APX™ TWO-WAY RADIOS

APX 5000/ APX 6000/ APX 6000XE/ SRX 2200 Detailed Service Manuals

ASTRO® APX™ 5000/ APX™ 6000/ APX™ 6000XE/ SRX 2200

VHF/700–800 MHz/UHF1/UHF2
Digital Portable Radios

Detailed Service Manual

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Foreword

The information contained in this manual relates to all ASTRO® APX™ 5000/ APX™ 6000/ APX™ 6000XE/ SRX2200 digital portable radios, unless otherwise specified. This manual provides sufficient information to enable qualified service shop technicians to troubleshoot and repair an ASTRO APX 5000/ APX 6000/ APX 6000XE/ SRX2200 digital portable radio to the component level.

For details on the operation of the radio or level 1 or 2 maintenance procedures, refer to the applicable manuals, which are available separately. A list of related publications is provided in the section, “Related Publications,” on page ix.

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 radio.

ATTENTION!

This radio is restricted to occupational use only to satisfy FCC RF energy exposure requirements. Before using this product, read the RF energy awareness information and operating instructions in the Product Safety and RF Exposure booklet enclosed with your radio (Motorola Publication part number 6881095C98) to ensure compliance with RF energy exposure limits.

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

Manual Revisions

Changes which occur after this manual is printed are described in FMRs (Florida Manual Revisions). These FMRs provide complete replacement pages for all added, changed, and deleted items, including pertinent parts list data, schematics, and component layout diagrams. To obtain FMRs, contact the Customer Care and Services Division (refer to “Appendix A Replacement Parts Ordering”).

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Document History

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

Edition	Description	Date
68012002028-A	Initial edition	Aug 2011
68012002028-B	Added APX 5000 info	Sept 2011
68012002028-C	Added UHF2 info Added UHF1: NUE7369A Added APX 6000XE and SRX 2200 info	Jun 2012

Notes

Table of Contents

List of Tables

Related Publications

List of Figures

Commercial Warranty

Limited Warranty

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

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

D. Breakage or damage to antennas unless caused directly by defects in material workmanship.

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- the damage or defect is caused by charging or using the battery in equipment or service other than the Product for which it is specified.

H. Freight costs to the repair depot.

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VII. Governing Law

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

Notes

Chapter 1 Introduction

1.1 General

This manual includes all the information needed to maintain peak product performance and maximum working time for the ASTRO APX 5000/ APX 6000/ APX 6000XE/ SRX 2200 radio. This detailed level of service (component level) is typical of the service performed by some service centers, self-maintained customers, and distributors.

Use this manual in conjunction with the *ASTRO APX 5000/ APX 6000*/ APX 6000XE/ SRX 2200 VHF (136–174 MHz), UHF1 (380–470 MHz), UHF2 (450–520 MHz) and 764–870 MHz *Digital Portable Radios Basic Service Manual* (Motorola part number 68012002028), which can help in troubleshooting a problem to a particular printed circuit (PC) board.

Conduct the basic performance checks outlined in the basic service manual first to verify the need to analyze the radio and to help pinpoint the functional problem area. In addition, you will become familiar with the radio test mode of operation, which is a helpful tool. If any basic receive or transmit parameters fail to be met, the radio should be aligned according to the radio alignment procedure.

Included in other areas of this manual are functional block diagrams, detailed theory of operation, troubleshooting charts and waveforms, schematics, and parts lists. You should become familiar with these sections to aid in determining circuit problems. Also included are component location diagrams to aid in locating individual circuit components and some IC diagrams, which identify some convenient probe points.

“Chapter 3, Theory of Operation,” on page 3-1, contains detailed descriptions of the operations of many circuits. Once you locate the problem area, review the troubleshooting flowchart for that circuit to fix the problem.

1.2 Notations Used in This Manual

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

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

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

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or injury.

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or injury.

Chapter 2 Radio Power

This chapter provides a detailed circuit description of the power distribution of an ASTRO APX 5000/ APX 6000/ APX 6000XE/ SRX 2200 radio.

2.1 General

In the ASTRO APX 5000/ APX 6000/ APX 6000XE/ SRX 2200 radio, power (B+) is distributed to two boards: the transceiver (RF) board and the VOCON board (see Figure 2-1 on page 2-2).

Power for the radio is provided through a battery supplying a nominal 7.5 Vdc directly to the transceiver. The following battery types and capacities are available:

Table 2-1. Batteries

Part Number	Description
NNTN7033	4100 mAh IMPRES Li-Ion, Intrinsically Safe, Rugged
NNTN7034	4200 mAh IMPRES Li-Ion, Rugged
NNTN7035	2000 mAh IMPRES NiMH, Intrinsically Safe, Rugged
NNTN7036	2000 mAh IMPRES NiMH, Intrinsically Safe, IP67
NNTN7037	2100 mAh IMPRES NiMH, IP67
NNTN7038	2900 mAh IMPRES Li-Ion, IP67
NNTN7573	2100 mAh IMPRES NiMH, Rugged
NNTN8092	2300 mAh IMPRES Li-Ion, Intrinsically Safe, Rugged
NNTN8182	2900 mAh Li-Ion, Rugged, Military
PMNN4403	2150 mAh IMPRES Li-Ion, Slim, IP67

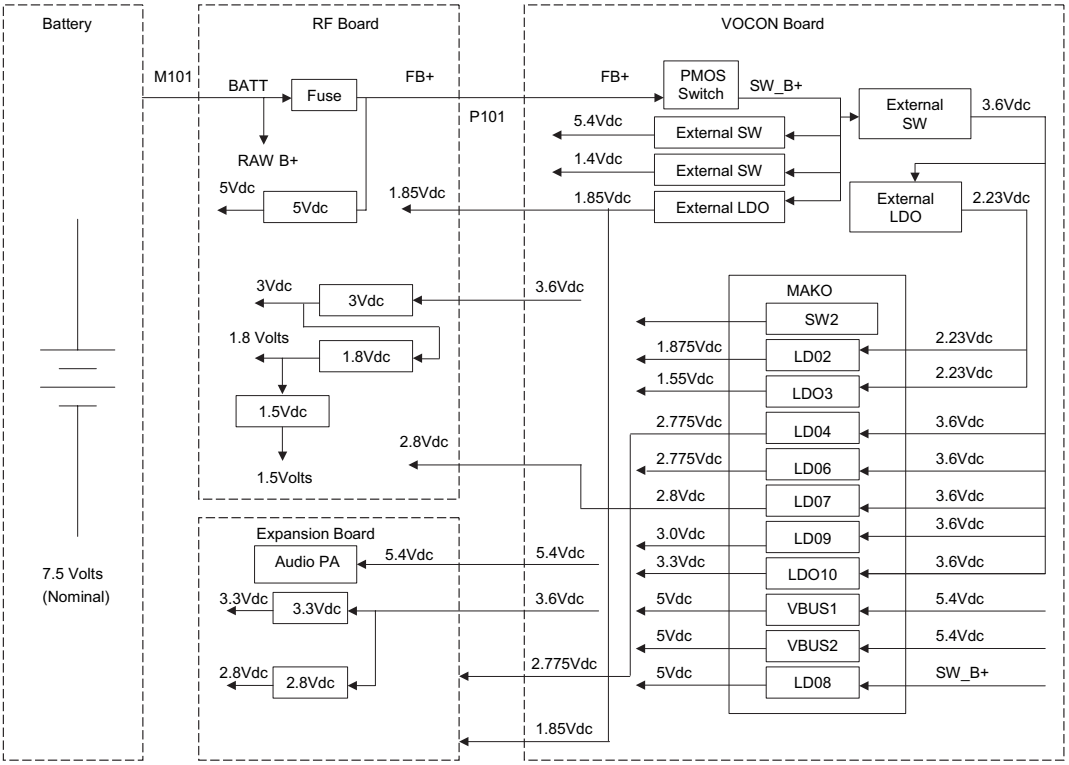


Figure 2-1. DC Power Distribution

B+ from the battery is electrically switched to most of the radio, rather than routed through the On/Off/volume control knob, S2. The electrical switching of B+ supports a *keep-alive* mode. Under software control, even when the On/Off/volume control knob has been turned to the Off position, power remains on until the MCU completes its power-down, at which time the radio is physically powered down.

2.2 DC Power Routing – Transceiver Board

NOTE: Refer to Table 8-1, “List of Transceiver Schematics and Board Overlays,” on page 8-1 for a listing of schematics showing the transceiver board DC power routing components.

Connector M101, the B-plus assembly, connects the battery to the transceiver board. Component E200 forms a power-line filter for signal DC_ RAW_B+, which supplies battery voltage to the transmitter section. Fuse F200 and filter C202, L200, C203 supply fused B plus to the VOCON board.

In turn, the VOCON board supplies VSW1 regulated 3.6 Vdc, 2.78 Vdc, and 1.85 Vdc. The 3.6 Vdc supplies regulator U201 and controls switch Q201 which supplies fuse B+ to regulator U200. Regulator U201 supplies regulator U202 which in turn supplies regulator U203. The 2.78 Vdc supplies the Trident IC U702, 16.8 MHz crystal circuit and Logic Expander IC U703. The 1.85 sets the logic level for the SPI and SSI data.

The transceiver board has four regulators 5 Vdc (U200), 3 Vdc (U201), 1.8 Vdc (U202) and 1.5 Vdc (U203). The 5 volt regulator supplies the FGU section, transmitter ALC and receiver back end. The 3 volt regulator supplies dc for the receiver front ends, mixer, receiver back end and GPS. The 1.8 volt regulator supplies dc for the receiver front end and mixer. The 1.5 volt regulator supplies dc for the buffers in the FGU section.

The transceiver regulated power supplies are summarized in Table 2-2.

Table 2-2. Transceiver Voltage Regulators

Reference Designator	IC Name	Output Signal Name	Description
U200	LP2989	DC_LIN_5V	Regulated 5.0 Vdc
U201	LP5900	DC_LIN_3V	Regulated 3.0 Vdc
U202	LP5900	DC_LIN_1_8V	Regulated 1.8 Vdc
U203	LP5952	DC_LIN_1_5V	Regulated 1.5 Vdc

2.3 DC Power Routing – VOCON Board

NOTE: Refer to Table 8-2, "List of VOCON Schematics and Board Overlays," on page 8-2 for a listing of schematics showing the VOCON board DC power routing components.

Refer to "3.2.2 DC Distribution" on page 3-27 for details on DC Power Routing for VOCON Board.

Notes

Chapter 3 Theory of Operation

This chapter provides a detailed circuit description of the ASTRO APX 5000/ APX 6000/ APX 6000XE/ SRX 2200 transceiver and VOCON boards. When reading the theory of operation, refer to the appropriate schematic and component location diagrams located in the back of this manual. This detailed theory of operation can help isolate the problem to a particular component.

The ASTRO APX 5000/ APX 6000/ APX 6000XE radio, which is a single-band synthesized radio, is available in the VHF (136–174 MHz), 7/800 (764–870 MHz), UHF1 (380–470 MHz) and UHF2 (450–520 MHz) frequency bands. The ASTRO SRX 2200 radio is available in the VHF (136–174 MHz) and UHF1 (380–470 MHz) frequency bands. The UHF1 band SRX 2200 is available with a low power setting that limits the transmit power to 0.25 watt.

All ASTRO APX 5000/ APX 6000/ APX 6000XE/ SRX 2200 radios are capable of both analog operation (12.5 kHz or 25 kHz bandwidths), ASTRO mode operation (12.5 kHz digital only), and X2-TDMA mode (25 kHz only).

The ASTRO APX 5000/ APX 6000/ APX 6000XE/ SRX 2200 radio (Figure 3-1) consists of the following:

- **VOCON Board** – contains a dual-core processor which includes both the microcontroller unit (MCU) and a digital signal processor (DSP) core, the processor's memory devices, an audio and power supply support integrated circuit (IC), a digital support IC, and an external audio power amplifier.
- **Transceiver (XCVR) Board** – contains all transmit, receive, and frequency generation circuitry, including the digital receiver back-end IC and the reference oscillator.
- **Expansion Board**
  - Standard – contains the internal audio power amplifier circuitry and a Type III secure IC.
  - Full-Feature – contains the internal audio power amplifier circuitry, a combination Global Positioning System (GPS)/Bluetooth 2.1 IC and support circuitry, a 3-axes digital accelerometer, an e-MMC NAND flash, and a Type III secure IC.
- **Top Display** – 112 pixels x 32 pixels, transflective monochrome liquid crystal display (LCD).
- **Control Top** – contains five switches: On/Off & Volume Knob, a 16 position Channel/Frequency Knob with concentric 2 position switch (for Secure Enable/Disable operation), a 3 position toggle switch for Zone Selection, and a push button switch used for Emergency calling. The control top also includes a TX/RX LED that is solid amber upon receive, red on PTT, and blinks amber on secure TX/RX.
- **Front Display (Dual-Display Version only)** – 130 pixels x 130 pixels, transflective color LCD.
- **Keypad (Dual-Display Version Only)** – Limited keypad version has a 3 x 2 Menu keypad with a 4-way navigation button; Full keypad version also has a 3 x 4 alphanumeric keypad.

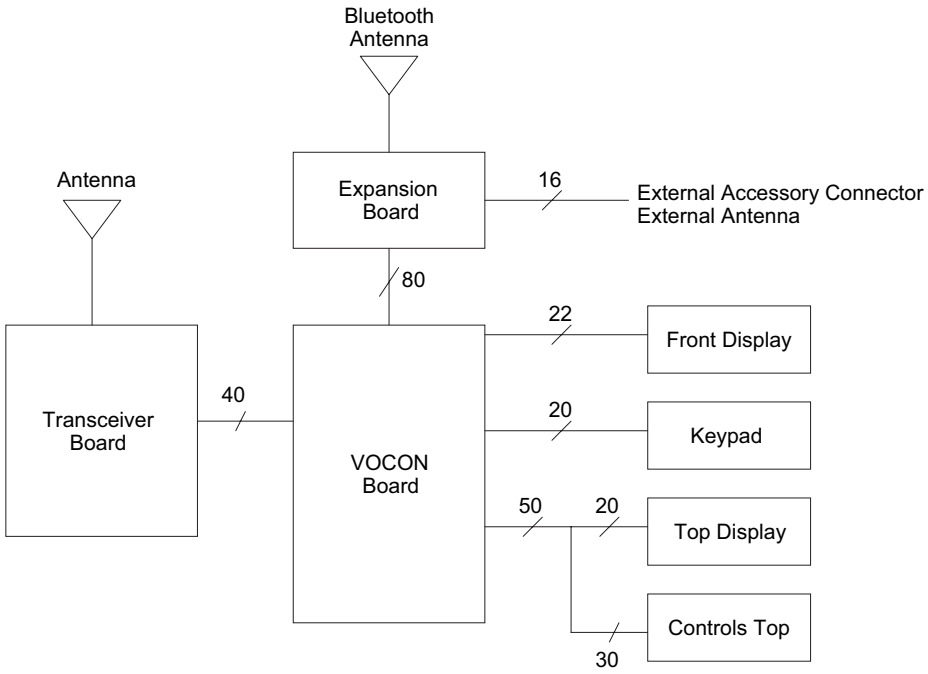


Figure 3-1. APX 5000/ APX 6000/ APX 6000XE/ SRX 2200 Overall Block Diagram

3.1 Transceiver Board

The transceiver (XCVR) board performs the transmitter and receiver functions necessary to translate between voice and data from the VOCON board and the modulated radio-frequency (RF) carrier at the antenna. The transceiver board contains all the radio's RF circuits for the following major components:

- Receiver
- Transmitter
- Frequency Generation Unit (FGU)

Figure 3-2 illustrates the VHF transceiver board block diagram, Figure 3-3 and Figure 3-4 illustrates the UHF1, UHF2 and 7/800 transceiver block diagrams.

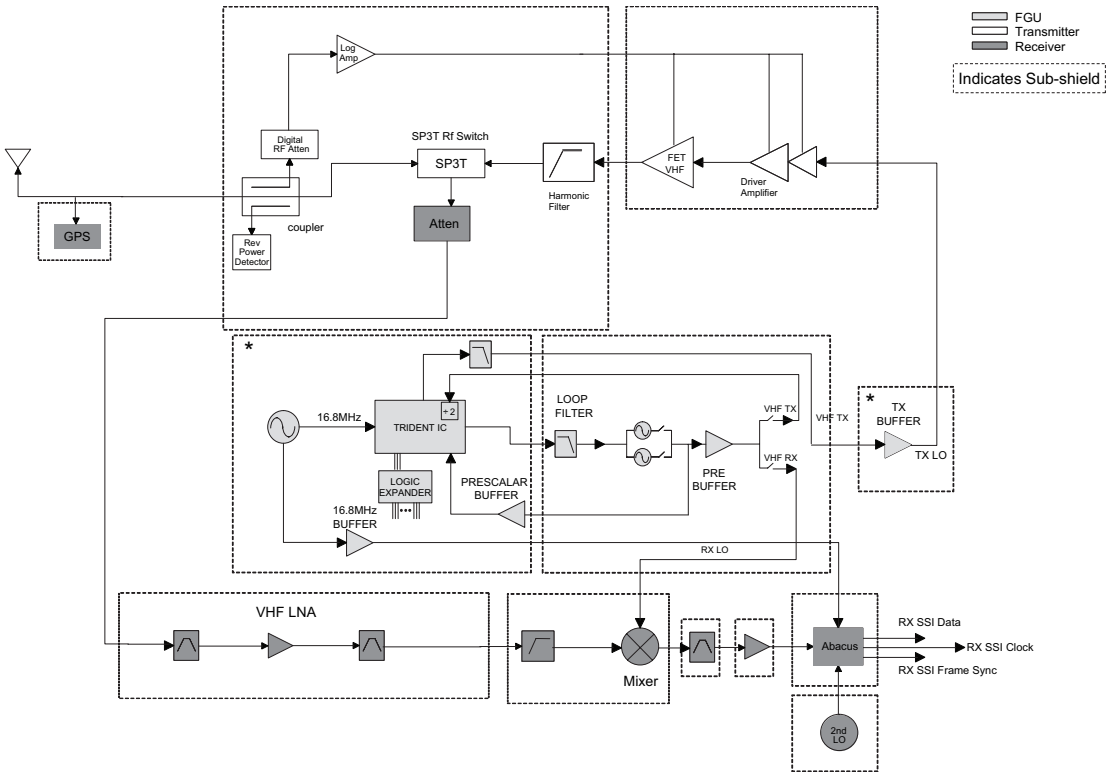


Figure 3-2. Transceiver (VHF) Block Diagram (Power and Control Omitted)

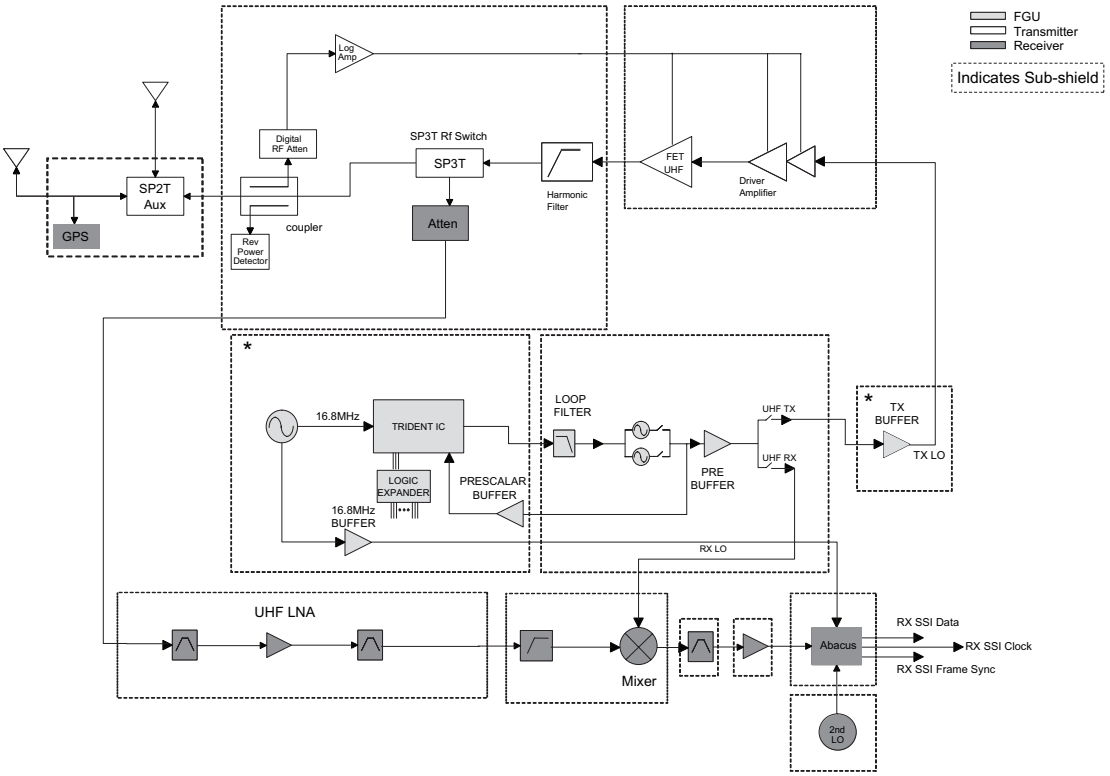


Figure 3-3. Transceiver (UHF1 and UHF2) Block Diagram (Power and Control Omitted)

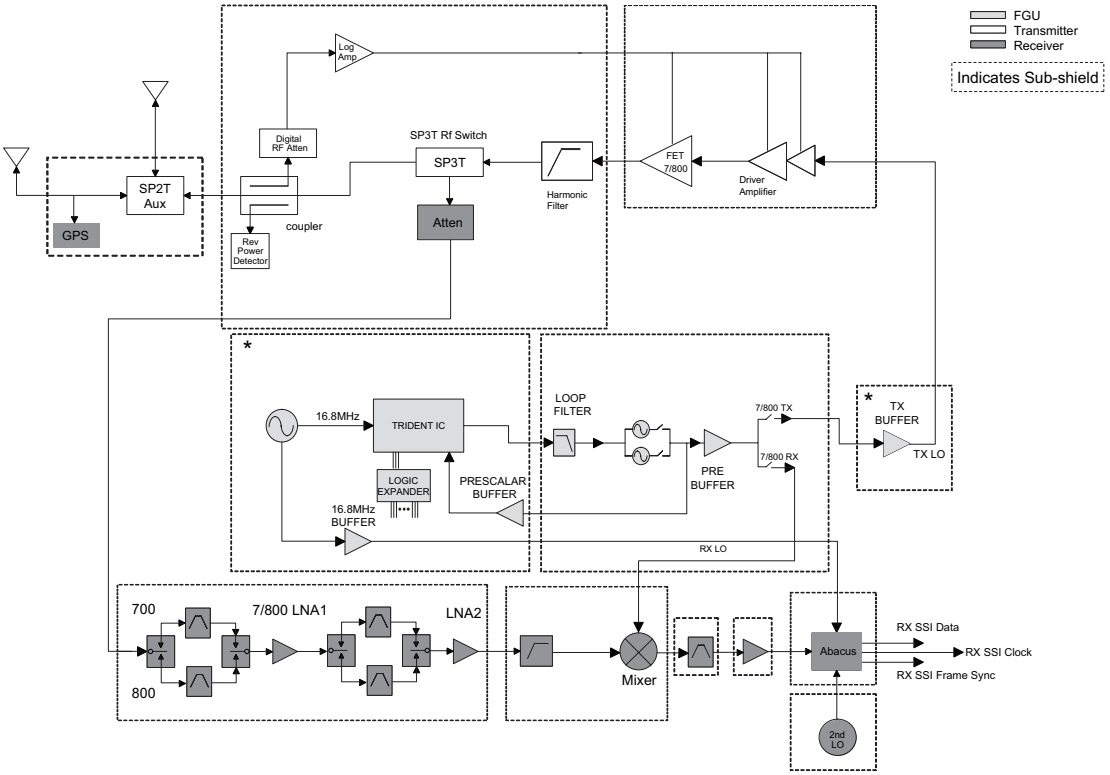


Figure 3-4. Transceiver (7/800) Block Diagram (Power and Control Omitted)

3.1.1 Interconnections

This section describes the various interconnections for the transceiver board.

3.1.1.1 Battery Connector M101

Battery connector M101 solders to the transceiver printed circuit board. The connector has 5 gold plated contacts that mate with the battery, two contacts for positive, two for negative and one for the Dig_Battery_Data. Signal descriptions are in Table 3-1.

Table 3-1. Battery Connector M101

Pin No.	Signal	Description
1	DC_BATT	Battery positive terminal, nominally 7.5 Vdc
2	Dig_Battery_Data	Battery status, from battery to VOCON
3	Ground	Battery negative terminal, tied to PCB ground

3.1.1.2 VOCON Connector J1001

VOCON connector J1001 is a 40 pin board to board connector that connects to XCVR board connector P101. This is a digital interface carrying DC power, control, and data between the XCVR and VOCON boards.

Table 3-2 lists the connector pins, their signals, and functions. SPI refers to serial peripheral interface, which is the control bus from the microprocessor. SSI is the serial synchronous interface bus for data to and from the DSP. There is a RX SSI bus for demodulated data from the receiver and a TX SSI bus for modulation data to the transmitter.

Table 3-2. VOCON Connector J1001

Pin No.	VOCON Signal	XCVR Signal	XCVR I/O	Type	Description
1	GROUND	GROUND	–	–	–
2	EEPROM_SPI_CS	DIG_CTRL_SPI_EEPROM_PE	I	spi	SPI EEprom chip select
3	16.8_MHZ_SINEWAVE	CLK_16_8MHZ	O	rf	16.8 MHz reference clock
4	GROUND	GROUND	–	–	–
5	GROUND	GROUND	–	–	–
6	V_EXT_1.85	DC_LIN_1_875_D	I	dc	Regulated 1.85 V
7	RF_BRD_RSTB	DIG_CTRL_RSTB	I/O	control	Reset
8	V_2.8_RF	DC_LIN_2_775V	I	dc	Regulated 2.775 V
9	DMCS	DIG_CTRL_SSI_TRIGGER	I	ssi	SSI Trigger
10	F2_PARAMP	DIG_CTRL_IO49	I	control	TX Slot enable
11	RX_FSYNC	DIG_DATA_SSI_RX_FS	O	ssi	RX SSI frame sync

Table 3-2. VOCON Connector J1001 (Continued)

Pin No.	VOCON Signal	XCVR Signal	XCVR I/O	Type	Description
12	TX_INH	DIG_CTRL_TX_INHIBIT_TYPE_1	I	control	TX inhibit control for secure
13	RX_DA	DIG _DATA _SSI _RX _DOUTA	O	ssi	RX SSI data
14	RF_DAC_SPI_CS	DIG_CTRL_SPI_DAC_PE	I	spi	SPI DAC chip select
15	RX_CLK	CLK_SSI_RX	O	ssi	RX SSI clock
16	ISET	ANA_CTRL_ISET	I	control	MAKO Ramp
17	TX_FSYNC	DIG_TX_SSI_FS	I	ssi	TX SSI frame sync
18	TX_DA_CONN	DIG_DATA_TX_SSI	I	ssi	TX SSI data
19	TX_CLK	DIG_TX_SSI_CLK	I	ssi	TX SSI clock
20	V_Coin_Cell	V_Coin_Cell	–	dc	Coin cell battery
21	GPS_ANT	RF_GPS	O	rf	GPS_RF signal
22	ABACUS_SPI_CS	DIG_CTRL_SPI_ABACUS_PE	I	spi	SPI Abacus chip select
23	F2_SYNCB	DIG_SYNCB	I	control	Synchronize RX SSI data
24	GROUND	GROUND	–	–	–
25	LOCK_DET_A	DIG_CTRL_LOCK	O	status	FGU lock detect
26	BSTAT	DIG_BATTERY_DATA	I/O	1 wire	IMPRES Battery status
27	TRIDENT_SPI_CS	DIG_CTRL_SPI_TRIDENT_PE	I	spi	SPI Trident chip select
28	UNSW_B+	DC_FUSED _B+	O	dc	Fused B+ to VOCON
29	SPI_DSP_MISO	DIG_DATA_SPI_MISO	O	spi	SPI data out
30	UNSW_B+	DC_FUSED _B+	O	dc	Fused B+ to VOCON
31	SPI_DSP_MOSI	DIG_DATA_SPI_MOSI	I/O	spi	SPI data I/O
32	UNSW_B+	DC_FUSED _B+	O	dc	Fused B+ to VOCON
33	SPI_DSP_CLK	DIG_SPI_CLK	I	spi	SPI clock
34	UNSW_B+	DC_FUSED _B+	O	dc	Fused B+ to VOCON
35	GROUND	GROUND	–	–	–
36	UNSW_B+	DC_FUSED _B+	O	dc	Fused B+ to VOCON
37	VCC_SW_3.6	DC_SW1_3_6V	I	dc	Regulated 3.6 V
38	GROUND	GROUND	–	–	–
39	GROUND	GROUND	–	–	–
40	GROUND	GROUND	–	–	–

3.1.1.3 Antenna Port J101

Antenna port J101 is a surface-mount, miniature coaxial connector for the antenna cable.

3.1.1.4 Serial EEPROM

The electrically erasable programmable memory (EEPROM), U101, holds all of the transceiver tuning data. This allows transceivers to be tuned in the factory and installed in the field without retuning.

3.1.1.5 Power Conditioning Components

DC power-conditioning components include zener diodes, capacitors, ferrite beads, a power inductor, and the fuse. Diodes VR200 and VR101 provide over-voltage protection. Ferrite beads (designated E, etc.) and capacitors suppress electromagnetic interference from the transceiver.

The power-line filter consisting of L200, C202, and C203 suppresses digital noise from the VOCON board switching power supplies that could degrade the transmitter spectral purity.

Ground clips M103 and M104 make contact between the transceiver board ground and the radio chassis. The chassis connection is a necessary electrical reference point to complete the antenna circuit path. Shields SH1 through SH14 appear on the schematic to show their connection to ground.

3.1.2 Receiver

In the VHF radio, the RF signal is received at the antenna and is routed through a Receive/Transmit Multi Switch (SP3T). In the UHF1, UHF2 and 7/800 radio, the signal goes from the antenna and is routed through an Auxiliary Switch before the Multi Switch (SP3T) IC. After the switch, the RF signal passes through a diplexer circuit and a controllable external 15 dB attenuator. The output of the attenuator leads to the receiver front end section.

- VHF band (See Figure 3-5.)
- UHF1 and UHF2 bands (See Figure 3-6.)
- 7/800 band (See Figure 3-7.)

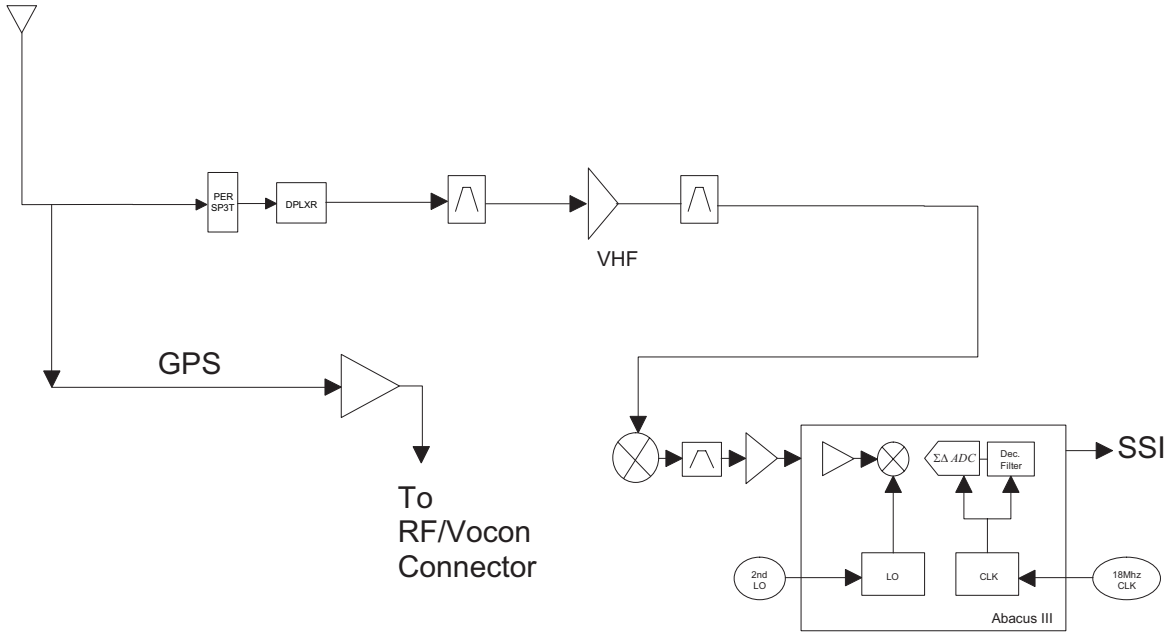


Figure 3-5. Receiver Block Diagram (VHF)

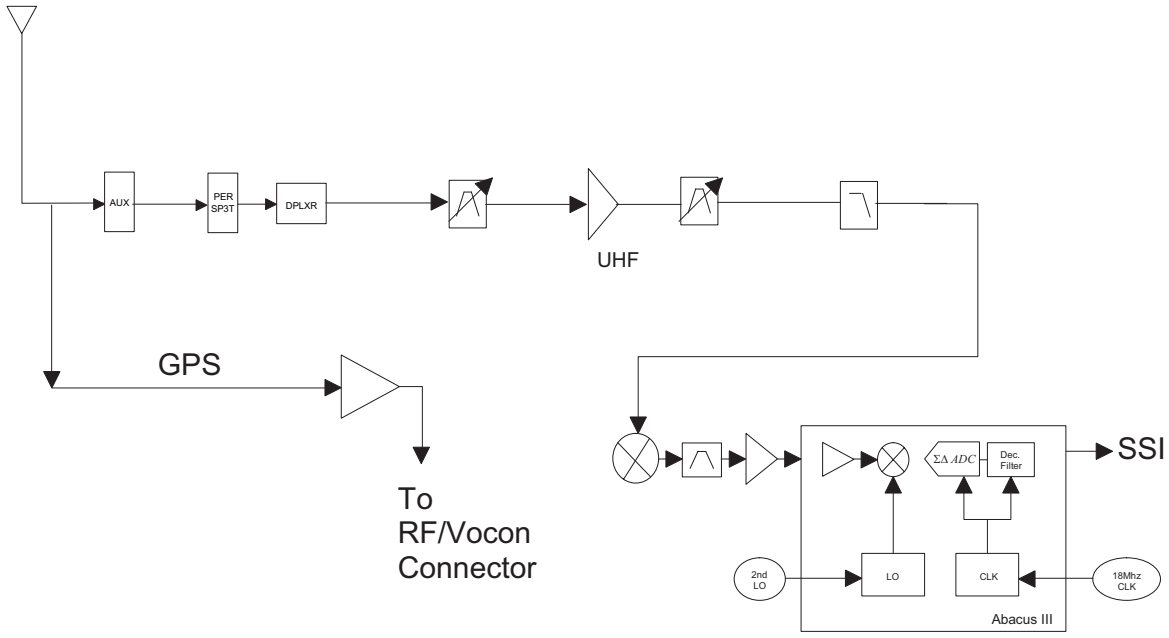


Figure 3-6. Receiver Block Diagram (UHF1 and UHF2)

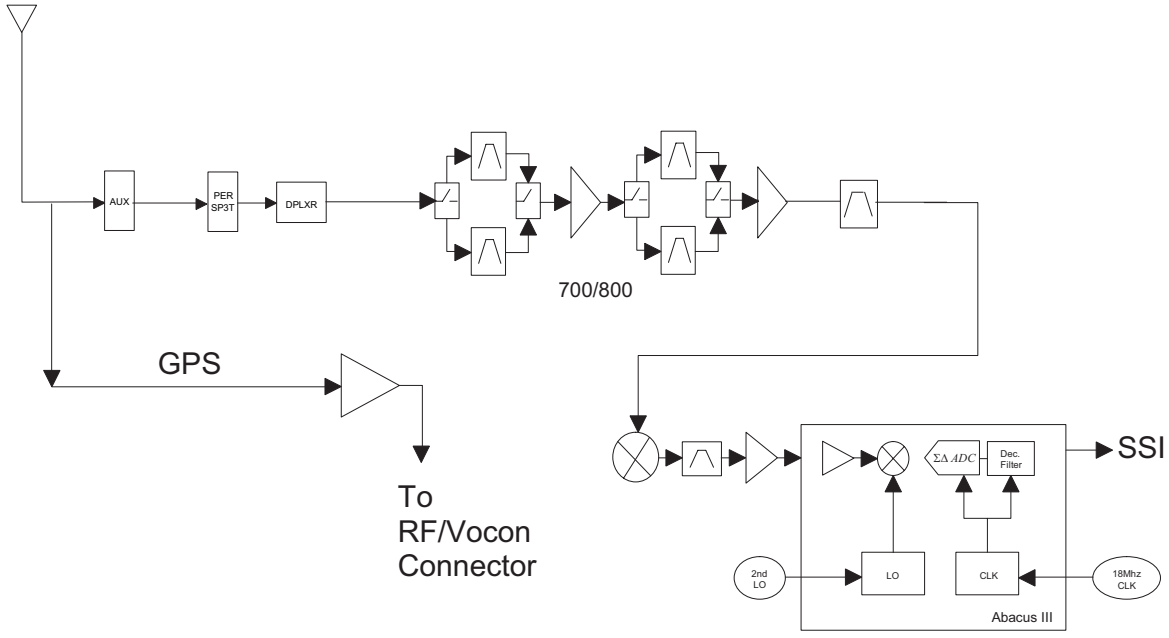


Figure 3-7. Receiver Block Diagram (7/800)

3.1.2.1 VHF Front-End

From the attenuator, U1149, a VHF signal is routed to the first pre-selector filter followed by a Low Noise Amplifier (LNA) and a second pre-selector filter. Both filters are discrete and fixed designs and are used to band limit the incoming energy and suppress known spurious responses such as Image and the ½ IF spur. The LNA active device is an NPN transistor (U302) with active bias provided by transistor pair Q302.

The output of the second pre-selector filter is applied to the RF port of the Mixer IC via balun transformer, T503. The Mixer IC, U506, is driven by a Local Oscillator (LO) signal generated by the Trident synthesizer IC, U702, at the LO port to down-convert the RF signal to a 109.65 MHz intermediate frequency (IF). It is a passive, high linearity design with balanced inputs at the RF and IF ports and internal LO buffer. The down converted IF signal is passed through a 3-pole crystal filter, FL501, and an IF amplifier, Q503, which drive the input of the Analog to Digital Converter IC, U601

3.1.2.2 UHF1 Front-End

From the attenuator, U1149, a UHF1 signal is routed to the first pre-selector filter followed by a Low Noise Amplifier (LNA) and a second pre-selector filter. Both filters are discrete and tunable designs and are used to band limit the incoming energy and suppress known spurious responses such as Image spur. The LNA active device is an NPN transistor (U2032) with active bias provided by transistor pair Q2022. The output of the second pre-selector filter is applied to a discrete Low Pass Filter (LPF). The output of the LPF is applied to the RF port of the Mixer IC via a balun transformer, T503. The Mixer IC, U506, is driven by a Local Oscillator (LO) signal generated by the Trident synthesizer IC, U702, at the LO port to down-convert the RF signal to a 109.65 MHz intermediate frequency (IF). It is a passive, high linearity design with balanced inputs at the RF and IF ports and internal LO buffer. The down converted IF signal is passed through a 3-pole crystal filter, FL501, and an IF amplifier, Q503, which drives the input of the Analog to Digital Converter IC, U601.

3.1.2.3 UHF2 Front-End

From the attenuator, U1149, a UHF2 signal is routed to the first pre-selector filter followed by a Low Noise Amplifier (LNA) and a second pre-selector filter. Both filters are discrete and tunable designs and are used to band limit the incoming energy and suppress known spurious responses such as Image spur. The LNA active device is an NPN transistor (U2032) with active bias provided by transistor pair Q2022. The output of the second pre-selector filter is applied to a discrete Low Pass Filter (LPF). The output of the LPF is applied to the RF port of the Mixer IC via a balun transformer, T503. The Mixer IC, U506, is driven by a Local Oscillator (LO) signal generated by the Trident synthesizer IC, U702, at the LO port to down-convert the RF signal to a 109.65 MHz intermediate frequency (IF). It is a passive, high linearity design with balanced inputs at the RF and IF ports and internal LO buffer. The down converted IF signal is passed through a 3-pole crystal filter, FL501, and an IF amplifier, Q503, which drives the input of the Analog to Digital Converter IC, U601.

3.1.2.4 700/800 Front-End

From the attenuator, U1149, a 700 MHz or 800 MHz band signal is routed to an SPST band select switch, U402, which selects the 700 or the 800 band signal and routes it to the appropriate first pre-selector filter, FL401. A second band select switch, U404, selects the output of the appropriate filter and applies it to an LNA followed by a similar pre-selector filter/ band-select switch circuit. The signal is then routed to second LNA, U407, whose output is applied to a discrete image filter. Both preselector filters are Surface Acoustic Wave designs (EPCOS B4232) used to band limit the received energy and suppress known spurious responses such as Image and the ½ IF spur. The output of the discrete image filter is applied to the RF port of the Mixer IC, U506, via a balun transformer, T503. The Mixer IC is driven by an LO signal generated by the Trident synthesizer IC, U702, and applied to the LO port to down-convert the RF signal to a 109.65 MHz intermediate frequency (IF). The IF signal is passed through a crystal filter, FL501, and an IF amplifier, Q503, which drive the input of the Analog to Digital Converter IC, U601.

3.1.2.5 Analog To Digital Converter

The ADC used in APX/ SRX is the AD9864 IC, U601, from Analog Devices. The IC front end down converts the first IF to a second IF, a 2.25 MHz signal, by mixing a 107.4 MHz LO signal generated by an integrated synthesizer and external VCO with active device U602 and resonator L604. The second IF is sampled at 18 MHz, a signal generated by an integrated clock synthesizer and VCO device with external resonator L605.

The sampled signal is decimated by a factor of 900 to 20 kHz and converted to SSI format at the ADC's output. The Serial Synchronous Interface (SSI) serial data waveform is composed of a 16 bit in-phase word (I) followed by a 16 bit Quadrature word (Q). A 20 kHz Frame Synch and 1.2MHz clock waveform are used to synchronize the SSI IQ data transfer to the Digital Signal Processor IC (OMAP) for post-processing and demodulation. The clock frequency is adjustable and is selected automatically by software to prevent self quieting.

3.1.3 Transmitter

The transmitter takes modulated RF from the FGU and amplifies it to the rated output power to produce the modulated carrier at the antenna.

NOTE: Refer to Table 8-1, “List of Transceiver Schematics and Board Overlays,” on page 8-1 for a listing of transmitter-related schematics that will aid in the following discussion.

The transmitter (Figure 3-8 on page 3-11) for the VHF radio consists of one LDMOS high power transistor for the VHF band. The same topology applied for the 7/800 radio (Figure 3-10 on page 3-12) where one LDMOS high power transistor is used for the 7/800 MHz band. Similarly for UHF1 and UHF2 radios, one LDMOS transistor is used to cater for the UHF1/ UHF2 band which is depicted by Figure 3-9 on page 3-11. The high power transistor is driven by an RF driver IC that receives its input signal from the voltage controlled oscillator. Transmitter power is controlled by a discrete power control circuit that senses the output of a directional coupler and adjusts PA control voltage to maintain the correct power level. The TX signals pass through their respective harmonic filters, a TX/RX switch, and embedded directional coupler, a RF switch and then the antenna. The SP2T switch just before the antenna does not exist on the VHF radio.

The UHF1 SRX 2200 is available with a low power setting that limits the transmit power to 0.25 watt. The rest of the APX 5000/ APX 6000 radios and the SRX 2200 VHF radio are able to be limited to 1 watt minimum output power.

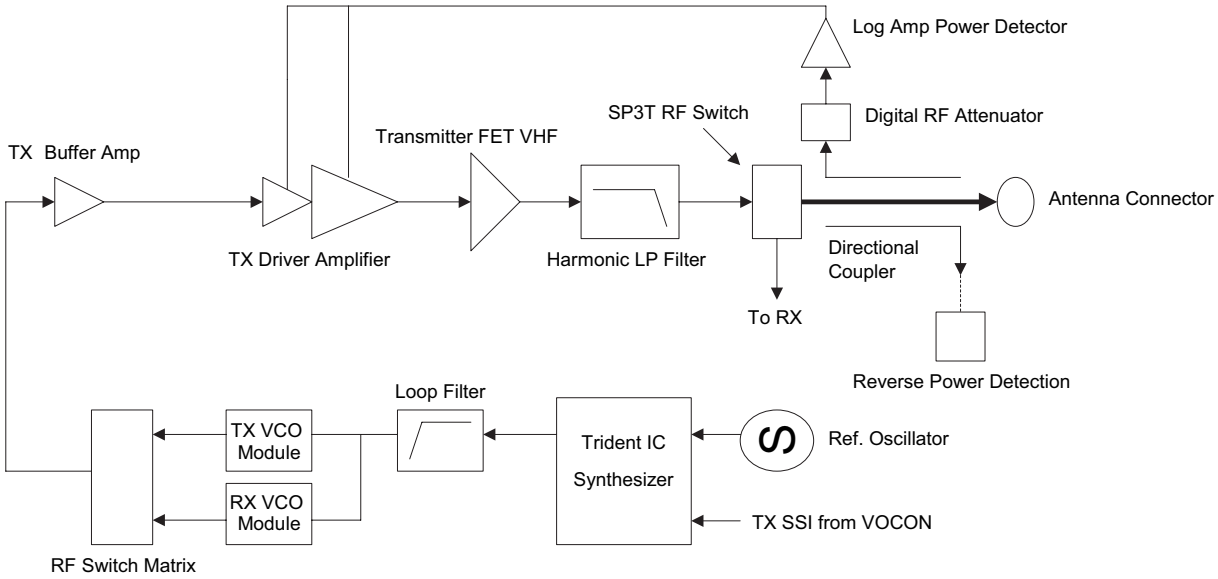


Figure 3-8. Transmitter Block Diagram (VHF)

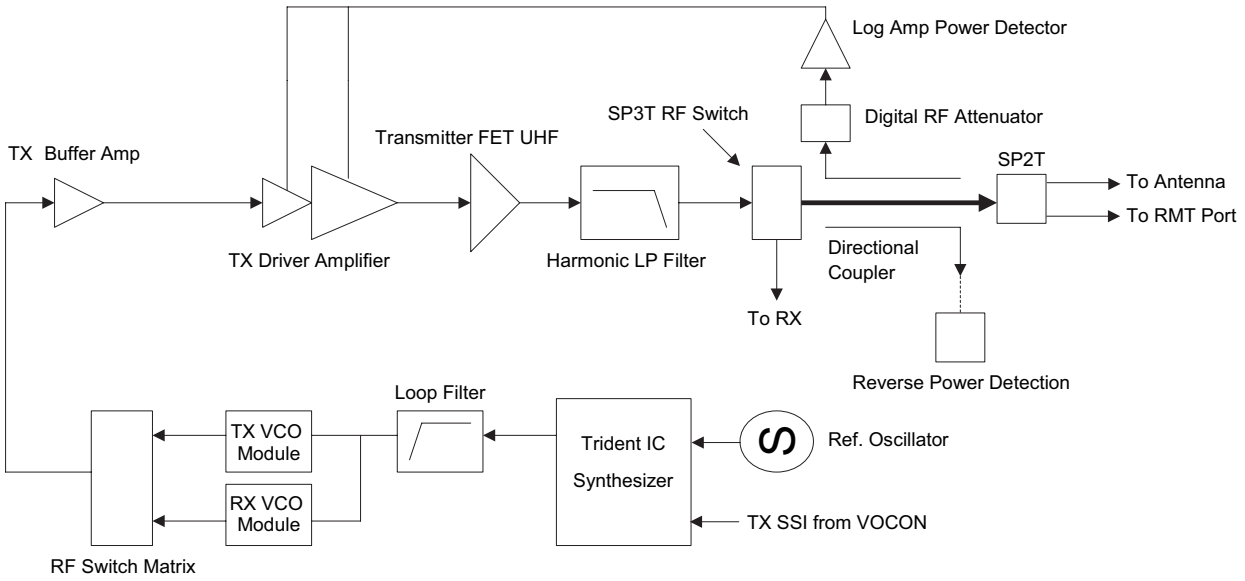


Figure 3-9. Transmitter Block Diagram (UHF1 and UHF2)

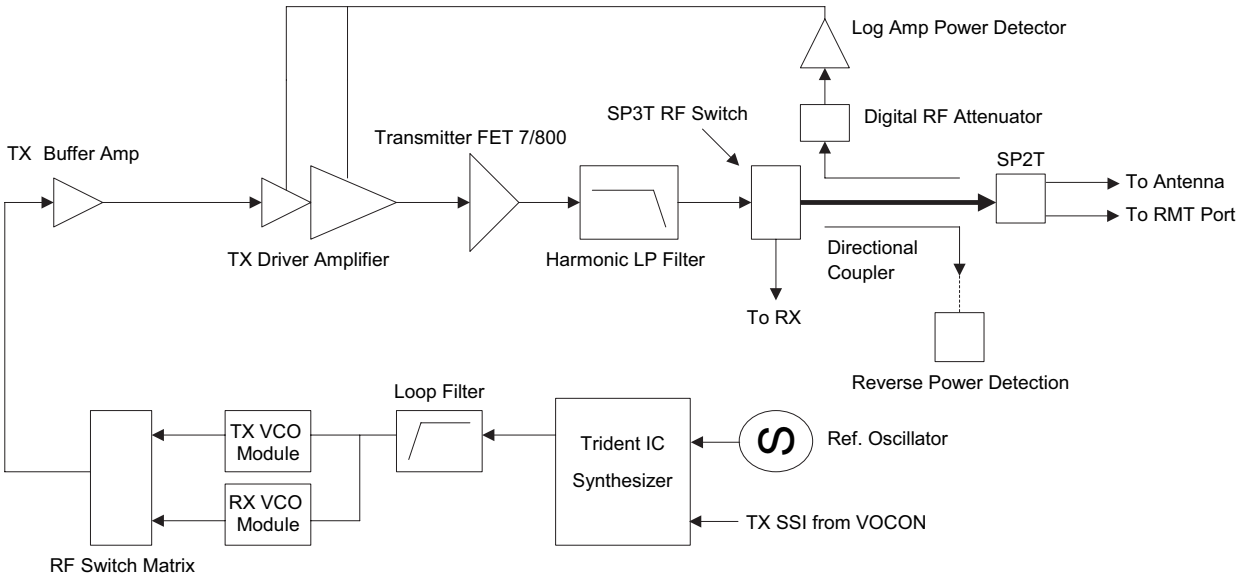


Figure 3-10. Transmitter Block Diagram (7/800)

3.1.3.1 Driver Amplifier

The driver amplifier IC (VHF – U902, UHF1 – U1602, UHF2 – U1500 and 7/800 – U1002) contains one LDMOS FET amplifier stages and an internal resistor bias networks. Pin 16 is the RF input. Modulated RF from the FGU, at a level of +3 dBm ±2 dB, is coupled through a blocking capacitor to the gate of FET-1. An LC inter-stage matching network connects the first stage output VD1 to the second stage input G2. The RF output from the drain of FET-2 is pin 6 (RFOUT1). Gain control is provided by a voltage applied to pin 1 (VCNTRL). Typical output power is about +27 dBm (500 mW) with VCNTRL at 5.5 V.

VHF: L901 and C904 are the components for the inter-stage matching network. Components C907, C910, L904, C913, C914, L905 and C916 provide the match to the final device Q901. C907 also serves as a DC block.

UHF1: L1601 and C1604 is the inter-stage matching network of the driver amplifier IC, C1607, C1610, L1604, C1613, C1614, L1605 and C1616 serve as matching circuit of the driver IC to the final device of Q1601. Capacitor C1607 also works as DC block to the circuit.

UHF2: L1501 and C1504 is the inter-stage matching network of the driver amplifier IC. C1508, C1509, C1510, C1511, L1502, L1503, and L1504 serve as matching circuit of the driver IC to the final device of Q1500. Capacitor C1510 also works as DC block to the circuit.

700–800 MHz: L1002, C1002 and C1004 are the inter-stage matching network. Components C1013 and C1023 match the output impedance to the input of the final device (Q1001); capacitor C1013 also serves as the DC block.

3.1.3.2 Power Amplifier Transistor

The power amplifier transistors, Q901, Q1013, Q1500 and Q1601 are LDMOS FETs housed in a high-power, surface-mount, ring package. To prevent thermal damage, it is essential that the heat sink of the power module be held in place against the radio chassis using the RF board screw. All FETs are matched using a lowpass topology. Drain bias is applied through L906 for the VHF, L1606 for UHF1, L1505 for UHF2 and L1007 for the 7/800 MHz. Gain is dynamically controlled by adjusting the gate bias. The gate is insulated from the drain and source so that gate bias current is essentially zero

VHF: The output match consists of elements L907, C920, C921, L908, C922, L909, C924, L910, C923 and C928. Gate bias is applied through R903, R904, R905, C915 and C917.

UHF1: C1620, C1621, C1622, L1609, C1624, L1610, C1623, C1628 and C1625 are the elements of the output matching network apart from a transmission-line structure. The Gate biasing is applied through a biasing network consists of R1603, R1604, R1605, C1615 and C1617.

UHF2: C1516, C1517, C1518, C1520, C1521, C1527, and L1507 are the elements of the output matching network apart from a transmission-line structure. The Gate biasing is applied through a biasing network consists of R1502, R1503, R1504 and C1522.

700–800 MHz: The input impedance-matching network is C1013 and C1023. A transmission-line structure and C1019, C1020, L009 and C1021 form the output-matching network. Gate bias applied through R1003, R1004, C1015 and R1005.

3.1.3.3 Directional Coupler

A directional coupler senses the transmitter forward and reverse power as control signals in the transmitter's automatic level control (ALC) loop. Isolated ports are terminated with external resistors.

VHF/UHF1/UHF2/700–800 MHz: The directional coupler consists of three embedded transmission lines.

3.1.3.4 Harmonic Filter

The harmonic filter is a high-power, low-loss, low-pass filter. Its purpose is to suppress transmitter harmonics. The filter also improves receiver out-of-band rejection. The appropriate shield over the filter must be in place to achieve the required stop band rejection.

VHF: The harmonic filter uses discrete components. The pass band is up to 190 MHz, and the stop band is above 260 MHz.

UHF1: The harmonic filter applies discrete components as the circuit line up. The pass band is up to 470 MHz while the stop band is above 740 MHz.

UHF2: The harmonic filter applies discrete components as the circuit line up. The pass band is up to 520 MHz while the stop band is above 1000 MHz.

700–800 MHz: The harmonic filter uses both discrete components and transmission lines. The pass band is up to 870 MHz, and the stop band is above 1500 MHz.

3.1.3.5 Antenna Switch

NOTE: Refer to Table 8-1, “List of Transceiver Schematics and Board Overlays,” on page 8-1 for a listing of schematics that will aid in the following discussion.

The antenna switch consists of a single pole triple-throw IC designated U1102. The IC is connected to the output of the two harmonic filters and it is connected to the receiver. The output of the switch is connected to the directional coupled via the inductor L1108. Control lines V1_V2 and V3 control the routing of the signal paths. During Rx operation, V3 is set high and V1_V2 is low. During Tx operation, V3 is set low and V1_V2 is high. This is the same case for VHF, UHF1, UHF2 and 7/800 radios.

There is a second IC designated U1111 at the output of the radio. This switch routes RF power to the main antenna or to the accessory GCAII connector on the side of the radio. This switch is controlled by control line DIG_CNTRL_RMT which connects to pin 13 of the IC. When this signal level is high, the power is routed to the antenna and when it is low the power is routed to the accessory connector.

NOTE: This switch does not exist on VHF radios.

3.1.3.6 Reverse Power Protection

The radio, while in receive mode is constantly monitoring the input power from the antenna. This power is sensed by the directional coupler and channeled into an RF detector U1106. The matching network between the coupler and the detector consists of R1107, L1102, C1105 and C1107. Once the input RF level exceeds a certain limit the detector trips a logic circuit then enables attenuation to protect the RF front end. This serves as to protect the front end from large signal damage.

3.1.3.7 Transmitter Power Control

In TX mode, the transmitter Automatic Level Control (ALC) section enables the transmitter and controls TX power in all modes. Power control is based on a unique dual control loop approach which utilizes voltage control in one loop and current control in the other. The voltage control loop is normally used in all transmit modes. The only time the current control loop controls TX power is during the end of a TX slot in TDMA (Phase 2) mode in the event transmitter saturation is detected. Several other functions included in the TX ALC section of the radio are RX/TX switching, thermal cutback of power, current cutback of power, and reverse power detection with a means to disable the receiver in the event of high reverse power at the antenna port.

3.1.3.7.1 Voltage Control Mode

The heart of the voltage control loop is a logarithmic amplifier based power control IC, U1105. Quad DAC, U1125, receives the power tuning values via the SPI bus and converts them into a voltage at “VOUTB.” Resistors, R1121 and R1122, form a voltage divider to set the full-scale value of the DAC, in this case approximately 1.4V. This power set voltage is then fed to the power control IC through the current cutback op amp, U1130, and then into a lesser-of-two voltage decision circuit, consisting of U1126 and U1127. This circuit, used exclusively in voltage control mode, provides the important function of combining the MAKO ramp output with the DAC power set voltage to permit power leveling since the MAKO DAC max amplitude cannot be controlled during TDMA mode. In all other TX modes, the MAKO output is a fixed voltage, approximately 1.5V, which is always higher than the DAC control voltage. The lesser-of-two circuit will then select the smaller input, the set voltage from U1125, resulting in immediate TX turn on in analog or ASTRO mode. IN TDMA mode, the MAKO line is a piecewise linear ramp whose timing is in accordance with Phase 2 requirements. At t = 0, the ramp line is smaller than the TX set voltage so the MAKO ramp will control the TX power level, resulting in a slower ramping up of the TX power. This continues until the MAKO ramp output reaches the level of the power tuning DAC (which is always lower than the MAKO ramp maximum) which causes control of TX power to be turned over to the power tuning DAC.

The output of the selector circuit passes through a 2nd order low pass filter (U1142) and then to the log amp, U1105. The low pass filter performs the dual function of improving transient ACPR by transforming a linear ramp with corners into a smooth second order waveform and by acting as a reconstruction filter for the DAC. The log amp converts RF power fed back from the TX PA into a current which is summed with the current from the conversion of the setpoint voltage from DAC U1125. Any imbalance between the RF input level and the level corresponding to the setpoint voltage is corrected at the VAPC output of the log amp which in turn drives the control voltage input of the RFPA. The setpoint voltage effectively nulls the error in the loop caused by changes in the RF level fed back to the log amp. RF from the RFPA is coupled through a directional coupler embedded in the PC board and passed through a LC equalizer and then to digital attenuator, U1112, which is used to implement thermal cutback in the event of an over-temperature condition.

Current protection and limiting in voltage control mode is provided by cascaded difference amplifiers, U1129 and U1130. A fixed threshold is provided by voltage divider, R1169 and R1170. SPDT switch, U1144, changes the current limit threshold based on the type of battery present. This threshold is based on the conversion characteristic of the current shunt monitor circuit of U1101. The output of the current shunt monitor is fed to the first stage of the difference amplifier. The setpoint voltage for the log amp is fed through the second stage of the difference amplifier. When the current shunt monitor voltage exceeds the fixed threshold, the first stage produces an output greater than 0V. Once the output of the first stage (U1129) is greater than zero, this value is subtracted from the setpoint voltage to the log amp in the second stage (U1130), resulting in a progressive cutback of power in the event PA current continues to climb above the threshold.

3.1.3.7.2 Thermal Cutback

Thermal cutback works only in voltage control mode, which is the primary mode of TX power control. Temperature is sensed by IC U1103 and is located next to both RFPA finals. Comparators, U1113 and U1114, establish two temperature trip points. The combined logic of the comparators and logic gate, U1121, together with the truth table of the digital attenuator IC, U1112, determine the amount of attenuation of the RF feedback to the log amp. Rated TX power is achieved with the attenuator at its maximum attenuation of 7 dB. The first temperature threshold will subtract 3 dB of TX power and the next (highest) trip point an additional 3 dB for 6 dB total.

3.1.3.7.3 Current Control Mode

In TDMA mode, excessive transient adjacent channel splatter caused by the RFPA, when it is under a greater degree of compression than is expected at nominal supply voltage, is mitigated through a system of saturation detection and switching of the TX power control mode from the voltage control loop to the current control loop. Comparator U1131 compares the log amp output in voltage control mode to a threshold voltage from DAC “C”, which sets the threshold for handover to current control mode and establishes the upper supply rail for the output of current loop integrator, U1104. This threshold is tuned in the factory to correspond to transmitter rated power which means that the threshold for handover occurs at a level corresponding to rated power minus 6% (9% for VHF radios) which is set by divider R1162 and R1163. When PA saturation exceeds this threshold and the MAKO T/R control signal (DIG_GPIO49) and DIG_DMCS combine logically to signal the end of the data portion of the TX slot, D-flip flop U1132 latches which in turn switches (via U1133 SPDT switch) the output of the current loop integrator, U1104, as a control voltage to the PA of the radio.

Integrator, U1104, acts as a PI (Proportional Integral) controller in current mode. Current feedback from the PA is obtained through current shunt resistor R1103 and sent to the current shunt monitor/ current to voltage converter, U1101. U1101 has a known gain characteristic for the current-to-voltage conversion. The MAKO ramp is passed through a RC low pass filter for smoothing and on to the current control integrator where it is proportioned with the voltage output of the current shunt monitor. The integrator supply voltage comes from DAC “C” of the Quad DAC, U1125. By way of tuning the DAC “C” value to match TX rated (tuned) power, this approach fixes the upper limit of the control voltage in current control mode to correspond to the tuned power level, further reducing excess adjacent channel splatter.

3.1.3.7.4 PA Offset, Control Voltage Gain Scaling

An offset voltage is applied to the control voltage at a summing junction made up of R1174 and R1154 as a means of further improving transient adjacent channel splatter in the VHF band by pre-biasing the PA. The output of DAC “A” is summed with either the output of the log amp or the integrator through R1174.

The value for DAC “A” has been established and fixed in the firmware. This offset value is padded to the control voltage and is sent to a non-inverting, gain-scaling amplifier, U901 (VHF) or U1601 (UHF1) or U1501 (UHF2) or U1001 (7/800 MHz) and then to the PA driver and final.

3.1.4 Frequency Generation Unit (FGU)

The frequency-generation function is performed by several ICs; multiple voltage-controlled oscillators (VCOs); and associated circuitry. The reference oscillator provides a frequency standard to the Trident IC, which controls the VCOs via the port expander. There are also buffers that amplify the VCO signal to the correct level for the next stage. Figure 3-11 below shows a block diagram of the FGU Section.

VHF: Two VCOs are employed: one to generate the first RX LO and the other to generate the transmit injection signals.

UHF1: Two VCOs generate the first Rx LO and two VCOs generate the transmit-injection signals.

UHF2: Two VCOs generate the first Rx LO and two VCOs generate the transmit-injection signals.

700–800 MHz: Two VCOs generate the first RX LO and three VCOs generate the transmit-injection signals.

NOTE: Refer to Table 8-1, “List of Transceiver Schematics and Board Overlays,” on page 8-1 for a listing of FGU-related schematics that will aid in the following discussion.

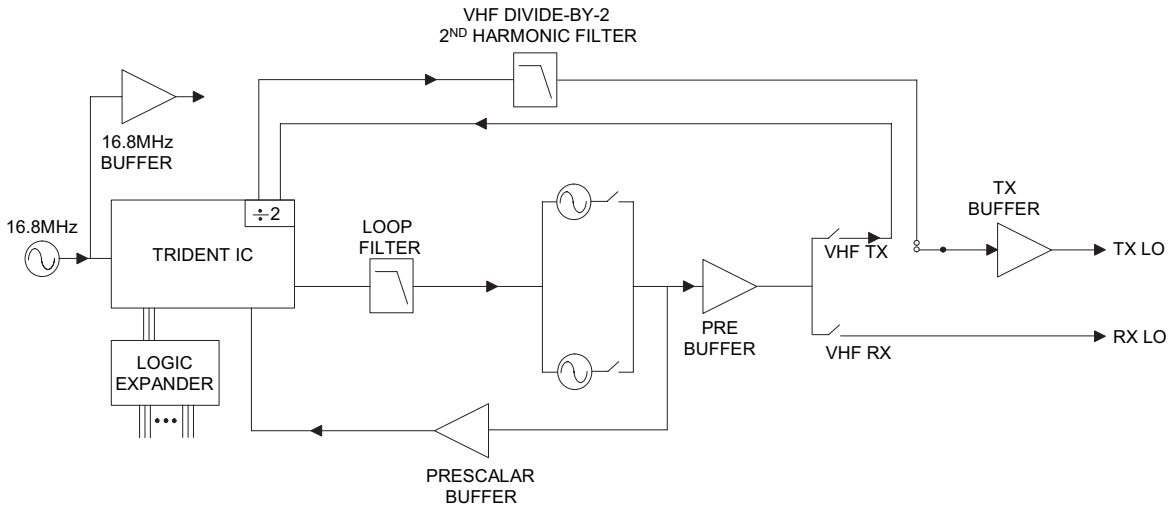


Figure 3-11. Synthesizer Block Diagram (VHF)

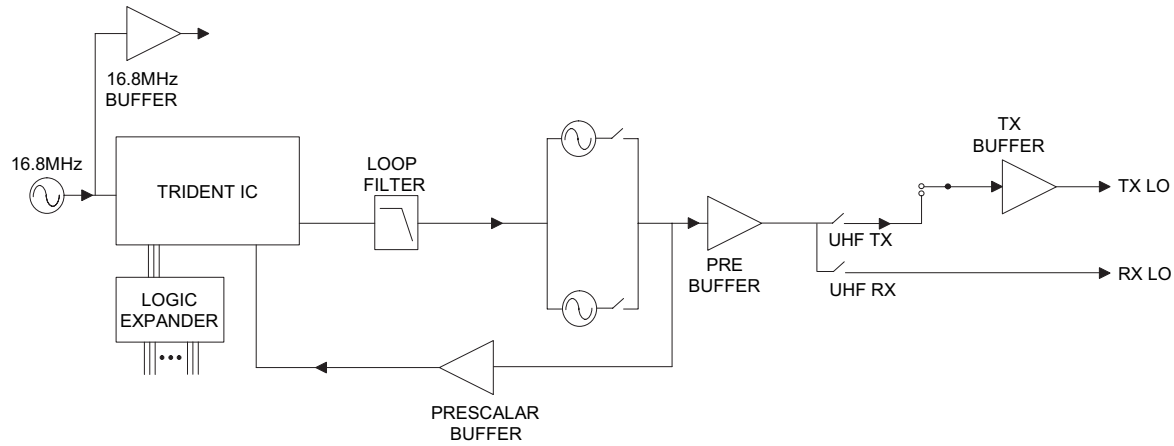


Figure 3-12. Synthesizer Block Diagram (UHF1 and UHF2)

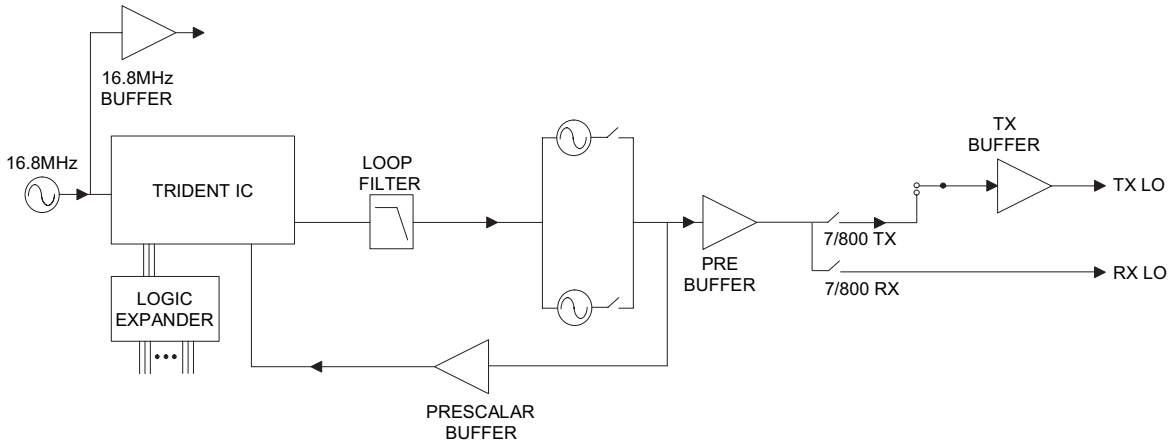


Figure 3-13. Synthesizer Block Diagram (7/800)

3.1.4.1 Reference Oscillator Y701

The radio's frequency stability and accuracy is derived from the Voltage-Controlled Temperature-Compensated Crystal Oscillator (VCTCXO), Y701. This 16.8 MHz oscillator is controlled by the voltage from the AUX_DAC pin of the Trident IC, U702, that can be programmed through a serial peripheral interface (SPI). The oscillator output at pin 3 is coupled through capacitor C736 to the Trident IC reference oscillator input. This reference is then passed through an internal buffer and is then coupled to the external BJT buffer (comprised of U746 and supporting circuitry) via C739. These buffers provide isolation for the 16.8 MHz output to the VOCON board and ABACUS IC. Components L753 and C754 form a low-pass filter to reduce the harmonics of the 16.8 MHz.

3.1.4.2 Trident IC U702

The Trident IC, U702, is a multiple protocol, multiple band transceiver Motorola-proprietary, CMOS IC, with built-in dual-port modulation. The Trident IC incorporates frequency division and comparison circuitry to keep the VCO signals stable. The Trident IC is controlled by the MCU through a serial bus. All of the synthesizer circuitry is enclosed in rigid metal cans on the transceiver board to reduce interference effects. Separate power supply inputs are used for the various functional blocks on the IC. Inductors L727, L733, L735, L738 and L741 provide isolation between the IC and the different power supplies. Host control is through a four-wire, smart SPI interface (pins D8, D9, D10 and C11). Some of the Trident IC functions include frequency synthesis, reference clock generation, modulation control, voltage multiplication and filtering, near-integer spurious reduction, RF divide-by-two and auxiliary SPI.

3.1.4.3 Synthesizer

Frequency synthesis functions include a low band and high band mode prescaler, a phase detector, a programmable loop divider and its control logic, a charge pump, and a lock detector output. Fractional-N synthesizer principles of operation are covered in detail in the manufacturers' literature. No similar discussion will be attempted here.

3.1.4.4 Clocks

U702, pin K5 (REF_IN), is the 16.8 MHz reference oscillator input from the VCTCXO (Y701).

3.1.4.5 Modulation

To support many voice, data, and signaling protocols, APX 5000/APX 6000/APX 6000XE/SRX 2200 radios must modulate the transmitter carrier frequency over a wide audio frequency range, from less than 10 Hz up to more than 6 kHz. The Trident IC supports audio frequencies down to zero Hz by using dual-port modulation. The digital audio signal at pin F11 (TXD) is transferred to the Trident baseband circuitry via the TX Serial Synchronous Interface (SSI) bus. The data is then internally divided into high and low-frequency components, which modify both the synthesizer dividers and the external VCOs through a signal on HP_MOD_OUT (pin L9). The DSP scaling is adjusted to achieve a flat modulation frequency response during the transmitter modulation balance calibration.

3.1.4.6 Voltage Multiplier and Superfilter

Pins H10 (VMULT2) and H11 (VMULT1) together with diode arrays D722 and D723 and their associated capacitors form the voltage multiplier. The voltage multiplier generates 10.625 Vdc to supply the phase detector and charge-pump output stage at pin F1 (MN_CP_VCC).

The superfilter is an active filter that provides a low-noise supply for the VCOs. The input is a regulated 5 Vdc from DC_LIN_5V at pin K4 (SF_SPLY). The output is a superfiltered voltage at pin J5 (SF_OUT).

3.1.4.7 Loop Filter

The components connected to pins G3 (MN_CP) and G2 (MN_ADAPT_CP) form a 4th-order, RC low-pass filter. Current from the charge-pump output, MN_CP, is transformed to voltage ANA_VTUNE, which modulates the VCOs. Extra current is supplied by MN_ADAPT_CP for rapid phase-lock acquisition during frequency changes. The lock detector output pin B4 (TEST1_LCKDET) goes to a logic “1” to indicate when the phase-lock loop is in lock.

3.1.4.8 Port Expander

U703 is a port expander that is controlled by the auxiliary SPI of the Trident IC; pins A7 (ASPI_DATA), B7 (ASPI_CLK) and C6 (ACE1_GPO7). Data sent on the main SPI bus with a specific header, tells the Trident IC to pass the data (via the auxiliary SPI lines) onto the port expander SPI lines, pins 32 (SCLK), 33 (DIN) and 34 (CS). The port expander then translates this auxiliary SPI data and turns on and off the select lines for the various VCOs, switches (that select the correct RF path for either VHF, UHF Range 1 or 7/800) and other logic external to the FGU. Table 3-3 below shows the logic settings for the port expander for the various bands.

Table 3-3. Port Expander Pin Settings

VHF TX	PIN NO.	1	2	3	4	5	6	7	8	9	10	12	13	14	15
	LOGIC	0	0	0	0	0	0	H	H	0	0	0	0	0	0
	PIN NO.	16	17	18	19	21	22	23	24	25	26	27	28	29	30
	LOGIC	0	H	0	0	0	H	H	H	0	H	0	0	0	0
VHF RX	PIN NO.	1	2	3	4	5	6	7	8	9	10	12	13	14	15
	LOGIC	H	H	H	H	0	0	0	0	0	0	0	0	0	0
	PIN NO.	16	17	18	19	21	22	23	24	25	26	27	28	29	30
	LOGIC	0	0	0	0	0	H	0	0	0	0	0	0	0	0
700 TX	PIN NO.	1	2	3	4	5	6	7	8	9	10	12	13	14	15
	LOGIC	0	0	0	0	H	0	0	0	H	0	0	0	0	0
	PIN NO.	16	17	18	19	21	22	23	24	25	26	27	28	29	30
	LOGIC	0	0	0	0	0	H	0	0	0	0	H	H	0	0
700 RX	PIN NO.	1	2	3	4	5	6	7	8	9	10	12	13	14	15
	LOGIC	0	0	H	0	H	0	0	0	0	H	0	0	0	0
	PIN NO.	16	17	18	19	21	22	23	24	25	26	27	28	29	30
	LOGIC	0	0	0	0	0	H	0	0	0	0	0	0	0	H
7/800 TX	PIN NO.	1	2	3	4	5	6	7	8	9	10	12	13	14	15
	LOGIC	H	0	0	0	0	H	0	0	0	0	0	0	0	0
	PIN NO.	16	17	18	19	21	22	23	24	25	26	27	28	29	30
	LOGIC	0	0	0	0	0	H	0	0	0	0	H	H	0	0
800 TX	PIN NO.	1	2	3	4	5	6	7	8	9	10	12	13	14	15
	LOGIC	0	0	0	0	H	0	0	0	0	H	0	0	0	0
	PIN NO.	16	17	18	19	21	22	23	24	25	26	27	28	29	30
	LOGIC	0	0	0	0	0	H	0	0	0	0	H	H	0	0
800 RX	PIN NO.	1	2	3	4	5	6	7	8	9	10	12	13	14	15
	LOGIC	0	0	H	0	H	0	0	0	H	0	0	0	0	0
	PIN NO.	16	17	18	19	21	22	23	24	25	26	27	28	29	30
	LOGIC	0	0	0	0	0	H	0	0	H	0	0	0	0	H

Table 3-3. Port Expander Pin Settings (Continued)

UHF

UHF R1 TX (380–445)	PIN NO.	1	2	3	4	5	6	7	8	9	10	12	13	14	15
	LOGIC	0	0	0	0	0	0	0	0	0	0	H	0	0	0
	PIN NO.	16	17	18	19	21	22	23	24	25	26	27	28	29	30
	LOGIC	0	H	0	0	0	H	H	H	0	0	H	0	H	0

UHF R1 TX (445–470)	PIN NO.	1	2	3	4	5	6	7	8	9	10	12	13	14	15
	LOGIC	0	0	0	0	0	0	0	0	0	0	0	H	0	0
	PIN NO.	16	17	18	19	21	22	23	24	25	26	27	28	29	30
	LOGIC	0	H	0	0	0	H	H	H	0	0	H	0	H	0

UHF R1 RX (380–449.65)	PIN NO.	1	2	3	4	5	6	7	8	9	10	12	13	14	15
	LOGIC	0	H	H	0	0	0	H	H	0	0	0	0	0	0
	PIN NO.	16	17	18	19	21	22	23	24	25	26	27	28	29	30
	LOGIC	0	0	0	0	0	H	H	0	0	0	0	0	0	0

UHF R1 RX (449.65–470)	PIN NO.	1	2	3	4	5	6	7	8	9	10	12	13	14	15
	LOGIC	0	H	H	0	0	0	H	0	0	0	0	0	0	H
	PIN NO.	16	17	18	19	21	22	23	24	25	26	27	28	29	30
	LOGIC	0	0	0	0	0	H	H	0	0	0	0	0	0	0

UHF R2 TX (450–520)	PIN NO.	1	2	3	4	5	6	7	8	9	10	12	13	14	15
	LOGIC	0	0	0	0	0	0	0	0	0	0	0	H	0	0
	PIN NO.	16	17	18	19	21	22	23	24	25	26	27	28	29	30
	LOGIC	0	H	0	0	0	H	H	H	0	0	H	0	H	0

UHF R2 RX (450–520)	PIN NO.	1	2	3	4	5	6	7	8	9	10	12	13	14	15
	LOGIC	0	H	H	0	0	0	H	0	0	0	0	0	0	H
	PIN NO.	16	17	18	19	21	22	23	24	25	26	27	28	29	30
	LOGIC	0	0	0	0	0	H	H	0	0	0	0	0	0	0

3.1.4.9 Buffers and VCOs

Q774 and surrounding circuitry is the prescalar buffer that takes the output of the VCOs and feeds the prescalar input to the Trident IC, pin G1 (M_PRSC).

Q713 and surrounding circuitry is a buffer that provides the correct drive level to the receiver section (via the transmission line TL_RX_LO) and to the input to the TX buffer (Q842 and surrounding circuitry). Q712 and surrounding circuitry provide the bias to the buffer. The buffer formed by Q713 and its associated circuitry is called a “pre-buffer” at this stage.

R712, R713 and R714 help provide some extra isolation to the receiver.

Q842 and surrounding circuitry is the transmit injection buffer. The transmit injection buffer provide the correct drive level to the transmitter section (via the transmission line TL_TX_LO). Q703 and surrounding circuitry provide the bias to the transmit injection buffer.

VHF: The TX and RX VCOs used for the VHF band are contained in Y704 and Y707 respectively. To select the VHF TX VCO, pin 3 (SEL1) must be at a high logic level and pin 5 (SEL2) at a low logic level, on Y704. The VHF TX output of Y704, pin 1 (POUT) goes to pin 4 (RF1) of U709. The output of U709, pin 1 (RFC), is then split into two signals. One to the prescalar buffer input and the other to the pre-buffer. The output of the prebuffer is then fed to pin 1 (RFC) of U710. The VHF TX signal then goes to the divide-by-two circuitry in the Trident IC, pin J2 (ESC_IN). Resistors R703, R704 and capacitors C705, C748 and C747 provide the correct bias for the divide-by-two output. The output of the divide-by-two circuitry, pin K1 (ESCD2_OUT) then goes through a 'second harmonic filter' (comprised of C800, C801, C803 and L802) and attenuator (comprised of R709, R710 and R711). The output of the attenuator is then fed to the transmit buffer (Q842 and surrounding circuitry). The output of the transmit injection buffer, then goes to the transmit section via the TL_TX_LO transmission line.

To select the VHF RX VCO, pin 3 (SEL1) must be at a high logic level and pin 5 (SEL2) at a low logic level, on Y707. The output of the VHF RX VCO, pin 1 (POUT) of Y707 goes to pin 8 (RF3) of U709. The output of U709, pin 1 (RFC) is split into two signals, one to the prescalar buffer (Q774) and the other to the pre-buffer. The output of the pre-buffer is then fed to pin 1 (RFC) of U710. The output of U710, pin 5 (RF2) then goes to the attenuator (comprised of R712, R713 and R714) and then fed to the receiver section via the TL_RX_LO transmission line.

UHF1: The TX and RX VCOs used for UHF1 are contained in Y705 and Y704. To select the UHF RX VCO from (380–450 MHz), pin 3 (SEL1) must be at a high logic level and pin 5 (SEL 2) at a low logic level, on Y704. To select UHF RX VCO (450–470 MHz), pin 3 (SEL1) must be at a low logic level and pin 5 (SEL 2) at a high logic level, on Y704. The UHF RX VCO output of Y704, pin 1 (POUT), is then fed to pin 4 (RF1) of switch U709. The output of U709, pin 1 (RFC), is then split into two signals. One to the prescalar buffer input and the other to the pre-buffer. The output of the prebuffer is then fed to pin 1 (RFC) of U710. The output of U710, pin 5 (RF2) then goes to the attenuator (comprised of R712, R713 and R714) and then fed to the receiver section via the TL_RX_LO transmission line.

To select the UHF TX VCO (380–445 MHz), pin 3 (SEL1) must be at a high logic level and pin 5 (SEL2) at a low logic level, on Y705. To select the UHF TX VCO (445–470 MHz), pin 3 (SEL1) must be at a low logic level and pin 5 (SEL2) at a high logic level, on Y705. The UHF TX VCO output of Y705, pin 1 (POUT), is then fed to pin 5 (RF2) of switch U709. The output of U709, pin 1 (RFC), is then split into two signals. One to the prescalar buffer input and the other to the pre-buffer. The output of the prebuffer is then fed to pin 1 (RFC) of U710. The output of U710, pin 4 (RF1) then goes to the transmit injection buffer (comprised of Q842 and surrounding circuitry).

UHF2: The TX and RX VCOs used for UHF2 are contained in Y705 and Y704. To select UHF RX VCO (450–520 MHz), pin 3 (SEL1) must be at a low logic level and pin 5 (SEL 2) at a high logic level, on Y704. The UHF RX VCO output of Y704, pin 1 (POUT), is then fed to pin 4 (RF1) of switch U709. The output of U709, pin 1 (RFC), is then split into two signals. One to the prescalar buffer input and the other to the pre-buffer. The output of the prebuffer is then fed to pin 1 (RFC) of U710. The output of U710, pin 5 (RF2) then goes to the attenuator (comprised of R712, R713 and R714) and then fed to the receiver section via the TL_RX_LO transmission line.

To select the UHF TX VCO (450–520 MHz), pin 3 (SEL1) must be at a low logic level and pin 5 (SEL2) at a high logic level, on Y705. The UHF TX VCO output of Y705, pin 1 (POUT), is then fed to pin 5 (RF2) of switch U709. The output of U709, pin 1 (RFC), is then split into two signals. One to the prescalar buffer input and the other to the pre-buffer. The output of the prebuffer is then fed to pin 1 (RFC) of U710. The output of U710, pin 4 (RF1) then goes to the transmit injection buffer (comprised of Q842 and surrounding circuitry).

700–800 MHz: The TX and RX VCOs used for 700–800 MHz are contained in Y706 and Y707. To select the 700 RX VCO, pin 5 (SEL2) must be at a high logic level and pin 3 (SEL1) at a low logic level, on Y706. The 700 RX VCO output of Y706, pin 1 (POUT), is then fed to pin 5 (RF2) of switch U709. The output of U709, pin 1 (RFC), is then split into two signals. One to the prescalar buffer input and the other to the pre-buffer. The output of the prebuffer is then fed to pin 1 (RFC) of U710. The output of U710, pin 5 (RF2) then goes to the attenuator (comprised of R712, R713 and R714) and then fed to the receiver section via the TL_RX_LO transmission line.

To select the 800 RX VCO, pin 3 (SEL1) must be at a high logic level and pin 5 (SEL2) at a low logic level, on Y706. The 800 RX VCO output of Y706, pin 1 (POUT), is then fed to pin 5 (RF2) of switch U709. The output of U709, pin 1 (RFC), is then split into two signals. One to the prescalar buffer input and the other to the pre-buffer. The output of the prebuffer is then fed to pin 1 (RFC) of U710. The output of U710 (RF2) then goes to the attenuator (comprised of R712, R713 and R714) and then fed to the receiver section via the TL_RX_LO transmission line.

To select the 700 TX VCO, pin 3 (SEL1) must be at a high logic level and pin 5 (SEL2) at a low logic level, on Y706. The 700 TX VCO output of Y706, pin 1 (POUT), is then fed to pin 5 (RF2) of switch U709. The output of U709, pin 1 (RFC), is then split into two signals. One to the prescalar buffer input and the other to the pre-buffer. The output of the prebuffer is then fed to pin 1 (RFC) of U710. The output of U710, pin 4 (RF1) then goes to the transmit injection buffer (comprised of Q842 and surrounding circuitry). The output of the transmit buffer, then goes to the transmit section via the TL_TX_LO line.

To select the 800 TX VCO, pin 5 (SEL2) must be at a high logic level and pin 3 (SEL1) at a low logic level, on Y706. The 800 TX VCO output of Y706, pin 1 (POUT), is then fed to pin 5 (RF2) of switch U709. The output of U709, pin 1 (RFC), is then split into two signals. One to the prescalar buffer input and the other to the pre-buffer. The output of the prebuffer is then fed to pin 1 (RFC) of U710. The output of U710, pin 4 (RF1) then goes then goes to the transmit injection buffer (comprised of Q842 and surrounding circuitry). The output of the transmit injection buffer, then goes to the transmit section via the TL_TX_LO line.

To select the 7/800 TX VCO, pin 5 (SEL2) must be at a high logic level and pin 3 (SEL1) at a low logic level, on Y707. The 7/800 talk around VCO output of Y707, pin 1 (POUT), is then fed to pin 8 (RF3) of switch U709. The output of U709, pin 1 (RFC), is then split into two signals. One to the prescalar buffer input and the other to the pre-buffer. The output of the prebuffer is then fed to pin 1 (RFC) of U710. The output of U710, pin 4 (RF1) then goes then goes to the transmit injection buffer (comprised of Q842 and surrounding circuitry). The output of the transmit injection buffer, then goes to the transmit section via the TL_TX_LO line

3.2 Controller

3.2.1 Controller Overview

This section provides a detailed circuit description of the APX 5000/APX 6000/APX 6000XE/ SRX 2000 controller design. The controller design consists of the following board and flexes:

Printed Circuit Boards

- VOCON Board
- Expansion Board
- GCAI Connector Board

Flexes

- Control Top (Top Display, Buttons, Knobs)
- Front Chassis Display
- Front Chassis Keypad
- GCAI (Global Core Accessory Interface)
- Side Controls
- Audio Side Microphone / Speaker / Bluetooth Antenna
- Data Side Microphone

The controller interconnection diagram (Figure 3-14) shows the various physical components of the design, along with how they are all connected. It also shows the key distinguishes between a flex connection and a board-to-board connection. A brief description of each of the components is provided below.

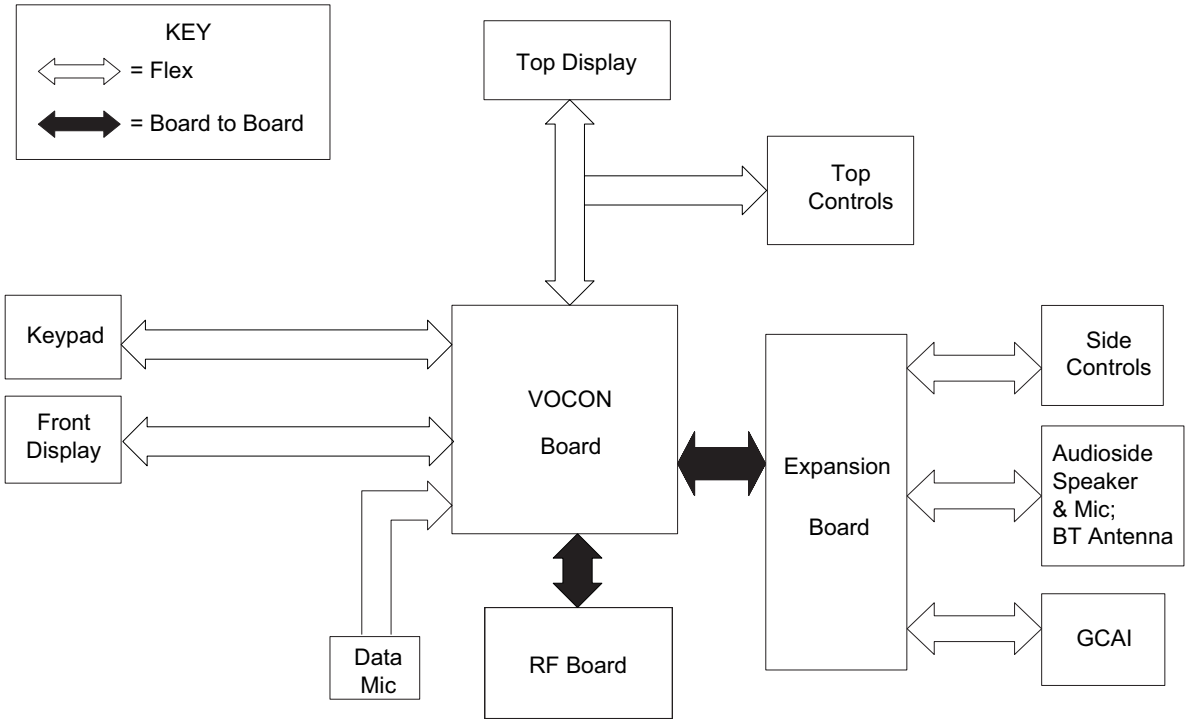


Figure 3-14. Controller Interconnection Diagram

3.2.1.1 Main Controller Components and Connections

3.2.1.1.1 VOCON Board

The VOCON Board contains the OMAP1710 dual-core processor, FLASH and SDRAM memory, Audio circuitry (MAKO and CODEC IC's), a Complex Programmable Logic Device (CPLD), and interfaces to the other components in the controller design.

Connectors

- RF Board – J1001
- Control Top – J2101
- Keypad – J2303
- Front Display – J2304
- Expansion Board – J4001

3.2.1.1.2 Expansion Board

The expansion board contains the Class D internal audio power amplifier with speaker connections, a Global Positioning System (GPS)/Bluetooth 2.1 combination IC and support circuitry, a 3-axes digital accelerometer, a Type III encryption IC, a 4GB e-MMC NAND flash, and connector interfaces to the GCAI board and side controls flex.

Connectors

- VOCON Board – P2001
- Side Controls – J2005
- GCAI – J2004

3.2.1.1.3 GCAI Connector / Board

The GCAI Connector Board contains the side connector pins, and interfaces to the expansion board through a flex. The board has this flex connector, along with components for ESD protection.

3.2.1.2 Top Controls / Flex

The control top contains the top display, the main RF antenna, and five switches: On/Off & Volume Knob, a 16-position Channel/Frequency Switch with concentric 2-position switch (for secure enable/disable operation), a 3 position toggle switch for Zone Selection, and a toggle switch used for Emergency Calling. The control top also includes an TX/RX LED that is solid amber upon receive, red on PTT, and blinking amber on secure RX.

3.2.1.2.1 Top Display

The Top Display is a FSTN transflective monochrome liquid crystal display (LCD) with a multi-color backlight (White, Red, Green, and Amber), which connects to the Control Top Flex (see Section 3.2.1.2: "Top Controls / Flex").

3.2.1.2.2 Front Display

The Front Display is a QVGA transflective color LCD, 130 pixels x 130 pixels with a white backlight. The display connects through a flex directly to a 22-pin connector located on the VOCON board.

3.2.1.2.3 Keypad / Flex

The keypad flex features a 3 x 2 Menu keypad with 4- way navigation button, and a 3 x 4 alphanumeric keypad. The keypad connects through a flex directly to a 20-pin connector on the VOCON board.

3.2.1.2.4 Data-Side Microphone

The data-side microphone is mounted on the front chassis and connects directly to the VOCON board through a set of pogo pins mounted on the VOCON board.

3.2.1.2.5 Side Controls Flex

The side controls flex contains the PTT, Side Top button, Side Middle button and Side Bottom button. The flex connects to the Expansion Board through a 10-pin connector.

3.2.1.2.6 Audio-Side Microphone, Speaker, and Bluetooth Antenna

The audio-side microphone and speaker flex assembly connects to the expansion board through spring clips. The Bluetooth antenna is also part of this flex assembly and also connects to the expansion board through spring clips.

3.2.1.2.7 RF Board

The RF board connects to the VOCON through a 40-pin board to board connector.

NOTE: See Table 7-2 on page 7-2 for pin assignments

3.2.1.3 Controller Electrical Architecture

An overview of the Controller electrical architecture is shown in Figure 3-15 below. The major components and electrical interfaces are shown.

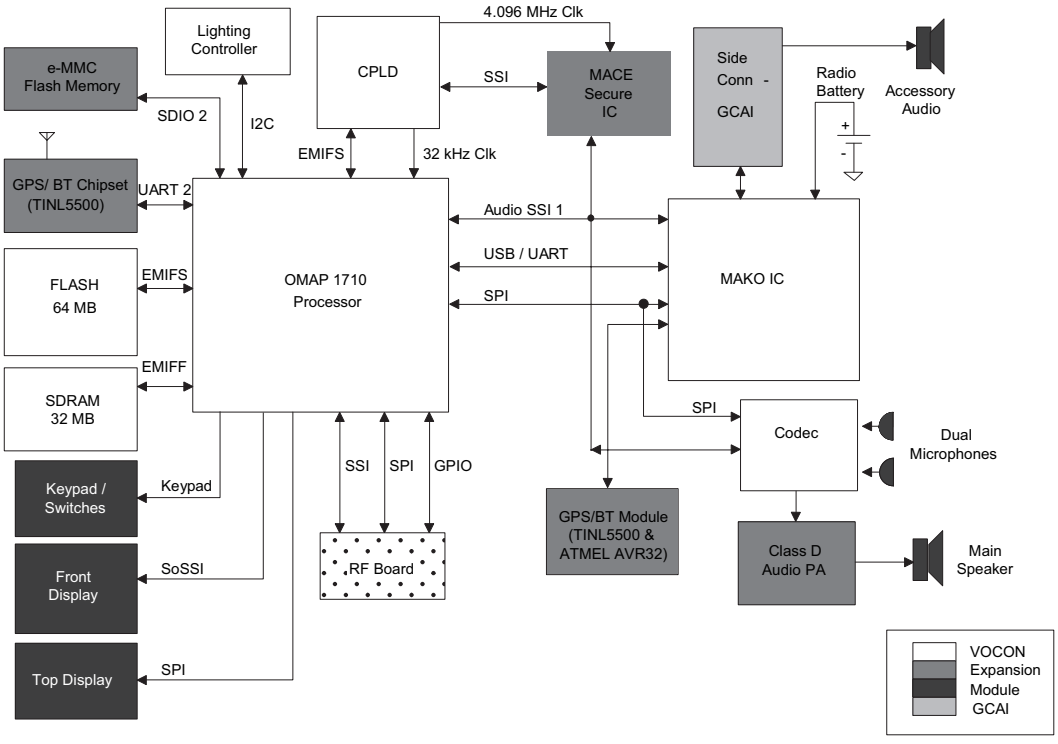


Figure 3-15. Controller Electrical Overview

The functional blocks of the controller are:

- DC Distribution
- Clock Sources
- Processor / Memory
- e-MMC Expandable Memory (expansion board)
- CPLD
- Audio – Internal and External
- MAKO
- User Interfaces
- RF Board Interface
- Type III Encryption Processor (expansion board)
- GPS/Bluetooth Combination IC (expansion board)

3.2.2 DC Distribution

SW_B+ supply comes from a pass FET (Q6501) that is powered by UNSW_B+ (battery voltage). The FET is activated once the power switch is in its on position. SW_B+ supplies the power for the entire controller. SW_B+ supplies MAKO and the external regulators. MAKO and the external regulators then regulate the voltage to the desired level. (See Figure 3-16.)

OMAP's core is supplied by VCC_SW_1.4 (U6507). 1.85 LDO supplies OMAP's IO, FLASH, CPLD, DDR, and MACE. See 3-4Table 3-4. for DC supplies and sources.

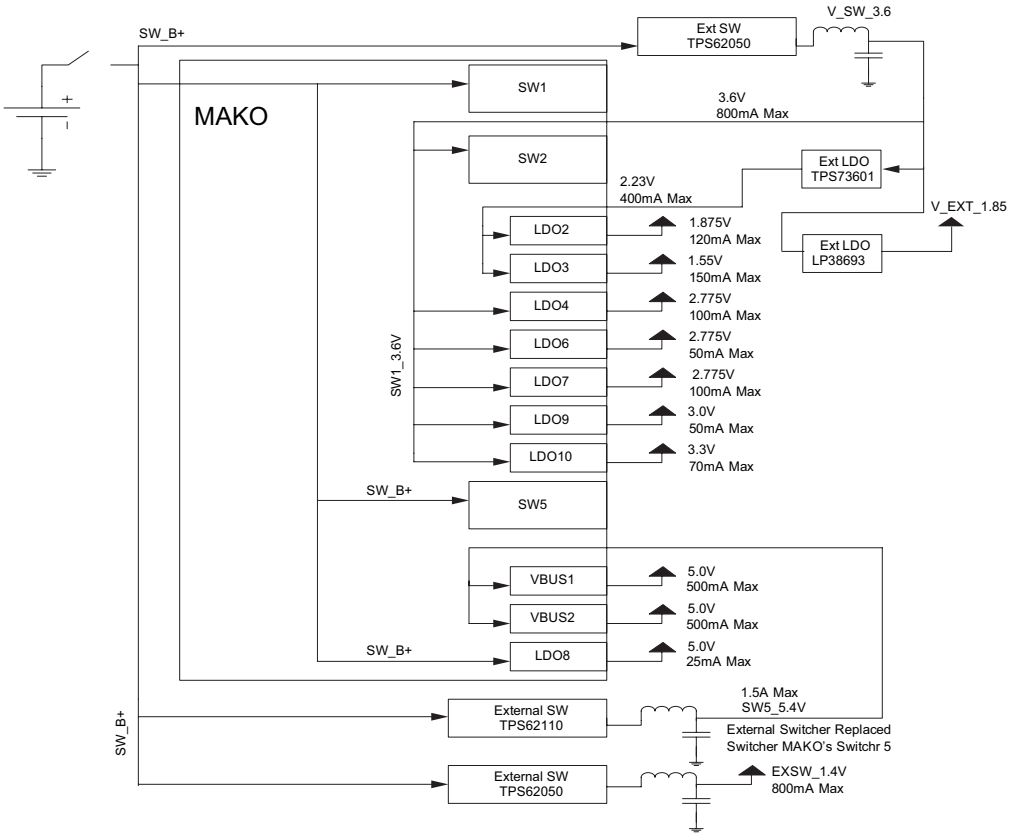


Figure 3-16. Controller DC Block Diagram

Table 3-4. DC Supplies and Sources for Controller

	V_SW_3.60	V_SW_1.4	V_EXT_1.85	V_SW_5	VBUS1	VBUS2	V_1.875	V_2.75D	V_2.775	V_3.0A	SW_B+
OMAP CORE		X									
OMAP IO			X								
DDR			X								
FLASH			X								
CPLD			X								
MACE			X								
CODEC							X			X	
GPS											
LGHT FRNT	X		X	X							
LGHT TOP	X			X							
RF BOARD	X						X		X		
MAKO	X								X		X
CLASS D PA											X
TOP DSPLY			X					X			
FRNT DSPLY			X					X			
USB SPLY						X					
16.8 SQR									X		

3.2.2.1 DC Distribution Major Components

The controller's DC section is made up of MAKO and external regulators. This section will give an overview of the schematics and circuitry that makes up the major supplies of the DC architecture.

3.2.2.1.1 MAKO

MAKO (U6501) is a custom power management IC manufactured by Atmel. MAKO controls almost all of the LDO supplies to the controller. Table 3-5 illustrates all of MAKO's LDO and the supplies that feed them. Figure 3-16 shows all of MAKO's LDOs their voltage level and components that can be accessed to verify operation. Figure 3-16 also shows where the battery supply and on off switch can be accessed. MAKO is also responsible for the timing sequence for the enabling of the regulators which is discussed further in section 3.1.3.7.1 and section 3.1.3.7.3 on pages 3-15 and 3-16.

Table 3-5. MAKO's LDO and Supplies

Name	Ref	Description	Level
ON_OFF_SWITCH	F_MECH_SW	ON/OFF Switch. Radio on when GND	GND
UNSW_B+	F_UNSW_B+	Radio Battery Voltage	9 – 6 V
SW_B+	R6593	Radio Supply Voltage	9 – 6 V
V_SAVE	C6538	LDO Output Present When Battery is Attached	2.5 V
V_1.875	C6581	LDO Output	1.875 V
V_1.55	R6561	LDO Output	1.55 V
V_2.775D	R6563	LDO Output	2775 V
V_2.775_EXP	R6562	LDO Output	2.775 V
V_2.8_RF	R6564	LDO Output	2.8 V
V_5.0A	R6565	LDO Output	5.0 V
V_3.3	R6566	LDO Output	3.3 V
V_3.0A	R6567	LDO Output	3.0 V

3.2.2.1.2 External Regulators: V_SW_1.4, V_SW_3.60

The controller board contains two TPS62050 regulators in order to regulate voltages of 1.4V and 3.6V. The TPS62050 is a synchronous step-down adjustable regulator. The switching regulator is capable of sourcing 800mA. Its output can be adjusted by using a voltage divider tied to the feedback pin. The regulators are powered from SW_B+. Figure 3-17 is the schematic for the V_SW_1.4 regulator that illustrates the supporting circuitry for the TPS62050.

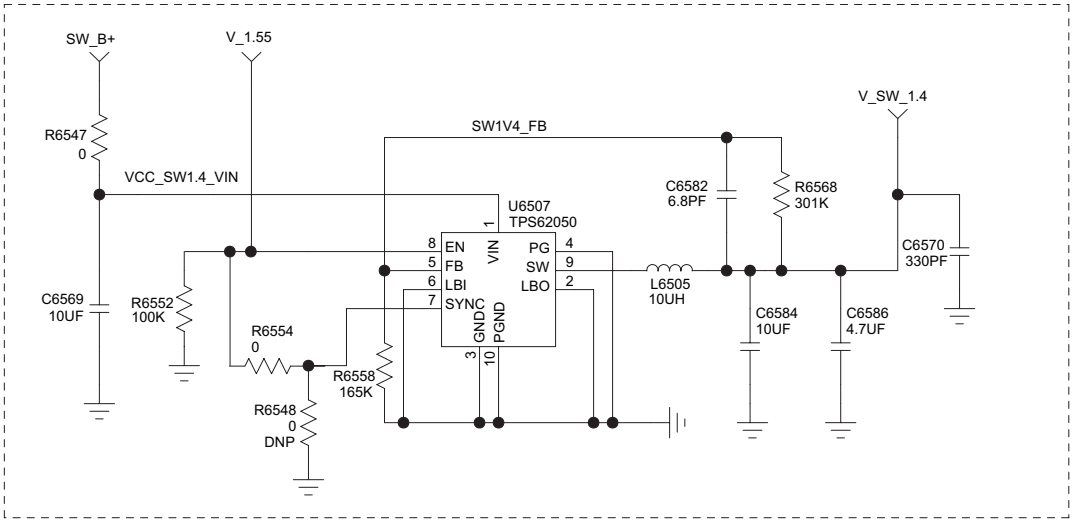


Figure 3-17. V_SW_1.4 Switched Power Supply

3.2.2.1.3 External Switcher 5

The controller board uses an external TI regulator (TPS62110, U6505) to regulate to 5.4V. The TPS62110 is a 1.5A capable synchronous step down converter. The output is adjusted using a voltage divider to the feedback pin. The regulator is powered from SW_B+. Figure 3-18 illustrates the SW5 circuitry. The SW5 circuit also includes or-gate logic that facilitates implementation of current saving PFM mode when the radio is in standby mode.

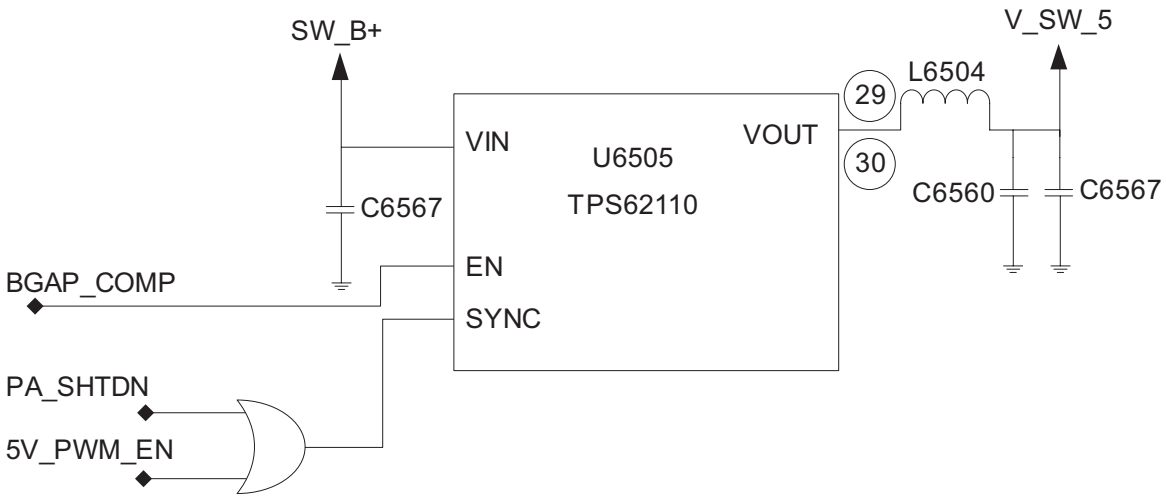


Figure 3-18. 5V Switched Power Supply

APX 5000/APX 6000/APX 6000XE/SRX 2200 has Pulse Switching option.
Mode 1: Pulse Frequency Modulation (PFM). A relatively noisy but highly efficient pulsing mode for Switched power supplies.
Mode 2: Pulse Width Modulation (PWM). Pulsing mode that is cleaner than PFM, used when risk of RF interference is present which includes both transmit and receive radio modes.

Table 3-6. Pulse Switching Combination

PA_SHTDN	5V_PWM_EN	SYN	MODE
0	0	0	PFM
0	1	1	PWM
1	0	1	PWM
1	1	1	PWM

3.2.2.1.4 Power-up Timing

The powering up of the radio starts with the MAKO. Once the radio knob is turned to the 'ON' position and battery voltage is supplied, a pass FET is activated to deliver battery voltage to MAKO and external regulators. The external 3.6 V is first turned on then MAKO activates its 24.576 MHz clock, and the remaining regulators begin to turn on. Once all the regulators have turned on, MAKO releases its reset. The CPLD is then powered on from the 1.875 V external regulator and takes MAKO 24.576 MHz clock and divides it to 32.768 kHz in order to provide for OMAP. OMAP starts to power up upon receiving voltages 1.4 V, 1.85 V, and the 32.768 kHz clock. OMAP than activates it 12 MHz clock and releases its reset. It then starts to run the boot loader stored in flash. A more detailed timing view of the regulators is shown in Figure 3-19.

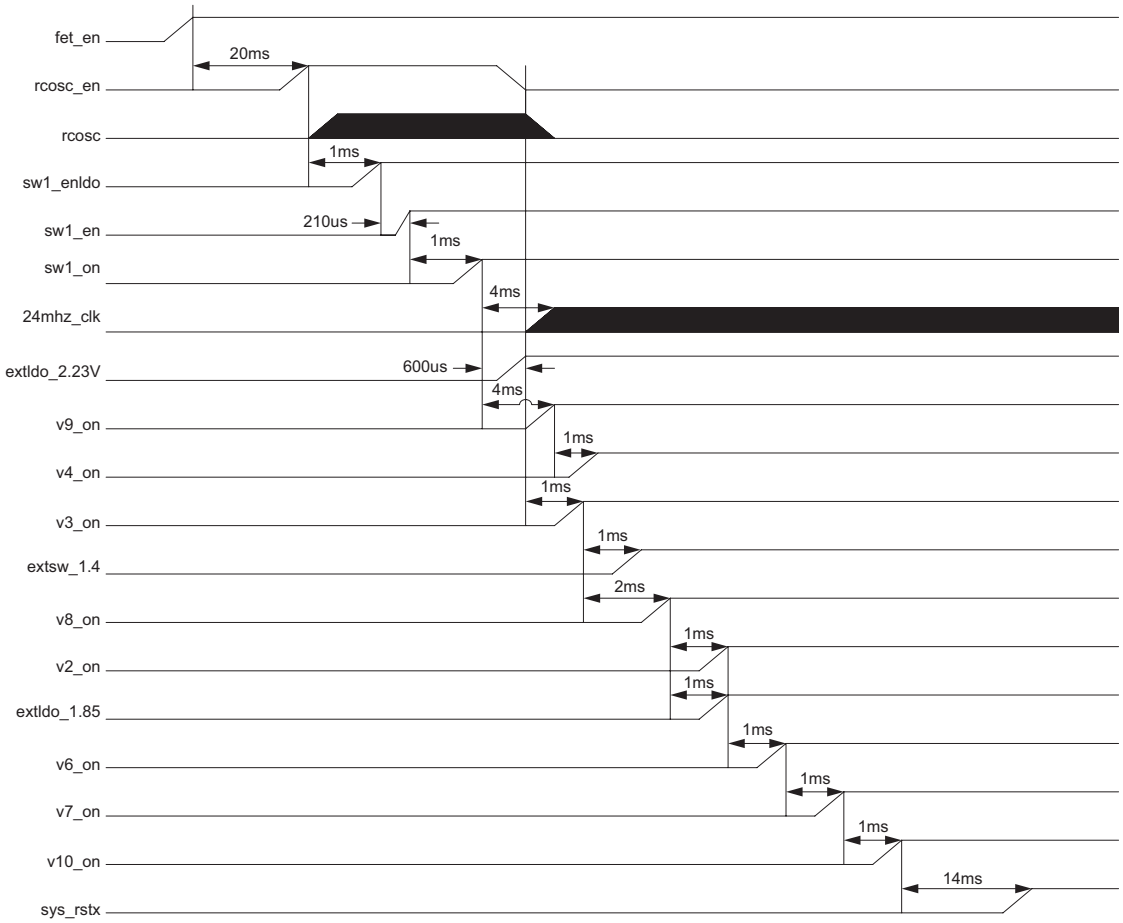


Figure 3-19. Power-up Timing Regulators

3.2.3 Clock Sources

The VOCON board contains multiple crystal clock sources. These sources are active upon power-up. Secondary clock frequencies are derived on the VOCON board from these crystal sources. In addition to the crystal frequencies, the VOCON receives a 16.8 MHz sine wave from the RF board, which is shaped into square wave and fed to the OMAP timer input. Screen shots and test points for these clock signals are shown in Chapter 6.

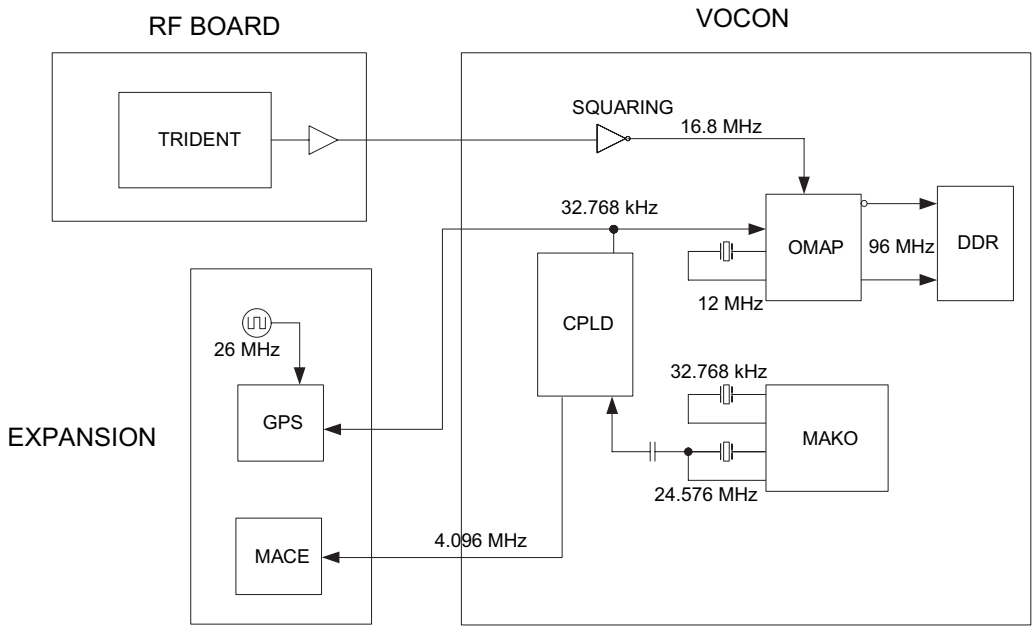


Figure 3-20. VOCON Clock Architecture

Table 3-7. VOCON Clock Distribution

Clock Source	Frequency	Type	Description	Clock Recipient	Suggested Probe Points
Y6501	24.576 MHz	Crystal Oscillator	MAKO 24 MHz & tapped into CPLD	U6501, U6101	R6574
Y6502	32.768 kHz	Crystal Oscillator	MAKO RTC	U6501	C6541
Y6601	12 MHz	Crystal Oscillator	OMAP CPU Clock	U6302	C6601
U6302	96 MHz	OMAP GPIO	DDR Clocks (Complementary signals)	U6301	TP6307 & TP6308
U6101	4.096 MHz	CPLD GPIO	MACE Clock	U2510 (to Expansion Board)	R6113
U6101	32.768 kHz	CPLD GPIO	OMAP Boot-Up clock & GPS/ Bluetooth digital clock	U6302 & U2401 (Expansion Board)	R6114 (GPS/BT) & R6115 (OMAP)
Y701 (RF board)	16.8 MHz	Crystal Oscillator	RF Frequency Synthesizer IC (Trident) TCXO	U6302	R6218

3.2.4 OMAP Processor and Memory

3.2.4.1 OMAP Processor (U6302)

The OMAP1710 dual core processor lies at the center of the VOCON design. The processor features utilized in the VOCON design include:

- ARM9 CPU core
- C55X DSP core
- 16KB shared internal RAM
- SSI Interfaces
- USB Interfaces
- Timers & Watchdog Timers
- Keyboard Matrix Interface
- 1-Wire Interface
- Multimedia Card
- LCD Controller
- I2C Interface
- SPI interface
- External Memory Synchronous Interface
- External Memory Asynchronous Interface
- UARTs
- GPIOs

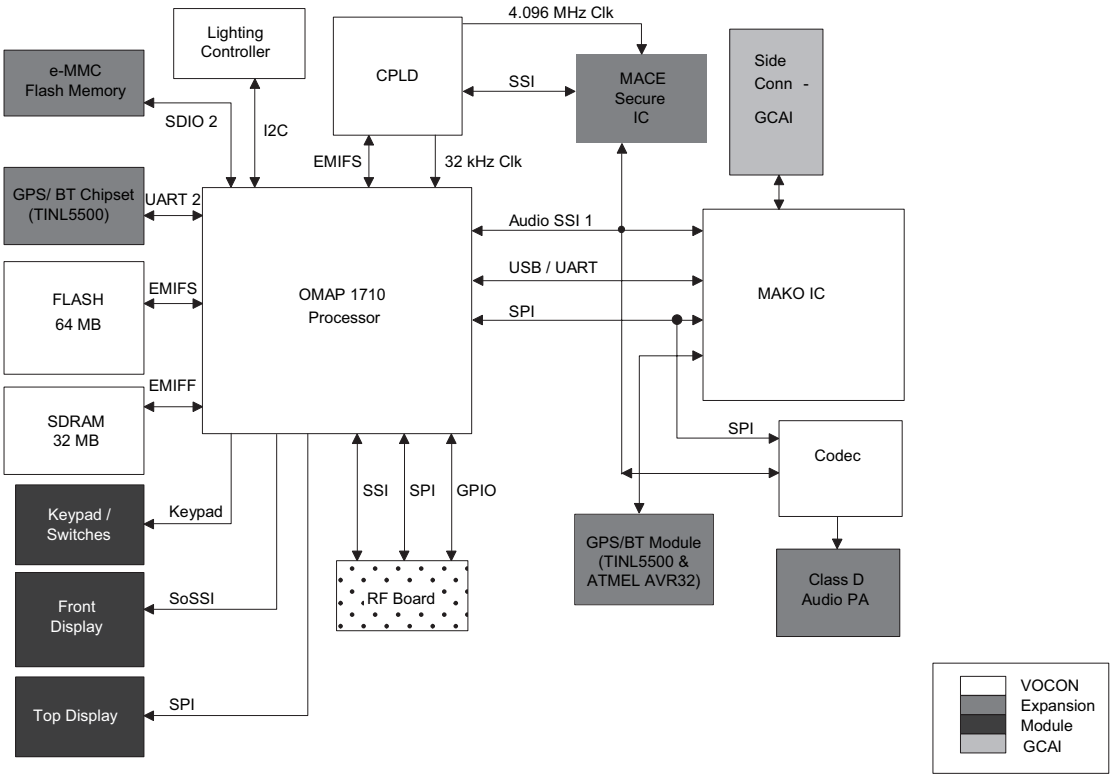


Figure 3-21. Overview of OMAP Interconnection with VOCON Peripherals

3.2.4.2 Memory

In addition to the internal RAM, the OMAP 1710 Processor (U6302) features three distinct external memory interfaces. All memory devices except the eMMC memory, is located on the VOCON board, as elaborated in Figure 3-21. The external memory interface is shown in Figure 3-22.

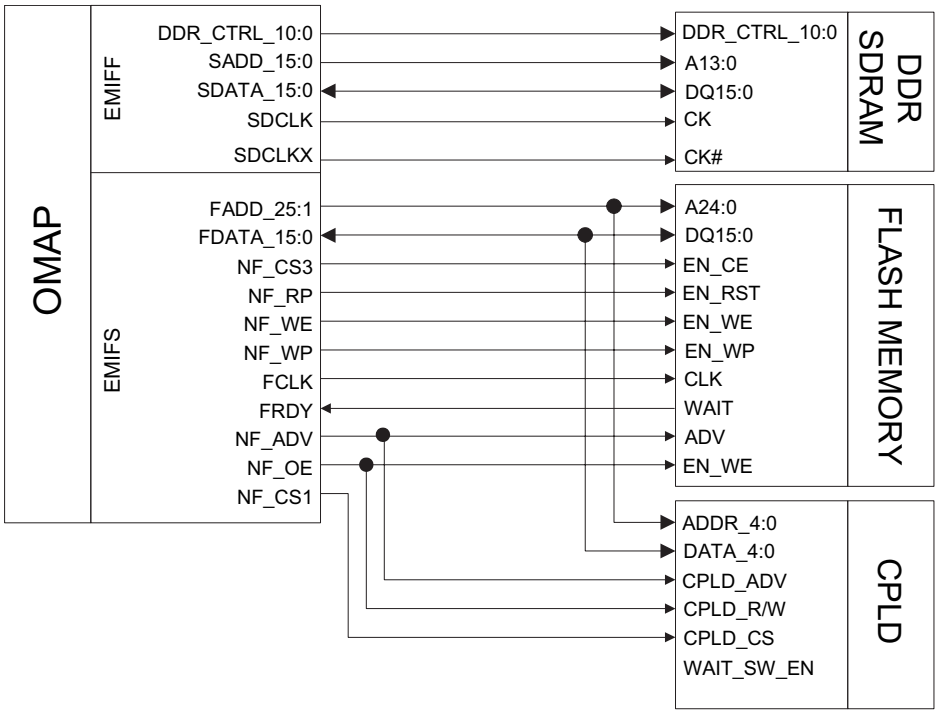


Figure 3-22. OMAP Memory Interface

3.2.4.3 Asynchronous External Memory Interface

The EMIFS is used for transferring data between the ARM or DSP cores and the 64 MB External NOR Flash memory (U6304). The Flash memory is a non-volatile memory unit, primarily used to store the radio's executable code, along with device configuration values, event logs, and initialization codes. The flash memory is primarily accessed during the VOCON's power up and power down cycles.

3.2.4.4 Flash Memory (6304)

The Flash memory located in close proximity to the OMAP processor is a 64 MB Numonyx 65nm StrataFlash. The flash interface uses 16 data bits and 25 address bits. The flash IC is enabled by OMAP processor's CS3 line. The flash IC also features a WAIT line that is capable of halting data flow between the processor and flash IC while operating in synchronous read mode.

3.2.4.5 CPLD Interface (U6101)

The CPLD (U6101) registers are also mapped to the Asynchronous External Memory Interface. These registers control the CPLD GPIO pins and enable the OMAP to expand its GPIO capability via memory mapped IO.

3.2.4.6 Synchronous External Memory Interface

This interfaces the OMAP to a 32 MB Double Data Rate (DDR) RAM IC (U6301). Upon boot-up OMAP configures this interface to operate in synchronous mode at 96MHz. This volatile memory unit is primarily accessed during code execution.

3.2.4.7 Double Data Rate (DDR) Memory (U6301)

The 32MB DDR Synchronous DRAM IC is interfaced to the OMAP using 13 address bits and a 16bit data bus. The DDR IC is driven by a complementary clock signal originating from the OMAP IC. The DDR clock is initialized to 96MHz by the OMAP boot code. Additional control signals are also dedicated for the DRAM interface, as illustrated in Figure 8-70. “ HLN5979B/ HLN5960A Controller Board Memory Interface Circuit” on page 8-136.

3.2.4.8 Multi-Media Card (MMC) Interface

The OMAP processor’s MMC interface is used for a 4GB external e-MMC NAND flash memory. This external memory is located on the expansion board. The VOCON board is connected to the expansion board through connector J4001.

3.2.4.9 eMMC Memory

The MMC2 port interface on the OMAP processor is configured as a Secure Digital interface used for memory modules. The memory module uses a 10bit interface, which include 4 bit wide bi-directional data bus, command line, clock and three direction control bits. The SDIO signals are conveyed to the expansion board via J4001. A 4GB eMMC is the only size used on the expansion board.

The Micron eMMC is a communication and mass data storage device that includes a Multi-Media Card (MMC) interface, a NAND Flash component, and a controller on an advanced 11-signal bus, which is compliant with the MMC system specification. Its low cost, small size, Flash technology independence, and high data throughput make e MMC ideal for smart phones, digital cameras, PDAs, MP3 players, and other portable applications. The nonvolatile eMMC draws no power to maintain stored data, delivers high performance across a wide range of operating temperatures, and resists shock and vibration disruption.

The MMC specification defines the communication protocol between a host and a device. The protocol is independent of the NAND Flash features included in the device and the device handles its management functions internally, making them invisible to the host processor.

Micron eMMC incorporates advanced technology for defect and error management. If a defective block is identified, the device completely replaces the defective block with one of the spare blocks. This process is invisible to the host and does not affect data space allocated for the user. The device also includes a built-in error correction code (ECC) algorithm to ensure that data integrity is maintained.

The card-specific data (CSD) register provides information about accessing the device contents. The CSD register defines the data format, error correction type, maximum data access time, and data transfer speed, as well as whether the DS register can be used. The programmable part of the register (entries marked with W or E in the following table) can be changed by the PROGRAM_CSD (CMD27) command. The maximum READ and WRITE data block lengths are 512 bytes, and the device size is 4095.

In order to accurately identify memory that is greater than 1GB, there is an additional register to consider. The 512-byte extended card-specific data (ECSD) register defines device properties and selected modes. The most significant 320 bytes are the properties segment. This segment defines device capabilities and cannot be modified by the host. The lower 192 bytes are the modes segment. The modes segment defines the configuration in which the device is working. The host can change the properties of modes segments using the SWITCH command.

A GPIO named "MMC_RESET" will be used to soft-reset the eMMC card. This will be an output from CPLD ball C7. This ball is on output high out of reset. On power-up software should drive the pin low for at least 5ms and then drive it high. After reset is driven high, software needs to wait 250ms before sending command CMD0 (argument = 0). Refer to the sw code to see how to add delays with MMC_CLK running for at least 74 clock cycles after any reset occurs. If not, the eMMC will fail to initialize and will not open since the OMAP does not run the clock continuously, so waiting 250ms with no clock running will not configure eMMC correctly.

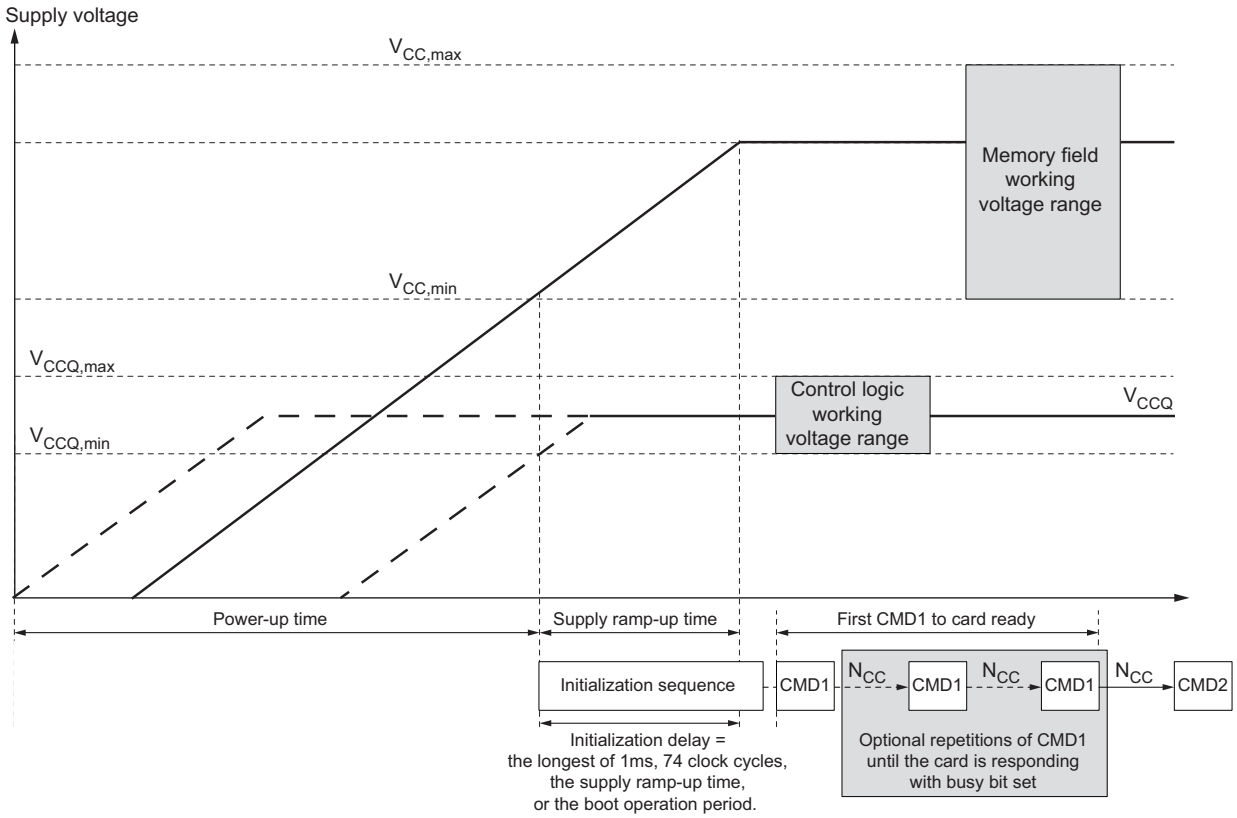
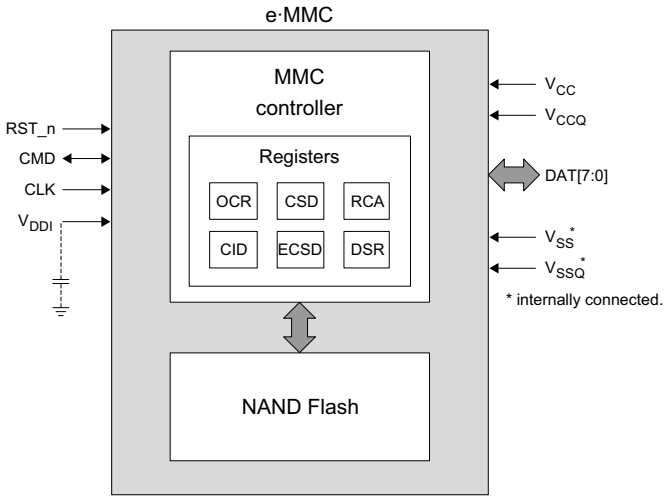


Figure 3-23. Timing of power-up and initialization of eMMC



Symbol	Type	Description
CLK	Input	Clock: Each cycle of the clock directs a transfer on the command line and on the data line(s). The frequency can vary between the minimum and the maximum clock frequency.
CMD	I/O	Command: This signal is a bidirectional command channel used for command and response transfers. The CMD signal has two bus modes: open-drain mode and push-pull mode (see Operating Modes). Commands are sent from the MMC host to the device, and responses are sent from the device to the host.
DAT[7:0]	I/O	Data I/O: These are bidirectional data signals. The DAT signals operate in push-pull mode. By default, after power-on or assertion of the RST_n signal, only DAT0 is used for data transfer. The MMC controller can configure a wider data bus for data transfer either using DAT[3:0] (4-bit mode) or DAT[7:0] (8-bit mode). eMMC includes internal pull-up resistors for data lines DAT[7:1]. Immediately after entering the 4-bit mode, the device disconnects the internal pull-up resistors on the DAT[3:1] lines. Upon entering the 8-bit mode, the device disconnects the internal pull-ups on the DAT[7:1] lines.
RST_n	Input	Reset: The RST_n signal is used by the host for resetting the device, moving the device to the pre-idle state. By default, the RST_n signal is temporarily disabled in the device. The host must set ECSD register byte 162, bits[1:0] to 0x1 to enable this functionality before the host can use it.
V_{CC}	Supply	V_{CC}: NAND interface (I/F) I/O and NAND Flash power supply.
V_{CCQ}	Supply	V_{CCQ}: eMMC controller core and eMMC I/F I/O power supply.
V_{SS}[1]	Supply	V_{SS}: NAND I/F I/O and NAND Flash ground connection.
V_{SSQ}[1]	Supply	V_{SSQ}: eMMC controller core and eMMC I/F ground connection.
V_{DDI}		Internal voltage node: At least a 0.1µF capacitor is required to connect V_{DDI} to ground. A 1µF capacitor is recommended. Do not tie to supply voltage or ground.
NC	–	No connect: No internal connection is present.
RFU	–	Reserved for future use: No internal connection is present. Leave it floating externally.

Note: 1. V_{SS} and V_{SSQ} are connected internally.

Figure 3-24. eMMC Topography

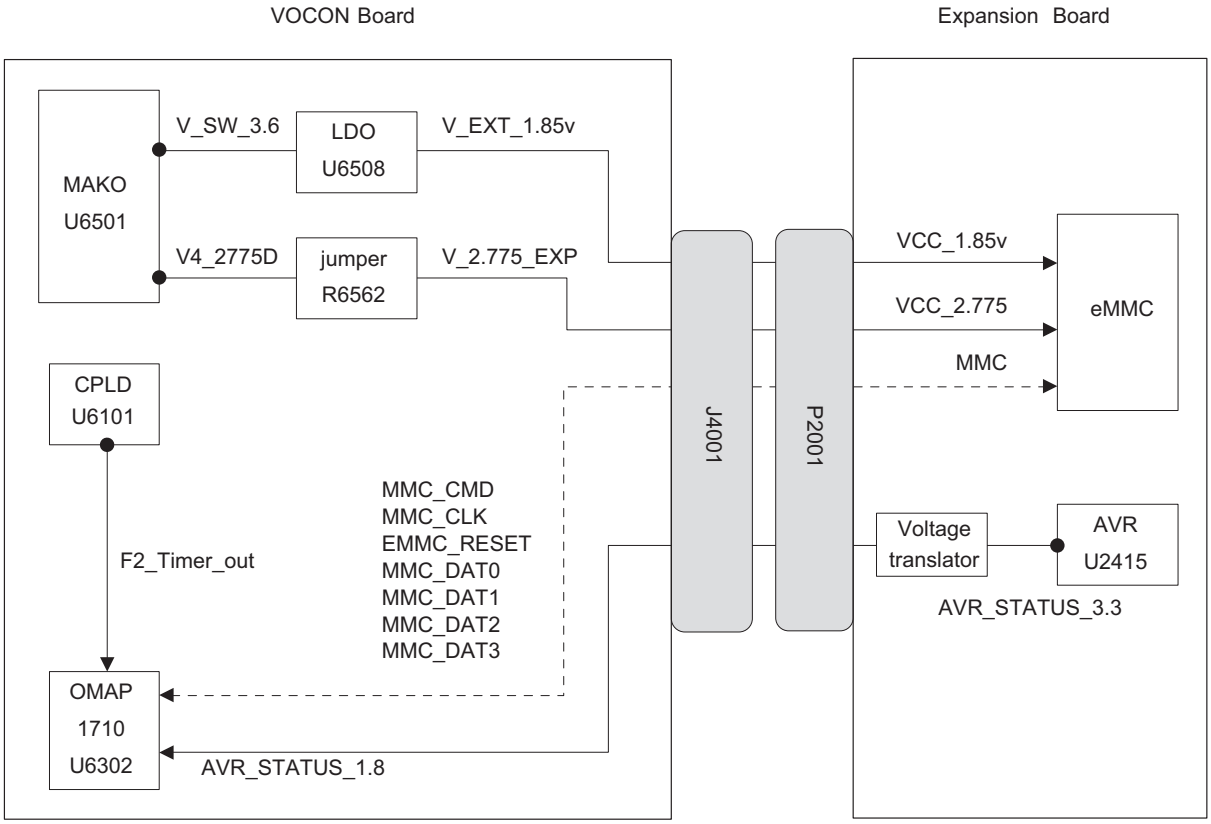


Figure 3-25. Block Diagram of VOCON and EXPANSION boards as related to eMMC

3.2.4.10 Peripheral Devices

The OMAP processor is equipped with multiple buses and interfaces that are configured for peripheral interconnection.

3.2.4.10.1 Receive and Transmit SSI

These two interfaces are dedicated for communicating with the RF deck digital interface, carrying receive and transmit base band signals. The OMAP processor generates the clock and FSYNC signals for the receive SSI interface. The RF deck generates these signals for the transmit SSI interface.

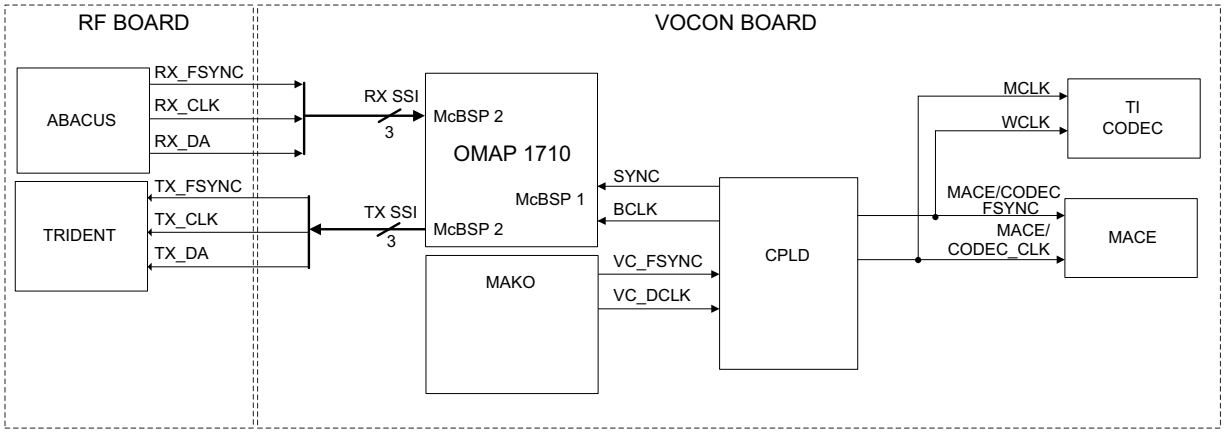


Figure 3-26. RX / TX SSI Configuration

3.2.4.10.2 Audio SSI

OMAP's McBSP1 interface is configured as a SSI interface dedicated to carry transmit and receive audio data to peripheral devices. The peripherals connected to this bus include MAKO, Audio CODEC, MACE and CPLD. The bus also connects to the option board via J3001. MAKO generates the clock and frame sync signals for this bus.

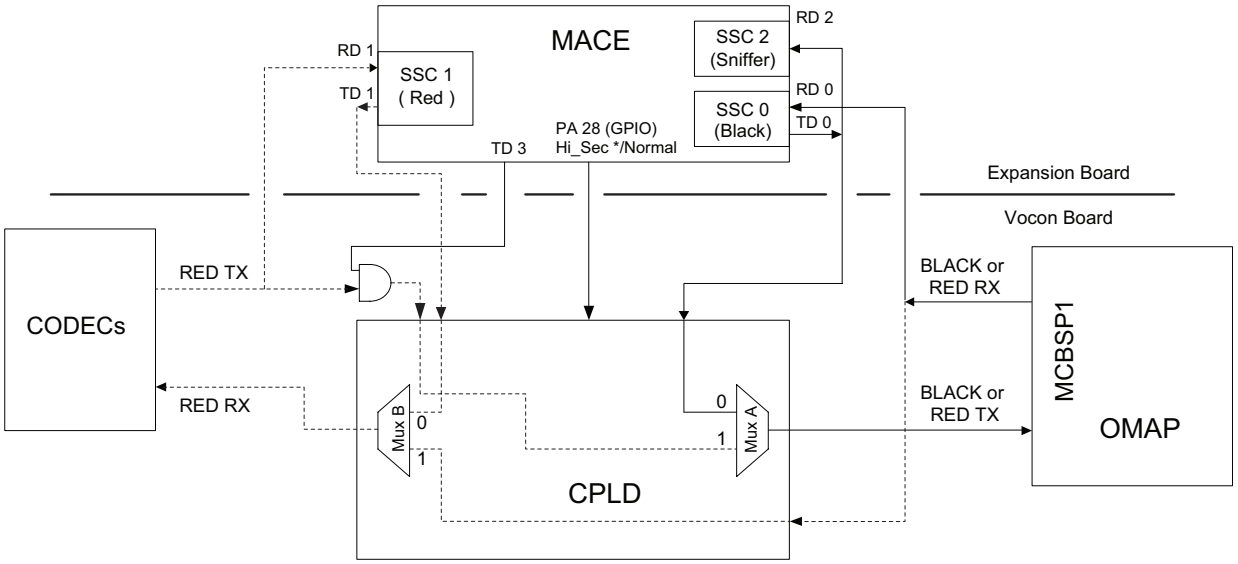


Figure 3-27. Audio SSI Configuration

3.2.4.10.3 ARM SPI

This SPI interface is controlled by OMAP's ARM core. Devices connected to this bus include MAKO, display controllers and the audio CODEC.

3.2.4.10.4 DSP SPI

This SPI interface is controlled by the DSP core of the OMAP processor. This bus is used to configure and control devices on the RF deck.

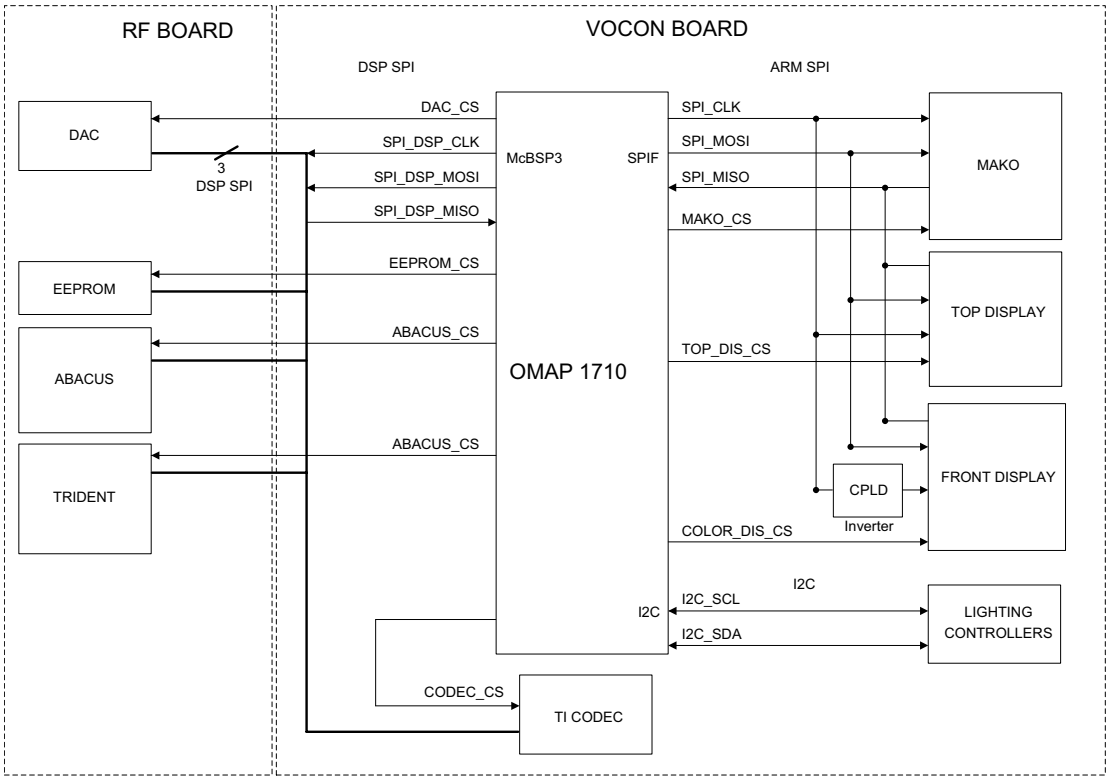


Figure 3-28. SPI and I2C Configuration

3.2.4.10.5 1-Wire

The OMAP's 1-wire line is available on the GCAI pin 16. The signal is routed to the side connector via J4001.

3.2.4.10.6 USB

The OMAP CPU's USB port is routed to the side connector via J4001. The USB signals on the side connector are illustrated in Figure 3-21, on page 3-34.

3.2.4.10.7 UARTs

Two of OMAP's UARTs are configured for peripheral interfacing.

The four-wire UART1, which is capable of hardware flow control, is available on the side connector for accessory devices. The signals are level translated via MAKO and routed to the side connector via J4001.

OMAP's UART2, which is a two wire interface, capable of software flow control only, is connected to the GPS receiver IC on the expansion board. The signals are routed to the expansion board via J4001.

3.2.4.10.8 CPLD (U6101)

The CoolRunner IC is a complex programmable logic device (CPLD) programmed specifically for the APX/ SRX product line. The CoolRunner IC is flash based and comes pre-programmed. It is contained in an 8x8mm, 132 BGA package with 0.5mm ball spacing. The primary functions of the CPLD are clock generation, GPIO expansion, SSI clock and frame sync direction control, F2 multiplexing, secure data control, main display off-loading, and clock inversion.

An external linear regulator, U6508, supplies the CPLD's 1.875 V core voltage. The 1.875 V core voltage is used for the CPLD's internal logic and I/O buffers. MAKO's 24.576 MHz clock source is used by the CPLD to generate a 32.768 kHz clock for OMAP booting, real time clock/timer, and for GPS. It is also used to generate 4.096 MHz for the MACE IC.

The CPLD is controlled through OMAP's EMIFS interface. It supports 31 configurable GPIOs. It also supports 20 input only pins that are accessible through an EMIFS read operation. Some of the GPIOs supported by the CPLD include GCAI_GPIO_0, F2_PARAMP_MON, and USB_CURR_LIM. Some examples of the inputs the CPLD is programmed to support are some of the top and side controls buttons (SEC_CLEAR, FREQ_SEL, MON, SIDE_1, SIDE_2, and TG0) and board ID. Figure 3-29 below shows the basic CPLD interfaces.

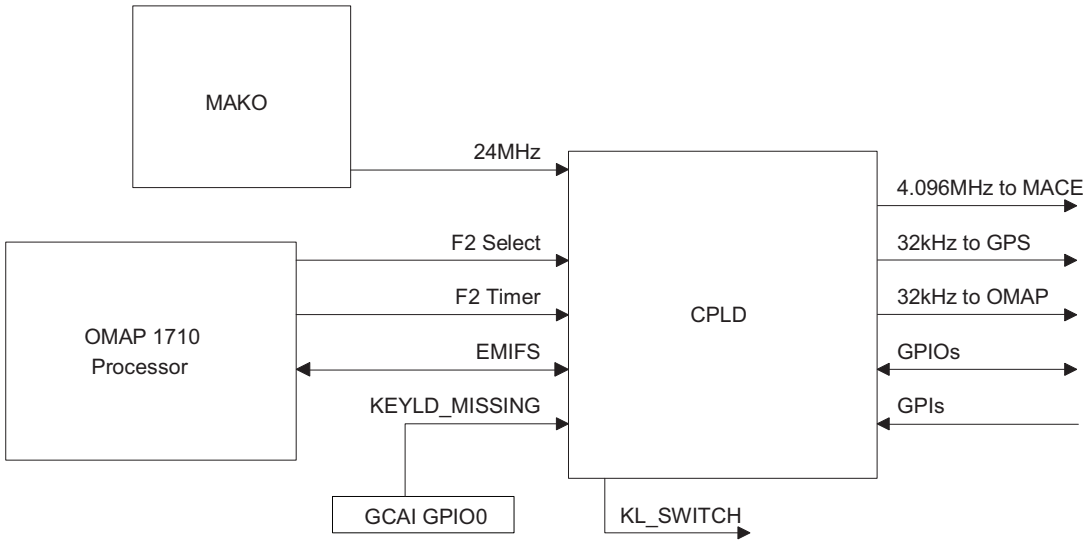


Figure 3-29. CPLD Block Diagram

3.2.5 Audio

The audio section of the VOCON design consists of:

- TI AIC33 voice CODEC
- TI TPA2034D1 class-D audio power amplifier
- MAKO audio sub-block

3.2.5.1 TX Audio path

The TX audio paths begin with three microphones. There are two internal microphones and one external microphone path going to the GCAI connector.

The internal microphone paths start with two microphones that are embedded within the radio. Both of the microphones are biased with a 4.7 V supply that is generated by the MAKO IC. This supply is solely dedicated to biasing the microphones. The microphone signals are AC coupled into the 16 bit TI AIC33 stereo CODEC on the MIC3R and MIC3L input pins. The TI AIC33 CODEC allows both microphone signals to be amplified, and simultaneously sampled and converted into digital data. The data is sent to the OMAP1710's DSP through the McBSP1 port where the DINC (dual input noise canceller) can process the data for both microphones and provide a high level of noise suppression. The digital data is sent to the OMAP1710 through the audio SSI (synchronous serial interface) bus where the MAKO IC is used as the interface's clock and frame sync generator.

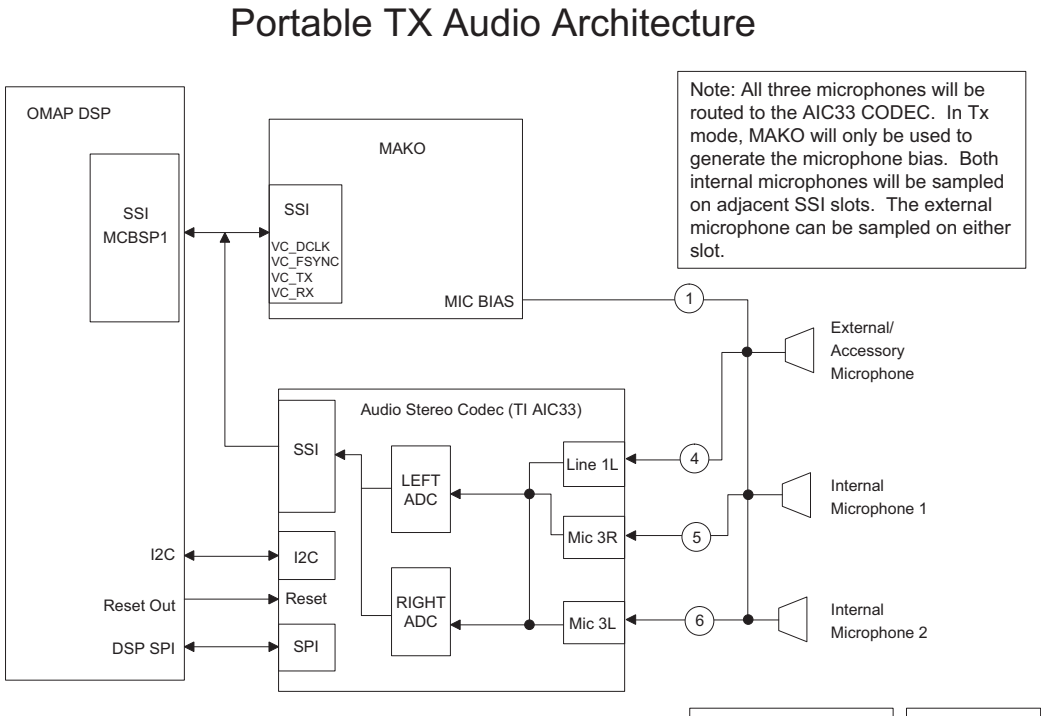


Figure 3-30. Audio TX Path Block Diagram

The external microphone path will also be supported by the TI AIC33 CODEC, using the LINE1LP pin on the IC. The LINE1LP is multiplexed with the MIC3R within the CODEC, and selected as the input when the external microphone path is chosen as the TX audio source. Similar to the internal microphone signals, the TI CODEC amplifies and samples the external microphone signal. The digital data is also sent to the OMAP1710's DSP through the McBSP1 port using the audio SSI bus.

3.2.5.2 RX Audio path

The RX audio path supports two internal speakers and one external speaker.

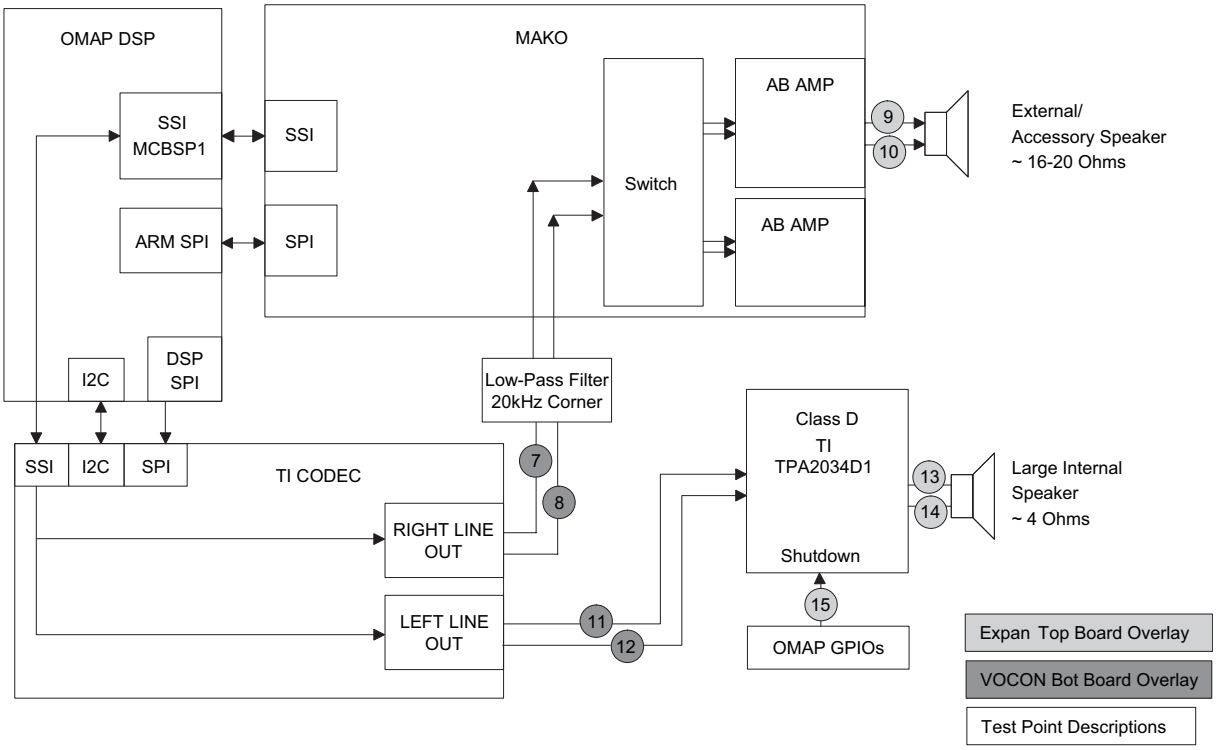


Figure 3-31. VOCON RX Audio Path Block Diagram

The RX internal audio path begins with the digital audio samples being sent from the OMAP1710's McBSP1 port to the TI AIC33 CODEC through the audio SSI bus. As in the TX audio paths, the MAKO IC is also used to generate the clock and frame sync for the audio SSI bus. Once the audio data is received by the TI CODEC, the CODEC proceeds to convert the data to analog and implements the volume control. The analog signal in the CODEC is then fully differential and gets sent out to the power amplifier through pins LEFT_LOP and LEFT_LOM. The TI TPA2034D1 Class D audio power amplifier accepts a fully differential analog input signal and will also drive a 4 Ohm loudspeaker differentially.

The external speaker path is almost identical to the internal speaker path. The digital audio data is sent from the OMAP1710's McBSP1 port to the TI AIC33 CODEC for digital to analog conversion and volume control. The external speaker path uses the MAKO IC's class-AB audio power amplifier to drive 16 Ohm to 28 Ohm external speakers. The input to MAKO IC's audio power amplifier is fully differential and comes from the TI CODEC's RIGHT_LOP and RIGHT_LOM. The output of the MAKO IC's audio amplifier is also fully differential and available on pins EXT_SPKR_P and EXT_SPKR_M.

3.2.6 User Interface

3.2.6.1 Control Top

The control top contains an On/Off & Volume Knob (S3), a sixteen-position Channel/Frequency Switch with programmable concentric two-position switch (S2), a three-position (A,B,C) Programmable Toggle Switch (S4), and an orange programmable Top Button (S1). The Control Top also includes a TX/RX LED that is solid amber upon receive, red on PTT, and blinks amber on secure RX. Additionally, the Control Top includes a transflective FSTN display. Control Top components are mounted on a flex circuit which connects to controller board connector J2101.

When the On/Off & Volume Knob (S3) is switched to the 'ON' position, the switch is grounded and MECH_SW is pulled low. MECH_SW is an input to MAKO (U6501). The logic low input enables an external FET (Q6501) gate voltage, FET_ENX, which switches UN_SW_B+ to SW_B+ and turns the radio on. Volume is also controlled through S3 and is an input to MAKO. The VOL signal is connected to a potentiometer biased between ground and 2.775 V (R6563) from MAKO. When the volume knob is turned, the VOL signal level is converted to a code word by MAKO's ADC and read by OMAP through SPI.

Switch S4 is the three-position, binary-coded, toggle switch typically used for expanded Zone/ Channel Selection. Two outputs of the switch,TOGGLE_0 and TOGGLE_1, are biased to 1.875 V. The third output is grounded. Two-bit codewords from the switch are read by OMAP through the CPLD's EMIFS interface and indicate which of the three positions is set.

The orange programmable Top Button (S1) is typically used for emergency. It is also biased to 1.875 V (R6507) and is an input (EMERG_BTN_X) to the CPLD. A button press is detected when EMERG_BTN_X is pulled low.

Like the three-position switch, the Frequency Switch (S3) is also binary coded. S3's output pins are connected to GPIO pins of the CPLD which provide a four-bit binary word (signals FREQ_SEL_0, FREQ_SEL_1, FREQ_SEL_2, and FREQ_SEL_3) to OMAP indicating which of the 16 pins of the switch is set. This switch provides an additional output, SEC_CLEAR, which is typically used for coded or clear mode selection. Selecting clear mode pulls this signal to a logic low, and it can be monitored from R2135.

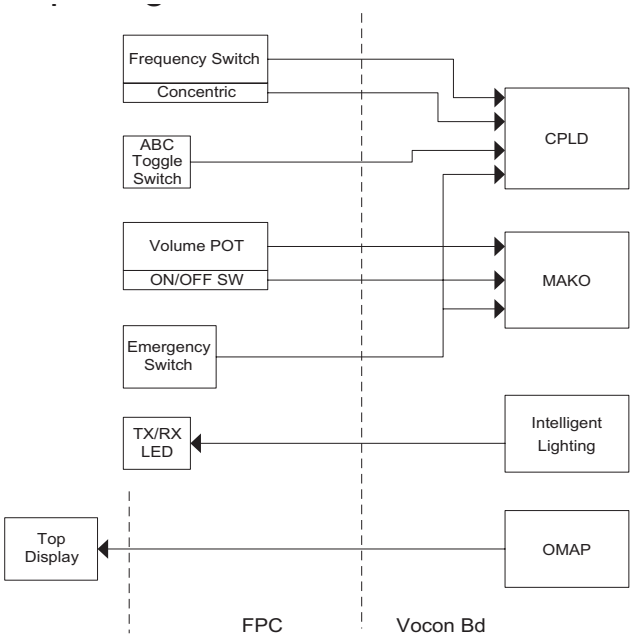


Figure 3-32. Control Top Block Diagram

3.2.6.2 APX 5000/ APX 6000/ APX 6000XE/ SRX 2200 LCD Display Modules

3.2.6.2.1 QVGA

The APX 5000/APX 6000/APX 6000XE/SRX 2200 radio can have up to 2 displays (QVGA and FSTN) depending upon the particular feature set and radio model ordered. The main Transflective 1.6" color display is a QVGA (130 x RGB x 130) active matrix TFT (Thin Film Transistor) LCD. A display flex connects the front display to the J2304 22-pin connector on VOCON board. The QVGA display uses the 8-bit Special optimized Screen Interface (SoSSI) for data and commands.

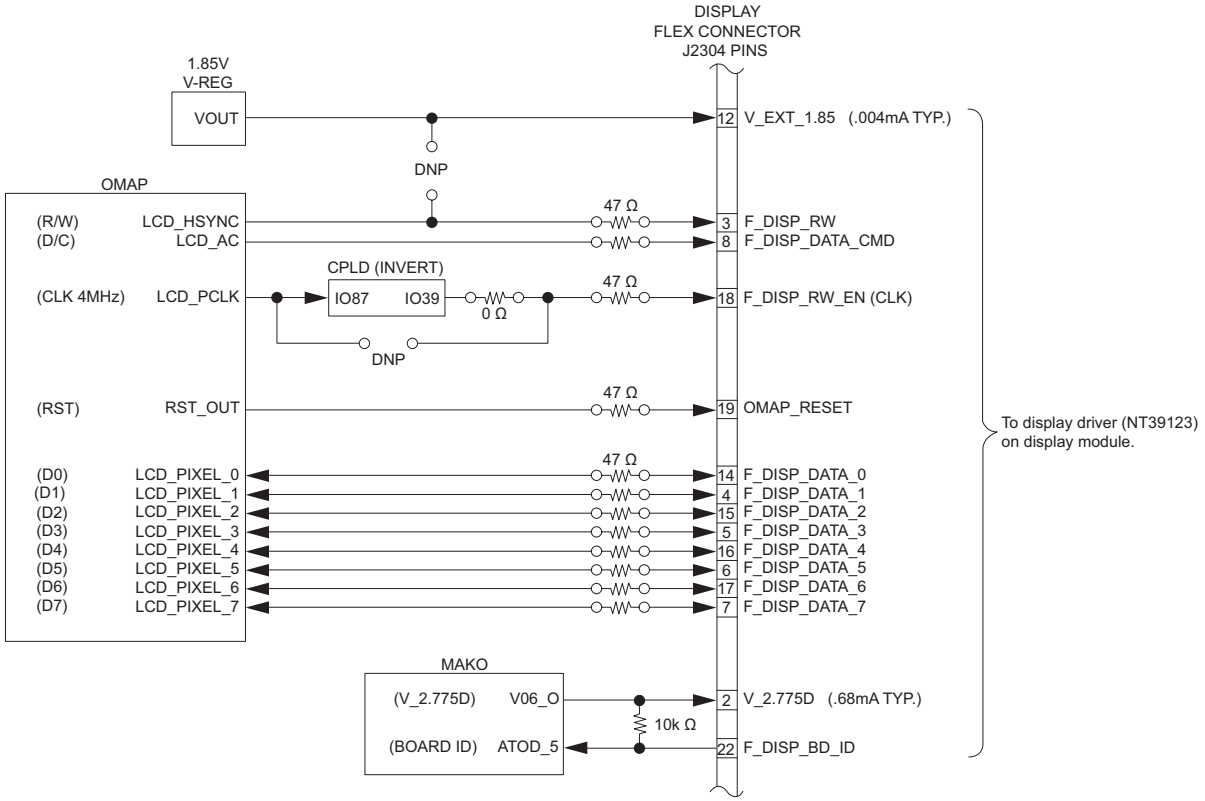


Figure 3-33. Display Circuit Detail Overview Block Diagram

The QVGA LCD Module operates using V_2.775D and V_EXT_1.85. The V_2.775D is the module's analog supply voltage sourced by LDO6 of MAKO. The V_EXT_1.85 is the module's IO voltage sourced by the 1.85V external LDO regulator. An 8-bit parallel bus is used for data and command communication between OMAP's SoSSI interface and LCD driver IC. The F_DISP_DATA_CMD signal indicated the type of data being sent to the driver. A '0' corresponds to command data and a '1' corresponds to display data. Data only travels in one direction, from OMAP to display driver. Therefore F_DISP_RW line will always be low. Display data is latched on the falling edge of the F_DISP_RW_EN signal.

The SoSSI interface uses the LCD DMA controller/bus to allow the LCD module to access system memory. Therefore the transfer of pixel data process will require less CPU processing power. An initiate DMA transfer command is used and display data is transferred to the LCD module automatically without intervention thus offloading the processor.

Prior to the LCD interpreting any commands, the correct display power-up sequence must be initiated. First the V_EXT_1.85 (1.875 V) and V_2.775D (2.775 V) supplies must be at 90% or above threshold and stable for 10us, and then reset can be asserted high. After OMAP de-asserts the reset out signal (OMAP_RESET) the SLPOUT command can be sent. Now configuration commands are ready to be sent to the LCD module.

The QVGA LCD module is only intended to operate up to +80°C due to ghosting effects. Therefore software will shut off the display and backlight if the +80°C limit is reached. The display and backlight will remain off until temperature drops below +75°C. The temperature sensor, U6401, for the display cut-off is located near the top display connector and is input into MAKO A/D Channel 3, pin M14.

For enhanced display readability, the default backlight is set to a dim state while the radio is in Standby mode; however, the backlight turns to full brightness through a button press, call receive, emergency call, and other status indicators. See Section 3.2.6.3: "Intelligent Lighting" for the display backlight operation.

3.2.6.2.2 FSTN

All APX 5000/APX 6000/APX 6000XE/SRX 2200 Radios are equipped with a caller ID (CID) top display. This top display is a 1.1", Transflective, FSTN (Film compensated Super Twisted Nematic) 32 row x 112 column LCD with black pixels on a light background. This display is a component of the control top sub-assembly with all interconnections passing through control top FPC. The display is controlled via OMAP's 3 wire SPI interface to program the display driver IC registers and send data/image information to the display. The active low chip select line, T_DISP_SPI_CS, is sent from the OMAP GPIO_5 pin P3. The T_DISP_DATA_CMD line indicates whether the data being sent across the SPI bus is register/command settings or if it's data/image information. The display driver contains internal GRAM, which stores the current display content information, and the data/image information is only sent when the display content needs to be updated.

Prior to sending any information to the LCD driver, the proper power-up sequence must be instantiated. First, the V_EXT_1.85 and V_2.775D voltage supplies must be stable for at least 1 ms. Next, the active low reset line, T_DISP_RESET, to the LCD driver must see a low pulse of 10 usec or longer prior to communicating to the LCD driver. Then, the register setting information will be sent to the display driver, followed by the image/data information.

The top LCD contains various LEDs for multiple backlight color combinations depending upon the mode of operation. The programmable default backlight setting is off in standby mode, but will illuminate to max brightness during a button push, call receive, receive mode, low battery, out of range, emergency, etc. The details of the top display backlight settings are listed in Section 3.2.6.3: "Intelligent Lighting". The top display contains 2 parallel side firing white LEDs and 2 parallel Red-Green side firing bi-color LEDs.

3.2.6.3 Intelligent Lighting

The APX 5000/APX 6000/APX 6000XE/SRX 2200 radio is equipped with numerous LEDs to provide intelligent lighting features. The VOCON board contains 2 lighting controller devices, which illuminate all the LEDs throughout the radio, as shown in Figure 3-34. The main lighting controller, U2204, provides white illumination to the main QVGA color display, and white keypad backlights. The secondary lighting controller, U2201, generates illumination for the top display backlight and TX/RX indicator lamp. Both lighting controller devices are controlled through OMAPs I2C interface (SCL and SDA). Some of the intelligent lighting color schemes are shown in Table 3-8.

Table 3-8. Color Schemes

	Color
Default	White
Out of Range	Red
Low Battery	Red
Emergency	Amber
Call Received	Green
Call Paged	Green

3.2.6.3.1 Main Lighting Controller

The boost lighting controller, U2204, provides backlight functionality for the main color QVGA display, and the white backlight on the keypad. Switcher 3.6 (V_SW_3.60) is used as main input voltage for the controller, while external 1.85 (V_EXT_1.85) is used for IO voltage. The controller communicates with the OMAP via standard I2C communication protocol. This communication allows the OMAP chip to enable, disable, and control the brightness of each LED. A reset line issued by OMAP, OMAP_RESET, can be used to set the device in reset. The charge pump capability of the lighting controller is currently not used. Refer to Figure 3-34.

The QVGA display has 3 LEDs powered by the external 3.6 regulator, V_SW_3.6. The cathode output (negative) of each LED is fed back into the LED driver to control the current thus controlling the brightness of the LEDs. The front display backlights are controlled by bank B of the LED controller.

The keypad backlighting uses 4 white LEDs for illumination. The keypad backlighting operates similar to the main QVGA display LEDs. The LEDs are powered by the external 3.6 regulator, V_SW_3.6. The cathode output (negative) of the LEDs is fed back into bank A of the LED driver to control the current thus controlling the brightness of the LEDs.

3.2.6.3.2 Secondary Lighting Controller

As previously mentioned the secondary lighting controller provides illumination to the top display backlight and Tx/Rx indicator lamp. The lighting controller and LEDs are powered by switcher 5 (V_SW_5). This lighting controller device uses a PWM output to control the dimming modes of operation for each LED. The device is controlled through the I2C interface, however, the I2C interface require an input high voltage between 3 V – 5.5 V, thus the level translator (U2202) is used to boost these signals to 5V logic.

Figure 3-34 shows the major connection scheme to this secondary lighting controller. The white, green, and red top display LEDs are connected to the lighting controller PWM outputs through ESD filter inductors L2204, L2203, L2202, respectively. The TX/RX status indicator LED uses a tri-color red, green, amber (RGA) LED.

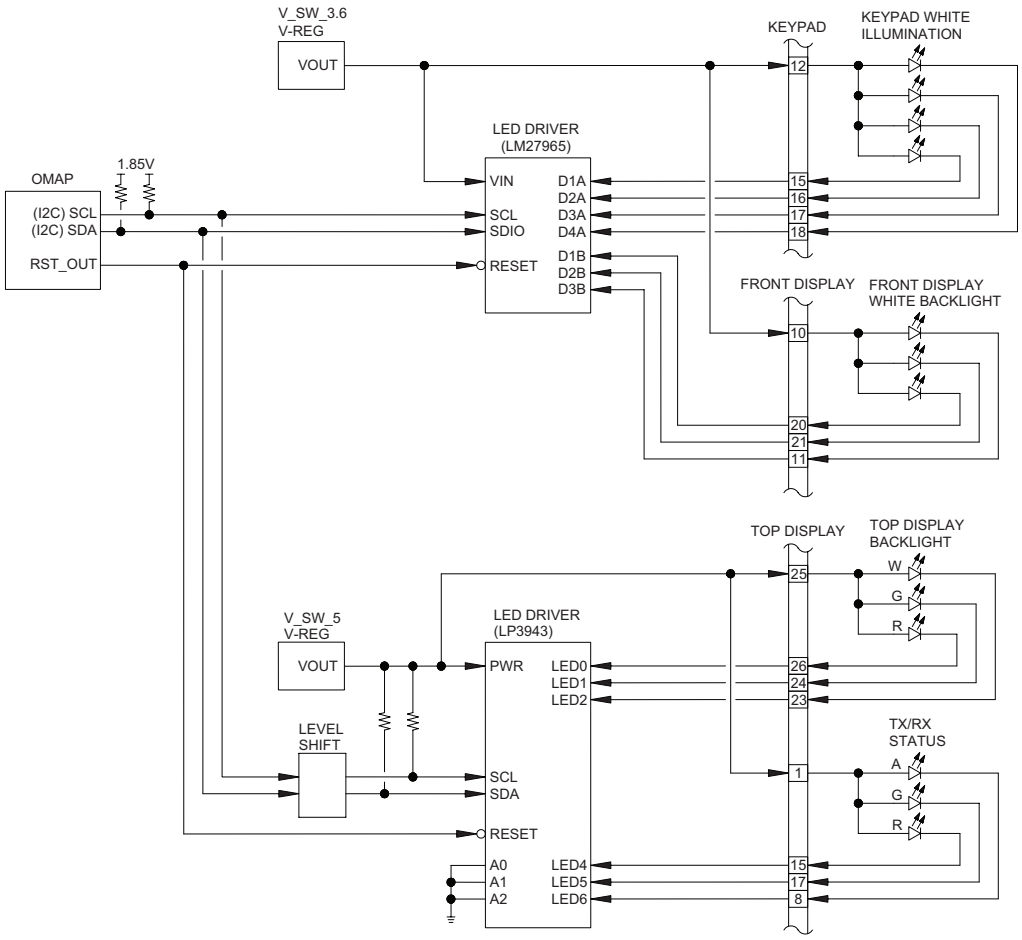


Figure 3-34. Lighting Controller Overview

3.2.6.3.3 Secondary Lighting Controller – SRX 2200

Figure 3-35 shows the major connection scheme to this secondary lighting controller exclusively for SRX 2200.

A lighting system has been put into place to accommodate night profiles. These profiles shift both displays and the keypad to a lower brightness. The LM27965 Lighting Controller, which controls the Front Display and Keypad during normal operation, is disabled during Night Operation/ Night Vision operation. The LM3943 is the only operating backlight driver during this mode and lower brightness levels are achieved by routing separate lines and decreasing the duty cycle of its pulse width modulated signal.

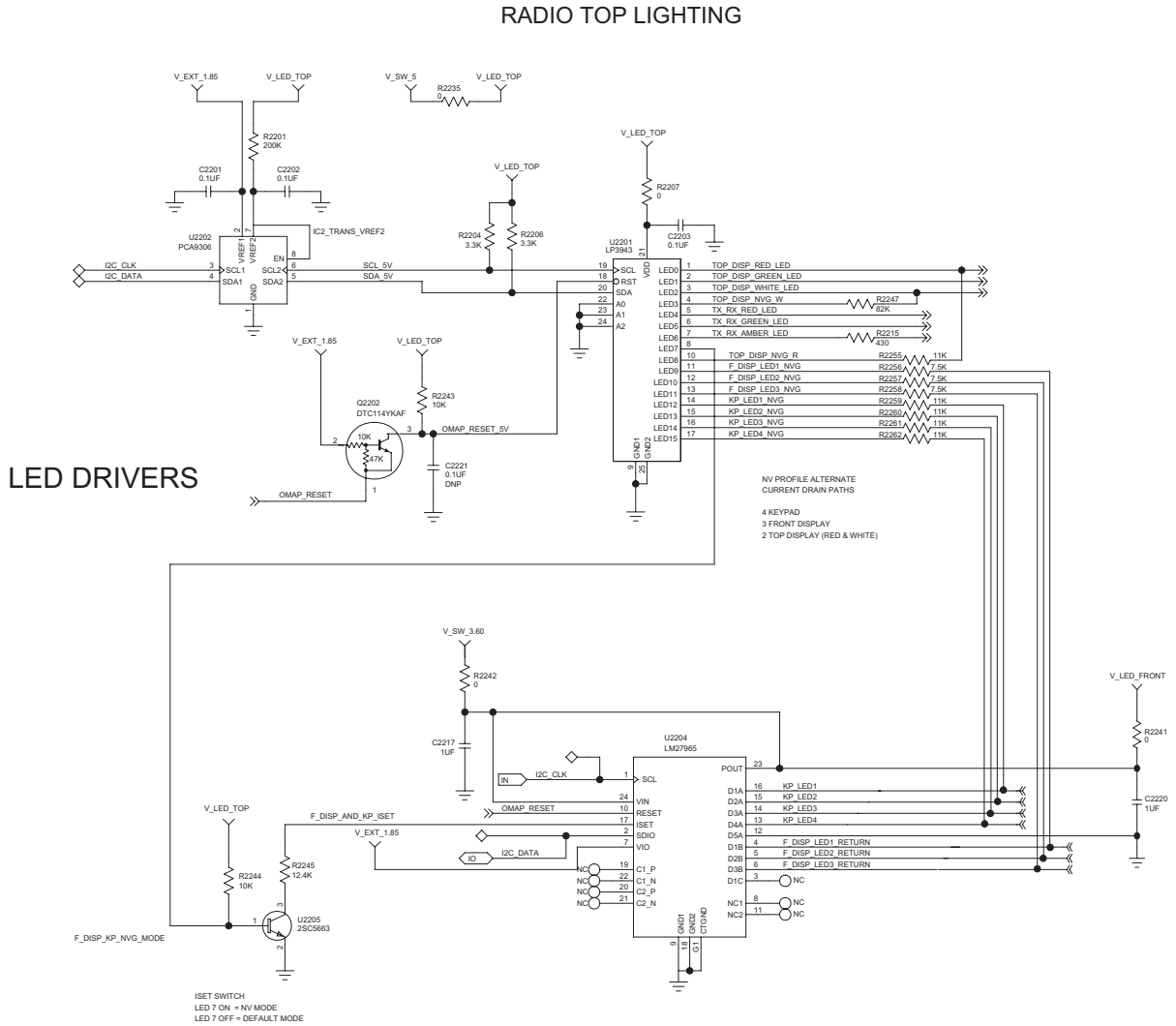


Figure 3-35. Lighting Controller – SRX 2200

3.2.6.4 Keypad

The Dual Display Model contains a 21 button keypad, which translates to a 5x5 row and column keypad matrix as shown in Figure 3-36. The keypad also contains LEDs for the backlighting of the keys, which is described in more detail in Section 3.2.6.3: "Intelligent Lighting". Every key is assigned a particular row and column to identify the unique key, as shown in keypad mapping Table 3-9. The keypad flex also contains 2, 6-channel filters that each row and column signal passes through. Each row of the keypad contains an external pull-up resistor, and all the rows are interrupt based inputs to OMAP. The columns are driven low by default in OMAP. When a key is pressed, the corresponding key row and column are shorted together and causes a low level to be input on the corresponding row in OMAP. Upon receiving the row interrupt, the OMAP IC is then programmed to scan the column output to determine which corresponding column was selected that generated the interrupt.

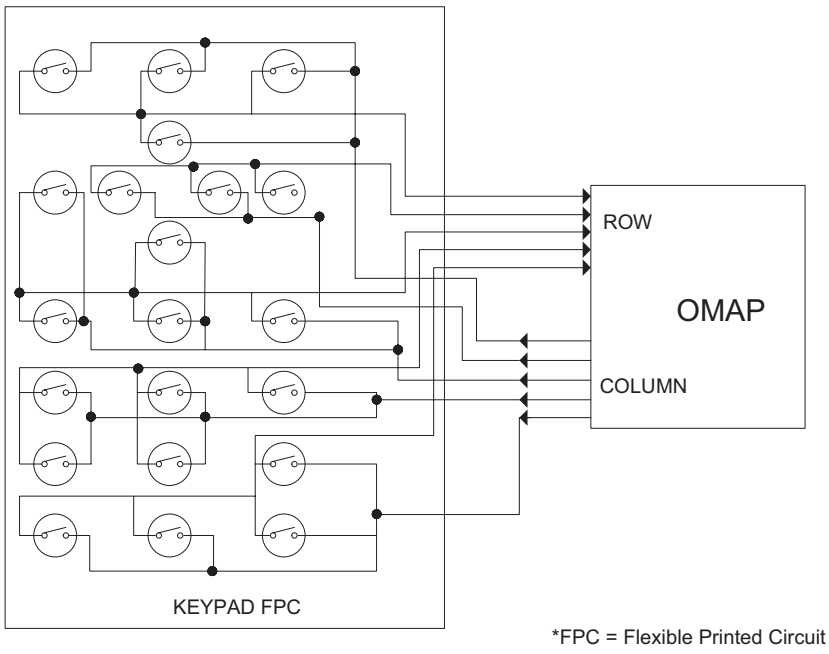


Figure 3-36. Keypad Interface Outline

Table 3-9. Key Map Matrix

Key	Row, Column Map	Key	Row, Column Map
	0 , 4	3 DEF	3 , 2
	1 , 4	4 GHI	2 , 0
	2 , 4	5 JKL	2 , 1
	4 , 0	6 MNO	2 , 2
	4 , 1	7 PQRS	1 , 0
	0 , 3	8 TUV	1 , 1
	4 , 2	9 WXYZ	1 , 2
	1 , 3	*	0 , 0

Table 3-9. Key Map Matrix (Continued)

Key	Row, Column Map	Key	Row, Column Map
	2 , 3		0 , 1
	3 , 0		0 , 2
	3 , 1		

3.2.6.5 Side Controls

The side controls include three programmable, momentary, pushbutton switches (Side Button 1 [SB1], Side Button 2 [SB2], Top Side Button [MON]) and a Push-To-Talk switch [PTT]. These components interface to the expansion board via connector J2005 through a two-piece, bonded flex circuit. A board-to-board connection routes the side controls signals from expansion board connector P2001 to connector J4001 of the controller board. See Chapter 7 for pin out names and numbers.

Side button 1 (R4006), side button 2 (R4007) and the top side button (R6101) are inputs to the CPLD and are biased to 1.875V. A button press is detected when the OMAP reads a 'LO' state from the CPLD EMIFS interface. PTT (R4005) is connected directly to OMAP and a button press is detected when a LO state is read.

3.2.6.6 GCAI

The GCAI (Global Communications Accessory Interface) connector is a 15 pin interface located on the side of the radio. The connector interfaces the radio with accessories and is used for programming. When the OMAP (U6501) detects that an accessory has been attached through a logic low on GPIO0, it will identify the device by reading the GCAI_ONE_WIRE line. Once the device type is identified, the appropriate signals are multiplexed through MAKO to the GCAI connector for the particular device. Figure 3-37 is a block diagram of the GCAI interface.

Mounted to the side connector is a printed circuit board that houses ESD protection circuitry and an auxiliary RF connector. The universal side connector interfaces with the expansion board via the P1 connector of a flex circuit and the J2004 connector of the expansion board. A board-to-board connection routes universal side connector signals through expansion board connector P2001 to the controller board. The figures below show the connections and signal assignments from the universal connector to the controller board.

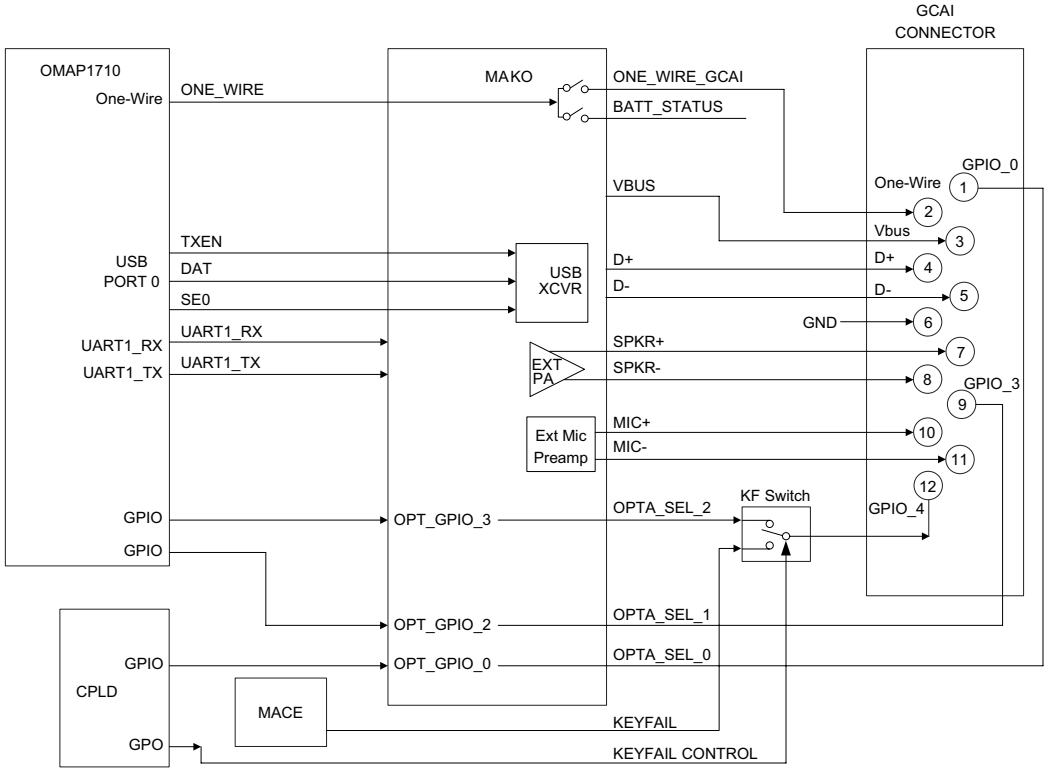


Figure 3-37. GCAI Signal Configuration

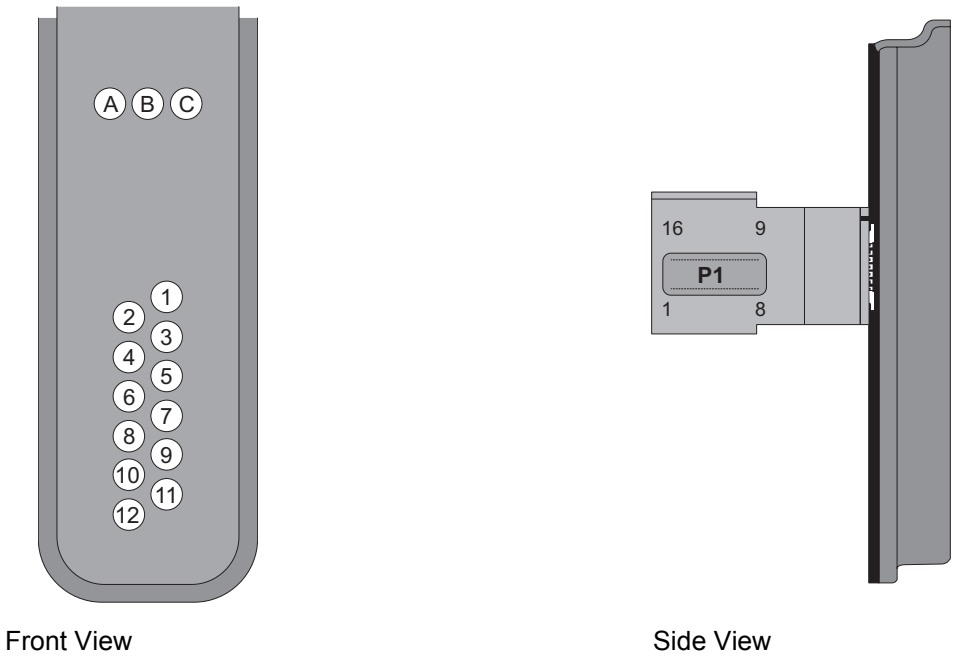


Figure 3-38. GCAI Connector

Table 3-10. P1 Pin Assignment

P1 PIN ASSIGNMENT	SIDE CONNECTOR SIGNAL
1	GCAI_VBUS_5V
2	GCAI_VBUS_5V
3	GND
4	GCAI_USB_P_GPIO1 / TxDc / FillReq
5	GCAI_USB_N_GPIO2 / RxDc / FillData
6	GND
7	GCAI_GPIO0 / PwrOn
8	GCAI_CTS_GPIO_4 / KeyFail / FillClk
9	GCAI_MIC_P
10	GCAI_MIC_N
11	GCAI_SPKR_N / LineOut-
12	GCAI_SPKR_P / LineOut+
13	GND
14	GCAI_RTS_GPIO_3 / OTG-ID / FillSen
15	GND
16	GCAI_ONE_WIRE

Table 3-11. GCAI Connector Pin Assignment

PIN ASSIGNMENT	SIGNAL
A	GND
B	GCAI_RF_INPUT
C	GND
1	GCAI_GPIO0 / PwrOn
2	GCAI_ONE_WIRE
3	GCAI_VBUS_5V
4	GCAI_USB_P_GPIO1 / TxDc / FillReq
5	GCAI_USB_N_GPIO2 / RxDc / FillData
6	GND
7	GCAI_SPKR_P / LineOut+
8	GCAI_SPKR_N / LineOut-
9	GCAI_RTS_GPIO_3 / OTG-ID / FillSen
10	GCAI_MIC_P

Table 3-11. GCAI Connector Pin Assignment (Continued)

PIN ASSIGNMENT	SIGNAL
11	GCAI_MIC_N
12	GCAI_CTS_GPIO_4 / KeyFail / FillClk

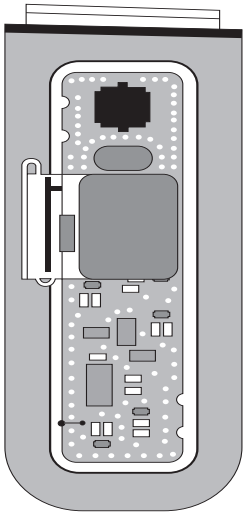


Figure 3-39. GCAI Connector – Back View

3.2.7 RF Interface

The VOCON to RF board interface through connector J1001. See Figure 3-40.

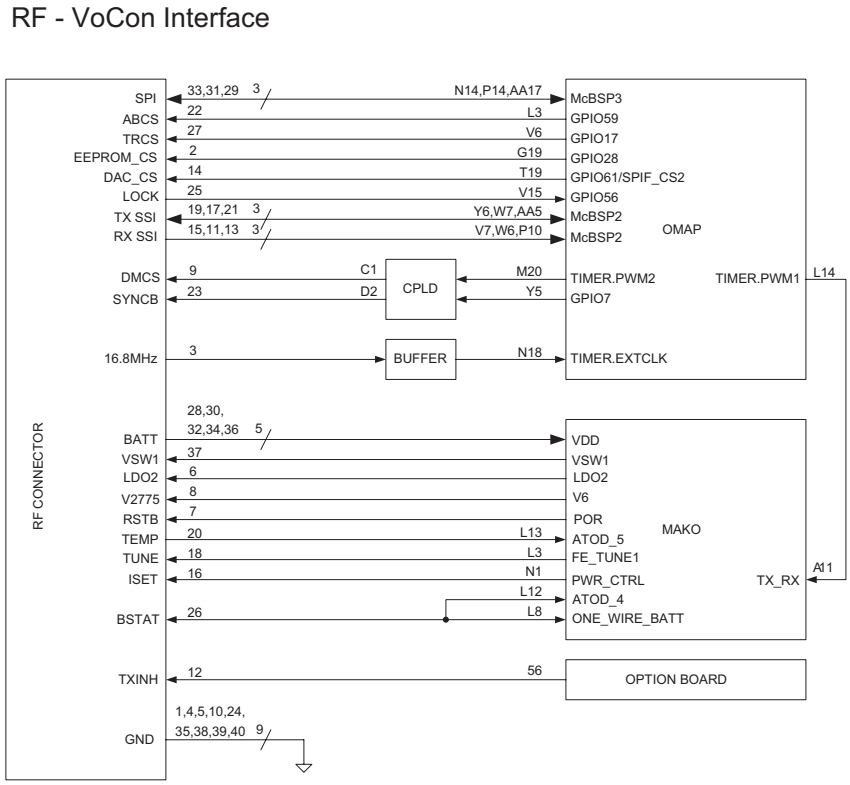


Figure 3-40. VOCON to RF Board Interface

The major interfaces are the TX and RX SSI buses, the SPI Bus with associated chip selects, the synchronization signals (DMCS,SYNCB), the 16.8 MHz clock, MAKO VDDs and I/O's, and the TX Inhibit from the Option Board.

3.2.7.1 TX SSI

The TX SSI interface provides the SSI data from the OMAP's DSP to the Trident IC on the RF board. The interface contains 3 signals, the TX frame sync, TX clock, and TX Data signals. The pin numbers for both the RF connector and OMAP IC are also shown in Figure 3-40.

3.2.7.2 RX SSI

The RX SSI interface provides the SSI data from the Abacus IC on the RF board to the OMAP's DSP. The interface contains 3 signals, the RX frame sync, RX clock, and RX Data signals. The pin numbers for both the RF connector and OMAP IC are shown in Figure 3-40.

3.2.7.3 Synchronization

The DMCS and SYNCB signals are used for synchronization between the RF and VOCON boards. These signals route from the OMAP IC timer outputs through the CPLD to the RF board. The DMCS signal connects to the Trident IC and the SYNCB connects to the ABACUS IC. The pin numbers for both of the signals are shown in Figure 3-40.

3.2.7.4 MAKO Interface

MAKO supplies some DC regulation and I/O support for the RF board. The main battery supply is provided by the RF board and is connected to MAKO. Regulated DC supplies based on this battery voltage are then provided by MAKO to the RF board. These supplies are VSW1, LDO2, and V6. The Power On Reset (POR) reset signal is also provided by MAKO to reset the RF board.

The One-Wire signal from the battery is provided by the RF board to MAKO's One-Wire segmentation circuit, which then connects the One-Wire data path to the OMAP IC. The TUNE, ISET, and TEMP signals are also interfaced to the MAKO IC.

3.2.7.5 TX Inhibit

The TX Inhibit I/O is reserved for future Option Board use, and is available at pin 12 for the RF connector and pin 56 of the option board connector.

3.2.8 Encryption

The encryption circuitry is placed on the expansion board and interfaces to the VOCON through the J4001-P2001 connector. The encryption circuitry is designed to digitally encrypt and decrypt voice and ASTRO data in the APX 5000/APX 6000/APX 6000XE/SRX 2200 radio. The Motorola Advanced Crypto Engine (MACE) IC is the main component in the encryption design, and has some discrete support circuitry along with the interfaces to the VOCON IC's (CPLD, OMAP, and Audio CODEC).

NOTE: The MACE IC is NOT serviceable. The information contained in this section is only intended to help determine whether a problem is due to the MACE IC or the radio itself.

Figure 3-41 below shows the Encryption architecture for the APX 5000/APX 6000/APX 6000XE/SRX 2200 radio.

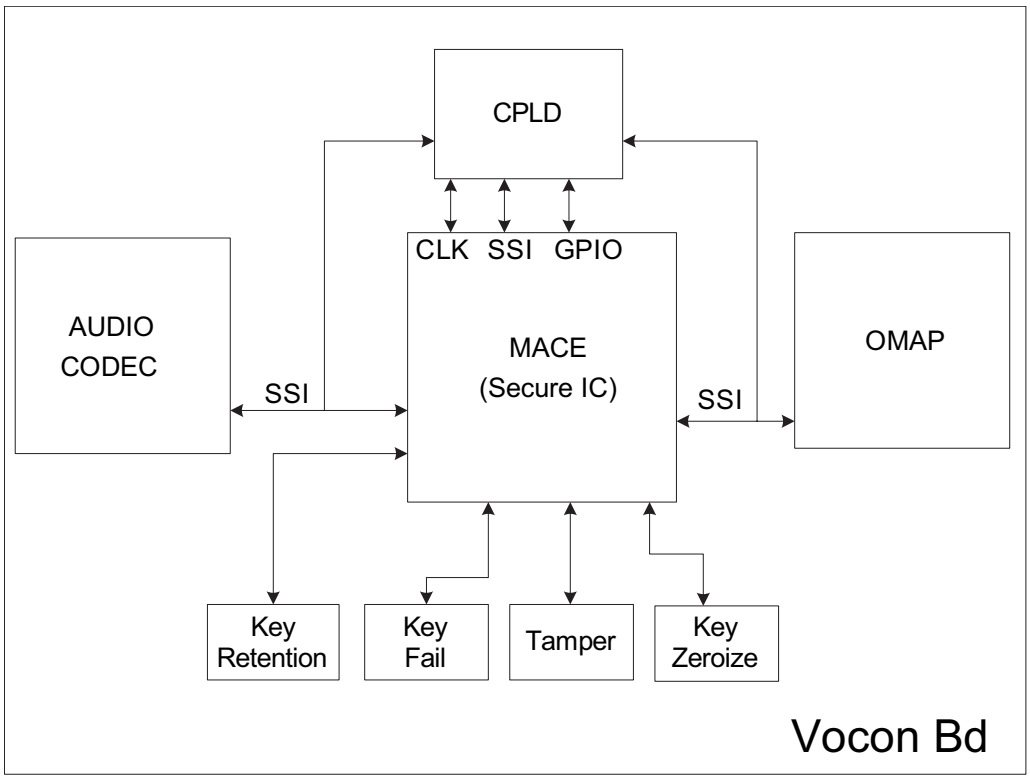


Figure 3-41. APX 5000/ APX 6000/ APX 6000XE/ SRX 2200 *Encryption Architecture*

As shown in Figure 3-41 above, the encryption design consists of 5 blocks:

- MACE IC
- Key Loading
- Key Retention
- Tamper
- Key Zeroize.

3.2.8.1 MACE IC

The encryption module uses the MACE IC and an encryption key variable to perform its encode/decode function. The encryption key variable is loaded into the MACE IC, via the GCAI (side) connector, from a hand-held, key variable loader (KVL). The MACE IC contains the particular encryption algorithm purchased. Table 3-12 lists the encryption algorithms and their corresponding kit numbers.

Once the MACE IC has its encryption keys and algorithm, it communicates with the radio' s host processor (OMAP) through the Synchronous Serial Interface (SSI) bus. Both commands and audio (clear and encrypted) are sent through the SSI bus. A communications failure between the host processor and the secure module will be indicated as an ERROR 09/10 message on the display.

Table below lists the encryption algorithms and their corresponding kit numbers.

Table 3-12. Encryption Algorithms and Corresponding Kit Numbers

KIT Number	Description
NNTN8171_	APX 5000/APX 6000/APX 6000XE/SRX 2200 DVP-XL KIT
NNTN8172_	APX 5000/APX 6000/APX 6000XE/SRX 2200 DVP-XL KIT with Bluetooth
NNTN8173_	APX 5000/APX 6000/APX 6000XE/SRX 2200 AES KIT
NNTN8174_	APX 5000/APX 6000/APX 6000XE/SRX 2200 AES KIT with Bluetooth
NNTN8175_	APX 5000/APX 6000/APX 6000XE/SRX 2200 DES/DES-XL/DES-OFB KIT
NNTN8176_	APX 5000/APX 6000/APX 6000XE/SRX 2200 DES/DES-XL/DES-OFB KIT with Bluetooth
NNTN8177_	APX 5000/APX 6000/APX 6000XE/SRX 2200 NO ALGO BASIC VERSION
NNTN8178_	APX 5000/APX 6000/APX 6000XE/SRX 2200 NO ALGO BASIC VERSION with Bluetooth

The MACE IC relies on a 4 MHz clock source provided by the CPLD, the clock is connected to MACE's XIN pin (U2510-P5).

3.2.8.2 Key Loading / Fail

Key variables are loaded into the MACE IC through the keyfail line. The signal originates from the GCAI connector (pin 8 of J2004) and is passed through the expansion board to the VOCON board. The signal is then selected by a multiplexer (U4003) controlled by CPLD output, KEYFAIL_CTRL, and the signal is routed back to the expansion board to the MACE's KYLD pin (U2510-B10).

3.2.8.3 Key Retention

The key variables are retained within the MACE IC's memory (SRAM or FLASH). The keys can be infinite key retention or 30-seconds key retention, depending on how the codeplug is set up. When set to infinite key retention, the keys are stored in the FLASH memory inside the MACE IC. When set to 30-second retention, the keys are stored in SRAM, and will be erased when the radio's battery is removed (after the 30 second delay). The key retention delay circuit controls this time through a comparator op-amp circuit (U2526). When the battery is removed, VSAVE (nominally 2.5 V) will eventually drop to 0V after 30 seconds, which will result in a 0V output from U2526. This output is the input to the CONT_1.875 regulator (U2525), which is nominally 3.3 V. When the regulator's output is 0 V, the keys in MACE's SRAM will be erased.

3.2.8.4 Tamper

The tamper function is intended to erase the encryption keys in a tampering situation. If the radio chassis is opened during operation, the tamper signal, which is normally connected to ground through spring contact M2533, will be disconnected from ground. This will be sensed by MACE through its tamper pin TPR0 (U2510-M2). Once this condition is sensed, the encryption keys will be erased.

3.2.8.5 Key Zeroize

The encryption keys can also be manually erased if infinite key retention is not turned on in codeplug, by holding down the Side Top button and emergency buttons during radio power-up. These two button inputs both connect to a dual transistor Q2537, which will release the Key_ZEROIZE signal sensed by MACE's TPR0 (U2510-M2). Once this condition is sensed (floating high), the encryption keys will be erased.

To troubleshoot the encryption circuitry, refer to the flowcharts in Chapter 5 “Troubleshooting Charts”.

3.3 Global Positioning Sytem (GPS)

The APX 6000/APX 6000XE/SRX 2200 GPS architecture employs the Texas Instruments NL5500 GPS IC (U2401) which decodes GPS signals at 1575.42 MHz (L1 band). It is capable of producing a final position solution including full tracking and data decode capability. The GPS signal is received by the main RF/GPS combination antenna. The GPS signal is then diplexed at the antenna port via a series resonant network, C1309 and L1305 which provides a very low capacitive load to the transceiver. The signal is routed through a low noise amplifier (LNA, U1304) on the RF board (and a SAW filter, FL1301 for UHF1 and UHF2 radios) and its output is applied to the RF-Vocon interface connectors (P101 to J1001) where it is eventually routed to the expansion board via the J4001 and P2001 connectors for processing by the GPS IC. Additional GPS diplexing components include C1150, L1114, C1122, and L1103 which provide proper termination at the Peregrine switch (U1102) output to minimize GPS signal leakage at the antenna port tap point at C1301. When the GPS signal reaches the expansion board, it goes through a SAW filter (FL2401), LNA (U2404), and a second SAW filter (FL2403), which then connects to the NL5500's GPS RF input (U2401 pin L2). The NL5500 IC is connected to the main OMAP processor via UART2. It is a two wire UART interface (TX and RX with no handshaking).

NOTE: The enable signal for the LNA U1304 on the RF board is generated by the GPS IC, and DC coupled onto the GPS RF signal which goes through the RF-Vocon-Expansion Interconnect.

The GPS receiver is setup in an autonomous continuous navigation mode where the current position is updated once per second. The GPS receiver continuously tracks satellites for as long as the radio is powered on to ensure the best possible accuracy. In the event the radio loses visibility of the satellites due to terrain or environmental factors such as driving through a tunnel or entering a building, the GPS will temporarily lose its position fix. If the signal outage is long enough, a power savings algorithm will then cycle the GPS in and out of a sleep mode to save battery life until the radio has moved back into an environment where the GPS signal is present.

The following table lists the power, clock, and I/O connections from the GPS IC to various peripherals.

Table 3-13. Power and I/O Pins for NI5500

Signal Name	Type	NL5500 ball(s)	Source/Destination [ref] (board	Description
VBAT	Power	A2, H1, D8	VSW_3.6 [U6504] (Vocon)	Main NL5500 power supply
VDDS	Power	B3, G10, K5, E2	VCC_1.85 [U6508] (Vocon)	I/O Power Supply
VDD_TCXO	Power	G1	VSW_3.6 [U6504] (Vocon)	TCXO Power Supply
RTC_CLK	Clock	H9	CPLD IO74 [U6101] (Vocon)	32kHz RTC
TCXO_CLK_LV	Clock	F1	TCXO [Y2204] (Expansion)	26MHz TCXO
GPS_nShutdown	Input	D5	CPLD IO91 [U6101] (Vocon)	GPS Reset
GPS_UART_TX	Output	F5	OMAP pin R9 [U6302] (Vocon)	GPS UART TX to OMAP UART RX
GPS_UART_RX	Input	E3	OMAP pin M18 [U6302] (Vocon)	OMAP UART TX to GPS UART RX
LNA_ENABLE	Output	H6	LNA [U1304] (RF) + LNA [U2404] (Expansion)	GPS External LNA Enable
GPS_LNA_IN	Input	L2	GPS antenna/front-end	GPS RF Input from antenna

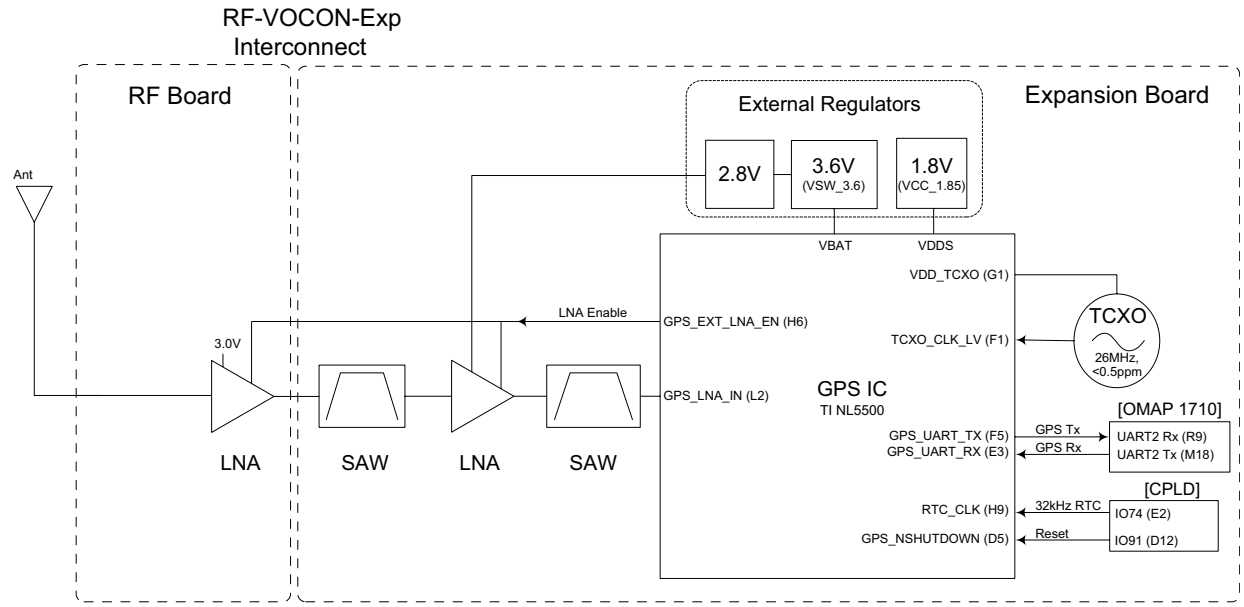


Figure 3-42. GPS Block Diagram (VHF/700–800 MHz)

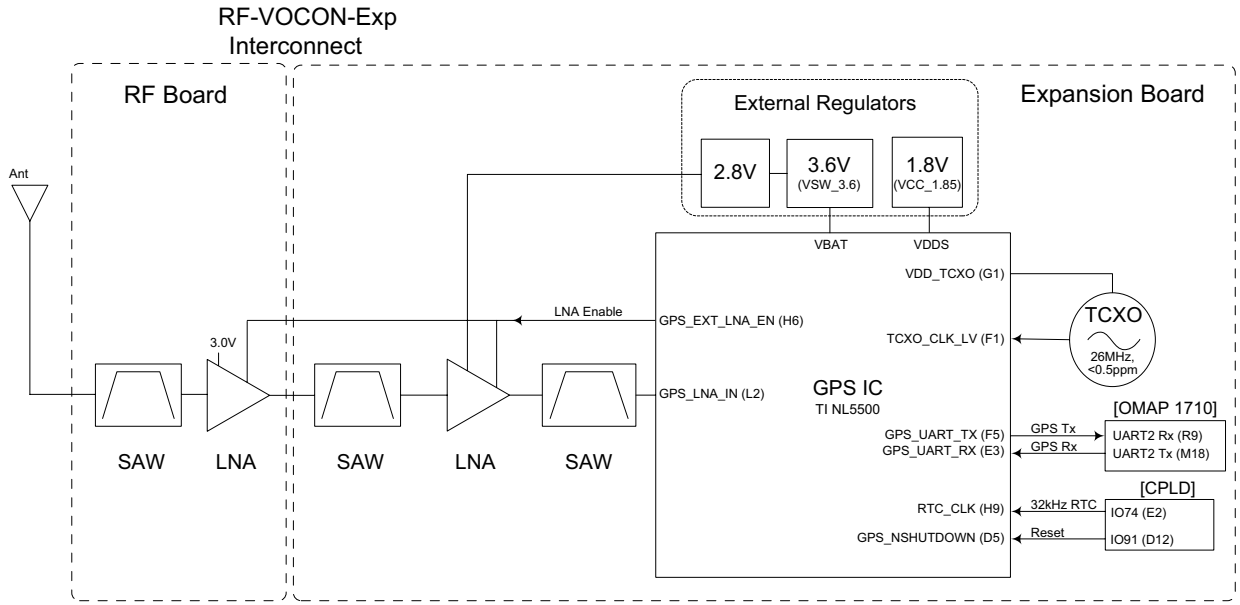


Figure 3-43. GPS Block Diagram (UHF1 and UHF2)

3.4 Accelerometer

3.4.1 General Overview

Accelerometer capabilities are achieved by the 3-axes “nano” accelerometer IC (LIS331DL) located on the expansion board. The LIS331DL is a digital output linear accelerometer in a LGA package. It is powered by the 3.3 LDO regulator placed in the expansion board. The complete device includes a sensing element and an IC interface to provide the signal to the AVR IC. When acceleration is applied to the sensor, an imbalance in capacitance is produced. This imbalance is measured and converted to an analog voltage that is finally available to the user by an analog to digital converter. The acceleration data is accessed through an SPI interface and presented to the AVR.

Figure 3-44. Directions of the Detectable Accelerations

NOTE: Please refer to User Guide and CPS for further details.

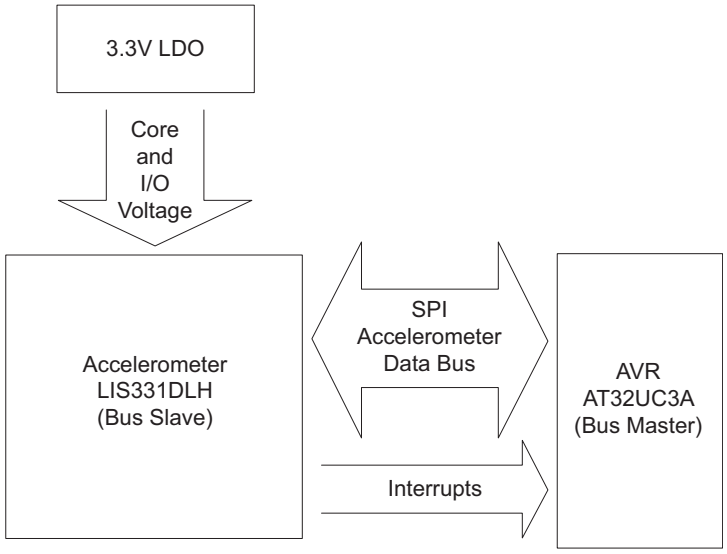


Figure 3-45. Accelerometer Block Diagram

The registers embedded on the LIS331DL are accessed through SPI serial interface. The following pins are responsible for the SPI communication.

Table 3-14. SPI Interface

Pin Name	Pin Description
CS	SPI Enable
SPC	SPI Serial Port Clock
SDI	SPI Serial Data Input
SDO	SPI Serial Data Output

CS is the serial port enable and it is controlled by the AVR (SPI Master). It goes low at the start of the transmission and toggles high at the end. SPC is the serial port clock and it is also controlled by the AVR. It is stopped high when the CS is high (no transmission). SDI and SDO are respectively the serial data input and output. These lines are driven at the falling edge of SPC and should be capture at the rising edge of SPC.

The following table provides a list of the registers and their respective addresses used for the accelerometer IC (LIS331DL).

Table 3-15. Register Address Map

Name	Type	Register Address		Default	Comment
		Hex	Binary		
Reserved (do not modify)		00 – 0E			Reserved
WHO_AM_I	r	0F	000 1111	110010	Dummy register
CTRL_REG1	rw	20	010 0000	111	
CTRL_REG2	rw	21	010 0001	0	
CTRL_REG3	rw	22	010 0010	0	
CTRL_REG4	rw	23	010 0011	0	
CTRL_REG5	rw	24	010 0100	0	
HP_FILTER_RESET	r	25	010 0101		Dummy register
REFERENCE	rw	26	010 0110	0	
STATUS_REG	r	27	010 0111	0	
OUT_X_L	r	28	010 1000	output	
OUT_X_H	r	29	010 1001	output	
OUT_Y_L	r	2A	010 1010	output	
OUT_Y_H	r	2B	010 1011	output	
OUT_Z_L	r	2C	010 1100	output	
OUT_Z_H	r	2D	010 1101	output	
Reserved (do not modify)		2E – 2F			Reserved
INT1_CFG	rw	30	011 0000	0	
INT1_SOURCE	r	31	011 0001	0	
INT1_THS	rw	32	011 0010	0	
INT1_DURATION	rw	33	011 0011	0	
INT2_CFG	rw	34	011 0100	0	
INT2_SOURCE	r	35	011 0101	0	
INT2_THS	rw	36	011 0110	0	
INT2_DURATION	rw	37	011 0111	0	
Reserved (do not modify)		38 – 3F			Reserved

NOTE: Refer to the part data sheet for a detailed explanation of the registers.

3.5 Bluetooth

The Bluetooth feature allows the radio the ability to connect wirelessly to a Bluetooth accessory or data terminal. This feature is implemented using a combination Bluetooth/GPS integrated circuit (IC, U2401), a low-frequency receiver (NFC, U2403), and a host controller (U2415) with external 16 MB SDRAM (U2413) located on the expansion board. The Bluetooth IC sends data to the host controller processor over an HCI USART link. The host controller processor communicates to the OMAP processor on the VOCON board through a dedicated USB port.

Each APX accessory that is capable of Bluetooth communication will have its own unique Bluetooth address. An external audio accessory headset can establish a digital connection using a low-data rate GFSK modulated signal hopping on 79 x 1 MHz wide Bluetooth channels from 2402 MHz to 2480 MHz in the ISM band. Bluetooth uses a frequency hopping spread spectrum (FHSS) technique to spread the RF power across the spectrum to reduce the interference and spectral power density. The frequency hopping allows the channel to change up to 1600 times a second (625 us time slot) based on a pseudo random sequence. If a packet is not received on one channel, the packet will be retransmitted on another channel.

The Bluetooth feature is accompanied by a Low-Frequency (LF) detection circuit. Once a radio has the Bluetooth feature enabled, a user can tap their LF enabled Bluetooth audio accessory with the radio at the pairing spot to establish a secure Bluetooth connection. The LF circuit provides the ability of a secure pairing connection with a Bluetooth accessory by sending secure messages including the BT address of the external accessory during pairing. The LF circuit uses a 125 kHz signal to communicate the secure pairing information over a dedicated SPI bus between the Bluetooth accessory and the AVR32 processor.

Low-frequency transmission is done by the host controller itself using a NOR gate. The Bluetooth antenna is made of a flexible PCB and is a modified PIFA with a 2.5 dBi gain. The Bluetooth antenna is mounted in the APX 5000/APX 6000/APX 6000XE/SRX 2200 speaker assembly:

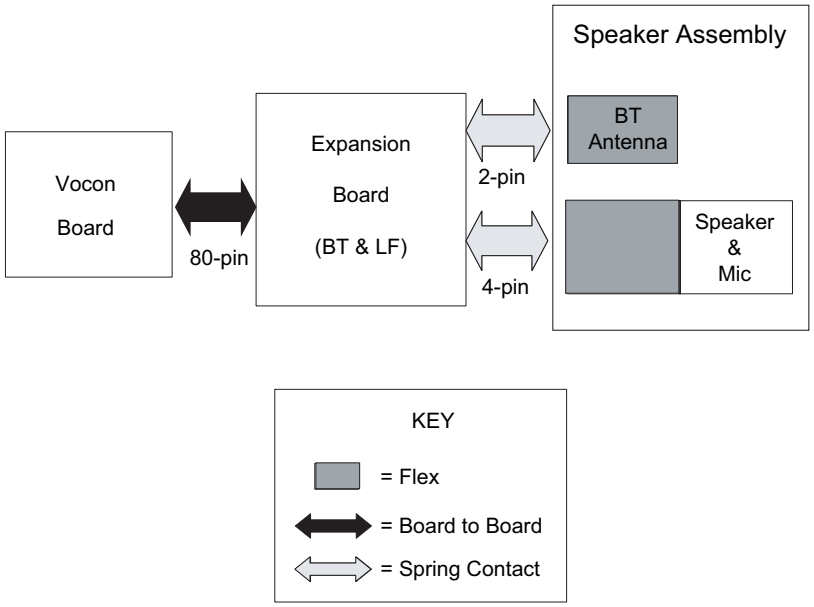


Figure 3-46. Relation of Bluetooth Antenna Assembly to Expansion Board

To connect a Bluetooth accessory, the blue pairing indicators on the accessory and the radio should be brought close to each other with the Bluetooth feature enabled and on in the radio. The LF/Bluetooth connection flow is shown in Figure 3-47.

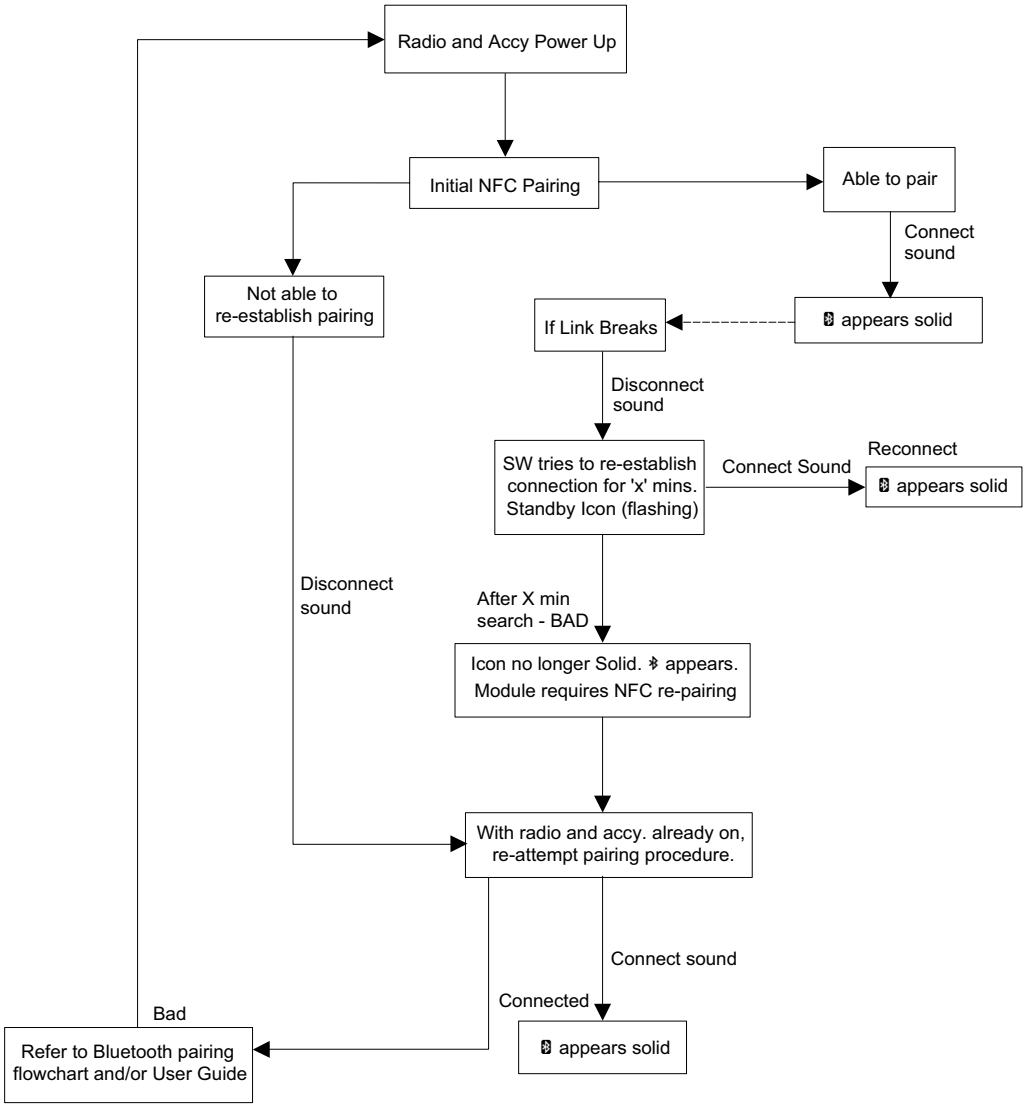


Figure 3-47. Bluetooth Connection Flowchart

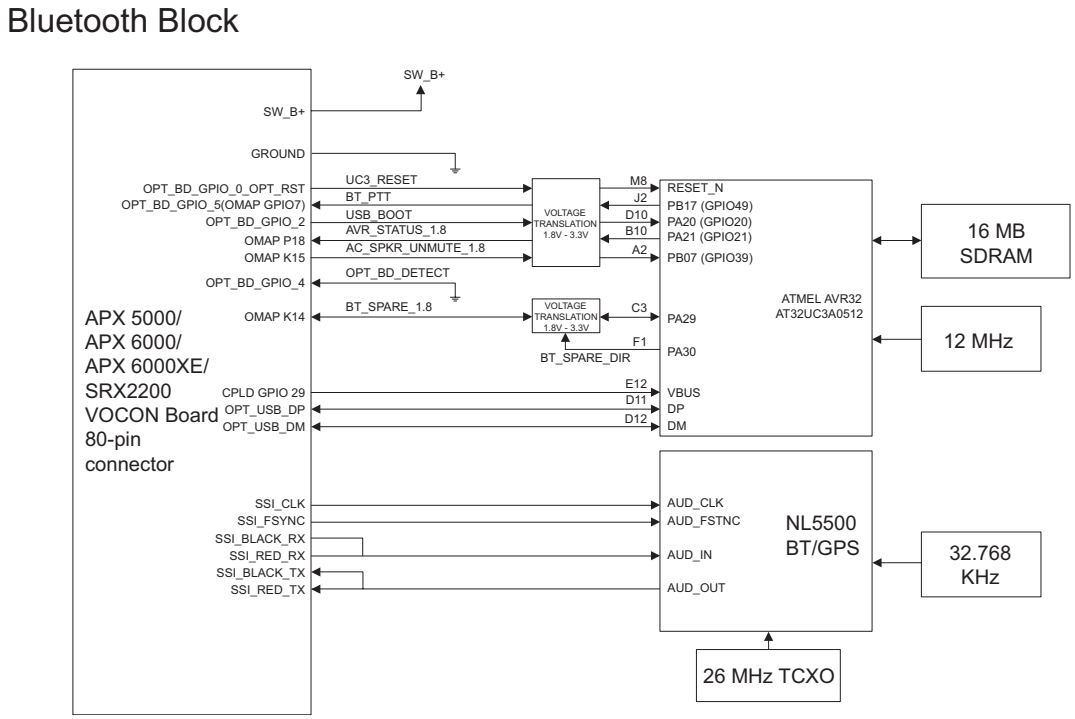


Figure 3-48. Bluetooth/Controller Interface with Clock Sources

The Bluetooth IC transceiver is connected to a dedicated Bluetooth antenna. Between the IC and antenna is a band-pass filter as sown in is shown in Figure 3-49.

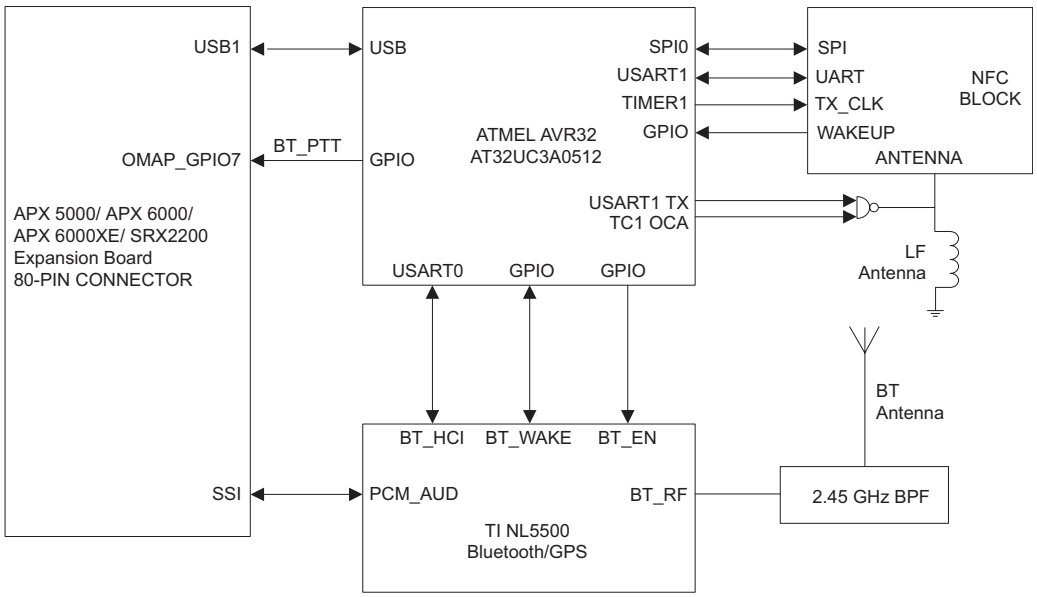


Figure 3-49. Bluetooth Functional Block Diagram

To verify the Bluetooth transmitter is operational, an RCMP command can be sent to transmit a constant carrier waveform on a Bluetooth frequency. To verify the LF transmit feature is operational, an RCMP command can be sent to transmit a constant carrier waveform at 125 kHz. There are similar RCMP commands for verifying BT/LF RSSI when a CW BT/LF signal is applied near the antennas of the BT/LF circuitry.

The Low-Frequency block diagram below shows the main connections:

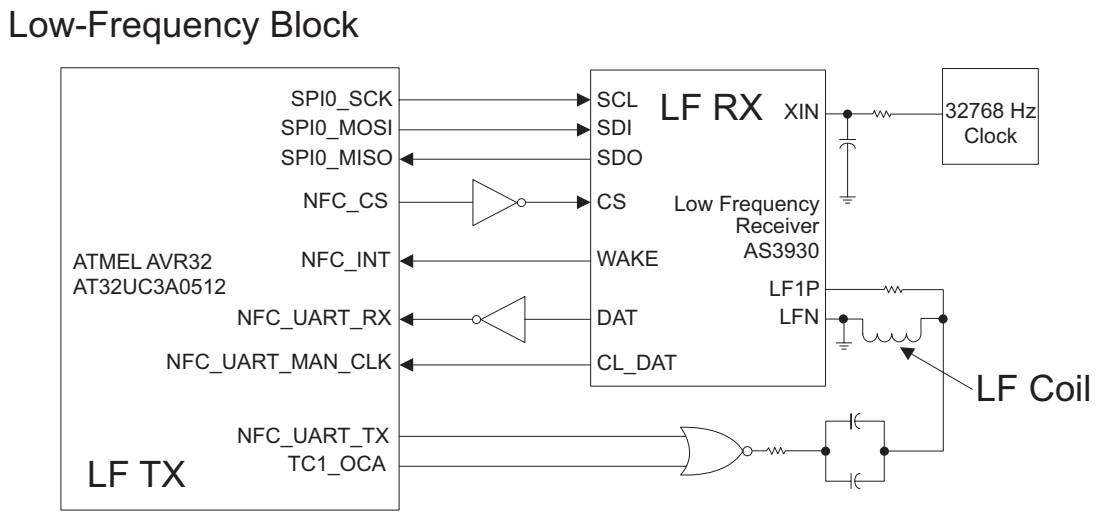


Figure 3-50. Bluetooth Low-Frequency Circuit Block Diagram

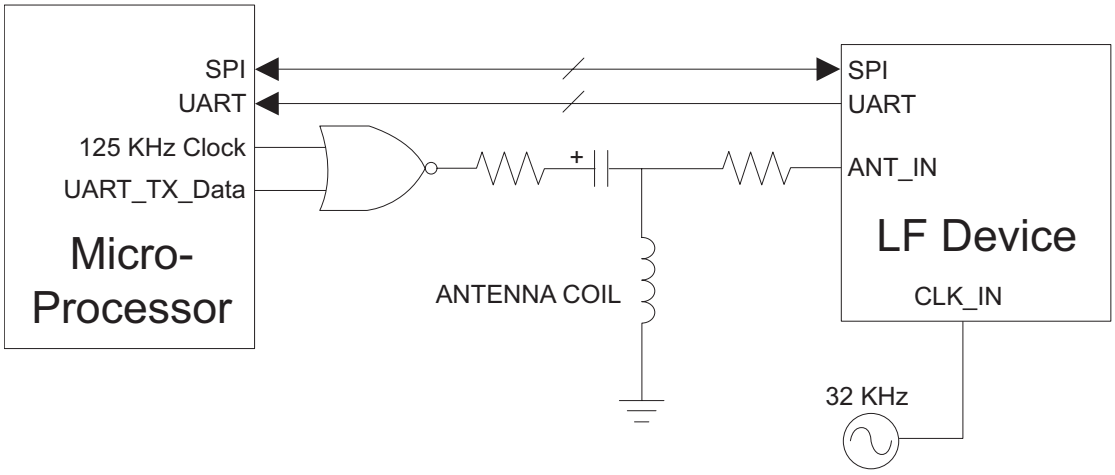


Figure 3-51. Bluetooth Low-Frequency Pairing Data Path

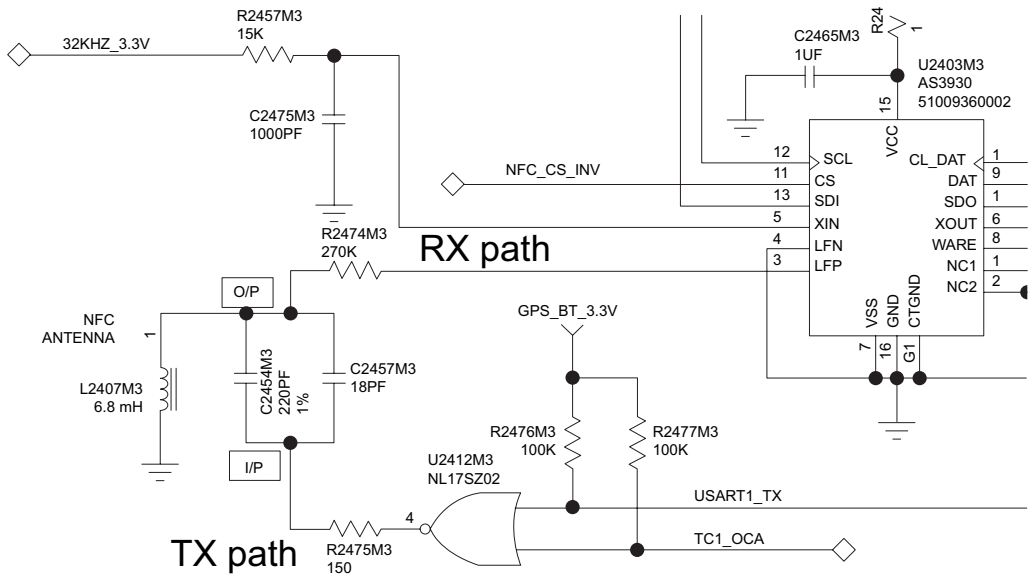


Figure 3-52. Detailed Low-Frequency Transmit/Receive Paths

3.5.1 Bluetooth Power

Our Bluetooth IC operates from a 3.6V (U6504, VBAT) switching regulator located on the VOCON board to supply the Bluetooth IC core and a 1.85V (U6508, VDDS) supply for the I/O. It has a shutdown (U2415 pin L3) that must be high for operation to work. The power-up/down sequence required for operation is shown in Figure 3-53.

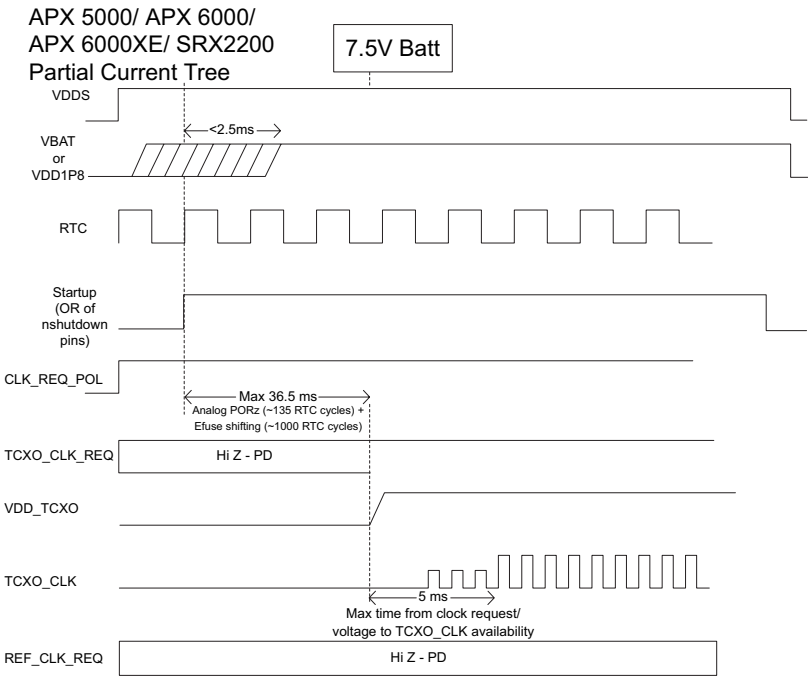


Figure 3-53. Chip Power-Up/Power-Down Sequence (Exernal Input/Output Shown)

The host processor operates from a 3.3V LDO regulator (U2402). The 1.85V regulator enables the 3.3V LDO regulator output. The LF receiver IC is powered from a 3.3V LDO regulator (U2402).

Figure 3-54 is a partial current tree showing the flow of current from the battery to the Bluetooth-related major components sourced by the 3.6V switching regulator on the VOCON.

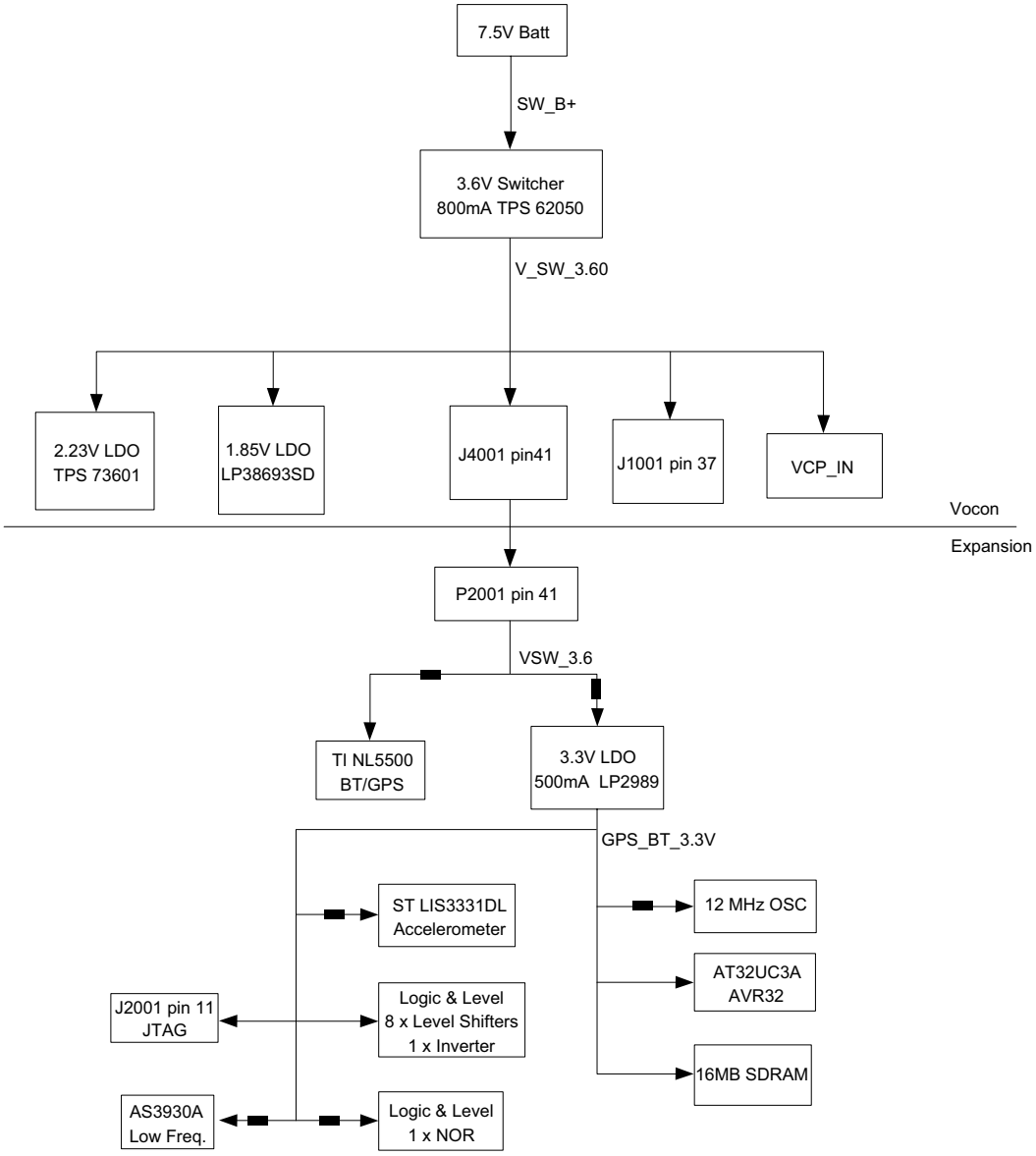


Figure 3-54. Current Distribution Tree for Bluetooth Circuitry

3.5.2 Bluetooth Clocks

The Bluetooth IC requires a 26 MHz TCXO (Y2204, TCXO_CLK) for the core and a 32.768 kHz (U6101 pin E2 on vocon, RTC_CLK) slow clock for the USART. This is the same clock used for the GPS portion of the BT/GPS combination IC.

The host processor IC requires a 12 MHz crystal oscillator (Y2475) clock. The LF receiver IC requires a 32.768 kHz (U6101 pin E2 on vocon, RTC_CLK) clock.

3.5.3 Bluetooth I/Os.

The communication between the Bluetooth IC and the host controller is by a four-wire HCI USART0 bus (RX, TX, CTS, RTS). The Bluetooth IC receives a firmware update over USART0 each time it is powered on. The LF receiver IC transmits its data over the USART1 s used for displaying debugging messages.

Table 3-16. Bluetooth Host Processor UART I/O

Signal Name	Pad Name	GPIO	MUX Function	Expansion Board Schematic Name	I/O
USART0 – RXD	PA00	0	A	BT_UART_TX_3.3V	I
USART0 – TXD	PA01	1	A	BT_UART_RX_3.3V	O
USART0 – RTS	PA03	3	A	BT_UART_CTS_3.3V	O
USART0 – CTS	PA04	4	A	BT_UART_RTS_3.3V	I
USART1 – RXD	PA05	5	A	USART1_RX	I
USART1 – TXD	PA06	6	A	USART1_TX	O
USART1 – CLK	PA07	7	A	USART1_CLK	I
USART2 – RXD	PB29	61	A	AVR_USART2_RX	I
USART2 – TXD	PB30	62	A	AVR_USART2_TX	O

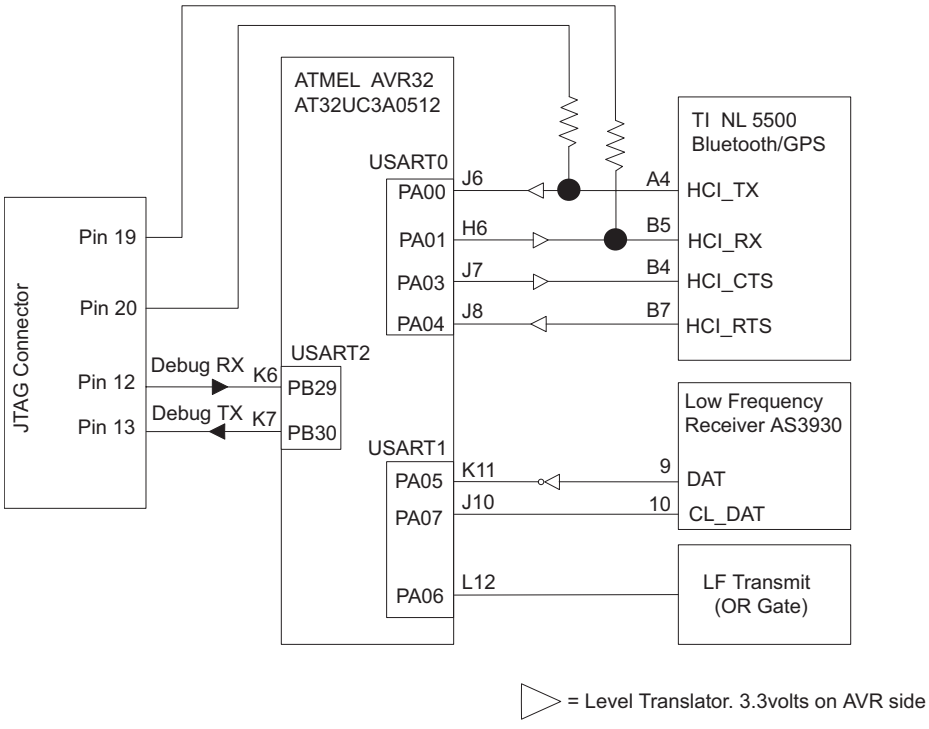


Figure 3-55. Bluetooth LF UART Connection Block Diagram

The Bluetooth IC shutdown (U2415 pin L3) and wakeup (U2415 pin K3) pins are also connected to the host controller. A Bluetooth PTT pin on the host controller (U2415 pin J2) tells the OMAP (U6302 pin Y5) when the user pressed the PTT button on the Bluetooth accessory. As the BT IC I/O is 1.8V, but the host controller I/O is 3.3V, level shifters are employed for interconnection between the two.

The host processor IC is connected to the LF receiver IC by a four-wire SPI bus. This SPI bus also communicates with an on-board accelerometer. The LF transmitter circuit uses a 125 kHz signal (U2415 pin M3) that is turned on and off (OOK) by the USART1_TX signal (U2415 pin L12).

Table 3-17. SPI I/O

Signal Name	Pad Name	GPIO	MUX Function	Expansion Board Schematic Name	I/O
SPIP – NPCS[2]	PA09	9	B	SPIO_CS2	O
SPIP – NPCS[0]	PA10	10	A	NFC_CS	O
SPIP – MISO	PA11	11	A	SPIO_MISO	I
SPIP – MOSI	PA12	12	A	SPIO_MOSI	O
SPIP – SCK	PA13	13	A	SPIO_CLK	O

The host processor is connected to the 3.3V SDRAM using a synchronous interface. The host processor is connected to the OMAP on the vocon by a full-speed USB (D11 & D12). VBus is a sense line only.

Table 3-18. USB I/O

Signal Name	Pin Name	Pad Name	Expansion Board Schematic Name	I/O
GPIO19	C12	PA19	USB_BOOT_3.3V	I
GPIO20	D10	PA20	ATMEL_BOOT	I
DP	D11	–	BT_AVR_USB_DP	I/O
DM	D12	–	BT_AVR_USB_DM	I/O
VBUS	E12	–	BT_AVR_VBUS	I

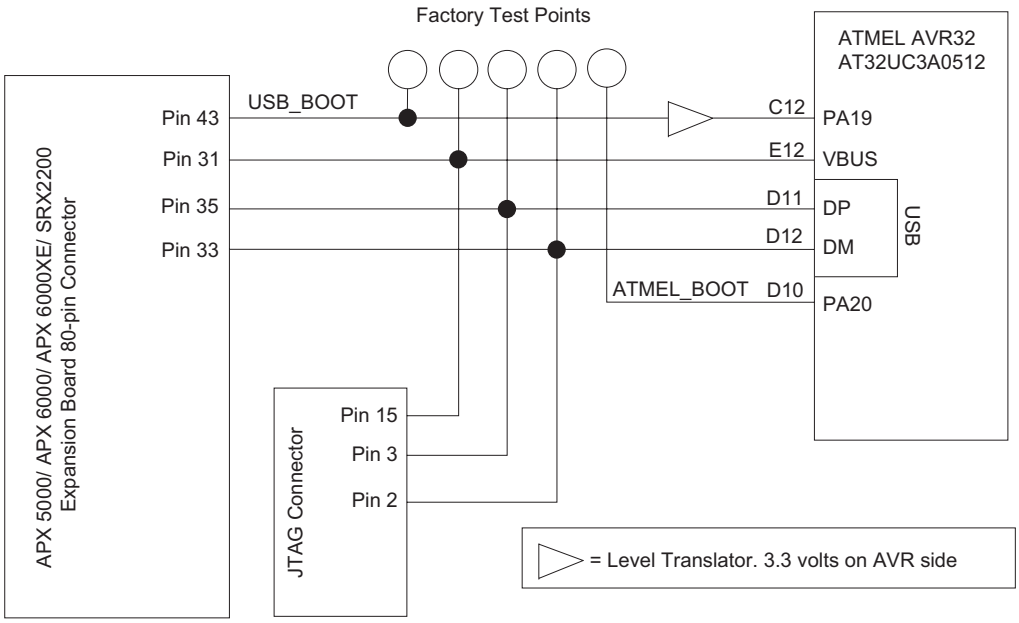


Figure 3-56. Bluetooth USB Interface Too Main VOCON

The ATMEL bootloader is being used as a first stage bootloader that will jump to the Motorola bootloader, which is a stage two bootloader. GPIO20 is used by the ATMEL bootloader to trap in Flash mode. GPIO19 will be used by the Motorola bootloader to trap in Flash mode. Both pins are active low.

The Bluetooth audio is sent over a two-channel PCM/SSI interface to the audio codec (U6405) on the VOCON board.

Table 3-19. GPIO I/O

Signal Name	Pad Name	GPIO	Expansion Board Schematic Name	I/O
GPIO41	PB09	41	BT_HOST_WAKEUP_3.3V	I
GPIO49	PB17	49	BT_PTT_3.3V	O
GPIO50	PB18	50	BT_SHUTDOWN_3.3V	O
GPIO51	PB19	51	BT_WAKEUP_3.3V	O

Notes

Chapter 4 Troubleshooting Procedures

The purpose of this chapter is to aid in troubleshooting problems with the ASTRO APX 5000/APX 6000/APX 6000XE/SRX2200 radio. It is intended to be detailed enough to localize the malfunctioning circuit and isolate the defective component. It also contains a listing of service tools recommended for PC board repair at the component level.

Most of the ICs are static sensitive devices. Do not attempt to disassemble the radio or troubleshoot a board without first referring to the following Handling Precautions section.

4.1 Handling Precautions

Complementary metal-oxide semiconductor (CMOS) devices, and other high-technology devices, are used in this family of radios. While the attributes of these devices are many, their characteristics make them susceptible to damage by electrostatic discharge (ESD) 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 this radio, and are especially important in low-humidity conditions. DO NOT attempt to disassemble the radio without observing the following handling precautions.

1. Eliminate static generators (plastics, Styrofoam, etc.) in the work area.
2. Remove nylon or double-knit polyester jackets, roll up long sleeves, and remove or tie back loose-hanging neckties.
3. Store and transport all static-sensitive devices in ESD-protective containers.
4. Disconnect all power from the unit before ESD-sensitive components are removed or inserted unless otherwise noted.
5. Use a static-safeguarded workstation, which can be accomplished through the use of an anti-static kit (Motorola part number 01-80386A82) or equivalent.This kit includes a wrist strap, two ground cords, a static-control table mat and a static-control floor mat.

4.2 Recommended Service Tools

Table 4-1 lists recommended service tools that can be used for PC board repairs at the component level. For listings of additional service tools, service aids, and test equipment that are recommended for all levels of service, refer to the APX 5000/APX 6000/APX 6000XE/SRX2200 basic service manual (see “Related Publications” on page ix).

Table 4-1. Recommended Service Tools

Motorola Part Number	Description	Application
1110027B23	Speaker Module Seal Lubricant	Used to ensure good sealing of the Speaker Module to the Main Chassis.
5880384G68	SMA to BNC Adapter	Adapts radio’s antenna port to BNC cabling of test equipment.
66009254001	APX 5000/ APX 6000 Battery Eliminator	Used in place of battery to connect radio to an external power supply. Requires RLN4510_.
66009255001	Grille Eliminator	Special tool used when pressure testing the radio. Replaces the radio grille to seal the port vent.
66009256001	Volume Potentiometer Outer Spanner Bit	Used to assemble and disassemble the spanner nut on the volume potentiometer.
66009258001	Antenna Spanner Bit	Used to assemble and disassemble the spanner nut on the antenna bushing.
66009259001	Vacuum Adapter	Submersible radios only. Connects the vacuum/pressure hose to the radio.
66009260001	Board Analysis Fixture	Special fixture that allows radio’s internal board to be mounted externally. Provides easy access to electronic circuits, required for board-level troubleshooting.
NLN9839_	Vacuum Pump Kit	Submersible radios only. Vacuum pump with gauge and vacuum hose. Requires 66009259001 Adapter Kit.
NTN4265_	Pressure Pump Kit	Submersible radios only. Pressure pump with gauge and pressure hose. Requires 66009259001 Adapter Kit.
DVN4233_	Customer Programming Software (CPS) and Tuner Software	CPS allows customer-specific programming of modes and features. Tuner software required to perform alignment of radio parameters.
PMKN4012_	Programming Cable	Used to program the radio through Customer Programming Software and Tuner Software.
PMKN4013_	Programming/Service Cable	Used to program and service the radio through Customer Programming Software and Tuner Software.
RLN4510_	7.5 Volt Universal Battery Eliminator	Used in conjunction with the 66009254001 to adjust the supply voltage to 7.5 Vdc. Allows a multimeter to be attached for monitoring and adjusting voltage and current levels.
RLN4460_	Portable Test Set	Used for radio performance checks. Connects to radio’s universal connector and allows remote switching and signal injection/outputs for test equipment measurements.

4.3 Standard Bias Table

Table 4-2 outlines some standard supply voltages and system clocks which should be present under normal operation. These should be checked as a first step to any troubleshooting procedure.

Table 4-2. Standard Operating Bias – DC Voltages

Name	Reference	Description	Level
MECH_SW	F_MECH_SW	ON/OFF Switch. Radio on when GND	GND
UNSW_B+	F_UNSW_B+	Radio Battery Voltage	9-6V
SW_B+	C6592	Radio Supply Voltage	9-6V
V_SAVE	C6538	LDO Output Present When Battery is Attached	2.5V
V_1.875	C6581	LDO Output	1.875V
V_1.55	R6561	LDO Output	1.55V
V_2.775D	R6563	LDO Output	2775V
V_2.775_EXP	R6562	LDO Output	2.775V
V_2.8_RF	R6564	LDO Output	2.8V
V_5.0A	R6565	LDO Output	5.0V
V_3.3	R6566	LDO Output	3.3V
V_3.0A	R6567	LDO Output	3.0V
V_EXT_1.8	R2302	LDO Output	1.85V
V_SW_1.4	E6502	Switcher Output	1.4V
V_SW_3.60	C6561	Switcher Output	3.6V
V_2.23	C6573	LDO Output	2.23V

Table 4-3. Standard Operating Bias – Clock Sources

Clock Source	Reference	Description	Frequency
Y6501	R6578	MAKO 24MHz & tapped into CPLD	24.576MHz
Y6502	C6541	MAKO RTC	32.768KHz
Y6601	C6601	OMAP CPU Clock	12MHz
U6302	TP6307 and TP6308	DDR Clocks (Complementary signals)	96MHz
U6101	R6114	MACE Clock	4MHz
U6101	R6115	GPS RTC clock	32.768KHz
Y701 (RF board)	R6218	RF Freq synth IC (Abacus) TCXO	16.8MHz

4.4 Power-Up Self-Check Errors

Each time the radio is turned on, the MCU and DSP perform a series of internal diagnostics. These diagnostics consist of checking such programmable devices as the FLASH ROMs, the EEPROM, and SRAM devices.

Problems detected during the power-up self-check routines are presented as error codes on the radio's display. For non-display radios, the problem is presented at power up by a single, low-frequency tone. Table 4-4 lists possible error codes, a description of each error code, and a recommended corrective action.

Table 4-4. Power-Up Self-Check Error Codes

Error Code/ Error Message	Description	Corrective Action
01/02	FLASH ROM Codeplug Checksum Non-Fatal Error	Reprogram the codeplug
01/12	Security Partition Checksum Non-Fatal Error	Send radio to depot
01/20	ABACUS Tune Failure Non-Fatal Error	Turn the radio off, then on
01/22	Tuning Codeplug Checksum Non-Fatal Error	Send radio to depot
01/81	Host ROM Checksum Fatal Error	Send radio to depot
01/82	FLASH ROM Codeplug Checksum Fatal Error	Reprogram the codeplug
01/88	External RAM Fatal Error – Note: Not a checksum failure	Send radio to depot
01/90	General Hardware Failure Fatal Error	Turn the radio off, then on
01/92	Security Partition Checksum Fatal Error	Send radio to depot
01/93	FLASHport Authentication Code Failure	Send radio to depot
01/98	Internal RAM Fail Fatal Error	Send radio to depot
01/A2	Tuning Codeplug Checksum Fatal Error	Send radio to depot
02/81	DSP ROM Checksum Fatal Error	Send radio to depot
02/88	DSP RAM Fatal Error – Note: Not a checksum failure	Turn the radio off, then on
02/90	General DSP Hardware Failure (DSP startup message not received correctly)	Turn the radio off, then on
09/10	Secure Hardware Error	Turn the radio off, then on
09/90	Secure Hardware Fatal Error	Turn the radio off, then on
Hardware board absent/ Hardware board absent then Man-Down Hw error	Expansion board is not connected properly to the radio	Ensure the Expansion board is fixed in place
Note: *If the corrective action does not fix the failure, send the radio to the depot.*		

4.5 Power-Up Self-Check Diagnostics and Repair (Not for Field Use)

Table 4-5 lists additional action items that can be used for the diagnosis and resolution of the error codes listed in Table 4-4 on page 4-4.

Table 4-5. Power-Up Self-Check Diagnostic Actions

Error Code/ Error Message	Diagnostic Actions
01/02	This non-fatal error will likely recover if the radio's power is cycled. In the event that this does not resolve the issue, the radio should be reflashed. If the error remains, send the radio to depot.
01/12	The radio should be sent to the depot for reflashing of the security codeplug.
01/20	Cycling radio power should resolve this issue.
01/22	The radio should be sent to the depot for reflash of the tuning codeplug followed by retuning of the radio.
01/81	The radio should be sent to the depot for reflashing of the host code.
01/82	The radio should be sent to the depot for reflashing of the radio codeplug.
01/88	Reflashing of the radio should first be performed. If this fails to resolve the issue, send the radio to depot.
01/90	Cycle power to radio. Continued failure indicates a likely IC failure In this event, radio should be sent to the depot for isolation and repair of the problem IC.
01/92	The radio should be sent to the depot for reprogramming of the security codeplug.
01/93	The radio should be sent to the depot for reflashing of the host code.
01/98	Send radio to the depot.
01/A2	The radio should be sent to the depot for reflashing of the tuning codeplug followed by re-tuning of the radio.
02/81	The radio should be sent to the depot for examination.
02/88	Cycle power to the radio. If this does not fix the problem, then the radio should be sent to the depot for reflashing of the DSP code.
02/90	Cycle power to the radio. If this fails to fix the problem, then the radio should be sent to the depot for reflashing of the DSP code.
09/10	Cycle power to the radio. If this fails then follow instructions in the secure hardware failure troubleshooting flowchart.
09/90	Cycle power to the radio. If this fails then follow instructions in the secure hardware failure troubleshooting flowchart.
Hardware board failed	Bluetooth error. Send radio to depot for examination.
Hardware board failed then Man-Down HW error	Man-Down feature unavailable. Send radio to depot for examination.

Table 4-5. Power-Up Self-Check Diagnostic Actions (Continued)

Error Code/ Error Message	Diagnostic Actions
Hardware board mismatch	Expansion board does not support bluetooth feature. Send radio to depot. If the Expansion board type supports “Full feature” – “Mace/GPS/BT/SDMem Exp Board”, updating the expansion board firmware should resolve the error message.
Hardware board mismatch then Man-Down HW error	Expansion board does not support either bluetooth or Man-down feature or both. If the Expansion board type supports “Full feature” – “Mace/GPS/BT/SDMem Exp Board”, updating the expansion board firmware should resolve the error message.

Chapter 5 Troubleshooting Charts

This section contains detailed troubleshooting flowcharts. These charts should be used as a guide in determining the problem areas. They are not a substitute for knowledge of circuit operation and astute troubleshooting techniques. It is advisable to refer to the related detailed circuit descriptions in the theory of operation sections prior to troubleshooting a radio.

5.1 List of Troubleshooting Charts

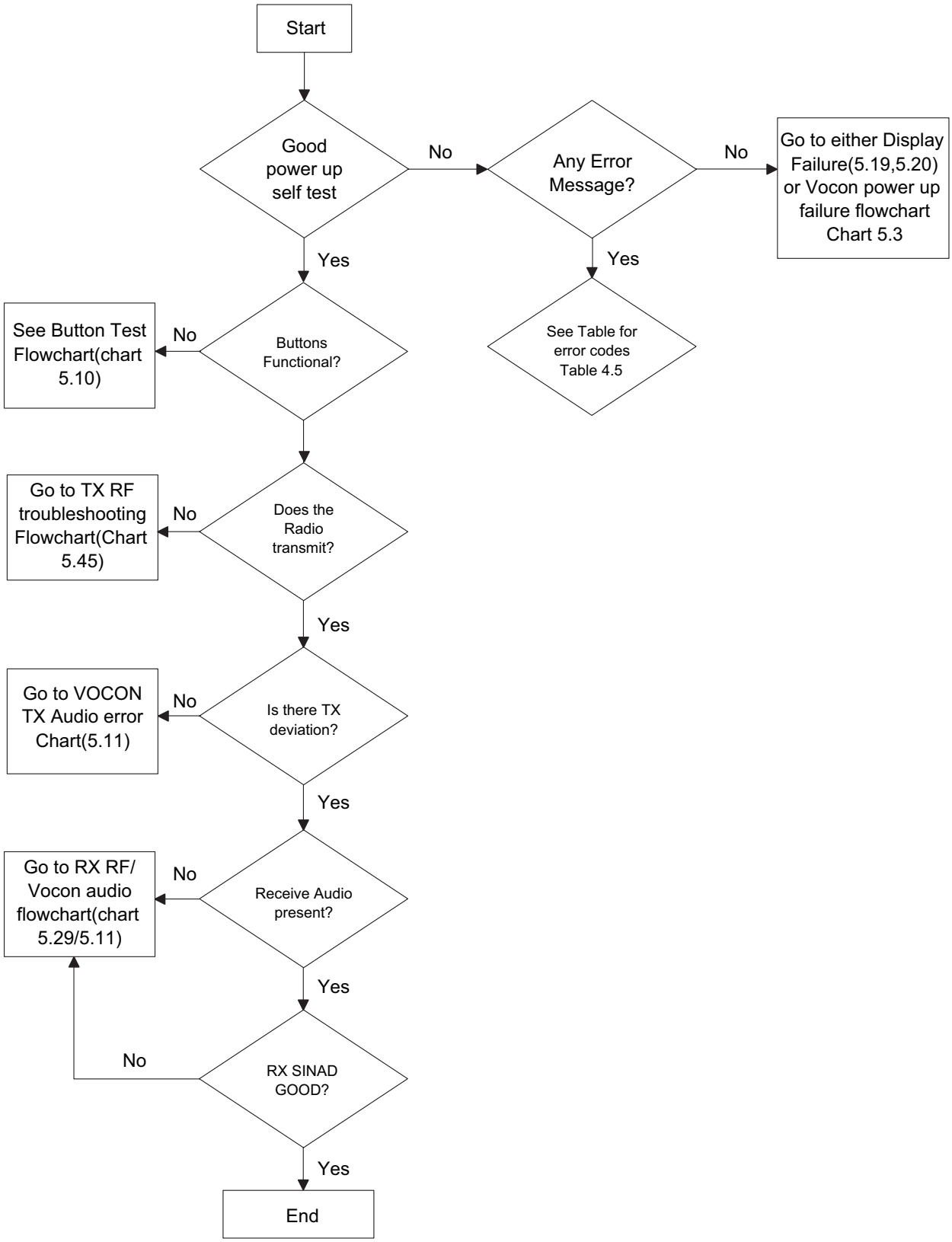
Most troubleshooting charts (see Table 5-1) end up by pointing to an IC to replace. It is not always noted, but it is good practice to verify supplies and grounds to the affected IC and to trace continuity to the malfunctioning signal and related circuitry before replacing any IC. For instance, if a clock signal is not available at a destination, continuity from the source IC should be checked before replacing the source IC.

Table 5-1. Troubleshooting Charts

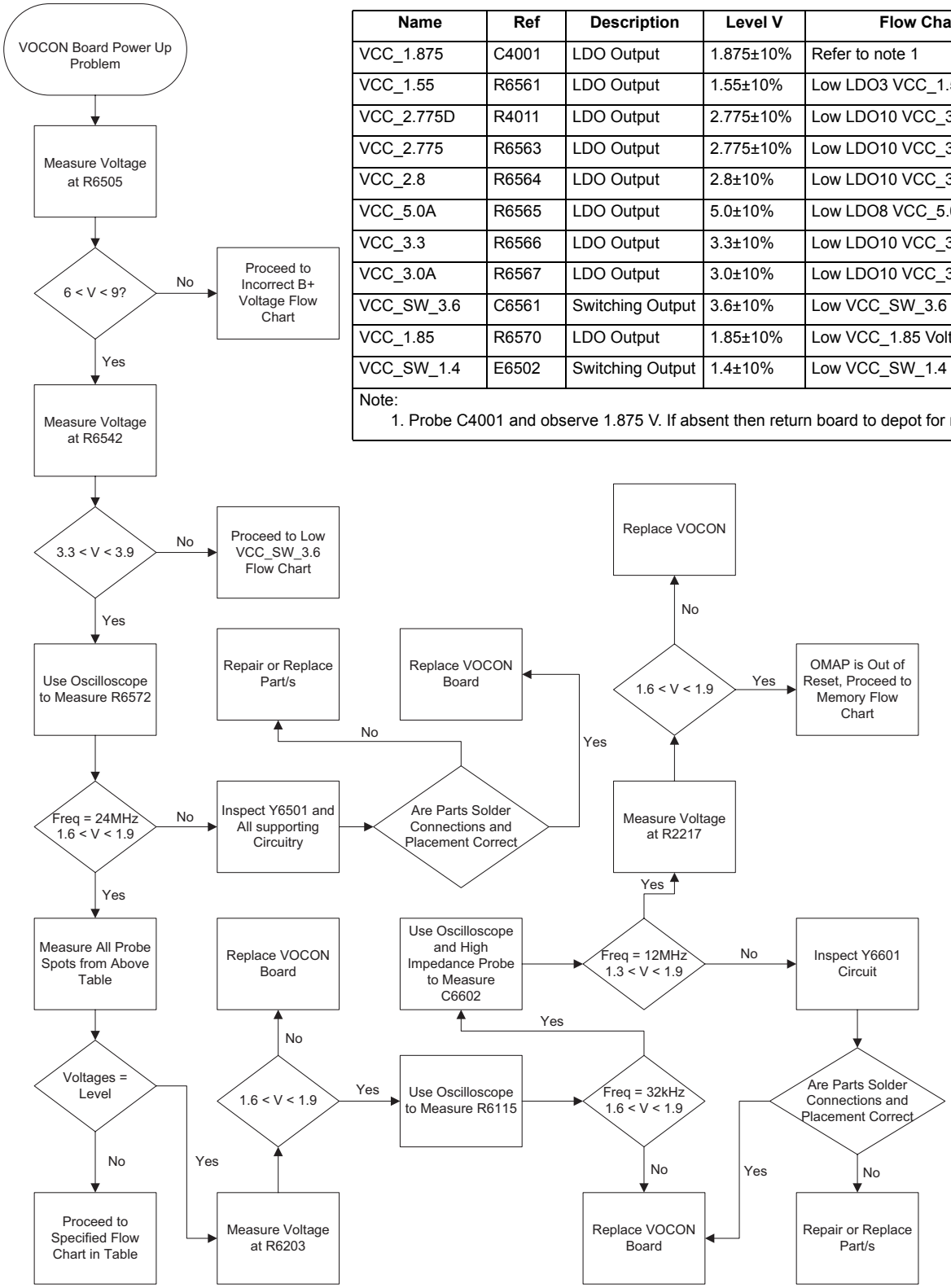
Table 5-1. Troubleshooting Charts (Continued)

Table 5-1. Troubleshooting Charts (Continued)

5.2 Main Troubleshooting Flowchart



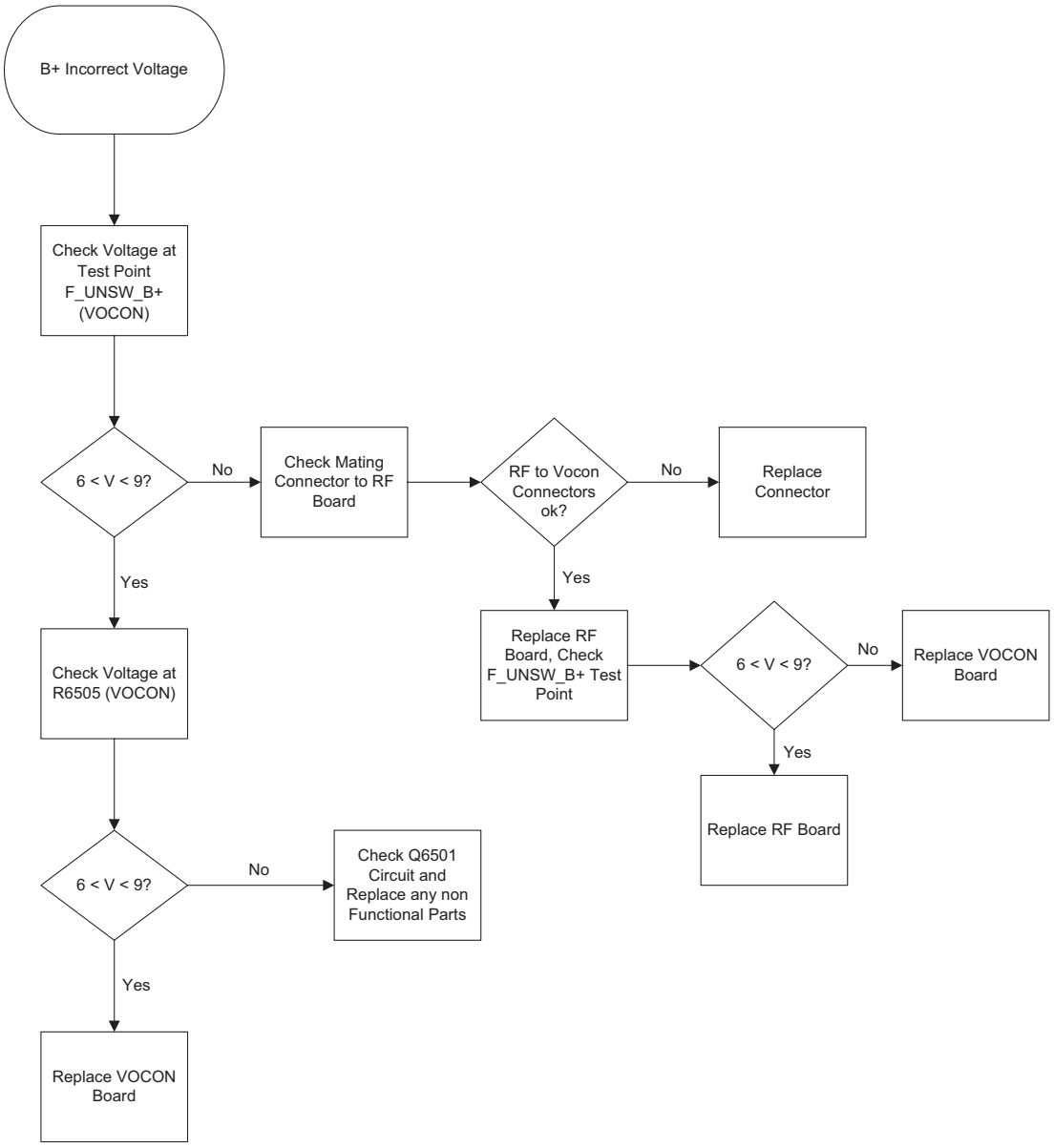
5.3 Power-Up Failure – VOCON Board



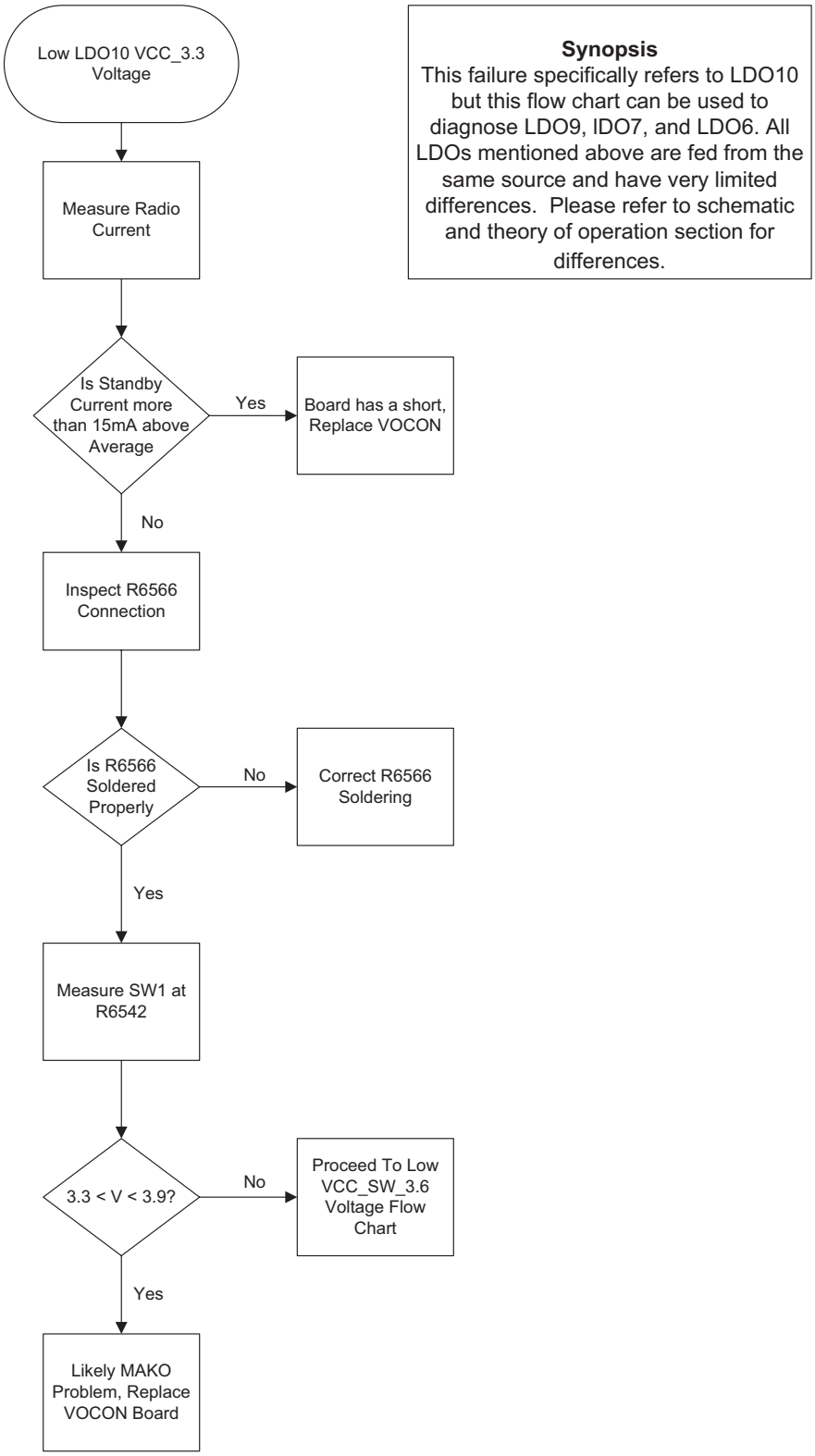
Name	Ref	Description	Level V	Flow Chart
VCC_1.875	C4001	LDO Output	1.875±10%	Refer to note 1
VCC_1.55	R6561	LDO Output	1.55±10%	Low LDO3 VCC_1.55 Voltage
VCC_2.775D	R4011	LDO Output	2.775±10%	Low LDO10 VCC_3.3 Voltage
VCC_2.775	R6563	LDO Output	2.775±10%	Low LDO10 VCC_3.3 Voltage
VCC_2.8	R6564	LDO Output	2.8±10%	Low LDO10 VCC_3.3 Voltage
VCC_5.0A	R6565	LDO Output	5.0±10%	Low LDO8 VCC_5.0A Voltage
VCC_3.3	R6566	LDO Output	3.3±10%	Low LDO10 VCC_3.3 Voltage
VCC_3.0A	R6567	LDO Output	3.0±10%	Low LDO10 VCC_3.3 Voltage
VCC_SW_3.6	C6561	Switching Output	3.6±10%	Low VCC_SW_3.6 Voltage
VCC_1.85	R6570	LDO Output	1.85±10%	Low VCC_1.85 Voltage
VCC_SW_1.4	E6502	Switching Output	1.4±10%	Low VCC_SW_1.4 Voltage

Note:
1. Probe C4001 and observe 1.875 V. If absent then return board to depot for repair.

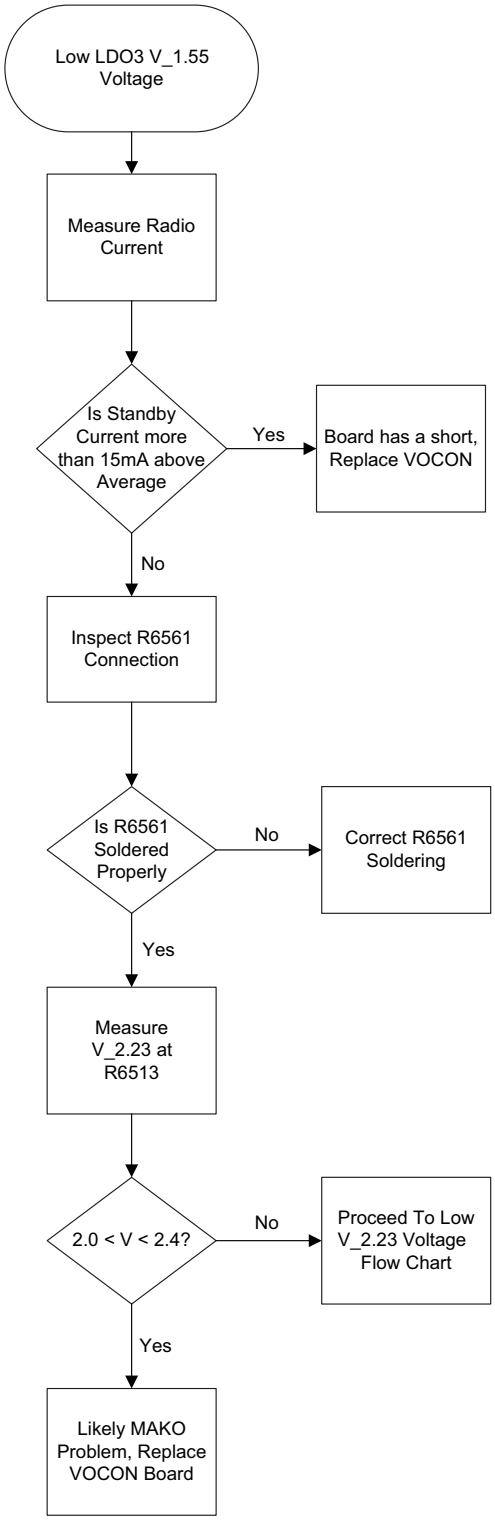
Power-Up Failure – B+ Incorrect Voltage



Power-Up Failure – Low LDO10 VCC_3.3 Voltage



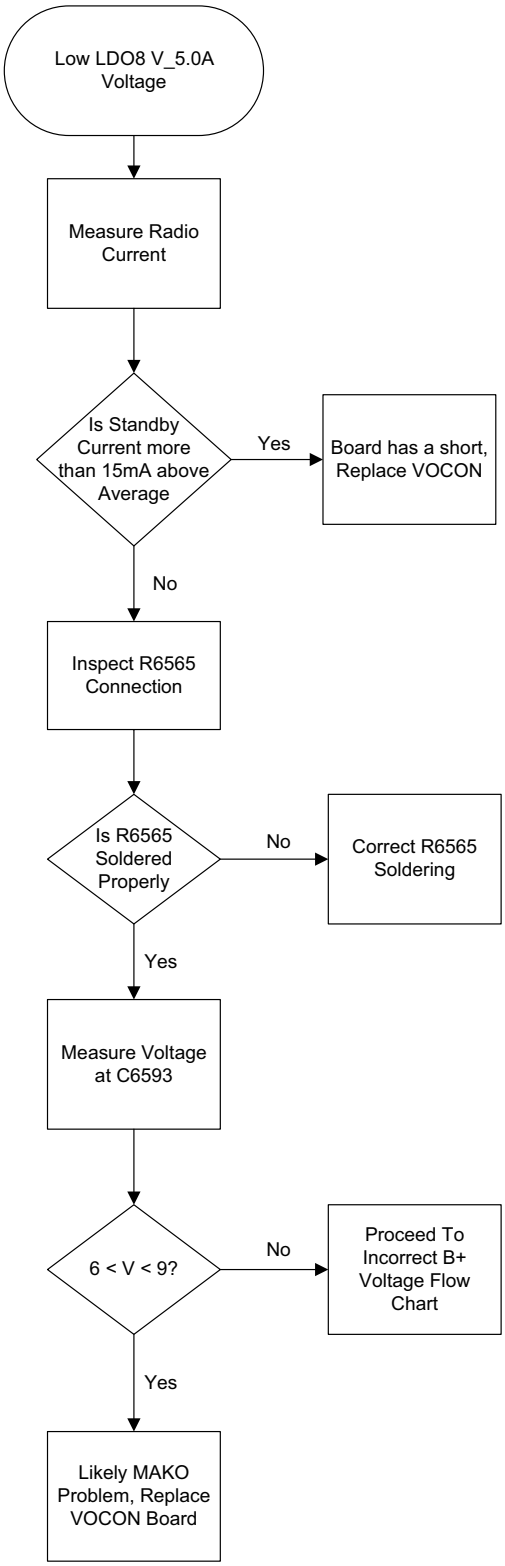
Power-Up Failure – Low LDO3 V_1.55 Voltage



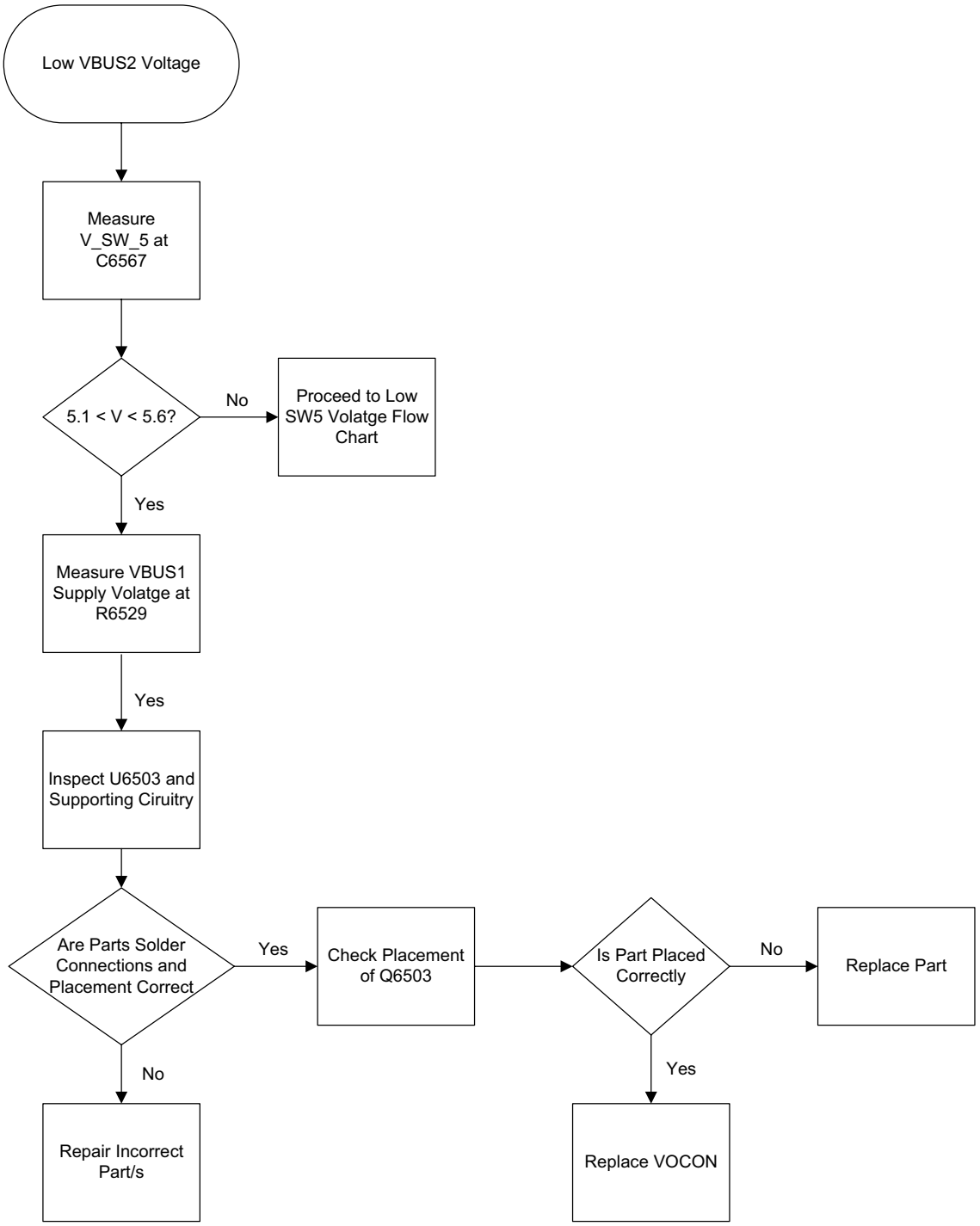
Synopsis

This failure specifically refers to LDO3 but this flow chart can be used to diagnose LDO2. All LDOs mentioned above are fed from the same source and have very limited differences. Please refer to schematic and theory of operation section for differences.

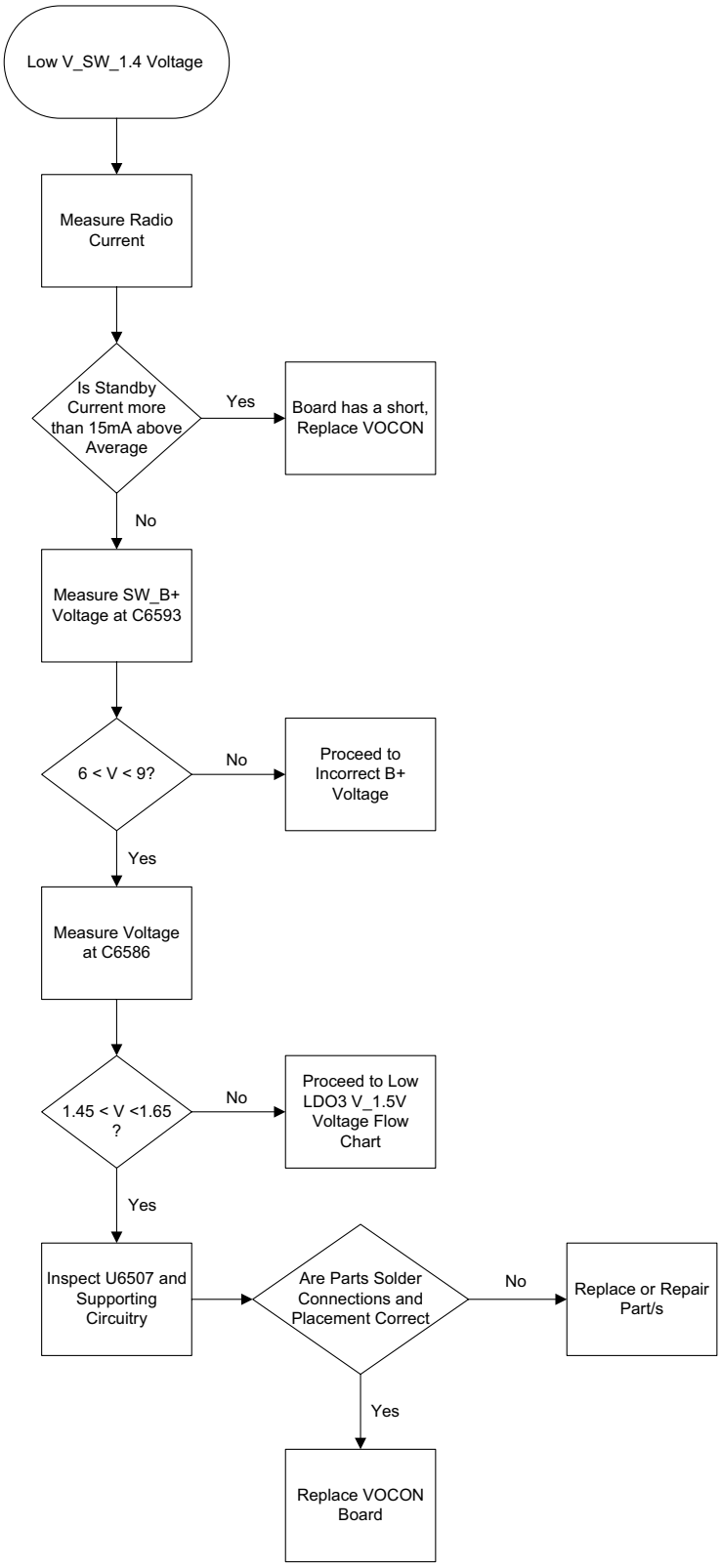
Power-Up Failure – Low LDO8 V_5.0A Voltage



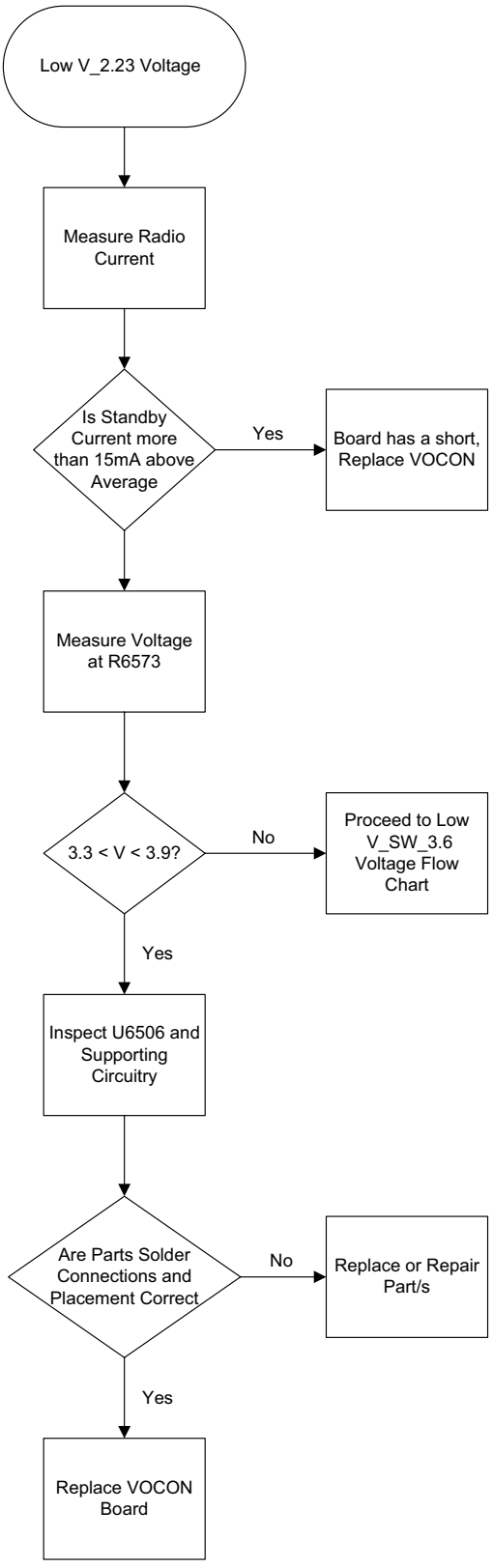
Power-Up Failure – Low VBUS2 Voltage



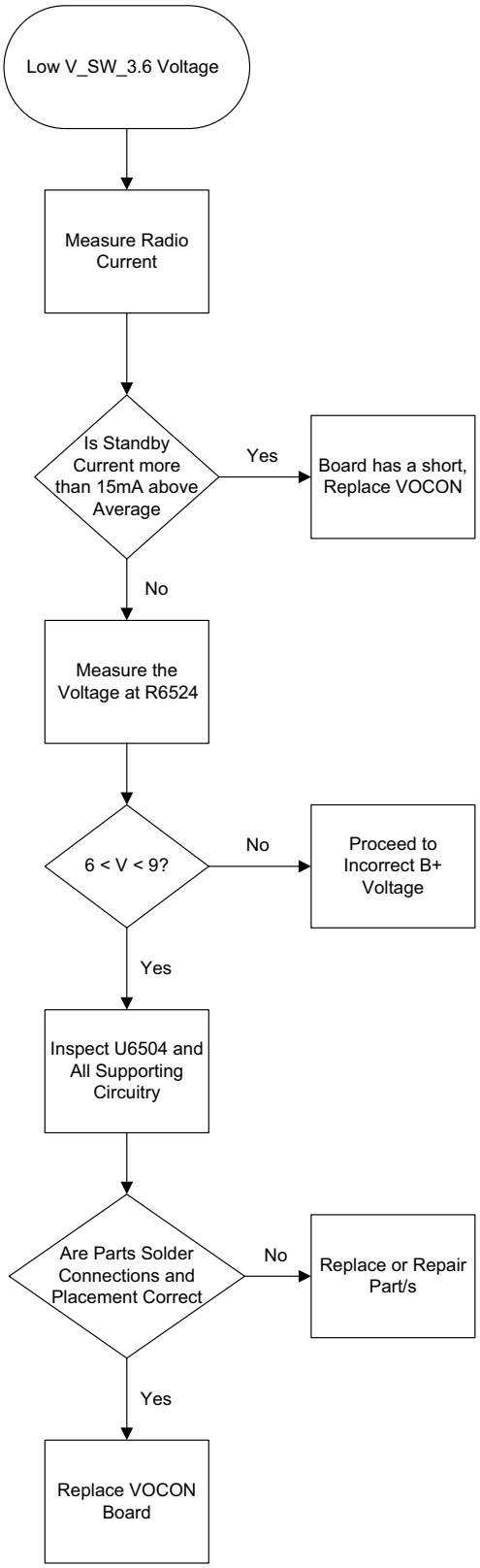
Power-Up Failure – Low V_SW_1.4 Voltage



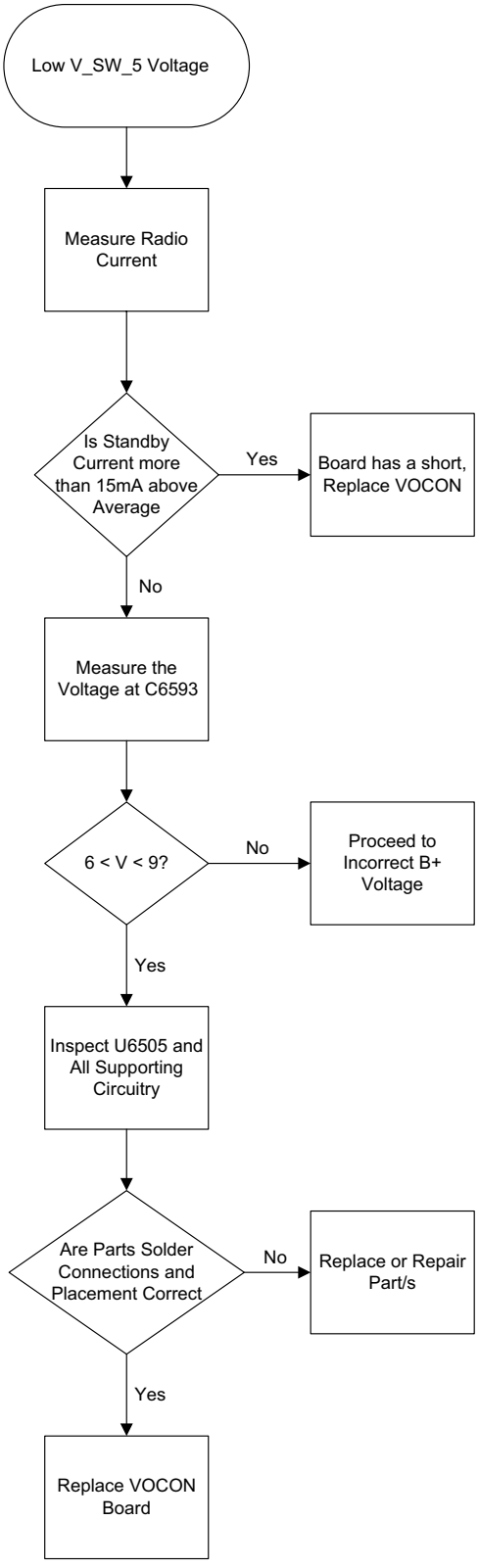
Power-Up Failure – Low V_2.23 Voltage



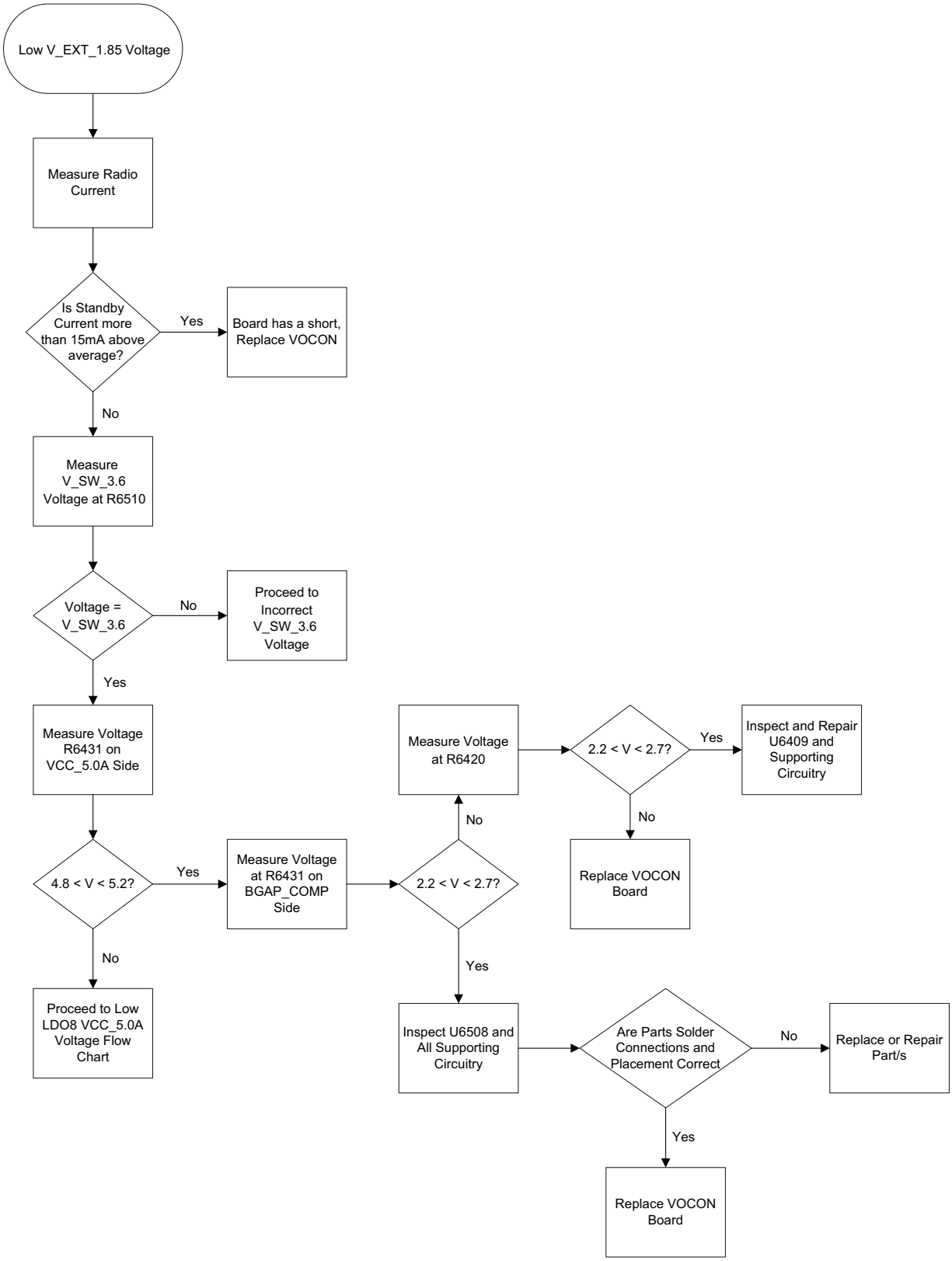
Power-Up Failure – Low V_SW_3.6 Voltage



Power-Up Failure – Low V_SW_5 Voltage

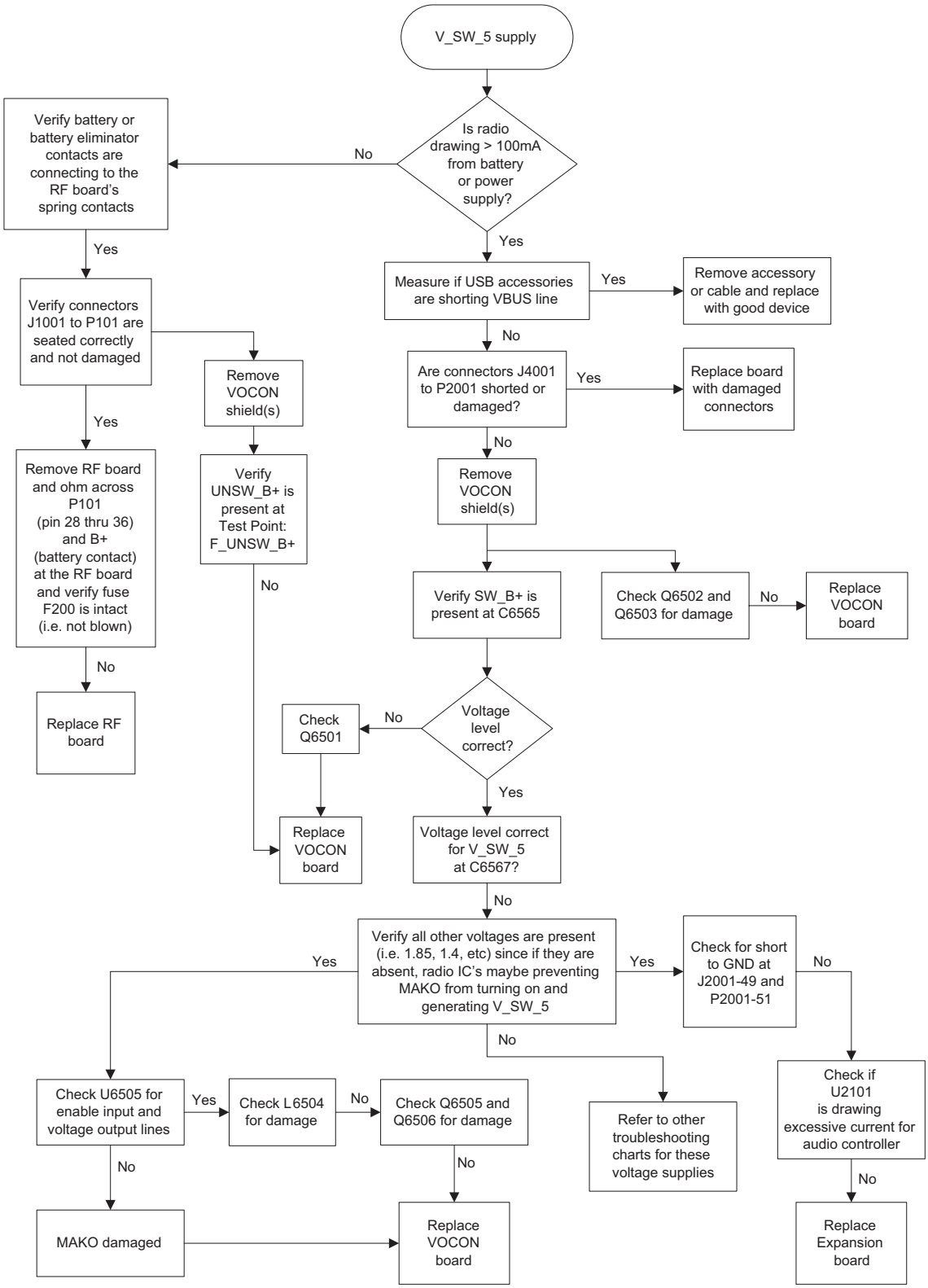


Power-Up Failure – Low V_EXT_1.85 Voltage

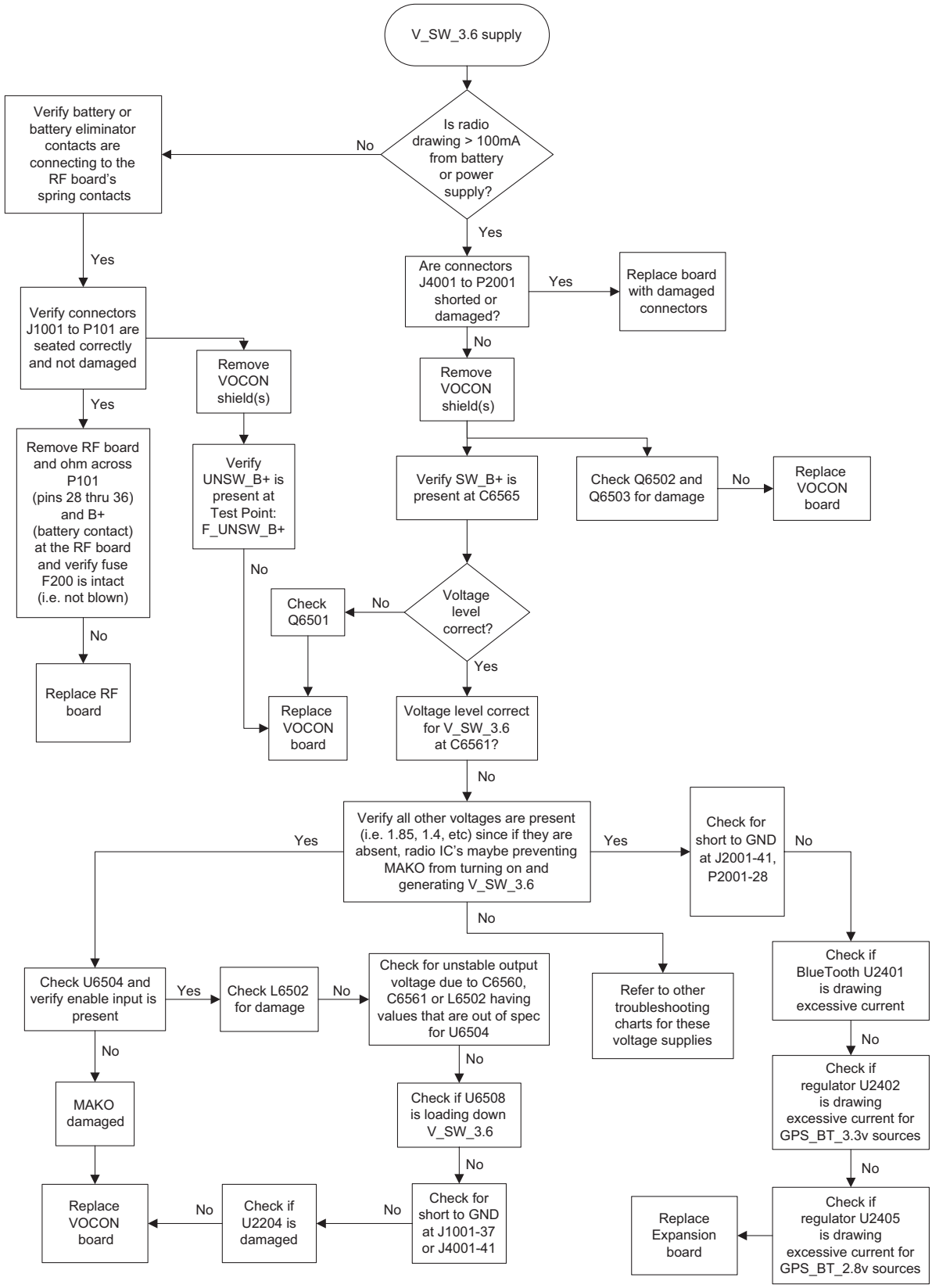


5.4 DC Supply Failure

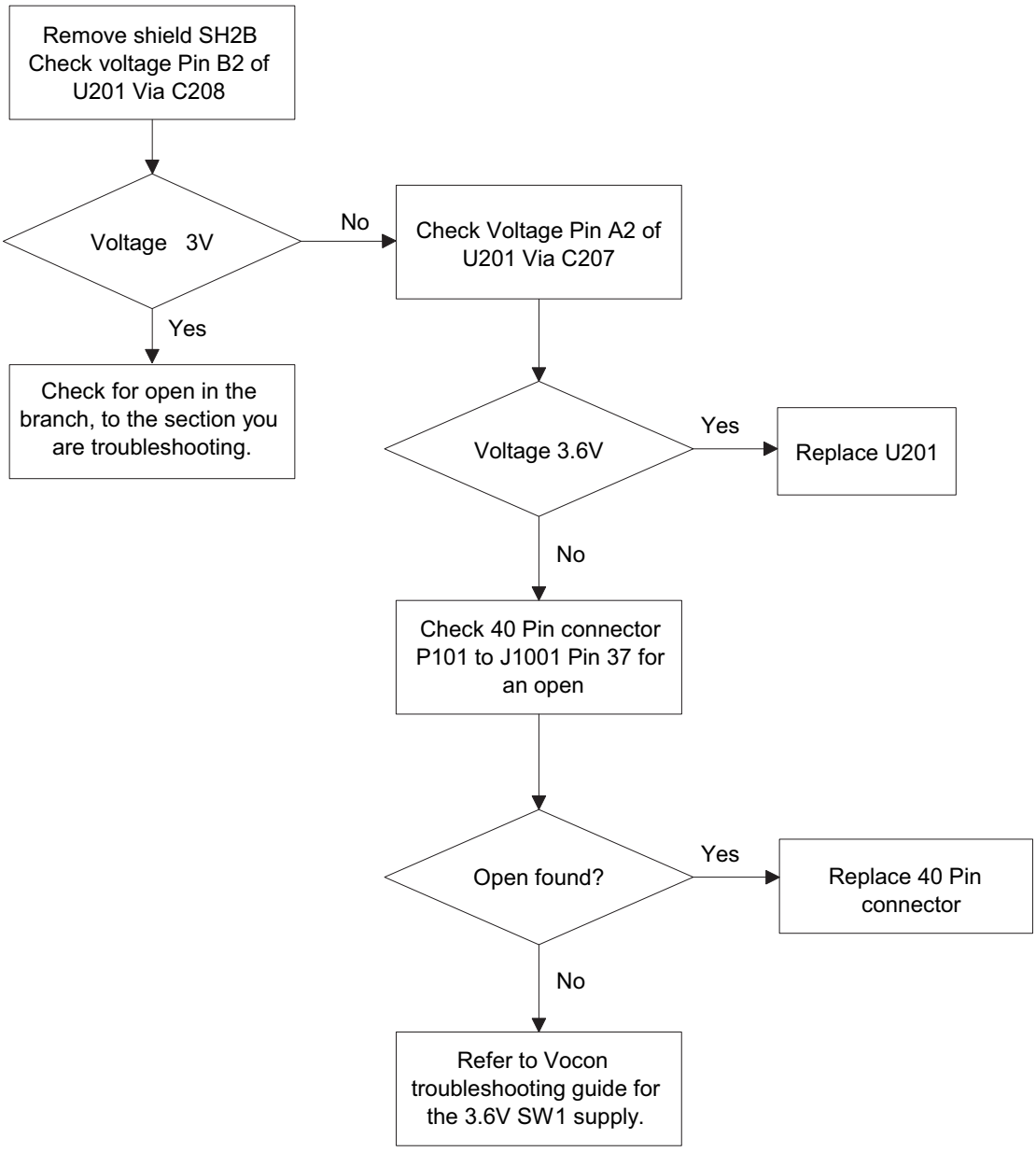
5.4.1 DC Supply 5 Volt Failure



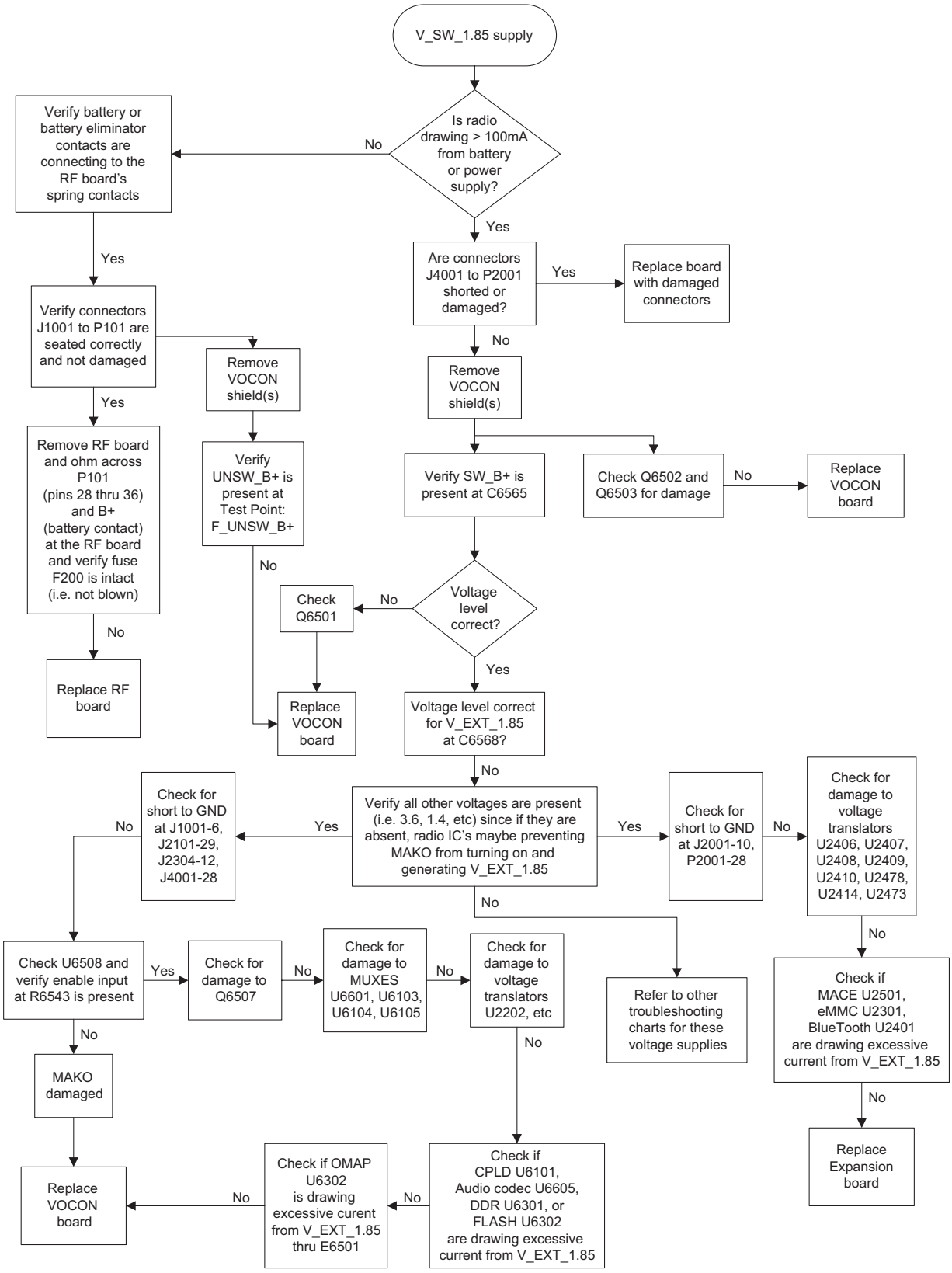
5.4.2 DC Supply 3.6 Volt Failure



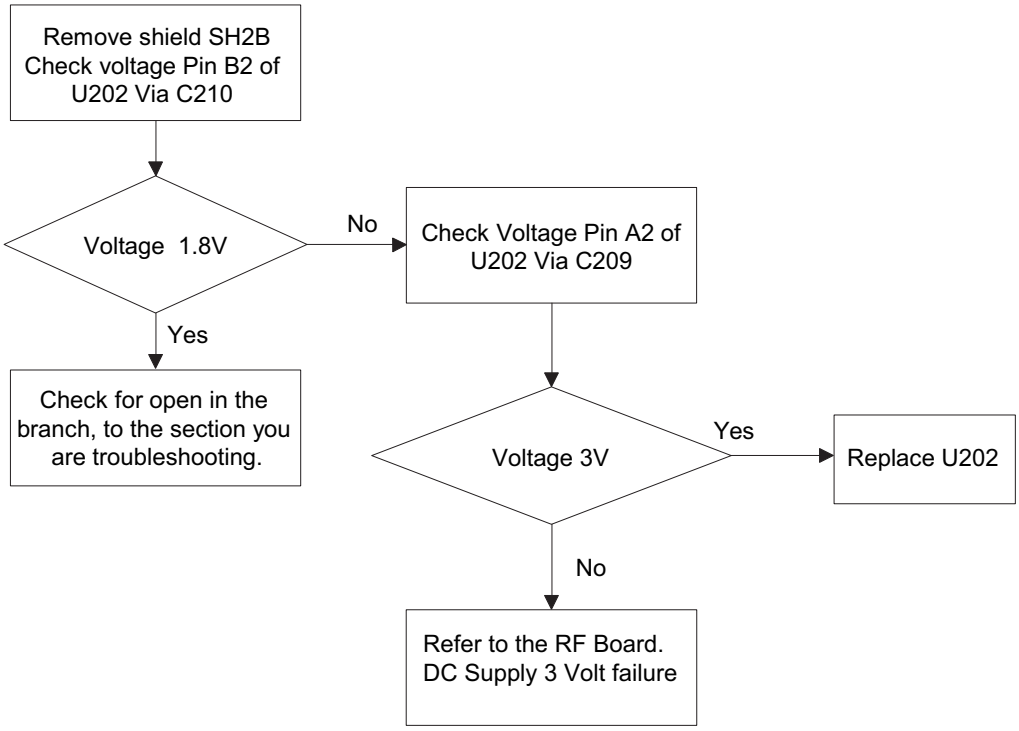
5.4.3 DC Supply 3 Volt Failure



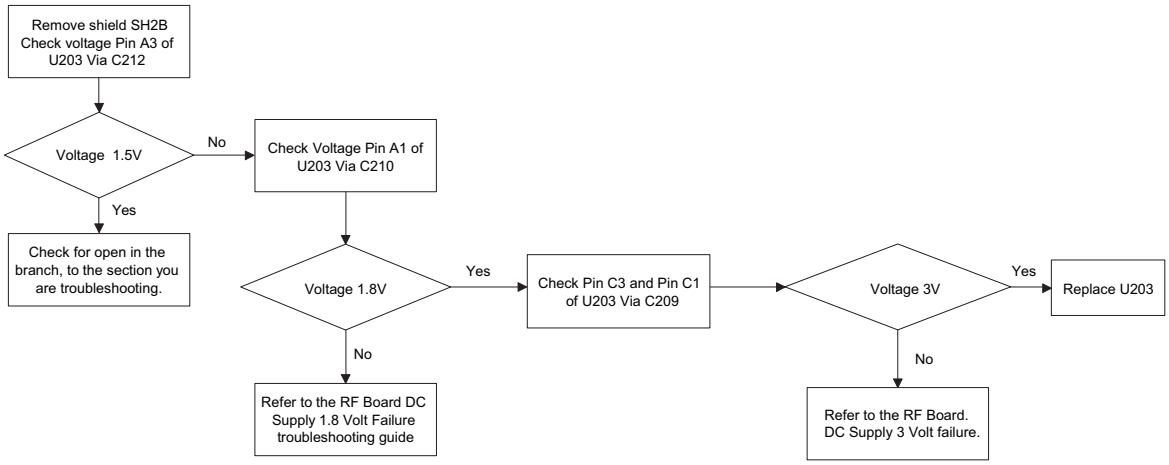
5.4.4 DC Supply 1.85 Volt Failure



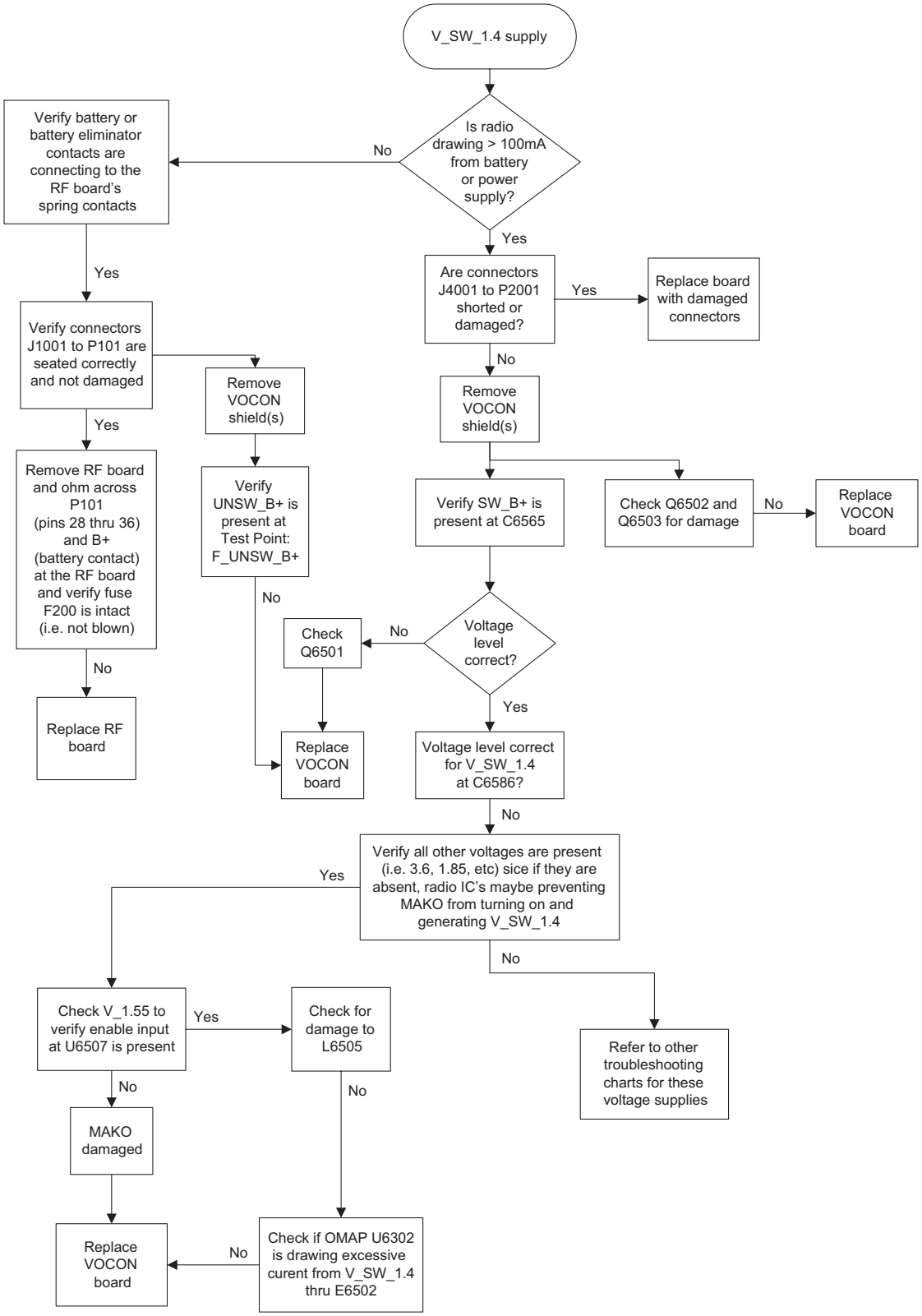
5.4.5 DC Supply 1.8 Volt Failure



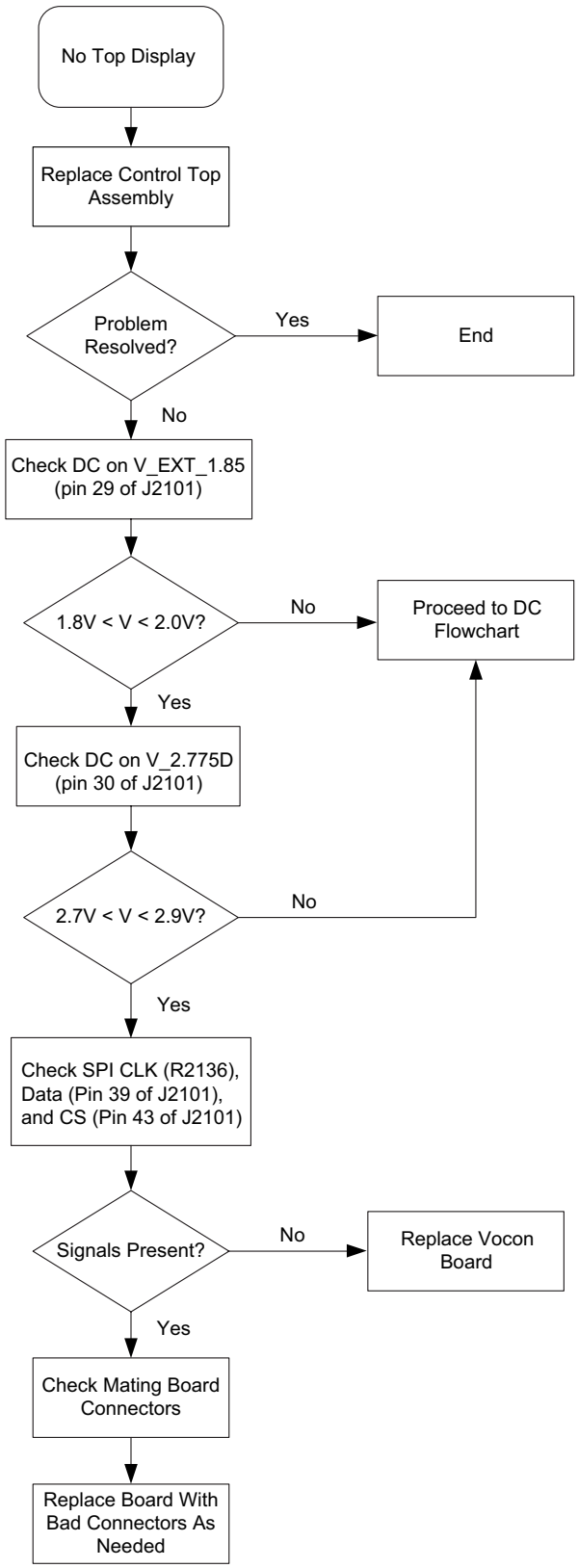
5.4.6 DC Supply 1.5 Volt Failure



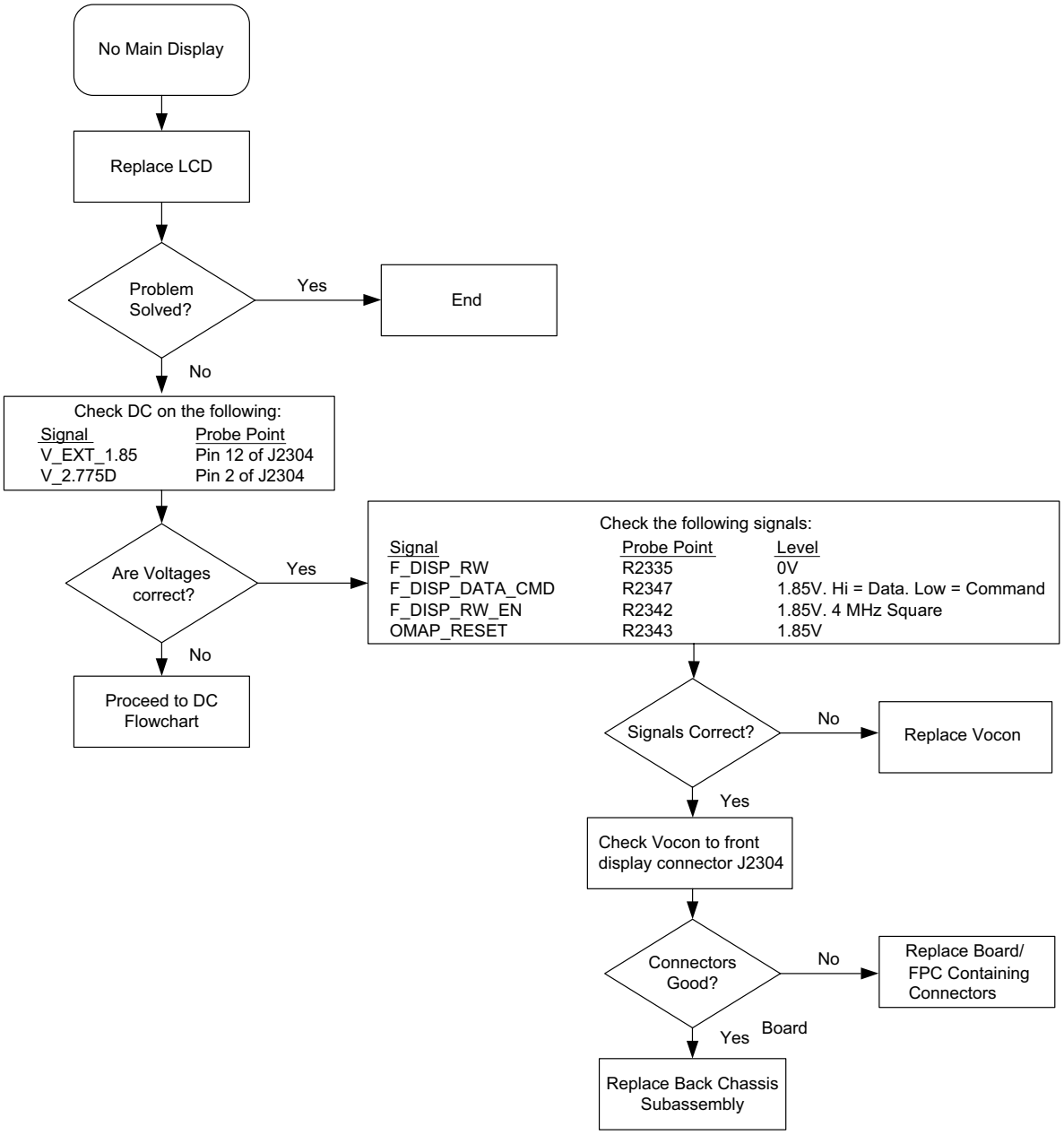
5.4.7 DC Supply 1.4 Volt Failure



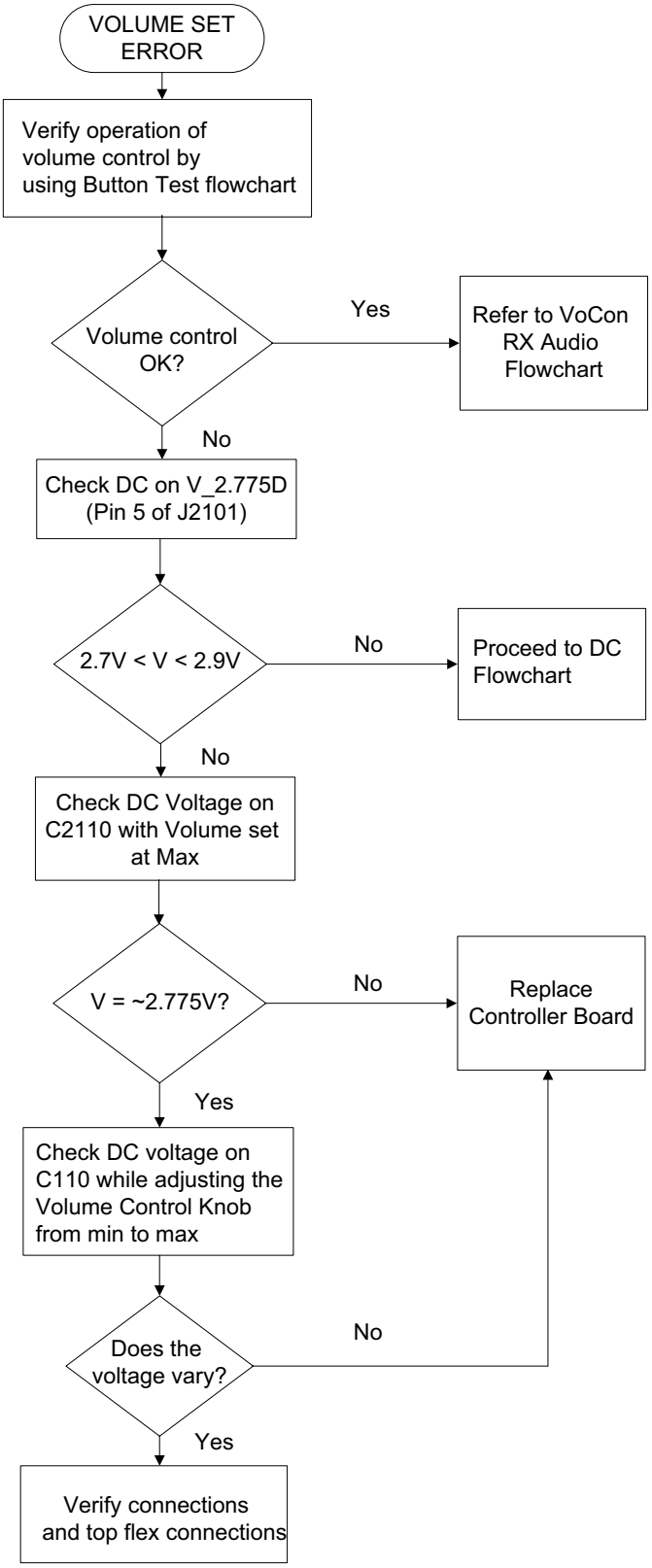
5.5 Top/CID Display Failure



5.6 Main Display Failure

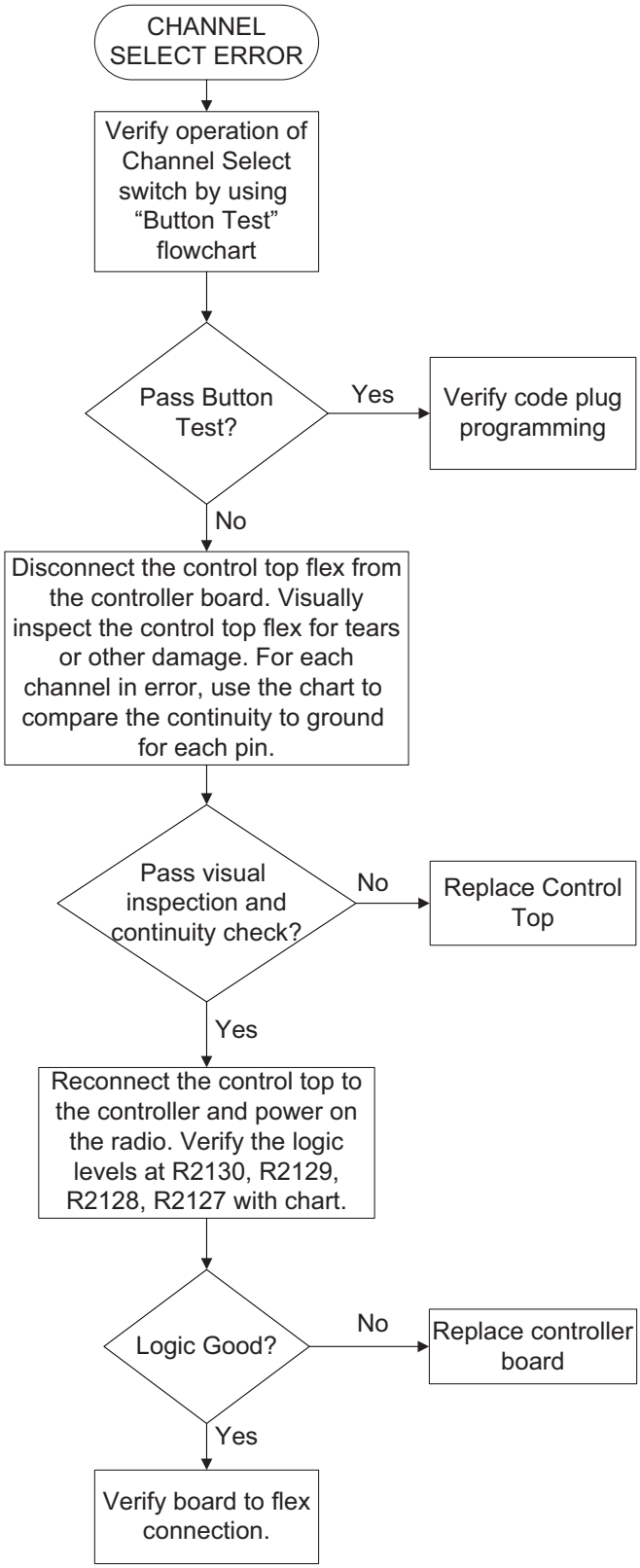


5.7 Volume Set Error

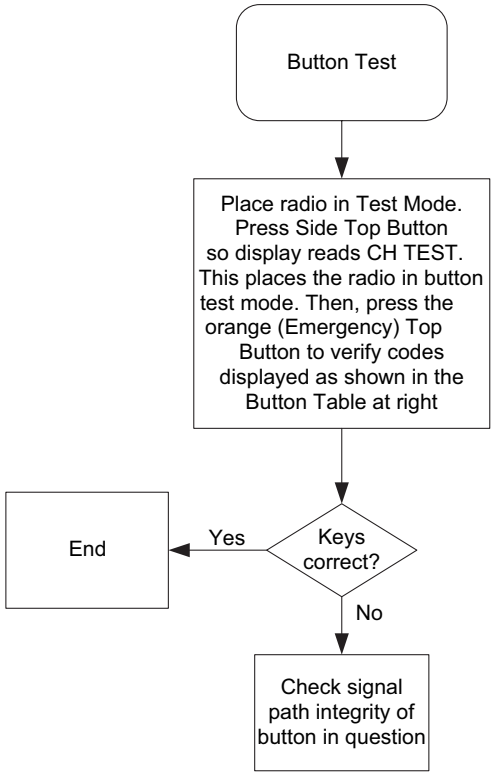


5.8 Channel Select Error

Physical Position	**RTA3** (R2130)	**RTA2** (R2129)	**RTA1** (R2128)	**RTA0** (R2127)
Channel 1	1	0	1	0
Channel 2	1	0	1	1
Channel 3	1	1	1	1
Channel 4	1	1	1	0
Channel 5	1	1	0	0
Channel 6	1	1	0	1
Channel 7	1	0	0	1
Channel 8	1	0	0	0
Channel 9	0	0	0	0
Channel 10	0	0	1	0
Channel 11	0	0	1	1
Channel 12	0	1	1	1
Channel 13	0	1	1	0
Channel 14	0	1	0	0
Channel 15	0	1	0	1
Channel 16	0	0	0	1



5.9 Keypad Error



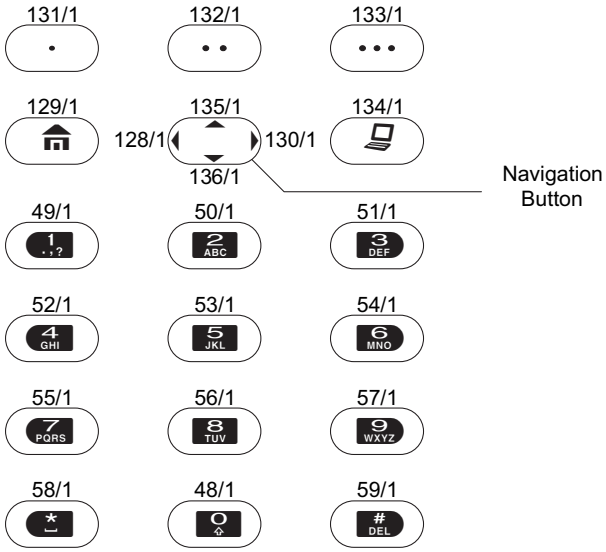
Synopsis

This chart relates to a failure in the button functions Basic Failure modes are as follows:

1) Failure in control top, side controls, or keypad flex assembly
2) Bad Connection
3) Defective Switches or pads
4) Defective Vocon Board

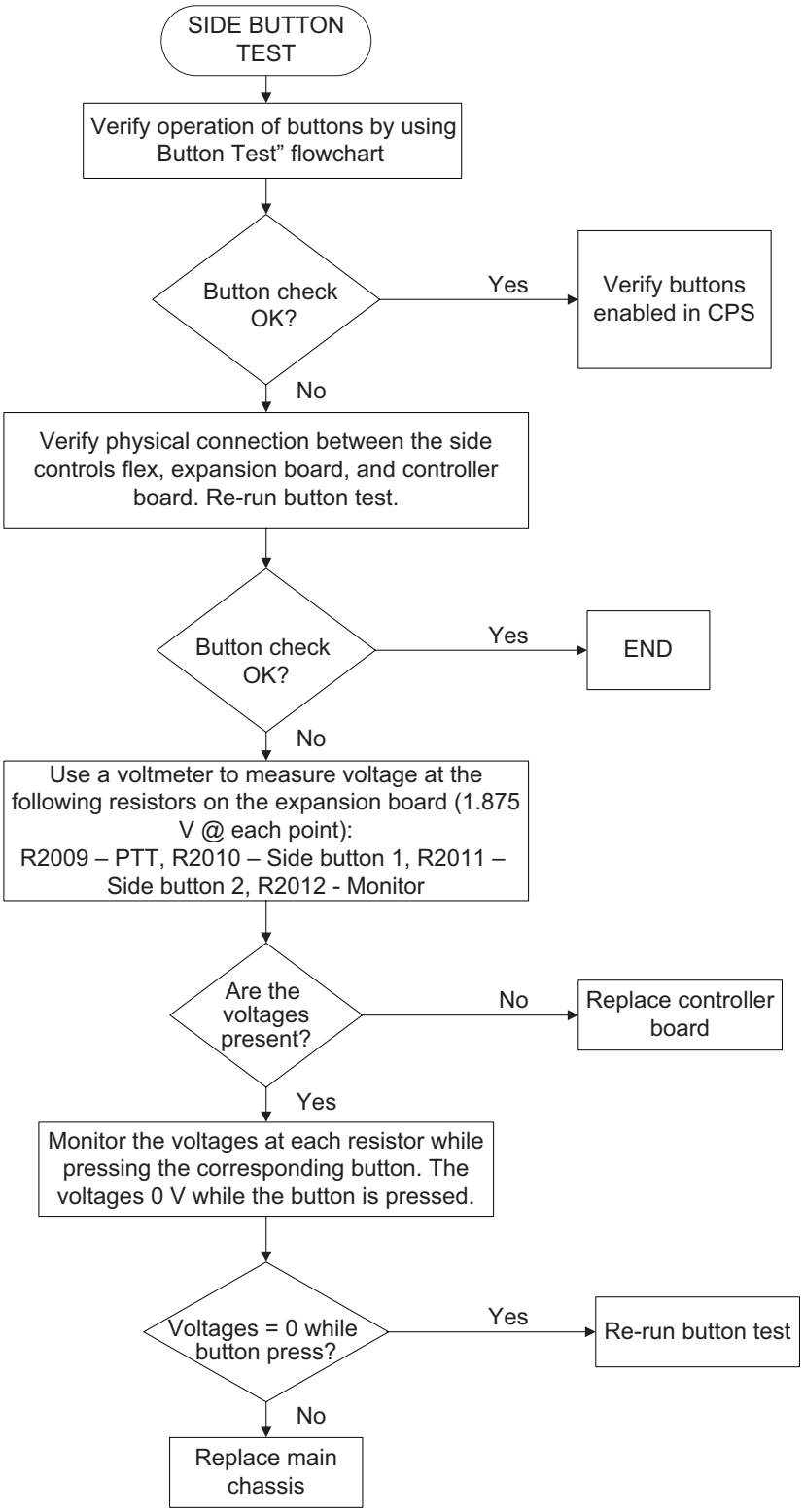
Button Table

Button	Code
PTT	1/0-1
Top Button (Emergency)	148/0-1
Side Button 1	96/0-1
Side Button 2	97/0-1
Side Button 3	98/0-1
Channel Select (Frequency)	4/0-15
Volume Control Knob	2/0-255
ABC Toggle Switch	67/0-2
Secure/Clear Select	65/0-1

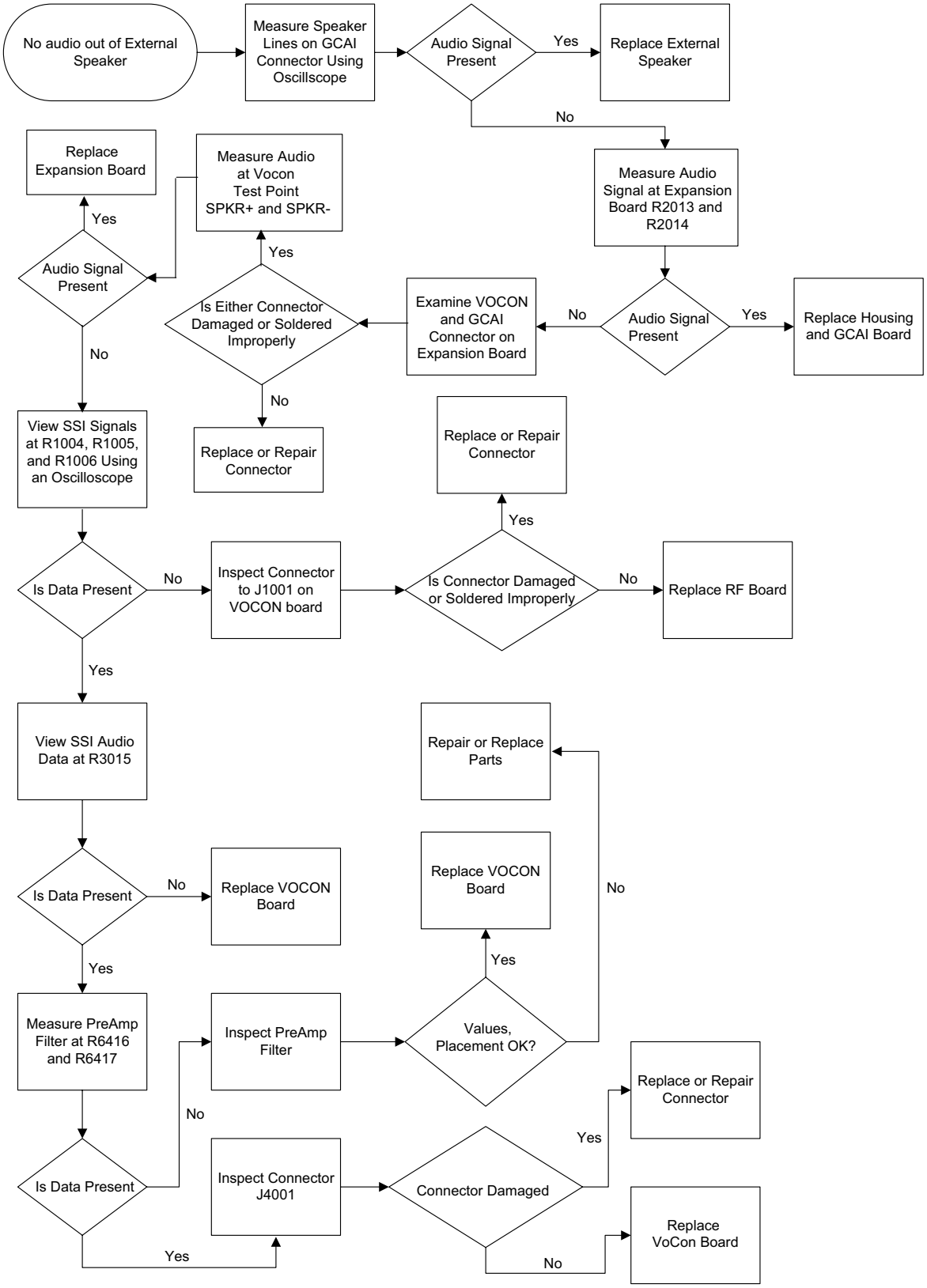


Note:
Numbers codes with a /1 are for a button pressed condition only. Number codes with a /0 are for a button release condition only.

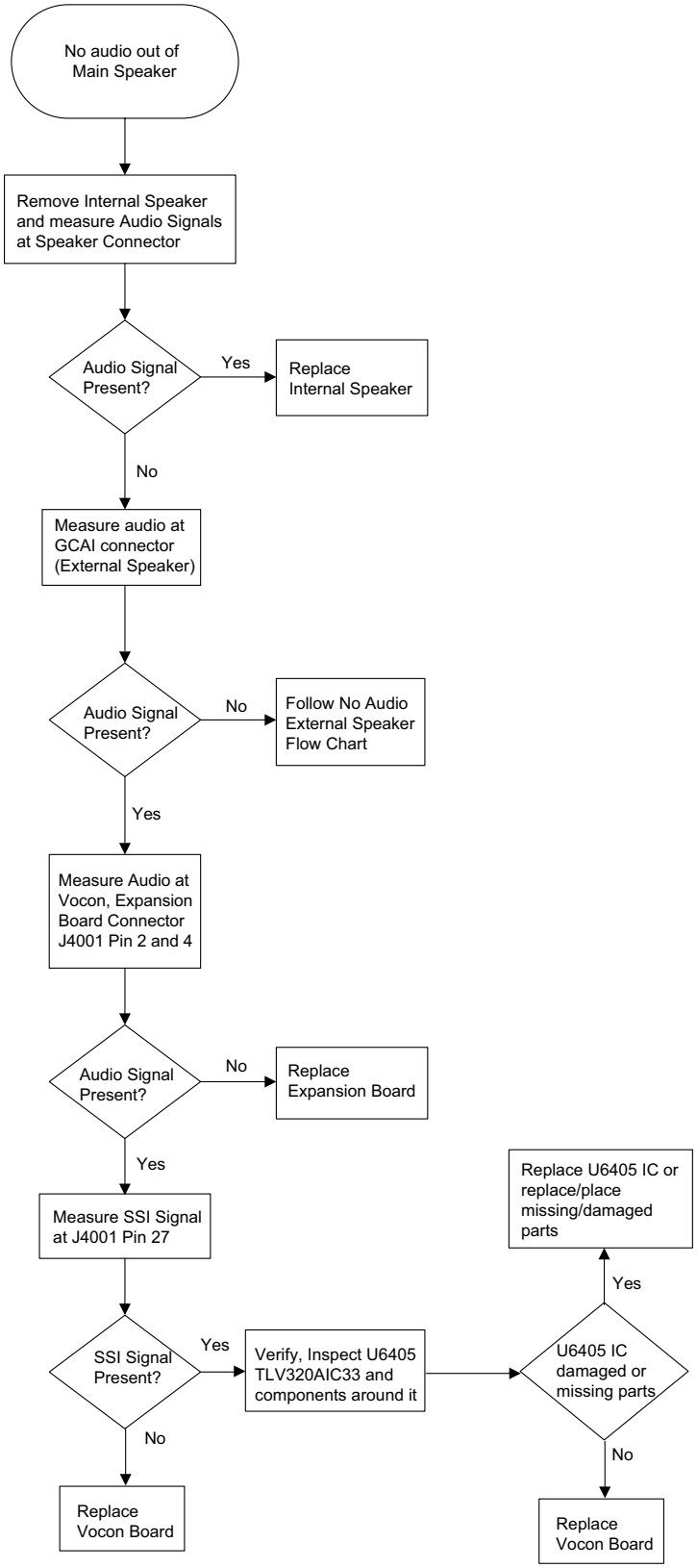
5.10 Side Button Error



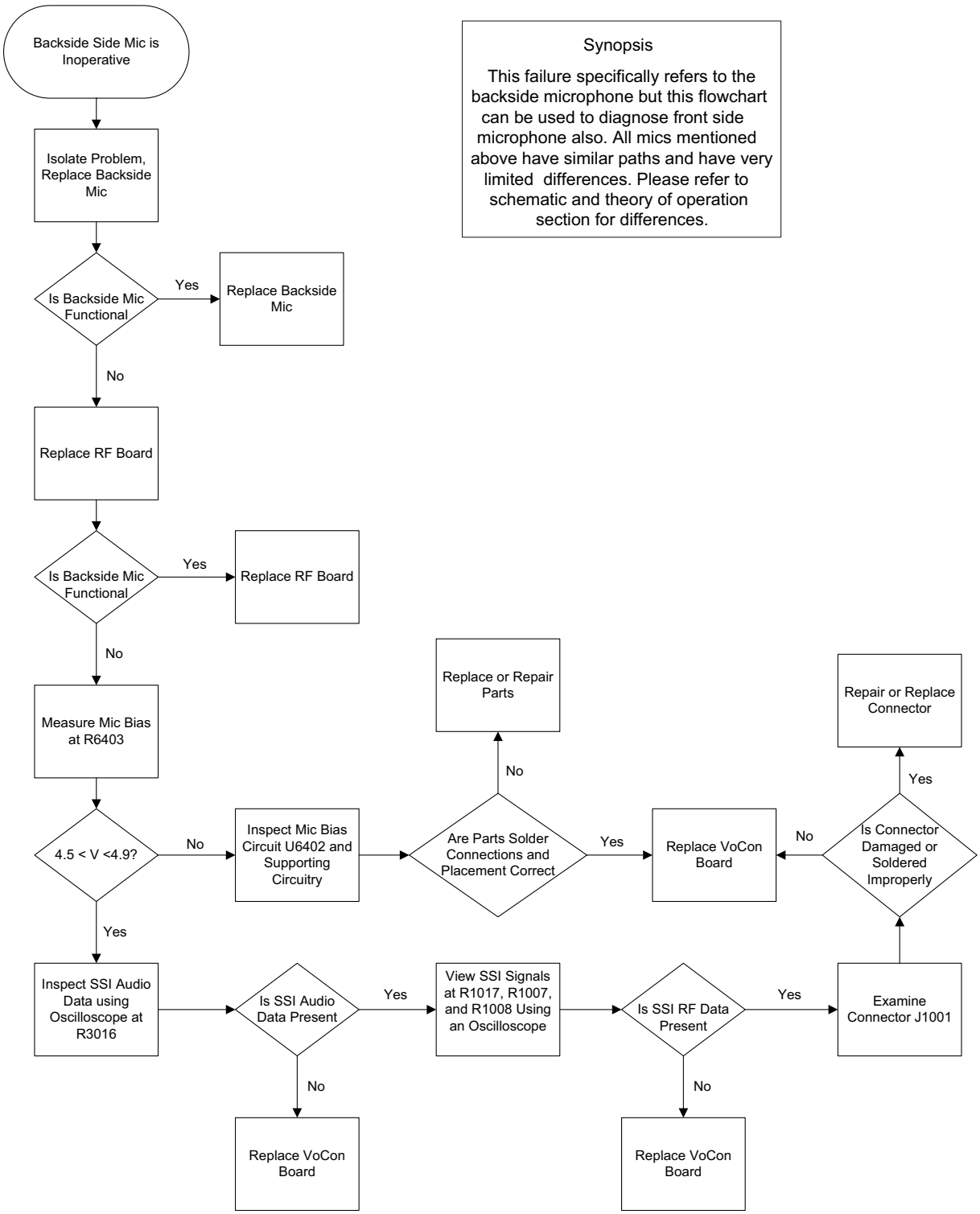
5.11 VOCON RX Audio Error – External Audio



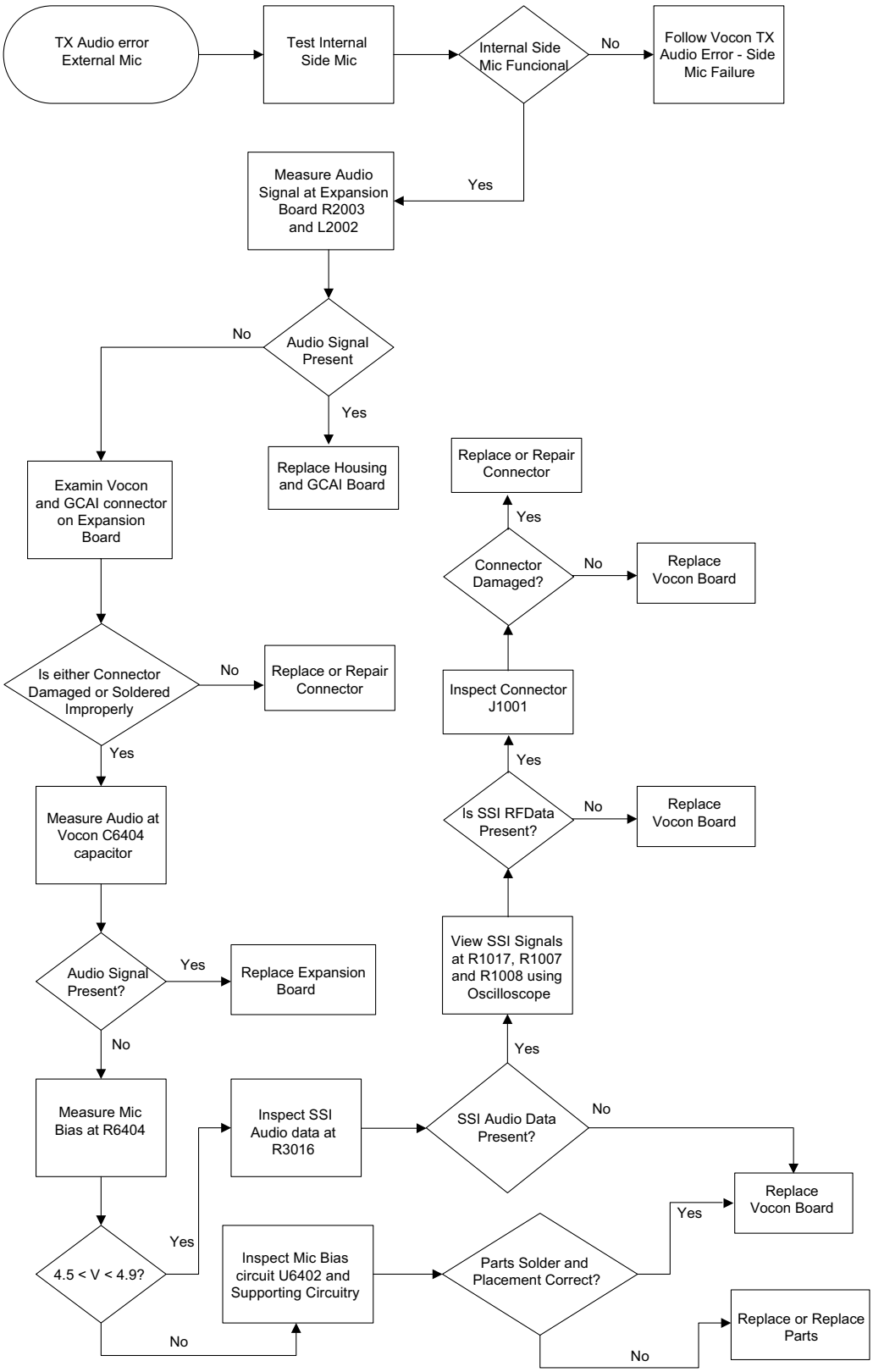
5.12 VOCON RX Audio Error – Internal Audio



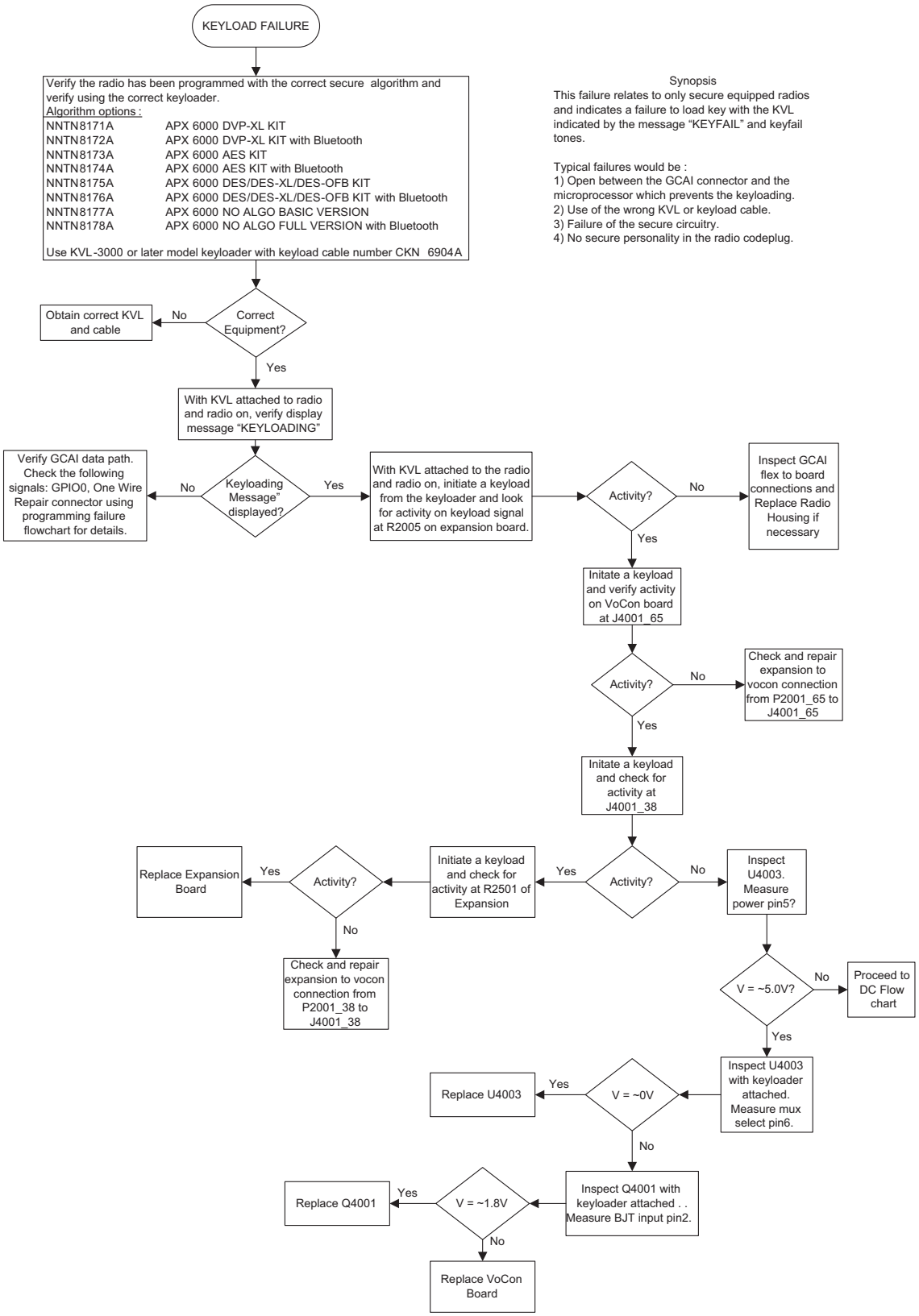
5.13 VOCON TX Audio Error – Backside Microphone



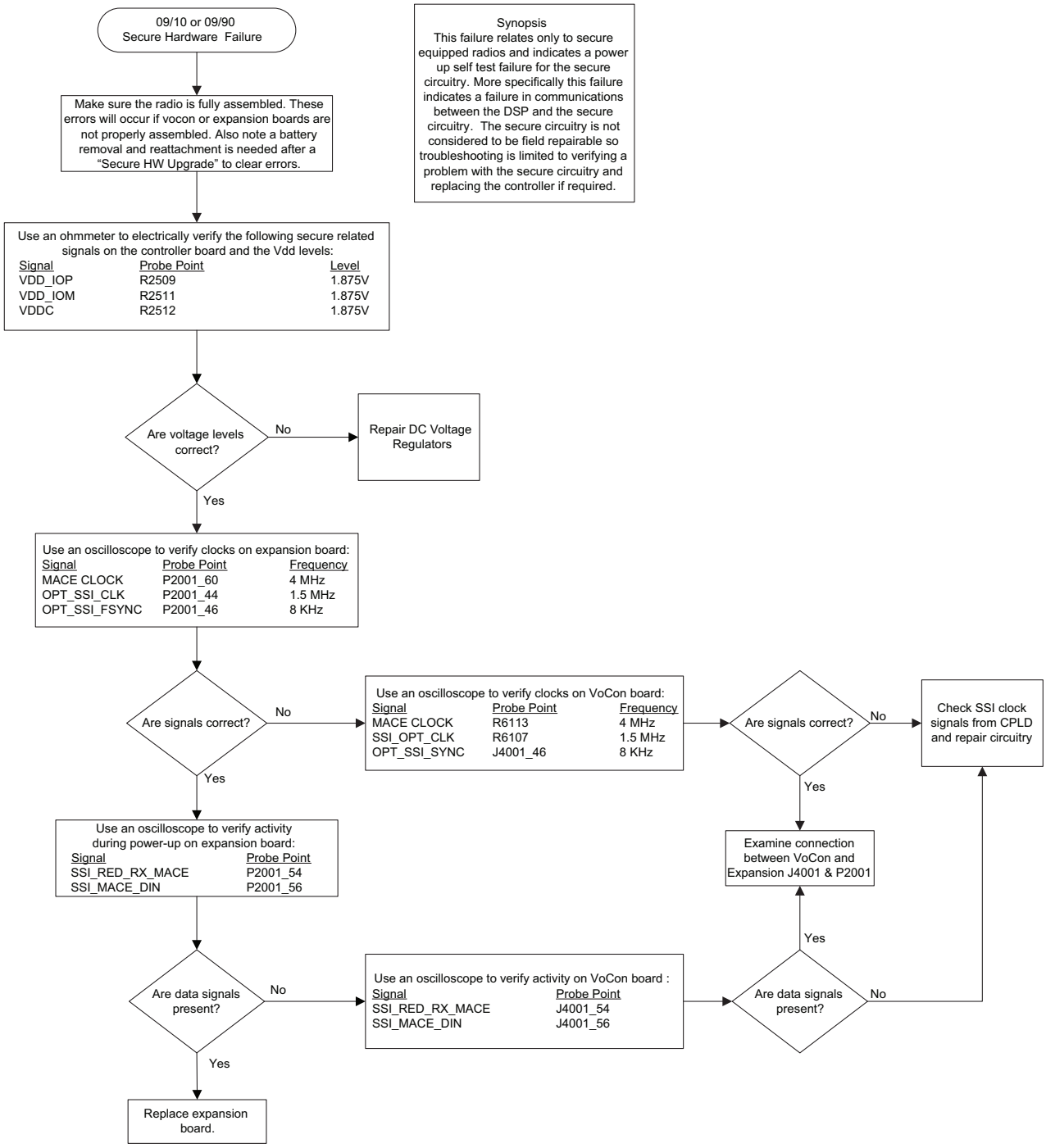
5.14 VOCON TX Audio Error – External Mic Failure



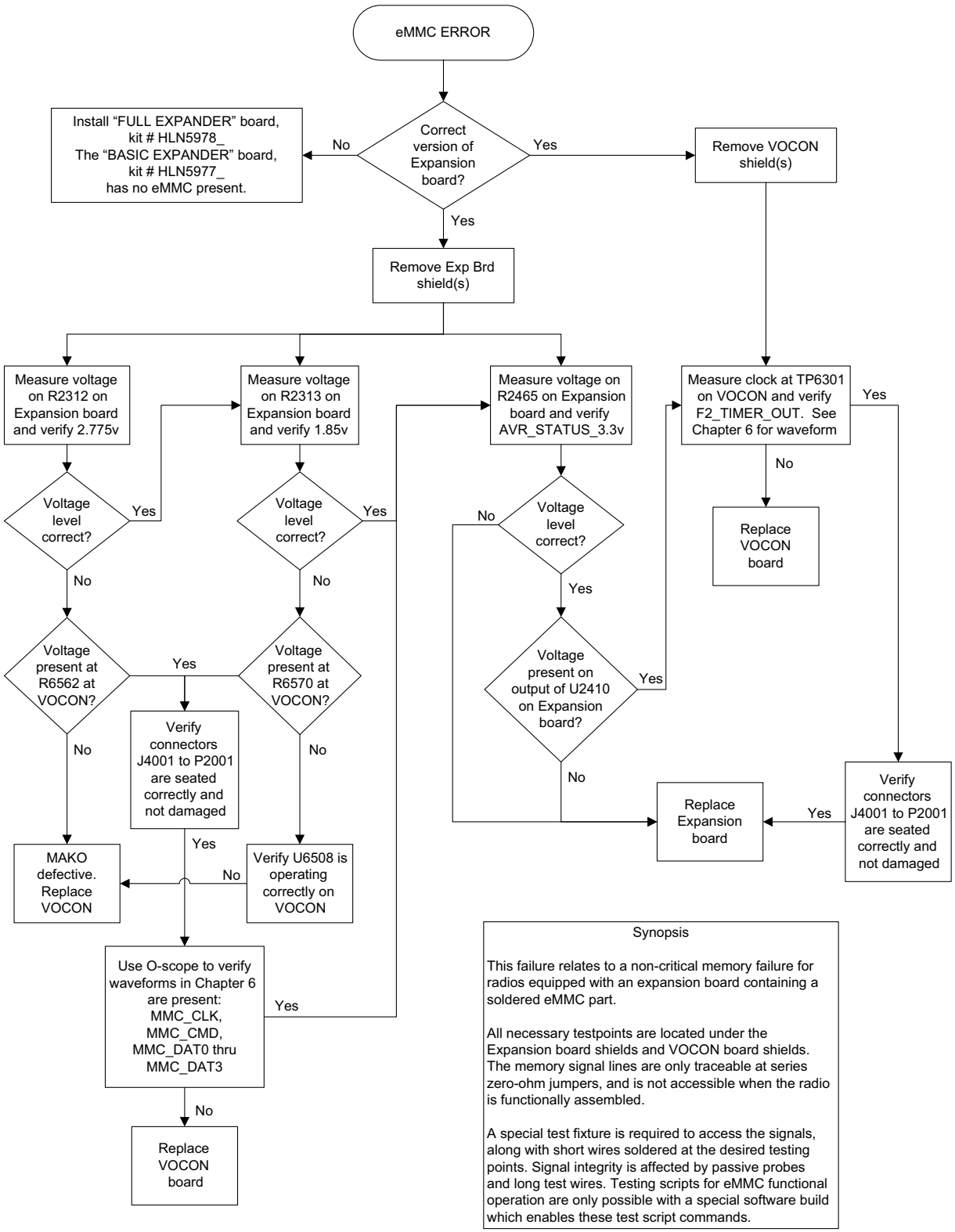
5.15 Keyload Failure



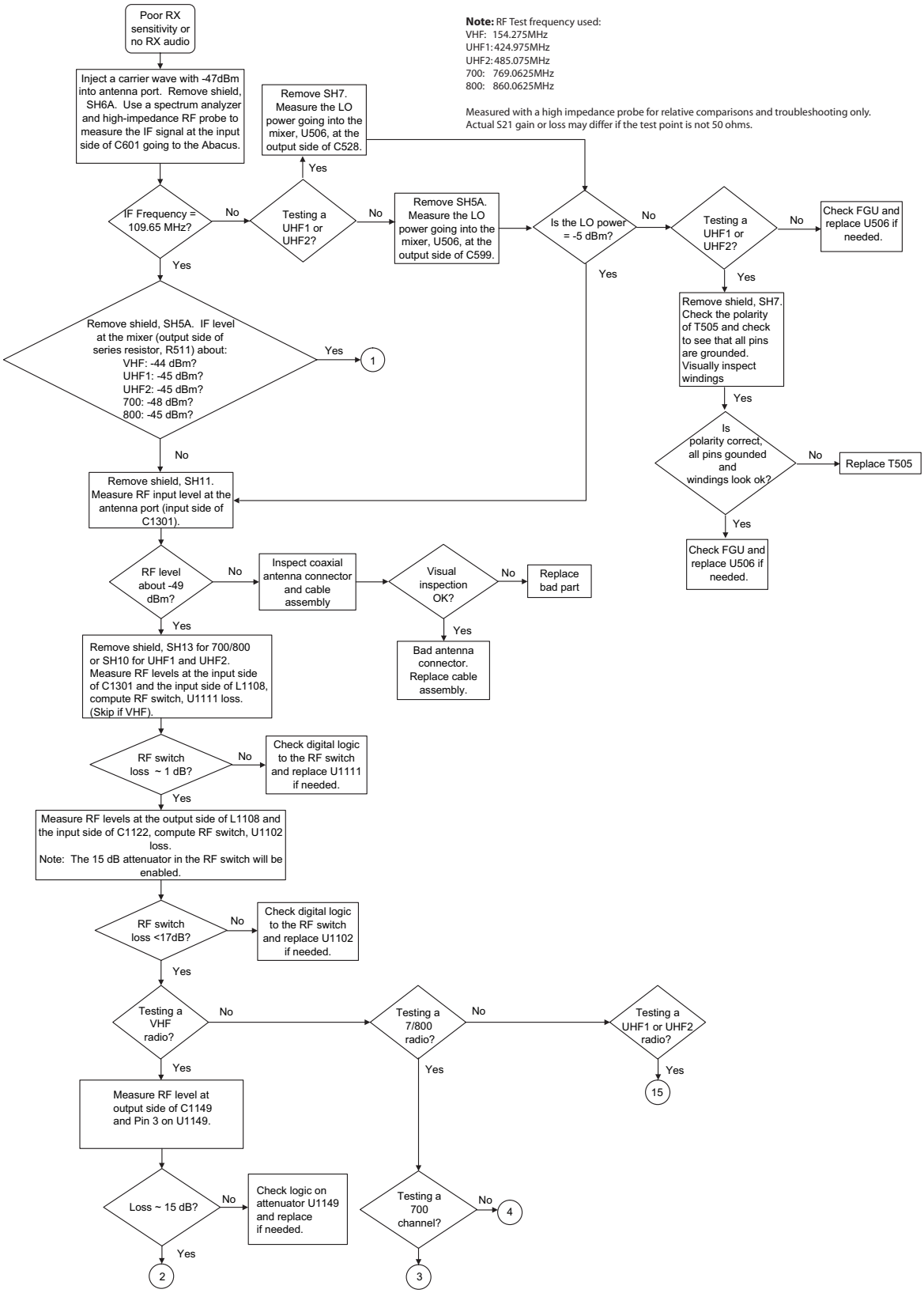
5.16 Secure Hardware Failure



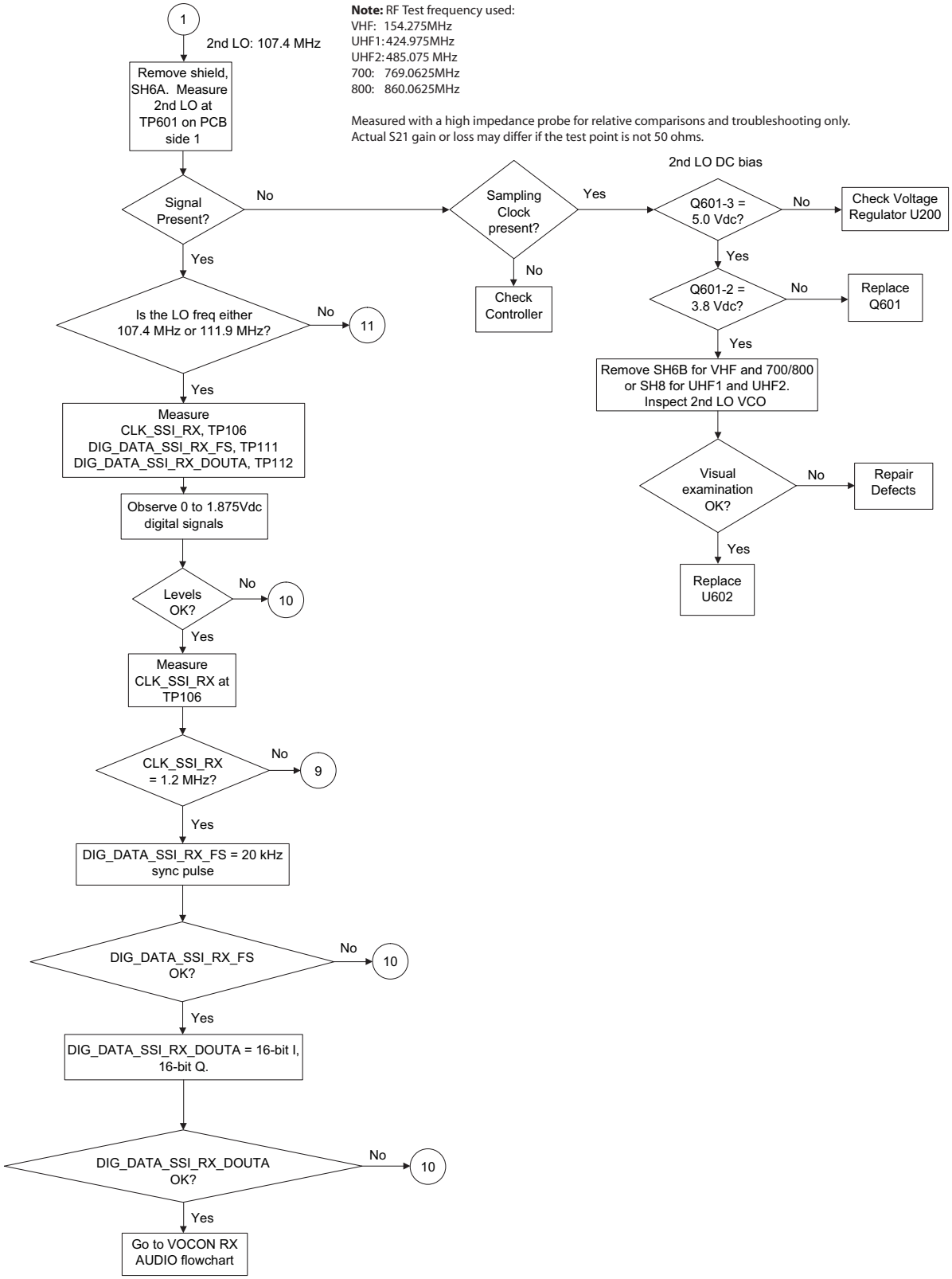
5.17 eMMC Memory Failure



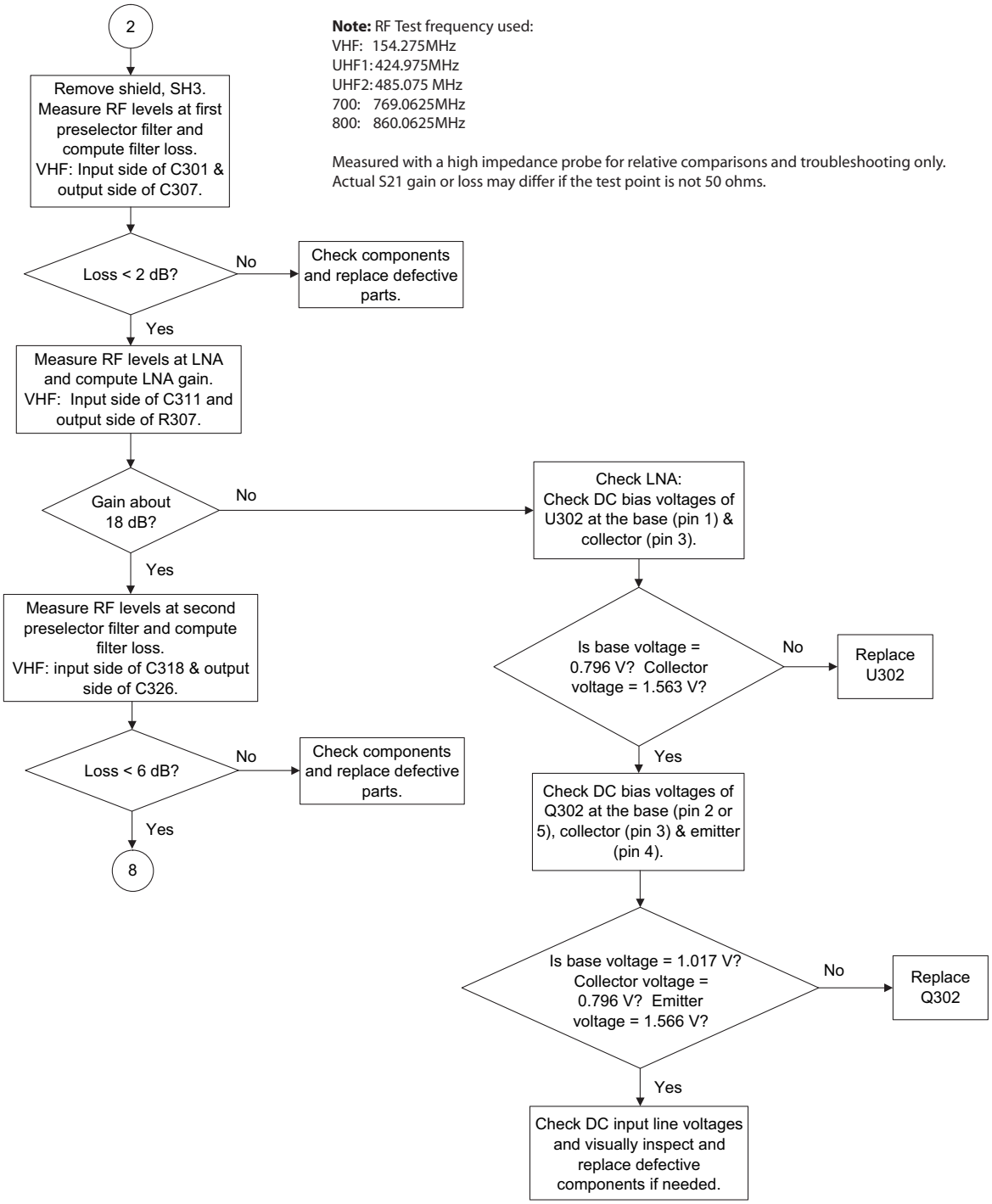
5.18 RX RF Failure – Page 1



RX RF Failure – Page 2



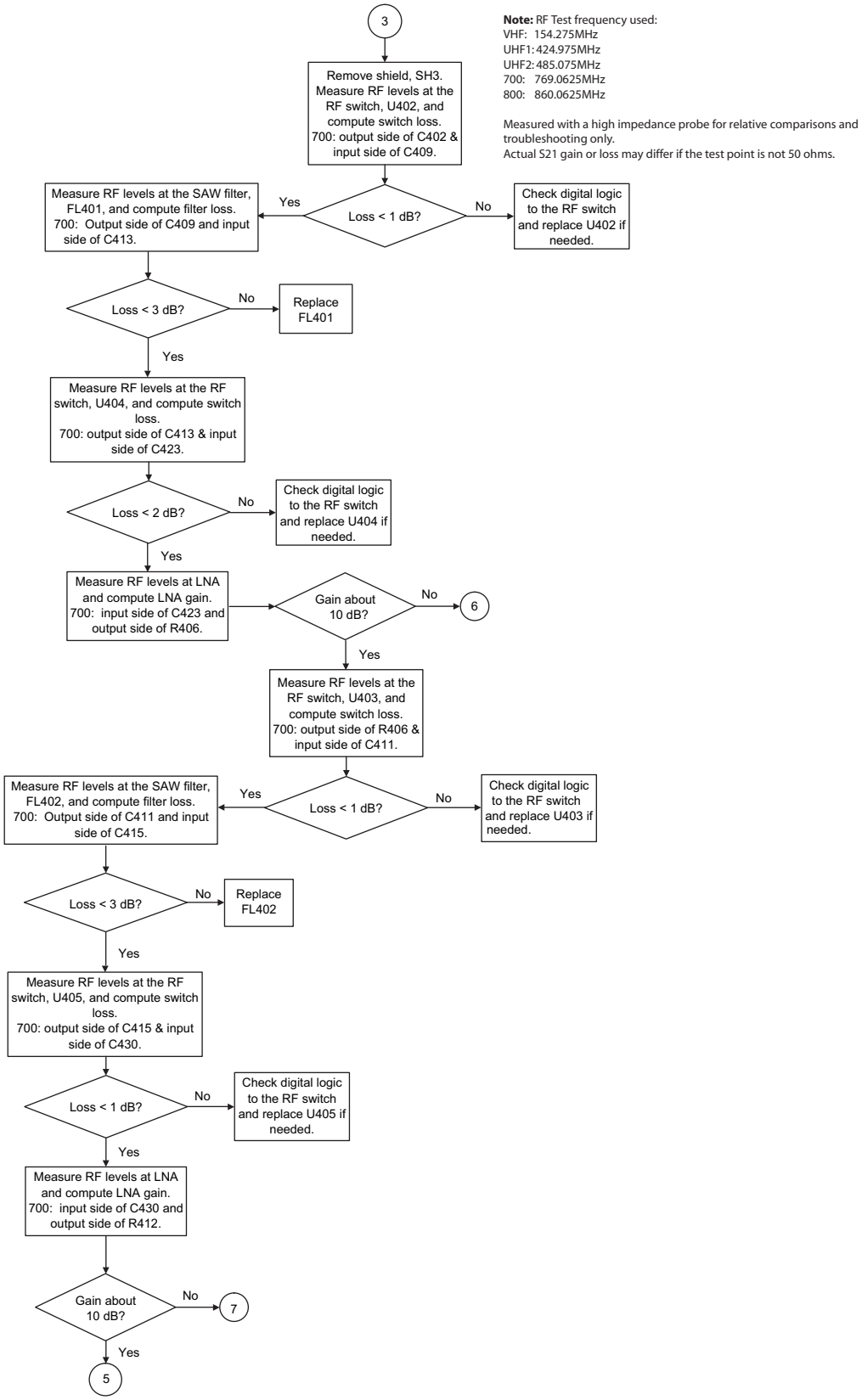
RX RF Failure – Page 3



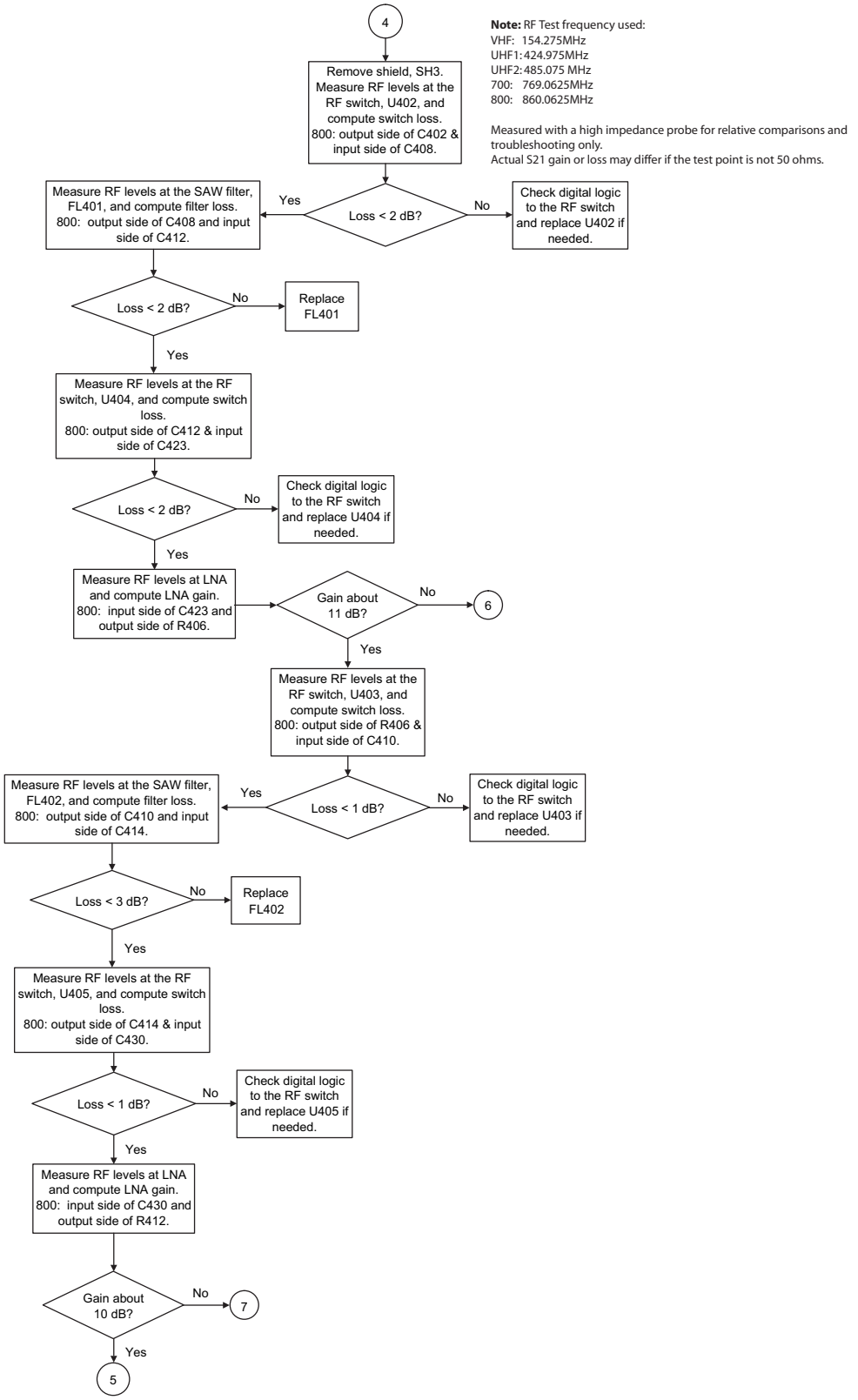
Note: RF Test frequency used:
VHF: 154.275MHz
UHF1: 424.975MHz
UHF2: 485.075 MHz
700: 769.0625MHz
800: 860.0625MHz

Measured with a high impedance probe for relative comparisons and troubleshooting only. Actual S21 gain or loss may differ if the test point is not 50 ohms.

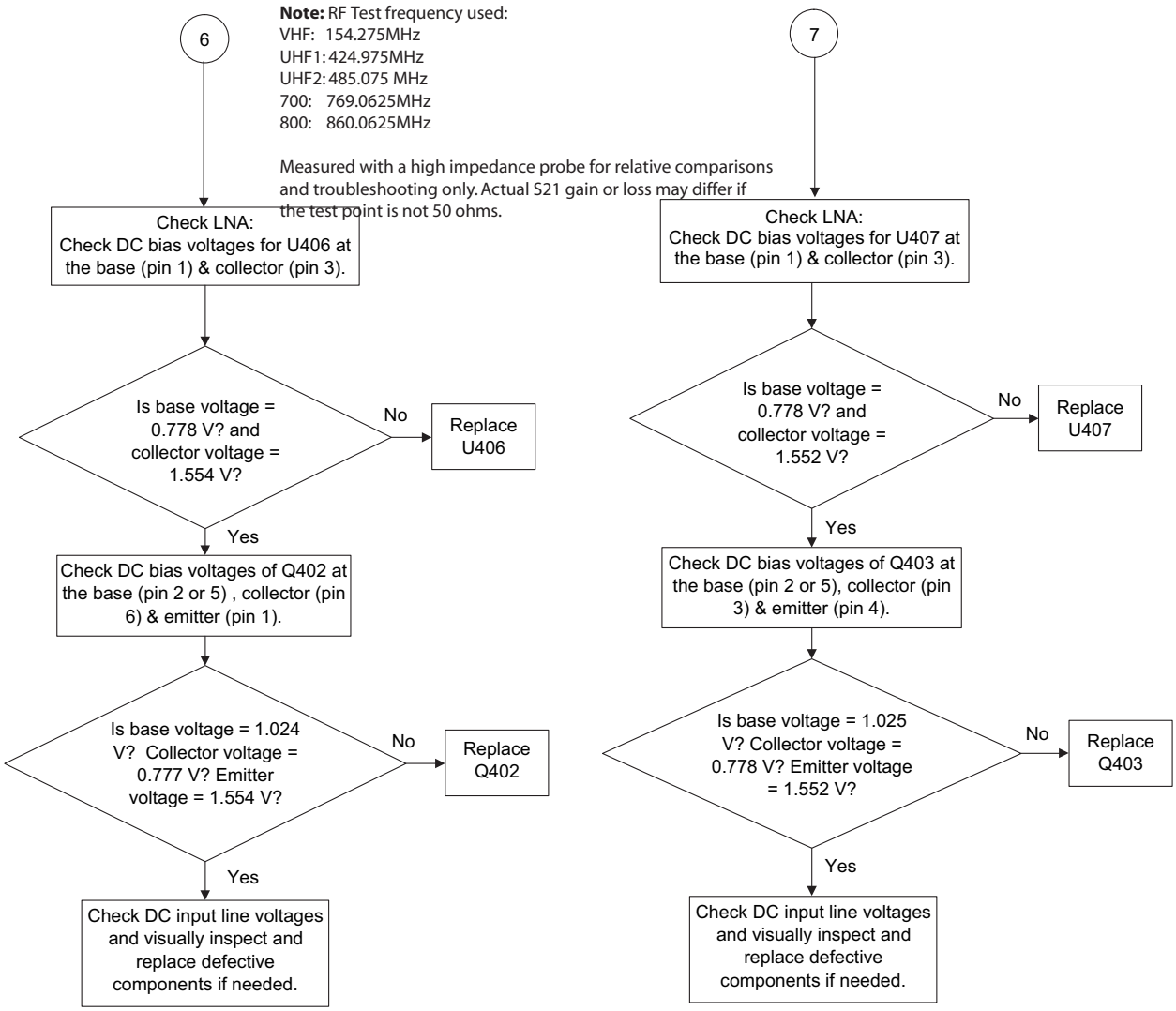
RX RF Failure – Page 4



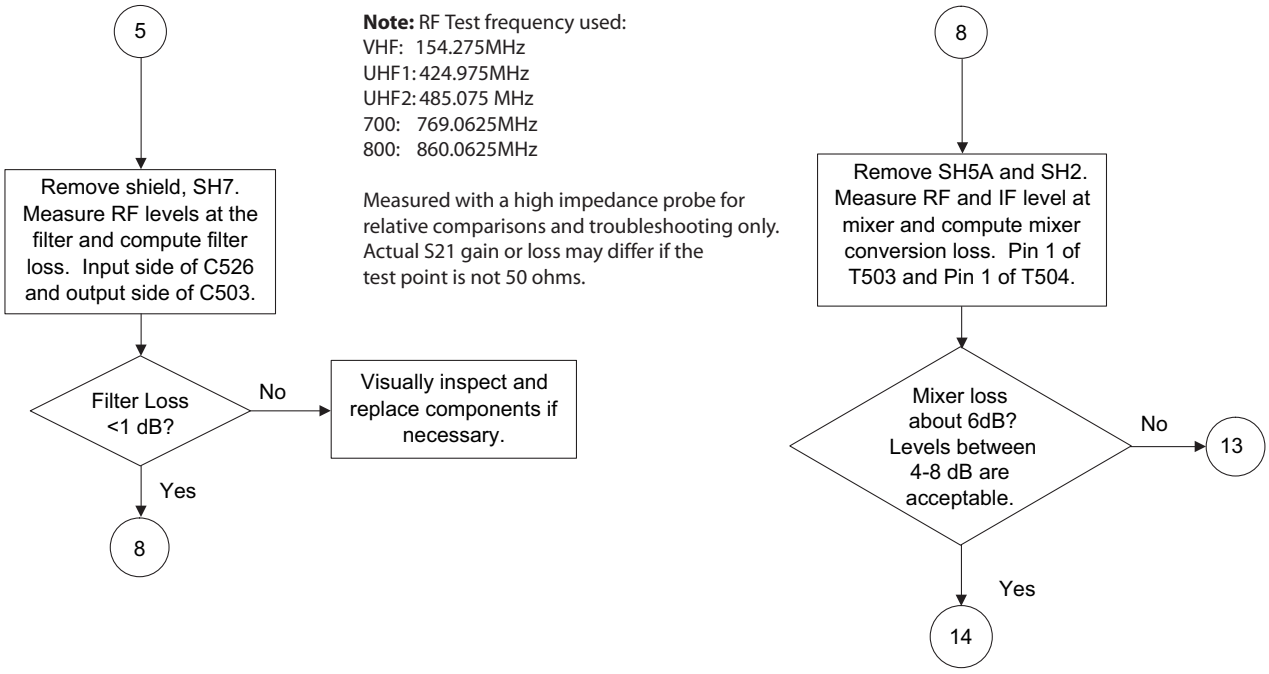
RX RF Failure – Page 5



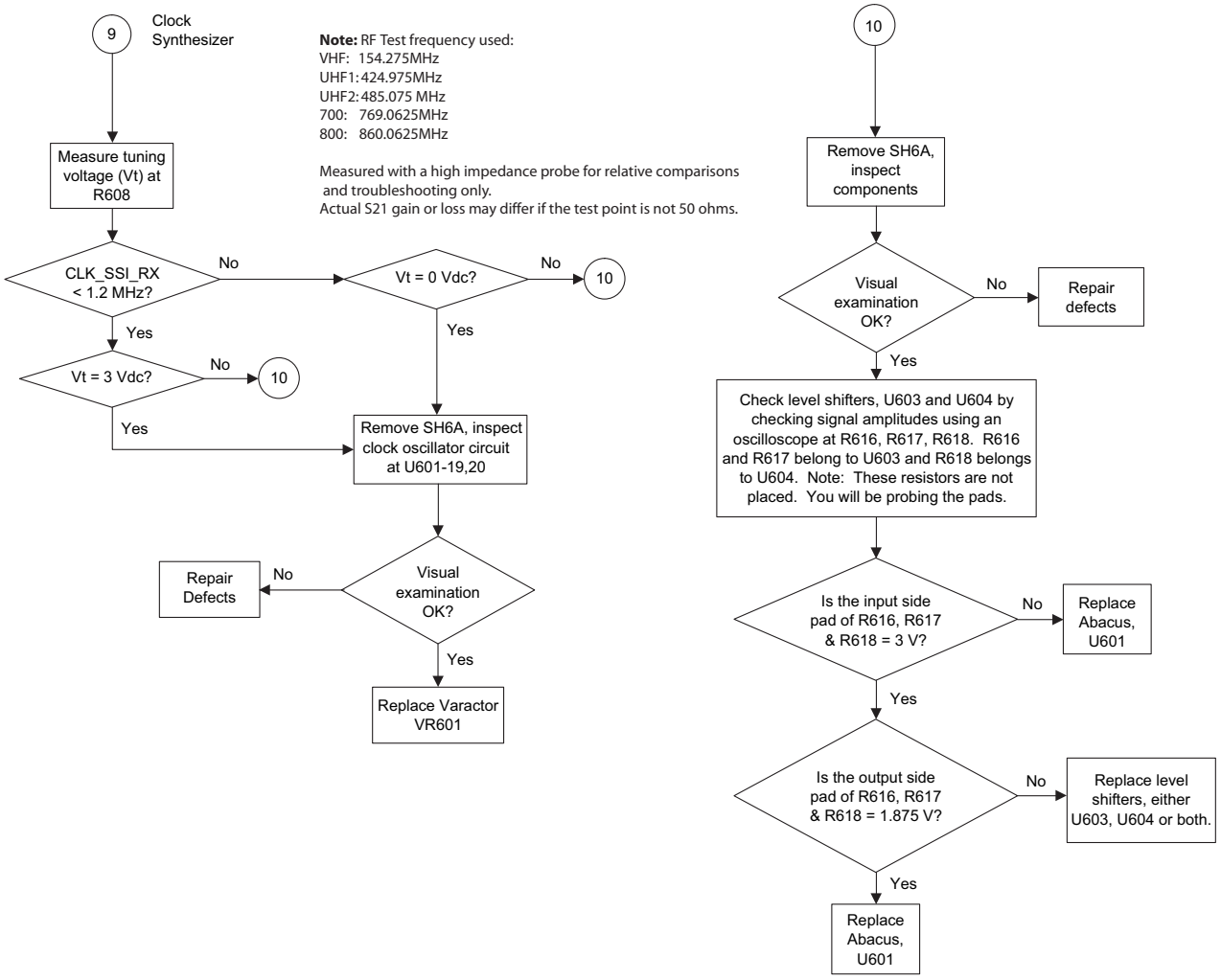
RX RF Failure – Page 6



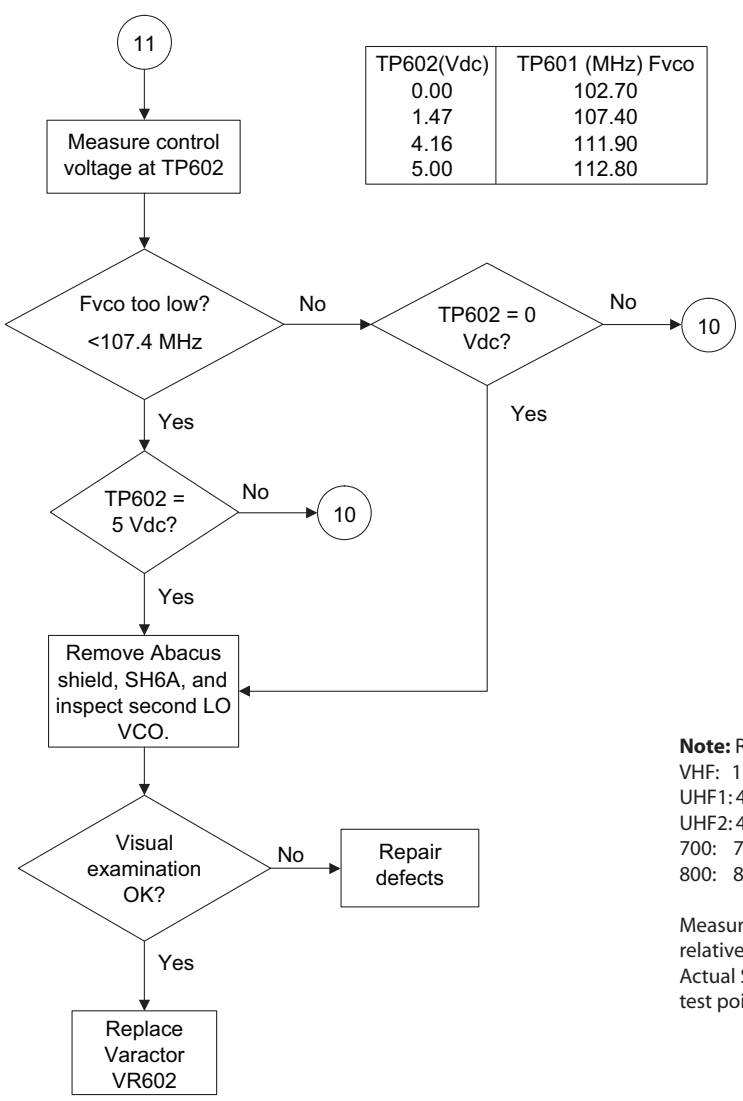
RX RF Failure – Page 7



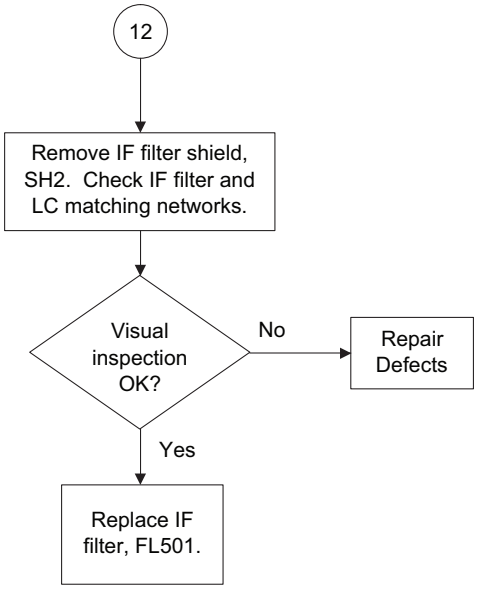
RX RF Failure – Page 8



RX RF Failure – Page 9



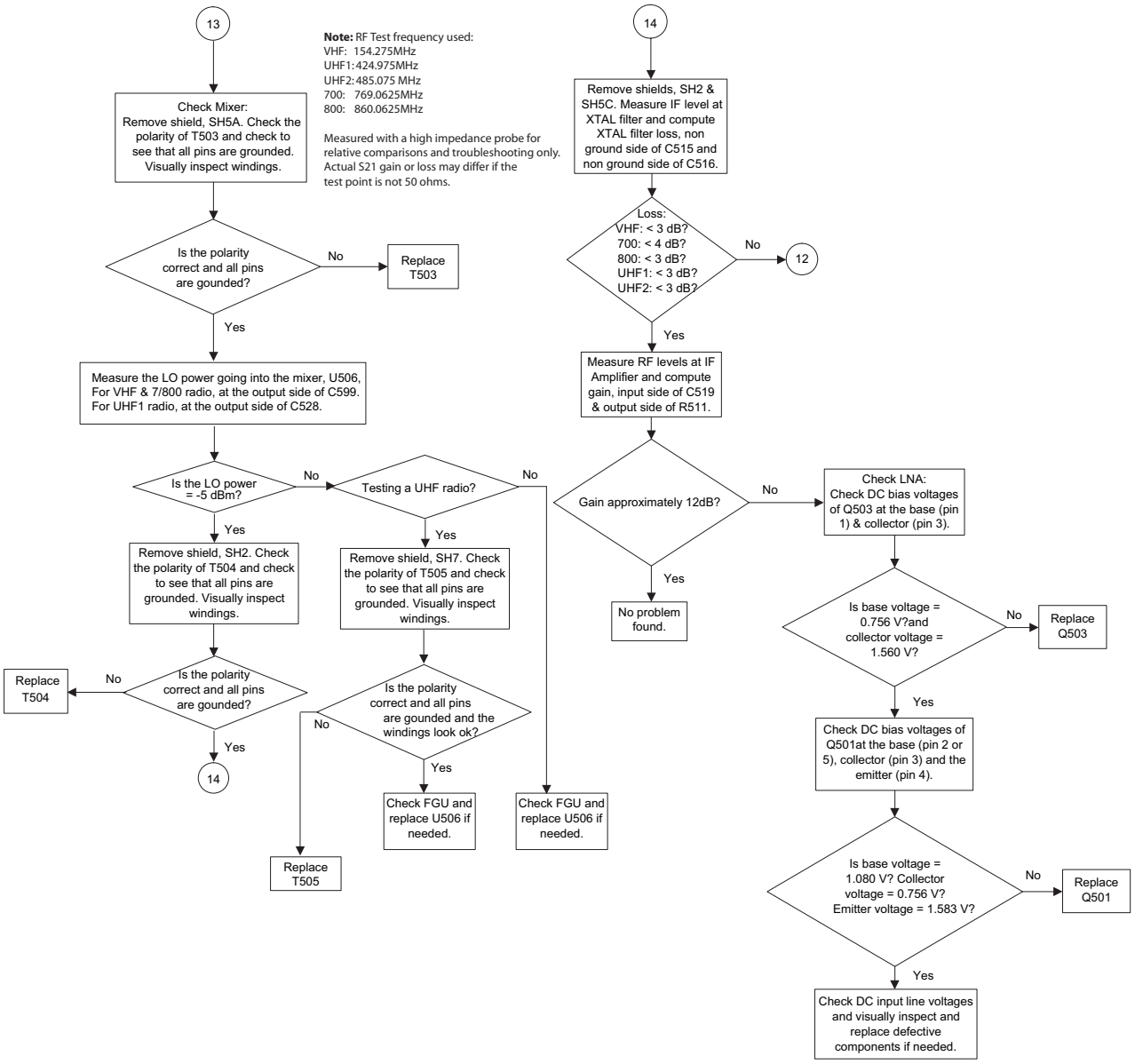
TP602(Vdc)	TP601 (MHz) Fvco
0.00	102.70
1.47	107.40
4.16	111.90
5.00	112.80



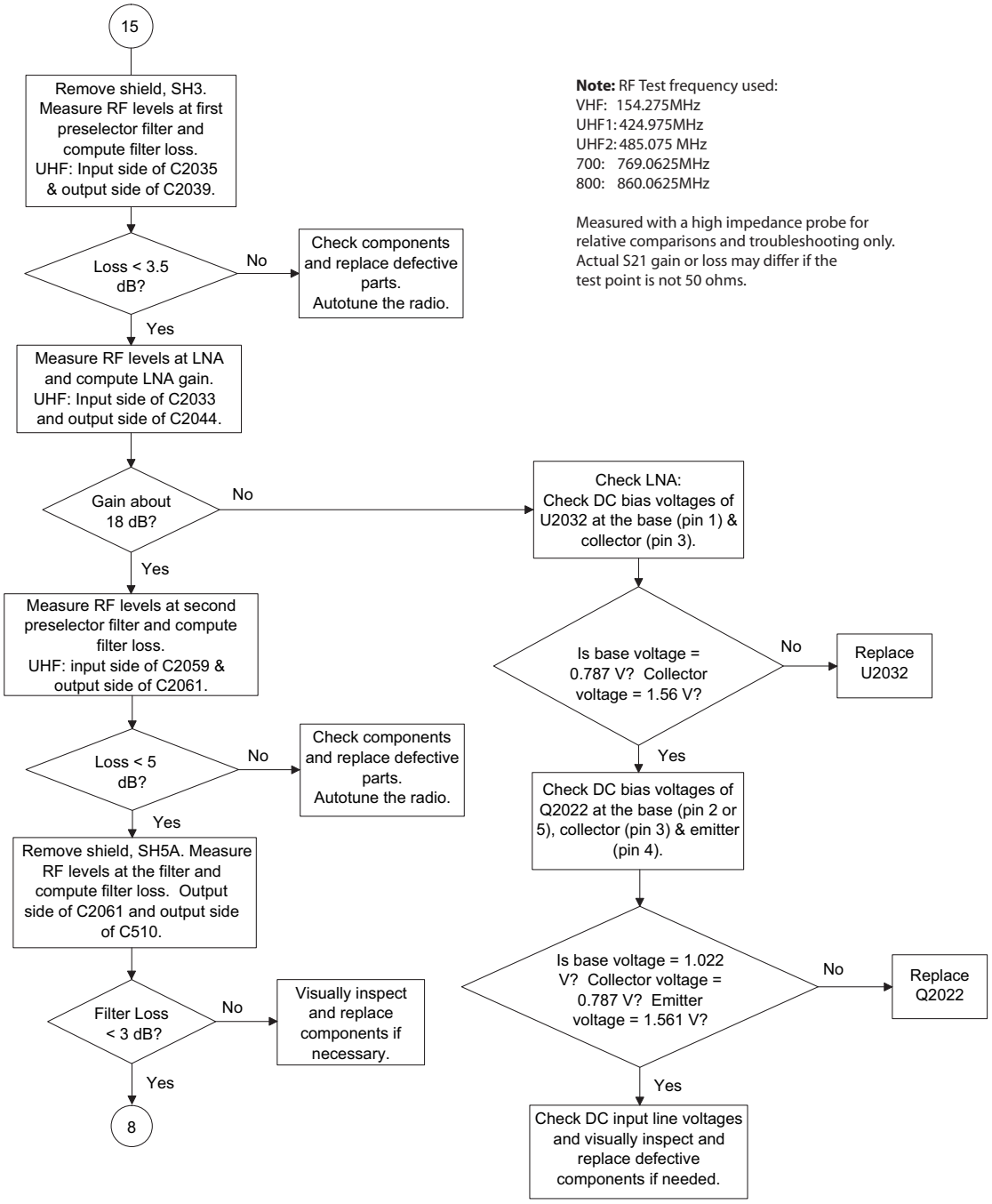
Note: RF Test frequency used:
VHF: 154.275MHz
UHF1: 424.975MHz
UHF2: 485.075MHz
700: 769.0625MHz
800: 860.0625MHz

Measured with a high impedance probe for relative comparisons and troubleshooting only. Actual S21 gain or loss may differ if the test point is not 50 ohms.

RX RF Failure – Page 10



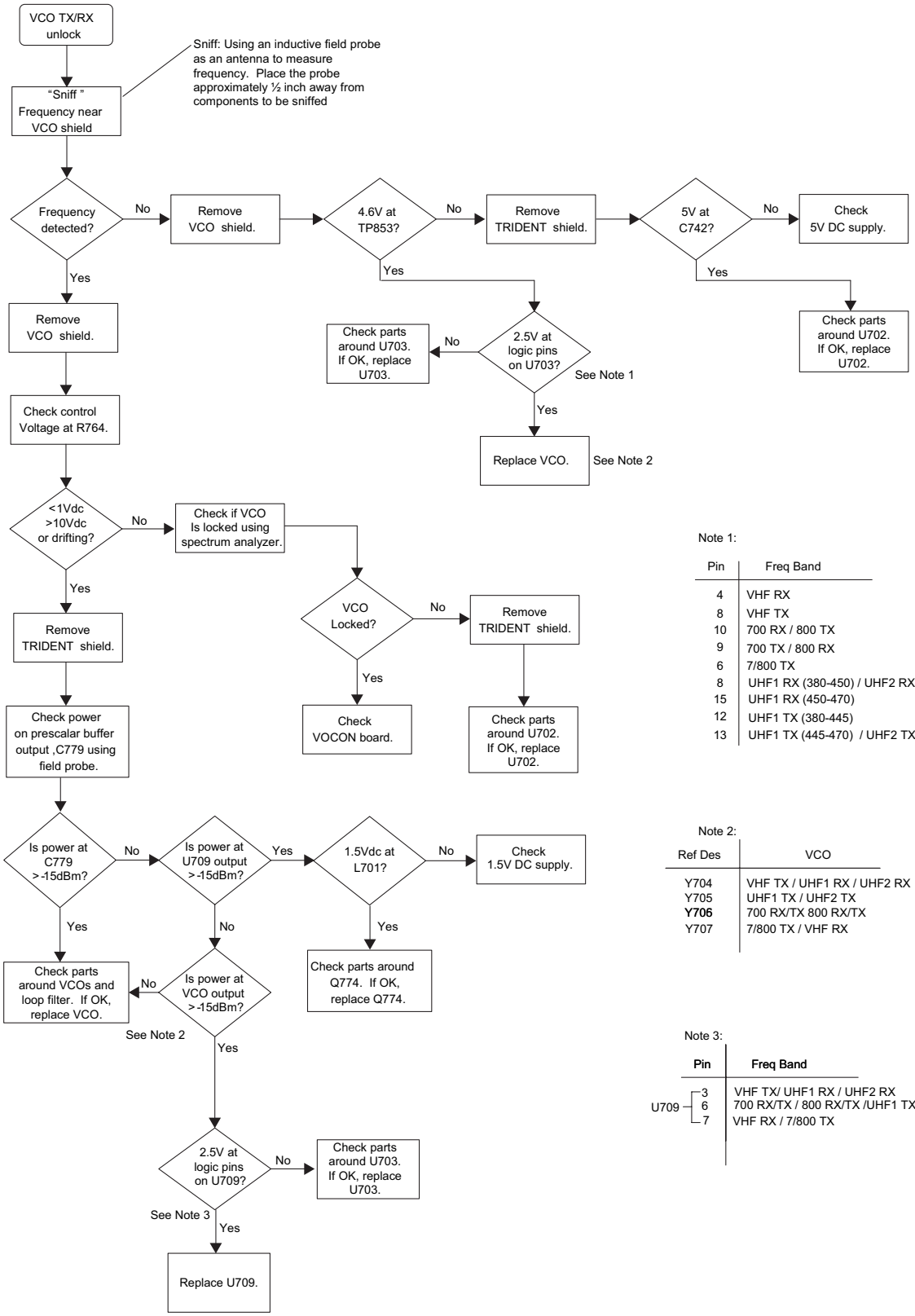
RX RF Failure – Page 11



Note: RF Test frequency used:
VHF: 154.275MHz
UHF1: 424.975MHz
UHF2: 485.075 MHz
700: 769.0625MHz
800: 860.0625MHz

Measured with a high impedance probe for relative comparisons and troubleshooting only. Actual S21 gain or loss may differ if the test point is not 50 ohms.

5.19 FGU Failure



Note 1:

Pin	Freq Band
4	VHF RX
8	VHF TX
10	700 RX / 800 TX
9	700 TX / 800 RX
6	7/800 TX
8	UHF1 RX (380-450) / UHF2 RX (450-520)
15	UHF1 RX (450-470)
12	UHF1 TX (380-445)
13	UHF1 TX (445-470) / UHF2 TX (450-520)

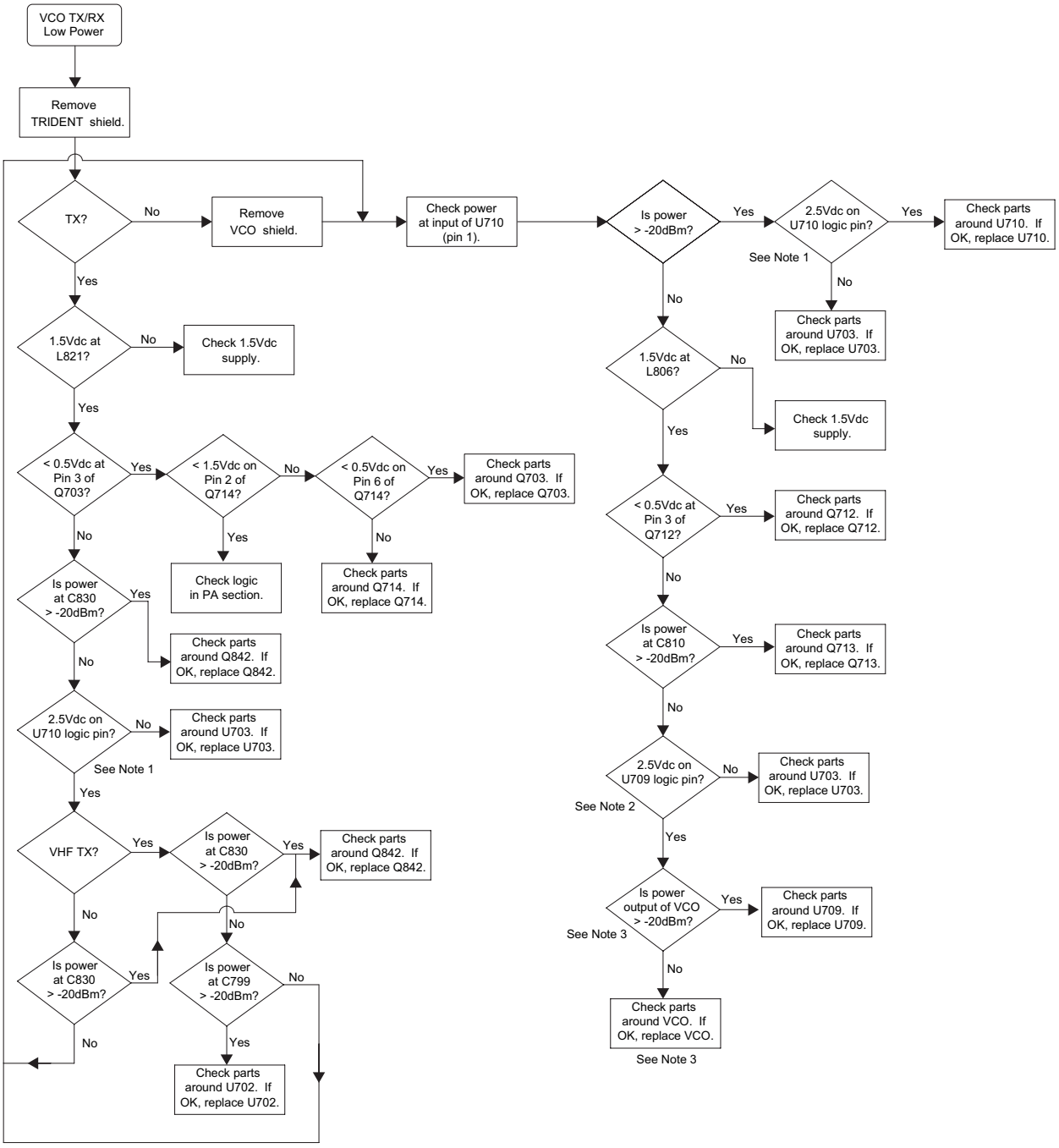
Note 2:

Ref Des	VCO
Y704	VHF TX / UHF1 RX / UHF2 RX
Y705	UHF1 TX / UHF2 TX
Y706	700 RX/TX 800 RX/TX
Y707	7/800 TX / VHF RX

Note 3:

	Pin	Freq Band
U709	3	VHF TX/ UHF1 RX / UHF2 RX
	6	700 RX/TX / 800 RX/TX /UHF1 TX/UHF2 TX
	7	VHF RX / 7/800 TX

5.20 FGU Power Failure



Note 1:

U710 Pin	Freq Band
3	700 / 800 / VHF RX / UHF1 RX/ UHF2 RX
6	700 / 800 TX / 7/800 TX / UHF1 TX/ UHF2 TX
7	VHF TX

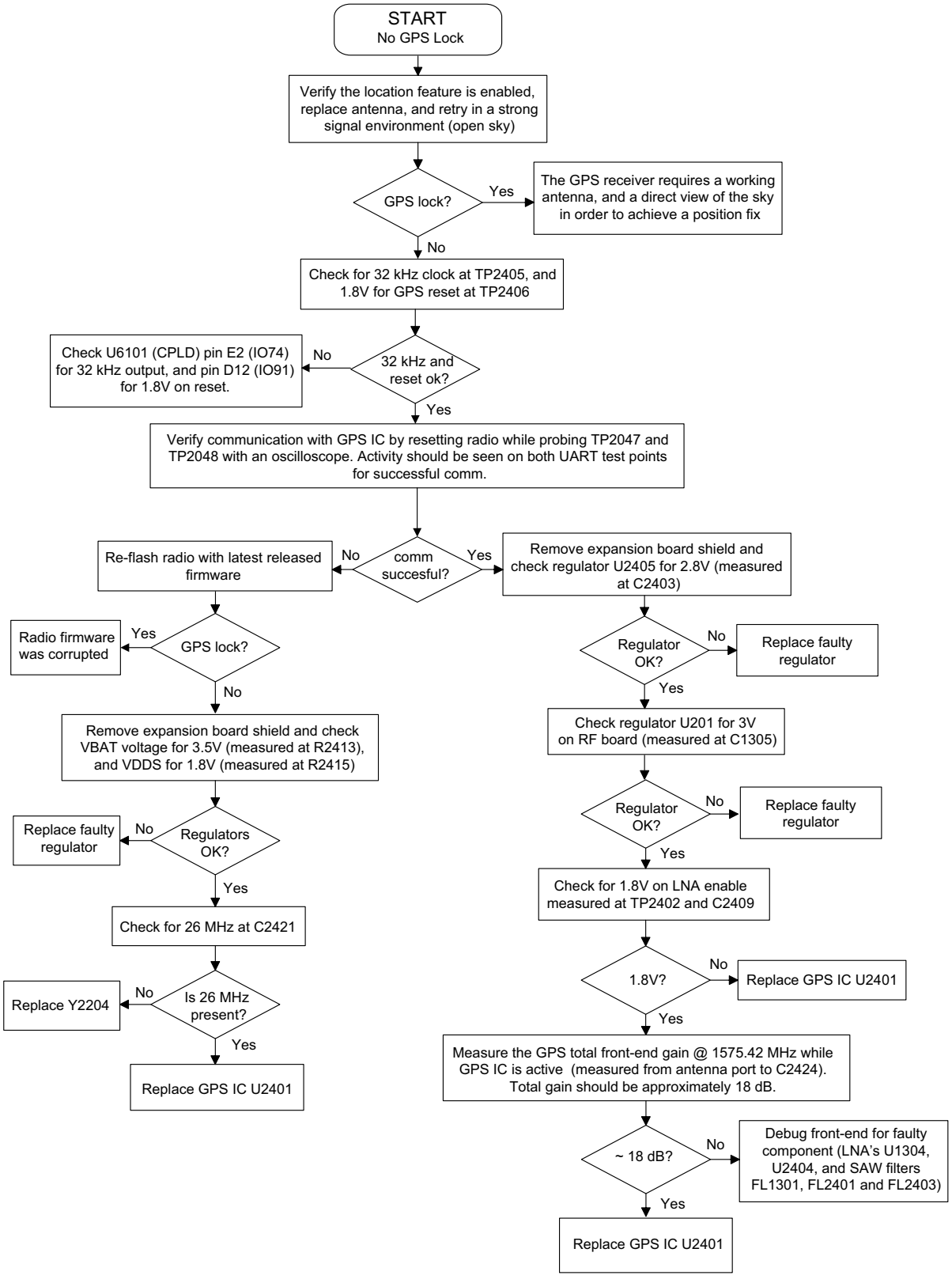
Note 2:

U709 Pin	Freq Band
3	VHF TX / UHF1 RX/ UHF2 RX
6	700 RX/TX / 800 RX/TX / UHF1 TX/ UHF2 TX
7	VHF RX / 7800 TX

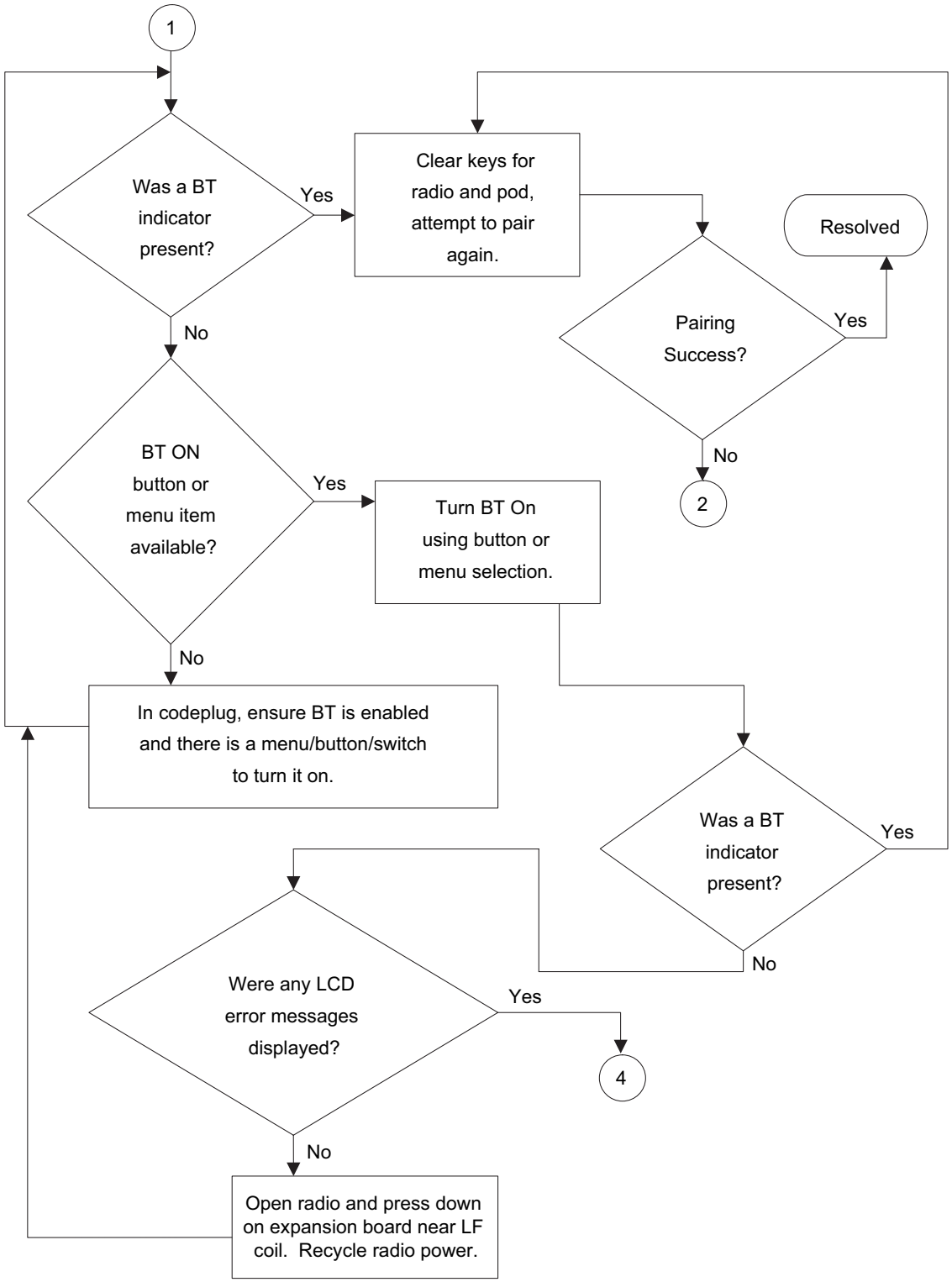
Note 3:

Ref Des	VCO
Y704	VHF TX / UHF1 RX/ UHF2 RX
Y705	UHF1 TX/ UHF2 TX
Y706	700 RX/TX 800 RX/TX
Y707	7/800 TX / VHF RX

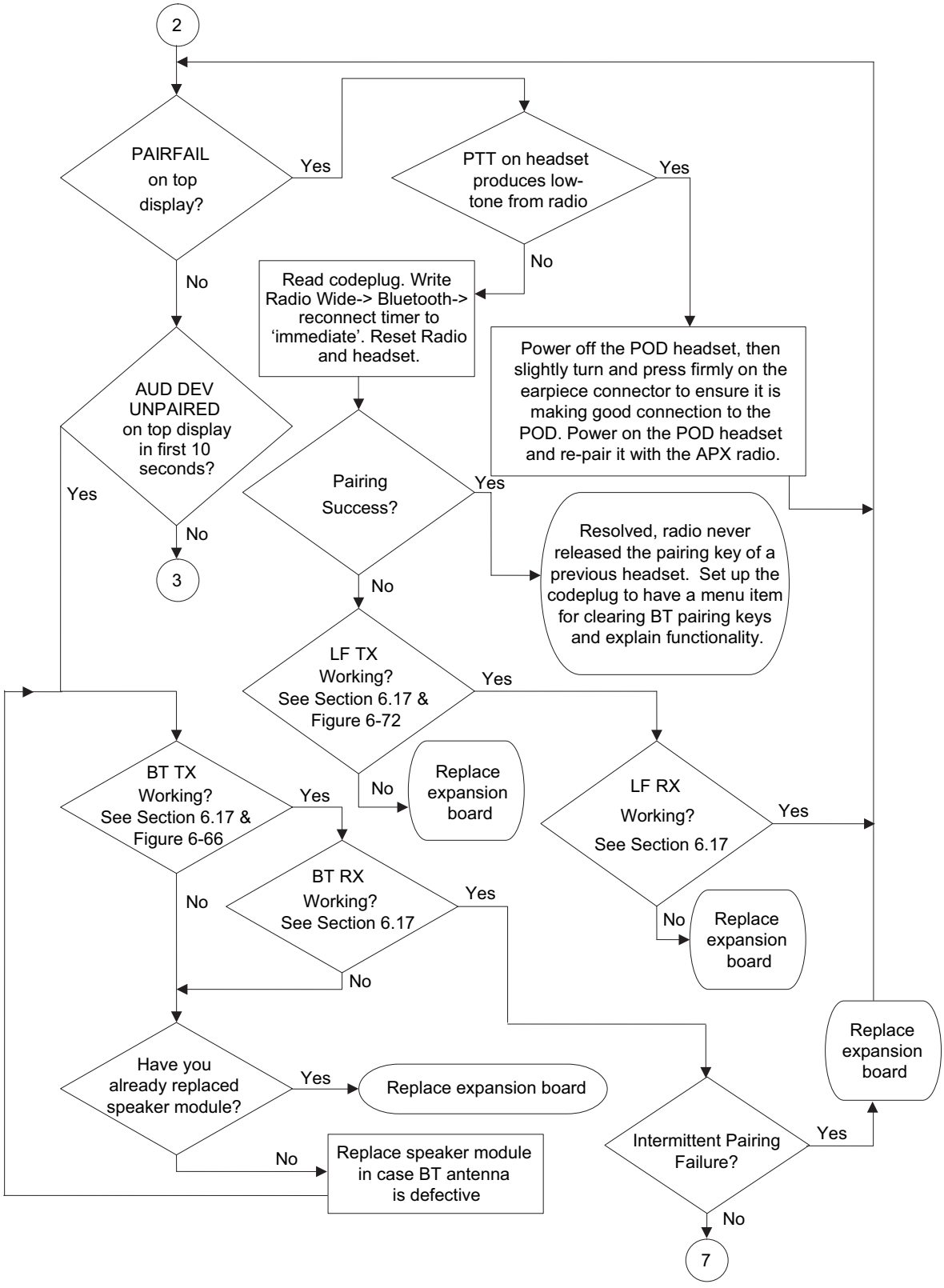
5.21 GPS Failure



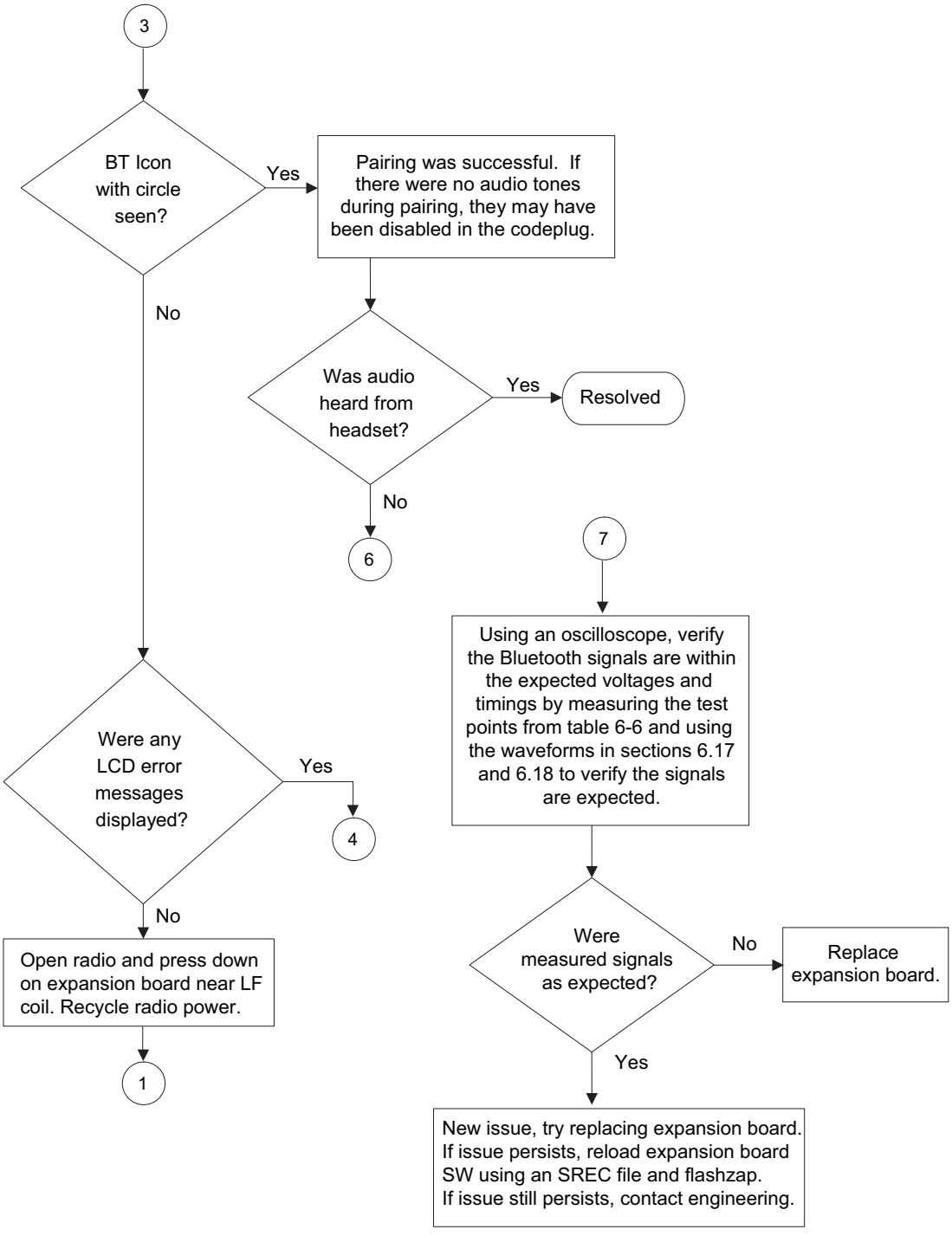
5.22 Bluetooth Failure – Page 1 (Pairing Issue)



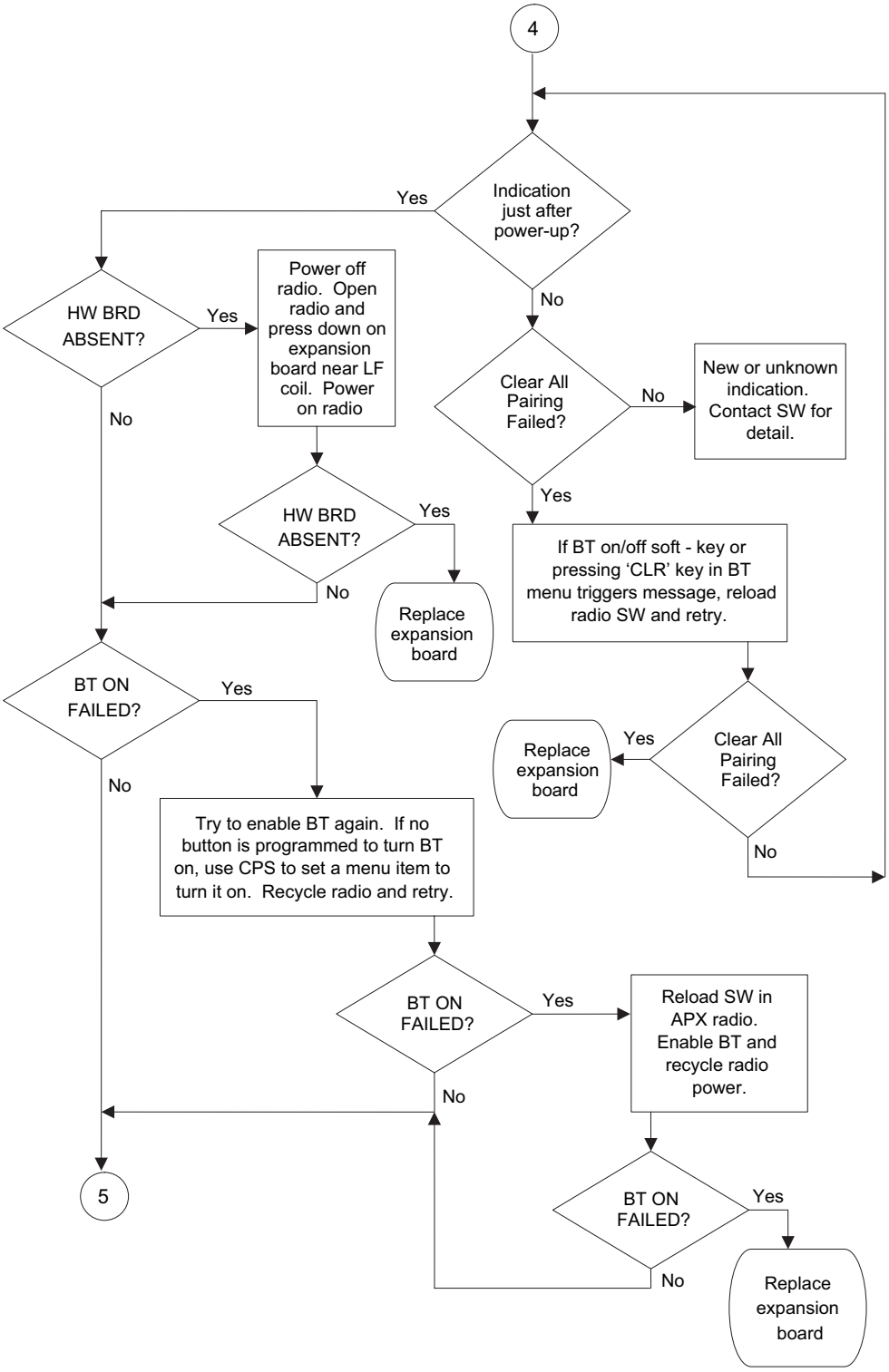
Bluetooth Failure – Page 2 (Pairing Issue)



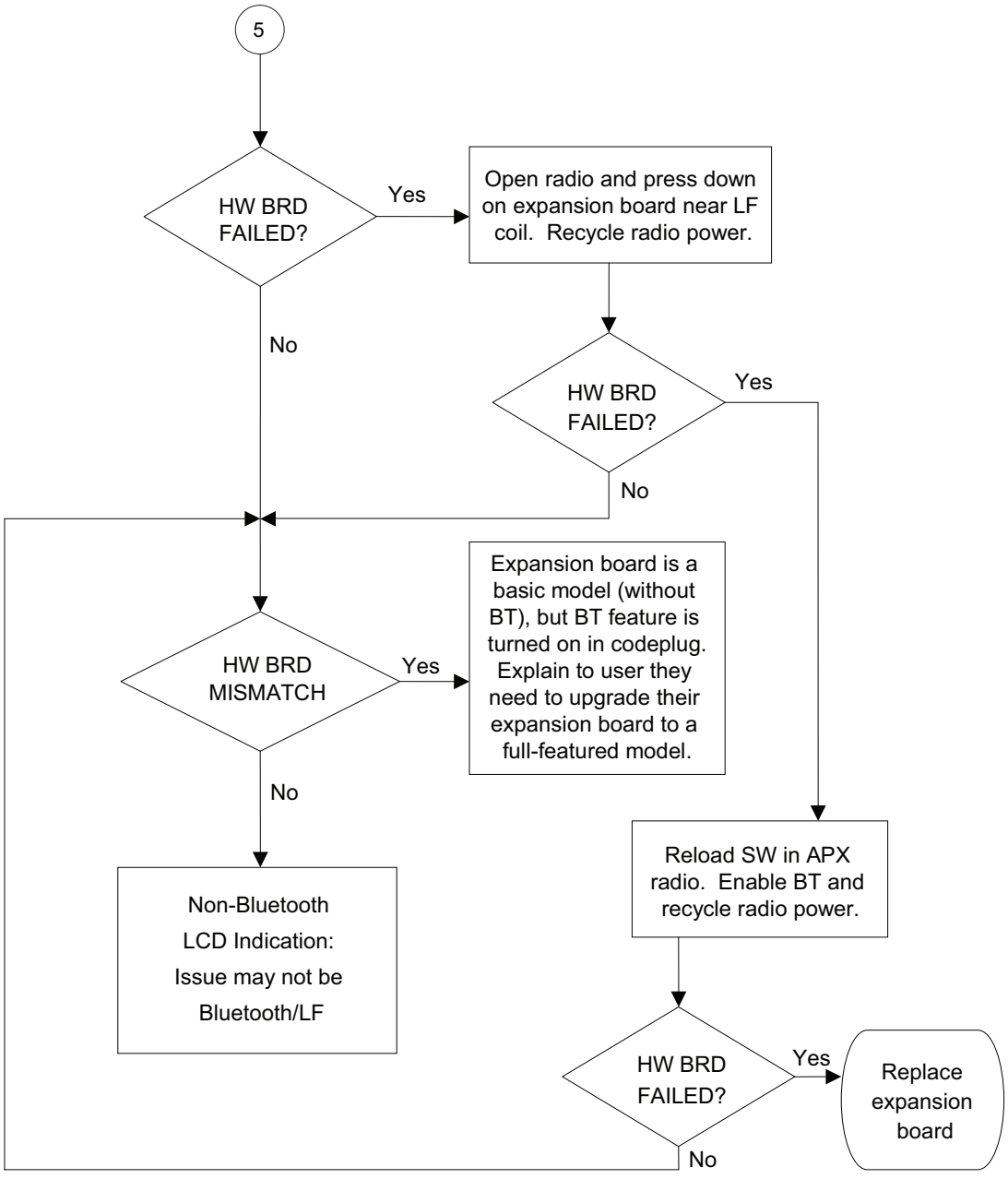
Bluetooth Failure – Page 3 (Pairing Issue)



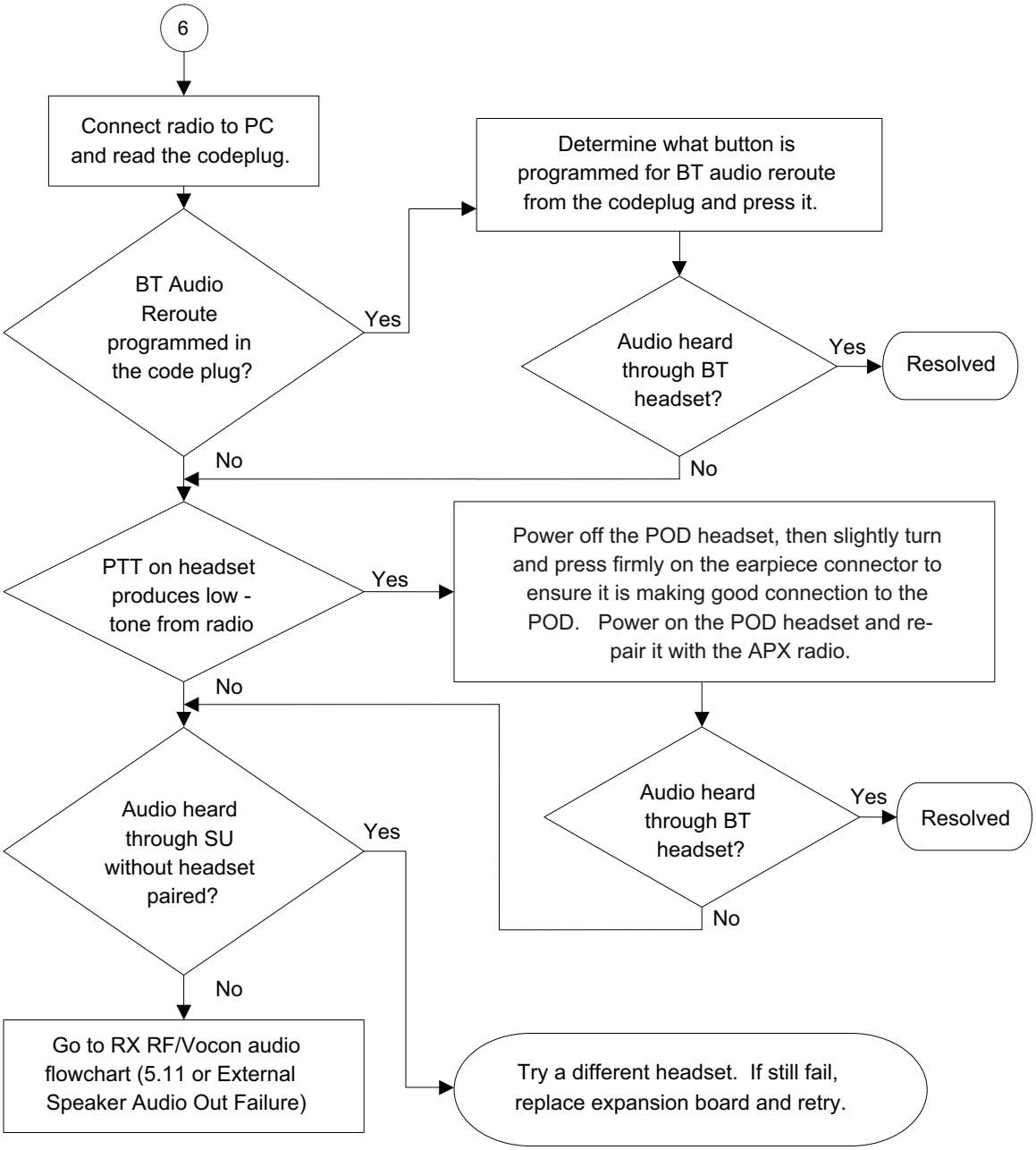
Bluetooth Failure – Page 4 (LCD Indication)



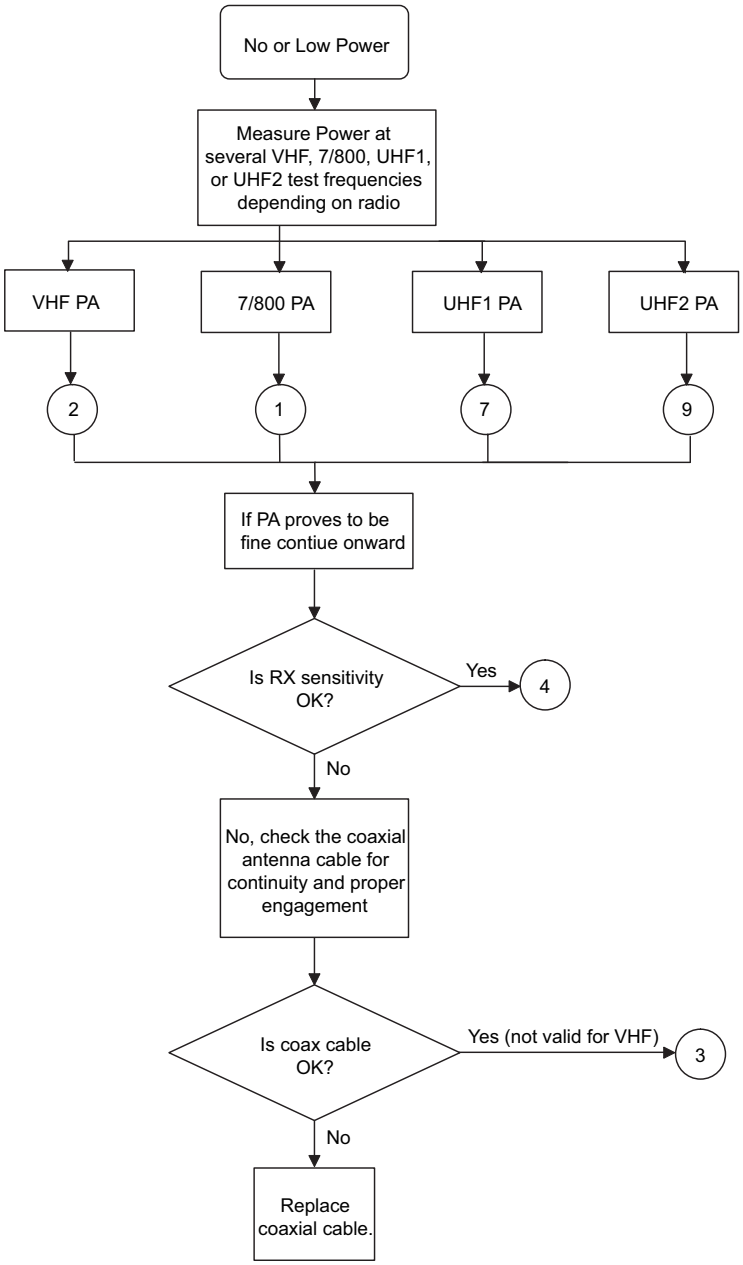
Bluetooth Failure – Page 5 (LCD Indication)



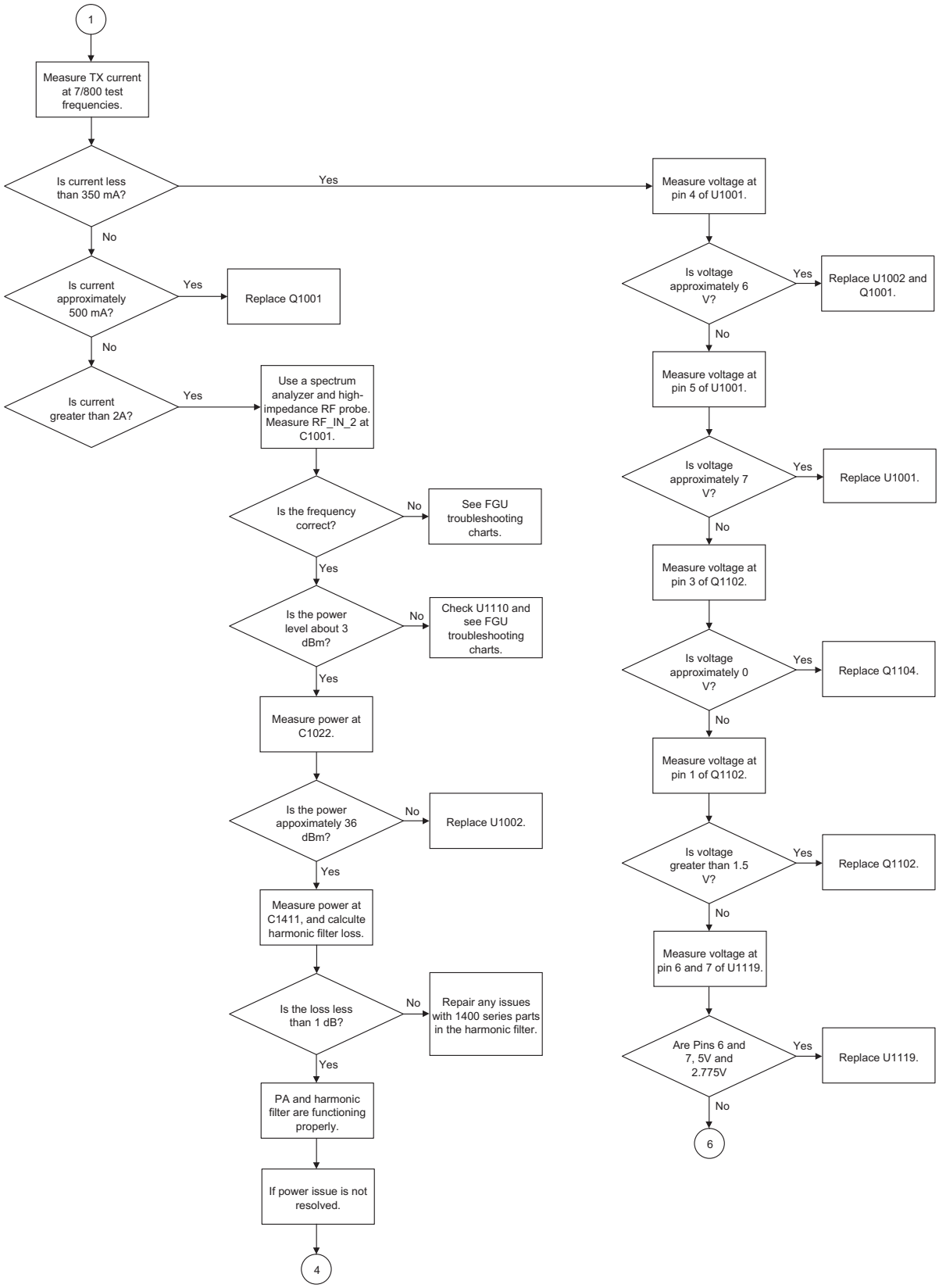
Bluetooth Failure – Page 6 (No Audio from Headset)



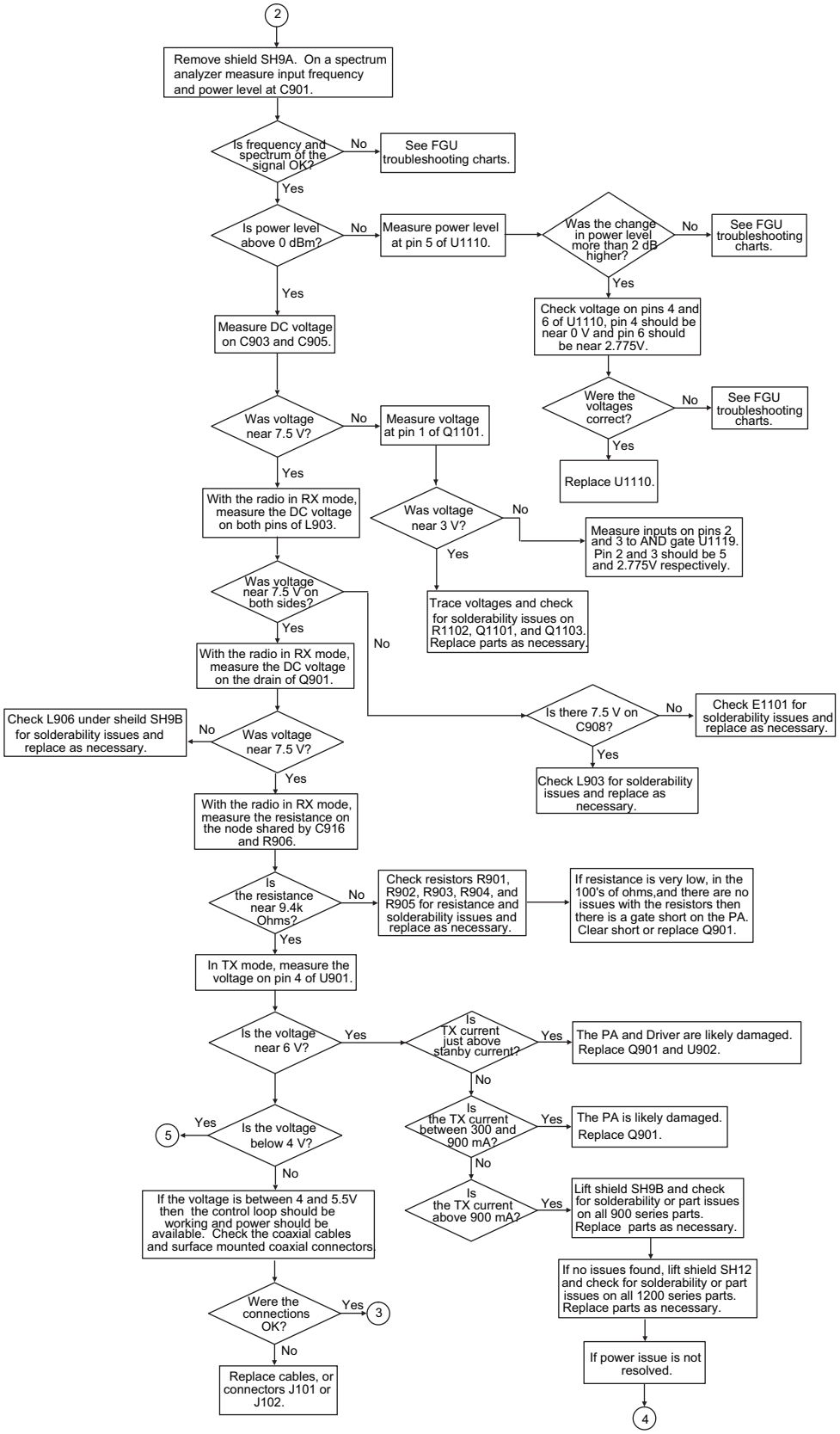
5.23 PA Failure – Main



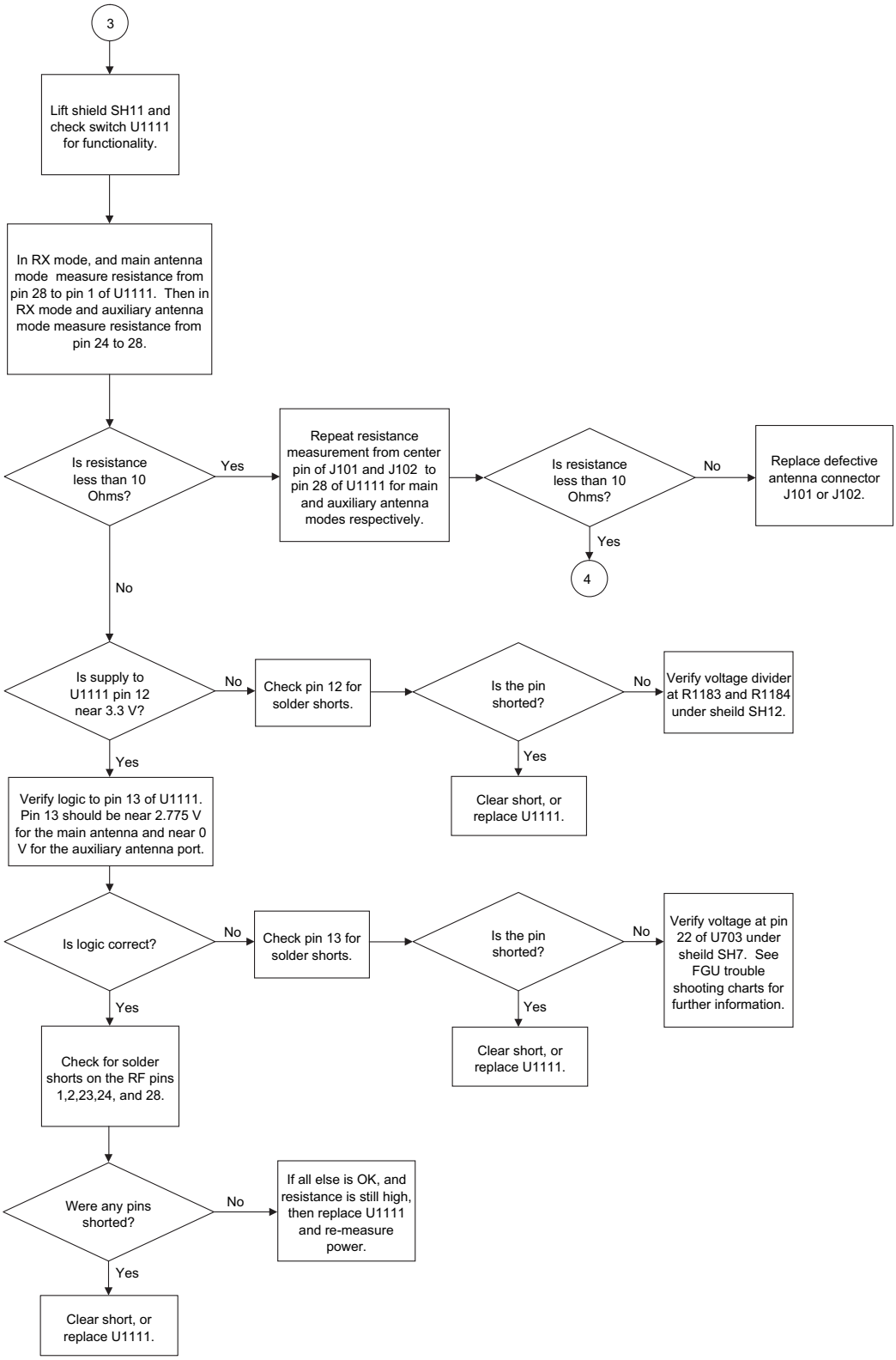
PA Failure – Page 1 (7/800 PA)



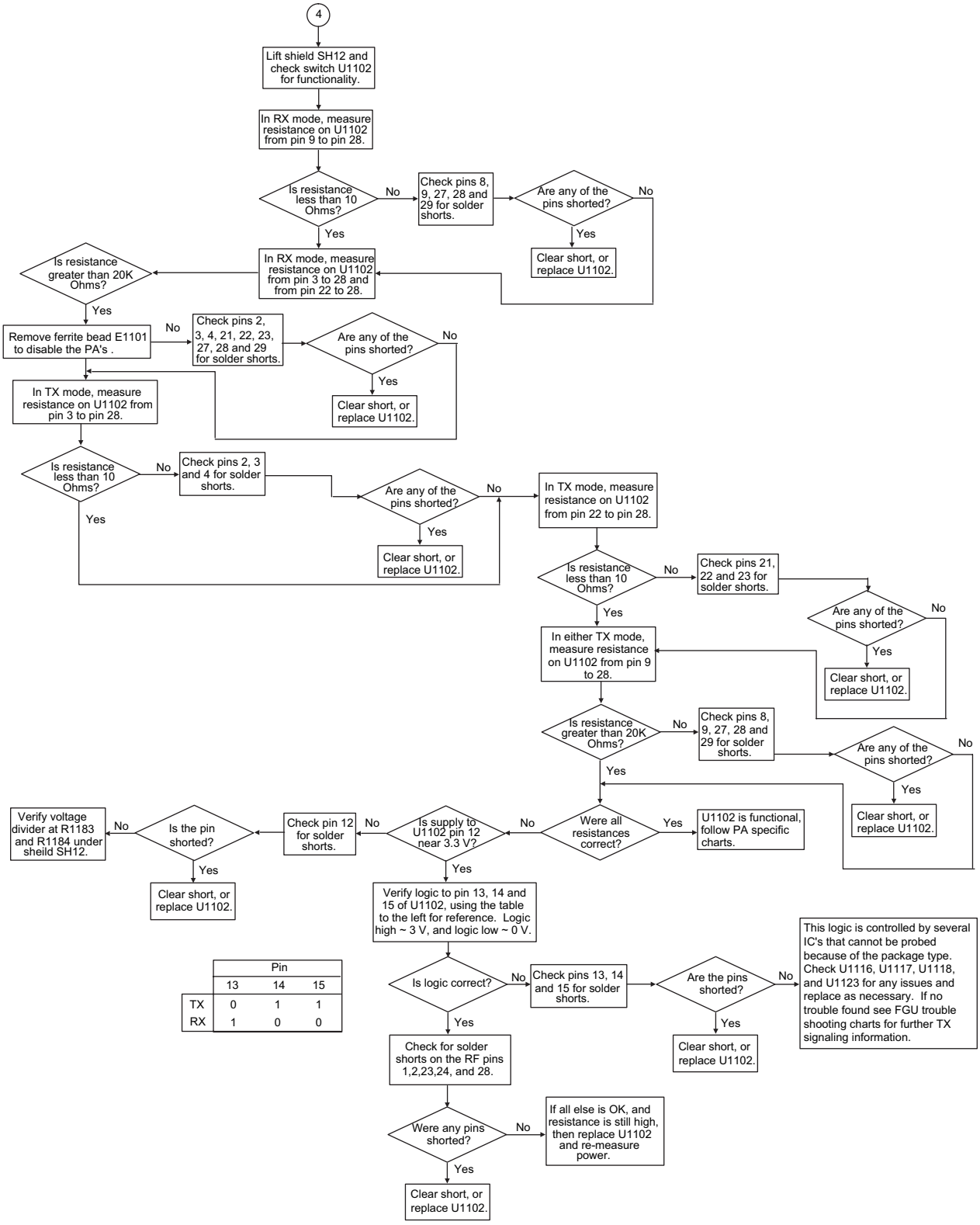
PA Failure – Page 2 (VHF PA)



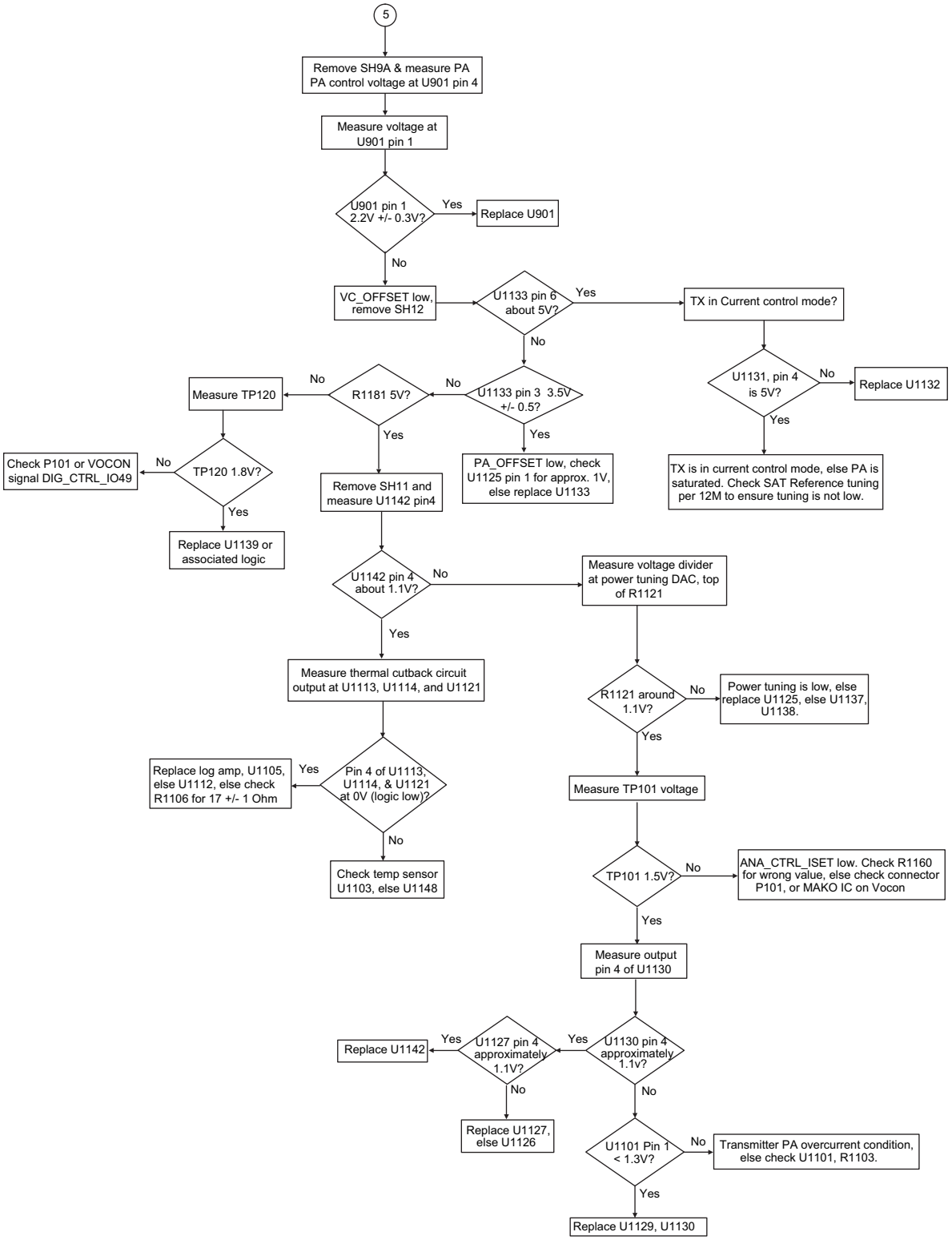
PA Failure – Page 3 (Aux Antenna Switch)



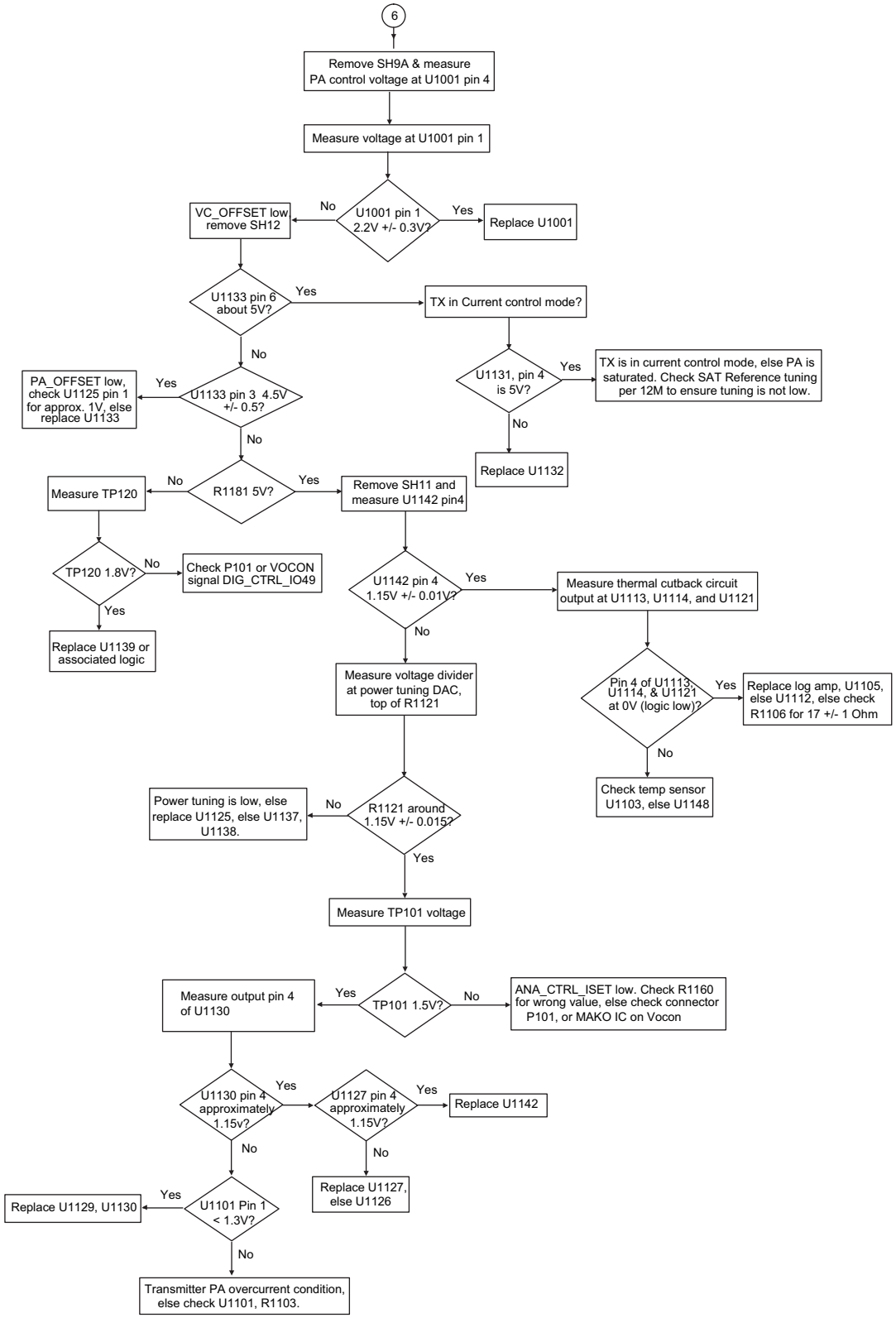
PA Failure – Page 4 (Multi Switch)



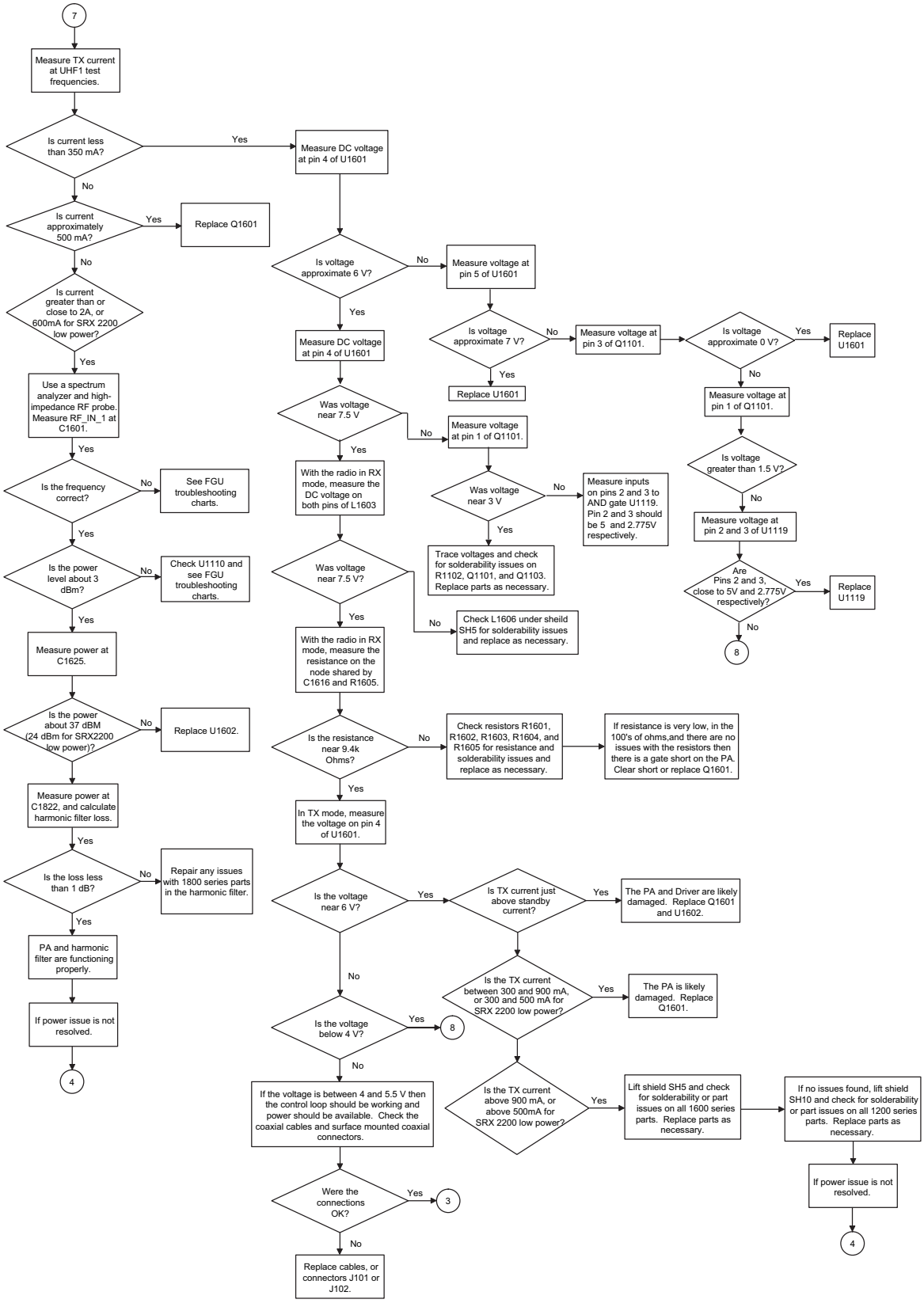
PA Failure – Page 5 (VHF ALC)



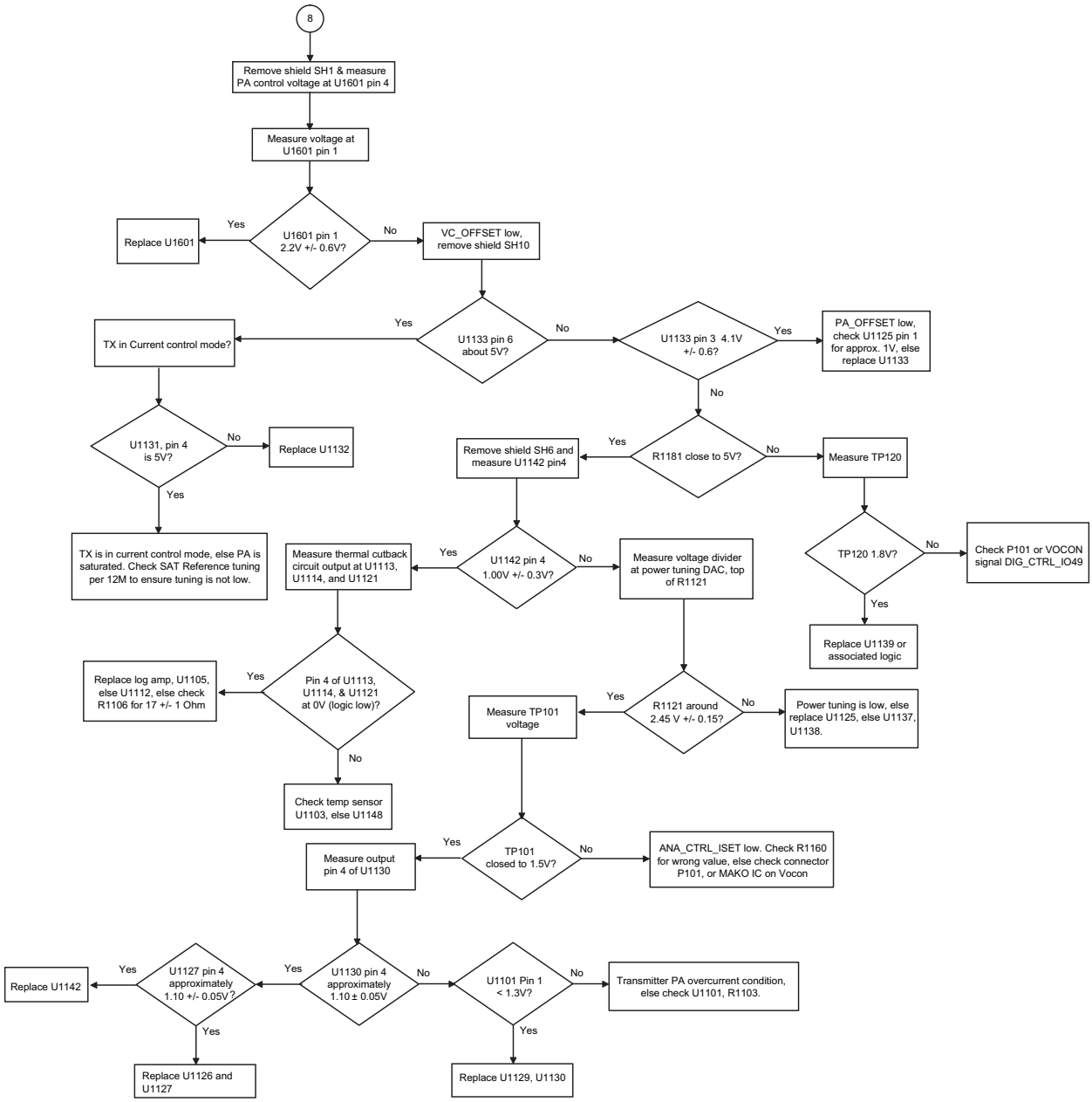
PA Failure – Page 6 (7/800 ALC)



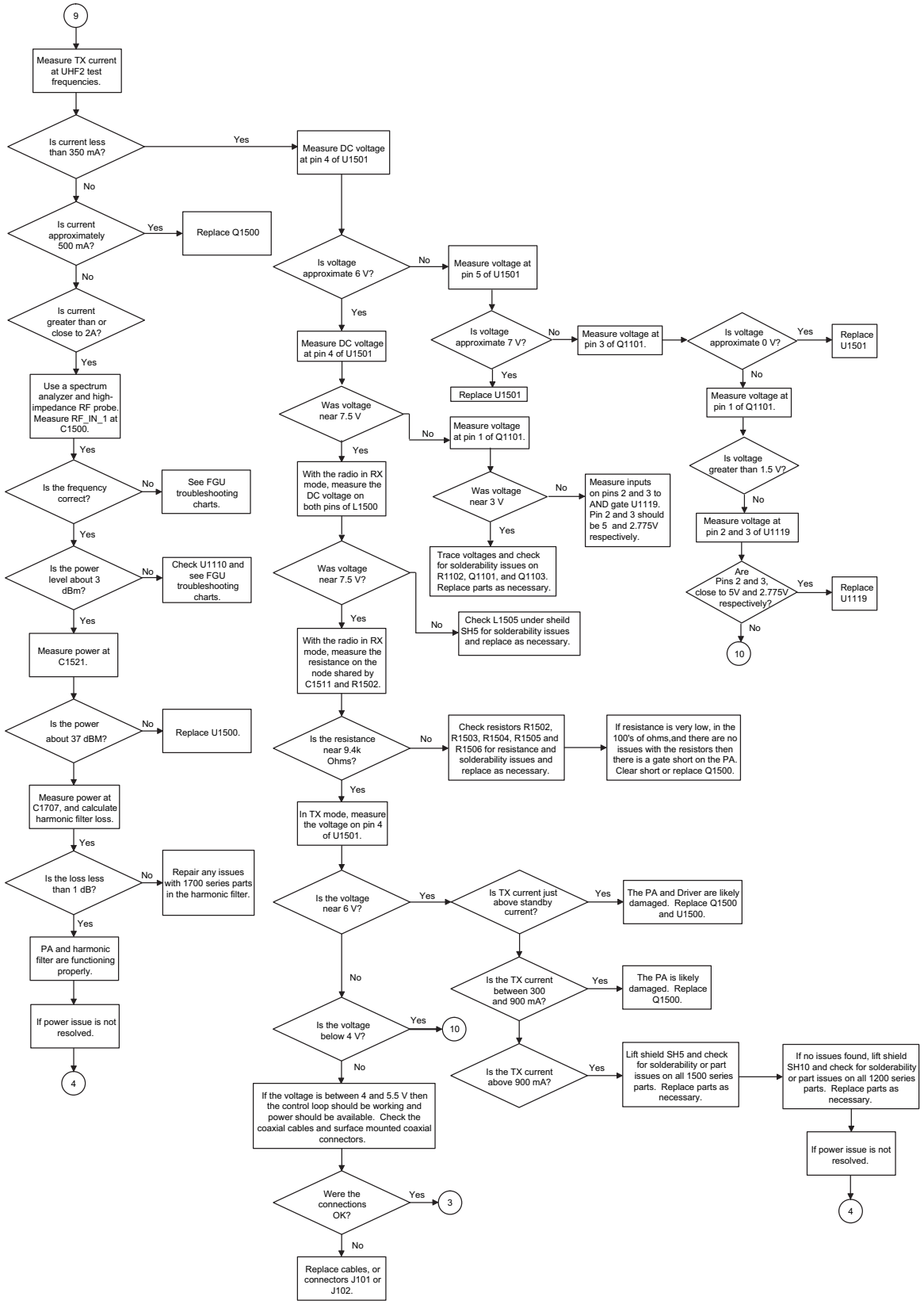
PA Failure – Page 7 (UHF1 PA)



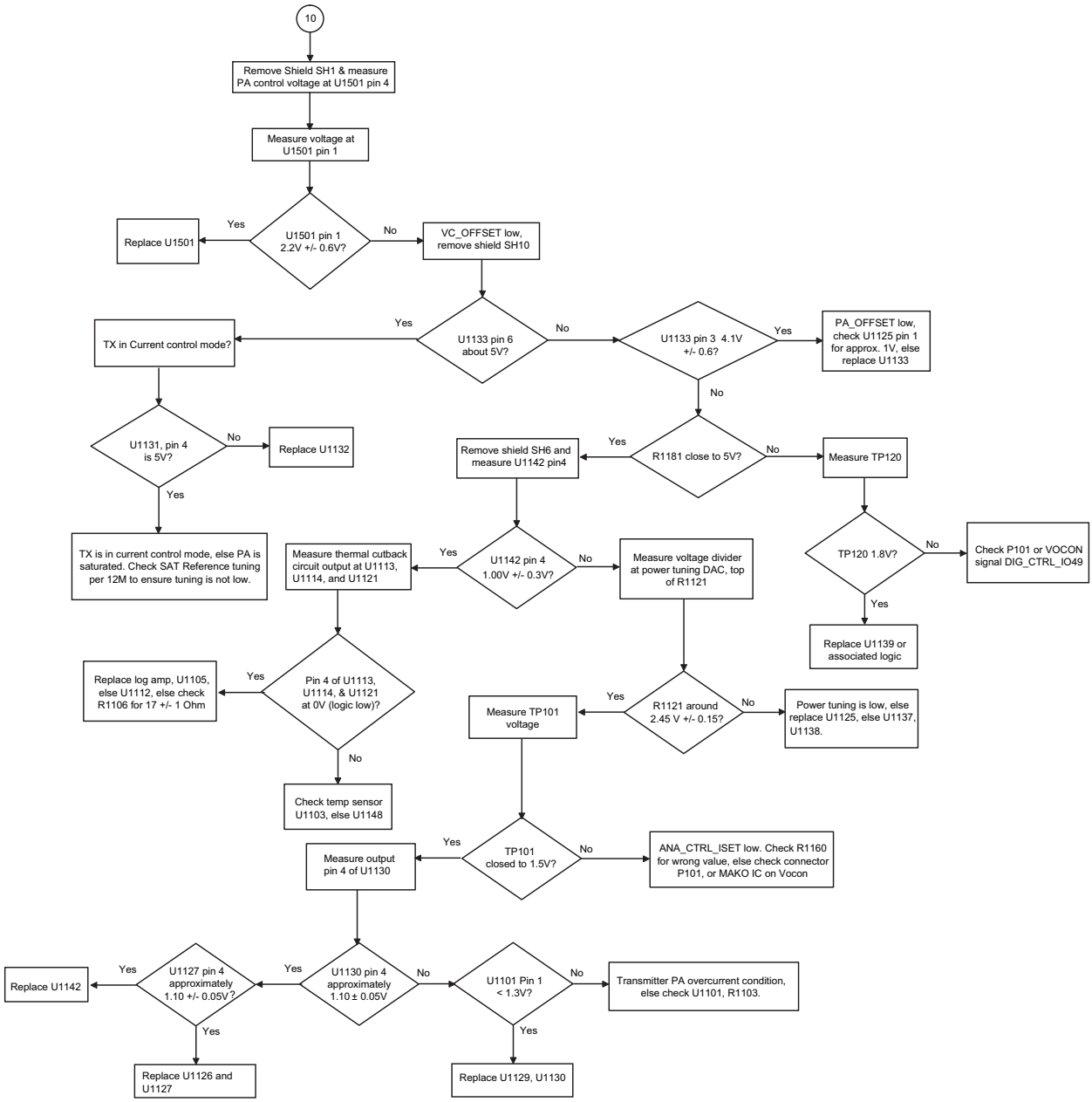
PA Failure – Page 8 (UHF1 ALC)



PA Failure – Page 9 (UHF2 PA)



PA Failure – Page 10 (UHF2 ALC)



Notes

Chapter 6 Troubleshooting Waveforms

This chapter contains images of waveforms that might be useful in verifying operation of certain parts of the circuitry. These waveforms are for reference only; the actual data depicted will vary depending on operating conditions.

6.1 List of Waveforms

Table 6-1 lists each waveform and the page on which the waveform can be found.

Table 6-1. List of Waveforms

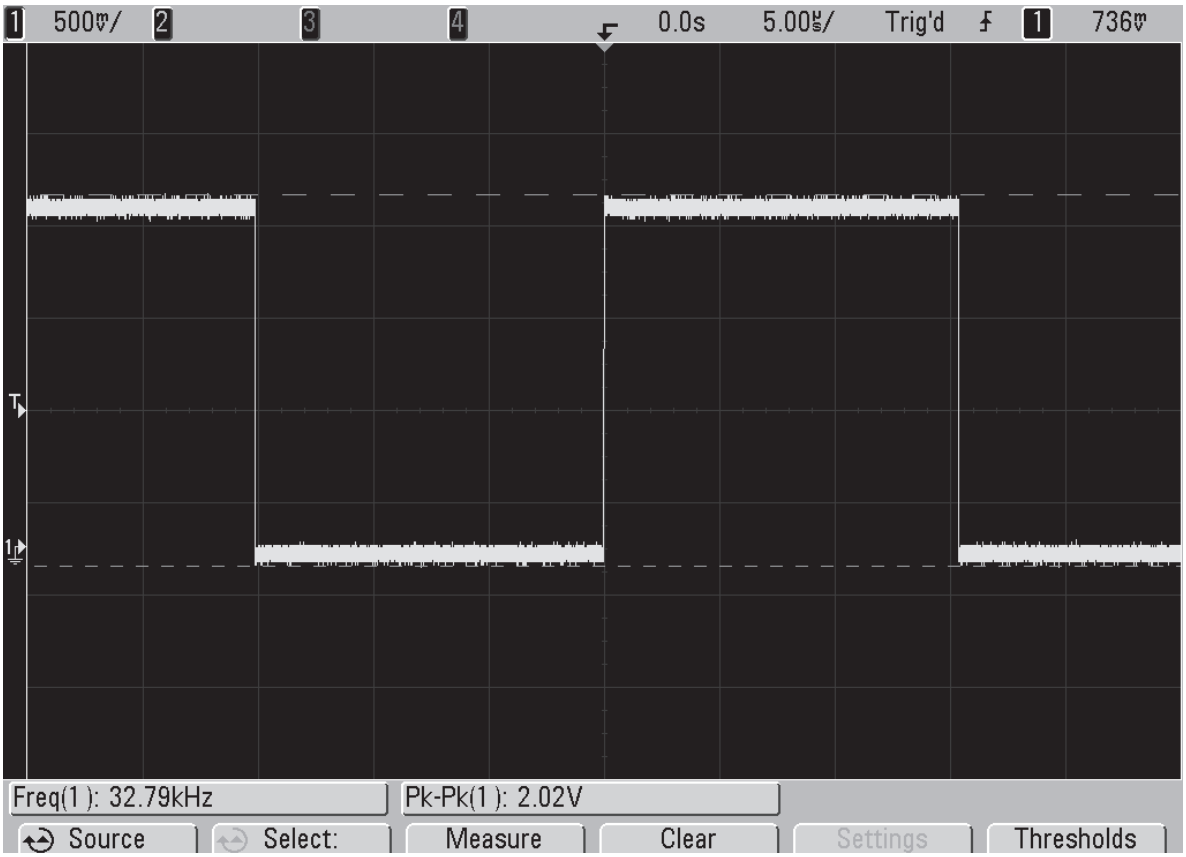
Table 6-1. List of Waveforms (Continued)

Table 6-1. List of Waveforms (Continued)

Table 6-1. List of Waveforms (Continued)

6.2 Clocks

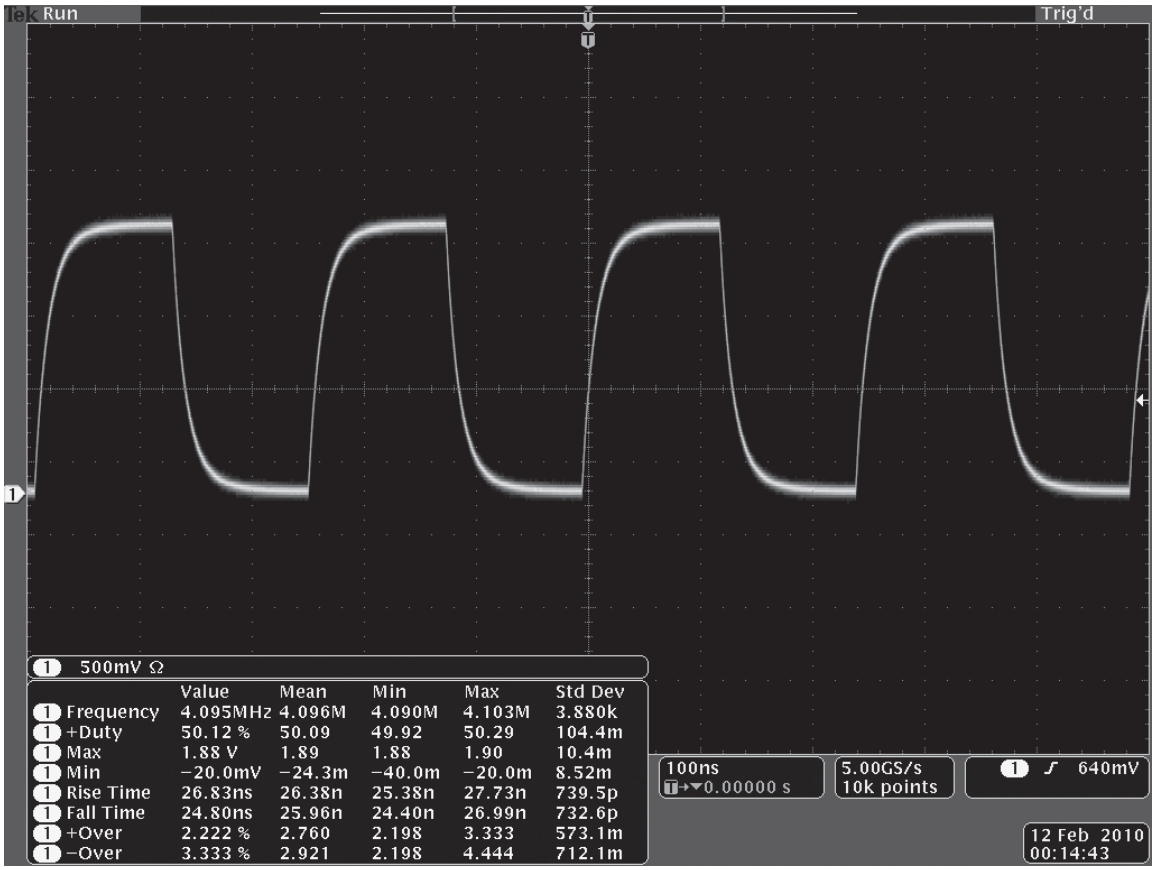
6.2.1 32 kHz Clock



Trace 1: Trace recorded at R6115.

Figure 6-1. 32 kHz Clock Waveform

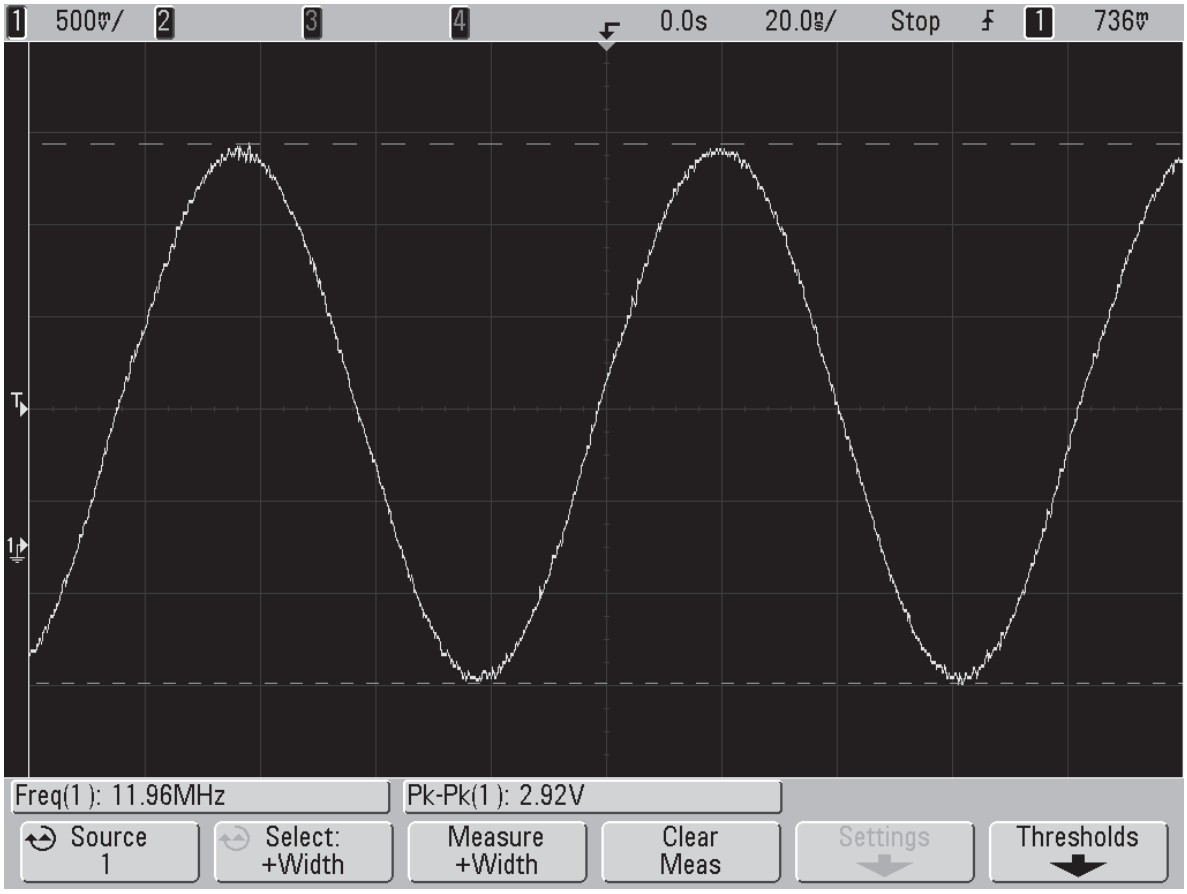
6.2.2 4 MHz Clock



Trace 1: Trace recorded at R6113.

Figure 6-2. 4 MHz Clock Waveform

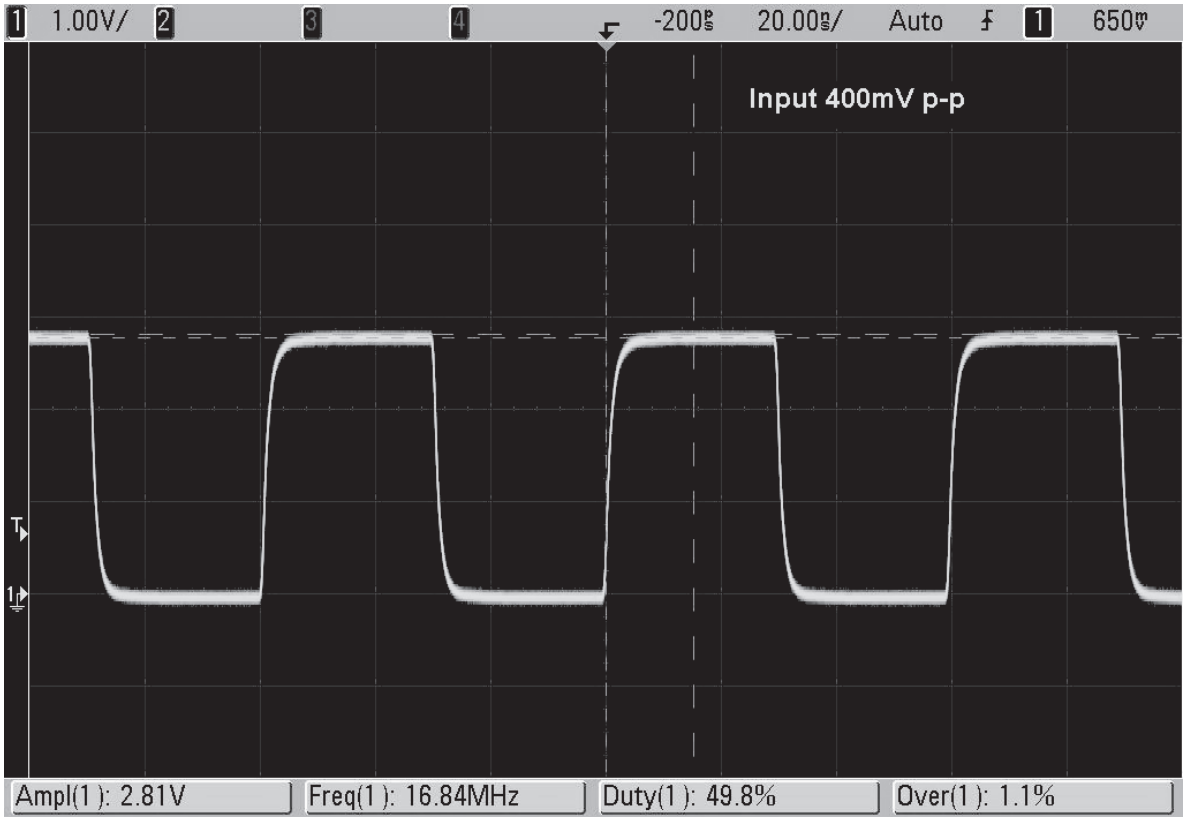
6.2.3 12 MHz Clock



Trace 1: Trace recorded at C6601.

Figure 6-3. 12 MHz Clock Waveform

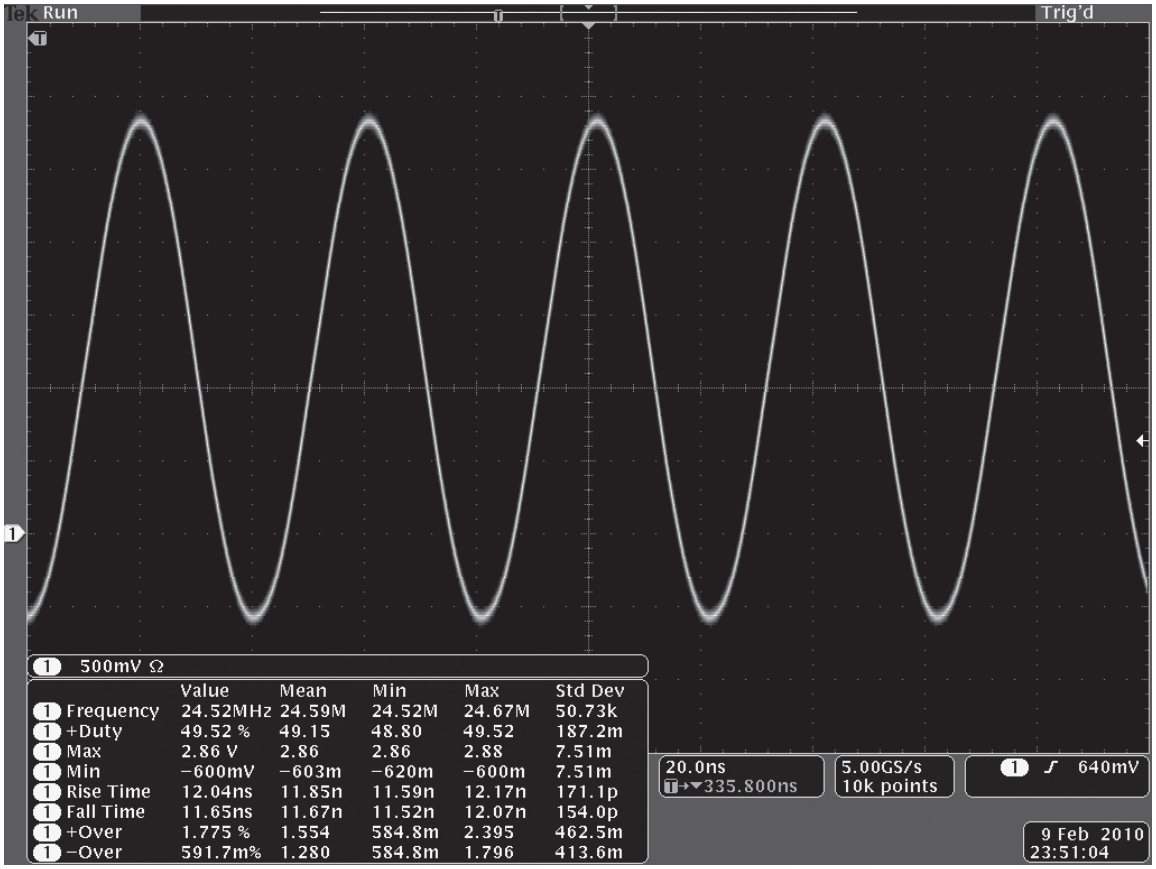
6.2.4 16.8 MHz Clock



Trace 1: Trace recorded at R6217.

Figure 6-4. 16.8 MHz Clock Waveform

6.2.5 24 MHz Clock

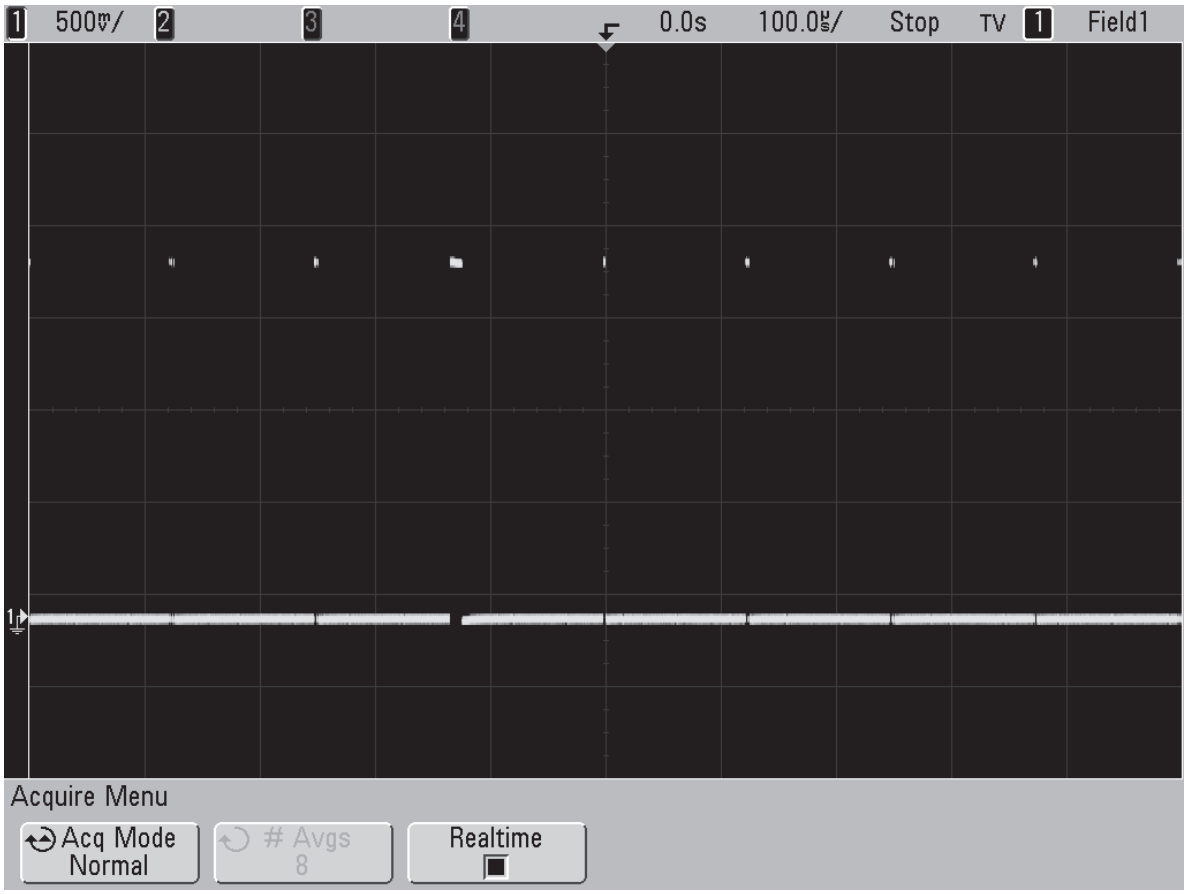


Trace 1: Trace recorded at C6592.

Figure 6-5. 24 MHz Clock Waveform

6.3 Audio SSI

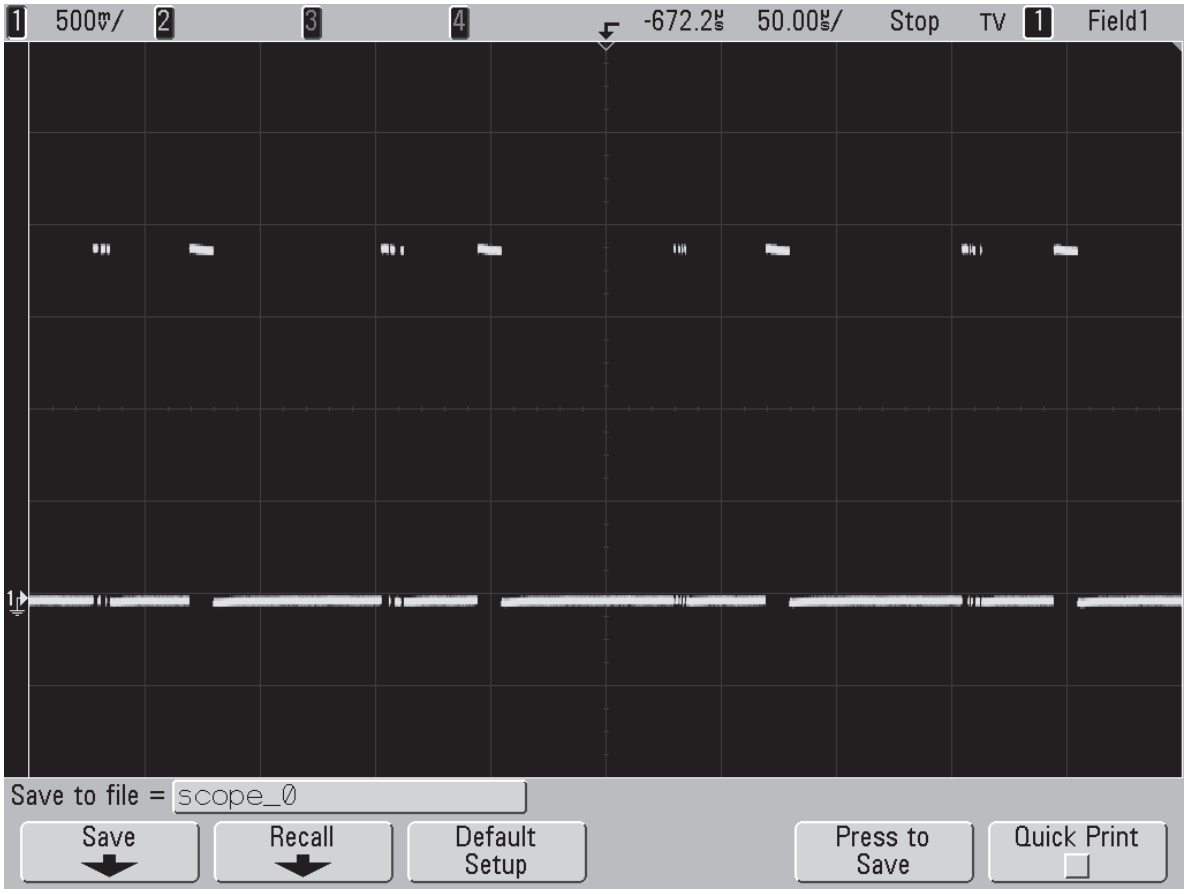
6.3.1 Red Tx



Trace 1: Trace recorded at Pin 25 of J4001.

Figure 6-6. Audio SSI – Red Tx Waveform

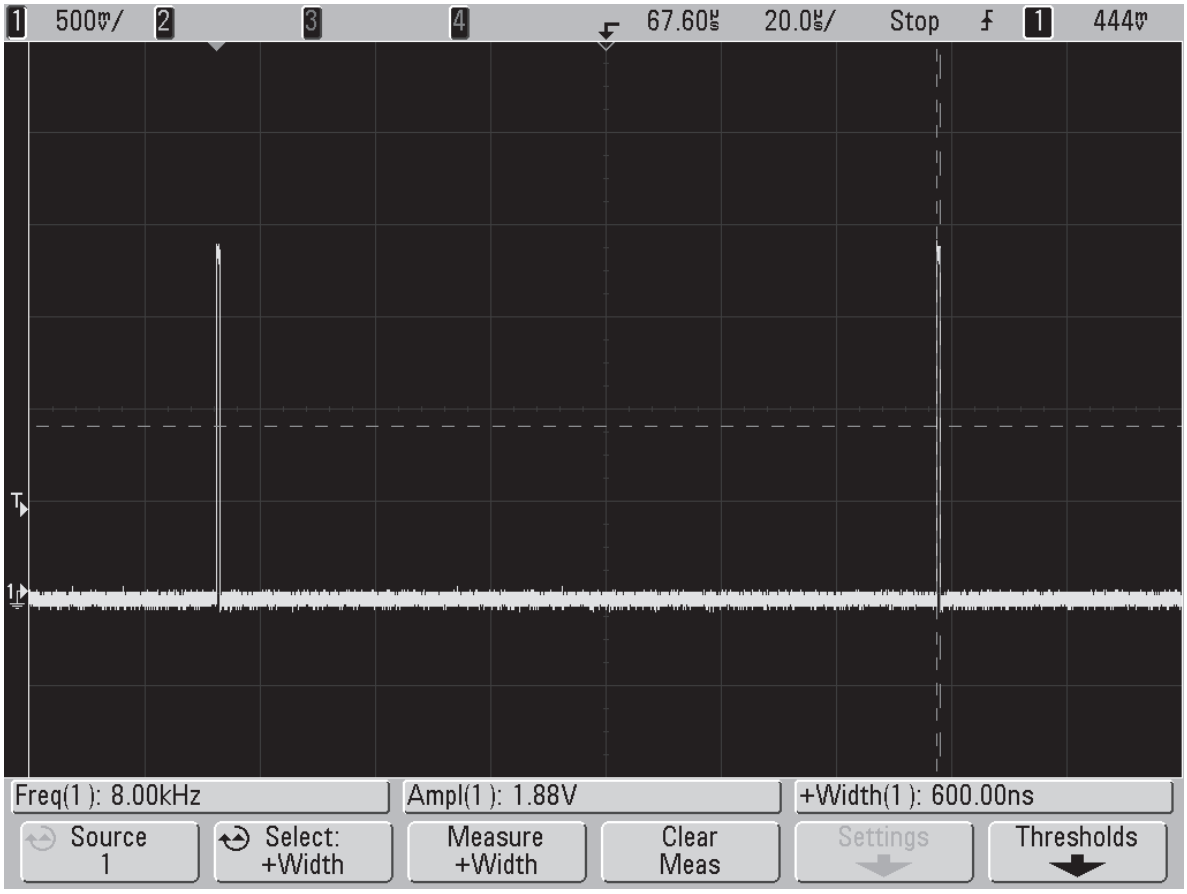
6.3.2 Red Rx



Trace 1: Trace recorded at Pin 27 of J4001.

Figure 6-7. Audio SSI – Red Rx Waveform

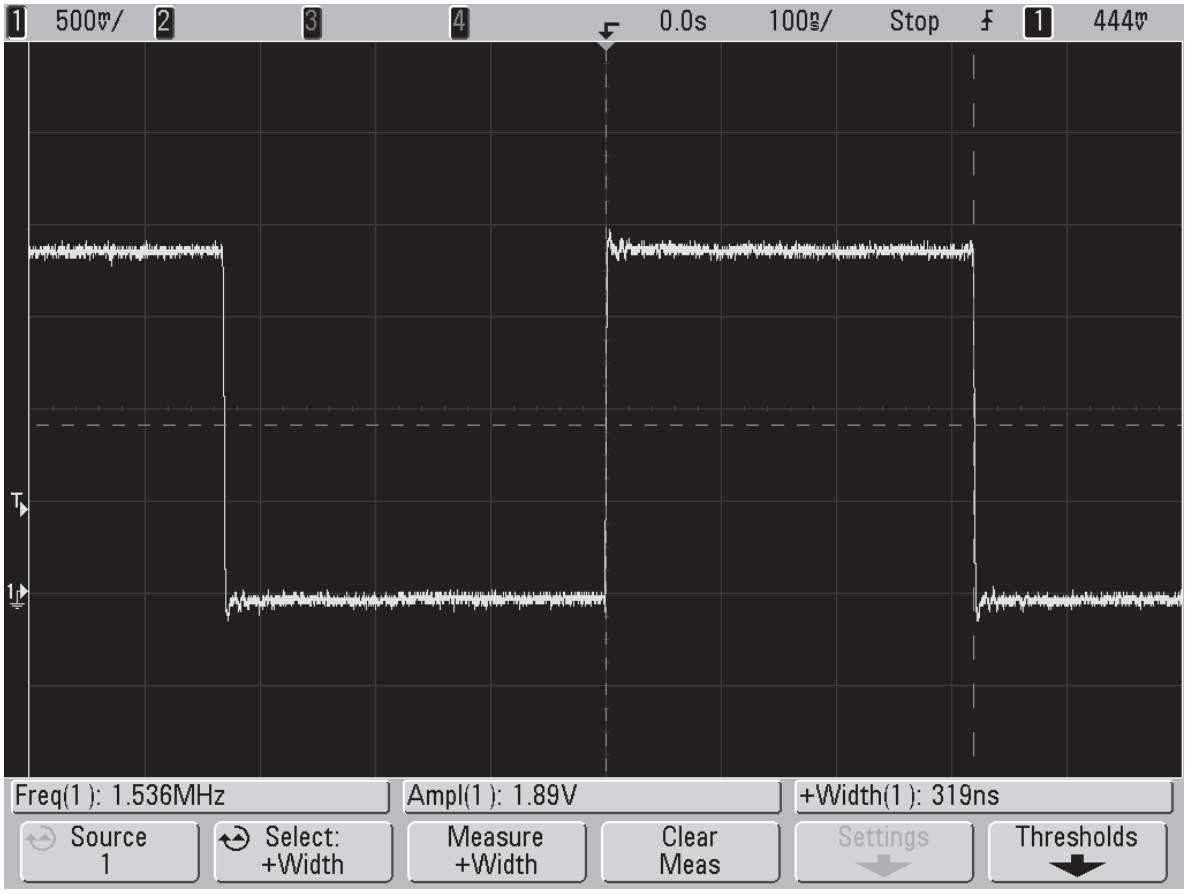
6.3.3 SYNC.



Trace 1: Trace recorded at Pin 46 of J4001.

Figure 6-8. Audio SSI – Sync. Waveform

6.3.4 BCLK

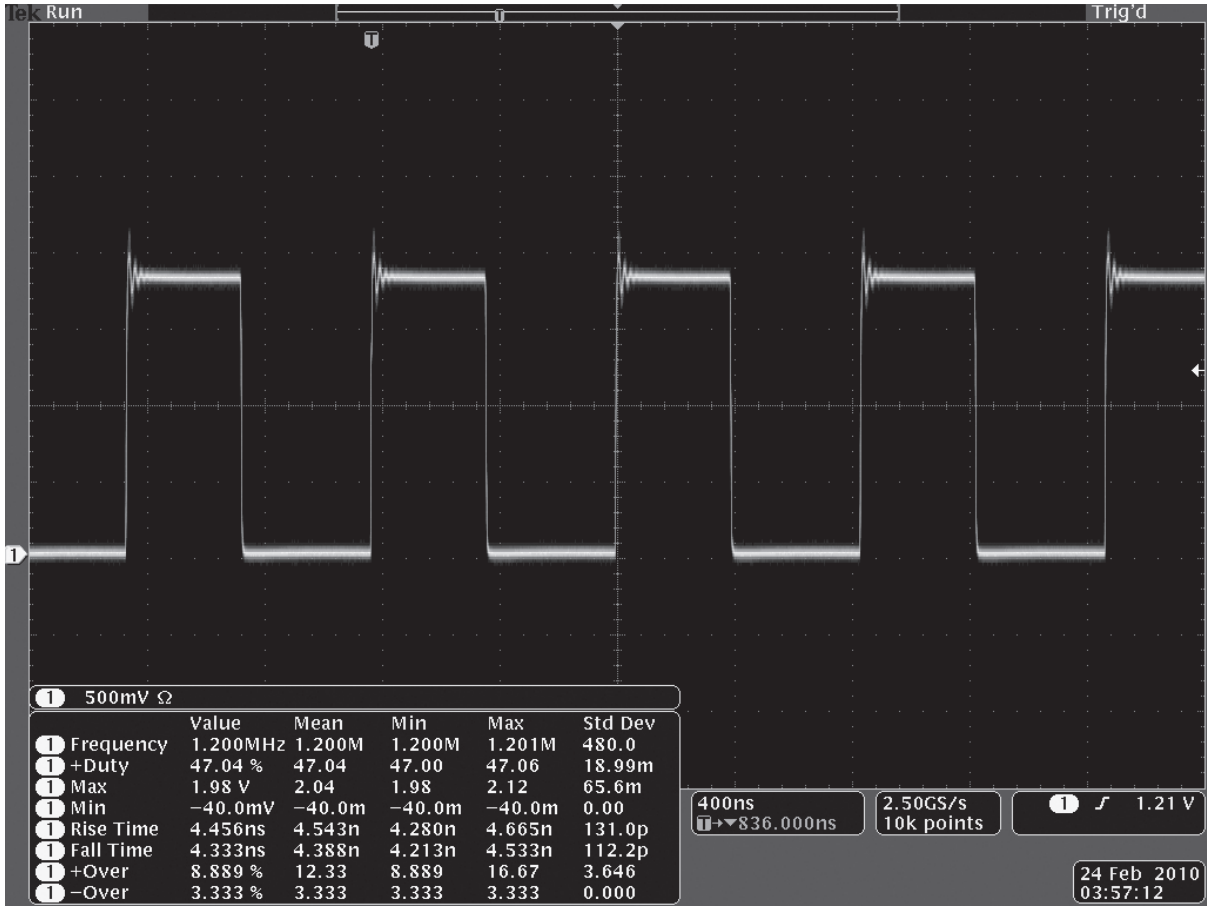


Trace 1: Trace recorded at R6107.

Figure 6-9. Audio SSI – BCLK. Waveform

6.4 RX SSI

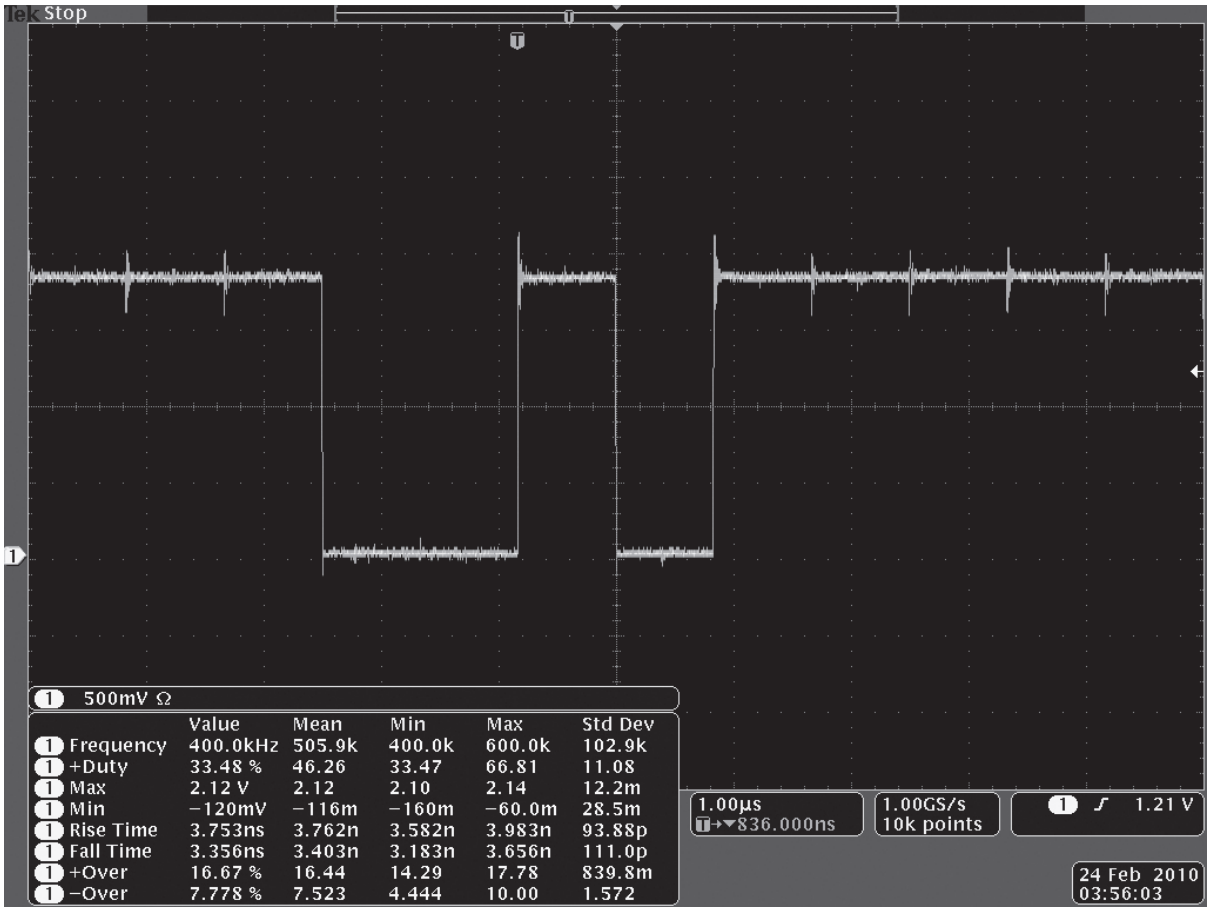
6.4.1 CLK.



Trace 1: Trace recorded at R1006.

Figure 6-10. RX SSI – CLK. Waveform

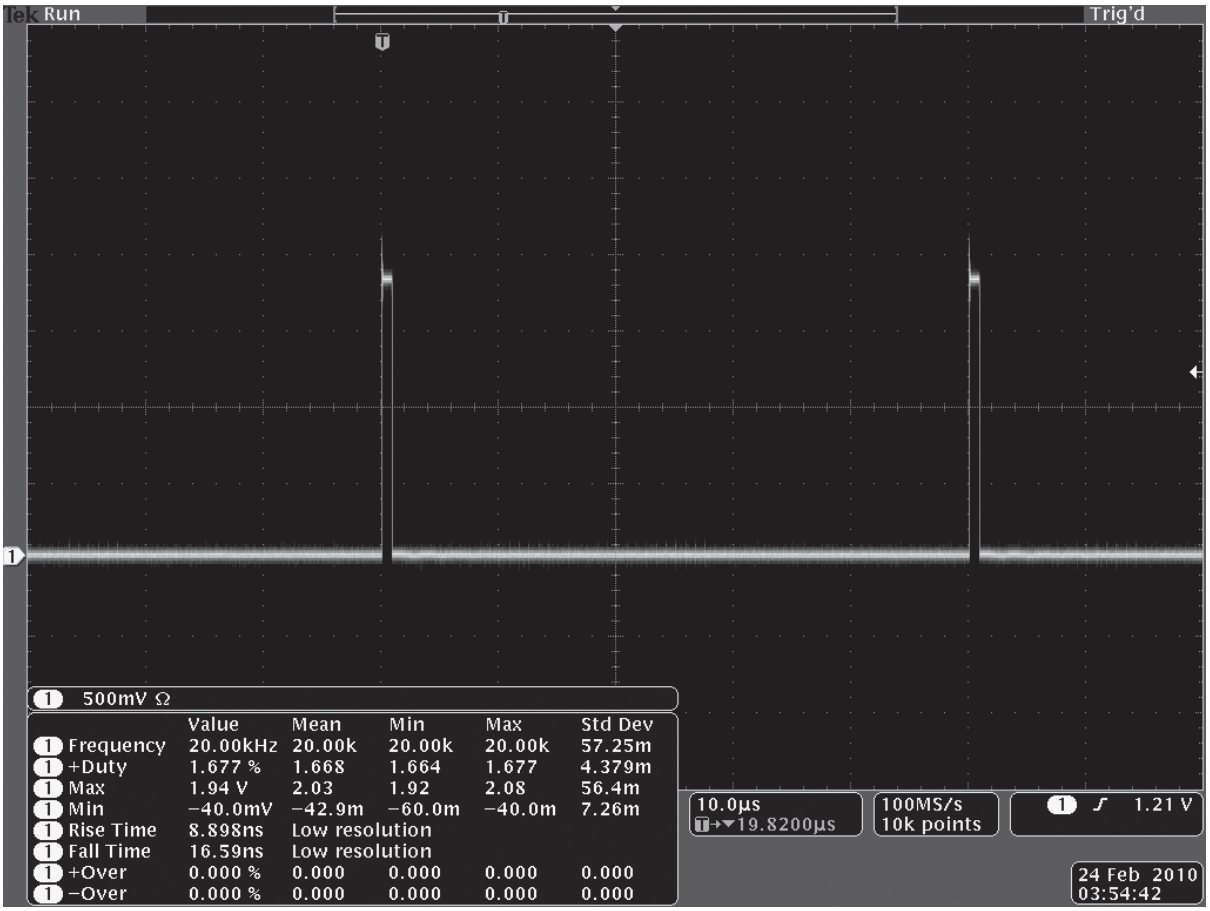
6.4.2 DA



Trace 1: Trace recorded at R1005.

Figure 6-11. RX SSI – DA Waveform

6.4.3 FSYNC.

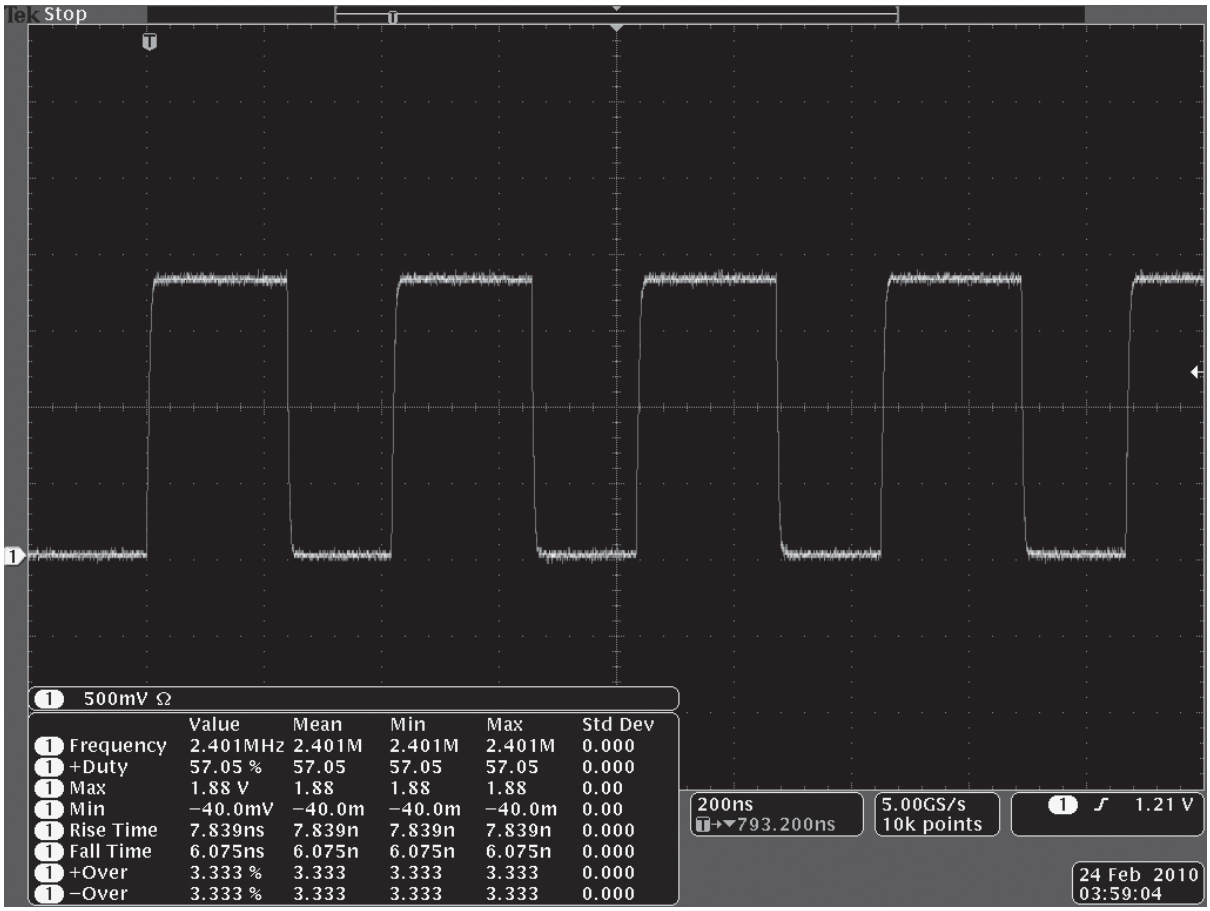


Trace 1: Trace recorded at R1004.

Figure 6-12. RX SSI – FSync. Waveform

6.5 TX SSI

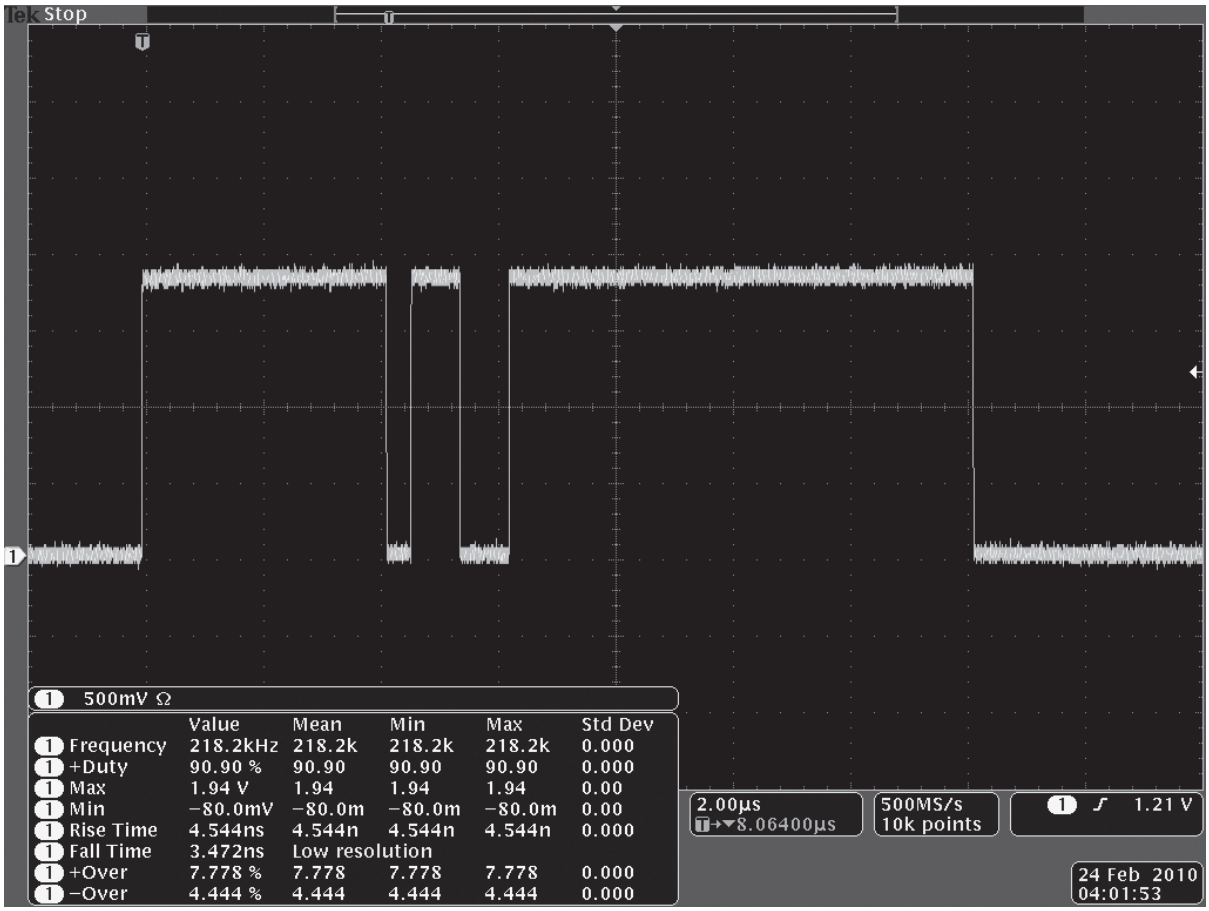
6.5.1 CLK.



Trace 1: Trace recorded at R1008.

Figure 6-13. TX SSI – TX CLK. Waveform

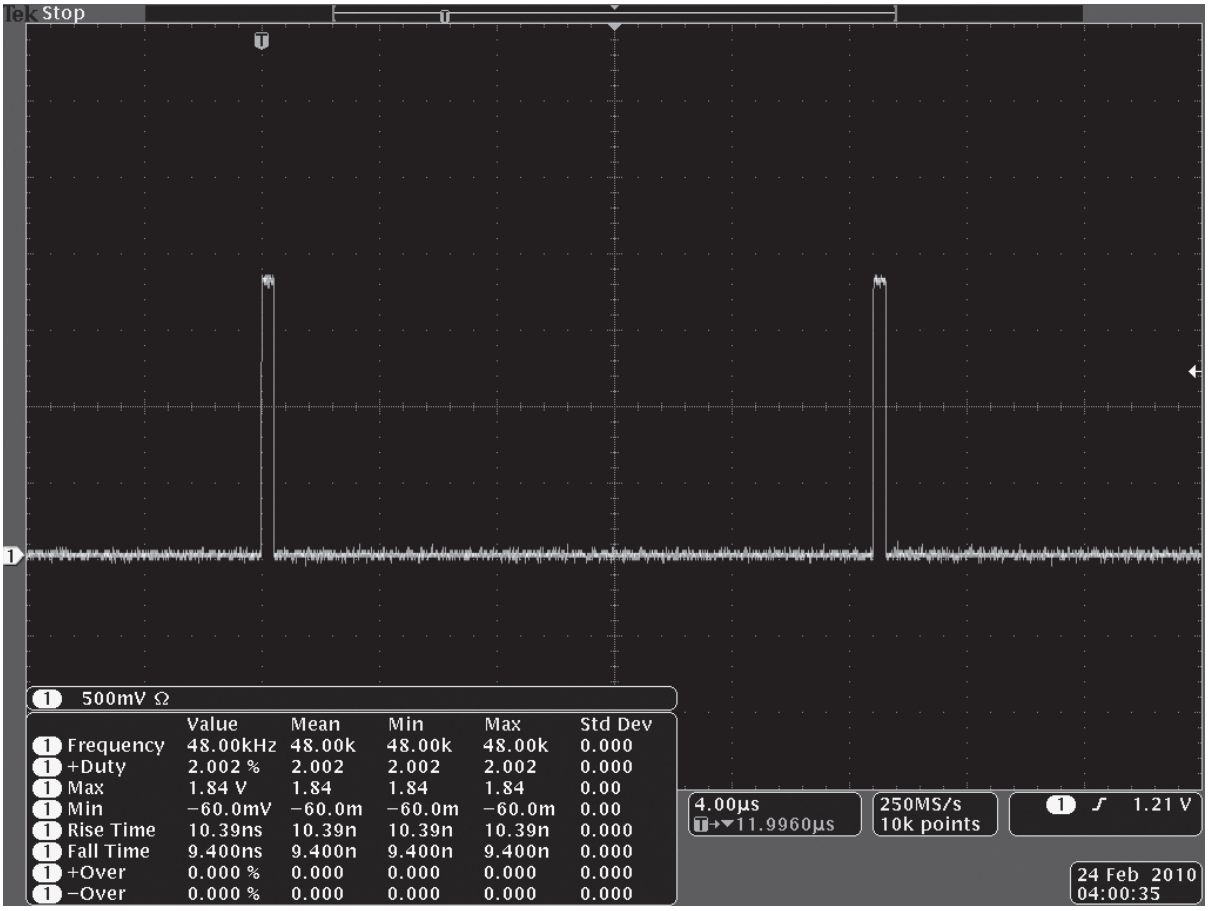
6.5.2 DA.



Trace 1: Trace recorded at R1017.

Figure 6-14. TX SSI – DA Waveform

6.5.3 FSYNC.

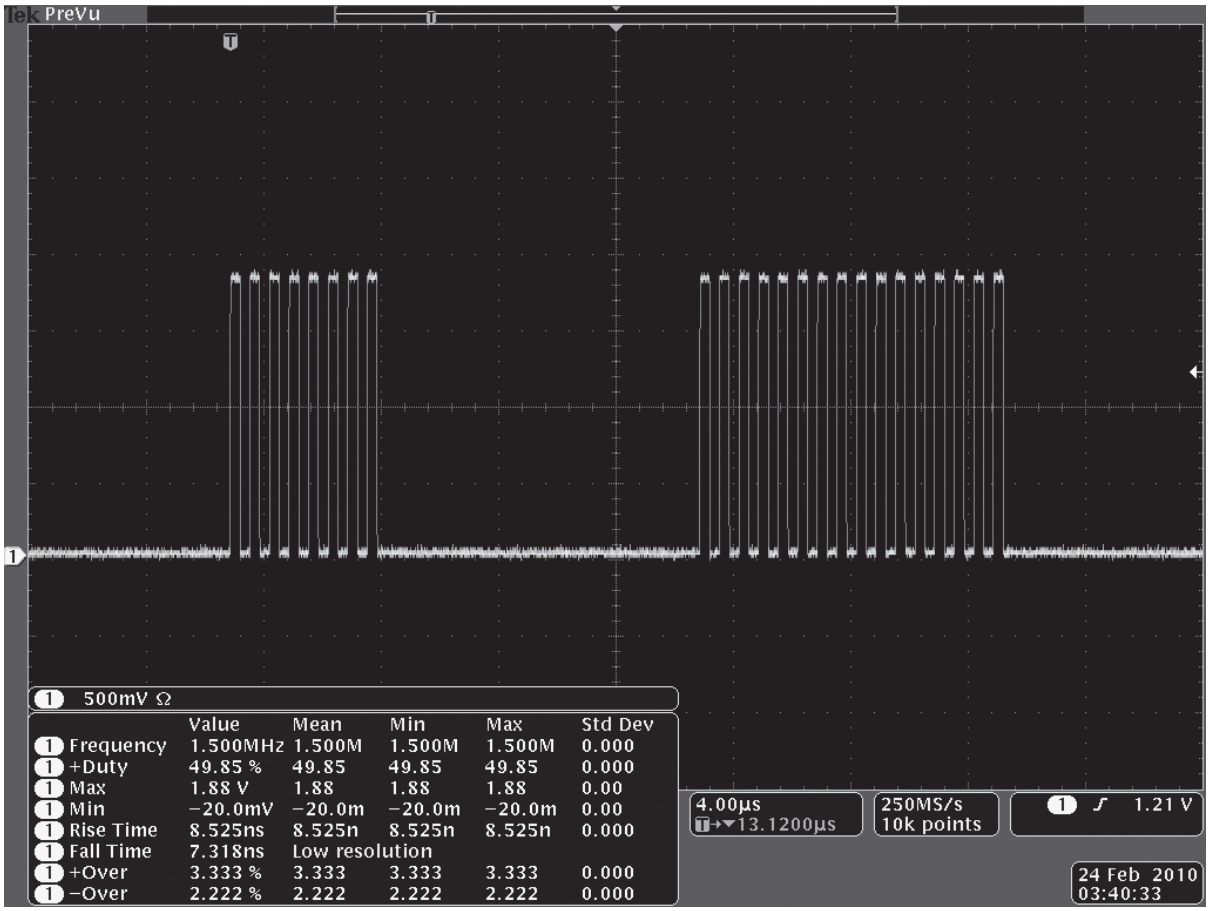


Trace 1: Trace recorded at R1007.

Figure 6-15. TX SSI – FSync. Waveform

6.6 SPI

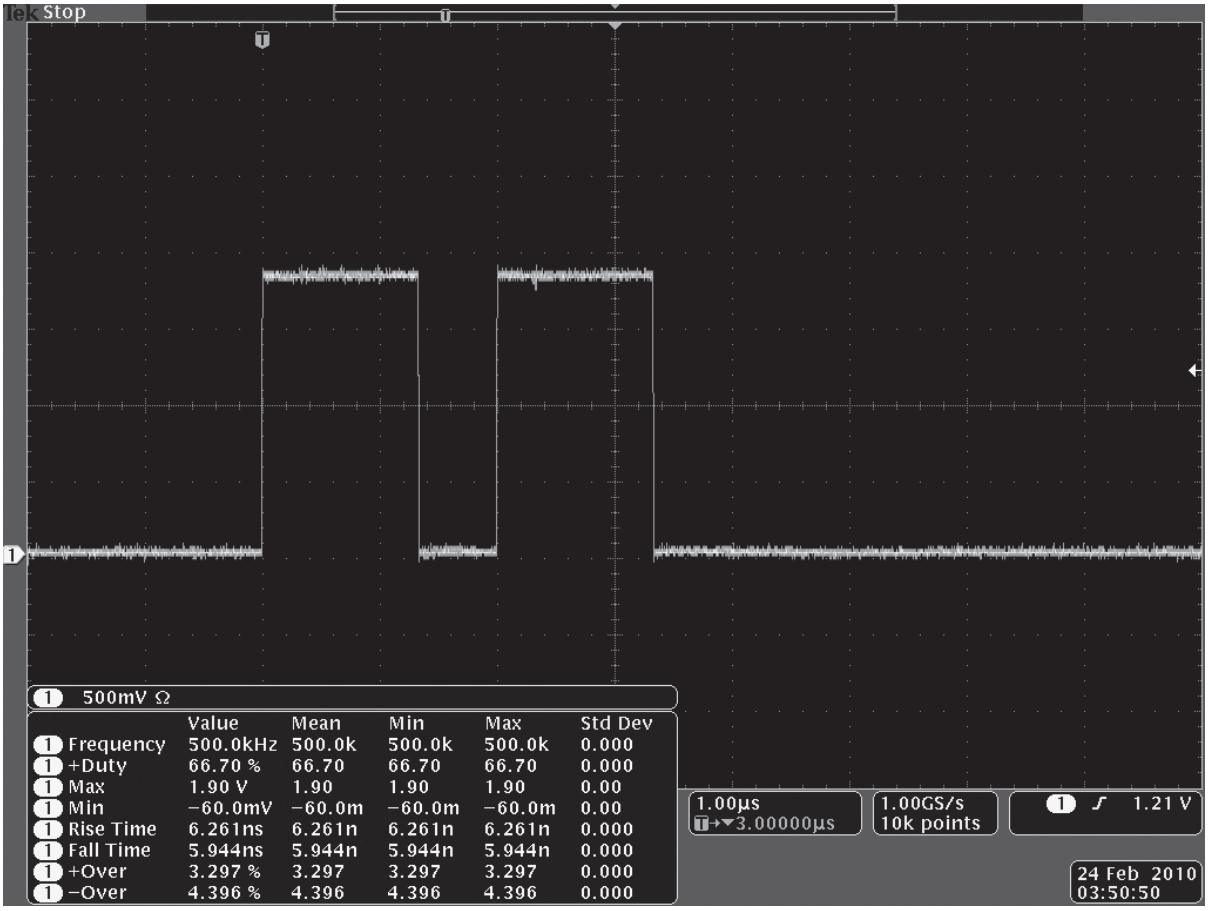
6.6.1 CLK



Trace 1: Trace recorded at R1003.

Figure 6-16. SPI – CLK Waveform

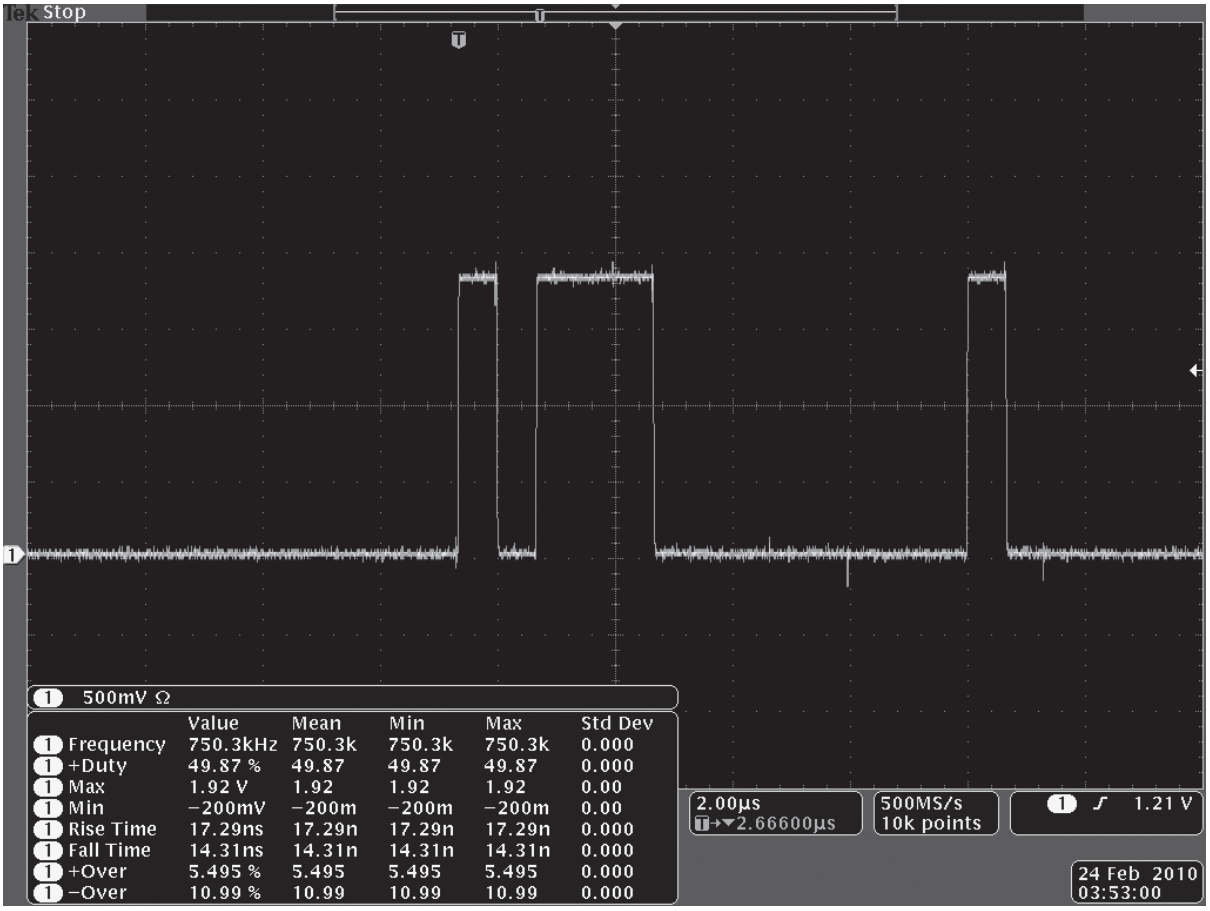
6.6.2 MOSI



Trace 1: Trace recorded at Pin 31 of J1001.

Figure 6-17. MOSI Waveform

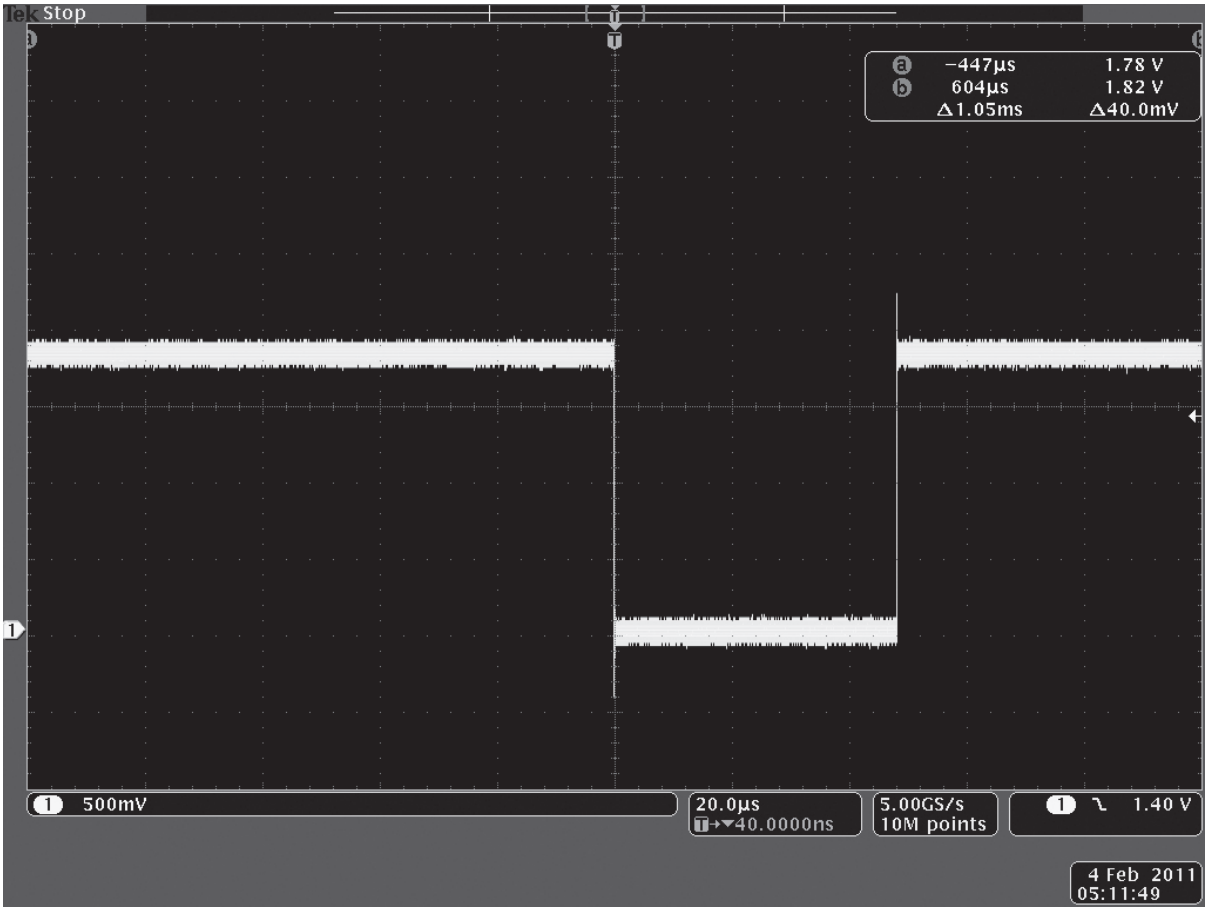
6.6.3 MISO



Trace 1: Trace recorded at Pin 29 of J1001.

Figure 6-18. MISO Waveform

6.6.4 CS

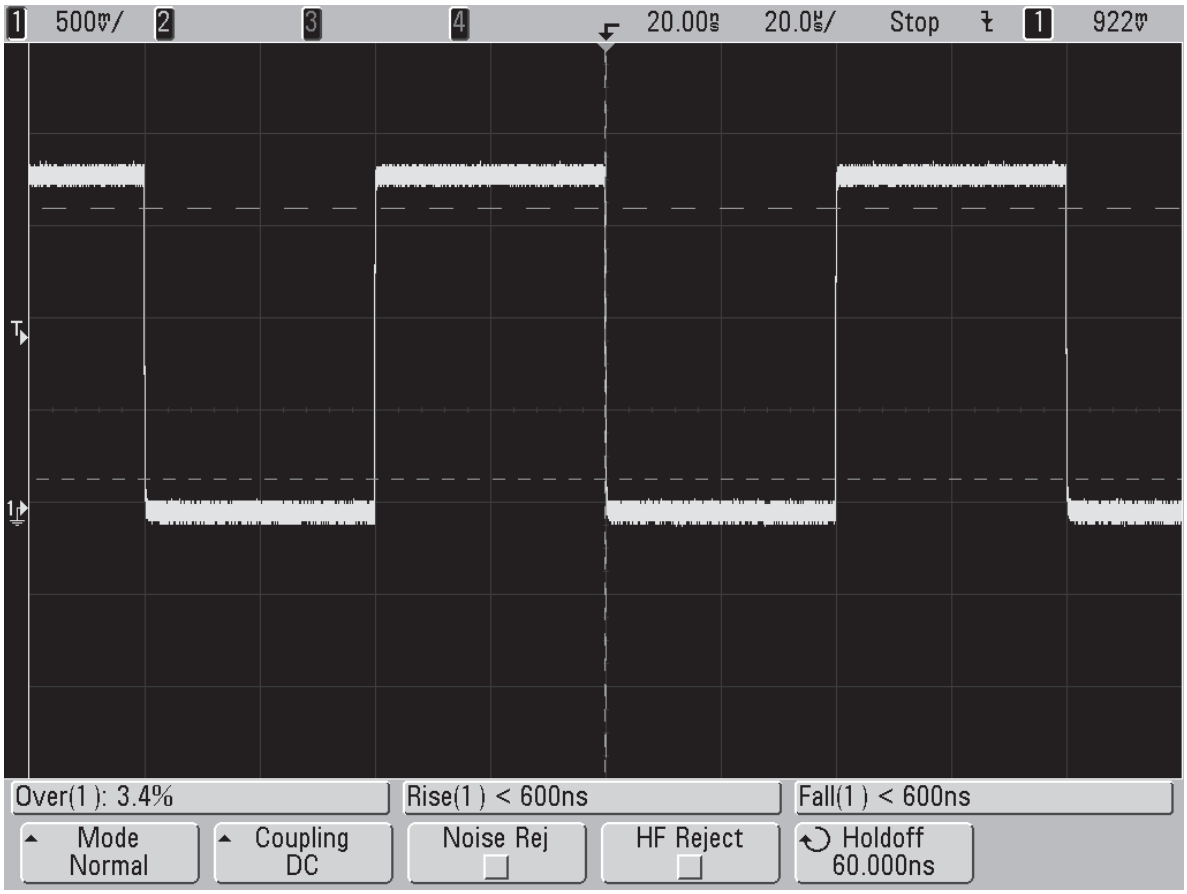


Trace 1: Trace recorded at R1018.

Figure 6-19. CS Waveform

6.7 I2C BUS

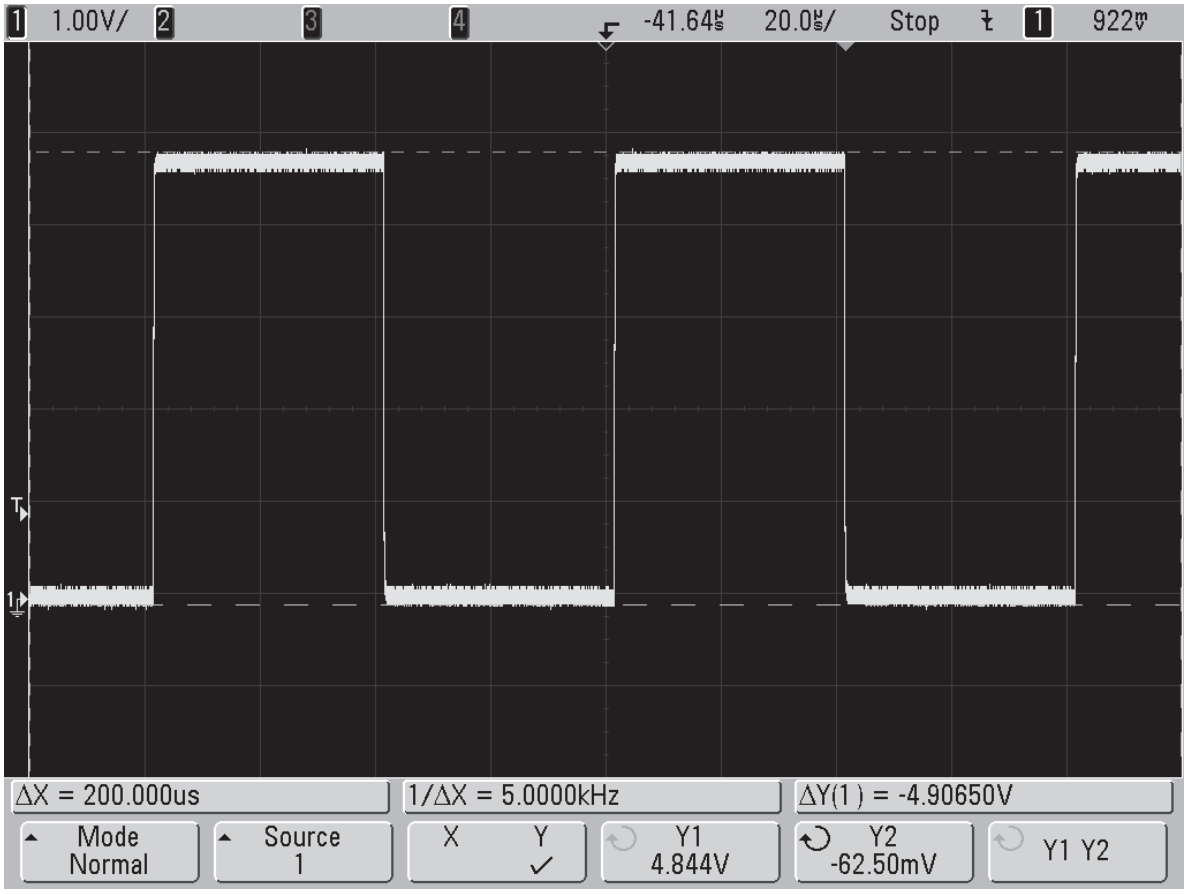
6.7.1 SCL



Trace 1: Trace recorded at R6208.

Figure 6-20. I2C Bus – SCA Waveform

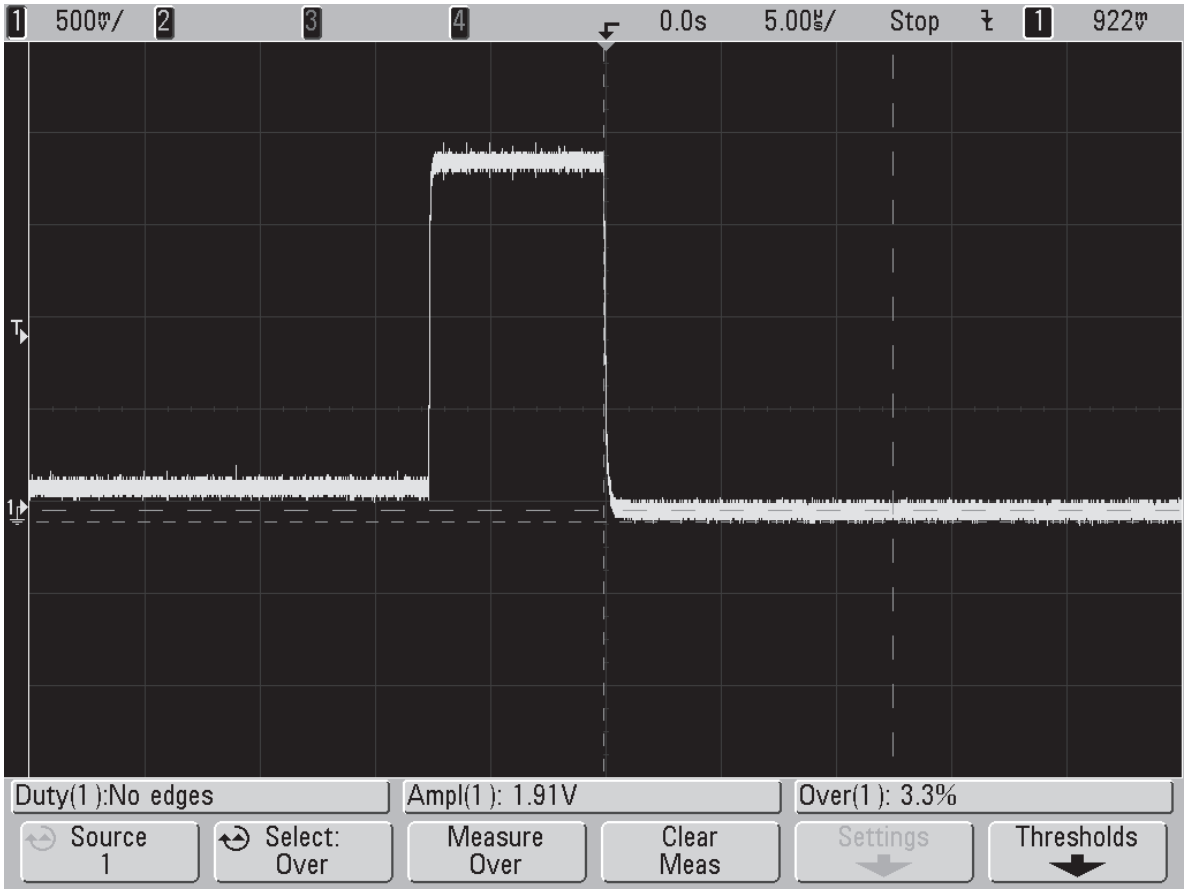
6.7.2 SCL 5V



Trace 1: Trace recorded at R2204.

Figure 6-21. I2C Bus – SCA 5V Waveform

6.7.3 SDA

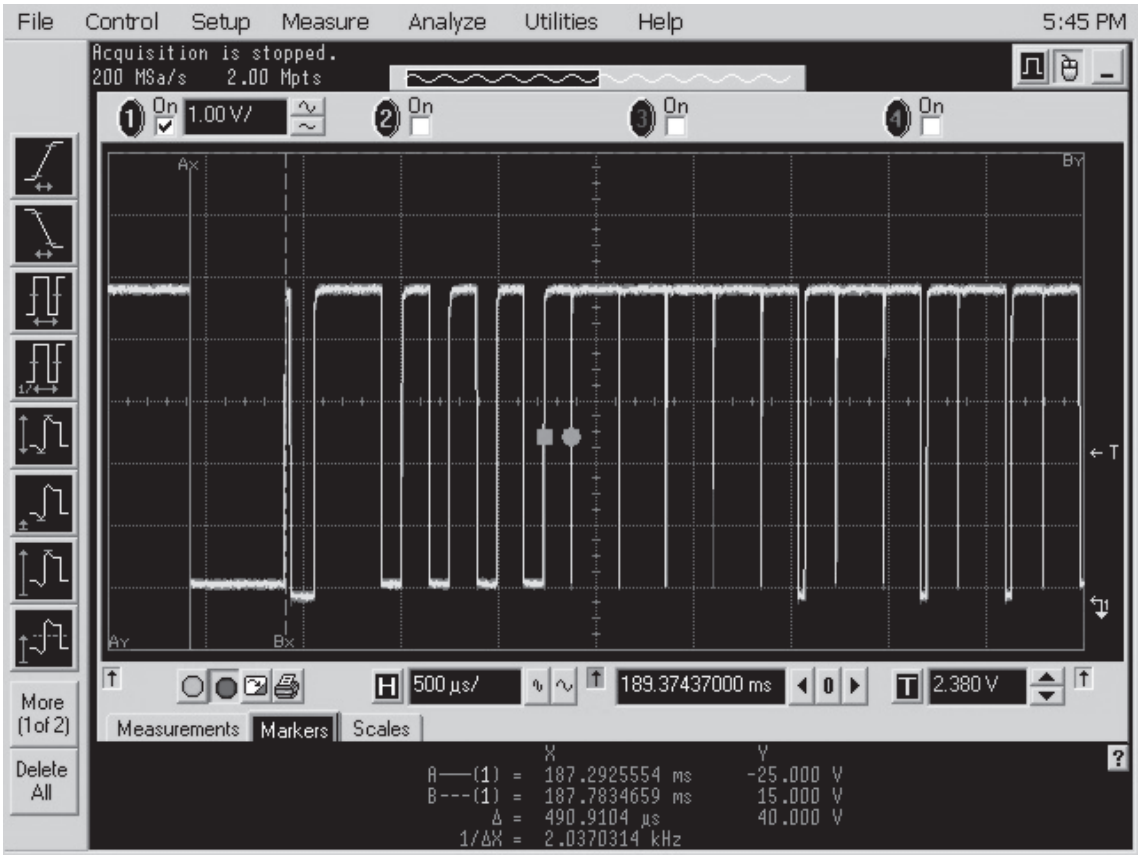


Trace 1: Trace recorded at R6209.

Figure 6-22. I2C Bus – SDA Waveform

6.8 One Wire

6.8.1 1-Wire

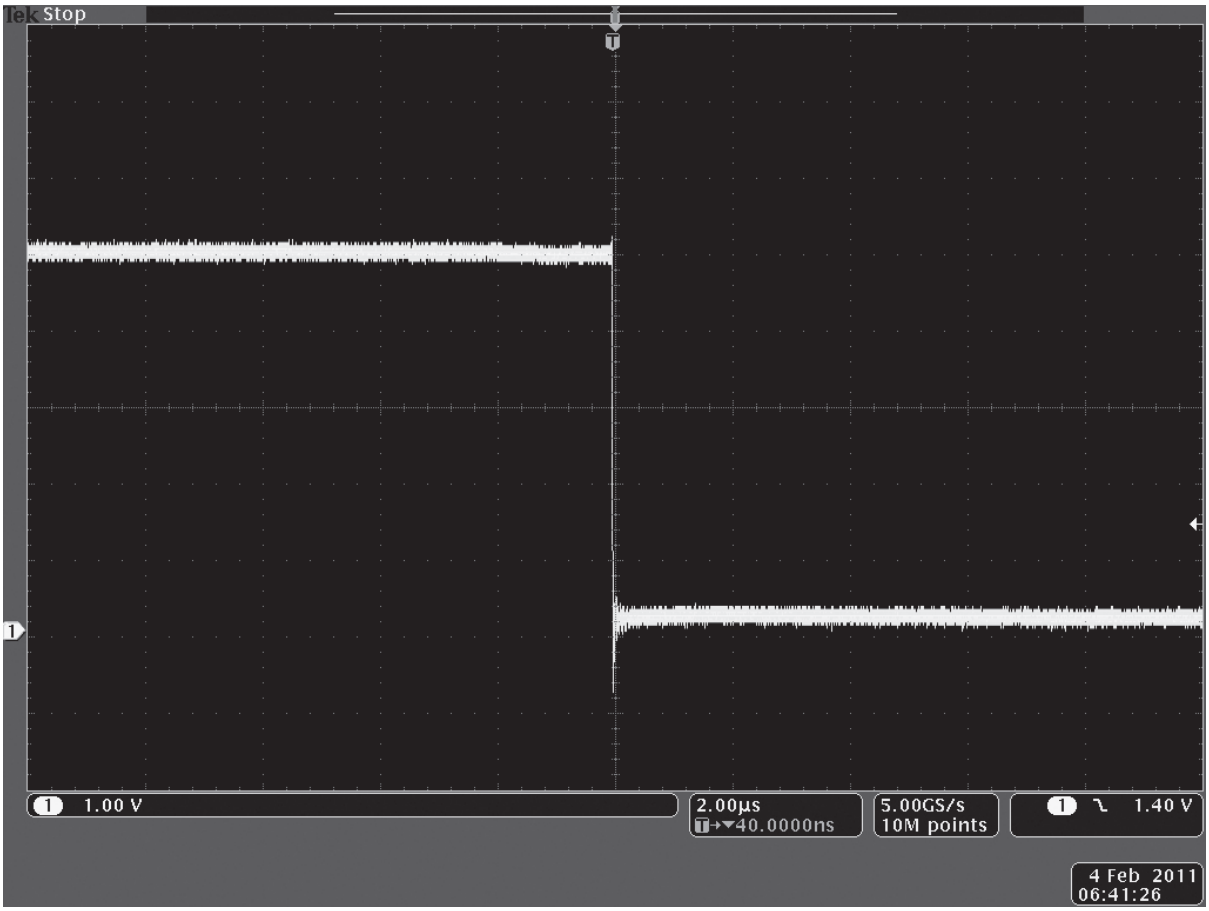


Trace 1: Trace recorded at R4009.

Figure 6-23. 1-Wire Waveform

6.9 GCAI

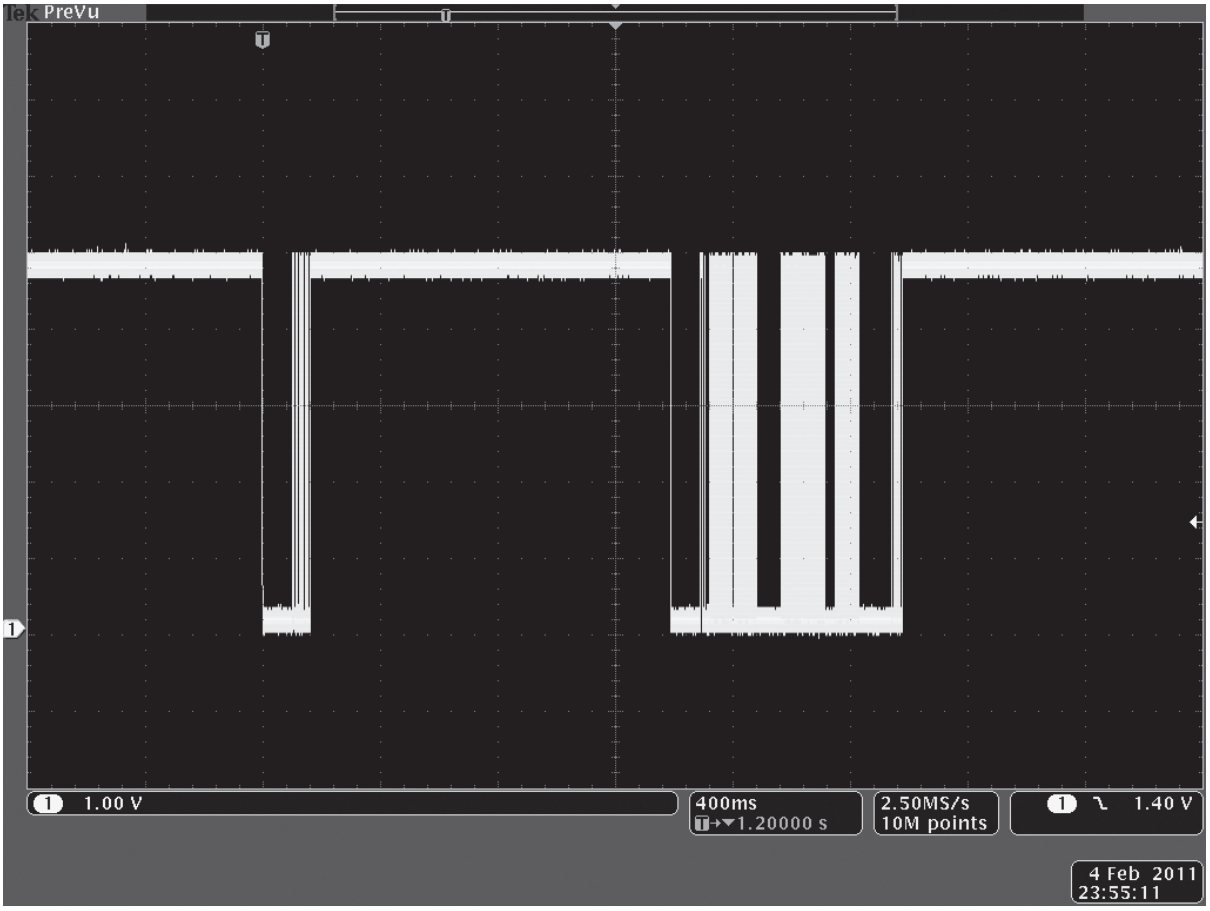
6.9.1 GPIO0



Trace 1: Trace recorded at D4001 after attaching an Accessory.

Figure 6-24. GCAI – GPIO0 Waveform

6.9.2 GPIO4 / Keyfail during Keyload

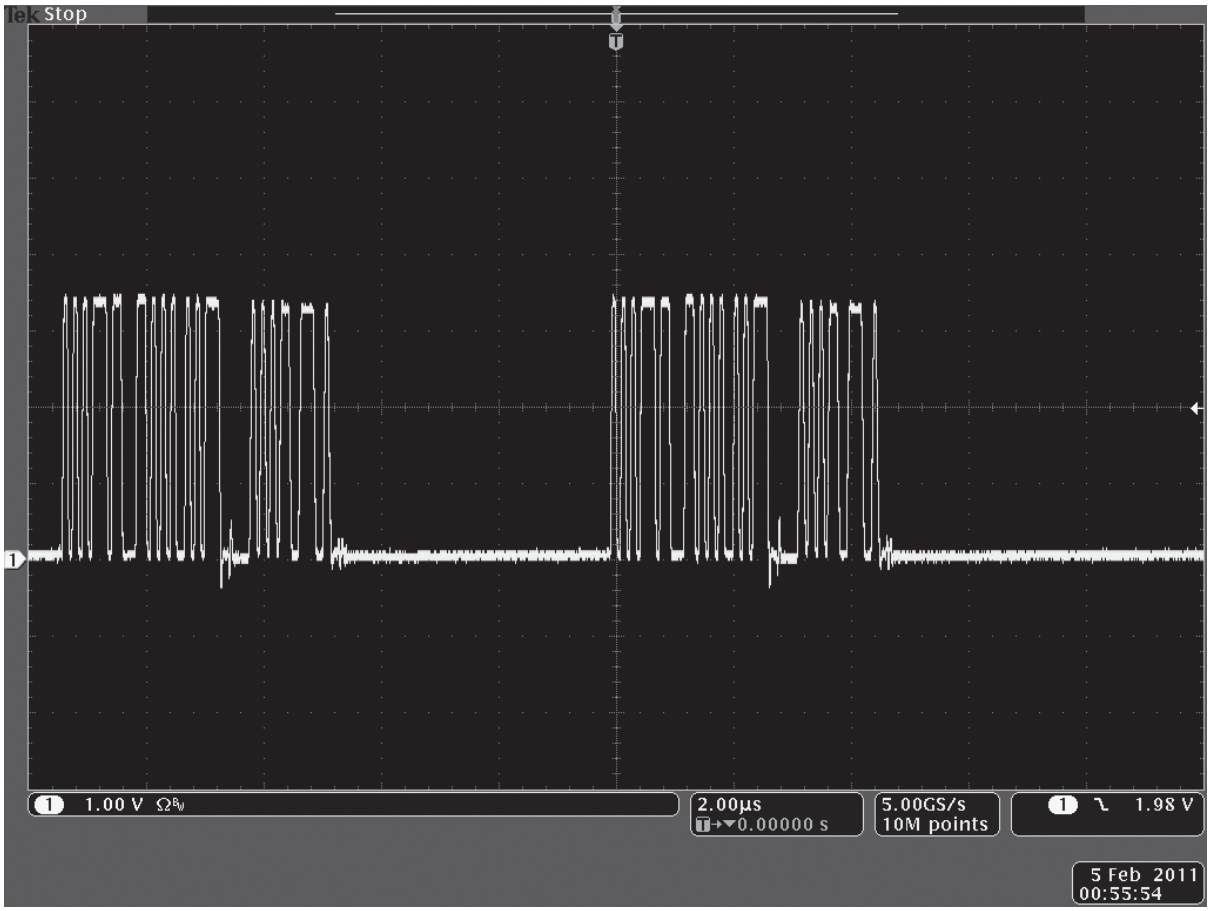


Trace 1: Trace recorded at Pin 65 of J4001 during Keyloading.

Figure 6-25. GCAI – GPIO4 Waveform

6.10 USB

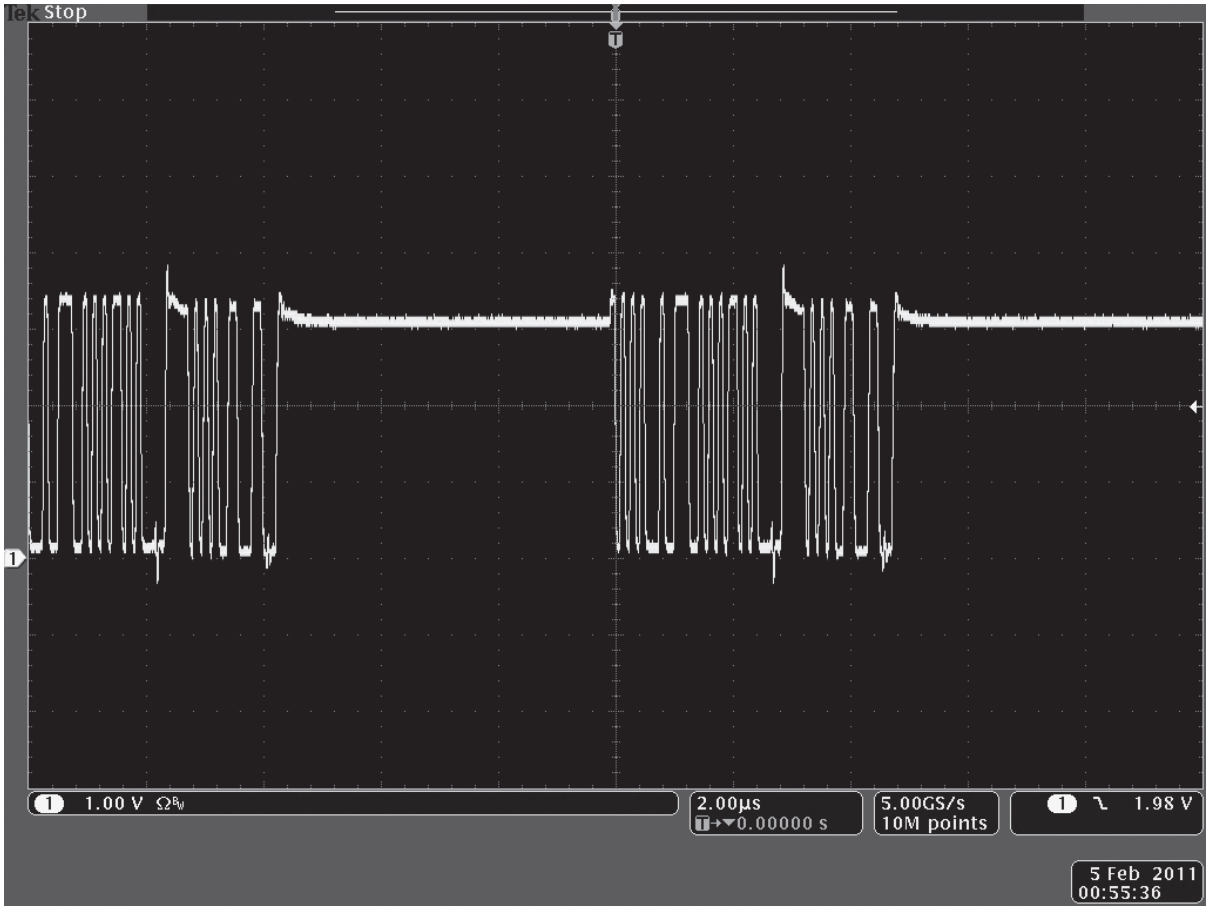
6.10.1 D-



Trace 1: Trace recorded at TP F_GCAI_USB-.

Figure 6-26. USB – D- Waveform

6.10.2 D+

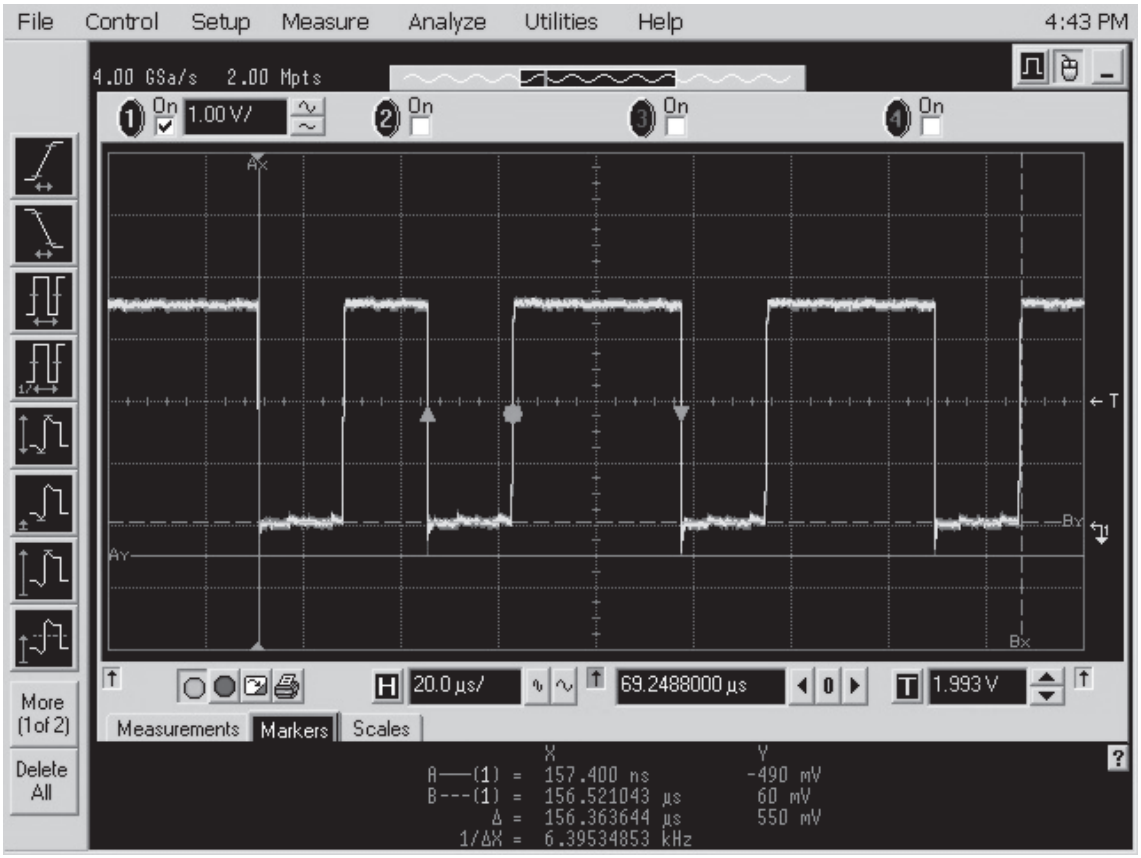


Trace 1: Trace recorded at TP F_GCAI_USB+.

Figure 6-27. USB – D+ Waveform

6.11 UART

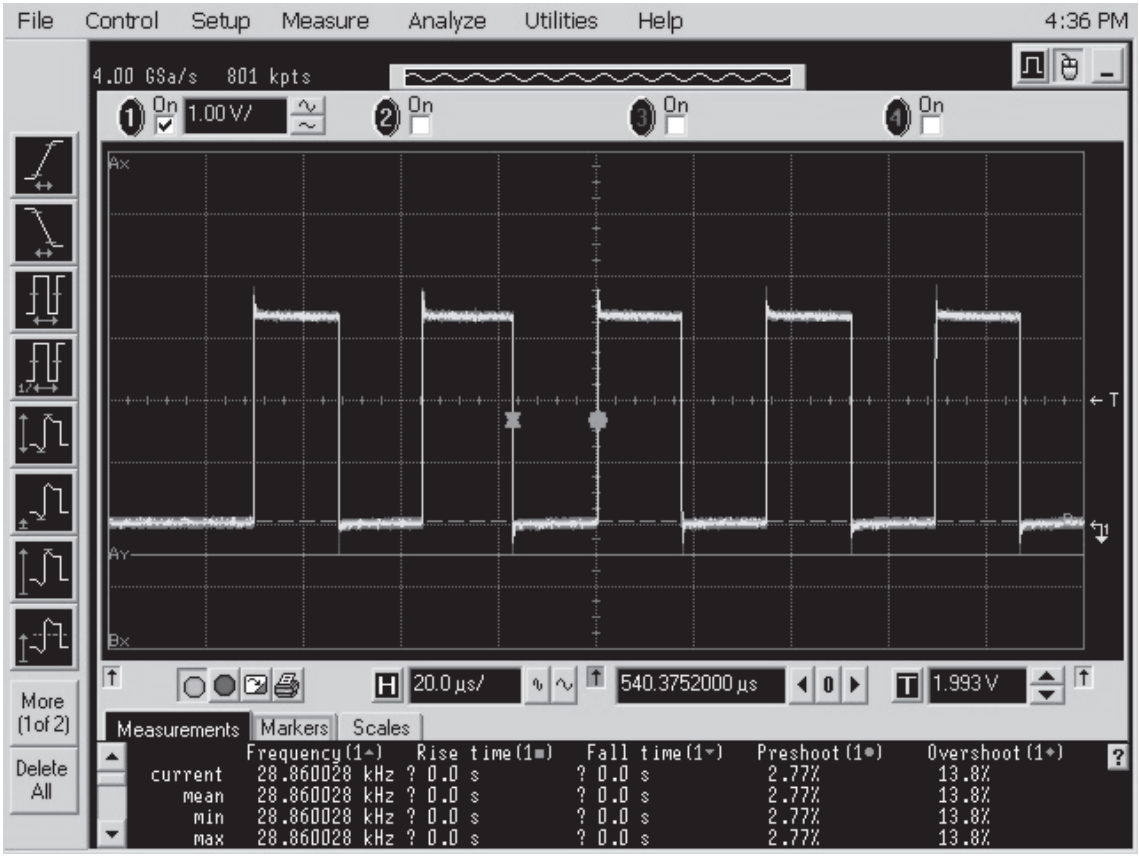
6.11.1 RX



Trace 1: Trace recorded at TP F_BOOT_RX.

Figure 6-28. UART – RX Waveform

6.11.2 TX

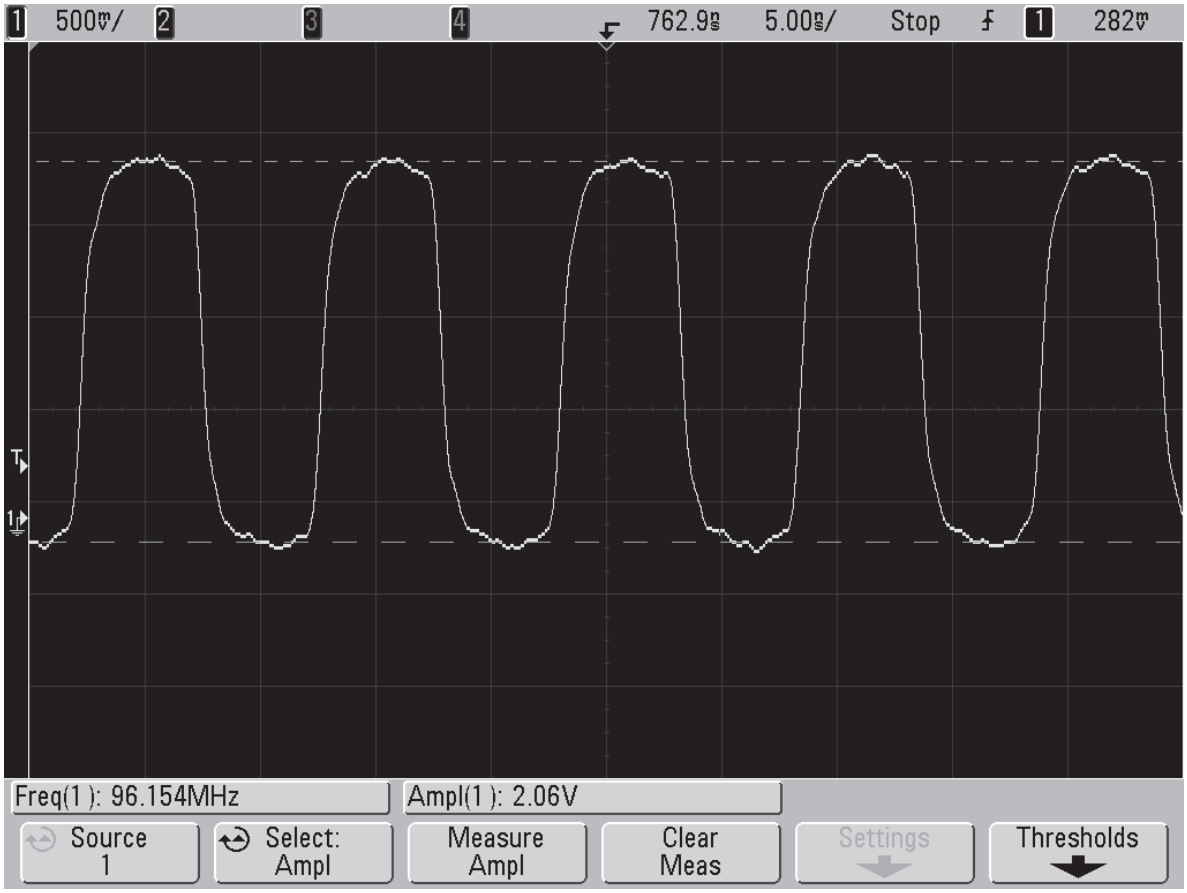


Trace 1: Trace recorded at TP F_BOOT_TX.

Figure 6-29. UART – TX Waveform

6.12 SDRAM

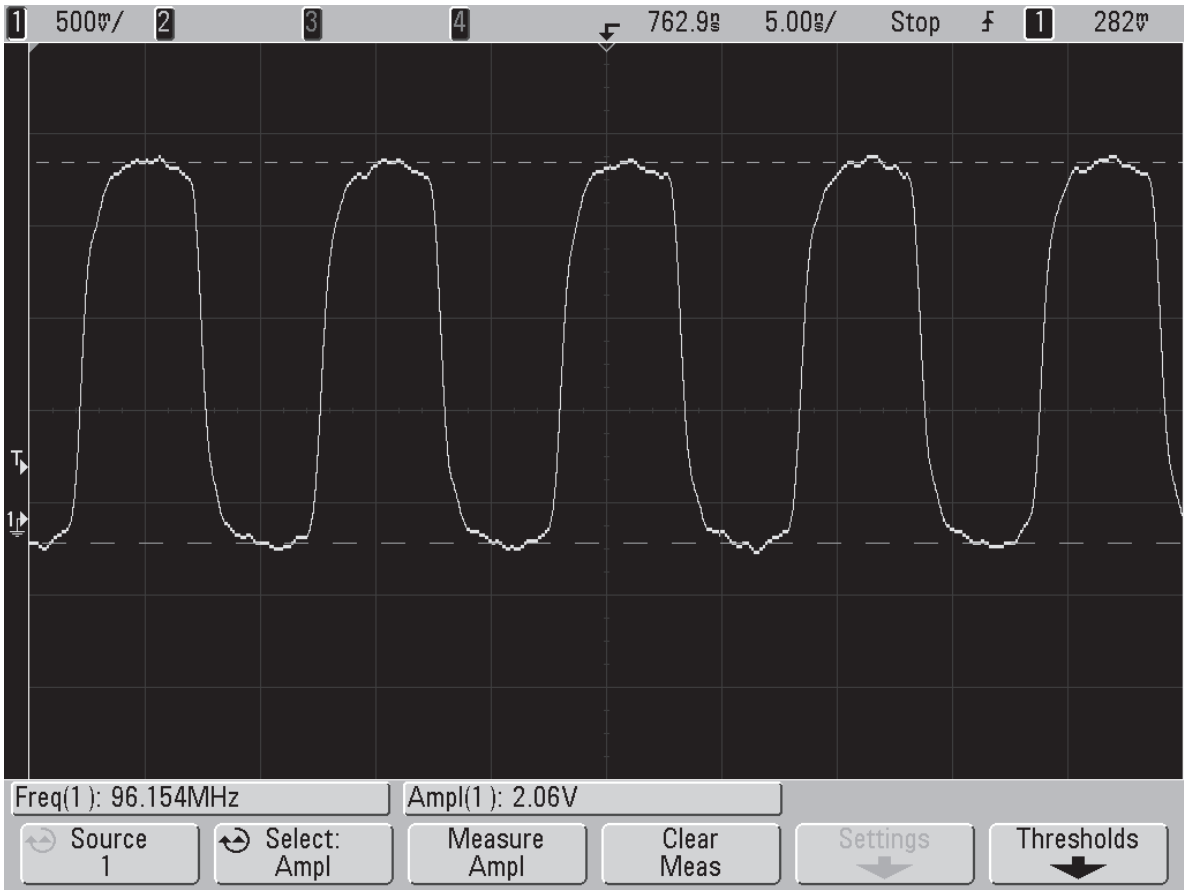
6.12.1 CLK



Trace 1: Trace recorded at TP6307.

Figure 6-30. SDRAM – CLK Waveform

6.12.2 CLKX

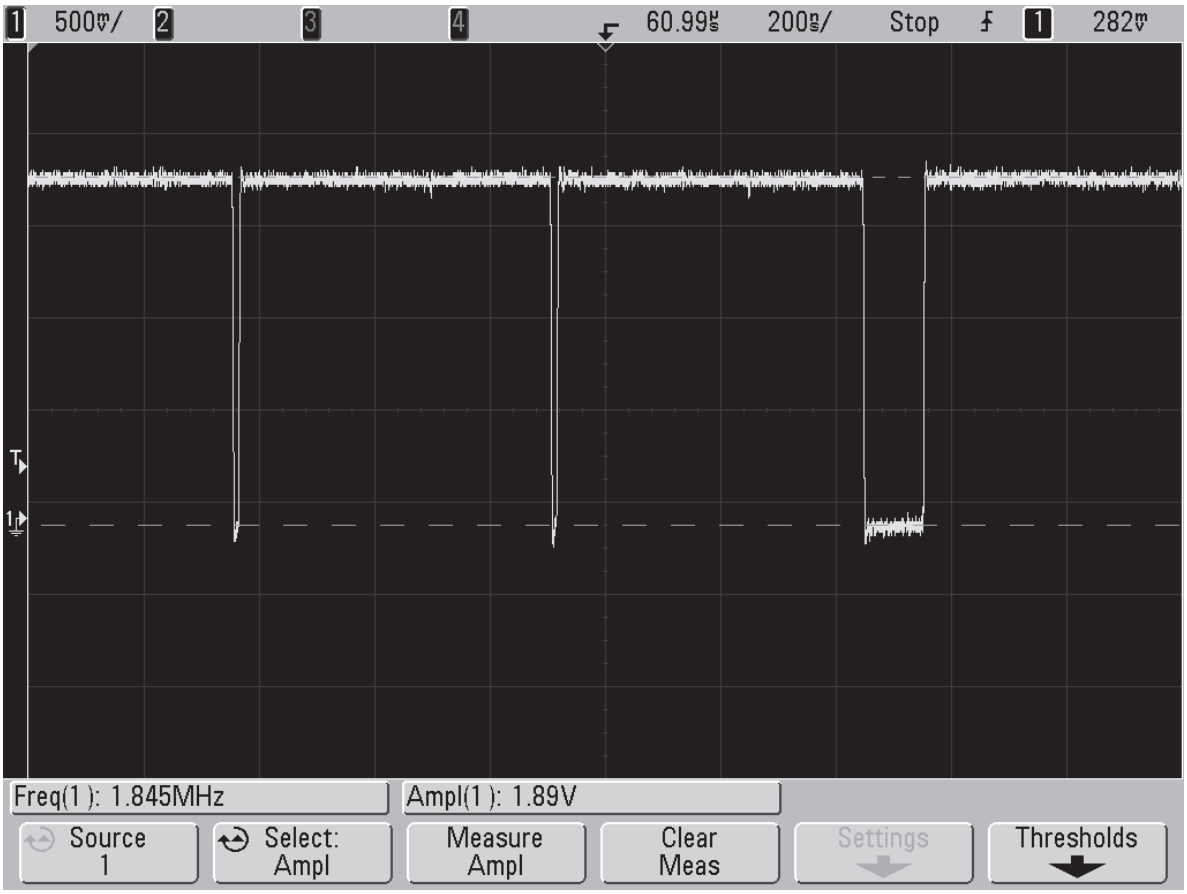


Trace 1: Trace recorded at TP6308.

Figure 6-31. SDRAM – CLKX Waveform

6.13 FLASH CONTROL

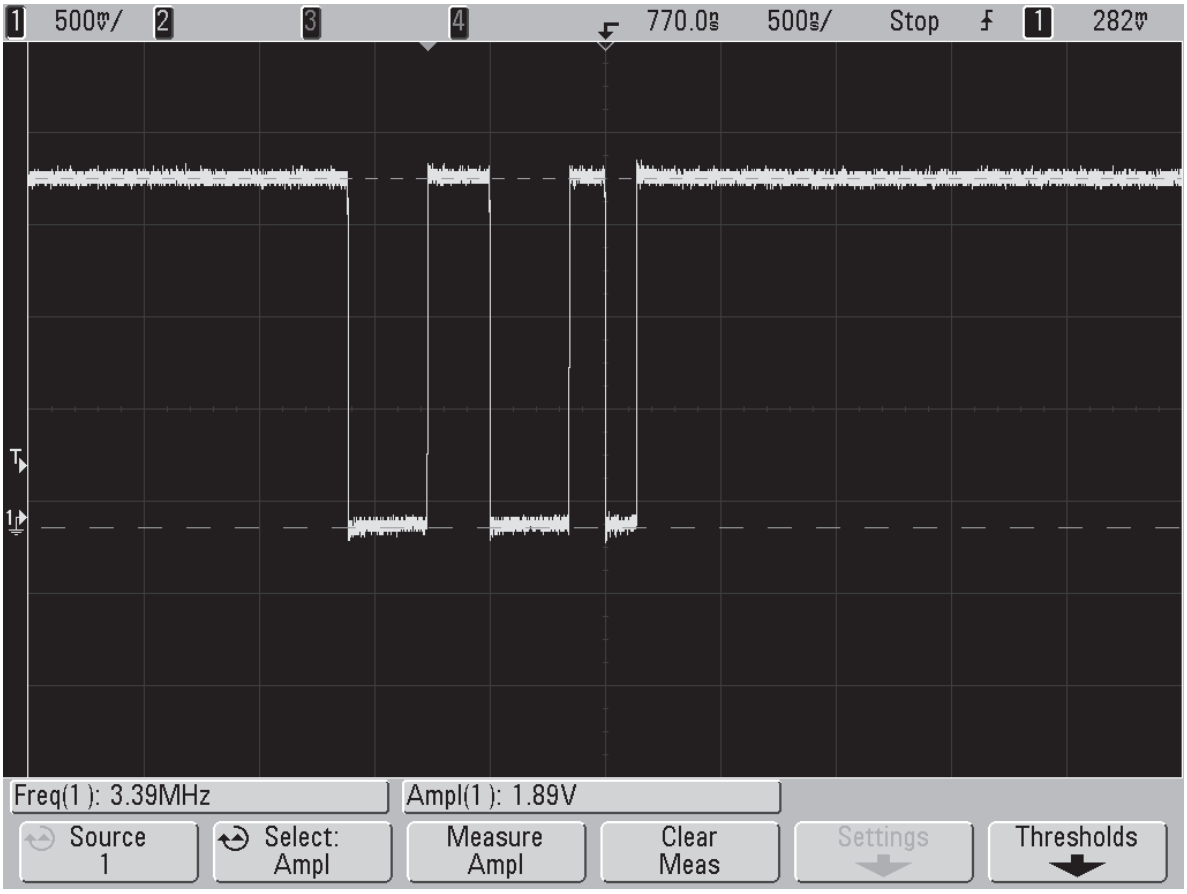
6.13.1 ADV



Trace 1: Trace recorded at R6314.

Figure 6-32. FLASH CONTROL – ADV Waveform

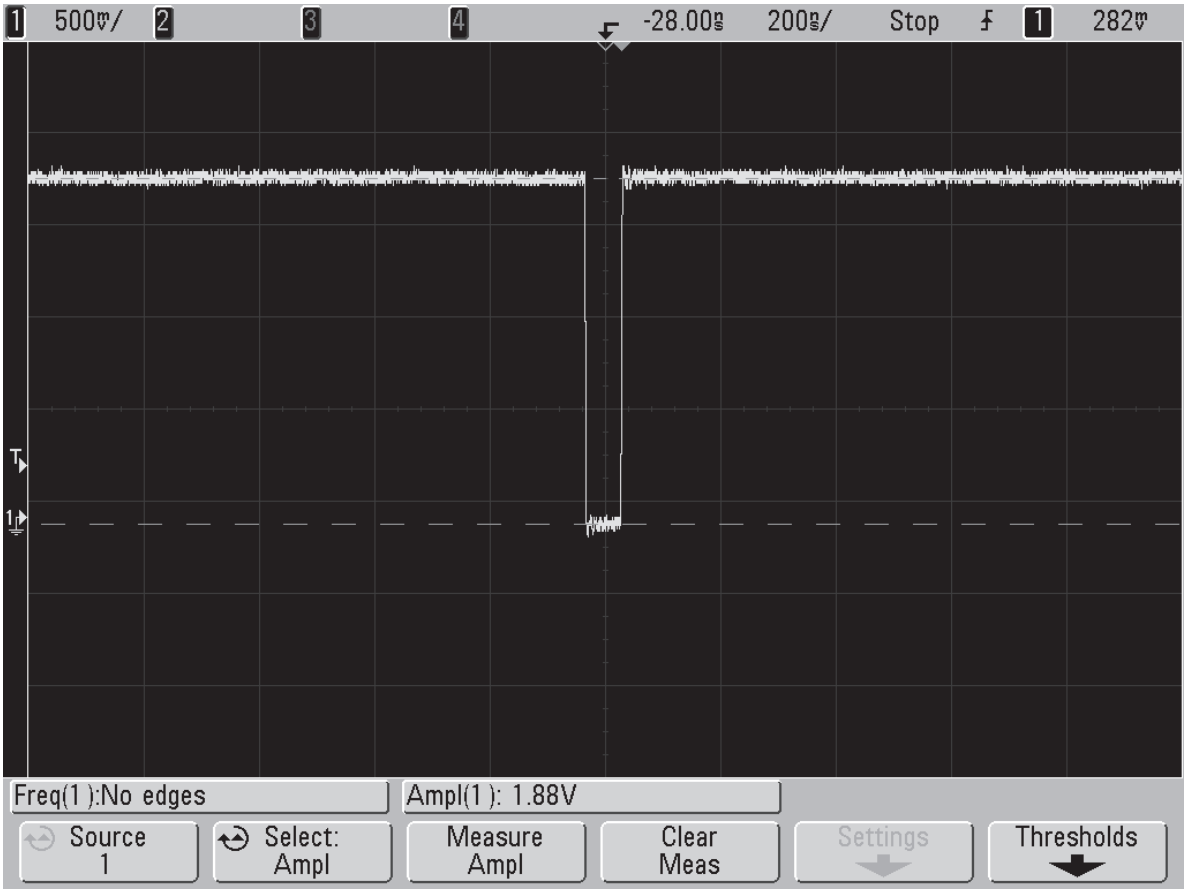
6.13.2 CS3



Trace 1: Trace recorded at R6311.

Figure 6-33. FLASH CONTROL – CS3 Waveform

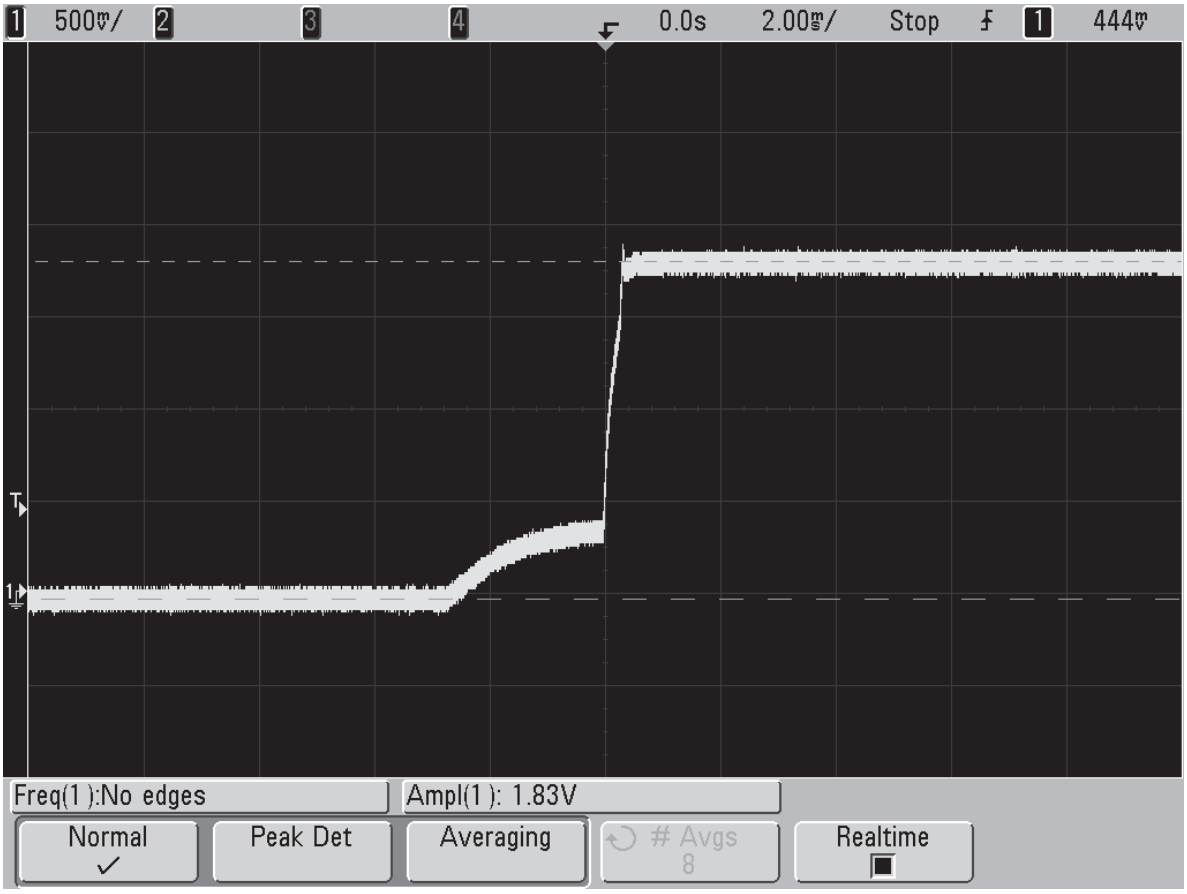
6.13.3 OE



Trace 1: Trace recorded at R6312.

Figure 6-34. FLASH CONTROL – OE Waveform

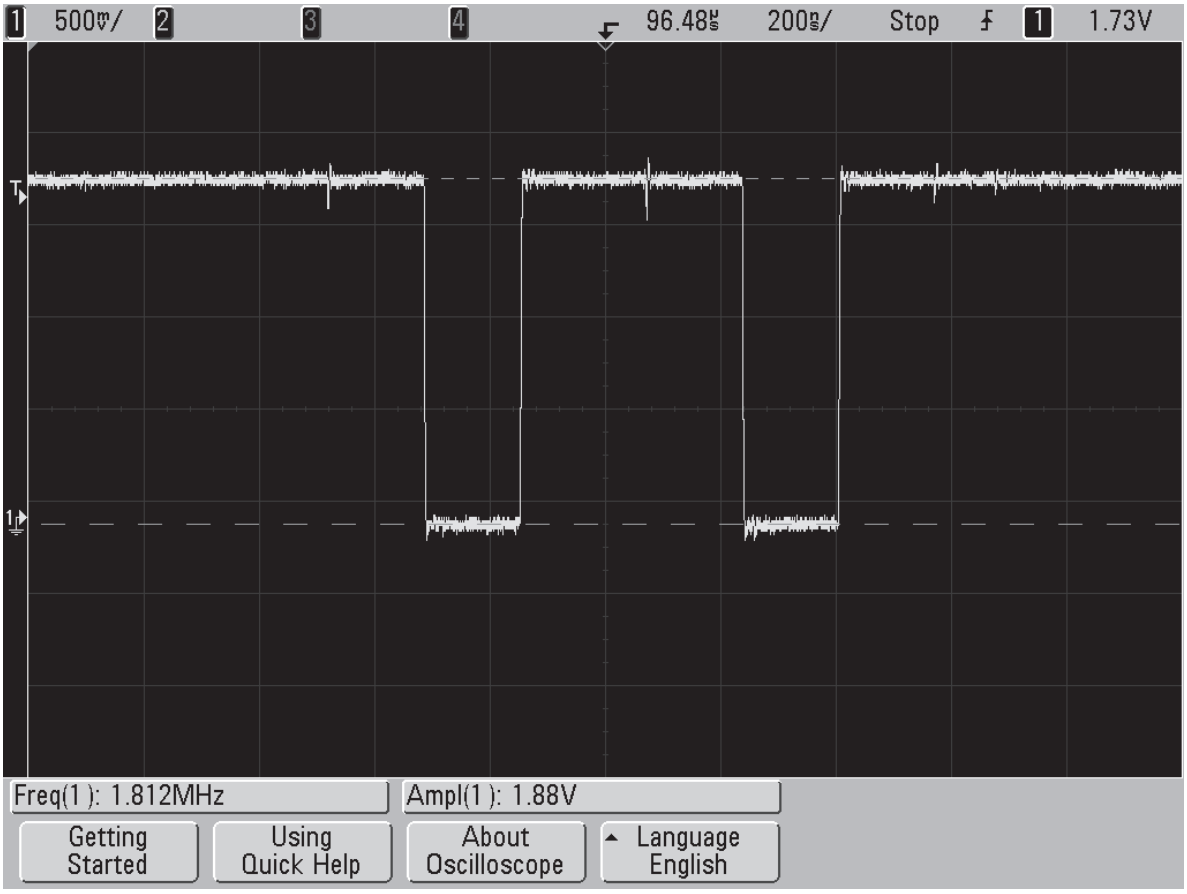
6.13.4 RDY



Trace 1: Trace recorded at R6316.

Figure 6-35. FLASH CONTROL – RDY Waveform

6.13.5 WE



Trace 1: Trace recorded at R6313.

Figure 6-36. FLASH CONTROL – WE Waveform

6.14 Expandable Memory (eMMC)

6.14.1 eMMC @ Power-On

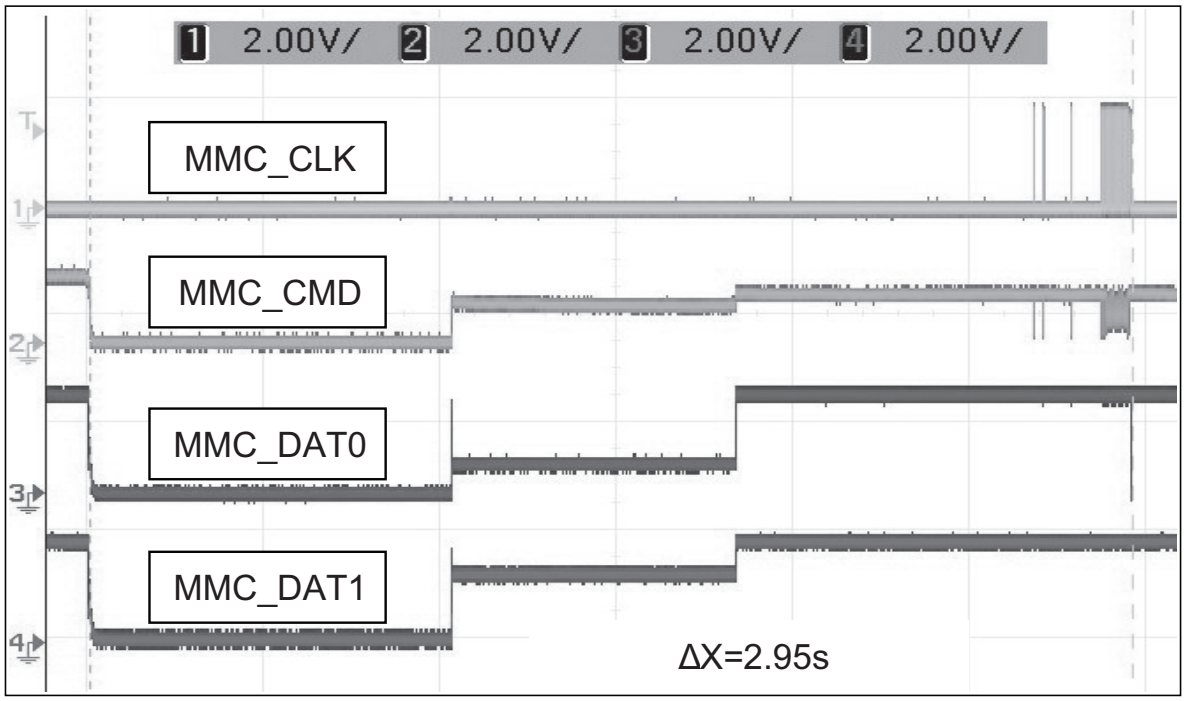


Figure 6-37. eMMC: Power-On until Final Initialization Waveforms

6.14.2 eMMC @ Successful Initialization

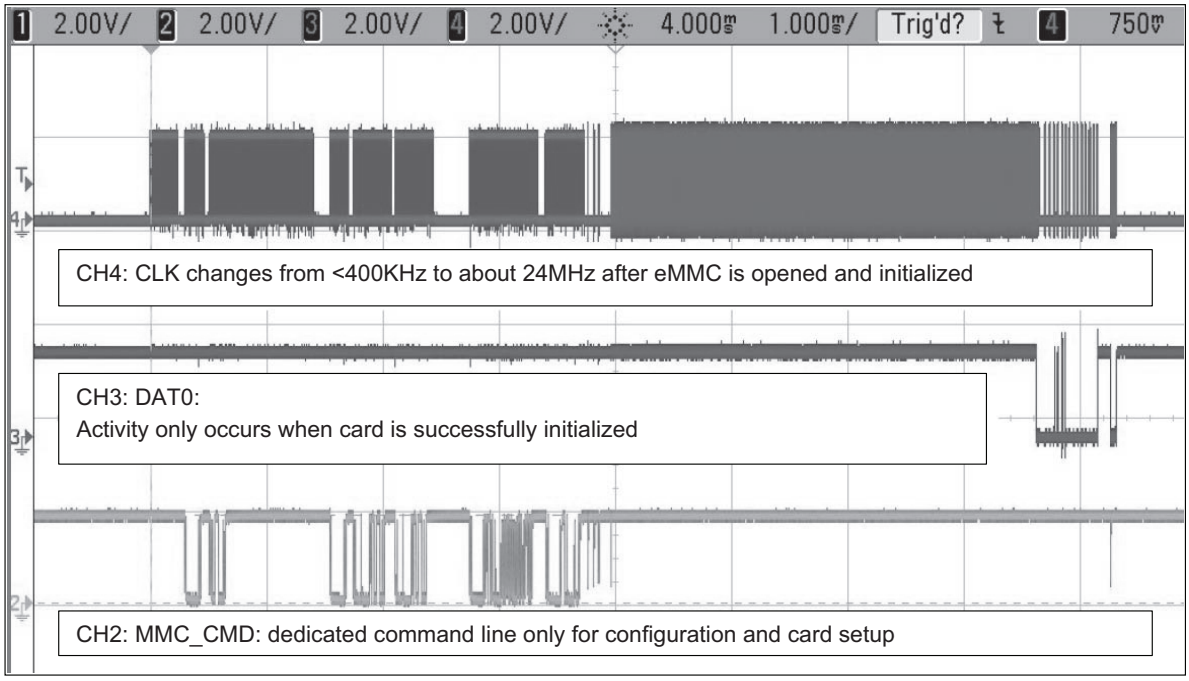


Figure 6-38. eMMC: Correct Detection, Configuration and Initialization Waveforms

6.14.3 eMMC Failure to Initialize

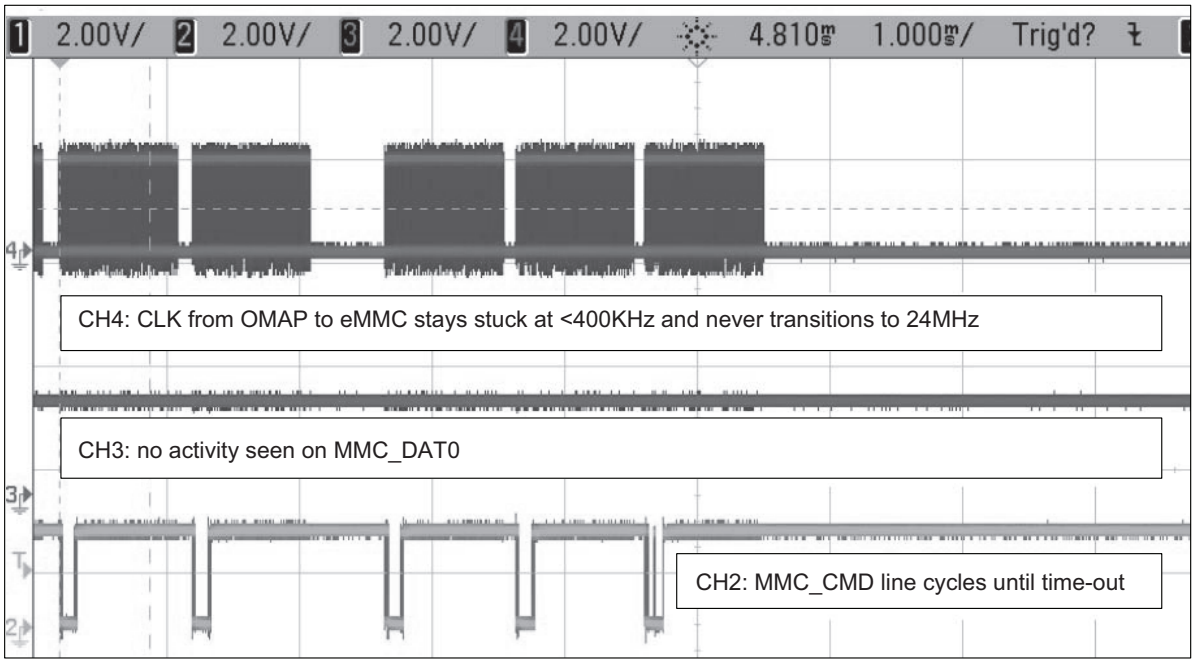


Figure 6-39. eMMC: Failure to Properly Detect, Configure and Initialize Waveforms

6.14.4 MMC_CLK @ < 400 kHz

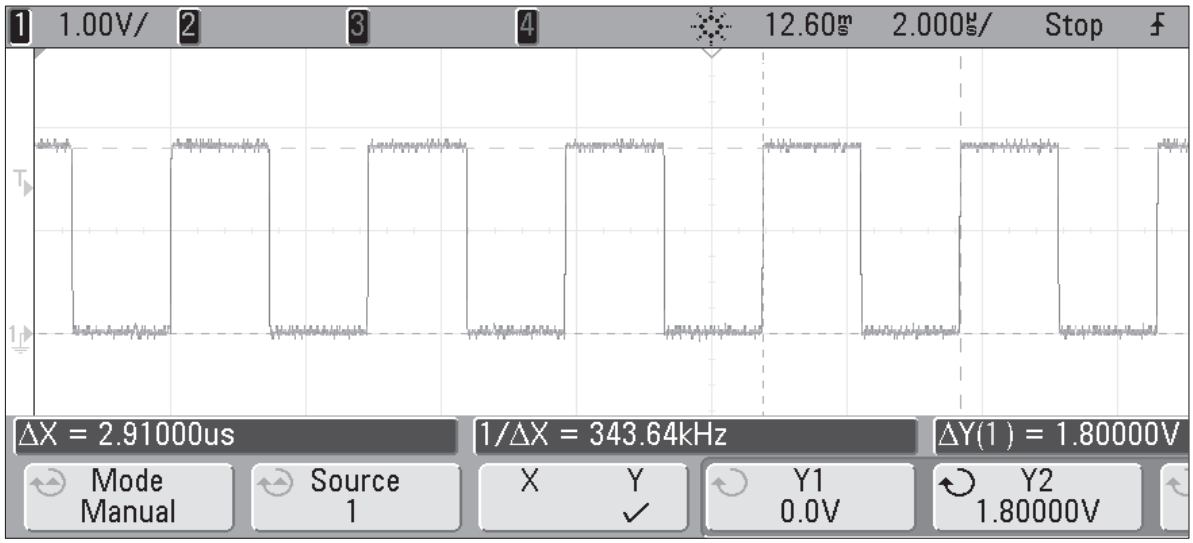


Figure 6-40. MMC_CLK @ < 400 kHz during "Clock Frequency Identification Mode"

6.14.5 MMC_CLK @ < 24 MHz

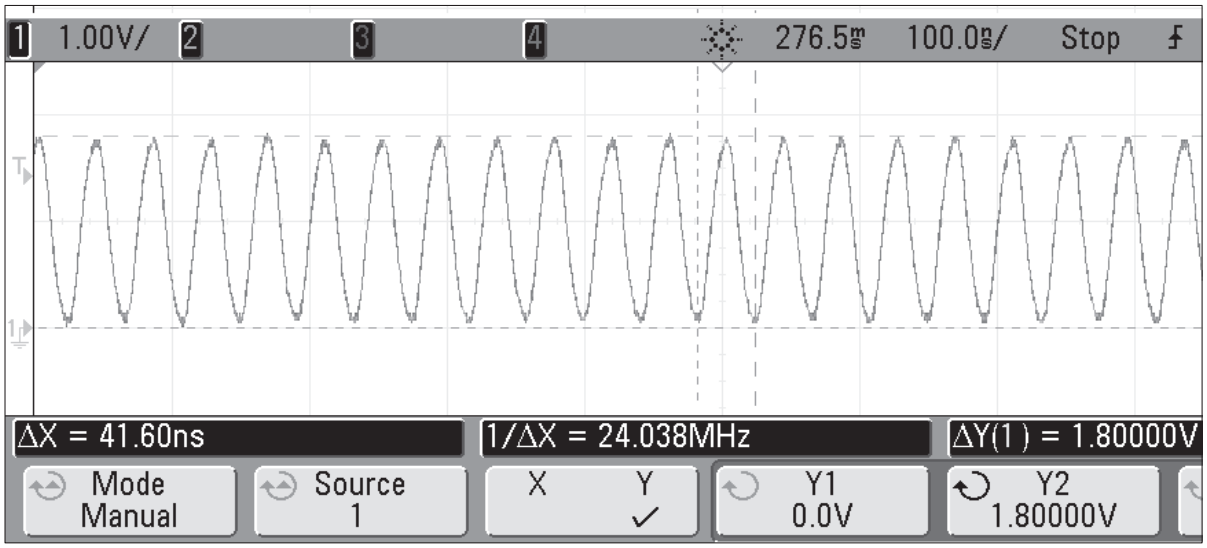


Figure 6-41. MMC_CLK @ < 24 MHz during "Clock Frequency Data Transfer Mode"

6.14.6 MMC_CMD: Correctly Measured

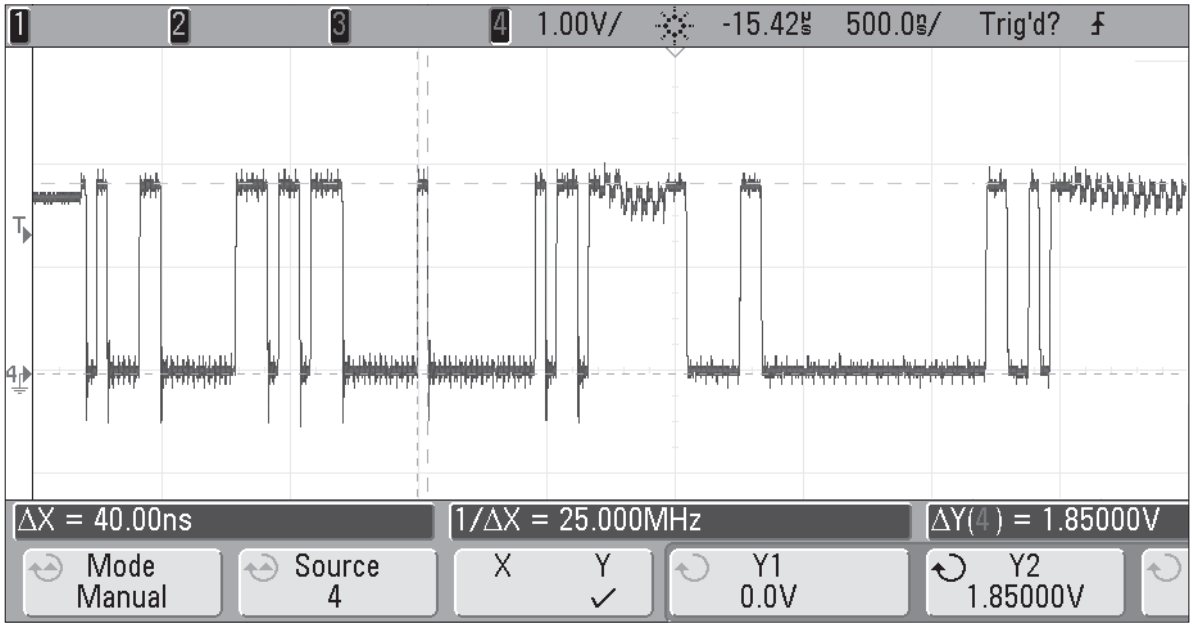


Figure 6-42. MMC_CMD actual waveform when probing with active probes; short wires; GND pin soldered

6.14.7 MMC_CMD: Incorrectly Measured

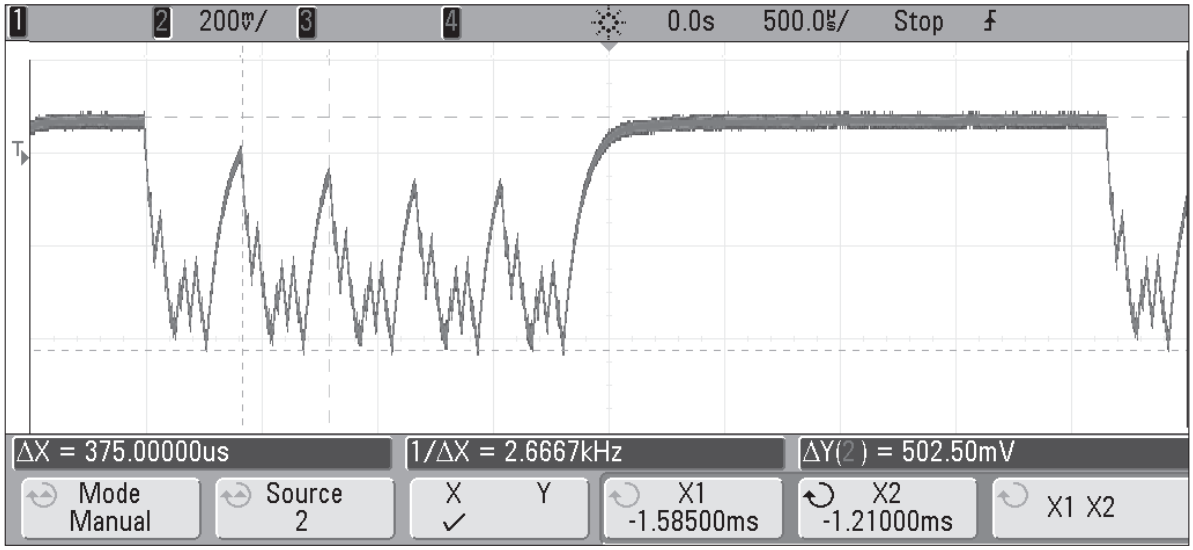


Figure 6-43. MMC_CMD misleading waveform when probing with passive probe; long wires; GND clip

6.14.8 eMMC @ Data Transfer

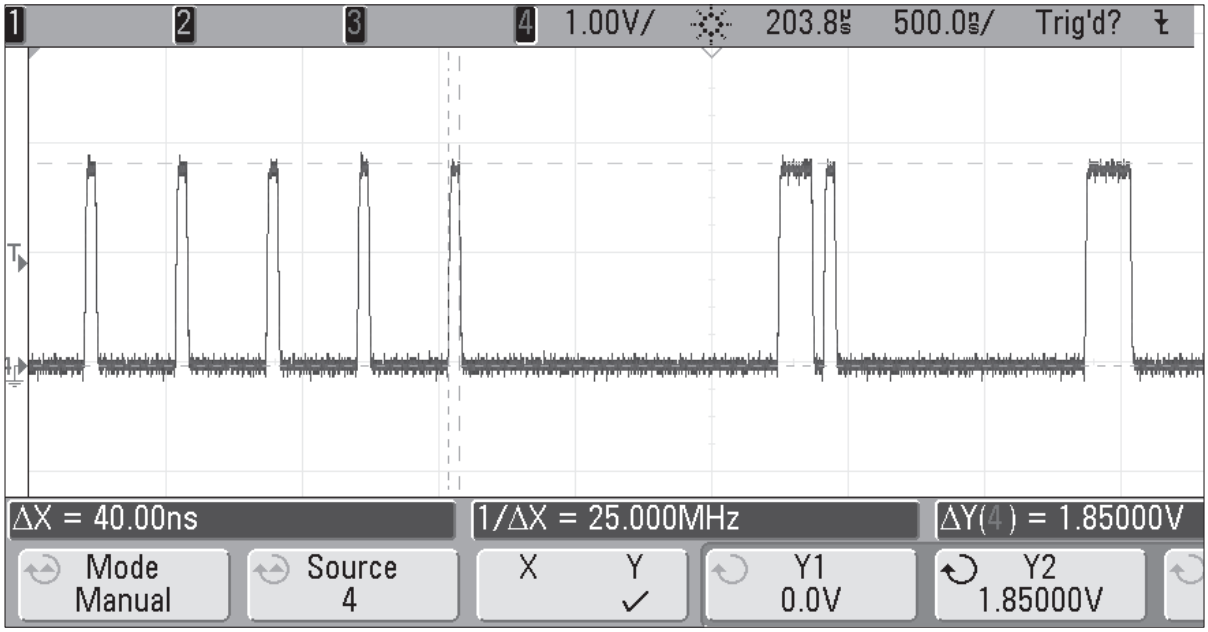


Figure 6-44. MMC_DAT0, MMC_DAT1, MMC_DAT2, MMC_DAT3 data lines during data transmission between eMMC and OMAP

6.14.9 eMMC : Clock

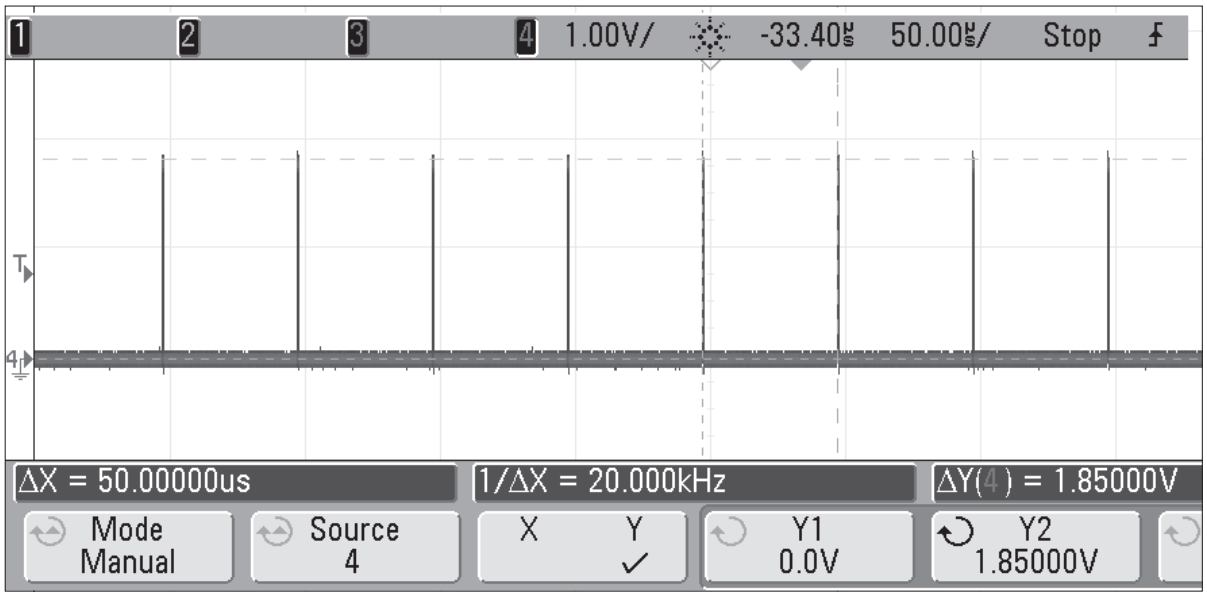
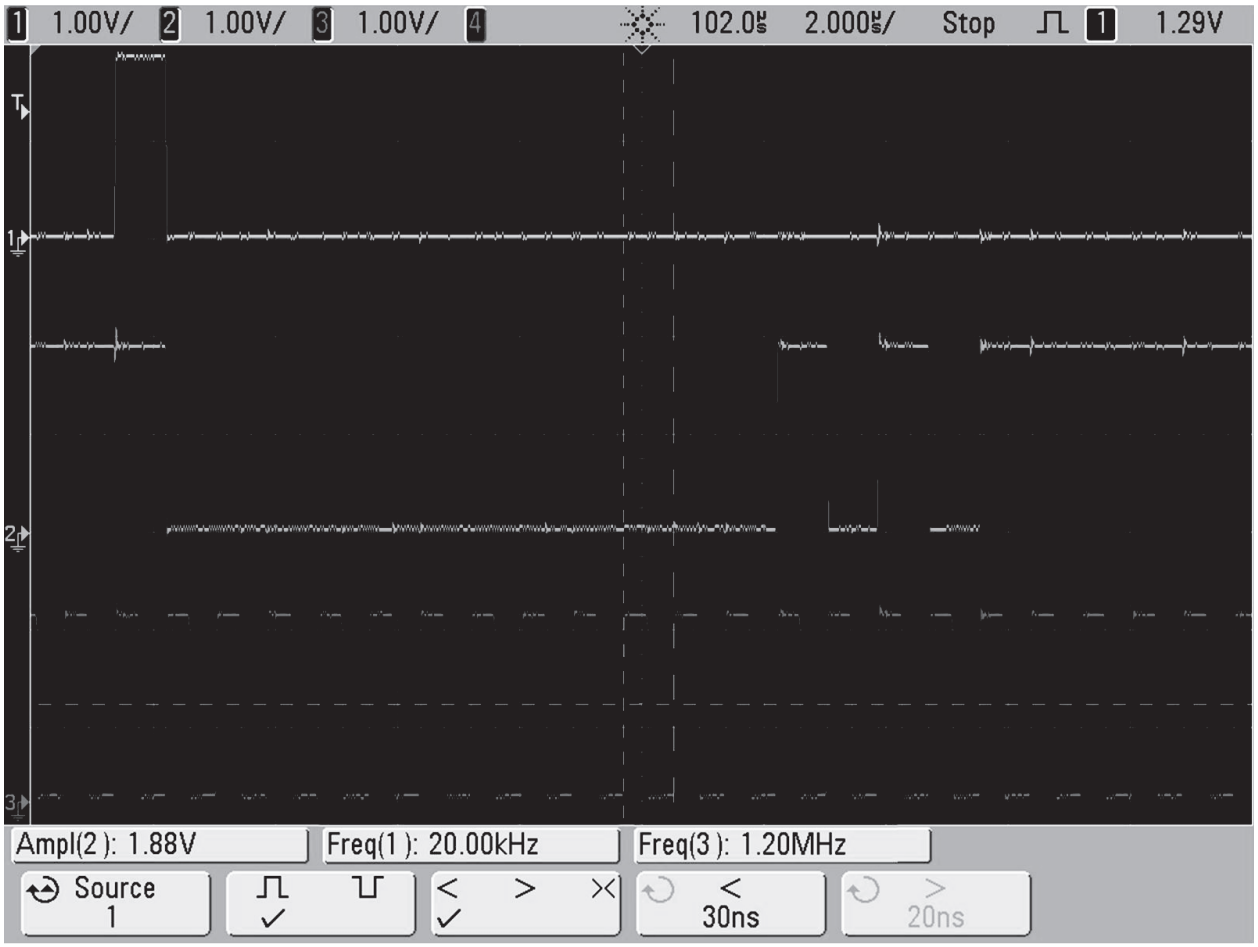


Figure 6-45. F2_TIMER_OUT clock from CPLD into OMAP for eMMC operation

6.15 Receive Baseband Signals

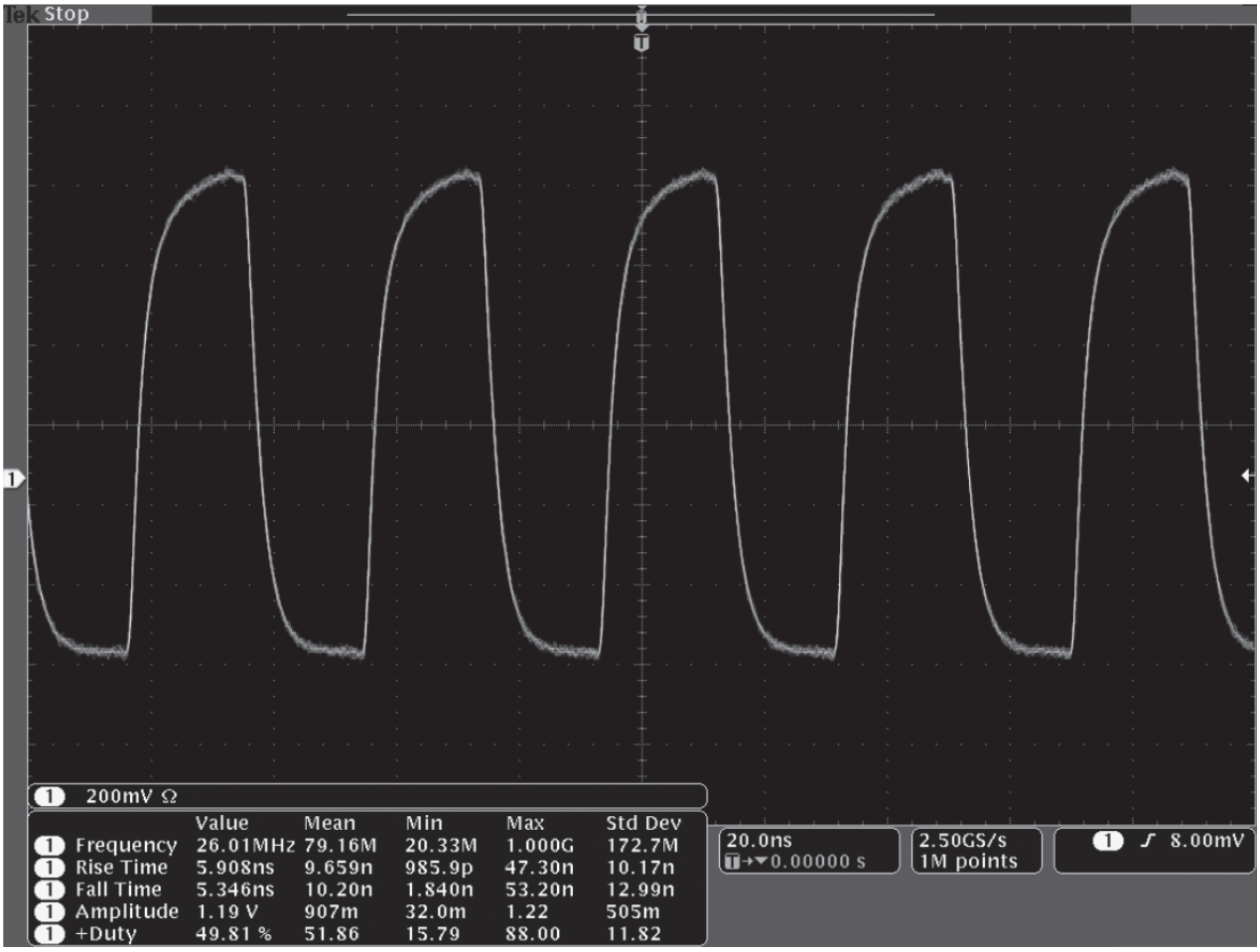


Trace 1: DIG_DATA_SSI_RX_FS at TP111 or
ABACUS_SSI 1 (RX_FSYNC) – R1004 of VOCON Main Board.
Trace 2: DIG_DATA_SSI_RX_DOUTA at TP112 or
ABACUS_SSI 2(RX_DA) – R1005 of VOCON Main Board.
Trace 3: CLK_SSI_RX at TP106 or
ABACUS_SSI 0 (RX_CLK) – R1006 of VOCON Main Board.

Figure 6-46. Received Baseband Waveforms

6.16 GPS

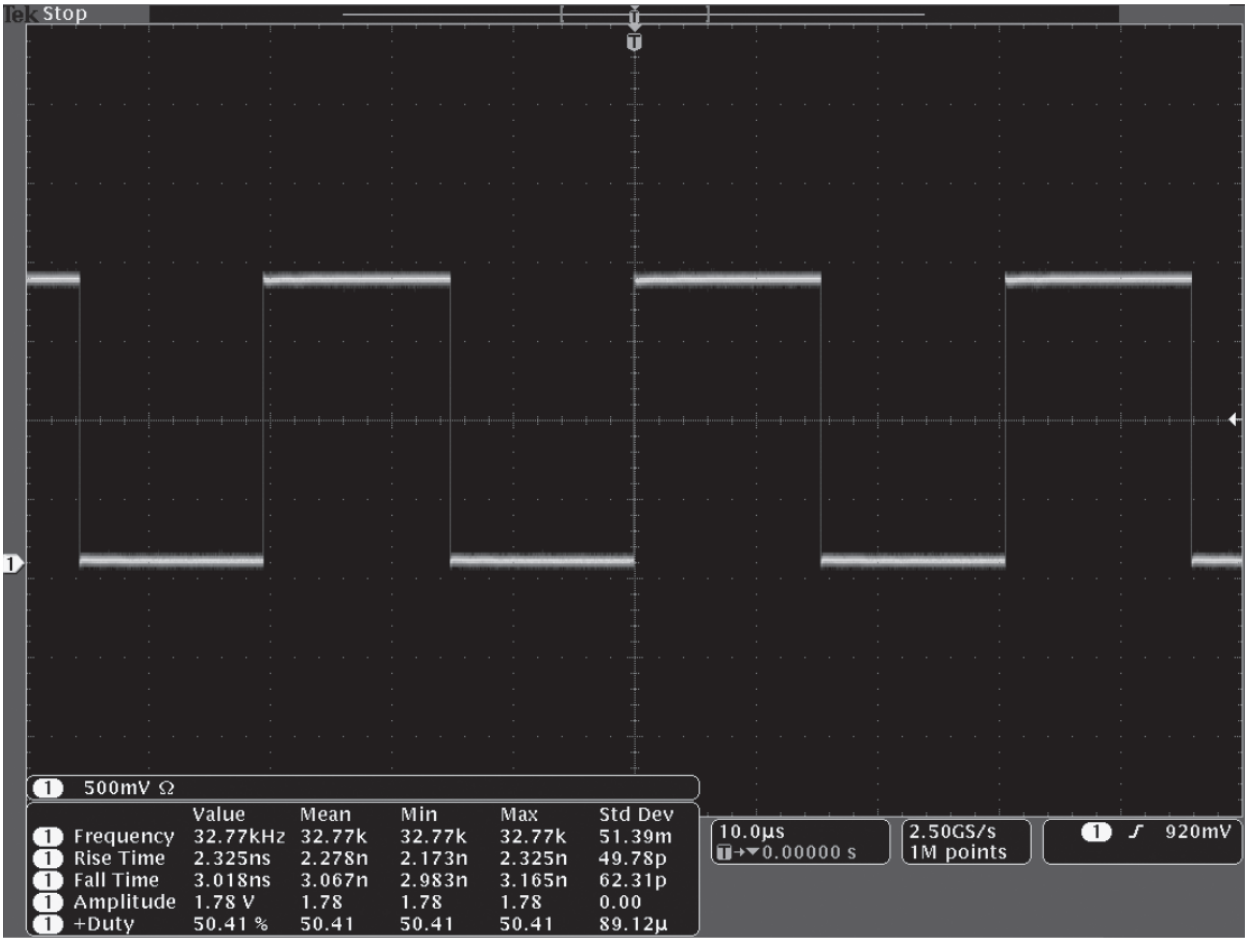
6.16.1 GPS TCXO (26 MHz TCXO)



Trace 1: Trace recorded at C2421 at Expansion Board.

Figure 6-47. GPS TCXO Waveforms

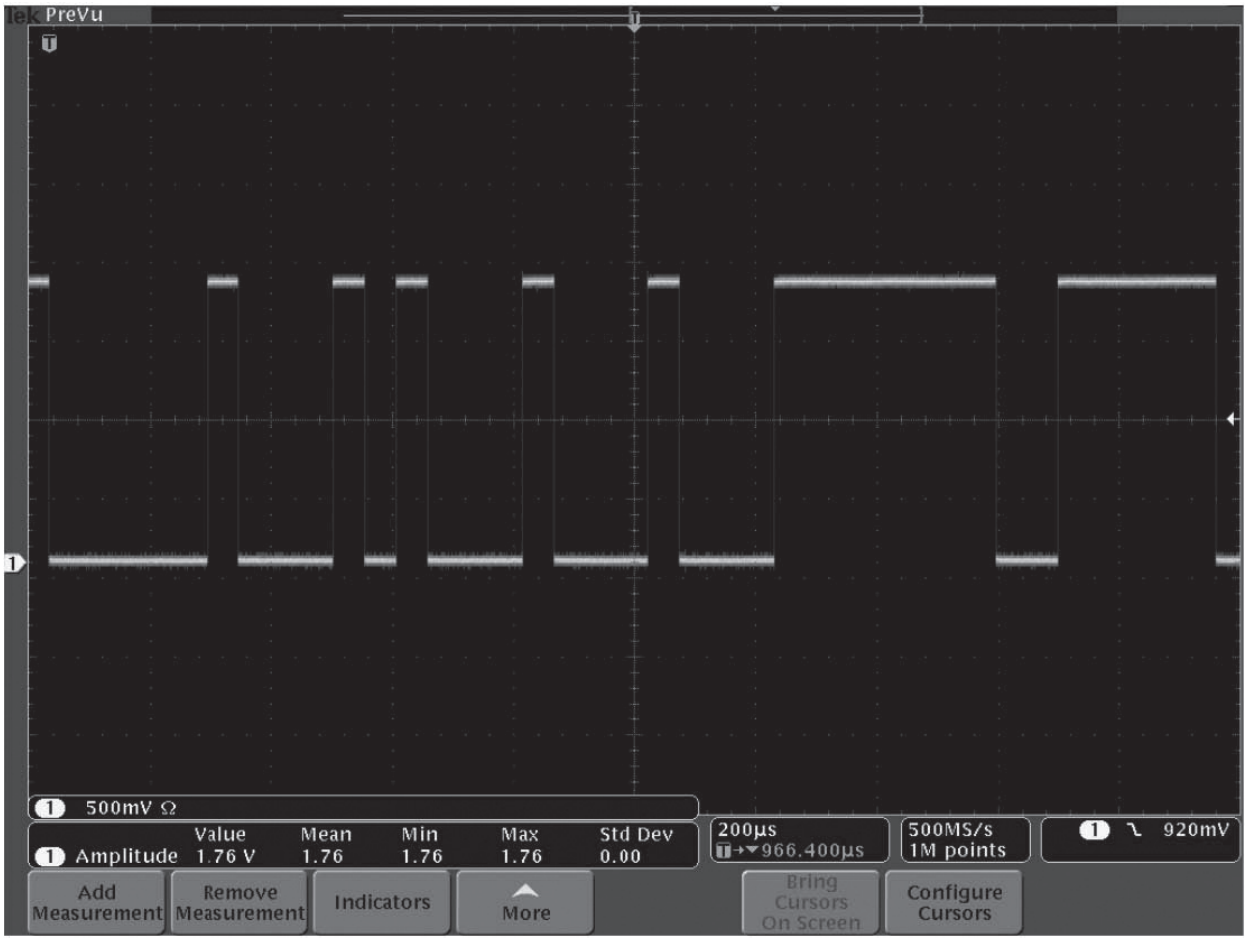
6.16.2 GPS RTC (GPS 32 kHz RTC)



Trace 1: Trace recorded at TP2405 of Expansion Board.

Figure 6-48. GPS RTC Waveforms

6.16.3 GPS UART (RX / TX) Data



Trace 1: Trace recorded at TP2407 (TX) / TP2408 (RX) of Expansion Board.

Figure 6-49. GPS UART DATA Waveforms

6.17 Bluetooth Troubleshooting Waveforms

A Bluetooth radiated or conducted signal at 2.402 GHz and a LF radiated signal at 125 kHz can be used to verify the receiver and transmitter on the radio are operational. Using an APX 5000/APX 6000/APX 6000XE/SRX2200 debug fixture, the BT/LF signals can be verified. A spectrum analyzer (such as an Aeroflex 3920 Digital Radio Test Set) can be connected to the debug fixture to verify the presence of such signals. A signal generator can be connected to the debug fixture to test the APX 5000/APX 6000/APX 6000XE/SRX2200 BT/LF receivers. Radiated Bluetooth TX/RX testing should be performed before conducted testing is performed in the fixture since the radio does not have to be opened for radiated testing. To test the presence of a radiated Bluetooth TX signal, an external Bluetooth antenna should be connected to the input of the sprectrum analyzer. To test the presence of a radiated Bluetooth RX signal, an external Bluetooth antenna should be connected to the output of a signal generator set to TX CW 2.402 Ghz. The speaker grille of the radio should be brought near the antenna during testing. The following is the procedure to activate the Bluetooth/LF transmitter or receiver using RCMP commands:

To send an RCMP command, connect a RS-232 com port GCAI cable between the radio and PC. Start HyperTerminal on com 1 (typical RS-232 port) using these settings: 9600 baud, 8-bit, non-parity, stop bit = 1, HW flow control. Type, “AT#DEBUG”, then type “rcmpraw:000c”.

Bluetooth Command to TX 2.402 GHz CW

Connect a spectrum analyzer to the Bluetooth port of the test fixture with a 6 dB attenuator in-line. Set the spectrum analyzer to 2.402 GHz center, 10 MHz span, RBW of 300 kHz, a VBW of 1 MHz, and a sweep time of 2.5 ms. There are two commands to verify a spectrum analyzer can read a 2.402 GHz wave from the radio BT transmitter. Enter the rcmpraw:00390207 command first, then enter rcmpraw:0039020100000F0006 (on SR 7.9 SW, use this command: rcmpraw:0039020100000F, but be aware that the TX signal may time out in less than 10 minutes).

Table 6-2. Bluetooth Command to TX

TEST	RCMPRAW CMD	RESPONSE
Bluetooth TX at 2.402 GHz CW Modulation	rcmpraw: 00390207	Success: 8039000207 Failure: 8039010207
	rcmpraw: 0039020100000F0006	Success: 8039000201 Failure: 8039010201

Successful Example Entry:

Type:rcmpraw:000c

Response:800c00

Type:rcmpraw:00390207

Response:8039000207

Type:rcmpraw:0039020100000F0006

Response:8039000201

Bluetooth Command to RX 2.402 GHz

The RSSI should increase significantly in the presence of a 2.402 GHz nearby signal. Using an external signal generator source signal of 2.402 GHz connected to the test fixture Bluetooth port, send this command to read the 2.402 GHz RSSI:

Table 6-3. Bluetooth Command to RX

TEST	RCMPRAW CMD	RESPONSE
Bluetooth RX at 2.402 GHz	rcmpraw:0039020D00	Success: 803900020dBB, where BB is the RSSI in hex. Failure: 803901

If no signal is detected, the response will be 803900020d80.

If no test equipment is available, an APX radio with BT functional could be used to verify the test radio. Hold the speaker grilles together on both radios. One radio could be used to TX while the other radio is used to RX.

Low Frequency (LF) Command to TX 125 kHz CW

Set the spectrum analyzer at 125 kHz center, 10 MHz span, RBW of 1 kHz, a VBW of 3 kHz, and a sweep time of 25 ms. Use this command to verify the LF coil is emitting a 125 kHz pulse by connecting the test fixture LF port to a spectrum analyzer:

Table 6-4. Low Frequency Command to TX

TEST	RCMPRAW CMD	RESPONSE
Low Freq. 125 kHz TX	rcmpraw: 00390303	Success: 8039000303* Failure: 8039010303*
Note: * In SR 7.9 SW release, the response is 8039000302 for a success and 8039010302 for a failure.		

Low Frequency (LF) Command to RX 125 kHz

Use this command to verify the LF coil is receiving a 125 kHz pulse generated by a signal generator connected to the test fixture LF port. The result contains the LF RSSI. This command is not in the initial SW release but is included in SR 7.11 SW.:

Table 6-5. Low Frequency Command to RX

TEST	RCMPRAW CMD	RESPONSE
Low Freq. 125 kHz RX	rcmpraw: 00390305	Success: 80390003BB, where BB is the RSSI in hex. Failure: 803901

If no signal is detected, the response will be 8039010305.

A fast verification that requires no additional test equipment can be done by sending the LF TX command, then the LF RX command directly afterwards. If both the transmitter and receiver are working, the response should be 803900030x, where x is typically between 4 and 6. Even if the response passes, the LF coil may be physically damaged. It is best to open the radio and observe the coil to ensure it is not damaged.

To test the LF RX using SR 7.9 SW, a POD accessory is required to verify communication.

These are the Bluetooth-related conducted signals that can be measured from test points on the expansion board. (See “HLN5977A/ HLN5978B Expansion Board Layout – Side 2” on page 8-164 for measurement locations):

Table 6-6. Bluetooth Test Points

TP	TP Name	Net Name	Description	Voltage	Measured
4	TP2416	VBUS	USB VBUS	5	4.96
5	TP2413	BT_AVR_RESET	BT AVR Reset	1.85	1.73
9	TP2005	VCC_1.85	VCC 1.85	1.85	1.86
10	TP2417	USB_BOOT_1.8V	USB Boot 1.8V	1.8	1.81
11	TP2466	ATMEL_BOOT_5	Atmel Boot	3.3	3.04
12	TP2010	GND	Ground	0	–
13	TP2011	VCC_2.775	VCC 2.775	2.775	2.74
14	TP2414	USB1_DP	USB+	3.3	3.43
15	TP2415	USB1_DM	USB-	3.3	3.47
16	TP2007	VSW_3.6	VSW 3.6	3.51	3.49
17	TP2405	GPS_BT_32KHZ	32 kHz clock	1.85	1.87
19	TP2401	GND	Ground	0	–

6.17.1 Bluetooth Startup: Vmax of TP16

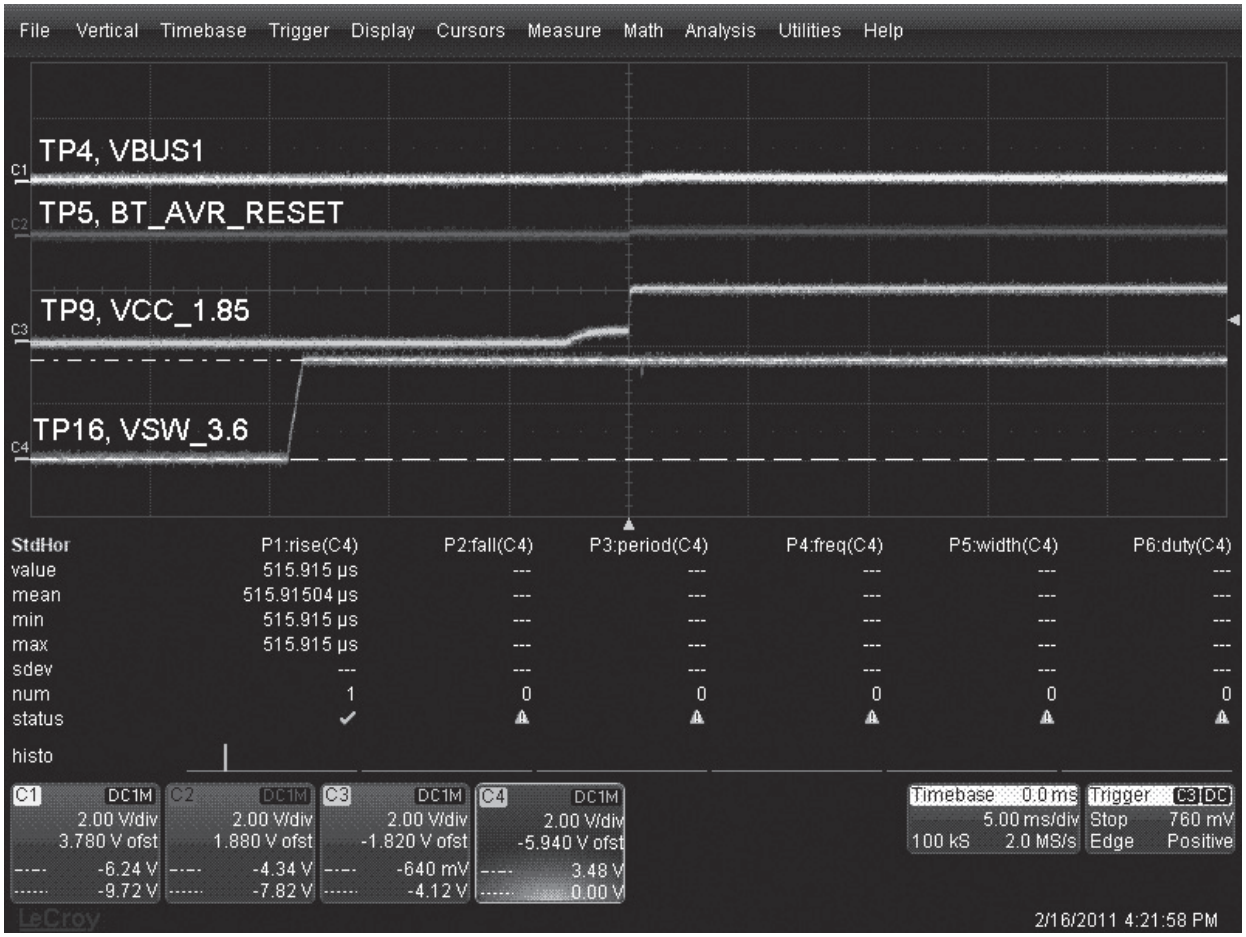


Figure 6-50. Startup Waveforms – Vmax of TP16

6.17.2 Bluetooth Startup: Timing Difference of TP9 to TP16

Figure 6-51. Startup – Timing Difference of TP9 to TP16

6.17.3 Bluetooth Startup: Timing Difference of TP5 to TP16 and Voltage Statistics

Figure 6-52. Startup – Timing Difference of TP5 to TP16 and Voltage Statistics

6.17.4 Bluetooth Startup: Timing Difference of TP4 to TP16 and Time Statistics

Figure 6-53. Startup – Timing Difference of TP4 to TP16 and Time Statistics

6.17.5 Bluetooth Startup: Timing Difference of TP4 to TP5 and Time Statistics

Figure 6-54. Startup – Timing Difference of TP4 to TP5 and Time Statistics

6.17.6 Bluetooth Startup: Vmax of TP5 and Time Statistics

Figure 6-55. Startup – Vmax of TP5 and Time Statistics

6.17.7 Bluetooth Startup: Vmax of TP4 and Time Statistics

Figure 6-56. Startup – Vmax of TP4 and Time Statistics

6.17.8 Bluetooth Startup: Vmax of TP5 and Voltage Statistics

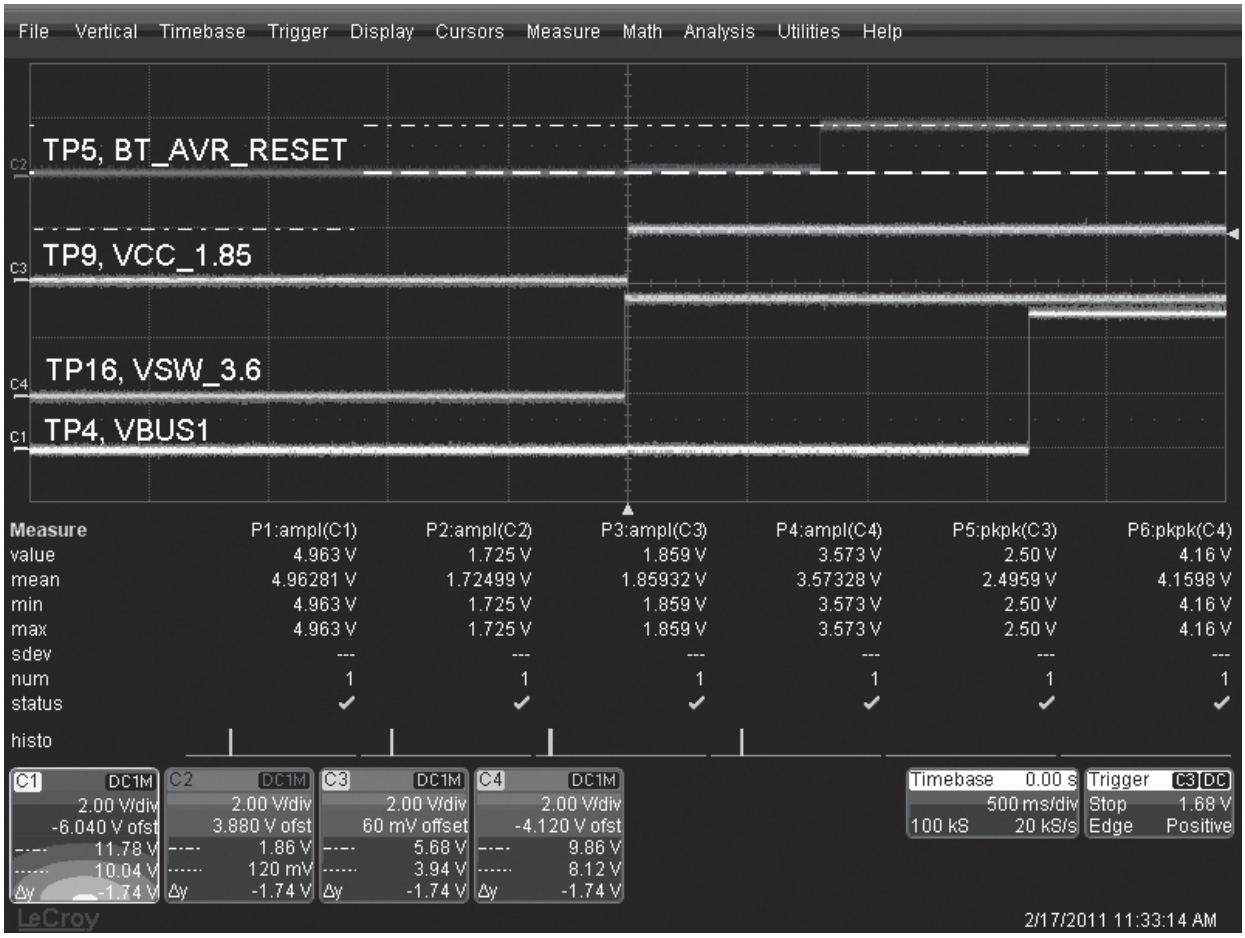


Figure 6-57. Startup – Vmax of TP5 and Voltage Statistics

6.17.9 Bluetooth Startup: Vmax of TP9 and Voltage Statistics

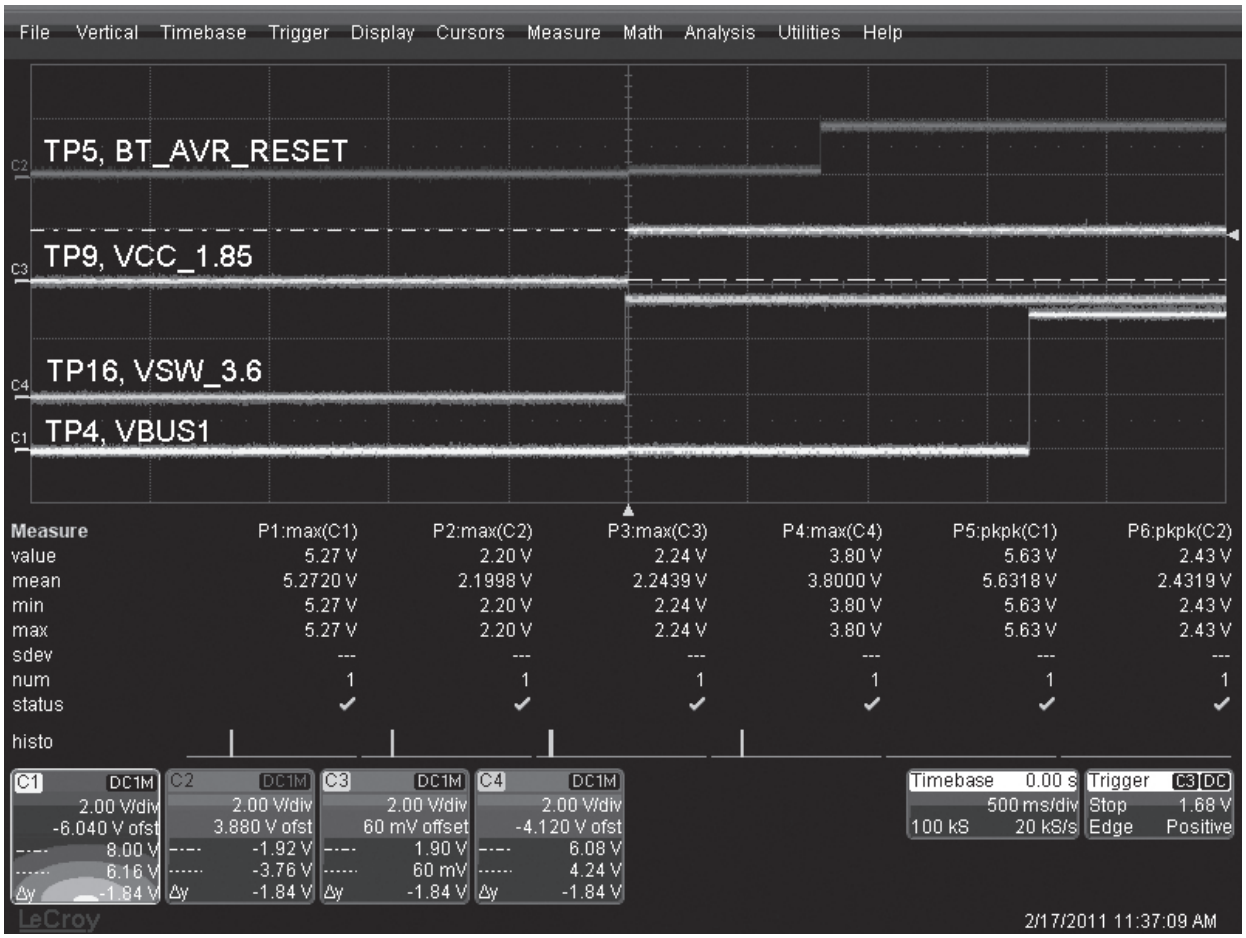


Figure 6-58. Startup – Vmax of TP9 and Voltage Statistics

6.17.10 Bluetooth Startup: Vmax of TP10 and Time Statistics

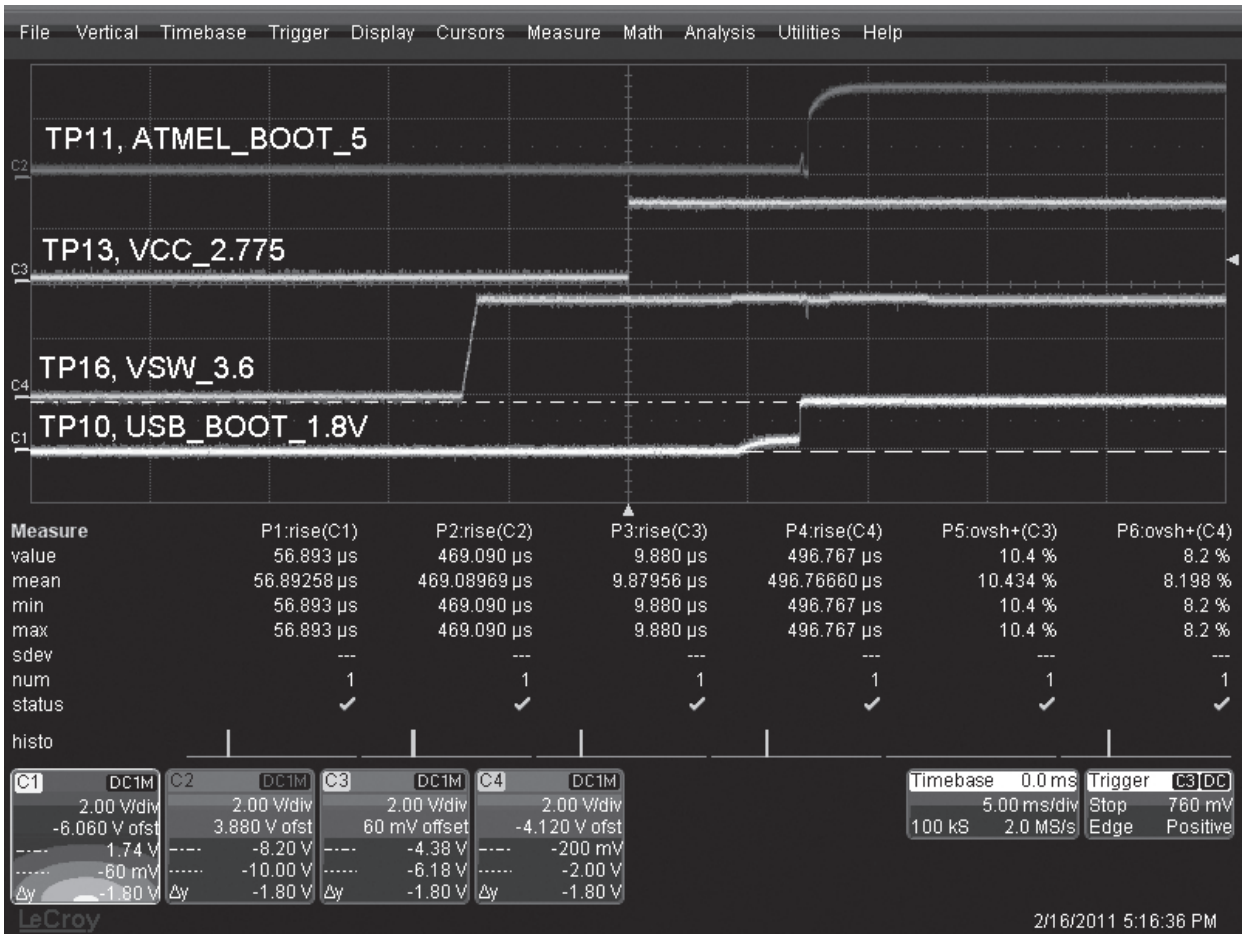


Figure 6-59. Startup – Vmax of TP10 and Time Statistics

6.17.11 Bluetooth Startup: Vmax of TP16 and Voltage Statistics

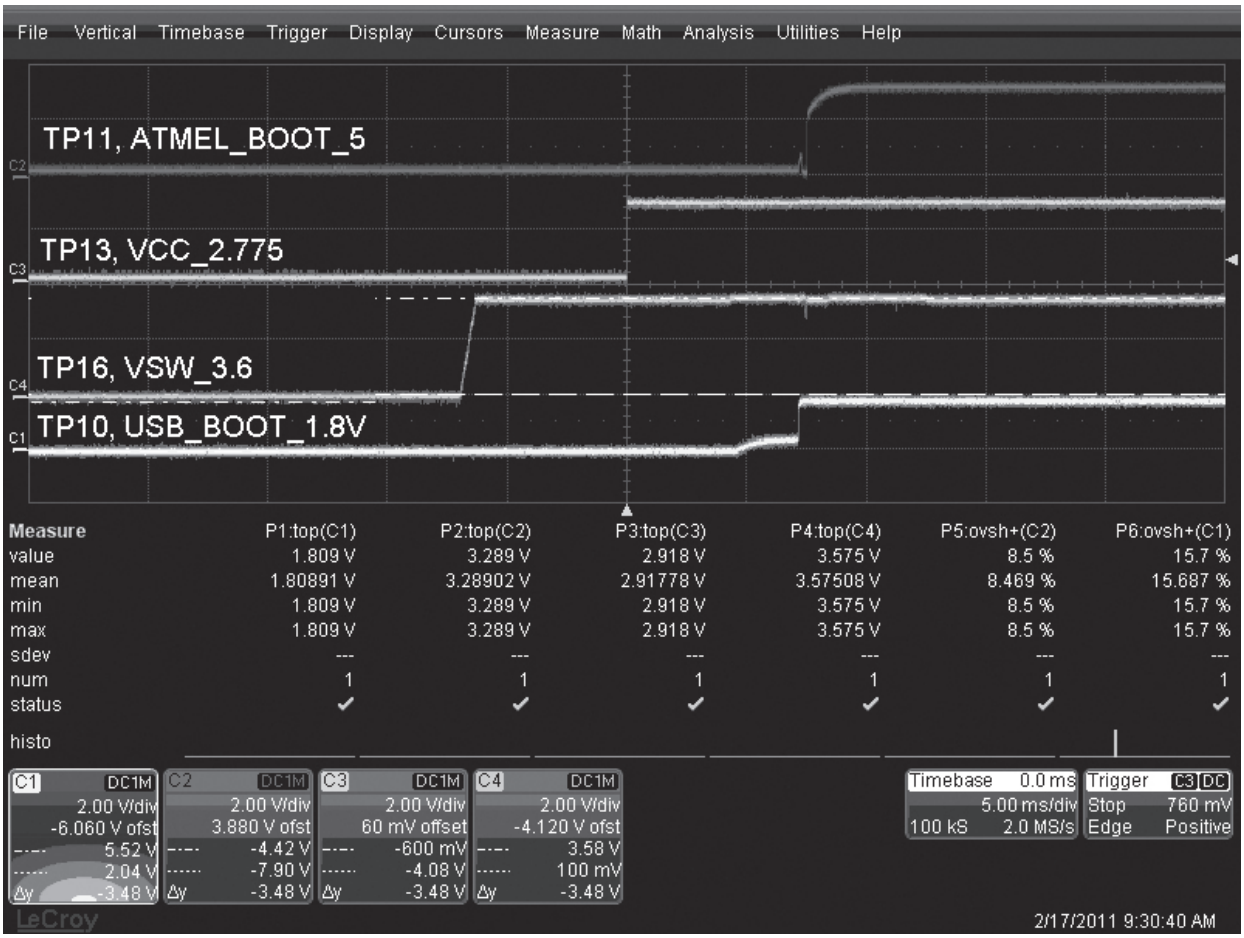


Figure 6-60. Startup – Vmax of TP16 and Voltage Statistics

6.17.12 Bluetooth Startup: Vmax of TP13 and Voltage Statistics

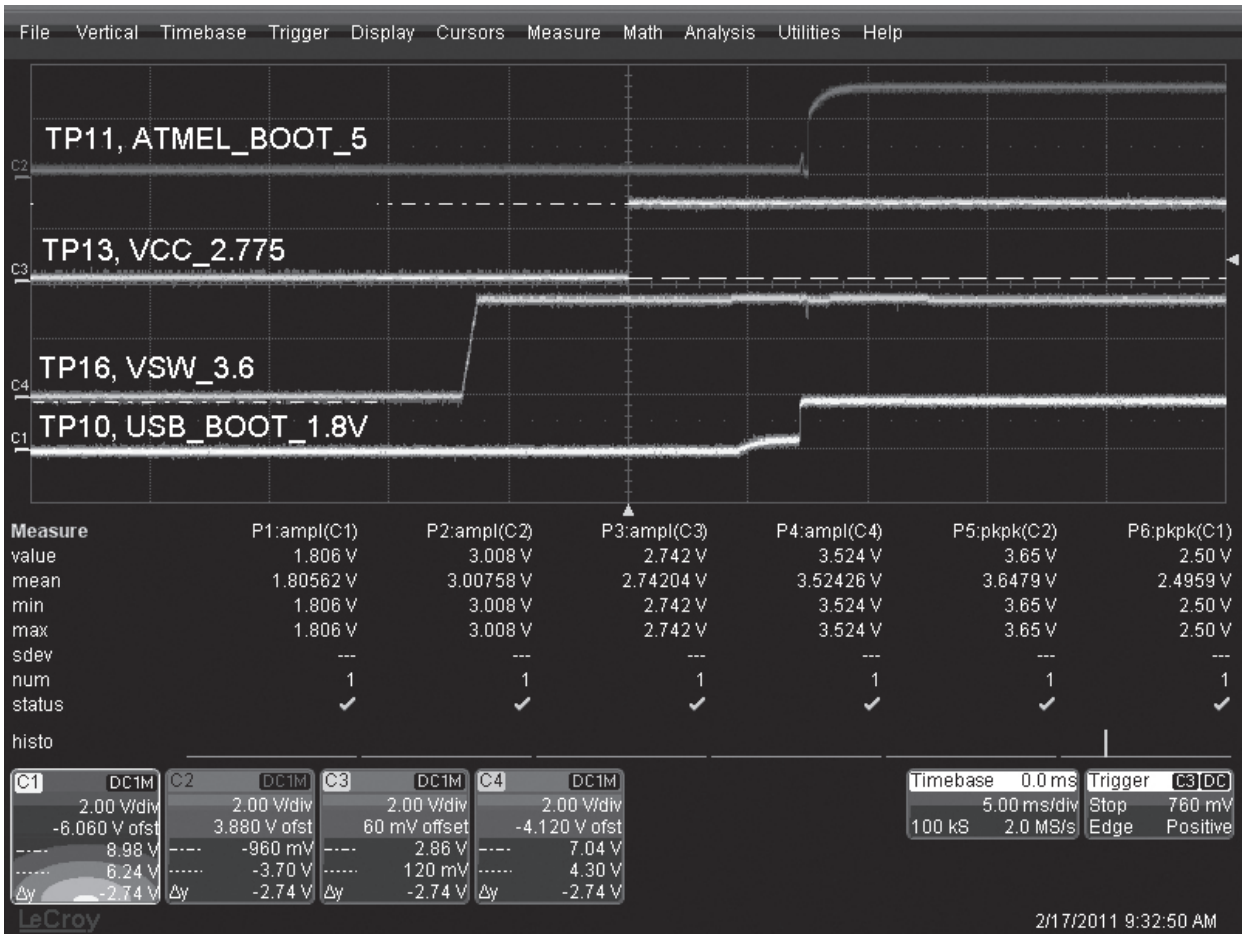


Figure 6-61. Startup – Vmax of TP13 and Voltage Statistics

6.17.13 Bluetooth Startup: Vmax of TP11 and Voltage Statistics

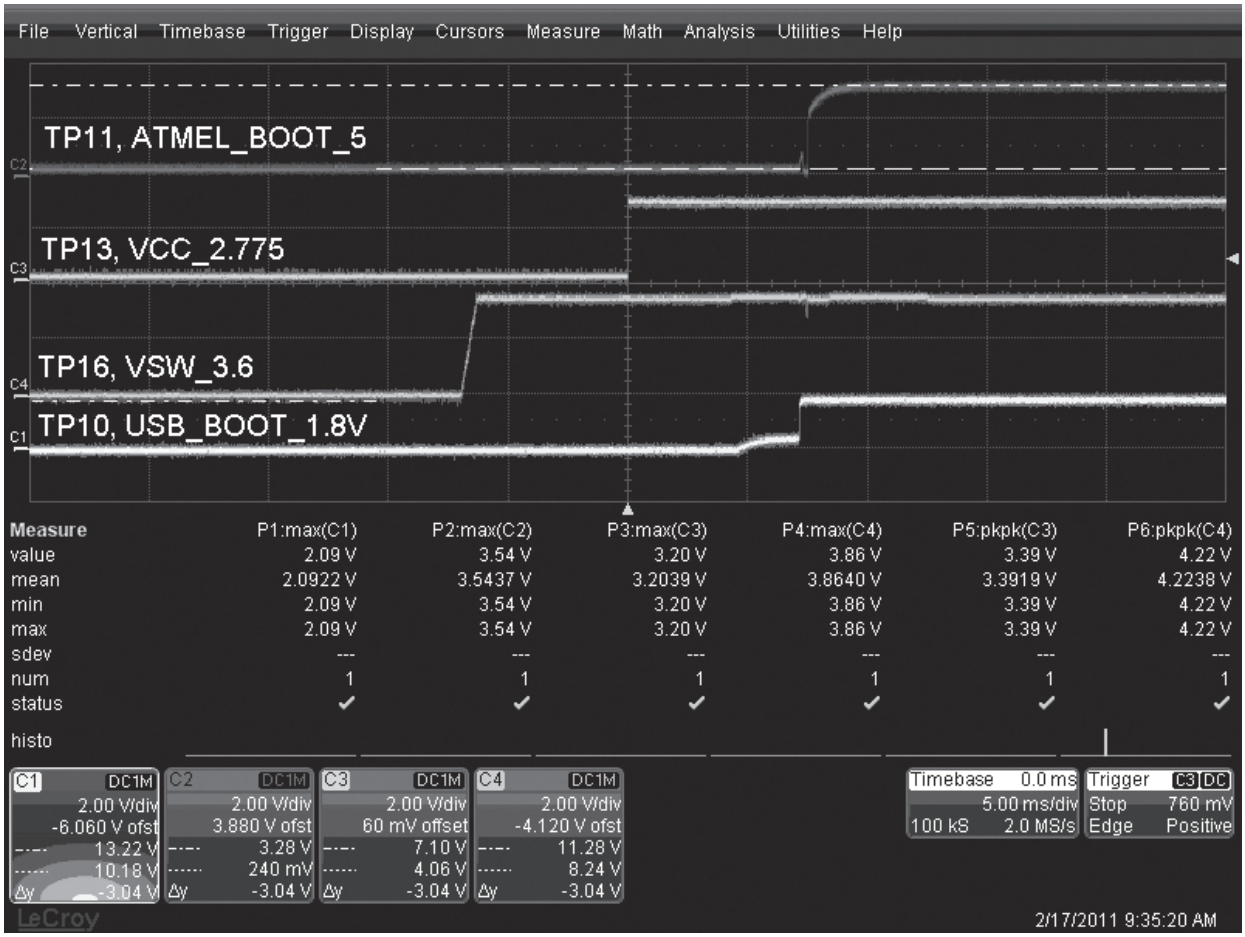


Figure 6-62. Startup – Vmax of TP11 and Voltage Statistics

6.17.14 Bluetooth Startup: Timing Difference of TP13 to TP16 and Time Statistics

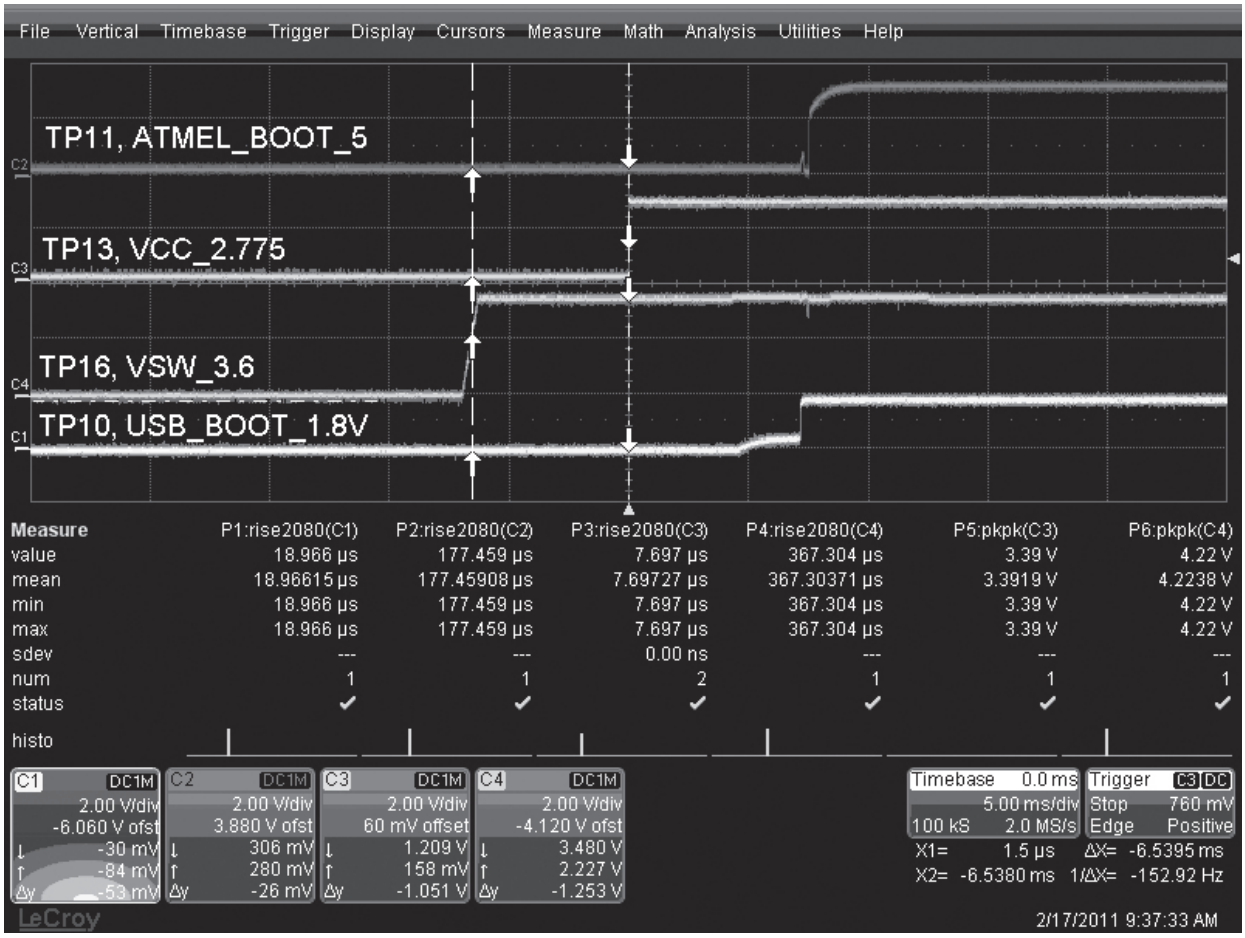


Figure 6-63. Startup – Timing Difference of TP13 to TP16 and Time Statistics

6.17.15 Bluetooth Startup: Timing Difference of TP10 to TP13 and Time Statistics

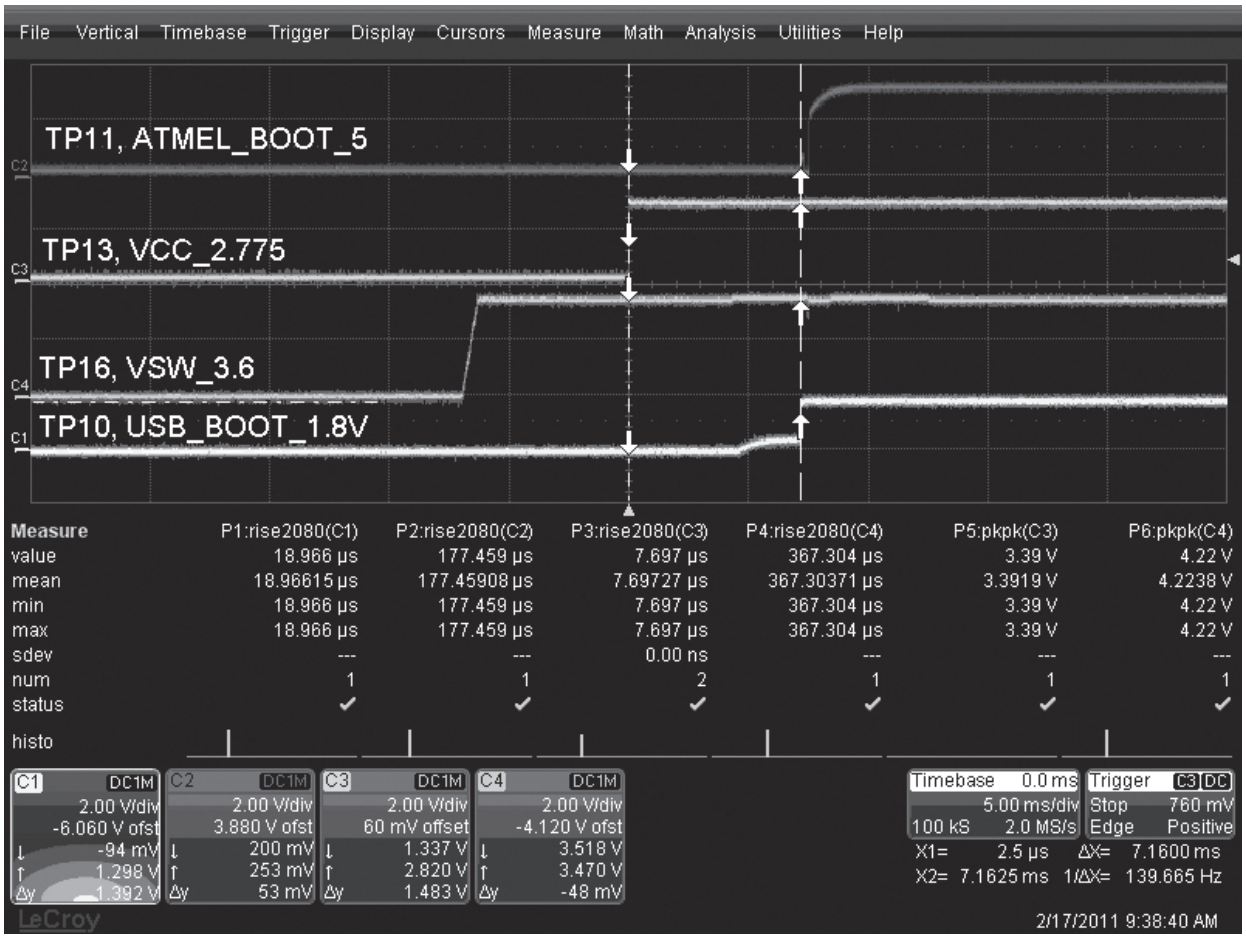


Figure 6-64. Startup – Timing Difference of TP10 to TP13 and Time Statistics

6.17.16 Bluetooth Startup: Timing Difference of TP11 to TP13 and Time Statistics

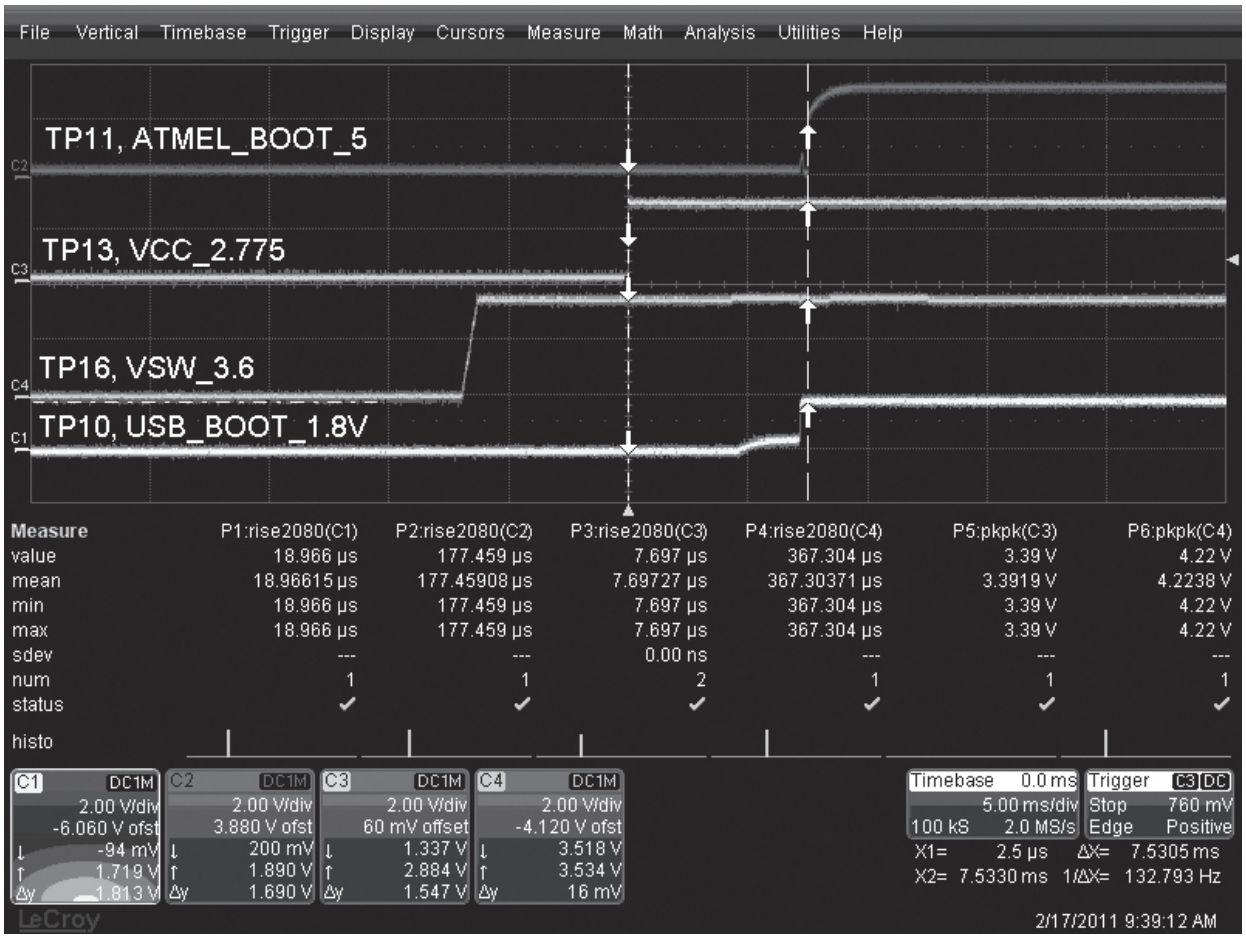


Figure 6-65. Startup – Timing Difference of TP11 to TP13 and Time Statistics

6.17.17 Bluetooth CW on Spectrum Analyzer

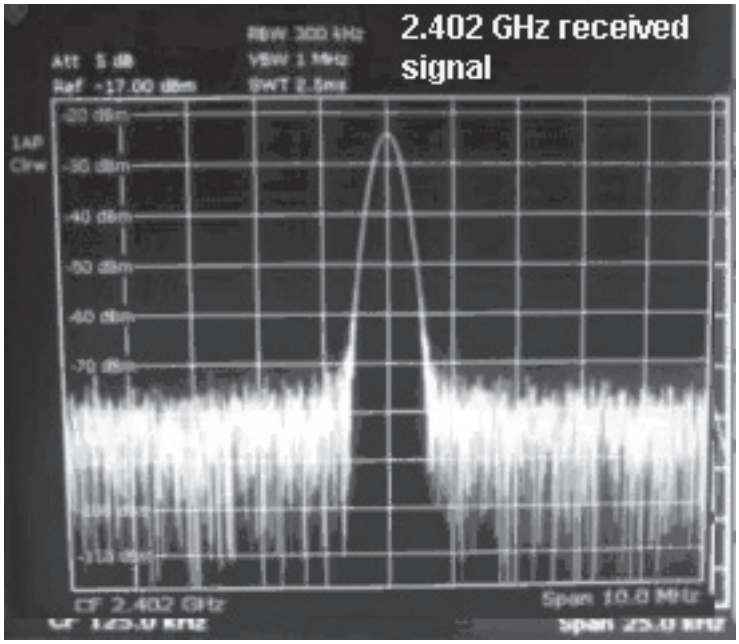


Figure 6-66. Bluetooth CW on Spectrum Analyzer

6.18 Bluetooth Steady-State

6.18.1 Expansion Board Waveforms – USB D+ Vmax and Packet Timing with Statistics

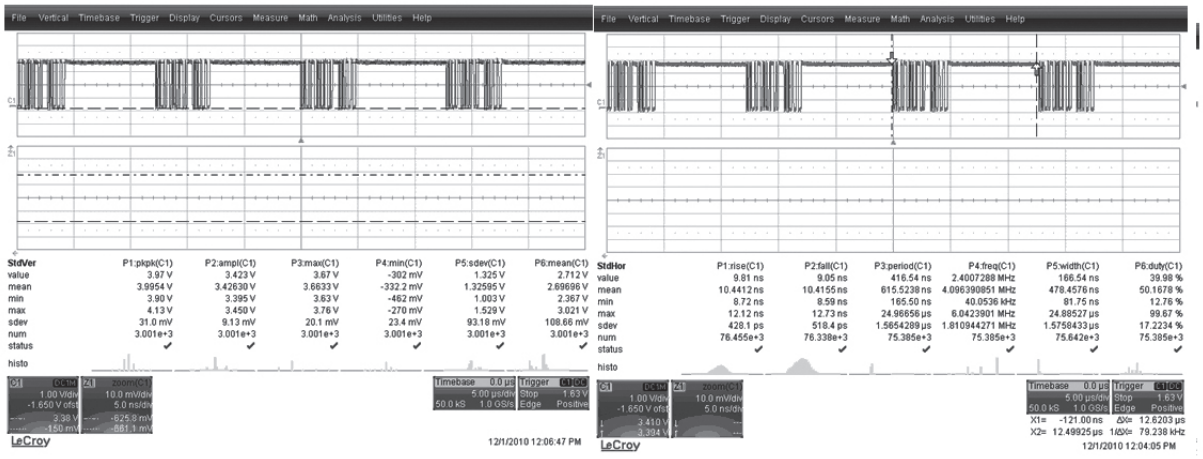


Figure 6-67. Expansion Board – USB D+ Vmax and Packet Timing with Statistics

6.18.2 Expansion Board Waveforms – USB D- Vmax and Packet Timing with Statistics

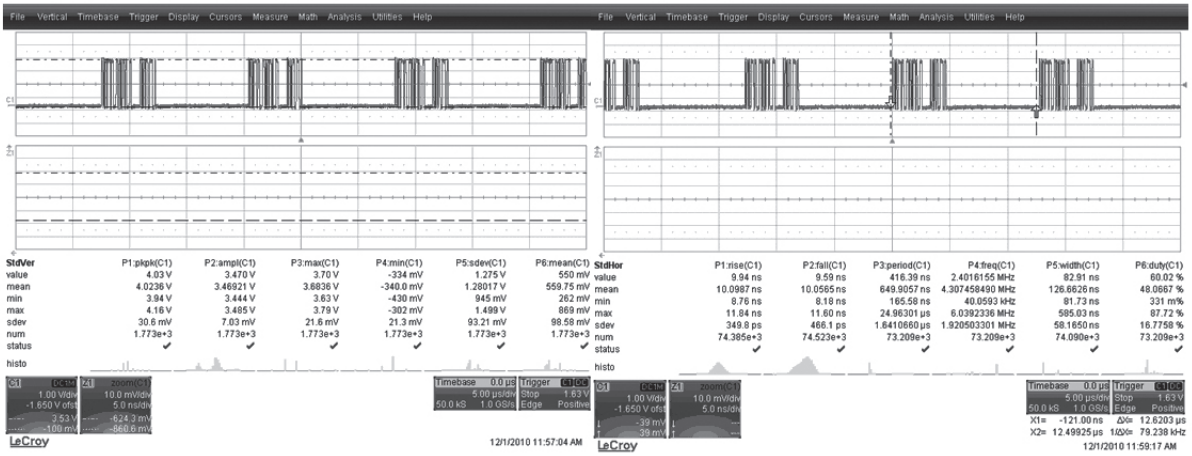


Figure 6-68. Expansion Board – USB D- Vmax and Packet Timing with Statistics

6.18.3 Expansion Board Waveforms – VSW_3.6 Voltage Statistics

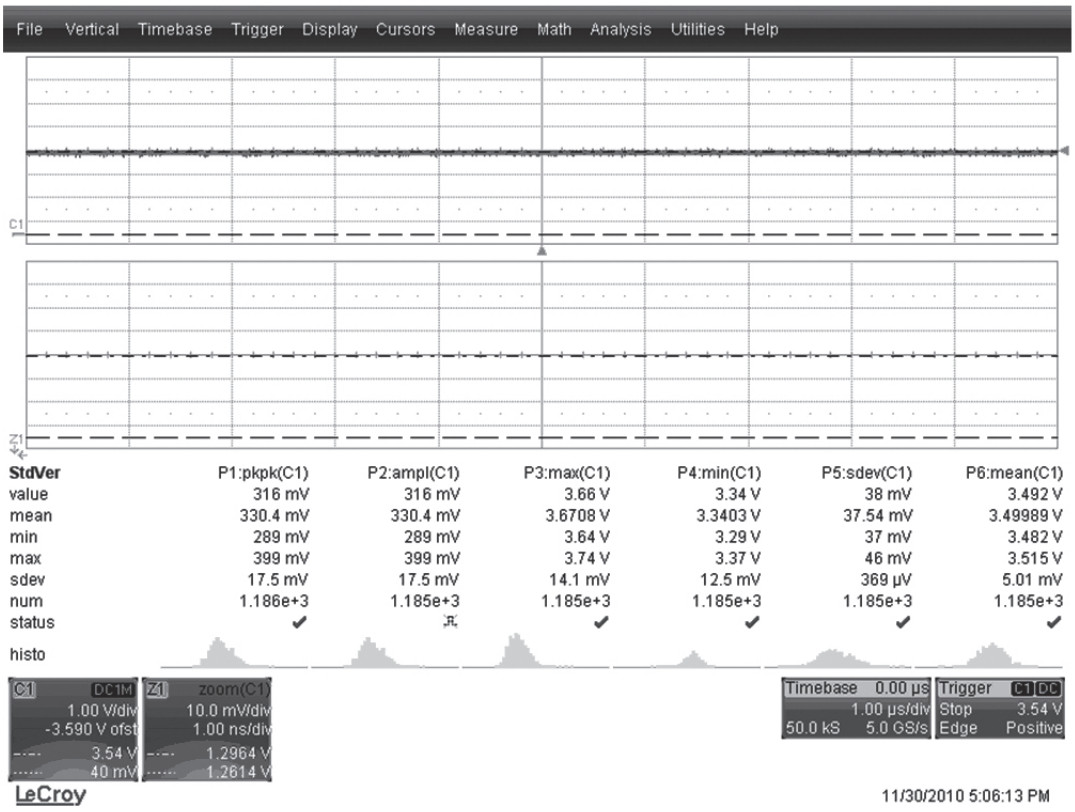


Figure 6-69. Expansion Board – VSW_3.6 Voltage Statistics

6.18.4 Expansion Board Waveforms – 32 kHz clock Vmax with Statistics

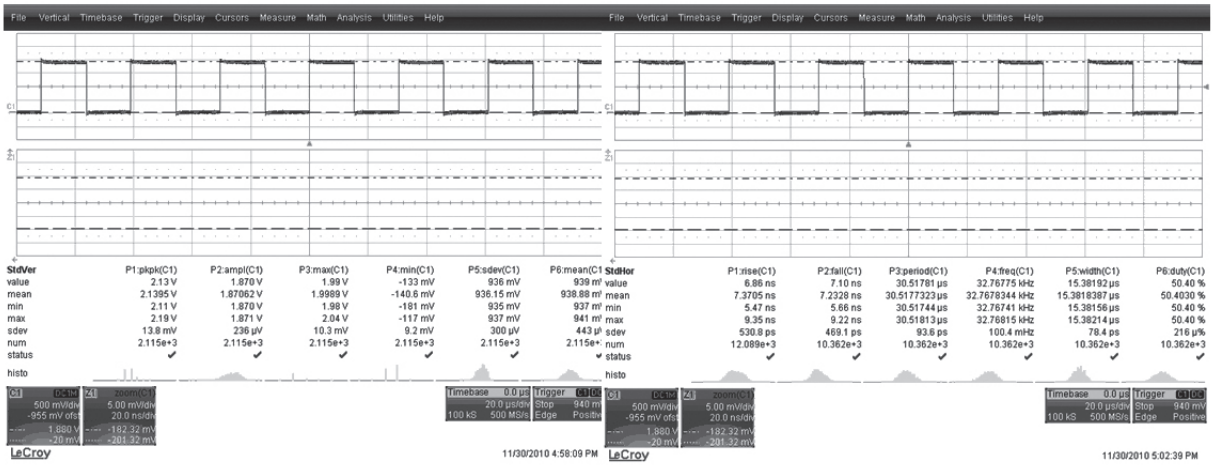


Figure 6-70. Expansion Board – 32 kHz clock Vmax with Statistics

6.18.5 Expansion Board Waveforms – LF Coil with TX and RX

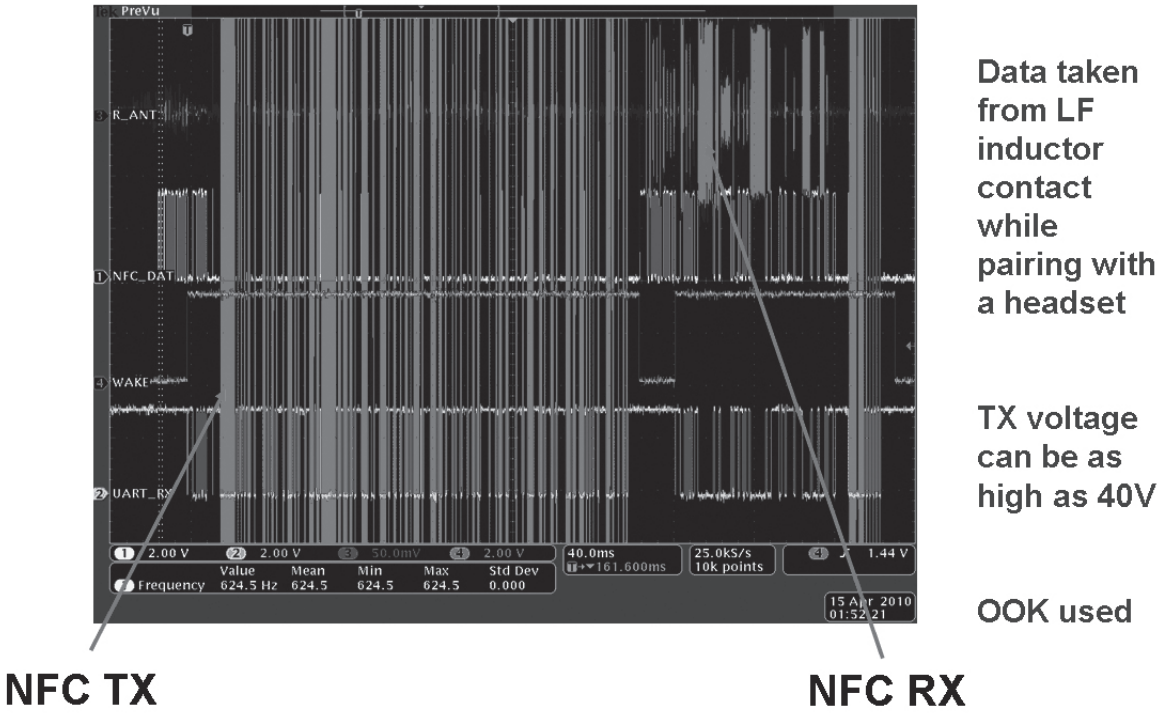


Figure 6-71. Expansion Board – LF Coil with TX and RX Waveform Measured by a Conducted Cable on LF Coil

6.19 LF CW on Spectrum Analyzer

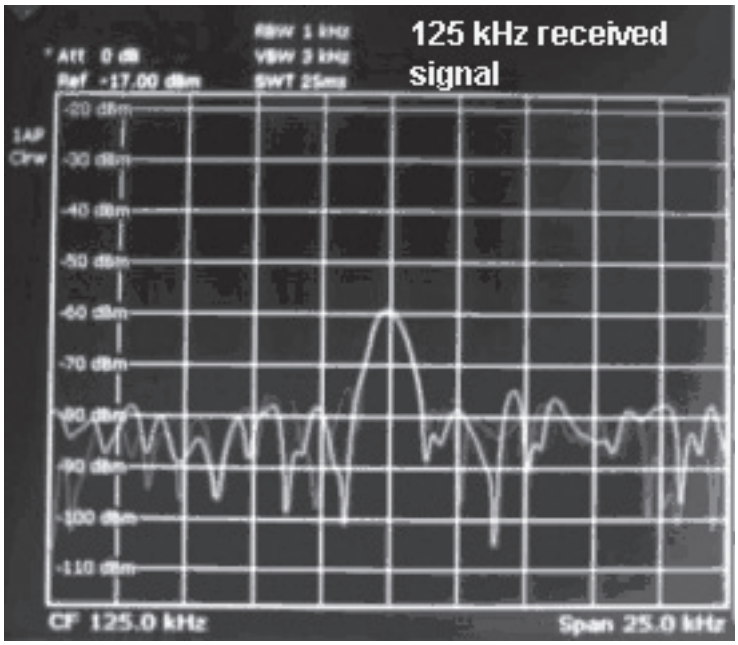


Figure 6-72. LF CW on Spectrum Analyzer

Notes

Chapter 7 Troubleshooting Tables

7.1 List of Board and IC Signals

Due to the nature of the schematic-generating program, signal names might be different when they are not directly connected to the same point. The tables in this chapter provide a cross reference to the various pinouts for these signals. Table 7-1 lists and provides links to each of the tables in this chapter.

Table 7-1. List of Tables of Board and IC Signals

Table 7-2. VOCON board to RF board connector Interface PIN-OUT

Test Place	VOCON Board		RF Transceiver Board		Test Place
	signal name	pin #	pin #	signal name	
chassis	GND	J1001-1	P101-1	GND	chassis
none	EEPROM_SPI_CS	J1001-2	P101-2	DIG_CTRL_SPI_EEPROM_PE	TP113
C6201	16.8_MHZ_SINEWAVE	J1001-3	P101-3	CLK_16_8_MHZ	C754
chassis	GND	J1001-4	P101-4	GND	chassis
chassis	GND	J1001-5	P101-5	GND	chassis
F_VREF_1.875V	V_EXT_1.85	J1001-6	P101-6	DC_LIN_1_875V_D	TP124
none	RF_BRD_RSTB	J1001-7	P101-7	DIG_CTRL_RSTB	R721
R6564	V_2.8_RF	J1001-8	P101-8	DC_LIN_2_775V	TP125
none	DMCS	J1001-9	P101-9	DIG_CTRL_SSI_TRIGGER	TP114
none	F2_PARAMP	J1001-10	P101-10	DIG_CTRL_IO49	TP120
R1004	RX_FSYNC	J1001-11	P101-11	DIG_DATA_SSI_RX_FS	TP111
none	TX_INH	J1001-12	P101-12	DIG_CTRL_TX_INHIBIT_TYPE_1	R103
R1005	RX_DA	J1001-13	P101-13	DIG_DATA_SSI_RX_DOUTA	TP112
R1018	RF_DAC_SPI_CS	J1001-14	P101-14	DIG_CTRL_SPI_DAC_PE	TP115
R1006	RX_CLK	J1001-15	P101-15	CLK_SSI_RX	TP106
R6427	ISET	J1001-16	P101-16	ANA_CTRL_ISET	TP101
R1007	TX_FSYNC	J1001-17	P101-17	DIG_TX_SSI_FS	TP102
C1006	TX_DA_CONN	J1001-18	P101-18	DIG_DATA_TX_SSI	TP103
R1008	TX_CLK	J1001-19	P101-19	DIG_TX_SSI_CLK	TP104
R6505	V_COIN_CELL	J1001-20	P101-20	M107 (battery)	R104
L4001	GPS_ANT	J1001-21	P101-21	RF_GPS	TP105
none	ABACUS_SPI_CS	J1001-22	P101-22	DIG_CTRL_SPI_ABACUS_PE	TP116
R1010	F2_SYNCB	J1001-23	P101-23	DIG_SYNCB	TP117
chassis	GND	J1001-24	P101-24	GND	chassis
R1011	LOCK_DET_A	J1001-25	P101-25	DIG_CTRL_LOCK	TP109
none	BSTAT	J1001-26	P101-26	DIG_BATTERY_DATA	C101
none	TRIDENT_SPI_CS	J1001-27	P101-27	DIG_CTRL_SPI_TRIDENT_PE	TP118
F_UNSW_B+	UNSW_B+	J1001-28	P101-28	DC_FUSED_B+	C203
none	SPI_DSP_MISO	J1001-29	P101-29	DIG_DATA_SPI_MISO	TP110
F_UNSW_B+	UNSW_B+	J1001-30	P101-30	DC_FUSED_B+	C203

Table 7-2. VOCON board to RF board connector Interface PIN-OUT (Continued)

Test Place	VOCON Board		RF Transceiver Board		Test Place
	signal name	pin #	pin #	signal name	
none	SPI_DSP_MOSI	J1001-31	P101-31	DIG_DATA_SPI_MOSI	TP107
F_UNSW_B+	UNSW_B+	J1001-32	P101-32	DC_FUSED_B+	C203
R1013	SPI_DSP_CLK	J1001-33	P101-33	DIG_SPI_CLK	TP108
F_UNSW_B+	UNSW_B+	J1001-34	P101-34	DC_FUSED_B+	C203
chassis	GND	J1001-35	P101-35	GND	chassis
F_UNSW_B+	UNSW_B+	J1001-36	P101-36	DC_FUSED_B+	C203
R6510	V_SW_3.60	J1001-37	P101-37	DC_SW1_3_6V	TP126
chassis	GND	J1001-38	P101-38	GND	chassis
chassis	GND	J1001-39	P101-39	GND	chassis
chassis	GND	J1001-40	P101-40	GND	chassis

Table 7-3. VOCON board to EXPANSION board connector Interface PIN-OUT

	VOCON Board		Expansion Board		
Test Place	**signal name**	**pin #**	**pin #**	**signal name**	**Test Place**
L4001	GPS_ANT	J4001-1	P2001-1	GPS_ANT	TP2402
R6414	PRE_CLASS_D_POS_DP	J4001-2	P2001-2	AUD_PA_IN_P	TP2008
chassis	GND	J4001-3	P2001-3	GND	chassis
R6415	PRE_CLASS_D_NEG_DP	J4001-4	P2001-4	AUD_PA_IN_N	TP2009
none	BT_AVR_RESET	J4001-5	P2001-5	BT_AVR_RESET	TP2413
R6308	PA_SHTDN	J4001-6	P2001-6	AUD_PA_SHUTDOWN	R2101
none	BT_PTT	J4001-7	P2001-7	BT_PTT	none
none	AUDIO_MIC_NEG_DP	J4001-8	P2001-8	AUD_MIC_N	none
none	GPS_RX	J4001-9	P2001-9	GPS_TX	R2420
F_AUDIO_MICP	AUDIO_MIC_POS_DP	J4001-10	P2001-10	AUD_MIC_P	C2001
none	GPS_TX	J4001-11	P2001-11	GPS_RX	R2421
chassis	GND	J4001-12	P2001-12	GND	chassis
none	GPS_SHUTDOWN	J4001-13	P2001-13	GPS_SHUTDOWN	R2462
R6305	MMC2_CLK	J4001-14	P2001-14	MMC_CLK	R2301
chassis	GND	J4001-15	P2001-15	GND	chassis
none	MMC2_CMD	J4001-16	P2001-16	MMC_CMD	R2302
none	GPS_BT_32KHZ	J4001-17	P2001-17	GPS_BT_32KHZ	none
none	MMC2_DAT0	J4001-18	P2001-18	MMC_DAT0	R2303
R6123	EMMC_RESET	J4001-19	P2001-19	EMMC_RESET	TP2301
none	MMC2_DAT1	J4001-20	P2001-20	MMC_DAT1	R2304
none	ACC_SPKR_UNMUTE	J4001-21	P2001-21	ACC_SPKR_UNMUTE_1.8	R2436
R6303	MMC2_DAT2	J4001-22	P2001-22	MMC_DAT2	R2305
none	BT_SPARE_1.8	J4001-23	P2001-23	BT_SPARE_1.8	R2488
R6302	MMC2_DAT3	J4001-24	P2001-24	MMC_DAT3	R2306
R6118	SSI_RED_TX_CODEC	J4001-25	P2001-25	SSI_RED_TX_CODEC	none
chassis	GND	J4001-26	P2001-26	GND	chassis
none	SSI_RED_RX_CODEC	J4001-27	P2001-27	SSI_RED_RX_CODEC	none
F_VREF_1.875V	V_EXT_1.85	J4001-28	P2001-28	VCC_1.85	TP2005

Table 7-3. VOCON board to EXPANSION board connector Interface PIN-OUT (Continued)

	VOCON Board		Expansion Board		
Test Place	**signal name**	**pin #**	**pin #**	**signal name**	**Test Place**
none	AVR_STATUS_1.8	J4001-29	P2001-29	AVR_STATUS_1.8V	none
OMAP_RESET_TP	OMAP_RESET	J4001-30	P2001-30	OMAP_RESET_OUT	none
C6544	VBUS1	J4001-31	P2001-31	VBUS1	none
none	MACE_RESET	J4001-32	P2001-32	MACE_RESET	none
R6623	USB1_NEG_DP	J4001-33	P2001-33	USB1_DM	none
none	MACE_WAKEUP	J4001-34	P2001-34	MACE_WAKEUP	TP2502
R6622	USB1_POS_DP	J4001-35	P2001-35	USB1_DP	none
none	TX_INHIBIT	J4001-36	P2001-36	TX_INHIBIT	none
none	EXP_BRD_ID	J4001-37	P2001-37	EXP_BRD_TYPE	R2021
none	KEYFAIL	J4001-38	P2001-38	KEYFAIL	R2501
chassis	GND	J4001-39	P2001-39	GND	chassis
none	SECURE_HIGH_NORM	J4001-40	P2001-40	MACE_SEC_CLR_MODE	none
C6561	V_SW_3.60	J4001-41	P2001-41	VSW_3.6	TP2007
chassis	GND	J4001-42	P2001-42	GND	chassis
none	AVR_BOOT	J4001-43	P2001-43	USB_BOOT_1.8V	TP2417
R6107	SSI_OPT_CLK	J4001-44	P2001-44	OPT_SSI_CLK	R2503
C6405	V_2.775_EXP	J4001-45	P2001-45	VCC_2.775	TP2011
none	OPT_SSI_SYNC	J4001-46	P2001-46	OPT_SSI_FSYNC	R2513
chassis	GND	J4001-47	P2001-47	GND	chassis
R6103	SSI_BLACK_RX	J4001-48	P2001-48	SSI_BLACK_RX	none
C6567	V_SW_5	J4001-49	P2001-49	VSW_5.4	TP2006
none	SSI_BLACK_TX_MACE	J4001-50	P2001-50	SSI_BLACK_TX_MACE	none
C6567	V_SW_5	J4001-51	P2001-51	VSW_5.4	TP2006
R6102	HIGH_SECURE_DATA_GATE	J4001-52	P2001-52	BLOCK_SSI_RED	none
chassis	GND	J4001-53	P2001-53	GND	chassis
none	SSI_RED_RX_MACE	J4001-54	P2001-54	SSI_RED_RX_MACE	none
R6525	EMERG_BTN	J4001-55	P2001-55	EMERG_BTN	none
none	SSI_MACE_TX_DIN	J4001-56	P2001-56	SSI_MACE_TX_DIN	none
R4005	PTT	J4001-57	P2001-57	CONN_INT_PTT	D2007

Table 7-3. VOCON board to EXPANSION board connector Interface PIN-OUT (Continued)

	VOCON Board		Expansion Board		
Test Place	**signal name**	**pin #**	**pin #**	**signal name**	**Test Place**
chassis	GND	J4001-58	P2001-58	GND	chassis
R4007	SIDE_2	J4001-59	P2001-59	CONN_SB2	C2013
R6113	4MHZ_MACE_CLK	J4001-60	P2001-60	MACE_CLOCK	none
R4006	SIDE_1	J4001-61	P2001-61	CONN_SB1	C2016
chassis	GND	J4001-62	P2001-62	GND	chassis
D6101	MONITOR	J4001-63	P2001-63	MONITOR	C2014
C6538	V_SAVE	J4001-64	P2001-64	VSAVE	D2521
none	GPIO_4_CTS_KEYFAIL_FILLCLK	J4001-65	P2001-65	GCAI_GPIO4_CTS	R2005
C6590	VRTC	J4001-66	P2001-66	VRTC	C2527
D4001	GPIO_0	J4001-67	P2001-67	GCAI_GPIO0	R2004
none	EXT_MIC_NEG_DP	J4001-68	P2001-68	GCAI_EXT_MIC_N	none
chassis	GND	J4001-69	P2001-69	GND	chassis
R6404	EXT_MIC_POS_DP	J4001-70	P2001-70	GCAI_EXT_MIC_P	L2002
F_GCAI_USB+	GPIO_1_DP_TXDC_FILLREQ	J4001-71	P2001-71	GCAI_USB_P_GPIO1	VR2002
SPKR-	EXT_SPKR_NEG_DP	J4001-72	P2001-72	GCAI_EXT_SPKR_N	VR2006
F_GCAI_USB	GPIO_2_DM_RXDC_FILLDATA	J4001-73	P2001-73	GCAI_USB_N_GPIO2	VR2003
SPKR+	EXT_SPKR_POS_DP	J4001-74	P2001-74	GCAI_EXT_SPKR_P	VR2005
chassis	GND	J4001-75	P2001-75	GND	chassis
chassis	GND	J4001-76	P2001-76	GND	chassis
F_V1BUS2	VBUS2	J4001-77	P2001-77	GCAI_VBUS_5V	D2002
none	GPIO_3_RTS_FILLSENSE	J4001-78	P2001-78	GCAI_RTS_GPIO3	D2009
F_V1BUS2	VBUS2	J4001-79	P2001-79	GCAI_VBUS_5V	D2002
F_GCAI_1WIRE	GCAI_1WIRE_5V	J4001-80	P2001-80	GCAI_ONE_WIRE	D2001

Table 7-4. VOCON board to Control Top with Top Display Interface PIN-OUT

Test Place	VOCON Board		Control Top with Top Display	
	signal name	pin #	pin #	signal name
R2235	V_LED_TOP	J2101-1	P1-1	TX/RX_LED_A
chassis	GND	J2101-2	P1-2	GND
chassis	GND	J2101-3	P1-3	GND
none	FREQ_SW_LED_WHITE	J2101-4	P1-4	RTA_LED_B
R6206	V_2.775D	J2101-5	P1-5	V2A
none	FREQ_SW_LED_GREEN	J2101-6	P1-6	RTA_LED_G
none	VOLUME	J2101-7	P1-7	VOL
R2215	TX_RX_AMBER_LED	J2101-8	P1-8	TX_LED_A
F_MECH_SW	ON_OFF_SWITCH	J2101-9	P1-9	MECH_SW
chassis	GND	J2101-10	P1-10	GND
R2133	TOGGLE_0_A	J2101-11	P1-11	TG0
R2130	FREQ_SEL_3_CONN	J2101-12	P1-12	RTA3
R2134	TOGGLE_1_A	J2101-13	P1-13	TG1
R2129	FREQ_SEL_2_CONN	J2101-14	P1-14	RTA2
none	TX_RX_RED_LED	J2101-15	P1-15	TX_LED_R
R2128	FREQ_SEL_1_CONN	J2101-16	P1-16	RTA1
none	TX_RX_GREEN_LED	J2101-17	P1-17	TX_LED_G
R2127	FREQ_SEL_0_CONN	J2101-18	P1-18	RTA0
D6501	EMERG_BTN	J2101-19	P1-19	EMER
R2135	SEC_CLEAR_CONN	J2101-20	P1-20	SEC_CLEAR
chassis	GND	J2101-21	P1-21	GND
chassis	GND	J2101-22	P1-22	GND
D2204	TOP_DISP_WHITE_LED	J2101-23	P1-23	LED_W
D2202	TOP_DISP_GREEN_LED	J2101-24	P1-24	LED_G
R2235	V_LED_TOP	J2101-25	P1-25	VLED_A
D2203	TOP_DISP_RED_LED	J2101-26	P1-26	LED_R
chassis	GND	J2101-27	P1-27	GND
chassis	GND	J2101-28	P1-28	GND
F_VREF_1.875V	V_EXT_1.85	J2101-29	P1-29	VDDIO
R6563	V_2.775D	J2101-30	P1-30	VDD

Table 7-4. VOCON board to Control Top with Top Display Interface PIN-OUT (Continued)

Test Place	VOCON Board		Control Top with Top Display	
	signal name	pin #	pin #	signal name
none	T_DISP_DATA_CMD	J2101-31	P1-31	D/C
none	OMAP_TDO	J2101-32	P1-32	OMAP_TDO
chassis	GND	J2101-33	P1-33	GND
none	RTCK	J2101-34	P1-34	RTCK
R2136	T_DISP_SPI_CLK2	J2101-35	P1-35	SCLK
R2117	TMS_CON	J2101-36	P1-36	OMAP/MACE TMS
chassis	GND	J2101-37	P1-37	GND
R2107	NTRST	J2101-38	P1-38	NTRST
none	T_DISP_SPI_MOSI	J2101-39	P1-39	SDA
none	CPLD_TDO	J2101-40	P1-40	CPLD_TDO
chassis	GND	J2101-41	P1-41	GND
R2118	CPLD_TMS_CON	J2101-42	P1-42	CPLD TMS
none	T_DISP_SPI_CS	J2101-43	P1-43	CS
R2116	TCK_CON	J2101-44	P1-44	TCK
chassis	GND	J2101-45	P1-45	GND
R2120	TDI_CON	J2101-46	P1-46	TDI
R2108	T_DISP_RESET	J2101-47	P1-47	RESET
none	no connect	J2101-48	P1-48	MACE_TDO
chassis	GND	J2101-49	P1-49	GND
nonew	no connect	J2101-50	P1-50	MACE_RTCK

Table 7-5. VOCON board to Front Display Interface PIN-OUT

Test Place	VOCON Board		Front Display	
	signal name	pin #	pin #	signal name
chassis	GND	J2304-1	J1-1	GND
C6203	V_2.775D	J2304-2	J1-2	VDDIO
R2335	F_DISP_RW	J2304-3	J1-3	VCI
R2345	F_DISP_DATA_1	J2304-4	J1-4	GND
R2348	F_DISP_DATA_3	J2304-5	J1-5	R/W
R2349	F_DISP_DATA_5	J2304-6	J1-6	D0
R2346	F_DISP_DATA_7	J2304-7	J1-7	D1
R2347	F_DISP_DATA_CMD	J2304-8	J1-8	D2
chassis	GND	J2304-9	J1-9	D3
R2241	V_LED_FRONT	J2304-10	J1-10	D4
R2337	F_DISP_LED3_RETURN	J2304-11	J1-11	D5
F_VREF_1.875V	V_EXT_1.85	J2304-12	J1-12	D6
chassis	GND	J2304-13	J1-13	D7
R2339	F_DISP_DATA_0	J2304-14	J1-14	E
R2340	F_DISP_DATA_2	J2304-15	J1-15	D/C
R2341	F_DISP_DATA_4	J2304-16	J1-16	RESET
R2338	F_DISP_DATA_6	J2304-17	J1-17	GND
R2342	F_DISP_RW_EN	J2304-18	J1-18	LED1-
OMAP_RESET_TP	OMAP_RESET	J2304-19	J1-19	LED+
R2336	F_DISP_LED1_RETURN	J2304-20	J1-20	LED2-
R2344	F_DISP_LED2_RETURN	J2304-21	J1-21	LED3-
R6424	F_DISP_BD_ID	J2304-22	J1-22	ID

Table 7-6. VOCON board to Keypad Interface PIN-OUT

Test Place	VOCON Board		Keypad	
	signal name	pin #	pin #	signal name
chassis	GND	J2303-1	P1-1	GND
none	KP_COL_0	J2303-2	P1-2	KP_COL_0
C2326	KP_ROW_0	J2303-3	P1-3	KP_ROW_0
none	KP_COL_1	J2303-4	P1-4	KP_COL_1
C2327	KP_ROW_1	J2303-5	P1-5	KP_ROW_1
none	KP_COL_2	J2303-6	P1-6	KP_COL_2
C2328	KP_ROW_2	J2303-7	P1-7	KP_ROW_2
none	KP_COL_3	J2303-8	P1-8	KP_COL_3
C2329	KP_ROW_3	J2303-9	P1-9	KP_ROW_3
none	KP_COL_4	J2303-10	P1-10	KP_COL_4
C2330	KP_ROW_4	J2303-11	P1-11	KP_ROW_4
R2241	V_LED_FRONT	J2303-12	P1-12	V_LED
chassis	GND	J2303-13	P1-13	GND
chassis	GND	J2303-14	P1-14	GND
R2355	KP_LED1	J2303-15	P1-15	KP_LED_1
R2354	KP_LED2	J2303-16	P1-16	KP_LED_2
R2353	KP_LED3	J2303-17	P1-17	KP_LED_3
R2352	KP_LED4	J2303-18	P1-18	KP_LED_4
chassis	GND	J2303-19	P1-19	GND
chassis	GND	J2303-20	P1-20	GND

Table 7-7. EXPANSION board to Accessory Connector (GCAI) Interface PIN-OUT

Test Place	Expansion Board	VOCON	Accessory Connector (GCAI)	
	signal name	pin #	pin #	signal name
D2002	GCAI_VBUS_5V	J2004-1	P1-1	GCAI_VBUS_5V
D2002	GCAI_VBUS_5V	J2004-2	P1-2	GCAI_VBUS_5V
chassis	GND	J2004-3	P1-3	GND
VR2003	GCAI_USB_N_GPIO2	J2004-4	P1-4	GCAI_USB_N_GPIO2
VR2002	GCAI_USB_P_GPIO1	J2004-5	P1-5	GCAI_USB_P_GPIO1
chassis	GND	J2004-6	P1-6	GND
R2004	GCAI_GPIO0_1	J2004-7	P1-7	GCAI_GPIO0
R2005	GCAI_GPIO4_CTS_1	J2004-8	P1-8	GCAI_CTS_GPIO4
VR2001	GCAI_EXT_MIC_P_2	J2004-9	P1-9	GCAI_MIC_P
none	GCAI_EXT_MIC_N	J2004-10	P1-10	GCAI_MIC_N
R2025	GCAI_EXT_SPKR_N_1	J2004-11	P1-11	GCAI_SPKR_N
R2024	GCAI_EXT_SPKR_P_1	J2004-12	P1-12	GCAI_SPKR_P
chassis	GND	J2004-13	P1-13	GND
D2009	GCAI_RTS_GPIO3	J2004-14	P1-14	GCAI_RTS_GPIO3
chassis	GND	J2004-15	P1-15	GND
D2001	GCAI_ONE_WIRE_1	J2004-16	P1-16	GCAI_ONE_WIRE

Table 7-8. EXPANSION board to Side Buttons Interface PIN-OUT

Test Place	VOCON Board		Side Buttons	
	signal name	pin #	pin #	signal name
chassis	GND	J2005-1	P1-1	GND
chassis	GND	J2005-2	P1-2	GND
R2012	CON_MONITOR_1	J2005-3	P1-3	MON_B
R2011	CONN_SB2_1	J2005-4	P1-4	SB_2_B
chassis	GND	J2005-5	P1-5	GND
chassis	GND	J2005-6	P1-6	GND
R2010	CONN_SB1_1	J2005-7	P1-7	SB_1_B
R2009	CON_INT_PTT_1	J2005-8	P1-8	PTT_B
chassis	GND	J2005-9	P1-9	GND
chassis	GND	J2005-10	P1-10	GND

Table 7-9. EXPANSION board to Speaker and Microphones Interface PIN-OUT

VOCON Board		Microphone spring/pin #	Data-Side Microphone signal name
signal name	spring/pin #		
DATA_MIC_POS_DP	M6401-1	pad 1	mic +
DATA_MIC_NEG_DP	M6401-2	pad 2	data-side microphone -

Expansion Board		Microphone spring/pin #	Speaker-Side Microphone signal name
signal name	spring/pin #		
AUD_MIC_P_1	M2005	pad 1	MIC_POS
AUD_MIC_N	M2004	pad 2	MIC_NEG

Expansion Board		Microphone spring/pin #	4 Ohm Speaker signal name
signal name	spring/pin #		
AUD_INT_SPKR_FILT_P	M2003	pad 1	SPKR_POS
AUD_INT_SPKR_FILT_N	M2002	pad 2	SPKR_NEG

Expansion Board		BT spring/pin #	BT Antenna signal name
signal name	spring/pin #		
BLUETOOTH ANTENNA	M2402	pad M2	BLUE_ANT
GND	M2401		

Table 7-10. EXPANSION board to AVR / JTAG Interface PIN-OUT

Test Place	Expansion Board	
	AVR / JTAG signal name	pin #
chassis	GND	J2001-1
none	USB1_DM	J2001-2
none	USB1_DP	J2001-3
none	AVR_TCK	J2001-4
R2026	AVR_MACE_TDO	J2001-5
R2028	AVR_MACE_TDI	J2001-6
R2030	AVR_MACE_TMS	J2001-7
none	BT_AVR_RESET_3.3V	J2001-8
R2450	USB_BOOT_1.8V	J2001-9
TP2005	VCC_1.85	J2001-10
R2493	GPS_BT_3.3V	J2001-11
R2444	AVR_USART2_RX	J2001-12
none	AVR_USART2_TX	J2001-13
chassis	GND	J2001-14
none	VBUS1	J2001-15
none	MACE_TCK	J2001-16
none	MACE_RTCK	J2001-17
none	MACE_NTRST	J2001-18
none	BT_HCI_RX	J2001-19
none	BT_HCI_TX	J2001-20
TP2404	BT_TX_DBG	J2001-21
chassis	GND	J2001-22

Table 7-11. Primary IC reference designators

Primary IC's	Reference designator	Component Location
OMAP 1710	U6302	VOCON (top-side)
DDR memory	U6301	VOCON (top-side)
FLASH	U6304	VOCON (top-side)
CPLD	U6101	VOCON (top-side)
Audio Codec	U6405	VOCON (top-side)
Front Lighting controller	U2204	VOCON (top-side)
MAKO	U6501	VOCON (bottom-side)
Top Lighting controller	U2201	VOCON (bottom-side)
Class D Audio PA audio controller	U2101	EXPANSION (top-side)
MACE	U2510	EXPANSION (top-side)
eMMC	U2301	EXPANSION (top-side)
BLUETOOTH & GPS combination IC	U2401	EXPANSION (bottom-side)
BlueTooth AVR processor	U2415	EXPANSION (bottom-side)
Low Frequency (LF) antenna	L2407	EXPANSION (bottom-side)
SDRAM	U2413	EXPANSION (bottom-side)
Accelerometer	U2416	EXPANSION (bottom-side)
Battery contact springs	M101	RF board (top-side)
Battery	M107	RF board (top-side)
Peregrine AUX switch	U1111	RF board (top-side)
VCO	Y704	RF board (top-side)
VCO	Y707	RF board (top-side)
PA Final stage device	Q1001	RF board (top-side)
TX Driver	U1002	RF board (top-side)
Mixer	U506	RF board (top-side)
Trident	U702	RF board (bottom-side)
TX/RX Multi-switch	U1102	RF board (bottom-side)
Logic Expander	U703	RF board (bottom-side)
Abacus III	U601	RF board (bottom-side)

Table 7-12. Overall GPIO pin functions across multiple boards

Signal Name	Description	Pin or Ball #	Active State	SW Initialized		HW Reset		
				Direction	*PU	State	Direction	*PU or PD
TP6309	Class D audio PA shutdown control	M7	0				Input	PU
AUDIO_PA_SHTDN	Engineering Test Point	M8		Output		0	Output	
CODEC_CS	DSP SPI chip select for TI dual CODEC	Y1	0	Output		1	Output	
ABACUS_CS	DSP SPI chip select for Abacus IC	L3	0	Output		0	Output	
TRIDENT_CS	DSP SPI chip select for Trident IC	V6	0	Output		0	Output	
SYNTHESIZER_LOCK	RF synthesizer lock detect	V15	1=Lock	Input	None		Input	None
F2_TIMER_DMCS	Timer output compare for DMCS or SYNCB	M20	1	Output			Input	PD
MAKO_TX_RX	Trigger for Mako DAC ramp	L14	1=TX	Output			*Input	None
EEPROM_CS	RF EEPROM SPI chip select	G19	0	Output		0	Output	
OPTION_SPI_CS	Option board SPI chip select	W9	0	Output		0	Output	
DAC_CS	RF DAC chip select	T19	0	Output			Input	PD
PUSH_TO_TALK	Push to talk button input	T20	0	Input	None		Input	PD
MAKO_INTX	Mako main interrupt	P15	0	Input	None		Input	None
MAKO_USB_INTX	Mako USB interrupt	AA9	0	Input	None		Input	PD
MAKO_OPTION_INTX	Mako Option interrupt	Y12	0	Input	None		Input	None
	Unused and Unwired OMAP Pin	M14		Input	PD		Input	PD
TOP_DISPLAY_CS	Top LCD SPI chip select	P3	0	Output		1	Output	
	Unused and Unwired OMAP Pin	V19		Output		0	Output	
MAKO_CS	Mako IC SPI chip select	N15	1	Output			Input	PD

Table 7-12. Overall GPIO pin functions across multiple boards (Continued)

Signal Name	Description	Pin or Ball #	Active State	SW Initialized		HW Reset		
				Direction	*PU	State	Direction	*PU or PD
MORTABLE	Specifies Mobile or Portable hardware	W13	0=Portable	Input	None	0	Output	
GCAI_GPIO3	GCAI pin 9, GPIO3	AA15		Input	None	0	Output	
GCAI_GPIO4	GCAI pin 12, GPIO4	R14		Input	None		Input	PD
BLUETOOTH_PTT	PTT signal from Bluetooth AVR	Y5	0=Pressed	Input	PU		Input	PD
F2_TIMER_INPUT_CAPTURE	Receives one of three timing signals mux'ed through CPLD - Abacus Sync, DMCS, Ramp DAC Trigger.	P20		Input	PD		Input	PD
BT_AVR_STATUS	AVR status read by OMAP	P18		Input	PU		Input	PD
ACC_SPKR_UNMUTE	BT_Audio_Accessory_Unmute signal	K15		Output			Input	PU
BT_SPARE_1.8	Bluetooth_Spare_GPIO	K14		I/0	PD		Input	PD
ENC_WAKEUP	MACE encryption wakeup	A6	1	Output		1	Output	
ENC_RESET	MACE encryption reset	B6	0	I/O	PU	1	I/O	PU
5V_PWM_EN	Forces SW5 to PWM	P14	1	Output	PU	0	Output	PU
GCAI_GPIO2	GCAI pin 5, GPIO2	C13		Input	None		Input	None
GCAI_GPIO1	GCAI pin 4, GPIO1	C11		Input	None		Input	None
GCAI_GPIO0	GCAI pin 1, GPIO0	M7		Input	None		Input	None
GCAI_VBUS_I_LIMIT	Current limit select for GCAI VBUS	C6	1=500mA	Output		0	Output	
F2_PARAMP_MON	Factory use to test F2 transmit timing. Allows TX/RX signal to appear on GCAI GPIO3.	C5	1=Factory Test	Output	PU	0	Output	PU
TOP_DISP_DATA_CTRL	Select for data or control on top display	P12	1=data	Output		0	Output	
TOP_DISPLAY_RESET	Reset for color front display	M12	0	Output		1	Output	
	Unused and Unwired OMAP Pin	N13		Output		0	Output	

Table 7-12. Overall GPIO pin functions across multiple boards (Continued)

Signal Name	Description	Pin or Ball #	Active State	SW Initialized		HW Reset		
				Direction	*PU	State	Direction	*PU or PD
	Unused and Unwired OMAP Pin	M14		Output		0	Output	
	Unused and Unwired OMAP Pin	N14		Output		0	Output	
GPS_SHUTDOWN	Shutdown to GPS	D12	0	Output		0	Output	
RF_RESET	Reset to RF board	A8	0	Output		0	Output	
	Unused and Unwired OMAP Pin	B7		Output		0	Output	
	Unused and Unwired OMAP Pin	B8		Output		1	Output	
MMC_RESET	MMC Card Reset	C7	0	Output	None	1	Output	None
	Unused and Unwired OMAP Pin	J2		Input	None		Input	None
	Unused and Unwired OMAP Pin	M8		Input	None		Input	None
BT_USB_BOOT	Bluetooth ‘boot’ signal	P8	0	Output	None		Input	None
BT_AVR_RESET	Bluetooth AVR32 Reset signal	M13	0	Output	None		Input	
KEY_FAIL_SWITCH	Enables keyload path for MACE secure.	A12	1	Output		0	Output	
SECURE_CLEAR	Secure/Clear switch	M6	TBD	Input	PU		Input	None
RTA3	Channel selector rotary switch	N11		Input	None		Input	3
RTA2	Channel selector rotary switch	K14		Input	None		Input	None
RTA1	Channel selector rotary switch	J13		Input	None		Input	None
RTA0	Channel selector rotary switch	K13		Input	None		Input	None
EMERGENCY	Emergency pushbutton	N7	0=Pressed	Input	PU		Input	PU
TG1	Toggle switch	N6		Input	PU		Input	PU
TG0	Toggle switch	N8		Input	PU		Input	PU
SB2	Side button #2	N5	0=Pressed	Input	PU		Input	PU

Table 7-12. Overall GPIO pin functions across multiple boards (Continued)

Signal Name	Description	Pin or Ball #	Active State	SW Initialized		HW Reset		
				Direction	*PU	State	Direction	*PU or PD
SB1	Side button #1	M5	0=Pressed	Input	PU		Input	PU
MONITOR	Monitor button	P11	0=Pressed	Input	PU		Input	PU
CPLD_VER4	CPLD version identifier bit 4	(REG)		Register			Register	
CPLD_VER3	CPLD version identifier bit 3	(REG)		Register			Register	
CPLD_VER2	CPLD version identifier bit 2	(REG)		Register			Register	
CPLD_VER1	CPLD version identifier bit 1	(REG)		Register			Register	
CPLD_VER0	CPLD version identifier bit 0	(REG)		Register			Register	
BOARD_ID8	Controller Board ID bit 8	H12		Input	PU		Input	PU
BOARD_ID7	Controller Board ID bit 7	H13		Input	PU		Input	PU
BOARD_ID6	Controller Board ID bit 6	G13		Input	PU		Input	PU
BOARD_ID5	Controller Board ID bit 5	F13		Input	PU		Input	PU
BOARD_ID4	Controller Board ID bit 4	D13		Input	PU		Input	PU
BOARD_ID3	Controller Board ID bit 3	E13		Input	PU		Input	PU
BOARD_ID2	Controller Board ID bit 2	C14		Input	PU		Input	PU
BOARD_ID1	Controller Board ID bit 1	D14		Input	PU		Input	PU
BOARD_ID0	Controller Board ID bit 0	F14		Input	PU		Input	PU
7/800_LNA_MIXER_ON	Turn on 7/800 MHZ LNA and mixer	30	1	Output			Input	None
800_PA_ON	Turns on TX 7V to second PA (800)	28	1	Output			Input	None
7/800_MOD_CAP_ACTIVE	Turns on mod switch in for 7/800 MHz TX only	26	1	Output			Input	None
VHF_TX_ON	Turns on TX 7V to first PA (VHF) and RF path 3 (VCO page) for divide by two	24	1	Output			Input	None
H67_VCO__PATH_ON	Turns on RF path for H67 VCO	1	1	Output			Input	None

Table 7-12. Overall GPIO pin functions across multiple boards (Continued)

Signal Name	Description	Pin or Ball #	Active State	SW Initialized		HW Reset		
				Direction	*PU	State	Direction	*PU or PD
ALL_RX_ACTIVE	Route LO to the mixer. Must be on for all RX modes.	3	1	Output			Input	None
H65_VCO_PATH_ON	Enables the path for VCO H65. Should be enabled for 700TX TA, 700 RX, 800 RX, and 800 TX TA	5	1	Output			Input	None
H68_VCO_PATH_ON	Selects the path for VCO H68. Must be on for VHF TX, UHFR1, and UHFR2.	7	1	Output			Input	None
VHF_RX_ON	Enables H67 VHF RX VCO. Also turns on VHF LNA.	2	1	Output			Input	None
TX_BUFFER_ON	Enables the TX buffer. On for all TX modes. Also turns on log amp.	4	1	Output			Input	None
7/800TX_VCO_ON	Turns on VCO H67.	6	1	Output			Input	None
VHF_TX_UHF_R1_VCO_ON	Turns on VCO H68, SEL 1. Used for VHF transmit and UHF1 RX.	8	1	Output			Input	None
700TX/800RX_VCO_ON	Turns on SEL 1 on H65 VCO. For 700 TX TA and 800 RX.	9	1	Output			Input	None
800TX/700RX_VCO_ON	Turns on SEL2 on H65 VCO. Used for 800 TX TA and 700 RX.	10	1	Output			Input	None
UHF_TX_R1_VCO_ON	Turns on VCO H66 SEL 1. Used for 380-450	12	1	Output			Input	None
UHF_TX_R2_VCO_ON	This is to turn on VCO H66 SEL 2. This would be used for 450-520	13	1	Output			Input	None
700RX_FRONT_END_ACTIVE	The enables the 700 path in the RX front end.	14	1	Output			Input	None
UHF_RX_R2_VCO_ON	This enables VCO H68 SEL 2.	15	1	Output			Input	None

Table 7-12. Overall GPIO pin functions across multiple boards (Continued)

Signal Name	Description	Pin or Ball #	Active State	SW Initialized		HW Reset		
				Direction	*PU	State	Direction	*PU or PD
RF_BRD_ID_BIT_0	RF Board ID bit 0	16	1	Input	PU		Input	None
ATTENUATORS_ON	Controls the front end attenuators for both VHF and 7/800 MHz, but NOT in Tx. The peregrine switch does not have a mode where it can be placed in TX while attenuating the RX path.	17	1	Output			Input	None
RF_BRD_ID_BIT_1	RF Board ID bit 1	18	1	Input	PU		Input	None
UNUSED1	Not connected.	19	1	Output			Input	None
RF_BRD_ID_BIT_2	RF Board ID bit 2	21	1	Input	PU		Input	None
REMOTE_ANTENNA_ACTIVE	Remote antenna select	22	1	Output			Input	None
H66_H68_PATH_ACTIVE	Selects path for VHF transmit, UR1 and UR2.	23	1	Output			Input	None
800RX_FRONT_END_ACTIVE	Enables the 800 path in the RX front end.	25	1	Output			Input	None
ALL_TX_ONLY_EXCEPT_VHF_TX	Enables RF path 1 (VCO page). On for all transmit modes except VHF transmit. Off for all RX modes	27	1	Output			Input	None
H66_VCO_PATH_ON	selects H66 VCOs path	29	1	Output			Input	None
NONE	OMAP GPIO1 determines default state of some EMIFS pins. Latched on rising edge of PWR_ON_RESET. Pulled low on PCB	R19		Input	PD	0	Input	PD
NONE	Unused, defaults to UART2.BCLK in reset mode 0. PD on PCB	Y4		Output	None	0	Output	None

Table 7-12. Overall GPIO pin functions across multiple boards (Continued)

Signal Name	Description	Pin or Ball #	Active State	SW Initialized		HW Reset		
				Direction	*PU	State	Direction	*PU or PD
OMAP_MPU_BOOT	Pin pulled high on PCB to select external boot on EMIFS CS3 (flash memory)	J20		Input	None	1	Input	None
RESET_MODE	Determines reset mode of OMAP. Latched on rising edge of PWR_ON_RESET. Pulled low on PCB (mode 0).	P12		Input	None	0	Input	None
MAKO_RESETX	Master cold reset input for entire 1710 chip, controlled by Mako IC	R12	0	Input	None		Input	None
MAKO_RESETX	MPU (ARM9) subsystem reset input, tied to PWRON_RESET (R12) on PCB	U20	0	Input	None		Input	None
OMAP_RESET	Reset output from OMAP used for CODEC, CPLD, Front Display, Lighting Controllers, MACE Tamper ckt.	AA20	0	Output	None	0	Output	None
MMC2_CLOCK	Clock for expanded memory (e-MMC)	Y10		Output	PD		Input	PD
MMC2_CLOCK_FEEDBACK	Clock feedback for expanded memory (e-MMC)	R18		Input	PD		Input	PD
MMC2_COMMAND	Command for expanded memory (e-MMC)	Y8		I/O	PU		Input	PD
MMC2_DATA_0	Data 0 for expanded memory (e-MMC)	W8		I/O	PU		Input	PD
MMC2_DATA_1	Data 1 for expanded memory (e-MMC)	V8		I/O	PU		Input	PD
MMC2_DATA_2	Data 2 for expanded memory (e-MMC)	W15		I/O	PU		Input	PD
MMC2_DATA_3	Data 3 for expanded memory (e-MMC)	R10		I/O	PU		Input	PD
UART1_TX	UART1 Serial Transmit Data	Y14		Output	None	0	Output	PD

Table 7-12. Overall GPIO pin functions across multiple boards (Continued)

Signal Name	Description	Pin or Ball #	Active State	SW Initialized		HW Reset		
				Direction	*PU	State	Direction	*PU or PD
UART1_RX	UART1 Serial Receive Data	V14		Input	PU		Input	PD
UART1_RTS	UART1 Request To Send (output)	AA15		Output	None	0	Output	PD
UART1_CTS	UART1 Clear To Send (input)	R14		Input	PU		Input	PD
UART3_TX	UART3 Serial Transmit Data	M18		Output	None	0	Output	PD
UART3_RX	UART3 Serial Receive Data	L14		Input	PU		Input	PD
USB1_TXEN	USB1 Transmit Enable	W16	0	Output	None		Input	None
USB1_DATA	USB1 Bidirectional Data	W14		I/O	None	0	Output	PD
USB1_SE0	USB1 Bidirectional Single Ended Zero	R13		I/O	None	U	Output	PD
USB0_TXEN	USB0 Transmit Enable	W4	0	Output	None	1	Output	PD
USB0_DATA	USB0 Bidirectional Data	P9		I/O	None		Input	None
USB0_SE0	USB0 Bidirectional Single Ended Zero	R8		I/O	None		Input	None
SSI_OMAP_CLOCK	SSI Clock into OMAP	G21		Input	None		Input	None
SSI_OMAP_SYNC	SSI Sync into OMAP	H15		Input	None		Input	None
SSI_OMAP_TXD	SSI Serial Data from CODEC	H20		Input	None		Input	PD
SSI_OMAP_RXD	SSI Serial Data to CODEC	H18		Output	None	0	Output	PD
SPI_ARM_CLK	ARM SPI Clock from OMAP	U19		I/O	PD		Input	None
SPI_ARM_MOSI	ARM SPI Data from OMAP	W21		I/O	PD	0	Output	PD
SPI_ARM_MISO	ARM SPI Data into OMAP	U18		Input	PD		Input	PD
SPI_DSP_CLK	DSP SPI Clock from OMAP	N14		I/O	PD		Input	None
SPI_DSP_MOSI	DSP SPI Data from OMAP	P14		Output	PD		Input	PD

Table 7-12. Overall GPIO pin functions across multiple boards (Continued)

Signal Name	Description	Pin or Ball #	Active State	SW Initialized		HW Reset		
				Direction	*PU	State	Direction	*PU or PD
SPI_DSP_MISO	DSP SPI Data into OMAP	AA17		Input	PD		Input	PD
GPS_UART_TX	UART Data from OMAP to GPS IC	M18		Output	None	0	Output	PD
GPS_UART_RX	UART Data from GPS IC to OMAP	R9		Input	PU		Input	PD
16.8_MHZ_CLK	Timer Reference Clock Input	N18		Input	None		Input	PD
TRIDENT_SSI[0]	Transmit SSI Clock from RF Board	Y6		Input	PD		Input	PD
TRIDENT_SSI[1]	Transmit SSI Frame Sync from RF Board	W7		Input	PD		Input	PD
TRIDENT_SSI[2]	Transmit SSI Data from OMAP	AA5		Output	PD	0	Output	PD
ABACUS_SSI[0]	Receive SSI Clock from RF Board	V7		I/O	PD		Input	None
ABACUS_SSI[1]	Receive SSI Frame Sync from RF Board	W6		I/O	PD		Input	None
ABACUS_SSI[2]	Receive SSI Data from RF Board	P10		Input	PD		Input	PD
SCL	I2C Clock	T18		I/O	None		Input	None
SDA	I2C Data	V20		I/O	None		Input	None
RTCK	JTAG Clock from Controller	Y17		I/O	None	U	Unknown	None
TCK	JTAG Clock from JTAG box to Controller	W18		Input	None		Input	PD
NTRST	JTAG Reset from JTAG box	Y18		Input	None		Input	
OMAP_TMS	JTAG Test Mode Select from JTAG box	V17		Input			Input	PD
OMAP_TDO	JTAG Data out from Controller	AA19		Output		0	Output	None
TDI	JTAD Data in from JTAG box to Controller	Y19		Input			Input	PD
NEMU0	Emulation pin 0, not used, pulled high on PCB	V16		I/O			Input	PU

Table 7-12. Overall GPIO pin functions across multiple boards (Continued)

Signal Name	Description	Pin or Ball #	Active State	SW Initialized		HW Reset		
				Direction	*PU	State	Direction	*PU or PD
NEMU1	Emulation pin 1, not used, pulled high on PCB	W17		I/O			Input	PU

Note:

* PU = Pull Up
* PD = Pull Down

Notes

Chapter 8 Schematics, Boards Overlays, and Parts Lists

This chapter contains the schematics, board overlays, and parts lists for the APX 5000/APX 6000/APX 6000XE/SRX2200 radio. Use them in conjunction with the theory of operation and the troubleshooting procedures, charts, and waveforms to isolate a problem to the component level.

When schematics are viewed online or as a PDF file, colors can be seen that denote power and signal paths. The red color denotes voltage paths, blue denotes the receive path, and green denotes the transmit path.

The following tables list the pages where the schematics and board overlays for the APX 5000/APX 6000 radio/APX 6000XE/SRX2200 are found.

8.1 List of Transceiver Schematics and Board Overlays

Table 8-1. List of Transceiver Schematics and Board Overlays

Table 8-1. List of Transceiver Schematics and Board Overlays (Continued)

Table 8-1. List of Transceiver Schematics and Board Overlays (Continued)

8.2 List of VOCON Schematics and Board Overlays

Table 8-2. List of VOCON Schematics and Board Overlays

8.3 List of Expansion Board Schematics and Overlays

Table 8-3. List of VOCON Schematics and Board Overlays

8.4 Transceiver (RF) Boards: VHF

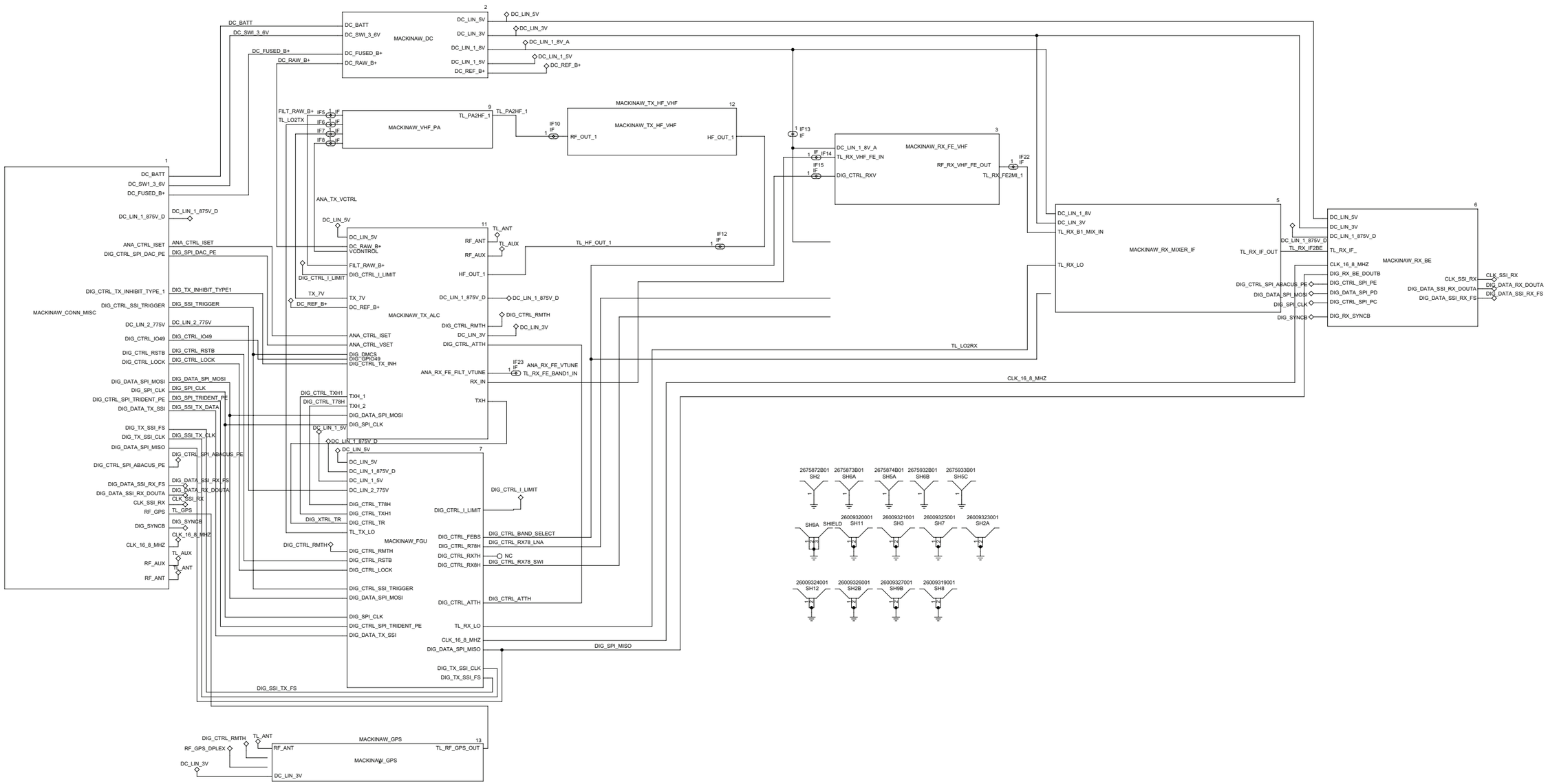


Figure 8-1. NUD7120A Transceiver (RF) Board Overall Circuit Schematic

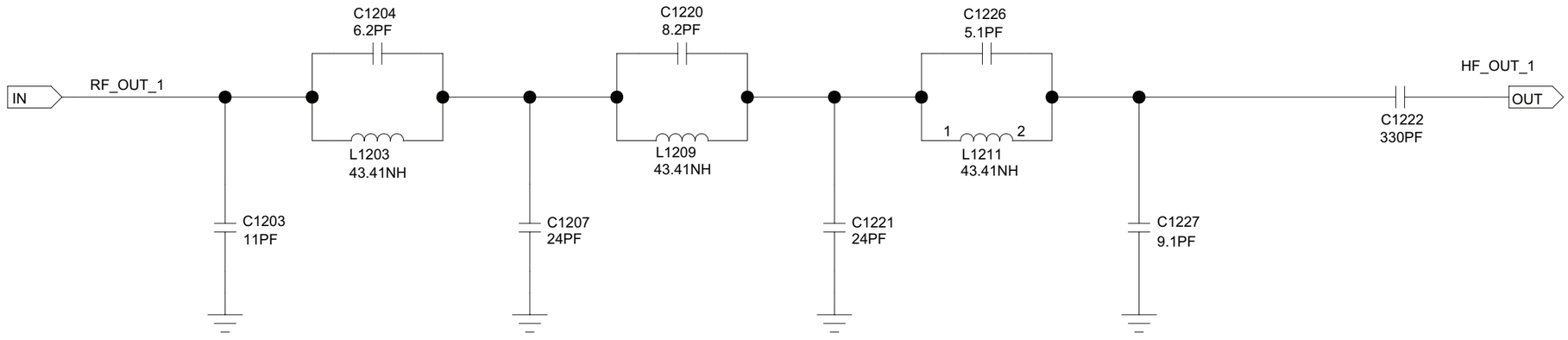


Figure 8-2. NUD7120A Harmonic Filter Circuit

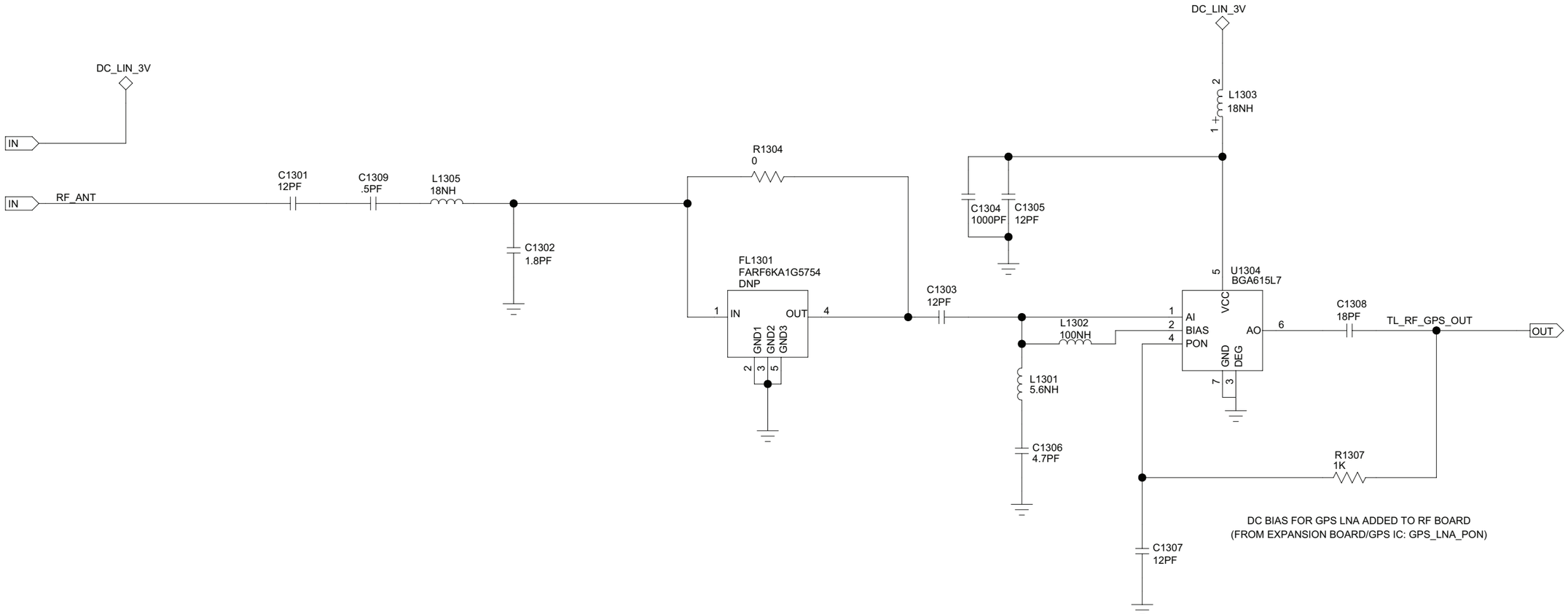


Figure 8-3. NUD7120A GPS Circuit

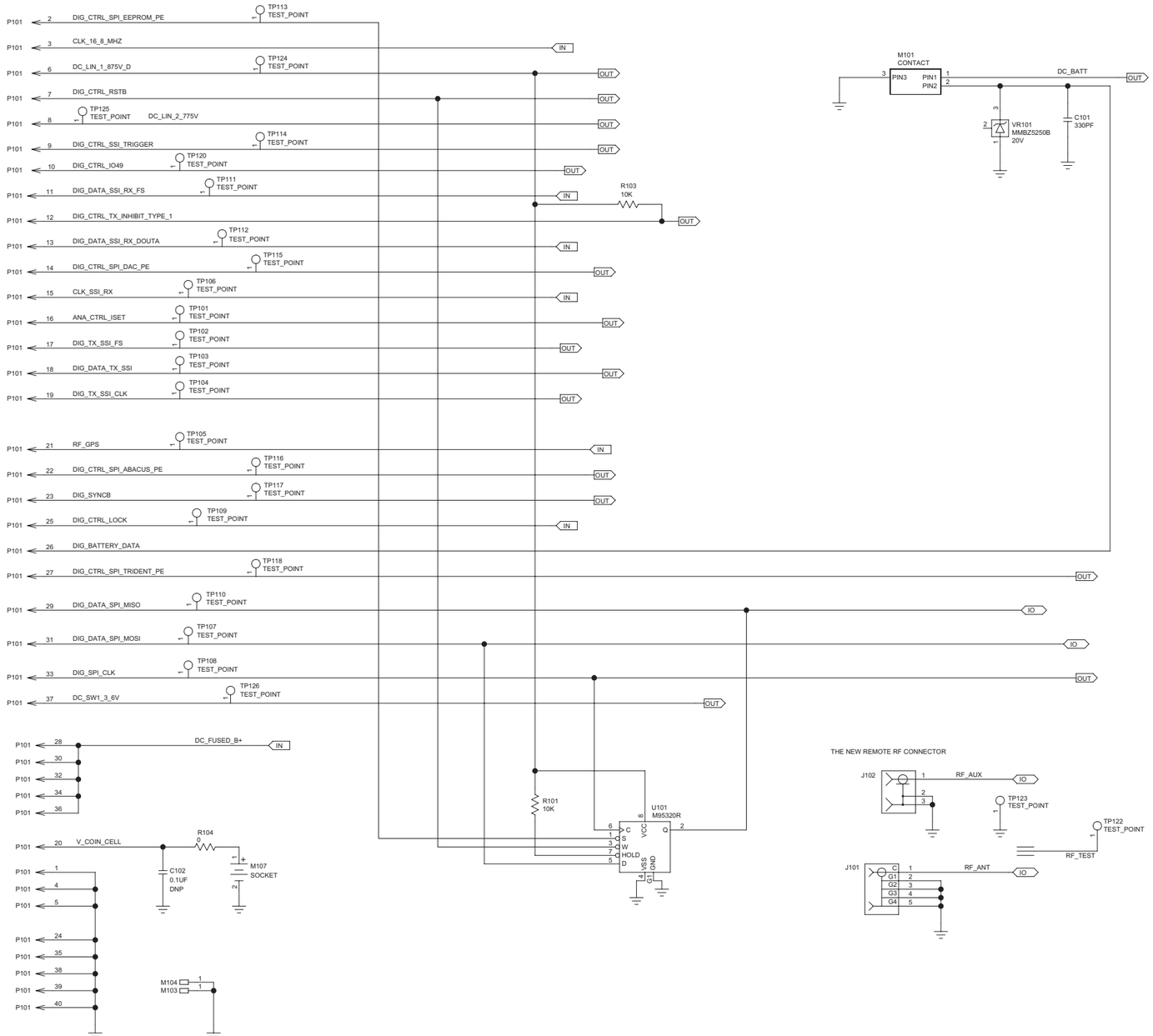


Figure 8-4. NUD7120A Miscellaneous Connector Circuit

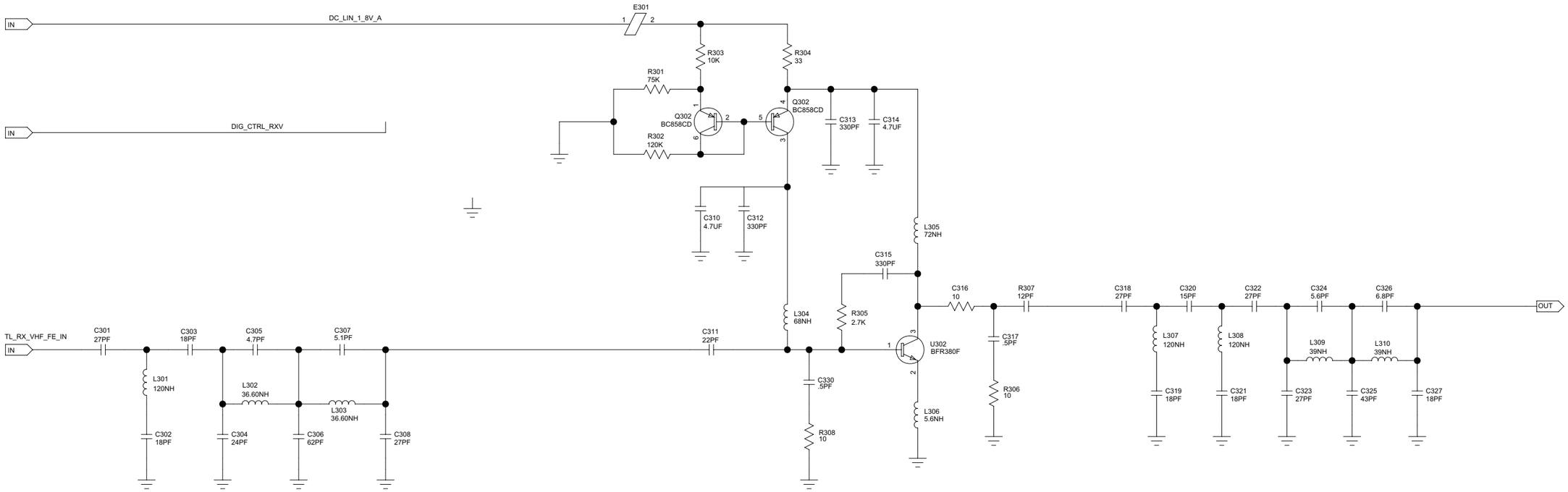


Figure 8-5. NUD7120A Receiver Front End Circuit

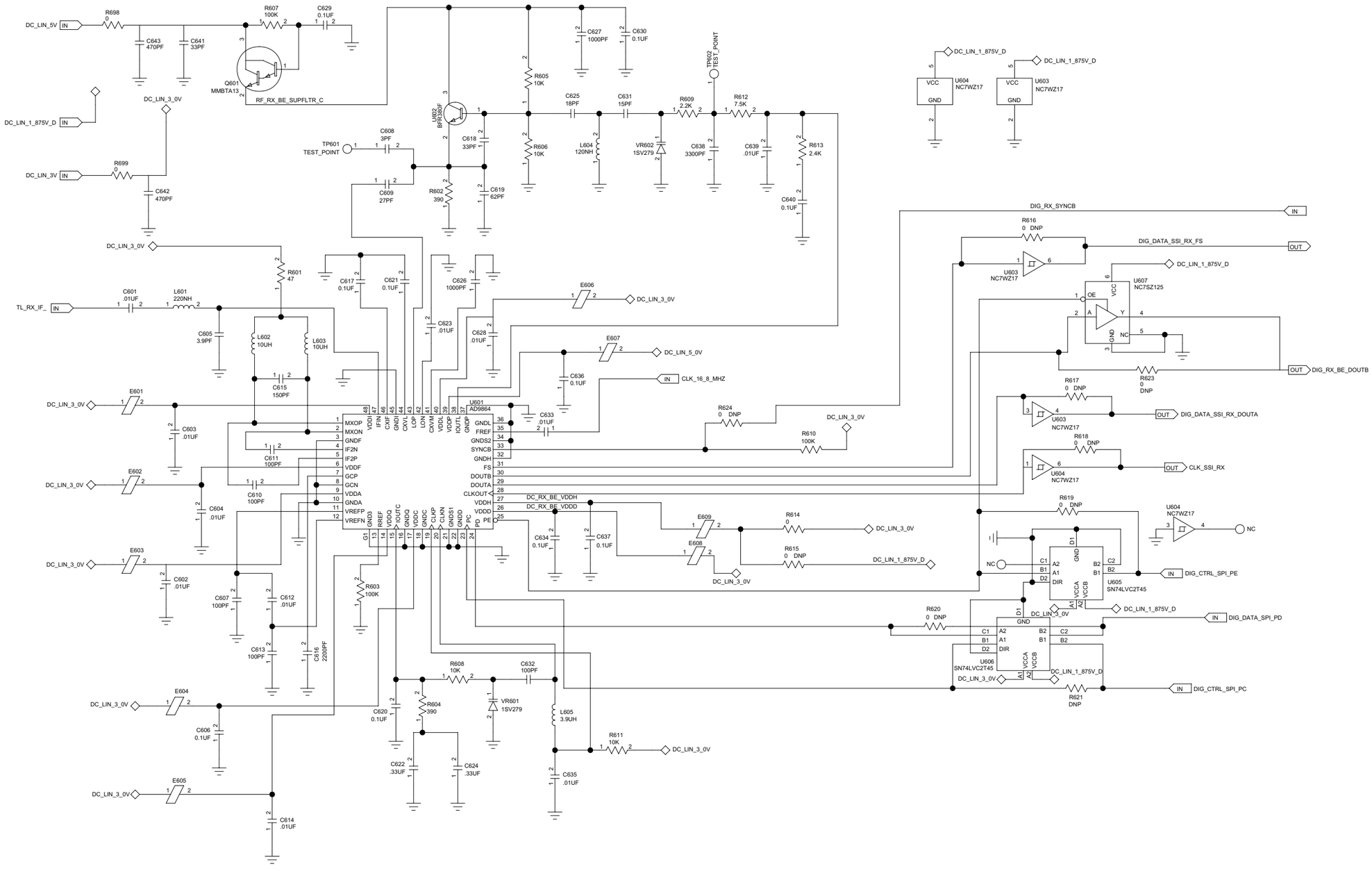


Figure 8-6. NUD7120A Receiver Back End Circuit

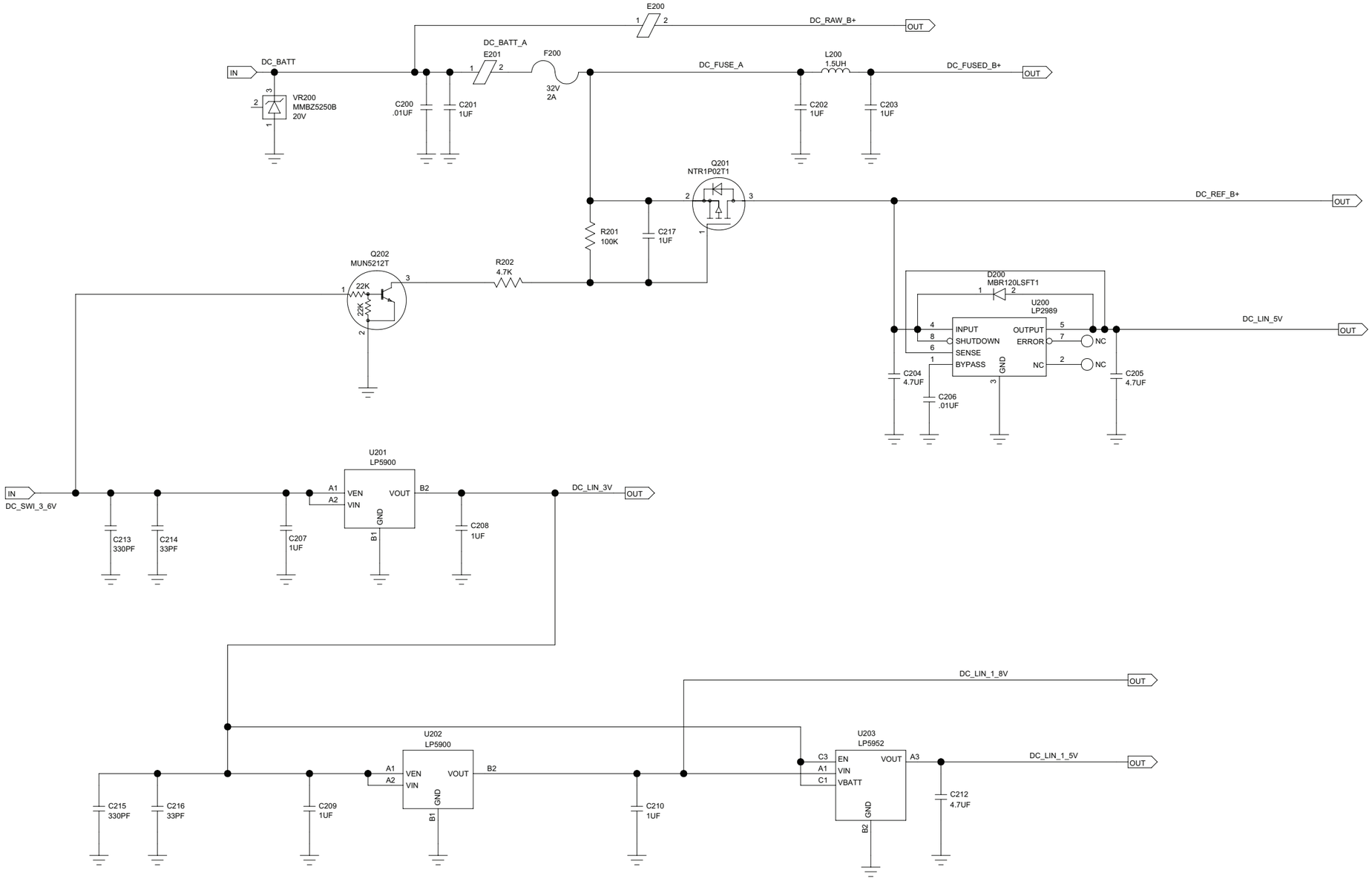


Figure 8-7. NUD7120A DC Power Circuit

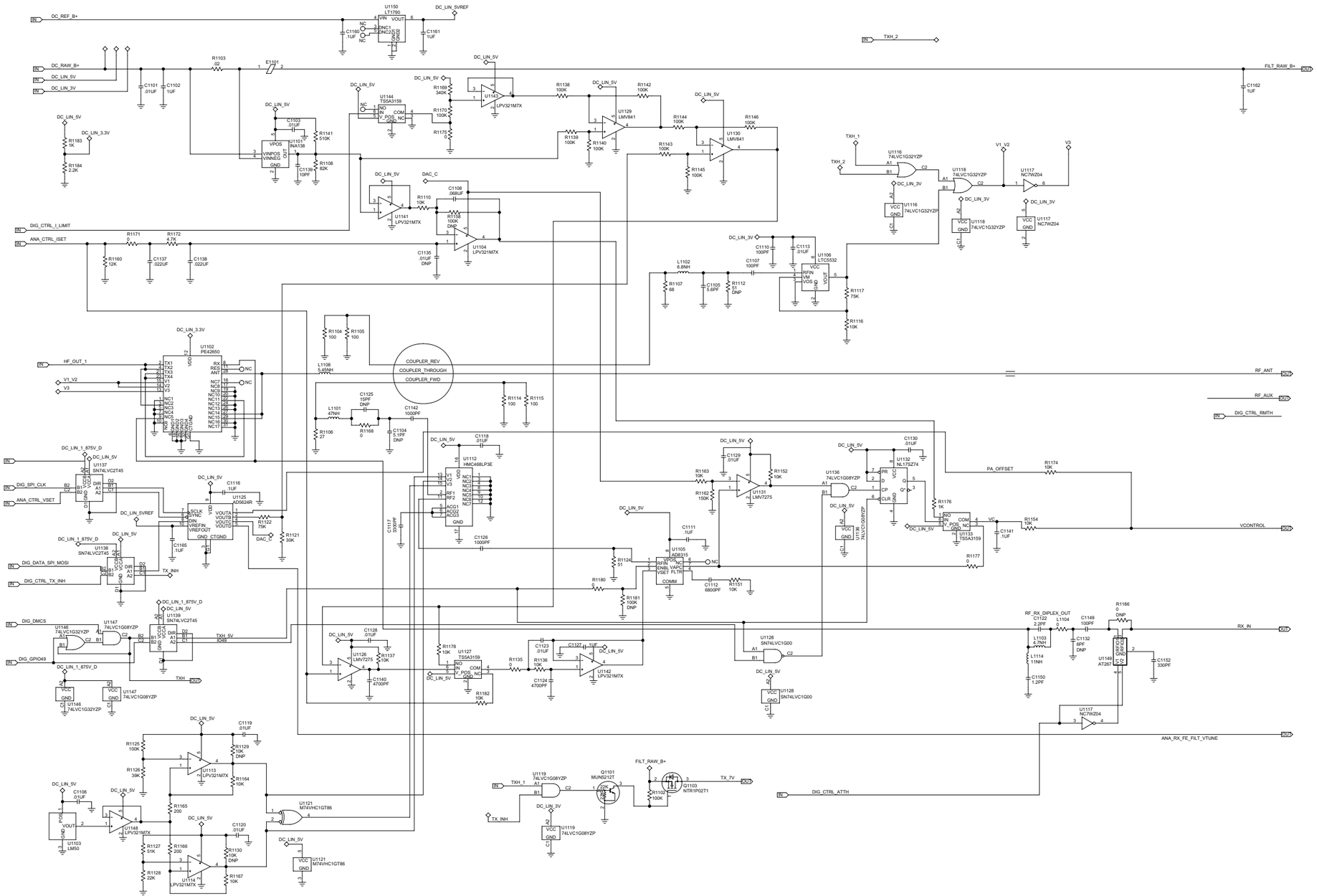
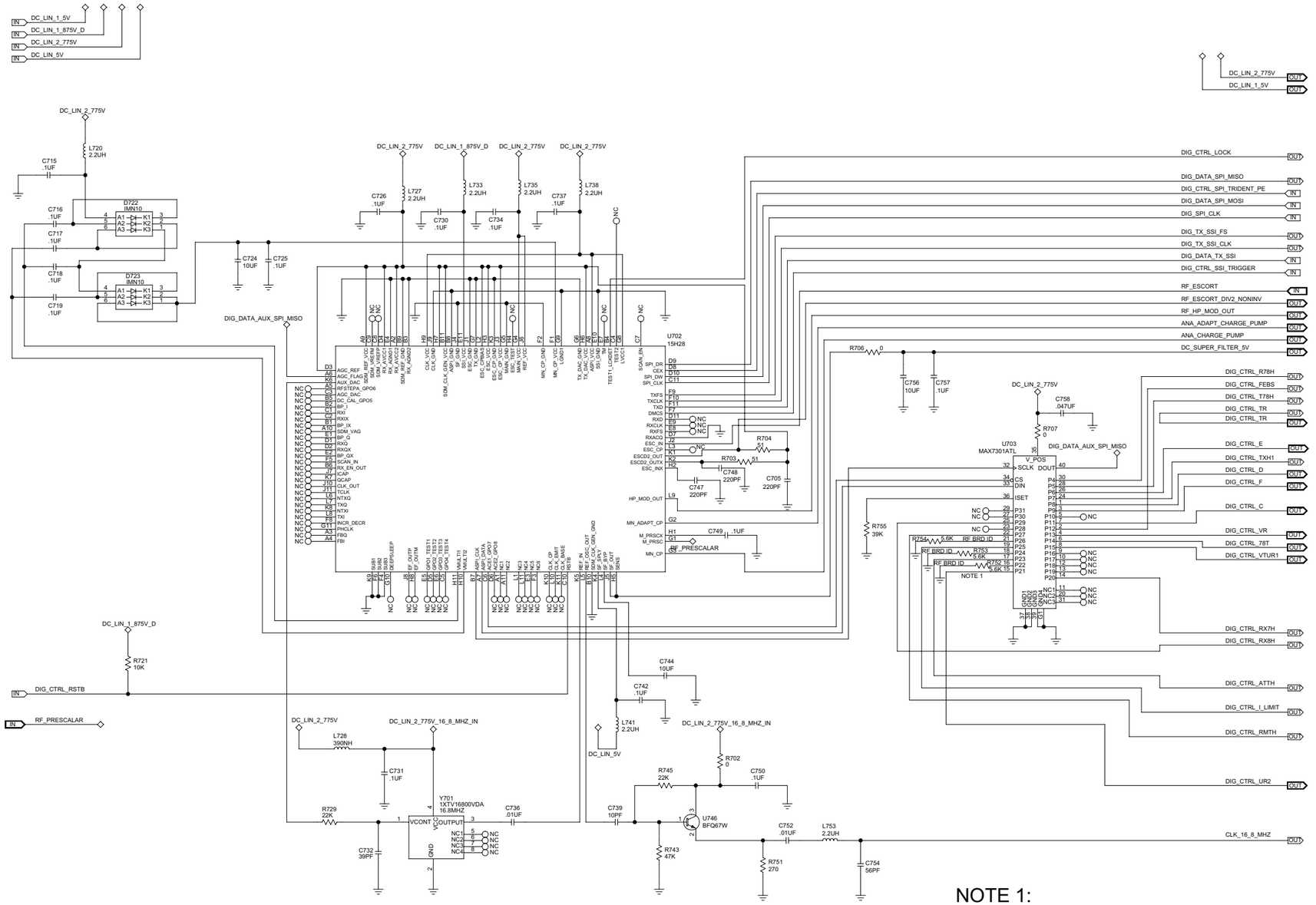


Figure 8-8. NUD7120A Transmitter and Automatic Level Control Circuits



NOTE 1:
NEED TO VERIFY RF BOARD ID FOR P1

Figure 8-9. NUD7120A Frequency Generation Unit (Synthesizer) Circuit – 1 of 2

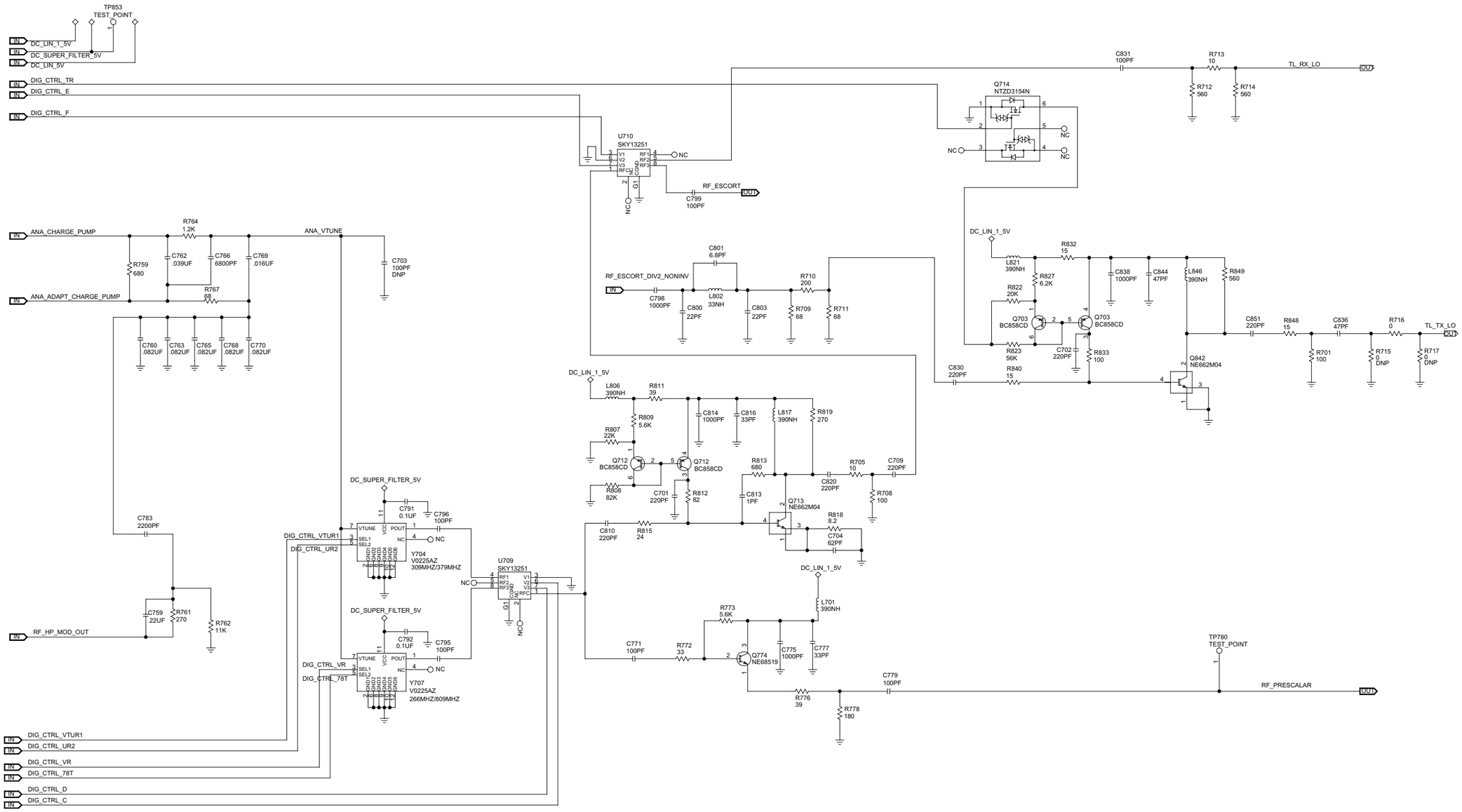


Figure 8-10. NUD7120A Frequency Generation Unit (VCO) Circuit – 2 of 2

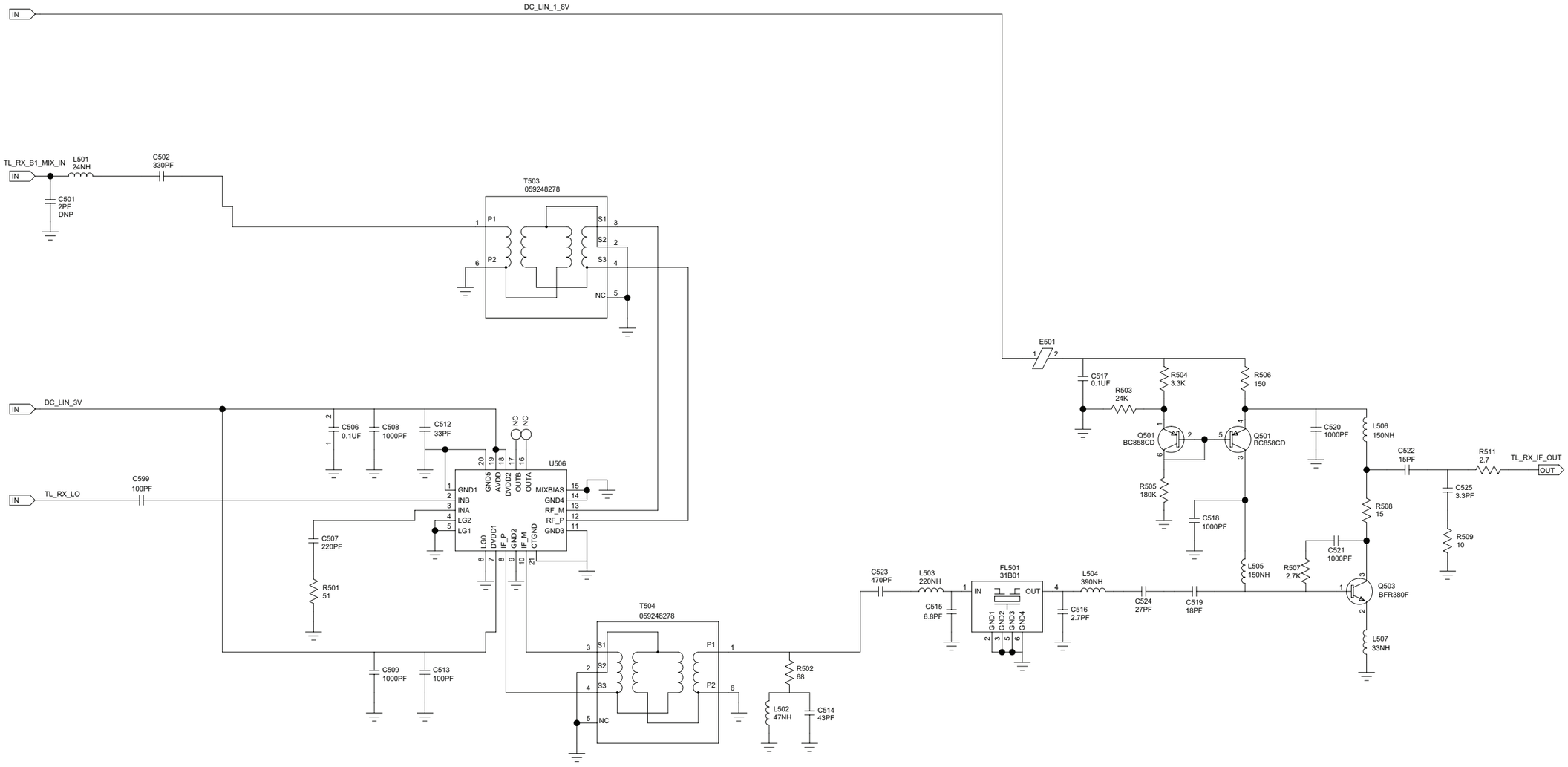


Figure 8-11. NUD7120A Mixer and IF Filter Circuits

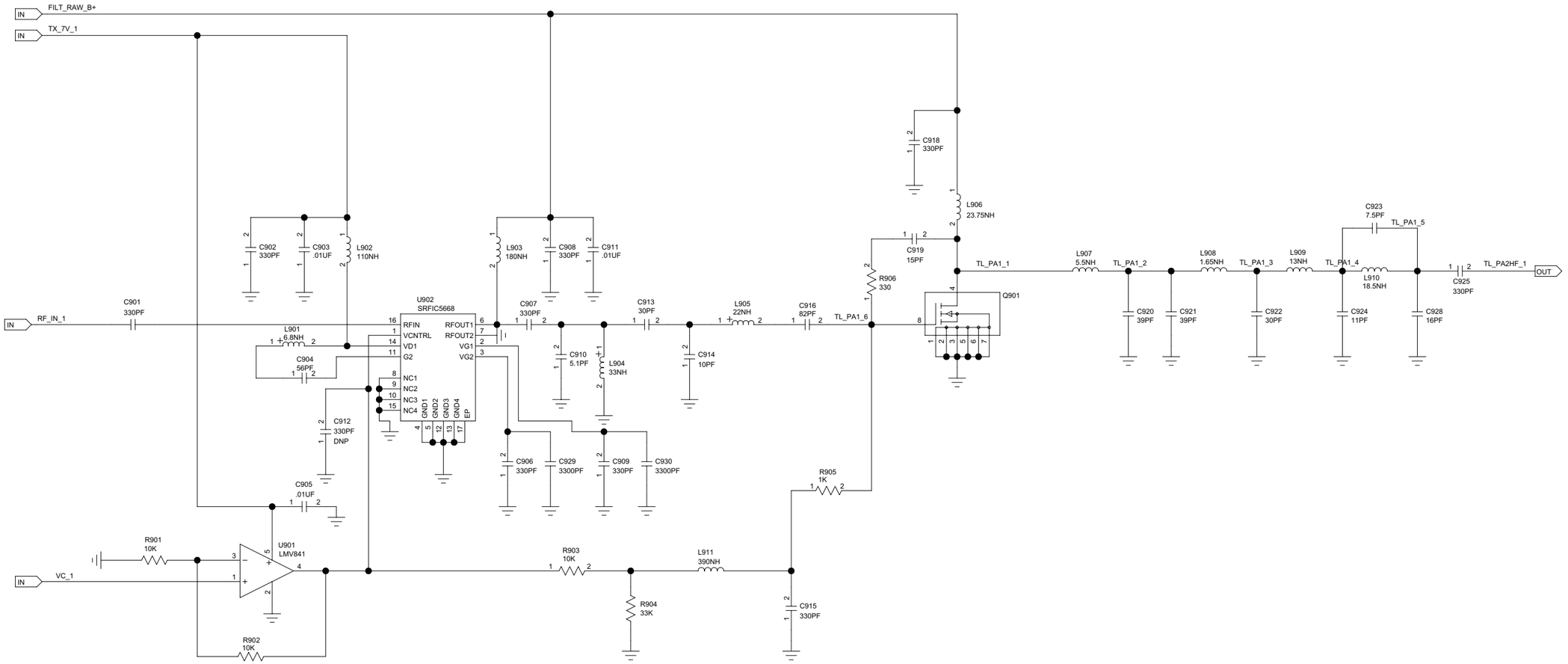


Figure 8-12. NUD7120A Power Amplifier Circuit

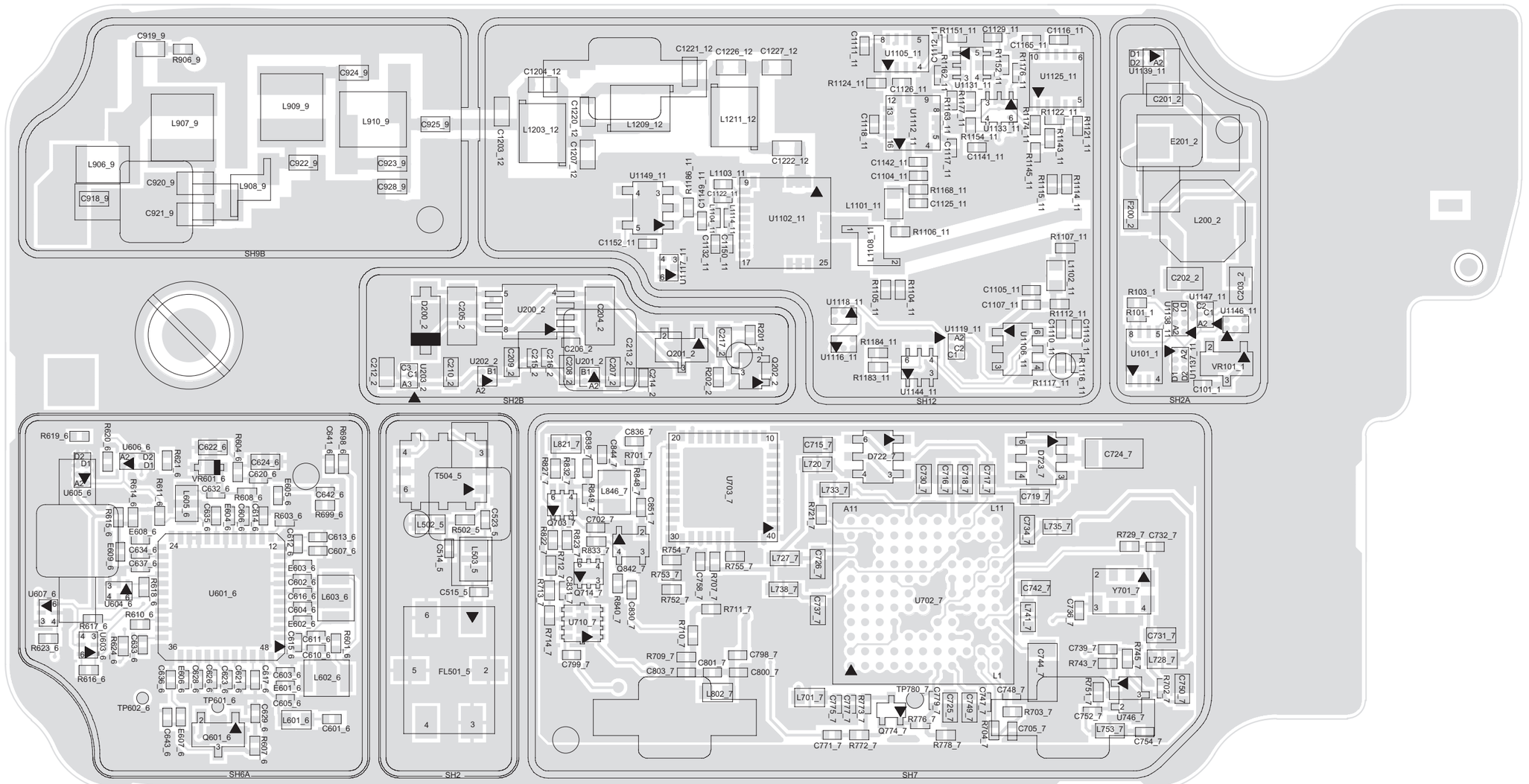


Figure 8-13. NUD7120A Transceiver (RF) Board Layout – Side 1

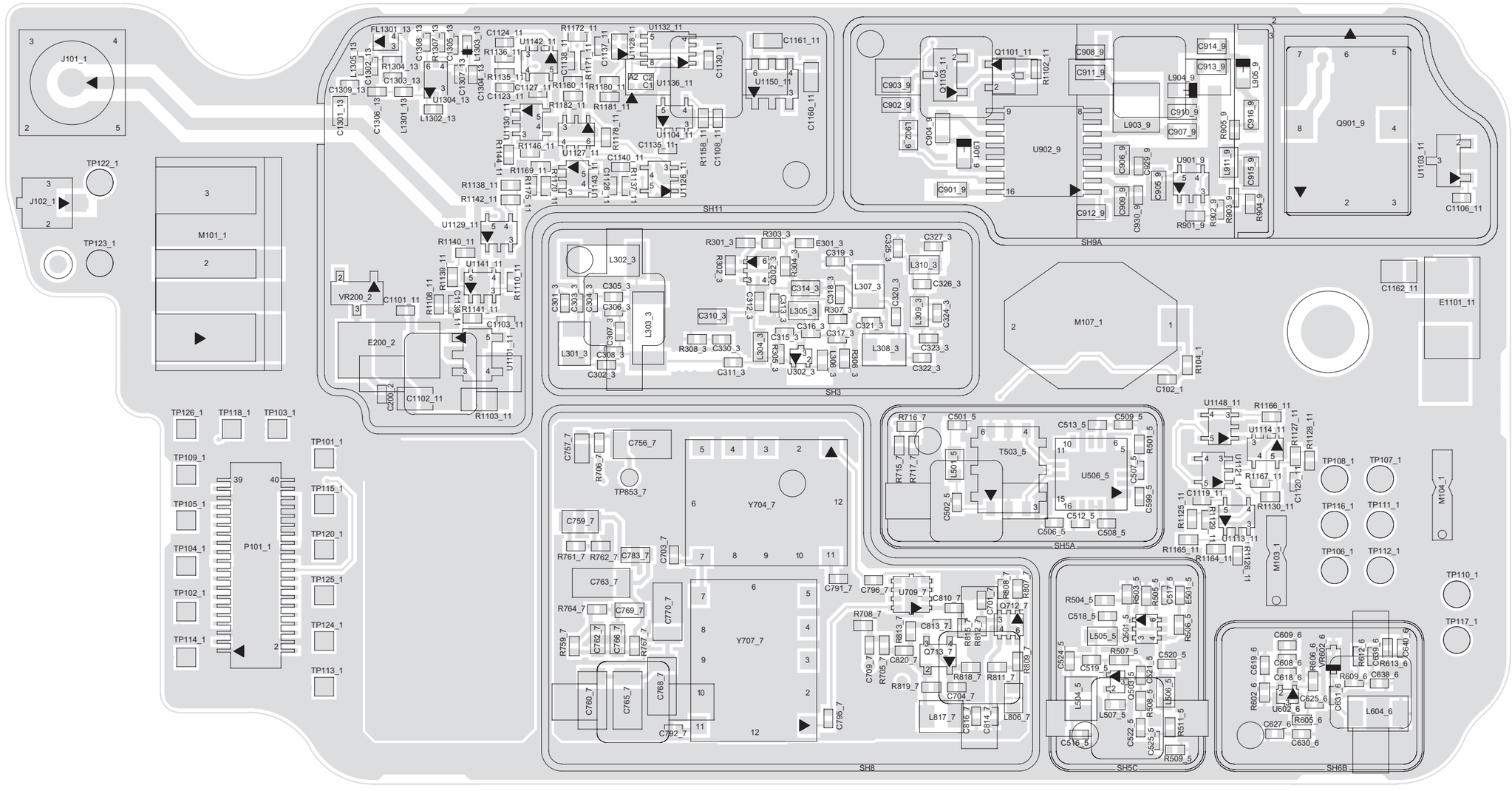


Figure 8-14. NUD7120A Transceiver (RF) Board Layout – Side 2

NUD7120A VHF Transceiver (RF) Board Parts List

Ref. Des.	Part Number	Description
C11	2113944A28	CAP CER CHP 18.0PF 50V 5%
C15	2113944A28	CAP CER CHP 18.0PF 50V 5%
C101	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C102	NOT PLACED	–
C200	2113945B02	CAP CER CHP 10,000PF 25V 10%
C201	2188468Y01	CAP CER 25V X7R 0805 1UF
C202	2188468Y01	CAP CER 25V X7R 0805 1UF
C203	2188468Y01	CAP CER 25V X7R 0805 1UF
C204	2113955D35	CAP,FXD,4.7UF,+10%,-10%, 16V-DC,1206,X7R,-55DEG CMIN,125DEG CMAX
C205	2113955D35	CAP,FXD,4.7UF,+10%,-10%, 16V-DC,1206,X7R,-55DEG CMIN,125DEG CMAX
C206	2113945B02	CAP CER CHP 10,000PF 25V 10%
C207	2113956B91	CAP,FXD,1UF,+10%,-10%,16V-DC,0603,X5R,-55DEG CMIN, 85DEG CMAX,PB
C208	2113956B91	CAP,FXD,1UF,+10%,-10%,16V-DC,0603,X5R,-55DEG CMIN, 85DEG CMAX,PB
C209	2113956B91	CAP,FXD,1UF,+10%,-10%,16V-DC,0603,X5R,-55DEG CMIN, 85DEG CMAX,PB
C210	2113956B91	CAP,FXD,1UF,+10%,-10%,16V-DC,0603,X5R,-55DEG CMIN, 85DEG CMAX,PB
C212	2113946D07	CAP,CHIP,4.7UF,+10%,-10%, 6.3V-DC,0603,X5R,-55DEG CMIN,85DEG CMA
C213	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C214	2113944A31	CAP CER CHP 33.0PF 50V 5%
C215	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C216	2113944A31	CAP CER CHP 33.0PF 50V 5%
C217	2113956B91	CAP,FXD,1UF,+10%,-10%,16V-DC,0603,X5R,-55DEG CMIN, 85DEG CMAX,PB
C301	2113944A30	CAP CER CHP 27.0PF 50V 5%
C302	2113944A28	CAP CER CHP 18.0PF 50V 5%
C303	2113944A28	CAP CER CHP 18.0PF 50V 5%
C304	2113944A81	CAP,FXD,24PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX,PB
C305	2113944A17	CAP CER CHP 4.7PF 50V +/- 0.25PF
C306	2113944A35	CAP CER CHP 62.0PF 50V 5%
C307	2113944A18	CAP CER CHP 5.1PF 50V +/- 0.5PF
C308	2113944A30	CAP CER CHP 27.0PF 50V 5%
C310	2113946D07	CAP,CHIP,4.7UF,+10%,-10%, 6.3V-DC,0603,X5R,-55DEG CMIN,85DEG CMA
C311	2113944A29	CAP CER CHP 22.0PF 50V 5%
C312	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C313	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C314	2113946D07	CAP,CHIP,4.7UF,+10%,-10%, 6.3V-DC,0603,X5R,-55DEG CMIN,85DEG CMA
C315	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C316	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
C317	2175389H01	CAP,.5PF, CHIP, 0402, CERAMIC, 50 V
C318	2113944A30	CAP CER CHP 27.0PF 50V 5%
C319	2113944A28	CAP CER CHP 18.0PF 50V 5%
C320	2113944A27	CAP CER CHP 15.0PF 50V 5%
C321	2113944A28	CAP CER CHP 18.0PF 50V 5%
C322	2113944A30	CAP CER CHP 27.0PF 50V 5%
C323	2113944A30	CAP CER CHP 27.0PF 50V 5%
C324	2113944A19	CAP CER CHP 5.6PF 50V +/- 0.5PF
C325	2113944A84	CAP,FXD,43PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX,PB
C326	2113944A21	CAP CER CHP 6.8PF 50V +/- 0.5PF
C327	2113944A28	CAP CER CHP 18.0PF 50V 5%
C330	2175389H01	CAP,.5PF, CHIP, 0402, CERAMIC, 50 V
C501	NOT PLACED	–
C502	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C506	2113946B04	CAP CER CHP 0.10UF 10V 10%
C507	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C508	2113945A09	CAP CER CHP 1000PF 50V 10%
C509	2113945A09	CAP CER CHP 1000PF 50V 10%
C512	2113944A31	CAP CER CHP 33.0PF 50V 5%
C513	2113944A40	CAP CER CHP 100.0PF 50V 5%
C514	2113944A84	CAP,FXD,43PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX,PB
C515	2113944A21	CAP CER CHP 6.8PF 50V +/- 0.5PF
C516	2113944A11	CAP CER CHP 2.7PF 50V +/- 0.25PF
C517	2113946B04	CAP CER CHP 0.10UF 10V 10%
C518	2113945A09	CAP CER CHP 1000PF 50V 10%
C519	2113944A31	CAP CER CHP 33.0PF 50V 5%
C520	2113945A09	CAP CER CHP 1000PF 50V 10%
C521	2113945A09	CAP CER CHP 1000PF 50V 10%
C522	2113944A27	CAP CER CHP 15.0PF 50V 5%
C523	2113944A48	CAP CER CHP 470.0 PF 50V 5%
C524	2113944A30	CAP CER CHP 27.0PF 50V 5%
C525	2113944A61	CAP,FXD,.5PF,.25PF+/-,50V-DC,0402,C0G,-55DEG CMIN,125DEG CMAX
C599	2113944A40	CAP CER CHP 100.0PF 50V 5%
C601	2113945B02	CAP CER CHP 10,000PF 25V 10%
C602	2113945B02	CAP CER CHP 10,000PF 25V 10%
C603	2113945B02	CAP CER CHP 10,000PF 25V 10%
C604	2113945B02	CAP CER CHP 10,000PF 25V 10%
C605	2113944A15	CAP CER CHP 3.9PF 50V +/- 0.25PF
C606	2113946B04	CAP CER CHP 0.10UF 10V 10%
C607	2113944A40	CAP CER CHP 100.0PF 50V 5%
C608	2113944A12	CAP CER CHP 3.0PF 50V +/- 0.25PF
C609	2113944A30	CAP CER CHP 27.0PF 50V 5%
C610	2113944A40	CAP CER CHP 100.0PF 50V 5%
C611	2113944A40	CAP CER CHP 100.0PF 50V 5%
C612	2113945B02	CAP CER CHP 10,000PF 25V 10%
C613	2113944A40	CAP CER CHP 100.0PF 50V 5%
C614	2113945B02	CAP CER CHP 10,000PF 25V 10%
C615	2113944A42	CAP CER CHP 150.0PF 50V 5%
C616	2113945A11	CAP CER CHP 2200PF 50V 10%
C617	2113946B04	CAP CER CHP 0.10UF 10V 10%
C618	2113944A31	CAP CER CHP 33.0PF 50V 5%
C619	2113944A35	CAP CER CHP 62.0PF 50V 5%
C620	2113946B04	CAP CER CHP 0.10UF 10V 10%
C621	2113946B04	CAP CER CHP 0.10UF 10V 10%
C622	2113946C07	CAP,FXD,.33UF,+10%,-10%, 10V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX
C623	2113945B02	CAP CER CHP 10,000PF 25V 10%
C624	2113946C07	CAP,FXD,.33UF,+10%,-10%, 10V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX
C625	2113944A28	CAP CER CHP 18.0PF 50V 5%
C626	2113945A09	CAP CER CHP 1000PF 50V 10%
C627	2113945A09	CAP CER CHP 1000PF 50V 10%
C628	2113945B02	CAP CER CHP 10,000PF 25V 10%
C629	2113946B04	CAP CER CHP 0.10UF 10V 10%
C630	2113946B04	CAP CER CHP 0.10UF 10V 10%
C631	2113944A27	CAP CER CHP 15.0PF 50V 5%

Ref. Des.	Part Number	Description
C632	2113944A40	CAP CER CHP 100.0PF 50V 5%
C633	2113945B02	CAP CER CHP 10,000PF 25V 10%
C634	2113946B04	CAP CER CHP 0.10UF 10V 10%
C635	2113945B02	CAP CER CHP 10,000PF 25V 10%
C636	2113946B04	CAP CER CHP 0.10UF 10V 10%
C637	2113946B04	CAP CER CHP 0.10UF 10V 10%
C638	2113945A12	CAP CER CHP 3300PF 50V 10%
C639	2113945B02	CAP CER CHP 10,000PF 25V 10%
C640	2113946B04	CAP CER CHP 0.10UF 10V 10%
C641	2113944A31	CAP CER CHP 33.0PF 50V 5%
C642	2113944A48	CAP CER CHP 470.0 PF 50V 5%
C643	2113944A48	CAP CER CHP 470.0 PF 50V 5%
C701	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C702	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C703	NOT PLACED	–
C704	2113944A35	CAP CER CHP 62.0PF 50V 5%
C705	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C709	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C715	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C716	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C717	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C718	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C719	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX

Ref. Des.	Part Number	Description
C724	2113955D37	CAP,FXD,10UF,+10%,-10%,16V-DC,1206,X7R,-55DEG CMIN, 125DEG CMAX
C725	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN,125DEG CMAX
C726	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C730	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C731	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C732	2113944A32	CAP CER CHP 39.0PF 50V 5%
C734	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C736	2113945B02	CAP CER CHP 10,000PF 25V 10%
C737	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C739	2113944A25	CAP CER CHP 10.0PF 50V +/- 0.5PF
C742	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C744	2113955D37	CAP,FXD,10UF,+10%,-10%,16V-DC,1206,X7R,-55DEG CMIN, 125DEG CMAX
C747	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C748	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C749	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C750	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C752	2113945B02	CAP CER CHP 10,000PF 25V 10%
C754	2113944A34	CAP CER CHP 56.0PF 50V 5%

Ref. Des.	Part Number	Description
C756	2113955D37	CAP,FXD,10UF,+10%,-10%,16V-DC,1206,X7R,-55DEG CMIN, 125DEG CMAX
C757	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C758	2113946B02	CAP CER CHP 0.047UF 10V 10,
C759	2113945G95	CAP,FXD,.22UF,+10%,-10%, 50V-DC,0805,X7R,-55DEG CMIN,125DEG CMAX
C760	2113944G97	CAP,FXD,.082UF,+5%,-5%,50V-DC,1206,C0G,-55DEG CMIN,125DEG CMAX
C762	2113945C26	CAP,FXD,.039UF,+10%,-10%, 50V-DC,0603,X7R,-55DEG CMIN,125DEG CMA
C763	2113944G97	CAP,FXD,.082UF,+5%,-5%,50V-DC,1206,C0G,-55DEG CMIN, 125DEG CMAX
C765	2113944G97	CAP,FXD,.082UF,+5%,-5%,50V-DC,1206,C0G,-55DEG CMIN, 125DEG CMAX
C766	2113945C01	CAP CER CHP 6800PF 50V 10%
C768	2113944G97	CAP,FXD,.082UF,+5%,-5%,50V-DC,1206,C0G,-55DEG CMIN,125DEG CMAX
C769	2113945C20	CAP,FXD,.016UF,+10%,-10%, 50V-DC,0603,X7R,-55DEG CMIN,125DEG CMA
C770	2113944G97	CAP,FXD,.082UF,+5%,-5%,50V-DC,1206,C0G,-55DEG CMIN, 125DEG CMAX
C771	2113944A40	CAP CER CHP 100.0PF 50V 5%
C775	2113945A09	CAP CER CHP 1000PF 50V 10%
C777	2113944A31	CAP CER CHP 33.0PF 50V 5%
C779	2113944A40	CAP CER CHP 100.0PF 50V 5%
C783	2113944C55	CAP CER CHP 1200.OPF 50V 5%
C791	2113946B04	CAP CER CHP 0.10UF 10V 10%
C792	2113946B04	CAP CER CHP 0.10UF 10V 10%
C795	2113944A40	CAP CER CHP 100.0PF 50V 5%
C796	2113944A40	CAP CER CHP 100.0PF 50V 5%
C798	2113945A09	CAP CER CHP 1000PF 50V 10%

Ref. Des.	Part Number	Description
C799	2113944A40	CAP CER CHP 100.0PF 50V 5%
C800	2113944A29	CAP CER CHP 22.0PF 50V 5%
C801	2113944A21	CAP CER CHP 6.8PF 50V +/- 0.5PF
C803	2113944A29	CAP CER CHP 22.0PF 50V 5%
C810	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C813	2113944A63	CAP,FXD,1PF,.25PF+/-,50V-DC,0402,C0G,-55DEG CMIN,125DEG CMAX,P
C814	2113945A09	CAP CER CHP 1000PF 50V 10%
C816	2113944A31	CAP CER CHP 33.0PF 50V 5%
C820	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C830	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C831	2113944A40	CAP CER CHP 100.0PF 50V 5%
C836	2113944A33	CAP CER CHP 47.0PF 50V 5%
C838	2113945A09	CAP CER CHP 1000PF 50V 10%
C844	2113944A33	CAP CER CHP 47.0PF 50V 5%
C851	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C901	2113944C04	CAP CER CHP 330.0PF 50V 5%
C902	2113944C04	CAP CER CHP 330.0PF 50V 5%
C903	2113945L49	CAP,FXD,.01UF,+5%,-5%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX,P
C904	2113944M36	CAP,FXD,56PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX,PB
C905	2113945L49	CAP,FXD,.01UF,+5%,-5%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX,P
C906	2113944C04	CAP CER CHP 330.0PF 50V 5%
C907	2113944C04	CAP CER CHP 330.0PF 50V 5%
C908	2113944C04	CAP CER CHP 330.0PF 50V 5%
C909	2113944C04	CAP CER CHP 330.0PF 50V 5%
C910	2113944C23	CAP CER CHP 5.1PF 50V +/- 0.5PF
C911	2113945L49	CAP,FXD,.01UF,+5%,-5%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX,P

Ref. Des.	Part Number	Description
C912	NOT PLACED	–
C913	2113944M29	CAP,FXD,30PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX,PB
C914	2113944M18	CAP,FXD,10PF,+2.5%,-2.5%, 50V-DC,0603,C0G,-55DEG CMIN,125DEG CMA
C915	2113944C04	CAP CER CHP 330.0PF 50V 5%
C916	2113944M40	CAP,FXD,82PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN,125DEG CMAX,PB
C918	2113944C04	CAP CER CHP 330.0PF 50V 5%
C919	2113944M22	CAP,FXD,15PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX,PB
C920	2113742J10	CAP 39.0 PF 5%
C921	2113742J10	CAP 39.0 PF 5%
C922	2113944M29	CAP,FXD,30PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX,PB
C923	2113944M15	CAP,FXD,7.5PF,.1PF+/-,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX
C924	2113944M19	CAP,FXD,11PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX,PB
C925	2113944C04	CAP CER CHP 330.0PF 50V 5%
C928	2113944M23	CAP,FXD,16PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX,PB
C929	2113945A12	CAP CER CHP 3300PF 50V 10%
C930	2113945A12	CAP CER CHP 3300PF 50V 10%
C1101	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1102	2188468Y01	CAP CER 25V X7R 0805 1UF
C1103	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1104	NOT PLACED	–
C1105	2113944A19	CAP CER CHP 5.6PF 50V +/-0.5PF
C1106	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1107	2113944A40	CAP CER CHP 100.0PF 50V 5%

Ref. Des.	Part Number	Description
C1108	2113946B03	CAP CER CHP 0.068UF 10V 10
C1110	2113944A40	CAP CER CHP 100.0PF 50V 5%
C1111	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C1112	2113945B01	CAP CER CHP 6800PF 25V 10%
C1113	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1116	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C1117	2113945A12	CAP CER CHP 3300PF 50V 10%
C1118	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1119	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1120	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1122	2175390H01	CAP, 2.2 PF, 0402, CERAMIC, 50V
C1123	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1124	2113945A13	CAP CER CHP 4700PF 50V 10%
C1125	NOT PLACED	–
C1126	2113945A09	CAP CER CHP 1000PF 50V 10%
C1127	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C1128	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1129	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1130	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1132	NOT PLACED	–
C1135	NOT PLACED	–
C1137	2113945B04	CAP,FXD,.022UF,+10%,-10%, 25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA

Ref. Des.	Part Number	Description
C1138	2113945B04	CAP,FXD,.022UF,+10%,-10%, 25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C1139	2113944A25	CAP CER CHP 10.0PF 50V +/-0.5PF
C1140	2113945A13	CAP CER CHP 4700PF 50V 10%
C1141	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C1142	2113945A09	CAP CER CHP 1000PF 50V 10%
C1149	2113944A40	CAP CER CHP 100.0PF 50V 5%
C1150	2175392H01	CAP, 1.2PF, 0402, CERAMIC, 50V
C1152	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C1160	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C1161	2113956B91	CAP,FXD,1UF,+10%,-10%,16V-DC,0603,X5R,-55DEG CMIN, 85DEG CMAX,PB
C1162	2188468Y01	CAP CER 25V X7R 0805 1UF
C1165	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C1203	2113944M19	CAP,FXD,11PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX,PB
C1204	2113944M13	CAP,FXD,6.2PF,.1PF+/-,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX
C1207	2113944M27	CAP,FXD,24PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX,PB
C1220	2113944M16	CAP,FXD,8.2PF,.1PF+/-,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX
C1221	2113944M27	CAP,FXD,24PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX,PB
C1222	2113944C04	CAP CER CHP 330.0PF 50V 5%
C1226	2113944M11	CAP,FXD,5.1PF,.1PF+/-,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX

Ref. Des.	Part Number	Description
C1227	2113944M17	CAP,FXD,9.1PF,.1PF+/-,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX
C1301	2113944M20	CAP,FXD,12PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX,PB
C1302	2114036F74	CAP,FXD,1.8PF,.05PF+/-,25V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C1303	2113944A26	CAP CER CHP 12.0PF 50V 5%
C1304	2113945A09	CAP CER CHP 1000PF 50V 10%
C1305	2113944A26	CAP CER CHP 12.0PF 50V 5%
C1306	2113944A17	CAP CER CHP 4.7PF 50V +/-0.25PF
C1307	2113944A26	CAP CER CHP 12.0PF 50V 5%
C1308	2113944A28	CAP CER CHP 18.0PF 50V 5%
C1309	2175389H01	CAP,.5PF, CHIP, 0402, CERAMIC, 50 V
D200	4813978A19	DIODE,RECT,MBR120,SM,SOD-123,1A,20V,SHTK,PB-FREE
D722	4815011H01	DIODE TRIPLE
D723	4815011H01	DIODE TRIPLE
E200	2405688Z01	INDUCTOR FERRITE BEAD
E201	2405688Z01	INDUCTOR FERRITE BEAD
E301	2480640Z01	SURFACE MOUNT FERRITE BEAD
E501	2480640Z01	SURFACE MOUNT FERRITE BEAD
E601	2480640Z01	SURFACE MOUNT FERRITE BEAD
E602	2480640Z01	SURFACE MOUNT FERRITE BEAD
E603	2480640Z01	SURFACE MOUNT FERRITE BEAD
E604	2480640Z01	SURFACE MOUNT FERRITE BEAD
E605	2480640Z01	SURFACE MOUNT FERRITE BEAD
E606	2480640Z01	SURFACE MOUNT FERRITE BEAD
E607	2480640Z01	SURFACE MOUNT FERRITE BEAD

Ref. Des.	Part Number	Description
E608	2480640Z01	SURFACE MOUNT FERRITE BEAD
E609	2480640Z01	SURFACE MOUNT FERRITE BEAD
E1101	2405688Z01	INDUCTOR FERRITE BEAD
F200	6575834B01	FUSE SURFACE MOUNT
FL130	NOT PLACED	–
FL501	4885631B01	XTAL FILT 3 POLE 109.65 MOTORO
J101	0909901V02	RECP SMT MCX
J102	0975886B01	RECEPTACLE, COAX CABLE
L200	2571269C01	INDUCTOR WW POWER 20%
L301	2414032F35	IDCTR,WW,120NH,5%,400MA,.51OHM,CER,35 Q,860MHZ SRF,SM,PB-FR
L302	2460591H08	HIGH Q, SURFACE MOUNT COILS 36.6 NH
L303	2460591H08	HIGH Q, SURFACE MOUNT COILS 36.6 NH
L304	2414017N22	IDCTR,CHIP,68NH,5%,400MA, 1.2OHM,CER,14 Q,800MHZ SRF,SM,0603
L305	2415429H34	CHIP INDUCTOR
L306	2415427H13	CHIP INDUCTOR
L307	2414032F35	IDCTR,WW,120NH,5%,400MA,.51OHM,CER,35 Q,860MHZ SRF,SM,PB-FR
L308	2414032F35	IDCTR,WW,120NH,5%,400MA, .51OHM,CER,35 Q,860MHZ SRF,SM,PB-FR
L309	2415429H28	CHIP INDUCTOR
L310	2415429H28	CHIP INDUCTOR
L501	2415429H23	CHIP INDUCTOR
L502	2415429H30	CHIP INDUCTOR
L503	2414032F38	IDCTR,WW,220NH,5%,400MA, .7OHM,CER,30 Q,630MHZ SRF, SM,PB-FRE
L504	2414032F41	IDCTR,WW,390NH,10%,200MA, 1.5OHM,CER,40 Q,730MHZ SRF,SM,PB-F
L505	2415429H39	CHIP INDUCTOR
L506	2415429H39	CHIP INDUCTOR
L507	2415427H12	CHIP INDUCTOR

Ref. Des.	Part Number	Description
L601	2415429H43	CHIP INDUCTOR
L602	2466505A01	COIL INDUCTOR
L603	2466505A01	COIL INDUCTOR
L604	2414032D16	IDCTR,WW,120NH,5%,800MA, .26OHM,CER,42 Q,1GHZ SRF,SM,PB-FREE
L605	2462587Q54	IND CHIP 3,900 NH 10%
L701	2415429H47	CHIP INDUCTOR
L720	2480646Z20	COIL MULTI-LAYER CHIP(2.20UH)
L727	2480646Z20	COIL MULTI-LAYER CHIP(2.20UH)
L728	2415429H47	CHIP INDUCTOR
L733	2480646Z20	COIL MULTI-LAYER CHIP(2.20UH)
L735	2480646Z20	COIL MULTI-LAYER CHIP(2.20UH)
L738	2480646Z20	COIL MULTI-LAYER CHIP(2.20UH)
L741	2480646Z20	COIL MULTI-LAYER CHIP(2.20UH)
L753	2480646Z20	COIL MULTI-LAYER CHIP(2.20UH)
L802	2415429H26	CHIP INDUCTOR
L806	2415429H47	CHIP INDUCTOR
L817	2414032F41	IDCTR,WW,390NH,10%,200MA, 1.5OHM,CER,40 Q,730MHZ SRF,SM,PB-F
L821	2415429H47	CHIP INDUCTOR
L846	2414032F41	IDCTR,WW,390NH,10%,200MA, 1.5OHM,CER,40 Q,730MHZ SRF,SM,PB-F
L901	2414017N10	IDCTR,CHIP,6.8NH,5%,600MA, .22OHM,CER,10 Q,2.7GHZ SRF,SM,0603
L902	2415429H37	CHIP INDUCTOR
L903	2414015A07	IDCTR,FXD,180NH,2%,750MA, .77OHM,CER,25 Q,700MHZ SRF,SM,1008
L904	2414017N18	IDCTR,CHIP,33NH,5%,600MA, .71OHM,CER,12 Q,1.1GHZ SRF,SM,0603
L905	2414017N16	IDCTR,CHIP,22NH,5%,600MA, .54OHM,CER,12 Q,1.3GHZ SRF,SM,0603

Ref. Des.	Part Number	Description
L906	2460591E24	COIL AIR WOUND INDUC 23.75
L907	2471968L13	LOW PROFILE MINI SPRING INDUCTOR
L908	2415428H01	AIR WOUND INDUCTOR
L909	2471968L11	13.0NH 2% LP AIRWOUND INDUCTOR
L910	2415385H03	COIL SURFACE MOUNT AIR WOUND
L911	2415429H47	CHIP INDUCTOR
L1101	2415429H30	CHIP INDUCTOR
L1102	2415429H10	CHIP INDUCTOR
L1103	2475393H01	INDUCTOR, 4.7NH, 0402, +/-0.1NH
L1104	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
L1108	2409348J04	IND AIR CORE 5.45NH 5% 2214
L1114	2475394H01	INDUCTOR, 11NH, 0402, +/-2%
L1203	2460591D81	COIL AIR WOUND INDUC 43.41
L1209	2460591D81	COIL AIR WOUND INDUC 43.41
L1211	2460591D81	COIL AIR WOUND INDUC 43.41
L1301	2488090Y10	INDUCTOR,MULTILAYER,5.6NH,1005,SMD,PB FREE
L1302	2488090Y25	INDUCTOR,MULTILAYER,100NH,1005,SMD,PB FREE
L1303	2414017P16	IDCTR,CHIP,18NH,5%,300MA, .76OHM,CER,9 Q,1.9GHZ SRF, SM,0402,P
L1305	2475391H01	INDUCTOR, 18 NH, CHIP, 0402, 2% TOL
M1	3275623B03	PAD, THERMAL ELECTRIC, MID-TIER
M2	75009299002	PAD, THERMAL
M3	1104959T01	COATING-CONTACT
M4	6071520M01	BATT COIN 3V LI RECHARGEABLE
M101	2871616H01	CONNECTOR, BPLUS
M103	3987977Y04	CONT,CONN,1CONT,ANT UNIV 4.5MM,UC 1.8
M104	3987977Y04	CONT,CONN,1CONT,ANT UNIV 4.5MM,UC 1.8
M107	0985888K02	SKT RTC BTTY LEAP
P101	2887818K05	PLUG 40PIN MATING CNTCR 1.5MM

Ref. Des.	Part Number	Description
PWB	84009363004	PCB, RF TRANSCEIVER
Q201	4813970A59	P-CH FET 1.0A 20V SOT-23 T&R
Q202	4813973A32	XSTR,BIP GP SS,NPN,SM,SC-70,SMT,50V,.202W,100MA,PB-FREE
Q302	4813973M75	XSTR,BIP GP SS,PNP,BC858, SOT-563,SMT,-30V,.357W,-100MA,100MHZ
Q501	4813973M75	XSTR,BIP GP SS,PNP,BC858, SOT-563,SMT,-30V,.357W,-100MA,100MHZ
Q503	4885316E32	TRANSISTOR, RF
Q601	4813973A04	XSTR,BIP GP SS,NPN,TA13, SM,SOT-23,SMT,30V,.225W, 300MA,125MHZ,P
Q703	4813973M75	XSTR,BIP GP SS,PNP,BC858, SOT-563,SMT,-30V,.357W,-100MA,100MHZ
Q712	4813973M75	XSTR,BIP GP SS,PNP,BC858, SOT-563,SMT,-30V,.357W,-100MA,100MHZ
Q713	4805585Q32	TRANSITOR, NPN RF
Q714	4889394V04	XSTR,FET GEN PURPOSE SMALL SIG,MOSFET,N-CH, ENHN,SM,20V,.25W,P
Q774	4885061Y01	XSTR NPN 6V 30UA 12GHZ PB-FREE
Q842	4805585Q32	TRANSITOR, NPN RF
Q901	5185633C90	MODULE,RING,XSTR,FET RF POWER, VHF
Q1101	4813973A32	XSTR,BIP GP SS,NPN,SM,SC-70,SMT,50V,.202W,100MA,PB-FREE
Q1103	4813970A59	P-CH FET 1.0A 20V SOT-23 T&R
R101	0613952R01	CER CHIP RES 10K OHM 5% 0402
R103	0613952R01	CER CHIP RES 10K OHM 5% 0402
R104	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R201	0613952R25	CER CHIP RES 100K OHM 5% 0402
R202	0613952Q89	CER CHIP RES 4700 OHM 5 0402

Ref. Des.	Part Number	Description
R301	0613952R22	CER CHIP RES 75K OHM 5 0402
R302	0613952R27	CER CHIP RES 120K OHM 5% 0402
R303	0613952R01	CER CHIP RES 10K OHM 5% 0402
R304	0613952Q37	CER CHIP RES 33.0 OHM 5 0402
R305	0613952Q83	CER CHIP RES 2700 OHM 5 0402
R306	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R307	2113944A26	CAP CER CHP 12.0PF 50V 5%
R308	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R501	0613952Q42	CER CHIP RES 51.0 OHM 5 0402
R502	0613952Q45	CER CHIP RES 68.0 OHM 5 0402
R503	0613952R10	CER CHIP RES 24K OHM 5 0402
R504	0613952Q85	CER CHIP RES 3300 OHM 5 0402
R505	0613952R31	CER CHIP RES 180K OHM 5% 0402
R506	0613952Q53	CER CHIP RES 150 OHM 5 0402
R507	0613952Q75	CER CHIP RES 1200 OHM 5 0402
R508	0613952Q29	CER CHIP RES 15.0 OHM 5 0402
R509	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R511	0613952Q11	CER CHIP RES 2.7 OHM 5 0402
R601	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R602	0613952Q63	CER CHIP RES 390 OHM 5 0402
R603	0613952R25	CER CHIP RES 100K OHM 5% 0402
R604	0613952Q63	CER CHIP RES 390 OHM 5 0402
R605	0613952R01	CER CHIP RES 10K OHM 5% 0402
R606	0613952R01	CER CHIP RES 10K OHM 5% 0402
R607	0613952R25	CER CHIP RES 100K OHM 5% 0402
R608	0613952R01	CER CHIP RES 10K OHM 5% 0402
R609	0613952Q81	CER CHIP RES 2200 OHM 5 0402
R610	0613952R25	CER CHIP RES 100K OHM 5% 0402
R611	0613952R01	CER CHIP RES 10K OHM 5% 0402
R612	0613952Q94	CER CHIP RES 7500 OHM 5 0402
R613	0613952Q82	CER CHIP RES 2400 OHM 5 0402
R614	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R615	NOT PLACED	–
R616	NOT PLACED	–
R617	NOT PLACED	–
R618	NOT PLACED	–
R619	NOT PLACED	–
R620	NOT PLACED	–
R621	NOT PLACED	–
R623	NOT PLACED	–
R624	NOT PLACED	–
R698	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R699	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R701	0613952Q49	CER CHIP RES 100 OHM 5 0402
R702	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R703	0613952Q42	CER CHIP RES 51.0 OHM 5 0402
R704	0613952Q42	CER CHIP RES 51.0 OHM 5 0402
R705	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R706	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R707	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R708	0613952Q49	CER CHIP RES 100 OHM 5 0402
R709	0613952Q45	CER CHIP RES 68.0 OHM 5 0402
R710	0613952Q56	CER CHIP RES 200 OHM 5 0402
R711	0613952Q45	CER CHIP RES 68.0 OHM 5 0402
R712	0613952Q67	CER CHIP RES 560 OHM 5 0402
R713	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R714	0613952Q67	CER CHIP RES 560 OHM 5 0402
R715	NOT PLACED	–
R716	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R717	NOT PLACED	–
R721	0613952R01	CER CHIP RES 10K OHM 5% 0402
R729	0613952R09	CER CHIP RES 22K OHM 5% 0402
R743	0613952R17	CER CHIP RES 47K OHM 5% 0402
R745	0613952R09	CER CHIP RES 22K OHM 5% 0402
R751	0613952Q59	CER CHIP RES 270 OHM 5 0402
R752	0613952Q91	CER CHIP RES 5600 OHM 5 0402
R753	0613952Q91	CER CHIP RES 5600 OHM 5 0402
R754	0613952Q91	CER CHIP RES 5600 OHM 5 0402
R755	0613952R15	CER CHIP RES 39K OHM 5% 0402
R759	0613952Q69	CER CHIP RES 680 OHM 5 0402
R761	0613952Q59	CER CHIP RES 270 OHM 5 0402
R762	0613952R02	CER CHIP RES 11K OHM 5 0402
R764	0613952Q75	CER CHIP RES 1200 OHM 5 0402
R767	0613952Q45	CER CHIP RES 68.0 OHM 5 0402
R772	0613952Q37	CER CHIP RES 33.0 OHM 5 0402
R773	0613952Q91	CER CHIP RES 5600 OHM 5 0402
R776	0613952Q39	CER CHIP RES 39.0 OHM 5 0402
R778	0613952Q55	CER CHIP RES 180 OHM 5 0402
R807	0613952R09	CER CHIP RES 22K OHM 5% 0402
R808	0613952R23	CER CHIP RES 82K OHM 5% 0402
R809	0613952Q91	CER CHIP RES 5600 OHM 5 0402
R811	0613952Q39	CER CHIP RES 39.0 OHM 5 0402
R812	0613952Q47	CER CHIP RES 82.0 OHM 5% 0402
R813	0613952Q69	CER CHIP RES 680 OHM 5 0402
R815	0613952Q34	CER CHIP RES 24.0 OHM 5 0402
R818	0613952Q23	CER CHIP RES 8.2 OHM 5 0402
R819	0613952Q59	CER CHIP RES 270 OHM 5 0402
R822	0613952R08	CER CHIP RES 20K OHM 5 0402
R823	0613952R19	CER CHIP RES 56K OHM 5% 0402
R827	0613952Q92	CER CHIP RES 6200 OHM 5 0402
R832	0613952Q29	CER CHIP RES 15.0 OHM 5 0402
R833	0613952Q49	CER CHIP RES 100 OHM 5 0402
R840	0613952Q29	CER CHIP RES 15.0 OHM 5 0402
R848	0613952Q29	CER CHIP RES 15.0 OHM 5 0402
R849	0613952Q67	CER CHIP RES 560 OHM 5 0402

Ref. Des.	Part Number	Description
R901	0613952R01	CER CHIP RES 10K OHM 5% 0402
R902	0613952R01	CER CHIP RES 10K OHM 5% 0402
R903	0613952R01	CER CHIP RES 10K OHM 5% 0402
R904	0613952R13	CER CHIP RES 33K OHM 5% 0402
R905	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R906	0613952Q61	CER CHIP RES 330 OHM 5 0402
R1102	0613952R25	CER CHIP RES 100K OHM 5% 0402
R1103	06009259001	LOW RESISTANCE THICK FILM RESISTOR
R1104	0613952Q49	CER CHIP RES 100 OHM 5 0402
R1105	0613952Q49	CER CHIP RES 100 OHM 5 0402
R1106	0613952Q35	CER CHIP RES 27.0 OHM 5 0402
R1107	0613952Q45	CER CHIP RES 68.0 OHM 5 0402
R1108	0613952R23	CER CHIP RES 82K OHM 5% 0402
R1110	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1112	NOT PLACED	–
R1114	0613952Q49	CER CHIP RES 100 OHM 5 0402
R1115	0613952Q49	CER CHIP RES 100 OHM 5 0402
R1116	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1117	0613952R22	CER CHIP RES 75K OHM 5 0402
R1121	0613952R12	CER CHIP RES 30K OHM 5 0402
R1122	0613952R22	CER CHIP RES 75K OHM 5 0402
R1124	0613952Q42	CER CHIP RES 51.0 OHM 5 0402
R1125	0613952R25	CER CHIP RES 100K OHM 5% 0402

Ref. Des.	Part Number	Description
R1126	0613952R15	CER CHIP RES 39K OHM 5% 0402
R1127	0613952R18	CER CHIP RES 51K OHM 5 0402
R1128	0613952R09	CER CHIP RES 22K OHM 5% 0402
R1129	NOT PLACED	–
R1130	NOT PLACED	–
R1135	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R1136	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1137	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1138	0613952R25	CER CHIP RES 100K OHM 5% 0402
R1139	0613952R25	CER CHIP RES 100K OHM 5% 0402
R1140	0613952R25	CER CHIP RES 100K OHM 5% 0402
R1141	0613952R42	CER CHIP RES 510K OHM 5 0402
R1142	0613952R25	CER CHIP RES 100K OHM 5% 0402
R1143	0613952R25	CER CHIP RES 100K OHM 5% 0402
R1144	0613952R25	CER CHIP RES 100K OHM 5% 0402
R1145	0613952R25	CER CHIP RES 100K OHM 5% 0402
R1146	0613952R25	CER CHIP RES 100K OHM 5% 0402
R1151	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1152	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1154	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1158	NOT PLACED	–
R1160	0613952R03	CER CHIP RES 12K OHM 5% 0402
R1162	0613952R29	CER CHIP RES 150K OHM 5% 0402
R1163	0613952R01	CER CHIP RES 10K OHM 5% 0402

Ref. Des.	Part Number	Description
R1164	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1165	0613952Q56	CER CHIP RES 200 OHM 5 0402
R1166	0613952Q56	CER CHIP RES 200 OHM 5 0402
R1167	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1168	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R1169	0613952P52	CER CHIP RES 340K OHM 1 0402
R1170	0613952P01	CER CHIP RES 100K OHM 1 0402
R1171	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R1172	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R1174	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1175	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R1176	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R1177	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R1178	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1180	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R1181	NOT PLACED	–
R1182	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1183	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R1184	0613952Q81	CER CHIP RES 2200 OHM 5 0402
R1186	NOT PLACED	–
R1304	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R1307	0613952Q73	CER CHIP RES 1000 OHM 5 0402
SH2A	26009323001	SHIELD, DC FILTER
SH2B	26009326001	SHIELD, DC REGULATOR

Ref. Des.	Part Number	Description
SH2	2675872B01	SHIELD, XTAL
SH3	26009321001	SHIELD, RX FRONT END
SH5A	2675874B01	SHIELD, MIXER
SH5C	2675933B01	SHIELD, IF AMP
SH6A	2675873B01	SHIELD, ABACUS
SH6B	2675932B01	SHIELD, 2ND LO VCO
SH7	26009325001	SHIELD, FGU
SH8	26009319001	SHIELD, VCO
SH9A	26009322001	SHIELD, RF PA
SH9B	26009327001	SHIELD, OUTPUT MATCH
SH11	26009320001	SHIELD, ALC
SH12	26009324001	SHIELD, HARMONIC FILTER
T503	2575851B01	RF TRANSFORMER BALUN
T504	2575851B01	RF TRANSFORMER BALUN
U101	5105443X07	EEPROM 32KBIT SERIAL SPI BUS
U200	5188493T01	IC,VREG/SWG,LP2989,SM,MINI SO-8 HI PRCN REG 5V
U201	5175771A99	LOW NOISE, 100MA LINEAR REGULATOR
U202	5175772B02	LINEAR REGULATOR 100MA 1.8V
U203	5175772B01	LINEAR VOLTAGE REGULATOR 350MA
U302	4885316E32	TRANSISTOR, RF
U506	5164852H82	IC, MIXER/ BUFFER
U601	5102495J14	IC,IF,IF DIGITILIZING SUBSYSTEM IC,AD9864,QFN
U602	4885316E32	TRANSISTOR, RF
U603	5109522E84	IC DUAL SCHMITT TRIG MICRO PAK
U604	5109522E84	IC DUAL SCHMITT TRIG MICRO PAK
U605	5164852H16	IC TRANSCEIVER W/LEVEL TRANSLATION
U606	5164852H16	IC TRANSCEIVER W/LEVEL TRANSLATION
U607	5186311J24	IC,BFR,1BITS,NC7SZ125,ACTIVE HIGH,B
U702	5164015H28	IC,TRIDENT,INTEG SYNTH,RX/TX BSBND
U703	5175772B06	28-PORT I/O EXPANDER

Ref. Des.	Part Number	Description
U709	5171972L01	SP3T RF SWITCH
U710	5171972L01	SP3T RF SWITCH
U746	4805218N63	RF TRANS SOT 323 BFQ67W
U901	5175143H01	WIDE SUPPLY RANGE OP AMP
U902	5115678H01	VHF/UHF/800/900 MHZ LDMOS DRIVER IC
U1101	5188032U43	IC,SENSING CIRCUIT,INA138, SM,SOT-23/5,1PER PKG
U1102	5175772B03	RECONFIGURABLE 10W SP5T/ 3T RF SWITC
U1103	5185070Y01	IC TEMPERATURE SENSOR PB-FREE
U1104	5185941F56	IC SINGLE LV LP OP AMPLIFIER
U1105	5180390L83	IC,CNTLR,SM,1PER PKG
U1106	5175772B05	PRECISION RF DETECTOR
U1112	5175772B04	1 DB LSB GAAS MMIC ATTENUATOR
U1113	5185941F56	IC SINGLE LV LP OP AMPLIFIER
U1114	5185941F56	IC SINGLE LV LP OP AMPLIFIER
U1116	5109522E93	2 INPUT OR GATE IN NANO PACKAGE (C87)
U1117	5103535B53	IC,INVTR,DL,NC7WZ04L6X,2PE R PKG,SC70
U1118	5109522E93	2 INPUT OR GATE IN NANO PACKAGE (C87)
U1119	5109522E94	2 INPUT AND GATE IN NANO PACKAGE (C87)
U1121	5114000B52	IC,XOR,LOGIC LEVEL SHIFTER,1PER PKG,SM,SOT-353,PB-FREE
U1125	51009382001	IC, QUAD DAC
U1126	5109817F77	IC COMPTR LM7275 5SC70 (D54)
U1127	5171779H01	SPDT ANALOG SWITCH
U1128	5188085K11	IC, SINGLE NAND GATE, 2-INPUT, POSITIVE, 5 DSBGA, PB-FREE
U1129	5175143H01	WIDE SUPPLY RANGE OP AMP
U1130	5175143H01	WIDE SUPPLY RANGE OP AMP
U1131	5109817F77	IC COMPTR LM7275 5SC70 (D54)

Ref. Des.	Part Number	Description
U1132	5114007M28	IC,F-F/D,1PER PKG,17SZ74,N-I, SM,SOIC8,PB-FREE
U1133	5171779H01	SPDT ANALOG SWITCH
U1136	5109522E94	2 INPUT AND GATE IN NANO PACKAGE (C87)
U1137	5164852H16	IC TRANSCEIVER W/LEVEL TRANSLATION
U1138	5164852H16	IC TRANSCEIVER W/LEVEL TRANSLATION
U1139	5164852H16	IC TRANSCEIVER W/LEVEL TRANSLATION
U1141	5185941F56	IC SINGLE LV LP OP AMPLIFIER
U1142	5185941F56	IC SINGLE LV LP OP AMPLIFIER
U1143	5185941F56	IC SINGLE LV LP OP AMPLIFIER
U1144	5171779H01	SPDT ANALOG SWITCH
U1146	5109522E93	2 INPUT OR GATE IN NANO PACKAGE (C87)
U1147	5109522E94	2 INPUT AND GATE IN NANO PACKAGE (C87)
U1148	5185941F56	IC SINGLE LV LP OP AMPLIFIER
U1149	5185941F45	ATTEN,VAR,14.4DBMIN,15.6DB MAX,0-2000 MHZFREQ,50OHM, PCMT,SOT
U1150	51009381001	LOW DROPOUT VOLTAGE REFERENCE
U1304	5105739X13	IC, SIGE GPS LOW NOISE AMP 1575 MHZ
VR101	4813977M29	DIODE,VREF,MBZ5250,SM,SOT -23,20V,.225W,ZEN
VR200	4813977M29	DIODE,VREF,MBZ5250,SM,SOT -23,20V,.225W,ZEN
VR601	4805656W87	DIODE,VCTR, @ 15V,1SV279, SOD-523/SC-79
VR602	4805656W87	DIODE,VCTR, @ 15V,1SV279, SOD-523/SC-79
Y701	4871886H01	16.8 MHZ VCTXO .8PPM
Y704	5164852H68	IC, VCO MODULE
Y707	5164852H67	IC, VCO MODULE

Notes

8.5 Transceiver (RF) Boards: UHF1

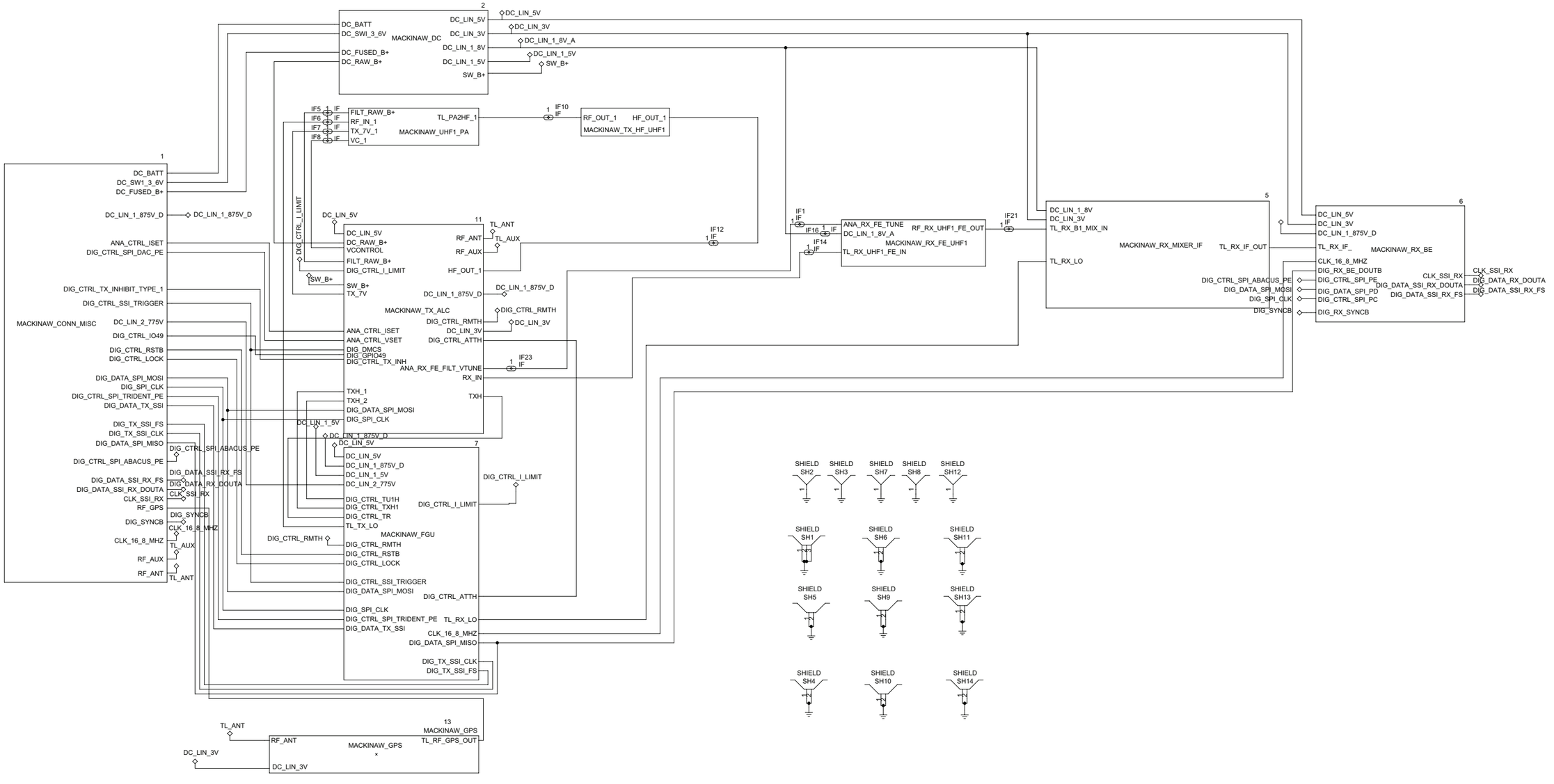


Figure 8-15. NUE7365A/ NUE7369A Transceiver (RF) Board Overall Circuit Schematic

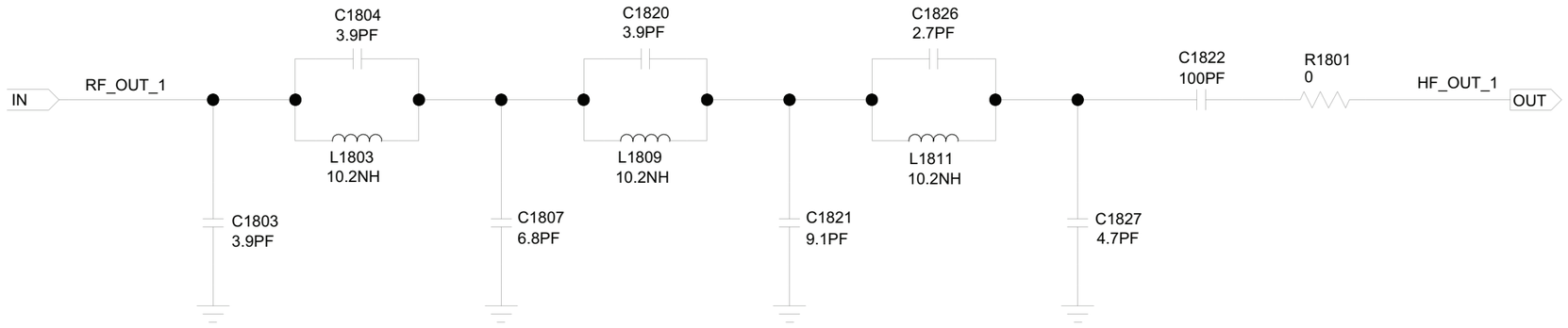


Figure 8-16. NUE7365A/ NUE7369A UHF1 Harmonic Filter Circuit

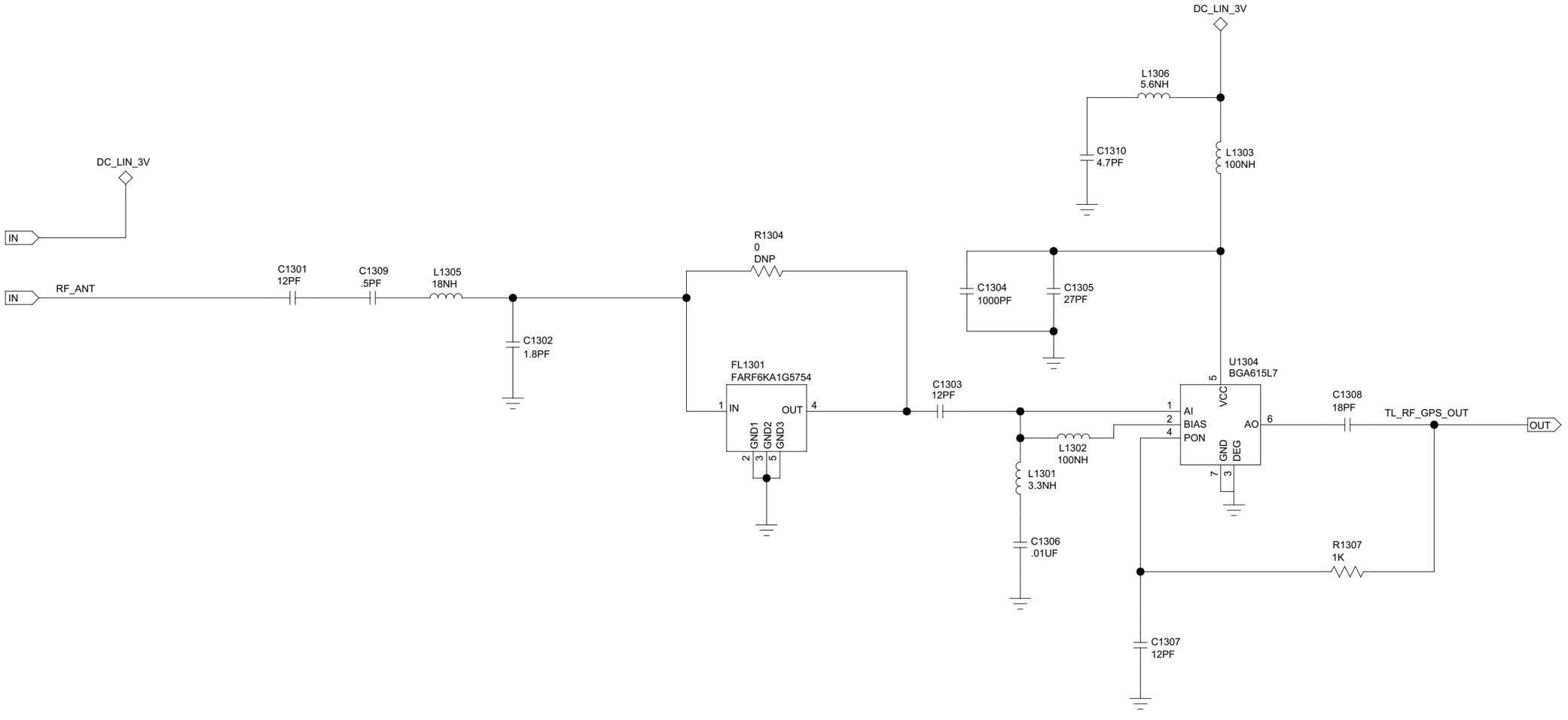


Figure 8-17. NUE7365A/ NUE7369A GPS Circuit

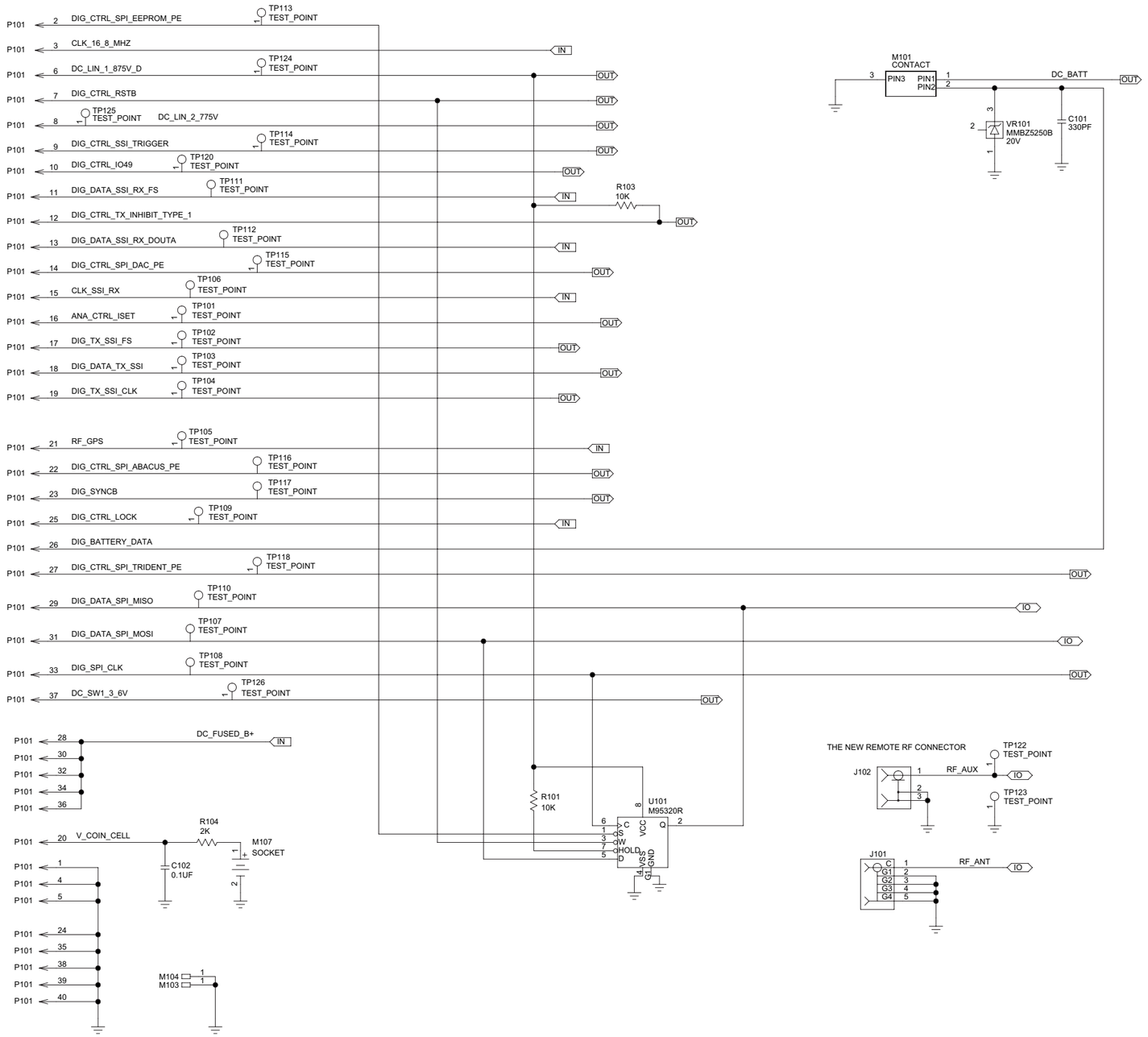


Figure 8-18. NUE7365A/ NUE7369A Miscellaneous Connector Circuit

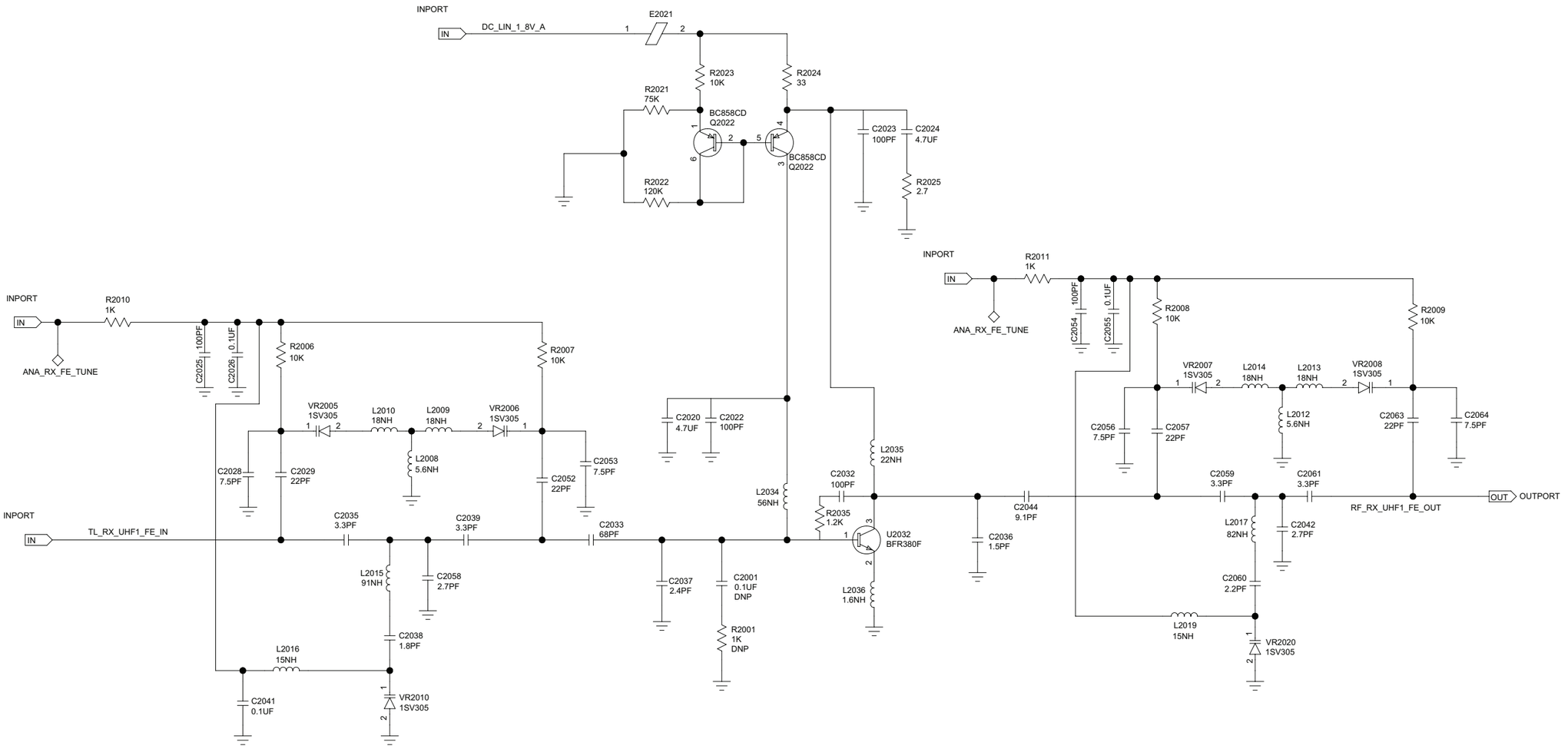


Figure 8-19. NUE7365A Receiver Front End Circuit

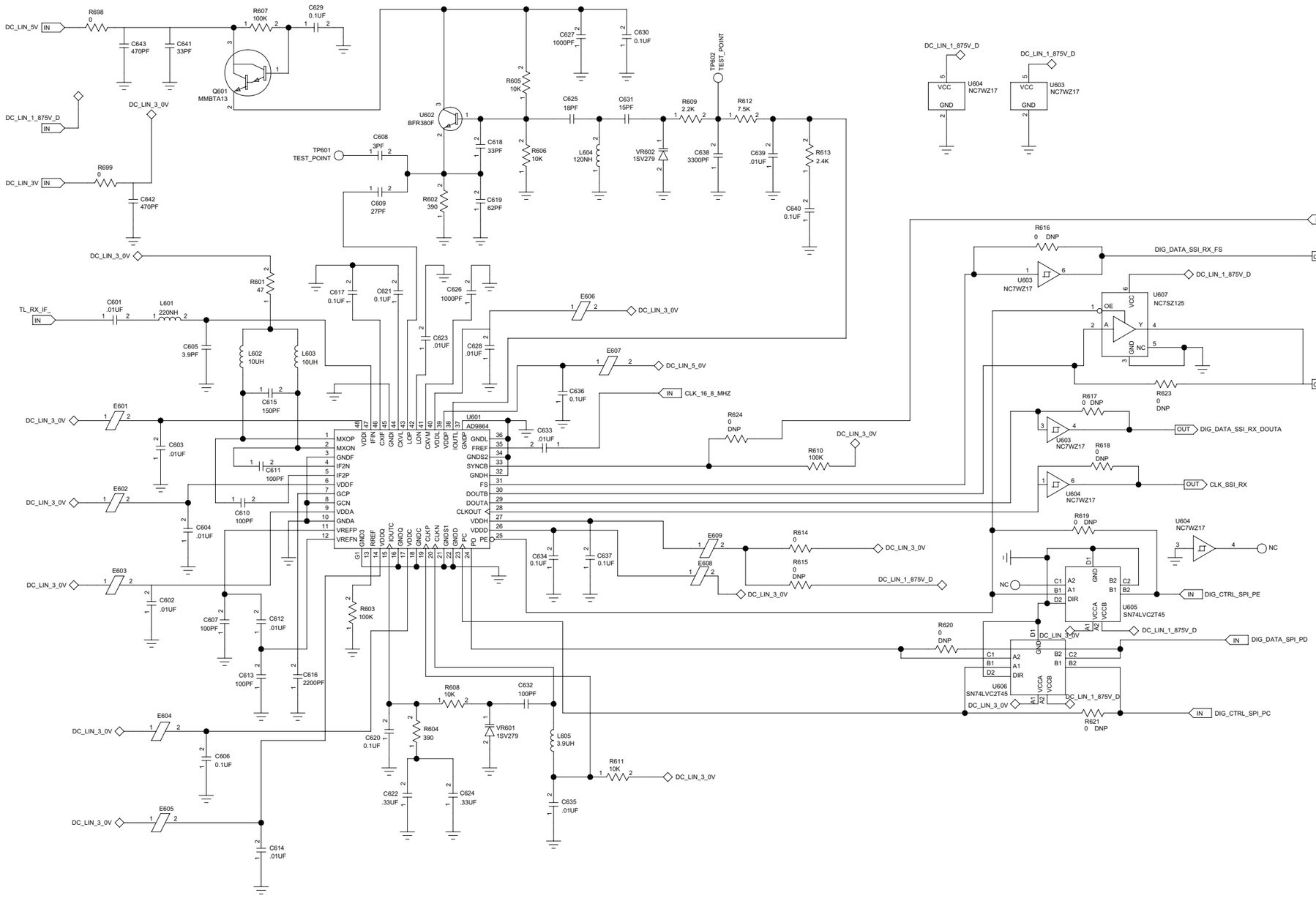


Figure 8-20. NUE7365A/ NUE7369A Receiver Back End Circuit

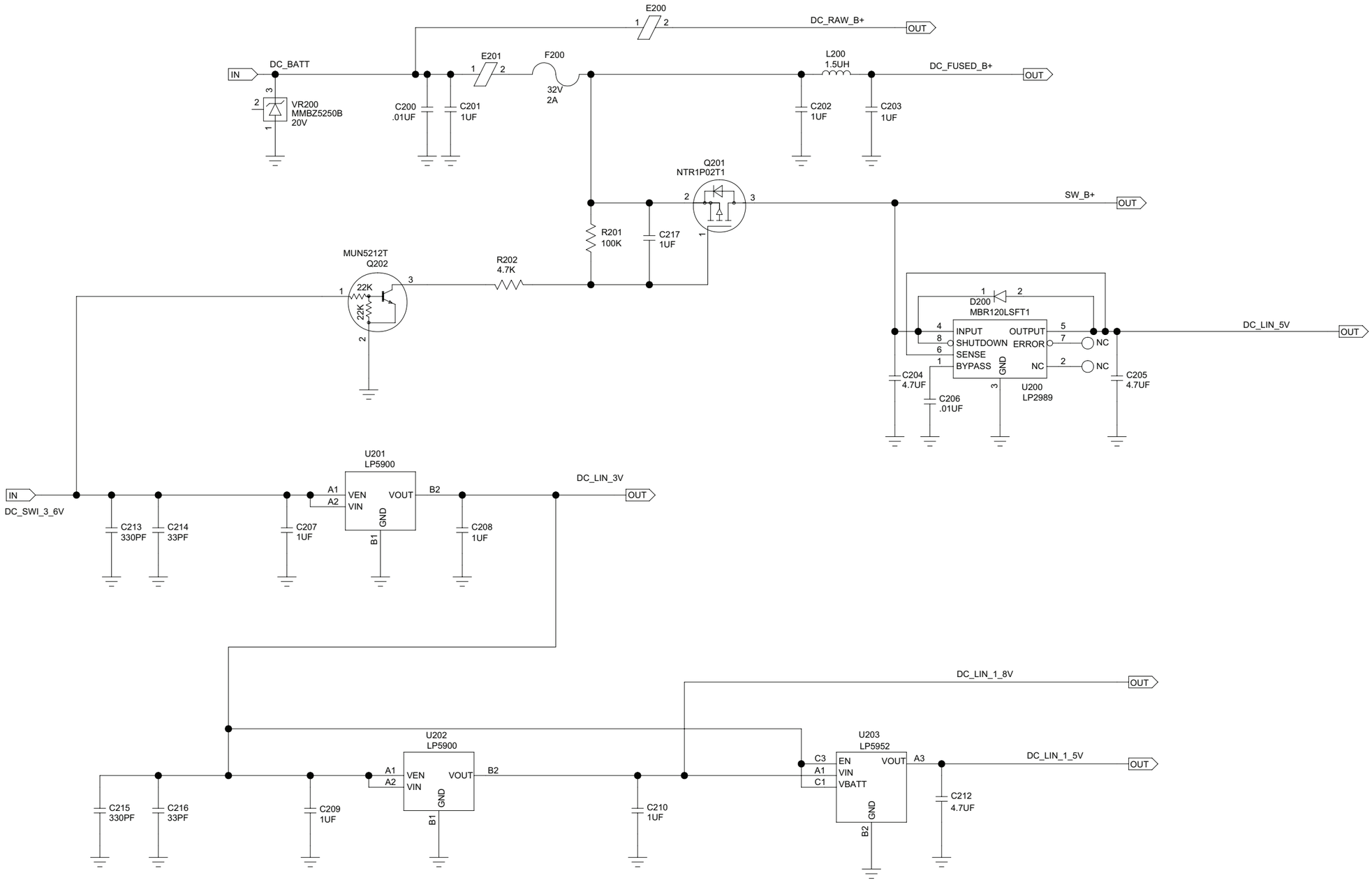


Figure 8-21. NUE7365A/ NUE7369A DC Power Circuit

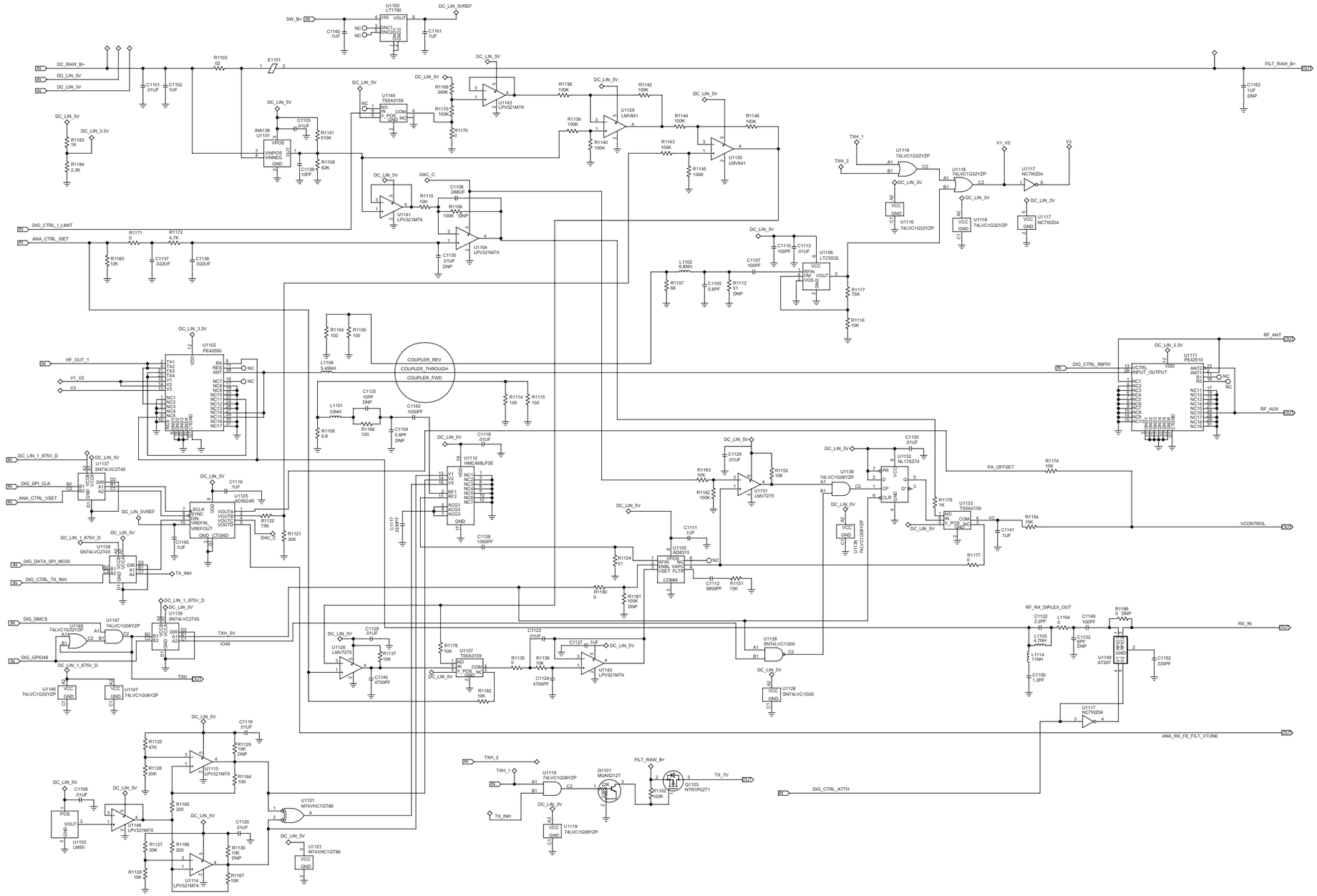


Figure 8-22. NUE7365A/ NUE7369A Transmitter and Automatic Level Control Circuits

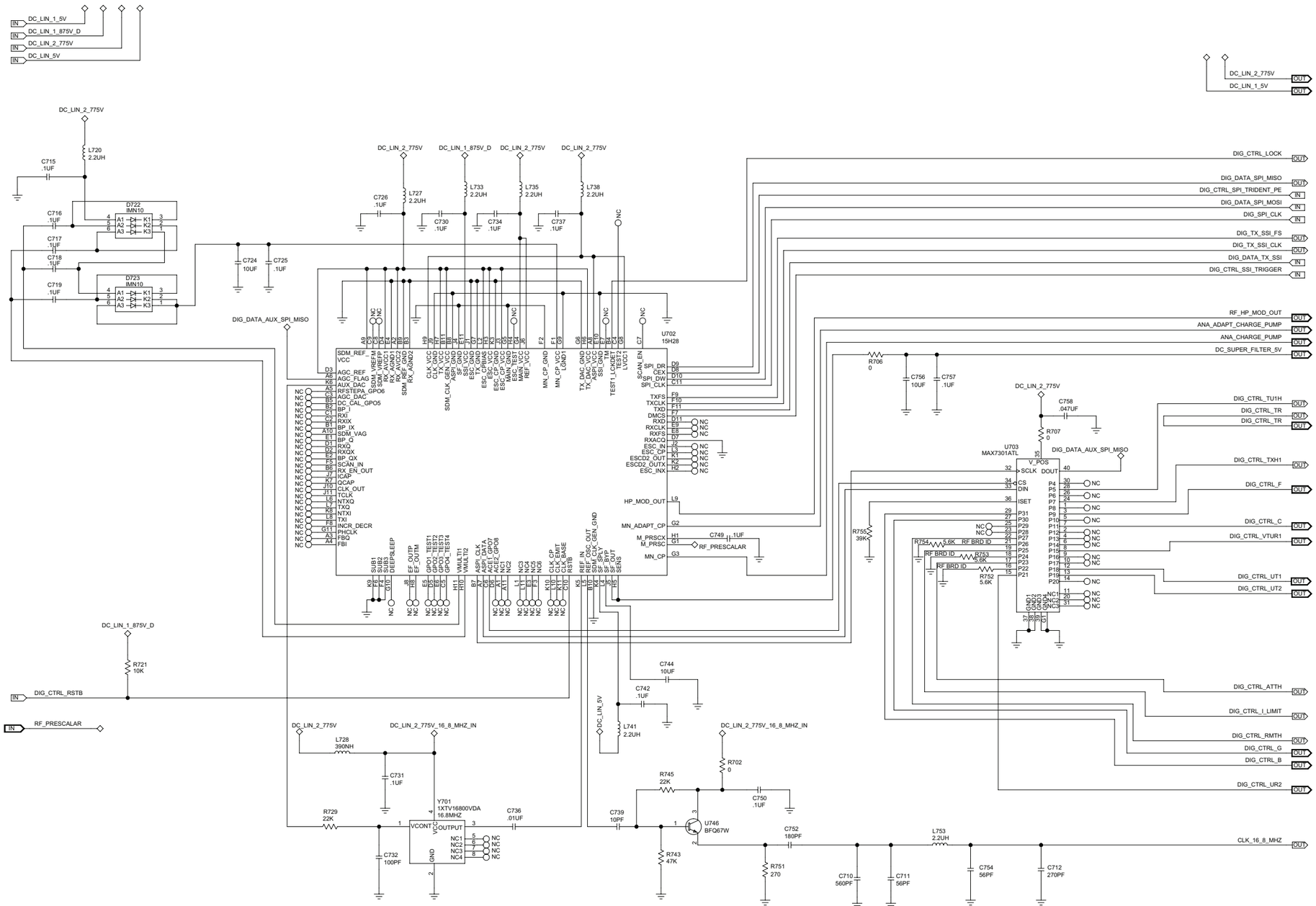


Figure 8-23. NUE7365A Frequency Generation Unit (Synthesizer) Circuit – 1 of 2

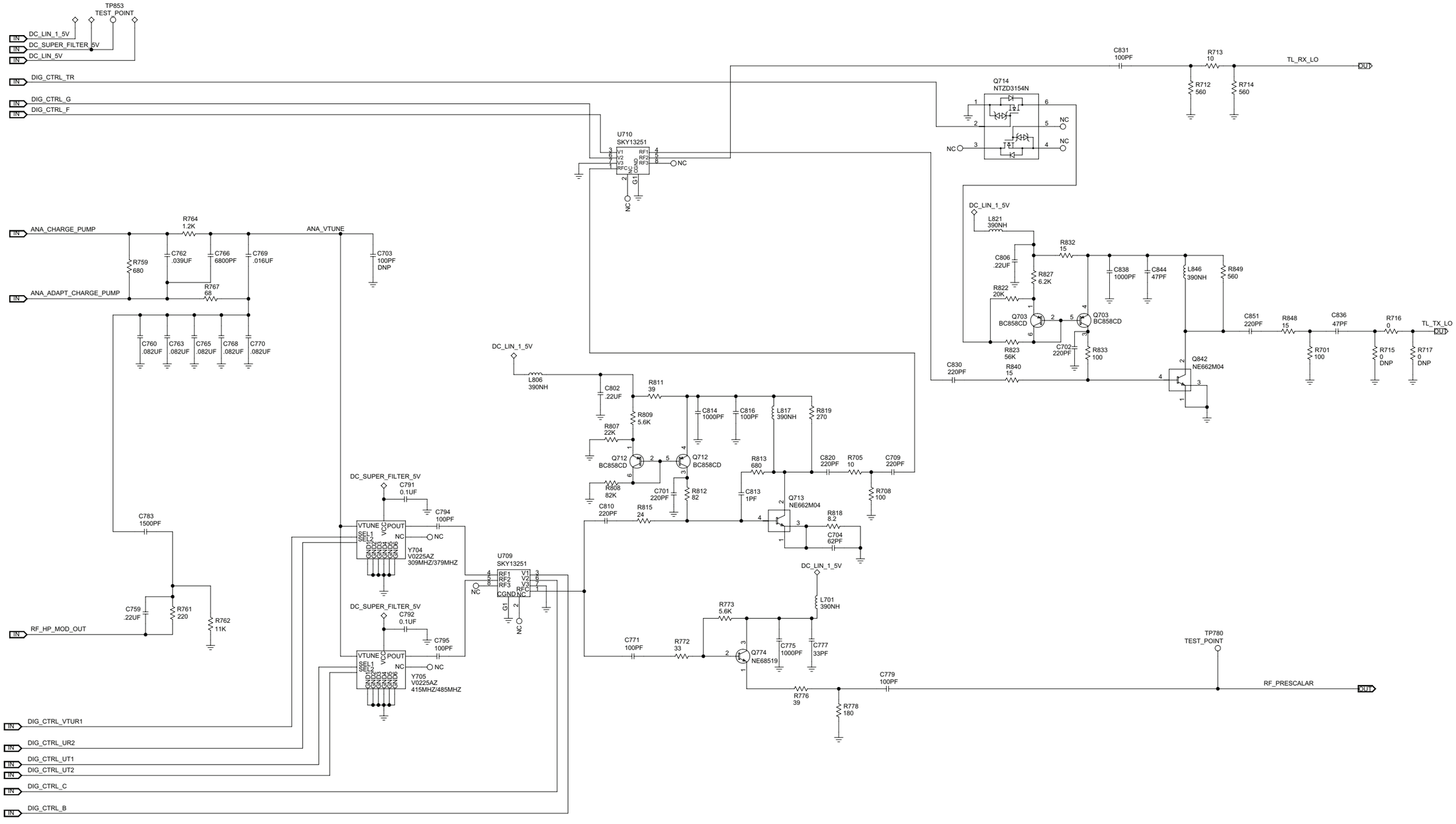


Figure 8-24. NUE7365A Frequency Generation Unit (VCO) Circuit – 2 of 2

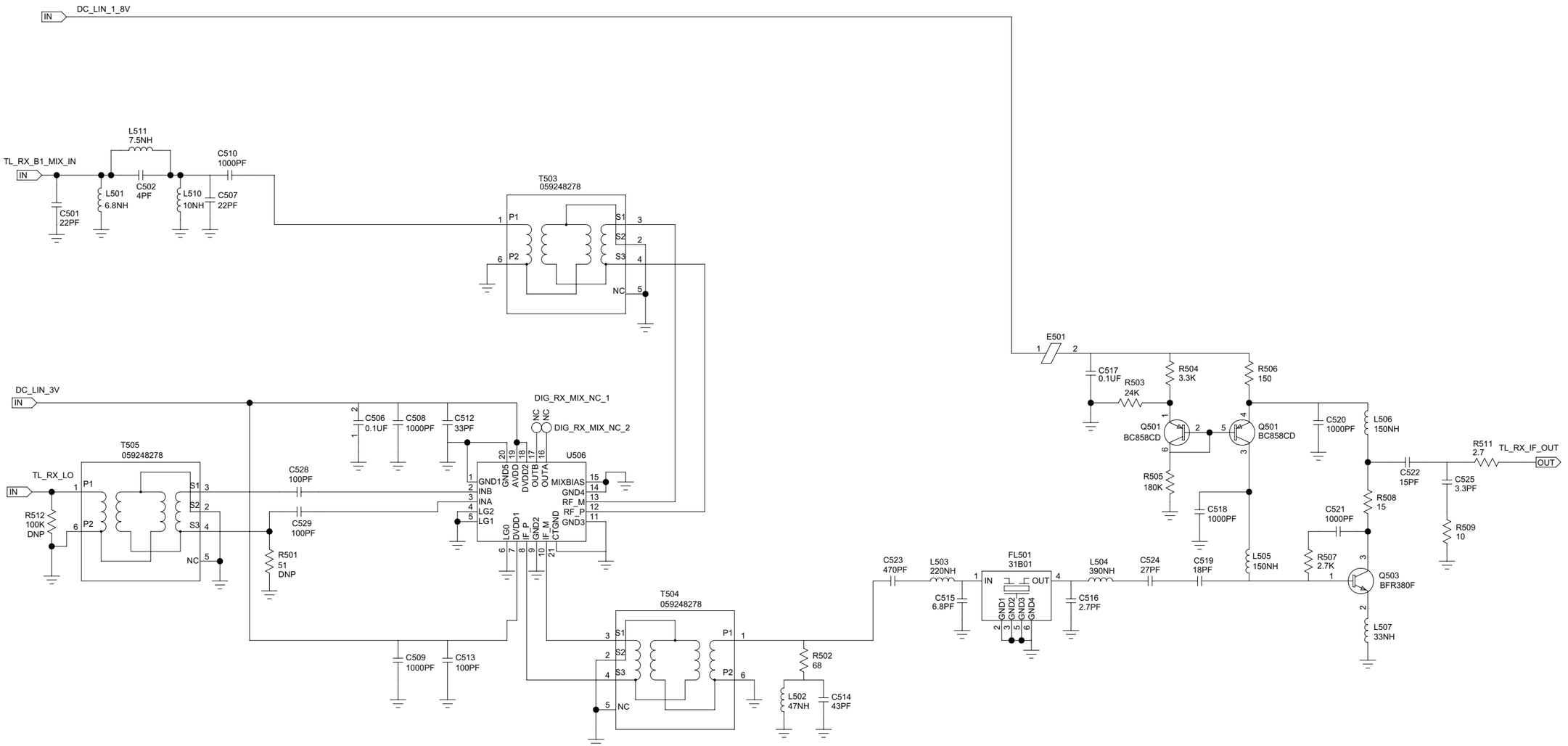


Figure 8-25. NUE7365A/ NUE7369A Mixer and IF Filter Circuits

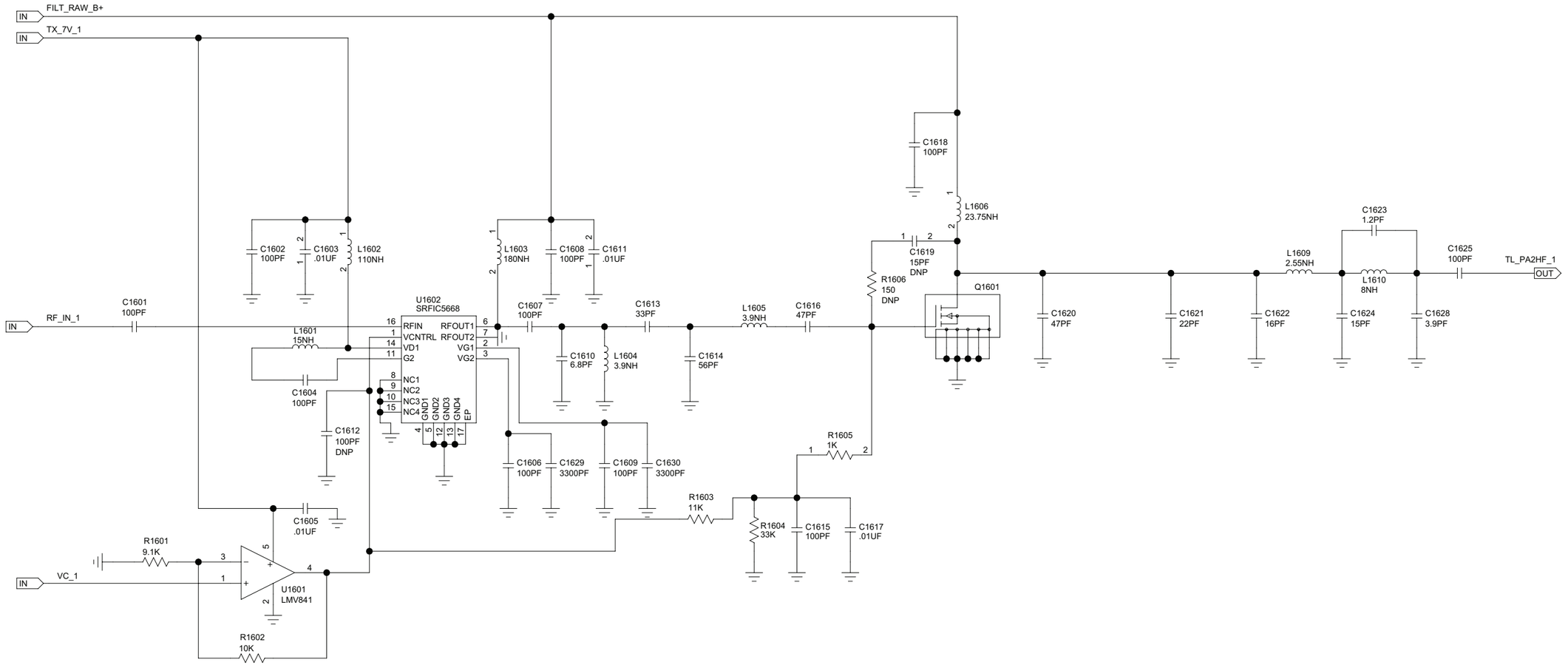


Figure 8-26. NUE7365A Power Amplifier Circuit

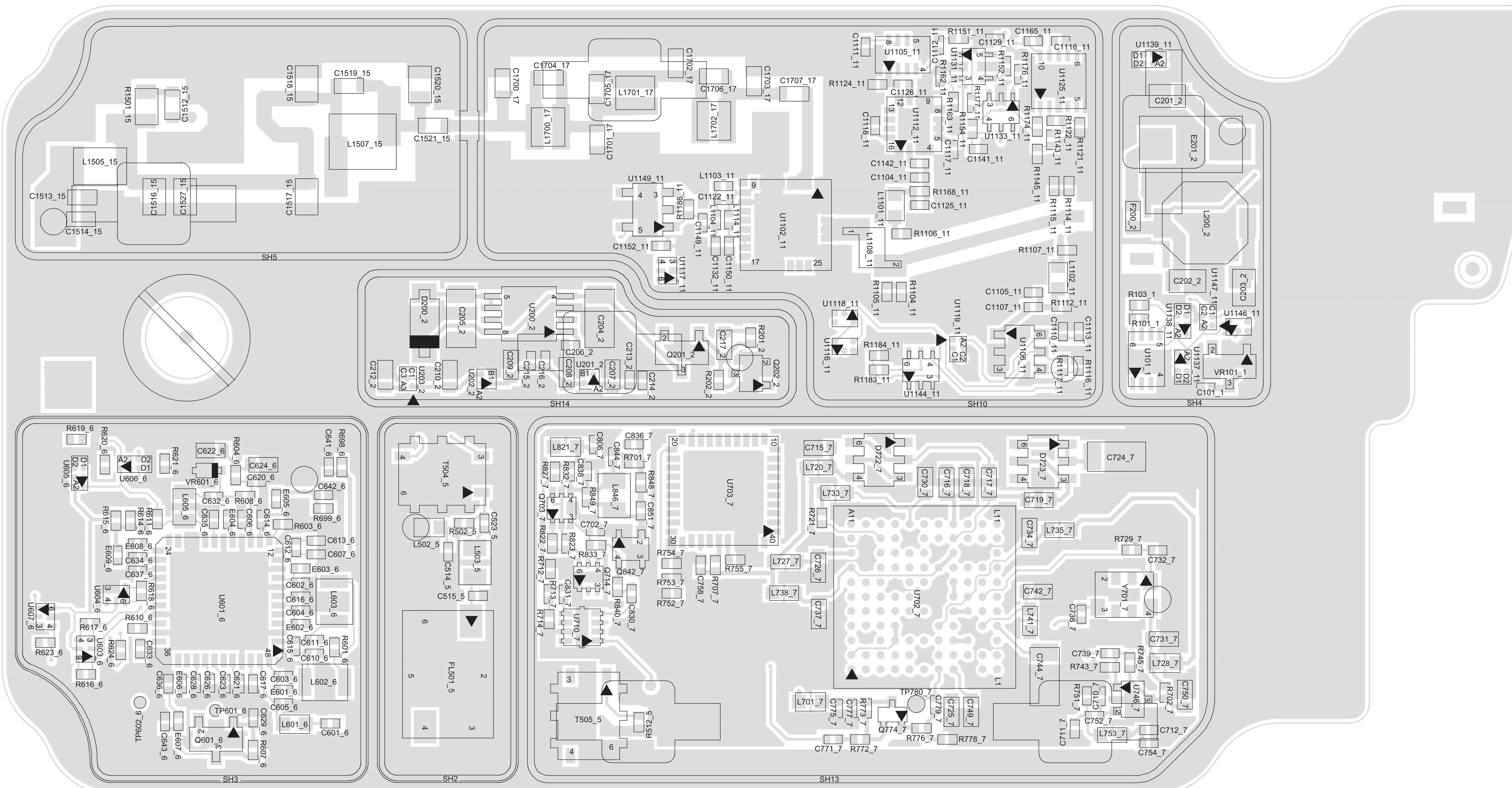


Figure 8-27. NUE7365A Transceiver (RF) Board Layout – Side 1

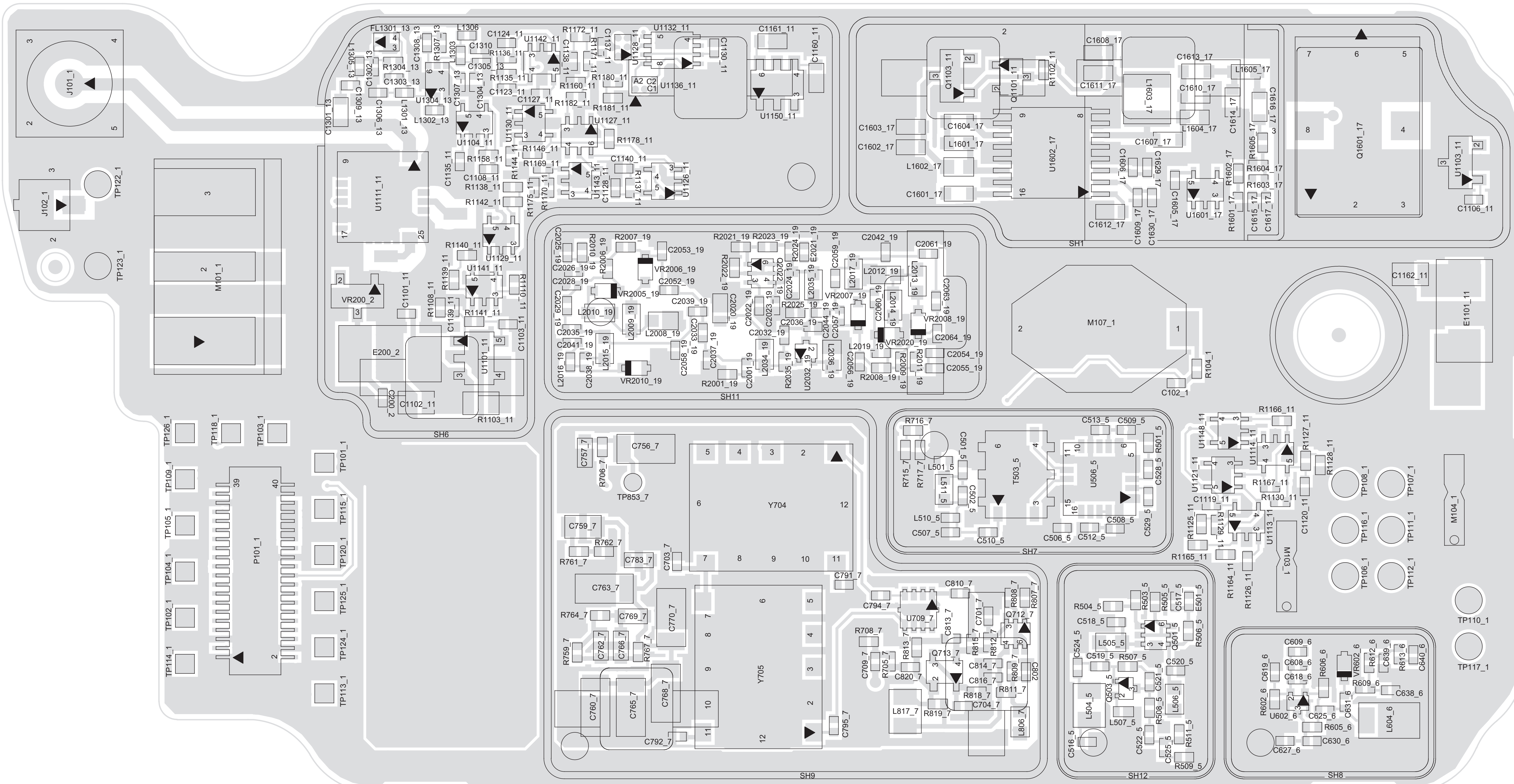


Figure 8-28. NUE7365A Transceiver (RF) Board Layout – Side 2

NUE7365A UHF1 Transceiver (RF) Board Parts List

Ref. Des.	Part Number	Description
C101	2113944A46	CAP,CHIP,330PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C102	2113946B04	CAP,CHIP,.1UF,+10%,-10%,10V-DC,0402,X5R,-55DEG CMIN, 85DEG CMAX
C200	2113945B02	CAP,CHIP,.01UF,+10%,-10%, 25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C201	2188468Y01	CAP,CHIP,1UF,+10,-10,25V-DC,0805,X7R
C202	2188468Y01	CAP,CHIP,1UF,+10,-10,25V-DC,0805,X7R
C203	2188468Y01	CAP,CHIP,1UF,+10,-10,25V-DC,0805,X7R
C204	2113955D35	CAP,FXD,4.7UF,+10%,-10%, 16V-DC,1206,X7R,-55DEG CMIN,125DEG CMAX
C205	2113955D35	CAP,FXD,4.7UF,+10%,-10%, 16V-DC,1206,X7R,-55DEG CMIN,125DEG CMAX
C206	2113945B02	CAP,CHIP,.01UF,+10%,-10%, 25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C207	2113956B91	CAP,FXD,1UF,+10%,-10%,16V-DC,0603,X5R,-55DEG CMIN, 85DEG CMAX,PB
C208	2113956B91	CAP,FXD,1UF,+10%,-10%,16V-DC,0603,X5R,-55DEG CMIN, 85DEG CMAX,PB
C209	2113956B91	CAP,FXD,1UF,+10%,-10%,16V-DC,0603,X5R,-55DEG CMIN, 85DEG CMAX,PB
C210	2113956B91	CAP,FXD,1UF,+10%,-10%,16V-DC,0603,X5R,-55DEG CMIN, 85DEG CMAX,PB
C212	2113946D07	CAP,CHIP,4.7UF,+10%,-10%, 6.3V-DC,0603,X5R,-55DEG CMIN,85DEG CMA
C213	2113944A46	CAP,CHIP,330PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C214	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX,P
C215	2113944A46	CAP,CHIP,330PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C216	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX,P
C217	2113956B91	CAP,FXD,1UF,+10%,-10%,16V-DC,0603,X5R,-55DEG CMIN, 85DEG CMAX,PB
C501	2115153H41	CAP,FXD,22PF,+1%,-1%,50V-DC,0402,C0G
C502	2115153H28	CAP,CER CHIP,4PF,.1PF+/-, +.1%,-.1%,50V-DC,0402,C0G
C506	2113946B04	CAP,CHIP,.1UF,+10%,-10%,10V-DC,0402,X5R,-55DEG CMIN, 85DEG CMAX
C507	2115153H41	CAP,FXD,22PF,+1%,-1%,50V-DC,0402,C0G
C508	2113945A09	CAP,CHIP,1000PF,+10%,-10%, 50V-DC,0402,X7R,-55DEG CMIN,125DEG CM
C509	2113945A09	CAP,CHIP,1000PF,+10%,-10%, 50V-DC,0402,X7R,-55DEG CMIN,125DEG CM
C510	2113944A52	CAP,CHIP,1000PF,+5%,-5%, 50V-DC,0402,C0G,-55DEG CMIN,125DEG CMAX
C512	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX,P
C513	2113944A40	CAP,CHIP,100PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C514	2113944A84	CAP,FXD,43PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX,PB
C515	2113944A21	CAP,CHIP,6.8PF,.5PF+/-,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C516	2113944A63	CAP,FXD,1PF,.25PF+/-,50V-DC, 0402,C0G,-55DEG CMIN, 125DEG CMAX,P
C517	2113946B04	CAP,CHIP,.1UF,+10%,-10%,10V-DC,0402,X5R,-55DEG CMIN, 85DEG CMAX
C518	2113945A09	CAP,CHIP,1000PF,+10%,-10%, 50V-DC,0402,X7R,-55DEG CMIN,125DEG CM
C519	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX,P
C520	2113945A09	CAP,CHIP,1000PF,+10%,-10%, 50V-DC,0402,X7R,-55DEG CMIN,125DEG CM
C521	2113945A09	CAP,CHIP,1000PF,+10%,-10%, 50V-DC,0402,X7R,-55DEG CMIN,125DEG CM
C522	2113944A27	CAP,CHIP,15PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX,P
C523	2113944A48	CAP,CHIP,470PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C524	2113944A36	CAP,CHIP,68PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX,P
C525	2113944A61	CAP,FXD,.5PF,.25PF+/-,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C528	2113944A40	CAP,CHIP,100PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C529	2113944A40	CAP,CHIP,100PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C601	2113945B02	CAP,CHIP,.01UF,+10%,-10%, 25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C602	2113945B02	CAP,CHIP,.01UF,+10%,-10%, 25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C603	2113945B02	CAP,CHIP,.01UF,+10%,-10%, 25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C604	2113945B02	CAP,CHIP,.01UF,+10%,-10%,25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C605	2113944A15	CAP,CHIP,3.9PF,.25PF+/-,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMA
C606	2113946B04	CAP,CHIP,.1UF,+10%,-10%,10V-DC,0402,X5R,-55DEG CMIN, 85DEG CMAX
C607	2113944A40	CAP,CHIP,100PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C608	2113944A12	CAP,CHIP,3PF,.25PF+/-,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C609	2113944A30	CAP,CHIP,27PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX,P
C610	2113944A40	CAP,CHIP,100PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C611	2113944A40	CAP,CHIP,100PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C612	2113945B02	CAP,CHIP,.01UF,+10%,-10%, 25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C613	2113944A40	CAP,CHIP,100PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C614	2113945B02	CAP,CHIP,.01UF,+10%,-10%, 25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C615	2113944A42	CAP,CHIP,150PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C616	2113945A11	CAP,CHIP,2200PF,+10%,-10%, 50V-DC,0402,X7R,-55DEG CMIN,125DEG CM
C617	2113946B04	CAP,CHIP,.1UF,+10%,-10%,10V-DC,0402,X5R,-55DEG CMIN, 85DEG CMAX
C618	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX,P
C619	2113944A35	CAP,CHIP,62PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX,P
C620	2113946B04	CAP,CHIP,.1UF,+10%,-10%,10V-DC,0402,X5R,-55DEG CMIN, 85DEG CMAX
C621	2113946B04	CAP,CHIP,.1UF,+10%,-10%,10V-DC,0402,X5R,-55DEG CMIN, 85DEG CMAX
C622	2113946C07	CAP,FXD,.33UF,+10%,-10%, 10V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX
C623	2113945B02	CAP,CHIP,.01UF,+10%,-10%, 25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA

Ref. Des.	Part Number	Description
C624	2113946C07	CAP,FXD,.33UF,+10%,-10%, 10V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX
C625	2113944A28	CAP,CHIP,18PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX,P
C626	2113945A09	CAP,CHIP,1000PF,+10%,-10%, 50V-DC,0402,X7R,-55DEG CMIN,125DEG CM
C627	2113945A09	CAP,CHIP,1000PF,+10%,-10%, 50V-DC,0402,X7R,-55DEG CMIN,125DEG CM
C628	2113945B02	CAP,CHIP,.01UF,+10%,-10%, 25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C629	2113946B04	CAP,CHIP,.1UF,+10%,-10%,10V-DC,0402,X5R,-55DEG CMIN, 85DEG CMAX
C630	2113946B04	CAP,CHIP,.1UF,+10%,-10%,10V-DC,0402,X5R,-55DEG CMIN, 85DEG CMAX
C631	2113944A27	CAP,CHIP,15PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX,P
C632	2113944A40	CAP,CHIP,100PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C633	2113945B02	CAP,CHIP,.01UF,+10%,-10%, 25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C634	2113946B04	CAP,CHIP,.1UF,+10%,-10%,10V-DC,0402,X5R,-55DEG CMIN, 85DEG CMAX
C635	2113945B02	CAP,CHIP,.01UF,+10%,-10%, 25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C636	2113946B04	CAP,CHIP,.1UF,+10%,-10%,10V-DC,0402,X5R,-55DEG CMIN,85DEG CMAX
C637	2113946B04	CAP,CHIP,.1UF,+10%,-10%,10V-DC,0402,X5R,-55DEG CMIN, 85DEG CMAX
C638	2113945A12	CAP,CHIP,3300PF,+10%,-10%, 50V-DC,0402,X7R,-55DEG CMIN,125DEG CM
C639	2113945B02	CAP,CHIP,.01UF,+10%,-10%, 25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C640	2113946B04	CAP,CHIP,.1UF,+10%,-10%,10V-DC,0402,X5R,-55DEG CMIN, 85DEG CMAX
C641	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX,P
C642	2113944A48	CAP,CHIP,470PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C643	2113944A48	CAP,CHIP,470PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C701	2113944A44	CAP,CHIP,220PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C702	2113944A44	CAP,CHIP,220PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C704	2113944A35	CAP,CHIP,62PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX,P
C709	2113944A44	CAP,CHIP,220PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C715	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C716	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C717	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C718	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C719	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C724	2113955D37	CAP,FXD,10UF,+10%,-10%,16V-DC,1206,X7R,-55DEG CMIN, 125DEG CMAX
C725	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C726	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C730	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C731	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C732	2113944A40	CAP,CHIP,100PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C734	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C736	2113945B02	CAP,CHIP,.01UF,+10%,-10%, 25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C737	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C739	2113944A25	CAP,CHIP,10PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX,P
C742	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C744	2113955D37	CAP,FXD,10UF,+10%,-10%,16V-DC,1206,X7R,-55DEG CMIN, 125DEG CMAX
C749	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C750	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C752	2113945B02	CAP,CHIP,.01UF,+10%,-10%, 25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C754	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX,P
C756	2113955D37	CAP,FXD,10UF,+10%,-10%,16V-DC,1206,X7R,-55DEG CMIN, 125DEG CMAX
C757	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C758	2113946B02	CAP,CHIP,.047UF,+10%,-10%, 10V-DC,0402,X5R,-55DEG CMIN,85DEG CMA
C759	2113945G95	CAP,FXD,.22UF,+10%,-10%, 50V-DC,0805,X7R,-55DEG CMIN,125DEG CMAX
C760	2113944G97	CAP,FXD,.082UF,+5%,-5%,50V-DC,1206,C0G,-55DEG CMIN, 125DEG CMAX
C762	2113945C26	CAP,FXD,.039UF,+10%,-10%, 50V-DC,0603,X7R,-55DEG CMIN,125DEG CMA
C763	2113944G97	CAP,FXD,.082UF,+5%,-5%,50V-DC,1206,C0G,-55DEG CMIN, 125DEG CMAX
C765	2113944G97	CAP,FXD,.082UF,+5%,-5%,50V-DC,1206,C0G,-55DEG CMIN,125DEG CMAX
C766	2113945C01	CAP,CHIP,6800PF,+10%,-10%, 50V-DC,0603,X7R,-55DEG CMIN,125DEG CM
C768	2113944G97	CAP,FXD,.082UF,+5%,-5%,50V-DC,1206,C0G,-55DEG CMIN, 125DEG CMAX
C769	2113945C20	CAP,FXD,.016UF,+10%,-10%, 50V-DC,0603,X7R,-55DEG CMIN,125DEG CMA
C770	2113944G97	CAP,FXD,.082UF,+5%,-5%,50V-DC,1206,C0G,-55DEG CMIN, 125DEG CMAX
C771	2113944A40	CAP,CHIP,100PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C775	2113945A09	CAP,CHIP,1000PF,+10%,-10%, 50V-DC,0402,X7R,-55DEG CMIN,125DEG CM
C777	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX,P
C779	2113944A40	CAP,CHIP,100PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C783	2113944C53	CAP,CHIP,1500PF,+5%,-5%, 50V-DC,0603,C0G,-55DEG CMIN,125DEG CMAX
C791	2113946B04	CAP,CHIP,.1UF,+10%,-10%,10V-DC,0402,X5R,-55DEG CMIN, 85DEG CMAX
C792	2113946B04	CAP,CHIP,.1UF,+10%,-10%,10V-DC,0402,X5R,-55DEG CMIN, 85DEG CMAX

Ref. Des.	Part Number	Description
C794	2113944A40	CAP,CHIP,100PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN,125DEG CMAX
C795	2113944A40	CAP,CHIP,100PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN,125DEG CMAX
C802	2113946B06	CAP,CHIP,.22UF,+10%,-10%,10V-DC,0402,X5R,-55DEG CMIN,85DEG CMAX
C806	2113946B06	CAP,CHIP,.22UF,+10%,-10%,10V-DC,0402,X5R,-55DEG CMIN,85DEG CMAX
C810	2113944A44	CAP,CHIP,220PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN,125DEG CMAX
C813	0613952Q69	RES,MF,680OHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
C814	2113945A09	CAP,CHIP,1000PF,+10%,-10%,50V-DC,0402,X7R,-55DEG CMIN,125DEG CM
C816	2113944A40	CAP,CHIP,100PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN,125DEG CMAX
C820	2113944A44	CAP,CHIP,220PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN,125DEG CMAX
C830	2113944A44	CAP,CHIP,220PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN,125DEG CMAX
C831	2113944A40	CAP,CHIP,100PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN,125DEG CMAX
C836	2113944A33	CAP,CHIP,47PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN,125DEG CMAX,P
C838	2113945A09	CAP,CHIP,1000PF,+10%,-10%,50V-DC,0402,X7R,-55DEG CMIN,125DEG CM
C844	2113944A33	CAP,CHIP,47PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN,125DEG CMAX,P
C851	2113944A44	CAP,CHIP,220PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN,125DEG CMAX
C1101	2113945B02	CAP,CHIP,.01UF,+10%,-10%,25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C1102	2188468Y01	CAP,CHIP,1UF,+10,-10,25V-DC,0805,X7R
C1103	2113945B02	CAP,CHIP,.01UF,+10%,-10%,25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C1105	2113944A19	CAP,CHIP,5.6PF,.5PF+/-,50V-DC,0402,C0G,-55DEG CMIN,125DEG CMAX
C1106	2113945B02	CAP,CHIP,.01UF,+10%,-10%,25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C1107	2113944A40	CAP,CHIP,100PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN,125DEG CMAX
C1108	2113946B03	CAP,CHIP,.068UF,+10%,-10%,10V-DC,0402,X5R,-55DEG CMIN,85DEG CMA
C1110	2113944A40	CAP,CHIP,100PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN,125DEG CMAX
C1111	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN,125DEG CMAX
C1112	2113945B02	CAP,CHIP,.01UF,+10%,-10%,25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C1113	2113945B02	CAP,CHIP,.01UF,+10%,-10%,25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C1116	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN,125DEG CMAX
C1117	2113945A12	CAP,CHIP,3300PF,+10%,-10%,50V-DC,0402,X7R,-55DEG CMIN,125DEG CM
C1118	2113945B02	CAP,CHIP,.01UF,+10%,-10%,25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C1119	2113945B02	CAP,CHIP,.01UF,+10%,-10%,25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C1120	2113945B02	CAP,CHIP,.01UF,+10%,-10%,25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C1122	2175390H01	CAP,CER,2.2PF,50V-DC,C0G,CAP, 2.2 PF, 0402, CERAMIC, 50V
C1123	2113945B02	CAP,CHIP,.01UF,+10%,-10%,25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C1124	2113945A13	CAP,CHIP,4700PF,+10%,-10%,50V-DC,0402,X7R,-55DEG CMIN,125DEG CM
C1126	2113945A09	CAP,CHIP,1000PF,+10%,-10%,50V-DC,0402,X7R,-55DEG CMIN,125DEG CM
C1127	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN,125DEG CMAX
C1128	2113945B02	CAP,CHIP,.01UF,+10%,-10%,25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C1129	2113945B02	CAP,CHIP,.01UF,+10%,-10%,25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C1130	2113945B02	CAP,CHIP,.01UF,+10%,-10%,25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C1137	2113945B04	CAP,FXD,.022UF,+10%,-10%,25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C1138	2113945B04	CAP,FXD,.022UF,+10%,-10%,25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C1139	2113944A25	CAP,CHIP,10PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN,125DEG CMAX,P
C1140	2113945A13	CAP,CHIP,4700PF,+10%,-10%,50V-DC,0402,X7R,-55DEG CMIN,125DEG CM
C1141	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN,125DEG CMAX
C1142	2113945A09	CAP,CHIP,1000PF,+10%,-10%,50V-DC,0402,X7R,-55DEG CMIN,125DEG CM
C1149	2113944A40	CAP,CHIP,100PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN,125DEG CMAX
C1150	2175392H01	CAP,CER,1.2PF,50V-DC,C0G,CAP, 1.2PF, 0402, CERAMIC, 50V
C1152	2113944A46	CAP,CHIP,330PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN,125DEG CMAX
C1160	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN,125DEG CMAX
C1161	2113956B91	CAP,FXD,1UF,+10%,-10%,16V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX,PB
C1165	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN,125DEG CMAX
C1301	2113944M20	CAP,FXD,12PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN,125DEG CMAX,PB
C1302	2114036F74	CAP,FXD,1.8PF,.05PF+/-,25V-DC,0402,C0G,-55DEG CMIN,125DEG CMAX
C1303	2113944A26	CAP,CHIP,12PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN,125DEG CMAX,P
C1304	2113945A09	CAP,CHIP,1000PF,+10%,-10%,50V-DC,0402,X7R,-55DEG CMIN,125DEG CM
C1305	2113944A30	CAP,CHIP,27PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN,125DEG CMAX,P
C1306	2113945B02	CAP,CHIP,.01UF,+10%,-10%,25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C1307	2113944A26	CAP,CHIP,12PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN,125DEG CMAX,P
C1308	2113944A28	CAP,CHIP,18PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN,125DEG CMAX,P
C1309	2175389H01	CAP,.5PF,CAP,.5PF, CHIP, 0402, CERAMIC, 50 V
C1310	2113944A17	CAP,CHIP,4.7PF,.25PF+/-,50V-DC,0402,C0G,-55DEG CMIN,125DEG CMA
C1601	2113944M42	CAP,FXD,100PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN,125DEG CMAX,P
C1602	2113944M42	CAP,FXD,100PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN,125DEG CMAX,P
C1603	2113945L49	CAP,FXD,.01UF,+5%,-5%,50V-DC,0603,X7R,-55DEG CMIN,125DEG CMAX,P

Ref. Des.	Part Number	Description
C1604	2113944M42	CAP,FXD,100PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX,P
C1605	2113945B02	CAP,CHIP,.01UF,+10%,-10%, 25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C1606	2113944A40	CAP,CHIP,100PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C1607	2113944M42	CAP,FXD,100PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX,P
C1608	2113944M42	CAP,FXD,100PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX,P
C1609	2113944A40	CAP,CHIP,100PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C1610	2113944M14	CAP,FXD,6.8PF,.1PF+/-,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX
C1611	2113945L49	CAP,FXD,.01UF,+5%,-5%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX,P
C1613	2113944M30	CAP,FXD,33PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX,PB
C1614	2113944M36	CAP,FXD,56PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX,PB
C1615	2113944A40	CAP,CHIP,100PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C1616	2113944M34	CAP,FXD,47PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX,PB
C1617	2113945B02	CAP,CHIP,.01UF,+10%,-10%, 25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C1618	2113944M42	CAP,FXD,100PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX,P
C1619	2113944M22	CAP,FXD,15PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX,PB
C1620	2171741M01	CAP,FXD,47PF,+5%,-5%,50V-DC,COG,HI Q CAP
C1621	2171741M08	CAP,CER CHIP,22PF,+5%,-5%,50V-DC,C0G,-55DEG CMIN, 125DEG CMAX,H
C1622	2113944M23	CAP,FXD,16PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX,PB
C1623	2113944C08	CAP,CHIP,1.2PF,.25PF+/-,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMA
C1624	2113944M22	CAP,FXD,15PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX,PB
C1625	2113944M42	CAP,FXD,100PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX,P
C1628	2113944M08	CAP,FXD,3.9PF,.1PF+/-,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX
C1629	2113945A12	CAP,CHIP,3300PF,+10%,-10%, 50V-DC,0402,X7R,-55DEG CMIN,125DEG CM
C1630	2113945A12	CAP,CHIP,3300PF,+10%,-10%, 50V-DC,0402,X7R,-55DEG CMIN,125DEG CM
C1803	2113944M08	CAP,FXD,3.9PF,.1PF+/-,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX
C1804	2113944M08	CAP,FXD,3.9PF,.1PF+/-,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX
C1807	2113944M14	CAP,FXD,6.8PF,.1PF+/-,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX
C1820	2113944M08	CAP,FXD,3.9PF,.1PF+/-,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX
C1821	2113944M17	CAP,FXD,9.1PF,.1PF+/-,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX
C1822	2113944M42	CAP,FXD,100PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX,P
C1826	2113944M04	CAP,FXD,2.7PF,.1PF+/-,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX
C1827	2113944M10	CAP,FXD,4.7PF,.1PF+/-,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX
C2020	2113946D07	CAP,CHIP,4.7UF,+10%,-10%, 6.3V-DC,0603,X5R,-55DEG CMIN,85DEG CMA
C2022	2113944A40	CAP,CHIP,100PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C2023	2113944A40	CAP,CHIP,100PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C2024	2113946D07	CAP,CHIP,4.7UF,+10%,-10%, 6.3V-DC,0603,X5R,-55DEG CMIN,85DEG CMA
C2025	2113944A40	CAP,CHIP,100PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C2026	2113946B04	CAP,CHIP,.1UF,+10%,-10%,10V-DC,0402,X5R,-55DEG CMIN, 85DEG CMAX
C2028	2115153H24	CAP,FXD,7.5PF,.1PF+/-,50V-DC,0402,C0G
C2029	2115153H41	CAP,FXD,22PF,+1%,-1%,50V-DC,0402,C0G
C2032	2115153H57	CAP,FXD,100PF,+1%,-1%,50V-DC,0402,C0G
C2033	2115153H53	CAP,FXD,68PF,50V-DC,0402, C0G
C2035	2115153H15	CAP,FXD,3.3PF,.1PF+/-,50V-DC,0402,C0G
C2036	2115153H07	CAP,FXD,1.5PF,.1PF+/-,50V-DC,0402,C0G
C2037	2115153H12	CAP,FXD,2.4PF,.1PF+/-,+4.2%, -4.2%,50V-DC,0402,C0G
C2038	2115153H09	CAP,FXD,1.8PF,.1PF+/-,50V-DC,0402,C0G
C2039	2115153H15	CAP,FXD,3.3PF,.1PF+/-,50V-DC,0402,C0G
C2041	2113946B04	CAP,CHIP,.1UF,+10%,-10%,10V-DC,0402,X5R,-55DEG CMIN, 85DEG CMAX
C2042	2115153H13	CAP,FXD,2.7PF,.1PF+/-,50V-DC,0402,C0G
C2044	2115153H26	CAP,CER CHIP,9.1PF,.1PF+/-,+.1%,-.1%,50V-DC,0402,C0G
C2052	2115153H41	CAP,FXD,22PF,+1%,-1%,50V-DC,0402,C0G
C2053	2115153H24	CAP,FXD,7.5PF,.1PF+/-,50V-DC,0402,C0G
C2054	2113944A40	CAP,CHIP,100PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX
C2055	2113946B04	CAP,CHIP,.1UF,+10%,-10%,10V-DC,0402,X5R,-55DEG CMIN, 85DEG CMAX
C2056	2115153H24	CAP,FXD,7.5PF,.1PF+/-,50V-DC,0402,C0G
C2057	2115153H41	CAP,FXD,22PF,+1%,-1%,50V-DC,0402,C0G
C2058	2115153H13	CAP,FXD,2.7PF,.1PF+/-,50V-DC,0402,C0G
C2059	2115153H15	CAP,FXD,3.3PF,.1PF+/-,50V-DC,0402,C0G
C2060	2115153H11	CAP,FXD,2.2PF,.1PF+/-,50V-DC,0402,C0G
C2061	2115153H15	CAP,FXD,3.3PF,.1PF+/-,50V-DC,0402,C0G
C2063	2115153H41	CAP,FXD,22PF,+1%,-1%,50V-DC,0402,C0G
C2064	2115153H24	CAP,FXD,7.5PF,.1PF+/-,50V-DC,0402,C0G
D200	4813978A19	DIODE,RECT,MBR120,SM,SOD-123,1A,20V,SHTK,PB-FREE
D722	4815011H01	DIODE,SWG,SM,300MA,80V,TRP
D723	4815011H01	DIODE,SWG,SM,300MA,80V,TRP
E200	2405688Z01	IDCTR,BEAD,FERR BEAD
E201	2405688Z01	IDCTR,BEAD,FERR BEAD
E501	2480640Z01	FLTR,FERR,SM,SUR MT FERR BEAD
E601	2480640Z01	FLTR,FERR,SM,SUR MT FERR BEAD
E602	2480640Z01	FLTR,FERR,SM,SUR MT FERR BEAD
E603	2480640Z01	FLTR,FERR,SM,SUR MT FERR BEAD
E604	2480640Z01	FLTR,FERR,SM,SUR MT FERR BEAD
E605	2480640Z01	FLTR,FERR,SM,SUR MT FERR BEAD

Ref. Des.	Part Number	Description
E606	2480640Z01	FLTR,FERR,SM,SUR MT FERR BEAD
E607	2480640Z01	FLTR,FERR,SM,SUR MT FERR BEAD
E608	2480640Z01	FLTR,FERR,SM,SUR MT FERR BEAD
E609	2480640Z01	FLTR,FERR,SM,SUR MT FERR BEAD
E1101	2405688Z01	IDCTR,BEAD,FERR BEAD
E2021	2480640Z01	FLTR,FERR,SM,SUR MT FERR BEAD
F200	6575834B01	FUSE,FST BLW,2A,32V,FUSE SUR MT
FL501	4885631B01	FLTR,MONOLITHIC CRYSTAL, BANDPASS,109.65MHZ NOM, -6.5MHZ MIN,6.5MH
FL1301	9102190J23	FLTR,SAW,BANDPASS,1.57542 GHZ NOM,SM,1.4X1.0MM,SMD, PB-FREE
J101	0909901V02	CONN,RCPT,SMT MCX
J102	0975886B01	RF CONN,F,RECEPTACLE, COAX CBL
L200	2571269C01	IDCTR,COIL,1.5UH,20%,2.9A, .059OHM,FERR,SM,WW PWR W18 COMP
L501	24012011014	IDCTR,WW,6.8NH,2%,1.5A, .055OHM,CER,5.8GHZ SRF,SM, 0402 HI Q
L502	2415429H30	IDCTR,WW,47NH,5%,600MA,C ER,SM,CHIP
L503	2414032F38	IDCTR,WW,220NH,5%,400MA, .7OHM,CER,30 Q,630MHZ SRF,SM,PB-FRE
L504	2414032F42	IDCTR,WW,470NH,10%,170MA, 2.5OHM,CER,40 Q,665MHZ SRF,SM,PB-F
L505	2415429H39	IDCTR,WW,150NH,5%,280MA, .92OHM,CER,SM,0603,CHIP
L506	2415429H39	IDCTR,WW,150NH,5%,280MA, .92OHM,CER,SM,0603,CHIP
L507	2415427H12	IDCTR,WW,5.1NH,5%,800MA, .083OHM,CER,SM,0402,CHIP
L510	24012011020	IDCTR,WW,1NH,2%,1.3A,.085O HM,CER,4.7GHZ SRF,SM,0402 HI Q C
L511	2478057A13	IDCTR,WW,7.5NH,2%,.08OHM, CER,41 Q,5.3GHZ SRF,PCMT, 7.5 NH S
L601	2415429H43	IDCTR,WW,220NH,5%,300MA, 2.1OHM,CER,0 AWG,SM,0603,CHIP
L602	2466505A01	CHIP INDUCTOR,CHIP,10UH, 5%,150MA,FERR,0 AWG,SM, PB-FREE
L603	2466505A01	CHIP INDUCTOR,CHIP,10UH, 5%, 150MA,FERR,0 AWG,SM, PB-FREE
L604	2414032D16	IDCTR,WW,120NH,5%,800MA, .26OHM,CER,42 Q,1GHZ SRF, SM,PB-FREE
L605	24013028001	COIL FORM,3.9UH IDCTR
L701	2415429H47	IDCTR,WW,390NH,5%,100MA, CER,SM,CHIP
L720	2480646Z20	IDCTR,FXD,2.2UH,10%,15MA, SM,MULTI-LAYER CHIP
L727	2480646Z20	IDCTR,FXD,2.2UH,10%,15MA, SM,MULTI-LAYER CHIP
L728	2415429H47	IDCTR,WW,390NH,5%,100MA, CER,SM,CHIP
L733	2480646Z20	IDCTR,FXD,2.2UH,10%,15MA, SM,MULTI-LAYER CHIP
L735	2480646Z20	IDCTR,FXD,2.2UH,10%,15MA, SM,MULTI-LAYER CHIP
L738	2480646Z20	IDCTR,FXD,2.2UH,10%,15MA, SM,MULTI-LAYER CHIP
L741	2480646Z20	IDCTR,FXD,2.2UH,10%,15MA, SM,MULTI-LAYER CHIP
L753	2480646Z20	IDCTR,FXD,2.2UH,10%,15MA, SM,MULTI-LAYER CHIP
L806	2415429H47	IDCTR,WW,390NH,5%,100MA, CER,SM,CHIP
L817	2414032F41	IDCTR,WW,390NH,10%,200MA, 1.5OHM,CER,40 Q,730MHZ SRF,SM,PB-F
L821	2415429H47	IDCTR,WW,390NH,5%,100MA, CER,SM,CHIP
L846	2414032F41	IDCTR,WW,390NH,10%,200MA, 1.5OHM,CER,40 Q,730MHZ SRF,SM,PB-F
L1101	2415429H26	IDCTR,WW,33NH,5%,600MA, .22OHM,CER,SM,0603,CHIP
L1102	2415429H10	IDCTR,WW,6.8NH,5%,700MA,.1 1OHM,CER,SM,0603,CHIP
L1103	2475393H01	IDCTR,COIL,4.7NH,2%,750MA,. 07OHM,SM,INDUCTOR, 4.7NH, 040
L1104	0613952R66	RES,MF,0OHM,5%,.0625W,SM, 0402,PB-FREE
L1108	2409348J04	IDCTR,5%,SM,AIR CORE 2214
L1114	2475394H01	IDCTR,COIL,11NH,2%,.14OHM, SM,INDUCTOR, 11NH, 0402, +/- 2
L1301	2488090Y07	IDCTR,CHIP,3.3NH,5%,300MA, CER,SM,0402,MULAY PB FREE
L1302	2488090Y25	IDCTR,CHIP,100NH,5%,90MA,C ER,SM,0402,MULAY PB FREE
L1303	2414017P25	IDCTR,CHIP,100NH,5%,100MA, 5.5OHM,CER,8 Q,650MHZ SRF,SM,0402
L1305	2475391H01	IDCTR,WW,18UH,2%,.27OHM,I NDUCTOR, 18 NH, CHIP, 0402, 2
L1306	2488090Y10	IDCTR,CHIP,5.6NH,5%,300MA, CER,SM,0402,MULAY PB FREE
L1601	2414017H14	IDCTR,CHIP,15NH,5%,3A,.32O HM,CER,12 Q,1.5GHZ SRF,SM,0603,PB-
L1602	2415429H37	IDCTR,WW,110NH,5%,300MA,.6 1OHM,CER,SM,0603,CHIP
L1603	2414015A07	IDCTR,FXD,180NH,2%,750MA,. 77OHM,CER,25 Q,700MHZ SRF,SM,1008
L1604	2414017H07	IDCTR,CHIP,3.9NH,300MA,.14O HM,CER,10 Q,3.4GHZ SRF,SM,0603,P
L1605	2414017H07	IDCTR,CHIP,3.9NH,300MA,.14O HM,CER,10 Q,3.4GHZ SRF,SM,0603,P
L1606	2460591E24	IDCTR,AW,23.75NH,COIL 23.75
L1609	2415428H02	IDCTR,AW,2.55NH,5%,1.6A,AIR ,3 TURNS,SM,AIR WOUND IDCTR
L1610	2415385H01	IDCTR,AW,8NH,2%,4A,.0026OH M,AIR,3 TURNS,RH,140 Q,5GHZ SRF,SM,8
L1803	2471884M01	IDCTR,AW,10.2NH,5%,AIR,SM, 10.2NH SQ SPR
L1809	2471884M01	IDCTR,AW,10.2NH,5%,AIR,SM, 10.2NH SQ SPR
L1811	2471884M01	IDCTR,AW,10.2NH,5%,AIR,SM, 10.2NH SQ SPR
L2008	2478057A09	IDCTR,WW,5.6NH,2%,1.7A, .036OHM,CER,48 Q,6.6GHZ SRF,SM,5.6 N
L2009	2478057A23	IDCTR,WW,18NH,2%,.066OHM, CER,41 Q,3.3GHZ SRF,PCMT, 18 NH SU
L2010	2478057A23	IDCTR,WW,18NH,2%,.066OHM, CER,41 Q,3.3GHZ SRF,PCMT,18 NH SU
L2012	2478057A09	IDCTR,WW,5.6NH,2%,1.7A, .036OHM,CER,48 Q,6.6GHZ SRF,SM,5.6 N
L2013	2478057A23	IDCTR,WW,18NH,2%,.066OHM, CER,41 Q,3.3GHZ SRF,PCMT,18 NH SU
L2014	2478057A23	IDCTR,WW,18NH,2%,.066OHM, CER,41 Q,3.3GHZ SRF,PCMT,18 NH SU
L2015	2478057A41	IDCTR,WW,91NH,2%,440MA, .58OHM,CER,1.65GHZ SRF,SM,0306 HI Q
L2016	2414017P15	IDCTR,CHIP,15NH,5%,300MA, .65OHM,CER,9 Q,1.95GHZ SRF,SM,0402
L2017	2478057A40	IDCTR,WW,82NH,2%,510MA, .46OHM,CER,1.8GHZ SRF,SM,0306 HI Q
L2019	2414017P15	IDCTR,CHIP,15NH,5%,300MA, .65OHM,CER,9 Q,1.95GHZ SRF,SM,0402
L2034	2478057A29	IDCTR,WW,56NH,2%,610MA, .3OHM,CER,5GHZ SRF,SM, 0306 HI Q CHI
L2035	2478057A24	IDCTR,WW,22NH,2%,.14OHM, CER,44 Q,3.15GHZ SRF,PCMT, 22 NH SU
L2036	2415429H01	IDCTR,WW,1.6NH,5%,700MA, .03OHM,CER,SM,0603,CHIP
M101	2871616H01	CONN,N/A,GLD,CONNECTOR, BPLUS
M103	3987977Y04	CONT,CONN,1CONT,ANT UNIV 4.5MM,UC 1.8

Ref. Des.	Part Number	Description
M104	3987977Y04	CONT,CONN,1CONT,ANT UNIV 4.5MM,UC 1.8
M107	0985888K02	BATTERY CONNECTOR,SKT, NI,LEAP
P101	2887818K05	RECTANGULAR CONNECTOR, STKNG,2 ROW,RCPT,40CONT, .5MM,GLD,VERT
PCB	84013067001	BOARD, PC, PORTABLE UHF1
Q201	4813970A59	XSTR,FET GP PWR,P-CH, ENHN,SM,SOT-23,20V,.4W,PB-FREE
Q202	4813973A32	XSTR,BIP GP SS,NPN,SM,SC-70,SMT,50V,.202W,100MA,PB-FREE
Q501	4813973M75	XSTR,BIP GP SS,PNP,BC858, SOT-563,SMT,-30V,.357W, -100MA,100MHZ
Q503	4885316E32	XSTR,BIP RF SML SGNL,SLCN, BFR380F,SM,SMT,6V,380W,80A ,14MHZ,TR
Q601	4813973A04	XSTR,BIP GP SS,NPN,TA13, SM,SOT-23,SMT,30V,.225W, 300MA,125MHZ,P
Q703	4813973M75	XSTR,BIP GP SS,PNP,BC858, SOT-563,SMT,-30V,.357W, -100MA,100MHZ
Q712	4813973M75	XSTR,BIP GP SS,PNP,BC858, SOT-563,SMT,-30V,.357W, -100MA,100MHZ
Q713	4805585Q32	XSTR,BIP RF SML SGNL,NPN, NE662M04,SM,SOT-343,3.3V, TRANSITO
Q714	4889394V04	XSTR,FET GP SS,MOSFET, N-CH,ENHN,SM,20V,.25W, PB-FREE TWO FETS
Q774	4885061Y01	XSTR,BIP RF SML SGNL,NPN, SM,12GHZ
Q842	4805585Q32	XSTR,BIP RF SML SGNL,NPN, NE662M04,SM,SOT-343,3.3V, TRANSITO
Q1101	4813973A32	XSTR,BIP GP SS,NPN,SM, SC-70,SMT,50V,.202W,100MA, PB-FREE
Q1103	4813970A59	XSTR,FET GP PWR,P-CH, ENHN,SM,SOT-23,20V,.4W, PB-FREE

Ref. Des.	Part Number	Description
Q1601	5185633C92	AMP MDL,MODULE,RING, XSTR, FET RF POWER, UHF
Q2022	4813973M75	XSTR,BIP GP SS,PNP,BC858, SOT-563,SMT,-30V,.357W, -100MA,100MHZ
R101	0613952R01	RES,MF,10KOHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R103	0613952R01	RES,MF,10KOHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R104	0613952Q80	RES,MF,2KOHM,5%,.0625W,SM ,0402,200PPM/CEL,PB-FREE
R201	0613952R25	RES,MF,100KOHM,5%,.0625W, SM,0402,200PPM/CEL,PB-FREE
R202	0613952Q89	RES,MF,4.7KOHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R502	0613952Q45	RES,MF,68OHM,5%,.0625W,SM ,0402,200PPM/CEL,PB-FREE
R503	0613952R10	RES,MF,24KOHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R504	0613952Q85	RES,MF,3.3KOHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R505	0613952R31	RES,MF,180KOHM,5%,.0625W, SM,0402,200PPM/CEL,PB-FREE
R506	0613952Q53	RES,MF,150OHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R507	0613952Q75	RES,MF,1.2KOHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R508	0613952Q29	RES,MF,15OHM,5%,.0625W,SM ,0402,200PPM/CEL,PB-FREE
R509	0613952Q25	RES,MF,10OHM,5%,.0625W,SM ,0402,200PPM/CEL,PB-FREE
R511	0613952Q11	RES,MF,2.7OHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R601	0613952Q41	RES,MF,47OHM,5%,.0625W,SM ,0402,200PPM/CEL,PB-FREE
R602	0613952Q63	RES,MF,390OHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R603	0613952R25	RES,MF,100KOHM,5%,.0625W, SM,0402,200PPM/CEL,PB-FREE
R604	0613952Q63	RES,MF,390OHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R605	0613952R01	RES,MF,10KOHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE

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R606	0613952R01	RES,MF,10KOHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R607	0613952R25	RES,MF,100KOHM,5%,.0625W, SM,0402,200PPM/CEL,PB-FREE
R608	0613952R01	RES,MF,10KOHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R609	0613952Q81	RES,MF,2.2KOHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R610	0613952R25	RES,MF,100KOHM,5%,.0625W, SM,0402,200PPM/CEL,PB-FREE
R611	0613952R01	RES,MF,10KOHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R612	0613952Q94	RES,MF,7.5KOHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R613	0613952Z41	RES,MF,2.4KOHM,1%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R614	0613952R66	RES,MF,0OHM,5%,.0625W,SM, 0402,PB-FREE
R698	0613952R66	RES,MF,0OHM,5%,.0625W,SM, 0402,PB-FREE
R699	0613952R66	RES,MF,0OHM,5%,.0625W,SM, 0402,PB-FREE
R701	0613952Q49	RES,MF,100OHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R702	0613952R66	RES,MF,0OHM,5%,.0625W,SM, 0402,PB-FREE
R705	0613952Q25	RES,MF,10OHM,5%,.0625W,SM ,0402,200PPM/CEL,PB-FREE
R706	0613952R66	RES,MF,0OHM,5%,.0625W,SM, 0402,PB-FREE
R707	0613952R66	RES,MF,0OHM,5%,.0625W,SM, 0402,PB-FREE
R708	0613952Q49	RES,MF,100OHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R712	0613952Q67	RES,MF,560OHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R713	0613952Q25	RES,MF,10OHM,5%,.0625W,SM ,0402,200PPM/CEL,PB-FREE
R714	0613952Q67	RES,MF,560OHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R716	0613952R66	RES,MF,0OHM,5%,.0625W,SM, 0402,PB-FREE
R721	0613952R01	RES,MF,10KOHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE

Ref. Des.	Part Number	Description
R729	0613952R09	RES,MF,22KOHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R743	0613952R17	RES,MF,47KOHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R745	0613952R09	RES,MF,22KOHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R751	0613952Q59	RES,MF,270OHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R752	0613952Q91	RES,MF,5.6KOHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R753	0613952Q91	RES,MF,5.6KOHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R754	0613952Q91	RES,MF,5.6KOHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R755	0613952R15	RES,MF,39KOHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R759	0613952Q69	RES,MF,680OHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R761	0613952Q57	RES,MF,220OHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R762	0613952R02	RES,MF,11KOHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R764	0613952Q75	RES,MF,1.2KOHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R767	0613952Q45	RES,MF,68OHM,5%,.0625W,SM ,0402,200PPM/CEL,PB-FREE
R772	0613952Q37	RES,MF,33OHM,5%,.0625W,SM ,0402,200PPM/CEL,PB-FREE
R773	0613952Q91	RES,MF,5.6KOHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R776	0613952Q39	RES,MF,39OHM,5%,.0625W,SM ,0402,200PPM/CEL,PB-FREE
R778	0613952Q55	RES,MF,180OHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R807	0613952R09	RES,MF,22KOHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R808	0613952R23	RES,MF,82KOHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R809	0613952Q91	RES,MF,5.6KOHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R811	0613952Q39	RES,MF,39OHM,5%,.0625W,SM ,0402,200PPM/CEL,PB-FREE
R812	0613952Q47	RES,MF,82OHM,5%,.0625W,SM ,0402,200PPM/CEL,PB-FREE

Ref. Des.	Part Number	Description
R813	2113944A63	CAP,FXD,1PF,.25PF+/-,50V-DC, 0402,C0G,-55DEG CMIN, 125DEG CMAX,P
R815	0613952Q34	RES,MF,24OHM,5%,.0625W,SM ,0402,200PPM/CEL,PB-FREE
R818	0613952Q23	RES,MF,8.2OHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R819	0613952Q59	RES,MF,270OHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R822	0613952R08	RES,MF,20KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R823	0613952R19	RES,MF,56KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R827	0613952Q92	RES,MF,6.2KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R832	0613952Q29	RES,MF,15OHM,5%,.0625W,SM ,0402,200PPM/CEL,PB-FREE
R833	0613952Q49	RES,MF,100OHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R840	0613952Q29	RES,MF,15OHM,5%,.0625W,SM ,0402,200PPM/CEL,PB-FREE
R848	0613952Q29	RES,MF,15OHM,5%,.0625W,SM ,0402,200PPM/CEL,PB-FREE
R849	0613952Q67	RES,MF,560OHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1102	0613952R25	RES,MF,100KOHM,5%,.0625W, SM,0402,200PPM/CEL,PB-FREE
R1103	06009259001	RES,SHUNT,.02OHM,.25W,SMD ,LOW RESISTANCE THK FLM RES
R1104	0613952Q49	RES,MF,100OHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1105	0613952Q49	RES,MF,100OHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1106	0613952Q21	RES,MF,6.8OHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1107	0613952Q45	RES,MF,68OHM,5%,.0625W,SM ,0402,200PPM/CEL,PB-FREE
R1108	0613952R23	RES,MF,82KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1110	0613952R01	RES,MF,10KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1114	0613952Q49	RES,MF,100OHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1115	0613952Q49	RES,MF,100OHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1116	0613952R01	RES,MF,10KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1117	0613952R22	RES,MF,75KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1121	0613952R12	RES,MF,30KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1122	0613952R22	RES,MF,75KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1124	0613952Q42	RES,MF,51OHM,5%,.0625W,SM ,0402,200PPM/CEL,PB-FREE
R1125	0613952R17	RES,MF,47KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1126	0613952R08	RES,MF,20KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1127	0613952R08	RES,MF,20KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1128	0613952R01	RES,MF,10KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1135	0613952R66	RES,MF,0OHM,5%,.0625W,SM, 0402,PB-FREE
R1136	0613952R01	RES,MF,10KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1137	0613952R01	RES,MF,10KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1138	0613952R25	RES,MF,100KOHM,5%,.0625W, SM,0402,200PPM/CEL,PB-FREE
R1139	0613952R25	RES,MF,100KOHM,5%,.0625W, SM,0402,200PPM/CEL,PB-FREE
R1140	0613952R25	RES,MF,100KOHM,5%,.0625W, SM,0402,200PPM/CEL,PB-FREE
R1141	0613952R42	RES,MF,510KOHM,5%,.0625W, SM,0402,200PPM/CEL,PB-FREE
R1142	0613952R25	RES,MF,100KOHM,5%,.0625W, SM,0402,200PPM/CEL,PB-FREE
R1143	0613952R25	RES,MF,100KOHM,5%,.0625W, SM,0402,200PPM/CEL,PB-FREE
R1144	0613952R25	RES,MF,100KOHM,5%,.0625W, SM,0402,200PPM/CEL,PB-FREE
R1145	0613952R25	RES,MF,100KOHM,5%,.0625W, SM,0402,200PPM/CEL,PB-FREE
R1146	0613952R25	RES,MF,100KOHM,5%,.0625W, SM,0402,200PPM/CEL,PB-FREE
R1151	0613952R05	RES,MF,15KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1152	0613952R01	RES,MF,10KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1154	0613952R01	RES,MF,10KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1160	0613952R03	RES,MF,12KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1162	0613952R29	RES,MF,150KOHM,5%,.0625W, SM,0402,200PPM/CEL,PB-FREE
R1163	0613952R01	RES,MF,10KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1164	0613952R01	RES,MF,10KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1165	0613952Q56	RES,MF,200OHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1166	0613952Q56	RES,MF,200OHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1167	0613952R01	RES,MF,10KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1168	0613952Q49	RES,MF,100OHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1169	0613952P52	RES,MF,340KOHM,1%,.0625W, SM,0402,200PPM/CEL,PB-FREE
R1170	0613952P01	RES,MF,100KOHM,1%,.0625W, SM,0402,200PPM/CEL,PB-FREE
R1171	0613952R66	RES,MF,0OHM,5%,.0625W,SM, 0402,PB-FREE
R1172	0613952Q89	RES,MF,4.7KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1174	0613952R01	RES,MF,10KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1175	0613952R66	RES,MF,0OHM,5%,.0625W,SM, 0402,PB-FREE
R1176	0613952Q73	RES,MF,1KOHM,5%,.0625W,SM ,0402,200PPM/CEL,PB-FREE
R1177	0613952R66	RES,MF,0OHM,5%,.0625W,SM, 0402,PB-FREE
R1178	0613952R01	RES,MF,10KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1180	0613952R66	RES,MF,0OHM,5%,.0625W,SM, 0402,PB-FREE
R1182	0613952R01	RES,MF,10KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1183	0613952Q73	RES,MF,1KOHM,5%,.0625W,SM ,0402,200PPM/CEL,PB-FREE
R1184	0613952Q81	RES,MF,2.2KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1307	0613952Q73	RES,MF,1KOHM,5%,.0625W,SM ,0402,200PPM/CEL,PB-FREE
R1601	0613952Q96	RES,MF,9.1KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1602	0613952R01	RES,MF,10KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1603	0613952R02	RES,MF,11KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1604	0613952R13	RES,MF,33KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R1605	0613952Q73	RES,MF,1KOHM,5%,.0625W,SM ,0402,200PPM/CEL,PB-FREE
R1606	0613952H61	RES,MF,330OHM,5%,.1W,SM, 0603,200PPM/CEL,PB-FREE
R1801	0685524Y01	RES,0OHM
R2006	0613952R01	RES,MF,10KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R2007	0613952R01	RES,MF,10KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R2008	0613952R01	RES,MF,10KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R2009	0613952R01	RES,MF,10KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE
R2010	0613952Q73	RES,MF,1KOHM,5%,.0625W,SM ,0402,200PPM/CEL,PB-FREE
R2011	0613952Q73	RES,MF,1KOHM,5%,.0625W,SM ,0402,200PPM/CEL,PB-FREE
R2021	0613952R22	RES,MF,75KOHM,5%,.0625W,S M,0402,200PPM/CEL,PB-FREE

Ref. Des.	Part Number	Description
R2022	0613952R27	RES,MF,120KOHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R2023	0613952R01	RES,MF,10KOHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R2024	0613952Q37	RES,MF,33OHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R2025	0613952Q11	RES,MF,2.7OHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R2035	0613952Q75	RES,MF,1.2KOHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
SH1	26009322001	SHLD,CAN,STL,PLTD,SHIELD, RF PA
SH2	2675872B01	SHLD,STL,SN PLT,SHIELD, XTAL
SH3	2675873B01	SHLD,STL,SN PLT,SHIELD, ABACUS
SH4	26009323001	SHLD,CAN,STL,PLTD,SHIELD, DC FLTR
SH5	26009327001	SHLD,CAN,STL,PLTD,SHIELD, OUT MATCH
SH6	26009320001	SHLD,CAN,STL,PLTD,SHIELD, ALC
SH7	2675874B01	SHLD,STL,SN PLT,SHIELD, MXR
SH8	2675932B01	SHLD,SHIELD, 2ND LO VCO
SH9	26009319001	SHLD,CAN,STL,PLTD,SHIELD, VCO
SH10	26009324001	SHLD,CAN,STL,PLTD,SHIELD, HAR FLTR
SH11	26009321001	SHLD,CAN,STL,PLTD,SHIELD, RX FRNT END
SH12	2675933B01	SHLD,SHIELD, IF AMP
SH13	26009325001	SHLD,CAN,STL,PLTD
SH14	26009326001	SHLD,CAN,STL,PLTD,SHIELD, DC REGLTR
T503	2575851B01	XFMR,BALUN,RF XFMR BALUN
T504	2575851B01	XFMR,BALUN,RF XFMR BALUN
T505	2575851B01	XFMR,BALUN,RF XFMR BALUN
U101	5105443X07	IC,SERIAL EEPROM,32/64 KBIT,DFN,EEPROM 32KBIT SER SPI BUS
U200	5188493T01	IC,VREG/SWG,LP2989,SM,MINI SO-8 HI PRCN REG 5V
U201	5175771A99	IC,LNR V REGLTR,FXD,100MA, VFBGA,LOW NOISE, 100MA LINEAR REGL
U202	5175772B02	IC,LNR V REGLTR,FXD,1.8V, 100MA,VFBGA,LINEAR REGLTR 100MA 1.8
U203	5175772B01	IC,LNR V REGLTR,FXD,1.5V, 350MA,VFBGA,LINEAR V REGLTR 350MA
U506	5164852H82	IC,MXR,IC, MIXER/ BFR
U601	5102495J14	IC,IF,IF DIGITILIZING SUBSYSTEM IC,AD9864,QFN
U602	4885316E32	XSTR,BIP RF SML SGNL,SLCN, BFR380F,SM,SMT,6V,380W,80A ,14MHZ,TR
U603	5109522E84	IC,DUAL SCHMITT TRIG MICRO PAK
U604	5109522E84	IC,DUAL SCHMITT TRIG MICRO PAK
U605	5164852H16	IC,TRANSLATING,2PER PKG, LVC2T45,TRANSCEIVER W/ VOLTAGE TRANSLATI
U606	5164852H16	IC,TRANSLATING,2PER PKG, LVC2T45,TRANSCEIVER W/ VOLTAGE TRANSLATI
U607	5186311J24	IC,BFR,1PER PKG, NC7SZ125, ACTIVE HIGH,BFR,3ST,SM,5.5
U702	5164015H28	IC,CUST,MULTI PROTOCOL/ BAND TRANSCVR IC,SM,BGA, TRIDENT, INTEG
U703	5175772B06	IC,SERIAL INTERFACE I/O EXPANDER,QFN,24BITS,28-PORT I/O EXPA
U709	5171972L01	IC,SW,SP3T RF SW
U710	5171972L01	IC,SW,SP3T RF SW
U746	4805218N63	XSTR,GEN PURPOSE SMALL SIG,SOT-323,BROADBAND & XSTR BF
U1101	5188032U43	IC,SENSING CIRCUIT,INA138, SM,SOT-23/5,1PER PKG,PB FREE
U1102	5175772B03	RF SWITCH,RF SWITCH,10W, RECONFIGURABLE 10W SP5T/ 3T RF SWITC
U1103	5185070Y01	IC,TEMP SENS
U1104	5185941F56	IC,OP AMP,1PER PKG,RAIL-RAIL,SOIC,IC SNGL LV LP OP AMP
U1105	5180390L83	IC,CNTLR,SM,1PER PKG
U1106	5175772B05	IC,LTC5532ES6,SOT-23,1PER PKG,PRCN RF DET
U1111	5175771A26	IC,SW,50OHM,CMOS FET SW SPDT, 10WATTS
U1112	5175772B04	IC,HMC468LP3E,QFN,1 DB LSB GAAS MMIC ATTEN
U1113	5185941F56	IC,OP AMP,1PER PKG,RAIL-RAIL,SOIC,IC SNGL LV LP OP AMP
U1114	5185941F56	IC,OP AMP,1PER PKG,RAIL-RAIL,SOIC,IC SNGL LV LP OP AMP
U1116	5109522E93	GATE,OR,SN74LVC1G32YZPR, 1PER PKG,SM,2 INPUT IN NANO PKG
U1117	5103535B53	IC,INVTR,DL,NC7WZ04L6X,2PER PKG,SC70
U1118	5109522E93	GATE,OR,SN74LVC1G32YZPR, 1PER PKG,SM,2 INPUT IN NANO PKG
U1119	5109522E94	GATE,AND,1PER PKG,SM,2 INPUT IN NANO PKG
U1121	5114000B52	IC,XOR,LOGIC LEVEL SHIFTER,1PER PKG,SM,SOT-353,PB-FREE
U1125	5175206H01	IC,DAC,W/ 5 PPM/C INT REF
U1126	5109817F77	IC,COMPTR,LMV7275,SC70-5
U1127	5171779H01	IC,ANLG SW,SC70,SC70-6, 1PER PKG,SPDT ANLG SW
U1128	5188085K11	IC,NAND,SINGLE 2 INPUT, SN74LVC1G00YZPR,SM,GATE, POS,5 DSBGA,PB-
U1129	5175143H01	IC,WIDE SPLY RANGE OP AMP
U1130	5175143H01	IC,WIDE SPLY RANGE OP AMP
U1131	5109817F77	IC,COMPTR,LMV7275,SC70-5
U1132	5114007M28	IC,F-F/D,1PER PKG,17SZ74, N-I,SM,SOIC8,PB-FREE
U1133	5171779H01	IC,ANLG SW,SC70,SC70-6, 1PER PKG,SPDT ANLG SW
U1136	5109522E94	GATE,AND,1PER PKG,SM,2 INPUT IN NANO PKG
U1137	5164852H16	IC,TRANSLATING,2PER PKG, LVC2T45,TRANSCEIVER W/ VOLTAGE TRANSLATI
U1138	5164852H16	IC,TRANSLATING,2PER PKG, LVC2T45,TRANSCEIVER W/ VOLTAGE TRANSLATI
U1139	5164852H16	IC,TRANSLATING,2PER PKG, LVC2T45,TRANSCEIVER W/ VOLTAGE TRANSLATI
U1141	5185941F56	IC,OP AMP,1PER PKG,RAIL-RAIL,SOIC,IC SNGL LV LP OP AMP
U1142	5185941F56	IC,OP AMP,1PER PKG,RAIL-RAIL,SOIC,IC SNGL LV LP OP AMP
U1143	5185941F56	IC,OP AMP,1PER PKG,RAIL-RAIL,SOIC,IC SNGL LV LP OP AMP
U1144	5171779H01	IC,ANLG SW,SC70,SC70-6, 1PER PKG,SPDT ANLG SW
U1146	5109522E93	GATE,OR,SN74LVC1G32YZPR, 1PER PKG,SM,2 INPUT IN NANO PKG
U1147	5109522E94	GATE,AND,1PER PKG,SM, 2 INPUT IN NANO PKG
U1148	5185941F56	IC,OP AMP,1PER PKG,RAIL-RAIL,SOIC,IC SNGL LV LP OP AMP
U1149	5185941F45	ATTEN,VAR,14.4DBMIN,15.6DB MAX,0-2000 MHZFREQ,50OHM, PCMT,SOT-25
U1150	51009381001	IC,MICROPOWER SOT-23 V REF
U1304	5105739X13	IC,AMP,SIGE,QFN,QFN,18DB, 1.57GHZMIN,1.57GHZMAX, .9DB,SIGE GPS LO
U1601	5175143H01	IC,WIDE SPLY RANGE OP AMP
U1602	5115678H01	IC,RF AMPLIFIER,BGA, TSSOP16EP,30MHZMIN,941MHZMAX,VHF/UHF/800
U2032	4885316E32	XSTR,BIP RF SML SGNL,SLCN, BFR380F,SM,SMT,6V,380W,80A ,14MHZ,TR
VR101	4813977M29	DIODE,VREF,MBZ5250,SM,SOT-23,20V,.225W,ZEN
VR200	4813977M29	DIODE,VREF,MBZ5250,SM,SOT-23,20V,.225W,ZEN

Ref. Des.	Part Number	Description
VR601	4805656W87	DIODE,VCTR, @ 15V,1SV279, SOD-523/SC-79,SOD-523/SC-79
VR602	4805656W87	DIODE,VCTR, @ 15V,1SV279, SOD-523/SC-79,SOD-523/SC-79
VR2005	4815096H01	DIODE,VCTR, @ 10V,1SV305G, SM,VCTR DIODE 1SV305
VR2006	4815096H01	DIODE,VCTR, @ 10V,1SV305G, SM,VCTR DIODE 1SV305
VR2007	4815096H01	DIODE,VCTR, @ 10V,1SV305G, SM,VCTR DIODE 1SV305
VR2008	4815096H01	DIODE,VCTR, @ 10V,1SV305G, SM,VCTR DIODE 1SV305
VR2010	4815096H01	DIODE,VCTR, @ 10V,1SV305G, SM,VCTR DIODE 1SV305
VR2020	4815096H01	DIODE,VCTR, @ 10V,1SV305G, SM,VCTR DIODE 1SV305
Y701	4871886H01	OSC,TCXO,16.8MHZ,SM,16.8 MHZ VCTXO .8PPM
Y704	5164852H68	OSC,VOLTAGE CONTROLLED, 411MHZ MAX,270MHZ MIN,SM, M9LX7WX2.5H,I
Y705	5164852H66	OSC,VOLTAGE CONTROLLED, 520MHZ MAX,380MHZ MIN,SM, M9LX7WX2.5H,I

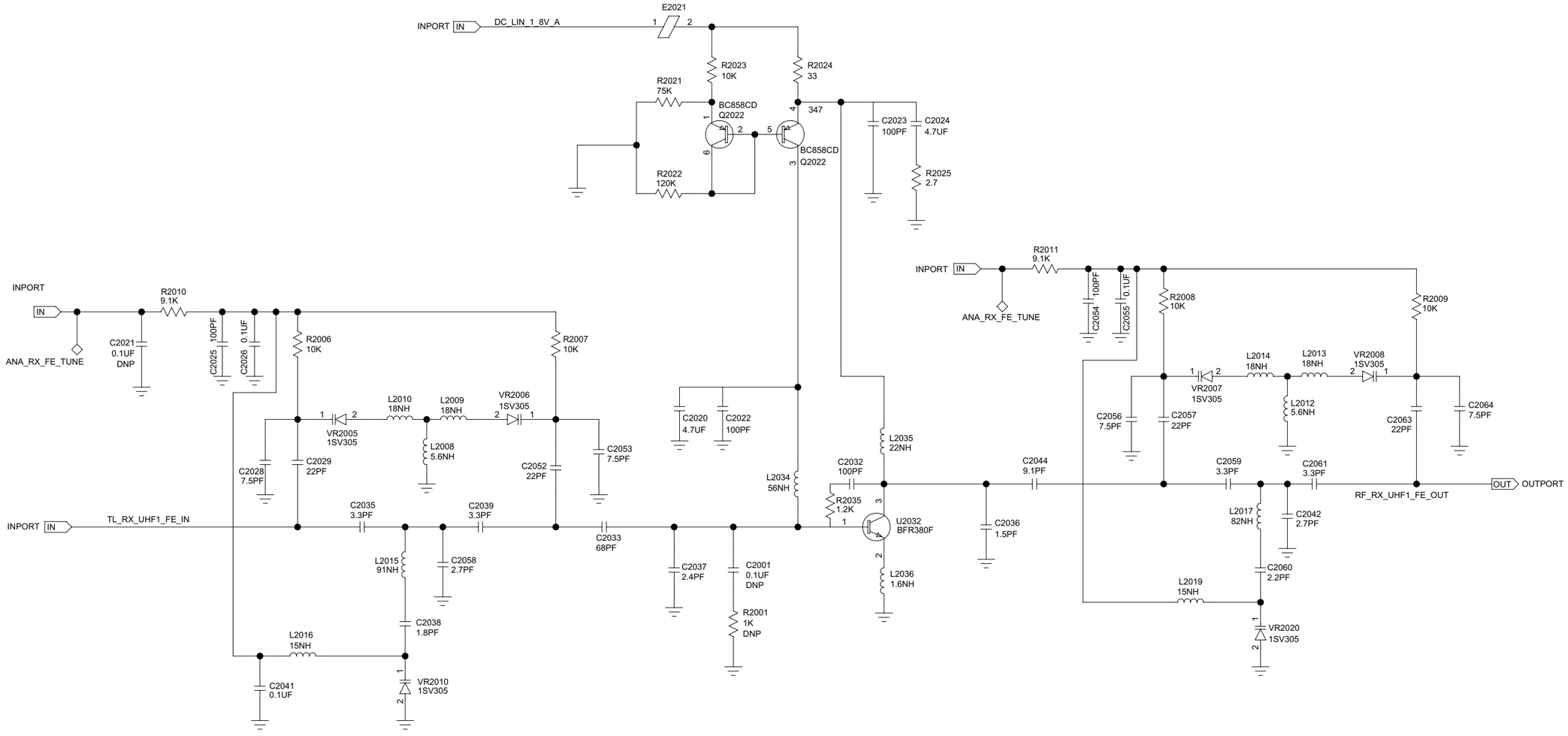


Figure 8-29. NUE7369A Receiver Front End Circuit

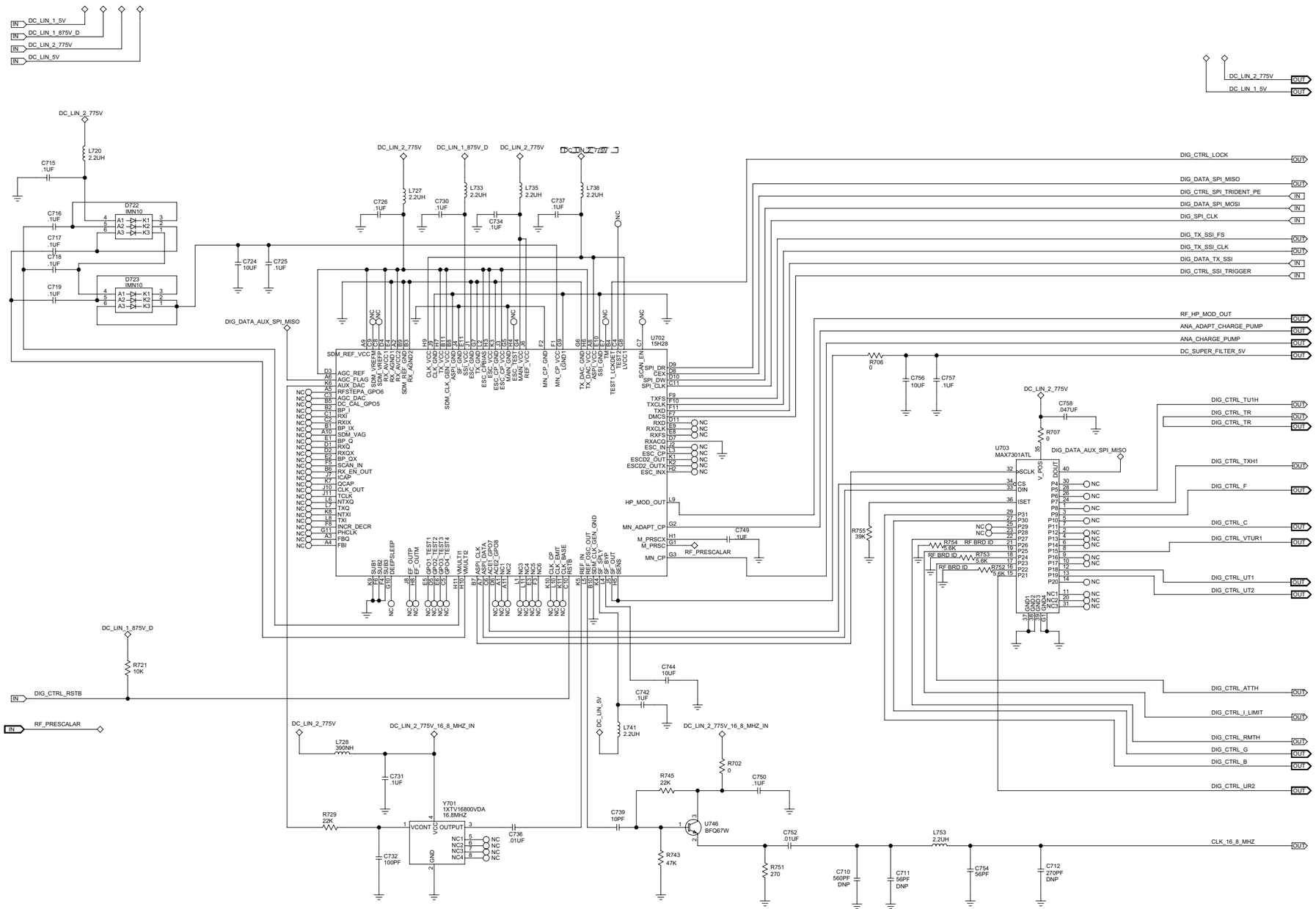


Figure 8-30. NUE7369A Frequency Generation Unit (Synthesizer) Circuit – 1 of 2

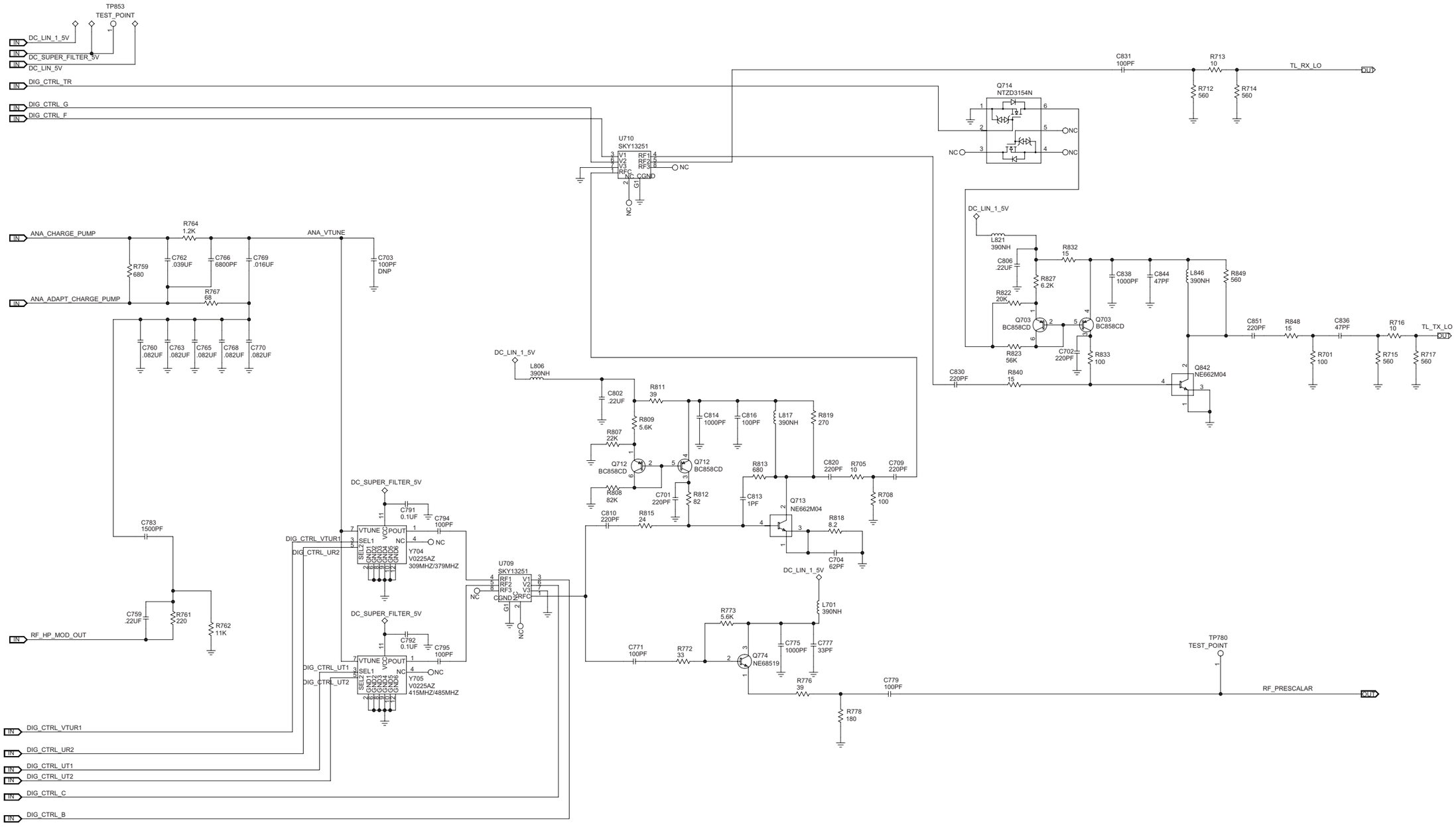


Figure 8-31. NUE7369A Frequency Generation Unit (VCO) Circuit – 2 of 2

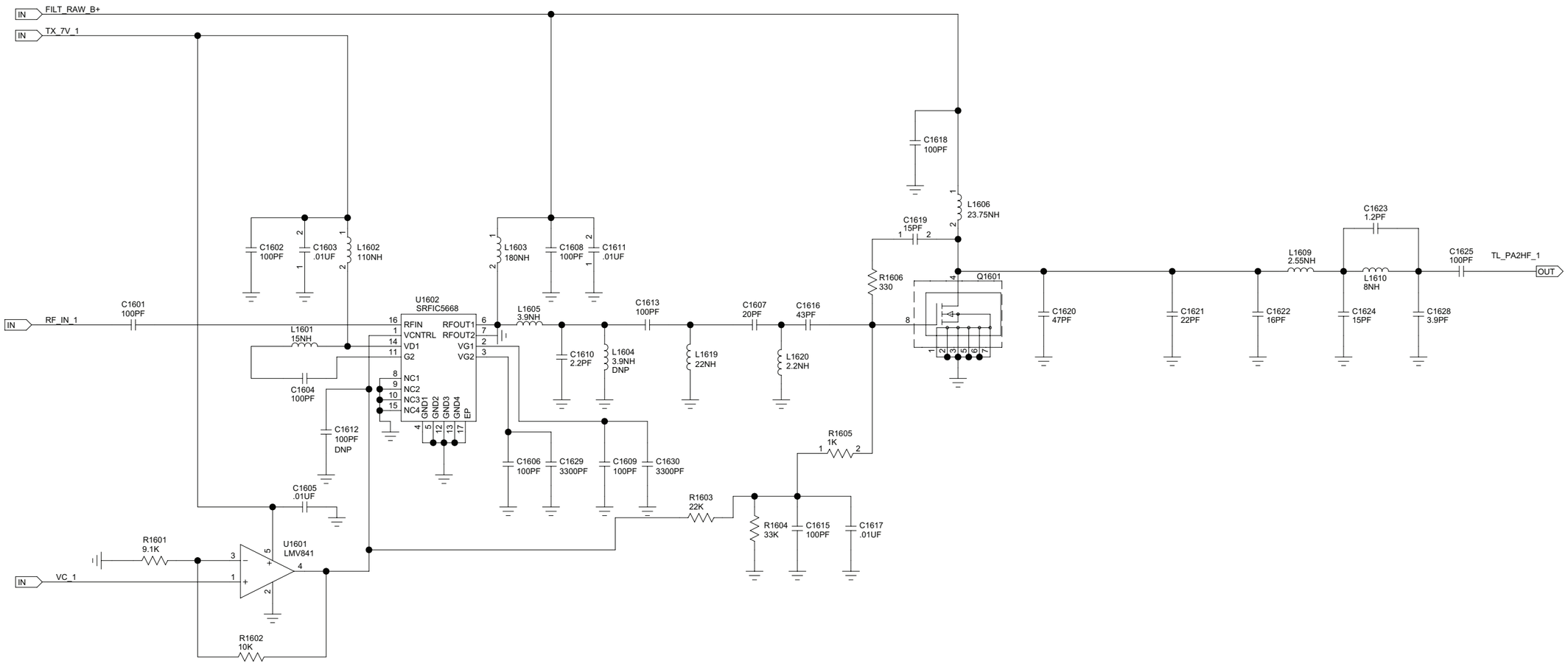


Figure 8-32. NUE7369A Power Amplifier Circuit

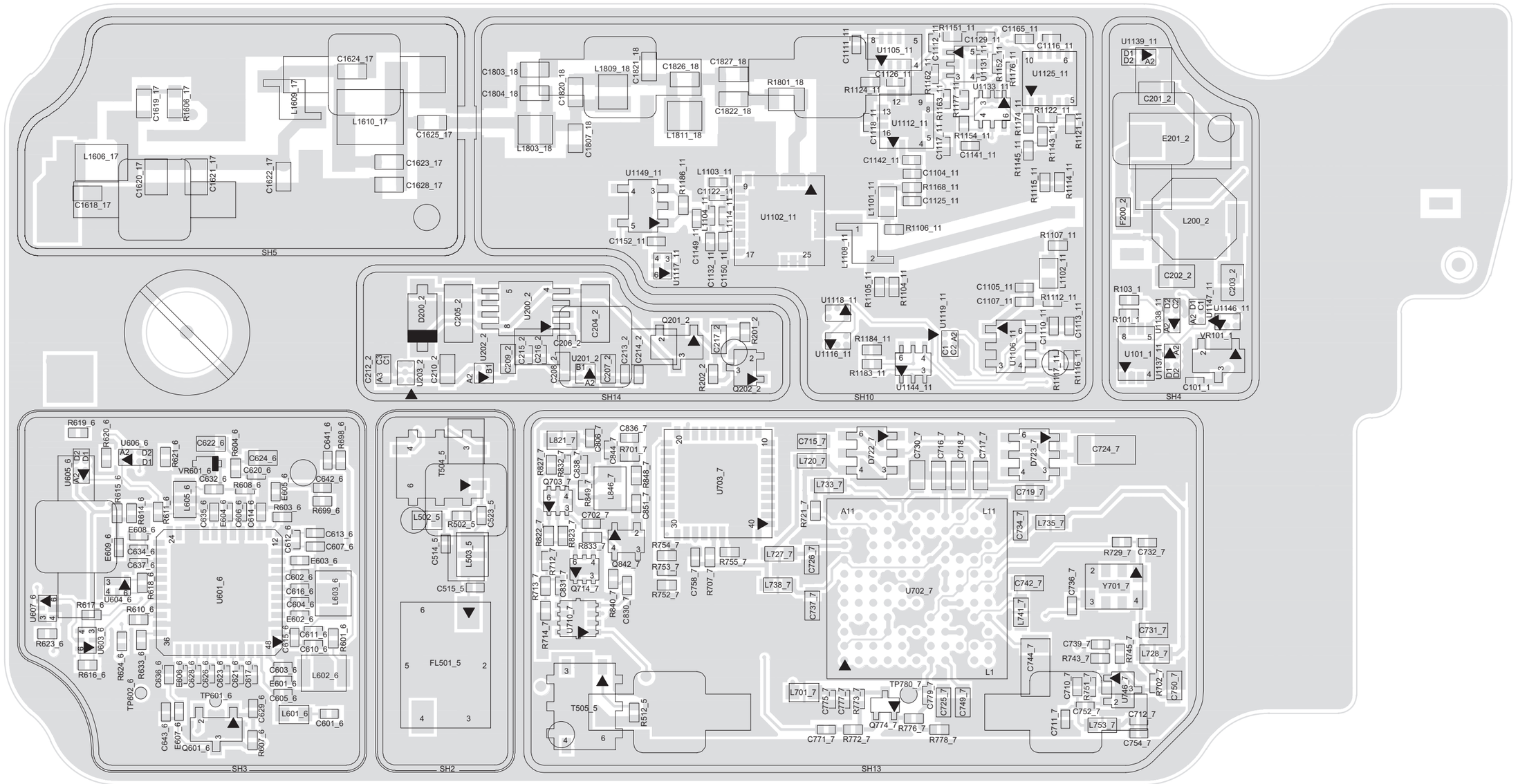


Figure 8-33. NUE7369A Transceiver (RF) Board Layout – Side 1

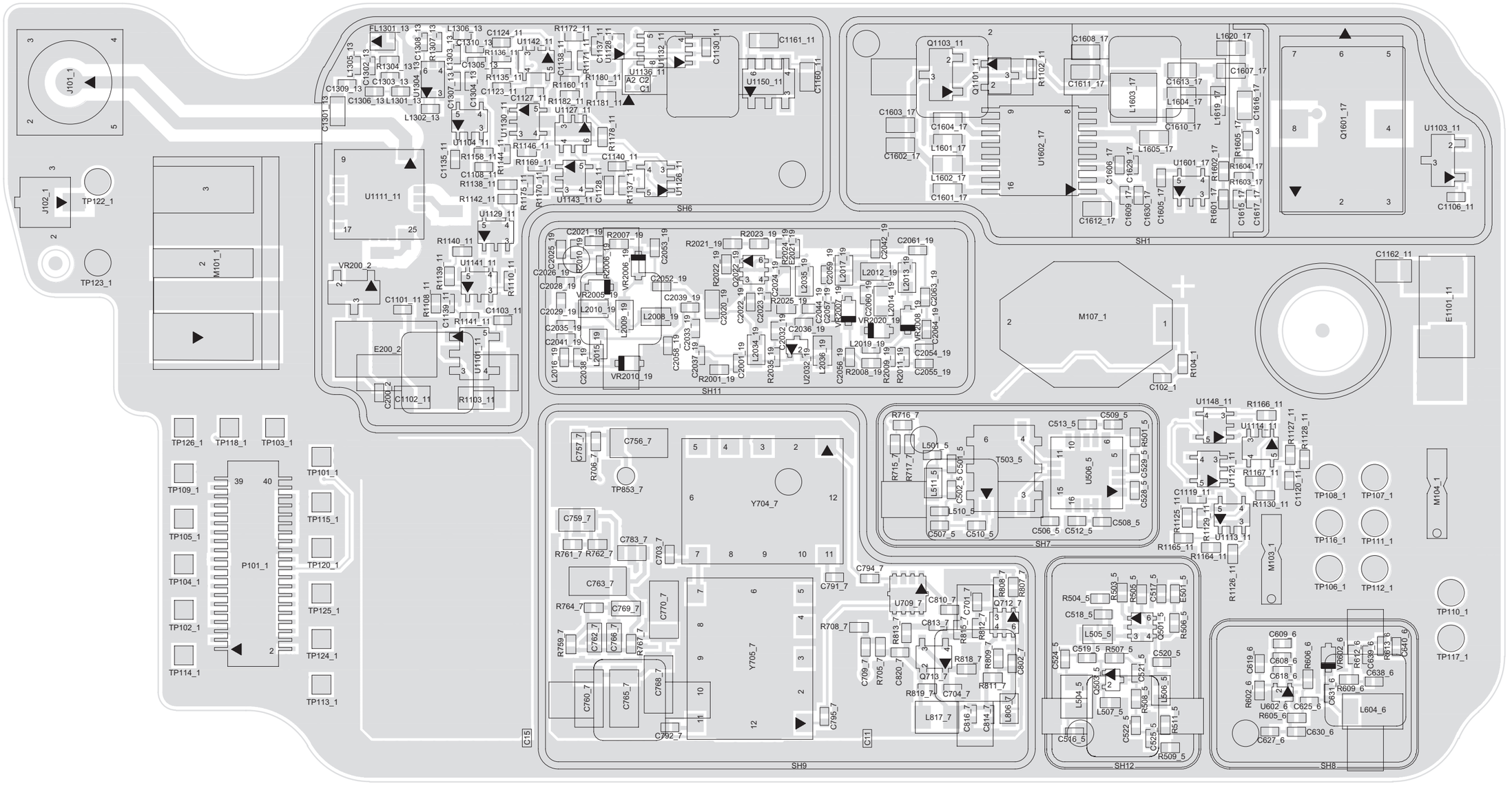


Figure 8-34. NUE7369A Transceiver (RF) Board Layout – Side 2

NUE7369A UHF1 Transceiver (RF) Board Parts List

Ref. Des.	Part Number	Description
C11	2113944A28	CAP CER CHP 18.0PF 50V 5%
C15	2113944A28	CAP CER CHP 18.0PF 50V 5%
C101	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C102	2113946B04	CAP CER CHP 0.10UF 10V 10%
C200	2113945B02	CAP CER CHP 10,000PF 25V 10%
C201	2188468Y01	CAP CER 25V X7R 0805 1UF
C202	2188468Y01	CAP CER 25V X7R 0805 1UF
C203	2188468Y01	CAP CER 25V X7R 0805 1UF
C204	2113955D35	CAP,FXD,4.7UF,+10%,-10%, 16V-DC
C205	2113955D35	CAP,FXD,4.7UF,+10%,-10%, 16V-DC
C206	2113945B02	CAP CER CHP 10,000PF 25V 10%
C207	2113956B91	CAP,FXD,1UF,+10%,-10%,16V-DC,0
C208	2113956B91	CAP,FXD,1UF,+10%,-10%,16V-DC,0
C209	2113956B91	CAP,FXD,1UF,+10%,-10%,16V-DC,0
C210	2113956B91	CAP,FXD,1UF,+10%,-10%,16V-DC,0
C212	2113946D07	CAP,CHIP,4.7UF,+10%,-10%, 6.3V-
C213	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C214	2113944A31	CAP CER CHP 33.0PF 50V 5%
C215	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C216	2113944A31	CAP CER CHP 33.0PF 50V 5%
C217	2113956B91	CAP,FXD,1UF,+10%,-10%,16V-DC,0
C501	2115153H41	CAP,CERAMIC CHIP,22PF,+1%, -1%,
C502	2115153H28	CAP, CERAMIC, COG
C506	2113946B04	CAP CER CHP 0.10UF 10V 10%
C507	2115153H41	CAP,CERAMIC CHIP,22PF,+1%, -1%,
C508	2113945A09	CAP CER CHP 1000PF 50V 10%
C509	2113945A09	CAP CER CHP 1000PF 50V 10%
C510	2113944A52	CAP CER CHP 1000.0 PF 50V 5%
C512	2113944A31	CAP CER CHP 33.0PF 50V 5%
C513	2113944A40	CAP CER CHP 100.0PF 50V 5%
C514	2113944A84	CAP,FXD,43PF,+5%,-5%,50V-DC,04
C515	2113944A21	CAP CER CHP 6.8PF 50V +/- 0.5P
C516	2113944A11	CAP CER CHP 2.7PF 50V +/- 0.25
C517	2113946B04	CAP CER CHP 0.10UF 10V 10%
C518	2113945A09	CAP CER CHP 1000PF 50V 10%
C519	2113944A28	CAP CER CHP 18.0PF 50V 5%
C520	2113945A09	CAP CER CHP 1000PF 50V 10%
C521	2113945A09	CAP CER CHP 1000PF 50V 10%
C522	2113944A27	CAP CER CHP 15.0PF 50V 5%
C523	2113944A48	CAP CER CHP 470.0 PF 50V 5%
C524	2113944A30	CAP CER CHP 27.0PF 50V 5%
C525	2113944A13	CAP CER CHP 3.3PF 50V +/- 0.25
C528	2113944A40	CAP CER CHP 100.0PF 50V 5%
C529	2113944A40	CAP CER CHP 100.0PF 50V 5%
C601	2113945B02	CAP CER CHP 10,000PF 25V 10%
C602	2113945B02	CAP CER CHP 10,000PF 25V 10%
C603	2113945B02	CAP CER CHP 10,000PF 25V 10%
C604	2113945B02	CAP CER CHP 10,000PF 25V 10%
C605	2113944A15	CAP CER CHP 3.9PF 50V +/- 0.25
C606	2113946B04	CAP CER CHP 0.10UF 10V 10%
C607	2113944A40	CAP CER CHP 100.0PF 50V 5%
C608	2113944A12	CAP CER CHP 3.0PF 50V +/- 0.25
C609	2113944A30	CAP CER CHP 27.0PF 50V 5%
C610	2113944A40	CAP CER CHP 100.0PF 50V 5%
C611	2113944A40	CAP CER CHP 100.0PF 50V 5%
C612	2113945B02	CAP CER CHP 10,000PF 25V 10%
C613	2113944A40	CAP CER CHP 100.0PF 50V 5%
C614	2113945B02	CAP CER CHP 10,000PF 25V 10%
C615	2113944A42	CAP CER CHP 150.0PF 50V 5%
C616	2113945A11	CAP CER CHP 2200PF 50V 10%
C617	2113946B04	CAP CER CHP 0.10UF 10V 10%
C618	2113944A31	CAP CER CHP 33.0PF 50V 5%
C619	2113944A35	CAP CER CHP 62.0PF 50V 5%
C620	2113946B04	CAP CER CHP 0.10UF 10V 10%
C621	2113946B04	CAP CER CHP 0.10UF 10V 10%
C622	2113946C07	CAP,FXD,.33UF,+10%,-10%, 10V-DC
C623	2113945B02	CAP CER CHP 10,000PF 25V 10%
C624	2113946C07	CAP,FXD,.33UF,+10%,-10%, 10V-DC
C625	2113944A28	CAP CER CHP 18.0PF 50V 5%
C626	2113945A09	CAP CER CHP 1000PF 50V 10%
C627	2113945A09	CAP CER CHP 1000PF 50V 10%
C628	2113945B02	CAP CER CHP 10,000PF 25V 10%
C629	2113946B04	CAP CER CHP 0.10UF 10V 10%
C630	2113946B04	CAP CER CHP 0.10UF 10V 10%
C631	2113944A27	CAP CER CHP 15.0PF 50V 5%
C632	2113944A40	CAP CER CHP 100.0PF 50V 5%
C634	2113946B04	CAP CER CHP 0.10UF 10V 10%
C635	2113945B02	CAP CER CHP 10,000PF 25V 10%
C636	2113946B04	CAP CER CHP 0.10UF 10V 10%
C637	2113946B04	CAP CER CHP 0.10UF 10V 10%
C638	2113945A12	CAP CER CHP 3300PF 50V 10%
C639	2113945B02	CAP CER CHP 10,000PF 25V 10%
C640	2113946B04	CAP CER CHP 0.10UF 10V 10%
C641	2113944A31	CAP CER CHP 33.0PF 50V 5%
C642	2113944A48	CAP CER CHP 470.0 PF 50V 5%
C643	2113944A48	CAP CER CHP 470.0 PF 50V 5%
C701	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C702	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C704	2113944A35	CAP CER CHP 62.0PF 50V 5%
C709	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C715	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C716	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C717	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C718	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C719	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C724	2113955D37	CAP,FXD,10UF,+10%,-10%,16V-DC,
C725	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C726	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C730	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C731	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C732	2113944A40	CAP CER CHP 100.0PF 50V 5%
C734	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C736	2113945B02	CAP CER CHP 10,000PF 25V 10%
C737	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C739	2113944A25	CAP CER CHP 10.0PF 50V +/- 0.5

Ref. Des.	Part Number	Description
C742	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C744	2113955D37	CAP,FXD,10UF,+10%,-10%,16V-DC,
C749	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C750	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C752	2113945B02	CAP CER CHP 10,000PF 25V 10%
C754	2113944A34	CAP CER CHP 56.0PF 50V 5%
C756	2113955D37	CAP,FXD,10UF,+10%,-10%,16V-DC,
C757	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C758	2113946B02	CAP CER CHP 0.047UF 10V 10,
C759	2113945G95	CAP,FXD,.22UF,+10%,-10%, 50V-DC
C760	2113944G97	CAP,FXD,.082UF,+5%,-5%,50V-DC,
C762	2113945C26	CAP,FXD,.039UF,+10%,-10%, 50V-D
C763	2113944G97	CAP,FXD,.082UF,+5%,-5%,50V-DC,
C765	2113944G97	CAP,FXD,.082UF,+5%,-5%,50V-DC,
C766	2113945C01	CAP CER CHP 6800PF 50V 10%
C768	2113944G97	CAP,FXD,.082UF,+5%,-5%,50V-DC,
C769	2113945C20	CAP,FXD,.016UF,+10%,-10%,50V-D
C770	2113944G97	CAP,FXD,.082UF,+5%,-5%,50V-DC,
C771	2113944A40	CAP CER CHP 100.0PF 50V 5%
C775	2113945A09	CAP CER CHP 1000PF 50V 10%
C777	2113944A31	CAP CER CHP 33.0PF 50V 5%
C779	2113944A40	CAP CER CHP 100.0PF 50V 5%
C783	2113944C53	CAP CER CHP 1500.OPF 50V 5
C791	2113946B04	CAP CER CHP 0.10UF 10V 10%
C792	2113946B04	CAP CER CHP 0.10UF 10V 10%
C794	2113944A40	CAP CER CHP 100.0PF 50V 5%

Ref. Des.	Part Number	Description
C795	2113944A40	CAP CER CHP 100.0PF 50V 5%
C802	2113946B06	CAP,CHIP,.22UF,+10%,-10%, 10V-D
C806	2113946B06	CAP,CHIP,.22UF,+10%,-10%, 10V-D
C810	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C813	2113944A63	CAP,FXD,1PF,.25PF+/-,50V-DC, 04
C814	2113945A09	CAP CER CHP 1000PF 50V 10%
C816	2113944A40	CAP CER CHP 100.0PF 50V 5%
C820	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C830	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C831	2113944A40	CAP CER CHP 100.0PF 50V 5%
C836	2113944A33	CAP CER CHP 47.0PF 50V 5%
C838	2113945A09	CAP CER CHP 1000PF 50V 10%
C844	2113944A33	CAP CER CHP 47.0PF 50V 5%
C851	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C1101	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1102	2188468Y01	CAP CER 25V X7R 0805 1UF
C1103	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1105	2113944A19	CAP CER CHP 5.6PF 50V +/- 0.5P
C1106	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1107	2113944A40	CAP CER CHP 100.0PF 50V 5%
C1108	2113946B03	CAP CER CHP 0.068UF 10V 10
C1110	2113944A40	CAP CER CHP 100.0PF 50V 5%
C1111	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,
C1112	2113945B01	CAP CER CHP 6800PF 25V 10%
C1113	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1116	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,

Ref. Des.	Part Number	Description
C1117	2113945A12	CAP CER CHP 3300PF 50V 10%
C1118	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1119	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1120	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1122	2175390H01	CAP, 2.2 PF, 0402, CERAMIC, 50
C1123	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1124	2113945A13	CAP CER CHP 4700PF 50V 10%
C1126	2113945A09	CAP CER CHP 1000PF 50V 10%
C1127	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,
C1128	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1129	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1130	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1137	2113945B04	CAP,FXD,.022UF,+10%,-10%,25V-D
C1138	2113945B04	CAP,FXD,.022UF,+10%,-10%,25V-D
C1139	2113944A25	CAP CER CHP 10.0PF 50V +/- 0.5
C1140	2113945A13	CAP CER CHP 4700PF 50V 10%
C1141	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,
C1142	2113945A09	CAP CER CHP 1000PF 50V 10%
C1149	2113944A40	CAP CER CHP 100.0PF 50V 5%
C1150	2175392H01	CAP, 1.2PF, 0402, CERAMIC, 50V
C1152	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C1160	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C1161	2113956B91	CAP,FXD,1UF,+10%,-10%,16V-DC,0

Ref. Des.	Part Number	Description
C1165	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,
C1301	2113944M20	CAP,FXD,12PF,+2%,-2%,50V-DC,06
C1302	2114036F74	CAP,FXD,1.8PF,.05PF+/-,25V-DC,
C1303	2113944A26	CAP CER CHP 12.0PF 50V 5%
C1304	2113945A09	CAP CER CHP 1000PF 50V 10%
C1305	2113944A30	CAP CER CHP 27.0PF 50V 5%
C1306	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1307	2113944A26	CAP CER CHP 12.0PF 50V 5%
C1308	2113944A28	CAP CER CHP 18.0PF 50V 5%
C1309	2175389H01	CAP,.5PF, CHIP, 0402, CERAMIC,
C1310	2113944A17	CAP CER CHP 4.7PF 50V +/- 0.25
C1601	2113944M42	CAP,FXD,100PF,+2%,-2%,50V-DC,0
C1602	2113944M42	CAP,FXD,100PF,+2%,-2%,50V-DC,0
C1603	2113945L49	CAP,FXD,.01UF,+5%,-5%,50V-DC,0
C1604	2113944M42	CAP,FXD,100PF,+2%,-2%,50V-DC,0
C1605	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1606	2113944A40	CAP CER CHP 100.0PF 50V 5%
C1607	2113944M25	CAP,FXD,20PF,+2%,-2%,50V-DC,06
C1608	2113944M42	CAP,FXD,100PF,+2%,-2%,50V-DC,0
C1609	2113944A40	CAP CER CHP 100.0PF 50V 5%
C1610	2113944M02	CAP,FXD,2.2PF,.1PF+/-,50V-DC,0
C1611	2113945L49	CAP,FXD,.01UF,+5%,-5%,50V-DC,0
C1613	2113944M42	CAP,FXD,100PF,+2%,-2%,50V-DC,0
C1615	2113944A40	CAP CER CHP 100.0PF 50V 5%
C1616	2113944M33	CAP,FXD,43PF,+2%,-2%,50V-DC,06

Ref. Des.	Part Number	Description
C1617	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1618	2113944M42	CAP,FXD,100PF,+2%,-2%,50V-DC,0
C1619	2113944M22	CAP,FXD,15PF,+2%,-2%,50V-DC,06
C1620	2171741M01	HIGH Q CAP
C1621	2171741M08	HIGH Q CAP, 22 PF
C1622	2113944M23	CAP,FXD,16PF,+2%,-2%,50V-DC,06
C1623	2113944C08	CAP CER CHP 1.2PF 50V +/-0.25
C1624	2113944M22	CAP,FXD,15PF,+2%,-2%,50V-DC,06
C1625	2113944M42	CAP,FXD,100PF,+2%,-2%,50V-DC,0
C1628	2113944M08	CAP,FXD,3.9PF,.1PF+/-,50V-DC,0
C1629	2113945A12	CAP CER CHP 3300PF 50V 10%
C1630	2113945A12	CAP CER CHP 3300PF 50V 10%
C1803	2113944M08	CAP,FXD,3.9PF,.1PF+/-,50V-DC,0
C1804	2113944M08	CAP,FXD,3.9PF,.1PF+/-,50V-DC,0
C1807	2113944M14	CAP,FXD,6.8PF,.1PF+/-,50V-DC,0
C1820	2113944M08	CAP,FXD,3.9PF,.1PF+/-,50V-DC,0
C1821	2113944M17	CAP,FXD,9.1PF,.1PF+/-,50V-DC,0
C1822	2113944M42	CAP,FXD,100PF,+2%,-2%,50V-DC,0
C1826	2113944M04	CAP,FXD,2.7PF,.1PF+/-,50V-DC,0
C1827	2113944M10	CAP,FXD,4.7PF,.1PF+/-,50V-DC,0
C2020	2113946D07	CAP,CHIP,4.7UF,+10%,-10%,6.3V-
C2022	2113944A40	CAP CER CHP 100.0PF 50V 5%
C2023	2113944A40	CAP CER CHP 100.0PF 50V 5%
C2024	2113946D07	CAP,CHIP,4.7UF,+10%,-10%,6.3V-

Ref. Des.	Part Number	Description
C2025	2113944A40	CAP CER CHP 100.0PF 50V 5%
C2026	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2028	2115153H24	CAP, CERAMIC, COG
C2029	2115153H41	CAP,CERAMIC CHIP,22PF,+1%,-1%,
C2032	2115153H57	CAP, CERAMIC, COG
C2033	2115153H53	CAP, CERAMIC, COG
C2035	2115153H15	CAP, CERAMIC, COG
C2036	2115153H07	CAP, CERAMIC, COG
C2037	2115153H12	CAP, CERAMIC, COG
C2038	2115153H09	CAP, CERAMIC, COG
C2039	2115153H15	CAP, CERAMIC, COG
C2041	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2042	2115153H13	CAP, CERAMIC, COG
C2044	2115153H26	CAP, CERAMIC, COG
C2052	2115153H41	CAP,CERAMIC CHIP,22PF,+1%,-1%,
C2053	2115153H24	CAP, CERAMIC, COG
C2054	2113944A40	CAP CER CHP 100.0PF 50V 5%
C2055	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2056	2115153H24	CAP, CERAMIC, COG
C2057	2115153H41	CAP,CERAMIC CHIP,22PF,+1%,-1%,
C2058	2115153H13	CAP, CERAMIC, COG
C2059	2115153H15	CAP, CERAMIC, COG
C2060	2115153H11	CAP, CERAMIC, COG
C2061	2115153H15	CAP, CERAMIC, COG
C2063	2115153H41	CAP,CERAMIC CHIP,22PF,+1%,-1%,
C2064	2115153H24	CAP, CERAMIC, COG
D200	4813978A19	DIODE,RECT,MBR120,SM,SOD-123,1
D722	4815011H01	DIODE TRIPLE
D723	4815011H01	DIODE TRIPLE
E200	2405688Z01	INDUCTOR FERRITE BEAD
E201	2405688Z01	INDUCTOR FERRITE BEAD
E501	2480640Z01	SURFACE MOUNT FERRITE BEAD
E601	2480640Z01	SURFACE MOUNT FERRITE BEAD

Ref. Des.	Part Number	Description
E602	2480640Z01	SURFACE MOUNT FERRITE BEAD
E603	2480640Z01	SURFACE MOUNT FERRITE BEAD
E604	2480640Z01	SURFACE MOUNT FERRITE BEAD
E605	2480640Z01	SURFACE MOUNT FERRITE BEAD
E606	2480640Z01	SURFACE MOUNT FERRITE BEAD
E607	2480640Z01	SURFACE MOUNT FERRITE BEAD
E608	2480640Z01	SURFACE MOUNT FERRITE BEAD
E609	2480640Z01	SURFACE MOUNT FERRITE BEAD
E1101	2405688Z01	INDUCTOR FERRITE BEAD
E2021	2480640Z01	SURFACE MOUNT FERRITE BEAD
F200	6575834B01	FUSE SURFACE MOUNT
FL501	91009300001	FILTER,MONOLITHIC CRYSTAL,BAND
FL1301	9102190J23	FLTR,SAW,BANDPASS,1.57542 GHZ N
J101	0909901V02	RECP SMT MCX
J102	0975886B01	RECEPTACLE, COAX CABLE
L200	2571269C01	INDUCTOR WW POWER 20%
L501	24012011014	0402 HIGH Q CHIP INDUCTOR
L502	2415429H30	CHIP INDUCTOR
L503	2414032F38	IDCTR,WW,220NH,5%,400MA,.7OHM,
L504	2414032F41	IDCTR,WW,390NH,10%,200MA,1.5OH
L505	2415429H39	CHIP INDUCTOR
L506	2415429H39	CHIP INDUCTOR
L507	2415427H36	CHIP INDUCTOR
L510	24012011020	0402 HIGH Q CHIP INDUCTOR
L511	2478057A13	7.5 NH SURFACE MOUNT INDUCTOR
L601	2415429H43	CHIP INDUCTOR
L602	2466505A01	COIL INDUCTOR
L603	2466505A01	COIL INDUCTOR

Ref. Des.	Part Number	Description
L604	2414032D16	IDCTR,WW,120NH,5%,800MA,.26OHM
L605	2414017Q54	IDCTR,FXD,3.9UH,10%,30MA,.9OHM
L701	2415429H47	CHIP INDUCTOR
L720	2480646Z20	COIL MULTI-LAYER CHIP(2.20UH)
L727	2480646Z20	COIL MULTI-LAYER CHIP(2.20UH)
L728	2415429H47	CHIP INDUCTOR
L733	2480646Z20	COIL MULTI-LAYER CHIP(2.20UH)
L735	2480646Z20	COIL MULTI-LAYER CHIP(2.20UH)
L738	2480646Z20	COIL MULTI-LAYER CHIP(2.20UH)
L741	2480646Z20	COIL MULTI-LAYER CHIP(2.20UH)
L753	2480646Z20	COIL MULTI-LAYER CHIP(2.20UH)
L806	2415429H47	CHIP INDUCTOR
L817	2414032F41	IDCTR,WW,390NH,10%,200MA,1.5OH
L821	2415429H47	CHIP INDUCTOR
L846	2414032F41	IDCTR,WW,390NH,10%,200MA,1.5OH
L1101	2415429H26	CHIP INDUCTOR
L1102	2415429H10	CHIP INDUCTOR
L1103	2475393H01	INDUCTOR, 4.7NH, 0402, +/-0.1NH
L1104	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
L1108	2409348J04	IND AIR CORE 5.45NH 5% 2214
L1114	2475394H01	INDUCTOR, 11NH, 0402, +/-2%
L1301	2488090Y07	INDUCTOR,MULTILAYER,3.3NH,1005
L1302	2488090Y25	INDUCTOR,MULTILAYER,100NH,1005
L1303	2414017P25	IDCTR,CHIP,100NH,5%,100MA,5.5O
L1305	2475391H01	INDUCTOR, 18 NH, CHIP, 0402, 2
L1306	2488090Y10	INDUCTOR,MULTILAYER,5.6NH,1005

Ref. Des.	Part Number	Description
L1601	2414017H14	IDCTR,CHIP,15NH,5%,3A, .32OHM,C
L1602	2415429H37	CHIP INDUCTOR
L1603	2414015A07	IDCTR,FXD,180NH,2%,750MA, .77OH
L1605	2414017H07	IDCTR,CHIP,3.9NH,300MA, .14OHM,
L1606	2460591E24	COIL AIR WOUND INDUC 23.75
L1609	2415428H02	AIR WOUND INDUCTOR
L1610	2415385H01	8 NH MINISPRING AIR CORE INDUC
L1619	2414017H16	IDCTR,CHIP,22NH,5%,300MA, .4OHM
L1620	2414017H04	IDCTR,CHIP,2.2NH,300MA, .1OHM,C
L1803	2471884M01	10.2NH SQUARE SPRING
L1809	2471884M01	10.2NH SQUARE SPRING
L1811	2471884M01	10.2NH SQUARE SPRING
L2008	2478057A09	5.6 NH SURFACE MOUNT INDUCTOR
L2009	2478057A23	18 NH SURFACE MOUNT INDUCTOR
L2010	2478057A23	18 NH SURFACE MOUNT INDUCTOR
L2012	2478057A09	5.6 NH SURFACE MOUNT INDUCTOR
L2013	2478057A23	18 NH SURFACE MOUNT INDUCTOR
L2014	2478057A23	18 NH SURFACE MOUNT INDUCTOR
L2015	2478057A41	0306 HIGH Q CHIP INDUCTOR
L2016	2414017P15	IDCTR,CHIP,15NH,5%,300MA, .65OH
L2017	2478057A40	0306 HIGH Q CHIP INDUCTOR
L2019	2414017P15	IDCTR,CHIP,15NH,5%,300MA, .65OH
L2034	2478057A29	0306 HIGH Q CHIP INDUCTOR
L2035	2478057A24	22 NH SURFACE MOUNT INDUCTOR
L2036	2415429H01	CHIP INDUCTOR
M1	3275623B03	PAD, THERMAL ELECTRIC, MID-TIE
M2	75009299002	PAD, THERMAL

Ref. Des.	Part Number	Description
M3	1104959T01	COATING-CONTACT
M4	6071520M01	BATT COIN 3V LI RECHARGEABLE
M101	2871616H02	CONNECTOR, BPLUS
M103	3987977Y04	CONT,CONN,1CONT,ANT UNIV 4.
M104	3987977Y04	CONT,CONN,1CONT,ANT UNIV 4.
M107	0985888K02	SKT RTC BTTY LEAP
P101	2887818K05	PLUG 40PIN MATING CNTCR 1.5MM
PWB	84009550002	PCB, RF TRANSCEIVER
Q201	4813970A59	P-CH FET 1.0A 20V SOT-23 T&R
Q202	4813973A32	XSTR,BIP GP SS,NPN,SM,SC-70,SM
Q501	4813973M75	XSTR,BIP GP SS,PNP,BC858,SOT-5
Q503	4885316E32	TRANSISTOR, RF
Q601	4813973A04	XSTR,BIP GP SS,NPN,TA13,SM,SOT
Q703	4813973M75	XSTR,BIP GP SS,PNP,BC858, SOT-5
Q712	4813973M75	XSTR,BIP GP SS,PNP,BC858, SOT-5
Q713	4805585Q32	TRANSITOR, NPN RF
Q714	4889394V04	XSTR,FET GEN PURPOSE SMALL SIG
Q774	4885061Y01	XSTR NPN 6V 30UA 12GHZ PB-FREE
Q842	4805585Q32	TRANSITOR, NPN RF
Q1101	4813973A32	XSTR,BIP GP SS,NPN,SM,SC-70,SM
Q1103	4813970A59	P-CH FET 1.0A 20V SOT-23 T&R
Q1601	5185633C92	MODULE,RING,XSTR, FET RF POWER
Q2022	4813973M75	XSTR,BIP GP SS,PNP,BC858, SOT-5
R101	0613952R01	CER CHIP RES 10K OHM 5% 0402
R103	0613952R01	CER CHIP RES 10K OHM 5% 0402

Ref. Des.	Part Number	Description
R104	0613952Q80	CER CHIP RES 2000 OHM 5 0402
R201	0613952R25	CER CHIP RES 100K OHM 5% 0402
R202	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R502	0613952Q45	CER CHIP RES 68.0 OHM 5 0402
R503	0613952R10	CER CHIP RES 24K OHM 5 0402
R504	0613952Q85	CER CHIP RES 3300 OHM 5 0402
R505	0613952R31	CER CHIP RES 180K OHM 5% 0402
R506	0613952Q53	CER CHIP RES 150 OHM 5 0402
R507	0613952Q83	CER CHIP RES 2700 OHM 5 0402
R508	0613952Q29	CER CHIP RES 15.0 OHM 5 0402
R509	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R511	0613952Q11	CER CHIP RES 2.7 OHM 5 0402
R601	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R602	0613952Q63	CER CHIP RES 390 OHM 5 0402
R603	0613952R25	CER CHIP RES 100K OHM 5% 0402
R604	0613952Q63	CER CHIP RES 390 OHM 5 0402
R605	0613952R01	CER CHIP RES 10K OHM 5% 0402
R606	0613952R01	CER CHIP RES 10K OHM 5% 0402
R607	0613952R25	CER CHIP RES 100K OHM 5% 0402
R608	0613952R01	CER CHIP RES 10K OHM 5% 0402
R609	0613952Q81	CER CHIP RES 2200 OHM 5 0402
R610	0613952R25	CER CHIP RES 100K OHM 5% 0402
R611	0613952R01	CER CHIP RES 10K OHM 5% 0402

Ref. Des.	Part Number	Description
R612	0613952Q94	CER CHIP RES 7500 OHM 5 0402
R613	0613952Q82	CER CHIP RES 2400 OHM 5 0402
R614	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R633	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R698	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R699	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R701	0613952Q49	CER CHIP RES 100 OHM 5 0402
R702	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R705	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R706	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R707	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R708	0613952Q49	CER CHIP RES 100 OHM 5 0402
R712	0613952Q67	CER CHIP RES 560 OHM 5 0402
R713	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R714	0613952Q67	CER CHIP RES 560 OHM 5 0402
R715	0613952Q67	CER CHIP RES 560 OHM 5 0402
R716	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R717	0613952Q67	CER CHIP RES 560 OHM 5 0402
R721	0613952R01	CER CHIP RES 10K OHM 5% 0402
R729	0613952R09	CER CHIP RES 22K OHM 5% 0402
R743	0613952R17	CER CHIP RES 47K OHM 5% 0402
R745	0613952R09	CER CHIP RES 22K OHM 5% 0402

Ref. Des.	Part Number	Description
R751	0613952Q59	CER CHIP RES 270 OHM 5 0402
R752	0613952Q91	CER CHIP RES 5600 OHM 5 0402
R753	0613952Q91	CER CHIP RES 5600 OHM 5 0402
R754	0613952Q91	CER CHIP RES 5600 OHM 5 0402
R755	0613952R15	CER CHIP RES 39K OHM 5% 0402
R759	0613952Q69	CER CHIP RES 680 OHM 5 0402
R761	0613952Q57	CER CHIP RES 220 OHM 5 0402
R762	0613952R02	CER CHIP RES 11K OHM 5 0402
R764	0613952Q75	CER CHIP RES 1200 OHM 5 0402
R767	0613952Q45	CER CHIP RES 68.0 OHM 5 0402
R772	0613952Q37	CER CHIP RES 33.0 OHM 5 0402
R773	0613952Q91	CER CHIP RES 5600 OHM 5 0402
R776	0613952Q39	CER CHIP RES 39.0 OHM 5 0402
R778	0613952Q55	CER CHIP RES 180 OHM 5 0402
R807	0613952R09	CER CHIP RES 22K OHM 5% 0402
R808	0613952R23	CER CHIP RES 82K OHM 5% 0402
R809	0613952Q91	CER CHIP RES 5600 OHM 5 0402
R811	0613952Q39	CER CHIP RES 39.0 OHM 5 0402
R812	0613952Q47	CER CHIP RES 82.0 OHM 5% 0402
R813	0613952Q69	CER CHIP RES 680 OHM 5 0402
R815	0613952Q34	CER CHIP RES 24.0 OHM 5 0402
R818	0613952Q23	CER CHIP RES 8.2 OHM 5 0402
R819	0613952Q59	CER CHIP RES 270 OHM 5 0402

Ref. Des.	Part Number	Description
R822	0613952R08	CER CHIP RES 20K OHM 5 0402
R823	0613952R19	CER CHIP RES 56K OHM 5% 0402
R827	0613952Q92	CER CHIP RES 6200 OHM 5 0402
R832	0613952Q29	CER CHIP RES 15.0 OHM 5 0402
R833	0613952Q49	CER CHIP RES 100 OHM 5 0402
R840	0613952Q29	CER CHIP RES 15.0 OHM 5 0402
R848	0613952Q29	CER CHIP RES 15.0 OHM 5 0402
R849	0613952Q67	CER CHIP RES 560 OHM 5 0402
R1102	0613952R25	CER CHIP RES 100K OHM 5% 0402
R1103	6009259001	LOW RESISTANCE THICK FILM RESI
R1104	0613952Q49	CER CHIP RES 100 OHM 5 0402
R1105	0613952Q49	CER CHIP RES 100 OHM 5 0402
R1106	0613952Q21	CER CHIP RES 6.8 OHM 5 0402
R1107	0613952Q45	CER CHIP RES 68.0 OHM 5 0402
R1108	0613952R23	CER CHIP RES 82K OHM 5% 0402
R1110	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1114	0613952Q49	CER CHIP RES 100 OHM 5 0402
R1115	0613952Q49	CER CHIP RES 100 OHM 5 0402
R1116	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1117	0613952R22	CER CHIP RES 75K OHM 5 0402
R1121	0613952R12	CER CHIP RES 30K OHM 5 0402
R1122	0613952R22	CER CHIP RES 75K OHM 5 0402
R1124	0613952Q42	CER CHIP RES 51.0 OHM 5 0402

Ref. Des.	Part Number	Description
R1125	0613952R09	CER CHIP RES 22K OHM 5% 0402
R1126	0613952Q96	CER CHIP RES 9100 OHM 5 0402
R1127	0613952R17	CER CHIP RES 47K OHM 5% 0402
R1128	0613952R09	CER CHIP RES 22K OHM 5% 0402
R1135	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R1136	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1137	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1138	0613952R25	CER CHIP RES 100K OHM 5% 0402
R1139	0613952R25	CER CHIP RES 100K OHM 5% 0402
R1140	0613952R25	CER CHIP RES 100K OHM 5% 0402
R1141	0613952R42	CER CHIP RES 510K OHM 5 0402
R1142	0613952R25	CER CHIP RES 100K OHM 5% 0402
R1143	0613952R25	CER CHIP RES 100K OHM 5% 0402
R1144	0613952R25	CER CHIP RES 100K OHM 5% 0402
R1145	0613952R25	CER CHIP RES 100K OHM 5% 0402
R1146	0613952R25	CER CHIP RES 100K OHM 5% 0402
R1151	0613952R05	CER CHIP RES 15K OHM 5% 0402
R1152	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1154	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1160	0613952R03	CER CHIP RES 12K OHM 5% 0402
R1162	0613952R29	CER CHIP RES 150K OHM 5% 0402
R1163	0613952R01	CER CHIP RES 10K OHM 5% 0402

Ref. Des.	Part Number	Description
R1164	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1165	0613952Q56	CER CHIP RES 200 OHM 5 0402
R1166	0613952Q56	CER CHIP RES 200 OHM 5 0402
R1167	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1168	0613952Q49	CER CHIP RES 100 OHM 5 0402
R1169	0613952P52	CER CHIP RES 340K OHM 1 0402
R1170	0613952P01	CER CHIP RES 100K OHM 1 0402
R1171	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R1172	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R1174	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1175	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R1176	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R1177	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R1178	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1180	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R1182	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1183	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R1184	0613952Q81	CER CHIP RES 2200 OHM 5 0402
R1307	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R1601	0613952Q96	CER CHIP RES 9100 OHM 5 0402
R1602	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1603	0613952R09	CER CHIP RES 22K OHM 5% 0402

Ref. Des.	Part Number	Description
R1604	0613952R13	CER CHIP RES 33K OHM 5% 0402
R1605	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R1606	0613952H61	CER CHIP RES 330 OHM 5 0603
R1801	0685524Y01	RES,ZERO OHM,0805
R2006	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2007	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2008	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2009	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2010	0613952Q96	CER CHIP RES 9100 OHM 5 0402
R2011	0613952Q96	CER CHIP RES 9100 OHM 5 0402
R2021	0613952R22	CER CHIP RES 75K OHM 5 0402
R2022	0613952R27	CER CHIP RES 120K OHM 5% 0402
R2023	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2024	0613952Q37	CER CHIP RES 33.0 OHM 5 0402
R2025	0613952Q11	CER CHIP RES 2.7 OHM 5 0402
R2035	0613952Q75	CER CHIP RES 1200 OHM 5 0402
SH1	26009322001	SHIELD, RF PA
SH2	2675872B01	SHIELD, XTAL
SH3	2675873B01	SHIELD, ABACUS
SH4	26009323001	SHIELD, DC FILTER
SH5	26009327001	SHIELD, OUTPUT MATCH
SH6	26009320001	SHIELD, ALC
SH7	2675874B01	SHIELD, MIXER
SH8	2675932B01	SHIELD, 2ND LO VCO
SH9	26009319001	SHIELD, VCO
SH10	26009324001	SHIELD, HARMONIC FILTER
SH11	26009321001	SHIELD, RX FRONT END
SH12	2675933B01	SHIELD, IF AMP
SH13	26009325001	SHIELD, FGU
SH14	26009326001	SHIELD, DC REGULATOR
T503	2575851B01	RF TRANSFORMER BALUN
T504	2575851B01	RF TRANSFORMER BALUN
T505	2575851B01	RF TRANSFORMER BALUN
U101	51009861001	EEPROM 32KBIT SERIAL SPI BUS
U101	5105443X07	EEPROM 32KBIT SERIAL SPI BUS
U200	5188493T01	IC,VREG/SWG,LP2989,SM,MINI SO-
U201	5175771A99	LOW NOISE, 100MA LINEAR REGULA
U202	5175772B02	LINEAR REGULATOR 100MA 1.8V
U203	5175772B01	LINEAR VOLTAGE REGULATOR 350MA
U506	5164852H82	IC, MIXER/ BUFFER
U601	5102495J14	IC,IF,IF DIGITILIZING SUBSYST
U602	4885316E32	TRANSISTOR, RF
U603	5109522E84	IC DUAL SCHMITT TRIG MICRO PAK
U604	5109522E84	IC DUAL SCHMITT TRIG MICRO PAK
U605	5164852H16	IC TRANSCEIVER W/LEVEL TRANSLA
U606	5164852H16	IC TRANSCEIVER W/LEVEL TRANSLA
U607	5186311J24	IC,BFR,1BITS,NC7SZ125,ACTIVE H
U702	5164015H28	IC,TRIDENT,INTEG SYNTH,RX/TX B
U703	5175772B06	28-PORT I/O EXPANDER
U709	5171972L01	SP3T RF SWITCH
U710	5171972L01	SP3T RF SWITCH
U746	4805218N63	RF TRANS SOT 323 BFQ67W
U1101	5188032U43	IC,SENSING CIRCUIT,INA138,SM,S
U1102	5175772B03	RECONFIGURABLE 10W SP5T/3T RF
U1103	5185070Y01	IC TEMPERATURE SENSOR PB-FREE
U1104	5185941F56	IC SINGLE LV LP OP AMPLIFIER
U1105	5180390L83	IC,CNTLR,SM,1PER PKG
U1106	5175772B05	PRECISION RF DETECTOR
U1111	5175771A26	CMOS FET SWITCH SPDT, 10WATTS
U1112	5175772B04	1 DB LSB GAAS MMIC ATTENUATOR
U1113	5185941F56	IC SINGLE LV LP OP AMPLIFIER
U1114	5185941F56	IC SINGLE LV LP OP AMPLIFIER
U1116	5109522E93	2 INPUT OR GATE IN NANO PACKAG
U1117	5103535B53	IC,INVTR,DL,NC7WZ04L6X, 2PER PK
U1118	5109522E93	2 INPUT OR GATE IN NANO PACKAG
U1119	5109522E94	2 INPUT AND GATE IN NANO PACKA
U1121	5114000B52	IC,XOR,LOGIC LEVEL SHIFTER,1PE
U1125	51009382001	IC, QUAD DAC
U1126	5109817F77	IC COMPTR LM7275 5SC70 (D54)
U1127	5171779H01	SPDT ANALOG SWITCH
U1128	5188085K11	IC, SINGLE NAND GATE, 2-INPUT,
U1129	5175143H01	WIDE SUPPLY RANGE OP AMP
U1130	5175143H01	WIDE SUPPLY RANGE OP AMP
U1131	5109817F77	IC COMPTR LM7275 5SC70 (D54)
U1132	5114007M28	IC,F-F/D,1PER PKG,17SZ74,N-I,S
U1133	5171779H01	SPDT ANALOG SWITCH
U1136	5109522E94	2 INPUT AND GATE IN NANO PACKA
U1137	5164852H16	IC TRANSCEIVER W/LEVEL TRANSLA
U1138	5164852H16	IC TRANSCEIVER W/LEVEL TRANSLA
U1139	5164852H16	IC TRANSCEIVER W/LEVEL TRANSLA
U1141	5185941F56	IC SINGLE LV LP OP AMPLIFIER
U1142	5185941F56	IC SINGLE LV LP OP AMPLIFIER
U1143	5185941F56	IC SINGLE LV LP OP AMPLIFIER
U1144	5171779H01	SPDT ANALOG SWITCH
U1146	5109522E93	2 INPUT OR GATE IN NANO PACKAG
U1147	5109522E94	2 INPUT AND GATE IN NANO PACKA
U1148	5185941F56	IC SINGLE LV LP OP AMPLIFIER
U1149	5185941F45	ATTEN,VAR,14.4DBMIN,15.6DB MAX,
U1150	51009381001	LOW DROPOUT VOLTAGE REFERENCE
U1304	5105739X13	IC, SIGE GPS LOW NOISE AMP 157
U1601	5175143H01	WIDE SUPPLY RANGE OP AMP
U1602	5115678H01	VHF/UHF/800/900 MHZ LDMOS DRIV
U2032	4885316E32	TRANSISTOR, RF
VR101	4813977M29	DIODE,VREF,MBZ5250,SM,SOT-23,2
VR200	4813977M29	DIODE,VREF,MBZ5250,SM,SOT-23,2
VR601	4805656W87	DIODE,VCTR, @ 15V,1SV279,SOD-
VR602	4805656W87	DIODE,VCTR, @ 15V,1SV279,SOD-
VR2005	4815096H01	VARACTOR DIODE 1SV305
VR2006	4815096H01	VARACTOR DIODE 1SV305
VR2007	4815096H01	VARACTOR DIODE 1SV305
VR2008	4815096H01	VARACTOR DIODE 1SV305
VR2010	4815096H01	VARACTOR DIODE 1SV305
VR2020	4815096H01	VARACTOR DIODE 1SV305
Y701	4871886H01	16.8 MHZ VCTXO .8PPM
Y704	5164852H68	IC, VCO MODULE
Y705	5164852H66	IC, VCO MODULE

Notes

8.6 Transceiver (RF) Boards: UHF2

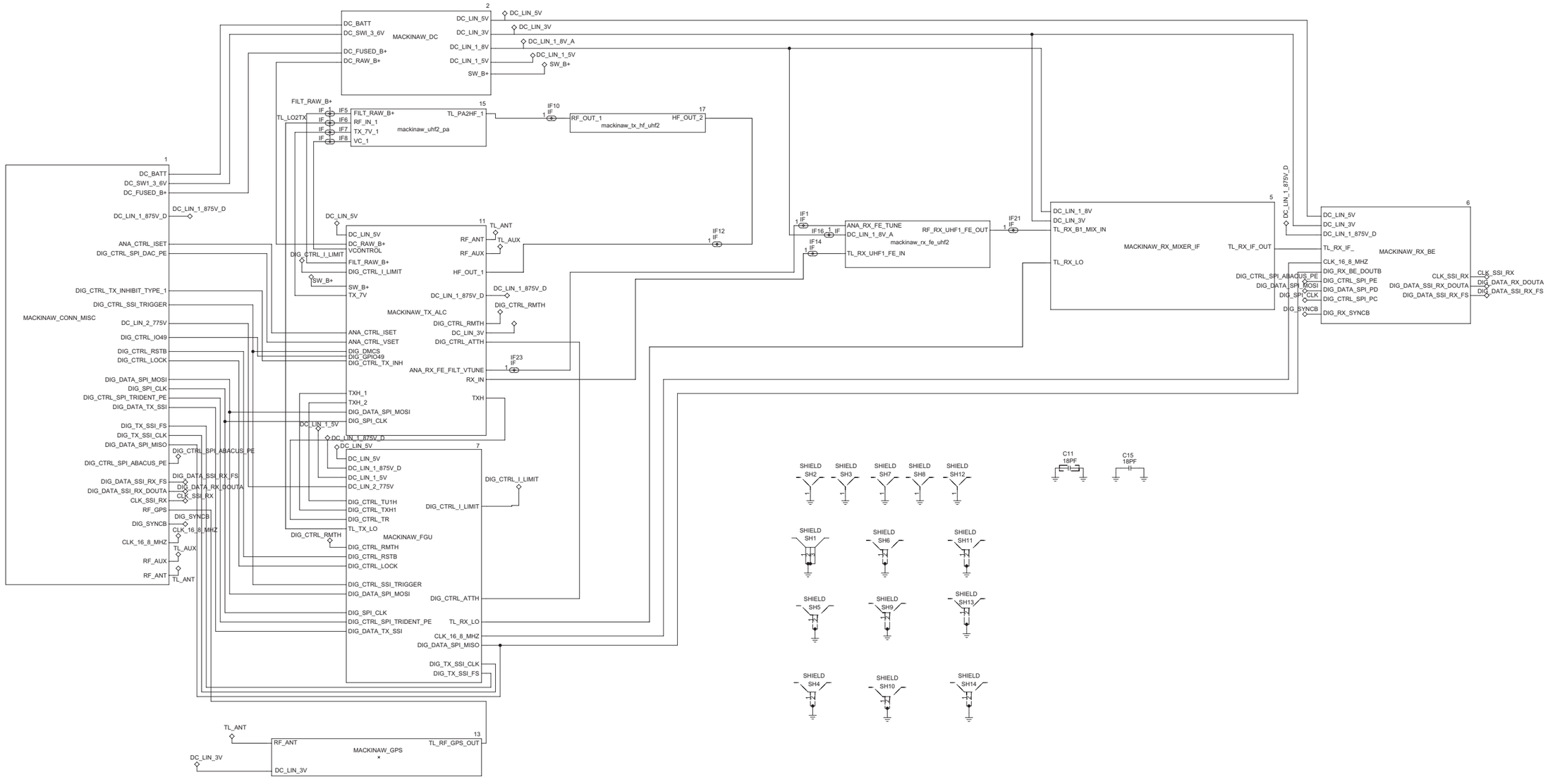


Figure 8-35. NUE7366A Transceiver (RF) Board Overall Circuit Schematic

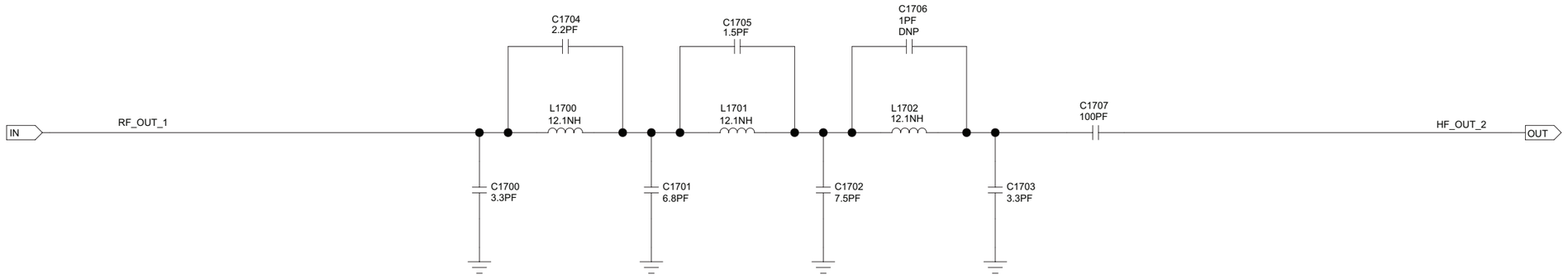


Figure 8-36. NUE7366A UHF2 Harmonic Filter Circuit

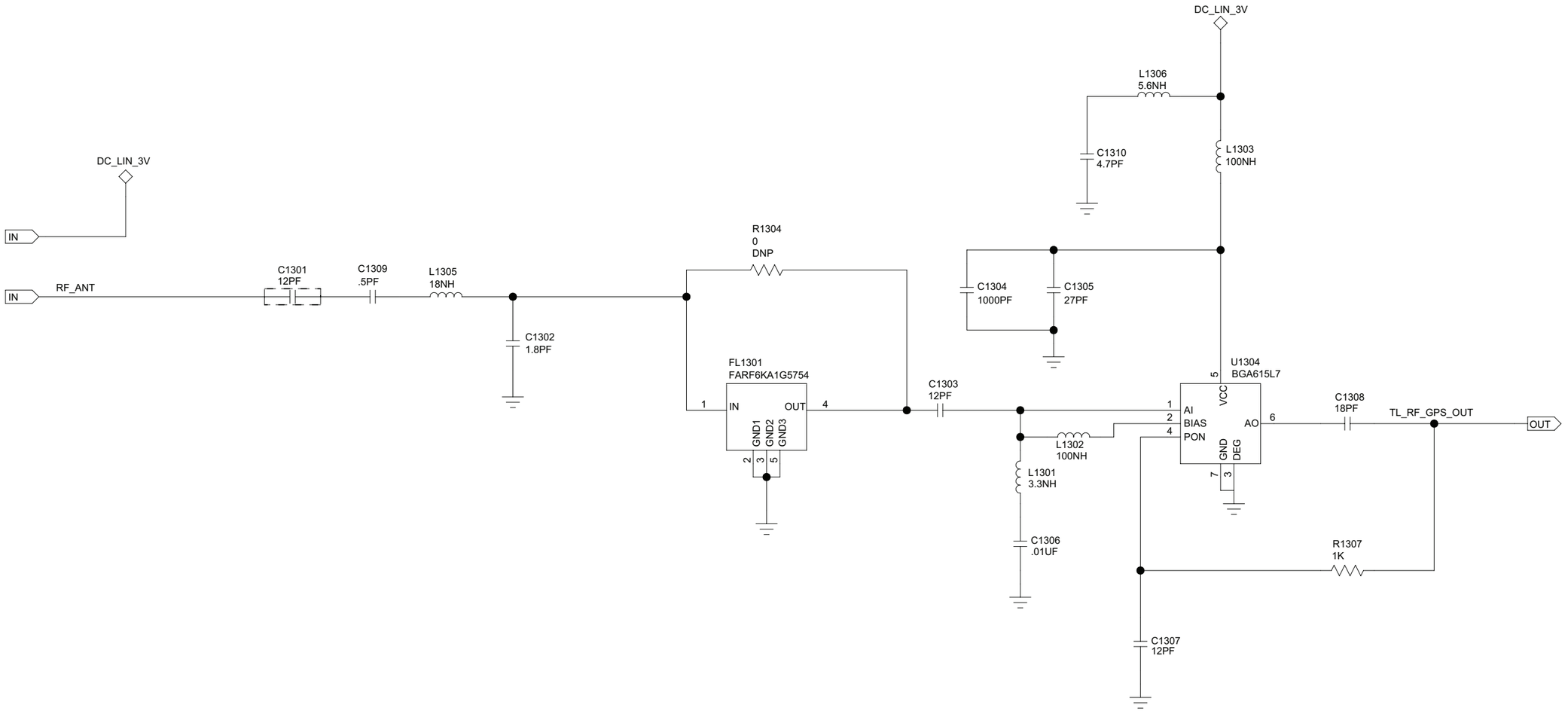


Figure 8-37. NUE7366A GPS Circuit

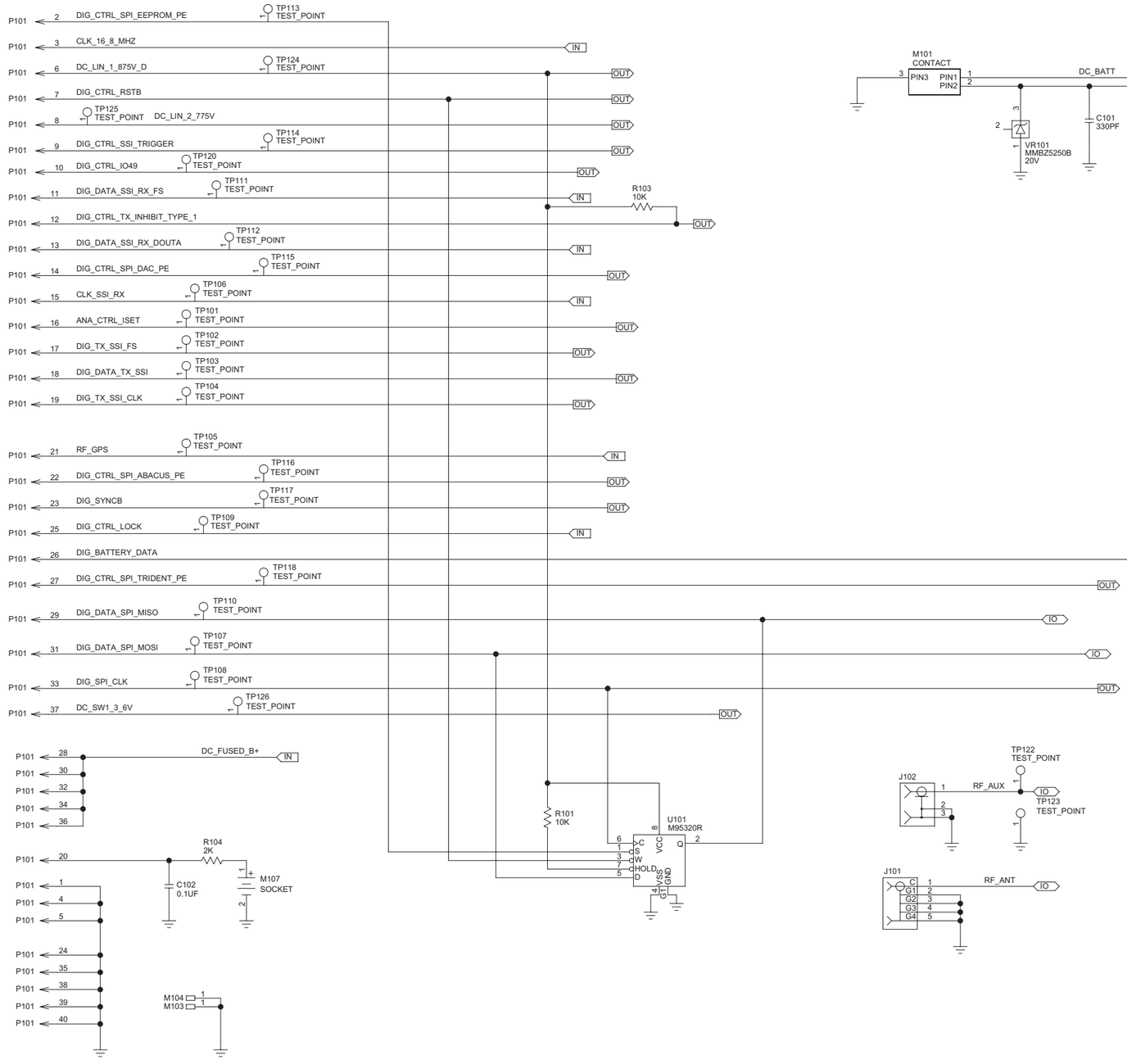


Figure 8-38. NUE7366A Miscellaneous Connector Circuit

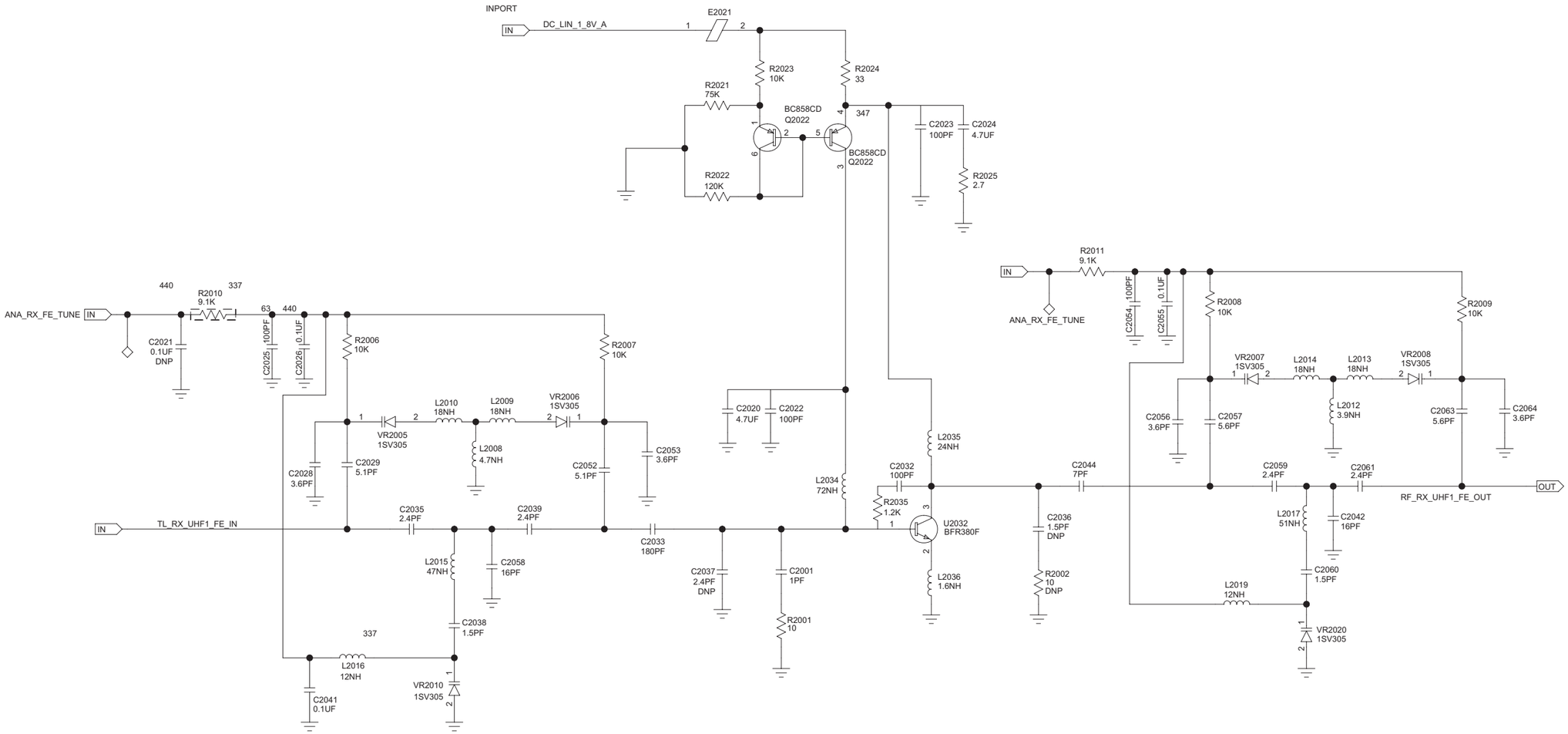


Figure 8-39. NUE7366A Receiver Front End Circuit

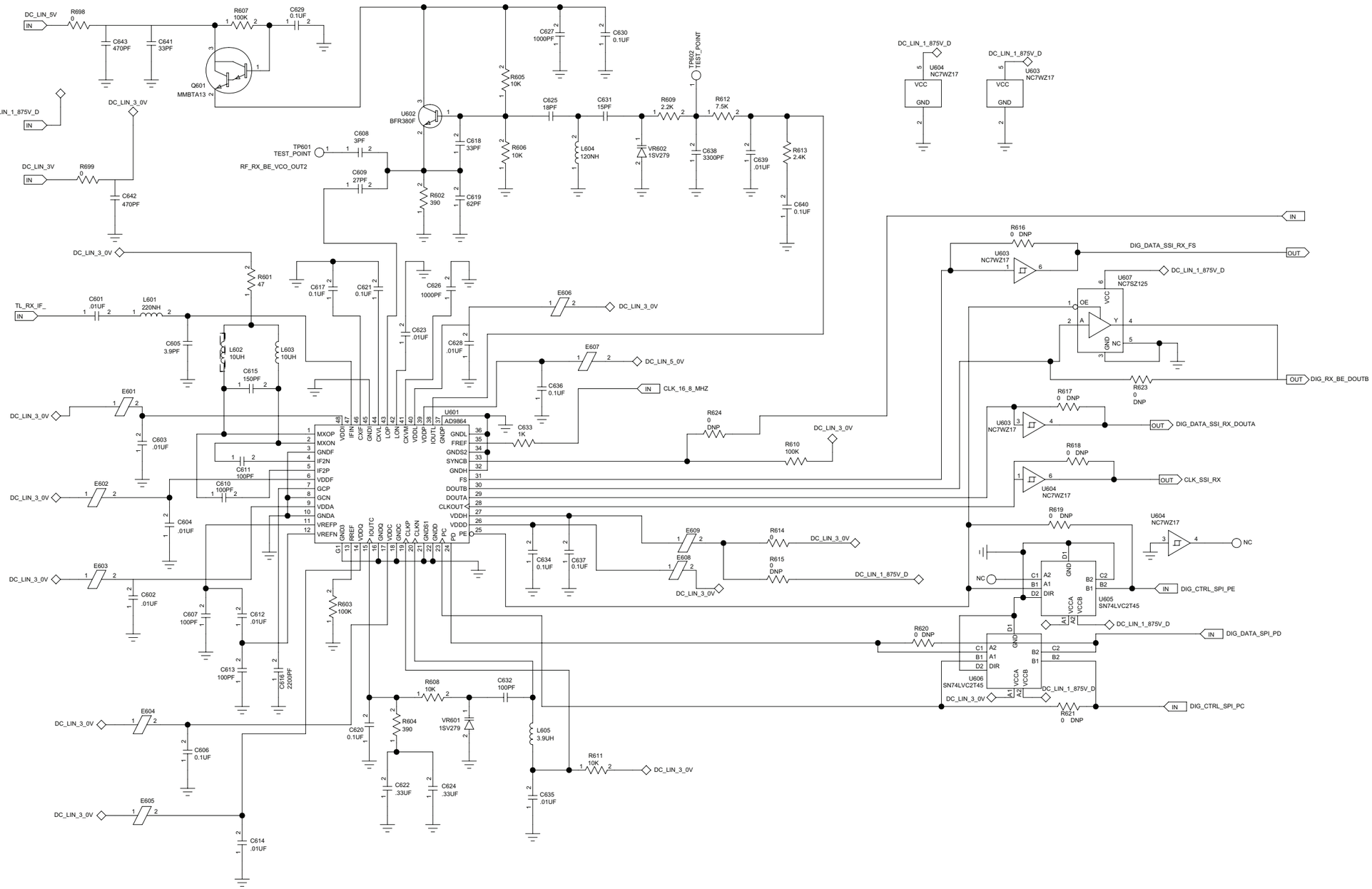


Figure 8-40. NUE7366A Receiver Back End Circuit

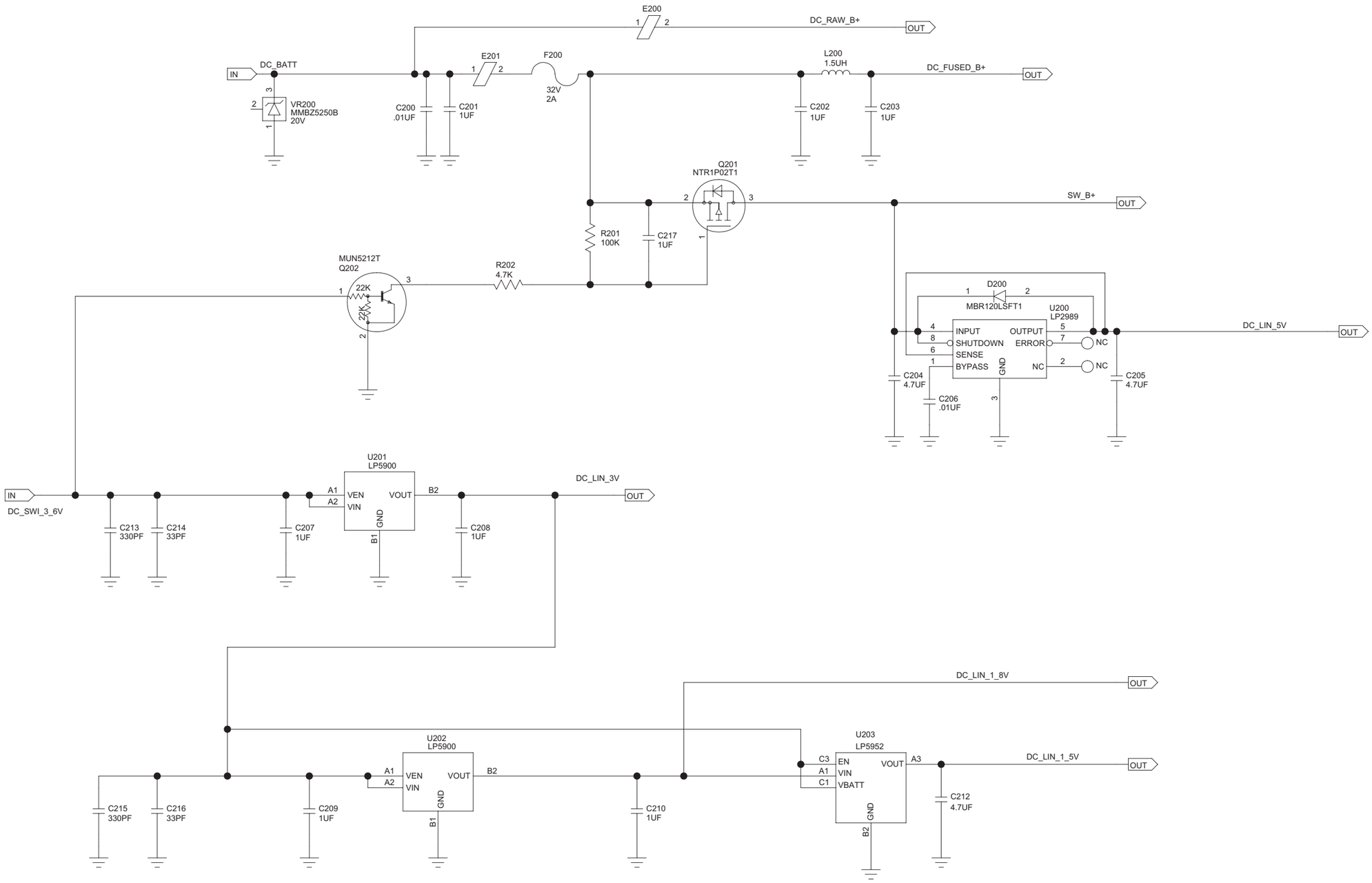


Figure 8-41. NUE7366A DC Power Circuit

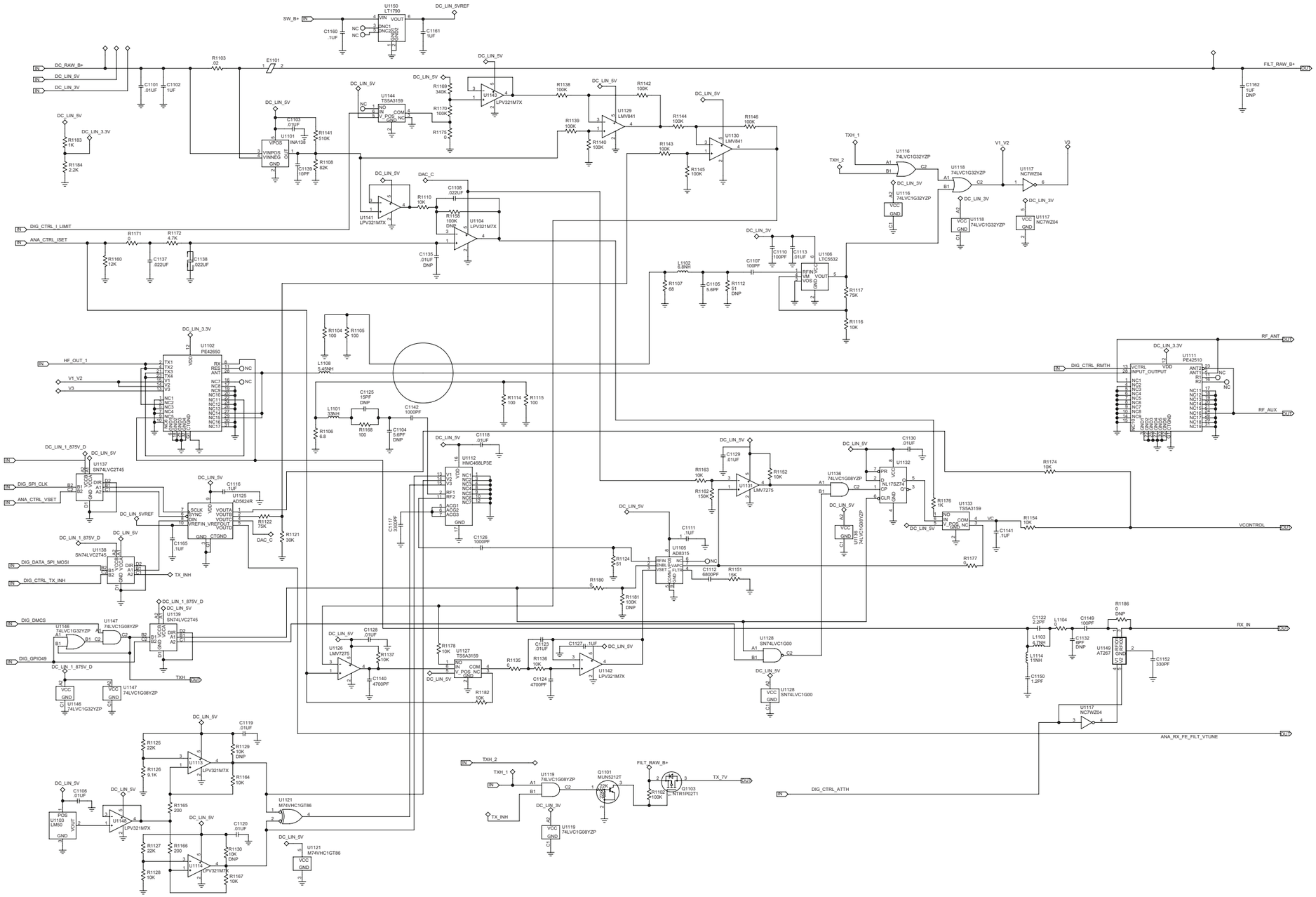


Figure 8-42. NUE7366A Transmitter and Automatic Level Control Circuits

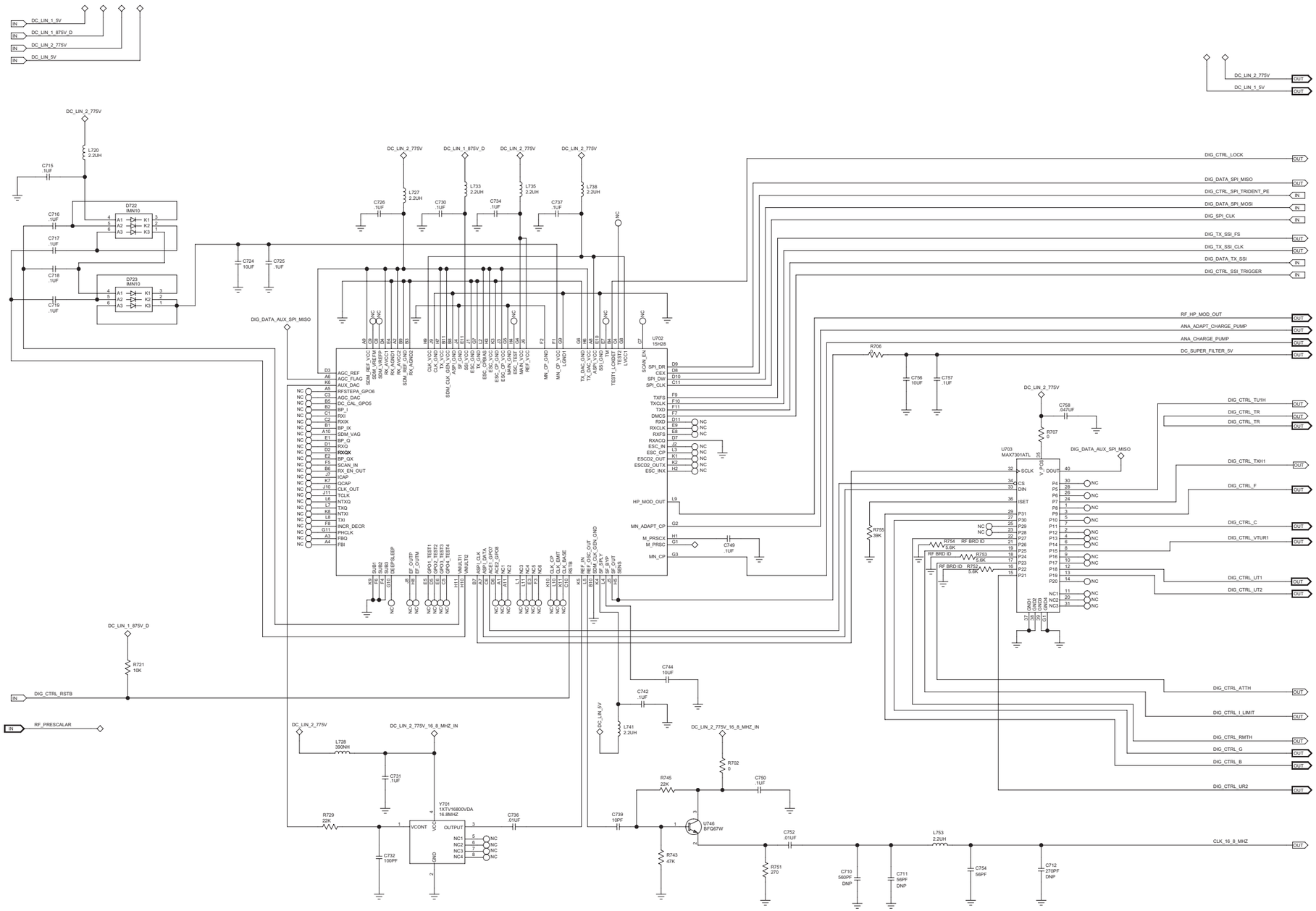


Figure 8-43. NUE7366A Frequency Generation Unit (Synthesizer) Circuit – 1 of 2

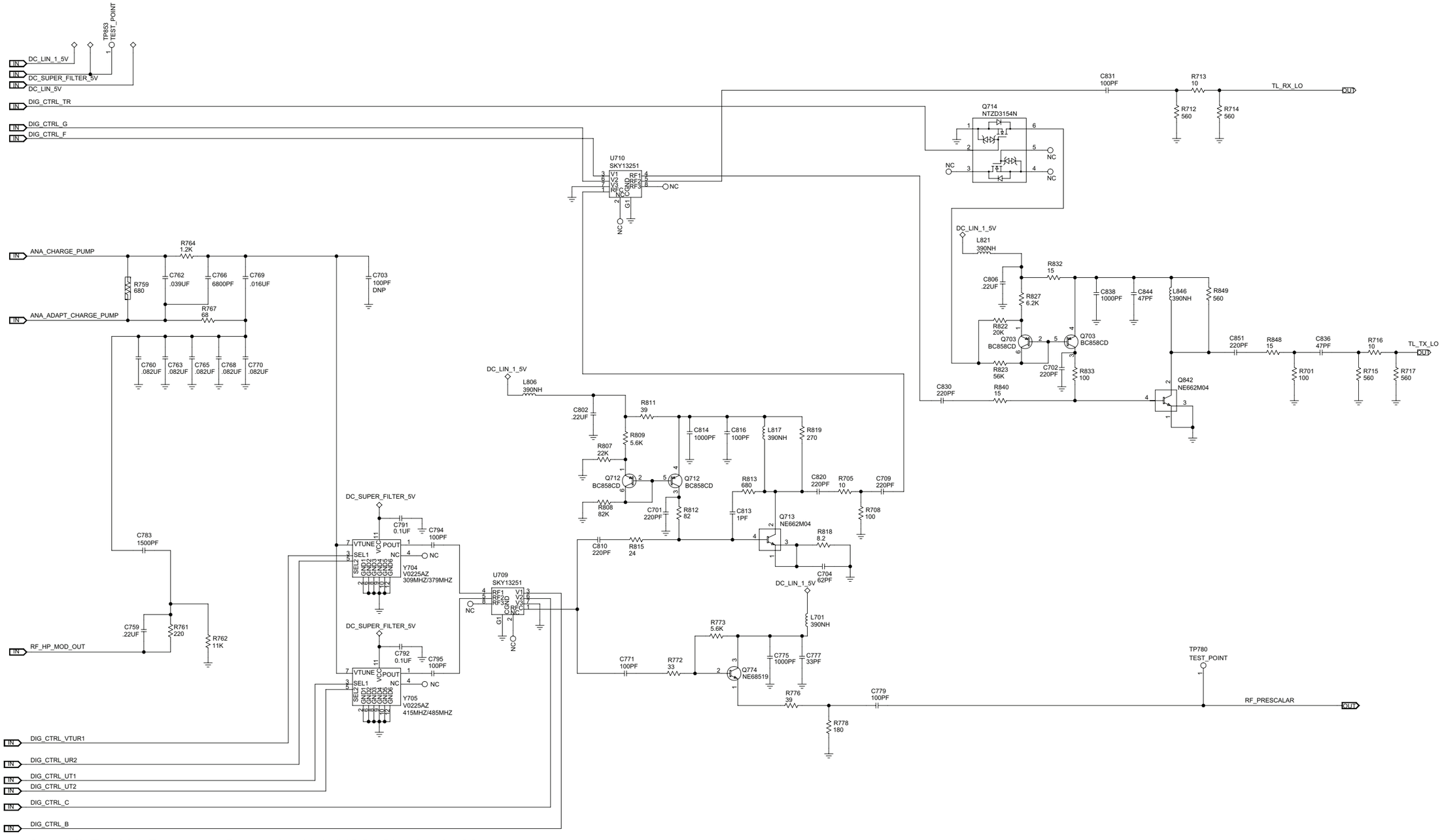


Figure 8-44. NUE7366A Frequency Generation Unit (VCO) Circuit – 2 of 2

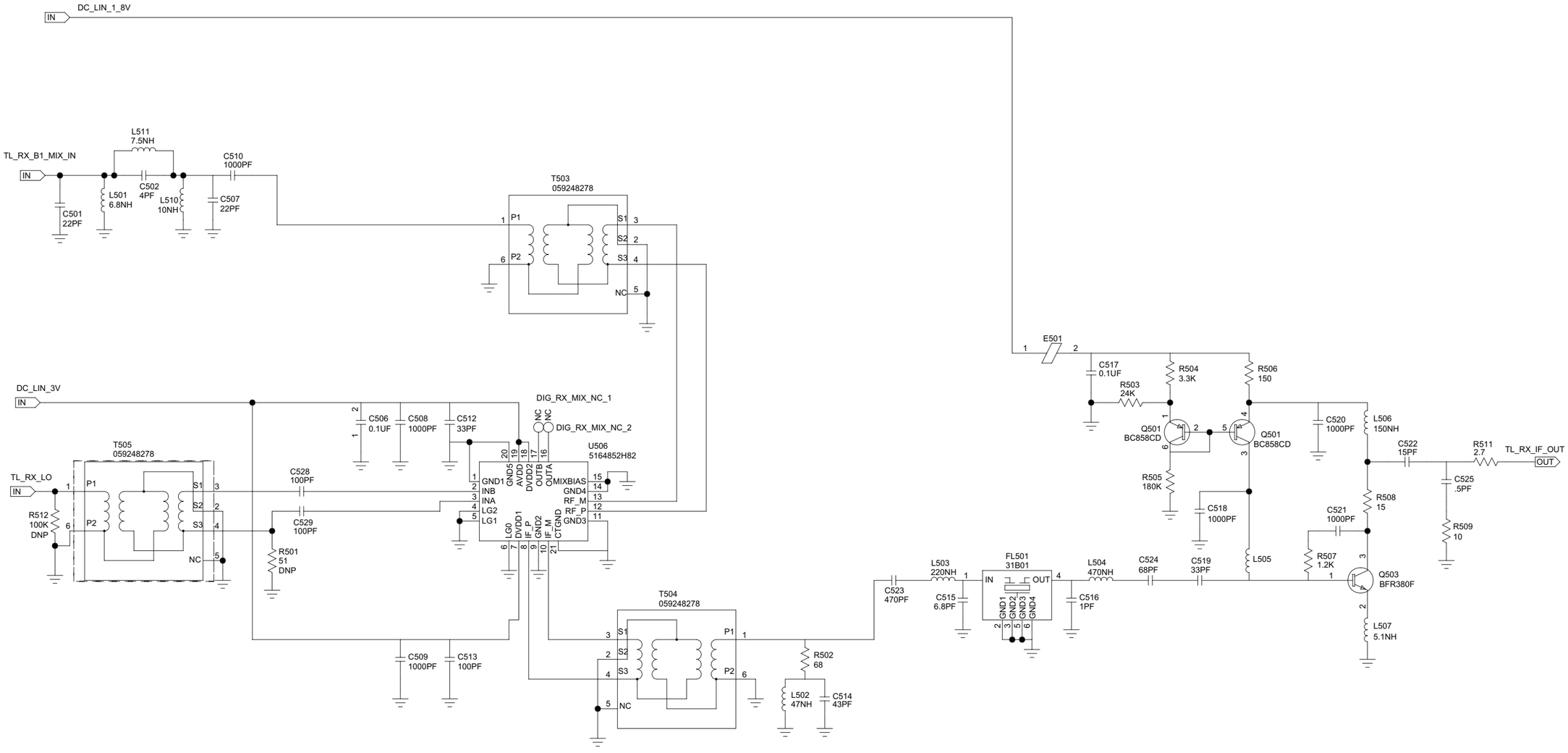


Figure 8-45. NUE7366A Mixer and IF Filter Circuits

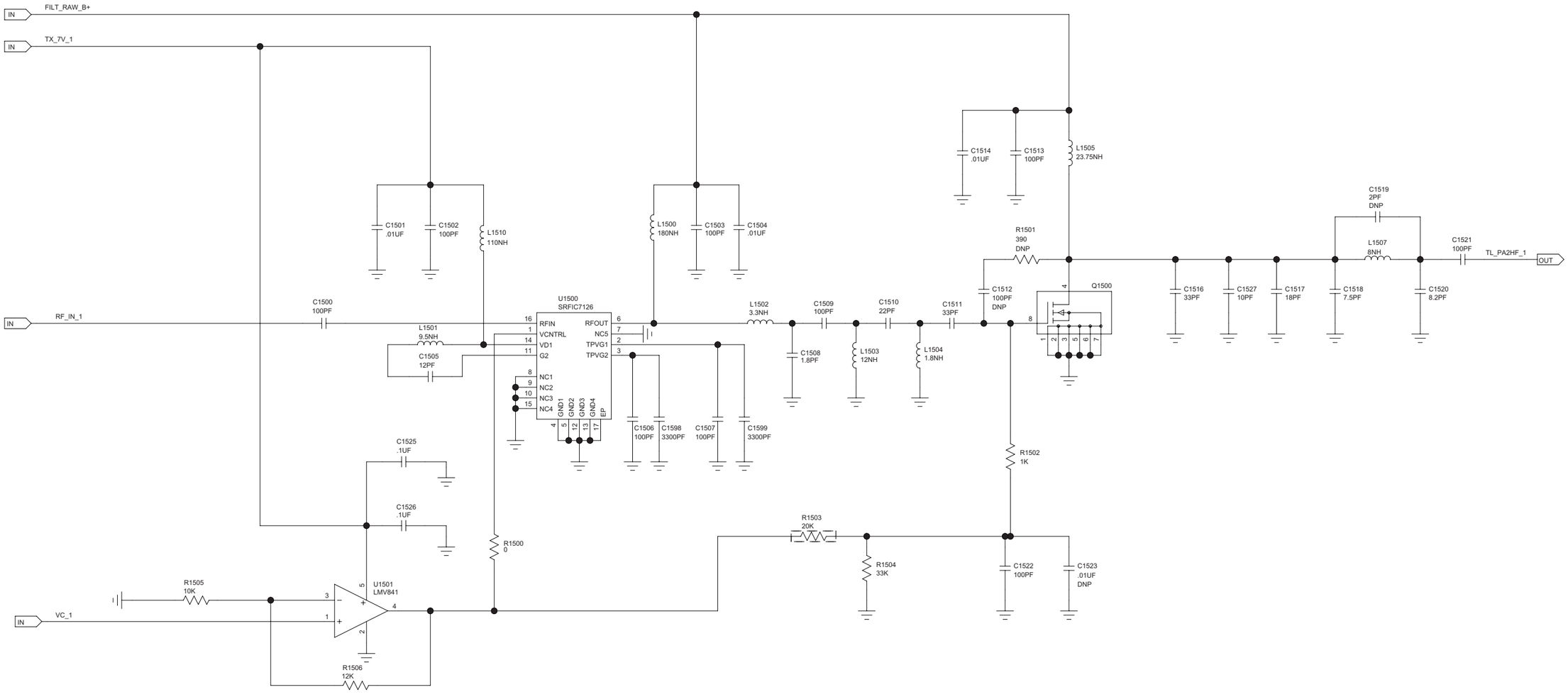


Figure 8-46. NUE7366A Power Amplifier Circuit

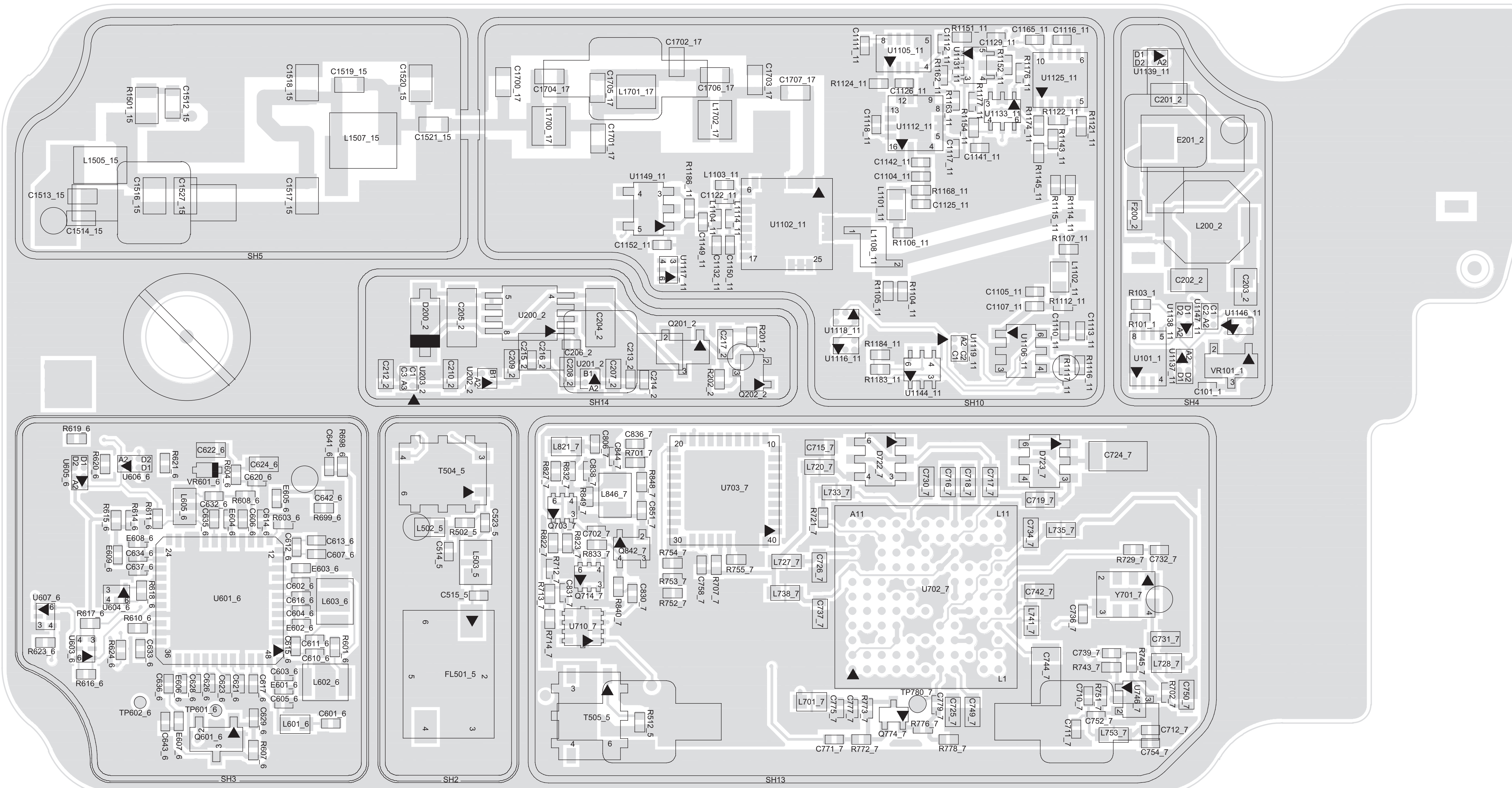


Figure 8-47. NUE7366A Transceiver (RF) Board Layout – Side 1

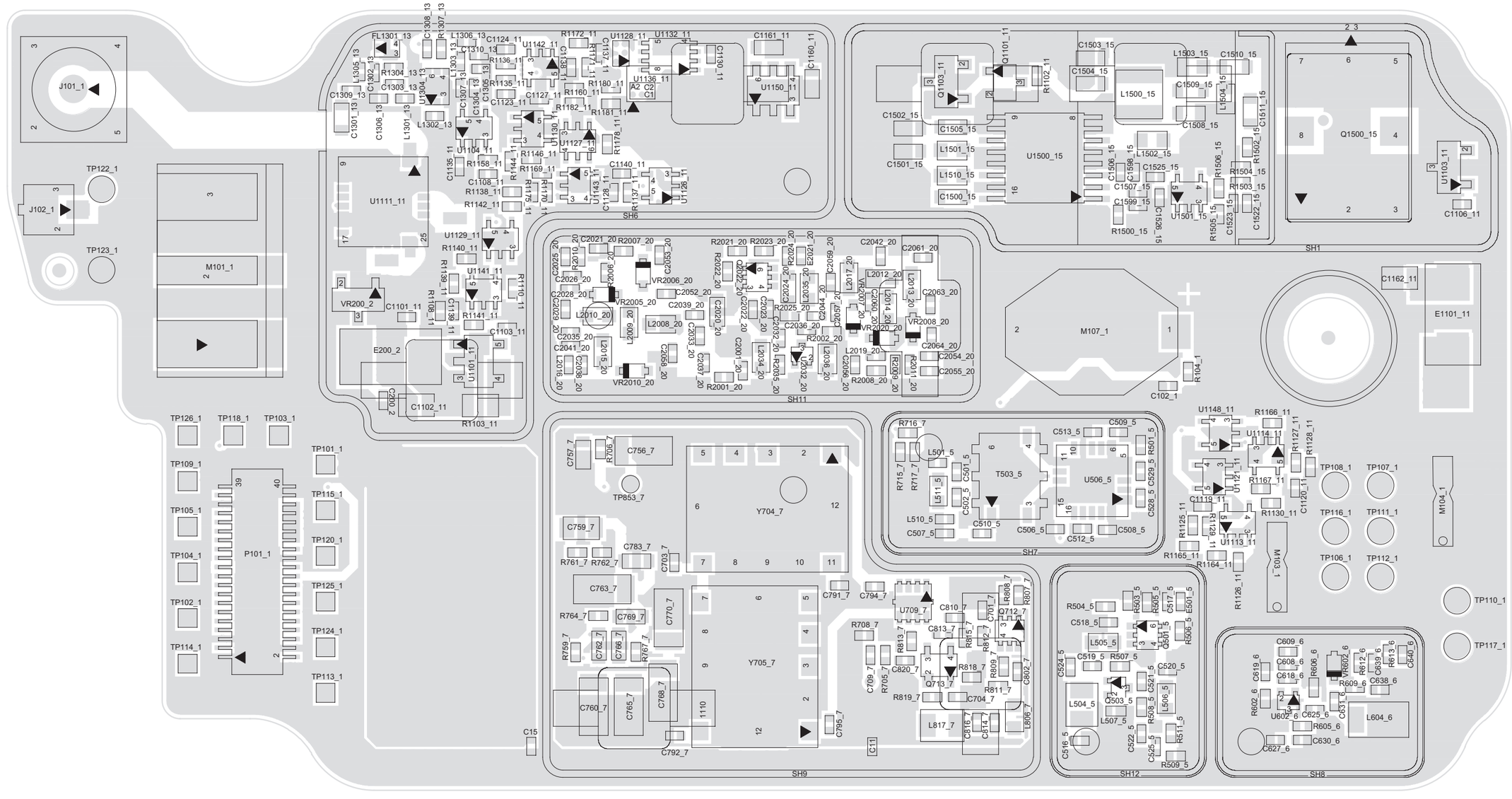


Figure 8-48. NUE7366A Transceiver (RF) Board Layout – Side 2

NUE7366A UHF2 Transceiver (RF) Board Parts List

Ref. Des.	Part Number	Description
C11	2113944A28	CAP CER CHP 18.0PF 50V 5%
C15	2113944A28	CAP CER CHP 18.0PF 50V 5%
C101	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C102	2113946B04	CAP CER CHP 0.10UF 10V 10%
C200	2113945B02	CAP CER CHP 10,000PF 25V 10%
C201	2188468Y01	CAP CER 25V X7R 0805 1UF
C202	2188468Y01	CAP CER 25V X7R 0805 1UF
C203	2188468Y01	CAP CER 25V X7R 0805 1UF
C204	2113955D35	CAP,FXD,4.7UF,+10%,-10%, 16V-DC
C205	2113955D35	CAP,FXD,4.7UF,+10%,-10%, 16V-DC
C206	2113945B02	CAP CER CHP 10,000PF 25V 10%
C207	2113956B91	CAP,FXD,1UF,+10%,-10%,16V-DC,1
C208	2113956B91	CAP,FXD,1UF,+10%,-10%,16V-DC,2
C209	2113956B91	CAP,FXD,1UF,+10%,-10%,16V-DC,3
C210	2113956B91	CAP,FXD,1UF,+10%,-10%,16V-DC,4
C212	2113946D07	CAP,CHIP,4.7UF,+10%,-10%, 6.3V-
C213	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C214	2113944A31	CAP CER CHP 33.0PF 50V 5%
C215	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C216	2113944A31	CAP CER CHP 33.0PF 50V 5%
C217	2113956B91	CAP,FXD,1UF,+10%,-10%,16V-DC,5
C501	2115153H41	CAP,CERAMIC CHIP,22PF,+1%, -1%,
C502	2115153H28	CAP, CERAMIC, COG
C506	2113946B04	CAP CER CHP 0.10UF 10V 10%
C507	2115153H41	CAP,CERAMIC CHIP,22PF,+1%, -1%,
C508	2113945A09	CAP CER CHP 1000PF 50V 10%
C509	2113945A09	CAP CER CHP 1000PF 50V 10%
C510	2113944A52	CAP CER CHP 1000.0 PF 50V 5%
C512	2113944A31	CAP CER CHP 33.0PF 50V 5%
C513	2113944A40	CAP CER CHP 100.0PF 50V 5%
C514	2113944A84	CAP,FXD,43PF,+5%,-5%,50V-DC,04
C515	2113944A21	CAP CER CHP 6.8PF 50V +/- 0.5P
C516	2113944A63	CAP,FXD,1PF,.25PF+/-,50V-DC, 05
C517	2113946B04	CAP CER CHP 0.10UF 10V 10%
C518	2113945A09	CAP CER CHP 1000PF 50V 10%
C519	2113944A31	CAP CER CHP 33.0PF 50V 5%
C520	2113945A09	CAP CER CHP 1000PF 50V 10%
C521	2113945A09	CAP CER CHP 1000PF 50V 10%
C522	2113944A27	CAP CER CHP 15.0PF 50V 5%
C523	2113944A48	CAP CER CHP 470.0 PF 50V 5%
C524	2113944A36	CAP CER CHP 68.0PF 50V 5%
C525	2113944A61	CAP,FXD,.5PF,.25PF+/-,50V-DC, 0
C528	2113944A40	CAP CER CHP 100.0PF 50V 5%
C529	2113944A40	CAP CER CHP 100.0PF 50V 5%
C601	2113945B02	CAP CER CHP 10,000PF 25V 10%
C602	2113945B02	CAP CER CHP 10,000PF 25V 10%
C603	2113945B02	CAP CER CHP 10,000PF 25V 10%
C604	2113945B02	CAP CER CHP 10,000PF 25V 10%
C605	2113944A15	CAP CER CHP 3.9PF 50V +/- 0.25
C606	2113946B04	CAP CER CHP 0.10UF 10V 10%
C607	2113944A40	CAP CER CHP 100.0PF 50V 5%
C608	2113944A12	CAP CER CHP 3.0PF 50V +/- 0.25
C609	2113944A30	CAP CER CHP 27.0PF 50V 5%
C610	2113944A40	CAP CER CHP 100.0PF 50V 5%
C611	2113944A40	CAP CER CHP 100.0PF 50V 5%
C612	2113945B02	CAP CER CHP 10,000PF 25V 10%
C613	2113944A40	CAP CER CHP 100.0PF 50V 5%
C614	2113945B02	CAP CER CHP 10,000PF 25V 10%
C615	2113944A42	CAP CER CHP 150.0PF 50V 5%
C616	2113945A11	CAP CER CHP 2200PF 50V 10%
C617	2113946B04	CAP CER CHP 0.10UF 10V 10%
C618	2113944A31	CAP CER CHP 33.0PF 50V 5%
C619	2113944A35	CAP CER CHP 62.0PF 50V 5%
C620	2113946B04	CAP CER CHP 0.10UF 10V 10%
C621	2113946B04	CAP CER CHP 0.10UF 10V 10%
C622	2113946C07	CAP,FXD,.33UF,+10%,-10%, 10V-DC
C623	2113945B02	CAP CER CHP 10,000PF 25V 10%
C624	2113946C07	CAP,FXD,.33UF,+10%,-10%, 10V-DC
C625	2113944A28	CAP CER CHP 18.0PF 50V 5%
C626	2113945A09	CAP CER CHP 1000PF 50V 10%
C627	2113945A09	CAP CER CHP 1000PF 50V 10%
C628	2113945B02	CAP CER CHP 10,000PF 25V 10%
C629	2113946B04	CAP CER CHP 0.10UF 10V 10%
C630	2113946B04	CAP CER CHP 0.10UF 10V 10%
C631	2113944A27	CAP CER CHP 15.0PF 50V 5%
C632	2113944A40	CAP CER CHP 100.0PF 50V 5%
C634	2113946B04	CAP CER CHP 0.10UF 10V 10%
C635	2113945B02	CAP CER CHP 10,000PF 25V 10%
C636	2113946B04	CAP CER CHP 0.10UF 10V 10%
C637	2113946B04	CAP CER CHP 0.10UF 10V 10%
C638	2113945A12	CAP CER CHP 3300PF 50V 10%
C639	2113945B02	CAP CER CHP 10,000PF 25V 10%
C640	2113946B04	CAP CER CHP 0.10UF 10V 10%
C641	2113944A31	CAP CER CHP 33.0PF 50V 5%
C642	2113944A48	CAP CER CHP 470.0 PF 50V 5%
C643	2113944A48	CAP CER CHP 470.0 PF 50V 5%
C701	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C702	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C703	NOT PLACED	–
C704	2113944A35	CAP CER CHP 62.0PF 50V 5%
C709	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C710	NOT PLACED	–
C711	NOT PLACED	–
C712	NOT PLACED	–
C715	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C716	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C717	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C718	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C719	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C724	2113955D37	CAP,FXD,10UF,+10%,-10%,16V-DC,
C725	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C726	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C730	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C731	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C732	2113944A40	CAP CER CHP 100.0PF 50V 5%
C734	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C736	2113945B02	CAP CER CHP 10,000PF 25V 10%
C737	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C739	2113944A25	CAP CER CHP 10.0PF 50V +/- 0.6
C742	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C744	2113955D37	CAP,FXD,10UF,+10%,-10%,16V-DC,
C749	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C750	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C752	2113945B02	CAP CER CHP 10,000PF 25V 10%
C754	2113944A34	CAP CER CHP 56.0PF 50V 5%

Ref. Des.	Part Number	Description
C756	2113955D37	CAP,FXD,10UF,+10%,-10%,16V-DC,
C757	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C758	2113946B02	CAP CER CHP 0.047UF 10V 10,
C759	2113945G95	CAP,FXD,.22UF,+10%,-10%,50V-DC
C760	2113944G97	CAP,FXD,.082UF,+5%,-5%,50V-DC,
C762	2113945C26	CAP,FXD,.039UF,+10%,-10%,50V-D
C763	2113944G97	CAP,FXD,.082UF,+5%,-5%,50V-DC,
C765	2113944G97	CAP,FXD,.082UF,+5%,-5%,50V-DC,
C766	2113945C01	CAP CER CHP 6800PF 50V 10%
C768	2113944G97	CAP,FXD,.082UF,+5%,-5%,50V-DC,
C769	2113945C20	CAP,FXD,.016UF,+10%,-10%,50V-D
C770	2113944G97	CAP,FXD,.082UF,+5%,-5%,50V-DC,
C771	2113944A40	CAP CER CHP 100.0PF 50V 5%
C775	2113945A09	CAP CER CHP 1000PF 50V 10%
C777	2113944A31	CAP CER CHP 33.0PF 50V 5%
C779	2113944A40	CAP CER CHP 100.0PF 50V 5%
C783	2113944C53	CAP CER CHP 1500.OPF 50V 5
C791	2113946B04	CAP CER CHP 0.10UF 10V 10%
C792	2113946B04	CAP CER CHP 0.10UF 10V 10%
C794	2113944A40	CAP CER CHP 100.0PF 50V 5%
C795	2113944A40	CAP CER CHP 100.0PF 50V 5%
C802	2113946B06	CAP,CHIP,.22UF,+10%,-10%,10V-D
C806	2113946B06	CAP,CHIP,.22UF,+10%,-10%,10V-D
C810	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C813	2113944A63	CAP,FXD,1PF,.25PF+/-,50V-DC,06
C814	2113945A09	CAP CER CHP 1000PF 50V 10%
C816	2113944A40	CAP CER CHP 100.0PF 50V 5%
C820	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C830	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C831	2113944A40	CAP CER CHP 100.0PF 50V 5%
C836	2113944A33	CAP CER CHP 47.0PF 50V 5%
C838	2113945A09	CAP CER CHP 1000PF 50V 10%
C844	2113944A33	CAP CER CHP 47.0PF 50V 5%
C851	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C1101	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1102	2188468Y01	CAP CER 25V X7R 0805 1UF
C1103	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1104	NOT PLACED	–
C1105	2113944A19	CAP CER CHP 5.6PF 50V +/- 0.5P
C1106	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1107	2113944A40	CAP CER CHP 100.0PF 50V 5%
C1108	2113945B04	CAP,FXD,.022UF,+10%,-10%,25V-D
C1110	2113944A40	CAP CER CHP 100.0PF 50V 5%
C1111	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,
C1112	2113945B01	CAP CER CHP 6800PF 25V 10%
C1113	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1116	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,
C1117	2113945A12	CAP CER CHP 3300PF 50V 10%
C1118	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1119	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1120	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1122	2175390H01	CAP, 2.2 PF, 0402, CERAMIC, 50
C1123	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1124	2113945A13	CAP CER CHP 4700PF 50V 10%
C1125	NOT PLACED	–
C1126	2113945A09	CAP CER CHP 1000PF 50V 10%
C1127	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,
C1128	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1129	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1130	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1132	NOT PLACED	–
C1135	NOT PLACED	–
C1137	2113945B04	CAP,FXD,.022UF,+10%,-10%,25V-D
C1138	2113945B04	CAP,FXD,.022UF,+10%,-10%,25V-D
C1139	2113944A25	CAP CER CHP 10.0PF 50V +/- 0.5
C1140	2113945A13	CAP CER CHP 4700PF 50V 10%
C1141	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,
C1142	2113945A09	CAP CER CHP 1000PF 50V 10%
C1149	2113944A40	CAP CER CHP 100.0PF 50V 5%
C1150	2175392H01	CAP, 1.2PF, 0402, CERAMIC, 50V
C1152	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C1160	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,
C1161	2113956B91	CAP,FXD,1UF,+10%,-10%,16V-DC,0
C1162	NOT PLACED	–
C1165	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,
C1301	2113944M20	CAP,FXD,12PF,+2%,-2%,50V-DC,07
C1302	2114036F74	CAP,FXD,1.8PF,.05PF+/-,25V-DC,
C1303	2113944A26	CAP CER CHP 12.0PF 50V 5%
C1304	2113945A09	CAP CER CHP 1000PF 50V 10%
C1305	2113944A30	CAP CER CHP 27.0PF 50V 5%
C1306	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1307	2113944A26	CAP CER CHP 12.0PF 50V 5%
C1308	2113944A28	CAP CER CHP 18.0PF 50V 5%
C1309	2175389H01	CAP,.5PF, CHIP, 0402, CERAMIC,
C1310	2113944A17	CAP CER CHP 4.7PF 50V +/- 0.25
C1500	2113944C45	CAP CER CHP 100.0PF 50V 5%
C1501	2113945C02	CAP CER CHP 10,000PF 50V 10%
C1502	2113944C45	CAP CER CHP 100.0PF 50V 5%
C1503	2113944C45	CAP CER CHP 100.0PF 50V 5%
C1504	2113945C02	CAP CER CHP 10,000PF 50V 10%
C1505	2113944M20	CAP,FXD,12PF,+2%,-2%,50V-DC,06
C1506	2113944A40	CAP CER CHP 100.0PF 50V 5%
C1507	2113944A40	CAP CER CHP 100.0PF 50V 5%
C1508	2113944C12	CAP CER CHP 1.8PF 50V +/- 0.25
C1509	2113944C45	CAP CER CHP 100.0PF 50V 5%
C1510	2113944M26	CAP,FXD,22PF,+2%,-2%,50V-DC,06
C1511	2113944M30	CAP,FXD,33PF,+2%,-2%,50V-DC,06
C1512	NOT PLACED	–
C1513	2113944C45	CAP CER CHP 100.0PF 50V 5%
C1514	2113945C02	CAP CER CHP 10,000PF 50V 10%
C1516	21007088001	0805 CAPACITOR
C1517	21007088008	18PF, 100V, COG, 5%, 0805 CAP
C1518	21007088007	0805 CAPACITOR
C1519	NOT PLACED	–
C1520	21007088005	0805 CAPACITOR
C1521	2113944C45	CAP CER CHP 100.0PF 50V 5%
C1522	2113944A40	CAP CER CHP 100.0PF 50V 5%
C1523	NOT PLACED	–
C1525	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,
C1526	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,
C1527	21007088006	0805 CAPACITOR
C1598	2113945A12	CAP CER CHP 3300PF 50V 10%
C1599	2113945A12	CAP CER CHP 3300PF 50V 10%
C1700	2113944M06	CAP,FXD,3.3PF,.1PF+/-,50V-DC, 0

Ref. Des.	Part Number	Description
C1701	2113944M14	CAP,FXD,6.8PF,.1PF+/-,50V-DC, 0
C1702	2113944M15	CAP,FXD,7.5PF,.1PF+/-,50V-DC,
C1703	2113944M06	CAP,FXD,3.3PF,.1PF+/-,50V-DC, 1
C1704	2113944M02	CAP,FXD,2.2PF,.1PF+/-,50V-DC, 0
C1705	2113944C67	CAP,FXD,1.5PF,.1PF+/-,50V-DC, 0
C1706	NOT PLACED	–
C1707	2113944C45	CAP CER CHP 100.0PF 50V 5%
C2001	2113944A63	CAP,FXD,1PF,.25PF+/-,50V-DC, 04
C2020	2113946D07	CAP,CHIP,4.7UF,+10%,-10%, 6.3V-
C2021	NOT PLACED	–
C2022	2113944A40	CAP CER CHP 100.0PF 50V 5%
C2023	2113944A40	CAP CER CHP 100.0PF 50V 5%
C2024	2113946D07	CAP,CHIP,4.7UF,+10%,-10%, 6.3V-
C2025	2113944A40	CAP CER CHP 100.0PF 50V 5%
C2026	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2028	2115153H16	CAP, CERAMIC, COG
C2029	2115153H20	CAP, CERAMIC, COG
C2032	2115153H57	CAP, CERAMIC, COG
C2033	2171051Y05	CAP,CER CHIP,180PF,+1%,-1%, 50V
C2035	2115153H12	CAP, CERAMIC, COG
C2036	NOT PLACED	–
C2037	NOT PLACED	–
C2038	2115153H07	CAP, CERAMIC, COG
C2039	2115153H12	CAP, CERAMIC, COG
C2041	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2042	2115153H38	CAP, CERAMIC, COG
C2044	2115153H31	CAP, CERAMIC, COG
C2052	2115153H20	CAP, CERAMIC, COG
C2053	2115153H16	CAP, CERAMIC, COG
C2054	2113944A40	CAP CER CHP 100.0PF 50V 5%
C2055	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2056	2115153H16	CAP, CERAMIC, COG
C2057	2115153H21	CAP, CERAMIC, COG

Ref. Des.	Part Number	Description
C2058	2115153H38	CAP, CERAMIC, COG
C2059	2115153H12	CAP, CERAMIC, COG
C2060	2115153H07	CAP, CERAMIC, COG
C2061	2115153H12	CAP, CERAMIC, COG
C2063	2115153H21	CAP, CERAMIC, COG
C2064	2115153H16	CAP, CERAMIC, COG
D200	4813978A19	DIODE,RECT,MBR120,SM, SOD-123,1
D722	4815011H01	DIODE TRIPLE
D723	4815011H01	DIODE TRIPLE
E200	2405688Z01	INDUCTOR FERRITE BEAD
E201	2405688Z01	INDUCTOR FERRITE BEAD
E501	2480640Z01	SURFACE MOUNT FERRITE BEAD
E601	2480640Z01	SURFACE MOUNT FERRITE BEAD
E602	2480640Z01	SURFACE MOUNT FERRITE BEAD
E603	2480640Z01	SURFACE MOUNT FERRITE BEAD
E604	2480640Z01	SURFACE MOUNT FERRITE BEAD
E605	2480640Z01	SURFACE MOUNT FERRITE BEAD
E606	2480640Z01	SURFACE MOUNT FERRITE BEAD
E607	2480640Z01	SURFACE MOUNT FERRITE BEAD
E608	2480640Z01	SURFACE MOUNT FERRITE BEAD
E609	2480640Z01	SURFACE MOUNT FERRITE BEAD
E1101	2405688Z01	INDUCTOR FERRITE BEAD
E2021	2480640Z01	SURFACE MOUNT FERRITE BEAD
F200	6575834B01	FUSE SURFACE MOUNT
FL501	91009300001	FILTER,MONOLITHIC CRYSTAL,BAND
FL1301	9102190J23	FLTR,SAW,BANDPASS,1.57542 GHZ N
J101	0909901V02	RECP SMT MCX
J102	0975886B01	RECEPTACLE, COAX CABLE

Ref. Des.	Part Number	Description
L200	2571269C01	INDUCTOR WW POWER 20%
L501	24012011014	0402 HIGH Q CHIP INDUCTOR
L502	2415429H30	CHIP INDUCTOR
L503	2414032F38	IDCTR,WW,220NH,5%,400MA, .7OHM,
L504	2414032F42	IDCTR,WW,470NH,10%,170MA, 2.5OH
L505	2415429H39	CHIP INDUCTOR
L506	2415429H39	CHIP INDUCTOR
L507	2415427H12	CHIP INDUCTOR
L510	24012011020	0402 HIGH Q CHIP INDUCTOR
L511	2478057A13	7.5 NH SURFACE MOUNT INDUCTOR
L601	2415429H43	CHIP INDUCTOR
L602	2466505A01	COIL INDUCTOR
L603	2466505A01	COIL INDUCTOR
L604	2414032D16	IDCTR,WW,120NH,5%,800MA, .26OHM
L605	2414017Q54	IDCTR,FXD,3.9UH,10%,30MA, .9OHM
L701	2415429H47	CHIP INDUCTOR
L720	2480646Z20	COIL MULTI-LAYER CHIP(2.20UH)
L727	2480646Z20	COIL MULTI-LAYER CHIP(2.20UH)
L728	2415429H47	CHIP INDUCTOR
L733	2480646Z20	COIL MULTI-LAYER CHIP(2.20UH)
L735	2480646Z20	COIL MULTI-LAYER CHIP(2.20UH)
L738	2480646Z20	COIL MULTI-LAYER CHIP(2.20UH)
L741	2480646Z20	COIL MULTI-LAYER CHIP(2.20UH)
L753	2480646Z20	COIL MULTI-LAYER CHIP(2.20UH)
L806	2415429H47	CHIP INDUCTOR
L817	2414032F41	IDCTR,WW,390NH,10%,200MA, 1.5OH
L821	2415429H47	CHIP INDUCTOR
L846	2414032F41	IDCTR,WW,390NH,10%,200MA, 1.5OH

Ref. Des.	Part Number	Description
L1101	2415429H26	CHIP INDUCTOR
L1102	2415429H10	CHIP INDUCTOR
L1103	2475393H01	INDUCTOR, 4.7NH, 0402, +/-0.1NH
L1104	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
L1108	2409348J04	IND AIR CORE 5.45NH 5% 2214
L1114	2475394H01	INDUCTOR, 11NH, 0402, +/-2%
L1301	2488090Y07	INDUCTOR,MULTILAYER,3.3NH ,1005
L1302	2488090Y25	INDUCTOR,MULTILAYER,100N H,1005
L1303	2414017P25	IDCTR,CHIP,100NH,5%,100MA, 5.5O
L1305	2475391H01	INDUCTOR, 18 NH, CHIP, 0402, 2
L1306	2488090Y10	INDUCTOR,MULTILAYER,5.6NH ,1005
L1500	2414015A07	IDCTR,FXD,180NH,2%,750MA, .77OH
L1501	2415429H14	CHIP INDUCTOR
L1502	2415429H03	CHIP INDUCTOR
L1503	2415429H17	CHIP INDUCTOR
L1504	2415429H02	CHIP INDUCTOR
L1505	2460591E24	COIL AIR WOUND INDUC 23.75
L1507	2415385H01	8 NH MINISPRING AIR CORE INDUC
L1510	2415429H37	CHIP INDUCTOR
L1700	2471902Y05	IDCTR,AW,12.1NH,5%,4.4A, .007OH
L1701	2471902Y05	IDCTR,AW,12.1NH,5%,4.4A ,.007OH
L1702	2471902Y05	IDCTR,AW,12.1NH,5%,4.4A, .007OH
L2008	2478057A07	4.7 NH SURFACE MOUNT INDUCTOR
L2009	2478057A23	18 NH SURFACE MOUNT INDUCTOR
L2010	2478057A23	19 NH SURFACE MOUNT INDUCTOR
L2012	2478057A05	3.9 NH SURFACE MOUNT INDUCTOR

Ref. Des.	Part Number	Description
L2013	2478057A23	20 NH SURFACE MOUNT INDUCTOR
L2014	2478057A23	21 NH SURFACE MOUNT INDUCTOR
L2015	2478057A35	0306 HIGH Q CHIP INDUCTOR
L2016	2414017P14	IDCTR,CHIP,12NH,5%,300MA, .6OHM
L2017	2478057A36	0306 HIGH Q CHIP INDUCTOR
L2019	2414017P14	IDCTR,CHIP,12NH,5%,300MA,. 6OHM
L2034	2478057A38	0306 HIGH Q CHIP INDUCTOR
L2035	2478057A26	24 NH SURFACE MOUNT INDUCTOR
L2036	2415429H01	CHIP INDUCTOR
M1	3275623B03	PAD, THERMAL ELECTRIC, MID-TIE
M2	75009299002	PAD, THERMAL
M3	1104959T01	COATING-CONTACT
M4	6071520M01	BATT COIN 3V LI RECHARGEABLE
M101	2871616H02	CONNECTOR, BPLUS
M103	3987977Y04	CONT,CONN,1CONT,ANT UNIV 4.
M104	3987977Y04	CONT,CONN,1CONT,ANT UNIV 4.
M107	0985888K02	SKT RTC BTTY LEAP
P101	2887818K05	PLUG 40PIN MATING CNTCR 1.5MM
PWB	84009519002	PCB, RF TRANSCEIVER
Q201	4813970A59	P-CH FET 1.0A 20V SOT-23 T&R
Q202	4813973A32	XSTR,BIP GP SS,NPN,SM, SC-70,SM
Q503	4885316E38	TRANSISTOR, RF
Q601	4813973A04	XSTR,BIP GP SS,NPN,TA13,SM,SOT
Q713	4805585Q32	TRANSITOR, NPN RF
Q714	4889394V04	XSTR,FET GEN PURPOSE SMALL SIG
Q774	4885061Y01	XSTR NPN 6V 30UA 12GHZ PB-FREE
Q842	4805585Q32	TRANSITOR, NPN RF
Q1101	4813973A32	XSTR,BIP GP SS,NPN,SM, SC-70,SM
Q1103	4813970A59	P-CH FET 1.0A 20V SOT-23 T&R
Q1500	5185633C92	MODULE,RING,XSTR, FET RF POWER
Q2022	4813973M75	XSTR,BIP GP SS,PNP,BC858, SOT-5
R101	0613952R01	CER CHIP RES 10K OHM 5% 0402
R103	0613952R01	CER CHIP RES 10K OHM 5% 0403
R104	0613952Q80	CER CHIP RES 2000 OHM 5 0402
R201	0613952R25	CER CHIP RES 100K OHM 5% 0411
R202	0613952Q89	CER CHIP RES 4700 OHM 5 0403
R501	NOT PLACED	–
R502	0613952Q45	CER CHIP RES 68.0 OHM 5 0402
R503	0613952R10	CER CHIP RES 24K OHM 5 0402
R504	0613952Q85	CER CHIP RES 3300 OHM 5 0402
R505	0613952R31	CER CHIP RES 180K OHM 5% 0402
R506	0613952Q53	CER CHIP RES 150 OHM 5 0402
R507	0613952Q75	CER CHIP RES 1200 OHM 5 0402
R508	0613952Q29	CER CHIP RES 15.0 OHM 5 0402
R509	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R511	0613952Q11	CER CHIP RES 2.7 OHM 5 0402
R512	NOT PLACED	–
R601	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R602	0613952Q63	CER CHIP RES 390 OHM 5 0402
R603	0613952R25	CER CHIP RES 100K OHM 5% 0412
R604	0613952Q63	CER CHIP RES 390 OHM 5 0402
R605	0613952R01	CER CHIP RES 10K OHM 5% 0422
R606	0613952R01	CER CHIP RES 10K OHM 5% 0423
R607	0613952R25	CER CHIP RES 100K OHM 5% 0413
R608	0613952R01	CER CHIP RES 10K OHM 5% 0424
R609	0613952Q81	CER CHIP RES 2200 OHM 5 0402
R610	0613952R25	CER CHIP RES 100K OHM 5% 0414
R611	0613952R01	CER CHIP RES 10K OHM 5% 0425
R612	0613952Q94	CER CHIP RES 7500 OHM 5 0402
R613	0613952Z41	RES,MF,2.4KOHM,1%,.0625W,SM,04
R614	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R615	NOT PLACED	–
R616	NOT PLACED	–
R617	NOT PLACED	–
R618	NOT PLACED	–
R619	NOT PLACED	–
R620	NOT PLACED	–
R621	NOT PLACED	–
R623	NOT PLACED	–
R624	NOT PLACED	–
R633	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R698	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R699	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R701	0613952Q49	CER CHIP RES 100 OHM 5 0407
R702	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R705	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R706	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R707	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R708	0613952Q49	CER CHIP RES 100 OHM 5 0408
R712	0613952Q67	CER CHIP RES 560 OHM 5 0402
R713	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R714	0613952Q67	CER CHIP RES 560 OHM 5 0402
R715	0613952Q67	CER CHIP RES 560 OHM 5 0402
R716	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R717	0613952Q67	CER CHIP RES 560 OHM 5 0402
R721	0613952R01	CER CHIP RES 10K OHM 5% 0426
R729	0613952R09	CER CHIP RES 22K OHM 5% 0402
R743	0613952R17	CER CHIP RES 47K OHM 5% 0402
R745	0613952R09	CER CHIP RES 22K OHM 5% 0402
R751	0613952Q59	CER CHIP RES 270 OHM 5 0402
R752	0613952Q91	CER CHIP RES 5600 OHM 5 0402
R753	0613952Q91	CER CHIP RES 5600 OHM 5 0403
R754	0613952Q91	CER CHIP RES 5600 OHM 5 0404
R755	0613952R15	CER CHIP RES 39K OHM 5% 0402
R759	0613952Q69	CER CHIP RES 680 OHM 5 0402
R761	0613952Q57	CER CHIP RES 220 OHM 5 0402
R762	0613952R02	CER CHIP RES 11K OHM 5 0402
R764	0613952Q75	CER CHIP RES 1200 OHM 5 0402
R767	0613952Q45	CER CHIP RES 68.0 OHM 5 0402
R772	0613952Q37	CER CHIP RES 33.0 OHM 5 0402
R773	0613952Q91	CER CHIP RES 5600 OHM 5 0405
R776	0613952Q39	CER CHIP RES 39.0 OHM 5 0402
R778	0613952Q55	CER CHIP RES 180 OHM 5 0402
R807	0613952R09	CER CHIP RES 22K OHM 5% 0402
R808	0613952R23	CER CHIP RES 82K OHM 5% 0402
R809	0613952Q91	CER CHIP RES 5600 OHM 5 0406
R811	0613952Q39	CER CHIP RES 39.0 OHM 5 0402

Ref. Des.	Part Number	Description
R812	0613952Q47	CER CHIP RES 82.0 OHM 5% 0402
R813	0613952Q69	CER CHIP RES 680 OHM 5 0403
R815	0613952Q34	CER CHIP RES 24.0 OHM 5 0402
R818	0613952Q23	CER CHIP RES 8.2 OHM 5 0402
R819	0613952Q59	CER CHIP RES 270 OHM 5 0402
R822	0613952R08	CER CHIP RES 20K OHM 5 0402
R823	0613952R19	CER CHIP RES 56K OHM 5% 0402
R827	0613952Q92	CER CHIP RES 6200 OHM 5 0402
R832	0613952Q29	CER CHIP RES 15.0 OHM 5 0402
R833	0613952Q49	CER CHIP RES 100 OHM 5 0409
R840	0613952Q29	CER CHIP RES 15.0 OHM 5 0402
R848	0613952Q29	CER CHIP RES 15.0 OHM 5 0402
R849	0613952Q67	CER CHIP RES 560 OHM 5 0402
R1102	0613952R25	CER CHIP RES 100K OHM 5% 0402
R1103	6009259001	LOW RESISTANCE THICK FILM RESI
R1104	0613952Q49	CER CHIP RES 100 OHM 5 0402
R1105	0613952Q49	CER CHIP RES 100 OHM 5 0403
R1106	0613952Q21	CER CHIP RES 6.8 OHM 5 0402
R1107	0613952Q45	CER CHIP RES 68.0 OHM 5 0402
R1108	0613952R23	CER CHIP RES 82K OHM 5% 0402
R1110	0613952R01	CER CHIP RES 10K OHM 5% 0404
R1112	NOT PLACED	–
R1114	0613952Q49	CER CHIP RES 100 OHM 5 0404
R1115	0613952Q49	CER CHIP RES 100 OHM 5 0405
R1116	0613952R01	CER CHIP RES 10K OHM 5% 0405
R1117	0613952R22	CER CHIP RES 75K OHM 5 0402
R1121	0613952R12	CER CHIP RES 30K OHM 5 0402
R1122	0613952R22	CER CHIP RES 75K OHM 5 0402
R1124	0613952Q42	CER CHIP RES 51.0 OHM 5 0402
R1125	0613952Z58	RES,MF,22KOHM,1%,.0625W, SM,040
R1126	0613952Z54	RES,MF,9.1KOHM,1%,.0625W, SM,04
R1127	0613952R09	CER CHIP RES 22K OHM 5% 0402
R1128	0613952R01	CER CHIP RES 10K OHM 5% 0406
R1129	NOT PLACED	–
R1130	NOT PLACED	–
R1135	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R1136	0613952R01	CER CHIP RES 10K OHM 5% 0407
R1137	0613952R01	CER CHIP RES 10K OHM 5% 0408
R1138	0613952R25	CER CHIP RES 100K OHM 5% 0403
R1139	0613952R25	CER CHIP RES 100K OHM 5% 0404
R1140	0613952R25	CER CHIP RES 100K OHM 5% 0405
R1141	0613952R42	CER CHIP RES 510K OHM 5 0402
R1142	0613952R25	CER CHIP RES 100K OHM 5% 0406
R1143	0613952R25	CER CHIP RES 100K OHM 5% 0407
R1144	0613952R25	CER CHIP RES 100K OHM 5% 0408
R1145	0613952R25	CER CHIP RES 100K OHM 5% 0409
R1146	0613952R25	CER CHIP RES 100K OHM 5% 0410
R1151	0613952R05	CER CHIP RES 15K OHM 5% 0402
R1152	0613952R01	CER CHIP RES 10K OHM 5% 0409
R1154	0613952R01	CER CHIP RES 10K OHM 5% 0410
R1158	NOT PLACED	–
R1160	0613952R03	CER CHIP RES 12K OHM 5% 0402
R1162	0613952R29	CER CHIP RES 150K OHM 5% 0402
R1163	0613952R01	CER CHIP RES 10K OHM 5% 0411
R1164	0613952R01	CER CHIP RES 10K OHM 5% 0411
R1165	0613952Q56	CER CHIP RES 200 OHM 5 0402
R1166	0613952Q56	CER CHIP RES 200 OHM 5 0402
R1167	0613952R01	CER CHIP RES 10K OHM 5% 0412
R1168	0613952Q49	CER CHIP RES 100 OHM 5 0406
R1169	0613952P52	CER CHIP RES 340K OHM 1 0402
R1170	0613952P01	CER CHIP RES 100K OHM 1 0402
R1171	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R1172	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R1174	0613952R01	CER CHIP RES 10K OHM 5% 0413
R1175	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R1176	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R1177	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R1178	0613952R01	CER CHIP RES 10K OHM 5% 0414
R1180	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R1181	NOT PLACED	–
R1182	0613952R01	CER CHIP RES 10K OHM 5% 0415
R1183	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R1184	0613952Q81	CER CHIP RES 2200 OHM 5 0402
R1186	NOT PLACED	–
R1304	NOT PLACED	–
R1307	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R1500	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R1501	NOT PLACED	–
R1502	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R1503	0613952R08	CER CHIP RES 20K OHM 5 0402
R1504	0613952R13	CER CHIP RES 33K OHM 5% 0402
R1505	0613952R01	CER CHIP RES 10K OHM 5% 0416
R1506	0613952R03	CER CHIP RES 12K OHM 5% 0402
R2001	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R2002	NOT PLACED	–
R2006	0613952R01	CER CHIP RES 10K OHM 5% 0417
R2007	0613952R01	CER CHIP RES 10K OHM 5% 0418
R2008	0613952R01	CER CHIP RES 10K OHM 5% 0419
R2009	0613952R01	CER CHIP RES 10K OHM 5% 0420
R2010	0613952Q96	CER CHIP RES 9100 OHM 5 0402
R2011	0613952Q96	CER CHIP RES 9100 OHM 5 0403
R2021	0613952R22	CER CHIP RES 75K OHM 5 0402
R2022	0613952R27	CER CHIP RES 120K OHM 5% 0402
R2023	0613952R01	CER CHIP RES 10K OHM 5% 0421
R2024	0613952Q37	CER CHIP RES 33.0 OHM 5 0402
R2025	0613952Q11	CER CHIP RES 2.7 OHM 5 0402
R2035	0613952Q75	CER CHIP RES 1200 OHM 5 0402
SH1	26009322001	SHIELD, RF PA
SH2	2675872B01	SHIELD, XTAL
SH3	2675873B01	SHIELD, ABACUS
SH4	26009323001	SHIELD, DC FILTER
SH5	26009327001	SHIELD, OUTPUT MATCH
SH6	26009320001	SHIELD, ALC
SH7	2675874B01	SHIELD, MIXER
SH8	2675932B01	SHIELD, 2ND LO VCO

Ref. Des.	Part Number	Description
SH9	26009319001	SHIELD, VCO
SH10	26009324001	SHIELD, HARMONIC FILTER
SH11	26009321001	SHIELD, RX FRONT END
SH12	2675933B01	SHIELD, IF AMP
SH13	26009325001	SHIELD, FGU
SH14	26009326001	SHIELD, DC REGULATOR
T503	2575851B01	RF TRANSFORMER BALUN
T504	2575851B01	RF TRANSFORMER BALUN
T505	2575851B01	RF TRANSFORMER BALUN
U101	5105443X07	EEPROM 32KBIT SERIAL SPI BUS
U200	5188493T01	IC,VREG/SWG,LP2989,SM,MINI SO-
U201	5175771A99	LOW NOISE, 100MA LINEAR REGULA
U202	5175772B02	LINEAR REGULATOR 100MA 1.8V
U203	5175772B01	LINEAR VOLTAGE REGULATOR 350MA
U506	5164852H82	IC, MIXER/ BUFFER
U601	5102495J14	IC,IF,IF DIGITILIZING SUBSYST
U602	4885316E38	TRANSISTOR, RF
U603	5109522E84	IC DUAL SCHMITT TRIG MICRO PAK
U604	5109522E84	IC DUAL SCHMITT TRIG MICRO PAK
U605	5164852H16	IC TRANSCEIVER W/LEVEL TRANSLA
U606	5164852H16	IC TRANSCEIVER W/LEVEL TRANSLA
U607	5186311J24	IC,BFR,1BITS,NC7SZ125,ACTIV E H
U702	5164015H28	IC,TRIDENT,INTEG SYNTH, RX/TX B
U703	5175772B06	28-PORT I/O EXPANDER
U709	5171972L01	SP3T RF SWITCH
U710	5171972L01	SP3T RF SWITCH
U746	4805218N63	RF TRANS SOT 323 BFQ67W
U1101	5188032U43	IC,SENSING CIRCUIT,INA138,SM,S
U1102	5175772B03	RECONFIGURABLE 10W SP5T/ 3T RF
U1103	5185070Y01	IC TEMPERATURE SENSOR PB-FREE
U1104	5185941F56	IC SINGLE LV LP OP AMPLIFIER
U1105	5180390L83	IC,CNTLR,SM,1PER PKG
U1106	5175772B05	PRECISION RF DETECTOR
U1111	5175771A26	CMOS FET SWITCH SPDT, 10WATTS
U1112	5175772B04	1 DB LSB GAAS MMIC ATTENUATOR
U1113	5185941F56	IC SINGLE LV LP OP AMPLIFIER
U1114	5185941F56	IC SINGLE LV LP OP AMPLIFIER
U1116	5109522E93	2 INPUT OR GATE IN NANO PACKAG
U1117	5103535B53	IC,INVTR,DL,NC7WZ04L6X, 2PER PK
U1118	5109522E93	2 INPUT OR GATE IN NANO PACKAG
U1119	5109522E94	2 INPUT AND GATE IN NANO PACKA
U1121	5114000B52	IC,XOR,LOGIC LEVEL SHIFTER,1PE
U1125	51009382001	IC, QUAD DAC
U1126	5109817F77	IC COMPTR LM7275 5SC70 (D54)
U1127	5171779H01	SPDT ANALOG SWITCH
U1128	5188085K11	IC, SINGLE NAND GATE, 2-INPUT,
U1129	5175143H01	WIDE SUPPLY RANGE OP AMP
U1130	5175143H01	WIDE SUPPLY RANGE OP AMP
U1131	5109817F77	IC COMPTR LM7275 5SC70 (D54)
U1132	5114007M28	IC,F-F/D,1PER PKG,17SZ74,N-I, S
U1133	5171779H01	SPDT ANALOG SWITCH
U1136	5109522E94	2 INPUT AND GATE IN NANO PACKA
U1137	5164852H16	IC TRANSCEIVER W/LEVEL TRANSLA
U1138	5164852H16	IC TRANSCEIVER W/LEVEL TRANSLA
U1139	5164852H16	IC TRANSCEIVER W/LEVEL TRANSLA
U1141	5185941F56	IC SINGLE LV LP OP AMPLIFIER
U1142	5185941F56	IC SINGLE LV LP OP AMPLIFIER
U1143	5185941F56	IC SINGLE LV LP OP AMPLIFIER
U1144	5171779H01	SPDT ANALOG SWITCH
U1146	5109522E93	2 INPUT OR GATE IN NANO PACKAG
U1147	5109522E94	2 INPUT AND GATE IN NANO PACKA
U1148	5185941F56	IC SINGLE LV LP OP AMPLIFIER
U1149	5185941F45	ATTEN,VAR,14.4DBMIN,15.6DB MAX,
U1150	51009381001	LOW DROPOUT VOLTAGE REFERENCE
U1304	5105739X13	IC, SIGE GPS LOW NOISE AMP 157
U1500	51012101001	VHF/UHF/800/900 MHZ LDMOS DRIV
U1501	5175143H01	WIDE SUPPLY RANGE OP AMP
U2032	4885316E38	TRANSISTOR, RF
VR101	4813977M29	DIODE,VREF,MBZ5250,SM, SOT-23,2
VR200	4813977M29	DIODE,VREF,MBZ5250,SM, SOT-23,2
VR601	4805656W87	DIODE,VCTR, @ 15V,1SV279, SOD-
VR602	4805656W87	DIODE,VCTR, @ 15V,1SV279, SOD-
VR2005	4815096H01	VARACTOR DIODE 1SV305
VR2006	4815096H01	VARACTOR DIODE 1SV305
VR2007	4815096H01	VARACTOR DIODE 1SV305
VR2008	4815096H01	VARACTOR DIODE 1SV305
VR2010	4815096H01	VARACTOR DIODE 1SV305
VR2020	4815096H01	VARACTOR DIODE 1SV305
Y701	4871886H01	16.8 MHZ VCTXO .8PPM
Y704	5164852H68	IC, VCO MODULE
Y705	5164852H66	IC, VCO MODULE

8.7 Transceiver (RF) Boards: 700–800 MHz

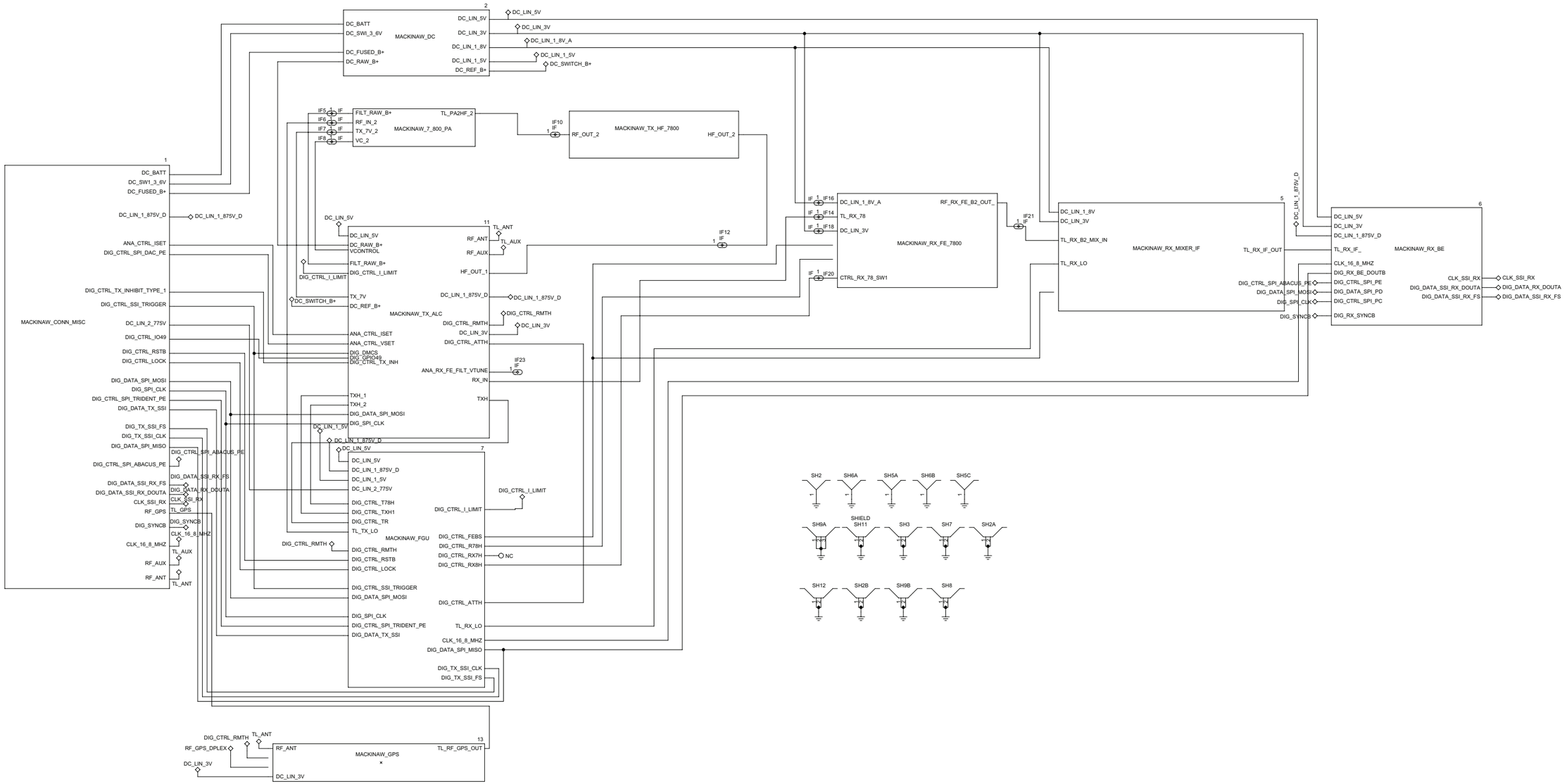


Figure 8-49. NUF6750A Transceiver (RF) Board Overall Circuit Schematic

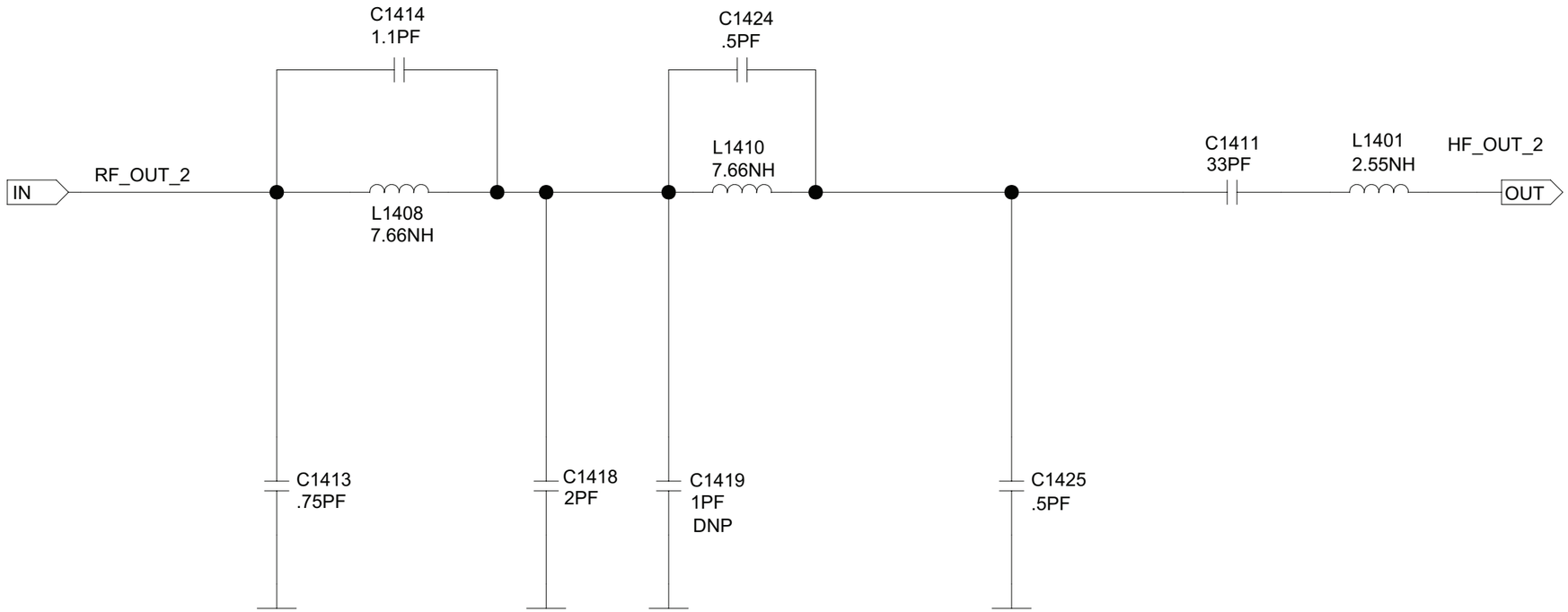


Figure 8-50. NUF6750A Harmonic Filter Circuit

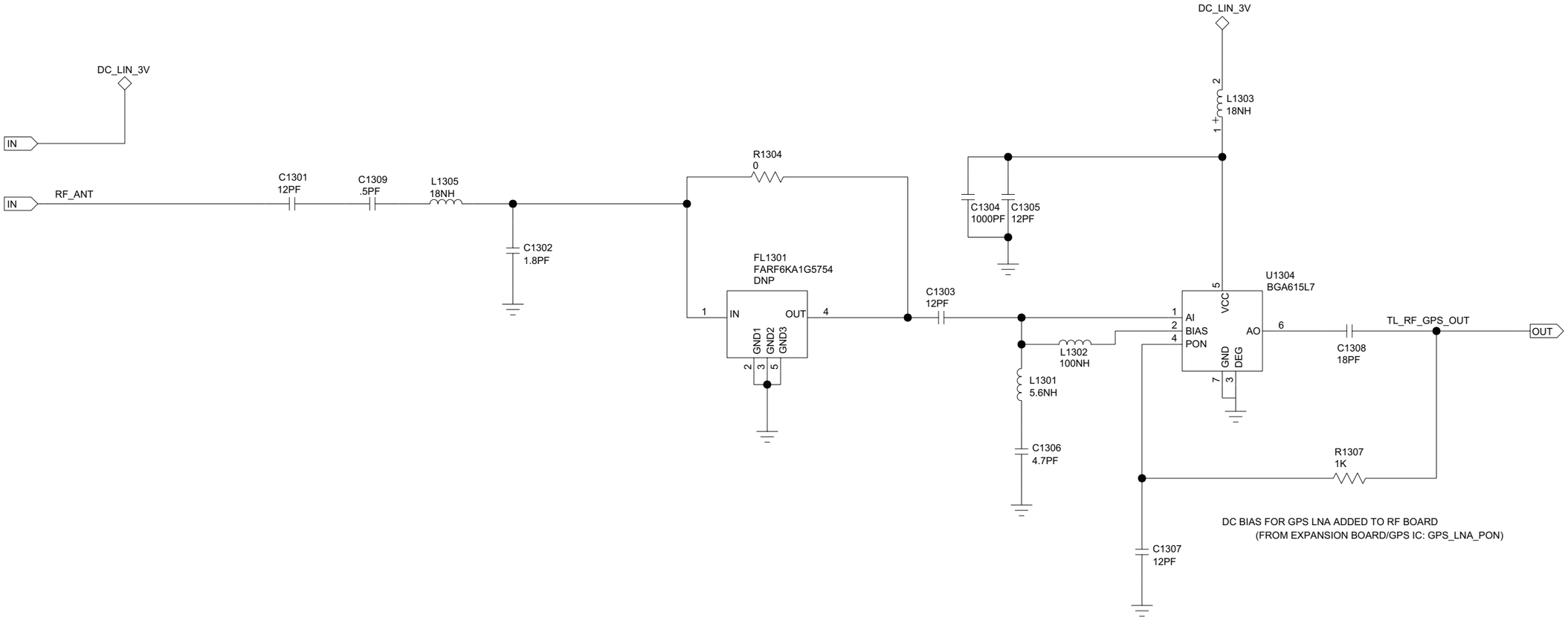


Figure 8-51. NUF6750A GPS Circuit

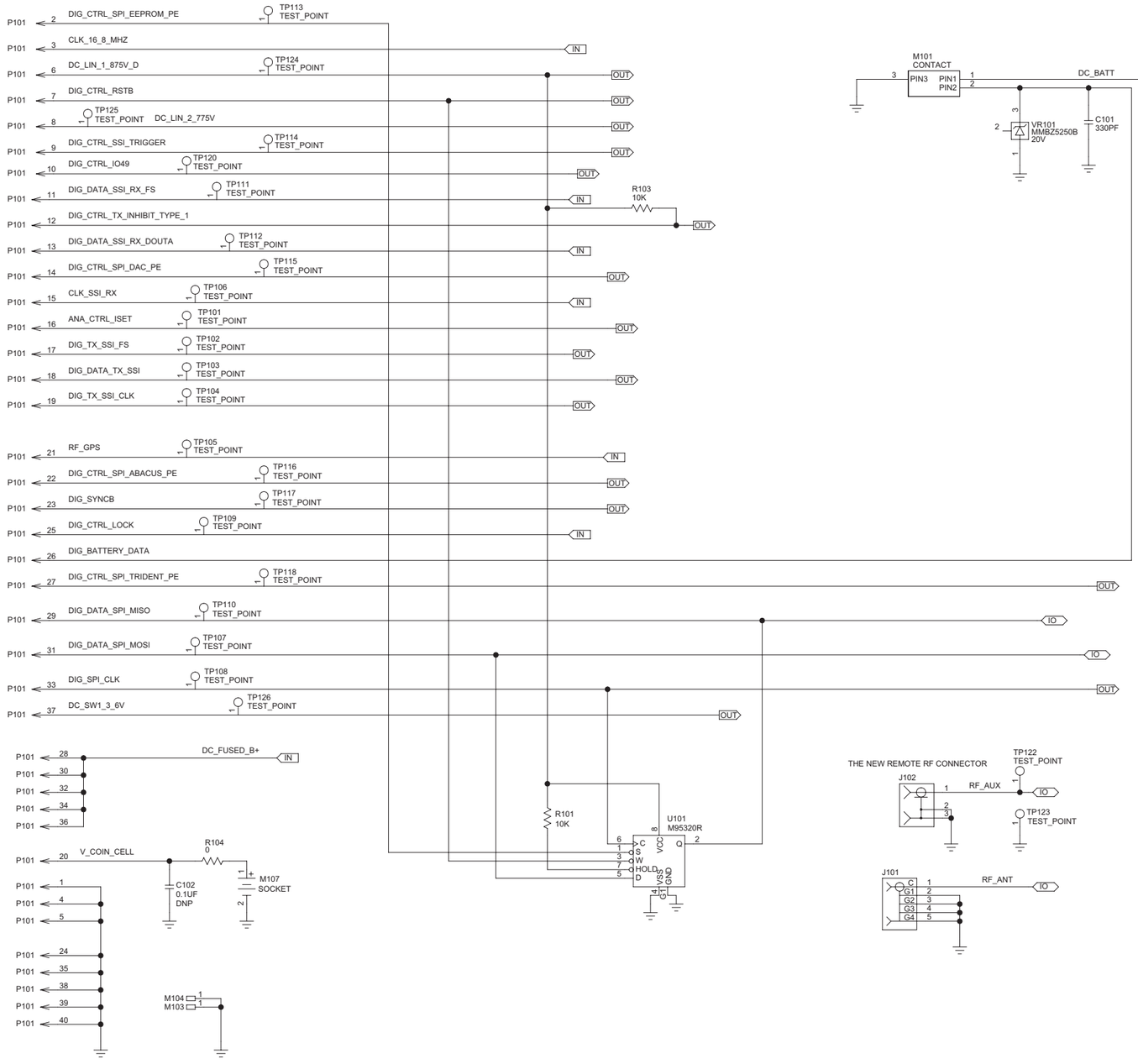


Figure 8-52. NUF6750A Miscellaneous Connector Circuit

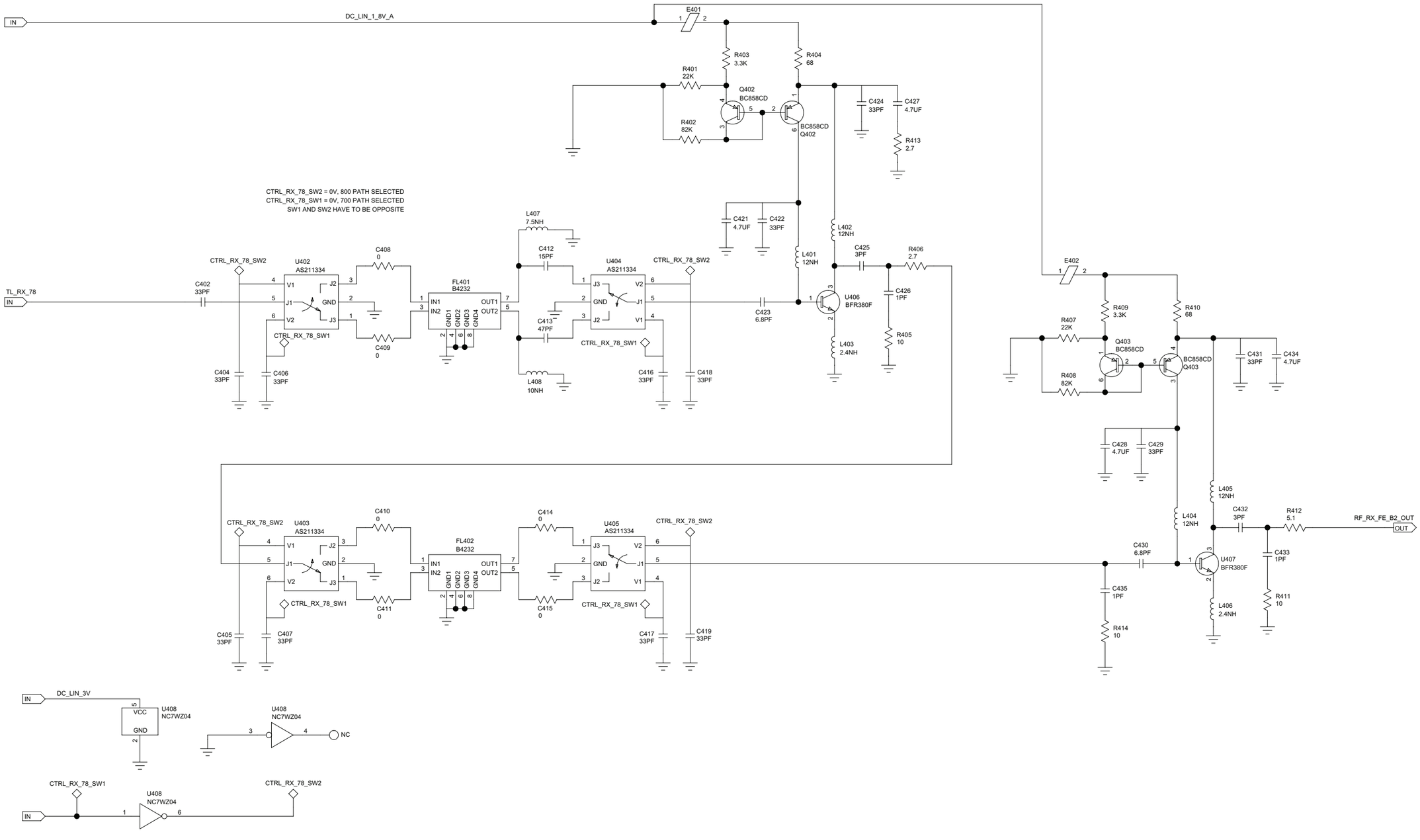


Figure 8-53. NUF6750A Receiver Front End Circuit

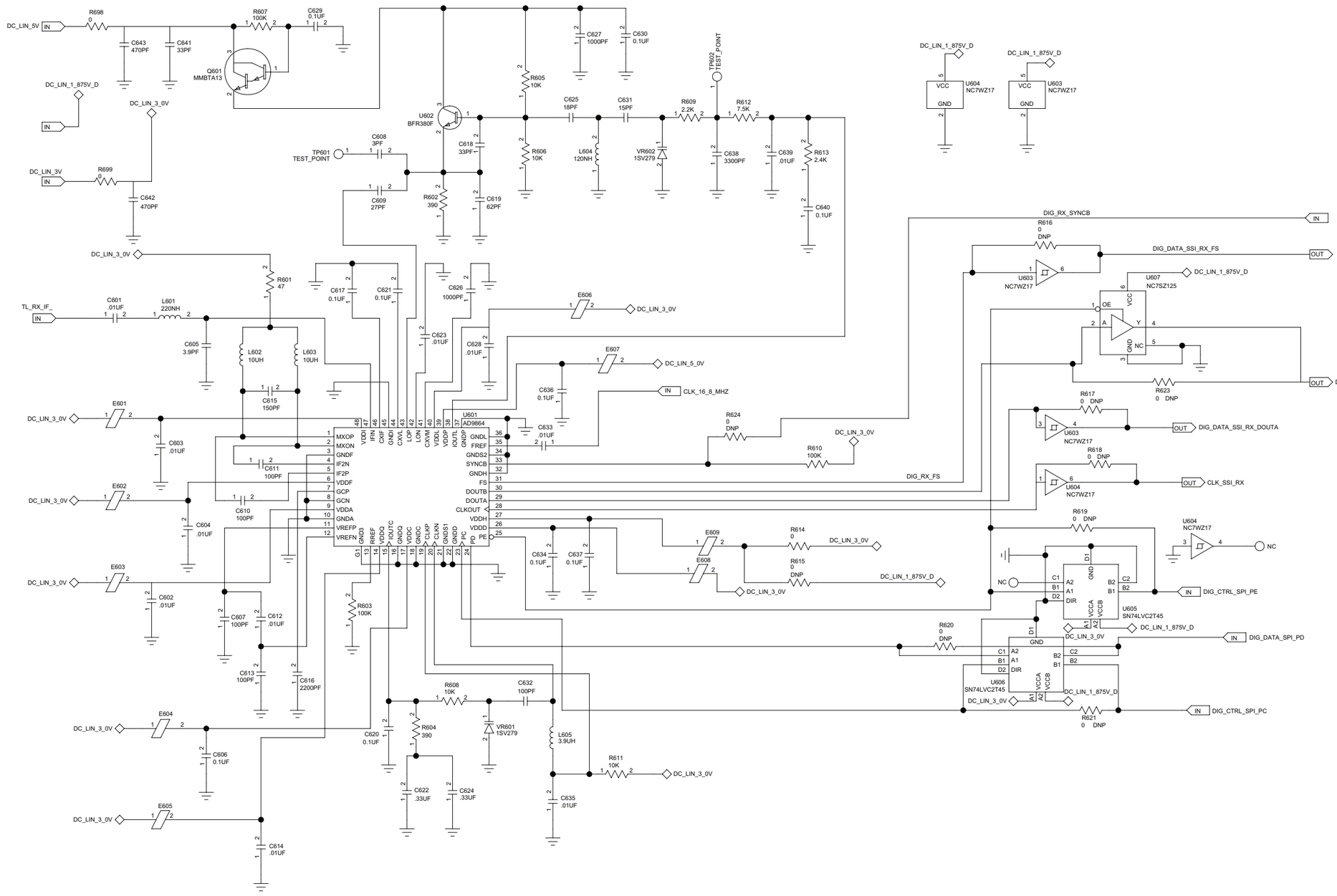


Figure 8-54. NUF6750A Receiver Back End Circuit

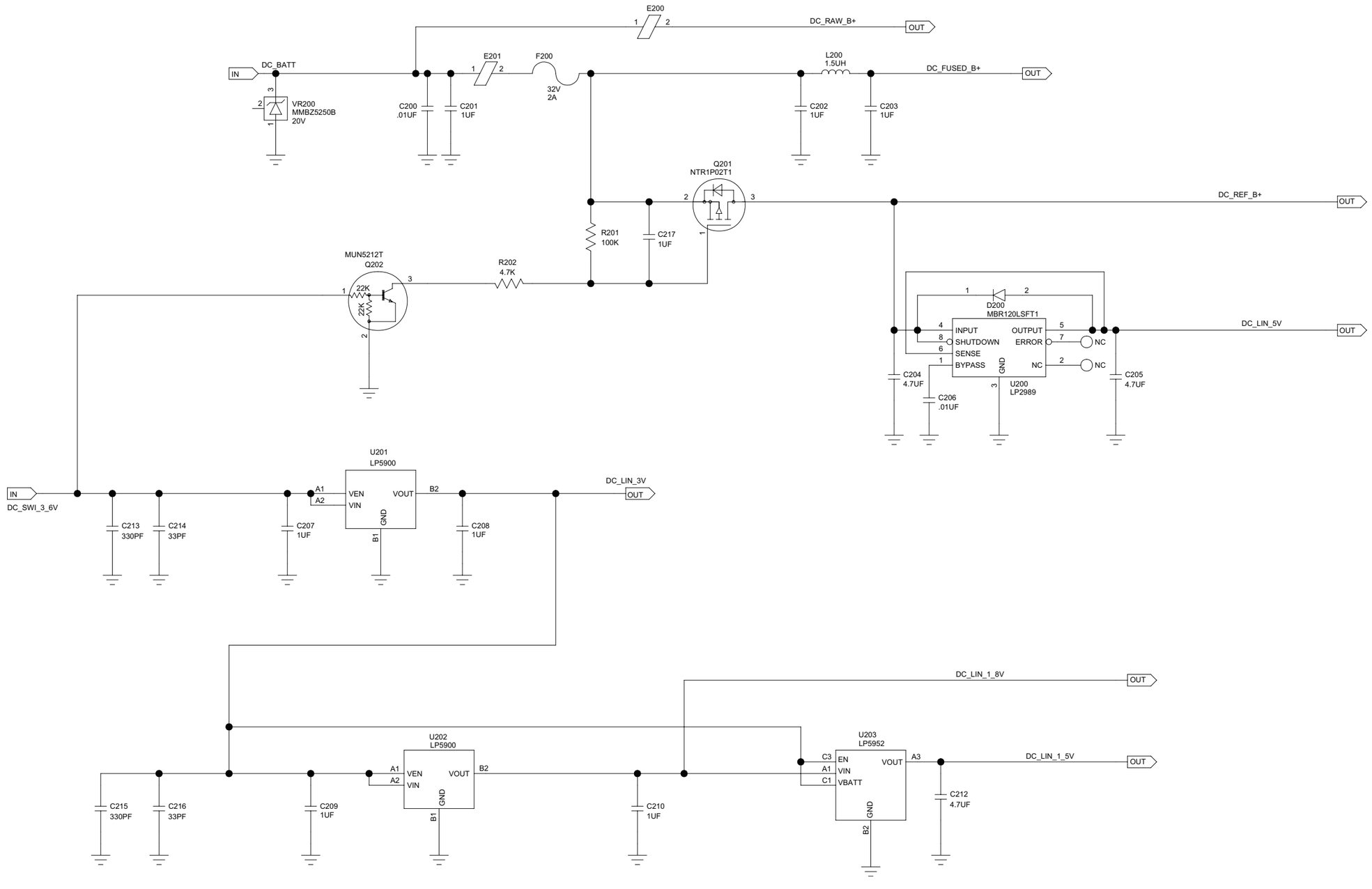


Figure 8-55. NUF6750A DC Power Circuit

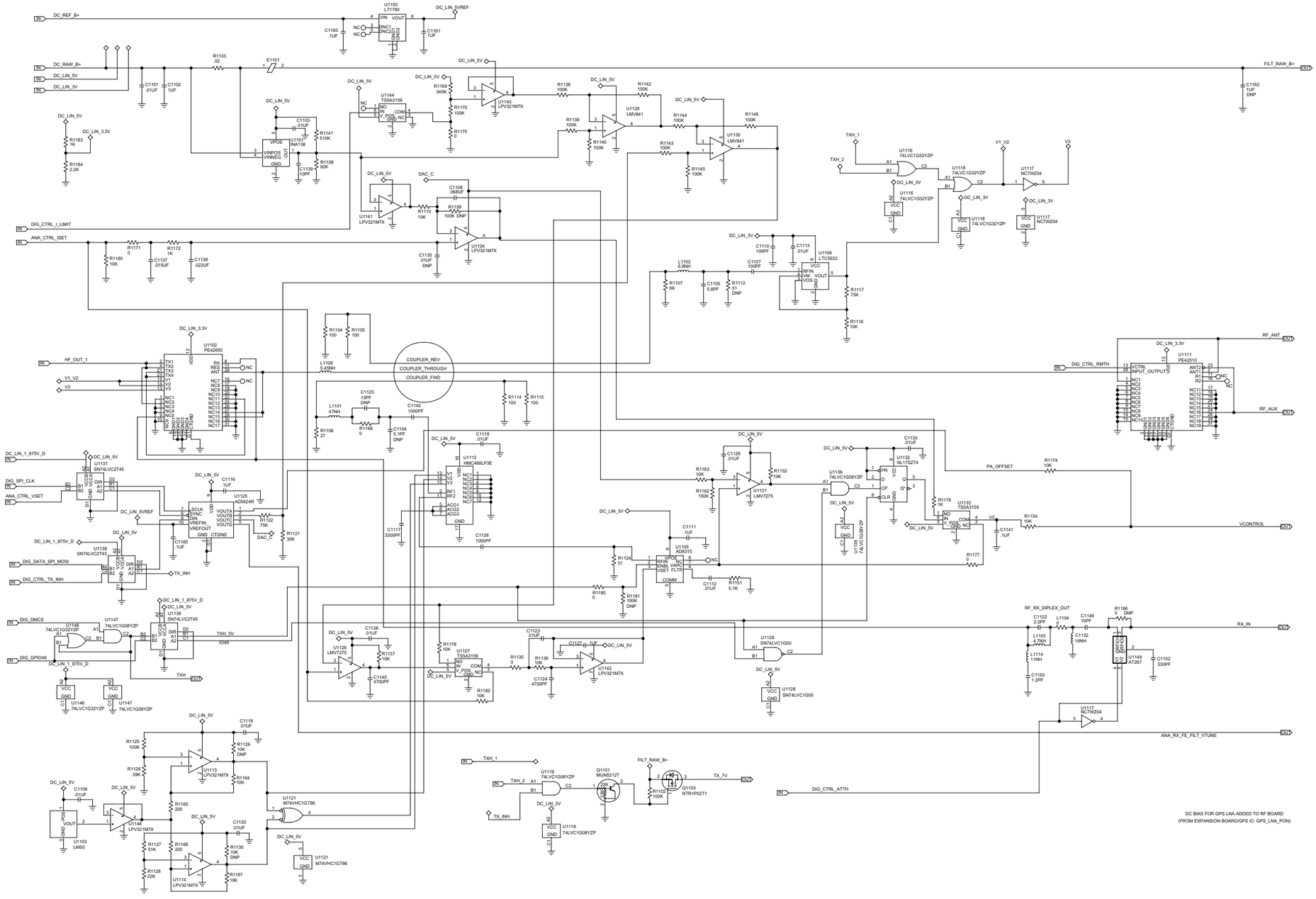


Figure 8-56. NUF6750A Transmitter and Automatic Level Control Circuits

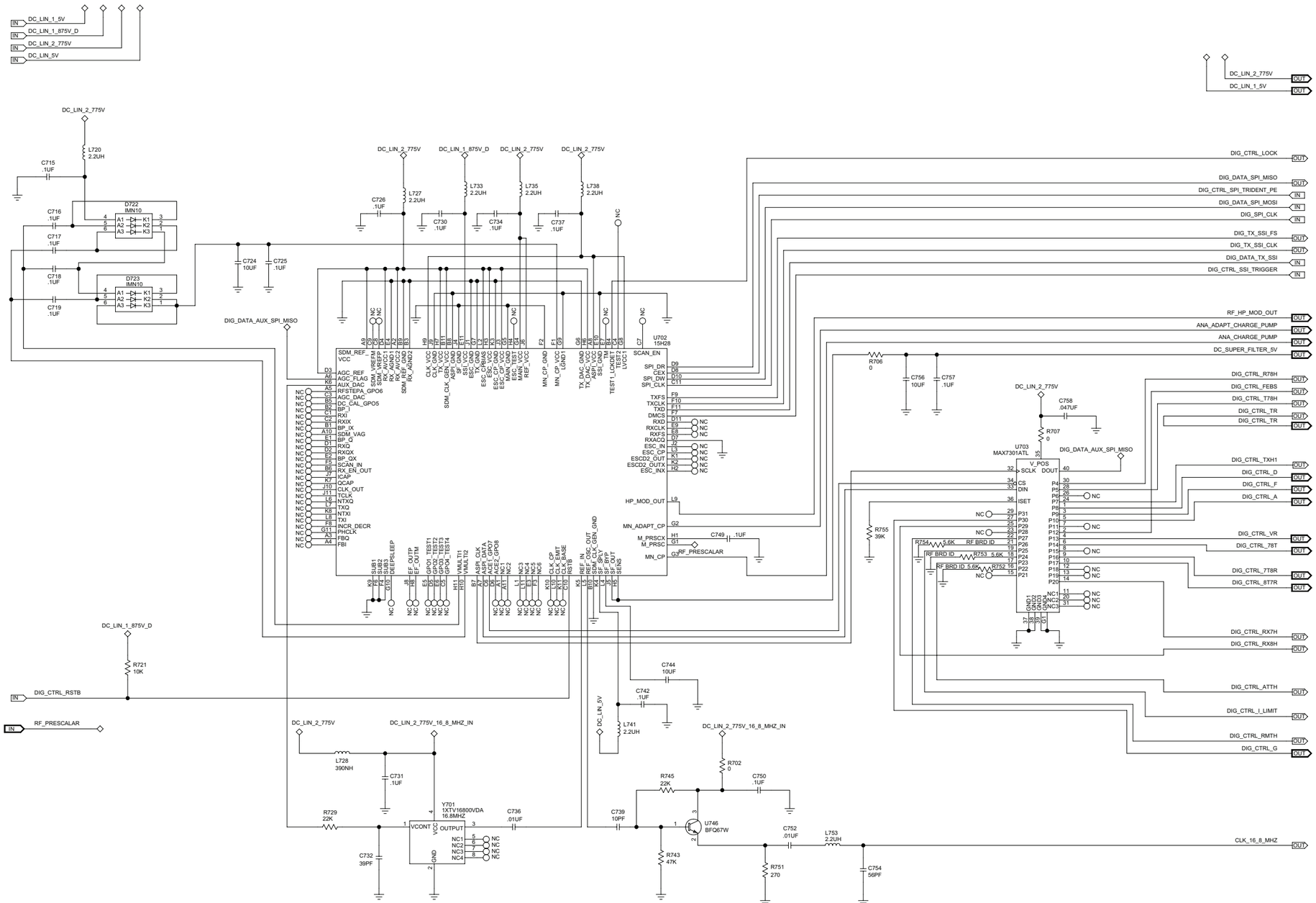


Figure 8-57. NUF6750A Frequency Generation Unit (Synthesizer) Circuit – 1 of 2

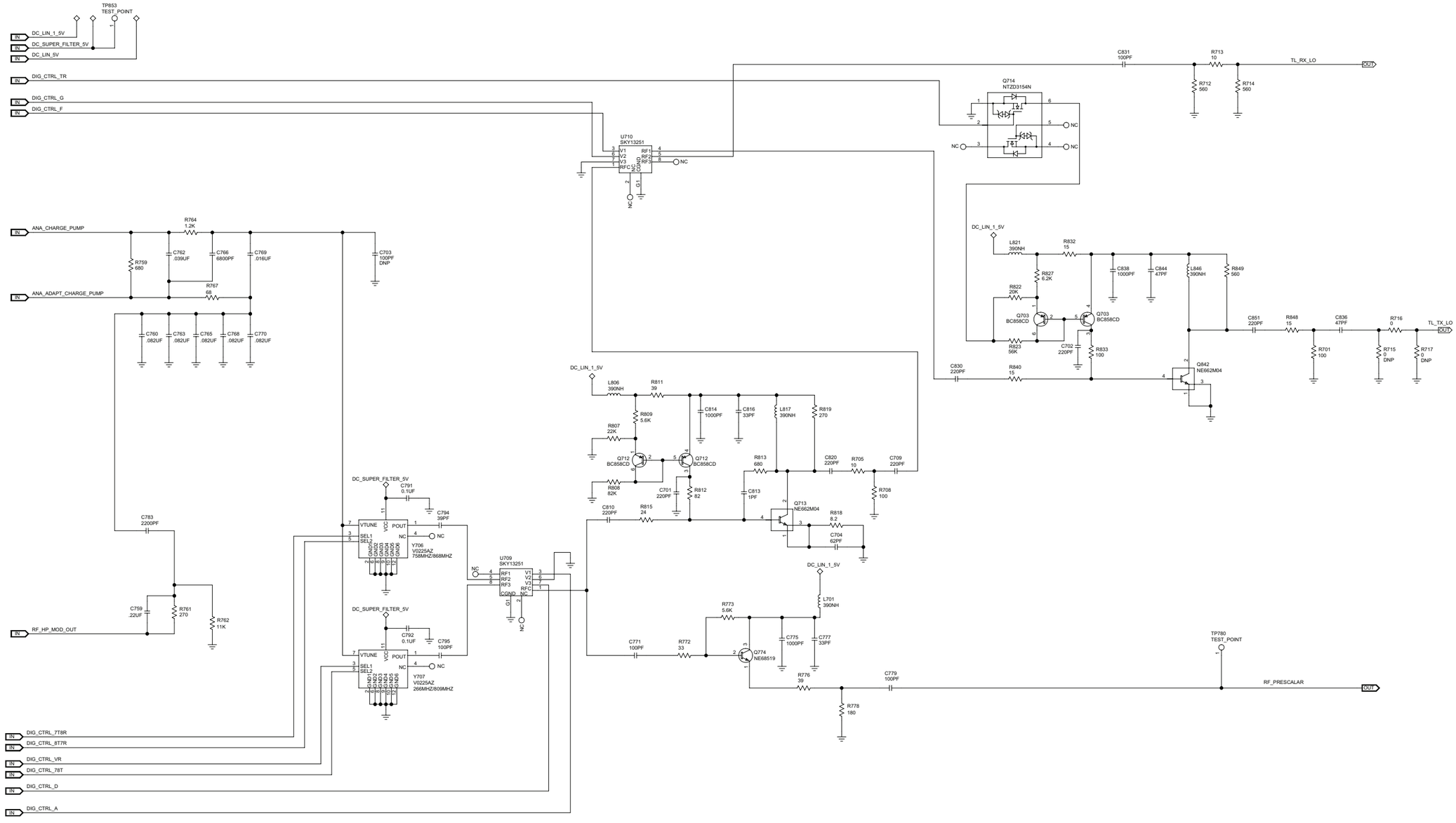


Figure 8-58. NUF6750A Frequency Generation Unit (VCO) Circuit – 2 of 2

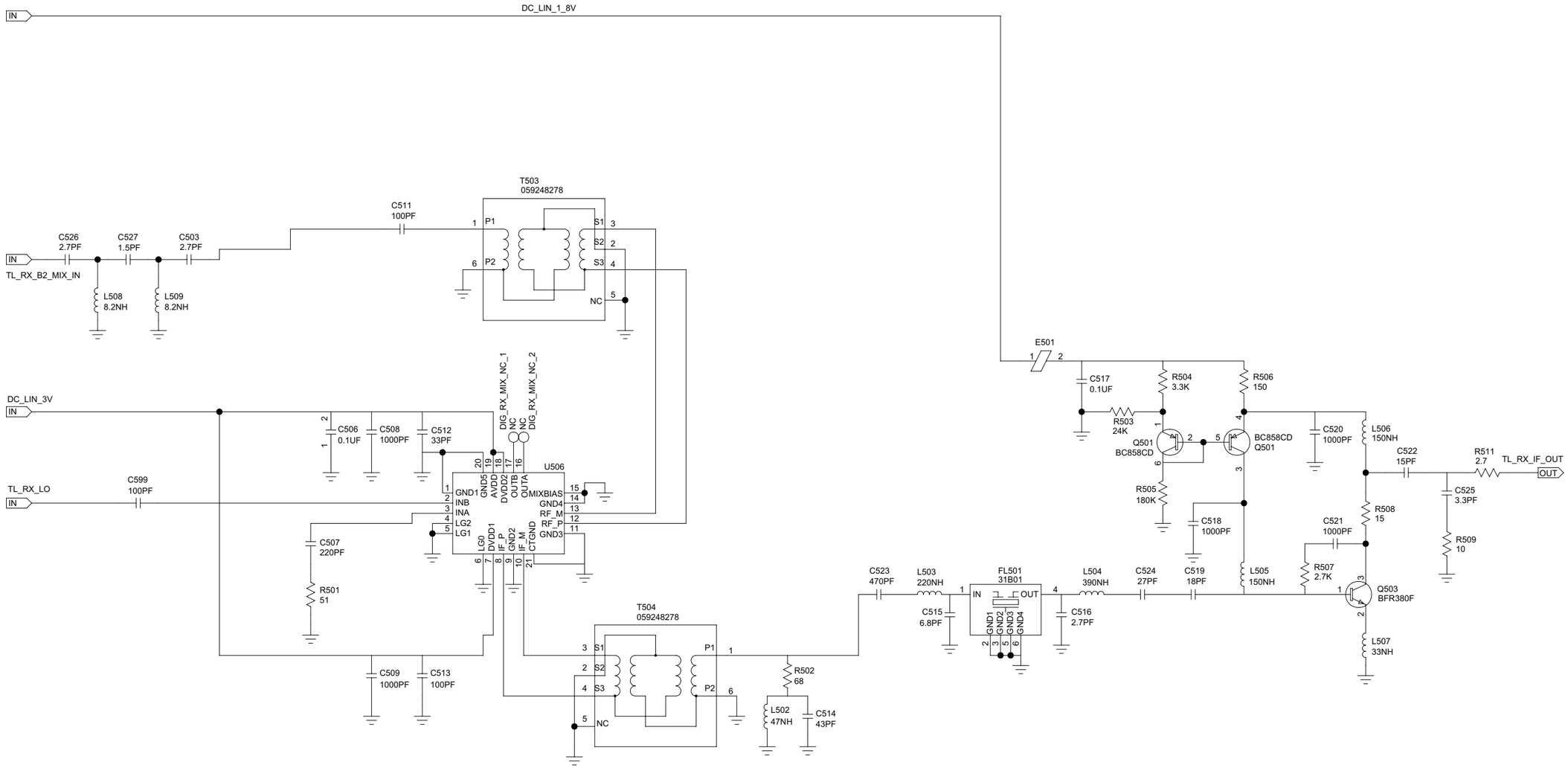


Figure 8-59. NUF6750A Mixer and IF Filter Circuits

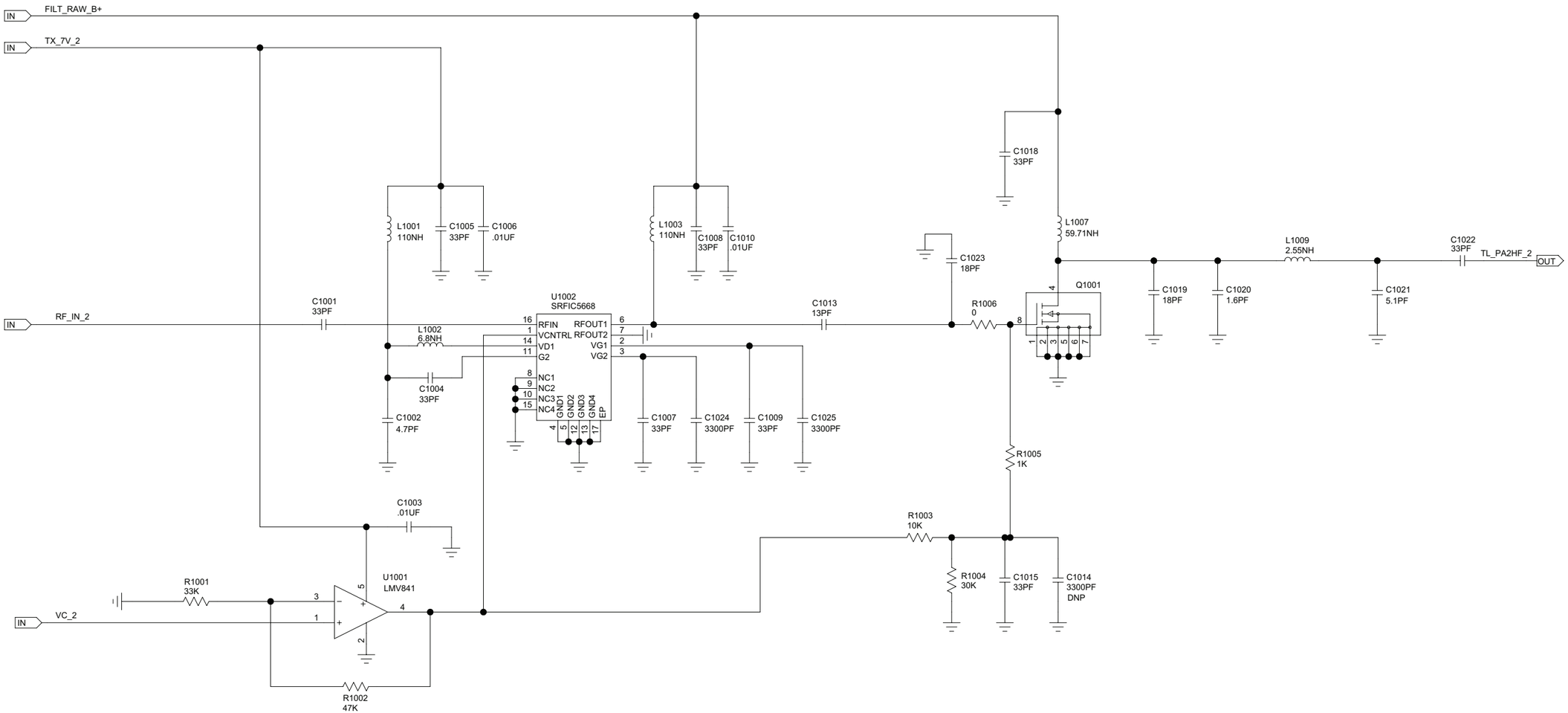


Figure 8-60. NUF6750A Power Amplifier Circuit

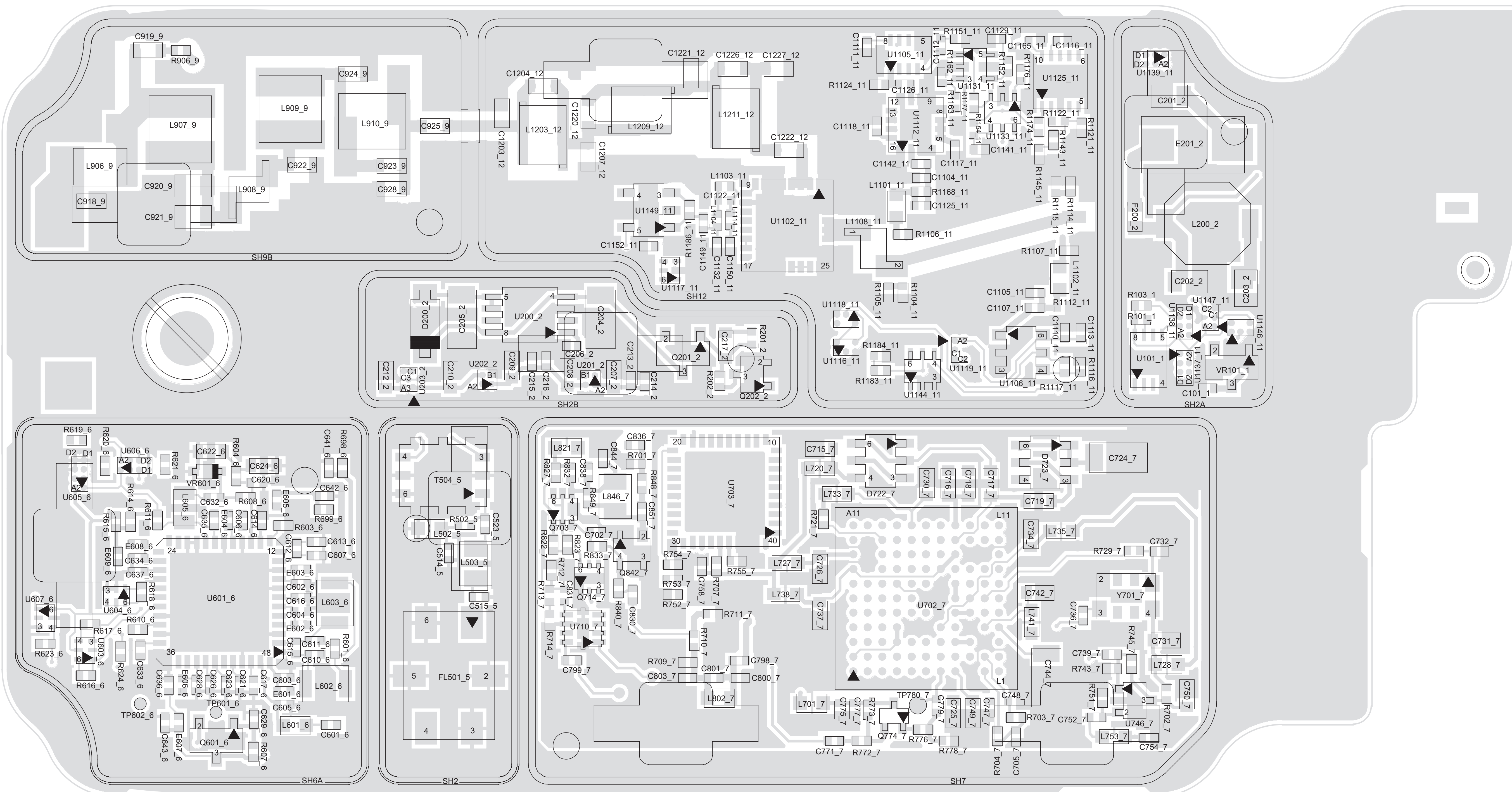


Figure 8-61. NUF6750A Transceiver (RF) Board Layout – Side 1

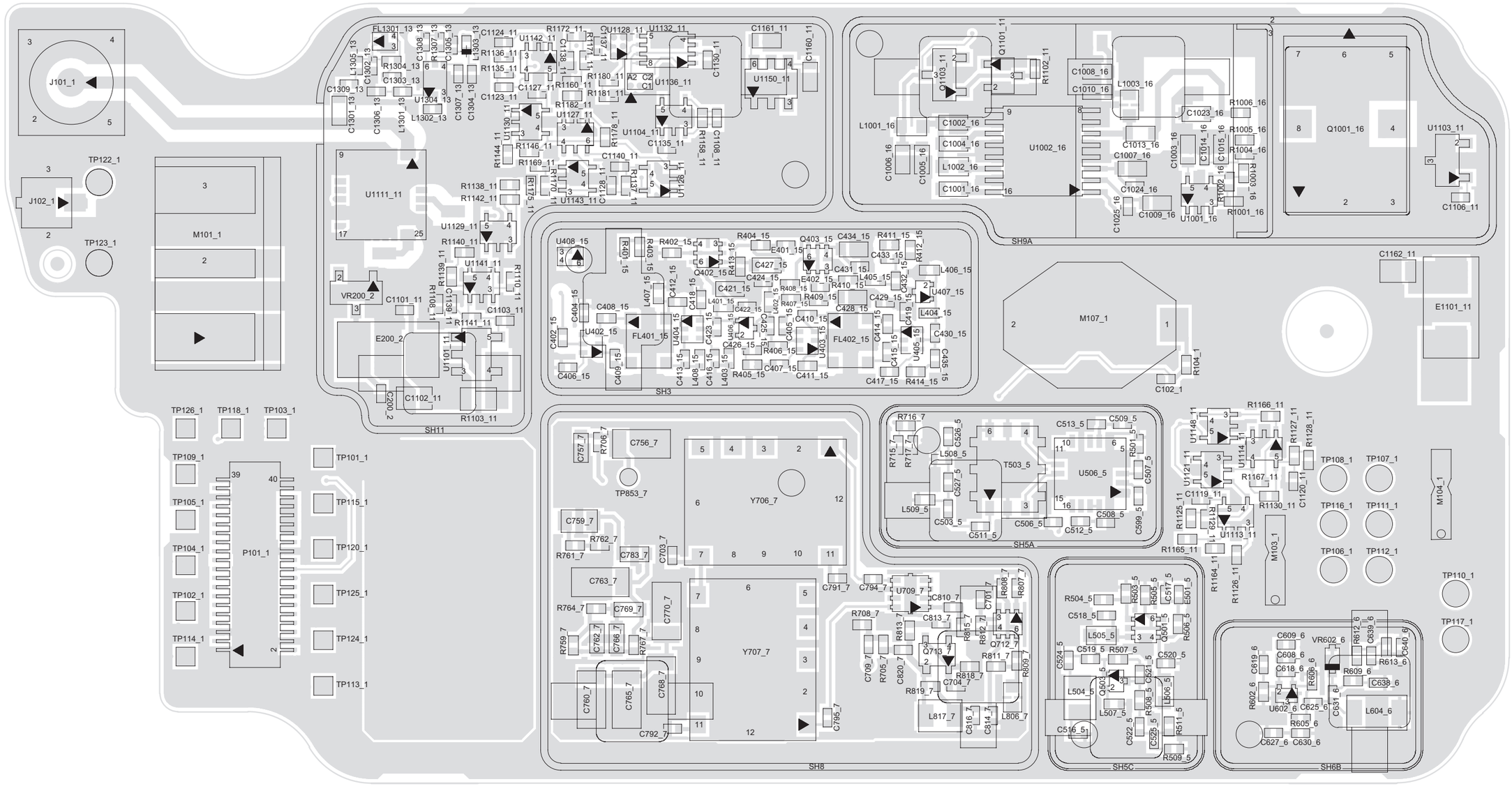


Figure 8-62. NUF6750A Transceiver (RF) Board Layout – Side 2

NUF6750A 700–800 MHz Transceiver (RF) Board Parts List

Ref. Des.	Part Number	Description
C101	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C102	NOT PLACED	–
C200	2113945B02	CAP CER CHP 10,000PF 25V 10%
C201	2188468Y01	CAP CER 25V X7R 0805 1UF
C202	2188468Y01	CAP CER 25V X7R 0805 1UF
C203	2188468Y01	CAP CER 25V X7R 0805 1UF
C204	2113955D35	CAP,FXD,4.7UF,+10%,-10%, 16V-DC,1206,X7R,-55DEG CMIN,125DEG CMAX
C205	2113955D35	CAP,FXD,4.7UF,+10%,-10%, 16V-DC,1206,X7R,-55DEG CMIN,125DEG CMAX
C206	2113945B02	CAP CER CHP 10,000PF 25V 10%
C207	2113956B91	CAP,FXD,1UF,+10%,-10%,16V-DC,0603,X5R,-55DEG CMIN, 85DEG CMAX,PB
C208	2113956B91	CAP,FXD,1UF,+10%,-10%,16V-DC,0603,X5R,-55DEG CMIN, 85DEG CMAX,PB
C209	2113956B91	CAP,FXD,1UF,+10%,-10%,16V-DC,0603,X5R,-55DEG CMIN, 85DEG CMAX,PB
C210	2113956B91	CAP,FXD,1UF,+10%,-10%,16V-DC,0603,X5R,-55DEG CMIN, 85DEG CMAX,PB
C212	2113946D07	CAP,CHIP,4.7UF,+10%,-10%, 6.3V-DC,0603,X5R,-55DEG CMIN,85DEG CMA
C213	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C214	2113944A31	CAP CER CHP 33.0PF 50V 5%
C215	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C216	2113944A31	CAP CER CHP 33.0PF 50V 5%
C217	2113956B91	CAP,FXD,1UF,+10%,-10%,16V-DC,0603,X5R,-55DEG CMIN, 85DEG CMAX,PB
C402	2113944A31	CAP CER CHP 33.0PF 50V 5%
C404	2113944A31	CAP CER CHP 33.0PF 50V 5%
C405	2113944A31	CAP CER CHP 33.0PF 50V 5%
C406	2113944A31	CAP CER CHP 33.0PF 50V 5%
C407	2113944A31	CAP CER CHP 33.0PF 50V 5%
C408	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
C409	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
C410	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
C411	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
C412	2113944A27	CAP CER CHP 15.0PF 50V 5%
C413	2113944A33	CAP CER CHP 47.0PF 50V 5%
C414	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
C415	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
C416	2113944A31	CAP CER CHP 33.0PF 50V 5%
C417	2113944A31	CAP CER CHP 33.0PF 50V 5%
C418	2113944A31	CAP CER CHP 33.0PF 50V 5%
C419	2113944A31	CAP CER CHP 33.0PF 50V 5%
C421	2113946D07	CAP,CHIP,4.7UF,+10%,-10%, 6.3V-DC,0603,X5R,-55DEG CMIN,85DEG CMA
C422	2113944A31	CAP CER CHP 33.0PF 50V 5%
C423	2113944A21	CAP CER CHP 6.8PF 50V +/- 0.5PF
C424	2113944A31	CAP CER CHP 33.0PF 50V 5%
C425	2113944A12	CAP CER CHP 3.0PF 50V +/- 0.25PF
C426	2113944A63	CAP,FXD,1PF,.25PF+/-,50V-DC, 0402,C0G,-55DEG CMIN, 125DEG CMAX,P
C427	2113946D07	CAP,CHIP,4.7UF,+10%,-10%, 6.3V-DC,0603,X5R,-55DEG CMIN,85DEG CMA
C428	2113946D07	CAP,CHIP,4.7UF,+10%,-10%, 6.3V-DC,0603,X5R,-55DEG CMIN,85DEG CMA
C429	2113944A31	CAP CER CHP 33.0PF 50V 5%
C430	2113944A21	CAP CER CHP 6.8PF 50V +/- 0.5PF
C431	2113944A31	CAP CER CHP 33.0PF 50V 5%
C432	2113944A12	CAP CER CHP 3.0PF 50V +/- 0.25PF
C433	2113944A63	CAP,FXD,1PF,.25PF+/-,50V-DC, 0402,C0G,-55DEG CMIN, 125DEG CMAX,P
C434	2113946D07	CAP,CHIP,4.7UF,+10%,-10%, 6.3V-DC,0603,X5R,-55DEG CMIN,85DEG CMA
C435	2113944A63	CAP,FXD,1PF,.25PF+/-,50V-DC, 0402,C0G,-55DEG CMIN, 125DEG CMAX,P
C503	2113944V13	CAP,FXD,2.7PF,.1PF+/-,50V-DC, 0402,C0G,-55DEG CMIN, 125DEG CMAX
C506	2113946B04	CAP CER CHP 0.10UF 10V 10%
C507	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C508	2113945A09	CAP CER CHP 1000PF 50V 10%
C509	2113945A09	CAP CER CHP 1000PF 50V 10%
C511	2113944A40	CAP CER CHP 100.0PF 50V 5%
C512	2113944A31	CAP CER CHP 33.0PF 50V 5%
C513	2113944A40	CAP CER CHP 100.0PF 50V 5%
C514	2113944A84	CAP,FXD,43PF,+5%,-5%,50V-DC,0402,C0G,-55DEG CMIN, 125DEG CMAX,PB
C515	2113944A21	CAP CER CHP 6.8PF 50V +/- 0.5PF
C516	2113944A11	CAP CER CHP 2.7PF 50V +/- 0.25PF
C517	2113946B04	CAP CER CHP 0.10UF 10V 10%
C518	2113945A09	CAP CER CHP 1000PF 50V 10%
C519	2113944A31	CAP CER CHP 33.0PF 50V 5%
C520	2113945A09	CAP CER CHP 1000PF 50V 10%
C521	2113945A09	CAP CER CHP 1000PF 50V 10%
C522	2113944A27	CAP CER CHP 15.0PF 50V 5%
C523	2113944A48	CAP CER CHP 470.0 PF 50V 5%
C524	2113944A30	CAP CER CHP 27.0PF 50V 5%
C525	2113944A61	CAP,FXD,.5PF,.25PF+/-,50V-DC, 0402,C0G,-55DEG CMIN, 125DEG CMAX
C526	2113944V13	CAP,FXD,2.7PF,.1PF+/-,50V-DC, 0402,C0G,-55DEG CMIN, 125DEG CMAX
C527	2113944V07	CAP,FXD,1.5PF,.1PF+/-,50V-DC, 0402,C0G,-55DEG CMIN, 125DEG CMAX
C599	2113944A40	CAP CER CHP 100.0PF 50V 5%
C601	2113945B02	CAP CER CHP 10,000PF 25V 10%
C602	2113945B02	CAP CER CHP 10,000PF 25V 10%
C603	2113945B02	CAP CER CHP 10,000PF 25V 10%
C604	2113945B02	CAP CER CHP 10,000PF 25V 10%
C605	2113944A15	CAP CER CHP 3.9PF 50V +/- 0.25PF
C606	2113946B04	CAP CER CHP 0.10UF 10V 10%
C607	2113944A40	CAP CER CHP 100.0PF 50V 5%
C608	2113944A12	CAP CER CHP 3.0PF 50V +/- 0.25PF
C609	2113944A30	CAP CER CHP 27.0PF 50V 5%
C610	2113944A40	CAP CER CHP 100.0PF 50V 5%
C611	2113944A40	CAP CER CHP 100.0PF 50V 5%
C612	2113945B02	CAP CER CHP 10,000PF 25V 10%
C613	2113944A40	CAP CER CHP 100.0PF 50V 5%
C614	2113945B02	CAP CER CHP 10,000PF 25V 10%
C615	2113944A42	CAP CER CHP 150.0PF 50V 5%
C616	2113945A11	CAP CER CHP 2200PF 50V 10%
C617	2113946B04	CAP CER CHP 0.10UF 10V 10%
C618	2113944A31	CAP CER CHP 33.0PF 50V 5%
C619	2113944A35	CAP CER CHP 62.0PF 50V 5%
C620	2113946B04	CAP CER CHP 0.10UF 10V 10%
C621	2113946B04	CAP CER CHP 0.10UF 10V 10%
C622	2113946C07	CAP,FXD,.33UF,+10%,-10%, 10V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX

Ref. Des.	Part Number	Description
C623	2113945B02	CAP CER CHP 10,000PF 25V 10%
C624	2113946C07	CAP,FXD,.33UF,+10%,-10%, 10V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX
C625	2113944A28	CAP CER CHP 18.0PF 50V 5%
C626	2113945A09	CAP CER CHP 1000PF 50V 10%
C627	2113945A09	CAP CER CHP 1000PF 50V 10%
C628	2113945B02	CAP CER CHP 10,000PF 25V 10%
C629	2113946B04	CAP CER CHP 0.10UF 10V 10%
C630	2113946B04	CAP CER CHP 0.10UF 10V 10%
C631	2113944A27	CAP CER CHP 15.0PF 50V 5%
C632	2113944A40	CAP CER CHP 100.0PF 50V 5%
C633	2113945B02	CAP CER CHP 10,000PF 25V 10%
C634	2113946B04	CAP CER CHP 0.10UF 10V 10%
C635	2113945B02	CAP CER CHP 10,000PF 25V 10%
C636	2113946B04	CAP CER CHP 0.10UF 10V 10%
C637	2113946B04	CAP CER CHP 0.10UF 10V 10%
C638	2113945A12	CAP CER CHP 3300PF 50V 10%
C639	2113945B02	CAP CER CHP 10,000PF 25V 10%
C640	2113946B04	CAP CER CHP 0.10UF 10V 10%
C641	2113944A31	CAP CER CHP 33.0PF 50V 5%
C642	2113944A48	CAP CER CHP 470.0 PF 50V 5%
C643	2113944A48	CAP CER CHP 470.0 PF 50V 5%
C701	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C702	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C703	NOT PLACED	–
C704	2113944A35	CAP CER CHP 62.0PF 50V 5%
C709	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C715	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C716	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C717	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C718	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C719	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C724	2113955D37	CAP,FXD,10UF,+10%,-10%,16V-DC,1206,X7R,-55DEG CMIN, 125DEG CMAX
C725	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C726	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C730	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C731	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C732	2113944A32	CAP CER CHP 39.0PF 50V 5%
C734	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C736	2113945B02	CAP CER CHP 10,000PF 25V 10%
C737	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C739	2113944A25	CAP CER CHP 10.0PF 50V +/- 0.5PF
C742	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C744	2113955D37	CAP,FXD,10UF,+10%,-10%,16V-DC,1206,X7R,-55DEG CMIN, 125DEG CMAX
C749	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C750	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C752	2113945B02	CAP CER CHP 10,000PF 25V 10%
C754	2113944A34	CAP CER CHP 56.0PF 50V 5%
C756	2113955D37	CAP,FXD,10UF,+10%,-10%,16V-DC,1206,X7R,-55DEG CMIN, 125DEG CMAX
C757	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMAX
C758	2113946B02	CAP CER CHP 0.047UF 10V 10,
C759	2113945G95	CAP,FXD,.22UF,+10%,-10%, 50V-DC,0805,X7R,-55DEG CMIN, 125DEG CMAX
C760	2113944G97	CAP,FXD,.082UF,+5%,-5%,50V-DC,1206,C0G,-55DEG CMIN, 125DEG CMAX
C762	2113945C26	CAP,FXD,.039UF,+10%,-10%, 50V-DC,0603,X7R,-55DEG CMIN, 125DEG CMA
C763	2113944G97	CAP,FXD,.082UF,+5%,-5%,50V-DC,1206,C0G,-55DEG CMIN, 125DEG CMAX
C765	2113944G97	CAP,FXD,.082UF,+5%,-5%,50V-DC,1206,C0G,-55DEG CMIN, 125DEG CMAX
C766	2113945C01	CAP CER CHP 6800PF 50V 10%
C768	2113944G97	CAP,FXD,.082UF,+5%,-5%,50V-DC,1206,C0G,-55DEG CMIN, 125DEG CMAX
C769	2113945C20	CAP,FXD,.016UF,+10%,-10%, 50V-DC,0603,X7R,-55DEG CMIN,125DEG CMA
C770	2113944G97	CAP,FXD,.082UF,+5%,-5%,50V-DC,1206,C0G,-55DEG CMIN, 125DEG CMAX
C771	2113944A40	CAP CER CHP 100.0PF 50V 5%
C775	2113945A09	CAP CER CHP 1000PF 50V 10%
C777	2113944A31	CAP CER CHP 33.0PF 50V 5%
C779	2113944A40	CAP CER CHP 100.0PF 50V 5%
C783	2113944C55	CAP CER CHP 1200.OPF 50V 5%
C791	2113946B04	CAP CER CHP 0.10UF 10V 10%
C792	2113946B04	CAP CER CHP 0.10UF 10V 10%
C794	2113944A32	CAP CER CHP 39.0PF 50V 5%
C795	2113944A40	CAP CER CHP 100.0PF 50V 5%
C810	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C813	2113944A63	CAP,FXD,1PF,.25PF+/-,50V-DC, 0402,C0G,-55DEG CMIN, 125DEG CMAX,P
C814	2113945A09	CAP CER CHP 1000PF 50V 10%
C816	2113944A31	CAP CER CHP 33.0PF 50V 5%
C820	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C830	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C831	2113944A40	CAP CER CHP 100.0PF 50V 5%
C836	2113944A33	CAP CER CHP 47.0PF 50V 5%
C838	2113945A09	CAP CER CHP 1000PF 50V 10%
C844	2113944A33	CAP CER CHP 47.0PF 50V 5%
C851	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C1001	2113944M30	CAP,FXD,33PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX,PB
C1002	2113944C22	CAP CER CHP 4.7PF 50V +/- 0.25PF
C1003	2113945C02	CAP CER CHP 10,000PF 50V 10%
C1004	2113944M30	CAP,FXD,33PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX,PB
C1005	2113944M30	CAP,FXD,33PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN,125DEG CMAX,PB
C1006	2113945C02	CAP CER CHP 10,000PF 50V 10%
C1007	2113944M30	CAP,FXD,33PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX,PB

Ref. Des.	Part Number	Description
C1008	2113944M30	CAP,FXD,33PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN,125DEG CMAX,PB
C1009	2113944M30	CAP,FXD,33PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN,125DEG CMAX,PB
C1010	2113945C02	CAP CER CHP 10,000PF 50V 10%
C1013	2113944M21	CAP,FXD,13PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN,125DEG CMAX,PB
C1014	NOT PLACED	–
C1015	2113944M30	CAP,FXD,33PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN,125DEG CMAX,PB
C1018	2113944M30	CAP,FXD,33PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN,125DEG CMAX,PB
C1019	21009257001	0805 18 PF ACCU-P CAPACITOR
C1020	2113944C11	CAP CER CHP 1.6PF 50V +/- 0.25PF
C1021	2113944C23	CAP CER CHP 5.1PF 50V +/- 0.5PF
C1022	2113944M30	CAP,FXD,33PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN,125DEG CMAX,PB
C1023	2113944M24	CAP,FXD,18PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN,125DEG CMAX,PB
C1024	2113945A12	CAP CER CHP 3300PF 50V 10%
C1025	2113945A12	CAP CER CHP 3300PF 50V 10%
C1101	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1102	2188468Y01	CAP CER 25V X7R 0805 1UF
C1103	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1104	NOT PLACED	–
C1105	2113944A19	CAP CER CHP 5.6PF 50V +/- 0.5PF
C1106	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1107	2113944A40	CAP CER CHP 100.0PF 50V 5%
C1108	2113946B03	CAP CER CHP 0.068UF 10V 10

Ref. Des.	Part Number	Description
C1110	2113944A40	CAP CER CHP 100.0PF 50V 5%
C1111	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN,125DEG CMAX
C1112	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1113	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1116	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN,125DEG CMAX
C1117	2113945A12	CAP CER CHP 3300PF 50V 10%
C1118	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1119	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1120	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1122	2175390H01	CAP, 2.2 PF, 0402, CERAMIC, 50V
C1123	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1124	2113945A13	CAP CER CHP 4700PF 50V 10%
C1125	NOT PLACED	–
C1126	2113945A09	CAP CER CHP 1000PF 50V 10%
C1127	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN,125DEG CMAX
C1128	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1129	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1130	2113945B02	CAP CER CHP 10,000PF 25V 10%
C1132	2415427H27	CHIP INDUCTOR
C1135	NOT PLACED	–
C1137	2113946A01	CAP CER CHP 0.015UF 16V 10%
C1138	2113945B04	CAP,FXD,.022UF,+10%,-10%,25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA

Ref. Des.	Part Number	Description
C1139	2113944A25	CAP CER CHP 10.0PF 50V +/- 0.5PF
C1140	2113945A13	CAP CER CHP 4700PF 50V 10%
C1141	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN,125DEG CMAX
C1142	2113945A09	CAP CER CHP 1000PF 50V 10%
C1149	2113944A25	CAP CER CHP 10.0PF 50V +/- 0.5PF
C1150	2175392H01	CAP, 1.2PF, 0402, CERAMIC, 50V
C1152	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C1160	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN,125DEG CMAX
C1161	2113956B91	CAP,FXD,1UF,+10%,-10%,16V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX,PB
C1162	NOT PLACED	–
C1165	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN,125DEG CMAX
C1301	2113944M20	CAP,FXD,12PF,+2%,-2%,50V-DC,0603,C0G,-55DEG CMIN,125DEG CMAX,PB
C1302	2114036F74	CAP,FXD,1.8PF,.05PF+/-,25V-DC,0402,C0G,-55DEG CMIN,125DEG CMAX
C1303	2113944A26	CAP CER CHP 12.0PF 50V 5%
C1304	2113945A09	CAP CER CHP 1000PF 50V 10%
C1305	2113944A26	CAP CER CHP 12.0PF 50V 5%
C1306	2113944A17	CAP CER CHP 4.7PF 50V +/- 0.25PF
C1307	2113944A26	CAP CER CHP 12.0PF 50V 5%
C1308	2113944A28	CAP CER CHP 18.0PF 50V 5%
C1309	2175389H01	CAP,.5PF, CHIP, 0402, CERAMIC, 50 V
C1411	2113944C36	CAP CER CHP 33.0PF 50V 5%
C1413	2113944C62	CAP,FXD,.75PF,.1PF+/-,50V-DC,0603,C0G,-55DEG CMIN,125DEG CMAX

Ref. Des.	Part Number	Description
C1414	2113944C64	CAP,FXD,1.1PF,.1PF+/-,50V-DC,0603,C0G,-55DEG CMIN,125DEG CMAX
C1418	2113944C13	CAP CER CHP 2.0PF 50V +/- 0.25PF
C1419	NOT PLACED	–
C1424	2113944C61	CAP,FXD,.5PF,.1PF+/-,50V-DC,0603,C0G,-55DEG CMIN,125DEG CMAX,P
C1425	2113944C61	CAP,FXD,.5PF,.1PF+/-,50V-DC,0603,C0G,-55DEG CMIN,125DEG CMAX,P
D200	4813978A19	DIODE,RECT,MBR120,SM,SOD-123,1A,20V,SHTK,PB-FREE
D722	4815011H01	DIODE TRIPLE
D723	4815011H01	DIODE TRIPLE
E200	2405688Z01	INDUCTOR FERRITE BEAD
E201	2405688Z01	INDUCTOR FERRITE BEAD
E401	2480640Z01	SURFACE MOUNT FERRITE BEAD
E402	2480640Z01	SURFACE MOUNT FERRITE BEAD
E501	2480640Z01	SURFACE MOUNT FERRITE BEAD
E601	2480640Z01	SURFACE MOUNT FERRITE BEAD
E602	2480640Z01	SURFACE MOUNT FERRITE BEAD
E603	2480640Z01	SURFACE MOUNT FERRITE BEAD
E604	2480640Z01	SURFACE MOUNT FERRITE BEAD
E605	2480640Z01	SURFACE MOUNT FERRITE BEAD
E606	2480640Z01	SURFACE MOUNT FERRITE BEAD
E607	2480640Z01	SURFACE MOUNT FERRITE BEAD
E608	2480640Z01	SURFACE MOUNT FERRITE BEAD
E609	2480640Z01	SURFACE MOUNT FERRITE BEAD
E1101	2405688Z01	INDUCTOR FERRITE BEAD
F200	6575834B01	FUSE SURFACE MOUNT

Ref. Des.	Part Number	Description
FL401	9175390A01	SAW FILTER, DUAL BAND 769/ 860.5
FL402	9175390A01	SAW FILTER, DUAL BAND 769/ 860.5
FL501	4885631B01	XTAL FILT 3 POLE 109.65 MOTORO
FL1301	NOT PLACED	–
J101	0909901V02	RECP SMT MCX
J102	0975886B01	RECEPTACLE, COAX CABLE
L200	2571269C01	INDUCTOR WW POWER 20%
L401	2415427H23	CHIP INDUCTOR
L402	2415427H23	CHIP INDUCTOR
L403	2415427H05	CHIP INDUCTOR
L404	2415427H23	CHIP INDUCTOR
L405	2415427H23	CHIP INDUCTOR
L406	2415427H05	CHIP INDUCTOR
L407	2415427H16	CHIP INDUCTOR
L408	2415427H21	CHIP INDUCTOR
L502	2415429H30	CHIP INDUCTOR
L503	2414032F38	IDCTR,WW,220NH,5%,400MA, .7OHM,CER,30 Q,630MHZ SRF, SM,PB-FRE
L504	2414032F41	IDCTR,WW,390NH,10%,200MA, 1.5OHM,CER,40 Q,730MHZ SRF,SM,PB-F
L505	2415429H39	CHIP INDUCTOR
L506	2415429H39	CHIP INDUCTOR
L507	2415427H12	CHIP INDUCTOR
L508	2415427H17	CHIP INDUCTOR
L509	2415427H17	CHIP INDUCTOR
L601	2415429H43	CHIP INDUCTOR
L602	2466505A01	COIL INDUCTOR
L603	2466505A01	COIL INDUCTOR
L604	2414032D16	IDCTR,WW,120NH,5%,800MA, .26OHM,CER,42 Q,1GHZ SRF, SM,PB-FREE
L605	2462587Q54	IND CHIP 3,900 NH 10%
L701	2415429H47	CHIP INDUCTOR
L720	2480646Z20	COIL MULTI-LAYER CHIP(2.20UH)
L727	2480646Z20	COIL MULTI-LAYER CHIP(2.20UH)
L728	2415429H47	CHIP INDUCTOR
L733	2480646Z20	COIL MULTI-LAYER CHIP(2.20UH)
L735	2480646Z20	COIL MULTI-LAYER CHIP(2.20UH)
L738	2480646Z20	COIL MULTI-LAYER CHIP(2.20UH)
L741	2480646Z20	COIL MULTI-LAYER CHIP(2.20UH)
L753	2480646Z20	COIL MULTI-LAYER CHIP(2.20UH)
L806	2415429H47	CHIP INDUCTOR
L817	2414032F41	IDCTR,WW,390NH,10%,200MA, 1.5OHM,CER,40 Q,730MHZ SRF,SM,PB-F
L821	2415429H47	CHIP INDUCTOR
L846	2414032F41	IDCTR,WW,390NH,10%,200MA, 1.5OHM,CER,40 Q,730MHZ SRF,SM,PB-F
L1001	2415429H37	CHIP INDUCTOR
L1002	2415429H10	CHIP INDUCTOR
L1003	2415429H37	CHIP INDUCTOR
L1007	2460591K40	COIL AIR WOUND INDUC 59.71
L1009	2415428H02	AIR WOUND INDUCTOR
L1101	2415429H30	CHIP INDUCTOR
L1102	2415429H10	CHIP INDUCTOR
L1103	2475393H01	INDUCTOR, 4.7NH, 0402, +/- 0.1NH
L1104	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
L1108	2409348J04	IND AIR CORE 5.45NH 5% 2214
L1114	2475394H01	INDUCTOR, 11NH, 0402, +/-2%
L1301	2488090Y10	INDUCTOR,MULTILAYER,5.6N H,1005,SMD,PB FREE
L1302	2488090Y25	INDUCTOR,MULTILAYER,100N H,1005,SMD,PB FREE
L1303	2414017P16	IDCTR,CHIP,18NH,5%,300MA, .76OHM,CER,9 Q,1.9GHZ SRF, SM,0402,P
L1305	2475391H01	INDUCTOR, 18 NH, CHIP, 0402, 2% TOL
L1401	2415428H02	AIR WOUND INDUCTOR
L1408	2460591A11	COIL AIR WOUND INDUC 7.66
L1410	2460591A11	COIL AIR WOUND INDUC 7.66
M1	3275623B03	PAD, THERMAL ELECTRIC, MID-TIER
M2	75009299002	PAD, THERMAL
M3	1104959T01	COATING-CONTACT
M4	6071520M01	BATT COIN 3V LI RECHARGEABLE
M101	2871616H01	CONNECTOR, BPLUS
M103	3987977Y04	CONT,CONN,1CONT,ANT UNIV 4.5MM,UC 1.8
M104	3987977Y04	CONT,CONN,1CONT,ANT UNIV 4.5MM,UC 1.8
M107	0985888K02	SKT RTC BTTY LEAP
P101	2887818K05	PLUG 40PIN MATING CNTCR 1.5MM
PWB	84009362001	PCB, RF TRANSCEIVER
Q201	4813970A59	P-CH FET 1.0A 20V SOT-23 T&R
Q202	4813973A32	XSTR,BIP GP SS,NPN,SM,SC-70,SMT,50V,.202W,100MA,PB-FREE
Q402	4813973M75	XSTR,BIP GP SS,PNP,BC858, SOT-563,SMT,-30V,.357W, -100MA,100MHZ
Q403	4813973M75	XSTR,BIP GP SS,PNP,BC858, SOT-563,SMT,-30V,.357W, -100MA,100MHZ
Q501	4813973M75	XSTR,BIP GP SS,PNP,BC858, SOT-563,SMT,-30V,.357W, -100MA,100MHZ
Q503	4885316E32	TRANSISTOR, RF
Q601	4813973A04	XSTR,BIP GP SS,NPN,TA13, SM,SOT-23,SMT,30V,.225W, 300MA,125MHZ,P
Q703	4813973M75	XSTR,BIP GP SS,PNP,BC858, SOT-563,SMT,-30V,.357W, -100MA,100MHZ
Q712	4813973M75	XSTR,BIP GP SS,PNP,BC858, SOT-563,SMT,-30V,.357W, -100MA,100MHZ
Q713	4805585Q32	TRANSITOR, NPN RF
Q714	4889394V04	XSTR,FET GEN PURPOSE SMALL SIG,MOSFET,N-CH, ENHN,SM,20V,.25W,P
Q774	4885061Y01	XSTR NPN 6V 30UA 12GHZ PB-FREE
Q842	4805585Q32	TRANSITOR, NPN RF
Q1001	5185633C91	MODULE,RING,XSTR,FET RF PWR,7/800
Q1101	4813973A32	XSTR,BIP GP SS,NPN,SM, SC-70,SMT,50V,.202W,100MA, PB-FREE
Q1103	4813970A59	P-CH FET 1.0A 20V SOT-23 T&R
R101	0613952R01	CER CHIP RES 10K OHM 5% 0402
R103	0613952R01	CER CHIP RES 10K OHM 5% 0402
R104	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R201	0613952R25	CER CHIP RES 100K OHM 5% 0402
R202	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R401	0613952R09	CER CHIP RES 22K OHM 5% 0402
R402	0613952R23	CER CHIP RES 82K OHM 5% 0402
R403	0613952Q85	CER CHIP RES 3300 OHM 5 0402
R404	0613952Q45	CER CHIP RES 68.0 OHM 5 0402
R405	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R406	0613952Q11	CER CHIP RES 2.7 OHM 5 0402
R407	0613952R09	CER CHIP RES 22K OHM 5% 0402
R408	0613952R23	CER CHIP RES 82K OHM 5% 0402
R409	0613952Q85	CER CHIP RES 3300 OHM 5 0402
R410	0613952Q45	CER CHIP RES 68.0 OHM 5 0402
R411	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R412	0613952Q18	CER CHIP RES 5.1 OHM 5 0402

Ref. Des.	Part Number	Description
R413	0613952Q11	CER CHIP RES 2.7 OHM 5 0402
R414	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R501	0613952Q42	CER CHIP RES 51.0 OHM 5 0402
R502	0613952Q45	CER CHIP RES 68.0 OHM 5 0402
R503	0613952R10	CER CHIP RES 24K OHM 5 0402
R504	0613952Q85	CER CHIP RES 3300 OHM 5 0402
R505	0613952R31	CER CHIP RES 180K OHM 5% 0402
R506	0613952Q53	CER CHIP RES 150 OHM 5 0402
R507	0613952Q75	CER CHIP RES 1200 OHM 5 0402
R508	0613952Q29	CER CHIP RES 15.0 OHM 5 0402
R509	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R511	0613952Q11	CER CHIP RES 2.7 OHM 5 0402
R601	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R602	0613952Q63	CER CHIP RES 390 OHM 5 0402
R603	0613952R25	CER CHIP RES 100K OHM 5% 0402
R604	0613952Q63	CER CHIP RES 390 OHM 5 0402
R605	0613952R01	CER CHIP RES 10K OHM 5% 0402
R606	0613952R01	CER CHIP RES 10K OHM 5% 0402
R607	0613952R25	CER CHIP RES 100K OHM 5% 0402
R608	0613952R01	CER CHIP RES 10K OHM 5% 0402
R609	0613952Q81	CER CHIP RES 2200 OHM 5 0402
R610	0613952R25	CER CHIP RES 100K OHM 5% 0402
R611	0613952R01	CER CHIP RES 10K OHM 5% 0402

Ref. Des.	Part Number	Description
R612	0613952Q94	CER CHIP RES 7500 OHM 5 0402
R613	0613952Q82	CER CHIP RES 2400 OHM 5 0402
R614	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R615	NOT PLACED	–
R616	NOT PLACED	–
R617	NOT PLACED	–
R618	NOT PLACED	–
R619	NOT PLACED	–
R620	NOT PLACED	–
R621	NOT PLACED	–
R623	NOT PLACED	–
R624	NOT PLACED	–
R698	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R699	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R701	0613952Q49	CER CHIP RES 100 OHM 5 0402
R702	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R705	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R706	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R707	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R708	0613952Q49	CER CHIP RES 100 OHM 5 0402
R712	0613952Q67	CER CHIP RES 560 OHM 5 0402
R713	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R714	0613952Q67	CER CHIP RES 560 OHM 5 0402
R715	NOT PLACED	–
R716	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R717	NOT PLACED	–
R721	0613952R01	CER CHIP RES 10K OHM 5% 0402

Ref. Des.	Part Number	Description
R729	0613952R09	CER CHIP RES 22K OHM 5% 0402
R743	0613952R17	CER CHIP RES 47K OHM 5% 0402
R745	0613952R09	CER CHIP RES 22K OHM 5% 0402
R751	0613952Q59	CER CHIP RES 270 OHM 5 0402
R752	0613952Q91	CER CHIP RES 5600 OHM 5 0402
R753	0613952Q91	CER CHIP RES 5600 OHM 5 0402
R754	0613952Q91	CER CHIP RES 5600 OHM 5 0402
R755	0613952R15	CER CHIP RES 39K OHM 5% 0402
R759	0613952Q69	CER CHIP RES 680 OHM 5 0402
R761	0613952Q59	CER CHIP RES 270 OHM 5 0402
R762	0613952R02	CER CHIP RES 11K OHM 5 0402
R764	0613952Q75	CER CHIP RES 1200 OHM 5 0402
R767	0613952Q45	CER CHIP RES 68.0 OHM 5 0402
R772	0613952Q37	CER CHIP RES 33.0 OHM 5 0402
R773	0613952Q91	CER CHIP RES 5600 OHM 5 0402
R776	0613952Q39	CER CHIP RES 39.0 OHM 5 0402
R778	0613952Q55	CER CHIP RES 180 OHM 5 0402
R807	0613952R09	CER CHIP RES 22K OHM 5% 0402
R808	0613952R23	CER CHIP RES 82K OHM 5% 0402
R809	0613952Q91	CER CHIP RES 5600 OHM 5 0402
R811	0613952Q39	CER CHIP RES 39.0 OHM 5 0402
R812	0613952Q47	CER CHIP RES 82.0 OHM 5% 0402

Ref. Des.	Part Number	Description
R813	0613952Q69	CER CHIP RES 680 OHM 5 0402
R815	0613952Q34	CER CHIP RES 24.0 OHM 5 0402
R818	0613952Q23	CER CHIP RES 8.2 OHM 5 0402
R819	0613952Q59	CER CHIP RES 270 OHM 5 0402
R822	0613952R08	CER CHIP RES 20K OHM 5 0402
R823	0613952R19	CER CHIP RES 56K OHM 5% 0402
R827	0613952Q92	CER CHIP RES 6200 OHM 5 0402
R832	0613952Q29	CER CHIP RES 15.0 OHM 5 0402
R833	0613952Q49	CER CHIP RES 100 OHM 5 0402
R840	0613952Q29	CER CHIP RES 15.0 OHM 5 0402
R848	0613952Q29	CER CHIP RES 15.0 OHM 5 0402
R849	0613952Q67	CER CHIP RES 560 OHM 5 0402
R1001	0613952R13	CER CHIP RES 33K OHM 5% 0402
R1002	0613952R17	CER CHIP RES 47K OHM 5% 0402
R1003	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1004	0613952R12	CER CHIP RES 30K OHM 5 0402
R1005	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R1006	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R1102	0613952R25	CER CHIP RES 100K OHM 5% 0402
R1103	06009259001	LOW RESISTANCE THICK FILM RESISTOR
R1104	0613952Q49	CER CHIP RES 100 OHM 5 0402
R1105	0613952Q49	CER CHIP RES 100 OHM 5 0402
R1106	0613952Q35	CER CHIP RES 27.0 OHM 5 0402

Ref. Des.	Part Number	Description
R1107	0613952Q45	CER CHIP RES 68.0 OHM 5 0402
R1108	0613952R23	CER CHIP RES 82K OHM 5% 0402
R1110	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1112	NOT PLACED	–
R1114	0613952Q49	CER CHIP RES 100 OHM 5 0402
R1115	0613952Q49	CER CHIP RES 100 OHM 5 0402
R1116	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1117	0613952R22	CER CHIP RES 75K OHM 5 0402
R1121	0613952R12	CER CHIP RES 30K OHM 5 0402
R1122	0613952R22	CER CHIP RES 75K OHM 5 0402
R1124	0613952Q42	CER CHIP RES 51.0 OHM 5 0402
R1125	0613952R33	CER CHIP RES 220K OHM 5% 0402
R1126	0613952R24	CER CHIP RES 91K OHM 5 0402
R1127	0613952R18	CER CHIP RES 51K OHM 5 0402
R1128	0613952R09	CER CHIP RES 22K OHM 5% 0402
R1129	NOT PLACED	–
R1130	NOT PLACED	–
R1135	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R1136	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1137	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1138	0613952R25	CER CHIP RES 100K OHM 5% 0402
R1139	0613952R25	CER CHIP RES 100K OHM 5% 0402
R1140	0613952R25	CER CHIP RES 100K OHM 5% 0402
R1141	0613952R42	CER CHIP RES 510K OHM 5 0402
R1142	0613952R25	CER CHIP RES 100K OHM 5% 0402
R1143	0613952R25	CER CHIP RES 100K OHM 5% 0402
R1144	0613952R25	CER CHIP RES 100K OHM 5% 0402
R1145	0613952R25	CER CHIP RES 100K OHM 5% 0402
R1146	0613952R25	CER CHIP RES 100K OHM 5% 0402
R1151	0613952Q90	CER CHIP RES 5100 OHM 5 0402
R1152	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1154	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1158	NOT PLACED	–
R1160	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1162	0613952R29	CER CHIP RES 150K OHM 5% 0402
R1163	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1164	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1165	0613952Q56	CER CHIP RES 200 OHM 5 0402
R1166	0613952Q56	CER CHIP RES 200 OHM 5 0402
R1167	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1168	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R1169	0613952P52	CER CHIP RES 340K OHM 1 0402
R1170	0613952P01	CER CHIP RES 100K OHM 1 0402
R1171	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R1172	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R1174	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1175	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R1176	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R1177	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R1178	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1180	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R1181	NOT PLACED	–
R1182	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1183	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R1184	0613952Q81	CER CHIP RES 2200 OHM 5 0402
R1186	NOT PLACED	–
R1304	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R1307	0613952Q73	CER CHIP RES 1000 OHM 5 0402
SH2	2675872B01	SHIELD, XTAL
SH2A	26009323001	SHIELD, DC FILTER
SH2B	26009326001	SHIELD, DC REGULATOR
SH3	26009321001	SHIELD, RX FRONT END
SH5A	2675874B01	SHIELD, MIXER
SH5C	2675933B01	SHIELD, IF AMP
SH6A	2675873B01	SHIELD, ABACUS
SH6B	2675932B01	SHIELD, 2ND LO VCO
SH7	26009325001	SHIELD, FGU
SH8	26009319001	SHIELD, VCO
SH9A	26009322001	SHIELD, RF PA
SH9B	26009327001	SHIELD, OUTPUT MATCH
SH11	26009320001	SHIELD, ALC
SH12	26009324001	SHIELD, HARMONIC FILTER
T503	2575851B01	RF TRANSFORMER BALUN
T504	2575851B01	RF TRANSFORMER BALUN
U101	5105443X07	EEPROM 32KBIT SERIAL SPI BUS
U200	5188493T01	IC,VREG/SWG,LP2989,SM,MINI SO-8 HI PRCN REG 5V
U201	5175771A99	LOW NOISE, 100MA LINEAR REGULATOR
U202	5175772B02	LINEAR REGULATOR 100MA 1.8V
U203	5175772B01	LINEAR VOLTAGE REGULATOR 350MA
U402	5180428L15	SW,RF SWITCH,SPDT,SMT, 6W,3V
U403	5180428L15	SW,RF SWITCH,SPDT,SMT, 6W,3V
U404	5180428L15	SW,RF SWITCH,SPDT,SMT, 6W,3V
U405	5180428L15	SW,RF SWITCH,SPDT,SMT, 6W,3V
U406	4885316E32	TRANSISTOR, RF
U407	4885316E32	TRANSISTOR, RF
U408	5103535B53	IC,INVTR,DL,NC7WZ04L6X, 2PER PKG,SC70
U506	5164852H82	IC, MIXER/ BUFFER
U601	5102495J14	IC,IF,IF DIGITILIZING SUBSYSTEM IC,AD9864,QFN
U602	4885316E32	TRANSISTOR, RF
U603	5109522E84	IC DUAL SCHMITT TRIG MICRO PAK
U604	5109522E84	IC DUAL SCHMITT TRIG MICRO PAK
U605	5164852H16	IC TRANSCEIVER W/LEVEL TRANSLATION
U606	5164852H16	IC TRANSCEIVER W/LEVEL TRANSLATION
U607	5186311J24	IC,BFR,1BITS,NC7SZ125,ACTI VE HIGH,B
U702	5164015H28	IC,TRIDENT,INTEG SYNTH, RX/TX BSBND
U703	5175772B06	28-PORT I/O EXPANDER
U709	5171972L01	SP3T RF SWITCH
U710	5171972L01	SP3T RF SWITCH
U746	4805218N63	RF TRANS SOT 323 BFQ67W
U1001	5175143H01	WIDE SUPPLY RANGE OP AMP
U1002	5115678H01	VHF/UHF/800/900 MHZ LDMOS DRIVER IC
U1101	5188032U43	IC,SENSING CIRCUIT,INA138, SM,SOT-23/5,1PER PKG
U1102	5175772B03	RECONFIGURABLE 10W SP5T/3T RF SWITC

Ref. Des.	Part Number	Description
U1103	5185070Y01	IC TEMPERATURE SENSOR PB-FREE
U1104	5185941F56	IC SINGLE LV LP OP AMPLIFIER
U1105	5180390L83	IC,CNTLR,SM,1PER PKG
U1106	5175772B05	PRECISION RF DETECTOR
U1111	5175771A26	CMOS FET SWITCH SPDT, 10WATTS
U1112	5175772B04	1 DB LSB GAAS MMIC ATTENUATOR
U1113	5185941F56	IC SINGLE LV LP OP AMPLIFIER
U1114	5185941F56	IC SINGLE LV LP OP AMPLIFIER
U1116	5109522E93	2 INPUT OR GATE IN NANO PACKAGE (C87)
U1117	5103535B53	IC,INVTR,DL,NC7WZ04L6X,2PER PKG,SC70
U1118	5109522E93	2 INPUT OR GATE IN NANO PACKAGE (C87)
U1119	5109522E94	2 INPUT AND GATE IN NANO PACKAGE (C87)
U1121	5114000B52	IC,XOR,LOGIC LEVEL SHIFTER,1PER PKG,SM, SOT-353,PB-FREE
U1125	51009382001	IC, QUAD DAC
U1126	5109817F77	IC COMPTR LM7275 5SC70 (D54)
U1127	5171779H01	SPDT ANALOG SWITCH
U1128	5188085K11	IC, SINGLE NAND GATE, 2-INPUT,POSITIVE, 5 DSBGA, PB-FREE
U1129	5175143H01	WIDE SUPPLY RANGE OP AMP
U1130	5175143H01	WIDE SUPPLY RANGE OP AMP
U1131	5109817F77	IC COMPTR LM7275 5SC70 (D54)
U1132	5114007M28	IC,F-F/D,1PER PKG,17SZ74,N-I, SM,SOIC8,PB-FREE
U1133	5171779H01	SPDT ANALOG SWITCH
U1136	5109522E94	2 INPUT AND GATE IN NANO PACKAGE (C87)
U1137	5164852H16	IC TRANSCEIVER W/LEVEL TRANSLATION
U1138	5164852H16	IC TRANSCEIVER W/LEVEL TRANSLATION
U1139	5164852H16	IC TRANSCEIVER W/LEVEL TRANSLATION
U1141	5185941F56	IC SINGLE LV LP OP AMPLIFIER
U1142	5185941F56	IC SINGLE LV LP OP AMPLIFIER
U1143	5185941F56	IC SINGLE LV LP OP AMPLIFIER
U1144	5171779H01	SPDT ANALOG SWITCH
U1146	5109522E93	2 INPUT OR GATE IN NANO PACKAGE (C87)
U1147	5109522E94	2 INPUT AND GATE IN NANO PACKAGE (C87)
U1148	5185941F56	IC SINGLE LV LP OP AMPLIFIER
U1149	5185941F45	ATTEN,VAR,14.4DBMIN,15.6DB MAX,0-2000 MHZFREQ,50OHM, PCMT,SOT
U1150	51009381001	LOW DROPOUT VOLTAGE REFERENCE
U1304	5105739X13	IC, SIGE GPS LOW NOISE AMP 1575 MHZ
VR101	4813977M29	DIODE,VREF,MBZ5250,SM,SOT -23,20V,.225W,ZEN
VR200	4813977M29	DIODE,VREF,MBZ5250,SM,SOT -23,20V,.225W,ZEN
VR601	4805656W87	DIODE,VCTR, @ 15V,1SV279, SOD-523/SC-79
VR602	4805656W87	DIODE,VCTR, @ 15V,1SV279, SOD-523/SC-79
Y701	4871886H01	16.8 MHZ VCTXO .8PPM
Y706	5164852H65	IC, VCO MODULE
Y707	5164852H67	IC, VCO MODULE

Notes

8.8 Controller Board

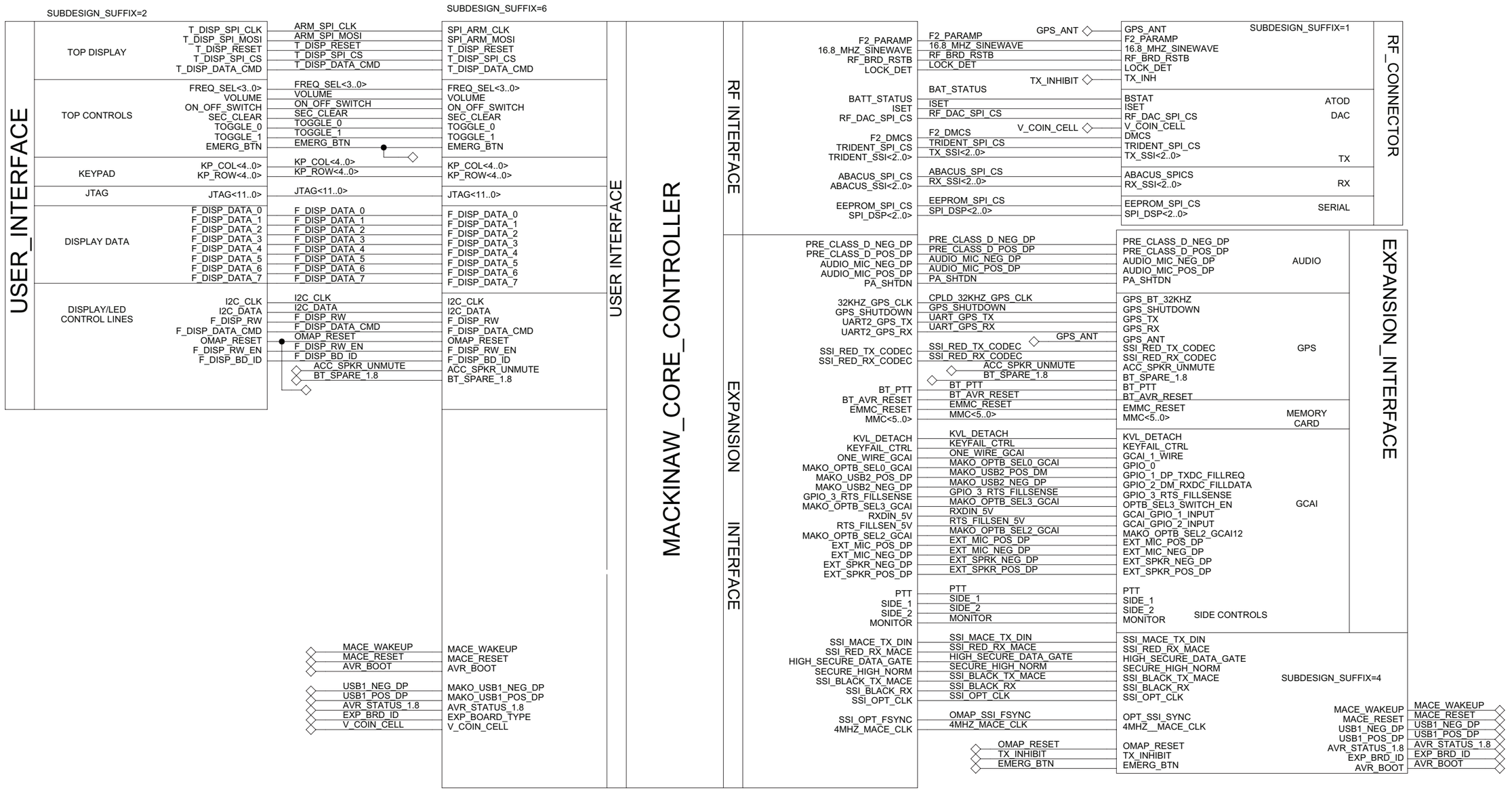


Figure 8-63. HLN5979B/ HLN5960AController Board Overall Schematic

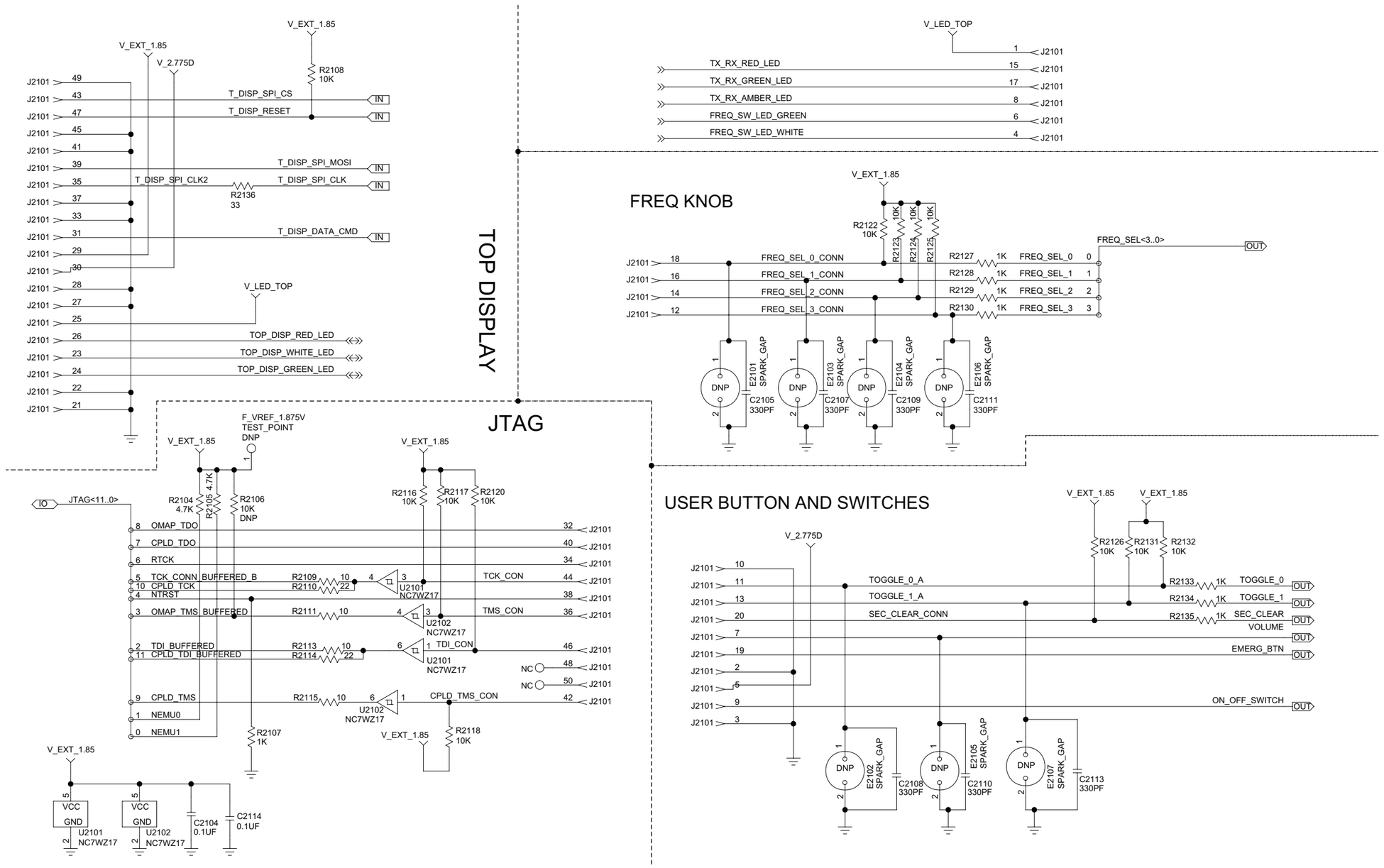
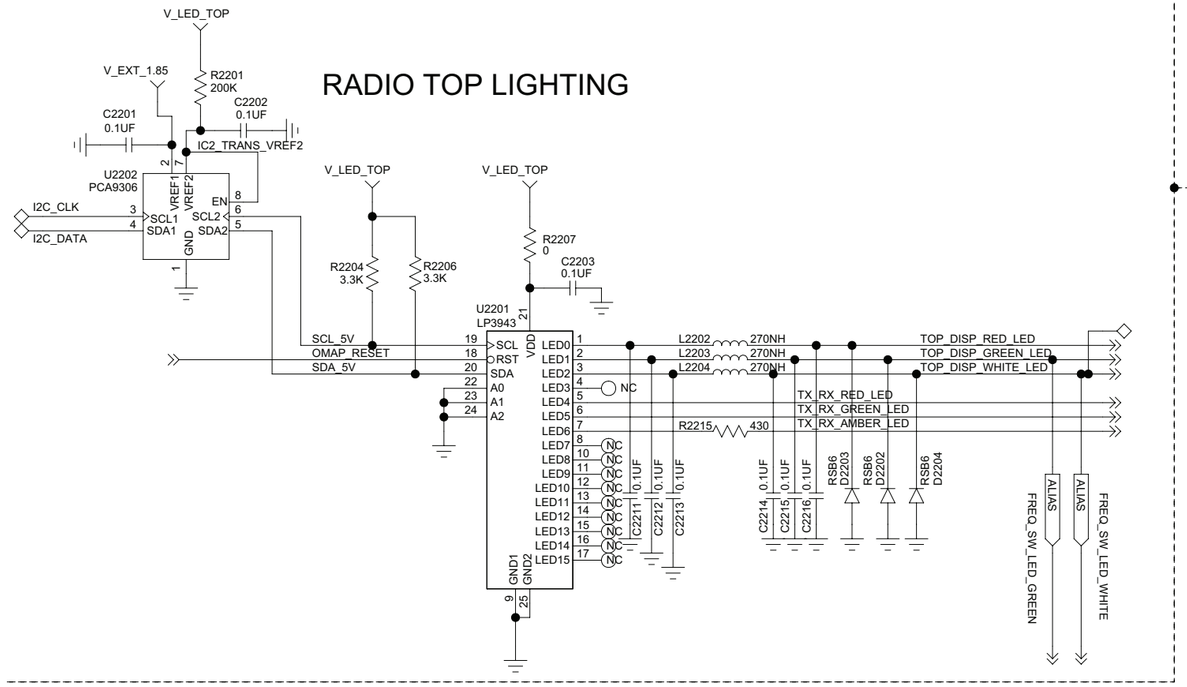


Figure 8-64. HLN5979B/ HLN5960A Controller Board Display, Controls and JTAG Schematics



LIGHTING CONTROLERS

FRONT DISPLAY AND KEYPAD LIGHTING

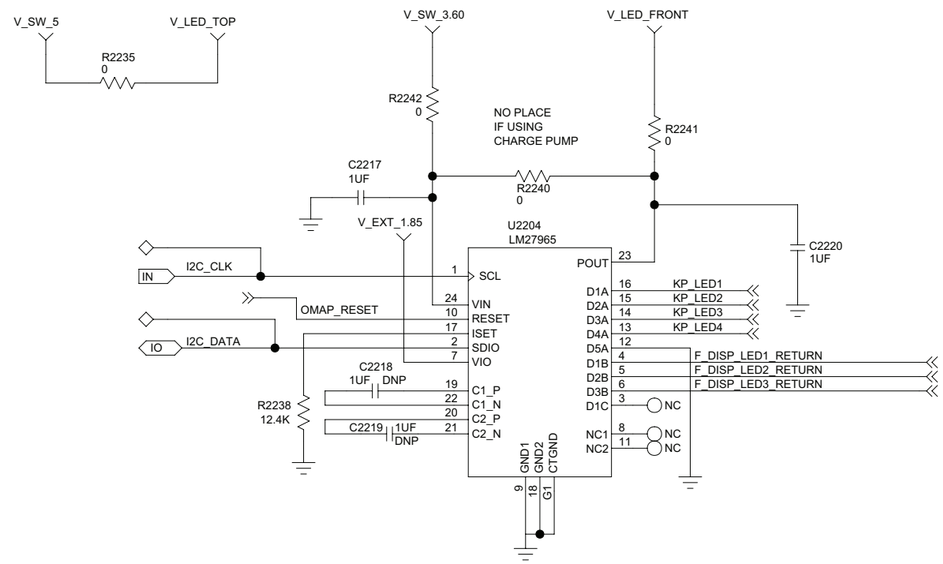


Figure 8-65. HLN5979B Controller Board Display/Keypad Lighting Control Circuits

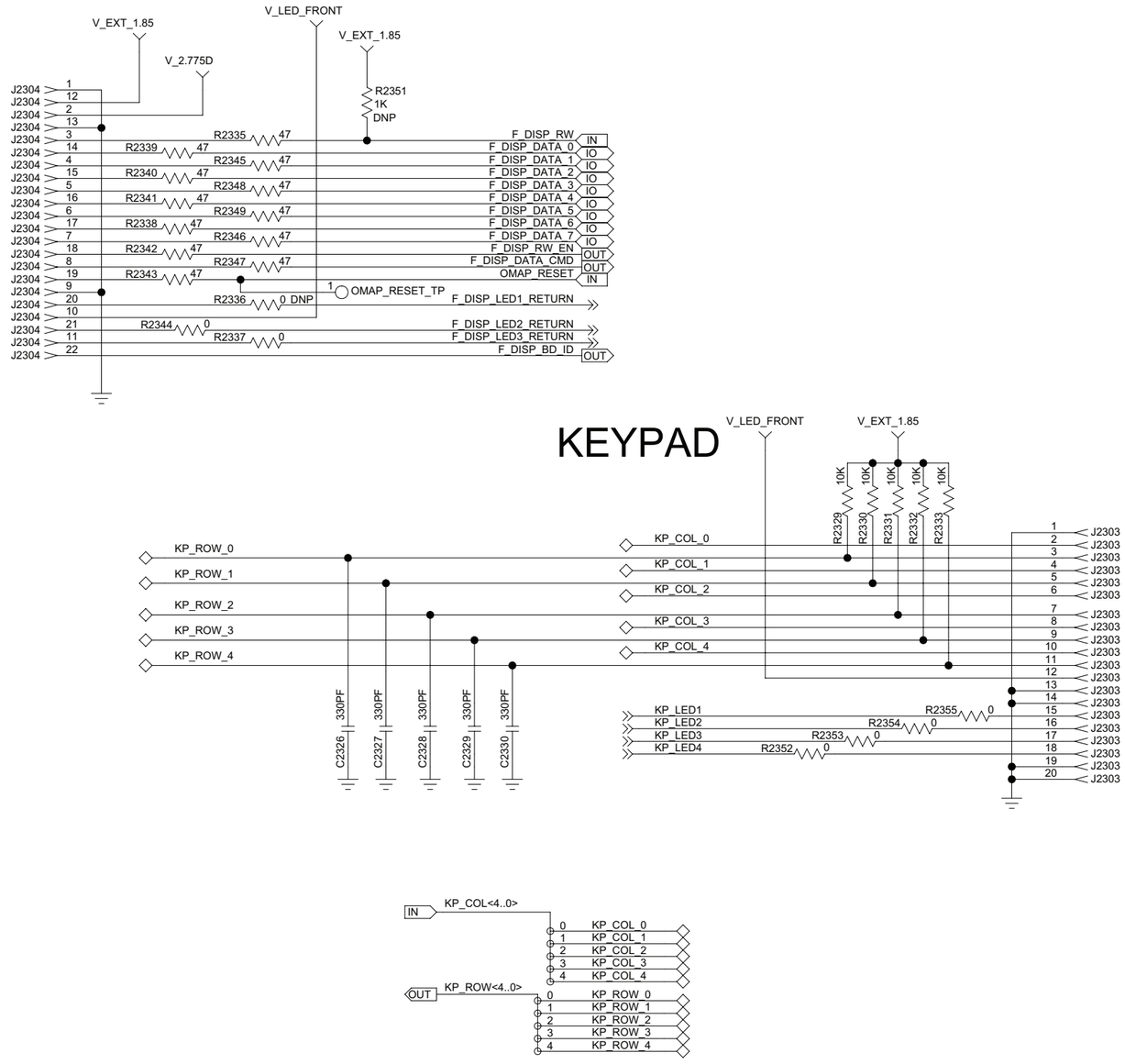


Figure 8-66. HLN5979B/ HLN5960A Controller Board LCD and Keypad Connector Circuits

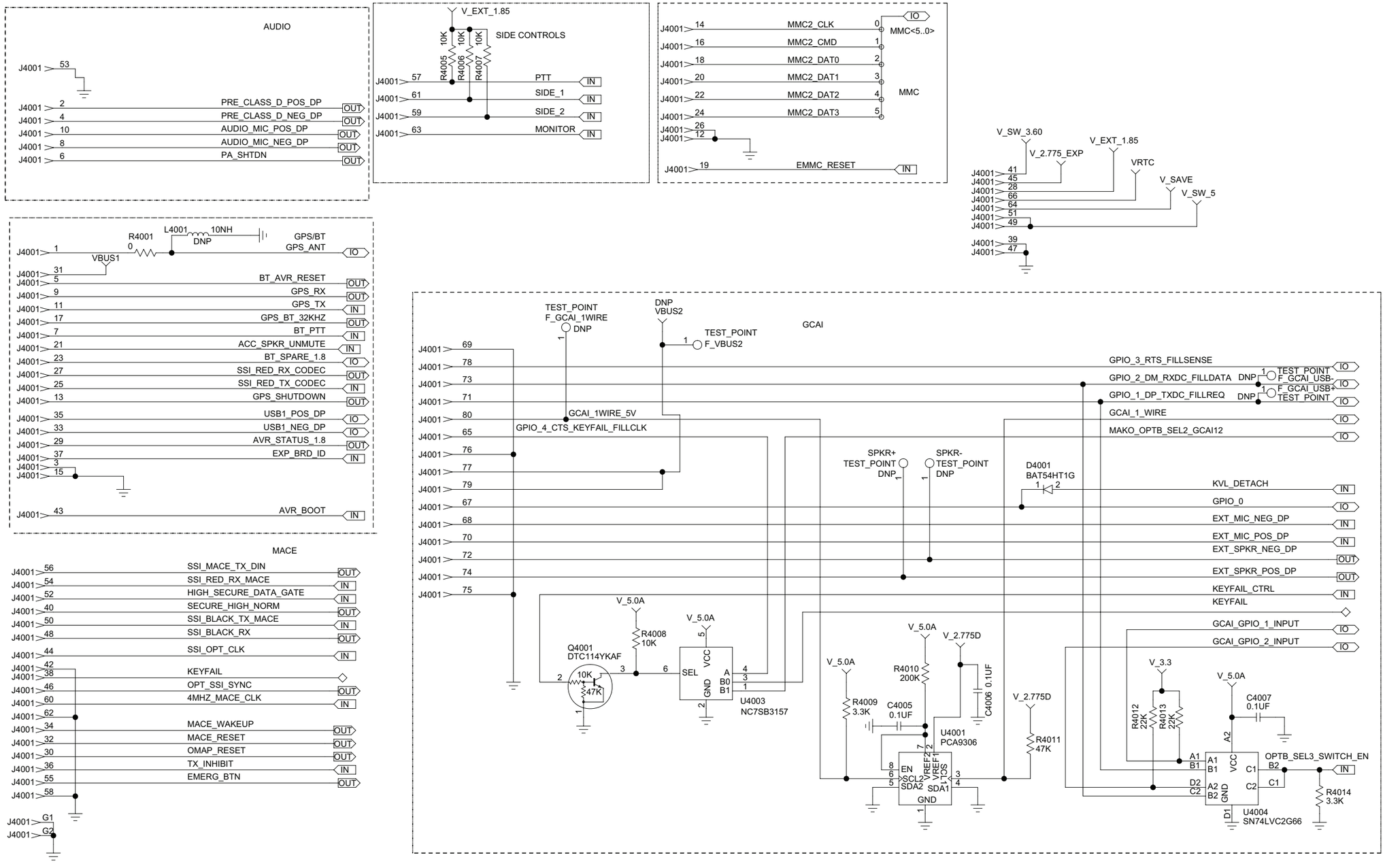


Figure 8-67. HLN5979B/ HLN5960A Controller Board Expansion Board Interface Circuits

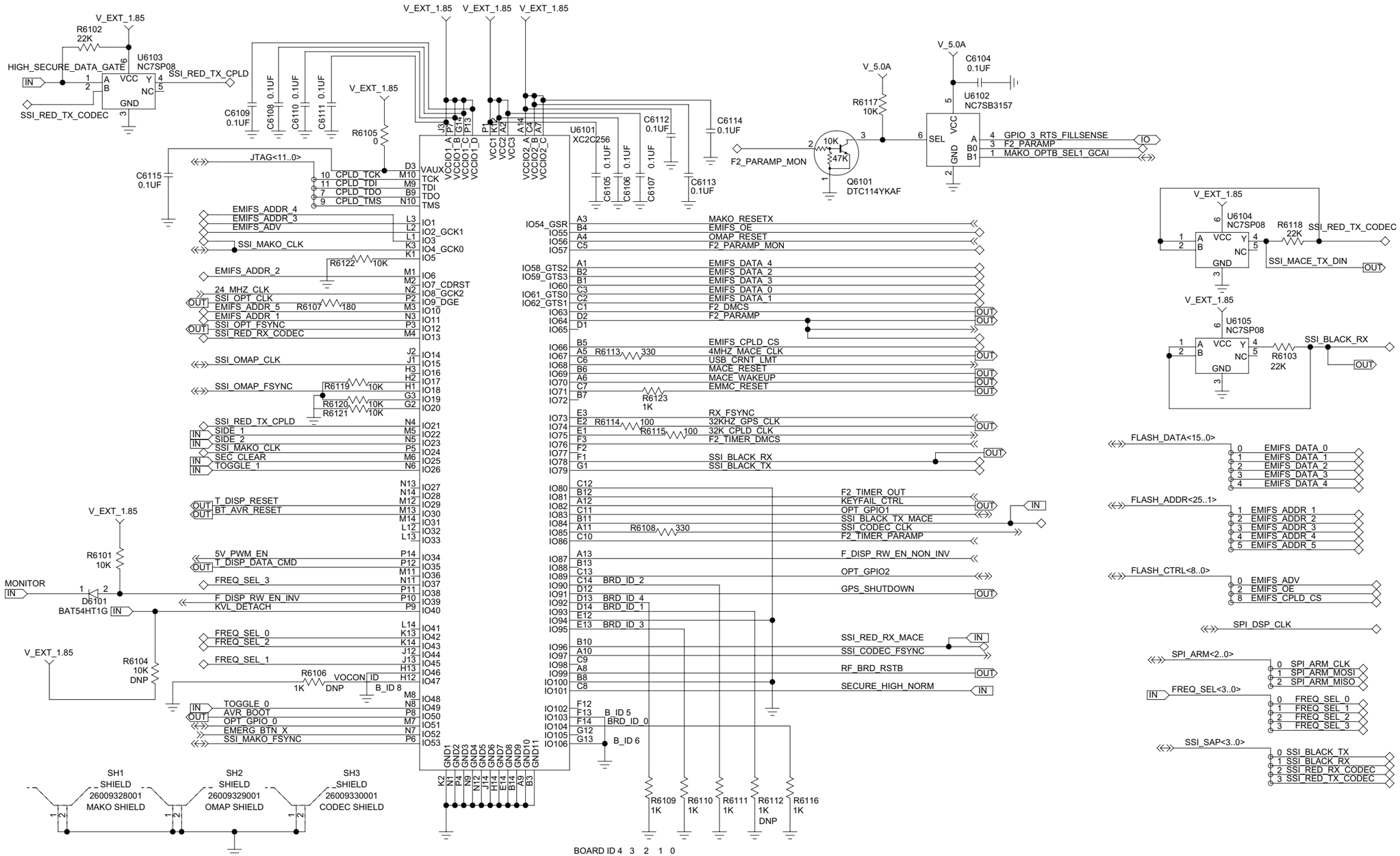


Figure 8-68. HLN5979B Controller Board CPLD Circuit

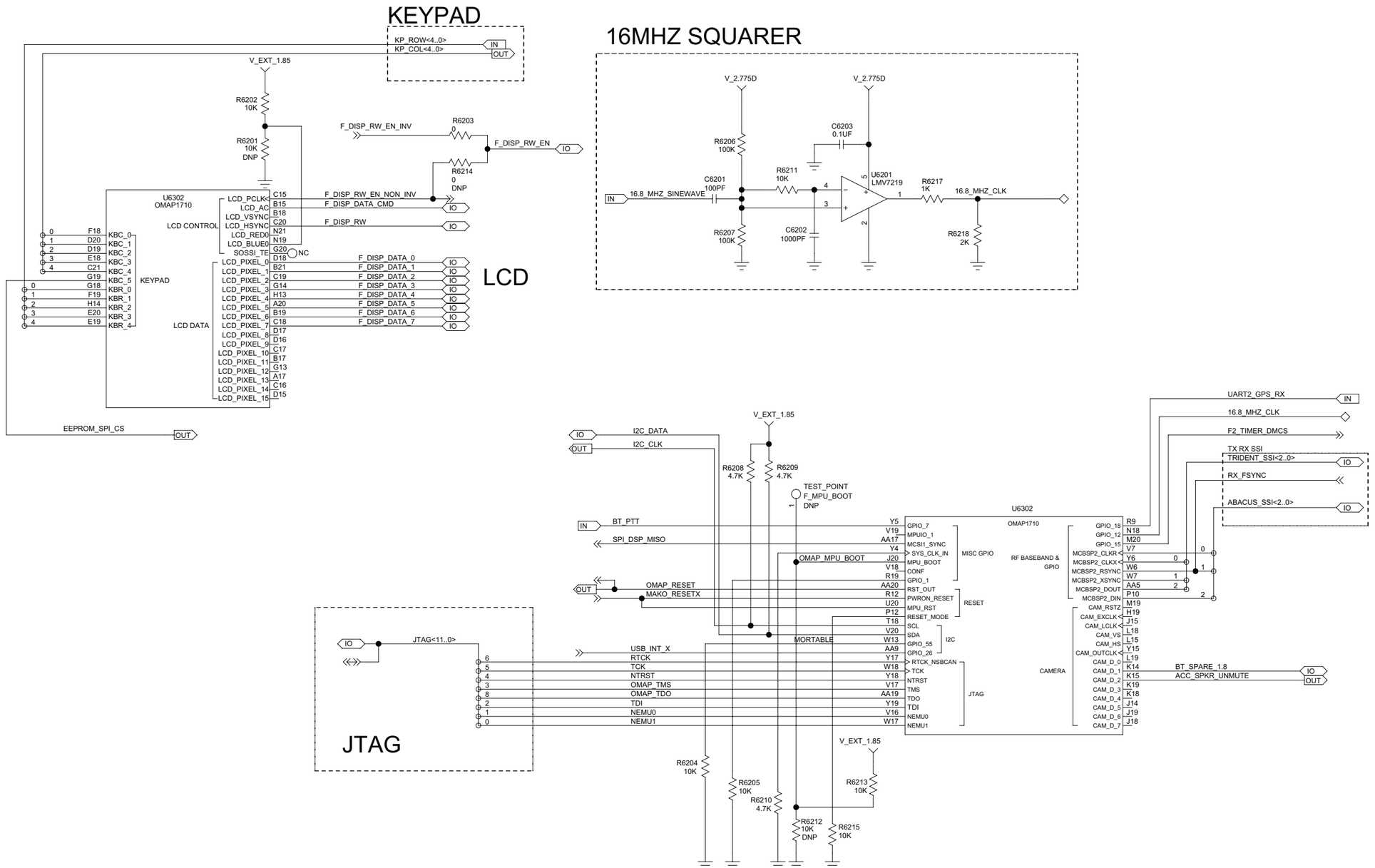


Figure 8-69. HLN5979B/ HLN5960A Controller Board OMAP User Interface Circuit

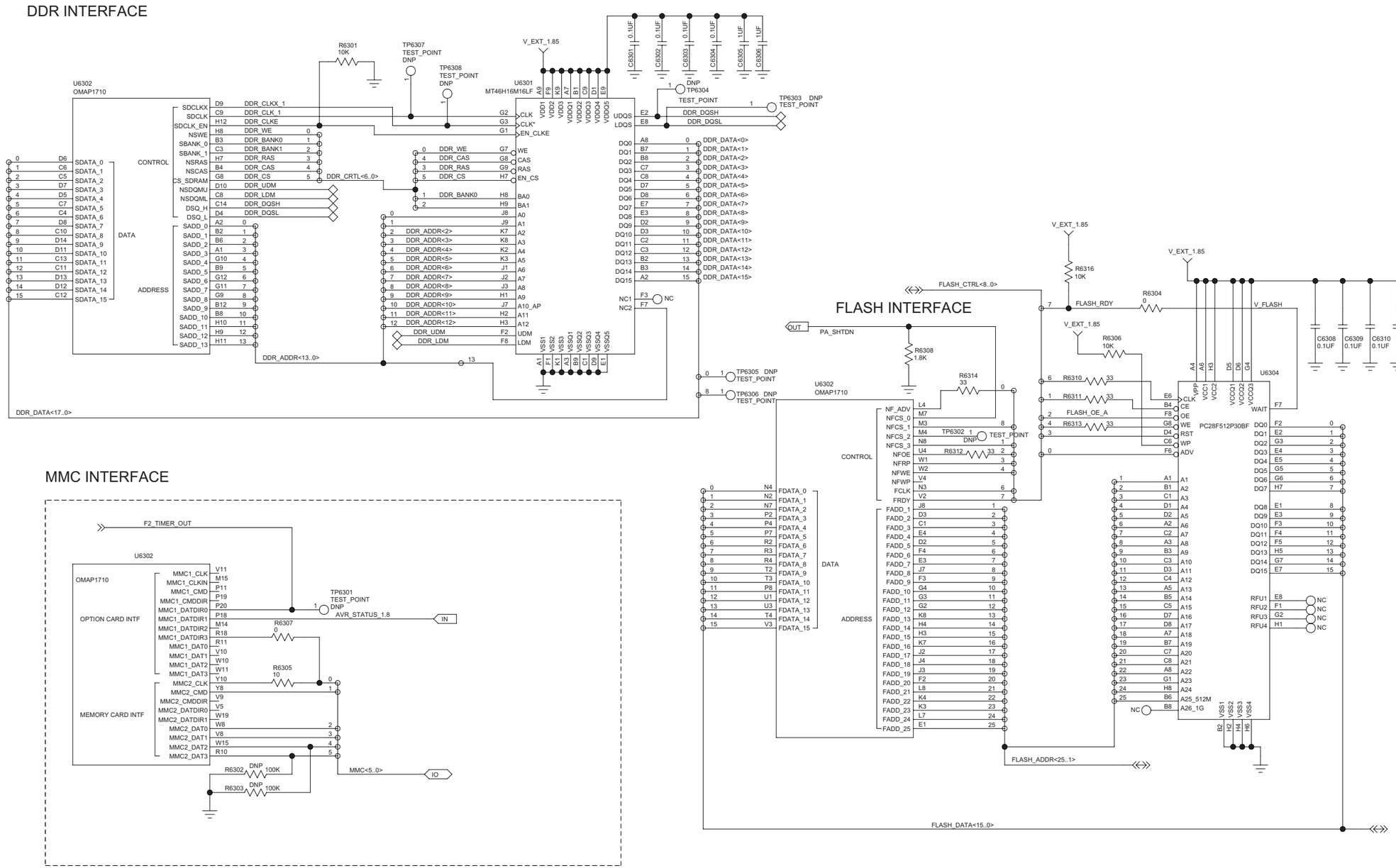


Figure 8-70. HLN5979B/ HLN5960A Controller Board Memory Interface Circuit

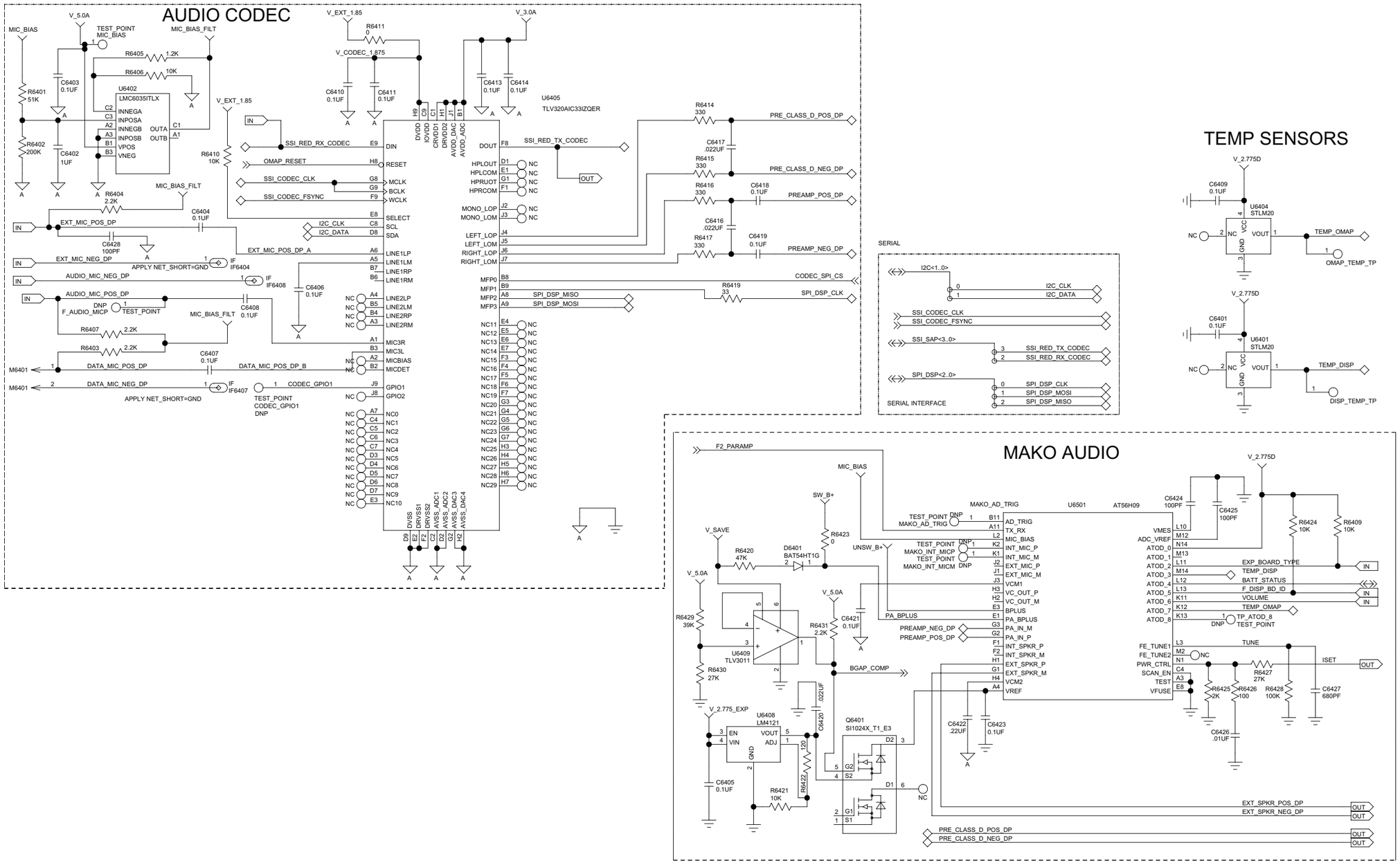


Figure 8-71. HLN5979B/ HLN5960A Controller Board Audio Circuit

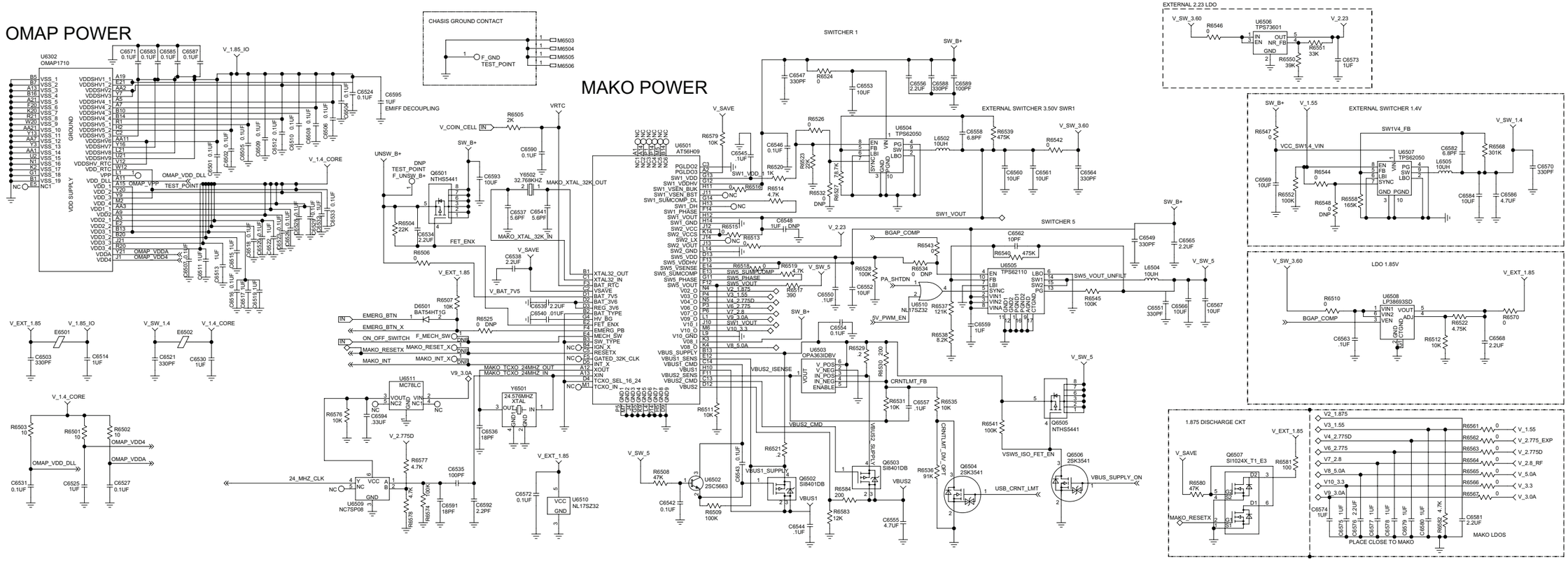


Figure 8-72. HLN5979B/ HLN5960A Controller Board MAKO/DC Circuits

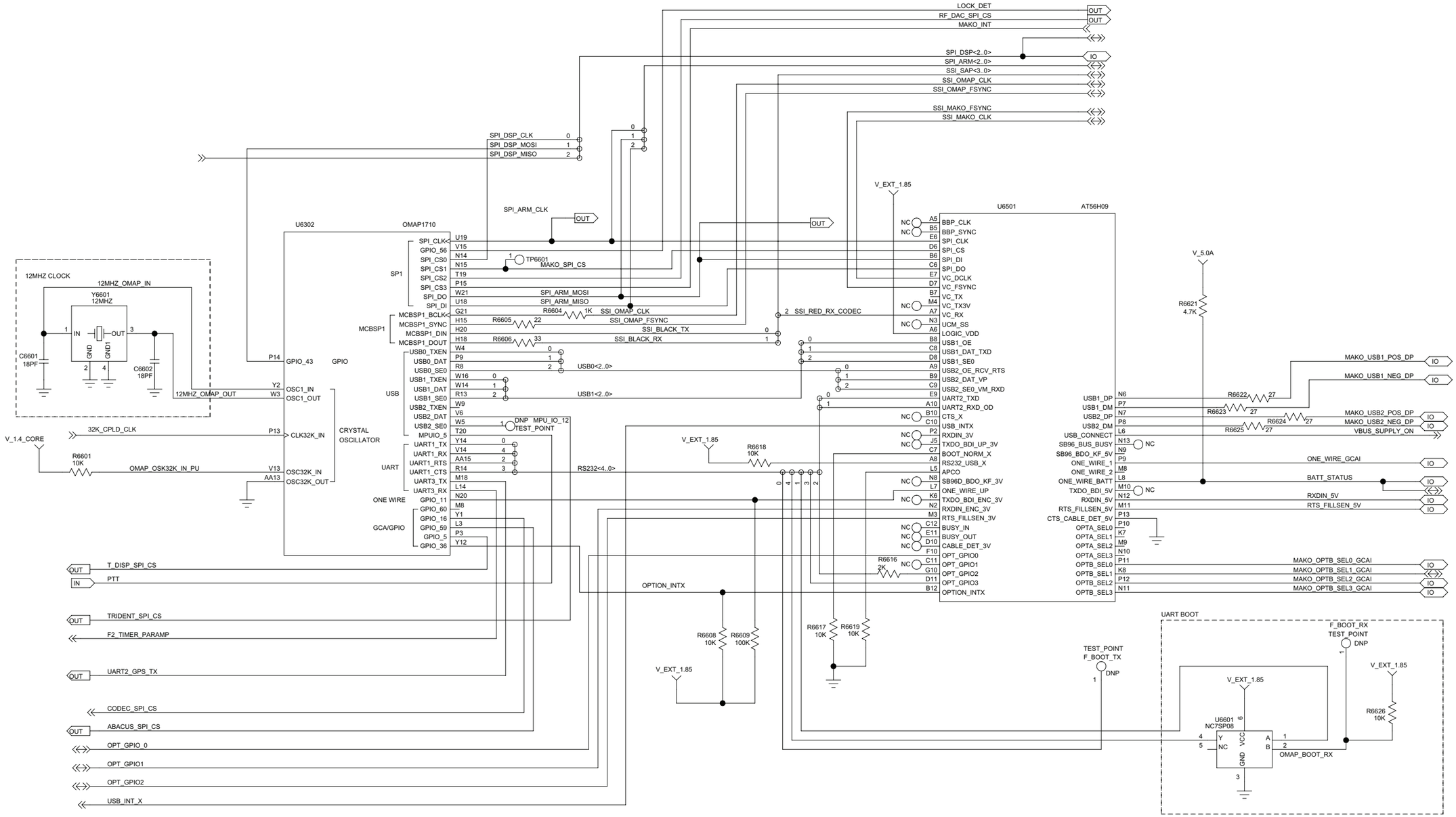


Figure 8-73. HLN5979B/ HLN5960A Controller Board Serial Interface Circuit

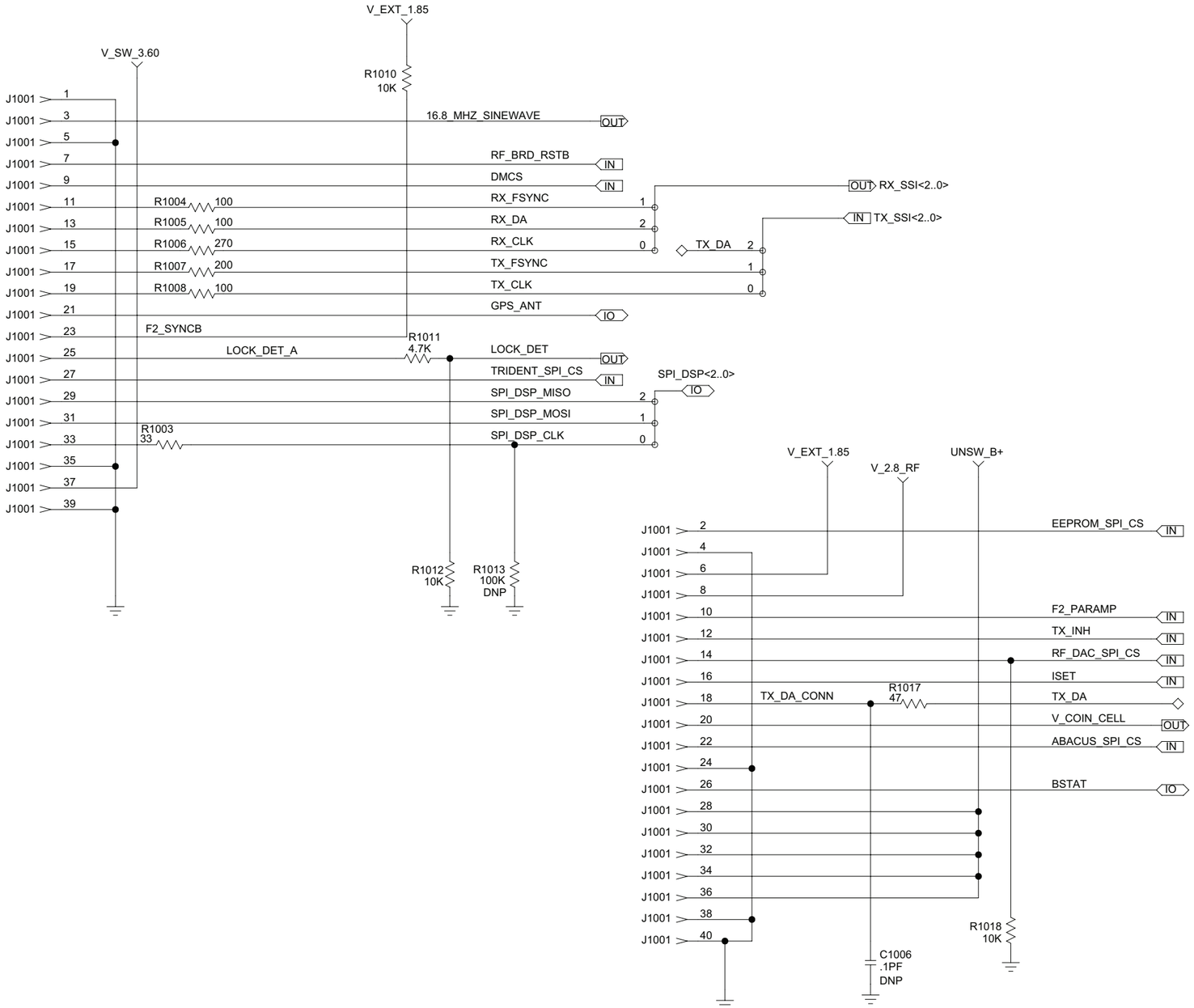


Figure 8-74. HLN5979B/ HLN5960A Controller Board RF Interface Circuit

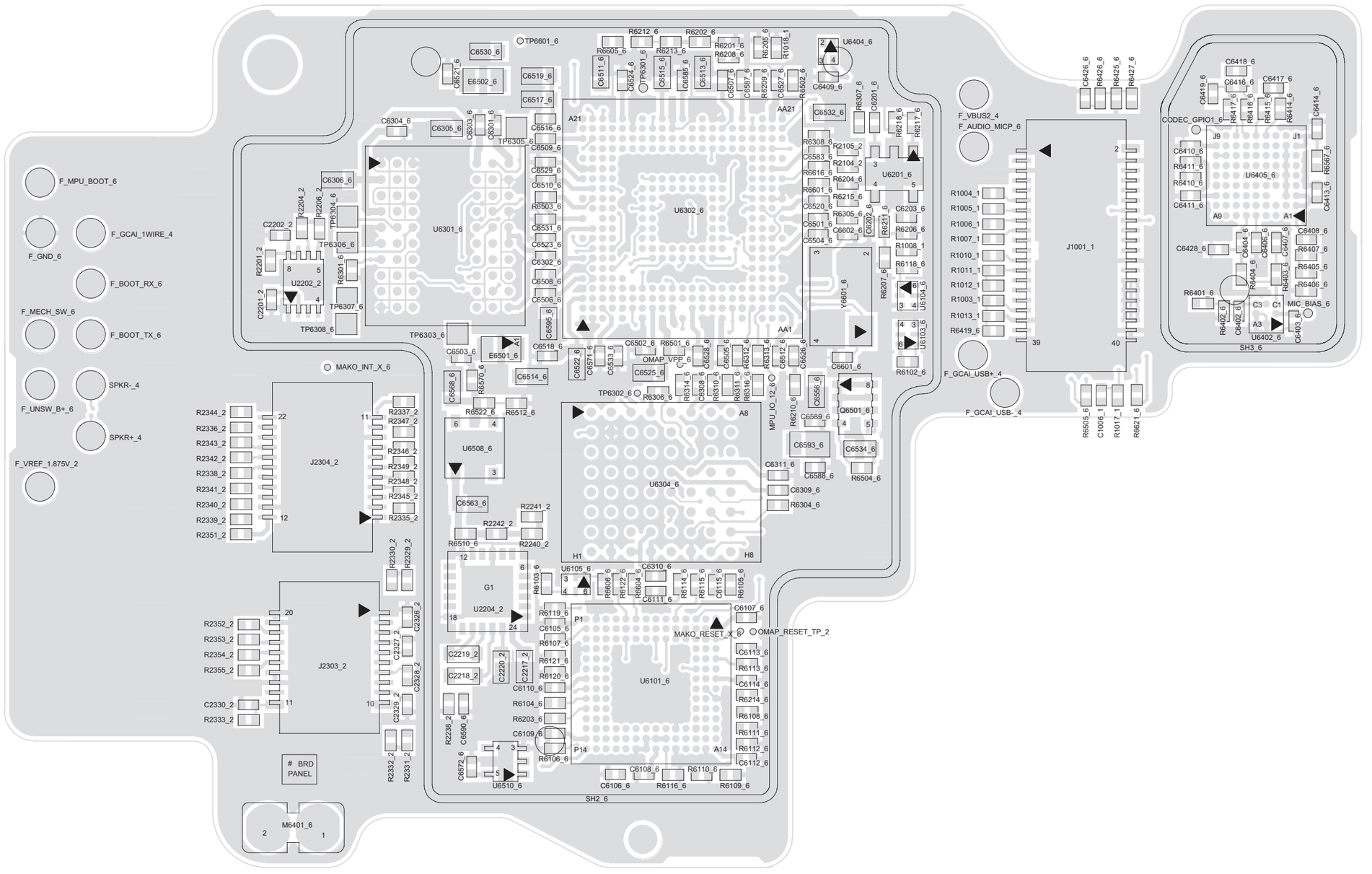


Figure 8-75. HLN5979B Controller Board Layout – Side 1

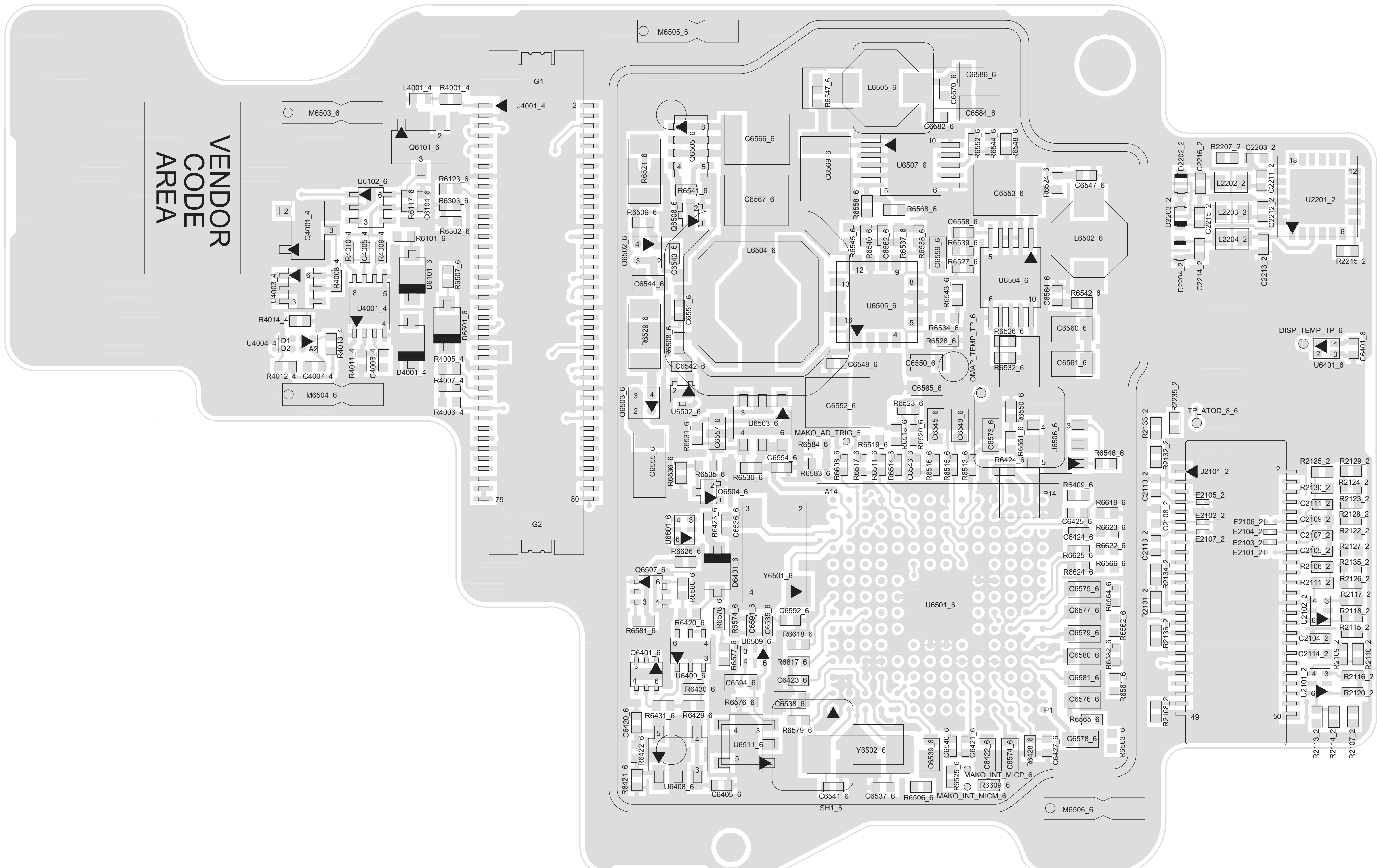


Figure 8-76. HLN5979B Controller Board Layout – Side 2

HLN5979B Controller Board Parts List

Ref. Des.	Part Number	Description
C2104	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2105	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C2107	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C2108	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C2109	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C2110	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C2111	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C2113	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C2114	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2201	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2202	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2203	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2211	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2212	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2213	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2214	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2215	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2216	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2217	2113946S35	CAP CER CHP 1.0UF 16V 10%
C2220	2113946S35	CAP CER CHP 1.0UF 16V 10%
C2326	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C2327	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C2328	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C2329	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C2330	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C4005	2113946B04	CAP CER CHP 0.10UF 10V 10%
C4006	2113946B04	CAP CER CHP 0.10UF 10V 10%
C4007	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6104	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6105	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6106	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6107	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6108	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6109	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6110	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6111	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6112	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6113	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6114	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6115	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6201	2113944A40	CAP CER CHP 100.0PF 50V 5%
C6202	2113945A09	CAP CER CHP 1000PF 50V 10%
C6203	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6301	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6302	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6303	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6304	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6305	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6306	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6308	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6309	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6310	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6311	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6401	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6402	2113956A51	CAP,FXD,1UF,+10%,-10%,6.3V-DC,0402,X5R,-55DEG CMIN,85DEG CMAX,P
C6403	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6404	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6405	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6406	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6407	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6408	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6409	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6410	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6411	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6413	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6414	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6416	2113945B04	CAP,FXD,.022UF,+10%,-10%,25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C6417	2113945B04	CAP,FXD,.022UF,+10%,-10%,25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C6418	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6419	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6420	2113945B04	CAP,FXD,.022UF,+10%,-10%,25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C6421	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6422	2113946C02	CAP CER CHP 0.22UF 10V 10%
C6423	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6424	2113944A40	CAP CER CHP 100.0PF 50V 5%
C6425	2113944A40	CAP CER CHP 100.0PF 50V 5%
C6426	2113945B02	CAP CER CHP 10,000PF 25V 10%
C6427	2113944A50	CAP CER CHP 680.0 PF 50V 5%
C6428	2113944A40	CAP CER CHP 100.0PF 50V 5%
C6501	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6502	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6503	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C6504	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6505	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6506	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6507	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6508	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6509	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6510	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6511	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6512	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6513	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6514	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6515	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6516	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6517	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6518	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6519	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6520	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6521	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C6522	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6523	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6524	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6525	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6526	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6527	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6528	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6529	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6530	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6531	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6532	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6533	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6534	2113956B33	CAP,FXD,2.2UF,+10%,-10%, 16V-DC,0603,X5R,-55DEG CMIN, 85DEG CMAX
C6535	2113743N50	CAP CHIP 100 PF 5 COG
C6536	2113944A28	CAP CER CHP 18.0PF 50V 5%
C6537	2113944A19	CAP CER CHP 5.6PF 50V +/- 0.5PF
C6538	2113956B33	CAP,FXD,2.2UF,+10%,-10%, 16V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX
C6539	2113956B33	CAP,FXD,2.2UF,+10%,-10%, 16V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX
C6540	2113945B02	CAP CER CHP 10,000PF 25V 10%
C6541	2113944A19	CAP CER CHP 5.6PF 50V +/- 0.5PF
C6542	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6543	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6544	2113945D04	CAP CER CHP 100,000PF 25V 10%
C6545	2113945D04	CAP CER CHP 100,000PF 25V 10%
C6546	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6547	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C6549	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C6550	2113945D04	CAP CER CHP 100,000PF 25V 10%
C6551	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C6552	2113956E91	CAP,FXD,10UF,+10%,-10%,16V-DC,1210,X5R,-55DEG CMIN,85DEG CMAX,P
C6553	2113956E91	CAP,FXD,10UF,+10%,-10%,16V-DC,1210,X5R,-55DEG CMIN, 85DEG CMAX,P
C6554	2113946B04	CAP CER CHP 0.10UF 10V 10%

Ref. Des.	Part Number	Description
C6555	2113955D45	CAP,FXD,4.7UF,+10%,-10%,10V-DC,1206,X7R,-55DEG CMIN,125DEG CMAX
C6556	2113956B33	CAP,FXD,2.2UF,+10%,-10%,16V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX
C6557	2113945D04	CAP CER CHP 100,000PF 25V 10%
C6558	2113944A21	CAP CER CHP 6.8PF 50V +/- 0.5PF
C6559	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6560	2113956C37	CAP,FXD,10UF,+10%,-10%,16V-DC,0805,X5R,-55DEG CMIN, 85DEG CMAX,P
C6561	2113956C37	CAP,FXD,10UF,+10%,-10%,16V-DC,0805,X5R,-55DEG CMIN, 85DEG CMAX,P
C6562	2113944A25	CAP CER CHP 10.0PF 50V +/- 0.5PF
C6563	2113945D04	CAP CER CHP 100,000PF 25V 10%
C6564	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C6565	2113956B33	CAP,FXD,2.2UF,+10%,-10%, 16V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX
C6566	2113956E91	CAP,FXD,10UF,+10%,-10%,16V-DC,1210,X5R,-55DEG CMIN,85DEG CMAX,P
C6567	2113956E91	CAP,FXD,10UF,+10%,-10%,16V-DC,1210,X5R,-55DEG CMIN,85DEG CMAX,P
C6568	2113956B33	CAP,FXD,2.2UF,+10%,-10%,16V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX
C6569	2113956E91	CAP,FXD,10UF,+10%,-10%,16V-DC,1210,X5R,-55DEG CMIN,85DEG CMAX,P
C6570	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C6571	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6572	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6573	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6574	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6575	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6576	2113956B33	CAP,FXD,2.2UF,+10%,-10%,1 6V-DC,0603,X5R,-55DEG CMIN, 85DEG CMAX

Ref. Des.	Part Number	Description
C6577	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6578	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6579	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6580	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6581	2113956B33	CAP,FXD,2.2UF,+10%,-10%,16V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX
C6582	2113944A21	CAP CER CHP 6.8PF 50V +/- 0.5PF
C6583	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6584	2113956C37	CAP,FXD,10UF,+10%,-10%,16V-DC,0805,X5R,-55DEG CMIN,85DEG CMAX,P
C6585	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6586	2113956C35	CAP,FXD,4.7UF,+10%,-10%,16V-DC,0805,X5R,-55DEG CMIN,85DEG CMAX
C6587	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6588	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C6589	2113944A40	CAP CER CHP 100.0PF 50V 5%
C6590	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6591	2113944A28	CAP CER CHP 18.0PF 50V 5%
C6592	2113944A09	CAP CER CHP 2.2PF 50V +/- 0.25PF
C6593	2113956C37	CAP,FXD,10UF,+10%,-10%,16V-DC,0805,X5R,-55DEG CMIN,85DEG CMAX,P
C6594	2113946C07	CAP,FXD,.33UF,+10%,-10%, 10V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX
C6595	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6601	2113944A28	CAP CER CHP 18.0PF 50V 5%
C6602	2113944A28	CAP CER CHP 18.0PF 50V 5%
D2202	4870359B01	DIODE,SUPR,SM,7.82V,.1W,ESD PROT,V360
D2203	4870359B01	DIODE,SUPR,SM,7.82V,.1W,ESD PROT,V360
D2204	4870359B01	DIODE,SUPR,SM,7.82V,.1W,ESD PROT,V360
D4001	4813978A25	SCHOTTKY 30V SOD-323 T&R PB FREE
D6101	4813978A25	SCHOTTKY 30V SOD-323 T&R PB FREE

Ref. Des.	Part Number	Description
D6401	4813978A25	SCHOTTKY 30V SOD-323 T&R PB FREE
D6501	4813978A25	SCHOTTKY 30V SOD-323 T&R PB FREE
E6501	2480067M02	CHK RF CHIP BEAD INDUCTOR
E6502	2480067M02	CHK RF CHIP BEAD INDUCTOR
J1001	0987817K05	40PIN RECPT MATING CNTCR 1.5MM
J2101	0975595B02	RECEPTACLE, 50 PIN
J2303	0987817K03	RECP 0.5 PITCH 20 CKT
J2304	0987817K01	RECP BTB 0.5P 1.5 STACK SMD
J4001	0909474T14	RECP INTBD 80CKT 4MM .5MM SMD
L2202	2415429H45	CHIP INDUCTOR
L2203	2415429H45	CHIP INDUCTOR
L2204	2415429H45	CHIP INDUCTOR
L6502	2471678H01	10UH INDCUTOR
L6504	24009268001	10UH 2.1A SHIELDED INDUCTOR
L6505	2471678H01	10UH INDUCTOR
M6401	3971831H02	CONTACT, 2 POGO HEADER
M6503	3987977Y04	CONT,CONN,1CONT,ANT UNIV 4.5MM,UC 1.8
M6504	3987977Y04	CONT,CONN,1CONT,ANT UNIV 4.5MM,UC 1.8
M6505	3987977Y04	CONT,CONN,1CONT,ANT UNIV 4.5MM,UC 1.8
M6506	3987977Y04	CONT,CONN,1CONT,ANT UNIV 4.5MM,UC 1.8
PWB	84009361001	PCB, VOCON
Q4001	4815261H01	TRANSISTOR,BIP GENERAL PURPOSE SMALL NPN
Q6101	4815261H01	TRANSISTOR,BIP GENERAL PURPOSE SMALL NPN
Q6401	4888795V06	XSTR,FET GP PWR,MOSFET, SM,SMT,20V,.25W,LEAD-FREE
Q6501	4813970A62	XSTR,FET GP PWR,MOSFET, P-CH,ENHN,CF,-20V,1.3W,PB-FREE
Q6502	4805585Q23	XSTR,FET GEN PURP,PB-FREE
Q6503	4805585Q23	XSTR,FET GEN PURP,PB-FREE

Ref. Des.	Part Number	Description
Q6504	4809579E77	FET, NCH MOS FET, 1.2MM X 1.2MM PACKAGE, SMD, W18 COMPLIANT
Q6505	4813970A62	XSTR,FET GP PWR,MOSFET,P-CH,ENHN,CF,-20V,1.3W,PB-FREE
Q6506	4809579E77	FET, NCH MOS FET, 1.2MM X 1.2MM PACKAGE, SMD, W18 COMPLIANT
Q6507	4888795V06	XSTR,FET GP PWR,MOSFET,SM,SMT,20V,.25 W,LEAD-FREE
R1003	0613952Q37	CER CHIP RES 33.0 OHM 5 0402
R1004	0613952Q49	CER CHIP RES 100 OHM 5 0402
R1005	0613952Q49	CER CHIP RES 100 OHM 5 0402
R1006	0613952Q59	CER CHIP RES 270 OHM 5 0402
R1007	0613952Q56	CER CHIP RES 200 OHM 5 0402
R1008	0613952Q49	CER CHIP RES 100 OHM 5 0402
R1010	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1011	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R1012	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1017	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R1018	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2104	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R2105	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R2107	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R2108	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2109	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R2110	0613952Q33	CER CHIP RES 22.0 OHM 5 0402
R2111	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R2113	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R2114	0613952Q33	CER CHIP RES 22.0 OHM 5 0402
R2115	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R2116	0613952R01	CER CHIP RES 10K OHM 5% 0402

Ref. Des.	Part Number	Description
R2117	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2118	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2120	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2122	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2123	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2124	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2125	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2126	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2127	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R2128	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R2129	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R2130	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R2131	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2132	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2133	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R2134	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R2135	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R2136	0613952Q37	CER CHIP RES 33.0 OHM 5 0402
R2201	0613952R32	CER CHIP RES 200K OHM 5 0402
R2204	0613952Q85	CER CHIP RES 3300 OHM 5 0402
R2206	0613952Q85	CER CHIP RES 3300 OHM 5 0402
R2207	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2215	0613952Q64	CER CHIP RES 430 OHM 5 0402

Ref. Des.	Part Number	Description
R2235	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2238	0613952N10	CER CHIP RES 12.4K OHM 1 0402
R2240	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2241	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2242	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2329	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2330	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2331	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2332	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2333	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2335	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R2336	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2337	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2338	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R2339	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R2340	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R2341	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R2342	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R2343	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R2344	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2345	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R2346	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R2347	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R2348	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R2349	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R2352	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2353	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM

Ref. Des.	Part Number	Description
R2354	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2355	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R4001	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R4005	0613952R01	CER CHIP RES 10K OHM 5% 0402
R4006	0613952R01	CER CHIP RES 10K OHM 5% 0402
R4007	0613952R01	CER CHIP RES 10K OHM 5% 0402
R4008	0613952R01	CER CHIP RES 10K OHM 5% 0402
R4009	0613952Q85	CER CHIP RES 3300 OHM 5 0402
R4010	0613952R32	CER CHIP RES 200K OHM 5 0402
R4011	0613952R17	CER CHIP RES 47K OHM 5% 0402
R4012	0613952R09	CER CHIP RES 22K OHM 5% 0402
R4013	0613952R09	CER CHIP RES 22K OHM 5% 0402
R4014	0613952Q85	CER CHIP RES 3300 OHM 5 0402
R6101	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6102	0613952R09	CER CHIP RES 22K OHM 5% 0402
R6103	0613952R09	CER CHIP RES 22K OHM 5% 0402
R6105	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6107	0613952Q55	CER CHIP RES 180 OHM 5 0402
R6108	0613952Q61	CER CHIP RES 330 OHM 5 0402
R6109	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R6110	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R6111	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R6113	0613952Q61	CER CHIP RES 330 OHM 5 0402
R6114	0613952Q49	CER CHIP RES 100 OHM 5 0402

Ref. Des.	Part Number	Description
R6115	0613952Q49	CER CHIP RES 100 OHM 5 0402
R6116	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R6117	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6118	0613952R09	CER CHIP RES 22K OHM 5% 0402
R6119	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6120	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6121	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6122	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6123	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R6202	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6203	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6204	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6205	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6206	0613952R25	CER CHIP RES 100K OHM 5% 0402
R6207	0613952R25	CER CHIP RES 100K OHM 5% 0402
R6208	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R6209	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R6210	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R6211	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6213	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6215	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6217	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R6218	0613952Q80	CER CHIP RES 2000 OHM 5 0402

Ref. Des.	Part Number	Description
R6301	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6304	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6305	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R6306	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6307	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6308	0613952Q79	CER CHIP RES 1800 OHM 5 0402
R6310	0613952Q37	CER CHIP RES 33.0 OHM 5 0402
R6311	0613952Q37	CER CHIP RES 33.0 OHM 5 0402
R6312	0613952Q37	CER CHIP RES 33.0 OHM 5 0402
R6313	0613952Q37	CER CHIP RES 33.0 OHM 5 0402
R6314	0613952Q37	CER CHIP RES 33.0 OHM 5 0402
R6316	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6401	0613952R18	CER CHIP RES 51K OHM 5 0402
R6402	0613952R32	CER CHIP RES 200K OHM 5 0402
R6403	0613952Q81	CER CHIP RES 2200 OHM 5 0402
R6404	0613952Q81	CER CHIP RES 2200 OHM 5 0402
R6405	0613952Q75	CER CHIP RES 1200 OHM 5 0402
R6406	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6407	0613952Q81	CER CHIP RES 2200 OHM 5 0402
R6409	0613952N01	CER CHIP RES 10.0K OHM 1 0402
R6410	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6411	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6414	0613952Q61	CER CHIP RES 330 OHM 5 0402
R6415	0613952Q61	CER CHIP RES 330 OHM 5 0402
R6416	0613952Q61	CER CHIP RES 330 OHM 5 0402
R6417	0613952Q61	CER CHIP RES 330 OHM 5 0402
R6419	0613952Q37	CER CHIP RES 33.0 OHM 5 0402

Ref. Des.	Part Number	Description
R6420	0613952R17	CER CHIP RES 47K OHM 5% 0402
R6421	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6422	0613952Q51	CER CHIP RES 120 OHM 5 0402
R6423	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6424	0613952N01	CER CHIP RES 10.0K OHM 1 0402
R6425	0613952Q80	CER CHIP RES 2000 OHM 5 0402
R6426	0613952Q49	CER CHIP RES 100 OHM 5 0402
R6427	0613952R11	CER CHIP RES 27K OHM 5% 0402
R6428	0613952R25	CER CHIP RES 100K OHM 5% 0402
R6429	0613952Z64	RES,MF,39KOHM,1%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R6430	0613952R11	CER CHIP RES 27K OHM 5% 0402
R6431	0613952Q81	CER CHIP RES 2200 OHM 5 0402
R6501	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R6502	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R6503	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R6504	0613952R09	CER CHIP RES 22K OHM 5% 0402
R6505	0613952Q80	CER CHIP RES 2000 OHM 5 0402
R6506	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6507	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6508	0613952R17	CER CHIP RES 47K OHM 5% 0402
R6509	0613952R25	CER CHIP RES 100K OHM 5% 0402
R6510	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6511	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6512	0613952N01	CER CHIP RES 10.0K OHM 1 0402

Ref. Des.	Part Number	Description
R6513	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6514	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R6515	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6516	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6517	0613952Q63	CER CHIP RES 390 OHM 5 0402
R6518	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6519	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R6520	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R6521	0615049H01	KAMAYA 0.2 OHM CHIP RESISTOR
R6522	0613952M66	CER CHIP RES 4750 OHM 1% 0402
R6523	0613952R09	CER CHIP RES 22K OHM 5% 0402
R6524	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6526	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6527	0613952N87	CER CHIP RES 78.7K OHM 1 0402
R6528	0613952R25	CER CHIP RES 100K OHM 5% 0402
R6529	0615049H01	KAMAYA 0.2 OHM CHIP RESISTOR
R6530	0613952L30	CER CHIP RES 200 OHM 1 0402
R6531	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6535	0613952N01	CER CHIP RES 10.0K OHM 1 0402
R6536	0613952Z72	RES,MF,91KOHM,1%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R6537	0613952P09	CER CHIP RES 121K OHM 1 0402
R6538	0613952Q95	CER CHIP RES 8200 OHM 5 0402
R6539	0613952P66	CER CHIP RES 475K OHM 1 0402

Ref. Des.	Part Number	Description
R6540	0613952P66	CER CHIP RES 475K OHM 1 0402
R6541	0613952R25	CER CHIP RES 100K OHM 5% 0402
R6542	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6543	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6544	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6545	0613952R25	CER CHIP RES 100K OHM 5% 0402
R6546	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6547	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6550	0613952Z64	RES,MF,39KOHM,1%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R6551	0613952Z62	RES,MF,33KOHM,1%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R6552	0613952R25	CER CHIP RES 100K OHM 5% 0402
R6558	0613952P22	CER CHIP RES 165K OHM 1 0402
R6561	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6562	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6563	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6564	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6565	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6566	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6567	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6568	0613952P47	CER CHIP RES 301K OHM 1 0402
R6570	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6574	0613952R25	CER CHIP RES 100K OHM 5% 0402

Ref. Des.	Part Number	Description
R6576	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6577	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R6578	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R6579	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6580	0613952R17	CER CHIP RES 47K OHM 5% 0402
R6581	0613952Q49	CER CHIP RES 100 OHM 5 0402
R6582	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R6583	0613952R03	CER CHIP RES 12K OHM 5% 0402
R6584	0613952Q56	CER CHIP RES 200 OHM 5 0402
R6601	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6604	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R6605	0613952Q33	CER CHIP RES 22.0 OHM 5 0402
R6606	0613952Q37	CER CHIP RES 33.0 OHM 5 0402
R6608	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6609	0613952R25	CER CHIP RES 100K OHM 5% 0402
R6616	0613952Q80	CER CHIP RES 2000 OHM 5 0402
R6617	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6618	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6619	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6621	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R6622	0613952Q35	CER CHIP RES 27.0 OHM 5 0402
R6623	0613952Q35	CER CHIP RES 27.0 OHM 5 0402
R6624	0613952Q35	CER CHIP RES 27.0 OHM 5 0402
R6625	0613952Q35	CER CHIP RES 27.0 OHM 5 0402
R6626	0613952R01	CER CHIP RES 10K OHM 5% 0402
SH1	26009328001	SHIELD, MAKO SWITCHERS
SH2	26009329001	SHIELD, OMAP MEMORY
SH3	26009330001	SHIELD, CODEC
U2101	5109522E84	IC DUAL SCHMITT TRIG MICRO PAK
U2102	5109522E84	IC DUAL SCHMITT TRIG MICRO PAK
U2201	5171679H01	LED LIGHT DRIVER
U2202	5164852H47	IC, I2C LEVEL TRANSLATOR
U2204	5187970L78	1.4MHZ WHITE LED DRIVER
U4001	5164852H47	IC, I2C LEVEL TRANSLATOR
U4003	5188691V01	IC,MUX/ DEMUX,NC7SB3157P6X,SM,SC 70-6,1PER PKG,BUS,PB FREE
U4004	5116783H01	SN74LVC2G66 ANALOG SWITCH
U6101	0180706J18	PROGRAMMED CPLD
U6102	5188691V01	IC,MUX/DEMUX, NC7SB3157P6X, SM, SC70-6,1PER PKG,BUS,PB FREE
U6103	5175114H01	SINGLE AND GATE MICROPAK
U6104	5175114H01	SINGLE AND GATE MICROPAK
U6105	5175114H01	SINGLE AND GATE MICROPAK
U6201	5185941F26	IC,COMPTR,LMV7219,NOPB
U6301	51012031001	32MB DIE SHRINK DDR SDRAM IC
U6302	5102495J13	IC,MICROP,P1710ZZGE,BGA,12 MHZ,32BITS
U6304	0105955U25	ASSY,IC,BGA SPEC PROG, FLASH MEMORY
U6401	5175772B38	IC ANALOG TEMPERATURE SENSOR
U6402	5115453H01	RAIL TO RAIL OUTPUT, 8 PIN BGA
U6404	5175772B38	IC ANALOG TEMPERATURE SENSOR
U6405	5188348V06	IC,AUDIO CODEC,SM,AUDIO CODEC
U6408	5188521T01	IC,VREF,SM,SOT23,1PER PKG, .5%,1.25 TO 13.75,PRCN BANDGAP ADJUS
U6409	51009000001	NANOPOWER, 1.8V, SOT23 COMPARATOR
U6501	5185143E77	IC, MAKO ASIC, CMOS PWR MGMT
U6502	4871987H01	LOW FREQUENCY TRANSISTOR
U6503	5171674H01	OP AMP
U6504	5171682H01	800MA BUCK REGULATOR
U6505	5189631P01	IC,0PER PKG,SYNC STEP-DOWN CONV
U6506	5184790Y04	IC,400MA ADJ VREG LDO,SOT23
U6507	5171682H01	800MA BUCK REGULATOR
U6508	51009366001	500MA LOW DROPOUT CMOS LINEAR REG.
U6509	5175114H01	SINGLE AND GATE MICROPAK
U6510	5114007A47	IC,OR,17SZ32,1PER PKG,SOT-353,PB FREE
U6511	5171339H01	MICROPOWER VOLTAGE REGULATOR
U6601	5175114H01	SINGLE AND GATE MICROPAK
Y6501	4864005H01	RESONATOR, CRYSTAL 24.576 MHZ
Y6502	4809995L05	XTAL QUARTZ 32.768KHZ CC4V-T1
Y6601	4802582S85	RESON,QRTZ,12MHZ,TOLERANCE10PPM,STABILITY15PPM,SM,FUND,LO

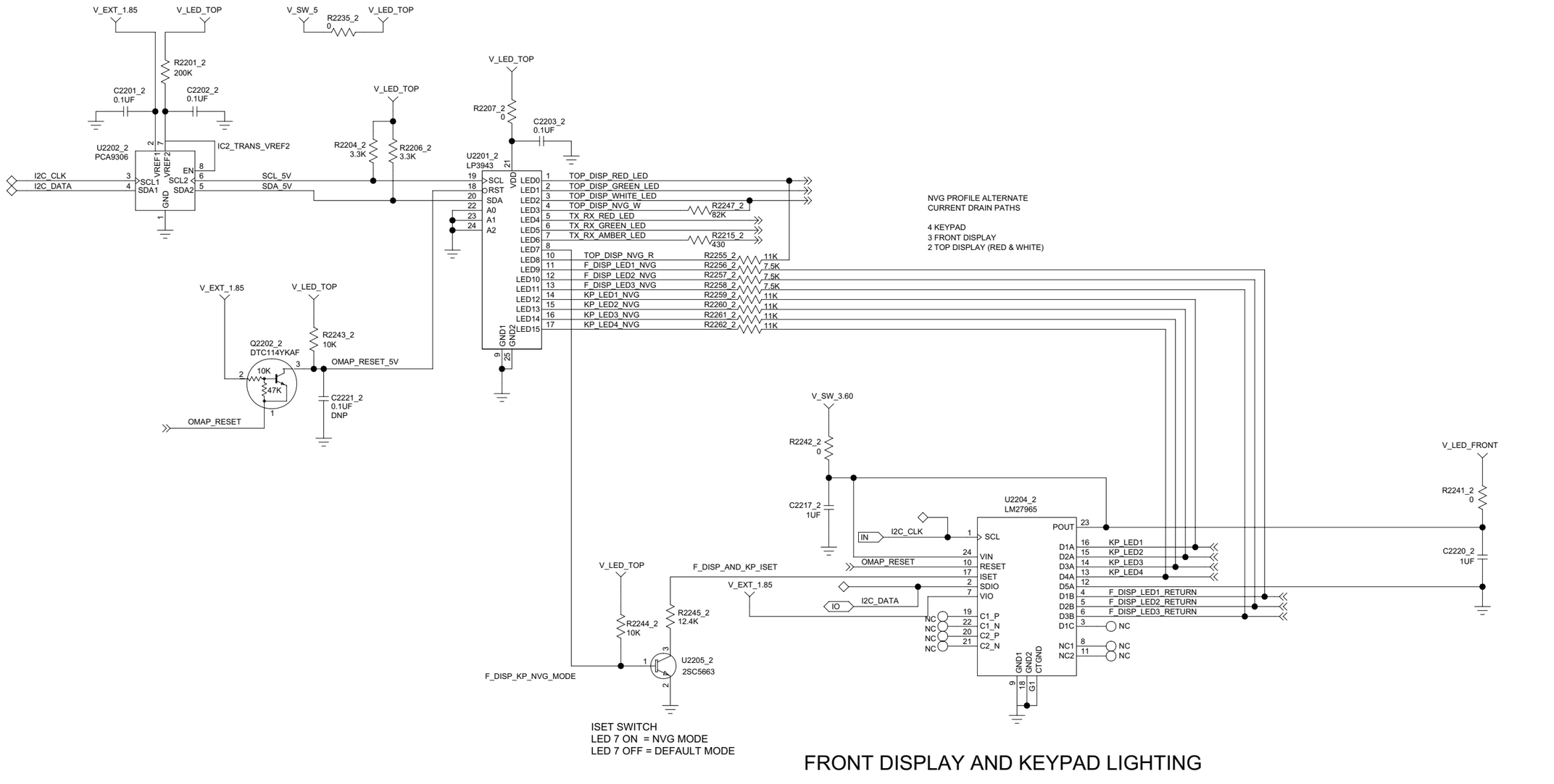


Figure 8-77. HLN5960A Controller Board Display/Keypad Lighting Control Circuits

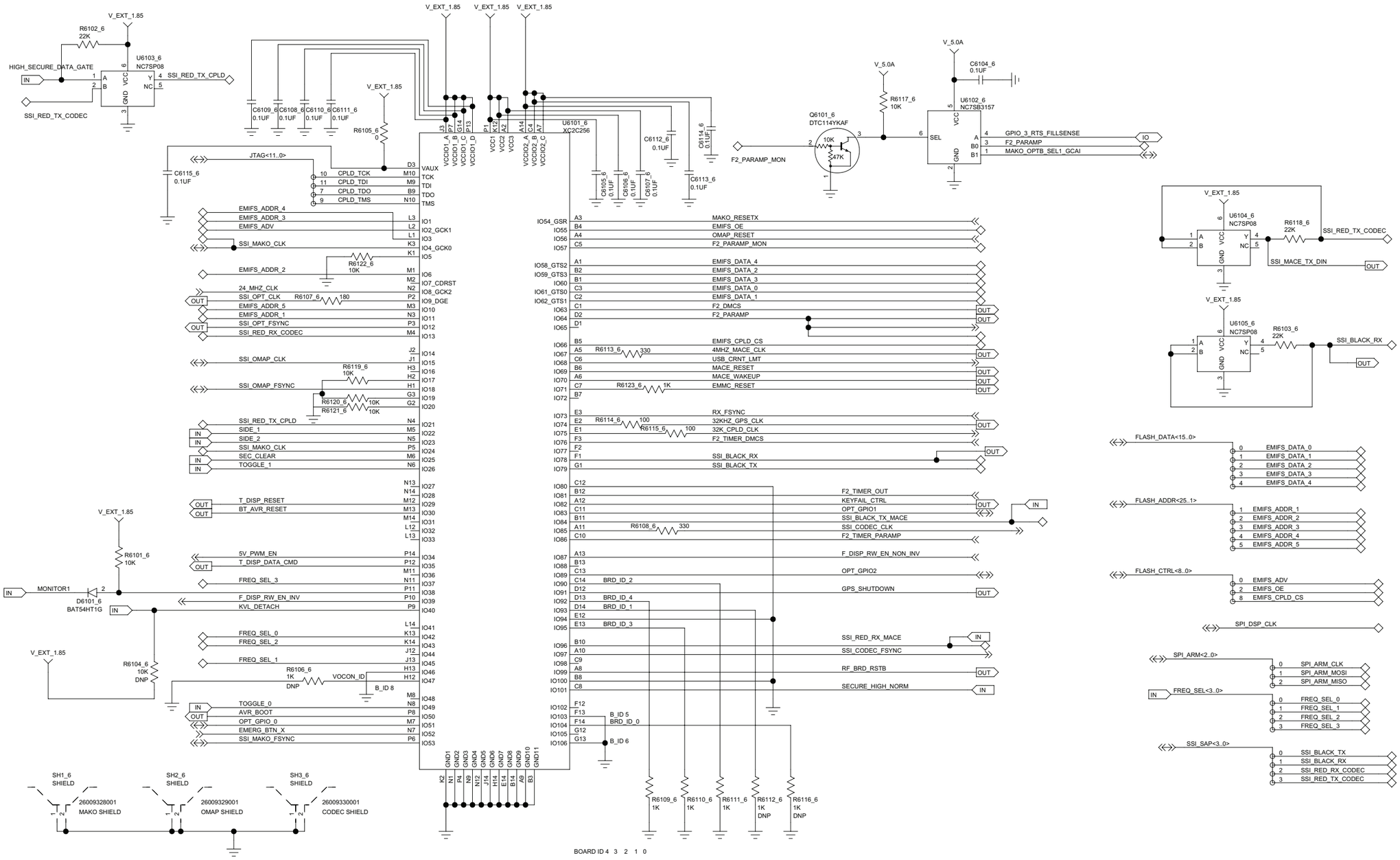


Figure 8-78. HLN5960A Controller Board CPLD Circuit

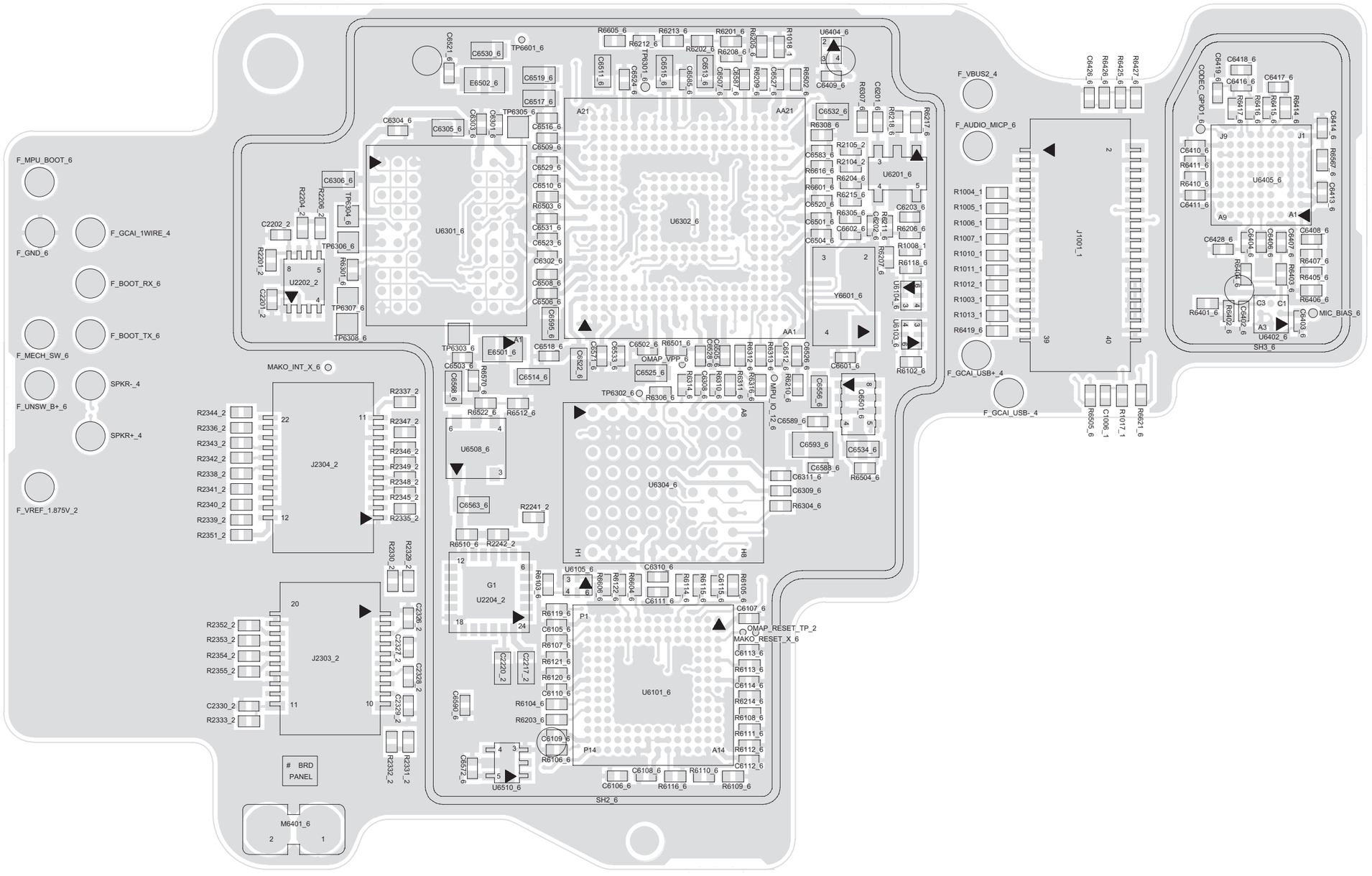


Figure 8-79. HLN5960A Controller Board Layout – Side 1

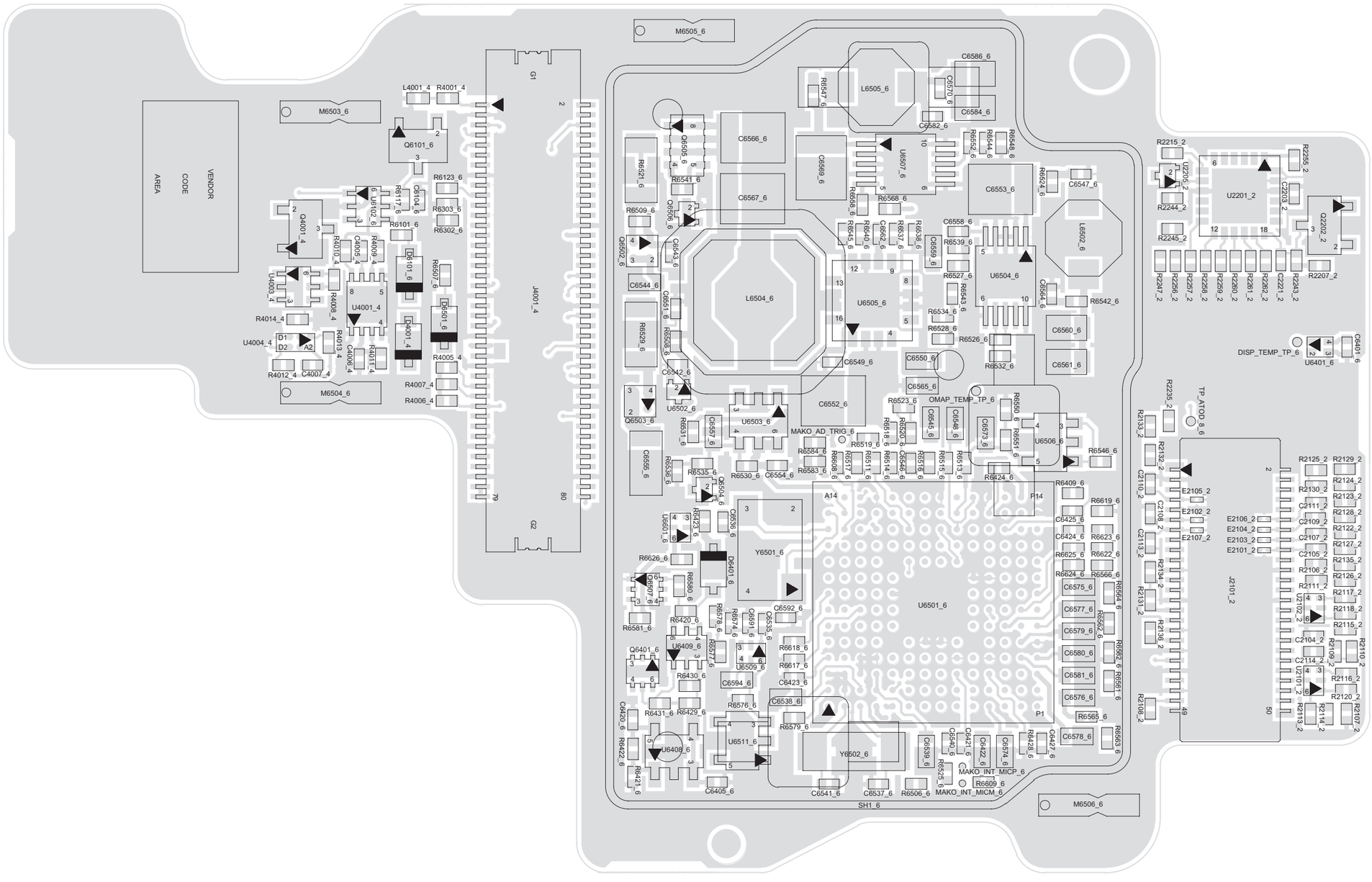


Figure 8-80. HLN5960A Controller Board Layout – Side 2

HLN5960A Controller Board Parts List

Ref. Des.	Part Number	Description
C2104	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2105	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C2107	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C2108	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C2109	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C2110	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C2111	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C2113	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C2114	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2201	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2202	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2203	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2217	2113946S35	CAP CER CHP 1.0UF 16V 10%
C2220	2113946S35	CAP CER CHP 1.0UF 16V 10%
C2326	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C2327	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C2328	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C2329	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C2330	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C4005	2113946B04	CAP CER CHP 0.10UF 10V 10%
C4006	2113946B04	CAP CER CHP 0.10UF 10V 10%
C4007	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6104	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6105	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6106	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6107	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6108	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6109	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6110	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6111	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6112	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6113	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6114	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6115	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6201	2113944A40	CAP CER CHP 100.0PF 50V 5%
C6202	2113945A09	CAP CER CHP 1000PF 50V 10%
C6203	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6301	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6302	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6303	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6304	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6305	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6306	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6308	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6309	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6310	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6311	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6401	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6402	2113956A51	CAP,FXD,1UF,+10%,-10%,6.3V-DC,0402,X5R,-55DEG CMIN, 85DEG CMAX,P
C6403	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6404	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6405	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6406	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6407	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6408	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6409	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6410	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6411	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6413	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6414	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6416	2113945B04	CAP,FXD,.022UF,+10%,-10%, 25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C6417	2113945B04	CAP,FXD,.022UF,+10%,-10%, 25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C6418	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6419	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6420	2113945B04	CAP,FXD,.022UF,+10%,-10%, 25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA
C6421	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6422	2113946C02	CAP CER CHP 0.22UF 10V 10%
C6423	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6424	2113944A40	CAP CER CHP 100.0PF 50V 5%
C6425	2113944A40	CAP CER CHP 100.0PF 50V 5%
C6426	2113945B02	CAP CER CHP 10,000PF 25V 10%
C6427	2113944A50	CAP CER CHP 680.0 PF 50V 5%
C6428	2113944A40	CAP CER CHP 100.0PF 50V 5%
C6501	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6502	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6503	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C6504	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6505	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6506	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6507	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6508	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6509	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6510	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6511	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6512	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6513	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6514	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6515	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6516	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6517	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6518	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6519	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6520	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6521	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C6522	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6523	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6524	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6525	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6526	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6527	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6528	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6529	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6530	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6531	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6532	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6533	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6534	2113956B33	CAP,FXD,2.2UF,+10%,-10%, 16V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX
C6535	2113944A40	CAP CER CHP 100.0PF 50V 5%
C6536	2113944A28	CAP CER CHP 18.0PF 50V 5%
C6537	2113944A19	CAP CER CHP 5.6PF 50V +/-0.5PF
C6538	2113956B33	CAP,FXD,2.2UF,+10%,-10%, 16V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX
C6539	2113956B33	CAP,FXD,2.2UF,+10%,-10%, 16V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX
C6540	2113945B02	CAP CER CHP 10,000PF 25V 10%
C6541	2113944A19	CAP CER CHP 5.6PF 50V +/-0.5PF
C6542	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6543	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6544	2113945D04	CAP CER CHP 100,000PF 25V 10%
C6545	2113945D04	CAP CER CHP 100,000PF 25V 10%
C6546	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6547	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C6549	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C6550	2113945D04	CAP CER CHP 100,000PF 25V 10%
C6551	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C6552	2113956E91	CAP,FXD,10UF,+10%,-10%,16V-DC,1210,X5R,-55DEG CMIN, 85DEG CMAX,P
C6553	2113956E91	CAP,FXD,10UF,+10%,-10%,16V-DC,1210,X5R,-55DEG CMIN, 85DEG CMAX,P
C6554	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6555	2113955D45	CAP,FXD,4.7UF,+10%,-10%, 10V-DC,1206,X7R,-55DEG CMIN,125DEG CMAX
C6556	2113956B33	CAP,FXD,2.2UF,+10%,-10%,16V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX
C6557	2113945D04	CAP CER CHP 100,000PF 25V 10%

Ref. Des.	Part Number	Description
C6558	2113944A21	CAP CER CHP 6.8PF 50V +/- 0.5PF
C6559	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6560	2113956C37	CAP,FXD,10UF,+10%,-10%,16V-DC,0805,X5R,-55DEG CMIN, 85DEG CMAX,P
C6561	2113956C37	CAP,FXD,10UF,+10%,-10%,16V-DC,0805,X5R,-55DEG CMIN, 85DEG CMAX,P
C6562	2113944A25	CAP CER CHP 10.0PF 50V +/- 0.5PF
C6563	2113945D04	CAP CER CHP 100,000PF 25V 10%
C6564	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C6565	2113956B33	CAP,FXD,2.2UF,+10%,-10%, 16V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX
C6566	2113956E91	CAP,FXD,10UF,+10%,-10%,16V-DC,1210,X5R,-55DEG CMIN, 85DEG CMAX,P
C6567	2113956E91	CAP,FXD,10UF,+10%,-10%,16V-DC,1210,X5R,-55DEG CMIN, 85DEG CMAX,P
C6568	2113956B33	CAP,FXD,2.2UF,+10%,-10%, 16V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX
C6569	2113956E91	CAP,FXD,10UF,+10%,-10%,16V-DC,1210,X5R,-55DEG CMIN, 85DEG CMAX,P
C6570	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C6571	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6572	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6573	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6574	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6575	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6576	2113956B33	CAP,FXD,2.2UF,+10%,-10%, 16V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX
C6577	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6578	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6579	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6580	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6581	2113956B33	CAP,FXD,2.2UF,+10%,-10%, 16V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX

Ref. Des.	Part Number	Description
C6582	2113944A21	CAP CER CHP 6.8PF 50V +/- 0.5PF
C6583	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6584	2113956C37	CAP,FXD,10UF,+10%,-10%,16V-DC,0805,X5R,-55DEG CMIN, 85DEG CMAX,P
C6585	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6586	2113956C35	CAP,FXD,4.7UF,+10%,-10%, 16V-DC,0805,X5R,-55DEG CMIN,85DEG CMAX
C6587	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6588	2113944A46	CAP CER CHP 330.0 PF 50V 5%
C6589	2113944A40	CAP CER CHP 100.0PF 50V 5%
C6590	2113946B04	CAP CER CHP 0.10UF 10V 10%
C6591	2113944A28	CAP CER CHP 18.0PF 50V 5%
C6592	2113944A09	CAP CER CHP 2.2PF 50V +/- 0.25PF
C6593	2113956C37	CAP,FXD,10UF,+10%,-10%,16V-DC,0805,X5R,-55DEG CMIN,85DEG CMAX,P
C6594	2113946C07	CAP,FXD,.33UF,+10%,-10%,10V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX
C6595	2113946S35	CAP CER CHP 1.0UF 16V 10%
C6601	2113944A28	CAP CER CHP 18.0PF 50V 5%
C6602	2113944A28	CAP CER CHP 18.0PF 50V 5%
D4001	4813978A25	SCHOTTKY 30V SOD-323 T&R PB FREE
D6101	4813978A25	SCHOTTKY 30V SOD-323 T&R PB FREE
D6401	4813978A25	SCHOTTKY 30V SOD-323 T&R PB FREE
D6501	4813978A25	SCHOTTKY 30V SOD-323 T&R PB FREE
E6501	2480067M02	CHK RF CHIP BEAD INDUCTOR
E6502	2480067M02	CHK RF CHIP BEAD INDUCTOR
J1001	0987817K05	40PIN RECPT MATING CNTCR 1.5MM
J2101	0975595B02	RECEPTACLE, 50 PIN
J2303	0987817K03	RECP 0.5 PITCH 20 CKT
J2304	0987817K01	RECP BTB 0.5P 1.5 STACK SMD
J4001	0909474T14	RECP INTBD 80CKT 4MM .5MM SMD

Ref. Des.	Part Number	Description
L6502	2471678H01	10UH INDCUTOR
L6504	24009268001	10UH 2.1A SHIELDED INDUCTOR
L6505	2471678H01	10UH INDCUTOR
M6401	3971831H02	CONTACT, 2 POGO HEADER
M6503	3987977Y04	CONT,CONN,1CONT,ANT UNIV 4.5MM,UC 1.8
M6504	3987977Y04	CONT,CONN,1CONT,ANT UNIV 4.5MM,UC 1.8
M6505	3987977Y04	CONT,CONN,1CONT,ANT UNIV 4.5MM,UC 1.8
M6506	3987977Y04	CONT,CONN,1CONT,ANT UNIV 4.5MM,UC 1.8
PWB	84009518001	PCB, VOCON
Q2202	4815261H01	TRANSISTOR,BIP GENERAL PURPOSE SMALL NPN
Q4001	4815261H01	TRANSISTOR,BIP GENERAL PURPOSE SMALL NPN
Q6101	4815261H01	TRANSISTOR,BIP GENERAL PURPOSE SMALL NPN
Q6401	48013068001	DUAL N-CHANNEL 20 V (D-S) MOSFET
Q6501	4813970A62	XSTR,FET GP PWR,MOSFET, P-CH,ENHN,CF,-20V,1.3W, PB-FREE
Q6502	4805585Q23	XSTR,FET GEN PURP,PB-FREE
Q6503	4805585Q23	XSTR,FET GEN PURP,PB-FREE
Q6504	4809579E77	FET, NCH MOS FET, 1.2MM X 1.2MM PACKAGE, SMD, W18 COMPLIANT
Q6505	4813970A62	XSTR,FET GP PWR,MOSFET, P-CH,ENHN,CF,-20V,1.3W, PB-FREE
Q6506	4809579E77	FET, NCH MOS FET, 1.2MM X 1.2MM PACKAGE, SMD, W18 COMPLIANT
Q6507	48013068001	DUAL N-CHANNEL 20 V (D-S) MOSFET
R1003	0613952Q37	CER CHIP RES 33.0 OHM 5 0402
R1004	0613952Q49	CER CHIP RES 100 OHM 5 0402
R1005	0613952Q49	CER CHIP RES 100 OHM 5 0402
R1006	0613952Q59	CER CHIP RES 270 OHM 5 0402
R1007	0613952Q56	CER CHIP RES 200 OHM 5 0402
R1008	0613952Q49	CER CHIP RES 100 OHM 5 0402

Ref. Des.	Part Number	Description
R1010	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1011	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R1012	0613952R01	CER CHIP RES 10K OHM 5% 0402
R1017	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R1018	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2104	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R2105	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R2107	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R2108	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2109	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R2110	0613952Q33	CER CHIP RES 22.0 OHM 5 0402
R2111	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R2113	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R2114	0613952Q33	CER CHIP RES 22.0 OHM 5 0402
R2115	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R2116	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2117	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2118	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2120	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2122	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2123	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2124	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2125	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2126	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2127	0613952Q73	CER CHIP RES 1000 OHM 5 0402

Ref. Des.	Part Number	Description
R2128	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R2129	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R2130	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R2131	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2132	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2133	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R2134	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R2135	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R2136	0613952Q37	CER CHIP RES 33.0 OHM 5 0402
R2201	0613952R32	CER CHIP RES 200K OHM 5 0402
R2204	0613952Q85	CER CHIP RES 3300 OHM 5 0402
R2206	0613952Q85	CER CHIP RES 3300 OHM 5 0402
R2207	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2215	0613952Q64	CER CHIP RES 430 OHM 5 0402
R2235	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2241	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2242	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2243	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2244	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2245	0613952N10	CER CHIP RES 12.4K OHM 1 0402
R2247	0613952R23	CER CHIP RES 82K OHM 5% 0402
R2255	0613952R02	CER CHIP RES 11K OHM 5 0402
R2256	0613952Q94	CER CHIP RES 7500 OHM 5 0402
R2257	0613952Q94	CER CHIP RES 7500 OHM 5 0402
R2258	0613952Q94	CER CHIP RES 7500 OHM 5 0402
R2259	0613952R02	CER CHIP RES 11K OHM 5 0402
R2260	0613952R02	CER CHIP RES 11K OHM 5 0402
R2261	0613952R02	CER CHIP RES 11K OHM 5 0402
R2262	0613952R02	CER CHIP RES 11K OHM 5 0402
R2329	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2330	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2331	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2332	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2333	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2335	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R2336	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2337	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2338	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R2339	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R2340	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R2341	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R2342	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R2343	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R2344	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2345	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R2346	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R2347	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R2348	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R2349	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R2352	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2353	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2354	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2355	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R4001	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R4005	0613952R01	CER CHIP RES 10K OHM 5% 0402
R4006	0613952R01	CER CHIP RES 10K OHM 5% 0402
R4007	0613952R01	CER CHIP RES 10K OHM 5% 0402
R4008	0613952R01	CER CHIP RES 10K OHM 5% 0402
R4009	0613952Q85	CER CHIP RES 3300 OHM 5 0402
R4010	0613952R32	CER CHIP RES 200K OHM 5 0402
R4011	0613952R17	CER CHIP RES 47K OHM 5% 0402
R4012	0613952R09	CER CHIP RES 22K OHM 5% 0402
R4013	0613952R09	CER CHIP RES 22K OHM 5% 0402
R4014	0613952Q85	CER CHIP RES 3300 OHM 5 0402
R6101	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6102	0613952R09	CER CHIP RES 22K OHM 5% 0402
R6103	0613952R09	CER CHIP RES 22K OHM 5% 0402
R6105	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6107	0613952Q55	CER CHIP RES 180 OHM 5 0402
R6108	0613952Q61	CER CHIP RES 330 OHM 5 0402
R6109	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R6110	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R6111	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R6113	0613952Q61	CER CHIP RES 330 OHM 5 0402
R6114	0613952Q49	CER CHIP RES 100 OHM 5 0402
R6115	0613952Q49	CER CHIP RES 100 OHM 5 0402
R6117	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6118	0613952R09	CER CHIP RES 22K OHM 5% 0402
R6119	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6120	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6121	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6122	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6123	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R6202	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6203	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6204	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6205	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6206	0613952R25	CER CHIP RES 100K OHM 5% 0402
R6207	0613952R25	CER CHIP RES 100K OHM 5% 0402
R6208	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R6209	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R6210	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R6211	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6213	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6215	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6217	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R6218	0613952Q80	CER CHIP RES 2000 OHM 5 0402
R6301	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6304	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6305	0613952Q25	CER CHIP RES 10.0 OHM 5 0402

Ref. Des.	Part Number	Description
R6306	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6307	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6308	0613952Q79	CER CHIP RES 1800 OHM 5 0402
R6310	0613952Q37	CER CHIP RES 33.0 OHM 5 0402
R6311	0613952Q37	CER CHIP RES 33.0 OHM 5 0402
R6312	0613952Q37	CER CHIP RES 33.0 OHM 5 0402
R6313	0613952Q37	CER CHIP RES 33.0 OHM 5 0402
R6314	0613952Q37	CER CHIP RES 33.0 OHM 5 0402
R6316	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6401	0613952R18	CER CHIP RES 51K OHM 5 0402
R6402	0613952R32	CER CHIP RES 200K OHM 5 0402
R6403	0613952Q81	CER CHIP RES 2200 OHM 5 0402
R6404	0613952Q81	CER CHIP RES 2200 OHM 5 0402
R6405	0613952Q75	CER CHIP RES 1200 OHM 5 0402
R6406	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6407	0613952Q81	CER CHIP RES 2200 OHM 5 0402
R6409	0613952N01	CER CHIP RES 10.0K OHM 1 0402
R6410	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6411	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6414	0613952Q61	CER CHIP RES 330 OHM 5 0402
R6415	0613952Q61	CER CHIP RES 330 OHM 5 0402
R6416	0613952Q61	CER CHIP RES 330 OHM 5 0402
R6417	0613952Q61	CER CHIP RES 330 OHM 5 0402
R6419	0613952Q37	CER CHIP RES 33.0 OHM 5 0402
R6420	0613952R17	CER CHIP RES 47K OHM 5% 0402
R6421	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6422	0613952Q51	CER CHIP RES 120 OHM 5 0402
R6423	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6424	0613952N01	CER CHIP RES 10.0K OHM 1 0402
R6425	0613952Q80	CER CHIP RES 2000 OHM 5 0402
R6426	0613952Q49	CER CHIP RES 100 OHM 5 0402
R6427	0613952R11	CER CHIP RES 27K OHM 5% 0402
R6428	0613952R25	CER CHIP RES 100K OHM 5% 0402
R6429	0613952Z64	RES,MF,39KOHM,1%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R6430	0613952R11	CER CHIP RES 27K OHM 5% 0402
R6431	0613952Q81	CER CHIP RES 2200 OHM 5 0402
R6501	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R6502	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R6503	0613952Q25	CER CHIP RES 10.0 OHM 5 0402
R6504	0613952R09	CER CHIP RES 22K OHM 5% 0402
R6505	0613952Q80	CER CHIP RES 2000 OHM 5 0402
R6506	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6507	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6508	0613952R17	CER CHIP RES 47K OHM 5% 0402
R6509	0613952R25	CER CHIP RES 100K OHM 5% 0402
R6510	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6511	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6512	0613952N01	CER CHIP RES 10.0K OHM 1 0402
R6513	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6514	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R6515	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6516	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6517	0613952Q63	CER CHIP RES 390 OHM 5 0402
R6518	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6519	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R6520	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R6521	0615049H01	KAMAYA 0.2 OHM CHIP RESISTOR
R6522	0613952M66	CER CHIP RES 4750 OHM 1% 0402
R6523	0613952R09	CER CHIP RES 22K OHM 5% 0402
R6524	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6526	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6527	0613952N87	CER CHIP RES 78.7K OHM 1 0402
R6528	0613952R25	CER CHIP RES 100K OHM 5% 0402
R6529	0615049H01	KAMAYA 0.2 OHM CHIP RESISTOR
R6530	0613952L30	CER CHIP RES 200 OHM 1 0402
R6531	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6535	0613952N01	CER CHIP RES 10.0K OHM 1 0402
R6536	0613952Z72	RES,MF,91KOHM,1%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R6537	0613952P09	CER CHIP RES 121K OHM 1 0402
R6538	0613952Q95	CER CHIP RES 8200 OHM 5 0402
R6539	0613952P66	CER CHIP RES 475K OHM 1 0402
R6540	0613952P66	CER CHIP RES 475K OHM 1 0402
R6541	0613952R25	CER CHIP RES 100K OHM 5% 0402
R6542	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6543	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6544	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6545	0613952R25	CER CHIP RES 100K OHM 5% 0402
R6546	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6547	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6550	0613952Z64	RES,MF,39KOHM,1%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R6551	0613952Z62	RES,MF,33KOHM,1%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R6552	0613952R25	CER CHIP RES 100K OHM 5% 0402
R6558	0613952P22	CER CHIP RES 165K OHM 1 0402
R6561	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6562	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6563	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6564	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6565	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6566	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6567	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6568	0613952P47	CER CHIP RES 301K OHM 1 0402
R6570	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R6574	0613952R25	CER CHIP RES 100K OHM 5% 0402
R6576	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6577	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R6578	0613952Q89	CER CHIP RES 4700 OHM 5 0402

Ref. Des.	Part Number	Description
R6579	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6580	0613952R17	CER CHIP RES 47K OHM 5% 0402
R6581	0613952Q49	CER CHIP RES 100 OHM 5 0402
R6582	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R6583	0613952R03	CER CHIP RES 12K OHM 5% 0402
R6584	0613952Q56	CER CHIP RES 200 OHM 5 0402
R6601	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6604	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R6605	0613952Q33	CER CHIP RES 22.0 OHM 5 0402
R6606	0613952Q37	CER CHIP RES 33.0 OHM 5 0402
R6608	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6609	0613952R25	CER CHIP RES 100K OHM 5% 0402
R6616	0613952Q80	CER CHIP RES 2000 OHM 5 0402
R6617	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6618	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6619	0613952R01	CER CHIP RES 10K OHM 5% 0402
R6621	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R6622	0613952Q35	CER CHIP RES 27.0 OHM 5 0402
R6623	0613952Q35	CER CHIP RES 27.0 OHM 5 0402
R6624	0613952Q35	CER CHIP RES 27.0 OHM 5 0402
R6625	0613952Q35	CER CHIP RES 27.0 OHM 5 0402
R6626	0613952R01	CER CHIP RES 10K OHM 5% 0402
SH1	26009328001	SHIELD, MAKO SWITCHERS
SH2	26009329001	SHIELD, OMAP MEMORY
SH3	26009330001	SHIELD, CODEC
U2101	5109522E84	IC DUAL SCHMITT TRIG MICRO PAK
U2102	5109522E84	IC DUAL SCHMITT TRIG MICRO PAK

Ref. Des.	Part Number	Description
U2201	5171679H01	LED LIGHT DRIVER
U2202	5164852H47	IC, I2C LEVEL TRANSLATOR
U2204	5187970L78	1.4MHZ WHITE LED DRIVER
U2205	4871987H01	LOW FREQUENCY TRANSISTOR
U4001	5164852H47	IC, I2C LEVEL TRANSLATOR
U4003	5188691V01	IC,MUX/DEMUX, NC7SB3157P6X,SM,SC70-6, 1PER PKG,BUS,PB FREE
U4004	5116783H01	SN74LVC2G66 ANALOG SWITCH
U6101	0180706J18	PROGRAMMED CPLD
U6102	5188691V01	IC,MUX/DEMUX, NC7SB3157P6X,SM,SC70-6,1PER PKG,BUS,PB FREE
U6103	5175114H01	SINGLE AND GATE MICROPAK
U6104	5175114H01	SINGLE AND GATE MICROPAK
U6105	5175114H01	SINGLE AND GATE MICROPAK
U6201	5185941F26	IC,COMPTR,LMV7219,NOPB
U6301	51012031001	32MB DIE SHRINK DDR SDRAM IC
U6302	5102495J13	IC,MICROP,P1710ZZGE,BGA, 12MHZ,32BITS
U6304	0105955U25	ASSY,IC,BGA SPEC PROG, FLASH MEMORY
U6401	5175772B38	IC ANALOG TEMPERATURE SENSOR
U6402	5115453H01	RAIL TO RAIL OUTPUT, 8 PIN BGA
U6404	5175772B38	IC ANALOG TEMPERATURE SENSOR
U6405	5188348V06	IC,AUDIO CODEC,SM,AUDIO CODEC
U6408	5188521T01	IC,VREF,SM,SOT23,1PER PKG, .5%,1.25 TO 13.75,PRCN BANDGAP ADJUS
U6409	51009000001	NANOPOWER, 1.8V, SOT23 COMPARATOR
U6501	5185143E77	IC, MAKO ASIC, CMOS PWR MGMT
U6502	4871987H01	LOW FREQUENCY TRANSISTOR
U6503	5171674H01	OP AMP
U6504	5171682H01	800MA BUCK REGULATOR

Ref. Des.	Part Number	Description
U6505	5189631P01	IC,SYNC STEP-DOWN CONV
U6506	5184790Y04	IC,400MA ADJ VREG LDO,SOT23
U6507	5171682H01	800MA BUCK REGULATOR
U6508	51009366001	500MA LOW DROPOUT CMOS LINEAR REG.
U6509	5175114H01	SINGLE AND GATE MICROPAK
U6510	5114007A47	IC,OR,17SZ32,1PER PKG, SOT-353,PB FREE
U6511	5171339H01	MICROPOWER VOLTAGE REGULATOR
U6601	5175114H01	SINGLE AND GATE MICROPAK
Y6501	4864005H01	RESONATOR, CRYSTAL 24.576 MHZ
Y6502	4809995L05	XTAL QUARTZ 32.768KHZ CC4V-T1
Y6601	4802582S85	RESON,QRTZ,12MHZ,TOLERANCE10PPM,STABILITY15PPM,SM,FUND,LO

8.9 Expansion Board

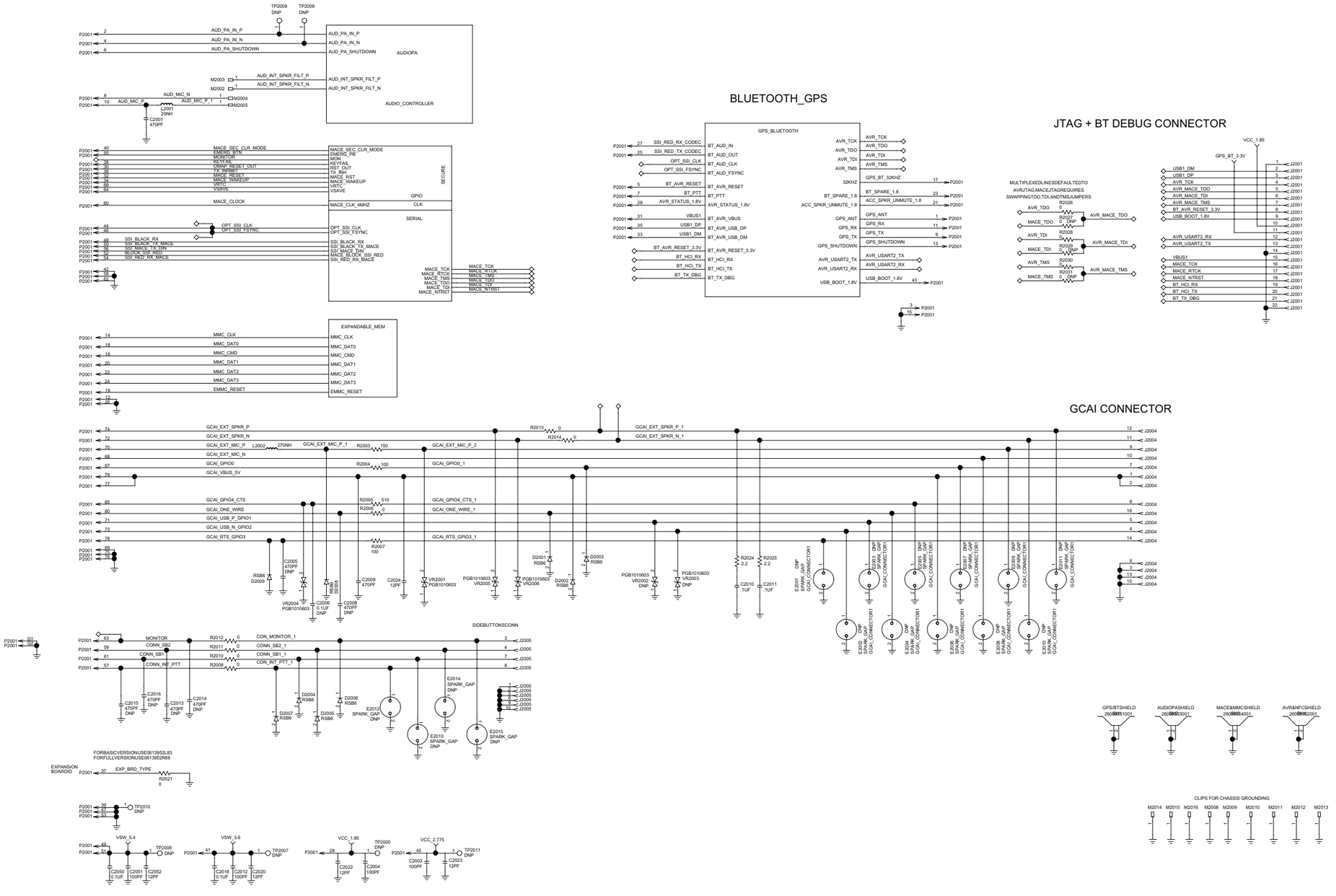


Figure 8-81. HLN5978B Expansion Board Overall Circuit Schematic

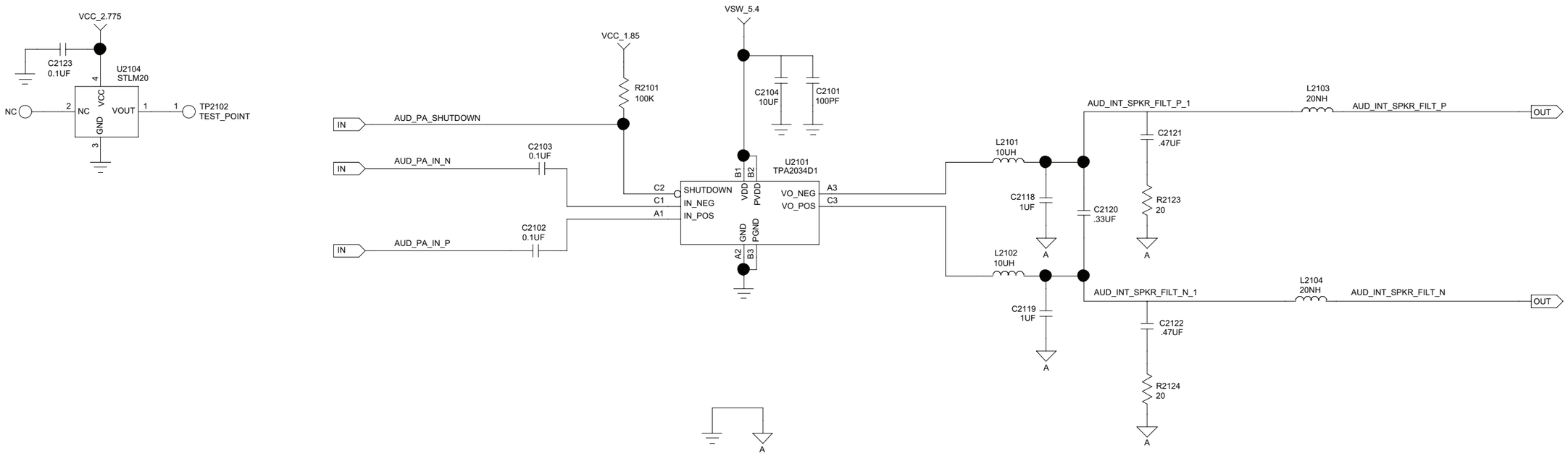


Figure 8-82. HLN5977A/ HLN5978B Audio Circuit

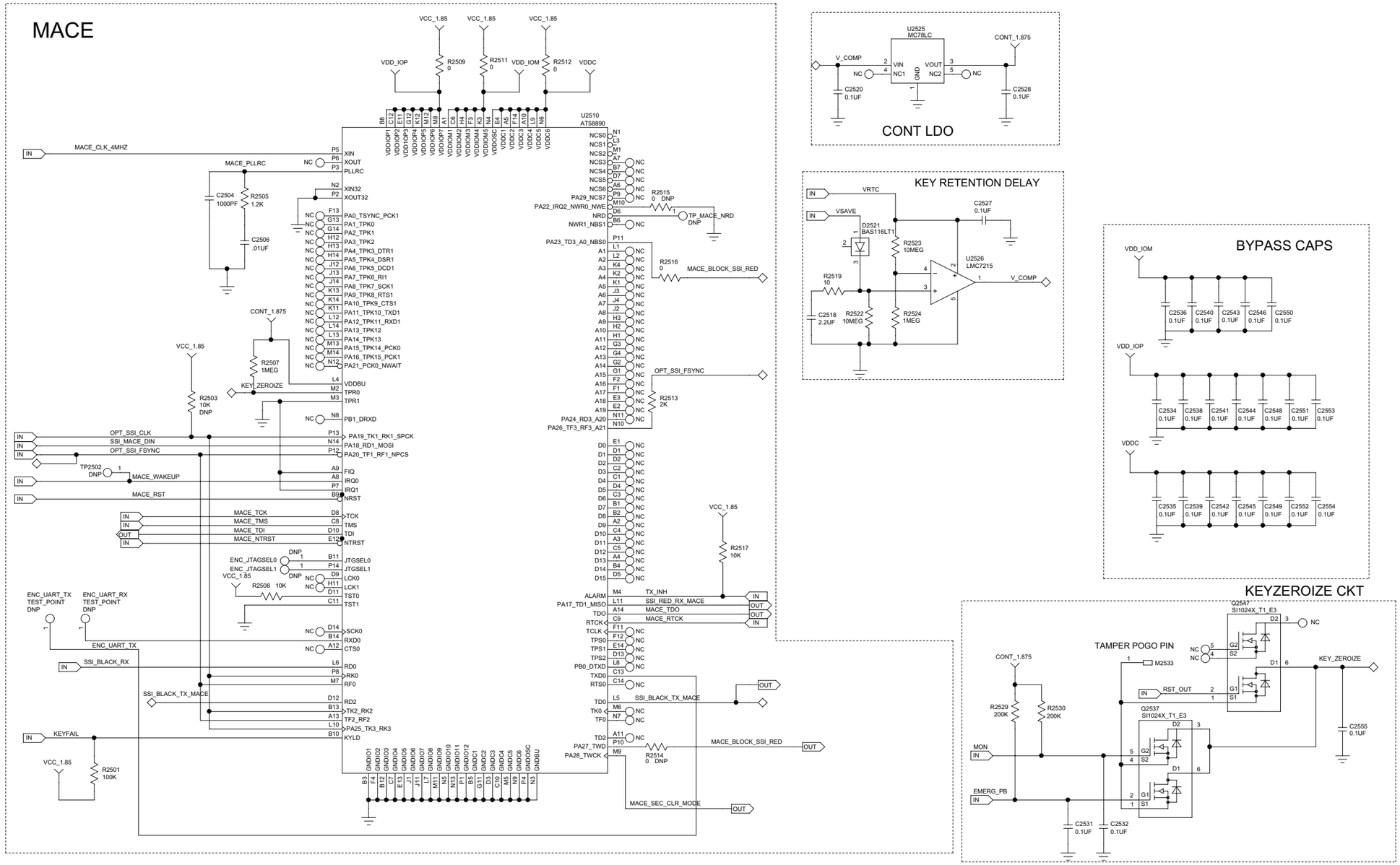


Figure 8-83. HLN5977A/ HLN5978B Secure Circuit

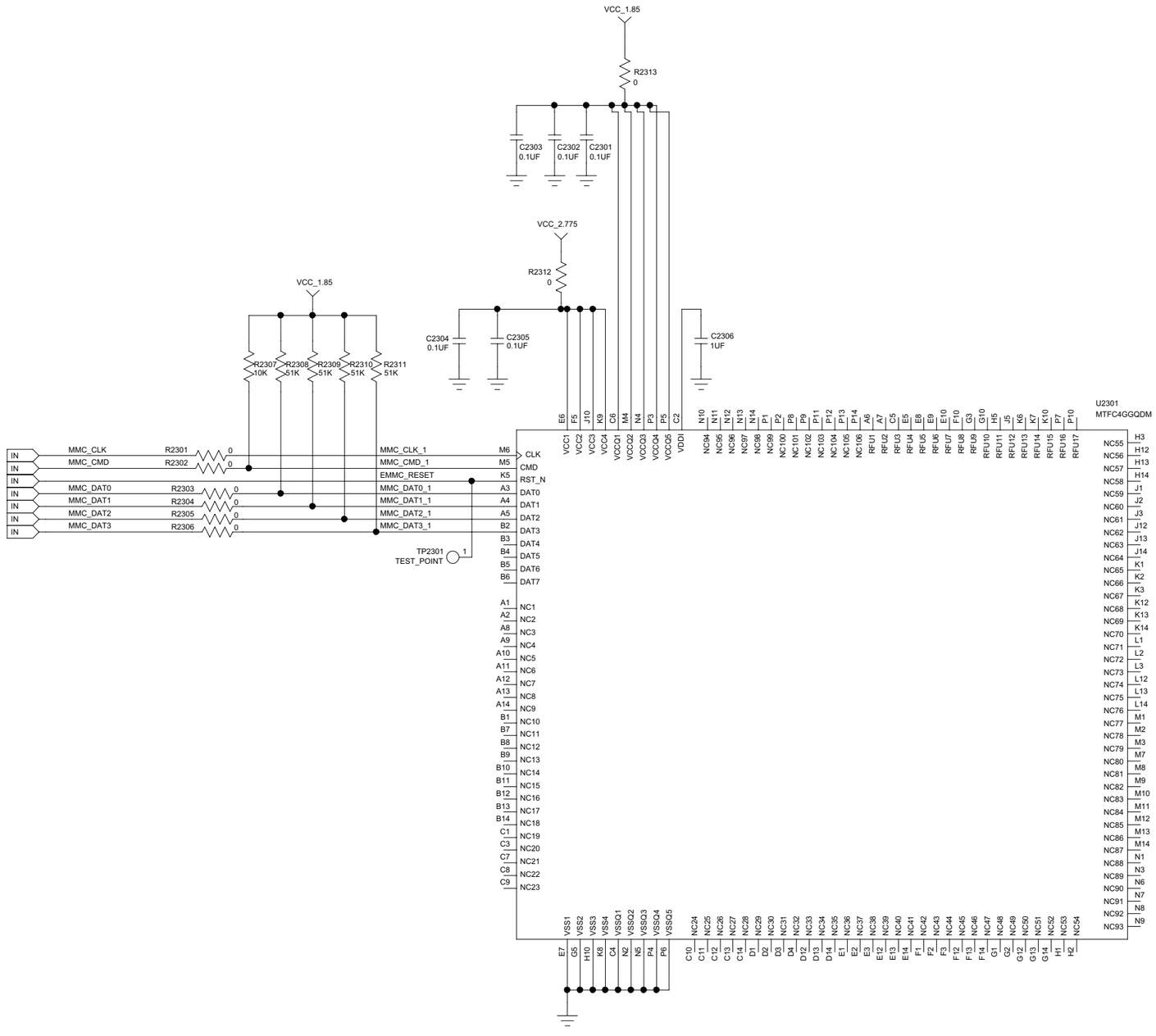


Figure 8-84. HLN5978B Expandable Memory Circuit

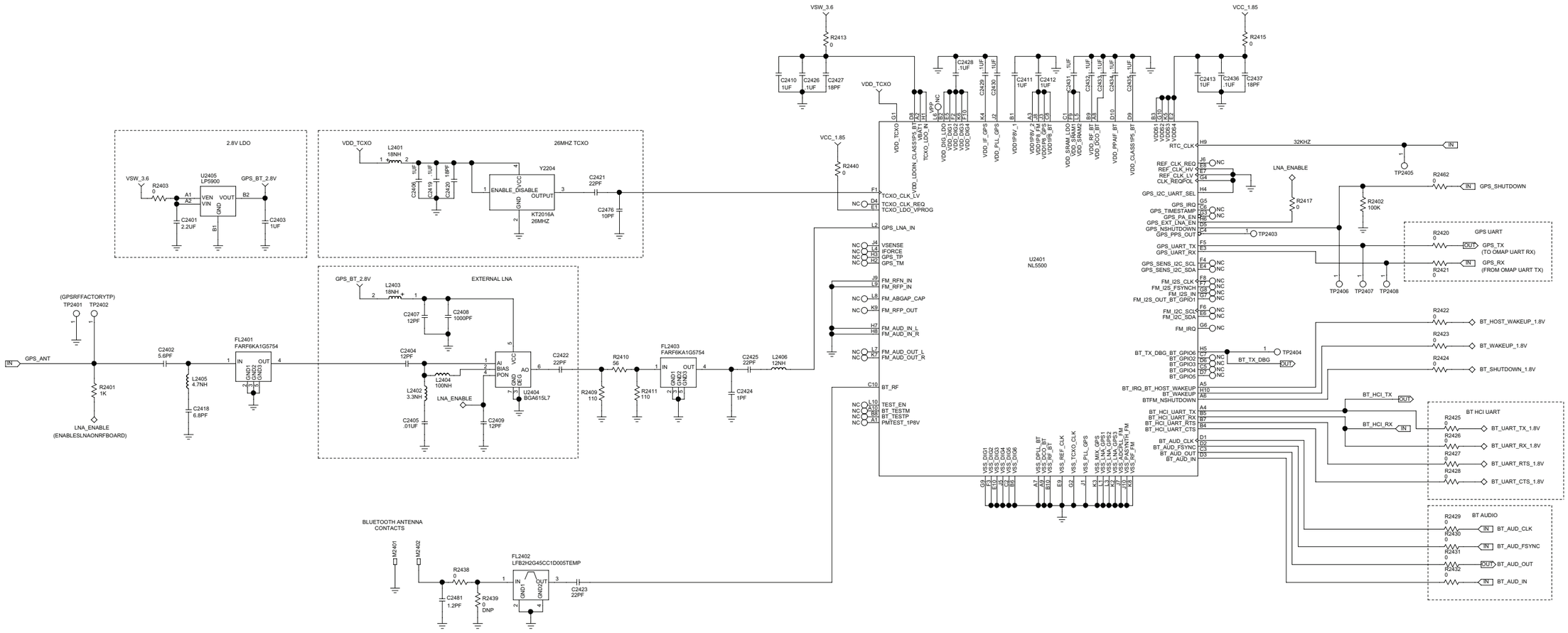


Figure 8-85. HLN5978B GPS Bluetooth Circuit – 1 of 2

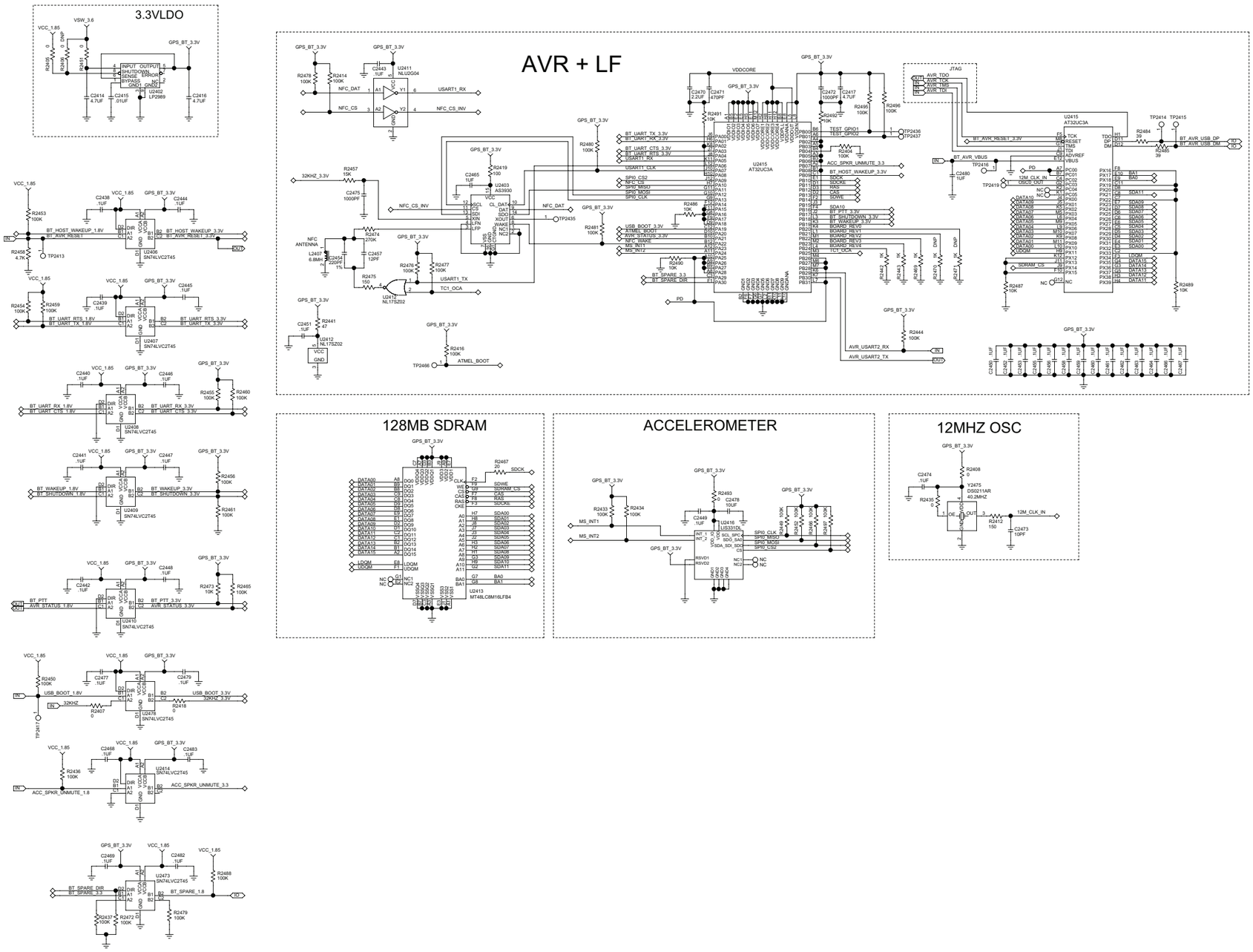


Figure 8-86. HLN5978B GPS Bluetooth Circuit – 2 of 2

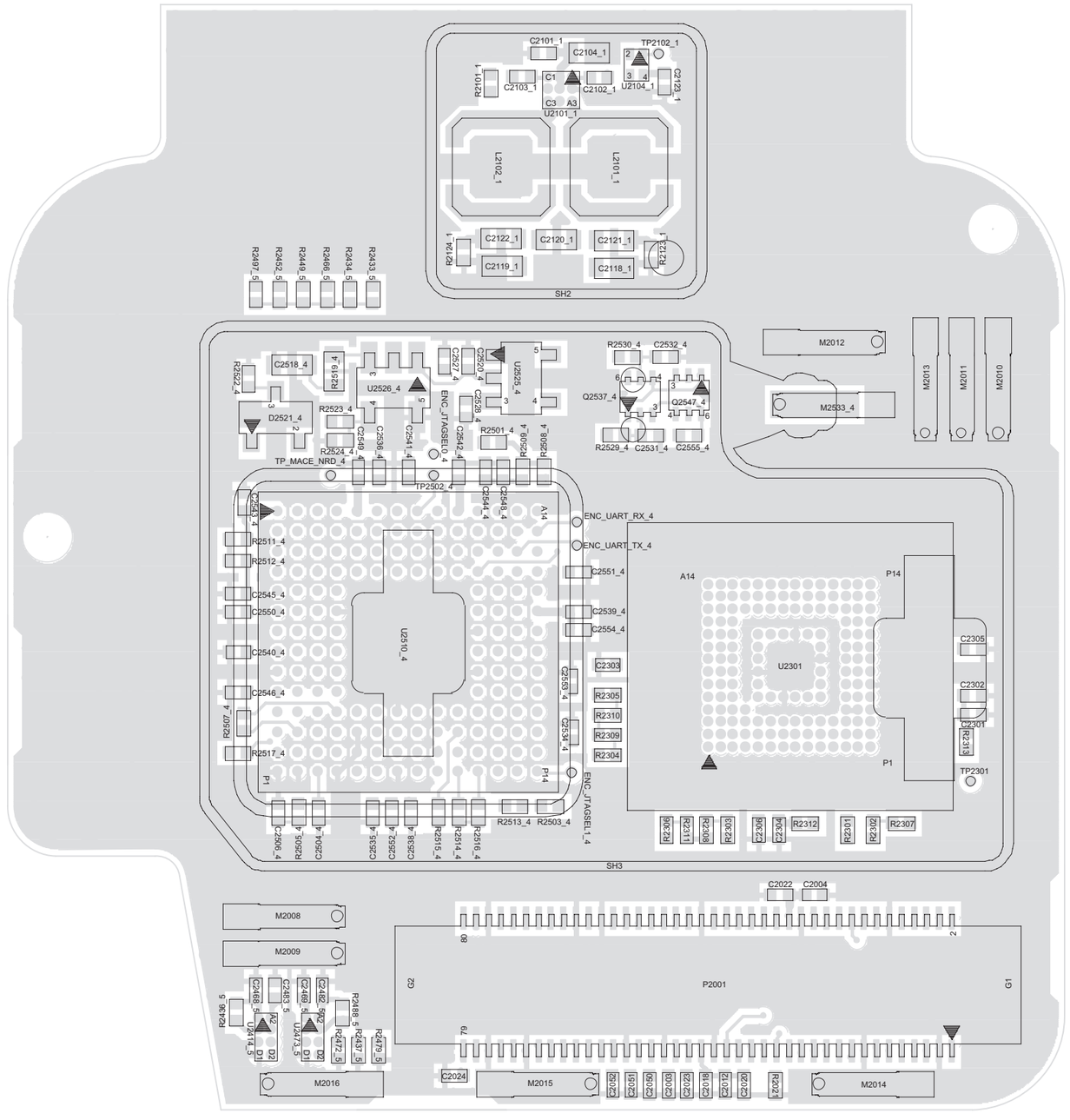


Figure 8-87. HLN5977A/ HLN5978B Expansion Board Layout – Side 1

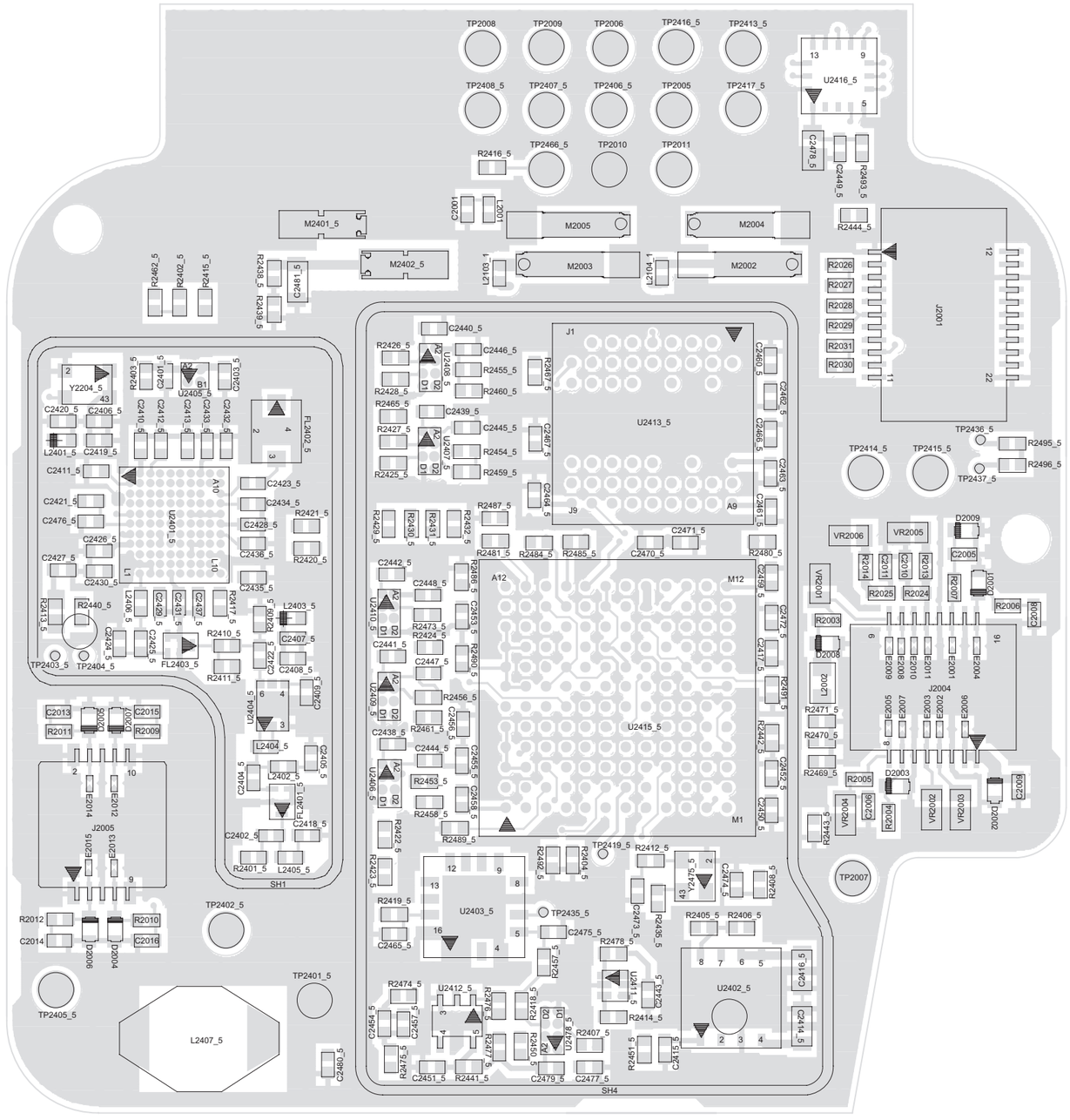


Figure 8-88. HLN5977A/ HLN5978B Expansion Board Layout – Side 2

HLN5977A Maze Expansion Board Parts List

Ref. Des.	Part Number	Description
C2001	2113945A05	CAP CER CHP 470PF 50V 10%
C2003	2113944A40	CAP CER CHP 100.0PF 50V 5%
C2004	2113944A40	CAP CER CHP 100.0PF 50V 5%
C2009	2113945A05	CAP CER CHP 470PF 50V 10%
C2010	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2011	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2012	2113944A40	CAP CER CHP 100.0PF 50V 5%
C2018	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2020	2113944A26	CAP CER CHP 12.0PF 50V 5%
C2022	2113944A26	CAP CER CHP 12.0PF 50V 5%
C2023	2113944A26	CAP CER CHP 12.0PF 50V 5%
C2024	2113944A26	CAP CER CHP 12.0PF 50V 5%
C2050	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2051	2113944A40	CAP CER CHP 100.0PF 50V 5%
C2052	2113944A26	CAP CER CHP 12.0PF 50V 5%
C2101	2113944A40	CAP CER CHP 100.0PF 50V 5%
C2102	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2103	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2104	2113956B54	CAP,FXD,10UF,+20%,-20%, 6.3V-DC,X5R,-55DEG CMIN, 85DEG CMAX,PB-F
C2118	2113946S35	CAP CER CHP 1.0UF 16V 10%
C2119	2113946S35	CAP CER CHP 1.0UF 16V 10%
C2120	2113946L05	CAP,FXD,.33UF,+80%,-20%, 16V-DC,0603,Y5V,-30DEG CMIN,85DEG CMAX
C2121	2113946C08	CAP,FXD,.47UF,+10%,-10%,10V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX
C2122	2113946C08	CAP,FXD,.47UF,+10%,-10%,10V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX
C2123	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2504	2113945A09	CAP CER CHP 1000PF 50V 10%
C2506	2113945B02	CAP CER CHP 10,000PF 25V 10%
C2520	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2527	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2528	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2531	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2532	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2534	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2535	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2536	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2538	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2539	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2540	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2541	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2542	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2543	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2544	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2545	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2546	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2548	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2549	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2550	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2551	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2552	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2553	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2554	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2555	2113946B04	CAP CER CHP 0.10UF 10V 10%
D2001	4870359B01	DIODE,SUPR,SM,7.82V,.1W, ESD PROT,V360
D2002	4870359B01	DIODE,SUPR,SM,7.82V,.1W, ESD PROT,V360
D2003	4870359B01	DIODE,SUPR,SM,7.82V,.1W, ESD PROT,V360
D2004	4870359B01	DIODE,SUPR,SM,7.82V,.1W, ESD PROT,V360
D2005	4870359B01	DIODE,SUPR,SM,7.82V,.1W, ESD PROT,V360
D2006	4870359B01	DIODE,SUPR,SM,7.82V,.1W, ESD PROT,V360
D2007	4870359B01	DIODE,SUPR,SM,7.82V,.1W, ESD PROT,V360
D2008	4870359B01	DIODE,SUPR,SM,7.82V,.1W, ESD PROT,V360
D2009	4870359B01	DIODE,SUPR,SM,7.82V,.1W, ESD PROT,V360
D2521	4871785H01	SWITCHING DIODE BAS116LT1G
J2001	0987817K01	RECP BTB 0.5P 1.5 STACK SMD
J2004	0987817K02	RECP 0.5 PITCH 16 CKT
J2005	0975595B01	RECEPTACLE, 10 PIN
L2001	24009271001	20NH HIGH CURRENT CHIP INDUCTOR
L2002	2415429H45	CHIP INDUCTOR
L2101	2471189M03	SHIELDED SMT POWER INDUCTOR 10UH
L2102	2471189M03	SHIELDED SMT POWER INDUCTOR 10UH
L2103	24009271001	20NH HIGH CURRENT CHIP INDUCTOR
L2104	24009271001	20NH HIGH CURRENT CHIP INDUCTOR
M2002	3987977Y01	CONTACT ANTENNA UNIVERSAL (D35)
M2003	3987977Y01	CONTACT ANTENNA UNIVERSAL (D35)
M2004	3987977Y01	CONTACT ANTENNA UNIVERSAL (D35)
M2005	3987977Y01	CONTACT ANTENNA UNIVERSAL (D35)
M2008	3987977Y01	CONTACT ANTENNA UNIVERSAL (D35)
M2009	3987977Y01	CONTACT ANTENNA UNIVERSAL (D35)
M2010	3987977Y01	CONTACT ANTENNA UNIVERSAL (D35)
M2011	3987977Y01	CONTACT ANTENNA UNIVERSAL (D35)
M2012	3987977Y01	CONTACT ANTENNA UNIVERSAL (D35)
M2013	3987977Y01	CONTACT ANTENNA UNIVERSAL (D35)
M2014	3987977Y01	CONTACT ANTENNA UNIVERSAL (D35)
M2015	3987977Y01	CONTACT ANTENNA UNIVERSAL (D35)
M2016	3987977Y01	CONTACT ANTENNA UNIVERSAL (D35)
M2401	39009330001	CONTACT, SPRING, 2.40MM, BLUETOOTH
M2402	39009330001	CONTACT, SPRING, 2.40MM, BLUETOOTH
M2533	3987977Y01	CONTACT ANTENNA UNIVERSAL (D35)
P2001	2809472T13	HDR 1NTBD 80CKT 2MM .5MM SMD
PWB	84009364002	MACKINAW MID-TIER EXPANSION PCB
C2518	2113956B33	CAP,FXD,2.2UF,+10%,-10%, 16V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX
Q2537	4888795V06	XSTR,FET GP PWR,MOSFET, SM,SMT,20V,.25W,LEAD-FREE
Q2547	4888795V06	XSTR,FET GP PWR,MOSFET, SM,SMT,20V,.25W,LEAD-FREE
R2003	0613952Q53	CER CHIP RES 150 OHM 5 0402
R2004	0613952Q49	CER CHIP RES 100 OHM 5 0402
R2005	0613952Q66	CER CHIP RES 510 OHM 5 0402
R2006	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2007	0613952Q49	CER CHIP RES 100 OHM 5 0402
R2009	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2010	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2011	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2012	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2013	24010062004	INDUCTOR, 10NH, 0402, 2%
R2014	24010062004	INDUCTOR, 10NH, 0402, 2%
R2021	0613952L83	CER CHIP RES 715 OHM 1 0402
R2024	0613952Q09	CER CHIP RES 2.2 OHM 5 0402
R2025	0613952Q09	CER CHIP RES 2.2 OHM 5 0402
R2026	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2028	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM

Ref. Des.	Part Number	Description
R2030	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2101	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2123	0613952Q32	CER CHIP RES 20.0 OHM 5 0402
R2124	0613952Q32	CER CHIP RES 20.0 OHM 5 0402
R2501	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2505	0613952Q75	CER CHIP RES 1200 OHM 5 0402
R2507	0613952R49	CER CHIP RES 1.0M OHM 5% 0402
R2508	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2509	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2511	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2512	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2513	0613952Q80	CER CHIP RES 2000 OHM 5 0402
R2516	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2517	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2519	0613952H25	CER CHIP RES 10.0 OHM 5% 0603
R2522	0613952R74	RES,MF,10MOHM,5%,.0625W,SM,0402,400PPM/CEL,PB-FREE
R2523	0613952R74	RES,MF,10MOHM,5%,.0625W,SM,0402,400PPM/CEL,PB-FREE
R2524	0613952R49	CER CHIP RES 1.0M OHM 5% 0402
R2529	0613952P30	CER CHIP RES 200K OHM 1 0402
R2530	0613952P30	CER CHIP RES 200K OHM 1 0402
SH2	26009333001	SHIELD, AUDIO AMPLIFIER
SH3	26009334001	SHIELD, MACE MMC
U2101	5187605U22	IC,AU AMP,1PER PKG,SM, PB-FREE

Ref. Des.	Part Number	Description
U2104	5175772B38	IC ANALOG TEMPERATURE SENSOR
U2510	5185912Y03	IC,CRYPTOGRAPHIC PROCESSOR
U2525	5171339H01	MICROPOWER VOLTAGE REGULATOR
U2526	5171988H01	CMOS COMPARATOR
VR2001	4805656W94	ZENER DIODE ESD SUPPRESSOR
VR2004	4805656W94	ZENER DIODE ESD SUPPRESSOR
VR2005	4805656W94	ZENER DIODE ESD SUPPRESSOR
VR2006	4805656W94	ZENER DIODE ESD SUPPRESSOR

HLN5978B Maze with Apps Expansion Board Parts List

Ref. Des.	Part Number	Description
C2001	2113945A05	CAP CER CHP 470PF 50V 10%
C2003	2113944A40	CAP CER CHP 100.0PF 50V 5%
C2004	2113944A40	CAP CER CHP 100.0PF 50V 5%
C2009	2113945A05	CAP CER CHP 470PF 50V 10%
C2010	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2011	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2012	2113944A40	CAP CER CHP 100.0PF 50V 5%
C2018	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2020	2113944A26	CAP CER CHP 12.0PF 50V 5%
C2022	2113944A26	CAP CER CHP 12.0PF 50V 5%
C2023	2113944A26	CAP CER CHP 12.0PF 50V 5%
C2024	2113944A26	CAP CER CHP 12.0PF 50V 5%
C2050	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2051	2113944A40	CAP CER CHP 100.0PF 50V 5%
C2052	2113944A26	CAP CER CHP 12.0PF 50V 5%
C2101	2113944A40	CAP CER CHP 100.0PF 50V 5%
C2102	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2103	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2104	2113956B54	CAP,FXD,10UF,+20%,-20%, 6.3V-DC,X5R,-55DEG CMIN, 85DEG CMAX,PB-F
C2118	2113946S35	CAP CER CHP 1.0UF 16V 10%
C2119	2113946S35	CAP CER CHP 1.0UF 16V 10%
C2120	2113946L05	CAP,FXD,.33UF,+80%,-20%, 16V-DC,0603,Y5V,-30DEG CMIN,85DEG CMAX
C2121	2113946C08	CAP,FXD,.47UF,+10%,-10%, 10V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX
C2122	2113946C08	CAP,FXD,.47UF,+10%,-10%, 10V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX
C2123	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2301	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2302	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2303	2113946B04	CAP CER CHP 0.10UF 10V 10%

Ref. Des.	Part Number	Description
C2304	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2305	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2306	2113956A51	CAP,FXD,1UF,+10%,-10%,6.3V-DC,0402,X5R,-55DEG CMIN,85DEG CMAX,P
C2401	2172180Y01	CAP,CHIP,2.2UF,+20%,-20%, 6.3V-DC,0402,X5R,-55DEG CMIN,85DEG
C2402	2113944A19	CAP CER CHP 5.6PF 50V +/-0.5PF
C2403	2113956A51	CAP,FXD,1UF,+10%,-10%,6.3V-DC,0402,X5R,-55DEG CMIN, 85DEG CMAX,P
C2404	2113944A26	CAP CER CHP 12.0PF 50V 5%
C2405	2113945B02	CAP CER CHP 10,000PF 25V 10%
C2406	2187893N01	CAP 1UF, 6.3V, X5R, 0402 PACKAGE
C2407	2113944A26	CAP CER CHP 12.0PF 50V 5%
C2408	2113945A09	CAP CER CHP 1000PF 50V 10%
C2409	2113944A26	CAP CER CHP 12.0PF 50V 5%
C2410	2187893N01	CAP 1UF, 6.3V, X5R, 0402 PACKAGE
C2411	2113956A51	CAP,FXD,1UF,+10%,-10%,6.3V-DC,0402,X5R,-55DEG CMIN, 85DEG CMAX,P
C2412	2113956A51	CAP,FXD,1UF,+10%,-10%,6.3V-DC,0402,X5R,-55DEG CMIN, 85DEG CMAX,P
C2413	2187893N01	CAP 1UF, 6.3V, X5R, 0402 PACKAGE
C2414	2113946D07	CAP,CHIP,4.7UF,+10%,-10%, 6.3V-DC,0603,X5R,-55DEG CMIN,85DEG CMA
C2415	2113945B02	CAP CER CHP 10,000PF 25V 10%
C2416	2113946D07	CAP,CHIP,4.7UF,+10%,-10%, 6.3V-DC,0603,X5R,-55DEG CMIN,85DEG CMA
C2417	21009322001	CAPACITOR,CERAMIC, SM, 4.7 UF
C2418	2113944A21	CAP CER CHP 6.8PF 50V +/-0.5PF

Ref. Des.	Part Number	Description
C2419	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2420	2113944A28	CAP CER CHP 18.0PF 50V 5%
C2421	2113944A29	CAP CER CHP 22.0PF 50V 5%
C2422	2113944A29	CAP CER CHP 22.0PF 50V 5%
C2423	2113944A29	CAP CER CHP 22.0PF 50V 5%
C2424	2115153H03	CAP, CERAMIC, COG
C2425	2113944A29	CAP CER CHP 22.0PF 50V 5%
C2426	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2427	2113944A28	CAP CER CHP 18.0PF 50V 5%
C2428	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2429	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2430	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2431	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2432	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2433	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2434	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2435	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2436	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2437	2113944A28	CAP CER CHP 18.0PF 50V 5%
C2438	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX

Ref. Des.	Part Number	Description
C2439	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2440	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2441	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2442	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2443	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2444	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2445	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2446	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2447	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2448	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2449	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2450	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2451	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2452	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2453	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2454	2171051Y01	CAP,FXD,220PF,+1%,-1%,50V-DC,C0G,-55DEG CMIN,125DEG CMAX,PB-

Ref. Des.	Part Number	Description
C2455	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2456	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2457	2113944A26	CAP CER CHP 12.0PF 50V 5%
C2458	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2459	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2460	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2461	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2462	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2463	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2464	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2465	2113956A51	CAP,FXD,1UF,+10%,-10%,6.3V-DC,0402,X5R,-55DEG CMIN, 85DEG CMAX,P
C2466	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2467	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2468	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2469	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2470	2172180Y01	CAP,CHIP,2.2UF,+20%,-20%, 6.3V-DC,0402,X5R,-55DEG CMIN,85DEG
C2471	2113945A05	CAP CER CHP 470PF 50V 10%

Ref. Des.	Part Number	Description
C2472	2113945A09	CAP CER CHP 1000PF 50V 10%
C2473	2113944A25	CAP CER CHP 10.0PF 50V +/- 0.5PF
C2474	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2475	2113945A09	CAP CER CHP 1000PF 50V 10%
C2476	2113944A25	CAP CER CHP 10.0PF 50V +/- 0.5PF
C2477	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2478	2113956B54	CAP,FXD,10UF,+20%,-20%, 6.3V-DC,X5R,-55DEG CMIN, 85DEG CMAX,PB-F
C2479	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2480	2113956A51	CAP,FXD,1UF,+10%,-10%,6.3V-DC,0402,X5R,-55DEG CMIN, 85DEG CMAX,P
C2481	2113944C65	CAP,FXD,1.2PF,.1PF+/-,50V-DC,0603,C0G,-55DEG CMIN, 125DEG CMAX
C2482	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2483	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R,-55DEG CMIN, 125DEG CMAX
C2504	2113945A09	CAP CER CHP 1000PF 50V 10%
C2506	2113945B02	CAP CER CHP 10,000PF 25V 10%
C2518	2113956B33	CAP,FXD,2.2UF,+10%,-10%, 16V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX
C2520	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2527	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2528	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2531	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2532	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2534	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2535	2113946B04	CAP CER CHP 0.10UF 10V 10%

Ref. Des.	Part Number	Description
C2536	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2538	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2539	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2540	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2541	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2542	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2543	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2544	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2545	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2546	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2548	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2549	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2550	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2551	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2552	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2553	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2554	2113946B04	CAP CER CHP 0.10UF 10V 10%
C2555	2113946B04	CAP CER CHP 0.10UF 10V 10%
D2001	4870359B01	DIODE,SUPR,SM,7.82V,.1W,ESD PROT,V360
D2002	4870359B01	DIODE,SUPR,SM,7.82V,.1W,ESD PROT,V360
D2003	4870359B01	DIODE,SUPR,SM,7.82V,.1W,ESD PROT,V360
D2004	4870359B01	DIODE,SUPR,SM,7.82V,.1W,ESD PROT,V360
D2005	4870359B01	DIODE,SUPR,SM,7.82V,.1W,ESD PROT,V360
D2006	4870359B01	DIODE,SUPR,SM,7.82V,.1W,ESD PROT,V360
D2007	4870359B01	DIODE,SUPR,SM,7.82V,.1W,ESD PROT,V360
D2008	4870359B01	DIODE,SUPR,SM,7.82V,.1W,ESD PROT,V360
D2009	4870359B01	DIODE,SUPR,SM,7.82V,.1W,ESD PROT,V360
D2521	4871785H01	SWITCHING DIODE BAS116LT1G
FL2401	9102190J23	FLTR,SAW,BANDPASS,1.57542 GHZ NOM,SM,1.4X1.0MM, SMD,PB-FREE

Ref. Des.	Part Number	Description
FL2402	91009294001	FILTER, CERAMIC, 2.45 GHZ BANDPASS
FL2403	9102190J23	FLTR,SAW,BANDPASS,1.57542 GHZ NOM,SM,1.4X1.0MM, SMD,PB-FREE
J2001	0987817K01	RECP BTB 0.5P 1.5 STACK SMD
J2004	0987817K02	RECP 0.5 PITCH 16 CKT
J2005	0975595B01	RECEPTACLE, 10 PIN
L2001	24009271001	20NH HIGH CURRENT CHIP INDUCTOR
L2002	2415429H45	CHIP INDUCTOR
L2101	2471189M03	SHIELDED SMT POWER INDUCTOR 10UH
L2102	2471189M03	SHIELDED SMT POWER INDUCTOR 10UH
L2103	24009271001	20NH HIGH CURRENT CHIP INDUCTOR
L2104	24009271001	20NH HIGH CURRENT CHIP INDUCTOR
L2401	2414017P16	IDCTR,CHIP,18NH,5%,300MA, .76OHM,CER,9 Q,1.9GHZ SRF,SM,0402,P
L2402	2488090Y07	INDUCTOR,MULTILAYER,3.3NH,1005,SMD,PB FREE
L2403	2414017P16	IDCTR,CHIP,18NH,5%,300MA, .76OHM,CER,9 Q,1.9GHZ SRF,SM,0402,P
L2404	2488090Y25	INDUCTOR,MULTILAYER,100NH,1005,SMD,PB FREE
L2405	2475393H01	INDUCTOR, 4.7NH, 0402, +/-0.1NH
L2406	2414017P14	IDCTR,CHIP,12NH,5%,300MA, .6OHM,CER,9 Q,2GHZ SRF,SM, 0402,PB-F
L2407	24009312001	6.8MH +-5% INDUCTOR
M2002	3987977Y01	CONTACT ANTENNA UNIVERSAL (D35)
M2003	3987977Y01	CONTACT ANTENNA UNIVERSAL (D35)
M2004	3987977Y01	CONTACT ANTENNA UNIVERSAL (D35)
M2005	3987977Y01	CONTACT ANTENNA UNIVERSAL (D35)

Ref. Des.	Part Number	Description
M2008	3987977Y01	CONTACT ANTENNA UNIVERSAL (D35)
M2009	3987977Y01	CONTACT ANTENNA UNIVERSAL (D35)
M2010	3987977Y01	CONTACT ANTENNA UNIVERSAL (D35)
M2011	3987977Y01	CONTACT ANTENNA UNIVERSAL (D35)
M2012	3987977Y01	CONTACT ANTENNA UNIVERSAL (D35)
M2013	3987977Y01	CONTACT ANTENNA UNIVERSAL (D35)
M2014	3987977Y01	CONTACT ANTENNA UNIVERSAL (D35)
M2015	3987977Y01	CONTACT ANTENNA UNIVERSAL (D35)
M2016	3987977Y01	CONTACT ANTENNA UNIVERSAL (D35)
M2401	39009330001	CONTACT, SPRING, 2.40MM, BLUETOOTH
M2402	39009330001	CONTACT, SPRING, 2.40MM, BLUETOOTH
M2533	3987977Y01	CONTACT ANTENNA UNIVERSAL (D35)
P2001	2809472T13	HDR 1NTBD 80CKT 2MM .5MM SMD
PWB	84009364002	MACKINAW MID-TIER EXPANSION PCB
Q2537	4888795V06	XSTR,FET GP PWR,MOSFET, SM,SMT,20V,.25W,LEAD-FREE
Q2547	4888795V06	XSTR,FET GP PWR,MOSFET, SM,SMT,20V,.25W,LEAD-FREE
R2003	0613952Q53	CER CHIP RES 150 OHM 5 0402
R2004	0613952Q49	CER CHIP RES 100 OHM 5 0402
R2005	0613952Q66	CER CHIP RES 510 OHM 5 0402
R2006	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2007	0613952Q49	CER CHIP RES 100 OHM 5 0402
R2009	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM

Ref. Des.	Part Number	Description
R2010	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2011	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2012	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2013	24010062004	INDUCTOR, 10NH, 0402, 2%
R2014	24010062004	INDUCTOR, 10NH, 0402, 2%
R2021	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2024	0613952Q09	CER CHIP RES 2.2 OHM 5 0402
R2025	0613952Q09	CER CHIP RES 2.2 OHM 5 0402
R2026	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2028	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2030	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2101	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2123	0613952Q32	CER CHIP RES 20.0 OHM 5 0402
R2124	0613952Q32	CER CHIP RES 20.0 OHM 5 0402
R2301	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2302	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2303	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2304	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2305	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2306	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2307	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2308	0613952R18	CER CHIP RES 51K OHM 5 0402
R2309	0613952R18	CER CHIP RES 51K OHM 5 0402
R2310	0613952R18	CER CHIP RES 51K OHM 5 0402

Ref. Des.	Part Number	Description
R2311	0613952R18	CER CHIP RES 51K OHM 5 0402
R2312	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2313	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2401	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R2402	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2403	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2404	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2405	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2407	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2408	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2409	0613952Q50	CER CHIP RES 110 OHM 5 0402
R2410	0613952Q43	CER CHIP RES 56.0 OHM 5 0402
R2411	0613952Q50	CER CHIP RES 110 OHM 5 0402
R2412	0613952Q53	CER CHIP RES 150 OHM 5 0402
R2413	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2414	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2415	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2416	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2417	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2418	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2419	0613952Q49	CER CHIP RES 100 OHM 5 0402
R2420	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2421	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2422	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2423	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2424	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2425	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2426	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2427	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2428	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2429	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2430	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2431	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2432	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2433	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2434	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2435	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2436	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2437	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2438	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2440	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2441	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R2442	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R2443	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R2444	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2449	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2450	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2451	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2452	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2453	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2454	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2455	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2456	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2457	0613952R05	CER CHIP RES 15K OHM 5% 0402
R2458	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R2459	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2460	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2461	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2462	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2465	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2466	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2467	0613952Q32	CER CHIP RES 20.0 OHM 5 0402
R2469	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R2472	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2473	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2474	0613952R35	CER CHIP RES 270K OHM 5% 0402
R2475	0613952Q53	CER CHIP RES 150 OHM 5 0402
R2476	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2477	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2478	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2479	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2480	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2481	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2484	0613952Q39	CER CHIP RES 39.0 OHM 5 0402
R2485	0613952Q39	CER CHIP RES 39.0 OHM 5 0402
R2486	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2487	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2488	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2489	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2490	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2491	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2492	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2493	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2495	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2496	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2497	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2501	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2505	0613952Q75	CER CHIP RES 1200 OHM 5 0402
R2507	0613952R49	CER CHIP RES 1.0M OHM 5% 0402

Ref. Des.	Part Number	Description
R2508	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2509	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2511	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2512	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2513	0613952Q80	CER CHIP RES 2000 OHM 5 0402
R2516	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R2517	0613952R01	CER CHIP RES 10K OHM 5% 0402
R2519	0613952H25	CER CHIP RES 10.0 OHM 5% 0603
R2522	0613952R74	RES,MF,10MOHM,5%,.0625W, SM,0402,400PPM/CEL,PB-FREE
R2523	0613952R74	RES,MF,10MOHM,5%,.0625W, SM,0402,400PPM/CEL,PB-FREE
R2524	0613952R49	CER CHIP RES 1.0M OHM 5% 0402
R2529	0613952P30	CER CHIP RES 200K OHM 1 0402
R2530	0613952P30	CER CHIP RES 200K OHM 1 0402
SH1	26009331001	SHIELD, GPS BLUETOOTH
SH2	26009333001	SHIELD, AUDIO AMPLIFIER
SH3	26009334001	SHIELD, MACE MMC
SH4	26009332001	SHIELD, AVR MEMORY
U2101	5187605U22	IC,AU AMP,1PER PKG,SM,PB-FREE
U2104	5175772B38	IC ANALOG TEMPERATURE SENSOR
U2301	51009573001	IC,FLASH,MMC,NAND,4 GB,FBGA
U2401	51007377001	IC, XCVR, BLUETOOTH, GPS, FM RX, FM TX
U2402	51002923001	IC,LNR V REGLTR,3.3V LP2989, NOPB
U2403	51009371001	RFID WAKEUP RECEIVER
U2404	5105739X13	IC, SIGE GPS LOW NOISE AMP 1575 MHZ

Ref. Des.	Part Number	Description
U2405	5187344N09	LOW NOISE, 100MA LINEAR REGULATOR 2.8V
U2406	5164852H16	IC TRANSCEIVER W/LEVEL TRANSLATION
U2407	5164852H16	IC TRANSCEIVER W/LEVEL TRANSLATION
U2408	5164852H16	IC TRANSCEIVER W/LEVEL TRANSLATION
U2409	5164852H16	IC TRANSCEIVER W/LEVEL TRANSLATION
U2410	5164852H16	IC TRANSCEIVER W/LEVEL TRANSLATION
U2411	5175856M01	DUAL INVERTER
U2412	5114007M45	IC,NOR,1PER PKG,SOT-353, PB-FREE
U2413	51009373001	IC SDRAM MEMORY MT48LC8M16LFB4
U2414	5164852H16	IC TRANSCEIVER W/LEVEL TRANSLATION
U2415	51009372001	IC MICROCONTROLLER AT32UC3A0512
U2416	51009669001	IC, ACCELEROMETER, MOTION SENSOR
U2473	5164852H16	IC TRANSCEIVER W/LEVEL TRANSLATION
U2478	5164852H16	IC TRANSCEIVER W/LEVEL TRANSLATION
U2510	5185912Y03	IC,CRYPTOGRAPHIC PROCESSOR
U2525	5171339H01	MICROPOWER VOLTAGE REGULATOR
U2526	5171988H01	CMOS COMPARATOR
VR2001	4805656W94	ZENER DIODE ESD SUPPRESSOR
VR2004	4805656W94	ZENER DIODE ESD SUPPRESSOR
VR2005	4805656W94	ZENER DIODE ESD SUPPRESSOR
VR2006	4805656W94	ZENER DIODE ESD SUPPRESSOR
Y2204	93009290001	26 MHZ TCXO
Y2475	48009319001	SMD CRYSTAL OSCILLATOR DS0211AR

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 Transceiver Board, VOCON Board and Expander Board Ordering Information

When ordering a replacement Transceiver Board, VOCON Board or Expander Board, refer to the applicable Model Chart in the front of this manual. Read the Transceiver Board, VOCON Board, or Expander Board note, and include the proper information with your order.

A.3 Motorola Online

Motorola Online users can access our online catalog at

http://www.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://www.motorola.com/businessonline

A.4 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.5 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.6 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.7 Parts Identification

Radio Products and Solutions Organization*
(United States and Canada)
1-800-422-4210

A.8 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).

Glossary

This glossary contains an alphabetical listing of terms and their definitions that are applicable to ASTRO 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
A/D	*See analog-to-digital conversion.*
Abacus IC	A custom integrated circuit providing a digital receiver intermediate frequency (IF) backend.
ADC	*See analog-to-digital converter.*
ALC	*See automatic level control.*
analog	Refers to a continuously variable signal or a circuit or device designed to handle such signals. *See also digital.*
analog-to-digital conversion	Conversion of an instantaneous dc voltage level to a corresponding digital value. *See also D/A.*
analog-to-digital converter	A device that converts analog signals into digital data. *See also DAC.*
automatic level control	A circuit in the transmit RF path that controls RF power amplifier output, provides leveling over frequency and voltage, and protects against high VSWR.
band	Frequencies allowed for a specific purpose.
BBP	*See baseband interface port.*
baseband interface port	Synchronous serial interface to the transceiver board used to transfer transmit and receive audio data.
BGA	*See ball grid array.*
ball grid array	A type of IC package characterized by solder balls arranged in a grid that are located on the underside of the package.
CODEC	*See coder/decoder.*
codeplug	Firmware that contains the unique personality for a system or device. A codeplug is programmable and allows changes to system and unit parameters. *See also firmware.*
coder/decoder	A device that encodes or decodes a signal.
CPS	*See Customer Programming Software.*

Term	Definition
Customer Programming Software	Software with a graphical user interface containing the feature set of an ASTRO radio.
D/A	*See digital-to-analog conversion.*
DAC	*See digital-to-analog converter.*
Data terminal equipment	Data terminal equipment; for example, a computer.
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. *See also analog.*
digital-to-analog conversion	Conversion of a digital signal to a voltage that is proportional to the input value. *See also A/D.*
digital-to-analog converter	A device that converts digital data into analog signals. *See also ADC.*
Digital Private-Line	A type of digital communication that utilizes privacy call, as well as memory channel and busy channel lock-out to enhance communication efficiency.
digital signal processor	A microcontroller specifically designed for performing the mathematics involved in manipulating analog information, such as sound, that has been converted into a digital form. DSP also implies the use of a data compression technique.
digital signal processor code	Object code executed by the Digital Signal Processor in an ASTRO subscriber radio. The DSP is responsible for computation-intensive tasks, such as decoding ASTRO signaling.
DPL	*See Digital Private-Line. See also PL.*
DSP	*See digital signal processor.*
DSP code	*See digital signal processor code.*
DTE	*See Data terminal equipment.*
EEPOT	Electrically Programmable Digital Potentiometer.
EEPROM	*See Electrically Erasable Programmable Read-Only Memory.*
Electrically Erasable Programmable Read-Only Memory	A special type of PROM that can be erased by exposing it to an electrical charge. An EEPROM retains its contents even when the power is turned off.

Term	Definition
Embedded Multi Media Card	Type of memory used.
eMMC	*See Embedded Multi Media Card.*
FCC	Federal Communications Commission.
firmware	Code executed by an embedded processor such as the Host or DSP in a subscriber radio. This type of code is typically resident in non-volatile memory and as such is more difficult to change than code executed from RAM.
FGU	*See frequency generation unit.*
flash	A non-volatile memory device similar to an EEPROM. Flash memory can be erased and reprogrammed in blocks instead of one byte at a time.
FLASHcode	A 13-digit code which uniquely identifies the System Software Package and Software Revenue Options that are enabled in a particular subscriber radio. FLASHcodes are only applicable for radios which are upgradeable through the FLASHport process.
FLASHport	A Motorola term that describes the ability of a radio to change memory. Every FLASHport radio contains a FLASHport EEPROM memory chip that can be software written and rewritten to, again and again.
FMR	*See Florida Manual Revision.*
Florida Manual Revision	A document that provides interim updates to a publication until the entire publication can be updated and reissued.
FracN	A Motorola-proprietary, CMOS fractional-N frequency synthesizer with built-in, dual-port modulation.
frequency	Number of times a complete electromagnetic-wave cycle occurs in a fixed unit of time (usually one second).
frequency generation unit	This unit generates ultra-stable, low-phase noise master clock and other derived synchronization clocks that are distributed throughout the communication network.
GCAI	Global Connector Accessory Interface.
General-Purpose Input/Output	Pins whose function is programmable.
Global Control Audio and Power IC	A mixed-signal (analog and digital) integrated circuit that provides control, audio, and voltage regulation functionality for the VOCON board.
GPIO	*See General-Purpose Input/Output.*

Term	Definition
host code	Object code executed by the host processor in an ASTRO subscriber radio. The host is responsible for control-oriented tasks such as decoding and responding to user inputs.
IC	*See integrated circuit.*
IF	Intermediate Frequency.
IMBE	A sub-band, voice-encoding algorithm used in ASTRO digital voice.
inbound signaling word	Data transmitted on the control channel from a subscriber unit to the central control unit.
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.
ISW	*See inbound signaling word.*
key-variable loader	A device used to load encryption keys into a radio.
kHz	*See kilohertz.*
kilohertz	One thousand cycles per second. Used especially as a radio-frequency unit.
KVL	*See key-variable loader.*
LCD	*See liquid-crystal display.*
LED	*See light emitting diode.*
light emitting diode	An electronic device that lights up when electricity is passed through it.
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.
LO	Local oscillator.
low-speed handshake	150-baud digital data sent to the radio during trunked operation while receiving audio.
LSH	*See low-speed handshake.*
Master In Slave Out	SPI data line from a peripheral to the MCU.
Master Out Slave In	SPI data line from the MCU to a peripheral.
MCU	*See microcontroller unit.*
MDC	Motorola Digital Communications.
MDI	MCU/DSP Interface internal to the microprocessor.
MHz	*See Megahertz.*

Term	Definition
Megahertz	One million cycles per second. Used especially as a radio-frequency unit.
microcontroller unit	Also written as µC. A microprocessor that contains RAM and ROM components, as well as communications and programming components and peripherals.
MISO	*See Master In Slave Out.*
MOSI	*See Master Out Slave In.*
multiplexer	An electronic device that combines several signals for transmission on some shared medium (e.g., a telephone wire).
MUX	*See multiplexer.*
night operation	A display mode intended for un-aided eye-sight in dark environments. This is accomplished by a reduced brightness level of the keypad, front and top displays. Also, an inverted color scheme utilizing red text, red numbers, and red icons on a black background at two low levels of backlighting.
night vision	A display mode intended for equipment aided eye-sight in dark environments, typically using some form of Night Vision Gear. This is accomplished by a significantly reduced brightness level of the keypad, front and top displays. Also, an inverted color scheme utilizing red text, red numbers, and red icons on a black background at three ultra-low levels of backlighting.
NiMH	Nickel-metal-hydride.
nv	*See night vision.*
OMPAC	*See over-molded pad-array carrier.*
open architecture	A controller configuration that utilizes a microprocessor with extended ROM, RAM, and EEPROM.
oscillator	An electronic device that produces alternating electric current and commonly employs tuned circuits and amplifying components.
OSW	*See outbound signaling word.*
OTAR	*See over-the-air rekeying.*
outbound signaling word	Data transmitted on the control channel from the central controller to the subscriber unit.
over-molded pad-array carrier	A Motorola custom IC package, distinguished by the presence of solder balls on the bottom pads.
over-the-air rekeying	Allows the dispatcher to remotely reprogram the encryption keys in the radio.

Term	Definition
PA	Power amplifier.
paging	One-way communication that alerts the receiver to retrieve a message.
PC Board	Printed Circuit Board. Also referred to as a PCB.
PCIC	*See Power Control IC.*
phase-locked loop	A circuit in which an oscillator is kept in phase with a reference, usually after passing through a frequency divider.
PL	*See private-line tone squelch.*
PLL	*See phase-locked loop.*
Power Control IC	The power control IC is intended for closed-loop bias control of power amplifiers. The device facilitates accurate control of the current delivered to the power amplifier (PA) via a control voltage.
private-line tone squelch	A continuous sub-audible tone that is transmitted along with the carrier. *See also DPL.*
Programmable Read-Only Memory	A memory chip on which data can be written only once. Once data has been written onto a PROM, it remains there forever.
PROM	*See Programmable Read-Only Memory.*
PTT	*See Push-to-Talk.*
Push-to-Talk	The switch or button usually located on the left side of the radio which, when pressed, causes the radio to transmit. When the PTT is released, the unit returns to receive operation.
radio frequency	The portion of the electromagnetic spectrum between audio sound and infrared light (approximately 10 kHz to 10 GHz).
radio frequency power amplifier	Amplifier having one or more active devices to amplify radio signals.
RAM	*See random access memory.*
random access memory	A type of computer memory that can be accessed randomly; that is, any byte of memory can be accessed without touching the preceding bytes.
read-only memory	A type of computer memory on which data has been prerecorded. Once data has been written onto a ROM chip, it cannot be removed and can only be read.
real-time clock	A module that keeps track of elapsed time even when a computer is turned off.
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.

Term	Definition
registers	Short-term data-storage circuits within the microcontroller unit or programmable logic IC.
repeater	Remote transmit/receive facility that re-transmits received signals in order to improve communications range and coverage (conventional operation).
repeater/talkaround	A conventional radio feature that permits communication through a receive/transmit facility, which re-transmits received signals in order to improve communication range and coverage.
RESET	Reset line: an input to the microcontroller that restarts execution.
RF	*See radio frequency.*
RF PA	*See radio frequency power amplifier.*
ROM	*See read-only memory.*
RPCIC	Regulator/power control IC.
RTC	*See real-time clock.*
RX	Receive.
RX DATA	Recovered digital data line.
SAP	*See Serial Audio CODEC Port.*
SCI IN	*See Serial Communication Interface Input Line.*
Serial Audio CODEC Port	SSI to and from the GCAP II IC CODEC used to transfer transmit and receive audio data.
Serial Communication Interface Input Line	A full-duplex (receiver/transmitter) asynchronous serial interface.
Serial Peripheral Interface	How the microcontroller communicates to modules and ICs through the CLOCK and DATA lines.
signal	An electrically transmitted electromagnetic wave.
Signal Qualifier mode	An operating mode in which the radio is muted, but still continues to analyze receive data to determine RX signal type.
softpot	*See software potentiometer.*
software	Computer programs, procedures, rules, documentation, and data pertaining to the operation of a system.
software potentiometer	A computer-adjustable electronic attenuator.
spectrum	Frequency range within which radiation has specific characteristics.

Term	Definition
SPI	*See Serial Peripheral Interface.*
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.
SRAM	*See static RAM.*
SSI	*See Synchronous Serial Interface.*
Standby mode	An operating mode in which the radio is muted but still continues to monitor data.
static RAM	A type of memory used for volatile, program/data memory that does not need to be refreshed.
Synchronous Serial Interface	DSP interface to peripherals that consists of a clock signal line, a frame synchronization signal line, and a data line.
system central controllers	Main control unit of the trunked dispatch system; handles ISW and OSW messages to and from subscriber units *(See ISW and OSW)*.
system select	The act of selecting the desired operating system with the system-select switch (also, the name given to this switch).
thin small-outline package	A type of dynamic random-access memory (DRAM) package that is commonly used in memory applications.
time-out timer	A timer that limits the length of a transmission.
TOT	*See time-out timer.*
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.
TSOP	*See thin small-outline package.*
TX	Transmit.
UART	*See also Universal Asynchronous Receiver Transmitter.*
UHF	Ultra-High Frequency.
Universal Asynchronous Receiver Transmitter	A microchip with programming that controls a computer's interface to its attached serial devices.
Universal Connector	Interface point for all accessories to the radio.
Universal Serial Bus	An external bus standard that supports data transfer rates of 12 Mbps.
USB	*See Universal Serial Bus.*

Term	Definition
VCO	*See voltage-controlled oscillator.*
VCOB IC	Voltage-Controlled Oscillator Buffer IC.
vector sum excited linear predictive coding	A voice-encoding technique used in ASTRO digital voice.
VHF	Very-High Frequency.
VIP	Vehicle Interface Port.
VOCON	*See vocoder/controller.*
vocoder	An electronic device for synthesizing speech by implementing a compression algorithm particular to voice. *See also voice encoder.*
vocoder/controller	A PC board that contains an ASTRO radio's microcontroller, DSP, memory, audio and power functions, and interface support circuitry.
voice encoder	The DSP-based system for digitally processing analog signals, and includes the capabilities of performing voice compression algorithms or voice encoding. *See also vocoder.*
voltage-controlled oscillator	An oscillator in which the frequency of oscillation can be varied by changing a control voltage.
VSELP	*See vector sum excited linear predictive coding.*

Notes

Index

Numerics

A

B

C

D

E

F

G

H

I

K

L

M

N

O

P

R

S

T

U

V

W

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