q58	240
R0106	0613952Q83	2.7K
R0107	0613952Q57	220
R0108	0613952Q80	2K
R0109	0613952R66	0
R0110	0613952Q42	51
R0111	0613952R66	0
R0113	0613952R01	10K

Circuit Ref	Motorola Part No.	Description
R0114	0613952Q80	2K
R0115	0613952R66	0
R0116	0613952R66	0
R0117	0613952R12	30K
R0118	0613952R66	0
R0119	0613952Q35	27
R0120	0613952R01	10K
R0122	NOT PLACED	–
R0123	0613952R19	56K
R0125	0613952R66	0
R0126	NOT PLACED	–
R0127	0613952Q49	100
R0128	0613952R66	0
R0131	0613952Q58	240
R0134	0613952Q35	27
R0139	0613952Q78	1.6K
R0140	0613952Q31	18
R0144	0613952R01	10K
R0146	0613952R66	0
R0147	NOT PLACED	–
R0148	0613952Q51	120
R0155	0613952R66	0
R0156	NOT PLACED	–
R0157	NOT PLACED	–
R0158	NOT PLACED	–
R0159	0613952R01	10K
R0160	0613952R25	100K
R0161	0613952R25	100K
R0201	0613952Q85	3.3K
R0202	0613952Q75	1.2K
R0203	0613952Q75	1.2K
R0204	0613952Q95	8.2K
R0205	0613952Q49	100
R0206	0613952R05	15K
R0207	0613952Q25	10
R0208	0613952Q42	51
R0210	0613952Q89	4.7K
R0211	0613952R66	0
R0212	0613952R66	0
R0213	0613952R01	10K
R0216	0613952Q51	120
R0218	0613952R01	10K
R0219	0613952Q66	510
R0220	0613952Q25	10
R0221	0613952Q66	510
R0224	0613952Q92	6.2K
R0225	0613952Q94	7.5K
R0226	0613952Q49	100
R0229	0613952Q54	160
R0230	0613952Q89	4.7K
R0301	0613952Q85	3.3K
R0302	0613952Q66	510
R0303	0613952Q66	510
R0304	0613952Q95	8.2K
R0305	0613952Q49	100
R0306	0613952R05	15K
R0307	0613952Q25	10
R0308	0613952Q42	51
R0310	0613952Q89	4.7K
R0311	0613952R66	0
R0312	0613952R66	0
R0316	0613952Q46	75
R0319	0613952R32	200K
R0320	0613952R05	15K
R0321	0613952Q83	2.7K
R0324	0613952Q80	2K
R0325	0613952Q95	8.2K
R0326	0613952Q49	100
R0327	0613952R01	10K
R0329	0613952Q50	110
R0331	0613952R01	10K
R0332	0613952Q56	200
R0333	0613952Q35	27
R0334	0613952Q56	200
R0337	0613952R66	0
R0400	0613952R11	27K
R0401	0613952Q69	680
R0402	0613958H25	10
R0403	0613952R66	0
R0404	0613952Q83	2.7K
R0405	0613952Q91	5.6K
R0406	0613952Q83	2.7K
R0407	0613952H63	390
R0409	0613952Q75	1.2K
R0410	0613952R25	100K
R0412	0613952R25	100K
R0413	0613952Q69	680
R0414	0613952Q69	680
R0415	0613952Q69	680
R0416	0613952Q69	680
R0417	0613958H39	39
R0418	0613952M55	3.65K
R0419	0613952Q75	1.2K
R0420	0613952Q75	1.2K
R0421	0613958H25	10
R0422	0613952K71	53.6
R0423	0613952L09	121
R0424	0613952L09	121
R0425	0613952L51	332
R0426	0613952Q83	2.7K
R0427	0613952Q42	51
R0428	0613952R01	10K
R0429	0613952Q69	680
R0430	0613952R01	10K
R0431	0613952R01	10K
R0432	0613952H69	680
R0433	0613952R66	0
R0500	0613952Q90	5.1K
R0501	0613952Q61	330
R0502	0613952R08	20K
R0503	0613952R12	30K
R0508	0613952R19	56K
R0509	0613952Q89	4.7K
R0510	0613952R12	30K
R0511	0613952Q75	1.2K
R0512	0613952Q42	51
R0601	0613952Q45	68
R0602	0613952R01	10K
R0603	0613952Q66	510
R0604	0613952R10	24K
R0605	0613952Q61	330
R0606	0613952Q42	51
R0607	NOT PLACED	–
R0608	0613952R66	0
R0609	0613952R66	0
R0610	0613952R66	0
R0611	0613952R66	0
R0612	0613952R66	0
R0613	0613952R66	0
R0614	0613952R66	0
R0615	0613952R66	0
R0616	0613952R25	100K
R0617	0613952R01	10K
R0618	0613952Q63	390
R0619	0613952R01	10K
R0620	0613952Q96	9.1K
R0621	0613952R66	0
R0622	NOT PLACED	–
R0623	NOT PLACED	–
R0624	0613952Q90	5.1K
R0625	0613952N69	51.1K
R0626	0613952N81	68.1K
R0627	0613952R66	0
R0700	NOT PLACED	–
R0702	NOT PLACED	–
R0703	0613958J74	0
R0706	0613958S53	150
R0711	0613952H47	82
R0713	0613959H12	30K
R0714	0613952H48	91
R0715	0613952H48	91
R0718	0613952H25	10
R0719	0613959Q25	10
R0720	0613952H25	10
R0722	0613952H89	4.7K
R0727	0613952H92	6.2K
R0728	0613952J01	10K
R0729	0613952J01	10K
R0730	0613952H73	1K
R0732	0613952H73	1K
R0734	0613952G67	0
R0735	0613959Y49	100
R0738	0613959Y42	51
R0739	NOT PLACED	–
R0740	0613952J25	100K
R0741	0613952J17	47K
R0742	0613959Q25	10
R0744	NOT PLACED	–
R0745	0613952H65	470
R0747	0613952H89	4.7K
R0748	0613952J19	56K
R0749	0613952G67	0
R0750	0613952J01	10K
R0751	0613952J08	20K
R0752	0613952G67	0
R0753	0613952H73	1K
R0754	0613952H25	10
R0755	0613952H25	10
R0756	0613952J25	100K
R0757	0613952J17	47K
R0759	0613952H25	10
R0760	0613952Q83	2.7K
R0761	0613952G67	0
R0762	0613958S29	15
R0763	0613958S29	15
R0764	0613958S29	15
R0765	NOT PLACED	–
R0766	NOT PLACED	–
R0767	0613958S29	15
R0768	0613958S29	15
R0769	NOT PLACED	–
R0770	NOT PLACED	
R0771	0613958S29	15
R0772	0613958S29	15
R0773	0613958S29	15
R0774	0613952J08	20K
R0775	NOT PLACED	–
R0776	0613958J74	0
R0777	0613952H25	10
R0778	NOT PLACED	–
R0900	0613952R19	56K
R0901	0613952R16	43K
R0902	0613952Q85	3.3K
R0903	0613952R09	22K

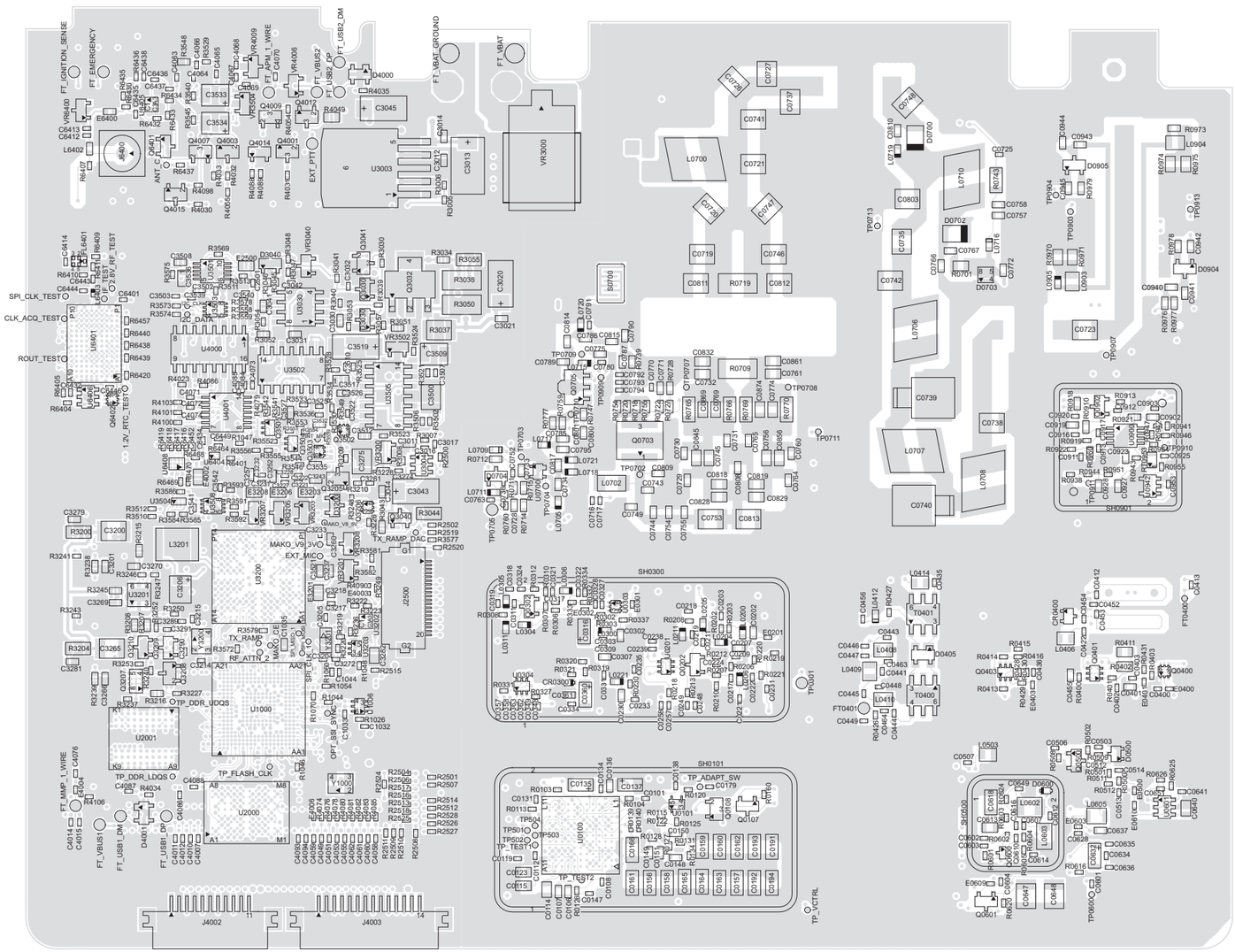
Circuit Ref	Motorola Part No.	Description
R0906	0613952R66	0
R0907	0613952R66	0
R0909	0613952R16	43K
R0910	0613952H73	1K
R0911	0613952Q61	330
R0912	0613952R13	33K
R0913	0613952R66	0
R0914	0613952R31	180K
R0915	0613952R21	68K
R0916	0613952Q93	6.8K
R0917	0613952H91	5.6K
R0918	0613952H63	390
R0919	0613952R15	39K
R0920	0613952R09	22K
R0921	0613952H81	2.2K
R0922	0613952R14	36K
R0923	0613952R66	0
R0924	0613952H91	5.6K
R0925	0613952H91	5.6K
R0926	0613958H53	150
R0927	0613952H42	51
R0928	0613958H39	39
R0929	0613958H39	39
R0930	0613952R07	18K
R0936	0613952N66	47.5K
R0937	0613952N21	16.2K
R0938	0613952R66	0
R0940	0613952R66	0
R0941	0613952R66	0
R0942	0613952M81	6.81K
R0943	0613952N58	39.2K
R0944	0613952R66	0
R0946	0613952M51	3.32K
R0947	0613952R66	0
R0950	0613952N01	10K
R0951	0613952N62	43.2K
R0954	0613952R40	430K
R0955	0613952P01	100K
R0960	0613952H82	2.4K
R0970	0613958H56	200
R0971	0613958H55	180
R0972	NOT PLACED	–
R0973	0613952G67	0
R0974	0613958H57	220
R0975	0613958H57	220
R0976	0613952H53	150
R0977	0613952H51	120
R0978	0613952G67	0
R0979	0613952G67	0
RT0908	0615585H01	THERMISTOR, 47K
RT0953	0615585H01	THERMISTOR, 47K

Circuit Ref	Motorola Part No.	Description
SH0100	2615362H01	SHIELD
SH0101	2615362H01	SHIELD
SH0300	2615362H01	SHIELD
SH0301	2615362H01	SHIELD
SH0500	2615576H01	SHIELD
SH0900	2686423Z02	SHIELD
SH0901	2686425Z02	SHIELD
SP0700	1015349H01	SOLDER PREFORM
SP0701	1015349H01	SOLDER PREFORM
SP0702	1015349H01	SOLDER PREFORM
SP0703	1015349H01	SOLDER PREFORM
SP0704	1015349H01	SOLDER PREFORM
SP0705	1015349H01	SOLDER PREFORM
SP0706	1015349H01	SOLDER PREFORM
SP0707	1015349H01	SOLDER PREFORM
T0400	2515121H01	BALUN XFMR
T0401	2515121H01	BALUN XFMR
U0100	5104932K08	IC, FRACN SYNTHESIZER
U0101	5114000B59	ANALOG SWITCH
U0201	4815267H01	DUAL PNP
U0303	NOT PLACED	–
U0304	4815267H01	DUAL PNP
U0600	5102495J14	IC, RF ASIC
U0601	5115391H01	VOLTAGE REGULATOR
U0700	4802246J29	PA PRE-DRIVER
U0900	5115147H01	DUAL OPAMP
U0901	5115147H01	DUAL OPAMP
U0940	5180390L83	IC, PA CONTROLLER
U0941	5115391H01	VOLTAGE REGULATOR
U0942	5114004A35	VOLTAGE DETECTOR
VR0700	4813977M11	DIODE, 5.6V ZENER
Y0100	5116032H01	0.5PPM 16.8 MHz TCXO (GPS Models only)

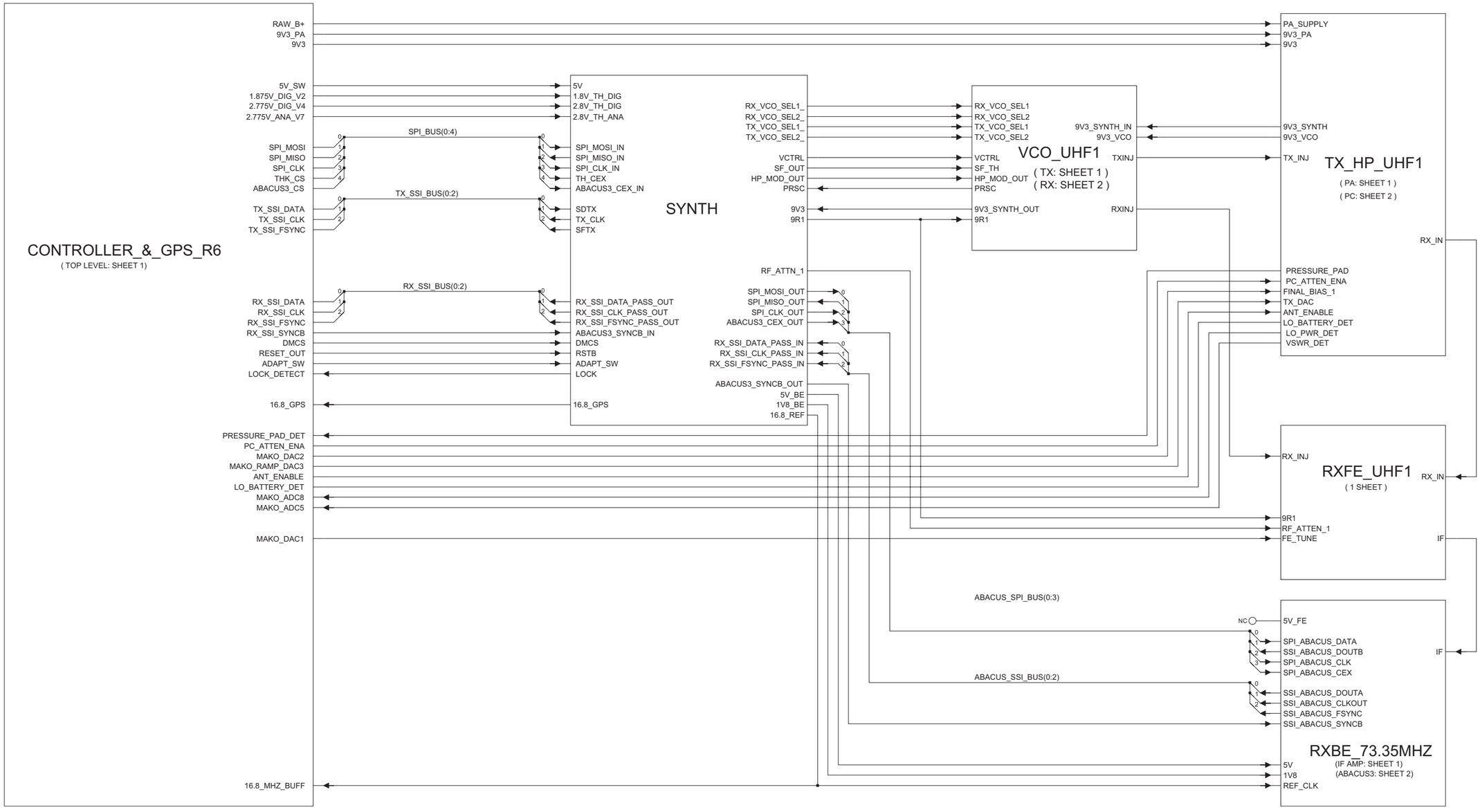
3.0 UHF1 (403–470 MHz) 25–40W PCB / Schematics / Parts List



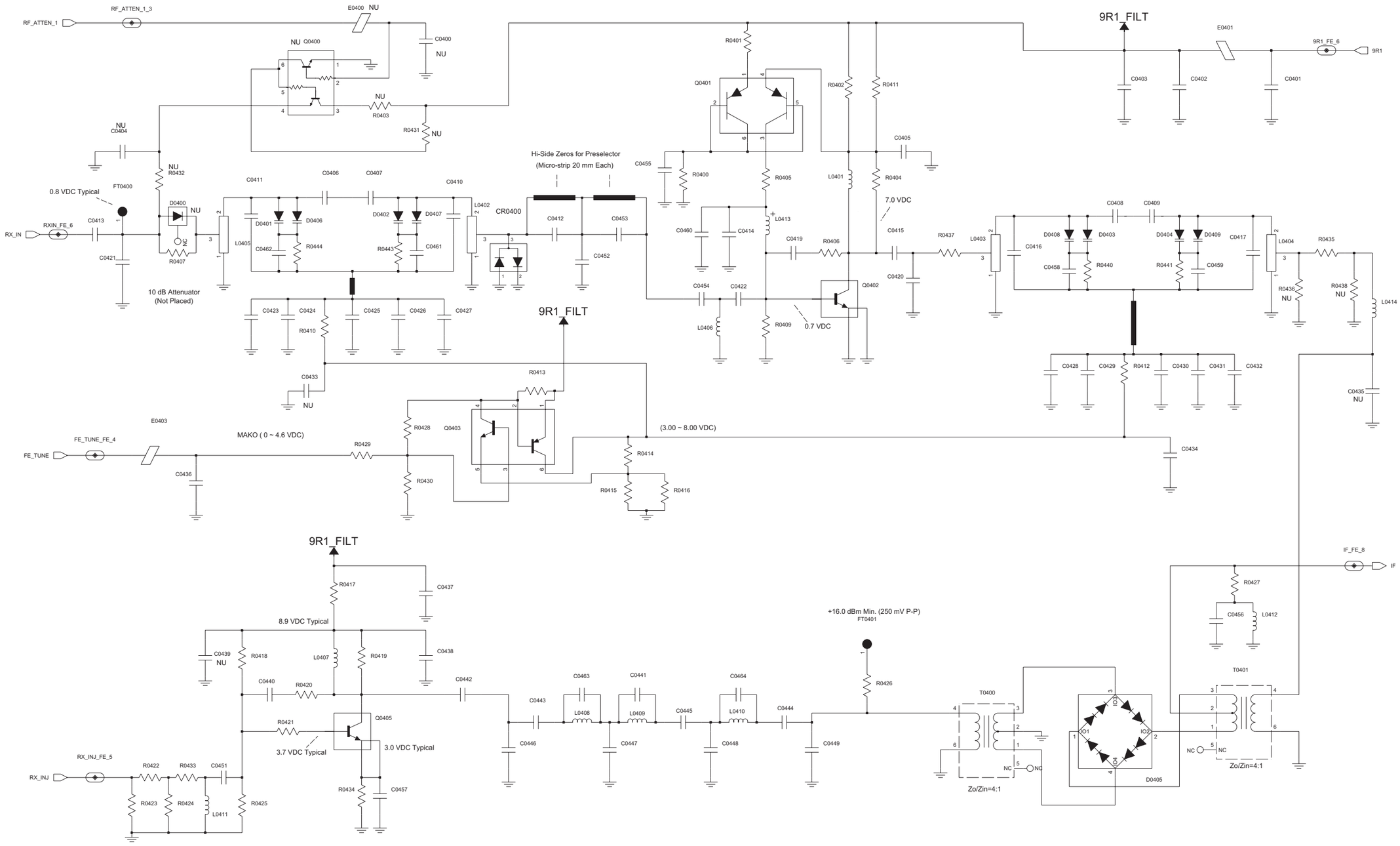
UHF1 (403–470 MHz) 25–40W 8486777Z15 Top Side



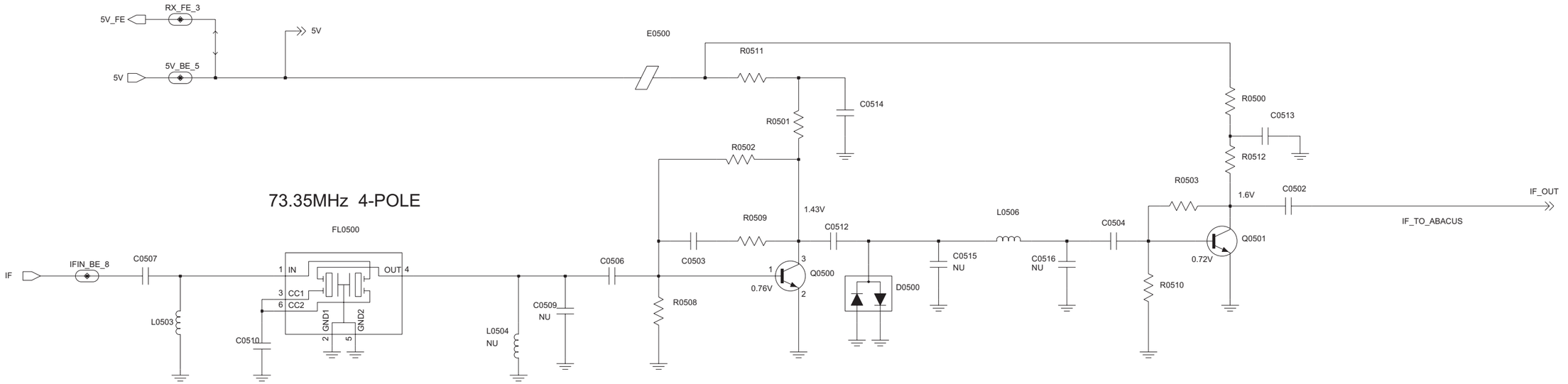
UHF1 (403–470 MHz) 25–40W 8486777Z15 Bottom Side

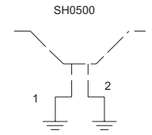


UHF1 (403–470 MHz) 25–40W Overall Schematic Diagram

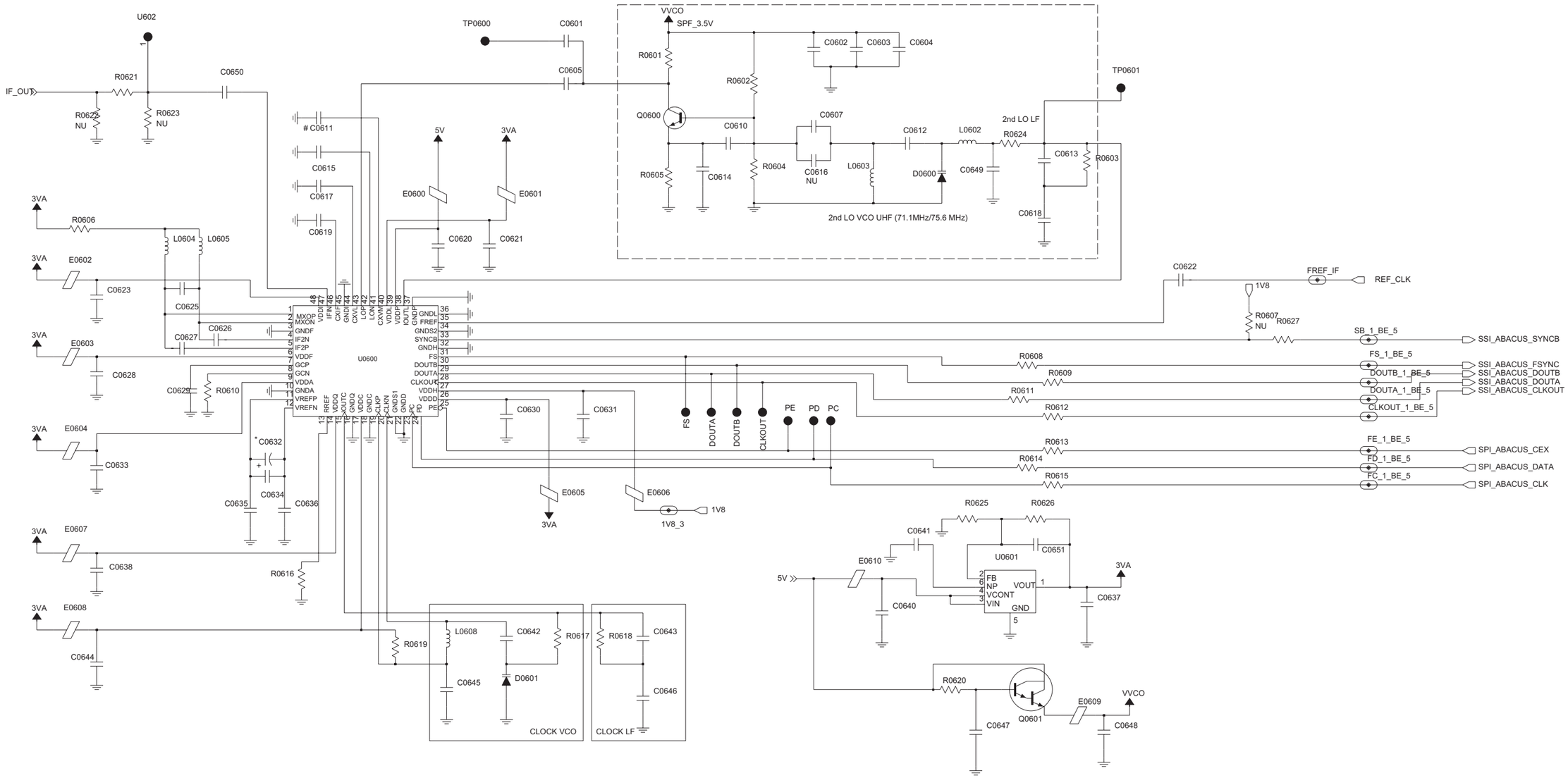


UHF1 (403–470 MHz) 25–40W Receiver Front-End Schematic Diagram

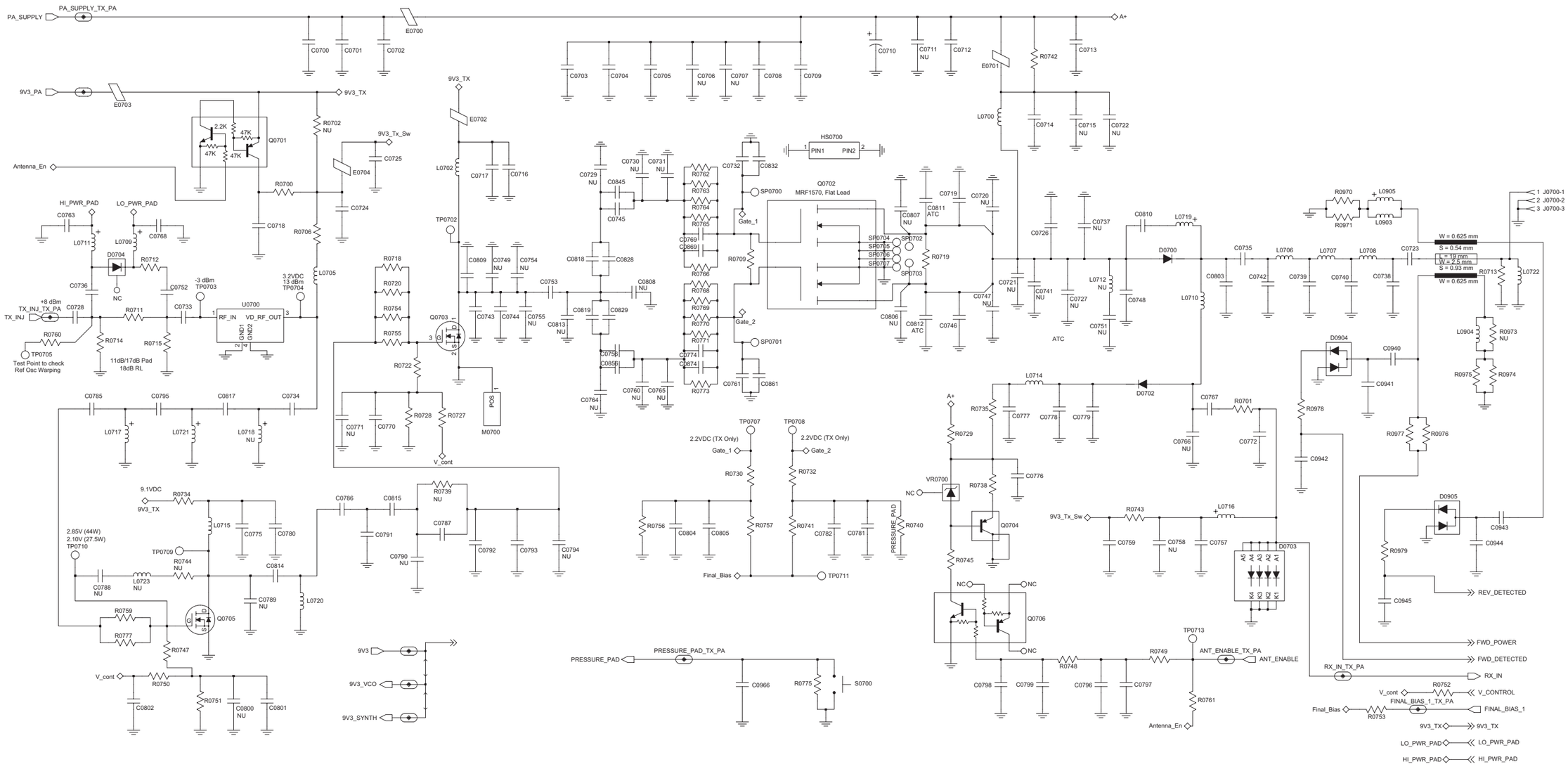




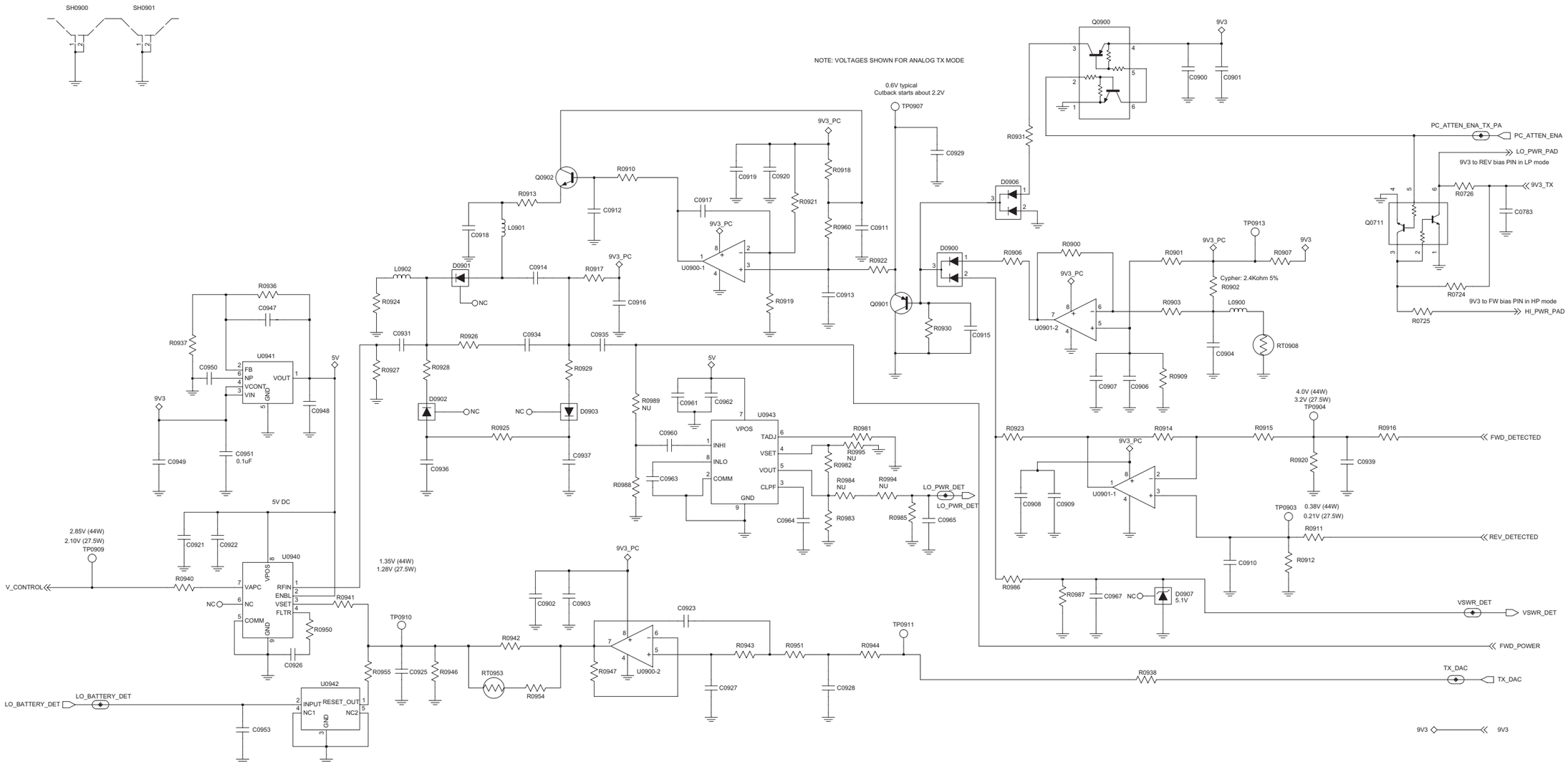
UHF1 (403–470 MHz) 25–40W Receiver IF Amp Schematic Diagram



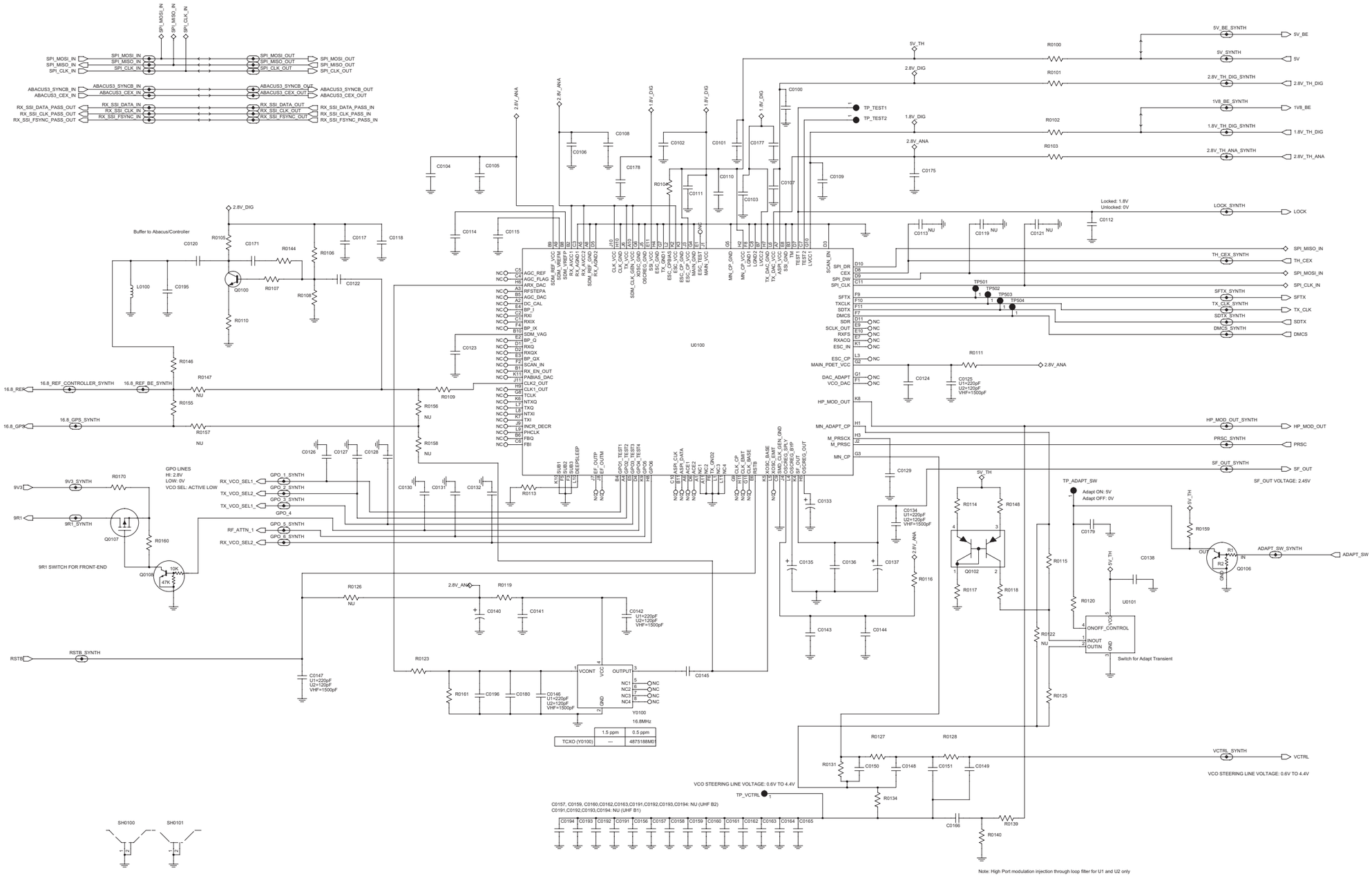
UHF1 (403–470 MHz) 25–40W Receiver Back-End Schematic Diagram



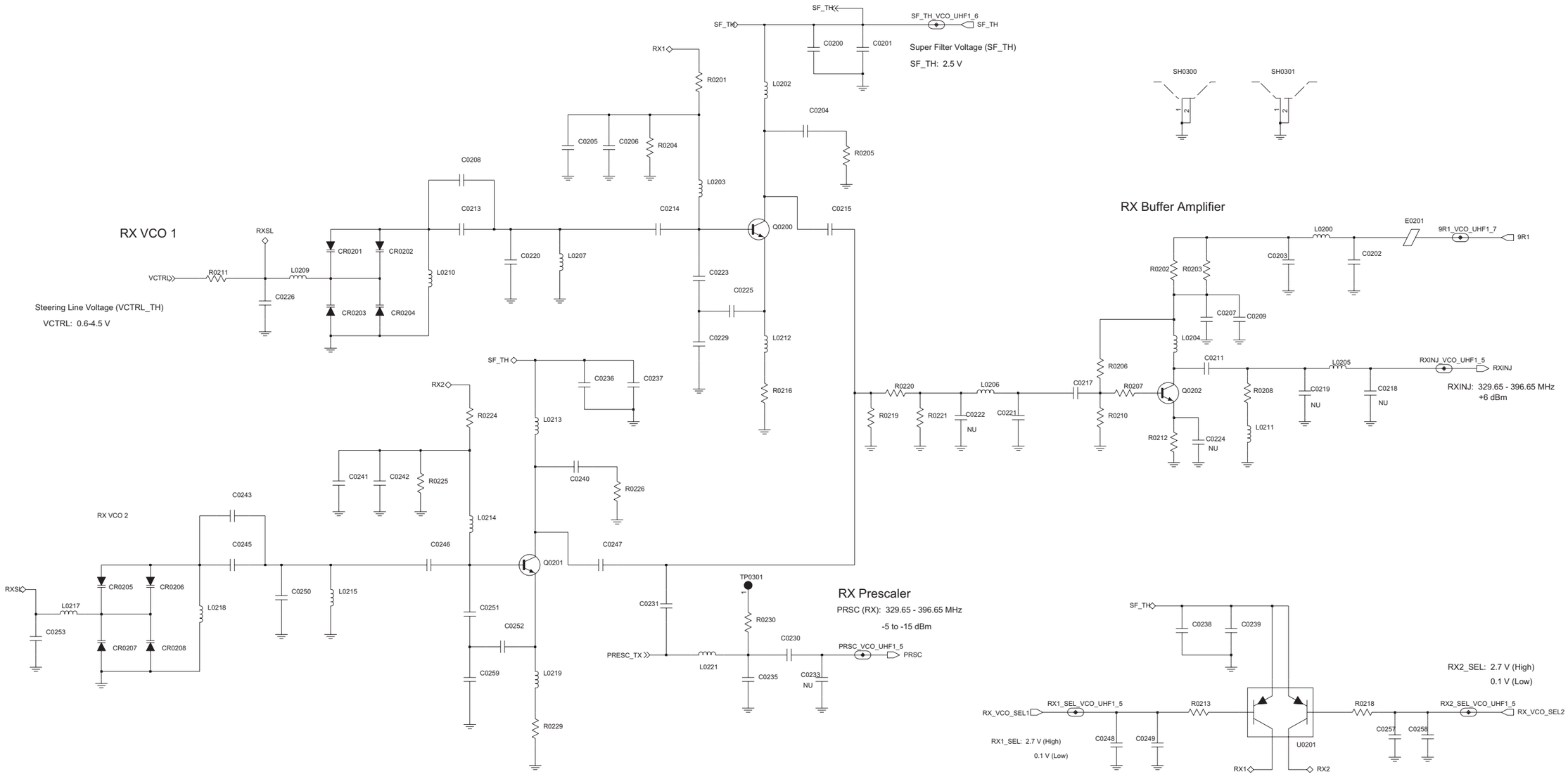
UHF1 (403–470 MHz) 25–40W Power Amplifier Schematic Diagram



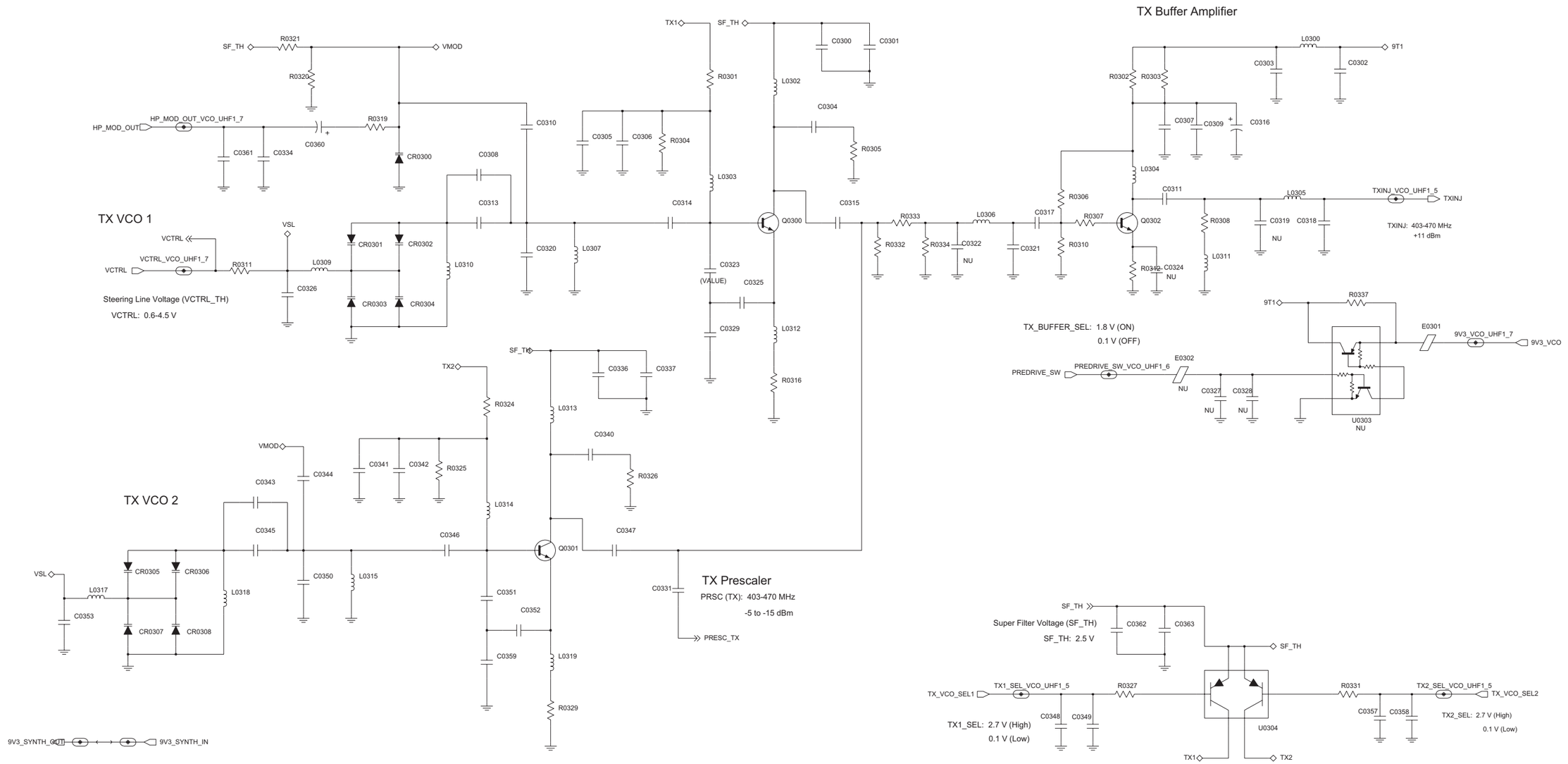
UHF1 (403–470 MHz) 25–40W Power Control Schematic Diagram



UHF1 (403–470 MHz) 25–40W Synthesizer Schematic Diagram



UHF1 (403–470 MHz) 25–40W Receiver VCO Schematic Diagram



UHF1 (403–470 MHz) 25–40W Transmit VCO Schematic Diagram

UHF1 PCB 8486777Z15 Parts List 25–40W

Circuit Ref	Motorola Part No.	Description
C0100	2113944A44	220pF
C0101	2113944A44	220pF
C0102	2113944A44	220pF
C0103	2113945C31	0.1uF
C0104	2113944A44	220pF
C0105	2113945C31	0.1uF
C0106	2113945C31	0.1uF
C0107	2113945C31	0.1uF
C0108	2113944A44	220pF
C0109	2113945C31	0.1uF
C0110	2113945C31	0.1uF
C0111	2113945C31	0.1uF
C0112	2113944A44	220pF
C0113	NOT PLACED	–
C0114	2113946E02	1.0uF
C0115	2113946E02	1.0uF
C0117	2113944A44	220pF
C0118	2113945C31	0.1uF
C0119	NOT PLACED	–
C0120	2113945B02	.01uF
C0121	NOT PLACED	–
C0122	2113945B02	.01uF
C0123	2113946E02	1.0uF
C0124	2113945C31	0.1uF
C0125	2113944A44	220pF
C0126	2113944A44	220pF
C0127	2113944A44	220pF
C0128	2113944A44	220pF
C0129	2113945C31	0.1uF
C0130	2113944A44	220pF
C0131	2113944A44	220pF
C0132	2113944A44	220pF
C0133	2313960B30	4.7uF
C0134	2113944A44	220pF
C0135	2313960B32	10uF
C0136	2113945C31	0.1uF
C0137	2313960B32	10uF
C0138	2113944A44	220pF
C0140	2313960B30	4.7uF
C0141	2113945C31	0.1uF
C0142	2113944A44	220pF
C0143	2113944A44	220pF
C0144	2113945C31	0.1uF
C0145	2113945B02	.01uF
C0146	2113944A44	220pF
C0147	2113944A44	220pF
C0148	2113945D01	.033uF
C0149	2113945C04	.022uF
C0150	2113945C31	0.1uF
C0151	2113945C31	0.1uF
C0156	2185419D06	0.1uF
C0157	2185419D06	0.1uF
C0158	2185419D06	0.1uF
C0159	2185419D06	0.1uF
C0160	2185419D06	0.1uF
C0161	2185419D06	0.1uF
C0162	2185419D06	0.1uF
C0163	2185419D06	0.1uF
C0164	2185419D06	0.1uF
C0165	2185419D06	0.1uF
C0166	2185419D06	0.1uF
C0171	2113945B02	.01uF
C0175	2113944A44	220pF
C0177	2113944A44	220pF
C0178	2113944A44	220pF
C0179	2113944A44	220pF
C0180	2113945C31	0.1uF
C0191	NOT PLACED	–
C0192	NOT PLACED	–
C0193	NOT PLACED	–
C0194	NOT PLACED	–
C0195	2113945A05	470pF
C0196	2113946H02	10uF
C0200	2113944A44	220pF
C0201	2113945Y02	0.10uF
C0202	2113945C02	.01uF
C0203	2113944A44	220pF
C0204	2113944A44	220pF
C0205	2113945Y02	0.10uF
C0206	2113944A44	220pF
C0207	2113945C04	.022uF
C0208	2115153H18	4.3pF
C0209	2113944A44	220pF
C0211	2113944A44	220pF
C0213	2115153H17	3.9pF
C0214	2115153H34	11pF
C0215	2115153H20	5.1pF
C0217	2113944A44	220pF
C0218	NOT PLACED	–
C0219	NOT PLACED	–
C0220	2115153H17	3.9pF
C0221	2115153H14	3.0pF
C0222	NOT PLACED	–
C0223	2115153H46	36pF
C0224	NOT PLACED	–
C0225	2115153H51	56pF
C0226	2113944A44	220pF
C0229	2115153H42	24pF
C0230	2113944C47	150pF
C0231	2115153H14	3.0pF
C0233	NOT PLACED	–
C0235	2115153H22	6.2pF
C0236	2113944A44	220pF
C0237	2113945Y02	0.10uF
C0238	2113944A44	220pF
C0239	2113945Y02	0.10uF
C0240	2113944A44	220pF
C0241	2113945Y02	0.10uF
C0242	2113944A44	220pF
C0243	2115153H13	2.7pF
C0245	2115153H14	3.0pF
C0246	2115153H27	10pF
C0247	2115153H20	5.1pF
C0248	2113944A44	220pF
C0249	2113945Y02	0.10uF
C0250	2115153H16	3.6pF
C0251	2115153H40	20pF
C0252	2115153H48	43pF
C0253	2113944A44	220pF
C0257	2113944A44	220pF
C0258	2113945Y02	0.10uF
C0259	2115153H35	12pF
C0300	2113944A44	220pF
C0301	2113945Y02	0.10uF
C0302	2113945C02	.01uF
C0303	2113944A44	220pF
C0304	2113944A44	220pF
C0305	2113945Y02	0.10uF
C0306	2113944A44	220pF
C0307	2113945C04	.022uF
C0308	2115153H15	3.3pF
C0309	2113944A44	220pF
C0310	2115153H01	0.5pF
C0311	2113944A44	220pF
C0313	2115153H15	3.3pF
C0314	2115153H35	12pF
C0315	2115153H20	5.1pF
C0316	2313960B32	10uF
C0317	2113944A44	220pF
C0318	2115153H15	3.3pF
C0319	NOT PLACED	–
C0320	2115153H20	5.1pF
C0321	2115153H24	7.5pF
C0322	NOT PLACED	–
C0323	2115153H43	27pF
C0324	NOT PLACED	–
C0325	2115153H51	56pF
C0326	2113944A44	220pF
C0327	NOT PLACED	–
C0328	NOT PLACED	–
C0329	2115153H38	16pF
C0331	2115153H14	3.0pF
C0334	2113944A44	220pF
C0336	2113944A44	220pF
C0337	2113945Y02	0.10uF
C0340	2113944A44	220pF
C0341	2113945Y02	0.10uF
C0342	2113944A44	220pF
C0343	2115153H15	3.3pF
C0344	2115153H01	0.5pF
C0345	2115153H15	3.3pF
C0346	2115153H24	7.5pF
C0347	2115153H20	5.1pF
C0348	2113944A44	220pF
C0349	2113945Y02	0.10uF
C0350	2115153H18	4.3pF
C0351	2115153H42	24pF
C0352	2115153H50	51pF
C0353	2113944A44	220pF
C0357	2113944A44	220pF
C0358	2113945Y02	0.10uF
C0359	2115153H38	16pF
C0360	2313960B30	4.7uF
C0361	2113944C51	1000pF
C0362	2113944A44	220pF
C0363	2113945Y02	0.10uF
C0400	NOT PLACED	–
C0401	2113945C31	0.1uF
C0402	2113944A44	220pF
C0403	2115153H49	47pF
C0404	NOT PLACED	–
C0405	2113944A44	220pF
C0406	2115153H27	10pF
C0407	2115153H13	2.7pF
C0408	2115153H27	10pF
C0409	2115153H13	2.7pF
C0410	2115153H22	6.2pF
C0411	2115153H22	6.2pF
C0412	2115153H20	5.1pF
C0413	2115153H57	100pF
C0414	2113944A44	220pF
C0415	2115153H21	5.6pF
C0416	2115153H22	6.2pF
C0417	2115153H22	6.2pF
C0419	2113945Y02	0.10uF
C0420	2115153H03	1.0pF
C0421	2115153H13	2.7pF
C0422	2115153H26	9.1pF
C0423	2113944A44	220pF
C0424	2113944A44	220pF
C0425	2113944A44	220pF
C0426	2113944A44	220pF
C0427	2113944A44	220pF

Circuit Ref	Motorola Part No.	Description
C0428	2113944A44	220pF
C0429	2113944A44	220pF
C0430	2113944A44	220pF
C0431	2113944A44	220pF
C0432	2113944A44	220pF
C0433	NOT PLACED	–
C0434	2113944A44	220pF
C0435	2115153H17	3.9pF
C0436	2113944A44	220pF
C0437	2113944A44	220pF
C0438	2113944A44	220pF
C0439	NOT PLACED	–
C0440	2113944A44	220pF
C0441	2115153H11	2.2pF
C0442	2115153H25	8.2pF
C0443	2115153H41	22pF
C0444	2115153H41	22pF
C0445	2115153H37	15pF
C0446	2115153H20	5.1pF
C0447	2115153H27	10pF
C0448	2115153H26	9.1pF
C0449	2115153H20	5.1pF
C0451	2115153H41	22pF
C0452	2115153H26	9.1pF
C0453	2115153H20	5.1pF
C0454	2115153H26	9.1pF
C0455	2113945C31	0.1uF
C0456	2113944A40	100pF
C0457	2113945C31	0.1uF
C0458	2115153H40	20pF
C0459	2115153H40	20pF
C0460	2113946F05	10uF
C0461	2115153H40	20pF
C0462	2115153H40	20pF
C0463	2115153H06	1.3pF
C0464	2115153H06	1.3pF
C0502	2113945Y02	0.10uF
C0503	2113945Y02	0.10uF
C0504	2113945Y02	0.10uF
C0506	2113945Y02	0.10uF
C0507	2115153H39	18pF
C0509	NOT PLACED	–
C0510	2115153H22	6.2pF
C0512	2113945Y02	0.10uF
C0513	2113945Y02	0.10uF
C0514	2113945Y02	0.10uF
C0515	NOT PLACED	–
C0516	NOT PLACED	–
C0601	2115153H48	43pF
C0602	2113945B02	.01uF
C0603	2113944A44	220pF

Circuit Ref	Motorola Part No.	Description
C0604	2113945Y02	0.10uF
C0605	2115153H48	43pF
C0607	2115153H39	18pF
C0610	2115153H53	68pF
C0611	2113945A09	1000pF
C0612	2115153H34	11pF
C0613	2185419D03	0.01uF
C0614	2115153H48	43pF
C0615	2113945B02	.01uF
C0616	NOT PLACED	–
C0617	2113945Y02	0.10uF
C0618	2185419D06	0.1uF
C0619	2113945Y02	0.10uF
C0620	2113945Y02	0.10uF
C0621	2113945Y02	0.10uF
C0622	2113945A09	1000pF
C0623	2113945Y02	0.10uF
C0625	2113944C89	200pF
C0626	2113944A40	100pF
C0627	2113944A40	100pF
C0628	2113945Y02	0.10uF
C0629	2113945A11	2200pF
C0630	2113945Y02	0.10uF
C0631	2113945Y02	0.10uF
C0632	2313960B30	4.7uF
C0633	2113945Y02	0.10uF
C0634	2113945B02	.01uF
C0635	2113944A40	100pF
C0636	2113944A40	100pF
C0637	2113946S35	1.0uF
C0638	2113945Y02	0.10uF
C0640	2113946N03	2.2uF
C0641	2113945B02	.01uF
C0642	2115153H53	68pF
C0643	2113945Y02	0.10uF
C0644	2113945Y02	0.10uF
C0645	2113945B02	.01uF
C0646	2113946G04	0.68uF
C0647	2113946J03	10.0uF
C0648	2113946J03	10.0uF
C0649	2113945A12	3300pF
C0650	2115153H44	30pF
C0651	2115153H57	100pF
C0700	2113944C82	30pF
C0701	2113945C04	.022uF
C0702	2113944C55	2200pF
C0703	2113944C82	30pF
C0704	2113945C04	.022uF
C0705	2113944C51	1000pF
C0706	NOT PLACED	–
C0707	NOT PLACED	–

Circuit Ref	Motorola Part No.	Description
C0708	2113944C51	1000pF
C0709	2113945C31	0.1uF
C0710	2371403L02	10uF
C0711	NOT PLACED	–
C0712	2113944C51	1000pF
C0713	2111078B42	100pF
C0714	2111078B42	100pF
C0715	NOT PLACED	–
C0716	2113944A41	120pF
C0717	2113945A09	1000pF
C0718	2113945A09	1000pF
C0719	2111078B25	27pF
C0720	NOT PLACED	–
C0721	NOT PLACED	–
C0722	NOT PLACED	–
C0723	2111078B39	75pF
C0724	2113944A41	120pF
C0725	2113944A41	120pF
C0726	2111078B20	18pF
C0727	NOT PLACED	–
C0728	2113944C42	75pF
C0729	NOT PLACED	–
C0730	NOT PLACED	–
C0731	NOT PLACED	–
C0732	2113951B41	24pF
C0733	2113944C42	75pF
C0734	2113944C84	43pF
C0735	2111078B39	75pF
C0736	2113944A41	120pF
C0737	NOT PLACED	–
C0738	2111078B07	5.6pF
C0739	2185400Y36	12pF
C0740	2185400Y36	12pF
C0741	NOT PLACED	–
C0742	2111078B07	5.6pF
C0743	2113944C37	39pF
C0744	2113944C38	47pF
C0745	2113944F44	12pF
C0746	2111078B25	27pF
C0747	NOT PLACED	–
C0748	2111078B11	8.2pF
C0749	NOT PLACED	–
C0751	NOT PLACED	–
C0752	2113944A41	120pF
C0753	2111078B39	75pF
C0754	NOT PLACED	–
C0755	NOT PLACED	–
C0756	2113944F44	12pF
C0757	2113944C42	75pF
C0758	NOT PLACED	–
C0759	2113944C42	75pF

Circuit Ref	Motorola Part No.	Description
C0760	NOT PLACED	–
C0761	2113951B41	24pF
C0763	2113944A41	120pF
C0764	NOT PLACED	–
C0765	NOT PLACED	–
C0766	NOT PLACED	–
C0767	2113944C42	75pF
C0768	2113944A41	120pF
C0769	2113944F51	24pF
C0770	2113944A41	120pF
C0771	NOT PLACED	–
C0772	2113944C16	2.7pF
C0774	2113944F51	24pF
C0775	2113945C04	.022uF
C0776	2113944C42	75pF
C0777	2113944C47	150pF
C0778	2111078B30	34pF
C0779	2111078B29	33pF
C0780	2113944A41	120pF
C0781	2113944C42	75pF
C0782	2113944C51	1000pF
C0783	2113944A41	120pF
C0785	2113944C42	75pF
C0786	2113944C84	43pF
C0787	2113944C84	43pF
C0788	NOT PLACED	–
C0789	NOT PLACED	–
C0790	NOT PLACED	–
C0791	2113944A80	20pF
C0792	2113944A28	18pF
C0793	2113944A25	10pF
C0794	NOT PLACED	–
C0795	2113944C75	8.2pF
C0796	2113944C42	75pF
C0797	2113944C51	1000pF
C0798	2113944C51	1000pF
C0799	2113944C42	75pF
C0800	NOT PLACED	–
C0801	2113944A41	120pF
C0802	2113944A41	120pF
C0803	2111078B01	3.3pF
C0804	2113944C42	75pF
C0805	2113944C51	1000pF
C0806	NOT PLACED	–
C0807	NOT PLACED	–
C0808	NOT PLACED	–
C0809	2113944C30	10pF
C0810	2113944C42	75pF
C0811	NOT PLACED	–
C0812	NOT PLACED	–
C0813	NOT PLACED	–

Circuit Ref	Motorola Part No.	Description
C0814	2113944C46	120pF
C0815	2113944C41	68pF
C0817	2113951A31	7.50pF
C0818	2113944F54	33pF
C0819	2113944F54	33pF
C0828	2113944F54	33pF
C0829	2113944F54	33pF
C0832	2113951B41	24pF
C0845	2113944F44	12pF
C0856	2113944F44	12pF
C0861	2113951B41	24pF
C0869	2113944F51	24pF
C0874	2113944F51	24pF
C0900	2113944A41	120pF
C0901	2113945C31	0.1uF
C0902	2113945C31	0.1uF
C0903	2113944A41	120pF
C0904	2113944A41	120pF
C0906	2113944A41	120pF
C0907	2113945C02	.01uF
C0908	2113945C31	0.1uF
C0909	2113944A41	120pF
C0910	2113944A41	120pF
C0911	2113944A41	120pF
C0912	2113944A41	120pF
C0913	2113944A41	120pF
C0914	2113944A41	120pF
C0915	2113944A41	120pF
C0916	2113944A41	120pF
C0917	2113945A09	1000pF
C0918	2113944A41	120pF
C0919	2113945C31	0.1uF
C0920	2113944A41	120pF
C0921	2113945C31	0.1uF
C0922	2113944A41	120pF
C0923	2113944C55	2200pF
C0925	2113944A41	120pF
C0926	2113945L41	4700pF
C0927	2113944C02	220pF
C0928	2113944C53	1500pF
C0929	2113944A41	120pF
C0931	2113944A41	120pF
C0934	2113944A41	120pF
C0935	2113944A41	120pF
C0936	2113944A41	120pF
C0937	2113944A41	120pF
C0939	2113944A41	120pF
C0940	2113944C46	120pF
C0941	2113944M17	9.1pF
C0942	2113944C42	75pF
C0943	2113944C42	75pF

Circuit Ref	Motorola Part No.	Description
C0944	2113944M06	3.3pF
C0945	2113944C42	75pF
C0947	2113944A40	100pF
C0948	2113946S35	1.0uF
C0949	2113946G01	2.2uF
C0950	2113945A09	1000pF
C0951	2113945C31	0.1uF
C0953	2113944A41	120pF
C0960	2113944A52	1000pF
C0961	2113945C31	0.1uF
C0962	2113944A40	100pF
C0963	2113944A52	1000pF
C0964	2113944A23	8.2pF
C0965	2113944A40	100pF
C0966	2113944A41	120pF
C0967	2113944A41	120pF
CR0201	4815096H01	DIODE VARACTOR 1SV305
CR0202	4815096H01	DIODE VARACTOR 1SV305
CR0203	4815096H01	DIODE VARACTOR 1SV305
CR0204	4815096H01	DIODE VARACTOR 1SV305
CR0205	4815096H01	DIODE VARACTOR 1SV305
CR0206	4815096H01	DIODE VARACTOR 1SV305
CR0207	4815096H01	DIODE VARACTOR 1SV305
CR0208	4815096H01	DIODE VARACTOR 1SV305
CR0300	4815096H01	DIODE VARACTOR 1SV305
CR0301	4815096H01	DIODE VARACTOR 1SV305
CR0302	4815096H01	DIODE VARACTOR 1SV305
CR0303	4815096H01	DIODE VARACTOR 1SV305
CR0304	4815096H01	DIODE VARACTOR 1SV305
CR0305	4815096H01	DIODE VARACTOR 1SV305
CR0306	4815096H01	DIODE VARACTOR 1SV305
CR0307	4815096H01	DIODE VARACTOR 1SV305
CR0308	4815096H01	DIODE VARACTOR 1SV305
CR0400	4813974A19	DIODE, SCHOTTKY
D0400	NOT PLACED	–
D0401	4885055Y01	DIODE VARACTOR 1SV229
D0402	4885055Y01	DIODE VARACTOR 1SV229
D0403	4885055Y01	DIODE VARACTOR 1SV229
D0404	4885055Y01	DIODE VARACTOR 1SV229
D0405	4815090H01	DIODE, MIXER
D0406	4885055Y01	DIODE VARACTOR 1SV229
D0407	4885055Y01	DIODE VARACTOR 1SV229
D0408	4885055Y01	DIODE VARACTOR 1SV229
D0409	4885055Y01	DIODE VARACTOR 1SV229
D0500	4813974A19	DIODE, SCHOTTKY
D0600	4815096H01	DIODE VARACTOR 1SV305
D0601	4815096H01	DIODE VARACTOR 1SV305
D0700	4802482J02	DIODE, PIN
D0702	4802482J02	DIODE, PIN
D0703	4875430M01	DIODE, PIN
D0704	4813974A06	DIODE, PIN

Circuit Ref	Motorola Part No.	Description
D0900	4813978C02	DIODE, SWITCHING
D0901	4815023H01	DIODE, PIN
D0902	4815024H01	DIODE, PIN
D0903	4815024H01	DIODE, PIN
D0904	4813974A21	DIODE, SCHOTTKY
D0905	4813974A21	DIODE, SCHOTTKY
D0906	4813978C02	DIODE, SWITCHING
D0907	4813977M10	DIODE, 5.1V ZENER
E0201	2409134J25	FERRITE BEAD
E0301	2409134J25	FERRITE BEAD
E0302	NOT PLACED	–
E0400	NOT PLACED	–
E0401	2409134J25	FERRITE BEAD
E0403	2409134J25	FERRITE BEAD
E0500	2409134J25	FERRITE BEAD
E0600	2409134J25	FERRITE BEAD
E0601	2409134J25	FERRITE BEAD
E0602	2409134J25	FERRITE BEAD
E0603	2409134J25	FERRITE BEAD
E0604	2409134J25	FERRITE BEAD
E0605	2409134J25	FERRITE BEAD
E0606	2409134J25	FERRITE BEAD
E0607	2409134J25	FERRITE BEAD
E0608	2409134J25	FERRITE BEAD
E0609	2409134J25	FERRITE BEAD
E0610	2480640Z01	FERRITE BEAD
E0700	2485011Y01	FERRITE BEAD
E0701	2485011Y01	FERRITE BEAD
E0702	7671656M01	FERRITE BEAD
E0703	2485011Y01	FERRITE BEAD
E0704	2409134J25	FERRITE BEAD
FL0500	9116854H02	73.35 MHZ CRYSTAL FILTER
HS0700	0104038J81	HEATSINK
J0700	0905901V11	MINI-U RF CONNECTOR
L0100	2414017N29	270nH
L0200	2414017N28	220nH
L0202	2414032F42	470nH
L0203	2414032F42	470nH
L0204	2414017N28	220nH
L0205	2414017N20	47nH
L0206	2414017N14	15nH
L0207	2415385H02	12.5nH
L0209	2414032F42	470nH
L0210	2414015A21	27nH
L0211	2414017N28	220nH
L0212	2414032F42	470nH
L0213	2414032F42	470nH
L0214	2414032F42	470nH
L0215	2415385H02	12.5nH
L0217	2414032F42	470nH
L0218	2414015A20	22nH

Circuit Ref	Motorola Part No.	Description
L0219	2414032F42	470nH
L0221	2414017N19	39nH
L0300	2414017N28	220nH
L0302	2414032F42	470nH
L0303	2414032F42	470nH
L0304	2414017N28	220nH
L0305	2414017N19	39nH
L0306	2414017N12	10nH
L0307	2415385H01	8nH
L0309	2414032F42	470nH
L0310	2414015A32	18nH
L0311	2414017N28	220nH
L0312	2414032F42	470nH
L0313	2414032F42	470nH
L0314	2414032F42	470nH
L0315	2415385H01	8nH
L0317	2414032F42	470nH
L0318	2414015A32	18nH
L0319	2414032F42	470nH
L0401	2414015B24	15nH
L0402	NOT PLACED	–
L0403	NOT PLACED	–
L0404	NOT PLACED	–
L0405	NOT PLACED	–
L0406	2414015B29	10nH
L0407	2414015B16	27nH
L0408	2414015B15	22nH
L0409	2414015B15	22nH
L0410	2414015B15	22nH
L0411	2414015B15	22nH
L0412	2414017N20	47nH
L0413	2414017N28	220nH
L0414	2414015B17	18nH
L0503	2414015B27	390nH
L0504	NOT PLACED	–
L0506	2414032B66	820nH
L0602	2414032K23	2.7uH
L0603	2414032D20	270nH
L0604	2466505A01	10uH
L0605	2466505A01	10uH
L0608	2414032B76	4.7uH
L0700	2460592A01	17nH
L0702	2479990G01	33.47nH
L0705	2414017N26	150nH
L0706	2460592A01	17nH
L0707	2460592A01	17nH
L0708	2460592A01	17nH
L0709	2414017N26	150nH
L0710	2460592A02	12.5nH
L0711	2414017N26	150nH
L0712	NOT PLACED	–

Circuit Ref	Motorola Part No.	Description
L0714	2479990N01	43.67nH
L0715	2414017N26	150nH
L0716	2414017N27	180nH
L0717	2414017N06	3.3nH
L0718	NOT PLACED	–
L0719	2414017N22	68nH
L0720	2414017N06	3.3nH
L0721	2414017N11	8.2nH
L0722	2414032B60	390nH
L0723	NOT PLACED	–
L0900	2414032D30	1uH
L0901	2414032F42	470nH
L0902	2414032F42	470nH
L0903	2414032F23	12nH
L0904	2414032F22	8.2nH
L0905	2414017N24	100nH
M0700	2686201B02	HEATSINK
Q0100	4802197J95	NPN RF TRANSISTOR
Q0102	4815359H01	DUAL PNP
Q0106	4816134H01	ANALOG SWITCH
Q0107	4813970A59	P-CHANNEL MOSFET
Q0108	4815261H01	ANALOG SWITCH
Q0200	4885061Y01	NPN RF TRANSISTOR
Q0201	4885061Y01	NPN RF TRANSISTOR
Q0202	4802197J95	NPN RF TRANSISTOR
Q0300	4885061Y01	NPN RF TRANSISTOR
Q0301	4885061Y01	NPN RF TRANSISTOR
Q0302	4802197J95	NPN RF TRANSISTOR
Q0400	NOT PLACED	–
Q0401	4815267H01	DUAL PNP
Q0402	4885593U03	NPN RF TRANSISTOR
Q0403	4815270H01	ANALOG SWITCH
Q0405	4885593U03	NPN RF TRANSISTOR
Q0500	4802197J95	NPN RF TRANSISTOR
Q0501	4802197J95	NPN RF TRANSISTOR
Q0600	4805793Y10	NPN RF TRANSISTOR
Q0601	4813973A04	NPN DARLINGTON
Q0701	4816013H01	DUAL NPN/PNP
Q0702	48012048002	RF POWER AMPLIFIER, LDMOS
Q0703	4816548H01	N_CHANNEL LDMOS DRIVER
Q0704	4813973B02	PNP
Q0705	4816547H01	N-CHANNEL LDMOS PRE-DRIVER
Q0706	4815272H01	ANALOG SWITCH
Q0711	4815271H01	ANALOG SWITCH
Q0900	4815272H01	ANALOG SWITCH
Q0901	4813973A13	PNP
Q0902	4813973M07	NPN
R0100	0613952R66	0
R0101	0613952R66	0
R0102	0613952R66	0
R0103	0613952R66	0
R0104	0613952R17	47K
R0105	0613952Q58	240
R0106	0613952Q83	2.7K
R0107	0613952Q57	220
R0108	0613952Q80	2K
R0109	0613952R66	0
R0110	0613952Q42	51
R0111	0613952R66	0
R0113	0613952R01	10K
R0114	0613952Q80	2K
R0115	0613952R66	0
R0116	0613952R66	0
R0117	0613952R12	30K
R0118	0613952R66	0
R0119	0613952Q35	27
R0120	0613952R01	10K
R0122	NOT PLACED	–
R0123	0613952R19	56K
R0125	0613952R66	0
R0126	NOT PLACED	–
R0127	0613952Q49	100
R0128	0613952R66	0
R0131	0613952Q58	240
R0134	0613952Q35	27
R0139	0613952Q78	1.6K
R0140	0613952Q31	18
R0144	0613952R01	10K
R0146	0613952R66	0
R0147	NOT PLACED	–
R0148	0613952Q60	300
R0155	0613952R66	0
R0156	NOT PLACED	–
R0157	NOT PLACED	–
R0158	NOT PLACED	–
R0159	0613952R01	10K
R0160	0613952R25	100K
R0161	0613952R25	100K
R0170	0613952R66	0
R0201	0613952Q85	3.3K
R0202	0613952Q75	1.2K
R0203	0613952Q75	1.2K
R0204	0613952Q95	8.2K
R0205	0613952Q49	100
R0206	0613952R05	15K
R0207	0613952Q25	10
R0208	0613952Q42	51
R0210	0613952Q89	4.7K
R0211	0613952R66	0
R0212	0613952R66	0
R0213	0613952R01	10K
R0216	0613952Q51	120
R0218	0613952R01	10K
R0219	0613952Q66	510
R0220	0613952Q25	10
R0221	0613952Q66	510
R0224	0613952Q92	6.2K
R0225	0613952Q94	7.5K
R0226	0613952Q49	100
R0229	0613952Q54	160
R0230	0613952Q89	4.7K
R0301	0613952Q85	3.3K
R0302	0613952Q66	510
R0303	0613952Q66	510
R0304	0613952Q95	8.2K
R0305	0613952Q49	100
R0306	0613952R05	15K
R0307	0613952Q33	22
R0308	0613952Q42	51
R0310	0613952Q89	4.7K
R0311	0613952R66	0
R0312	0613952R66	0
R0316	0613952Q46	75
R0319	0613952R32	200K
R0320	0613952R05	15K
R0321	0613952Q83	2.7K
R0324	0613952Q80	2K
R0325	0613952Q95	8.2K
R0326	0613952Q49	100
R0327	0613952R01	10K
R0329	0613952Q50	110
R0331	0613952R01	10K
R0332	0613952Q56	200
R0333	0613952Q35	27
R0334	0613952Q56	200
R0337	0613952R66	0
R0400	0613952R05	15K
R0401	0613952Q91	5.6K
R0402	0613958H55	180
R0403	NOT PLACED	–
R0404	0613952Q57	220
R0405	0613952Q91	5.6K
R0406	0613952Q83	2.7K
R0407	0613952G67	0
R0409	0613952Q75	1.2K
R0410	0613952R25	100K
R0411	0613958H55	180
R0412	0613952R25	100K
R0413	0613952Q69	680
R0414	0613952Q69	680
R0415	0613952Q69	680
R0416	0613952Q69	680
R0417	0613958H25	10
R0418	0613952Q77	1.5K
R0419	0613952Q83	2.7K
R0420	0613952Q83	2.7K
R0421	0613958H25	10
R0422	0613952K25	17.8
R0423	0613952L46	294
R0424	0613952L46	294
R0425	0613952Q75	1.2K
R0426	0613952Q83	2.7K
R0427	0613952Q25	10
R0428	0613952R01	10K
R0429	0613952Q69	680
R0430	0613952R01	10K
R0431	NOT PLACED	–
R0432	NOT PLACED	–
R0433	0613952R66	0
R0434	0613958H49	100
R0435	0613952R66	0
R0436	0613952Q67	560
R0437	0613952R66	0
R0438	0613952Q67	560
R0440	0613952R25	100K
R0441	0613952R25	100K
R0443	0613952R25	100K
R0444	0613952R25	100K
R0500	0613952Q90	5.1K
R0501	0613952Q61	330
R0502	0613952R08	20K
R0503	0613952R12	30K
R0508	0613952R19	56K
R0509	0613952Q89	4.7K
R0510	0613952R12	30K
R0511	0613952Q75	1.2K
R0512	0613952Q42	51
R0601	0613952Q45	68
R0602	0613952R01	10K
R0603	0613952Q80	2K
R0604	0613952R10	24K
R0605	0613952Q61	330
R0606	0613952Q42	51
R0607	NOT PLACED	–
R0608	0613952R66	0
R0609	0613952R66	0
R0610	0613952R66	0
R0611	0613952R66	0
R0612	0613952R66	0
R0613	0613952R66	0
R0614	0613952R66	0
R0615	0613952R66	0

Circuit Ref	Motorola Part No.	Description
R0616	0613952R25	100K
R0617	0613952R01	10K
R0618	0613952Q63	390
R0619	0613952R01	10K
R0620	0613952Q96	9.1K
R0621	0613952R66	0
R0622	NOT PLACED	–
R0623	NOT PLACED	–
R0624	0613952Q90	5.1K
R0625	0613952N69	51.1K
R0626	0613952N81	68.1K
R0627	0613952R66	0
R0700	0613958H44	62
R0701	0613958J74	0
R0702	NOT PLACED	–
R0706	0613958S51	120
R0709	0613959Q60	300
R0711	0613952H57	220
R0712	0613952H48	91
R0713	0613959H12	30K
R0714	0613952H46	75
R0715	0613952H46	75
R0718	0613952H25	10
R0719	0613959Q25	10
R0720	0613952H25	10
R0722	0613952H89	4.7K
R0724	0613952H79	1.8K
R0725	0613952Q59	270
R0726	0613952N01	10K
R0727	0613952H95	8.2K
R0728	0613952J01	10K
R0729	0613952J01	10K
R0730	0613952H73	1K
R0732	0613952H73	1K
R0734	0613952G67	0
R0735	0613959Y49	100
R0738	0613959Y42	51
R0739	NOT PLACED	–
R0740	0613952J25	100K
R0741	0613952J17	47K
R0742	0613959Q25	10
R0743	0613958S73	1K
R0744	NOT PLACED	–
R0745	0613952H65	470
R0747	0613952H89	4.7K
R0748	0613952J19	56K
R0749	0613952G67	0
R0750	0613952J07	18K
R0751	0613952J08	20K
R0752	0613952G67	0
R0753	0613952H73	1K

Circuit Ref	Motorola Part No.	Description
R0754	0613952H25	10
R0755	0613952H25	10
R0756	0613952J25	100K
R0757	0613952J17	47K
R0759	0613952H25	10
R0760	0613952Q83	2.7K
R0761	0613952G67	0
R0762	0613958S29	15
R0763	0613958S29	15
R0764	0613958S29	15
R0765	0613958S29	15
R0766	0613958S29	15
R0768	0613958S29	15
R0769	0613958S29	15
R0770	0613958S29	15
R0771	0613958S29	15
R0773	0613958S29	15
R0775	0613952G67	0
R0777	0613952H25	10
R0900	0613952N73	56.2K
R0901	0613952N62	43.2K
R0902	0613952M50	3.24K
R0903	0613952N34	22.1K
R0906	0613952R66	0
R0907	0613952R66	0
R0909	0613952N62	43.2K
R0910	0613952H73	1K
R0911	0613952N01	10K
R0912	0613952N30	20K
R0913	0613952R66	0
R0914	0613952P26	182K
R0915	0613952N81	68.1K
R0916	0613952M59	4.02K
R0917	0613952H91	5.6K
R0918	0613952H63	390
R0919	0613952R15	39K
R0920	0613952N42	26.7K
R0921	0613952H81	2.2K
R0922	0613952R14	36K
R0923	0613952R66	0
R0924	0613952H91	5.6K
R0925	0613952H91	5.6K
R0926	0613958H53	150
R0927	0613952H42	51
R0928	0613958H39	39
R0929	0613958H39	39
R0930	0613952R07	18K
R0931	0613952R66	0
R0936	0613952N66	47.5K
R0937	0613952N21	16.2K
R0938	0613952R66	0

Circuit Ref	Motorola Part No.	Description
R0940	0613952R66	0
R0941	0613952R66	0
R0942	0613952M81	6.81K
R0943	0613952N58	39.2K
R0944	0613952R66	0
R0946	0613952M51	3.32K
R0947	0613952R66	0
R0950	0613952N01	10K
R0951	0613952N62	43.2K
R0954	0613952R40	430K
R0955	0613952P01	100K
R0960	0613952H82	2.4K
R0970	0613958H56	200
R0971	0613958H55	180
R0973	NOT PLACED	–
R0974	0613958H55	180
R0975	0613958H56	200
R0976	0613952H53	150
R0977	0613952H53	150
R0978	0613952G67	0
R0979	0613952G67	0
R0981	0613952R07	18K
R0982	0613952R01	10K
R0983	0613952R01	10K
R0984	NOT PLACED	–
R0985	0613952N81	68.1K
R0986	0613952N81	68.1K
R0987	0613952N81	68.1K
R0988	0613952Q42	51
R0989	NOT PLACED	–
R0994	NOT PLACED	–
R0995	NOT PLACED	–
RT0908	0615585H01	47K
RT0953	0615585H01	47K
SH0100	2615362H01	SHIELD
SH0101	2615362H01	SHIELD
SH0300	2615362H01	SHIELD
SH0301	2615362H01	SHIELD
SH0500	2615576H01	SHIELD
SH0900	2686423Z02	SHIELD
SH0901	2686425Z02	SHIELD
T0400	2515121H01	BALUN XFMR
T0401	2515121H01	BALUN XFMR
U0100	5104932K08	IC, FRACN SYNTHESIZER
U0101	5114000B59	ANALOG SWITCH
U0201	4815267H01	DUAL PNP
U0303	NOT PLACED	–
U0304	4815267H01	DUAL PNP
U0600	5102495J14	IC, RF ASIC
U0601	5115391H01	VOLTAGE REGULATOR
U0700	4802246J29	PA PRE-DRIVER

Circuit Ref	Motorola Part No.	Description
U0900	5115147H01	DUAL OPAMP
U0901	5115147H01	DUAL OPAMP
U0940	5180390L83	IC, PA CONTROLLER
U0941	5115391H01	VOLTAGE REGULATOR
U0942	5114004A35	VOLTAGE DETECTOR
U0943	5178286A01	IC, VOLTAGE DETECTOR
VR0700	4813977M11	DIODE, 5.6V ZENER
Y0100	5116032H01	0.5 PPM 16.8 MHZ TCXO (GPS Models Only)

XPR 8300/XPR 8400 MOTOTRBO Repeater

Chapter 9

UHF2 (450–512 MHz)

1–40W

Service Information

Issue: September, 2010

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Chapter 9 - UHF2 High Power Service Information

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Section 1

THEORY OF OPERATION

1.0 Introduction

The MOTOTRBO repeater consists of two MOTOTRBO mobile radios; one to act as a receiver, and one to act as a transmitter and controller. Both of these radios contain specialized software that allows them to function together as a repeater. The Repeater also contains a Repeater Indicator board and a Connector board. A block diagram of the repeater is shown in Figure 1-1. The Repeater Indicator board contains the Front-Panel LED circuitry as well as an Ethernet interface. The Connector board is a multifunctional board that is primarily used to pass signals to and from modules inside the chassis to the outside of the chassis.

The Repeater contains the following assemblies and sections:

- Receiver
- Transmitter
- Repeater Indicator Board
- Connector Board
- Fan
- AC/DC PSU

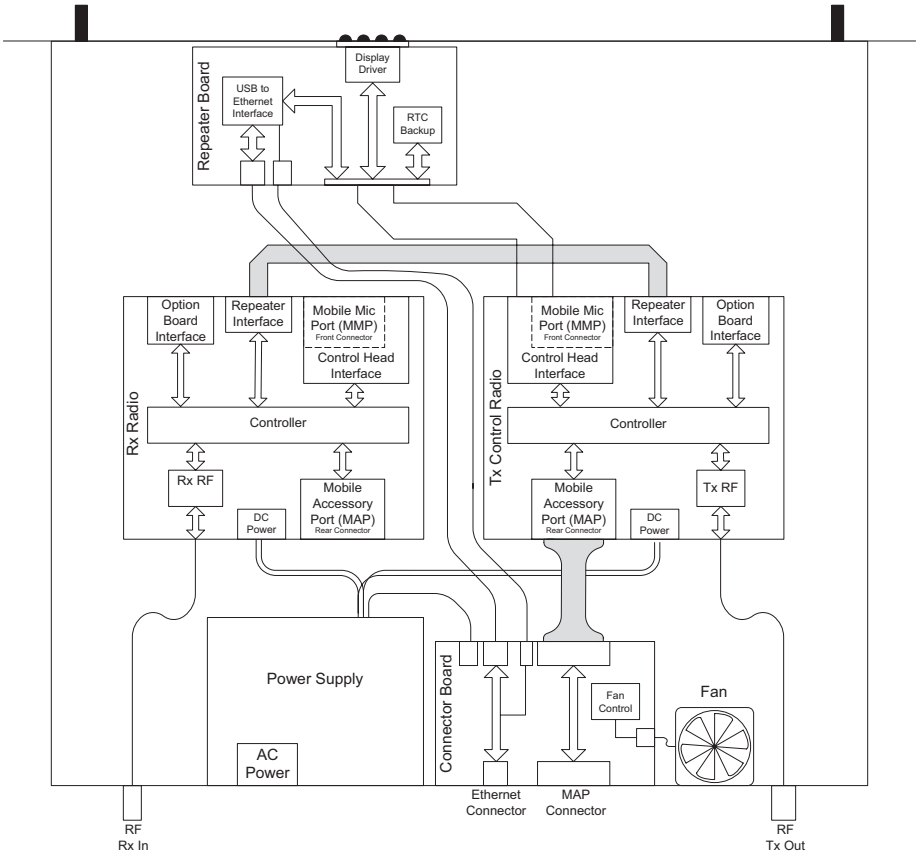


Figure 1-1 Repeater Block Diagram

1.1 Receiver

The receiver uses a transceiver board which is based on the mobile radio's transceiver board. The board uses the same PCB as the mobile radio board, but is populated differently to work in the Repeater application. Only the receiver related functions of the board are utilized in this application, even though the circuitry for transmit also exists on the board.

The Repeater receiver is identical in functionality to the mobile radio's receiver differing only in the audio path. On the mobile radio, the decoded audio is sent to a DAC, and then to the speaker. In the Repeater, this audio information is sent out through the SSI link to the transmit radio to be processed. Details of the receiver theory of operation can be found in Section 3.1.

1.2 Transmitter

The transmitter consists of a transceiver board which is based on the mobile radio's transceiver board housed in a transmit chassis. The transmit radio is identical to the receive board from a hardware standpoint. The difference between the two is the software that is running on them, how they are connected within the Repeater, and an additional heat sink that is mounted to the chassis. The added heatsink and the Repeater fan allow the transmitter to be cooled sufficiently when operating in a 60°C, full-duty cycle environment.

The transmit radio acts as the master controller for the Repeater. It handles all controller related tasks for the Repeater, including management of the receive radio. The transmit radio is responsible for processing the audio sent from the receive radio and repeating it out at the Tx frequency. Details of the transmitter theory of operation can be found in Section 3.2.

1.3 Repeater Indicator Board

The Repeater Indicator board contains circuitry to drive the front panel indicator LEDs, an RTC battery for the RTC in the transmit radio, as well as an Ethernet controller.

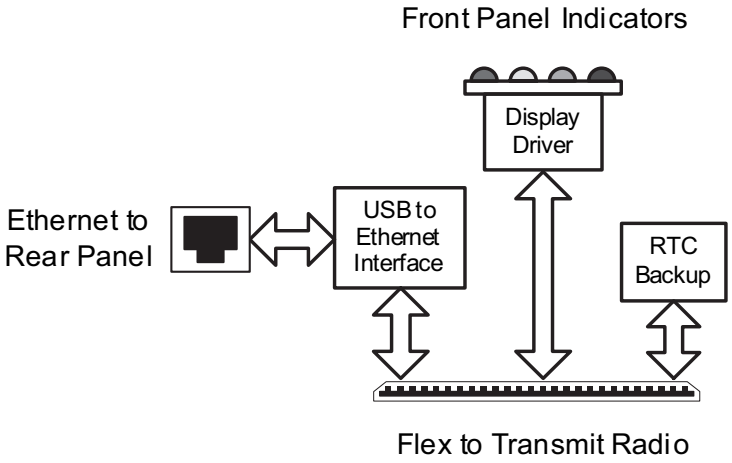


Figure 1-2 Repeater Indicator Board Block Diagram

All of the indicator LEDs that are on the front of the Repeater chassis reside on the Repeater Indicator board. Each is controlled by a shift register (U6) data out signal and a digital transistor. The shift register accepts serial data in from the transmit radio's OMAP processor via a SPI bus. A 74LVC07 buffer (U9) level shifts these signals from 3.3 V to 1.8 V.

The Repeater Disable LED is a dual-purpose LED that is hardware controlled initially at power-up. As soon as VBUS power is available on the Repeater Indicator board, the hardware circuitry for the Repeater Disable LED will cause it to blink periodically. When the software initialization is completed by the firmware, the blink circuitry will get disabled by the firmware. At that point, the Repeater Disable LED can be used for its intended purpose of displaying when the Repeater Disable function is turned on.

The power LED is the only LED that is not controlled by the software. This bi-color LED gets turned on green when the 13.8 V output from the power supply is valid. It turns on red when A/C power is lost, and the repeater's backup battery is used.

The Real Time Clock (RTC) battery (M1) is connected to the transmit radio through the Control Head (J1, pin 30).

Details of the Ethernet Controller can be found in Chapter 2.

1.4 Connector Board

The Connector board has two purposes: provide a place for the Repeater's MAP and Ethernet connectors to be mounted and a location for the Repeater's fan control circuitry.

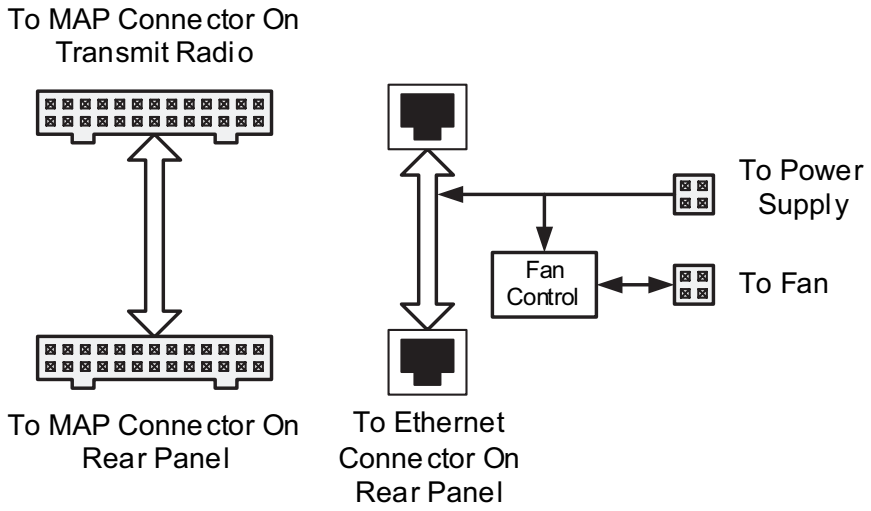


Figure 1-3 Connector Board Block Diagram

1.5 Fan

The fan control logic is provided by the fan controller IC (U51). This is a device from Cypress Semiconductor. There are basically two functions provided by the fan controller. First, it provides a PWM output based on a temperature input, and secondly, it provides detection of fan failure based on the fan tachometer reading.

The Repeater's internal chassis temperature is measured with an LM50 precision temperature sensor IC (U52). This IC outputs a voltage that is linearly proportional to temperature at 10 mV/°C, and with an offset of +500 mV. The output voltage of the LM50 ranges from +200 mV at -30°C to 1.1 V at +60°C.

The fan controller IC (U51) controls the speed of the fan by adjusting the PWM output (pin 1) from 0% to 100%. As long as the fan continues to work, pulses are output from the fan and input to the fan controller (pin 2).

1.6 AC/DC Power Supply

The Repeater uses the PMPN4001A switch-mode, Power Supply Unit (PSU). It is capable of 200 W and designed for a 50 W UHF or VHF repeater system. This supply has UL, CE, and TUV regulatory approvals and is usable in all regions by using the correct line cord. The AC input is auto-ranging with no manual switch being specified to operate from 90 V-270 V and 47 Hz-63 Hz. It outputs a nominal voltage of 13.8 V with a voltage tolerance of +/- 5%.

It has Power Factor Correction circuitry and is rated at 15 A across the whole operating temperature range of -30°C to +60°C. It also has a built-in battery revert circuit with a float output available for maintaining the charge on a battery and has UL, CE, & TUV approvals. The battery revert connector is accessible in the back of the power supply.

The supply has over-load, over-voltage, and over-temperature protection. In an overload condition, the PSU goes into a hiccup mode where it recovers automatically after the fault condition is removed. During an over-voltage condition, the PSU shuts down and will have to be re-powered on to recover. In an over-temperature condition, the PSU also shuts down, but will recover after the temperature goes down.

The PSU is not designed to be field serviceable. If it is determined that the PSU is not functioning, the whole unit needs to be replaced.

2.0 Repeater Interconnections and Cables

Figure 1-4 shows the Cable interconnections inside the Repeater.

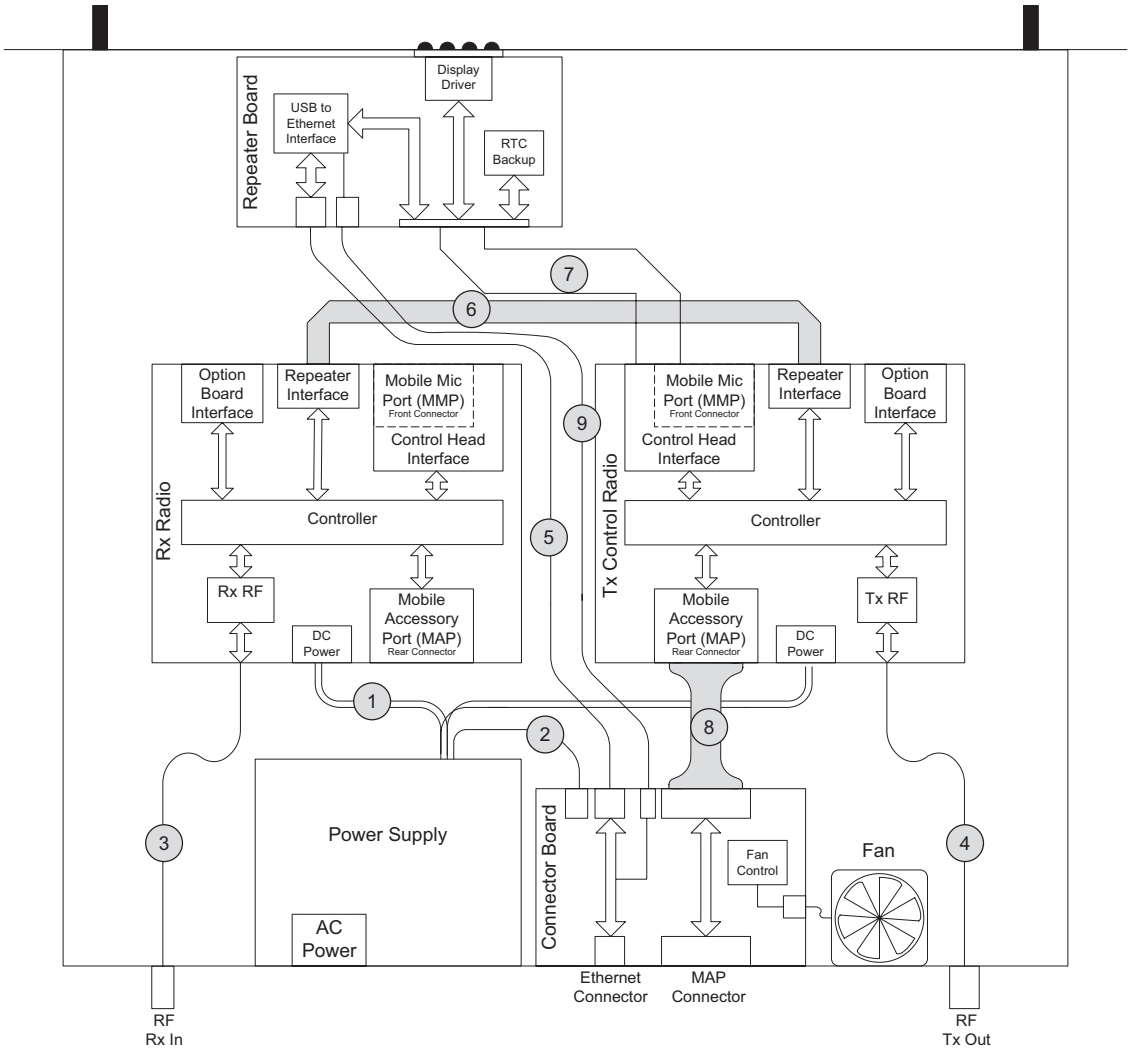


Figure 1-4 Repeater Cabling Diagram

The details of each of these cables/interconnections are as follows:

1. Two conductor DC power cables to the transmit and receive radios.
2. Six conductor DC power cable to the connector Board. Supplies power for the fan and Repeater Indicator board via cable 6.
3. RF Coax to connect the receive radio to the back of the Repeater. This cable has a BNC connector on the Repeater's rear panel.
4. RF Coax to connect the transmit radio to the back of the Repeater. This cable has an N type connector on the Repeater's rear panel.
5. CAT5 cable with RJ45 style connectors on both ends. This cable connects the Ethernet controller on the Repeater Indicator board to the Repeater's back panel and provides power from the Connector Board to the Repeater Indicator board for the LED indicators.

6. Eleven conductor flex cable. Provides the SSI connection between the transmit and receive radios. Refer to Section 1.5 for more details on this interface.
7. Thirty conductor flex cable. Provides the connection from the transmit radio to the Repeater Indicator board and includes SPI signals to drive the LED indicators, RTC backup supply, and the interface to the Ethernet controller.
8. Twenty six conductor cable. Provides the connection from the transmit radio's MAP to the MAP located on the Repeater's rear panel.
9. Eight pin conductor cable. Provides Ethernet LED signals from Repeater Board and HWID signals from Connector Board (Applicable for 32 MB repeaters only).

3.0 Mobile Radio's Theory of Operation

The sections that follow provide a detailed theory of operation for the UHF circuits in the two MOTOTRBO mobile radios. For details of the theory of operation and troubleshooting for the associated Controller circuits, refer to the Controller Section of this manual.

3.1 UHF2 (450–512 MHz) Receiver Circuitry

The UHF Band 2 receiver is configured as a dual-conversion superheterodyne receiver, capable of both FM and 4-level FSK demodulation. Its primary features are tunable filtering in the front-end and advanced DSP (digital signal processing) for audio recovery. The overall block diagram is shown below in Figure 1-5. The receiver in general can be divided into three sections, front-end, back-end, and DSP.

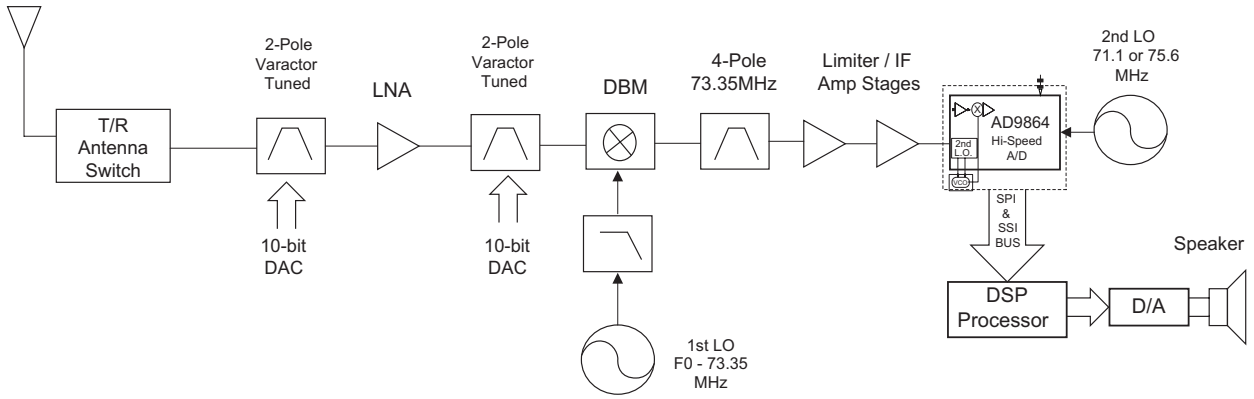


Figure 1-5 Receiver Block Diagram

3.1.1 Receiver Front-End

RF energy is routed from the antenna through the External Connector (J0700) to a pin diode transmit/receive antenna switch comprised of D0700, D0702, and D0703. The antenna switch is controlled in two different modes, either via the release of the PTT button in analog mode or by the main processor when in digital mode. When the radio is receiving, RF energy is routed from the T/R antenna switch to the front-end. The front-end provides rejection of any unwanted out-of-band energy and the initial frequency conversion to the first IF (Intermediate Frequency) of 73.35 MHz. Part of this rejection process is facilitated by two 2-pole/5-zero varactor-tuned filters, which provide well over 75 dB of image rejection. The center frequency is adjustable over the specified receive band and is controlled via a 10-bit DAC output that is scaled up by a voltage-doubler (Q0403) to

provide the needed linearity and voltage range during operation. On UHF Band 2, the varactor diodes are doubled-up on each side of the filter, which increases the overall IP3 of the filter, and thus, improves intermodulation rejection. One other important role of the front-end is to amplify the RF level coming into the receiver. The LNA (low noise amplifier), Q0402, provides the necessary gain to help maintain the needed S/N for weak signal operation.

The first frequency conversion process is accomplished with a class 2 double-balanced octo-quad diode ring mixer (D0405). The first local oscillator also feeds the mixer stage via an injection amplifier and harmonic filtering. The LO is driven by a two-stage injection amp (Q0302 & Q0405), providing a minimum of +18.5 dBm at the mixer. Between the VCO buffer (Q0302) and injection amplifier (Q0405) stages is a 3 dB pi attenuator to increase the reverse isolation of the injection lineup. This is needed to help mitigate any "pulling" on the main LO while in TDMA mode. The amplified LO power then passes through a 3-pole 2-zero low-pass filter stage before reaching the mixer. This filter reduces any unwanted products from the first LO that may cause unwanted spurious frequencies in the mixer output. The two filter zeros are optimized to reject the LO second harmonic, which can degrade the system IP2.

3.1.2 Receiver Back-End

After the first frequency conversion to 73.35 MHz, the IF signal passes though a crystal filter (FL0500) with a minimum 3 dB BW of 13 kHz. The signal is then routed through a 2-stage limiter/amplifier (Q0500 & Q0501). The limiter/amplifier stage applies the similar principle of strong and weak signal management as in the front-end, to help achieve a dynamic range of well over 100 dB without over-driving the DAC, internal to the AD9864 IC.

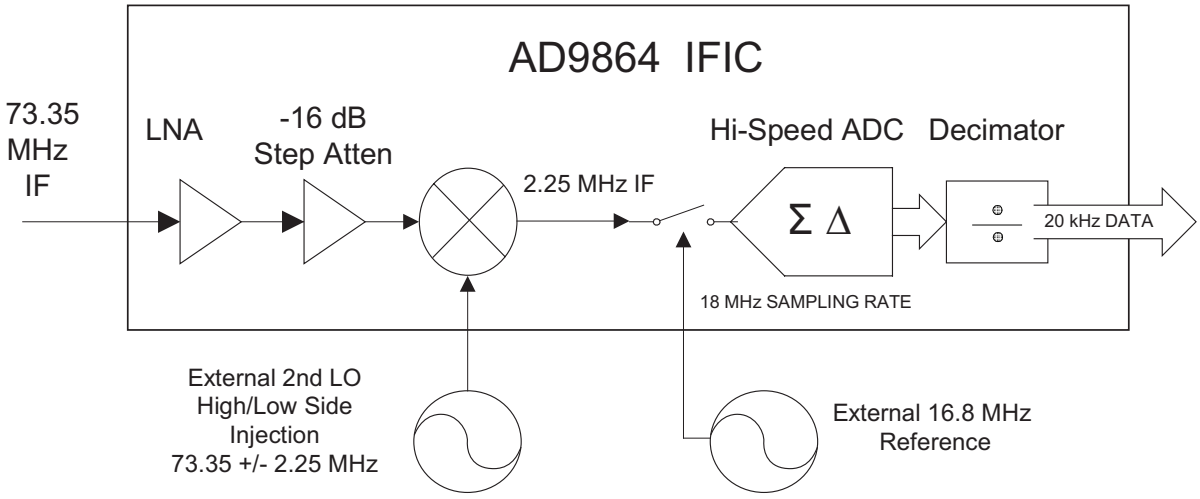


Figure 1-6 AD9864 Block Diagram

The 73.35 MHz IF signal finally reaches the AD9864 (U0600), as shown in Figure 1-6. Here another frequency down-conversion to 2.25 MHz takes place before the resultant RF voltage gets sampled by a Sigma-Delta converter. The Sigma-Delta converter is a high-speed DAC that outputs a 20 kHz data stream to the main DSP.

3.1.3 Receiver DSP (Digital Signal Processing)

Shown below in Figure 1-7 is the block diagram of the signal flow through the receiver back-end. All blocks within the dotted box represent the DSP software algorithms internal to U1000.

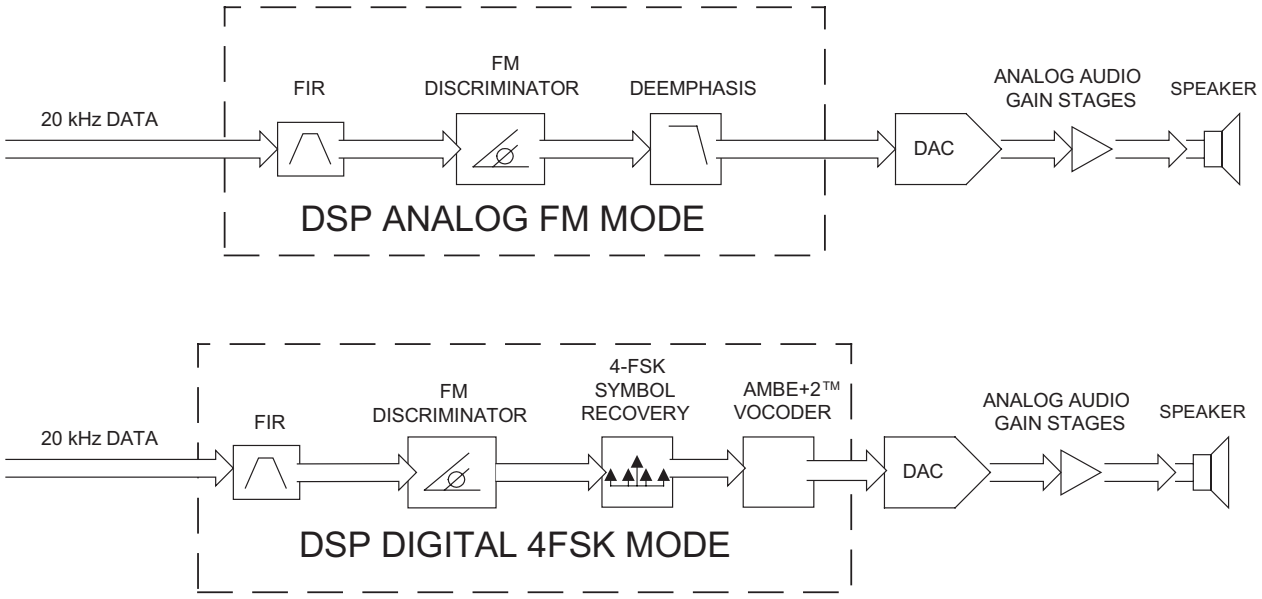


Figure 1-7 Signal Flow through Receiver Back-End

The DSP takes the incoming 20 kHz data-stream and passes the information through an FIR (Finite Impulse Response) filter, which provides rejection from any in-band adjacent channel interference. The remaining filtered data is then sent through the FM Discriminator routine. This routine is primarily responsible for base-band information recovery. Depending on whether the radio is in analog or digital mode determines the kind of signal processing used. If the radio is in analog mode, the recovered base-band data is sent through FM De-emphasis and sub-audible tone (CTCSS/ CDCSS) recovery subroutines in the DSP code. If the radio is in digital mode, the recovered base-band information is sent through a Symbol Recovery routine. The resultant data is then routed through a standard AMBE+2™ vocoder for processing.

The output signal from either the analog or digital mode signal processing (still represented by hi-speed data), is sent to a DAC (U3200), which converts the data stream back into usable audio. This stage drives several additional gain stages. These gain stages consist of an I2C audio attenuator (U3501) and a high-power audio PA (U3500) providing the user with at least 3 W of power through an internal speaker and 13 W of audio to an external speaker.

3.2 UHF2 (450–512 MHz) Transmitter Circuitry - 40 Watt

The Transmitter consists of the power amplifier (PA) circuitry and the power control circuitry. The power amplifier provides amplification of the signal from the VCO up to the desired output power. The power control block is responsible for ensuring that the desired output power level is maintained in both analog and digital modes, as well as protecting the power amplifier from damage due to heat, antenna mismatch, out-of-range battery voltage, and poor assembly. The output power of the transmitter can be set to operate between 1 W and 40 W.

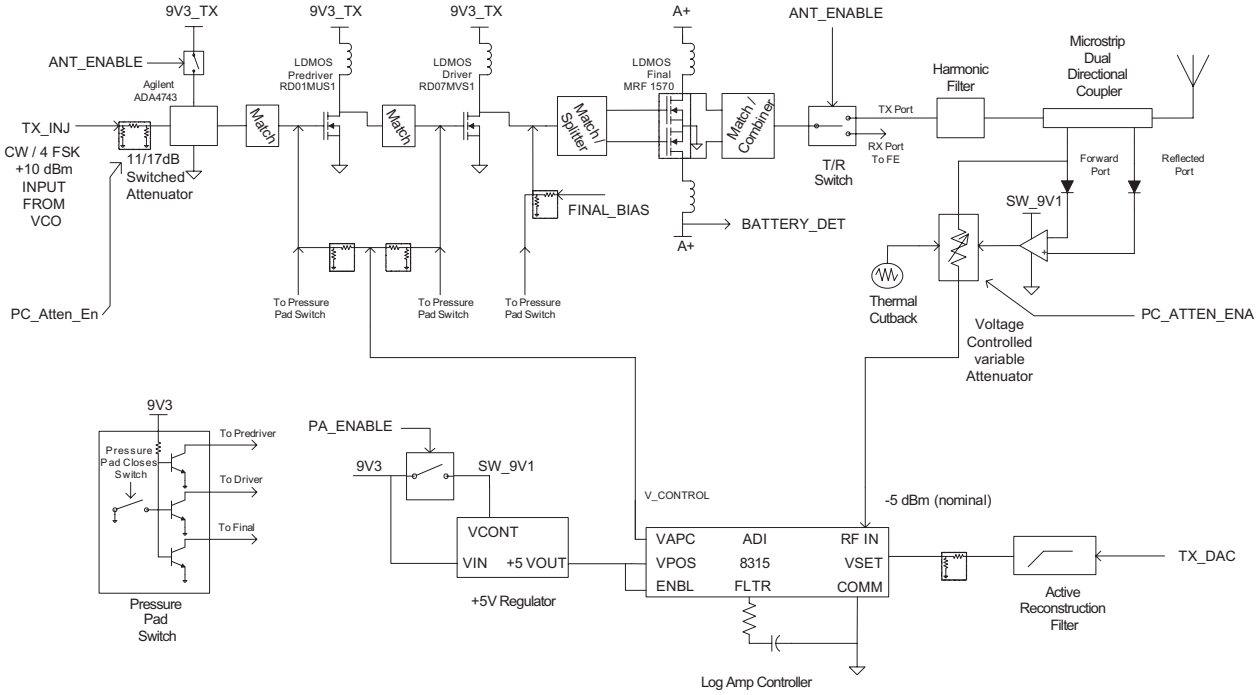


Figure 1-8 UHF Band 2 40 Watt High-Power Transmitter Detailed Block Diagram

3.2.1 Power Amplifier

The radio's 40 Watt power amplifier (PA) is a 4-stage amplifier which amplifies the output of the VCO to the required transmit power level. The first stage is an LDMOS (Lateral Double Diffuse MOS) 50 ohm fixed-gain block (ADA-4743, U0700) followed by the adjustable gain LDMOS pre-driver (RD01MUS1, Q0705), an adjustable gain LDMOS driver (RD07MVS1, Q0703), and the fixed-gain LDMOS final device (MRF1570, Q0702). A transmit/receive (T/R) switch and a harmonic filter complete the transmit lineup.

3.2.2 Input Stage (50 Ohm Fixed-Gain Block)

The first stage (ADA-4743, U0700) is an integrated circuit with internally matched 50 ohm input and output stages providing approximately 16 dB power gain. It provides reverse isolation between the PA and the VCO to lessen the risk of VCO load-pull and it also supplies appropriate power to the pre-driver stage. The ADA-4743 is biased at 33 mA during transmit by R0706, which is switched to 9V3_TX during Tx operation by Q0701 (controlled by Antenna_En). The ADA-4743 is preceded by a switchable resistive pad that is 11 dB in high-power mode and 17 dB in low-power mode.

3.2.3 Pre-Driver Stage

The next stage is a low-power, LDMOS device (RD01MUS1, Q0705), which delivers up to +27 dBm to the driver stage. Its gain is controlled by varying the gate bias voltage and varies from low gain up to approximately 14 dB power gain. The gate bias voltage is controlled in parallel with the driver stage by the V_cont signal.

The input match to this stage is a high-pass topology consisting of C0734, L0718, C0817, L0721, C0795, L0717, and C0785. High-pass matches are used where appropriate to minimize the chances of low frequency regeneration within the amplifier. R0759 and R0777 are required to improve the bandwidth of this circuit. The inter-stage match between the pre-driver and driver stages is comprised of L0720, C0786, and C0791 arranged in a high-pass topology. Additional pads are provided on the transceiver board to allow for possible engineering optimizations to this match. These are non-populated parts C0789, C0792, R0739, and C0794.

3.2.4 Driver Stage

The third stage is a medium-power, LDMOS device (RD07MVS1, Q0703), which delivers up to +36 dBm to the final device. Its gain is controlled by varying the gate bias voltage and varies from low gain up to approximately 11 dB of power gain. The gate bias voltage is controlled with the V_cont signal and is controlled in parallel with the pre-driver stage gain.

R0718, R0720, R0754, and R0755 are required to improve the bandwidth of the driver stage. The inter-stage match (as well as the power splitter) between the driver and final device uses a band-pass topology.

3.2.5 Final Stage

The final stage is a high-power LDMOS device (MRF1570, Q0702) consisting of two parallel, high-power devices within 1 plastic package. The package is mounted to a copper carrier to improve thermal conductivity to the chassis and also to more tightly control the RF load, allowing higher and more consistent maximum output power. This stage is biased at a quiescent current of 700 mA and operates with a fixed gain of approximately 10 dB, allowing up to +48 dBm of output power. The quiescent current is set by adjusting the Final_Bias signal. Both elements of this transistor are fabricated on the same semiconductor die and are well matched, allowing control via a single voltage.

Both the input and output matching circuits of this stage have extremely critical part location requirements. Any repairs must be done with care to ensure the replaced components are placed accurately and properly soldered. Of particular concern are input matching capacitors C0732, C0832, C0861, and C0761. The resistor networks at the gates of transistor Q0702, R0762 through R0773, improve the bandwidth of the circuit.

The output matching circuit and power combiner is comprised of C0807, C0719, C0806, C0746, C0726, and C0737, and associated microstrips fabricated on the printed circuit board. R0719 and R0709 are added as a preventative measure against half-carrier regeneration. Inductor L0712 and capacitor C0751 form a trap around 500 MHz to attenuate any ½ Fc signals.

If the final device fails and has to be replaced, R0719 should be carefully inspected to insure against any damage caused by the final device. Replacement of the final device requires that the bias voltage be re-tuned using the Customer Programming Software (CPS). Care must be taken not to damage the device by exceeding the maximum allowed quiescent current which is 1 A. The device can tolerate up to 5 A for brief periods of time without damage.

3.2.6 Antenna Switch

The Antenna Switch (T/R switch) has 2 modes, transmit mode and receive mode. An explanation of the functionality of each follows below:

Transmit mode: The antenna switch utilizes the existing dc feed (A+) to the final stage device (Q0702). Both PIN diodes, D0700 and D0702, are turned on during key-up by forward biasing them. Forward biasing is achieved by pulling down the voltage at the cathode end of D0702 to around 12.2 V (0.7 V drop across each diode). Q0704 is configured as a current sink that maintains the current through the antenna switch diodes at 50 mA, as set by VR0700 and R0738. The current sink is enabled during transmit mode by ANT_ENABLE asserting through Q0706 and associated circuitry. When the PIN diodes are conducting, an RF ground is formed at the anode of the lower PIN diode D0702, which places the series L0710 in parallel with C0803. The values of L0710 and C0803 are chosen so that they are in parallel resonance at the center of the transmit band, making them appear as an open circuit so that a 50 ohm power path is maintained through the top PIN diode to the harmonic filter. To further attenuate the Tx signal to prevent it from getting to the Rx front-end, a PIN diode pair (D0703) is placed in the Rx path. This diode pair shorts to ground in transmit mode so that the receiver sees a minimum of transmitter power.

Receive mode: The DC current through the PIN diodes is interrupted by turning off the current sink. The RF path now flows from the harmonic filter, through the matching circuit formed by C0803 and L0710, and then to the matching network C0766, C0767, R0701, and C0772. The additional shunt diodes (D0703) will be high impedance since no bias current is flowing from the switched Tx power line.

3.2.7 Harmonic Filter

Inductors L0706, L0707, L0708, and capacitors C0742, C0739, C0740, and C0738 form a 7-element low-pass filter to attenuate harmonic energy from the transmitter. R0713 is used to drain any electrostatic charges that might otherwise build up on the antenna. The harmonic filter also prevents high-level RF signals above the receiver pass-band from reaching the receiver circuits, improving spurious response rejection.

3.2.8 Directional Coupler

The dual-directional microstrip coupler is implemented at the harmonic filter output to sample both forward and reverse directed transmitter power. RF power from the transmitter PA passes through the microstrip coupler before reaching the antenna. Forward RF power is coupled to the U0940 log detector/controller via the voltage-controlled attenuator (VCA) stage consisting of pin diodes D0901, D0902, and D0903. The log detector/controller regulates the gain of PA stages Q0703 and Q0705 (via V_cont), thus ensuring that the forward power out of the radio is held to a constant value.

The directional coupler functions not only as part of the transmitter power regulation circuit but also as part of the VSWR load-detection circuitry. Its physical location close to the antenna connector allows accurate VSWR sense at the transmitter output. Forward and reverse coupled signals are rectified by D0904 and D0905, respectively. DC voltage FWD_DETECTED is proportional to RF power while REV_DETECTED is proportional to reflected RF power. The detected voltages are fed to the respective inputs of difference amplifier U0901. The difference amplifier output is applied to the variable attenuator control stage U0900-1. An abnormally high reflected power level, i.e., a damaged antenna, also causes an increase in the difference amplifier output voltage. This causes a reduction in attenuation by the VCA. As a result, the greater RF signal applied to the log detector / controller causes the controller to reduce the gain of PA stages Q0703 and Q0705. Transmitter power is thus reduced to prevent damage to the final device due to an improper load.

3.2.9 Power Control

The transmitter uses PA controller IC, U0940, to control the power output of the radio. A portion of the forward RF power from the transmitter is sampled by the directional coupler and delivered via the VCA to the RFIN port of the PA controller IC (pin 1). The PA controller, a log detector type, provides temperature-stable, high-accuracy control over a typical 50 dB dynamic range.

The MAKO IC contains a digital-to-analog converter (DAC), which provides a reference voltage (TX_DAC) at the input of reconstruction filter stage U0900-2. The filtered reference voltage at the output of U0900-2 is divided by the combination of R0942 and R0946 before reaching the VSET input of the PA controller IC (pin 3). Thermistor RT0953 is used in combination with R0954 to compensate reference voltage drift at operating temperature extremes. Reference voltage level is programmable through the SPI lines of the MAKO. This reference voltage is proportional to the desired power setting of the transmitter and is factory programmed at several points across the frequency range of the transmitter to offset frequency response variations of the transmitter's coupled power circuits.

The PA controller IC provides a dc output voltage at pin 7 (VAPC), which is divided to provide gate bias for PA pre-driver and driver stages. The 0-5 V range at U0940, pin 7, is applied as V_CONTROL to power-adjust the transmitter by controlling the gate bias of stages Q0703 and Q0705. Voltage divider combination R0727 and R0728 provides gate bias to Q0703 while divider combination R0750 and R0751 provides gate bias to Q0705. This adjusts the transmitter power output to the intended value. The ratio of each of these resistive dividers is chosen to insure that Q0703 and Q0705 are both running at their nominal design condition at rated output power. Variations in sampled forward transmitter power cause the PA controller IC to adjust the control voltage above or below its nominal value to raise or lower output power in order to maintain transmitter output power relative to the reference voltage applied to VSET.

3.2.10 Power Ramp Profile Control

In order to minimize the transient adjacent channel power at the transmitter's output, the ramped power follows a raised cosine profile. The PA controller IC has a linear slope function when scaled in dB/V. To achieve the desired raised cosine profile of the output power, the ramped reference voltage provided by the MAKO DAC follows a raised cosine approximation. The MAKO DAC reference output is low-pass filtered by the DAC reconstruction filter before it is applied to the VSET input of the PA controller IC.

Reconstruction filtering reduces spurious emissions in the RF spectrum as a result of the finite steps of the DAC. Loop filter capacitor C0926, in conjunction with resistor R0950 and the integrator within the PA controller IC, set the loop dynamics. The loop response has been optimized to achieve sufficient speed to follow the required ramping profiles while meeting switching transient requirements over varied power levels. Accurate control of the power-rise (ramp-up) and power-decay (ramp-down) characteristics minimizes splatter into adjacent channels.

3.2.11 Thermal Protection

Thermistor RT0908, in combination with R0902, form a voltage divider with the output proportional to the sensed transceiver board temperature in the vicinity of the transmitter driver and final devices. The voltage divider output is routed to an operational amplifier U0901-2, which provides a dc voltage via diode junction D0900 to control the attenuation level of the VCA stage. For the condition that the temperature threshold set by resistive divider combination R0901 and R0909 is reached, the VCA is driven to increase the RFIN signal at the PA controller IC (pin 1). This increase will cause the controller IC to adjust the PA control voltage below its nominal value to decrease transmitter output power. Temperature will be reduced by lowering transmitter output power relative to the reference voltage applied to VSET.

3.2.12 Out-of-Range Battery Protection

Transmitter power cutback under extended battery supply voltage operation is provided for by monitoring the battery supply in the controller circuit of the radio in order to change the VSET input of the PA controller IC (pin 3) for reduced transmitter output.

3.2.13 Pressure Pad Switch

The power control circuitry includes a safety switch (S0700) that consists of a conductive portion of the rubber pad, which pushes the RF final transistor Q0702 against the chassis. When the chassis cover and rubber pad are properly assembled, the conductive portion of the pad contacts a pattern on the transceiver board, electrically closing switch S0700. If the cover and pad are not in place, switch S0700 is open-circuited and the power control circuit is disabled, turning off the gate bias to Q0702, Q0703, and Q0705. This prevents thermal damage of the RF transistors which could occur if the transmitter is operated without adequate heat sinking.

3.3 Frequency Generation Circuitry

The synthesizer subsystem consists of the reference oscillator (Y0100), the fractional-N synthesizer IC (Tomahawk II, U0100), and the voltage controlled oscillator (VCO).

3.3.1 Reference Oscillator

The reference oscillator (Y0100) contains a temperature compensated crystal oscillator with a frequency of 16.8 MHz. A digital-to-analog (DAC) converter internal to U0100 (Tomahawk) and controlled by the microprocessor via serial interface (SPI), sets the voltage at the AUX_DAC output of U0100 (pin H6) to set the frequency of the oscillator. The output of the oscillator (pin 3 of Y0100) is applied to pin K5 (XOSC_BASE) of U0100.

3.3.2 Fractional-N Synthesizer

The Tomahawk II synthesizer IC (U0100) consists of a pre-scaler, a programmable divider and divider control logic, phase detector, charge pump, a D/A converter in the high frequency analog modulation path, an attenuator to balance the high and low frequency modulation paths, a serial interface for control (SPI), a serial interface for modulation (SSI), and a super filter for the regulated 2.45 V.

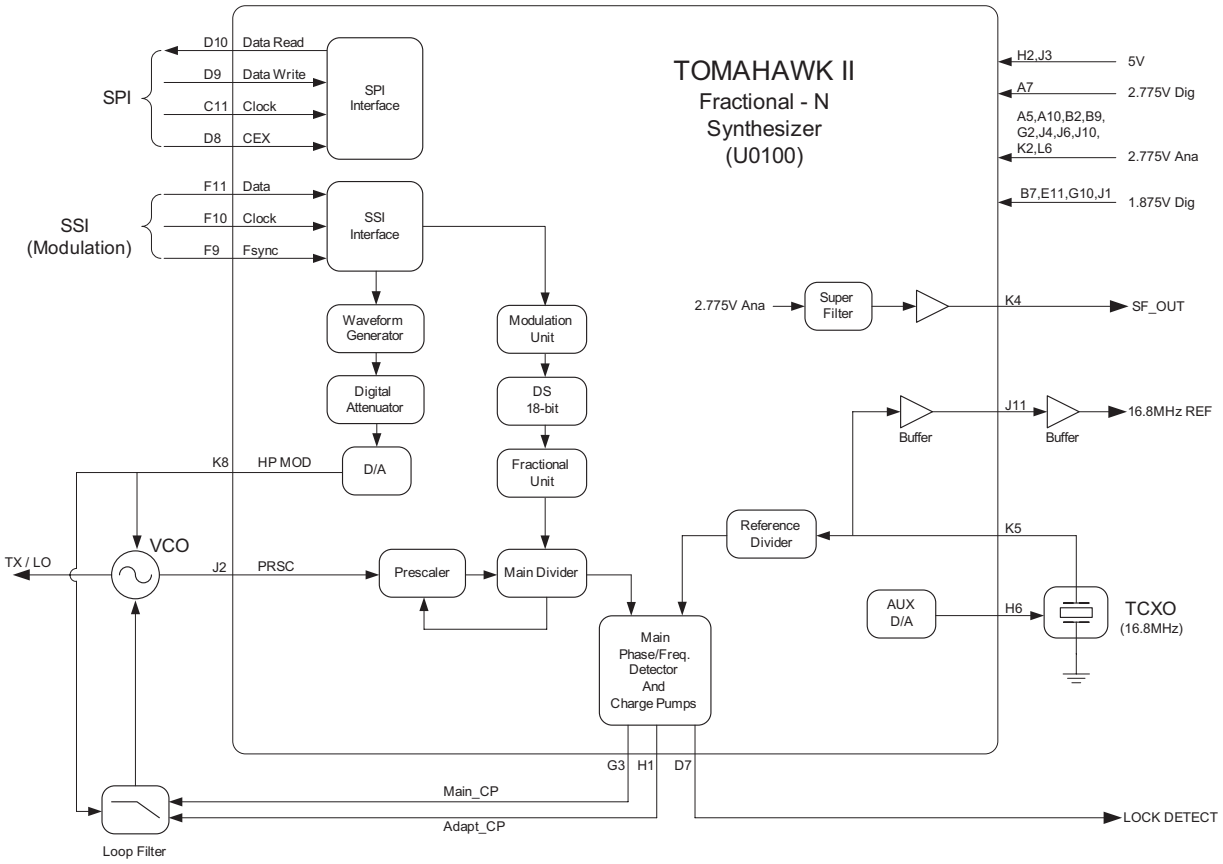


Figure 1-9 UHF Band 2 Synthesizer Block Diagram

A voltage of 2.775 V applied to the super filter input (U0100 pin J4) supplies an output voltage of 2.45 V (SF_OUT) at pin K4. This supplies the VCO and the VCO modulation bias circuit (via R0321). The super filter supply voltage is provided by the 2.775 V regulator within U3200. The synthesizer is also supplied by the 5 V regulator, U3002, another 2.775 V regulator within U3200, and a 1.875 V regulator within U3200.

The output signal LOCK (U0100-D7) provides information about the lock status of the synthesizer loop. A high level at this output indicates a stable loop. A discrete buffer amplifier (Q0100) provides a buffered 16.8 MHz reference frequency to other parts of the radio.

The serial programming interface (SPI) is connected to the microprocessor via the data lines SPI_DW (U0100-D9) and SPI_DR (U0100-D10), clock line SPI_CLK (U0100-C11), and chip enable line CEX (U0100-D8). The serial modulation interface (SSI) is connected to the DSP via the data line SDTX (U0100-F11), clock line TXCLK (U0100-F10), and frame sync line SFTX (U0100-F9).

3.3.3 Voltage Controlled Oscillator (VCO)

The voltage controlled oscillator (VCO) subsystem consists of four Colpitts oscillators (two each for Tx and Rx), a single-stage Tx buffer amplifier, a single-stage Rx buffer amplifier, oscillator bias control switches, and the modulation circuitry.

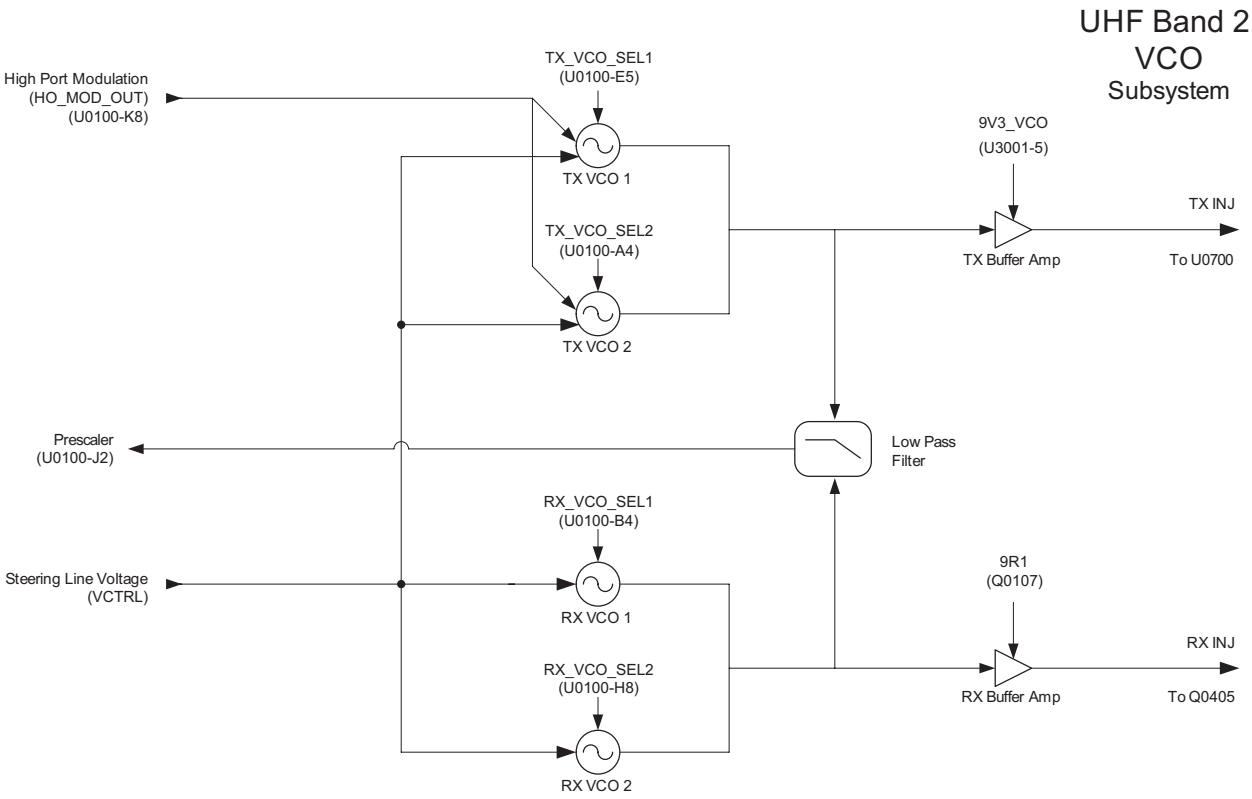


Figure 1-10 UHF Band 2 VCO Block Diagram

Due to the limited steering line voltage provided by the Tomahawk Synthesizer IC (U0100), the UHF Band 2 VCO design incorporates a total of four oscillators; two varactor-tunable Colpitts oscillators each for Tx and Rx. Each oscillator has a tuning range of 38.5 MHz, sufficient to cover the Rx and Tx frequency ranges of 376.65 MHz to 438.65 MHz and 450 MHz to 512 MHz, respectively. The oscillators resonate at fundamental operating frequencies. Four (active-low logic) general purpose output lines (GPO1, GPO2, GPO3, and GPO6) from the Tomahawk IC (U0100-B4, A4, E5, and H8) provide the control for independent bias selection to each oscillator (VCO_SEL) via the PNP transistor switches U0304 and U0201. The 2.45 V super filtered output, SF_OUT of the Tomahawk IC (U0100-K4), supplies the bias to the oscillators. A portion of the VCO output signal is lightly coupled through coupling capacitors C0331 and C0231, routed through a low-pass filter (formed by L0221, C0235, C0230, and C0233), and fed back to the M_PRSC input of the Tomahawk IC (U0100-J2).

High-port modulation is scaled through a voltage divider (comprised of R0319, R0320, and R0321) and applied to the Tx modulation varactor diode CR0300. The Tx VCO frequency is modulated via coupling capacitors C0310 and C0344. High-port modulation is also applied to the VCO steering line (through R0139, R0140, and C0166) which modulates the main VCO tuning varactors.

A discrete single-stage Tx buffer amplifier (comprised of the NPN transistor Q0302 and surrounding components) amplifies the signal from the Tx oscillator to the level required by the first stage of the transmitter power amplifier (U0700). The Tx buffer amplifier also provides sufficient isolation from any undesired load-pulling from the power amplifier. The bias for Q0302 is provided by the 9.3 V regulator U3001.

A discrete single-stage Rx buffer amplifier (comprised of the NPN transistor Q0202 and surrounding components) amplifies the signal from the Rx oscillator to the level required by the LO injection amplifier (Q0405). The Rx buffer amplifier also provides sufficient isolation from any undesired load-pulling from high input levels in the receiver front-end. GPO4 from the Tomahawk IC (U0100-D4) controls the transistor switch (comprised of Q0108 and Q0107) that enables the 9.1 V bias to Q0202 (via the 9.3 V regulator U3001).

3.3.4 Synthesizer Operation

The complete synthesizer subsystem is comprised mainly of the Tomahawk synthesizer IC, reference oscillator (crystal oscillator with temperature compensation), loop filter circuitry, VCO, and DC supplies. The VCO feedback signal, PRSC, is fed to pin J2 of U0100 (M_PRSC) via a low-pass filter (L0221, C0235, C0230, and C0233), which attenuates harmonics and provides the correct level to close the phase-locked loop.

The prescaler in the synthesizer IC (U0100) is a four-level prescaler capable of dividing by 4, 5, 6, and 7**.** The main loop N divider is configured to be an 8-bit divider. The divide-by-N portion of the main loop is set via the SPI. The fractional portion of the divider is realized using a 3-accumulator, 24-bit fractional divider. The SPI is used to set the desired divide ratio.

The output of the prescaler is applied to the main loop divider. The output of the main divider is sent to the phase/frequency detector, which compares the main divider's output signal with the reference signal. The reference signal is generated by dividing down the signal of the reference oscillator (Y0100). The output signal of the phase/frequency detector is a pulsed signal which is routed to the charge pumps. The main charge pump current is programmable through the SPI with its output at pin G3 of U0100 (MN_CP). The loop filter transforms this current into a steering voltage that is applied to the VCO.

To reduce lock time when new frequency data has been loaded into the synthesizer, an adapt charge pump providing much greater current than the main charge pump is turned on for a finite amount of time to quickly charge or discharge the loop filter capacitors to steer the VCO to the desired frequency. The output of the adapt charge pump passes to the loop filter via pin H1 of U0100 (MN_ADAPT_CP). When the synthesizer is within the lock range and the adapt timer runs out, the adapt charge pump is powered down and the main charge pump takes over. A settled synthesizer loop is indicated by a high level at signal LOCK (U0100-D7), which is routed to the microprocessor. Q0102 is configured as a current source to provide a steady 0.8 mA during the adapt period. U0101 is an analog switch that opens the adapt path slightly before the end of the adapt period to prevent the current from the current source from pushing the VCO off frequency.

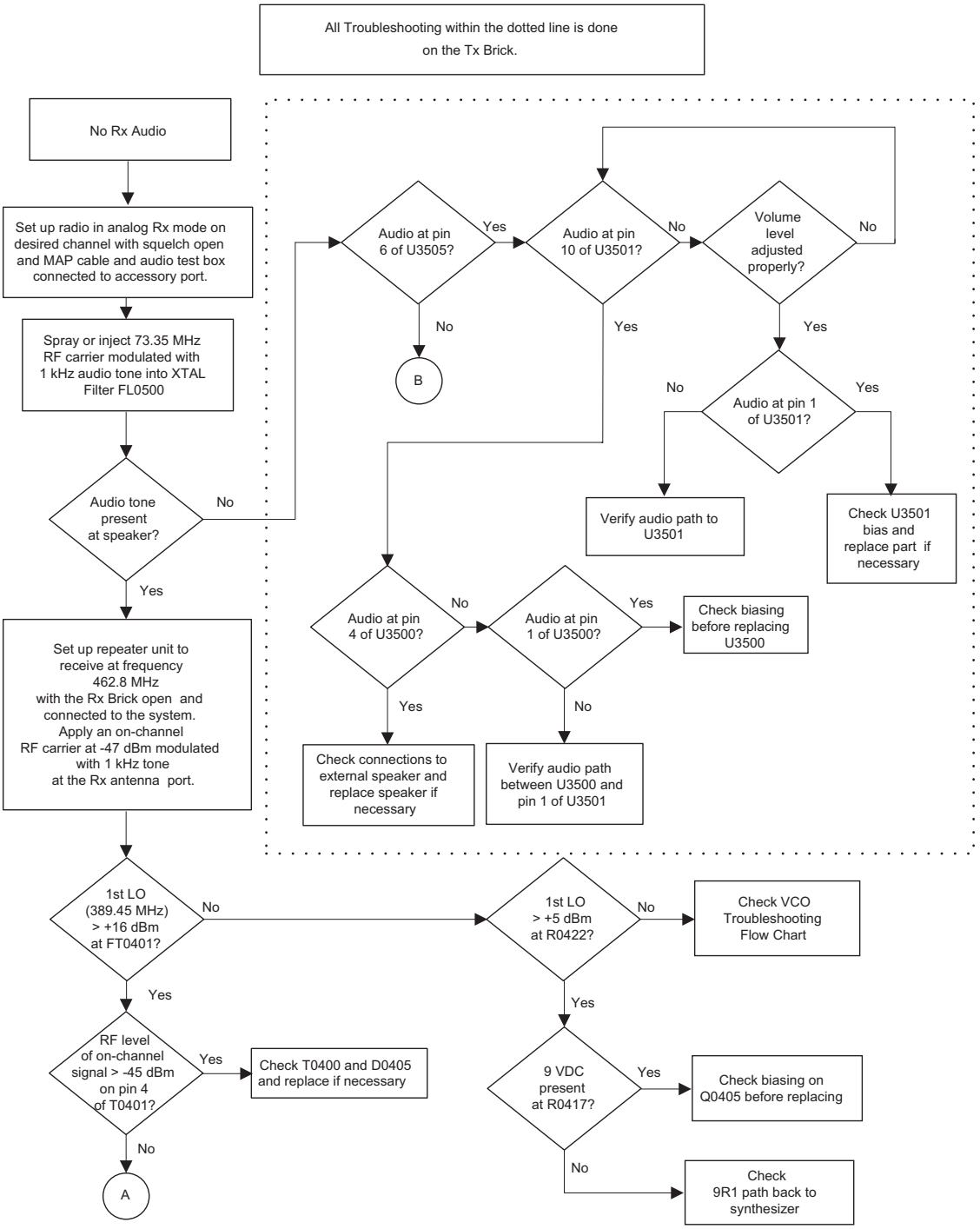
Modulation is performed by applying a digital data stream via the SSI bus from the DSP (U1000) to the synthesizer (U0100). In order to meet spurious and phase noise requirements, the PLL bandwidth was designed to be narrower than the full modulation bandwidth, therefore requiring the use of dual-port modulation. Internal to the synthesizer (U0100), low-port modulation is added to the fractional-N division numerator to trace out the modulation versus time while the high-port data stream passes through an interpolating waveform generator, a digital attenuator (for modulation balancing), and then is converted to an analog signal through a 10-bit DAC before modulating the VCO. This high-port analog modulation output (HP_MOD_OUT, U0100-K8) is connected to the VCO modulation varactor diode (CR0300) via C0360 and R0319, and to the loop filter via R0139, R0140, and C0166.

Notes

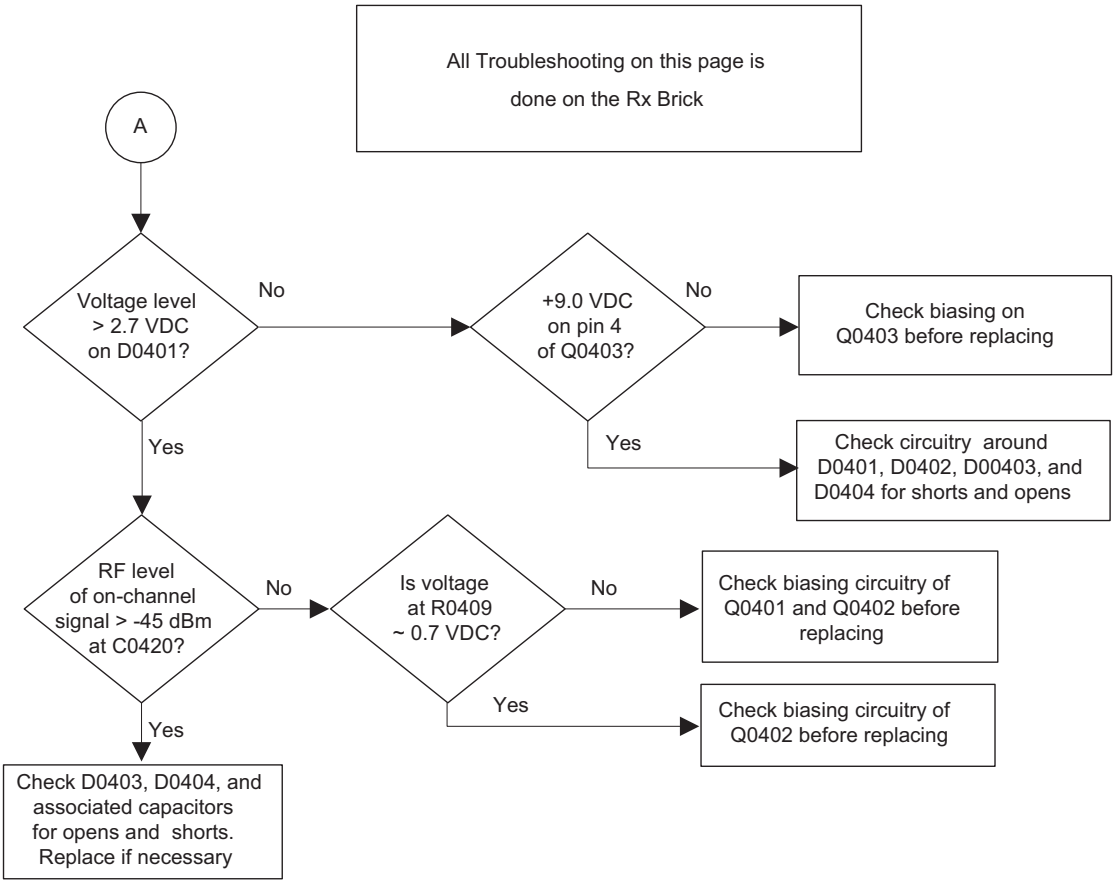
Section 2

TROUBLESHOOTING CHARTS

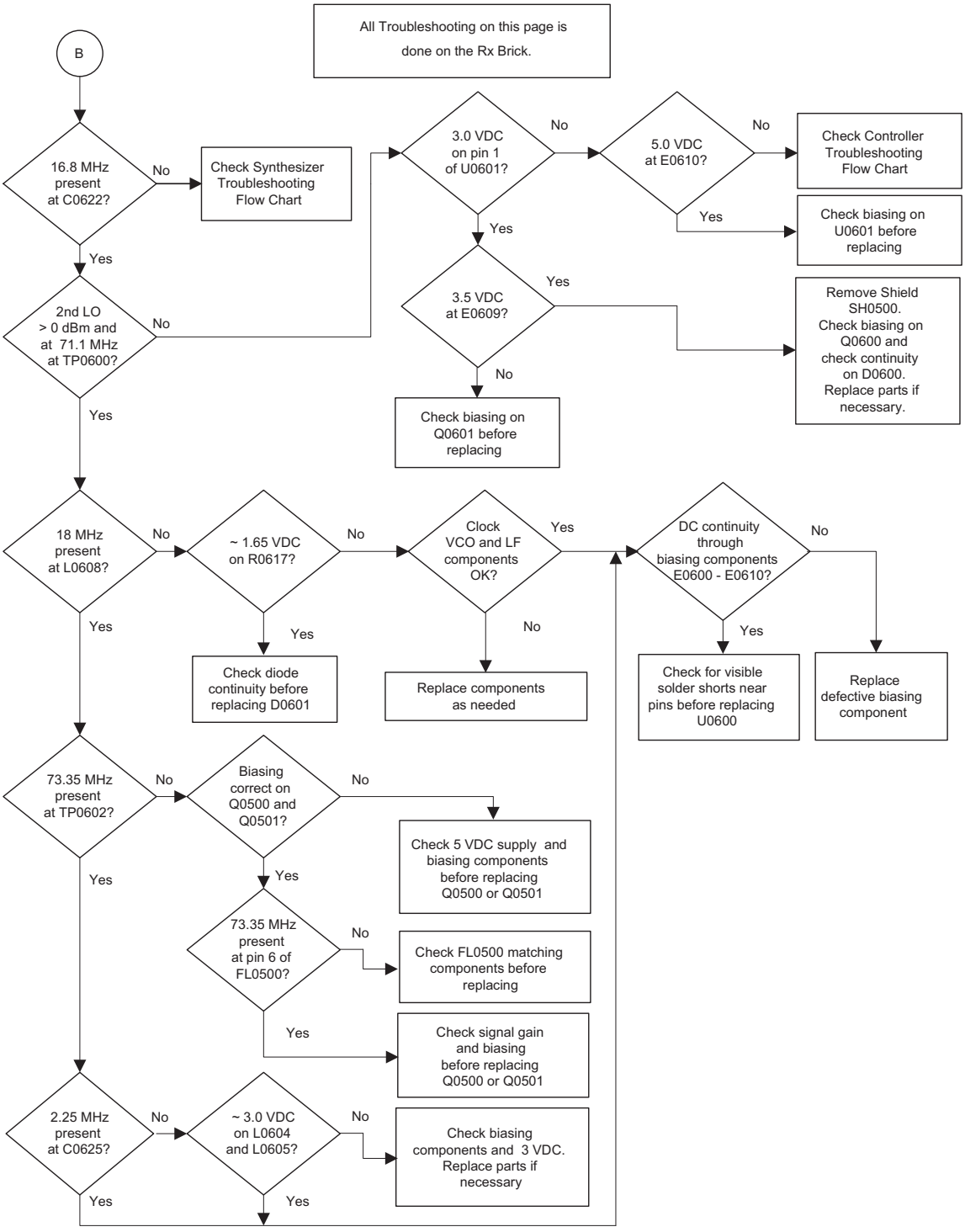
1.0 Troubleshooting Flow Chart for Receiver (Sheet 1 of 3)



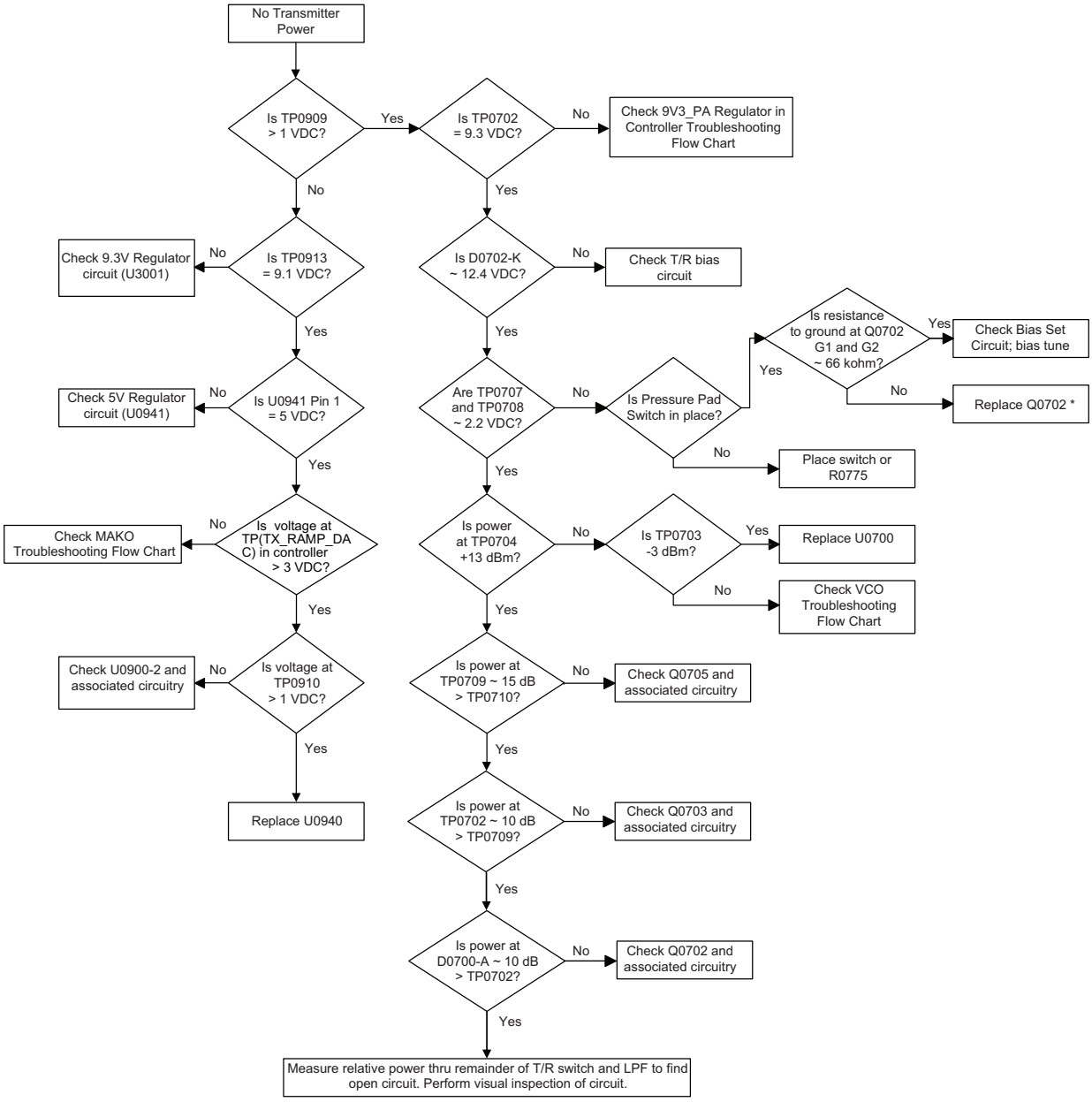
1.1 Troubleshooting Flow Chart for Receiver (Sheet 2 of 3)



1.2 Troubleshooting Flow Chart for Receiver (Sheet 3 of 3)



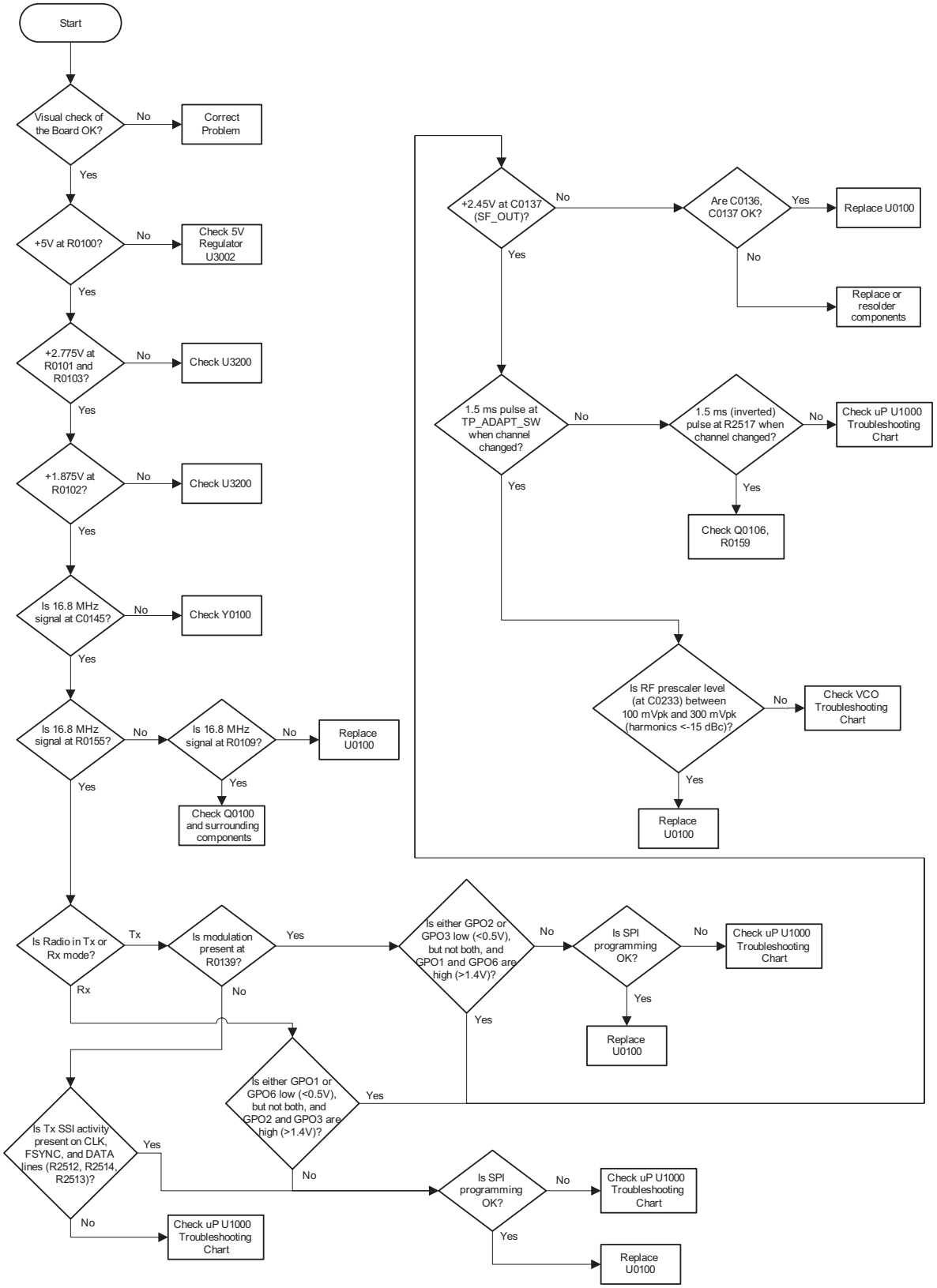
2.0 Troubleshooting Flow Chart for 40 Watt Transmitter



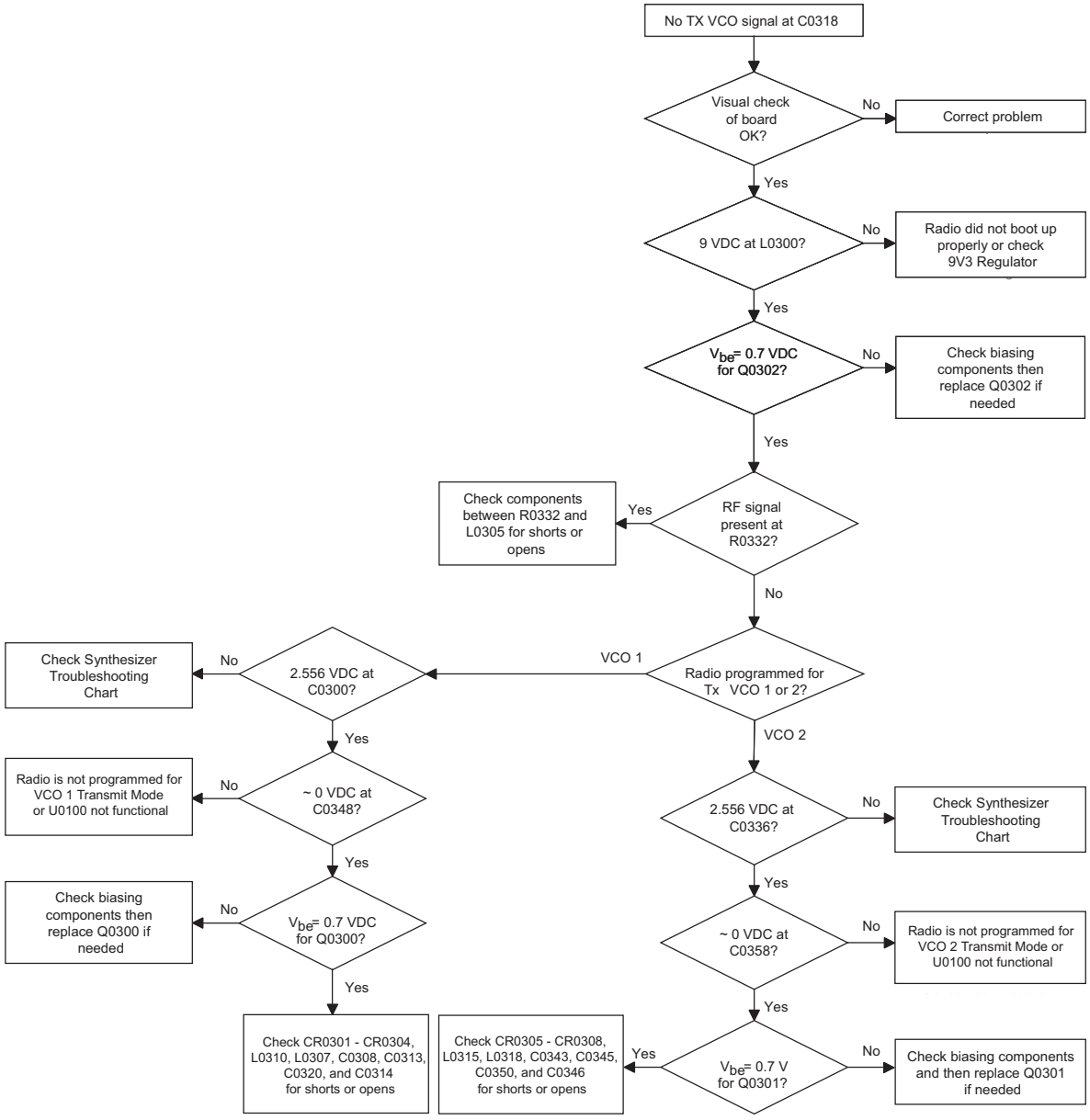
* Note: If Q0702 is replaced, radio must be bias set and power set.

1) Levels are during Transmit Mode (analog), 13.6V at battery connector, 50 ohm termination on transmitter.
2) Make sure PCB is screwed into chassis during these tests to avoid final device damage.
3) When making measurements within the transmitter using an RF power probe, be careful that the rating of the probe is not exceeded. The “relative” measurements listed in the flow chart should be made with a scope probe connected to a spectrum analyzer or similar instrument to avoid damaging sensitive power probes.

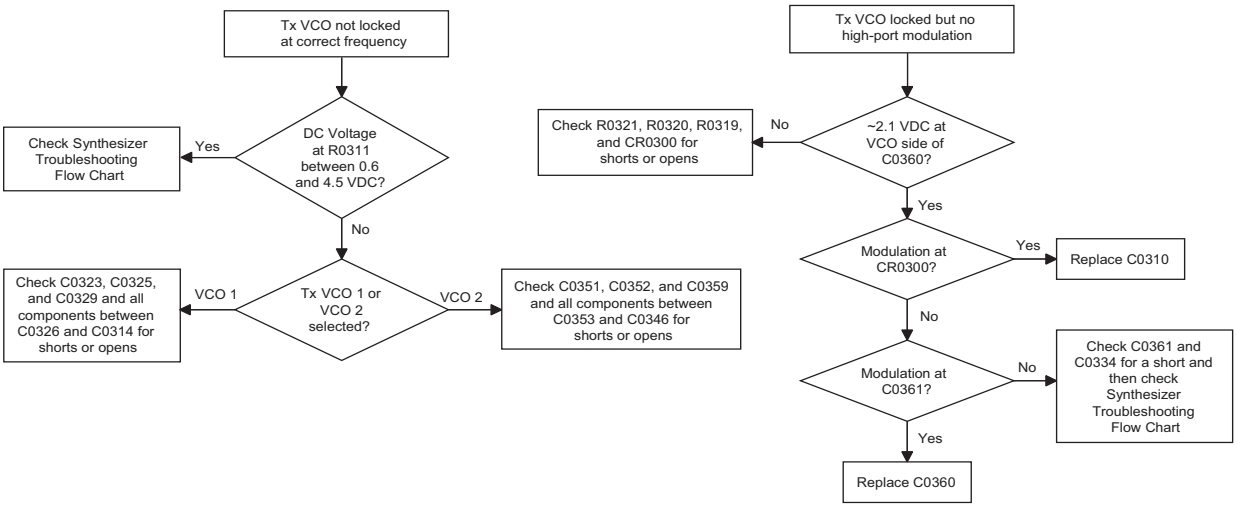
3.0 Troubleshooting Flow Chart for Synthesizer



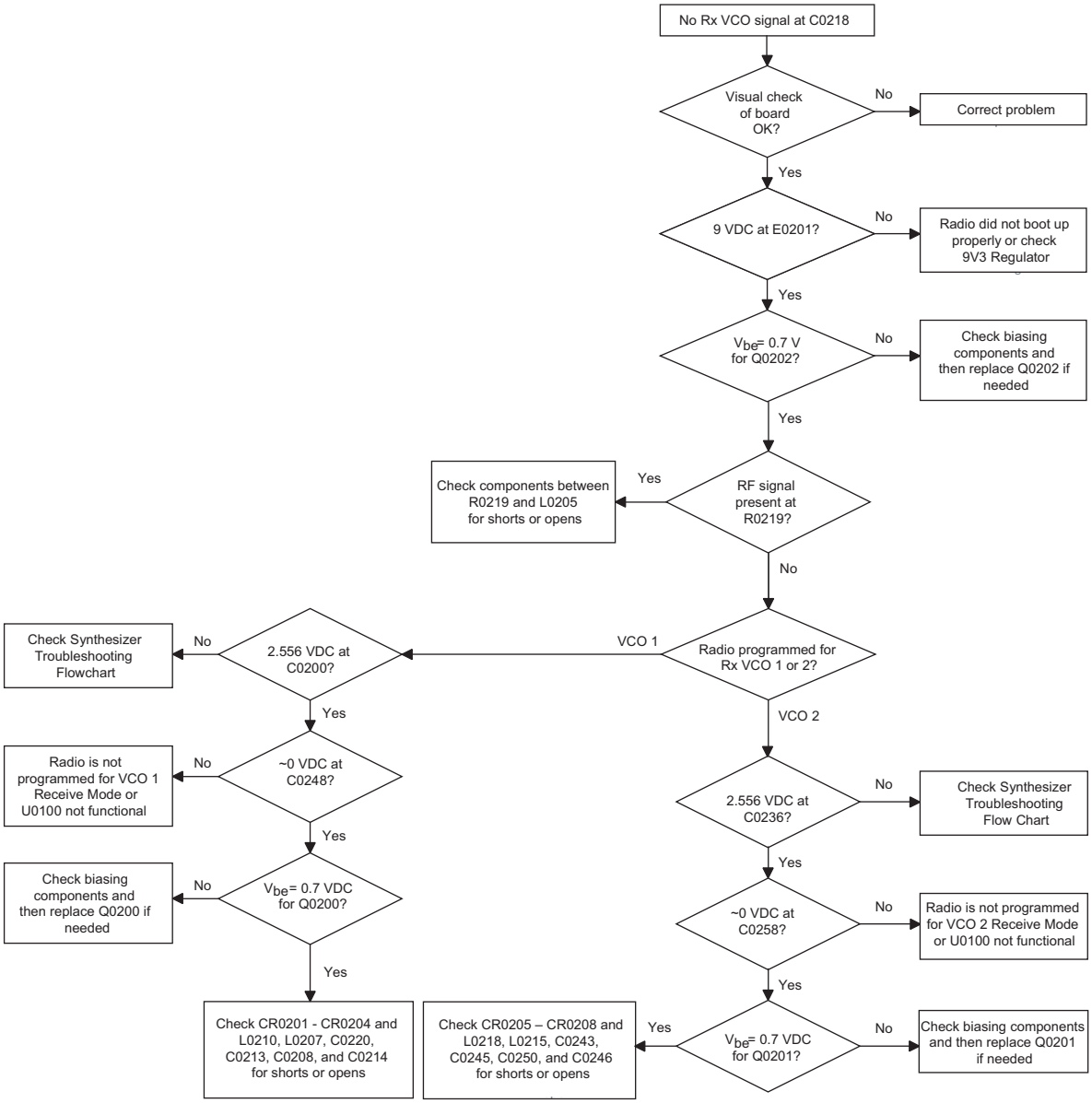
4.0 Troubleshooting Flow Chart for Tx VCO (Sheet 1 of 2)



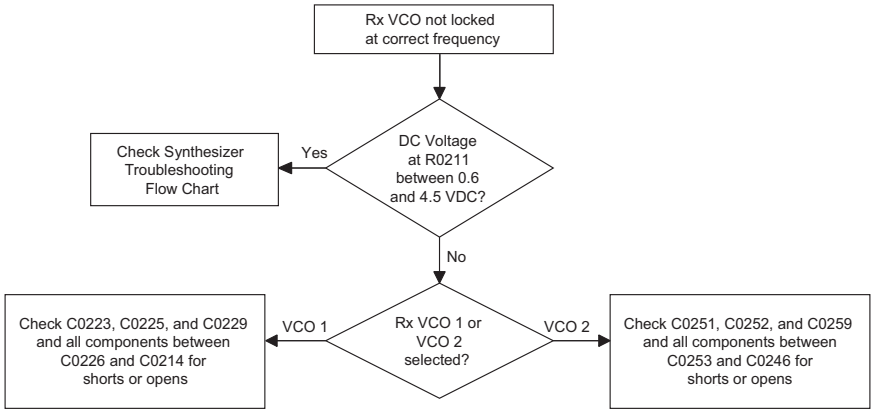
4.1 Troubleshooting Flow Chart for Tx VCO (Sheet 2 of 2)



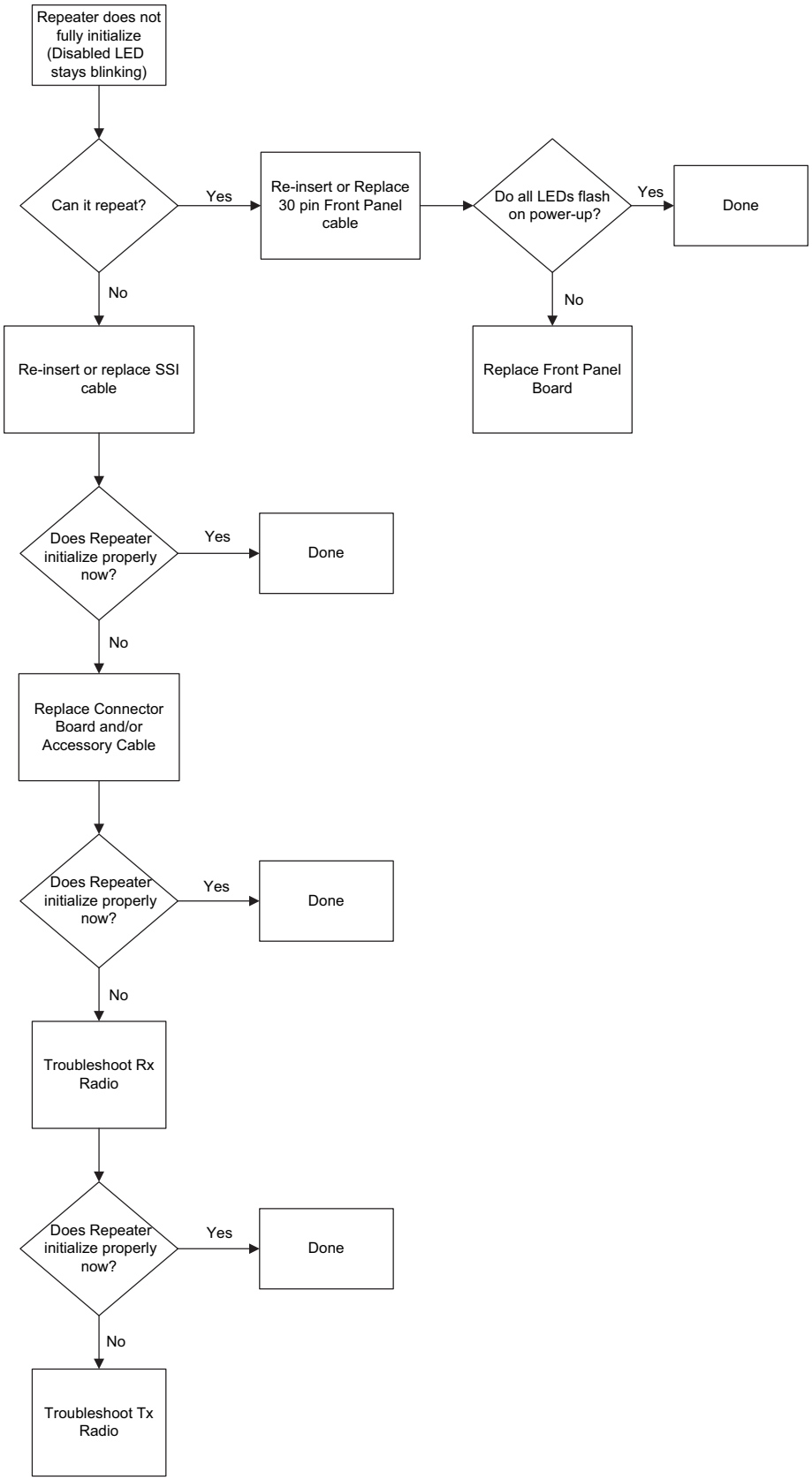
5.0 Troubleshooting Flow Chart for Rx VCO (Sheet 1 of 2)



5.1 Troubleshooting Flow Chart for Rx VCO (Sheet 2 of 2)



6.0 Troubleshooting Flow Chart for Repeater



Section 3

UHF2 PCB / SCHEMATICS / PARTS LIST

1.0 Allocation of Schematics and Circuit Boards

1.1 Controller Circuits

The UHF circuits are contained on the Printed Circuit Board (PCB) which also contains the Controller circuits. This Chapter shows the schematics for the UHF circuits only, refer to the Controller section for details of the related Controller circuits. The PCB component layouts and the Parts List in this Chapter show both the Controller and UHF circuit components. The UHF schematics and the related PCB and parts list are shown in the table below.

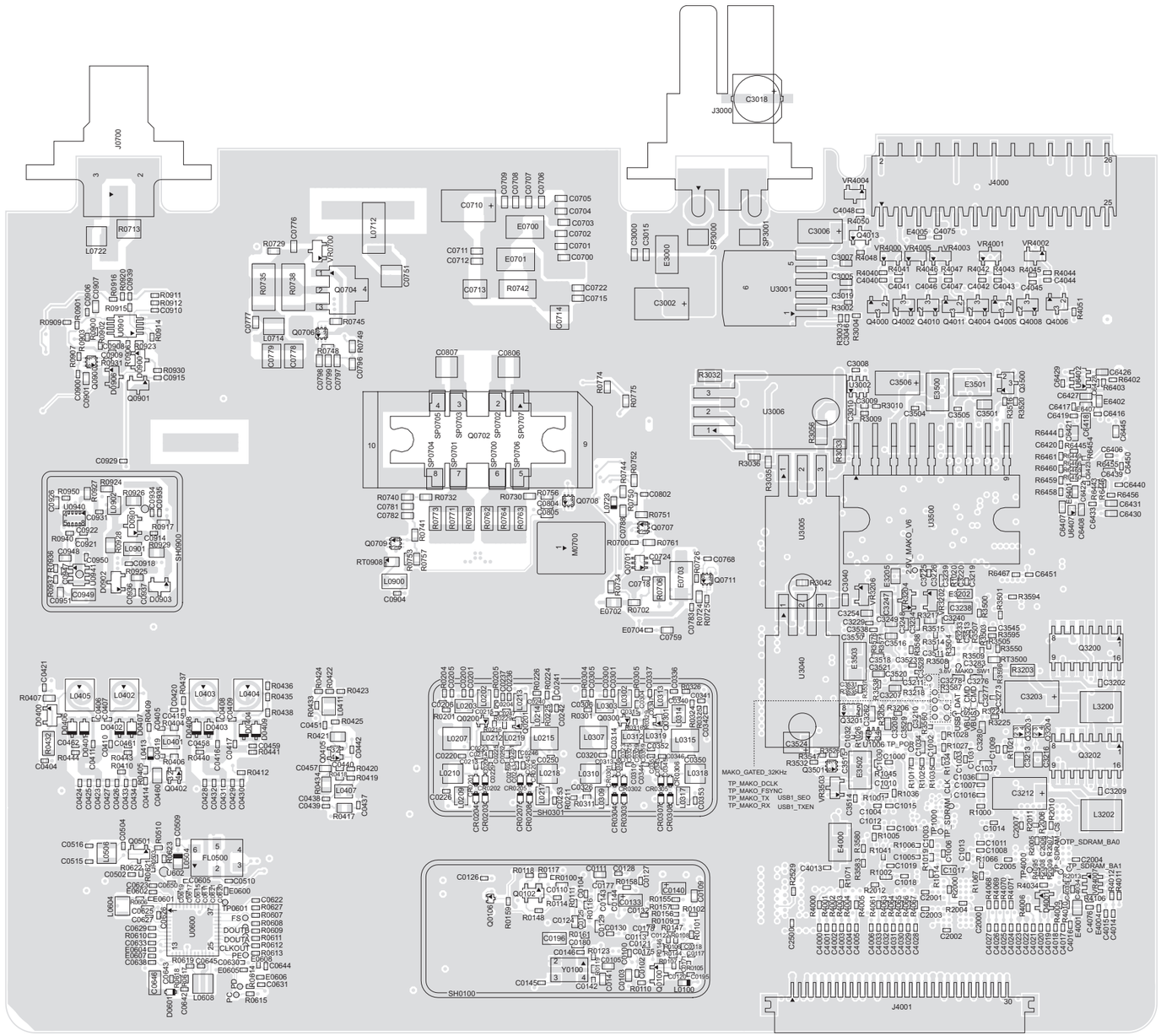
Table 3-1 UHF2 1–40W Diagrams and Parts List

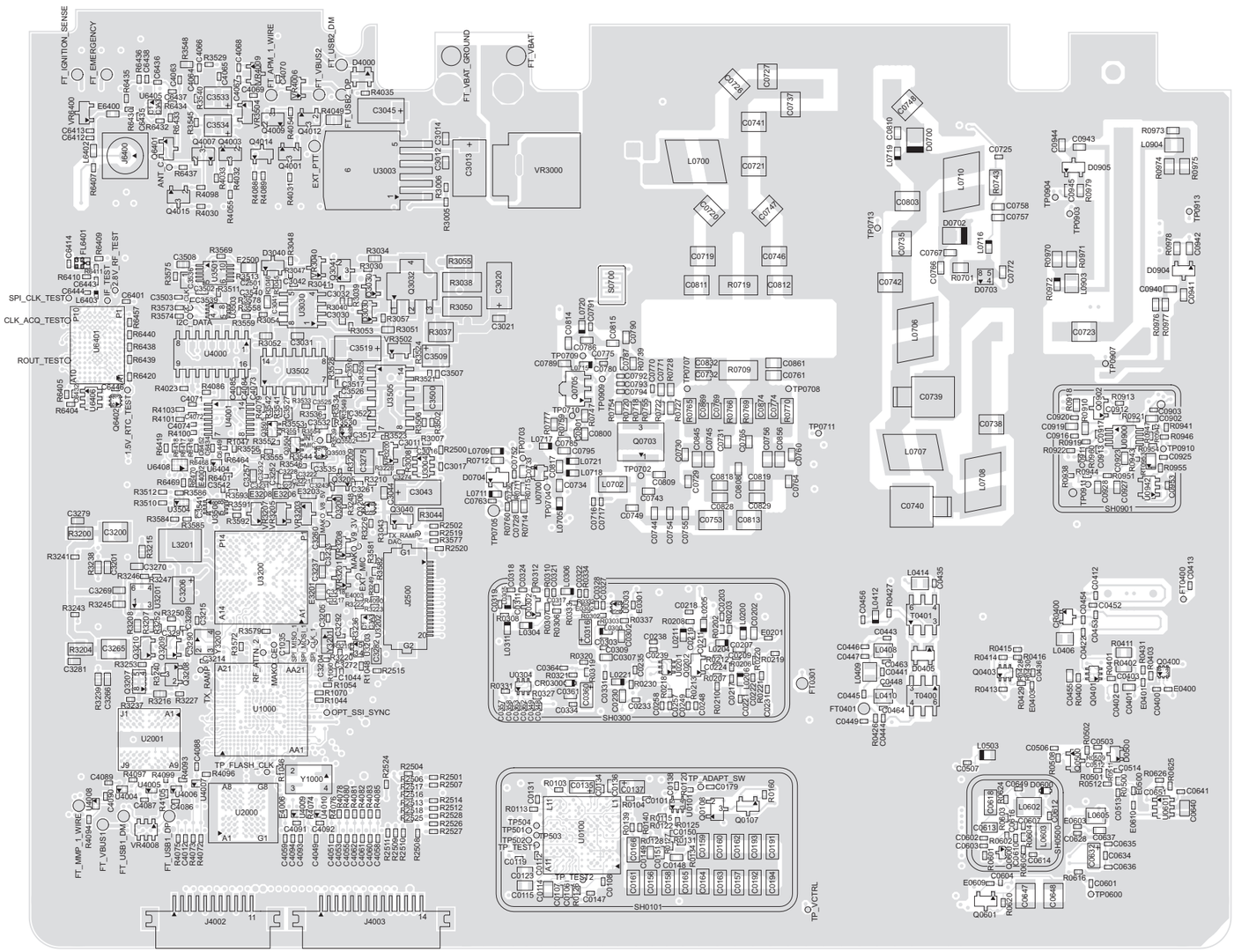
PCB :	
8471696M01 Main Board Top Side	Page 3-3
8471696M01 Main Board Bottom Side	Page 3-4
SCHEMATICS	
Overall	**Page 3-5**
Receiver Front- End	**Page 3-6**
Receiver IF Amp	**Page 3-7**
Receiver Back-End	**Page 3-8**
Power Amplifier	**Page 3-9**
Power Control	**Page 3-10**
Synthesizer	**Page 3-11**
Receiver VCO	**Page 3-12**
Transmit VCO	**Page 3-13**
Parts List	
8471696M01	**Page 3-14**

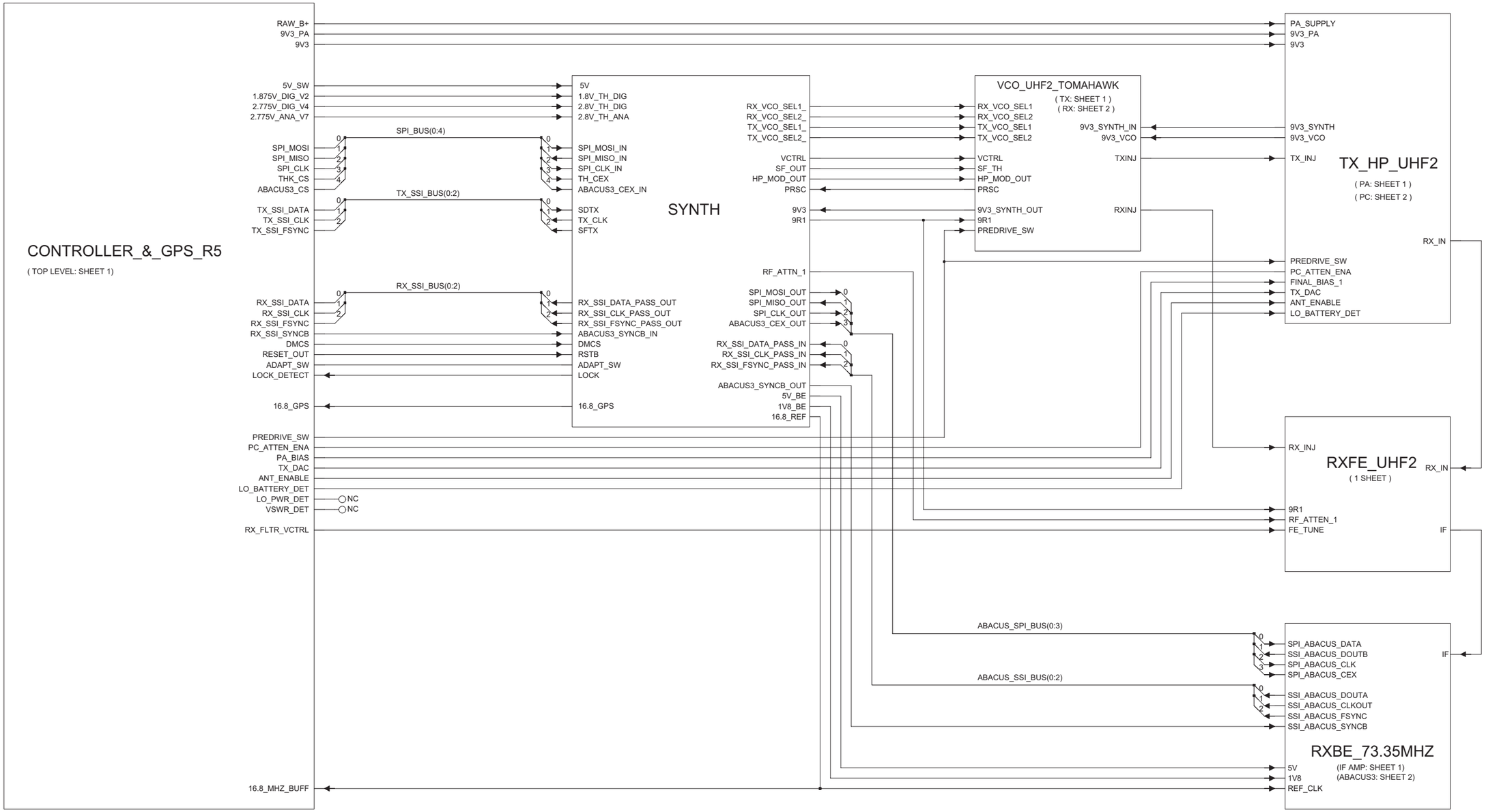
Table 3-2: UHF2 1–40W Diagrams and Parts List

PCB :	
8471696M02 Main Board Top Side	Page 3-19
8471696M02 Main Board Bottom Side	Page 3-20
SCHEMATICS	
Overall	**Page 3-21**
Receiver Front- End	**Page 3-22**
Receiver IF Amp	**Page 3-23**
Receiver Back-End	**Page 3-24**
Power Amplifier	**Page 3-25**
Power Control	**Page 3-26**
Synthesizer	**Page 3-27**
Receiver VCO	**Page 3-28**
Transmit VCO	**Page 3-29**
Parts List	
8471696M02	**Page 3-30**

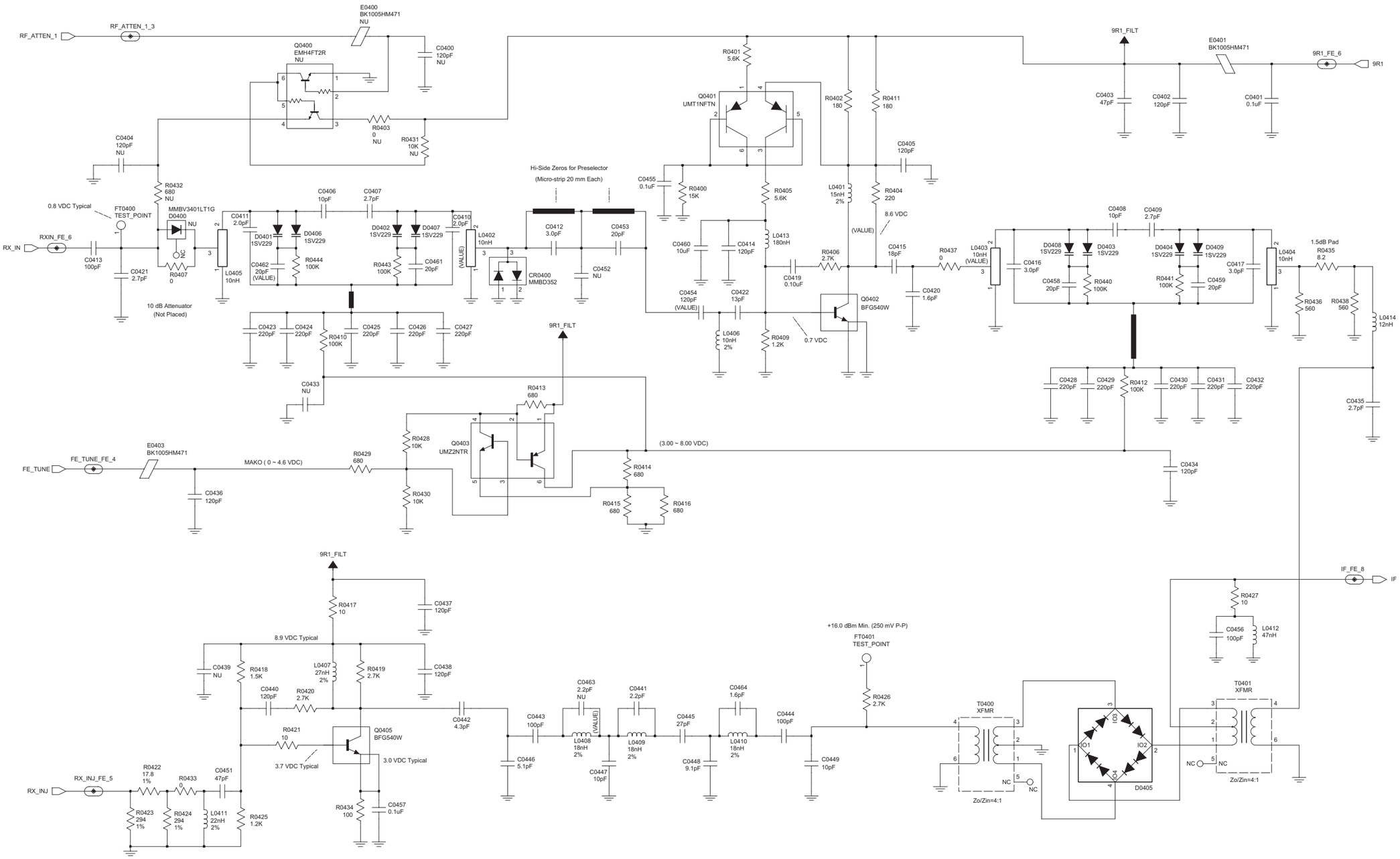
2.0 UHF2 (450–512 MHz) 1–40W PCB / Schematics / Parts List


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TP_MAKO_TX
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USB1_TXEN
TP_MAKO_RST
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TP_SDRAM_CKE
OTP_SDRAM_BA0
SP_SDRAM_BA1
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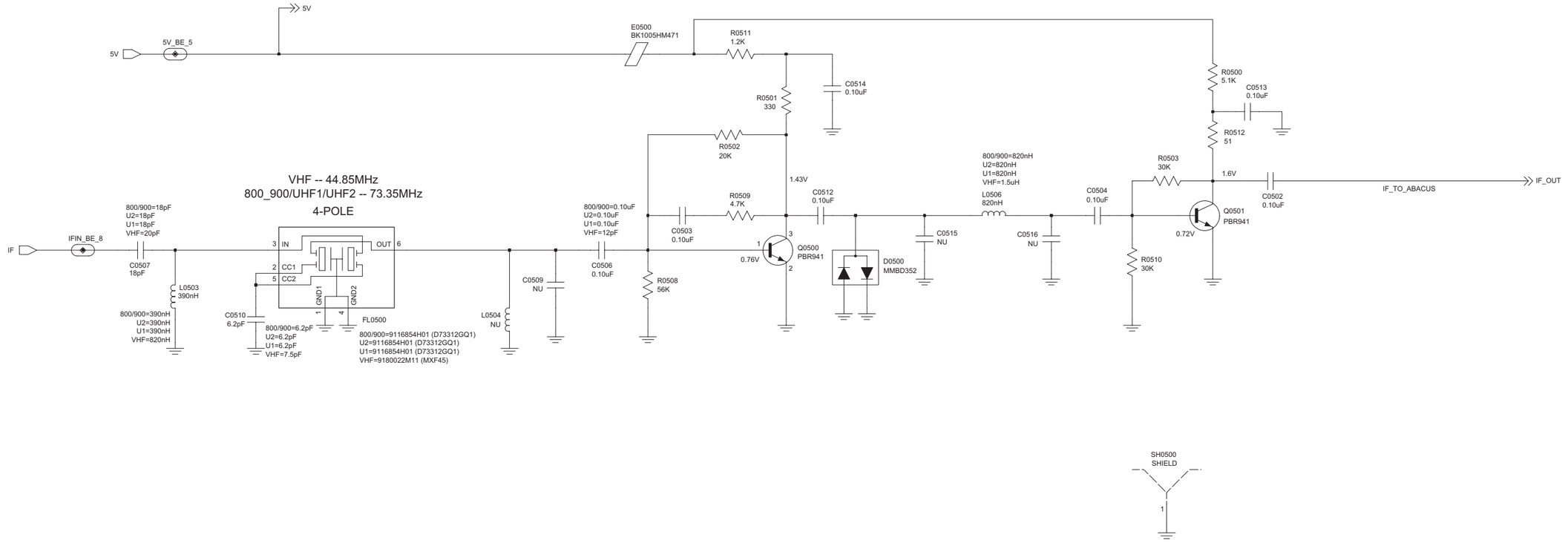

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FT_VBAT_GROUND
FT_VBAT
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U3303
VR3000
L0700
U3200
U1000
U2001
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Y1000
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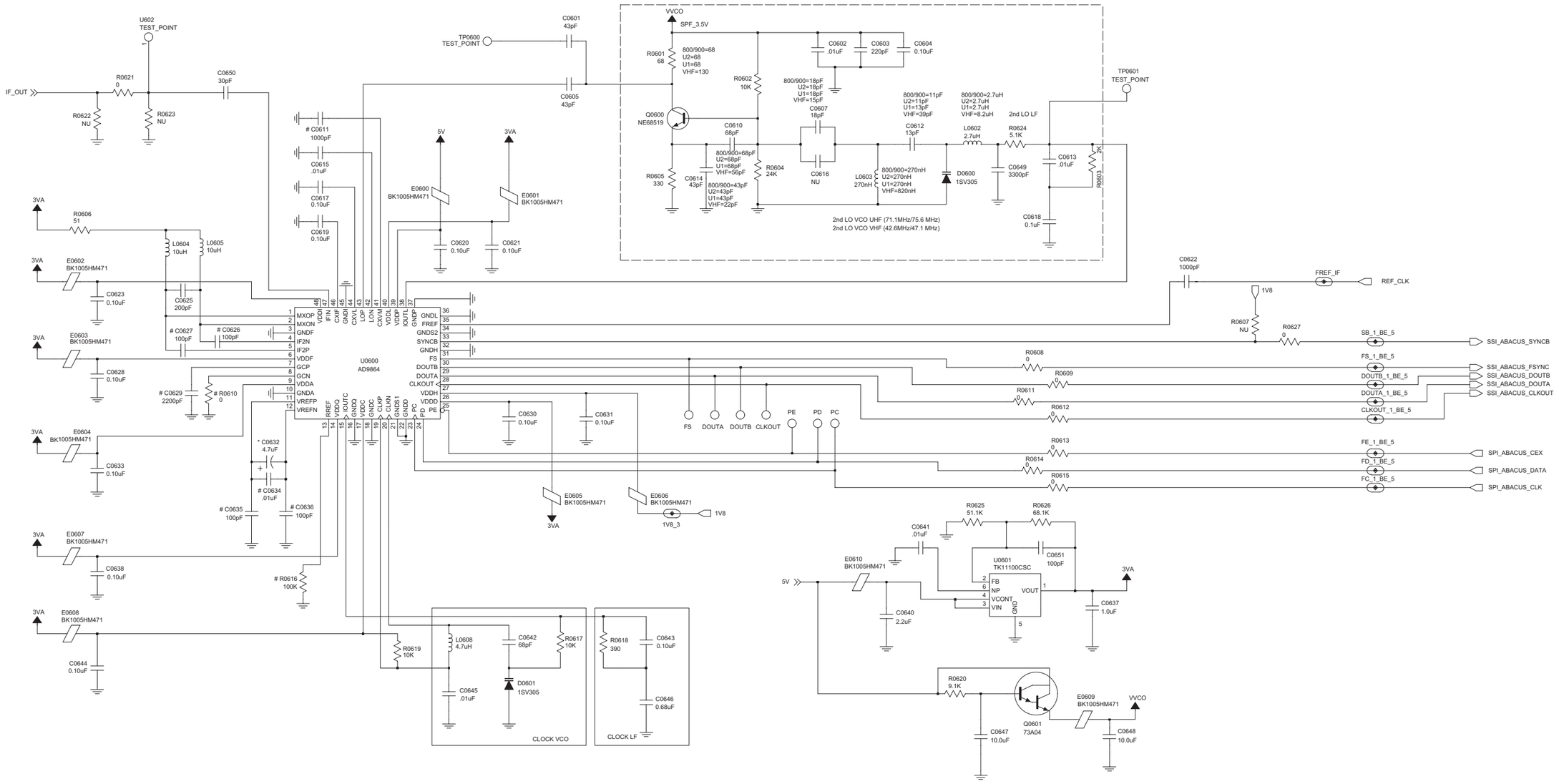
UHF2 (450–512 MHz) 1–40W Overall Schematic Diagram



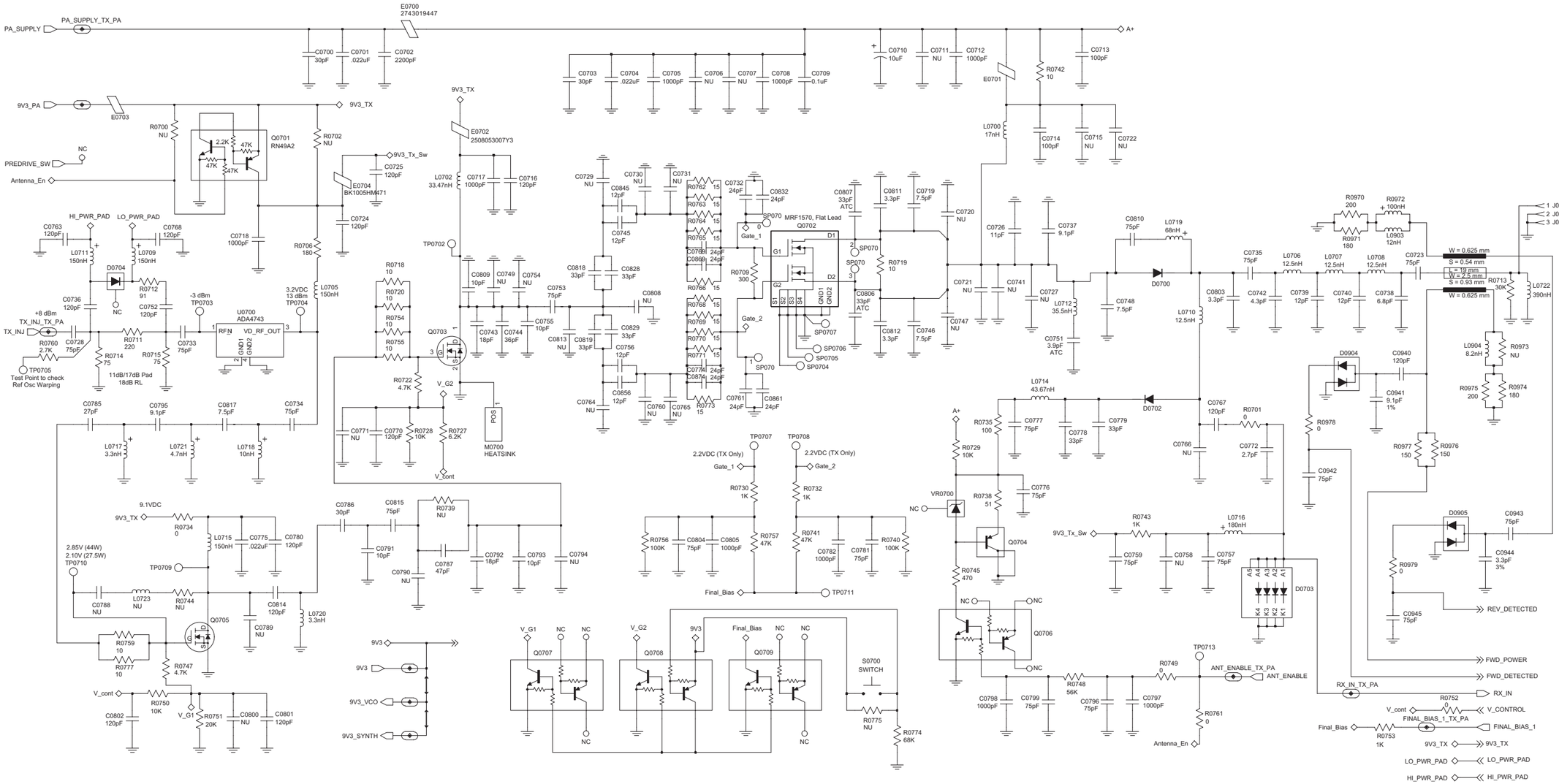
UHF2 (450–512 MHz) 1–40W Receiver Front-End Schematic Diagram



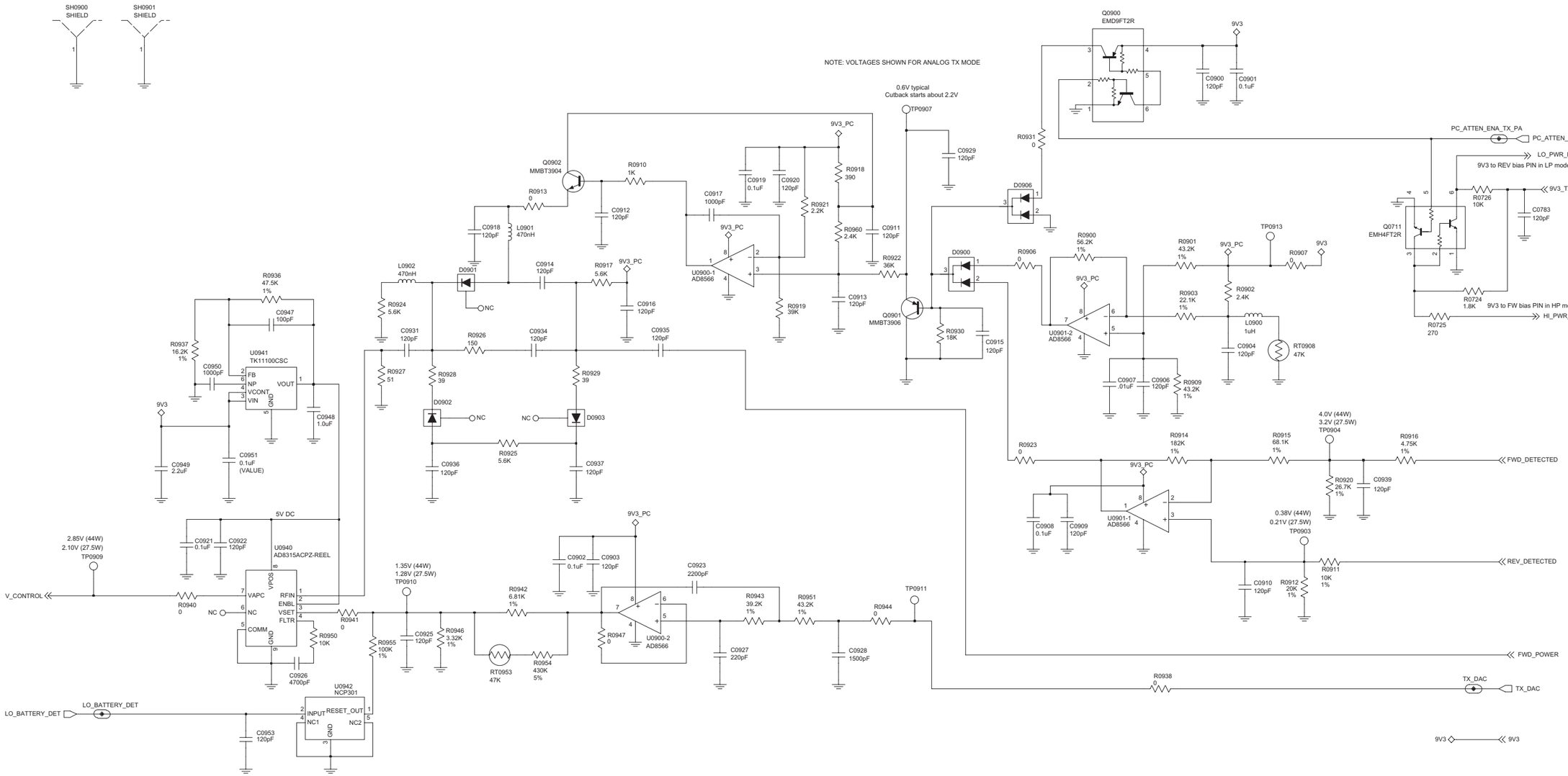
UHF2 (450–512 MHz) 1–40W Receiver IF Amp Schematic Diagram



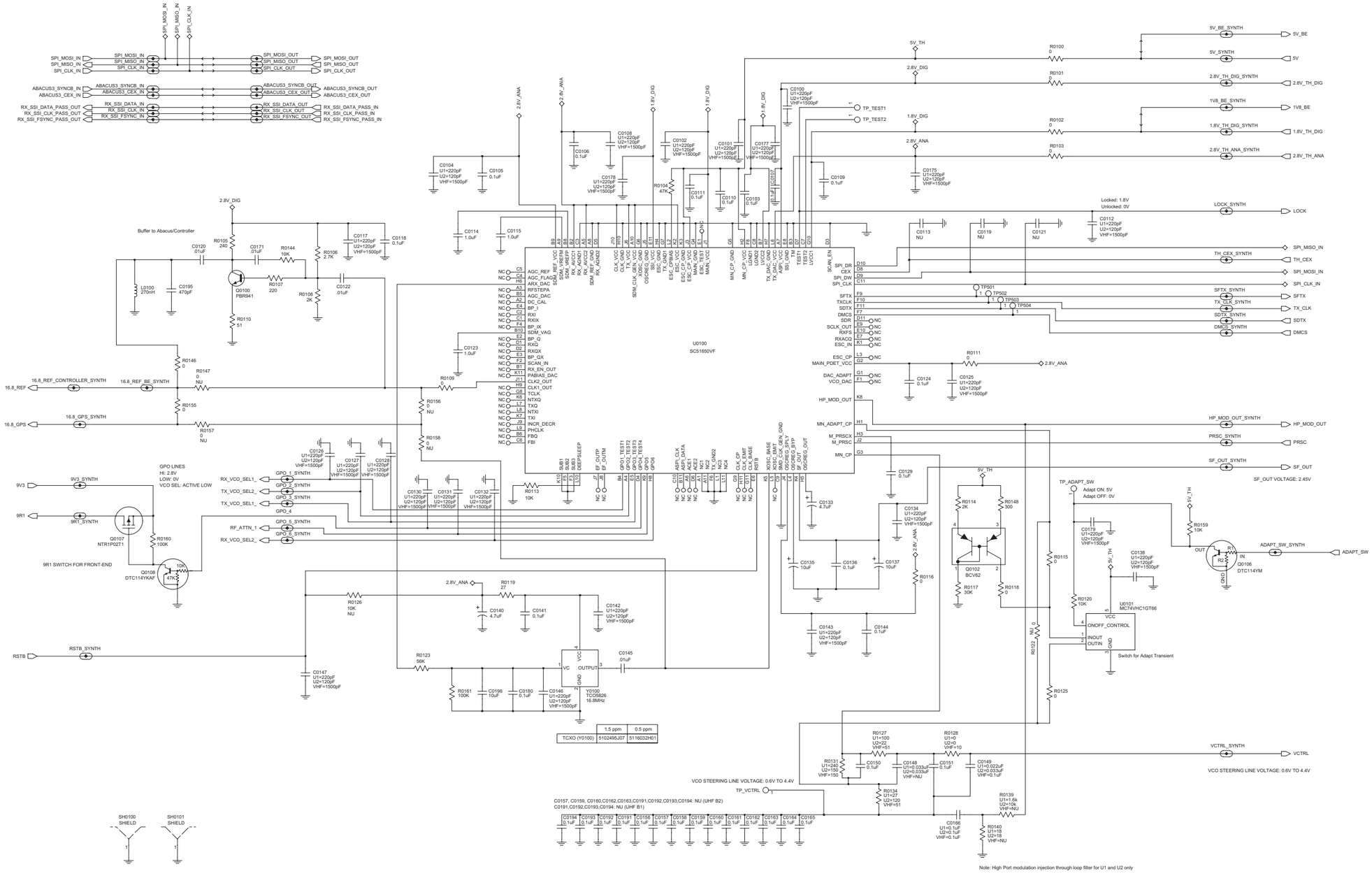
UHF2 (450–512 MHz) 1–40W Receiver Back-End Schematic Diagram



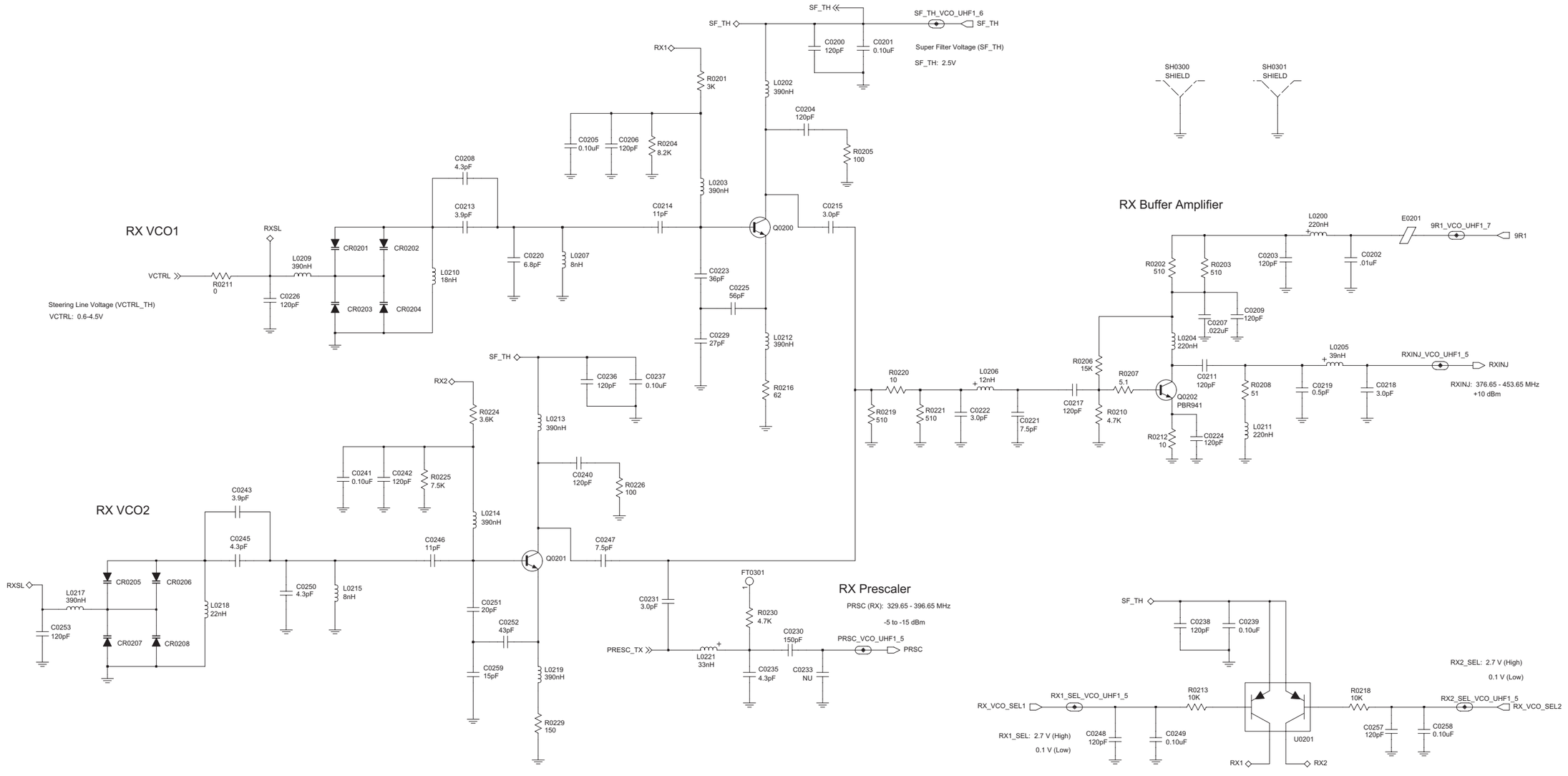
UHF2 (450–512 MHz) 1–40W Power Amplifier Schematic Diagram



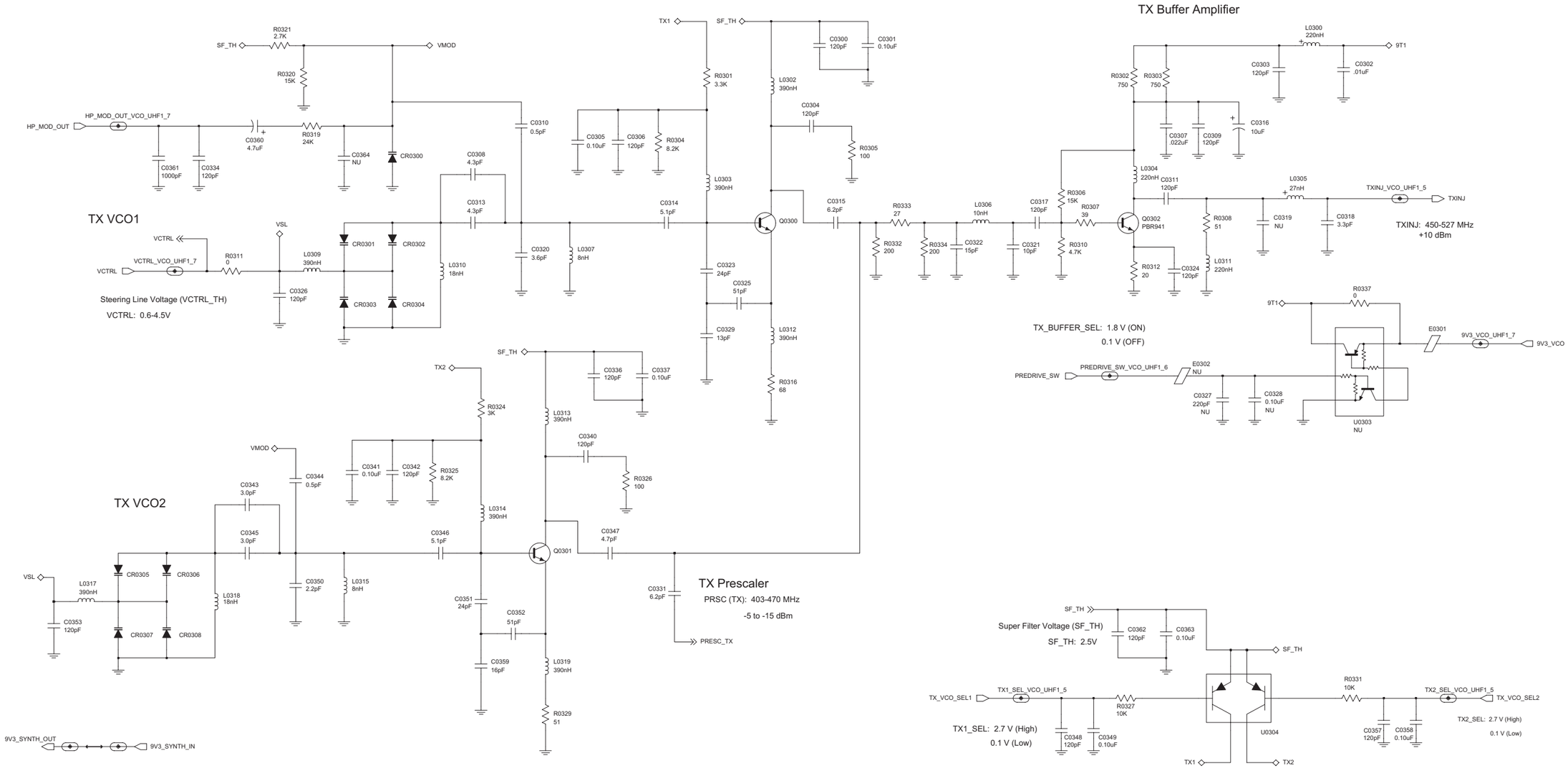
UHF2 (450–512 MHz) 1–40W Power Control Schematic Diagram



UHF2 (450–512 MHz) 1–40W Synthesizer Schematic Diagram



UHF2 (450–512 MHz) 1–40W Receiver VCO Schematic Diagram



UHF2 (450–512 MHz) 1–40W Transmit VCO Schematic Diagram

UHF2 PCB 8471696M01 Parts List 1–40W

Circuit Ref	Motorola Part No.	Description
C0100	2113944A41	120pF
C0101	2113944A41	120pF
C0102	2113944A41	120pF
C0103	2113945C31	0.1uF
C0104	2113944A41	120pF
C0105	2113945C31	0.1uF
C0106	2113945C31	0.1uF
C0107	2113945C31	0.1uF
C0108	2113944A41	120pF
C0109	2113945C31	0.1uF
C0110	2113945C31	0.1uF
C0111	2113945C31	0.1uF
C0112	2113944A41	120pF
C0113	NOT PLACED	–
C0114	2113946E02	1.0uF
C0115	2113946E02	1.0uF
C0117	2113944A41	120pF
C0118	2113945C31	0.1uF
C0119	NOT PLACED	–
C0120	2113945B02	.01uF
C0121	NOT PLACED	–
C0122	2113945B02	.01uF
C0123	2113946E02	1.0uF
C0124	2113945C31	0.1uF
C0125	2113944A41	120pF
C0126	2113944A41	120pF
C0127	2113944A41	120pF
C0128	2113944A41	120pF
C0129	2113945C31	0.1uF
C0130	2113944A41	120pF
C0131	2113944A41	120pF
C0132	2113944A41	120pF
C0133	2313960B30	4.7uF
C0134	2113944A41	120pF
C0135	2313960B32	10uF
C0136	2113945C31	0.1uF
C0137	2313960B32	10uF
C0138	2113944A41	120pF
C0140	2313960B30	4.7uF
C0141	2113945C31	0.1uF
C0142	2113944A41	120pF
C0143	2113944A41	120pF
C0144	2113945C31	0.1uF
C0145	2113945B02	.01uF
C0146	2113944A41	120pF
C0147	2113944A41	120pF
C0148	2113945D01	.033uF
C0149	2113945D01	.033uF
C0150	2113945C31	0.1uF
C0151	2113945C31	0.1uF
C0156	2185419D06	0.1uF
C0157	NOT PLACED	–
C0158	2185419D06	0.1uF
C0159	NOT PLACED	–
C0160	NOT PLACED	–
C0161	2185419D06	0.1uF
C0162	NOT PLACED	–
C0163	NOT PLACED	–
C0164	2185419D06	0.1uF
C0165	2185419D06	0.1uF
C0166	2185419D06	0.1uF
C0171	2113945B02	.01uF
C0175	2113944A41	120pF
C0177	2113944A41	120pF
C0178	2113944A41	120pF
C0179	2113944A41	120pF
C0180	2113945C31	0.1uF
C0191	NOT PLACED	–
C0192	NOT PLACED	–
C0193	NOT PLACED	–
C0194	NOT PLACED	–
C0195	2113945A05	470pF
C0196	2113946H02	10uF
C0200	2113944A41	120pF
C0201	2113945Y02	0.10uF
C0202	2113945C02	.01uF
C0203	2113944A41	120pF
C0204	2113944A41	120pF
C0205	2113945Y02	0.10uF
C0206	2113944A41	120pF
C0207	2113945C04	.022uF
C0208	2115153H18	4.3pF
C0209	2113944A41	120pF
C0211	2113944A41	120pF
C0213	2115153H17	3.9pF
C0214	2115153H34	11pF
C0215	2115153H14	3.0pF
C0217	2113944A41	120pF
C0218	2115153H14	3.0pF
C0219	2115153H01	0.5pF
C0220	2115153H23	6.8pF
C0221	2115153H24	7.5pF
C0222	2115153H14	3.0pF
C0223	2115153H46	36pF
C0224	2113944A41	120pF
C0225	2115153H51	56pF
C0226	2113944A41	120pF
C0229	2115153H43	27pF
C0230	2113944C47	150pF
C0231	2115153H14	3.0pF
C0233	NOT PLACED	–
C0235	2115153H18	4.3pF
C0236	2113944A41	120pF
C0237	2113945Y02	0.10uF
C0238	2113944A41	120pF
C0239	2113945Y02	0.10uF
C0240	2113944A41	120pF
C0241	2113945Y02	0.10uF
C0242	2113944A41	120pF
C0243	2115153H17	3.9pF
C0245	2115153H18	4.3pF
C0246	2115153H34	11pF
C0247	2115153H24	7.5pF
C0248	2113944A41	120pF
C0249	2113945Y02	0.10uF
C0250	2115153H18	4.3pF
C0251	2115153H40	20pF
C0252	2115153H48	43pF
C0253	2113944A41	120pF
C0257	2113944A41	120pF
C0258	2113945Y02	0.10uF
C0259	2115153H37	15pF
C0300	2113944A41	120pF
C0301	2113945Y02	0.10uF
C0302	2113945C02	.01uF
C0303	2113944A41	120pF
C0304	2113944A41	120pF
C0305	2113945Y02	0.10uF
C0306	2113944A41	120pF
C0307	2113945C04	.022uF
C0308	2115153H18	4.3pF
C0309	2113944A41	120pF
C0310	2115153H01	0.5pF
C0311	2113944A41	120pF
C0313	2115153H18	4.3pF
C0314	2115153H20	5.1pF
C0315	2115153H22	6.2pF
C0316	2313960B32	10uF
C0317	2113944A41	120pF
C0318	2115153H15	3.3pF
C0319	NOT PLACED	–
C0320	2115153H16	3.6pF
C0321	2115153H27	10pF
C0322	2115153H37	15pF
C0323	2115153H42	24pF
C0324	2113944A41	120pF
C0325	2115153H50	51pF
C0326	2113944A41	120pF
C0327	NOT PLACED	–
C0328	NOT PLACED	–
C0329	2115153H36	13pF
C0331	2115153H22	6.2pF
C0334	2113944A41	120pF
C0336	2113944A41	120pF
C0337	2113945Y02	0.10uF
C0340	2113944A41	120pF
C0341	2113945Y02	0.10uF
C0342	2113944A41	120pF
C0343	2115153H14	3.0pF
C0344	2115153H01	0.5pF
C0345	2115153H14	3.0pF
C0346	2115153H20	5.1pF
C0347	2115153H19	4.7pF
C0348	2113944A41	120pF
C0349	2113945Y02	0.10uF
C0350	2115153H11	2.2pF
C0351	2115153H42	24pF
C0352	2115153H50	51pF
C0353	2113944A41	120pF
C0357	2113944A41	120pF
C0358	2113945Y02	0.10uF
C0359	2115153H38	16pF
C0360	2313960B30	4.7uF
C0361	2113944C51	1000pF
C0362	2113944A41	120pF
C0363	2113945Y02	0.10uF
C0364	NOT PLACED	–
C0400	NOT PLACED	–
C0401	2113945C31	0.1uF
C0402	2113944A41	120pF
C0403	2115153H49	47pF
C0404	NOT PLACED	–
C0405	2113944A41	120pF
C0406	2115153H27	10pF
C0407	2115153H13	2.7pF
C0408	2115153H27	10pF
C0409	2115153H13	2.7pF
C0410	2115153H10	2.0pF
C0411	2115153H10	2.0pF
C0412	2115153H14	3.0pF
C0413	2115153H57	100pF
C0414	2113944A41	120pF
C0415	2115153H39	18pF
C0416	2115153H14	3.0pF
C0417	2115153H14	3.0pF
C0419	2113945Y02	0.10uF
C0420	2115153H08	1.5pF
C0421	2115153H13	2.7pF
C0422	2115153H36	13pF
C0423	2113944A44	220pF
C0424	2113944A44	220pF
C0425	2113944A44	220pF
C0426	2113944A44	220pF

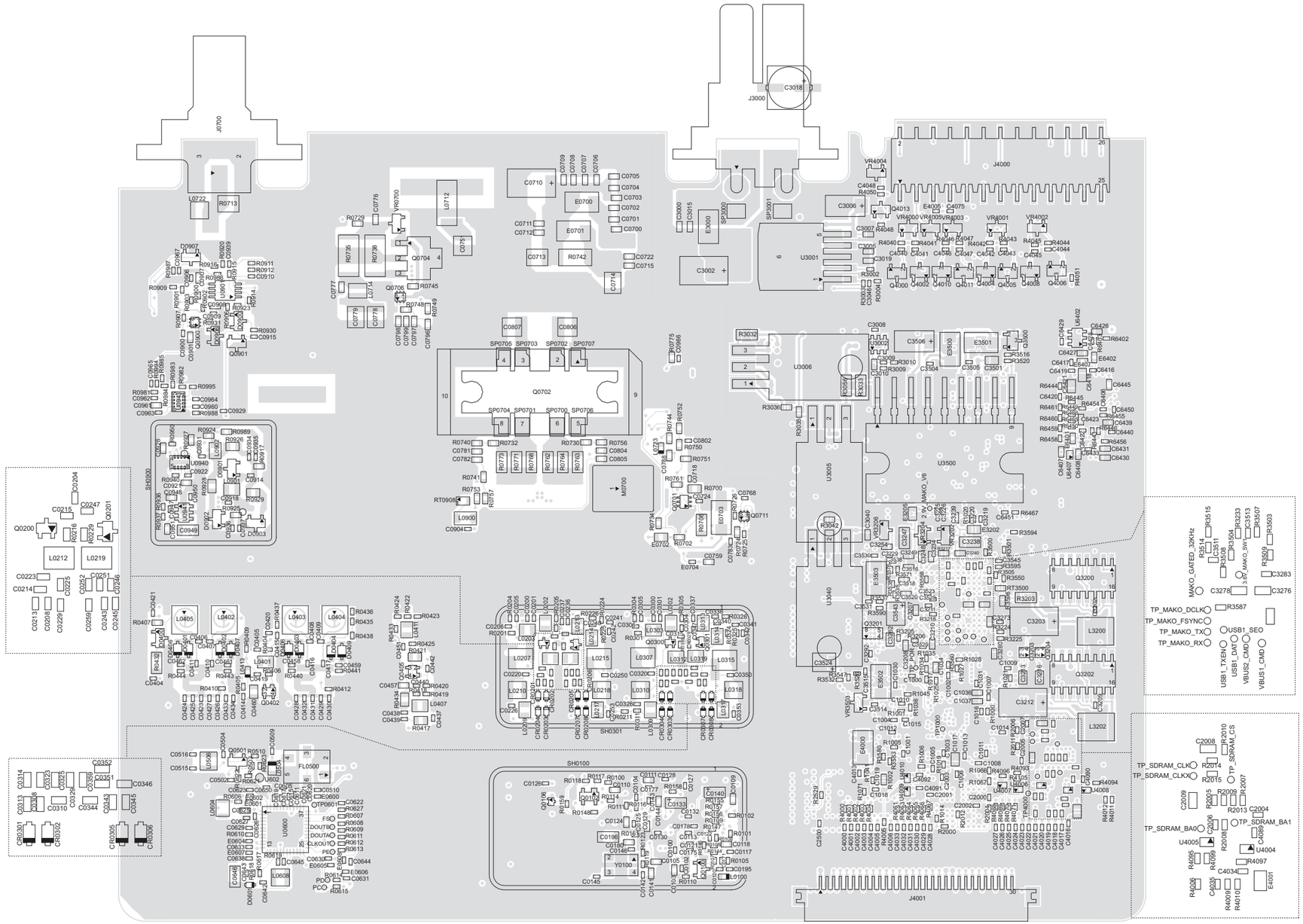
Circuit Ref	Motorola Part No.	Description
C0427	2113944A44	220pF
C0428	2113944A44	220pF
C0429	2113944A44	220pF
C0430	2113944A44	220pF
C0431	2113944A44	220pF
C0432	2113944A44	220pF
C0433	NOT PLACED	–
C0434	2113944A41	120pF
C0435	2115153H13	2.7pF
C0436	2113944A41	120pF
C0437	2113944A41	120pF
C0438	2113944A41	120pF
C0439	NOT PLACED	–
C0440	2113944A41	120pF
C0441	2115153H11	2.2pF
C0442	2115153H18	4.3pF
C0443	2115153H57	100pF
C0444	2115153H57	100pF
C0445	2115153H43	27pF
C0446	2115153H20	5.1pF
C0447	2115153H27	10pF
C0448	2115153H26	9.1pF
C0449	2115153H27	10pF
C0451	2115153H49	47pF
C0452	NOT PLACED	–
C0453	2115153H40	20pF
C0454	2113944A41	120pF
C0455	2113945C31	0.1uF
C0456	2113944A40	100pF
C0457	2113945C31	0.1uF
C0458	2115153H40	20pF
C0459	2115153H40	20pF
C0460	2113946F05	10uF
C0461	2115153H40	20pF
C0462	2115153H40	20pF
C0463	NOT PLACED	–
C0464	2115153H08	1.5pF
C0502	2113945Y02	0.10uF
C0503	2113945Y02	0.10uF
C0504	2113945Y02	0.10uF
C0506	2113945Y02	0.10uF
C0507	2115153H39	18pF
C0509	NOT PLACED	–
C0510	2115153H22	6.2pF
C0512	2113945Y02	0.10uF
C0513	2113945Y02	0.10uF
C0514	2113945Y02	0.10uF
C0515	NOT PLACED	–
C0516	NOT PLACED	–
C0601	2115153H48	43pF
C0602	2113945B02	.01uF
C0603	2113944A44	220pF
C0604	2113945Y02	0.10uF
C0605	2115153H48	43pF
C0607	2115153H39	18pF
C0610	2115153H53	68pF
C0611	2113945A09	1000pF
C0612	2115153H34	11pF
C0613	2185419D03	0.01uF
C0614	2115153H48	43pF
C0615	2113945B02	.01uF
C0616	NOT PLACED	–
C0617	2113945Y02	0.10uF
C0618	2185419D06	0.1uF
C0619	2113945Y02	0.10uF
C0620	2113945Y02	0.10uF
C0621	2113945Y02	0.10uF
C0622	2113945A09	1000pF
C0623	2113945Y02	0.10uF
C0625	2113944C89	200pF
C0626	2113944A40	100pF
C0627	2113944A40	100pF
C0628	2113945Y02	0.10uF
C0629	2113945A11	2200pF
C0630	2113945Y02	0.10uF
C0631	2113945Y02	0.10uF
C0632	2313960B30	4.7uF
C0633	2113945Y02	0.10uF
C0634	2113945B02	.01uF
C0635	2113944A40	100pF
C0636	2113944A40	100pF
C0637	2113946S35	1.0uF
C0638	2113945Y02	0.10uF
C0640	2113946N03	2.2uF
C0641	2113945B02	.01uF
C0642	2115153H53	68pF
C0643	2113945Y02	0.10uF
C0644	2113945Y02	0.10uF
C0645	2113945B02	.01uF
C0646	2113946G04	0.68uF
C0647	2113946J03	10.0uF
C0648	2113946J03	10.0uF
C0649	2113945A12	3300pF
C0650	2115153H44	30pF
C0651	2115153H57	100pF
C0700	2113944C82	30pF
C0701	2113945C04	.022uF
C0702	2113944C55	2200pF
C0703	2113944C82	30pF
C0704	2113945C04	.022uF
C0705	2113944C51	1000pF
C0706	NOT PLACED	–
C0707	NOT PLACED	–
C0708	2113944C51	1000pF
C0709	2113945C31	0.1uF
C0710	2371403L02	10uF
C0711	NOT PLACED	–
C0712	2113944C51	1000pF
C0713	2111078B42	100pF
C0714	2111078B42	100pF
C0715	NOT PLACED	–
C0716	2113944A41	120pF
C0717	2113945A09	1000pF
C0718	2113945A09	1000pF
C0719	2111078B10	7.5pF
C0720	NOT PLACED	–
C0721	NOT PLACED	–
C0722	NOT PLACED	–
C0723	2111078B39	75pF
C0724	2113944A41	120pF
C0725	2113944A41	120pF
C0726	2111078B14	11pF
C0727	NOT PLACED	–
C0728	2113944C42	75pF
C0729	NOT PLACED	–
C0730	NOT PLACED	–
C0731	NOT PLACED	–
C0732	2113951B41	24pF
C0733	2113944C42	75pF
C0734	2113944C42	75pF
C0735	2111078B39	75pF
C0736	2113944A41	120pF
C0737	2111078B12	9.1pF
C0738	2111078B09	6.8pF
C0739	2171388L01	12pF
C0740	2171388L01	12pF
C0741	NOT PLACED	–
C0742	2111078B04	4.3pF
C0743	2113944C33	18pF
C0744	2113944C83	36pF
C0745	2113944F44	12pF
C0746	2111078B10	7.5pF
C0747	NOT PLACED	–
C0748	2111078B10	7.5pF
C0749	NOT PLACED	–
C0751	2185400Y24	3.9pF
C0752	2113944A41	120pF
C0753	2111078B39	75pF
C0754	NOT PLACED	–
C0755	2113944C30	10pF
C0756	2113944F44	12pF
C0757	2113944C42	75pF
C0758	NOT PLACED	–
C0759	2113944C42	75pF
C0760	NOT PLACED	–
C0761	2113951B41	24pF
C0763	2113944A41	120pF
C0764	NOT PLACED	–
C0765	NOT PLACED	–
C0766	NOT PLACED	–
C0767	2113944C46	120pF
C0768	2113944A41	120pF
C0769	2113944F51	24pF
C0770	2113944A41	120pF
C0771	NOT PLACED	–
C0772	2113944C16	2.7pF
C0774	2113944F51	24pF
C0775	2113945C04	.022uF
C0776	2113944C42	75pF
C0777	2113944C42	75pF
C0778	2111078B29	33pF
C0779	2111078B29	33pF
C0780	2113944A41	120pF
C0781	2113944C42	75pF
C0782	2113944C51	1000pF
C0783	2113944A41	120pF
C0785	2113944C35	27pF
C0786	2113944C82	30pF
C0787	2113944C38	47pF
C0788	NOT PLACED	–
C0789	NOT PLACED	–
C0790	NOT PLACED	–
C0791	2113944A25	10pF
C0792	2113944A28	18pF
C0793	2113944A25	10pF
C0794	NOT PLACED	–
C0795	2113944C29	9.1pF
C0796	2113944C42	75pF
C0797	2113944C51	1000pF
C0798	2113944C51	1000pF
C0799	2113944C42	75pF
C0800	NOT PLACED	–
C0801	2113944A41	120pF
C0802	2113944A41	120pF
C0803	2111078B01	3.3pF
C0804	2113944C42	75pF
C0805	2113944C51	1000pF
C0806	2185400Y46	33pF
C0807	2185400Y46	33pF
C0808	NOT PLACED	–
C0809	2113944C30	10pF
C0810	2113944C42	75pF
C0811	2111078B01	3.3pF
C0812	2111078B01	3.3pF

Circuit Ref	Motorola Part No.	Description
C0813	NOT PLACED	–
C0814	2113944C46	120pF
C0815	2113944C42	75pF
C0817	2113944C27	7.5pF
C0818	2113944F54	33pF
C0819	2113944F54	33pF
C0828	2113944F54	33pF
C0829	2113944F54	33pF
C0832	2113951B41	24pF
C0845	2113944F44	12pF
C0856	2113944F44	12pF
C0861	2113951B41	24pF
C0869	2113944F51	24pF
C0874	2113944F51	24pF
C0900	2113944A41	120pF
C0901	2113945C31	0.1uF
C0902	2113945C31	0.1uF
C0903	2113944A41	120pF
C0904	2113944A41	120pF
C0906	2113944A41	120pF
C0907	2113945C02	.01uF
C0908	2113945C31	0.1uF
C0909	2113944A41	120pF
C0910	2113944A41	120pF
C0911	2113944A41	120pF
C0912	2113944A41	120pF
C0913	2113944A41	120pF
C0914	2113944A41	120pF
C0915	2113944A41	120pF
C0916	2113944A41	120pF
C0917	2113945A09	1000pF
C0918	2113944A41	120pF
C0919	2113945C31	0.1uF
C0920	2113944A41	120pF
C0921	2113945C31	0.1uF
C0922	2113944A41	120pF
C0923	2113944C55	2200pF
C0925	2113944A41	120pF
C0926	2113945L41	4700pF
C0927	2113944C02	220pF
C0928	2113944C53	1500pF
C0929	2113944A41	120pF
C0931	2113944A41	120pF
C0934	2113944A41	120pF
C0935	2113944A41	120pF
C0936	2113944A41	120pF
C0937	2113944A41	120pF
C0939	2113944A41	120pF
C0940	2113944C46	120pF
C0941	2113944M17	9.1pF
C0942	2113944C42	75pF
C0943	2113944C42	75pF
C0944	2113944M06	3.3pF
C0945	2113944C42	75pF
C0947	2113944A40	100pF
C0948	2113946S35	1.0uF
C0949	2113946G01	2.2uF
C0950	2113945A09	1000pF
C0951	2113945C31	0.1uF
C0953	2113944A41	120pF
CR0201	4815096H01	DIODE VARACTOR 1SV305
CR0202	4815096H01	DIODE VARACTOR 1SV305
CR0203	4815096H01	DIODE VARACTOR 1SV305
CR0204	4815096H01	DIODE VARACTOR 1SV305
CR0205	4815096H01	DIODE VARACTOR 1SV305
CR0206	4815096H01	DIODE VARACTOR 1SV305
CR0207	4815096H01	DIODE VARACTOR 1SV305
CR0208	4815096H01	DIODE VARACTOR 1SV305
CR0300	4815096H01	DIODE VARACTOR 1SV305
CR0301	4815096H01	DIODE VARACTOR 1SV305
CR0302	4815096H01	DIODE VARACTOR 1SV305
CR0303	4815096H01	DIODE VARACTOR 1SV305
CR0304	4815096H01	DIODE VARACTOR 1SV305
CR0305	4815096H01	DIODE VARACTOR 1SV305
CR0306	4815096H01	DIODE VARACTOR 1SV305
CR0307	4815096H01	DIODE VARACTOR 1SV305
CR0308	4815096H01	DIODE VARACTOR 1SV305
CR0400	4813974A19	DIODE, SCHOTTKY
D0400	NOT PLACED	–
D0401	4885055Y01	DIODE VARACTOR 1SV229
D0402	4885055Y01	DIODE VARACTOR 1SV229
D0403	4885055Y01	DIODE VARACTOR 1SV229
D0404	4885055Y01	DIODE VARACTOR 1SV229
D0405	4815090H01	DIODE, MIXER
D0406	4885055Y01	DIODE VARACTOR 1SV229
D0407	4885055Y01	DIODE VARACTOR 1SV229
D0408	4885055Y01	DIODE VARACTOR 1SV229
D0409	4885055Y01	DIODE VARACTOR 1SV229
D0500	4813974A19	DIODE, SCHOTTKY
D0600	4815096H01	DIODE VARACTOR 1SV305
D0601	4815096H01	DIODE VARACTOR 1SV305
D0700	4802482J02	DIODE, PIN
D0702	4802482J02	DIODE, PIN
D0703	4875430M01	DIODE, PIN
D0704	4813974A06	DIODE, PIN
D0900	4813978C02	DIODE, SWITCHING
D0901	4815023H01	DIODE, PIN
D0902	4815024H01	DIODE, PIN
D0903	4815024H01	DIODE, PIN
D0904	4813974A21	DIODE, SCHOTTKY
D0905	4813974A21	DIODE, SCHOTTKY
D0906	4813978C02	DIODE, SWITCHING
E0201	2409134J25	FERRITE BEAD
E0301	2409134J25	FERRITE BEAD
E0302	NOT PLACED	–
E0400	NOT PLACED	–
E0401	2409134J25	FERRITE BEAD
E0403	2409134J25	FERRITE BEAD
E0500	2409134J25	FERRITE BEAD
E0600	2409134J25	FERRITE BEAD
E0601	2409134J25	FERRITE BEAD
E0602	2409134J25	FERRITE BEAD
E0603	2409134J25	FERRITE BEAD
E0604	2409134J25	FERRITE BEAD
E0605	2409134J25	FERRITE BEAD
E0606	2409134J25	FERRITE BEAD
E0607	2409134J25	FERRITE BEAD
E0608	2409134J25	FERRITE BEAD
E0609	2409134J25	FERRITE BEAD
E0610	2480640Z01	FERRITE BEAD
E0700	2485011Y01	FERRITE BEAD
E0701	2485011Y01	FERRITE BEAD
E0702	7671656M01	FERRITE BEAD
E0703	2485011Y01	FERRITE BEAD
E0704	2409134J25	FERRITE BEAD
FL0500	9116854H01	73.35MHZ CRYSTAL FILTER
J0700	0905901V11	MINI-U RF CONNECTOR
L0100	2414017N29	270nH
L0200	2414017N28	220nH
L0202	2414032F41	390nH
L0203	2414032F41	390nH
L0204	2414017N28	220nH
L0205	2414017N19	39nH
L0206	2414017N13	12nH
L0207	2415385H01	8nH
L0209	2414032F41	390nH
L0210	2414015A32	18nH
L0211	2414017N28	220nH
L0212	2414032F41	390nH
L0213	2414032F41	390nH
L0214	2414032F41	390nH
L0215	2415385H01	8nH
L0217	2414032F41	390nH
L0218	2414015A20	22nH
L0219	2414032F41	390nH
L0221	2414017N18	33nH
L0300	2414017N28	220nH
L0302	2414032F41	390nH
L0303	2414032F41	390nH
L0304	2414017N28	220nH
L0305	2414017N17	27nH
L0306	2414017N12	10nH
L0307	2415385H01	8nH
L0309	2414032F41	390nH
L0310	2414015A32	18nH
L0311	2414017N28	220nH
L0312	2414032F41	390nH
L0313	2414032F41	390nH
L0314	2414032F41	390nH
L0315	2415385H01	8nH
L0317	2414032F41	390nH
L0318	2414015A32	18nH
L0319	2414032F41	390nH
L0401	2414015B24	15nH
L0402	NOT PLACED	–
L0403	NOT PLACED	–
L0404	NOT PLACED	–
L0405	NOT PLACED	–
L0406	2414015B29	10nH
L0407	2414015B16	27nH
L0408	2414015B17	18nH
L0409	2414015B17	18nH
L0410	2414015B17	18nH
L0411	2414015B15	22nH
L0412	2414017N20	47nH
L0413	2414017N27	180nH
L0414	2414015B23	12nH
L0503	2414015B27	390nH
L0504	NOT PLACED	–
L0506	2414032B66	820nH
L0602	2414032K23	2.7uH
L0603	2414032D20	270nH
L0604	2466505A01	10uH
L0605	2466505A01	10uH
L0608	2414032B76	4.7uH
L0700	2460592A01	17nH
L0702	2479990G01	33.47nH
L0705	2414017N26	150nH
L0706	2460592A02	12.5nH
L0707	2460592A02	12.5nH
L0708	2460592A02	12.5nH
L0709	2414017N26	150nH
L0710	2460592A02	12.5nH
L0711	2414017N26	150nH
L0712	2415385H07	35.5nH
L0714	2479990N01	43.67nH
L0715	2414017N26	150nH
L0716	2414017N27	180nH
L0717	2414017N06	3.3nH
L0718	2414017N12	10nH
L0719	2414017N22	68nH
L0720	2414017N06	3.3nH
L0721	2414017N08	4.7nH
L0722	2414032B60	390nH

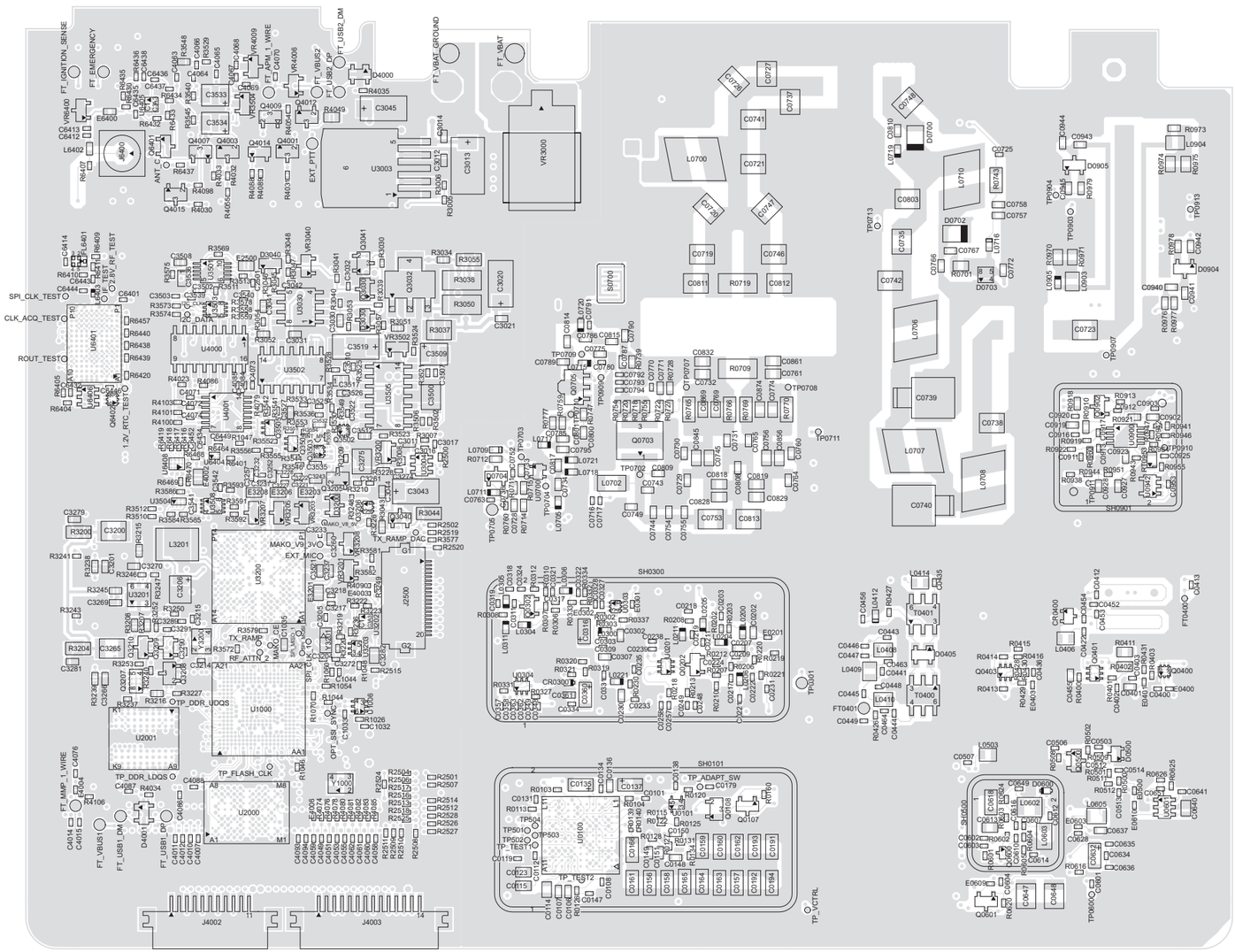
Circuit Ref	Motorola Part No.	Description
L0723	NOT PLACED	–
L0900	2414032D30	1uH
L0901	2414032F42	470nH
L0902	2414032F42	470nH
L0903	2414032F23	12nH
L0904	2414032F22	8.2nH
M0700	2686201B02	HEATSINK
Q0100	4802197J95	NPN RF TRANSISTOR
Q0102	4815359H01	DUAL PNP
Q0106	4816134H01	ANALOG SWITCH
Q0107	4813970A59	P-CHANNEL MOSFET
Q0108	4815261H01	ANALOG SWITCH
Q0200	4885061Y01	NPN RF TRANSISTOR
Q0201	4885061Y01	NPN RF TRANSISTOR
Q0202	4802197J95	NPN RF TRANSISTOR
Q0300	4885061Y01	NPN RF TRANSISTOR
Q0301	4885061Y01	NPN RF TRANSISTOR
Q0302	4802197J95	NPN RF TRANSISTOR
Q0400	NOT PLACED	–
Q0401	4815267H01	DUAL PNP
Q0402	4885593U03	NPN RF TRANSISTOR
Q0403	4815270H01	DUAL NPN/PNP
Q0405	4885593U03	NPN RF TRANSISTOR
Q0500	4802197J95	NPN RF TRANSISTOR
Q0501	4802197J95	NPN RF TRANSISTOR
Q0600	4885061Y01	NPN RF TRANSISTOR
Q0601	4813973A04	NPN DARLINGTON
Q0701	4816013H01	DUAL NPN/PNP
Q0702	0105958T75	MRF1570 PA ASSEMBLY
Q0703	4816548H01	N-CHANNEL LDMOS DRIVER
Q0704	4813973B02	PNP
Q0705	4816547H01	N-CHANNEL LDMOS PRE-DRIVER
Q0706	4815272H01	ANALOG SWITCH
Q0707	4815272H01	ANALOG SWITCH
Q0708	4815272H01	ANALOG SWITCH
Q0709	4815272H01	ANALOG SWITCH
Q0711	4815271H01	ANALOG SWITCH
Q0900	4815272H01	ANALOG SWITCH
Q0901	4813973A13	PNP
Q0902	4813973M07	NPN
R0100	0613952R66	0
R0101	0613952R66	0
R0102	0613952R66	0
R0103	0613952R66	0
R0104	0613952R17	47K
R0105	0613952Q58	240
R0106	0613952Q83	2.7K
R0107	0613952Q57	220
R0108	0613952Q80	2K
R0109	0613952R66	0
R0110	0613952Q42	51
R0111	0613952R66	0
R0113	0613952R01	10K
R0114	0613952Q80	2K
R0115	0613952R66	0
R0116	0613952R66	0
R0117	0613952R12	30K
R0118	0613952R66	0
R0119	0613952Q35	27
R0120	0613952R01	10K
R0122	NOT PLACED	–
R0123	0613952R19	56K
R0125	0613952R66	0
R0126	NOT PLACED	–
R0127	0613952Q33	22
R0128	0613952R66	0
R0131	0613952Q53	150
R0134	0613952Q51	120
R0139	0613952R01	10K
R0140	0613952Q31	18
R0144	0613952R01	10K
R0146	0613952R66	0
R0147	NOT PLACED	–
R0148	0613952Q60	300
R0155	0613952R66	0
R0156	NOT PLACED	–
R0157	NOT PLACED	–
R0158	NOT PLACED	–
R0159	0613952R01	10K
R0160	0613952R25	100K
R0161	0613952R25	100K
R0201	0613952Q84	3K
R0202	0613952Q66	510
R0203	0613952Q66	510
R0204	0613952Q95	8.2K
R0205	0613952Q49	100
R0206	0613952R05	15K
R0207	0613952Q18	5.1
R0208	0613952Q42	51
R0210	0613952Q89	4.7K
R0211	0613952R66	0
R0212	0613952Q25	10
R0213	0613952R01	10K
R0216	0613952Q44	62
R0218	0613952R01	10K
R0219	0613952Q66	510
R0220	0613952Q25	10
R0221	0613952Q66	510
R0224	0613952Q86	3.6K
R0225	0613952Q94	7.5K
R0226	0613952Q49	100
R0229	0613952Q53	150
R0230	0613952Q89	4.7K
R0301	0613952Q85	3.3K
R0302	0613952Q70	750
R0303	0613952Q70	750
R0304	0613952Q95	8.2K
R0305	0613952Q49	100
R0306	0613952R05	15K
R0307	0613952Q39	39
R0308	0613952Q42	51
R0310	0613952Q89	4.7K
R0311	0613952R66	0
R0312	0613952Q32	20
R0316	0613952Q45	68
R0319	0613952R10	24K
R0320	0613952R05	15K
R0321	0613952Q83	2.7K
R0324	0613952Q84	3K
R0325	0613952Q95	8.2K
R0326	0613952Q49	100
R0327	0613952R01	10K
R0329	0613952Q42	51
R0331	0613952R01	10K
R0332	0613952Q56	200
R0333	0613952Q35	27
R0334	0613952Q56	200
R0337	0613952R66	0
R0400	0613952R05	15K
R0401	0613952Q91	5.6K
R0402	0613958H55	180
R0403	NOT PLACED	–
R0404	0613952Q57	220
R0405	0613952Q91	5.6K
R0406	0613952Q83	2.7K
R0407	0613952G67	0
R0409	0613952Q75	1.2K
R0410	0613952R25	100K
R0411	0613958H55	180
R0412	0613952R25	100K
R0413	0613952Q69	680
R0414	0613952Q69	680
R0415	0613952Q69	680
R0416	0613952Q69	680
R0417	0613958H25	10
R0418	0613952Q77	1.5K
R0419	0613952Q83	2.7K
R0420	0613952Q83	2.7K
R0421	0613958H25	10
R0422	0613952K25	17.8
R0423	0613952L46	294
R0424	0613952L46	294
R0425	0613952Q75	1.2K
R0426	0613952Q83	2.7K
R0427	0613952Q25	10
R0428	0613952R01	10K
R0429	0613952Q69	680
R0430	0613952R01	10K
R0431	NOT PLACED	–
R0432	NOT PLACED	–
R0433	0613952R66	0
R0434	0613958H49	100
R0435	0613952Q23	8.2
R0436	0613952Q67	560
R0437	0613952R66	0
R0438	0613952Q67	560
R0440	0613952R25	100K
R0441	0613952R25	100K
R0443	0613952R25	100K
R0444	0613952R25	100K
R0500	0613952Q90	5.1K
R0501	0613952Q61	330
R0502	0613952R08	20K
R0503	0613952R12	30K
R0508	0613952R19	56K
R0509	0613952Q89	4.7K
R0510	0613952R12	30K
R0511	0613952Q75	1.2K
R0512	0613952Q42	51
R0601	0613952Q45	68
R0602	0613952R01	10K
R0603	0613952Q80	2K
R0604	0613952R10	24K
R0605	0613952Q61	330
R0606	0613952Q42	51
R0607	NOT PLACED	–
R0608	0613952R66	0
R0609	0613952R66	0
R0610	0613952R66	0
R0611	0613952R66	0
R0612	0613952R66	0
R0613	0613952R66	0
R0614	0613952R66	0
R0615	0613952R66	0
R0616	0613952R25	100K
R0617	0613952R01	10K
R0618	0613952Q63	390
R0619	0613952R01	10K
R0620	0613952Q96	9.1K
R0621	0613952R66	0
R0622	NOT PLACED	–
R0623	NOT PLACED	–
R0624	0613952Q90	5.1K

Circuit Ref	Motorola Part No.	Description
R0625	0613952N69	51.1K
R0626	0613952N81	68.1K
R0627	0613952R66	0
R0700	NOT PLACED	–
R0701	0613958J74	0
R0702	NOT PLACED	–
R0706	0613958S55	180
R0709	0613959Q60	300
R0711	0613952H57	220
R0712	0613952H48	91
R0713	0613959H12	30K
R0714	0613952H46	75
R0715	0613952H46	75
R0718	0613952H25	10
R0719	0613959Q25	10
R0720	0613952H25	10
R0722	0613952H89	4.7K
R0724	0613952H79	1.8K
R0725	0613952Q59	270
R0726	0613952N01	10K
R0727	0613952H92	6.2K
R0728	0613952J01	10K
R0729	0613952J01	10K
R0730	0613952H73	1K
R0732	0613952H73	1K
R0734	0613952G67	0
R0735	0613959Y49	100
R0738	0613959Y42	51
R0739	NOT PLACED	–
R0740	0613952J25	100K
R0741	0613952J17	47K
R0742	0613959Q25	10
R0743	0613958S73	1K
R0744	NOT PLACED	–
R0745	0613952H65	470
R0747	0613952H89	4.7K
R0748	0613952J19	56K
R0749	0613952G67	0
R0750	0613952J01	10K
R0751	0613952J08	20K
R0752	0613952G67	0
R0753	0613952H73	1K
R0754	0613952H25	10
R0755	0613952H25	10
R0756	0613952J25	100K
R0757	0613952J17	47K
R0759	0613952H25	10
R0760	0613952Q83	2.7K
R0761	0613952G67	0
R0762	0613958S29	15
R0763	0613958S29	15
R0764	0613958S29	15
R0765	0613958S29	15
R0766	0613958S29	15
R0768	0613958S29	15
R0769	0613958S29	15
R0770	0613958S29	15
R0771	0613958S29	15
R0773	0613958S29	15
R0774	0613952J21	68K
R0775	NOT PLACED	–
R0777	0613952H25	10
R0900	0613952N73	56.2K
R0901	0613952N62	43.2K
R0902	0613952Q82	2.4K
R0903	0613952N34	22.1K
R0906	0613952R66	0
R0907	0613952R66	0
R0909	0613952N62	43.2K
R0910	0613952H73	1K
R0911	0613952N01	10K
R0912	0613952N30	20K
R0913	0613952R66	0
R0914	0613952P26	182K
R0915	0613952N81	68.1K
R0916	0613952M66	4.75K
R0917	0613952H91	5.6K
R0918	0613952H63	390
R0919	0613952R15	39K
R0920	0613952N42	26.7K
R0921	0613952H81	2.2K
R0922	0613952R14	36K
R0923	0613952R66	0
R0924	0613952H91	5.6K
R0925	0613952H91	5.6K
R0926	0613958H53	150
R0927	0613952H42	51
R0928	0613958H39	39
R0929	0613958H39	39
R0930	0613952R07	18K
R0931	0613952R66	0
R0936	0613952N66	47.5K
R0937	0613952N21	16.2K
R0938	0613952R66	0
R0940	0613952R66	0
R0941	0613952R66	0
R0942	0613952M81	6.81K
R0943	0613952N58	39.2K
R0944	0613952R66	0
R0946	0613952M51	3.32K
R0947	0613952R66	0
R0950	0613952N01	10K
R0951	0613952N62	43.2K
R0954	0613952R40	430K
R0955	0613952P01	100K
R0960	0613952H82	2.4K
R0970	0613958H56	200
R0971	0613958H55	180
R0972	2414017N24	100nH
R0973	NOT PLACED	–
R0974	0613958H55	180
R0975	0613958H56	200
R0976	0613952H53	150
R0977	0613952H53	150
R0978	0613952G67	0
R0979	0613952G67	0
RT0908	0615585H01	THERMISTOR, 47K
RT0953	0615585H01	THERMISTOR, 47K
SH0100	2615362H01	SHIELD
SH0101	2615362H01	SHIELD
SH0300	2615362H01	SHIELD
SH0301	2615362H01	SHIELD
SH0500	2615576H01	SHIELD
SH0900	2686423Z02	SHIELD
SH0901	2686425Z02	SHIELD
SP0700	1015349H01	SOLDER PREFORM
SP0701	1015349H01	SOLDER PREFORM
SP0702	1015349H01	SOLDER PREFORM
SP0703	1015349H01	SOLDER PREFORM
SP0704	1015349H01	SOLDER PREFORM
SP0705	1015349H01	SOLDER PREFORM
SP0706	1015349H01	SOLDER PREFORM
SP0707	1015349H01	SOLDER PREFORM
T0400	2515121H01	BALUN XFMR
T0401	2515121H01	BALUN XFMR
U0100	5104932K08	IC, FRACN SYNTHESIZER
U0101	5114000B59	ANALOG SWITCH
U0201	4815267H01	DUAL PNP
U0303	NOT PLACED	–
U0304	4815267H01	DUAL PNP
U0600	5102495J14	IC, RF ASIC
U0601	5115391H01	VOLTAGE REGULATOR
U0700	4802246J29	PA PRE-DRIVER
U0900	5115147H01	DUAL OPAMP
U0901	5115147H01	DUAL OPAMP
U0940	5180390L83	IC, PA CONTROLLER
U0941	5115391H01	VOLTAGE REGULATOR
U0942	5114004A35	VOLTAGE DETECTOR
VR0700	4813977M11	DIODE, 5.6V ZENER
Y0100	5116032H01	0.5PPM 16.8MHZ TCXO

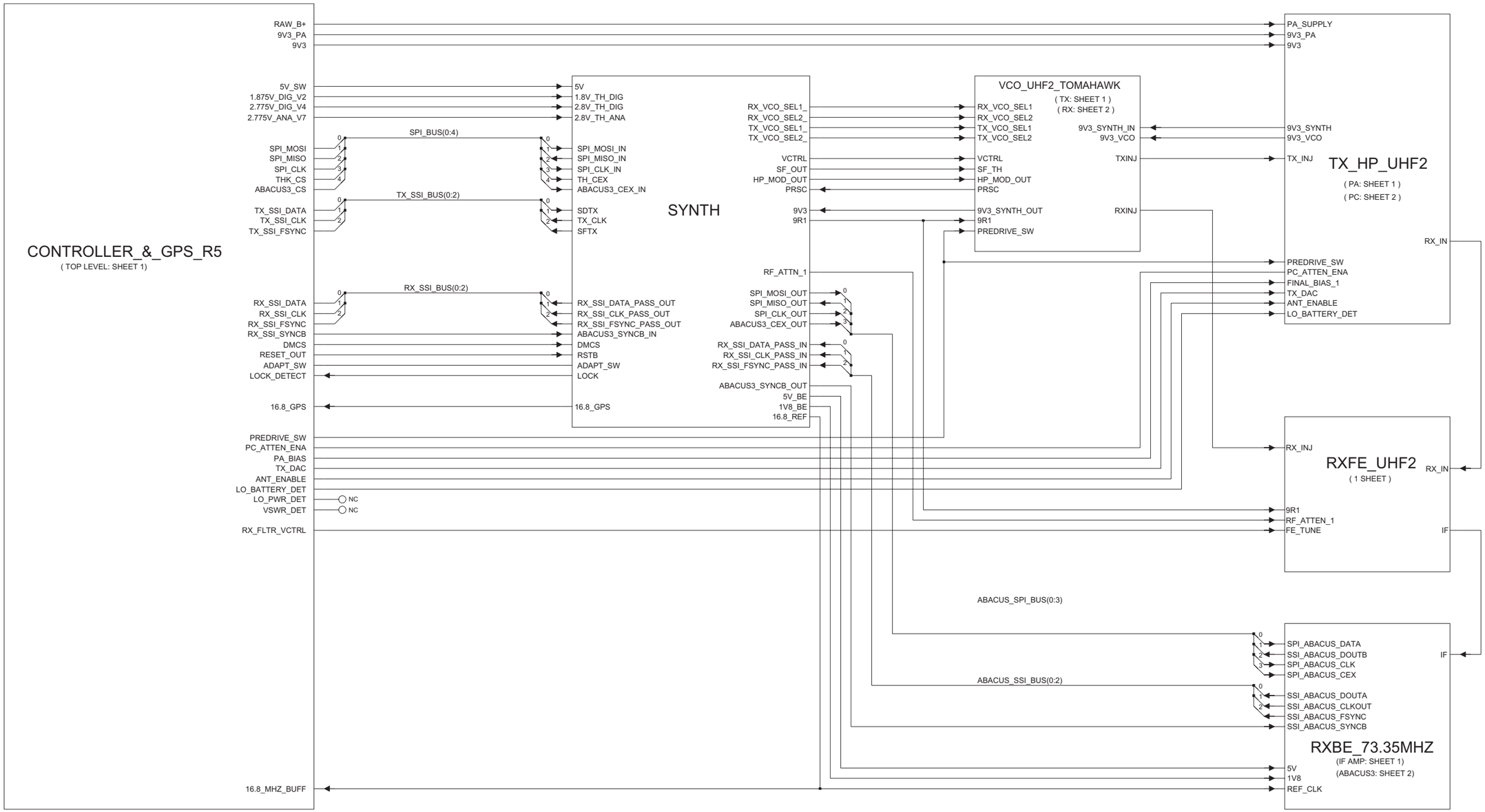
3.0 UHF2 (450–512 MHz) 1– 40W PCB / Schematics / Parts List



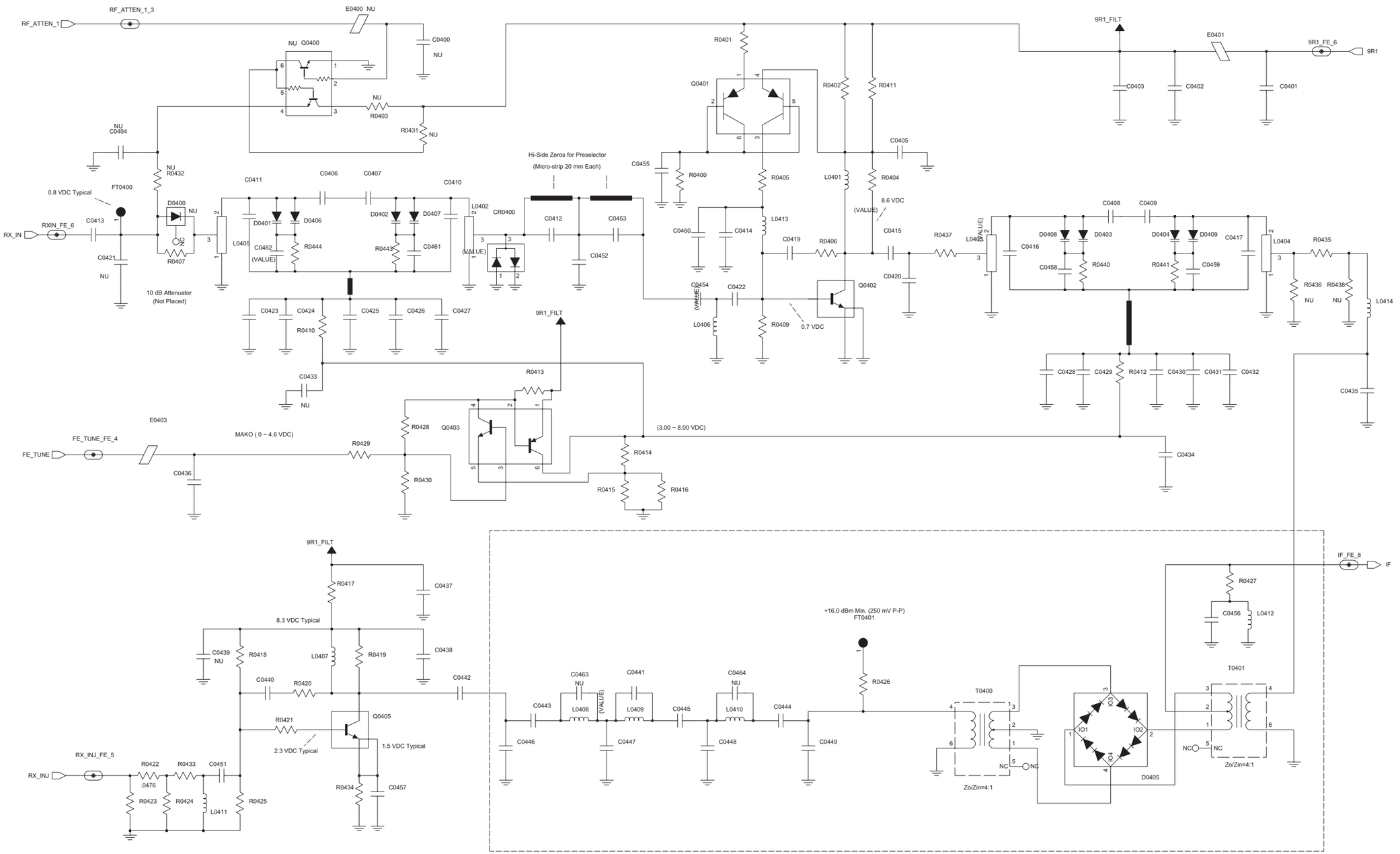
UHF2 (450–512 MHz) 1–40W 8471696M02 Top Side



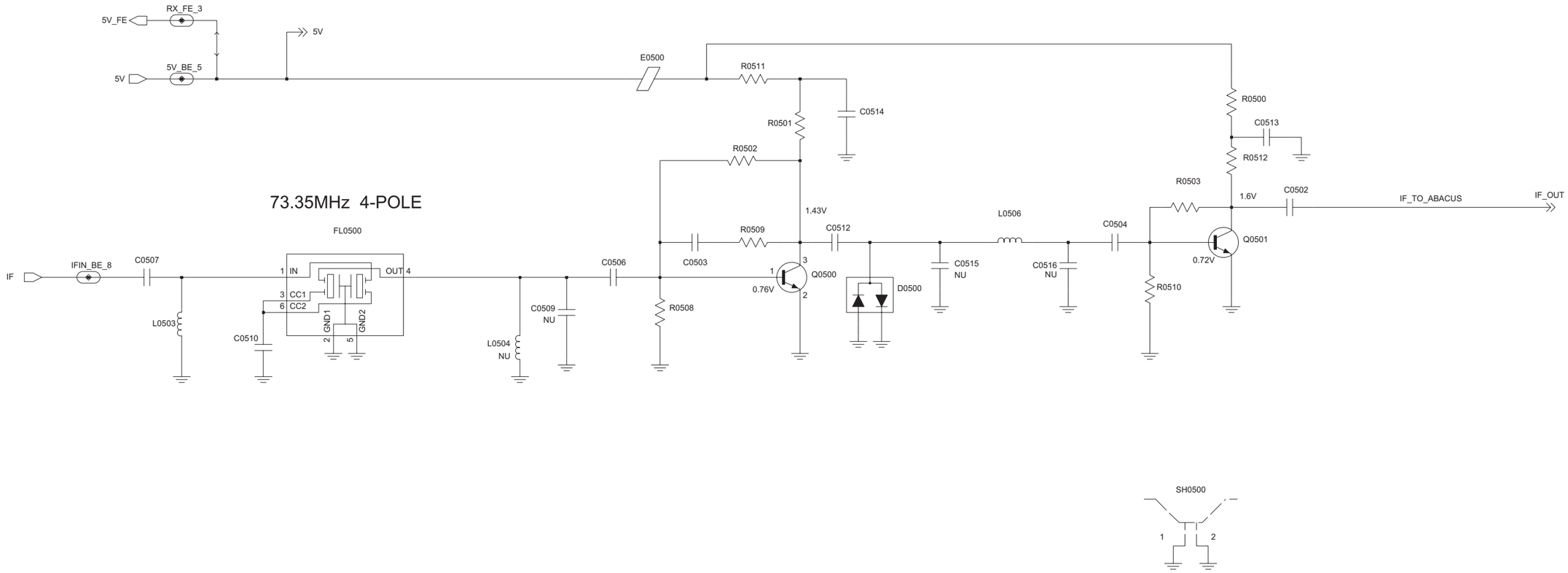
UHF2 (450–512 MHz) 1–40W 8471696M02 Bottom Side



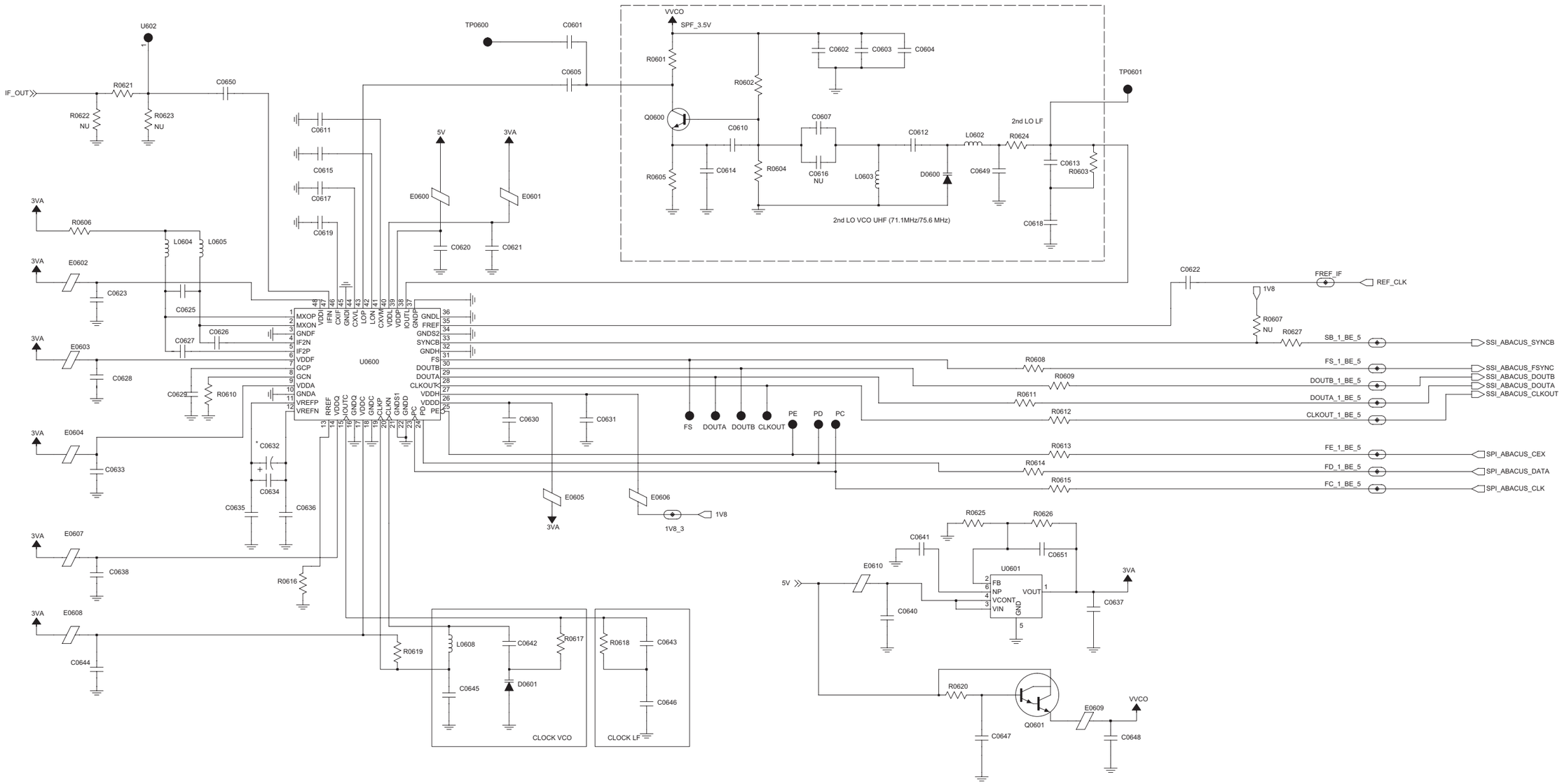
UHF2 (450–512 MHz) 1–40W Overall Schematic Diagram



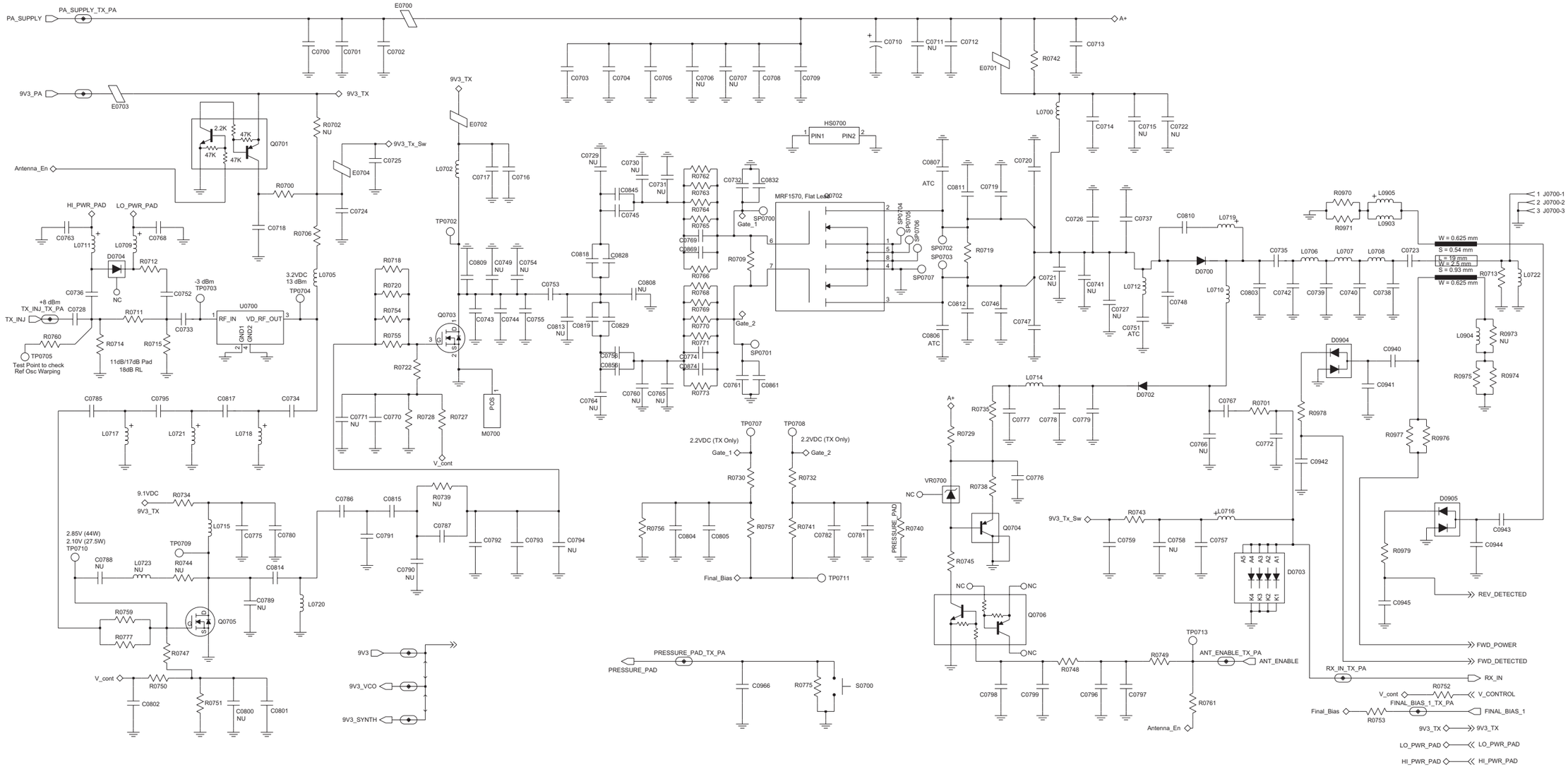
UHF2 (450–512 MHz) 1–40W Receiver Front-End Schematic Diagram



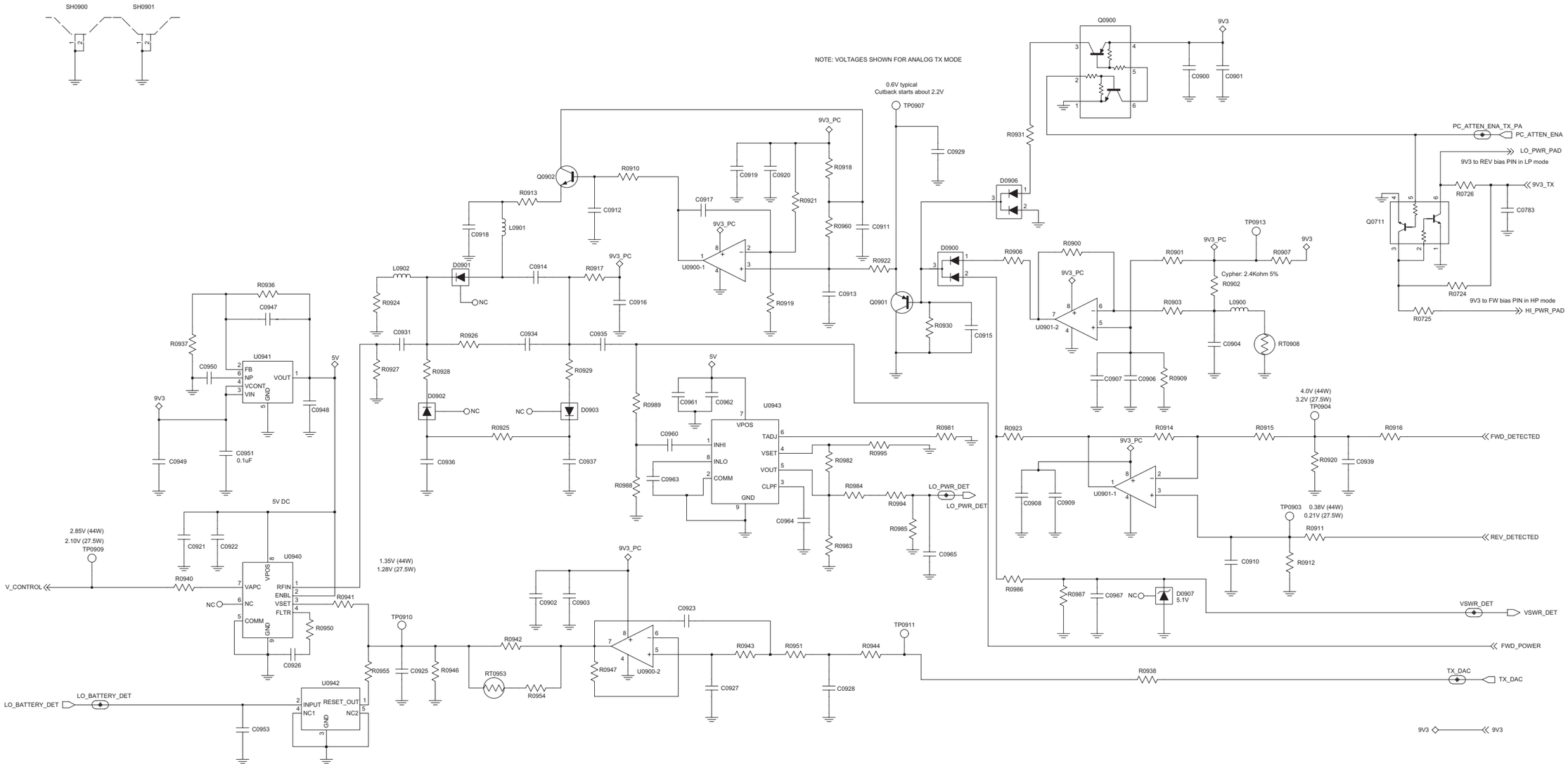
UHF2 (450–512 MHz) 1–40W Receiver IF Amp Schematic Diagram



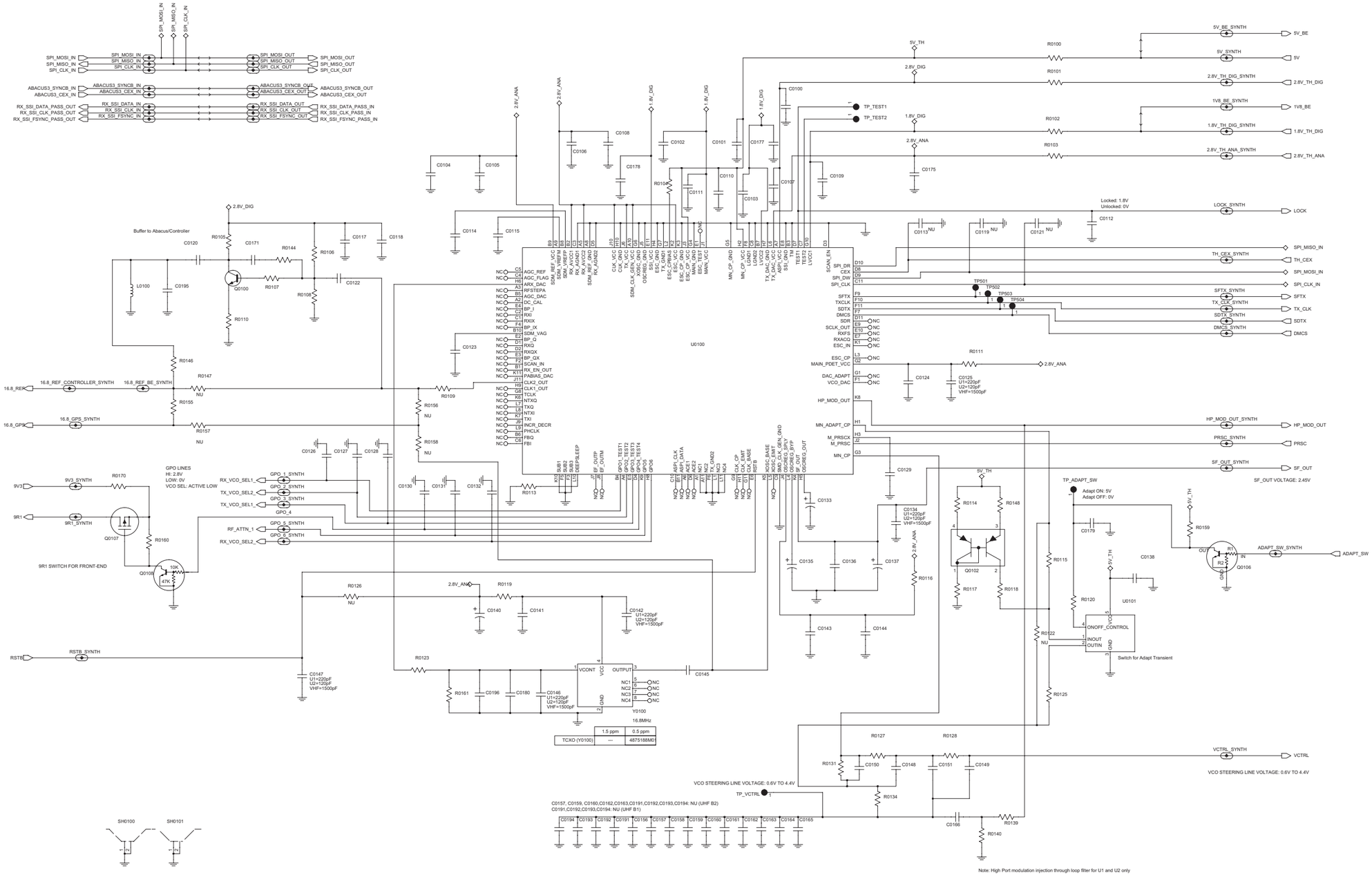
UHF2 (450–512 MHz) 1–40W Receiver Back-End Schematic Diagram



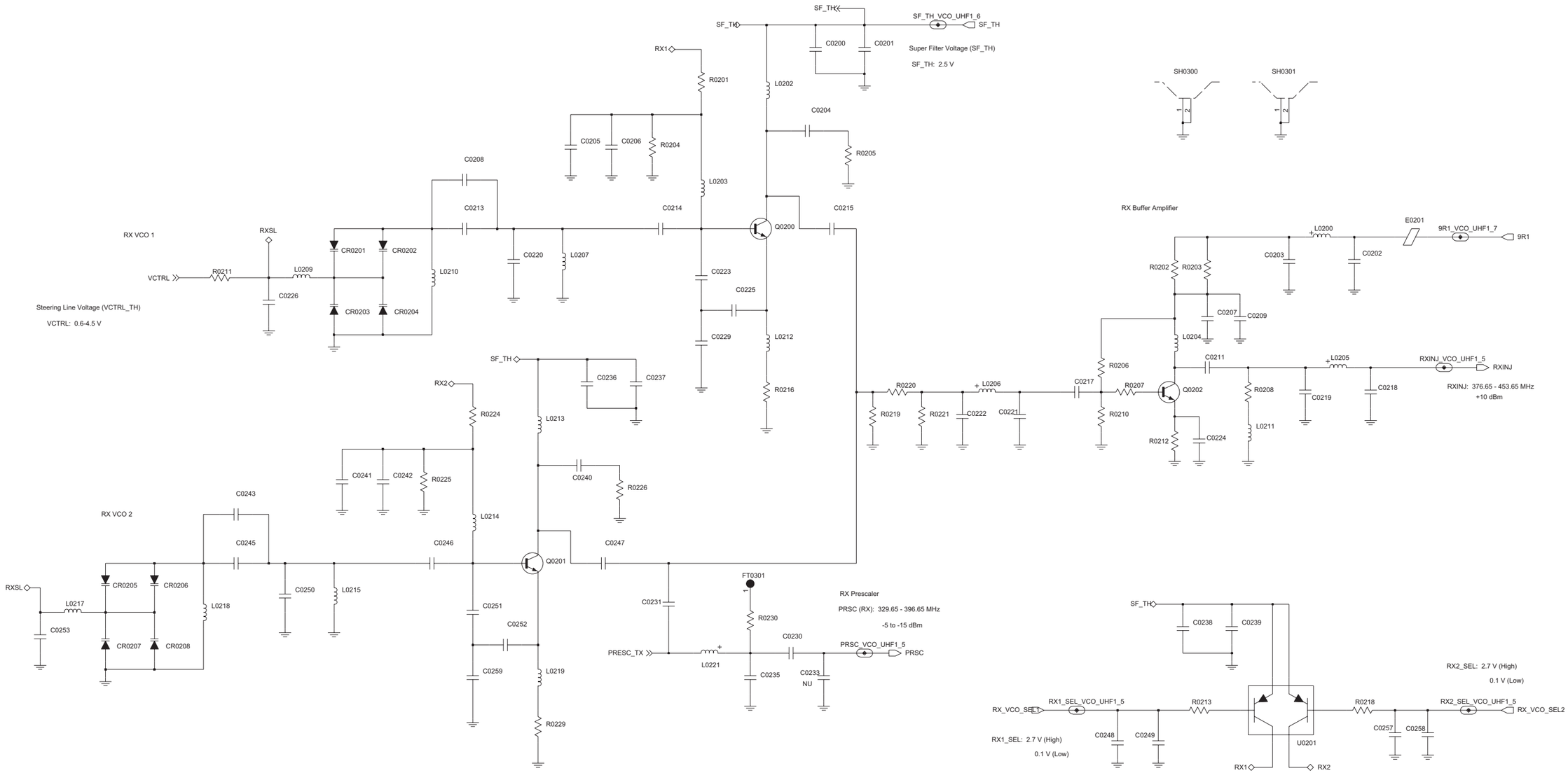
UHF2 (450–512 MHz) 1–40W Power Amplifier Schematic Diagram



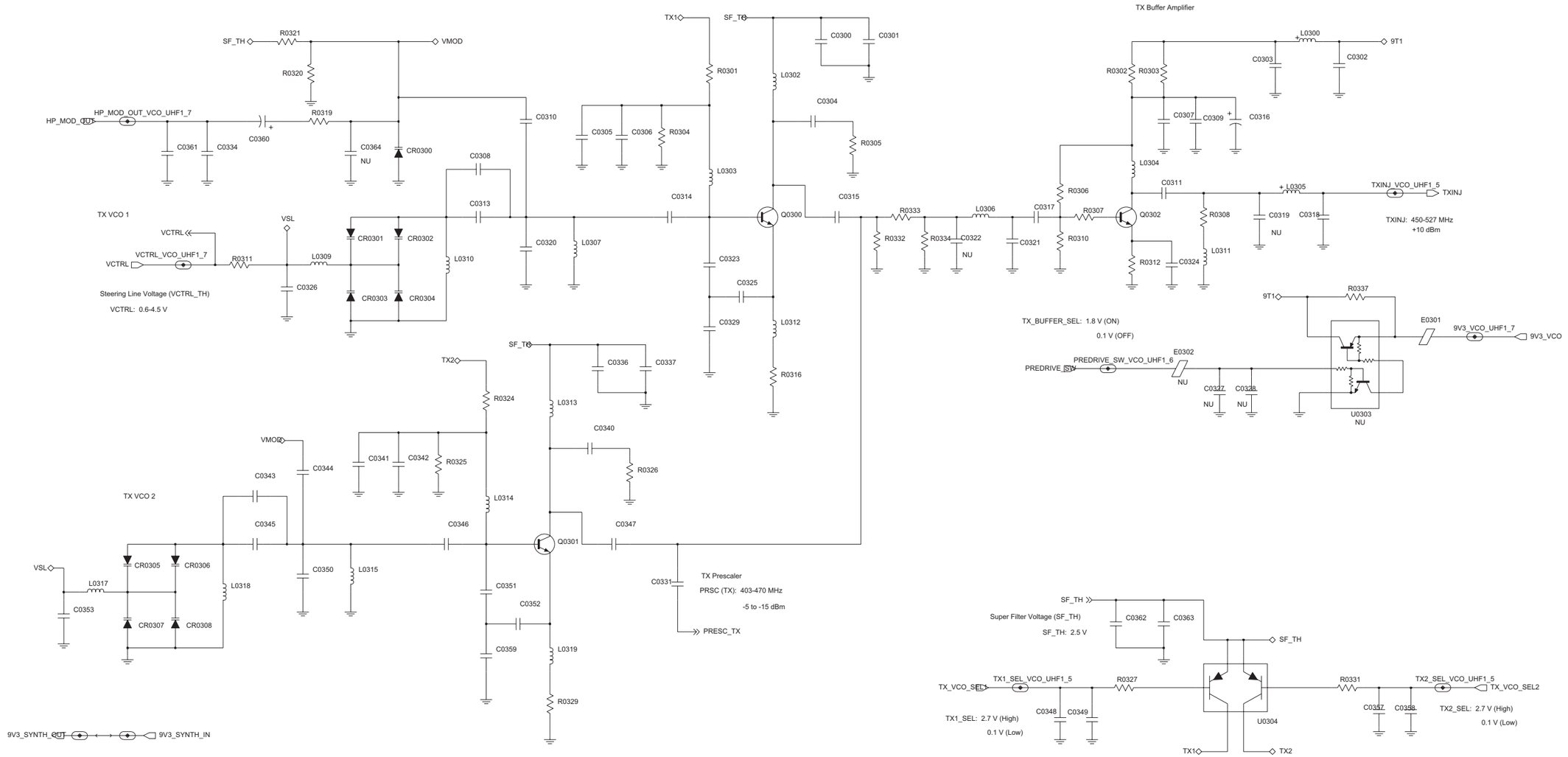
UHF2 (450–512 MHz) 1–40W Power Control Schematic Diagram



UHF2 (450–512 MHz) 1–40W Synthesizer Schematic Diagram



UHF2 (450–512 MHz) 1–40W Receiver VCO Schematic Diagram



UHF2 (450–512 MHz) 1–40W Transmit VCO Schematic Diagram

UHF2 PCB 8471696M02 Parts List 1–40W

Circuit Ref	Motorola Part No.	Description
C0100	2113944A41	120pF
C0101	2113944A41	120pF
C0102	2113944A41	120pF
C0103	2113945C31	0.1uF
C0104	2113944A41	120pF
C0105	2113945C31	0.1uF
C0106	2113945C31	0.1uF
C0107	2113945C31	0.1uF
C0108	2113944A41	120pF
C0109	2113945C31	0.1uF
C0110	2113945C31	0.1uF
C0111	2113945C31	0.1uF
C0112	2113944A41	120pF
C0113	NOT PLACED	–
C0114	2113946E02	1.0uF
C0115	2113946E02	1.0uF
C0117	2113944A41	120pF
C0118	2113945C31	0.1uF
C0119	NOT PLACED	–
C0120	2113945B02	.01uF
C0121	NOT PLACED	–
C0122	2113945B02	.01uF
C0123	2113946E02	1.0uF
C0124	2113945C31	0.1uF
C0125	2113944A41	120pF
C0126	2113944A41	120pF
C0127	2113944A41	120pF
C0128	2113944A41	120pF
C0129	2113945C31	0.1uF
C0130	2113944A41	120pF
C0131	2113944A41	120pF
C0132	2113944A41	120pF
C0133	2313960B30	4.7uF
C0134	2113944A41	120pF
C0135	2313960B32	10uF
C0136	2113945C31	0.1uF
C0137	2313960B32	10uF
C0138	2113944A41	120pF
C0140	2313960B30	4.7uF
C0141	2113945C31	0.1uF
C0142	2113944A41	120pF
C0143	2113944A41	120pF
C0144	2113945C31	0.1uF
C0145	2113945B02	.01uF
C0146	2113944A41	120pF
C0147	2113944A41	120pF
C0148	2113945D01	.033uF
C0149	2113945D01	.033uF
C0150	2113945C31	0.1uF
C0151	2113945C31	0.1uF
C0156	2185419D06	0.1uF
C0157	NOT PLACED	–
C0158	2185419D06	0.1uF
C0159	NOT PLACED	–
C0160	NOT PLACED	–
C0161	2185419D06	0.1uF
C0162	NOT PLACED	–
C0163	NOT PLACED	–
C0164	2185419D06	0.1uF
C0165	2185419D06	0.1uF
C0166	2185419D06	0.1uF
C0171	2113945B02	.01uF
C0175	2113944A41	120pF
C0177	2113944A41	120pF
C0178	2113944A41	120pF
C0179	2113944A41	120pF
C0180	2113945C31	0.1uF
C0191	NOT PLACED	–
C0192	NOT PLACED	–
C0193	NOT PLACED	–
C0194	NOT PLACED	–
C0195	2113945A05	470pF
C0196	2113946H02	10uF
C0200	2113944A41	120pF
C0201	2113945Y02	0.10uF
C0202	2113945C02	.01uF
C0203	2113944A41	120pF
C0204	2113944A41	120pF
C0205	2113945Y02	0.10uF
C0206	2113944A41	120pF
C0207	2113945C04	.022uF
C0208	2115153H18	4.3pF
C0209	2113944A41	120pF
C0211	2113944A41	120pF
C0213	2115153H17	3.9pF
C0214	2115153H34	11pF
C0215	2115153H14	3.0pF
C0217	2113944A41	120pF
C0218	2115153H14	3.0pF
C0219	2115153H01	0.5pF
C0220	2115153H23	6.8pF
C0221	2115153H24	7.5pF
C0222	2115153H14	3.0pF
C0223	2115153H46	36pF
C0224	2113944A41	120pF
C0225	2115153H51	56pF
C0226	2113944A41	120pF
C0229	2115153H43	27pF
C0230	2113944C47	150pF
C0231	2115153H14	3.0pF
C0233	NOT PLACED	–
C0235	2115153H18	4.3pF
C0236	2113944A41	120pF
C0237	2113945Y02	0.10uF
C0238	2113944A41	120pF
C0239	2113945Y02	0.10uF
C0240	2113944A41	120pF
C0241	2113945Y02	0.10uF
C0242	2113944A41	120pF
C0243	2115153H17	3.9pF
C0245	2115153H18	4.3pF
C0246	2115153H34	11pF
C0247	2115153H24	7.5pF
C0248	2113944A41	120pF
C0249	2113945Y02	0.10uF
C0250	2115153H18	4.3pF
C0251	2115153H40	20pF
C0252	2115153H48	43pF
C0253	2113944A41	120pF
C0257	2113944A41	120pF
C0258	2113945Y02	0.10uF
C0259	2115153H37	15pF
C0300	2113944A41	120pF
C0301	2113945Y02	0.10uF
C0302	2113945C02	.01uF
C0303	2113944A41	120pF
C0304	2113944A41	120pF
C0305	2113945Y02	0.10uF
C0306	2113944A41	120pF
C0307	2113945C04	.022uF
C0308	2115153H18	4.3pF
C0309	2113944A41	120pF
C0310	2115153H01	0.5pF
C0311	2113944A41	120pF
C0313	2115153H18	4.3pF
C0314	2115153H20	5.1pF
C0315	2115153H22	6.2pF
C0316	2313960B32	10uF
C0317	2113944A41	120pF
C0318	2115153H15	3.3pF
C0319	NOT PLACED	–
C0320	2115153H16	3.6pF
C0321	2115153H27	10pF
C0322	2115153H37	15pF
C0323	2115153H42	24pF
C0324	2113944A41	120pF
C0325	2115153H50	51pF
C0326	2113944A41	120pF
C0327	NOT PLACED	–
C0328	NOT PLACED	–
C0329	2115153H36	4.3pF
C0331	2115153H22	6.2pF
C0334	2113944A41	120pF
C0336	2113944A41	120pF
C0337	2113945Y02	0.10uF
C0340	2113944A41	120pF
C0341	2113945Y02	0.10uF
C0342	2113944A41	120pF
C0343	2115153H14	3.0pF
C0344	2115153H01	0.5pF
C0345	2115153H14	3.0pF
C0346	2115153H20	5.1pF
C0347	2115153H19	4.7pF
C0348	2113944A41	120pF
C0349	2113945Y02	0.10uF
C0350	2115153H11	2.2pF
C0351	2115153H42	24pF
C0352	2115153H50	51pF
C0353	2113944A41	120pF
C0357	2113944A41	120pF
C0358	2113945Y02	0.10uF
C0359	2115153H38	16pF
C0360	2313960B30	4.7uF
C0361	2113944C51	1000pF
C0362	2113944A41	120pF
C0363	2113945Y02	0.10uF
C0364	NOT PLACED	–
C0400	NOT PLACED	–
C0401	2113945C31	0.1uF
C0402	2113944A41	120pF
C0403	2115153H49	47pF
C0404	NOT PLACED	–
C0405	2113944A41	120pF
C0406	2115153H27	10pF
C0407	2115153H13	2.7pF
C0408	2115153H27	10pF
C0409	2115153H13	2.7pF
C0410	2115153H10	2.0pF
C0411	2115153H10	2.0pF
C0412	2115153H14	3.0pF
C0413	2115153H57	100pF
C0414	2113944A41	120pF
C0415	2115153H39	18pF
C0416	2115153H14	3.0pF
C0417	2115153H14	3.0pF
C0419	2113945Y02	0.10uF
C0420	2115153H08	1.6pF
C0421	2115153H13	2.7pF
C0422	2115153H36	4.3pF
C0423	2113944A44	220pF
C0424	2113944A44	220pF
C0425	2113944A44	220pF
C0426	2113944A44	220pF

Circuit Ref	Motorola Part No.	Description
C0427	2113944A44	220pF
C0428	2113944A44	220pF
C0429	2113944A44	220pF
C0430	2113944A44	220pF
C0431	2113944A44	220pF
C0432	2113944A44	220pF
C0433	NOT PLACED	–
C0434	2113944A41	120pF
C0435	2115153H13	2.7pF
C0436	2113944A41	120pF
C0437	2113944A41	120pF
C0438	2113944A41	120pF
C0439	NOT PLACED	–
C0440	2113944A41	120pF
C0441	2115153H11	2.2pF
C0442	2115153H18	4.3pF
C0443	2115153H57	100pF
C0444	2115153H57	100pF
C0445	2115153H43	27pF
C0446	2115153H20	5.1pF
C0447	2115153H27	10pF
C0448	2115153H26	9.1pF
C0449	2115153H27	10pF
C0451	2115153H49	47pF
C0452	NOT PLACED	–
C0453	2115153H40	20pF
C0454	2113944A41	120pF
C0455	2113945C31	0.1uF
C0456	2113944A40	100pF
C0457	2113945C31	0.1uF
C0458	2115153H40	20pF
C0459	2115153H40	20pF
C0460	2113946F05	10uF
C0461	2115153H40	20pF
C0462	2115153H40	20pF
C0463	NOT PLACED	–
C0464	2115153H08	1.6pF
C0502	2113945Y02	0.10uF
C0503	2113945Y02	0.10uF
C0504	2113945Y02	0.10uF
C0506	2113945Y02	0.10uF
C0507	2115153H39	18pF
C0509	NOT PLACED	–
C0510	2115153H22	6.2pF
C0512	2113945Y02	0.10uF
C0513	2113945Y02	0.10uF
C0514	2113945Y02	0.10uF
C0515	NOT PLACED	–
C0516	NOT PLACED	–
C0601	2115153H48	43pF
C0602	2113945B02	.01uF

Circuit Ref	Motorola Part No.	Description
C0603	2113944A44	220pF
C0604	2113945Y02	0.10uF
C0605	2115153H48	43pF
C0607	2115153H39	18pF
C0610	2115153H53	68pF
C0611	2113945A09	1000pF
C0612	2115153H34	11pF
C0613	2185419D03	0.01uF
C0614	2115153H48	43pF
C0615	2113945B02	.01uF
C0616	NOT PLACED	–
C0617	2113945Y02	0.10uF
C0618	2185419D06	0.1uF
C0619	2113945Y02	0.10uF
C0620	2113945Y02	0.10uF
C0621	2113945Y02	0.10uF
C0622	2113945A09	1000pF
C0623	2113945Y02	0.10uF
C0625	2113944C89	200pF
C0626	2113944A40	100pF
C0627	2113944A40	100pF
C0628	2113945Y02	0.10uF
C0629	2113945A11	2200pF
C0630	2113945Y02	0.10uF
C0631	2113945Y02	0.10uF
C0632	2313960B30	4.7uF
C0633	2113945Y02	0.10uF
C0634	2113945B02	.01uF
C0635	2113944A40	100pF
C0636	2113944A40	100pF
C0637	2113946S35	1.0uF
C0638	2113945Y02	0.10uF
C0640	2113946N03	2.2uF
C0641	2113945B02	.01uF
C0642	2115153H53	68pF
C0643	2113945Y02	0.10uF
C0644	2113945Y02	0.10uF
C0645	2113945B02	.01uF
C0646	2113946G04	0.68uF
C0647	2113946J03	10.0uF
C0648	2113946J03	10.0uF
C0649	2113945A12	3300pF
C0650	2115153H44	30pF
C0651	2115153H57	100pF
C0700	2113944C82	30pF
C0701	2113945C04	.022uF
C0702	2113944C55	2200pF
C0703	2113944C82	30pF
C0704	2113945C04	.022uF
C0705	2113944C51	1000pF
C0706	NOT PLACED	–

Circuit Ref	Motorola Part No.	Description
C0707	NOT PLACED	–
C0708	2113944C51	1000pF
C0709	2113945C31	0.1uF
C0710	2371403L02	10uF
C0711	NOT PLACED	–
C0712	2113944C51	1000pF
C0713	2111078B42	100pF
C0714	2111078B42	100pF
C0715	2113944F79	560pF
C0716	2113944A41	120pF
C0717	2113945A09	1000pF
C0718	2113945A09	1000pF
C0719	2111078B04	4.3pF
C0720	NOT PLACED	–
C0721	2111078B04	4.3pF
C0722	NOT PLACED	–
C0723	2111078B39	75pF
C0724	2113944A41	120pF
C0725	2113944A41	120pF
C0726	2111078B19	16pF
C0727	NOT PLACED	–
C0728	2113944C42	75pF
C0729	NOT PLACED	–
C0730	NOT PLACED	–
C0731	NOT PLACED	–
C0732	2113951B41	24pF
C0733	2113944C42	75pF
C0734	2113944C42	75pF
C0735	2111078B39	75pF
C0736	2113944A41	120pF
C0737	2111078B01	3.3pF
C0738	2111078B09	6.8pF
C0739	2171388L01	12pF
C0740	2171388L01	12pF
C0741	NOT PLACED	–
C0742	2111078B04	4.3pF
C0743	2113944C33	18pF
C0744	2113944C83	36pF
C0745	2113944F44	12pF
C0746	2111078B04	4.3pF
C0747	NOT PLACED	–
C0748	2111078B11	8.2pF
C0749	NOT PLACED	–
C0751	2111078B11	8.2pF
C0752	2113944A41	120pF
C0753	2111078B39	75pF
C0754	NOT PLACED	–
C0755	2113944C30	10pF
C0756	2113944F44	12pF
C0757	2113944C42	75pF
C0758	NOT PLACED	–

Circuit Ref	Motorola Part No.	Description
C0759	2113944C42	75pF
C0760	NOT PLACED	–
C0761	2113951B41	24pF
C0763	2113944A41	120pF
C0764	NOT PLACED	–
C0765	NOT PLACED	–
C0766	NOT PLACED	–
C0767	2113944C46	120pF
C0768	2113944A41	120pF
C0769	2113944F51	24pF
C0770	2113944A41	120pF
C0771	NOT PLACED	–
C0772	2113944C16	2.7pF
C0774	2113944F51	24pF
C0775	2113945C04	.022uF
C0776	2113944C42	75pF
C0777	2113944C42	75pF
C0778	2111078B29	33pF
C0779	2111078B29	33pF
C0780	2113944A41	120pF
C0781	2113944C42	75pF
C0782	2113944C51	1000pF
C0783	2113944A41	120pF
C0785	2113944C35	27pF
C0786	2113944C82	30pF
C0787	2113944C38	47pF
C0788	NOT PLACED	–
C0789	NOT PLACED	–
C0790	NOT PLACED	–
C0791	2113944A25	10pF
C0792	2113944A28	18pF
C0793	2113944A25	10pF
C0794	NOT PLACED	–
C0795	2113944C29	9.1pF
C0796	2113944C42	75pF
C0797	2113944C51	1000pF
C0798	2113944C51	1000pF
C0799	2113944C42	75pF
C0800	NOT PLACED	–
C0801	2113944A41	120pF
C0802	2113944A41	120pF
C0803	2111078B01	3.3pF
C0804	2113944C42	75pF
C0805	2113944C51	1000pF
C0806	2185400Y45	30pF
C0807	2185400Y45	30pF
C0808	NOT PLACED	–
C0809	2113944C30	10pF
C0810	2113944C42	75pF
C0811	2111078B19	16pF
C0812	2111078B19	16pF

Circuit Ref	Motorola Part No.	Description
C0813	NOT PLACED	–
C0814	2113944C46	120pF
C0815	2113944C42	75pF
C0817	2113944C27	7.5pF
C0818	2113944F54	33pF
C0819	2113944F54	33pF
C0828	2113944F54	33pF
C0829	2113944F54	33pF
C0832	2113951B41	24pF
C0845	2113944F44	12pF
C0856	2113944F44	12pF
C0861	2113951B41	24pF
C0869	2113944F51	24pF
C0874	2113944F51	24pF
C0900	2113944A41	120pF
C0901	2113945C31	0.1uF
C0902	2113945C31	0.1uF
C0903	2113944A41	120pF
C0904	2113944A41	120pF
C0906	2113944A41	120pF
C0907	2113945C02	.01uF
C0908	2113945C31	0.1uF
C0909	2113944A41	120pF
C0910	2113944A41	120pF
C0911	2113944A41	120pF
C0912	2113944A41	120pF
C0913	2113944A41	120pF
C0914	2113944A41	120pF
C0915	2113944A41	120pF
C0916	2113944A41	120pF
C0917	2113945A09	1000pF
C0918	2113944A41	120pF
C0919	2113945C31	0.1uF
C0920	2113944A41	120pF
C0921	2113945C31	0.1uF
C0922	2113944A41	120pF
C0923	2113944C55	2200pF
C0925	2113944A41	120pF
C0926	2113945L41	4700pF
C0927	2113944C02	220pF
C0928	2113944C53	1500pF
C0929	2113944A41	120pF
C0931	2113944A41	120pF
C0934	2113944A41	120pF
C0935	2113944A41	120pF
C0936	2113944A41	120pF
C0937	2113944A41	120pF
C0939	2113944A41	120pF
C0940	2113944C46	120pF
C0941	2113944M17	9.1pF
C0942	2113944C42	75pF
C0943	2113944C42	75pF
C0944	2113944M06	3.3pF
C0945	2113944C42	75pF
C0947	2113944A40	100pF
C0948	2113946S35	1.0uF
C0949	2113946G01	2.2uF
C0950	2113945A09	1000pF
C0951	2113945C31	0.1uF
C0953	2113944A41	120pF
C0960	NOT PLACED	–
C0961	NOT PLACED	–
C0962	NOT PLACED	–
C0963	NOT PLACED	–
C0964	NOT PLACED	–
C0965	NOT PLACED	–
C0966	2113944A41	120pF
C0967	2113944A41	120pF
CR0201	4815096H01	DIODE VARACTOR 1SV305
CR0202	4815096H01	DIODE VARACTOR 1SV305
CR0203	4815096H01	DIODE VARACTOR 1SV305
CR0204	4815096H01	DIODE VARACTOR 1SV305
CR0205	4815096H01	DIODE VARACTOR 1SV305
CR0206	4815096H01	DIODE VARACTOR 1SV305
CR0207	4815096H01	DIODE VARACTOR 1SV305
CR0208	4815096H01	DIODE VARACTOR 1SV305
CR0300	4815096H01	DIODE VARACTOR 1SV305
CR0301	4815096H01	DIODE VARACTOR 1SV305
CR0302	4815096H01	DIODE VARACTOR 1SV305
CR0303	4815096H01	DIODE VARACTOR 1SV305
CR0304	4815096H01	DIODE VARACTOR 1SV305
CR0305	4815096H01	DIODE VARACTOR 1SV305
CR0306	4815096H01	DIODE VARACTOR 1SV305
CR0307	4815096H01	DIODE VARACTOR 1SV305
CR0308	4815096H01	DIODE VARACTOR 1SV305
CR0400	4813974A19	DIODE, SCHOTTKY
D0400	NOT PLACED	–
D0401	4885055Y01	DIODE VARACTOR 1SV229
D0402	4885055Y01	DIODE VARACTOR 1SV229
D0403	4885055Y01	DIODE VARACTOR 1SV229
D0404	4885055Y01	DIODE VARACTOR 1SV229
D0405	4815090H01	DIODE, MIXER
D0406	4885055Y01	DIODE VARACTOR 1SV229
D0407	4885055Y01	DIODE VARACTOR 1SV229
D0408	4885055Y01	DIODE VARACTOR 1SV229
D0409	4885055Y01	DIODE VARACTOR 1SV229
D0500	4813974A19	DIODE, SCHOTTKY
D0600	4815096H01	DIODE VARACTOR 1SV305
D0601	4815096H01	DIODE VARACTOR 1SV305
D0700	4802482J02	DIODE, PIN
D0702	4802482J02	DIODE, PIN
D0703	4875430M01	DIODE, PIN
D0704	4813974A06	DIODE, PIN
D0900	4813978C02	DIODE, SWITCHING
D0901	4815023H01	DIODE, PIN
D0902	4815024H01	DIODE, PIN
D0903	4815024H01	DIODE, PIN
D0904	4813974A21	DIODE, SCHOTTKY
D0905	4813974A21	DIODE, SCHOTTKY
D0906	4813978C02	DIODE, SWITCHING
D0907	4813977M10	DIODE, 5.1V ZENER
E0201	2409134J25	FERRITE BEAD
E0301	2409134J25	FERRITE BEAD
E0302	NOT PLACED	–
E0400	NOT PLACED	–
E0401	2409134J25	FERRITE BEAD
E0403	2409134J25	FERRITE BEAD
E0500	2409134J25	FERRITE BEAD
E0600	2409134J25	FERRITE BEAD
E0601	2409134J25	FERRITE BEAD
E0602	2409134J25	FERRITE BEAD
E0603	2409134J25	FERRITE BEAD
E0604	2409134J25	FERRITE BEAD
E0605	2409134J25	FERRITE BEAD
E0606	2409134J25	FERRITE BEAD
E0607	2409134J25	FERRITE BEAD
E0608	2409134J25	FERRITE BEAD
E0609	2409134J25	FERRITE BEAD
E0610	2480640Z01	FERRITE BEAD
E0700	2485011Y01	FERRITE BEAD
E0701	2485011Y01	FERRITE BEAD
E0702	7671656M01	FERRITE BEAD
E0703	2485011Y01	FERRITE BEAD
E0704	2409134J25	FERRITE BEAD
FL0500	9116854H02	73.35 MHZ CRYSTAL FILTER
HS0700	0104038J81	HEATSINK
J0700	0905901V11	MINI-U RF CONNECTOR
L0100	2414017N29	270nH
L0200	2414017N28	220nH
L0202	2414032F41	390nH
L0203	2414032F41	390nH
L0204	2414017N28	220nH
L0205	2414017N19	39nH
L0206	2414017N13	12nH
L0207	2415385H01	8nH
L0209	2414032F41	390nH
L0210	2414015A32	18nH
L0211	2414017N28	220nH
L0212	2414032F41	390nH
L0213	2414032F41	390nH
L0214	2414032F41	390nH
L0215	2415385H01	8nH
L0217	2414032F41	390nH
L0218	2414015A20	22nH
L0219	2414032F41	390nH
L0221	2414017N18	33nH
L0300	2414017N28	220nH
L0302	2414032F41	390nH
L0303	2414032F41	390nH
L0304	2414017N28	220nH
L0305	2414017N17	27nH
L0306	2414017N12	10nH
L0307	2415385H01	8nH
L0309	2414032F41	390nH
L0310	2414015A32	18nH
L0311	2414017N28	220nH
L0312	2414032F41	390nH
L0313	2414032F41	390nH
L0314	2414032F41	390nH
L0315	2415385H01	8nH
L0317	2414032F41	390nH
L0318	2414015A32	18nH
L0319	2414032F41	390nH
L0401	2414015B24	15nH
L0402	NOT PLACED	–
L0403	NOT PLACED	–
L0404	NOT PLACED	–
L0405	NOT PLACED	–
L0406	2414015B29	10nH
L0407	2414015B16	27nH
L0408	2414015B17	18nH
L0409	2414015B17	18nH
L0410	2414015B17	18nH
L0411	2414015B15	22nH
L0412	2414017N20	47nH
L0413	2414017N27	180nH
L0414	2414015B23	12nH
L0503	2414015B27	390nH
L0504	NOT PLACED	–
L0506	2414032B66	820nH
L0602	2414032K23	2.7uH
L0603	2414032D20	270nH
L0604	2466505A01	10uH
L0605	2466505A01	10uH
L0608	2414032B76	4.7uH
L0700	2460592A01	17nH
L0702	2479990G01	33.47nH
L0705	2414017N26	150nH
L0706	2460592A02	12.5nH
L0707	2460592A02	12.5nH
L0708	2460592A02	12.5nH
L0709	2414017N26	150nH
L0710	2460592A02	12.5nH
L0711	2414017N26	150nH

Circuit Ref	Motorola Part No.	Description
L0712	2415385H07	35.5nH
L0714	2479990N01	43.67nH
L0715	2414017N26	150nH
L0716	2414017N27	180nH
L0717	2414017N06	3.3nH
L0718	2414017N12	10nH
L0719	2414017N22	68nH
L0720	2414017N06	3.3nH
L0721	2414017N08	4.7nH
L0722	2414032B60	390nH
L0723	NOT PLACED	–
L0900	2414032D30	1uH
L0901	2414032F42	470nH
L0902	2414032F42	470nH
L0903	2414032F23	12nH
L0904	2414032F22	8.2nH
L0905	2414017N24	100nH
M0700	2686201B02	HEATSINK
Q0100	4802197J95	NPN RF TRANSISTOR
Q0102	4815359H01	DUAL PNP
Q0106	4816134H01	ANALOG SWITCH
Q0107	4813970A59	P-CHANNEL MOSFET
Q0108	4815261H01	ANALOG SWITCH
Q0200	4885061Y01	NPN RF TRANSISTOR
Q0201	4885061Y01	NPN RF TRANSISTOR
Q0202	4802197J95	NPN RF TRANSISTOR
Q0300	4885061Y01	NPN RF TRANSISTOR
Q0301	4885061Y01	NPN RF TRANSISTOR
Q0302	4802197J95	NPN RF TRANSISTOR
Q0400	NOT PLACED	–
Q0401	4815267H01	DUAL PNP
Q0402	4885593U03	NPN RF TRANSISTOR
Q0403	4815270H01	ANALOG SWITCH
Q0405	4885593U03	NPN RF TRANSISTOR
Q0500	4802197J95	NPN RF TRANSISTOR
Q0501	4802197J95	NPN RF TRANSISTOR
Q0600	4805793Y10	NPN RF TRANSISTOR
Q0601	4813973A04	NPN DARLINGTON
Q0701	4816013H01	DUAL NPN/PNP
Q0702	48012048002	RF POWER AMPLIFIER, LDMOS
Q0703	4816548H01	N_CHANNEL LDMOS DRIVER
Q0704	4813973B02	PNP
Q0705	4816547H01	N-CHANNEL LDMOS PRE-DRIVER
Q0706	4815272H01	ANALOG SWITCH
Q0711	4815271H01	ANALOG SWITCH
Q0900	4815272H01	ANALOG SWITCH
Q0901	4813973A13	PNP
Q0902	4813973M07	NPN
R0100	0613952R66	0

Circuit Ref	Motorola Part No.	Description
R0101	0613952R66	0
R0102	0613952R66	0
R0103	0613952R66	0
R0104	0613952R17	47K
R0105	0613952Q58	240
R0106	0613952Q83	2.7K
R0107	0613952Q57	220
R0108	0613952Q80	2K
R0109	0613952R66	0
R0110	0613952Q42	51
R0111	0613952R66	0
R0113	0613952R01	10K
R0114	0613952Q80	2K
R0115	0613952R66	0
R0116	0613952R66	0
R0117	0613952R12	30K
R0118	0613952R66	0
R0119	0613952Q35	27
R0120	0613952R01	10K
R0122	NOT PLACED	–
R0123	0613952R19	56K
R0125	0613952R66	0
R0126	NOT PLACED	–
R0127	0613952Q33	100
R0128	0613952R66	0
R0131	0613952Q53	150
R0134	0613952Q51	120
R0139	0613952R01	10K
R0140	0613952Q31	18
R0144	0613952R01	10K
R0146	0613952R66	0
R0147	NOT PLACED	–
R0148	0613952Q60	300
R0155	0613952R66	0
R0156	NOT PLACED	–
R0157	NOT PLACED	–
R0158	NOT PLACED	–
R0159	0613952R01	10K
R0160	0613952R25	100K
R0161	0613952R25	100K
R0170	0613952R66	0
R0201	0613952Q84	3K
R0202	0613952Q66	510
R0203	0613952Q66	510
R0204	0613952Q95	8.2K
R0205	0613952Q49	100
R0206	0613952R05	15K
R0207	0613952Q18	5.1
R0208	0613952Q42	51
R0210	0613952Q89	4.7K
R0211	0613952R66	0

Circuit Ref	Motorola Part No.	Description
R0212	0613952Q25	10
R0213	0613952R01	10K
R0216	0613952Q44	62
R0218	0613952R01	10K
R0219	0613952Q66	510
R0220	0613952Q25	10
R0221	0613952Q66	510
R0224	0613952Q86	3.6K
R0225	0613952Q94	7.5K
R0226	0613952Q49	100
R0229	0613952Q53	150
R0230	0613952Q89	4.7K
R0301	0613952Q85	3.3K
R0302	0613952Q70	750
R0303	0613952Q70	750
R0304	0613952Q95	8.2K
R0305	0613952Q49	100
R0306	0613952R05	15K
R0307	0613952Q39	39
R0308	0613952Q42	51
R0310	0613952Q89	4.7K
R0311	0613952R66	0
R0312	0613952Q32	20
R0316	0613952Q45	68
R0319	0613952R10	24K
R0320	0613952R05	15K
R0321	0613952Q83	2.7K
R0324	0613952Q84	3K
R0325	0613952Q95	8.2K
R0326	0613952Q49	100
R0327	0613952R01	10K
R0329	0613952Q42	51
R0331	0613952R01	10K
R0332	0613952Q56	200
R0333	0613952Q35	27
R0334	0613952Q56	200
R0337	0613952R66	0
R0400	0613952R05	15K
R0401	0613952Q91	5.6K
R0402	0613958H55	180
R0403	NOT PLACED	–
R0404	0613952Q57	220
R0405	0613952Q91	5.6K
R0406	0613952Q83	2.7K
R0407	0613952G67	0
R0409	0613952Q75	1.2K
R0410	0613952R25	100K
R0411	0613958H55	180
R0412	0613952R25	100K
R0413	0613952Q69	680
R0414	0613952Q69	680

Circuit Ref	Motorola Part No.	Description
R0415	0613952Q69	680
R0416	0613952Q69	680
R0417	0613958H25	10
R0418	0613952Q77	1.5K
R0419	0613952Q83	2.7K
R0420	0613952Q83	2.7K
R0421	0613958H25	10
R0422	0613952K25	17.8
R0423	0613952L46	294
R0424	0613952L46	294
R0425	0613952Q75	1.2K
R0426	0613952Q83	2.7K
R0427	0613952Q25	10
R0428	0613952R01	10K
R0429	0613952Q69	680
R0430	0613952R01	10K
R0431	NOT PLACED	–
R0432	NOT PLACED	–
R0433	0613952R66	0
R0434	0613958H49	100
R0435	0613952Q23	8.2
R0436	0613952Q67	560
R0437	0613952R66	0
R0438	0613952Q67	560
R0440	0613952R25	100K
R0441	0613952R25	100K
R0443	0613952R25	100K
R0444	0613952R25	100K
R0500	0613952Q90	5.1K
R0501	0613952Q61	330
R0502	0613952R08	20K
R0503	0613952R12	30K
R0508	0613952R19	56K
R0509	0613952Q89	4.7K
R0510	0613952R12	30K
R0511	0613952Q75	1.2K
R0512	0613952Q42	51
R0601	0613952Q45	68
R0602	0613952R01	10K
R0603	0613952Q80	2K
R0604	0613952R10	24K
R0605	0613952Q61	330
R0606	0613952Q42	51
R0607	NOT PLACED	–
R0608	0613952R66	0
R0609	0613952R66	0
R0610	0613952R66	0
R0611	0613952R66	0
R0612	0613952R66	0
R0613	0613952R66	0
R0614	0613952R66	0

Circuit Ref	Motorola Part No.	Description
R0615	0613952R66	0
R0616	0613952R25	100K
R0617	0613952R01	10K
R0618	0613952Q63	390
R0619	0613952R01	10K
R0620	0613952Q96	9.1K
R0621	0613952R66	0
R0622	NOT PLACED	–
R0623	NOT PLACED	–
R0624	0613952Q90	5.1K
R0625	0613952N69	51.1K
R0626	0613952N81	68.1K
R0627	0613952R66	0
R0700	0613958H44	62
R0701	0613958J74	0
R0702	NOT PLACED	–
R0706	0613958S51	120
R0709	0613959Q60	300
R0711	0613952H57	220
R0712	0613952H48	91
R0713	0613959H12	30K
R0714	0613952H46	75
R0715	0613952H46	75
R0718	0613952H25	10
R0719	0613959Q25	10
R0720	0613952H25	10
R0722	0613952H89	4.7K
R0724	0613952H79	1.8K
R0725	0613952Q59	270
R0726	0613952N01	10K
R0727	0613952H92	6.2K
R0728	0613952J01	10K
R0729	0613952J01	10K
R0730	0613952H73	1K
R0732	0613952H73	1K
R0734	0613952G67	0
R0735	0613959Y49	100
R0738	0613959Y42	51
R0739	NOT PLACED	–
R0740	0613952J25	100K
R0741	0613952J17	47K
R0742	0613959Q25	10
R0743	0613958S73	1K
R0744	NOT PLACED	–
R0745	0613952H65	470
R0747	0613952H89	4.7K
R0748	0613952J19	56K
R0749	0613952G67	0
R0750	0613952J01	10K
R0751	0613952J08	20K
R0752	0613952G67	0

Circuit Ref	Motorola Part No.	Description
R0753	0613952H73	1K
R0754	0613952H25	10
R0755	0613952H25	10
R0756	0613952J25	100K
R0757	0613952J17	47K
R0759	0613952H25	10
R0760	0613952Q83	2.7K
R0761	0613952G67	0
R0762	0613958S29	15
R0763	0613958S29	15
R0764	0613958S29	15
R0765	0613958S29	15
R0766	0613958S29	15
R0768	0613958S29	15
R0769	0613958S29	15
R0770	0613958S29	15
R0771	0613958S29	15
R0773	0613958S29	15
R0775	NOT PLACED	–
R0777	0613952H25	10
R0900	0613952N73	56.2K
R0901	0613952N62	43.2K
R0902	0613952M54	3.57K
R0903	0613952N34	22.1K
R0906	0613952R66	0
R0907	0613952R66	0
R0909	0613952N62	43.2K
R0910	0613952H73	1K
R0911	0613952N01	10K
R0912	0613952N30	20K
R0913	0613952R66	0
R0914	0613952P26	182K
R0915	0613952N81	68.1K
R0916	0613952M66	4.75K
R0917	0613952H91	5.6K
R0918	0613952H63	390
R0919	0613952R15	39K
R0920	0613952N42	26.7K
R0921	0613952H81	2.2K
R0922	0613952R14	36K
R0923	0613952R66	0
R0924	0613952H91	5.6K
R0925	0613952H91	5.6K
R0926	0613958H53	150
R0927	0613952H42	51
R0928	0613958H39	39
R0929	0613958H39	39
R0930	0613952R07	18K
R0931	0613952R66	0
R0936	0613952N66	47.5K
R0937	0613952N21	16.2K

Circuit Ref	Motorola Part No.	Description
R0938	0613952R66	0
R0940	0613952R66	0
R0941	0613952R66	0
R0942	0613952M81	6.81K
R0943	0613952N58	39.2K
R0944	0613952R66	0
R0946	0613952M51	3.32K
R0947	0613952R66	0
R0950	0613952N01	10K
R0951	0613952N62	43.2K
R0954	0613952R40	430K
R0955	0613952P01	100K
R0960	0613952H82	2.4K
R0970	0613958H56	200
R0971	0613958H55	180
R0973	NOT PLACED	–
R0974	0613958H55	180
R0975	0613958H56	200
R0976	0613952H53	150
R0977	0613952H53	150
R0978	0613952G67	0
R0979	0613952G67	0
R0981	NOT PLACED	–
R0982	NOT PLACED	–
R0983	NOT PLACED	–
R0984	NOT PLACED	–
R0985	NOT PLACED	–
R0986	0613952N81	68.1K
R0987	0613952N81	68.1K
R0988	NOT PLACED	–
R0989	NOT PLACED	–
R0994	NOT PLACED	–
R0995	0613952N02	10.2K
RT0908	0615585H01	47K
RT0953	0615585H01	47K
SH0100	2615362H01	SHIELD
SH0101	2615362H01	SHIELD
SH0300	2615362H01	SHIELD
SH0301	2615362H01	SHIELD
SH0500	2615576H01	SHIELD
SH0900	2686423Z02	SHIELD
SH0901	2686425Z02	SHIELD
SP0700	1015349H01	SOLDER_PREFORM
SP0701	1015349H01	SOLDER_PREFORM
SP0702	1015349H01	SOLDER_PREFORM
SP0703	1015349H01	SOLDER_PREFORM
SP0704	1015349H01	SOLDER_PREFORM
SP0705	1015349H01	SOLDER_PREFORM
SP0706	1015349H01	SOLDER_PREFORM
SP0707	1015349H01	SOLDER_PREFORM
T0400	2515121H01	BALUN XFMR

Circuit Ref	Motorola Part No.	Description
T0401	2515121H01	BALUN XFMR
U0100	5104932K08	IC, FRACN SYNTHESIZER
U0101	5114000B59	ANALOG SWITCH
U0201	4815267H01	DUAL PNP
U0303	NOT PLACED	–
U0304	4815267H01	DUAL PNP
U0600	5102495J14	IC, RF ASIC
U0601	5115391H01	VOLTAGE REGULATOR
U0700	4802246J29	PA PRE-DRIVER
U0900	5115147H01	DUAL OPAMP
U0901	5115147H01	DUAL OPAMP
U0940	5180390L83	IC, PA CONTROLLER
U0941	5115391H01	VOLTAGE REGULATOR
U0942	5114004A35	VOLTAGE DETECTOR
U0943	5178286A01	IC, VOLTAGE DETECTOR
VR0700	4813977M11	DIODE, 5.6V ZENER
Y0100	5116032H01	0.5 PPM 16.8 MHZ TCXO (GPS Models Only)

Appendix A Replacement Parts Ordering

A.1 Basic Ordering Information

When ordering replacement parts or equipment information, the complete identification number should be included. This applies 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, and sufficient description of the desired component to identify it.

A.2 Motorola Online

Motorola Online users can access our online catalog at

http://motorola.com/businessonline

To register for online access, please call 1-800-422-4210 (for U.S. and Canada Service Centers only). International customers can obtain assistance at http://motorola.com/businessonline

A.3 Mail Orders

Mail orders are only accepted by the US Federal Government Markets Division (USFGMD).

Motorola
7031 Columbia Gateway Drive
3rd Floor - Order Processing
Columbia, MD 21046
U.S.A.

A.4 Telephone Orders

Radio Products and Solutions Organization*
(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
1-847-538-8023 (United States and Canada)

U.S. Federal Government Markets Division (USFGMD)
1-877-873-4668
8:30 AM to 5:00 PM (Eastern Standard Time)

A.5 Fax Orders

Radio Products and Solutions Organization*
(United States and Canada)
1-800-622-6210
1-847-576-3023 (United States and Canada)

USFGMD
(Federal Government Orders)
1-800-526-8641 (For Parts and Equipment Purchase Orders)

A.6 Parts Identification

Radio Products and Solutions Organization*
(United States and Canada)
1-800-422-4210

A.7 Product Customer Service

Radio Products and Solutions Organization (United States and Canada)
1-800-927-2744

* The Radio Products and Solutions Organization (RPSO) was formerly known as the Radio Products Services Division (RPSD) and/or the Accessories and Aftermarket Division (AAD).

Appendix B Motorola Service Centers

B.1 Servicing Information

If a unit requires further complete testing, knowledge and/or details of component level troubleshooting or service than is customarily performed at the basic level, please send the repeater to a Motorola Service Center as listed below.

B.2 Motorola Service Center

45D Butterfield Trail
El Paso, TX 79906
Tel: 1-800-227-6772

B.3 Motorola Federal Technical Center

4395 Nicole Drive
Lanham, MD 20706
Tel: 1-800-969-6680
Fax: 1-800-784-4133

B.4 Motorola Canadian Technical Logistics Center

Motorola Canada Ltd.
8133 Warden Avenue
Markham, Ontario, L6G 1B3
Tel: 1-800-543-3222
Fax: 1-888-331-9872 or 1-905-948-5970

Notes

Glossary

This glossary contains an alphabetical listing of terms and their definitions that are applicable to portable and mobile subscriber radio products. All terms do not necessarily apply to all radios, and some terms are merely generic in nature.

Term	Definition
Analog	Refers to a continuously variable signal or a circuit or device designed to handle such signals.
Band	Frequencies allowed for a specific purpose.
CPS	Customer Programming Software: Software with a graphical user interface containing the feature set of a radio.
Default	A pre-defined set of parameters.
Digital	Refers to data that is stored or transmitted as a sequence of discrete symbols from a finite set; most commonly this means binary data represented using electronic or electromagnetic signals.
DPL	Digital Private-Line: A type of digital communications that utilizes privacy call, as well as memory channel and busy channel lock out to enhance communication efficiency.
FCC	Federal Communications Commission.
Frequency	Number of times a complete electromagnetic-wave cycle occurs in a fixed unit of time (usually one second).
GPIO	General-Purpose Input/Output: Pins whose function is programmable.
IC	Integrated Circuit: An assembly of interconnected components on a small semiconductor chip, usually made of silicon. One chip can contain millions of microscopic components and perform many functions.
IF	Intermediate Frequency.
kHz	kilohertz: One thousand cycles per second. Used especially as a radio-frequency unit.
LCD	Liquid-Crystal Display: An LCD uses two sheets of polarizing material with a liquid-crystal solution between them. An electric current passed through the liquid causes the crystals to align so that light cannot pass through them.
LED	Light Emitting Diode: An electronic device that lights up when electricity is passed through it.
MDC	Motorola Digital Communications.
MHz	Megahertz: One million cycles per second. Used especially as a radio-frequency unit.
Paging	One-way communication that alerts the receiver to retrieve a message.
PC Board	Printed Circuit Board. Also referred to as a PCB.

Term	Definition
PL	Private-Line Tone Squelch: A continuous sub-audible tone that is transmitted along with the carrier.
Programming Cable	A cable that allows the CPS to communicate directly with the radio using USB.
Receiver	Electronic device that amplifies RF signals. A receiver separates the audio signal from the RF carrier, amplifies it, and converts it back to the original sound waves.
Repeater	Remote transmit/receive facility that re-transmits received signals in order to improve communications range and coverage (conventional operation).
RF	Radio Frequency: The portion of the electromagnetic spectrum between audio sound and infrared light (approximately 10 kHz to 10 GHz).
Signal	An electrically transmitted electromagnetic wave.
Spectrum	Frequency range within which radiation has specific characteristics.
Squelch	Muting of audio circuits when received signal levels fall below a pre-determined value. With carrier squelch, all channel activity that exceeds the radio's preset squelch level can be heard.
TOT	Time-out Timer: A timer that limits the length of a transmission.
TPL	Tone Private Line.
Transceiver	Transmitter-receiver. A device that both transmits and receives analog or digital signals. Also abbreviated as XCVR.
Transmitter	Electronic equipment that generates and amplifies an RF carrier signal, modulates the signal, and then radiates it into space.
TX	Transmit.
UHF	Ultra-High Frequency.
USB	Universal Serial Bus: An external bus standard that supports data transfer rates of 12 Mbps.
USB_DM_MAP	USB D- Connection at the rear accessory connector.
USB_DP_MAP	USB D+ Connection at the rear accessory connector.
VHF	Very High Frequency.
VIP	Vehicle Interface Port.
XPR	Refers to Digital Professional Repeater model names in the MOTOTRBO Professional Digital Two-Way Radio System.



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www.motorola.com/mototrbo





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