MOTOROLA

MANUAL REVISION
6816985H01-A

ASTRO® XTS™ 2500/XTS™2500I/ XTS™ 2250/XTS™ 1500/MT 1500/PR 1500 Detailed Service Manual

This revision outlines changes that have occurred since the printing of your manual. Use this information to supplement your manual. Installation of these changes in earlier equipment is not necessary except as recommended in Motorola Service and Repair Notes (SRNs).

REVISION CHANGE:

Please use the following information to supplement your existing basic service manual. The table that follows lists the pages attached to this PMR and their related basic service manual chapter.

Page	Section No.	Section Title	Description
13	2.1	Introduction	Changed VHF to UHF2 range.
13	2.2	Analog Mode of Operation-Receiving	Changed IF signal frequency to 73.35 MHz.
14	2.5	Main RF Board Overview	Changed title, receiver front end modules and frequency generation function.
15	2.6	Vocoder Circuitry Overview	Modified first bullet statement for voice signal.
17	3.2	Radio Power Up or Down	Changed the description for MAKO IC.
17	3.3	General	Modified description for the ON/OFF/Volume control knob.
18	3.4	B+ Main Board Routing	Changed title and description during transmit mode.
19	3.4	B+ Main Board Routing	Changed the description during receive mode. Modified Figure 3-1 B+ Routing for Main Board.
20	3.5	B+ and +5V Routing for VOCON	Modified description and Figure 3-2 XTS 2500/XTS 2500I DC Distribution (for all other kits).
23	4.2	Frequency Synthesis	Changed descriptions.
24	4.2	Antenna Switch	Changed description of transmit and receive mode.
25	4.41	Front End	Modified description, components and Intermediate Frequency.
26	4.42	Back End	Modified description.

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26	4.5	Transmitter	Removed VHF descriptions.
27	4.5	Transmitter	Modified description.
28	4.6.1.1	Patriot IC (U800)	Modified description.
32	4.6.2.1.1	Voltage Regulation	Changed component designators.
33	4.6.2.1.1	Voltage Regulation	Modified description.
43	5.2	Handling Precautions	Added “Important Note“
49	6.2	List of Troubleshooting Flowcharts	Changed VHF to UHF2 range.
50	6.3	UHF Range2 Radio Main Trouble-shooting Chart	Changed VHF to UHF2 range.
53 to 56	6.6 to 6.9	Troubleshooting Charts	Updated charts.
60, 64, 66, 68 to 70	6.13, 6.17, 6.19, 6.21 to 6.23	Troubleshooting Charts	Updated charts.
75 to 118	7.3 to 7.45	Troubleshooting Waveforms	Updated tables and waveform diagrams.
121 to 138	8.2 to 8.6	Tables	Updated Tables.
141 to 165	9	Schematics, Board Overlays, and Parts Lists	Updated Schematics and board overlays.

Chapter 2 Overall Characteristics

2.1 Introduction

This manual is to be used in conjunction with the ASTRO XTS 2500/XTS 2500l Digital Portable Radios Basic Service Manual (Motorola part number 6816984H01), which uses the pass/fail service approach to radio problems.

The ASTRO XTS 2500/XTS 2500l digital portable radio is a dual-band, (trunked/conventional), microcontroller-based transceiver incorporating a Digital Signal Processor (DSP). The microcontroller handles the general radio control, monitors status, and processes commands input from the keypad or other user controls. The DSP processes the typical analog signals and generates the standard signaling digitally to provide compatibility with existing analog systems. In addition, it provides for digital modulation techniques, utilizing voice encoding techniques with error correction schemes, to provide the user with enhanced range and audio quality all in a reduced bandwidth channel requirement. It allows embedded signaling which can mix system information and data with digital voice to add the capability of supporting a multitude of system features.

The three ASTRO XTS 2500/XTS 2500l digital portable radio models (I, II, and III) are available in the UHF Range 2 (450 - 520 MHz) band.

The ASTRO XTS 2500/XTS 2500l digital portable radio consists of:

- a **main board**,
- a **universal flex**, and
- **display** and **keypad** assemblies (models II and III only).
- **display** only with **no keypad** (model 1.5 only)

The **main board** contains the microcontroller unit (MCU) and its associated memory and memory management integrated circuit (IC), the audio power amplifier, and a switching regulator. The board also contains the digital signal processor (DSP) and its support IC and associated memories. All transmit, receive, and frequency generation circuitry, including the digital receiver back-end IC and the reference oscillator are included on the main board.

The **universal flex** contains the universal connector, speaker, and a microphone.

The **display** module is a six-line x 12-character, liquid-crystal display (LCD) with associated circuitry. This module utilizes chip-on-flex technology and is not considered field-repairable.

The **keypad** module is either a 3 x 2 (Model II), or a 3 x 6 (Model III) button module with backlighting.

2.2 Analog Mode of Operation-Receiving

When the radio is *receiving*, the signal comes from the antenna connector to the radio board, passes through the RX/TX switch and the receiver front end. The signal is then filtered, amplified, and mixed with the first local-oscillator signal generated by the voltage-controlled oscillator (VCO).

The resulting intermediate frequency (IF) signal (73.35 MHz) is fed to the IF circuitry, where the signal is again filtered and amplified. This amplified signal is passed to the digital back-end IC, where it is mixed with the second local oscillator to create the second IF at 2.25 MHz. It is then converted to a digital bit stream and mixed a third time to produce a baseband signal. This signal is passed to the Vocoder and Controller (VOCON) circuitry through a current-driven output. Please see page 4-6 for a detailed description of the VOCON functional blocks.

In the VOCON circuitry, the DSP decodes the information in the signal and identifies the appropriate destination for it. For a voice signal, the DSP will route the digital voice data to the CODEC for conversion to an analog signal. The CODEC will then present the signal to the audio power amplifier, which drives the speaker. For signaling information, the DSP will decode the message and pass it to the microcontroller unit.

2.3 Analog Mode of Operation-Transmitting

When the radio is *transmitting*, microphone audio is passed through gain stages to the CODEC, where the signal is digitized. The CODEC passes digital data to the DSP, where pre-emphasis and low-pass (splatter) filtering is done. The DSP returns this signal to a digital-to-analog converter (D/A), where it is reconverted into an analog signal and scaled for application to the voltage-controlled oscillator as a modulation signal.

Transmitted signaling information is accepted by the DSP from the microcontroller unit, coded appropriately, and passed to the D/A, which handles it the same as a voice signal. Modulation information is passed to the synthesizer along the modulation line. A modulated carrier is provided to the RF PA, which transmits the signal under dynamic power control.

2.4 ASTRO Mode (Digital Mode) of Operation

In the ASTRO mode (digital mode) of operation, the transmitted or received signal is limited to a discrete set of deviation levels, instead of varying continuously. The receiver handles an ASTRO-mode signal identically to an analog-mode signal up to the point where the DSP decodes the received data. In the ASTRO receive mode, the DSP uses a specifically defined algorithm to recover information.

In the ASTRO transmit mode, microphone audio is processed identically to an analog mode, with the exception of the algorithm the DSP uses to encode the information. This algorithm will result in deviation levels that are limited to discrete levels.

2.5 Main RF Board Overview

The receiver front end consists of:

1. Two wide-band varactor-tunable filters.
2. Wide-band, low-noise amplifier.
3. Active mixer stage.

The receive path of the antenna switch feeds directly into a preselector filter, followed by a Low Noise Amplifier (LNA) and a post-selector filter, then the mixer. Both filters are supplied with a single control voltage from one of the Power Control IC DACs (Digital-to-Analog Converters). The output of the post-selector filter is sent to the active mixer stage.

The frequency generation function is performed by two ICs and its associated circuitries. The reference oscillator provides a frequency standard to the synthesizer/prescaler IC, which controls the Receive (RX) and Transmit (TX) Voltage Controlled Oscillators. The synthesizer/prescaler circuit module incorporates frequency-division and comparison circuitry to keep the VCO signals stable. The synthesizer/prescaler IC is controlled by the microcontroller unit through a serial bus.

The digital back-end IC (ABACUS-III) consists of the following:

- an amplifier
- the second mixer
- an IF analog-to-digital converter
- a baseband down-converter, and
- a 18 MHz synthesis circuit to provide a sampling clock to the circuitry. The second LO is generated by discrete components external to the IC. The output of the ABACUS-III IC is a current-driven digital bit stream.

The transmitter consists of an RF driver IC and a final stage power amplifier. The RF driver IC gets an injection signal from the VCO. Transmit power is controlled by a power-control IC that monitors the output of a directional coupler and adjusts the PA control voltages correspondingly. The signal passes through a RX/TX switch that uses PIN diodes to automatically provide an appropriate interface to transmit or receive signals.

2.6 Vocoder Circuitry Overview

In the VOCON circuitry, the digital-signal processor (DSP) supports IC digital filters, discriminates the signal, and passes it to the DSP. The DSP decodes the information in the signal and identifies the following destination for the signal:

- For voice signal, the DSP routes the digital voice data to the Coder-Decoder (CODEC) for conversion to an analog signal. The CODEC then presents the signal to the audio pre-amplifier and audio power amplifier (integrated into the MAKO IC), which drives the speaker.
- For signaling information, the DSP decodes the message and passes it to the microcontroller unit.

Notes

Chapter 3 Radio Power

3.1 Introduction

This chapter of the manual provides a detailed circuit description of the power distribution for an ASTRO XTS 2500/XTS 2500l digital portable radio. This manual is to be used in conjunction with the ASTRO XTS 2500/XTS 2500l Digital Portable Radios Basic Service Manual (Motorola part number 6816984H01), which uses the pass/fail service approach to radio problems.

3.2 Radio Power Up or Down

Radio power up begins when the radio ON/OFF/Volume control knob is turned to the on position, placing 7.5 volts on the MECH_SW line. This signal activates the pass element (Q700, Q701 and Q703), enabling SW_B+ and RFSW_B+.

The 7.5 Volts on the MECH_SW line turns Q701 ON, which in turn drives the MECH_SW pin on the MAKO IC (U701) low. With the high-low transition on the MECH_SW pin, the MAKO IC then pulls the FET_ENX pin (or VPP_EN line) low, enabling external P-MOSFETs Q700 and Q703. Q700 and Q703 applies SW_B+ to MAKO IC and VoCon and RF_SWB+ to the RF section of the board. After application of the power to SW_B+, the regulators VSW1, VSW2, V1.875, V1.55, V2.9 and VCC5 are sequentially turned ON. After the regulators are stable, the RESETX pin is asserted low for an additional 16ms and then released to allow the dual-core processor to start.

The radio power down sequence begins from the ON/OFF switch that disables Q701. This causes the MECH_SW pin on the MAKO IC to be pulled High. Then, the INT_X pin (or MAKO_INT) is drawn low and the 125ms Watchdog timer is started. The dual core processor (through SPI communication busses) then initiates the powering down process of the radio. At this point, the watchdog timer can be kept alive by the dual-core processor (via the SPI bus) allowing for software cleanup. Upon expiration of the watchdog timer, the MAKO IC asserts the RESETX pin and turns off all DC regulators including SW_B+ and RF_SWB+ (Q700 and Q703 turn off when the MAKO IC drives the FET_ENX pin high).

3.3 General

In the XTS 2500/XTS 2500l radio, power (B+) is distributed to one board that contains both the transceiver and controller sections. There is an additional backup battery (Motorola part number 6003710K08) mounted directly on the board; see the basic service manual for details.

Power for the radio is provided through a battery supplying a nominal 7.5Vdc directly to the transceiver. The battery is available in the following forms:

- NTN9815_ Nickel-Cadmium, Hi Capacity
- NTN9816_ Nickel-Cadmium, Hi Capacity, FM Approved
- NNTN9857_ Jedray NiMH Impres Standard Battery
- NNTN9858_ Jedray NiMH Impres FM Battery
- NNTN6263_ Jedray NiMH Impres FM Immersible Battery

B+ from the battery is electrically switched to most of the radio, rather than routed through the ON/OFF/Volume control knob, S501. The electrical switching of B+ supports a “keep-alive” mode. Under software control, even though the ON/OFF/Volume control knob has been turned to the “off” position, power remains on until the MCU completes its power-down sequence.

3.4 B+ Routing for UHF2 Band Main Board

Refer to Figure 3-1 and the appropriate schematic diagram in the back of this manual.

Raw B+ (7.5V) from the battery enters the radio through a 3-contact connector (B500). UNSW_B+ (through fuse F500), RAW_B+ and mechanical switch S501 derives power from it.

Through fuse F500, UNSW_B+ supplies to MAKO BAT_7V5 pin, MAKO BPLUS (PA CODEC block) pin, Q700 and Q703. It is also routed to pin 3 of connector J601.

During the transmit mode, RAW_B+ feeds to U101 PA Driver, Q101 Final PA and U102 Power Control IC.

During the receive mode, the linear regulator (U500) provides 5V to the mixer (U1) and the ABACUS III IC (U401). U500 also provides 5V to the Frequency Generation Unit's (FGU) FracN (U201).

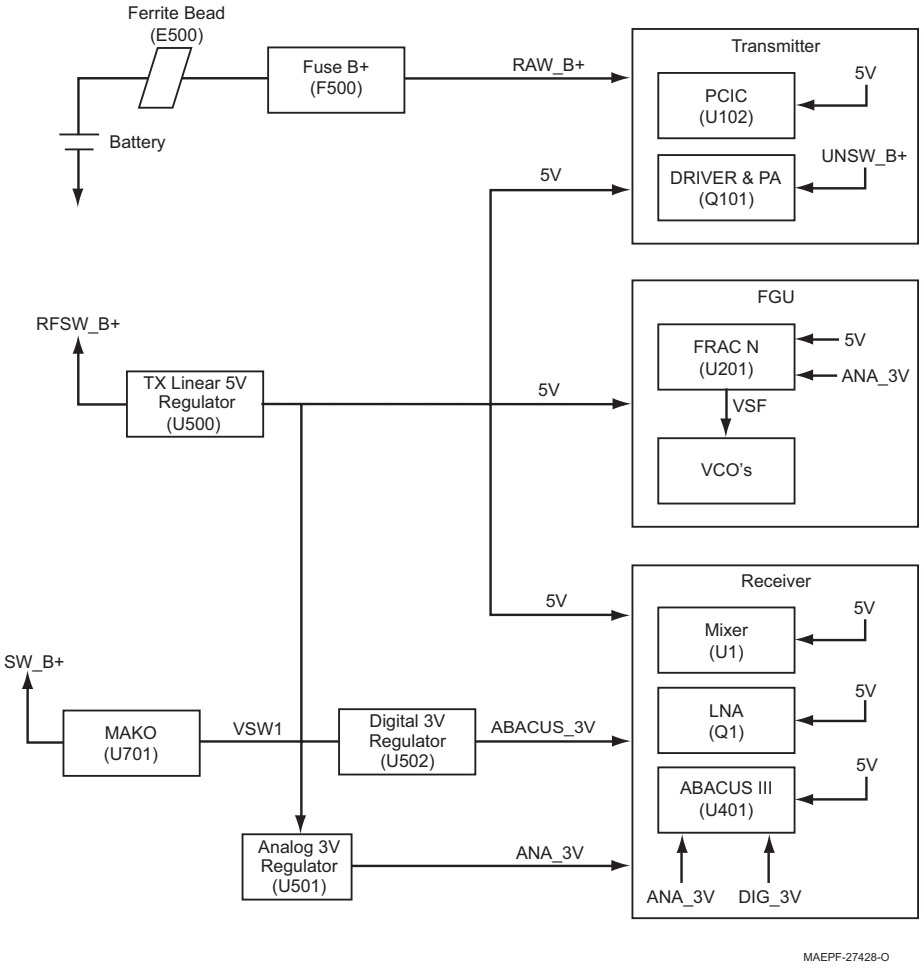

Figure 3-1. B+ Routing for Main Board

3.5 B+ and +5V Routing for VOCON

Refer to Figure 3-2 and the appropriate schematic diagrams in the back of this manual.

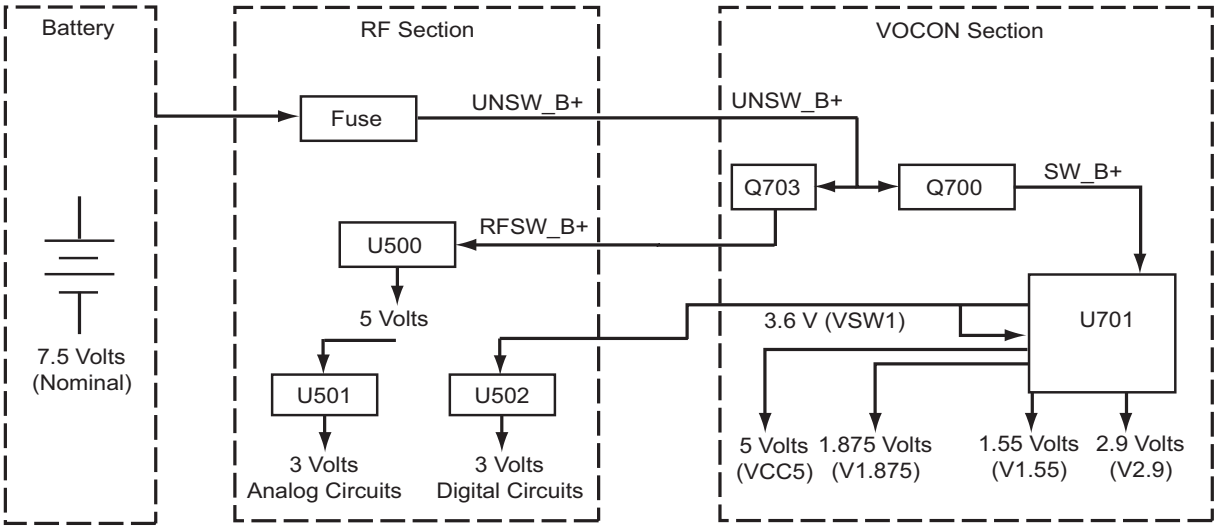

Figure 3-2. XTS 2500/XTS 2500I DC Distribution (for all other kits)

Power for the radio is derived from a 7.5 volt battery (UNSW_B+), which is applied to the power mosfet (Q703 and Q700) in the RF and VOCON sections respectively.

Q700 is a power mosfet switch that provides SW_B+ to the MAKO IC to U500 (the 5V regulator) in the RF section.

The digital circuits in the VOCON section are powered from regulators located in the MAKO IC. The MAKO IC provides five software-programmable supplies (VSW1, V1.55, V1.875, V2.9 and VCC5). VSW1 provides voltage to U502 that regulates 3 Volts to digital circuits, while U500 supplies to U501 that power analog circuits with 3 Volts in the RF section. The initial and programmed output of VSW2 (C715) is 2.3V. The VSW2 is used internal to the MAKO IC to supply the 1.875V (V1.875) and 1.55V (V1.55) linear voltage regulators.

Chapter 4 Detailed Theories of Operation

4.1 Introduction

This chapter provides a detailed circuit description of the ASTRO XTS 2500/XTS 2500l/XTS 2250/ XTS 1500 radio board. 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.

This manual is to be used in conjunction with the ASTRO XTS 2500, XTS 2500l, XTS 2250, XTS 1500, MT 1500 Digital Portable Radios Basic Service Manual (Motorola part number 6816984H01), which uses the pass/fail service approach to radio problems.

4.2 Frequency Synthesis

For UHF Range 2 (450-520 MHz), the complete synthesizer subsystem consists of the following:

- The **reference oscillator** (Y200)
- Two **voltage-controlled oscillators** (TX and RX)
- One **voltage-controlled oscillator buffer IC** (U250)
- The **synthesizer** (U202)

The reference oscillator contains a temperature-compensated 16.8 MHz crystal. This oscillator is digitally tuned and contains a temperature-referenced, six-bit, analog-to-digital (A/D) converter. The output of the oscillator (pin 3 on Y200) is applied to pin 23 (XTAL1) of U202 through capacitor C214.

The voltage-controlled oscillators (VCOs) are varactor-tuned. The voltage (2-9.5V) varies as it is being applied to varactors D251 to D254 and D270 to D273 of their respective VCO. The capacitance of the varactors also varies, thereby changing the output frequency of the VCOs. Both VCOs are used to cover the entire 70 MHz bandwidth of this UHF range (450-520 MHz):

- TX VCO covers the transmit frequencies from 450-520 MHz
- RX VCO covers the receive frequencies from 376.65-446.65 MHz

The TX and RX VCOs are selected using AUX 3 from U202. Both VCOs are connected to the same prescaler filter (C292, L266 and R266) feeding back to PREIN of the U202, through C293.

The synthesizer IC consists of the following:

- A prescaler
- A programmable loop divider
- A divider logic control
- A phase detector
- A charge pump
- An A/D converter for low-frequency digital modulation
- A balance attenuator to balance the high-frequency analog modulation to the low-frequency digital modulation
- A 13V positive voltage multiplier
- A serial interface for control
- A filter for the regulated 5 and 3 volts

The 13V, being generated by the positive voltage multiplier circuitry, should be present at pin 47 of U202. The serial interface (SRL) is connected to the microprocessor via the data line (pin 7 of U202), the clock line (pin 8 of U202), and the chip-enable line (pin 9 of U202).

The complete synthesizer subsystem works as follows:

1. The buffered output of the VCO is present at R294 in receive mode and R275 during transmit mode.
2. The output of the prescaler filter is present at C293 and applied to pin 32 of U202. The prescaler in U202 is a dual-modulus type with selectable divider ratios. This divider ratio is controlled by the loop divider, which in turn receives its input from the SRL. The loop divider adds or subtracts phase to the prescaler divider by changing the divider ratio via the modulus control line.
3. The output of the prescaler is then applied to the loop divider.
4. The output of the loop divider then feeds the phase detector. The phase detector will compare the loop divider's output signal form the VCOs. The VCO signal is divided down after it is applied to pin 32 of U202. The result of the comparison is a pulsed DC signal which is applied to the charge pump.
5. The charge pump outputs a current that will be present at pin 43 of U202. The loop filter consisting of R202, C202, R203, C203, R201, C201, C236, C237, C238, C239 and C240 will convert this current into a voltage that will be applied to varactors D251, D252, D253, D254, D270, D271, D272, and D273 to alter the output frequency of the VCO.

In order to modulate the PLL, the following two-port modulation method is utilized: The analog modulating signal is applied to (1) the A/D converter as well as to (2) the balance attenuator:

1. The A/D converter converts the low-frequency analog modulating signal into a digital code. When the digital code is applied to the loop divider, it causes the carrier to deviate.
2. The balance attenuator is used to adjust the VCO’s deviation sensitivity to high-frequency modulating signals.

4.3 Antenna Switch

An electronic PIN diode switch steers RF between the receiver and transmitter. The common node of the switch is at capacitors C171 and C180 for UHF Range 2.

1. In transmit mode:
   a. RF is routed to the anode of diode D170.
   b. Bias current, sourced from RAW_B+ is routed through PIN diodes D170 and D171, biasing them to a low-impedance state.
2. In receive mode:
   a. RF is routed through C179 to pre-selector filter.
   b. PIN diodes D170 and D171 are unbiased and thus at high impedance.

4.4 Receiver

The receiver consists of the following:

- Front end
- Back end

4.4.1 Front End

For the purposes of this discussion, the receiver front end is defined as being the circuitry from the antenna switch to the output of the IF crystal filter. The UHF2 front end converts the received RF signal to the 1st IF frequency of 73.35 MHz, while at the same time providing for spurious immunity and adjacent channel selectivity. A review of the inter-stage components of the front end follows, with emphasis on troubleshooting considerations.

The received RF signal is passed through quarter wavelength components C180, L176, and C178, (which are anti-resonant at the radio's transmitter frequencies). Both PIN diodes D170 and D171 must be reverse biased to properly route the received RF signal.

Next is the step attenuator (U2). This attenuator provides 15 dB step attenuation to protect the receiver from strong RF signals. The attenuator is controller by a DSP-based algorithm that continuously monitors signal strength. When the ON threshold is exceeded (approximately -95 dBM), the attenuator is activated via a DAC in the PCIC by the host. The attenuator remains activated until the signal drops below the OFF threshold (approximately -115 dBM including the 15 dB attenuation). Hysteresis and timer functions are included in the algorithm to enhance performance. The algorithm controlling the attenuator is enabled via the CPS for each personality. When the algorithm is disabled, the attenuator is essentially a short circuit from input to output.

The step following the step attenuator is the varactor-tuned preselector filter made up of C1, C2, C3, C4, C5, L1, L2, C63, C64, CR1 and CR2. The preselector is positioned right after the antenna switch to provide the receiver preamp with some protection against strong signal, out-of-band signals, and first-image suppression.

After the preselector filter, the received signal is applied to the receiver preamp, Q29. The preamp is a transistor, which has been biased and matched for optimum intermodulation (IM), noise figure (NF), and gain performance. Components L3 and C7 match the input of the amp to the step attenuator output. The preamp is supplied by a 5V analog regulator and is biased at approximately 0.75Vdc at the base and 2Vdc at the collector.

The output of the amp is matched to a second two-pole preselector filter of the type previously discussed. The match is via C35 and L31. The subsequent stage in the receiver chain is the 1st mixer U1, which uses high-side injection, to convert the RF carrier to an intermediate frequency (IF) of 73.35 MHz. Since high-side injection is used, the LO frequency is offset above the RF carrier by 73.35 MHz, or Flo = Frf + 73.35 MHz. The mixer utilizes GaAs technology in a double-balanced, Gilbert Cell configuration.

A balun transformer (T51) is used to couple the RF signal into the mixer. The primary winding of T51 is matched to the preceding stage by L57, C51 and C90. The secondary winding of T51 provides a differential output. The center tap pin is grounded via an 75-ohm resistor that sets the mixer bias current.

The final stage in the receiver front end is a two-pole crystal filter (FL51). The crystal filter provides some of the receiver's adjacent channel selectivity and intermodulation. The crystal filter provides at least 75dB of second image protection and improves IM distortion in the ABACUS III IC.

4.4.2 Back End

In the **ABACUS IC (U401)**, the first IF frequency is amplified and then down-converted to the second IF frequency (2.25 MHz). At this point, the analog signal is converted into two digital bit streams by a sigma-delta A/D converter. The bit streams are then digitally filtered, mixed down to baseband, and filtered again. The output data stream is then sent to the Patriot IC, where it is decoded to produce the recovered audio.

The ABACUS IC (U401) is electronically programmable. The amount of filtering, which is dependent on the radio channel spacing and signal type, is controlled by the microcomputer. Additional filtering, which used to be provided externally by a conventional ceramic filter, is replaced by internal digital filters in the ABACUS IC.

The ABACUS IC contains a feedback Automatic Gain Control (AGC) circuit to expand the dynamic range of the sigma-delta converter. The differential output data contains the quadrature (I and Q) information in 16-bit words, the AGC information in a 9-bit word, imbedded word sync information, and fill bits. Two synthesizers are available on the chip for second LO and sampling clock (18 MHz) generation.

The second LO/VCO is a Colpitts oscillator built around transistor Q401. Varactor diode (D402) in the VCO is used to adjust the VCO frequency. The control signal for the varactor is derived from a loop filter consisting of C440, R417, C441, R418, and C480. The sampling clock is derived from a negative resistance generator (on the chip) available at CLKP, CLKN, and an external tank circuit (L403, C423, and D401). The loop filter for the clock is realized by C448, R408, and C425.

4.5 Transmitter

The RF power amplifier (PA) consists of

- an RF driver (**U101**) and
- a Silicon N-Channel MOSFET type transistor RF power amplifier (**Q101**).

RF input drive level of approximately +3dBm is supplied from the transmit VCO buffer. This input drive level is applied to pin 16 (RFIN) of **U101**. The dc power is applied to pins 6, 7, and 14 of **U101** and to the drain of **Q101** via a filtered RAW_B+. Power control is achieved by varying the dc bias (and thus the gain) at pin 1 of **U101** and the gate of **Q101**. The amplified RF signal leaves the RF final PA (**Q101**) at the drain and is applied to the discrete directional coupler via an impedance match. The RF signal passes through the coupler, a discrete antenna switch, and a discrete harmonic filter before finally reaching the antenna launch connector.

A portion of the forward RF power is sampled by the directional coupler, applied to the diode (D172) for rectification, and the resulting dc signal is fed back to pin 1 of the Power Control IC (PCIC, U102). This dc signal is representative of the forward RF power being passed through the directional coupler. The dc signal is used by the PCIC to regulate the transmitted RF power level.

The PCIC is the heart of the power control loop. The rectified feedback is internally compared to an internal Digital-to-Analog Converter (DAC) output voltage in the PCIC to determine the amount of DC bias voltage at pin 4. This voltage at pin 4 of the PCIC controls the gain (and thus the output power, as explained above) of the RF driver (**U101**) and the RF power amplifier (**Q101**) via a fixed resistor divider network.

U103 senses the temperature of the printed circuit board (PCB) near the RF Power Amplifier (**Q101**) and provides a dc level representative of this temperature to pin 30 of the PCIC. The PCIC uses this input to cut back the output power level after a certain temperature threshold is reached. This ensures (1) radio integrity while transmitting in extreme ambient conditions hotter than the radio's operating temperature range and (2) acts as a safety feature to prevent any thermal runaway fault conditions.

Pin 32 of the PCIC powers the Temperature Sense IC (U103) and forward biases the antenna switch diodes (D170 and D171) while the radio is in transmit mode. This routes the RF signal from the transmitter to the antenna, as explained above. The antenna switch diodes are not biased during receive and standby modes; therefore, any RF signal present at the antenna is applied to the receiver.

4.6 VOCON Functional Blocks

The three main functional blocks of the VOCON section consist of the following sections:

- the Controller and Memory Section, consisting of the following components:
  - the Patriot IC (U800)
  - the dual-core processor with the microcontroller unit (MCU) and a digital signal processor (DSP)
  - the SRAM IC (U804) and FLASH IC (U803) memory devices.
- the Audio and Power Section and digital support are all embedded into the MAKO IC (U701).
- the Interface Support Section, consisting of the following components:
  - the ESD protection circuitry
  - the side connector interface circuitry, and
  - the Option board.

4.6.1 Controller and Memory Section

Three main ICs are in the controller and memory section of the main board schematic: the Patriot IC (U800), the static RAM (SRAM) (U804), and the Flash memory (U803).

4.6.1.1 Patriot IC (U800)

The Patriot IC (U800) is a dual-core processor containing both a 32-bit microcontroller unit (MCU) and a 16-bit digital signal processor (DSP) in one IC package. It comes in a 256 pin, ball grid array (BGA) package with 1mm pitch solder balls. The Patriot is supplied with two voltages: 1.875 volts (E801) and 2.9 volts (E800). The 1.875-volt supply is used as the core voltage as well as the interface to the memory devices and display. Most of the pins on the Patriot operate from the 2.9-volt supply.

There are two main clocks that are provided to the Patriot:

1. The CKIH pin is provided by a 16.8MHz sine wave; this is the most important clock since it is internally used to generate the clocks for both the MCU and DSP cores, as well as most of the peripherals.
2. A 2.9-volt peak-to-peak 32.768kHz square wave is supplied to the MCU and DSP cores. It is generated by an external 32.768kHz crystal (Y701), and a clock buffer circuit that includes U712, U713, U714, C742, C743, C791, C743, C792, R745, R747, R748, R799, R741 and R742. This signal is supplied to the CKIL pin on the dual-core processor. While not as widely used as the 16.8MHz clock, the 32.768kHz clock is needed by some components in the dual-core processor, including the reset circuitry.

4.6.1.1.1 Microcontroller Unit (MCU)

The MCU portion of the Patriot has 22.5Kx32 bits of internal RAM and 1Kx32 bits of internal ROM. The internal ROM is used for the bootstrapping code. The MCU has several peripherals, including the following:

- an External Interface Module (EIM)
- the Multiple Queue Serial Peripheral Interface (MQSPI)
- two Universal Asynchronous Receiver/Transmitter (UART) modules, and
- the One-Wire Interface module.

The MCU communicates internally to the DSP through the MCU/DSP Interface (MDI).

General Purpose Input/Output Module (GPIO)

The GPIO (General Purpose Input/Output) Module is shared by the MCU and the DSP. This module consists of four 16-pin bi-directional ports and a 15 pin bi-directional port. While some of these pins on these ports are being used for other functions (UART, SPI, SAP, BBP, and Interrupt pins), the remaining pins on those ports may be programmed to become GPIOs that may be used by either the DSP or the MCU. Each GPIO pin has up to 8 alternate output functions and up to 4 alternate input functions. This allows for the GPIO pins to be routed internally to pertinent Patriot modules. Additionally, the GPIO module adds selectable edge-triggered or level-sensitive interrupt functionality to the GPIO pins. An example of GPIO pins include the following:

- the LED control signals (RED_LED and GREEN_LED).

4.6.1.2 SRAM (U804)

The static RAM (SRAM) is an asynchronous, 1 MB CMOS device that is capable of 70 ns access speed. It is supplied with 1.8 volts. The SRAM has 19 address lines and 16 data lines connected to the External Interface Module (EIM) of the Patriot IC through the ADDR(23:0) and DATA(15:0) busses.

The SRAM has an active low chip-select EN_CE that is connected to the EIM CS2_N pin. When the SRAM EN_CE pin is not asserted, the SRAM is in standby mode, which reduces current consumption.

Two other control signals from the EIM that change the mode of the SRAM are the read/write signal (R/W), and the output enable signal (OE). The R/W of the EIM is connected to the SRAM EN_WE pin while the OE signal from the EIM is connected to the SRAM EN_OE pin. The SRAM is in read mode when the EN_WE pin is not asserted and the EN_OE pin is asserted. The SRAM is in write mode when the EN_WE pin is asserted, regardless of the state of the EN_OE pin.

The other SRAM pins are the lower byte enable pin EN_BLE and the upper byte enable pin EN_BHE. These pins are used to determine which byte (EN_BLE controls data lines 0-7 and EN_BHE controls data lines 8-15) is being used when there is a read or a write request from the Patriot. The EN_BLE pin is controlled by the EIM EB1_N signal while the EN_BHE pin is controlled by the EB0_N signal.

4.6.1.3 Flash Memory (U803)

The Flash memory IC is a 8-megabyte CMOS device with simultaneous read/write or simultaneous read/erase operation capabilities with 70 ns access speed. It is supplied with 1.8 volts. The Flash memory has its 22 address lines and 16 data lines connected to the EIM of the Patriot IC through the ADDR(23:0) and DATA(15:0) busses. The Flash memory contains host firmware, DSP firmware, codeplug data, and tuning values.

The RESET_OUT of the Patriot IC (U800) is at the GPIO voltage logic level (see section 4.6.1.1). Components CR800 and R812 are used to convert the voltage down to a 1.8-volt logic level, and this 1.8 volt reset signal is fed to the Flash RESET pin. When this pin is asserted (active low logic), the Flash is in reset mode. In this mode, the internal circuitry powers down and the outputs become high impedance connections.

The Flash active low chip select pin, EN_CE, is connected to the active low CS0 pin (TP_CS0 test point) of the EIM. When the EN_CE is not asserted, the Flash is in standby mode which reduces the current consumption.

Several other active low controls pins determine what mode the Flash memory is in:

- the address valid pin ADV which is connected to the EIM LBA signal
- the output enable pin EN_OE that is connected to the EIM OE signal, and
- the write enable pin EN_WE which connected to the EIM EB1 signal.

For read mode, the ADV and EN_OE pins would be asserted while the EN_WE pin would not be asserted. When the EN_WE is asserted and the EN_OE pin is non-asserted, the Flash would operate in the write mode.

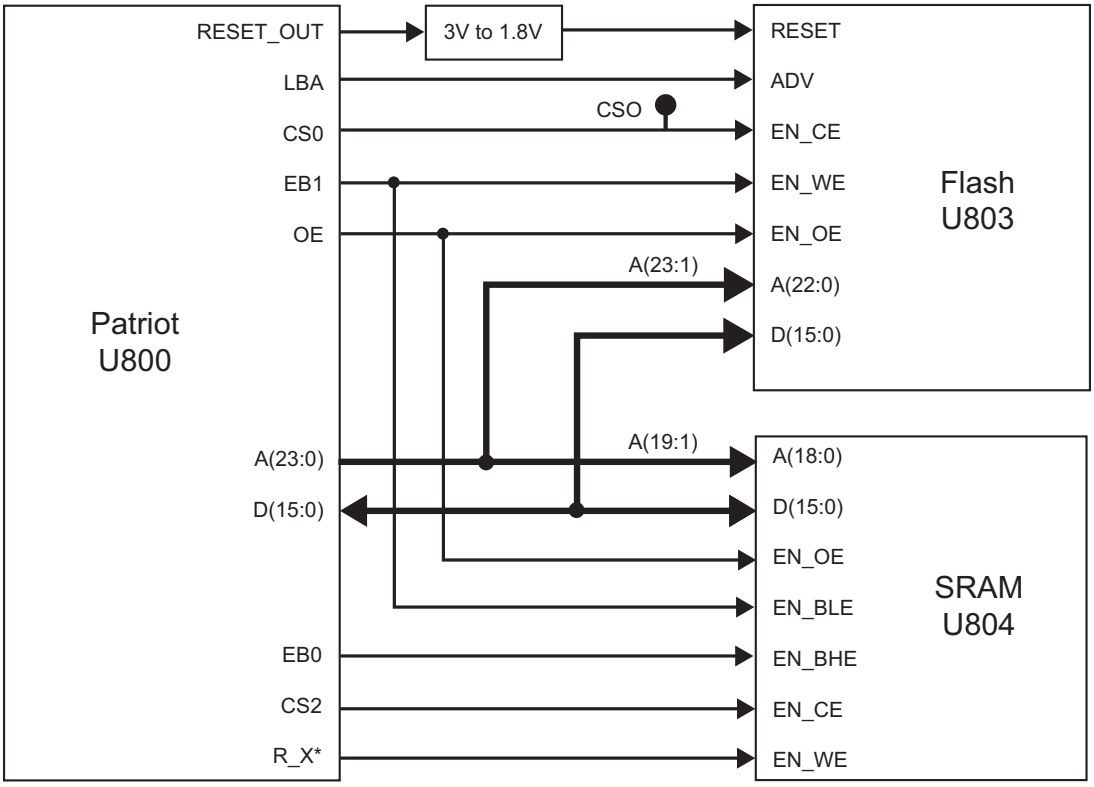

Figure 4-1. Controller Memory Interface

4.6.2 Audio and Power Section

Two main ICs reside in the audio and power section of the schematic diagram:

- the MAKO IC (U701)
- the VSW1 Driver IC (Q702)

4.6.2.1 MAKO IC (U701)

The MAKO IC is a mixed-signal IC that provides control, clock generation, digital support, audio, and voltage regulation functionality. It comes in a 176-pin, ball-grid array (BGA) package with 0.8mm pitch solder balls. The MAKO IC is supplied with switched battery voltage SW_B+.

4.6.2.1.1 Voltage Regulation

The MAKO IC contains all of the regulators that are used in the design of the VOCON board:

VSW1, VSW2, V_2.9, V1.55, V1.875, and VCC5. VSW1 is a programmable switching regulator controlled by the MAKO IC on pin SW1_SUMCOMP_DL, while the current is sourced by a driver Q702 using the switched battery voltage (SW_B+). The switching frequency of VSW1 is programmable by the dual-core processor through the SPI bus. The VSW1 voltage is supplied to the input pin of MAKO's VSW2 regulator (pin SW2_VCCS).

The VSW2 regulator is a SPI programmable switching regulator. The initial and programmed output of VSW2 at C715 is 2.3 volts. The VSW2 voltage is used internal to the MAKO IC to supply the 1.875 volt (V1.875) and 1.55 volt (V1.55) linear voltage regulators. The V1.875 voltage at L703 is supplied to the dual-core processor U401 (EIM voltage), SRAM U403, and Flash memory U803. The V1.55 voltage at R718 is supplied to the dual-core processor U800 (core voltage).

The V_2.9 volt regulator is a linear regulator within the MAKO IC that used VSW1 as its input. The initial output of V_2.9 at L704 is 2.775 volts, which is then programmed to 2.9 volts by the dual-core processor via the SPI bus. The V_2.9 voltage is supplied to the dual-core processor (I/O ring - SPI, BBP, SAP, UART, GPIO, etc.), the display module connector J601, and the many discrete components that interface with the dual-core processor and the MAKO IC.

4.6.2.1.2 Microcontroller Unit (MCU) Interface

The MAKO IC has a four-wire, SPI connection to the dual-core processor (SPI B). The SPI B clock is connected to the SPI_CLK pin E6. The SPI B MOSI line is connected to the SPI_DI pin B6. The SPI B MISO line is connected to the SPI_DO pin C6. The MAKO SPI B chip-select signal is connected to the SPI_CS pin D6. Through this interface, the dual-core processor can program the voltage regulators, the CODEC, the transmit and receive audio filters and amplifiers, digital support multiplexing, and read information from the ADC.

The MAKO IC has a 10-bit ADC with eight general-purpose channels and two voltage-monitoring channels. Five out of the eight general-purpose channels are assigned to the display backlight button on the control head (ATOD_2), the monitor volume (ATOD_1), the two-position toggle switch (ATOD_3), the OPT_SEL_IN (ATOD_8), and board type ID (ATOD_5). The other three general purpose channels are unused. Battery voltage is also monitored by the ADC. The dual-core processor reads the ADC values through the SPI bus.

4.6.2.1.3 Audio Circuitry

A16-bit CODEC is integrated into the MAKO IC and programmable by the dual-core processor through the SPI bus. The CODEC converts microphone audio data into a digital bit stream for processor by the DSP and converts receive audio data that was processed by the DSP into an analog audio signal for amplification to a speaker. The CODEC interfaces to the DSP through the 4-wire SAP bus. The CODEC clock, which is 512kHz, is generated by the MAKO IC and supplied on the VC_DCLK pin (R772). The CODEC 8 kHz frame synchronization signal is generated by the MAKO IC and supplied on the VC_FSYNC pin (R773). The CODEC transmit data signal is on the VC_TX3V pin and the CODEC receive data signal is on the VC_RX pin. For the MAKO IC to generate the clock and frame sync signals, a 24.576 MHz crystal Y702 is supplied to the XOUT and XIN pins.

The MAKO IC contains internal amplification (digital and analog), filtering, and multiplexing functionality for both receive and transmit audio. These functions are programmable by the dual core processor through the SPI bus. The input for the internal microphone audio (C755) is the INT_MIC_P pin, while the input for the external microphone audio (C754) is the EXT_MIC_P pin. The differential output for the internal speaker is the INT_SPKR_P pin and INT_SPKR_M pin. The differential output for the external speaker is the EXT_SPKR_P pin (C769) and EXT_SPKR_M pin (C768).

4.6.2.2 Regulator

The 5 V regulator is internal to the MAKO IC and uses SW_B+ as its input voltage at pin V08_I (C720). The 5 V supply (L705) is used by the bi-directional voltage translators integrated into the MAKO IC, the MAKO IC protection diodes, and the ESD protection circuitry.

The 1.55 V regulator (programmable through the SPI bus) is integrated into the MAKO IC. This regulator uses VSW2 to source the current. The 1.55 V supply (R718) is used by the dual-core processor U701 for it core voltage and clock amplifier.

4.6.2.3 Audio Pre-Amplifier

The audio pre-amplifier is integrated into the MAKO IC. The pre-amplifier's supply voltage and gain are programmable and controlled by the dual-core processor through the SPI bus. The input to the pre-amplifier is routed from the internal gain stages within the MAKO IC. The differential output of the pre-amplifier is the VC_OUT_P pin (R844) and VC_OUT_M pin (R798).

4.6.2.4 Audio Power Amplifier

The audio power amplifier, supplied by SW_B+, is integrated into the MAKO IC U701. The audio PA is a programmable BTL type and is controlled by the dual-core processor through the SPI bus. The operational state of the PA, as well as selecting between the internal and external audio path, is controlled by the dual-core processor via the SPI bus.

The differential input to the audio PA comes from a low-pass filter (R844, R798, C764, C765, and C790) at the output of the audio pre-amplifier.

4.6.3 Interface Support Section

The interface support section includes the following:

- the MAKO IC (U701)
- the ESD protection circuitry, and
- the universal connector interface circuitry.

4.6.3.1 MAKO IC U701

The digital-support functions are performed by the MAKO IC. The MAKO IC is contained in a 176-pin BGA with 0.8mm pitch solder balls. The MAKO IC is supplied with three clocks. It is supplied with a 16.8 MHz clock from the transceiver board. It uses a 32.768 kHz crystal to boot up the dual core processor and for the real-time clock. It also uses a 24.576 MHz crystal to generate the SAP clock and frame synchronization signals.

The MAKO IC includes that one-wire option detect support, watchdog timer, and the radio's universal (accessory) side connector interface. It also monitors the position of the on/off switch in order to control the power-up/power-down sequence.

4.6.3.1.1 Side Connector Interface, Logic Level Translation, and Boot Data Path Control

The LH Data bidirectional translation is performed internal to the MAKO IC and 3V logic level is on MAKO pin SB96D_BDO_KF_3V.

4.6.3.1.2 USB Transceiver

The USB transceiver is internal to MAKO IC U701, and is capable of transmitting and receiving serial data at a rate of 12 megabits per second. The differential USB data comes from the side connector, through the 33-ohm resistors R837 and R838 and then to the USB1_DP and USB1_DM pins on U701. The data will then go through some interfacing and multiplexing internal to the transceiver for 6-wire USB operation and onto the output pins. The USB receive interface through the transceiver to the dual core processor is as follows: DP routed to USB_VPI, DM routed to URXD1_USB_VMI, and the differentially decoded data is output on URTS1_XRXD pin.

The USB transmitter is enabled when the RS232_USB* and USB_TXENAB signals are both driven low by the dual-core processor. The single-ended data is output from the dual-core processor on the UTXD1_USB_VPO pin and goes to USB1_DAT_TXD on U701. The data is driven out differentially on the USB1_DP and USB1_DM pins, which go to the side connector. The dual-core processor sends the single-ended zero signal from pin USB_VMO to the USB1_SE0 pin on U701.

Key variables are loaded into the encryption module through connector J601, pin 34. Depending on the type of encryption module, up to 16 keys can be stored in the module at a time. The key can be infinite key retention or 30-seconds key retention, depending on how the codeplug is set up.

The radio' s host processor communicates with the encryption module on the Synchronous Serial Interface (SSI) bus. The SSI bus consists of four signal lines. A communications failure between the host processor and the secure module will be *ERROR 09/10 or S03 error* message on the display.

To troubleshoot the encryption module, refer to the flowcharts in Chapter 6 “Troubleshooting Charts.”

Table 4-2. Encryption Module Software Kits and Algorithms

Software Kit Number	Algorithm
Q667AB (7/800), Q667AE (V,U1,U2)	ADP SFWR DSP BASED CRYPTO
Q159AC	XTS 2500/XTS 2500I UCM HARDWARE ENCRYPTION
Q629AD	AES ENCRYPTION
Q625AU	DES, DES-XL, DES-OFB ENCRYPTION
Q668AC	ADP UCM ENCRYPTION W/DES, DES-XL, DES-OFB
H869BQ	MULTI KEY
Q406AC	ADP UCM ENCRYPTION
QA00204AA	MULTIKEY AND ADP
	ADP UCM ENCRYPTION W/AES

4.6.3.6 System Clocks

The Patriot is supplied with two clocks:

1. The first clock, a 16.8 MHz sine wave, comes from the RF portion of the radio. It is conditioned by the clock buffer circuit, which includes Q709, R722, R740, R729, R797, C726, C725 and C727.
2. The other clock supplied to Patriot is a 32.768 kHz square wave. This clock is generated by the external 32.768kHz crystal Y701, and a clock buffer circuit that includes U713, R745, R746, C743, C792, R742 and R741. This signal is supplied to the CKIL pin on the dual-core processor.

4.6.4 Transmit Audio Path

Refer to Figure 4-4. The single-ended internal microphone audio enters the VOCON board through 20 pin side connector (J650), and the internal microphone bias is set by circuitry that includes R751, R753, C751, C753 and C755. The internal microphone signal is connected to the INT_MIC_P pin, which is the input terminal on the MAKO IC internal op-amp G1 after the signal is multiplexed. The gain of the G1 pre-amp is set to +15 dB, which is programmed by dual-core processor SPI lines.

The external microphone audio enters the VOCON board through the remote connector J102, pin10, and the external microphone bias is set by circuitry that includes R750, R752, C750, C752 and C754. The external microphone signal is connected to the EXT_MIC_P pin, which is an input terminal on the MAKO IC internal op-amp G1 after the signal is multiplexed. The gain of the G1 pre-amp is set to +15 dB, which is programmed by dual-core processor SPI lines.

The dual-core processor, through the SPI bus, programs a multiplexer internal to the MAKO IC to select one of the microphone signals. Then, the selected microphone signal goes through the G1 pre-amplifier stage and on to a programmable gain amplifier (G2) before it goes to the CODEC for A/ D conversion. The resulting digital data is filtered and sent to the DSP on the CODEC_TX line from the MAKO IC VC_TX3V pin. After additional filtering and processing, the DSP sends the data-out from the STDB pin, labeled TX_SSI_DATA to the RF interface connector.

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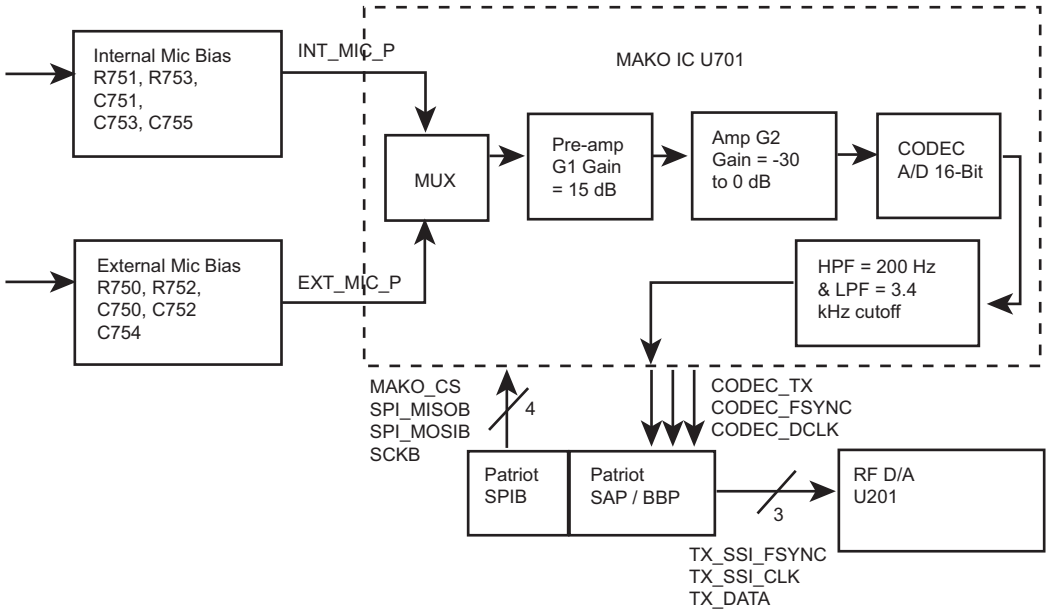


Figure 4-4. VOCON Transmit Audio Path

Chapter 5 Troubleshooting Procedures

5.1 Introduction

The purpose of this chapter is to aid in troubleshooting problems with the ASTRO XTS 2500/ XTS 2500l digital portable radio. It is intended to have enough detail to localize the malfunctioning circuit and isolate the defective component.

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

Caution

This manual is to be used in conjunction with the ASTRO XTS 2500/XTS 2500l Digital Portable Radio Basic Service Manual (Motorola part number 6816984H01), which uses the pass/fail service approach to radio problems.

5.2 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). This kit includes a wrist strap, two ground cords, a static-control table mat, and a static-control floor mat.
6. Always wear a conductive wrist strap when servicing this equipment. The Motorola part number for a replacement wrist strap that connects to the table mat is 42-80385A59.
7. When performing hot-air repair in close proximity to the backup battery (reference number M500), remove the backup battery before performing any rework to avoid damaging the battery.

Important Note: Always replace the 2 conductive pads (P/N: **2671104L01 and 2616342H02**, EMI shield, electrically conductive gasket) after rework that requires the radio RF board to be disassembled from the housing.

5.3 Voltage Measurement and Signal Tracing

It is a good idea to check the battery voltage under load. This can be done by measuring the OPT_B+ _VPP pin at the universal (side) connector (pin 4). The battery voltage should remain at or above 7.0 Vdc. If the battery voltage is less than 7.0 Vdc, the battery should be recharged or replaced, as necessary, prior to analyzing the radio.

In most situations, the problem circuit may be identified using a multimeter, RF millivoltmeter, oscilloscope (preferably with 100 MHz bandwidth or more), and a spectrum analyzer.

Caution

When checking a transistor or module, either in or out of circuit, do not use an ohmmeter having more than 1.5 volts dc appearing across the test leads, or use an ohms scale of less than x100.

5.4 Standard Bias Table

Table 5-1 outlines some standard supply voltages and system clocks that should be present under normal operation. These should be checked as a first step to any troubleshooting procedure.

Table 5-1. Standard Operating Bias

Signal Name	Nominal Value	Tolerance	Probe Point
Gated_32_KHZ	32.768kHz	±400ppm	C742
CKIH	16.8MHz		C726
16.8MHZ	16.8MHz		C726
POR	2.9V dc	±5%	D511, pin 2
MAKO_RESET	1.9V dc	±5%	D511, pin 2
VSW1	3.6V dc	±5%	R711
VSW2	2.3V dc	±5%	C715
V2.9	2.9V dc	±5%	L704
UNSW_B+	7.5V dc	6-9 V dc	R725
SW_B+	7.5V dc	6-9 V dc	R708
VCC5	5V dc	±5%	L705
VSAVE	2.5V dc	±5%	C704
RFSW_B+	7.5V dc	6-9 V dc	C730

Chapter 6 Troubleshooting Charts

6.1 Introduction

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

This manual is to be used in conjunction with the ASTRO XTS 2500/XTS 2500l Digital Portable Radios Basic Service Manual (Motorola part number 6816984H01), which uses the pass/fail service approach to radio problems.

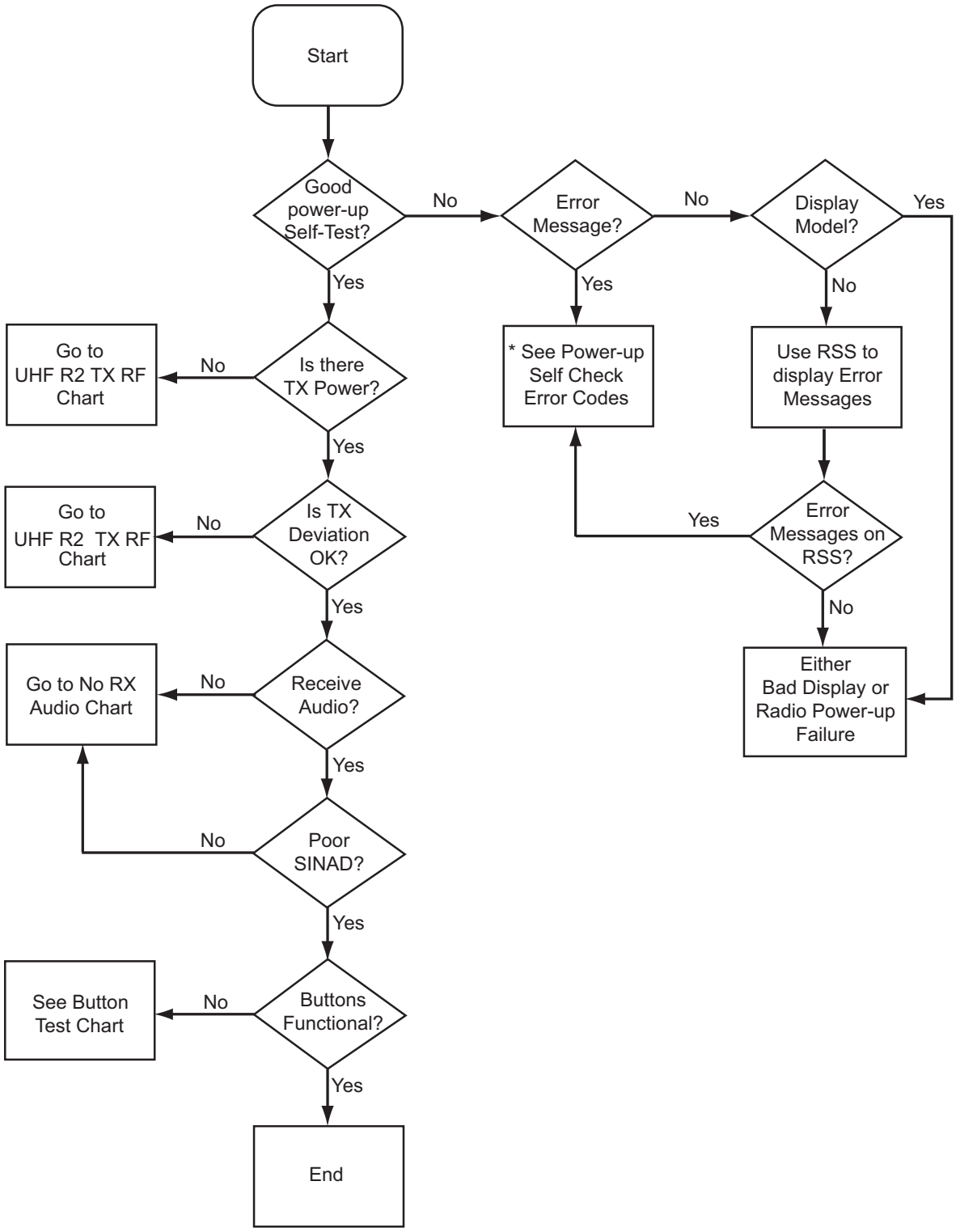
6.2 List of Troubleshooting Flowcharts

Most troubleshooting flowcharts 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 IC, continuity from the source IC should be checked before replacing the source IC.

Table 6-1. List of Troubleshooting Flowcharts

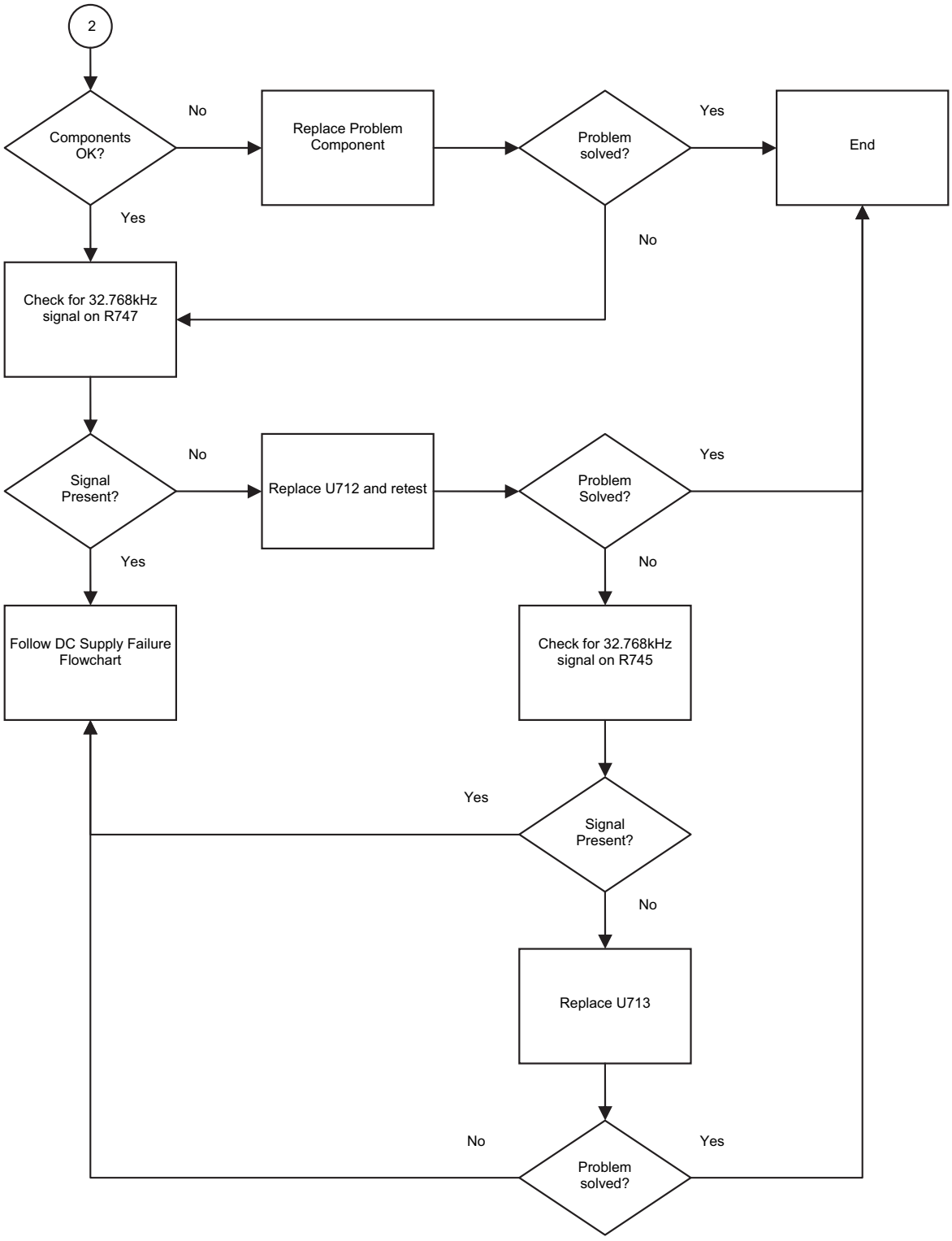
NOTE: µC is used in several of the following troubleshooting charts.
µC = microcontroller unit (MCU).

6.3 UHF Range 2 Radio Main Troubleshooting Chart

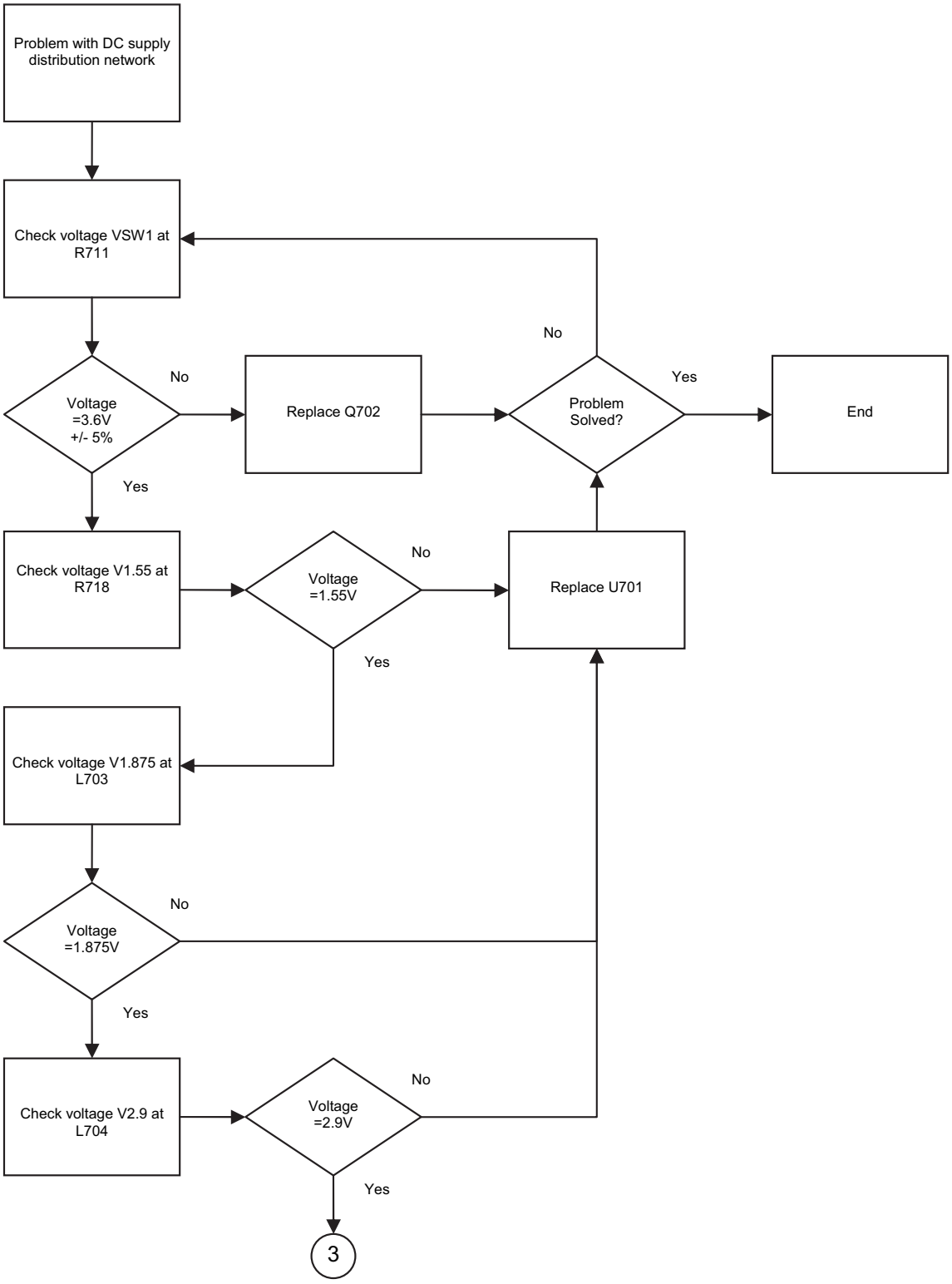


*Please see Table 5-2 on page 5-3.

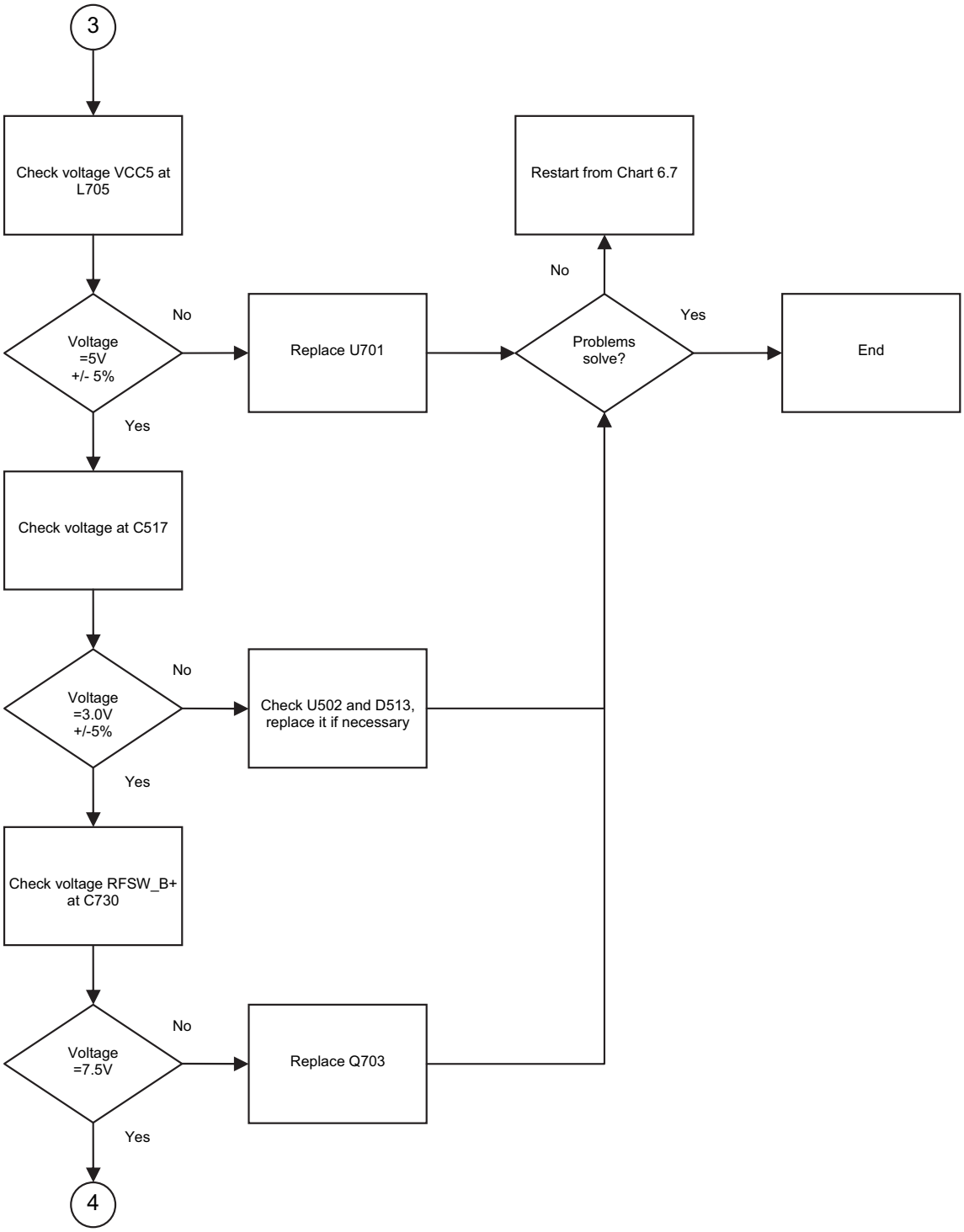
6.6 Radio Power-Up Fail Troubleshooting Chart (3 of 3)



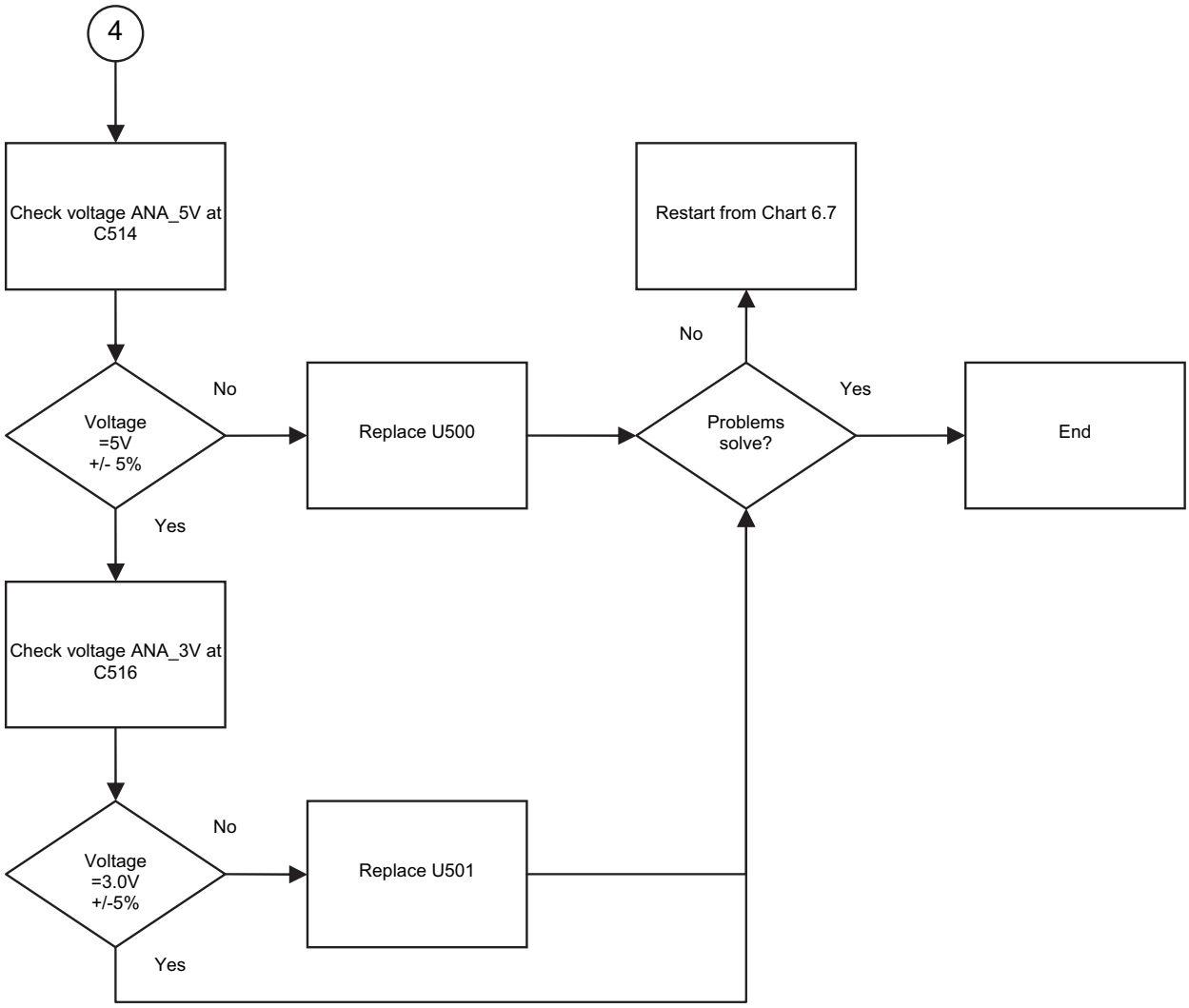
6.7 DC Supply Fail Troubleshooting Chart (1 of 3)



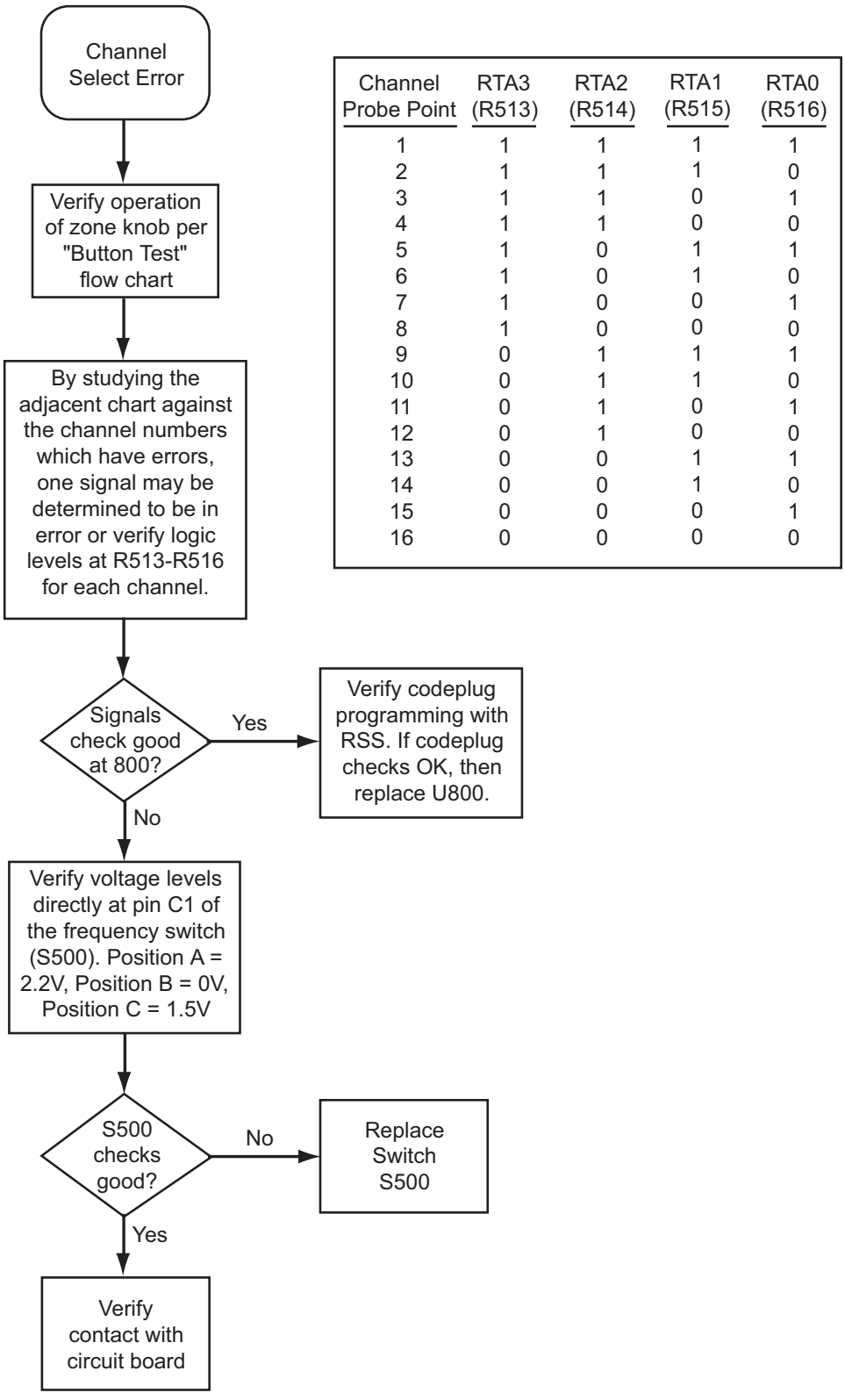
6.8 DC Supply Fail Troubleshooting Chart (2 of 3)



6.9 DC Supply Fail Troubleshooting Chart (3 of 3)



6.12 Zone/Channel Select Error Troubleshooting Chart



Channel Probe Point	RTA3 (R513)	RTA2 (R514)	RTA1 (R515)	RTA0 (R516)
1	1	1	1	1
2	1	1	1	0
3	1	1	0	1
4	1	1	0	0
5	1	0	1	1
6	1	0	1	0
7	1	0	0	1
8	1	0	0	0
9	0	1	1	1
10	0	1	1	0
11	0	1	0	1
12	0	1	0	0
13	0	0	1	1
14	0	0	1	0
15	0	0	0	1
16	0	0	0	0

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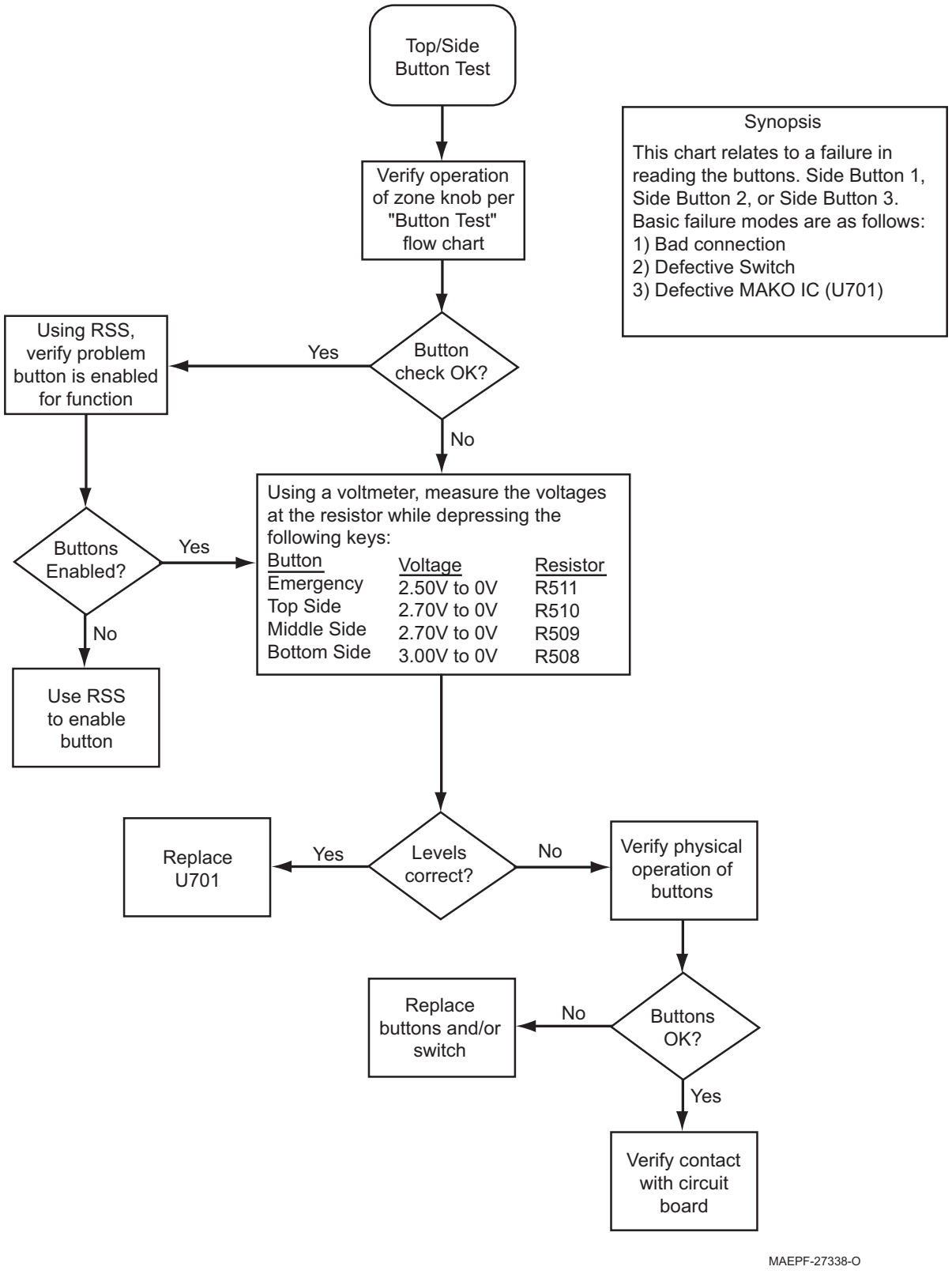
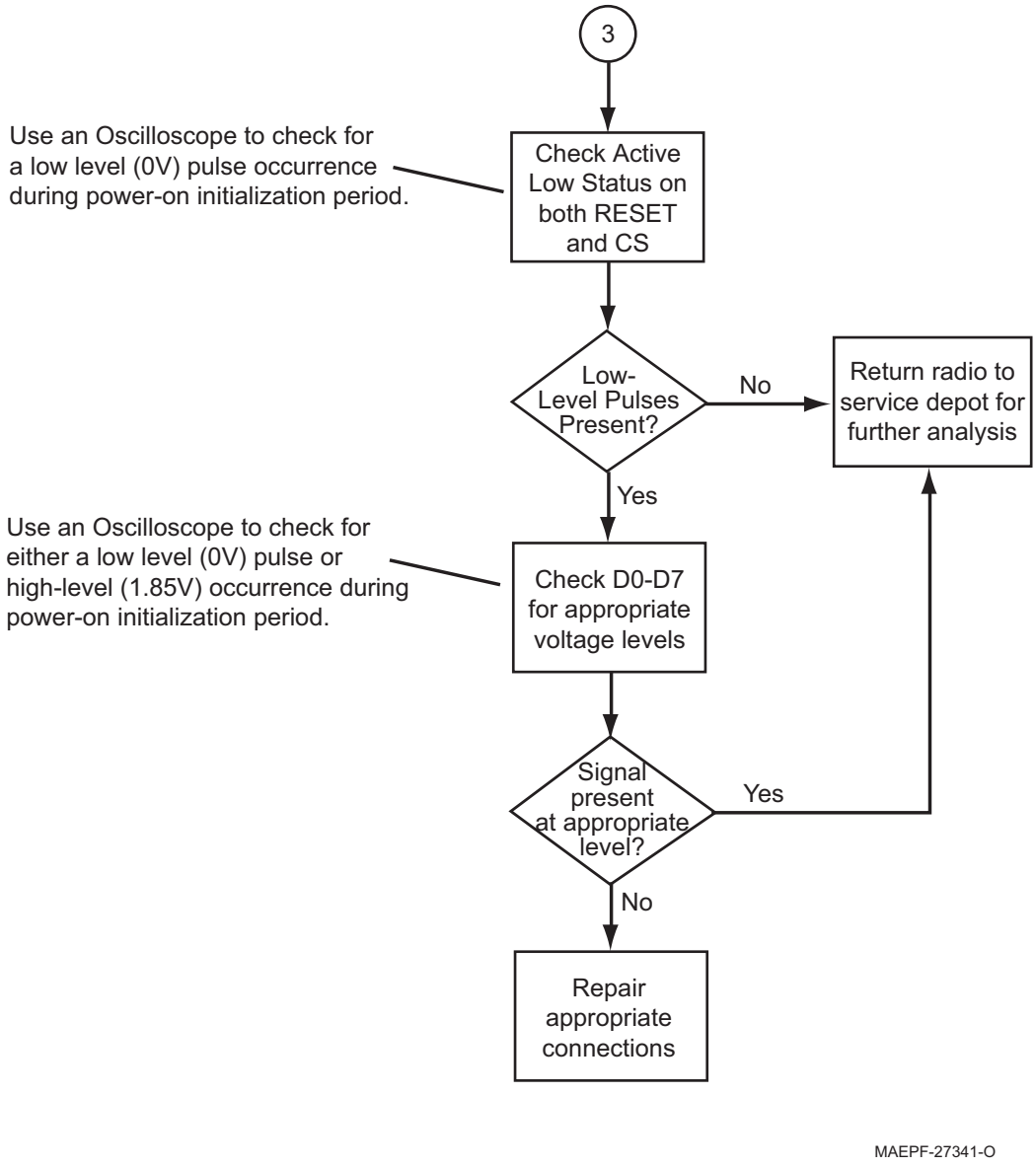
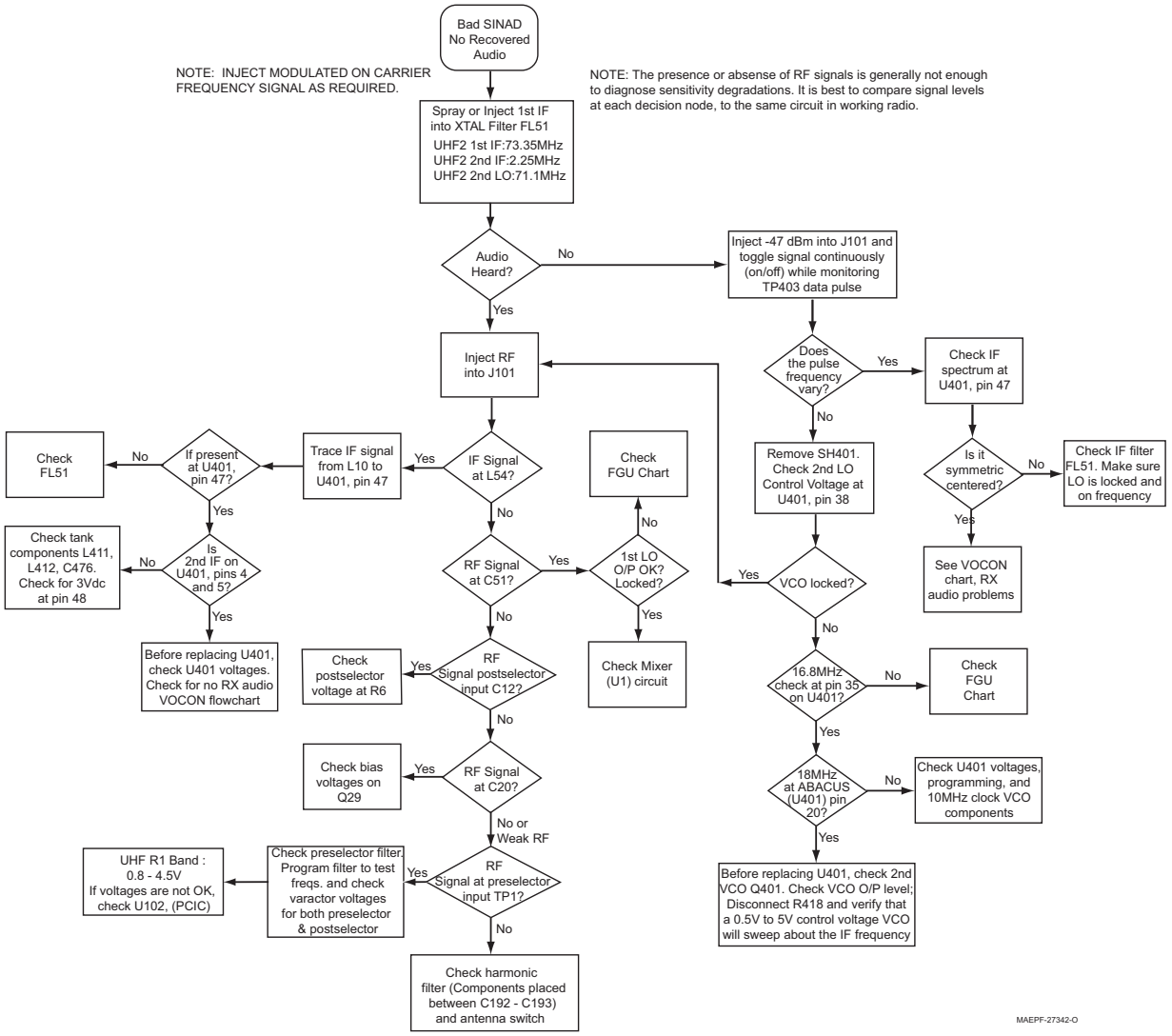
6.13 Top/Side Button Error Troubleshooting Chart



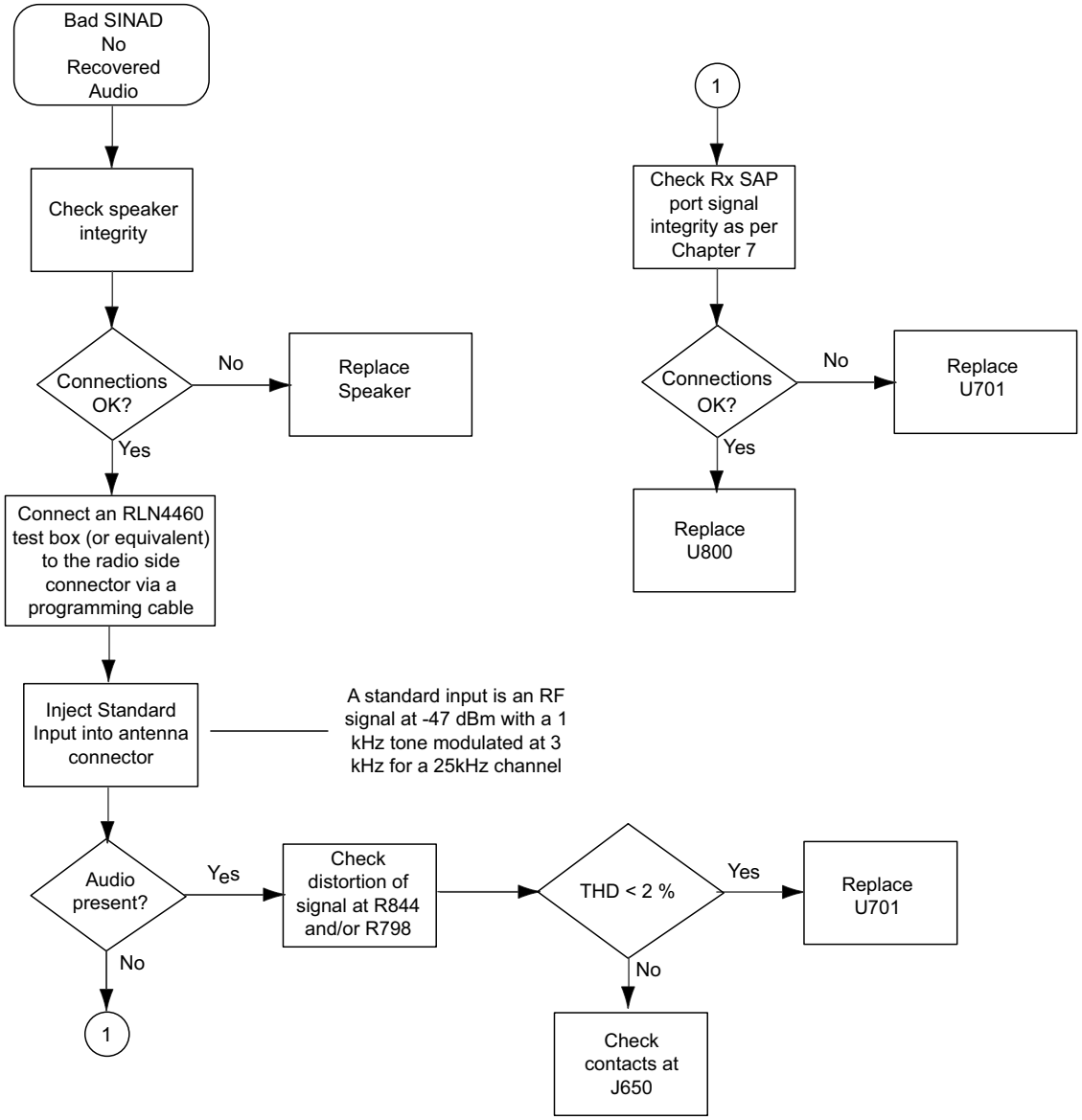
6.16 No Display Troubleshooting Chart (3 of 3)



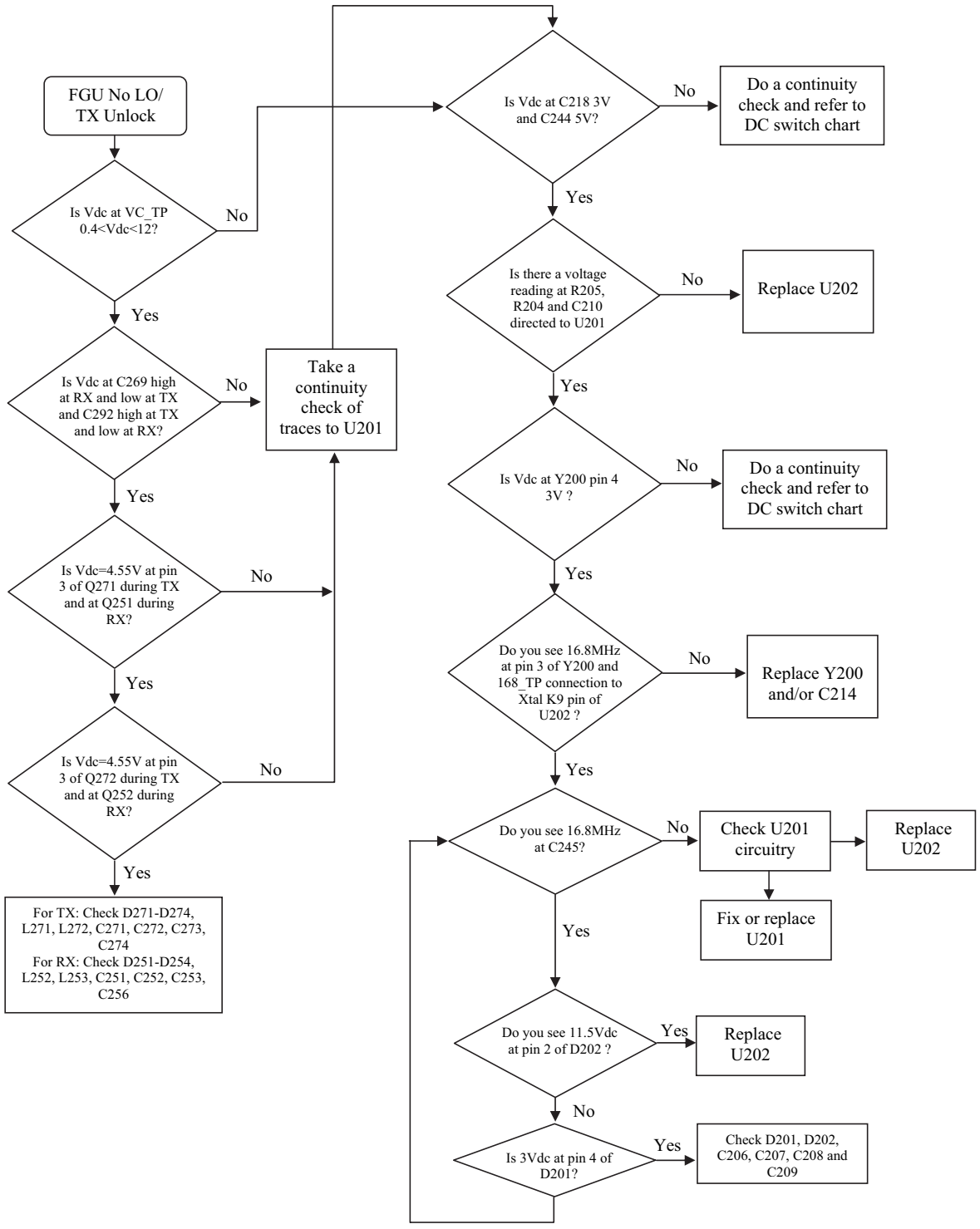
6.17 UHF Range 2 Receive RF Troubleshooting Chart



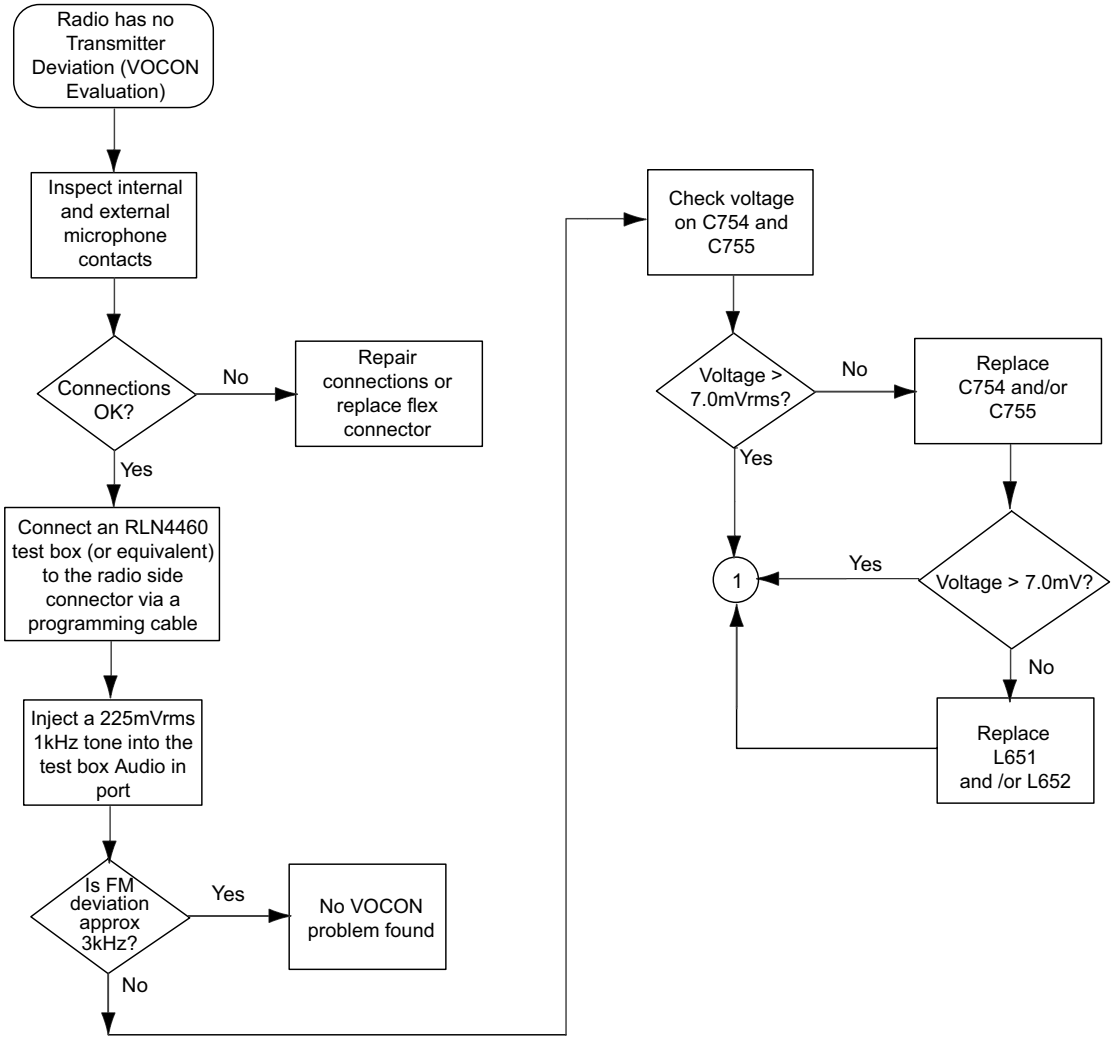
6.18 VOCON Receive Audio Troubleshooting Chart



6.19 UHF Range 2 Frequency Generation Unit Troubleshooting Chart



6.20 VOCON Transmit Audio Troubleshooting Chart (1 of 2)



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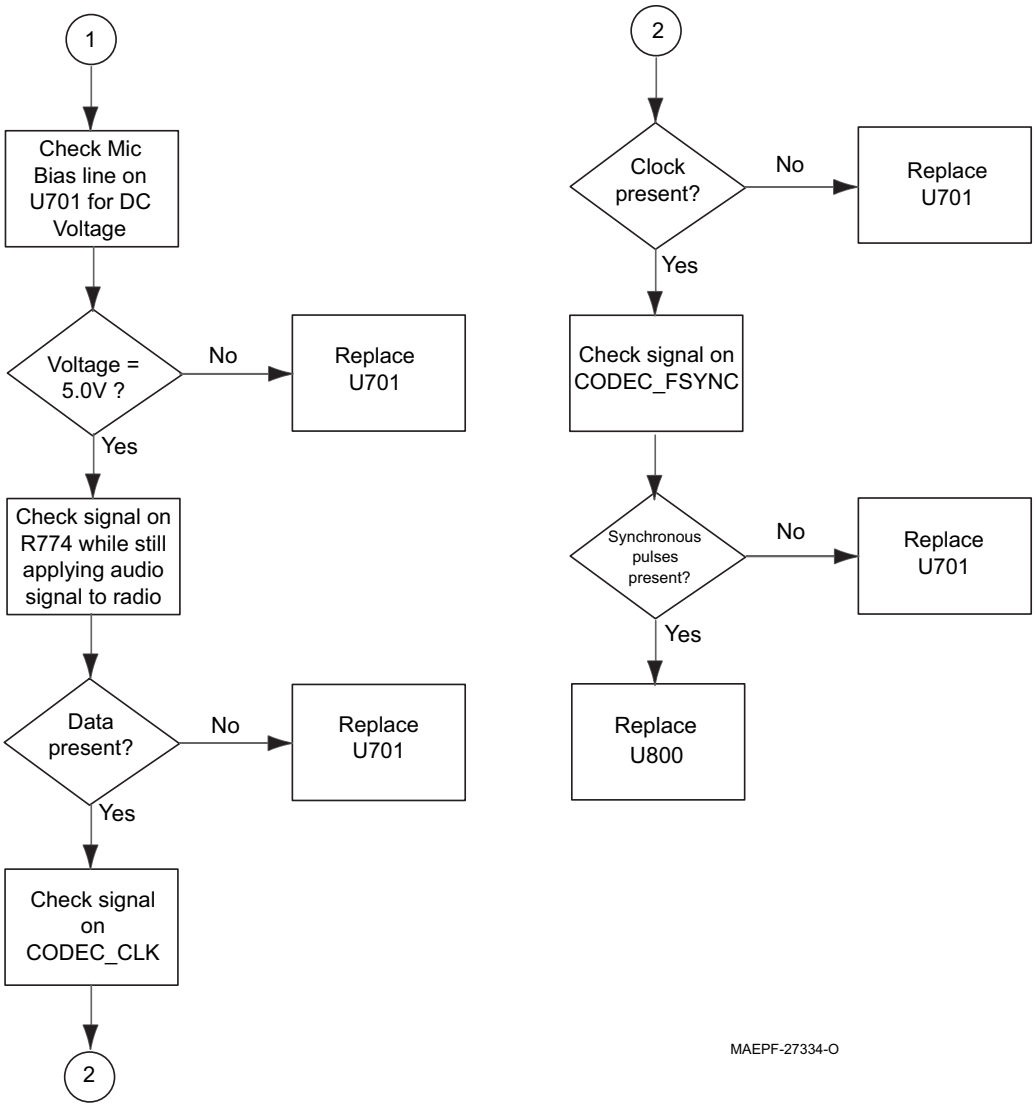
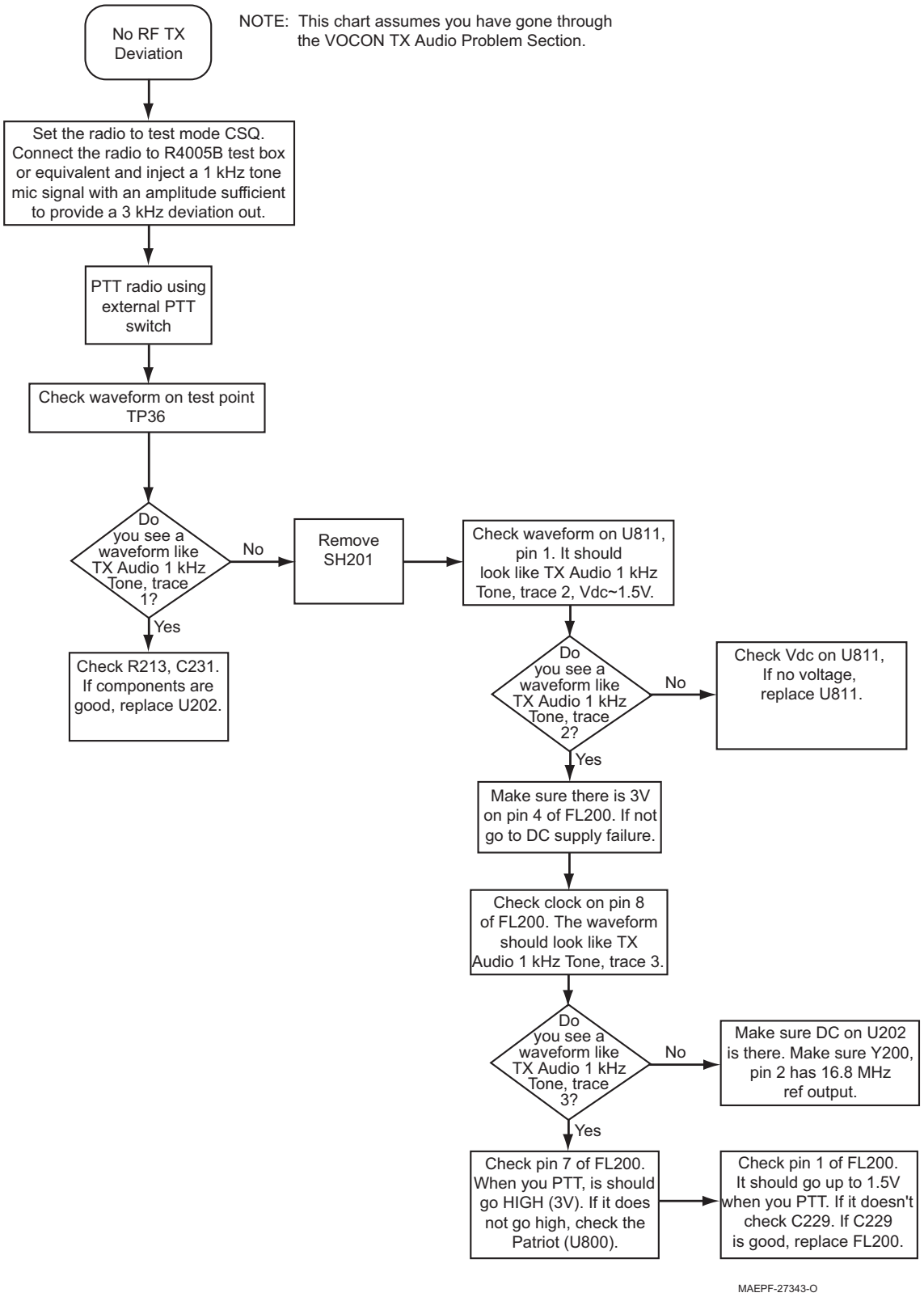
6.21 VOCON Transmit Audio Troubleshooting Chart (2 of 2)



6.22 No Transmit Deviation Troubleshooting Chart



6.23 UHF Range 2 Transmitter RF Troubleshooting Chart

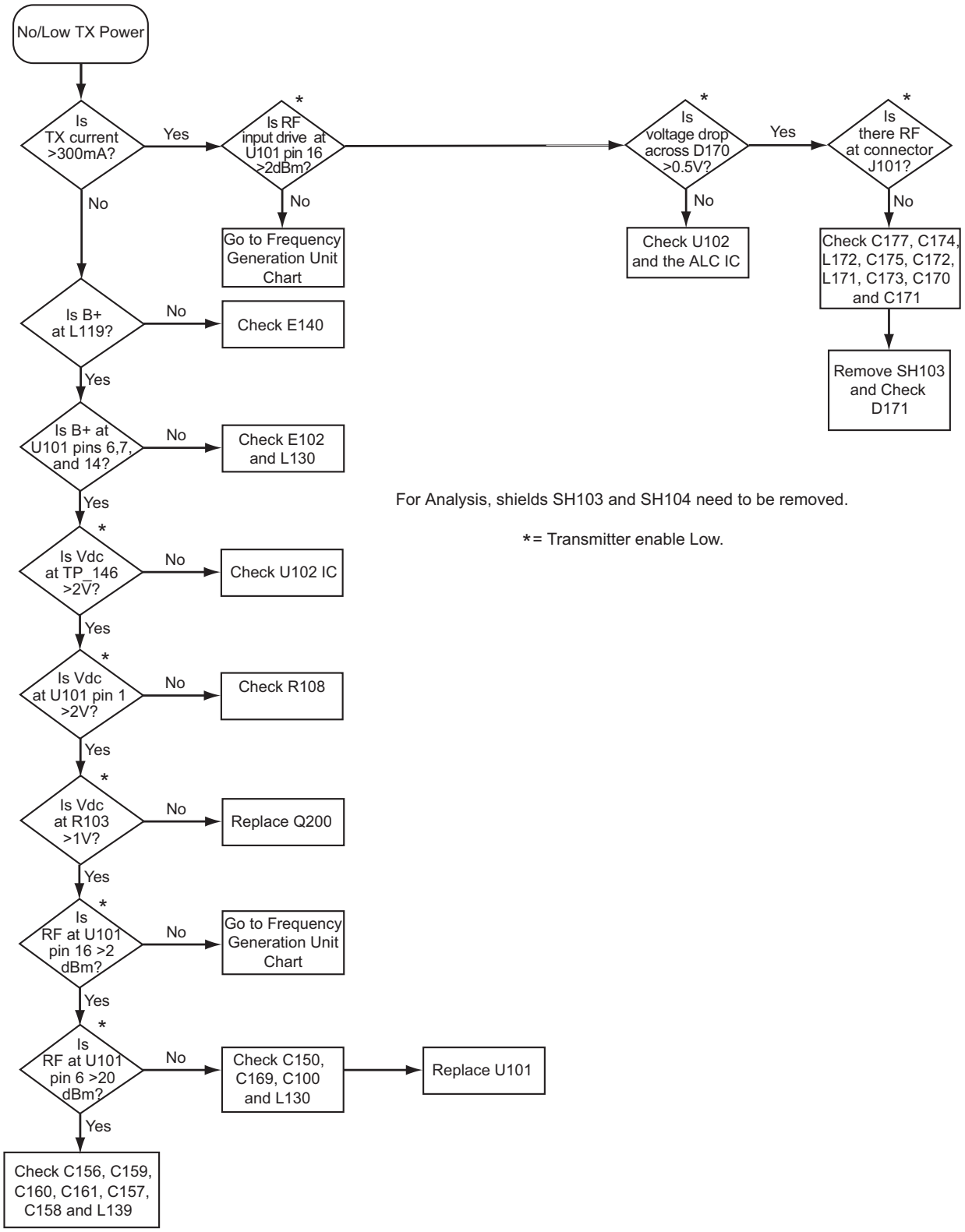


Table 7-2. RF Block Diagram Probe/Test Points

PP/TP	Name	Location	Under RF Shield?	Page
1	Antenna Input	J101, pin 5	No.	7-6
2	TX Signal at Harmonic Filter Input	C192	Yes.	7-7
3	Coupler RF Out	U103, pin 1	No.	7-8
4	TX Signal at PA	Q101, pin 3	No.	7-9
5	Coupler RF Feedback to PCIC	TP160	No.	7-10
6	PCIC Control Voltage	TP_146	No.	7-11
7	TX LO	R289	No.	7-12
8	Higher Level Voltage Multiplier	C210	Yes.	7-13
9	Superfilter Output	SF_TP	Yes.	7-14
11	Prescalar Input to FracN Synthesizer	TP23	Yes.	7-15
12	Reference Crystal Output	R729 and C726	No.	7-16
13	Mod In	TP36	No.	7-17
14	1st LO Control Voltage	VC_TP	No.	7-18
15	VCO Output	R266(Rx), R289(Tx) and TP23(prescaler)	Yes.	7-19
17	Frequency Out (16.8 MHz)	16out	No.	7-20
18	RX RF Input at Antenna Switch	D20, Pin 1	No.	7-21
20	Preselector Tuning Voltage	R1 and R2	No.	7-23
22	Analog 5V	U500, pin 5	No.	7-24
23	Preselector 1 Output	C5	Yes.	7-25
24	Low-Noise Amplifier Output	C12	Yes	7-26
25	Preselector 2 Output	C18	Yes	7-27
26	Mixer Out (IF)	L72	Yes.	7-28
27	Crystal Filter Out	L55	Yes	7-29
28	Abacus Analog 3V	U501, pin 5	No.	7-30
29	2nd LO Control Voltage	U401, pin 38	Yes.	7-31
30	2nd LO VCO Buffer Output	C433	Yes.	7-32
31	Analog 5V	U500, pin 5	No.	7-33
32	Abacus Digital 3V	U502, pin 5	No.	7-34
33	SPI Data	R802	No.	7-40
34	SPI CLK	R803	No.	7-41
35	Universal Chip Select	U102, pin 29	No	7-42
36	Abacus Chip Select	U401, pin 25	Yes.	7-43
37	RX SSI Data	SSI_D	No.	7-44

Table 7-2. RF Block Diagram Probe/Test Points (Continued)

PP/TP	Name	Location	Under RF Shield?	Page
38	RX SSI Clock	SSI_CLK	No.	7-45
39	RX SSI Frame Sync	SSI_FS	No.	7-46

PP = Probe Point
TP = Test Point

Note: For test/probe points indicated with the SH prefix, use an HP 85024A High Frequency Probe to detect a signal. The probe should be placed in center of the hole located on the top of the shield. Make sure the probe does not touch the shield or any other components.

7.4 Main Circuit Board RF Shield Locations

Viewed from Side 1

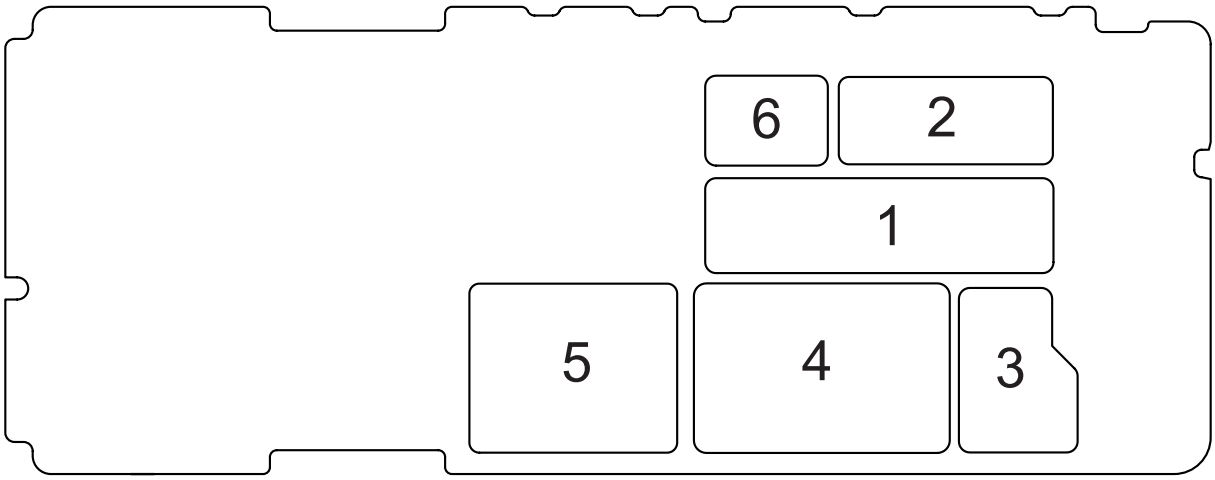


Table 7-3. Main Circuit Board Side 1 RF Shields

Item Number	Reference Number	Motorola Part Number	Description
1	SH51	2686700Z02	Shield, Mixer
2	SH402	2686698Z02	Shield, 2nd LO
3	SH102	2686701Z02	Shield, Harmonic Filter
4	SH101	2686702Z02	Shield, TX Driver
5	SH251	2616554H01	Shield, VCO Top
6	SH52	2686699Z02	Shield, Crystal IF

Viewed from Side 2

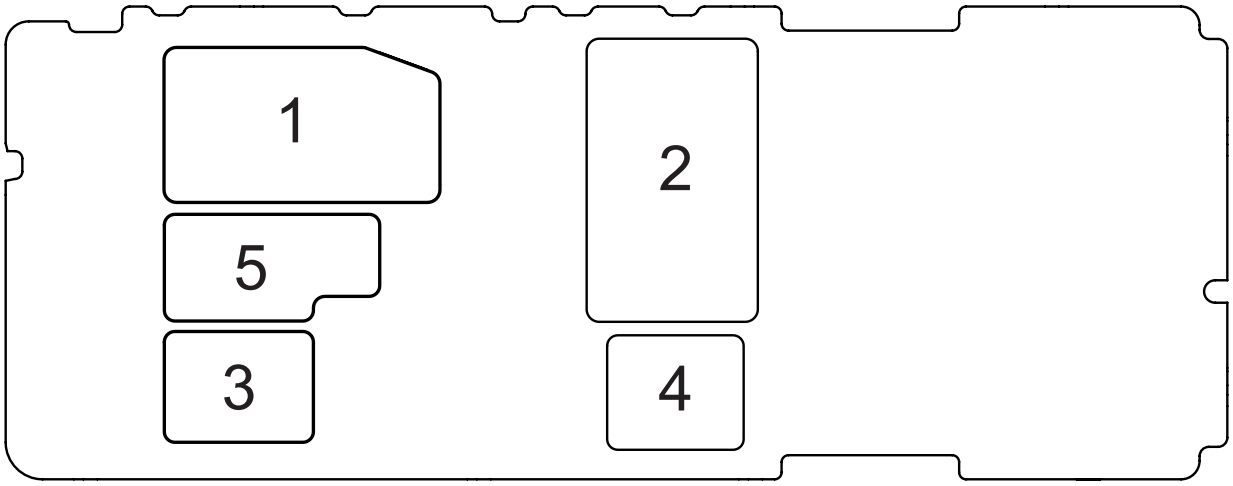
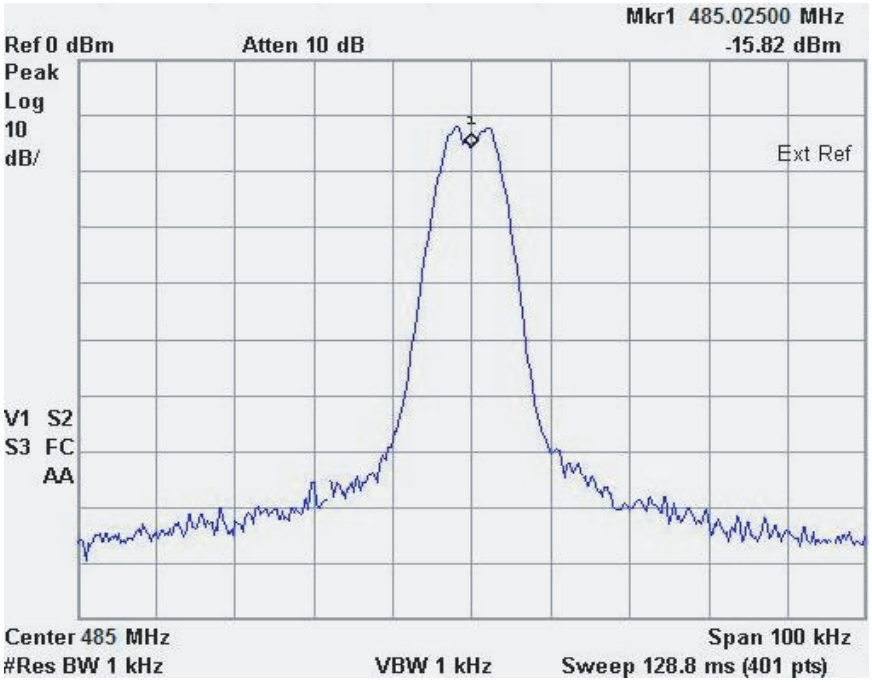
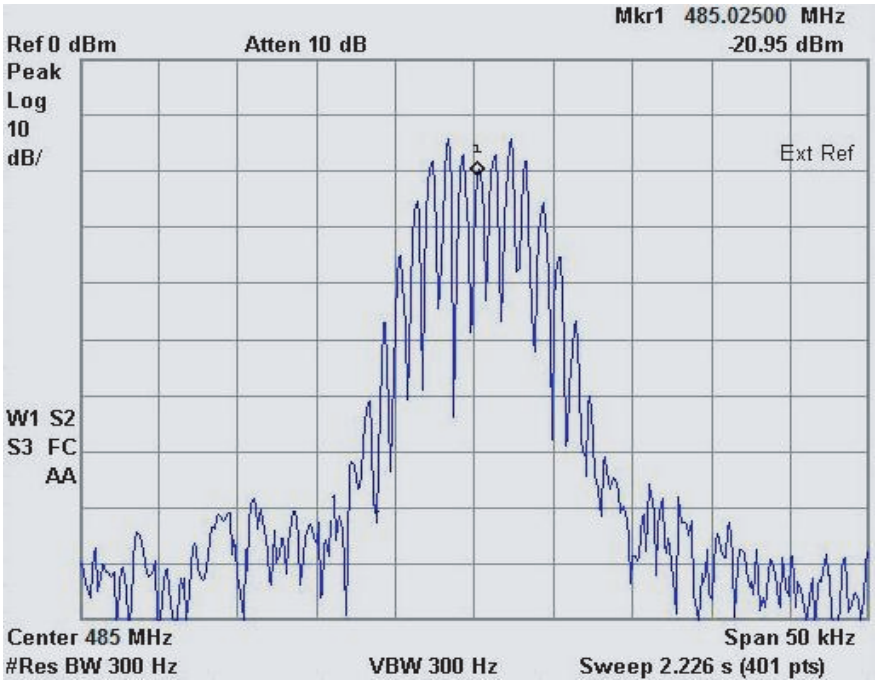


Table 7-4. Main Circuit Board Side 2 RF Shields

Item Number	Reference Number	Motorola Part Number	Description
1	SH401	2686706Z02	Shield, ABACUS
2	SH201	2686705Z02	Shield, Synthesizer
3	SH103	2686708Z02	Shield, Coupler Bottom
4	SH252	2616559H01	Shield, VCO Bottom
5	SH1	2686707Z02	Shield, Front End Filter

7.5 PP1 Antenna Input

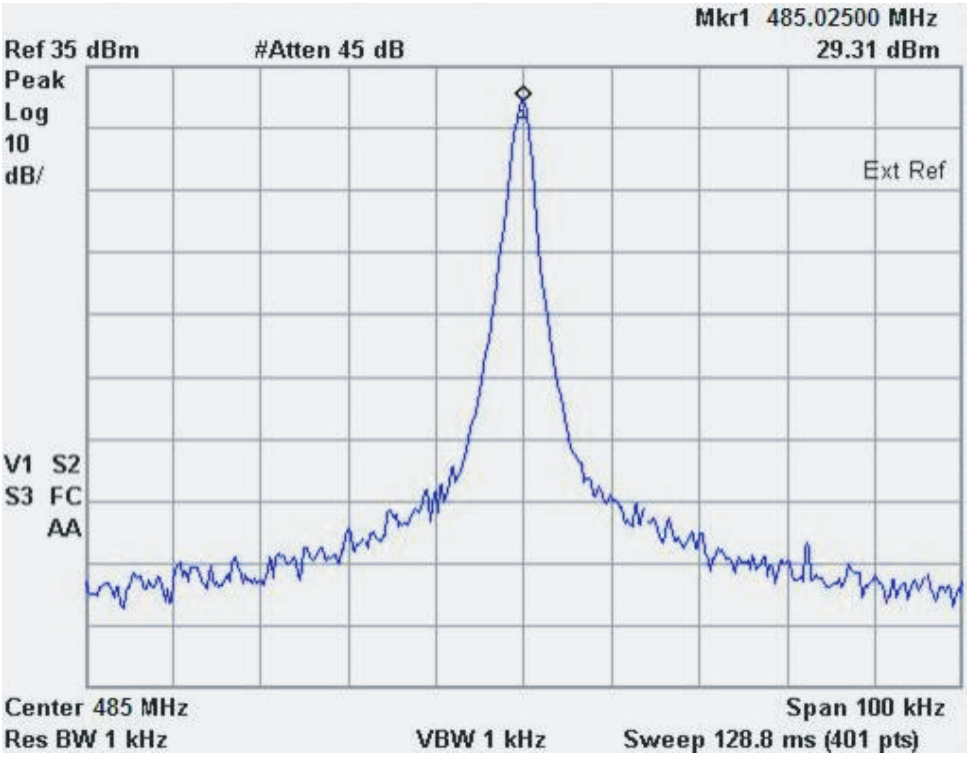




Probe point: J101, pin 5.

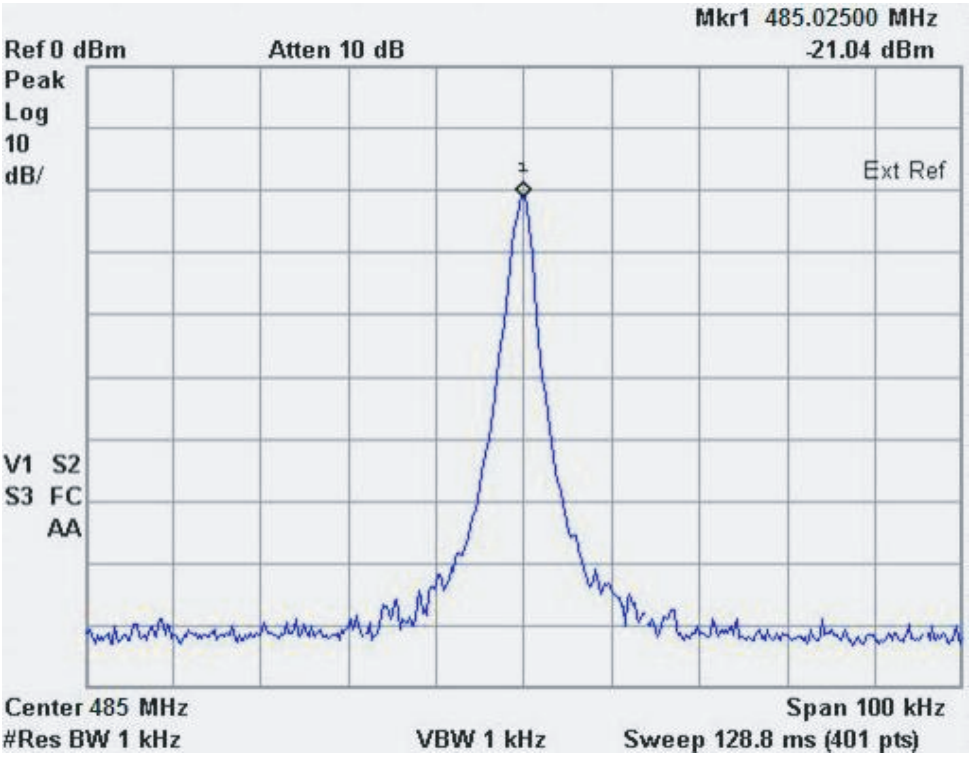
Typical RX signal with 1 kHz modulation. Display shows modulation components of carrier.

7.6 PP2 TX Signal at Harmonic Filter Input



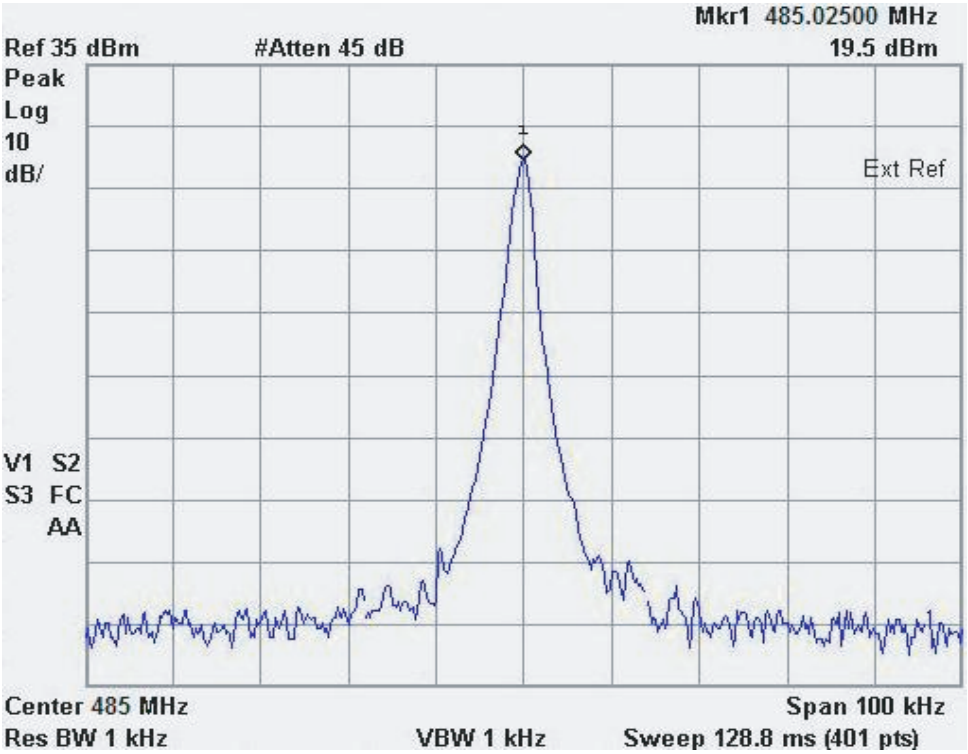
Probe point: C180 (located under shield).

7.7 PP3 Coupler RF Out



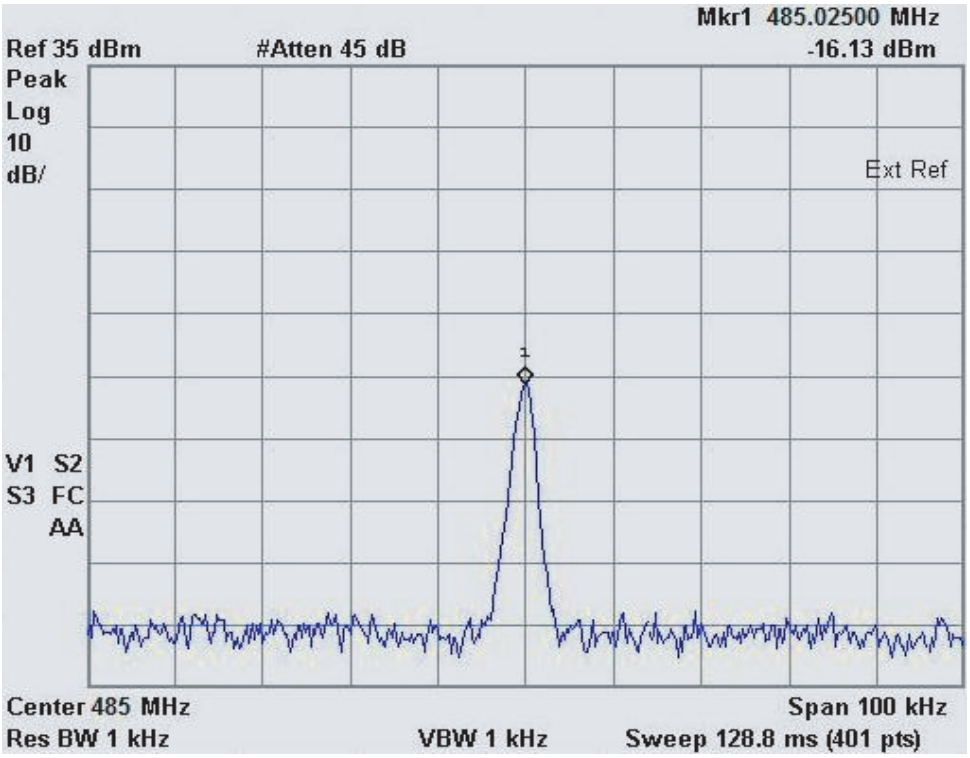
Probe point: U103, pin 1.

7.8 PP4 TX Signal at PA



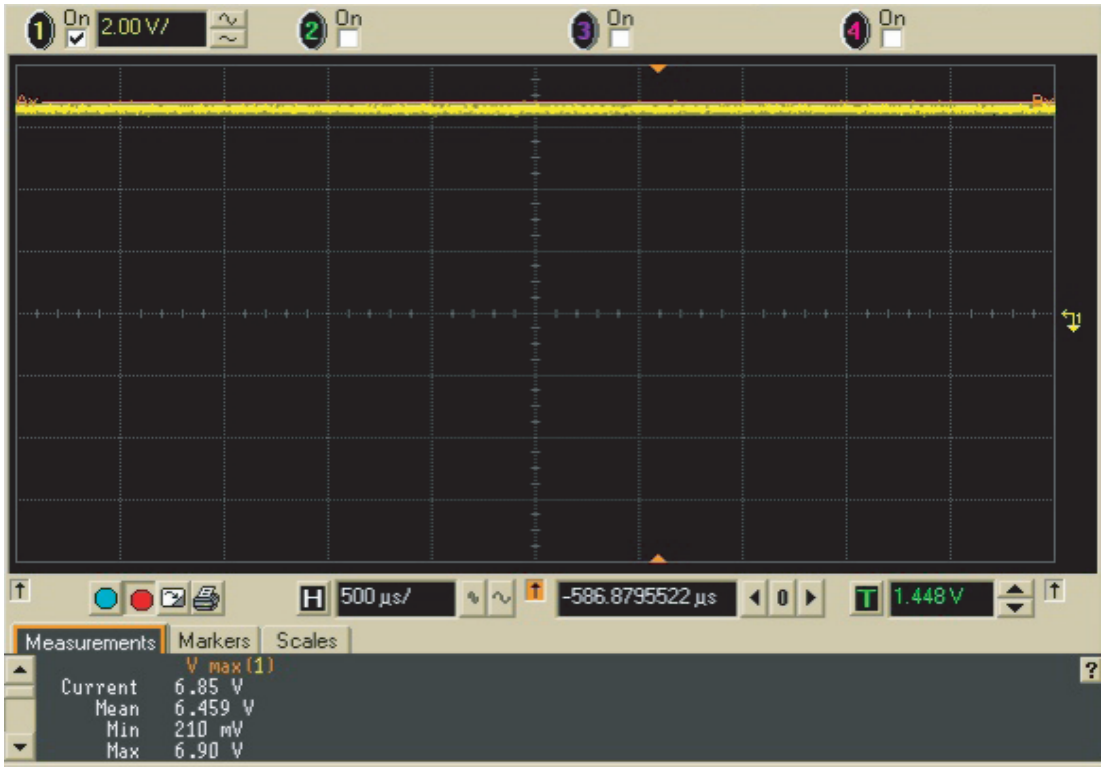
Probe point: Q101, pin 2.

7.9 TP5 Coupler RF Feedback to PCIC



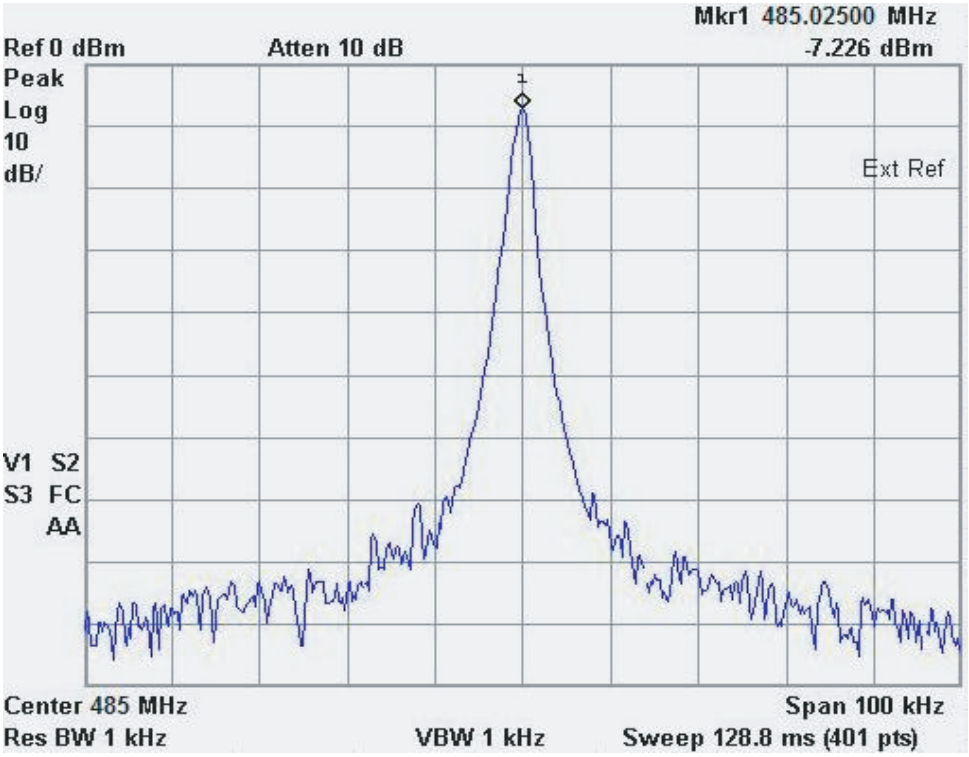
Test point: TP_160.

7.10 TP6 PCIC Control Voltage



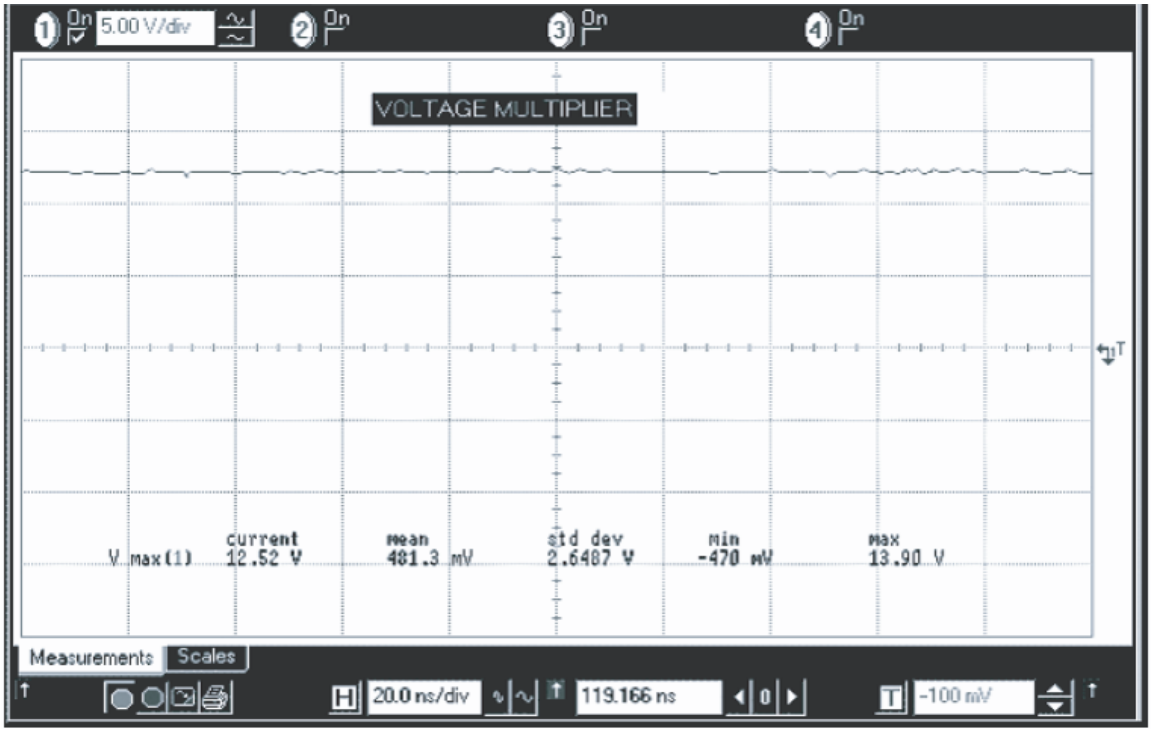
Test point: TP146.

7.11 PP7 TX LO



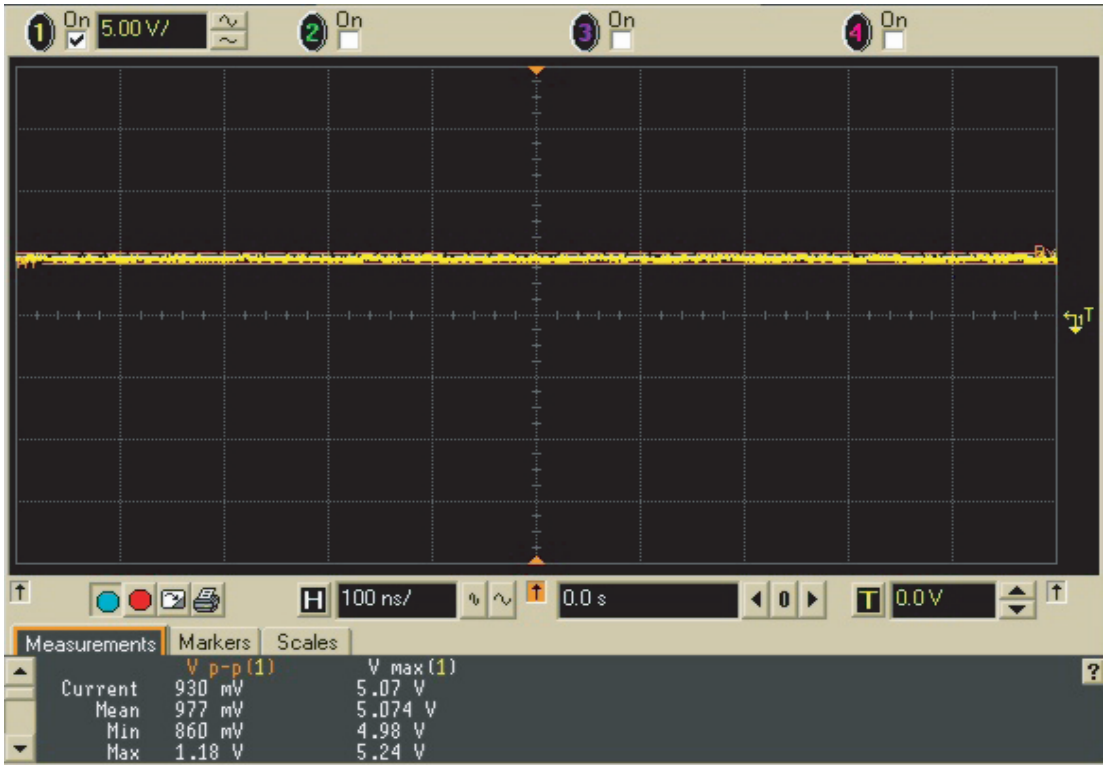
Probe point: TP299.

7.12 PP8 Higher Level Voltage Multiplier



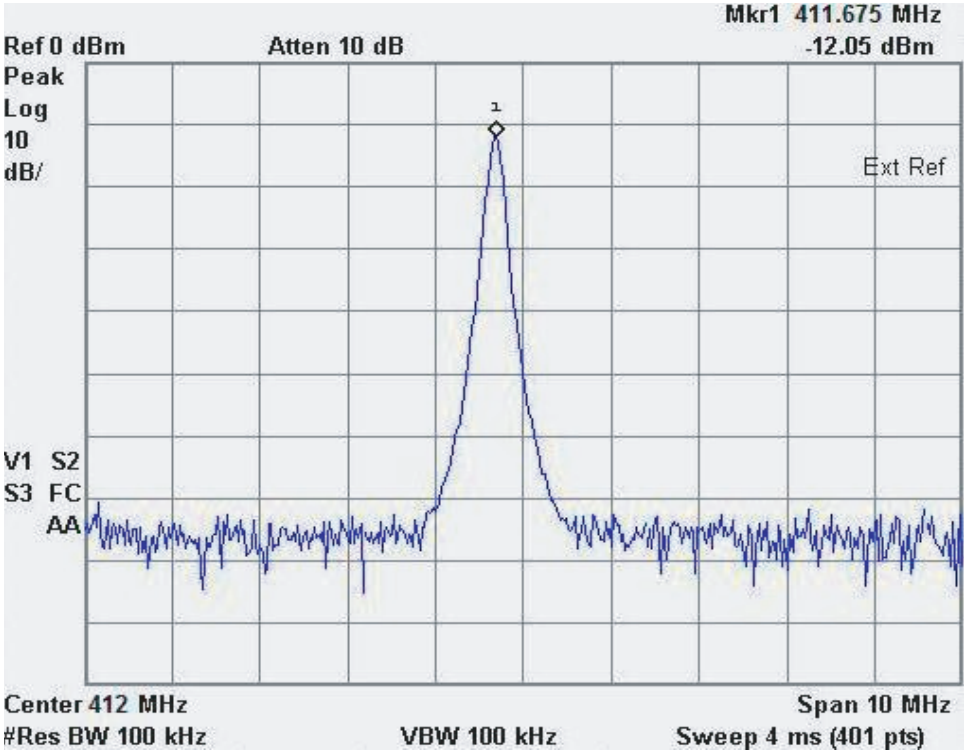
Probe point: C210 (located under shield).

7.13 PP9 Superfilter Output



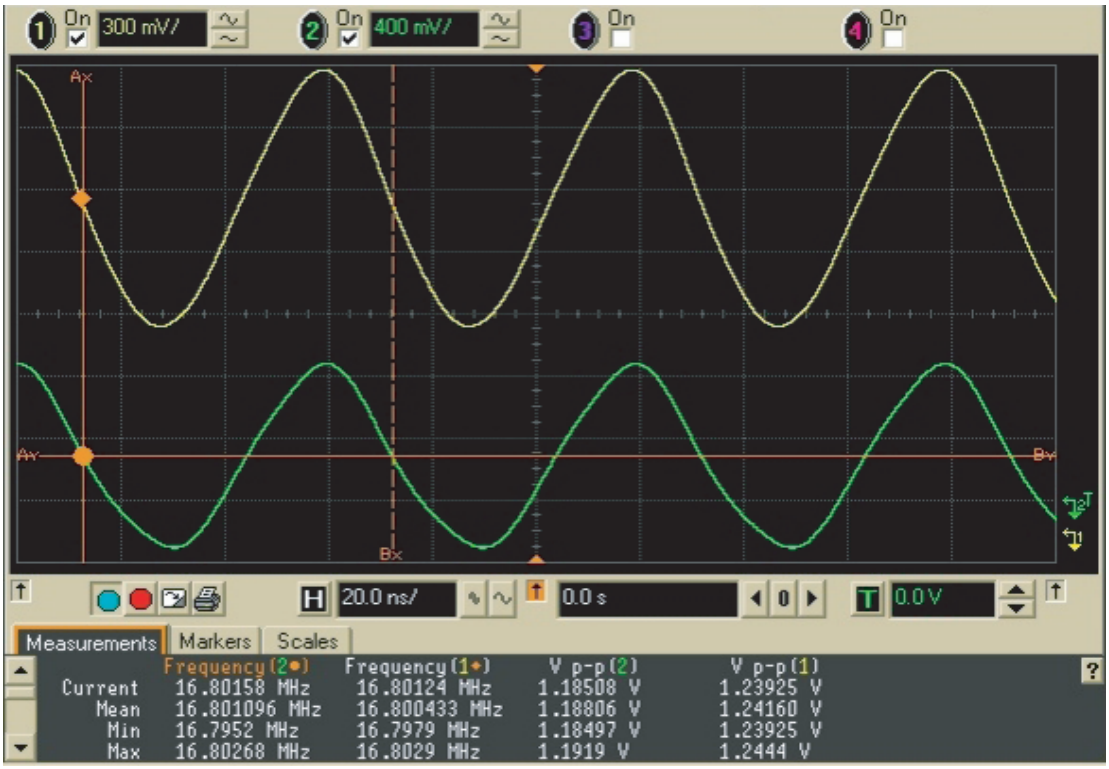
Probe point: SF_TP (located under shield).

7.14 PP11 Prescalar Input to FracN Synthesizer



Probe point: TP23 (located under shield).

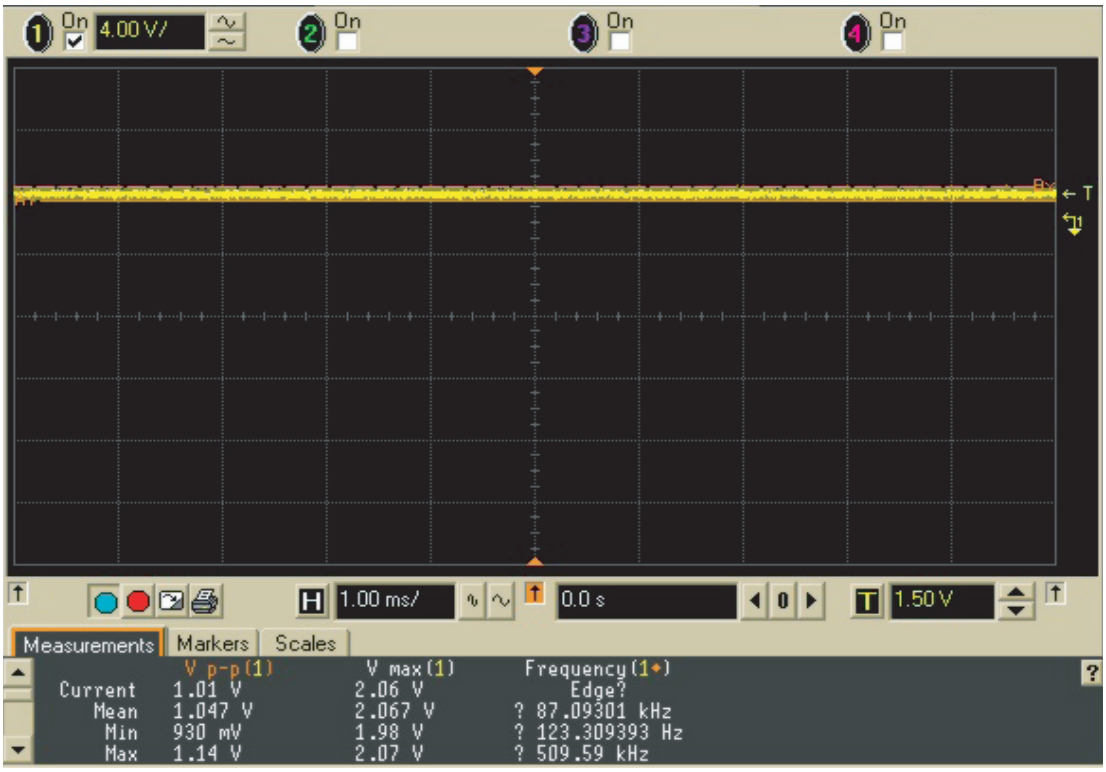
7.15 PP12 Reference Crystal Output



Probe point: R729 (16_8_filtered)

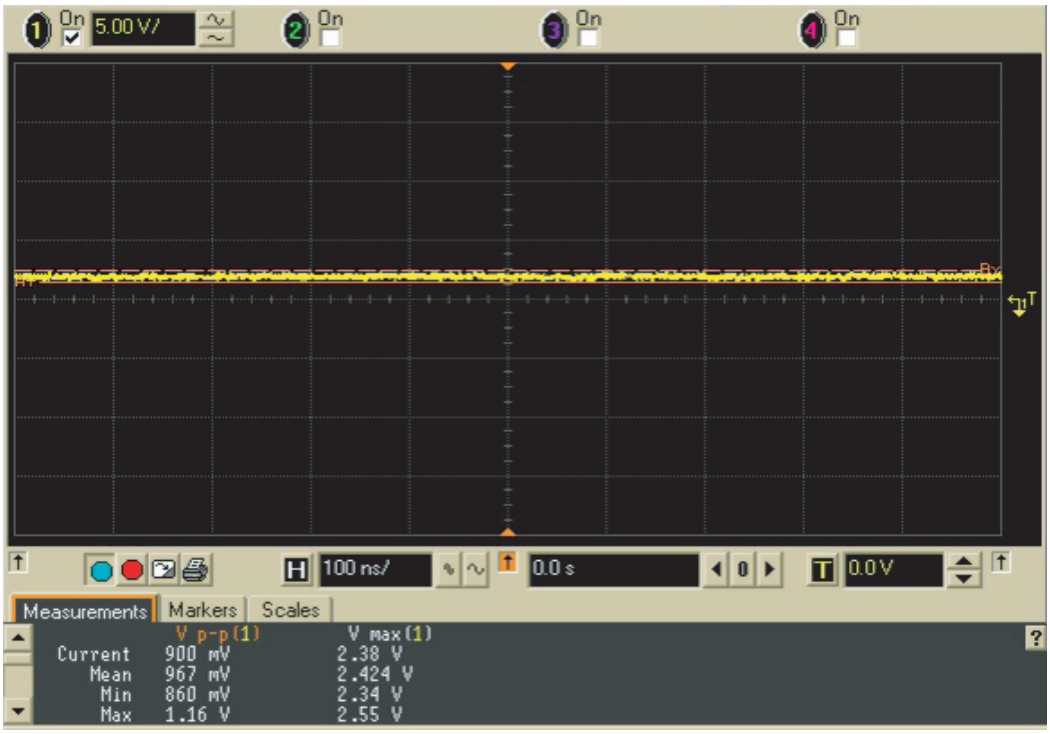
C726 (16_8MHZ).

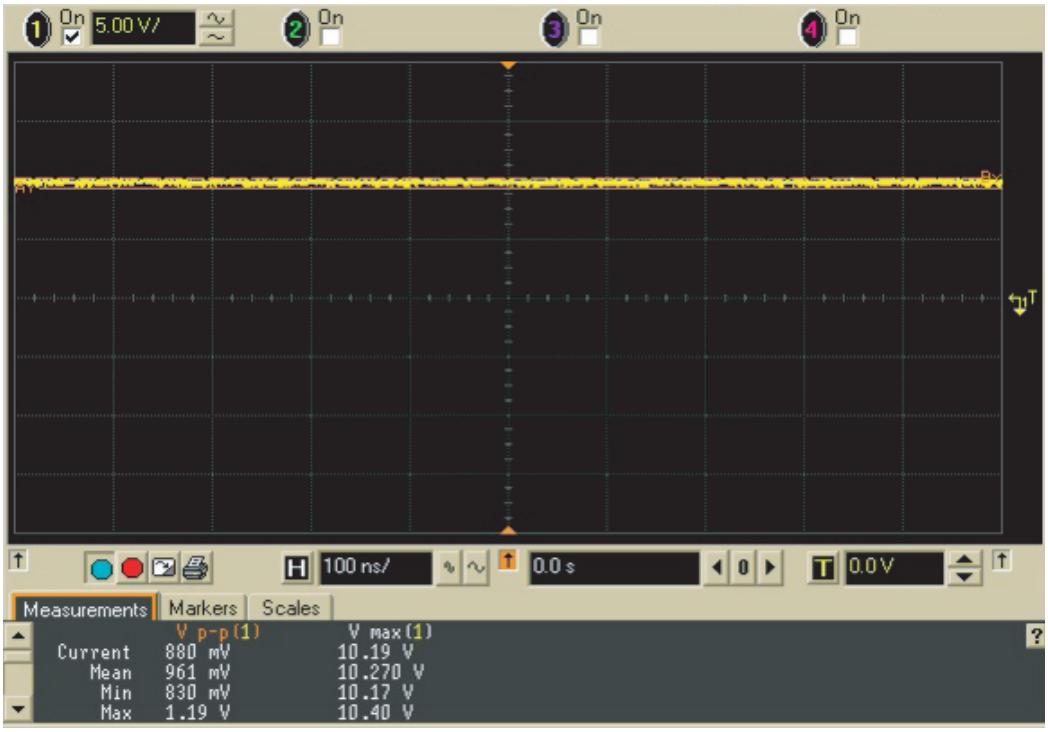
7.16 TP13 Mod In



Test point: TP36.

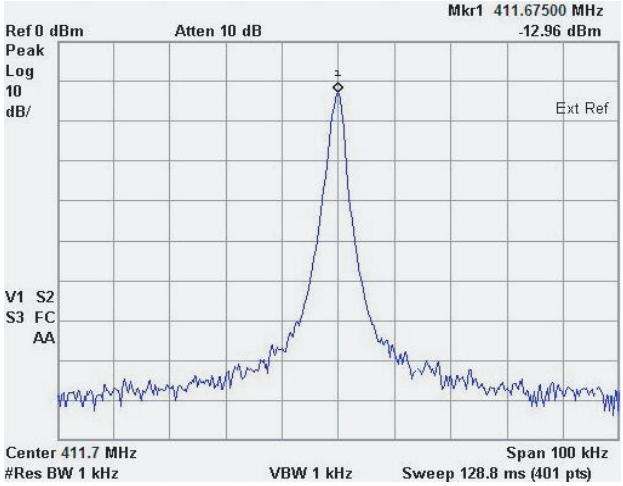
7.17 TP14 1st LO Control Voltage

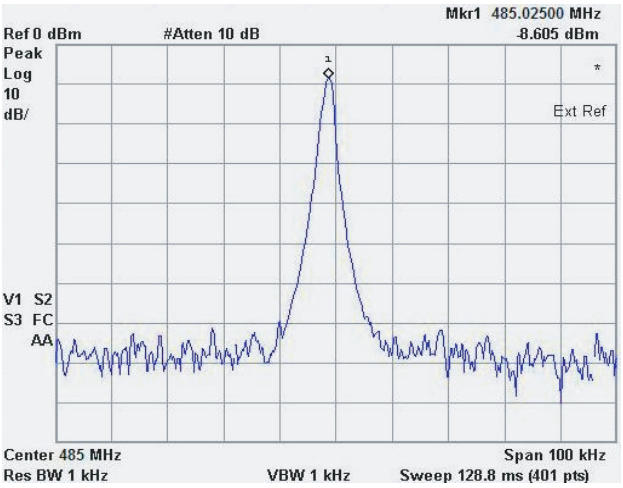


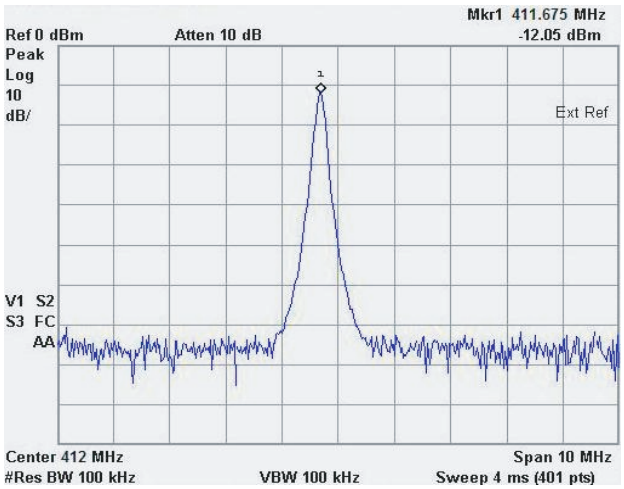


Test point VC_TP

7.18 PP15 VCO Output



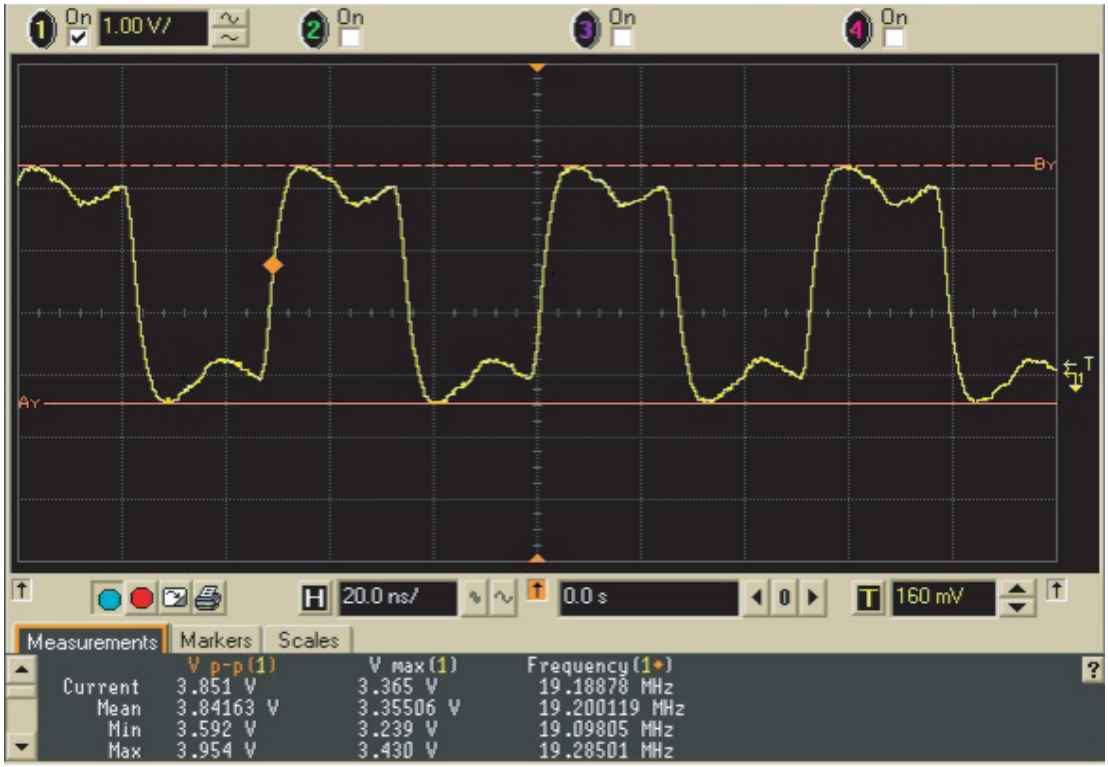




Probe point:TP298 for LO Output
TP299 for TX Output
TP23 for Preselector Output (located under shield).

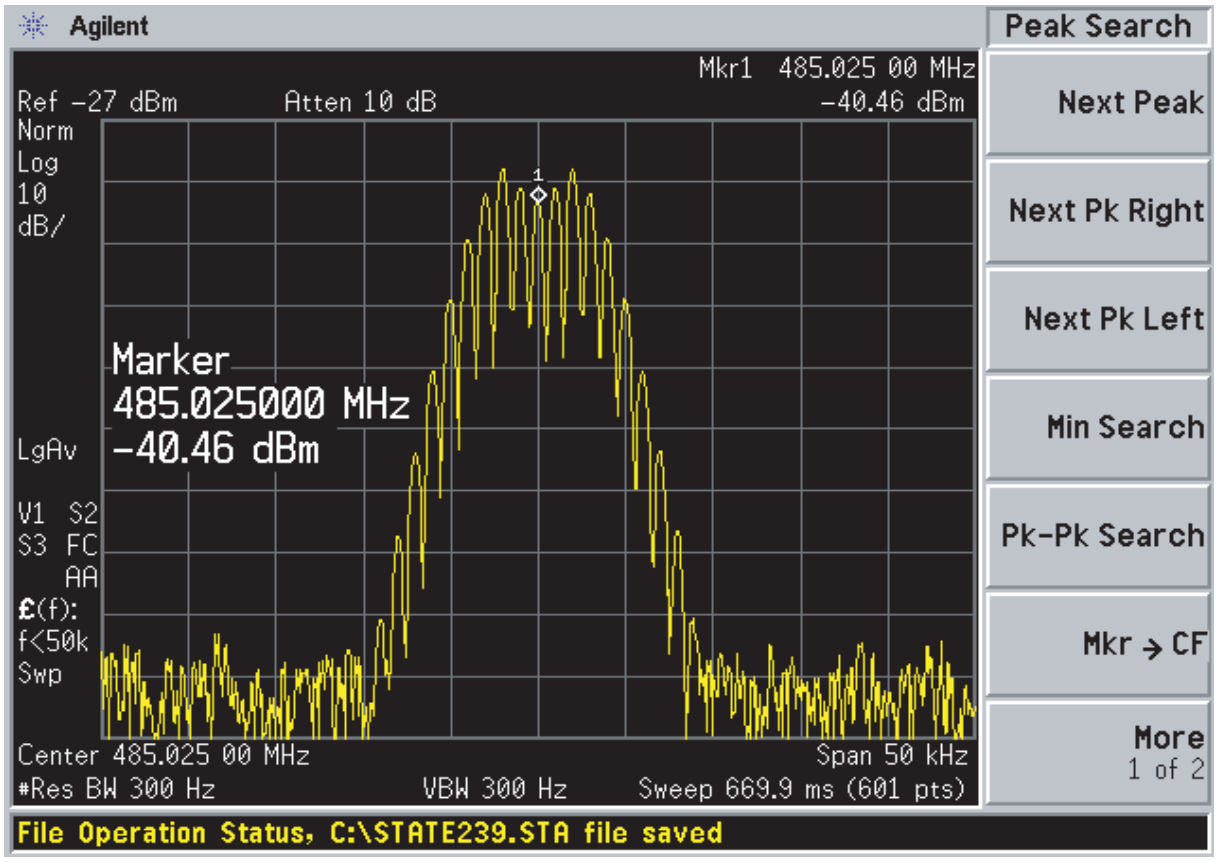
Probe point: C261 (located under shield).

7.19 PP17 Frequency Out (19.2 MHz)



Probe point: 16out (Test Point).

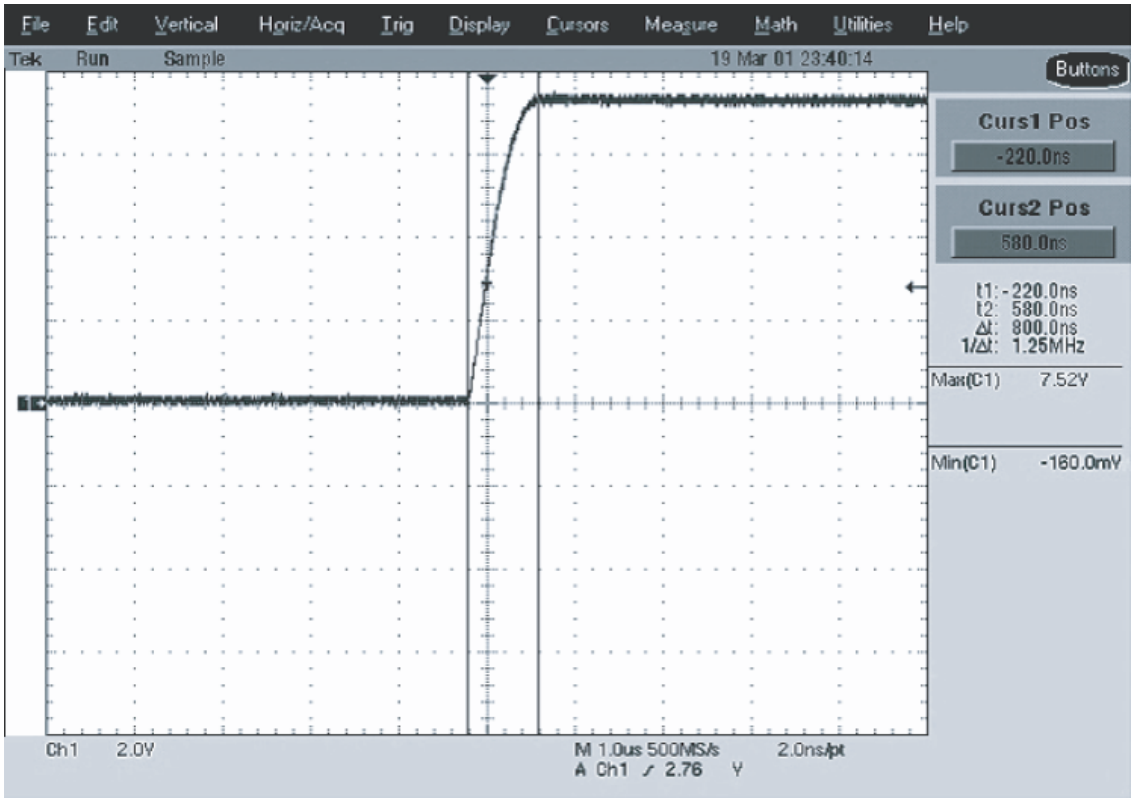
7.20 PP18 RX RF Input at Antenna Switch



Probe point: C1.

Typical RX signal with 1 kHz modulation. Display shows modulation components of carrier.

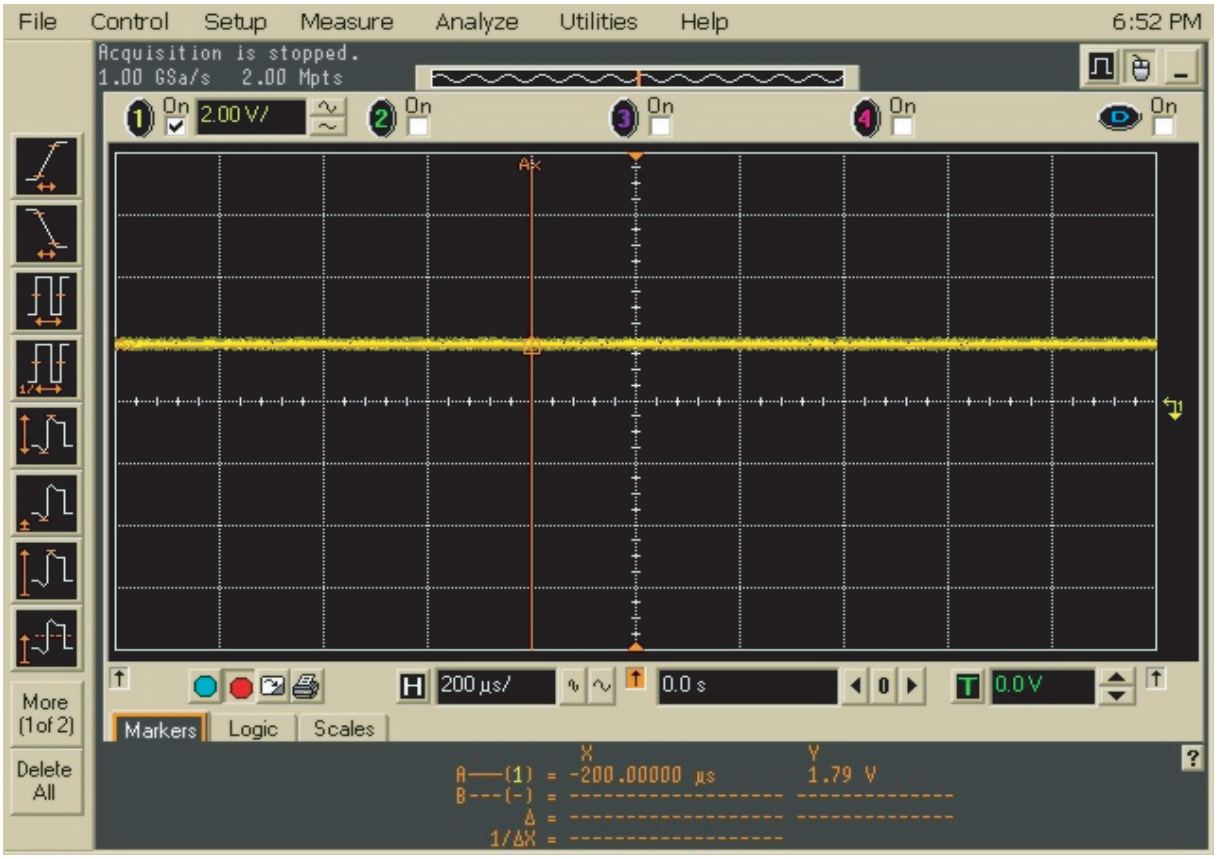
7.21 PP19 Antenna Switch Bias



Probe point: U103, pin 1.

Display shows transition between RX mode (low) and TX mode (high).

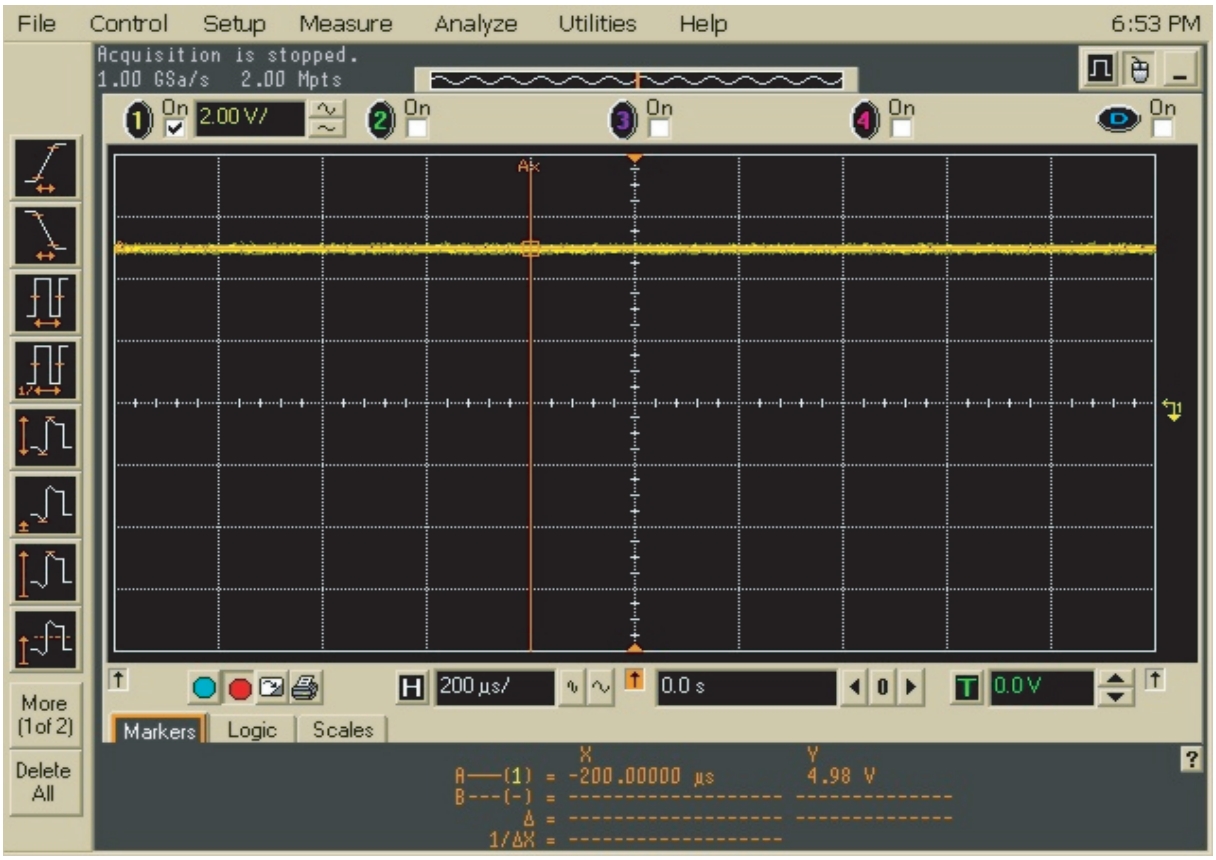
7.22 PP20 Preselector Tuning Voltage



Probe point: C15 and C46.

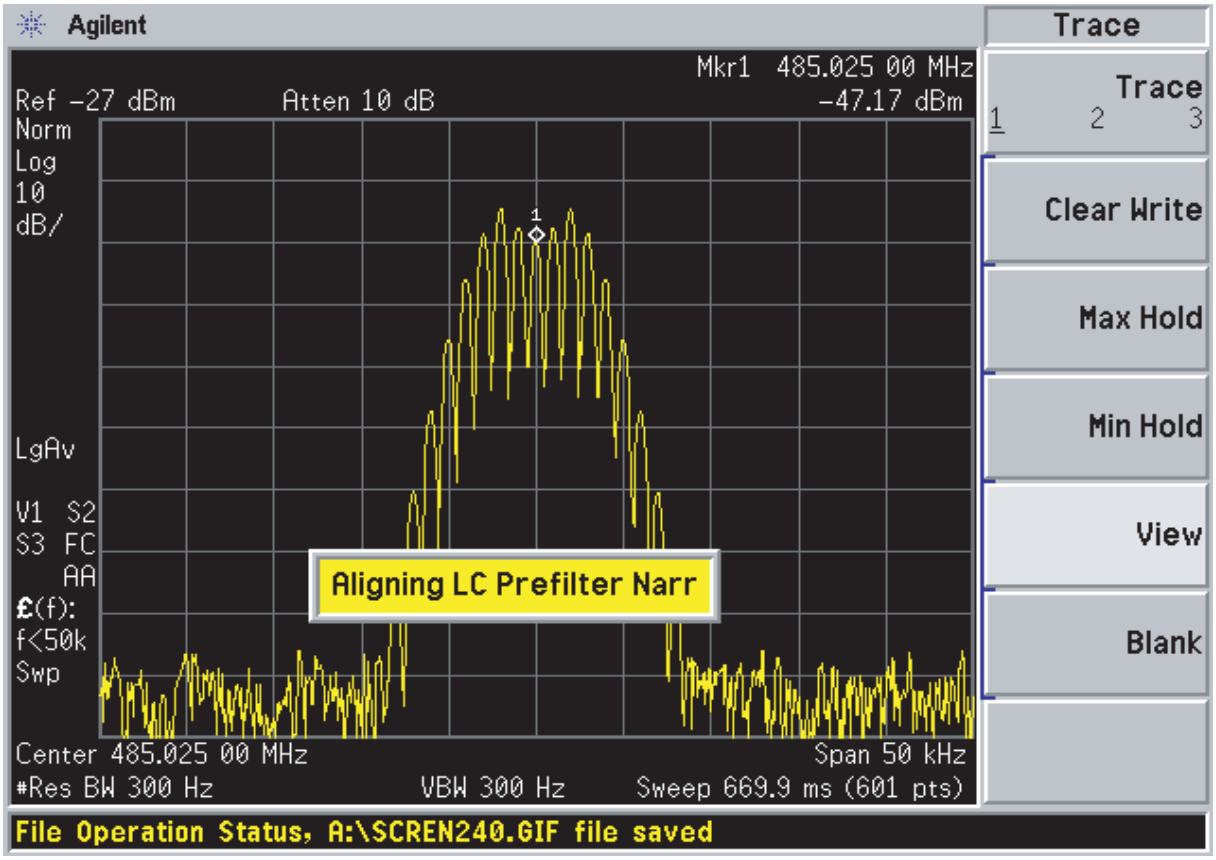
This is a typical value when tuned to receive at 136.075MHz.

7.23 PP22 Analog 5V



Probe point: U500, pin 5.

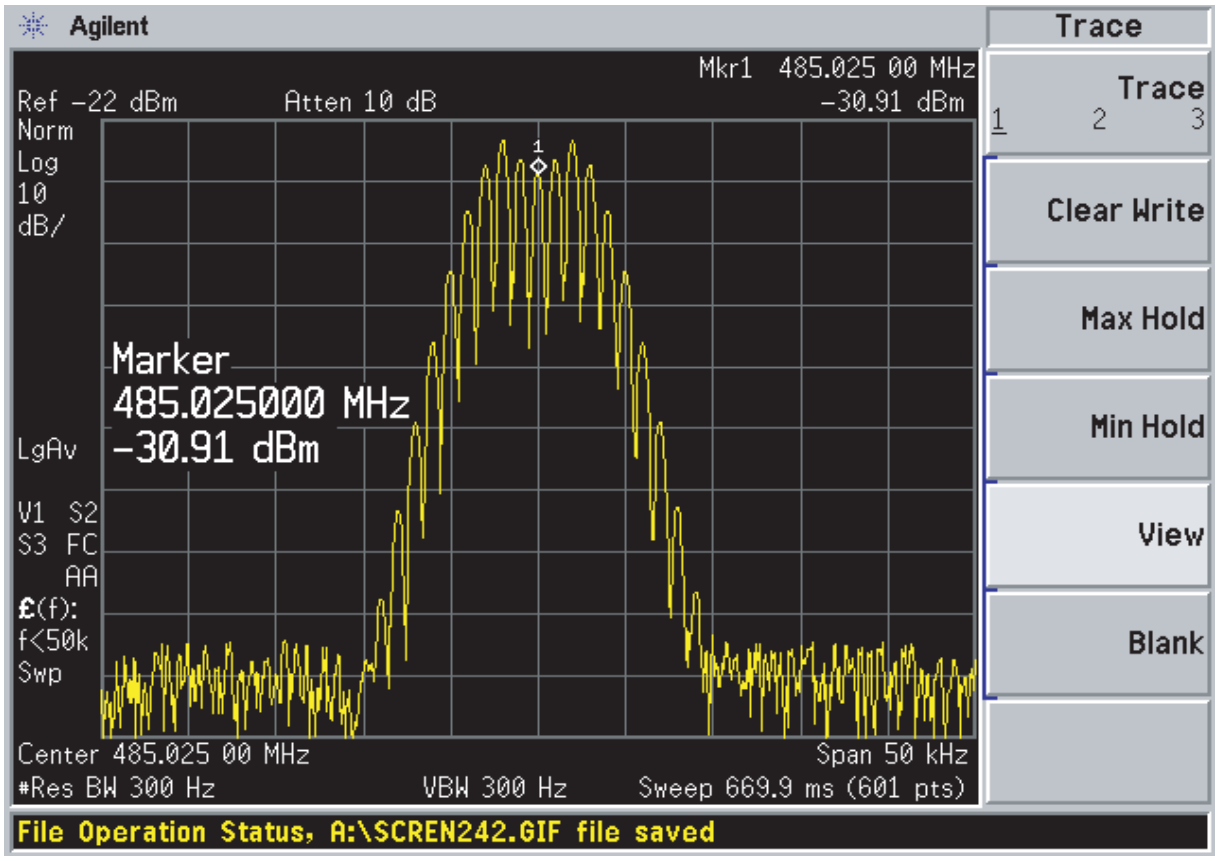
7.24 PP23 Preselector 1 Output



Probe point: C1.

Typical RX signal with 1 kHz modulation. Display shows modulation components of carrier.

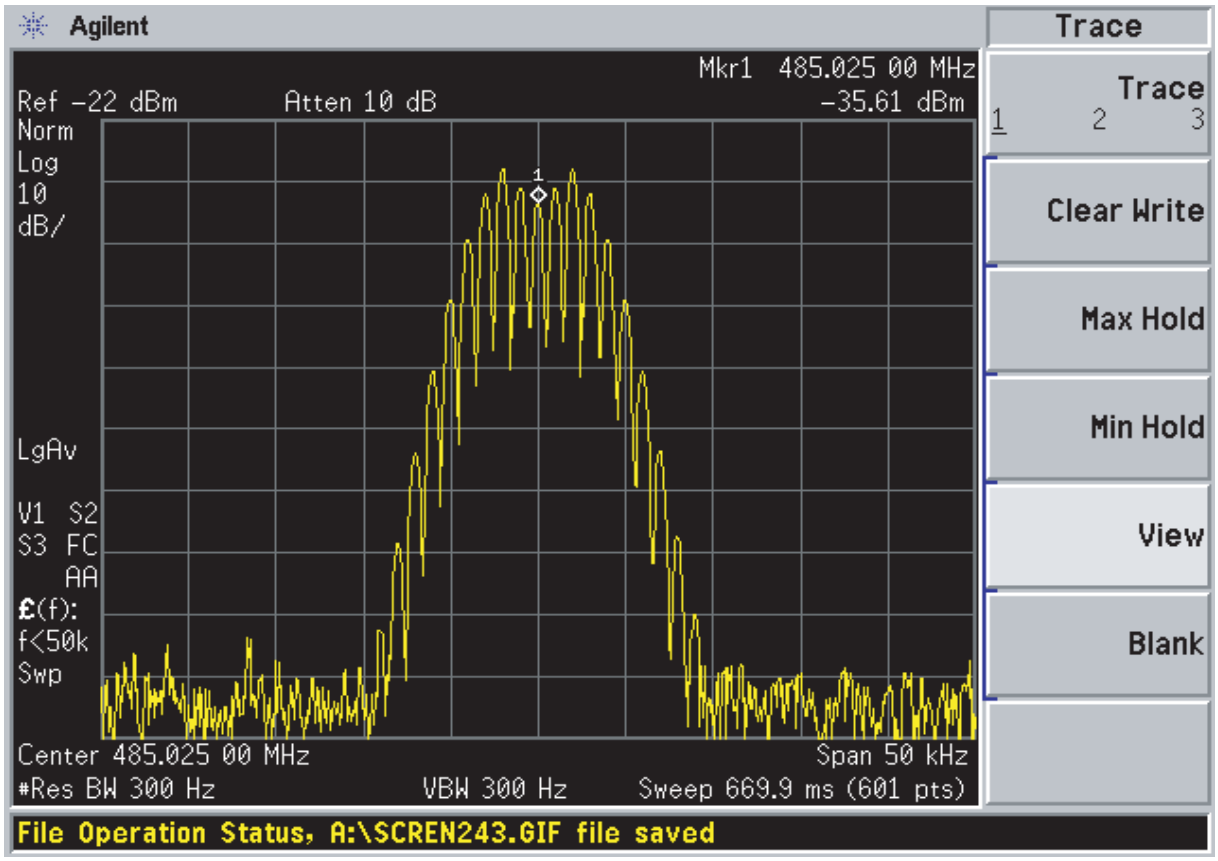
7.25 PP24 Low-Noise Amplifier Output



Probe point: C35.

Typical RX signal with 1 kHz modulation. Display shows modulation components of carrier.

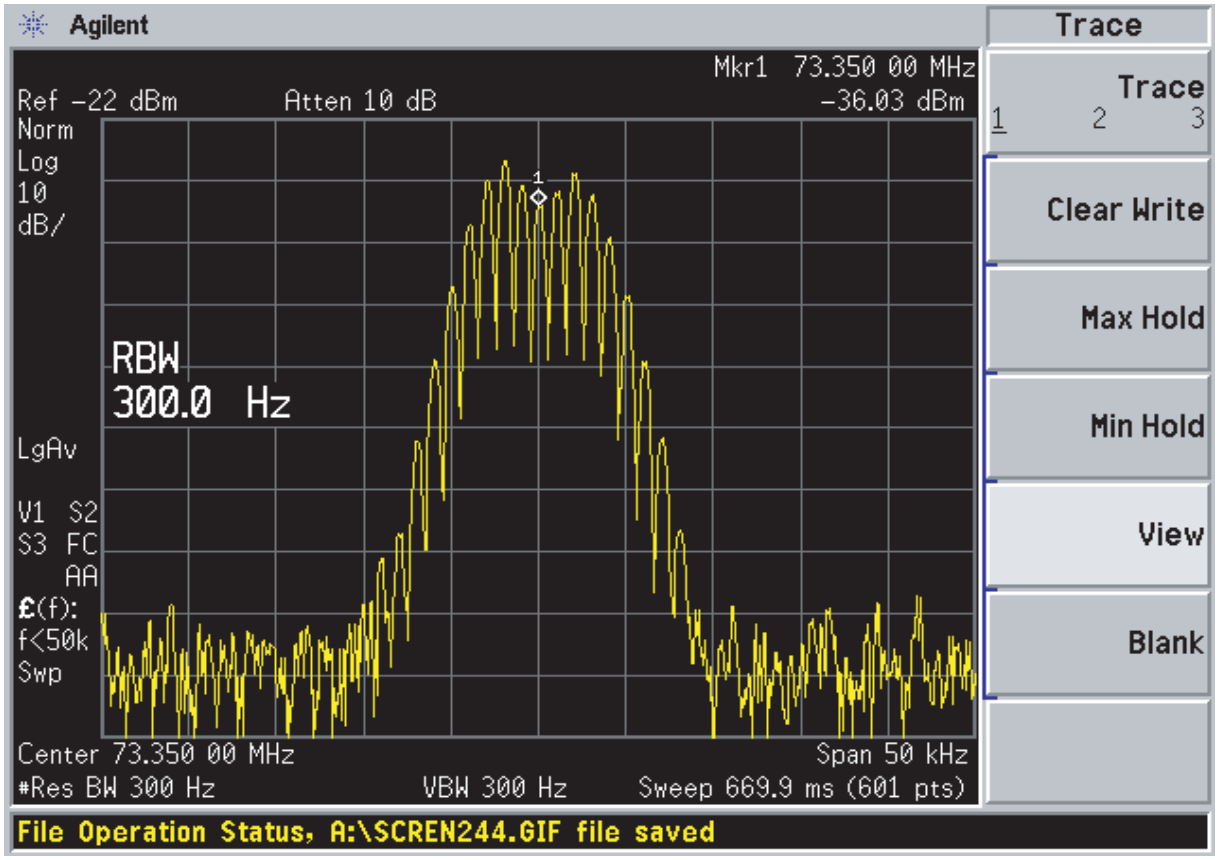
7.26 PP25 Preselector 2 Output



Probe point: C47.

Typical RX signal with 1 kHz modulation. Display shows modulation components of carrier.

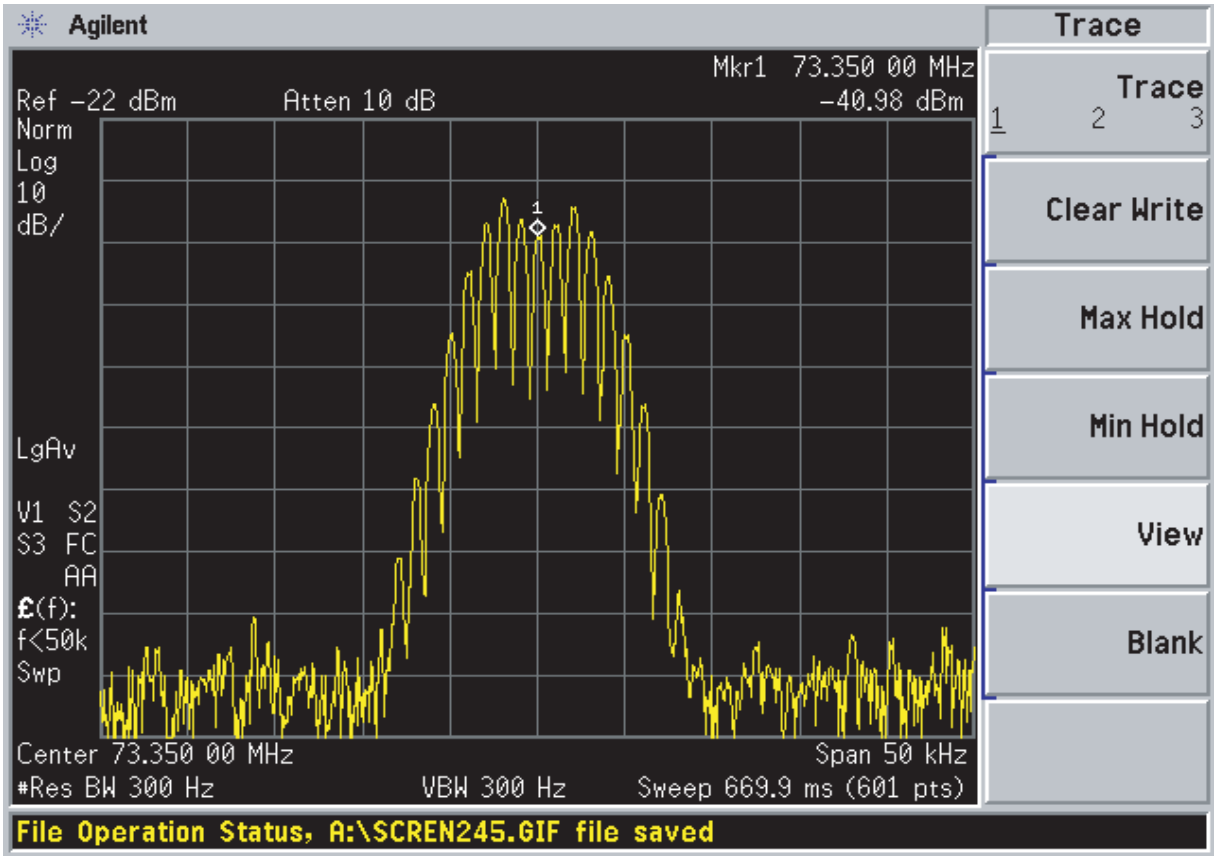
7.27 PP26 Mixer Out (IF)



Probe point: C68.

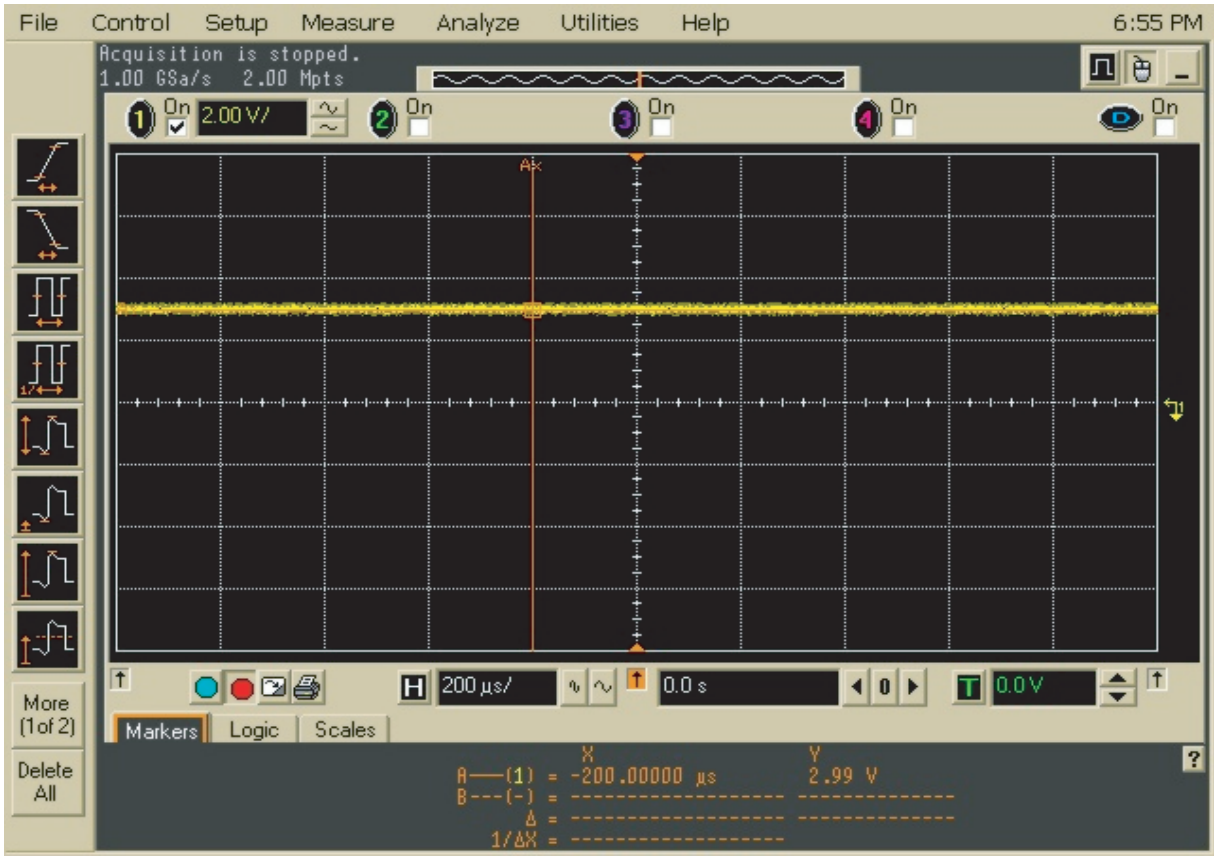
Typical RX signal with 1 kHz modulation. Display shows modulation components of carrier.

7.28 PP27 Crystal Filter Out



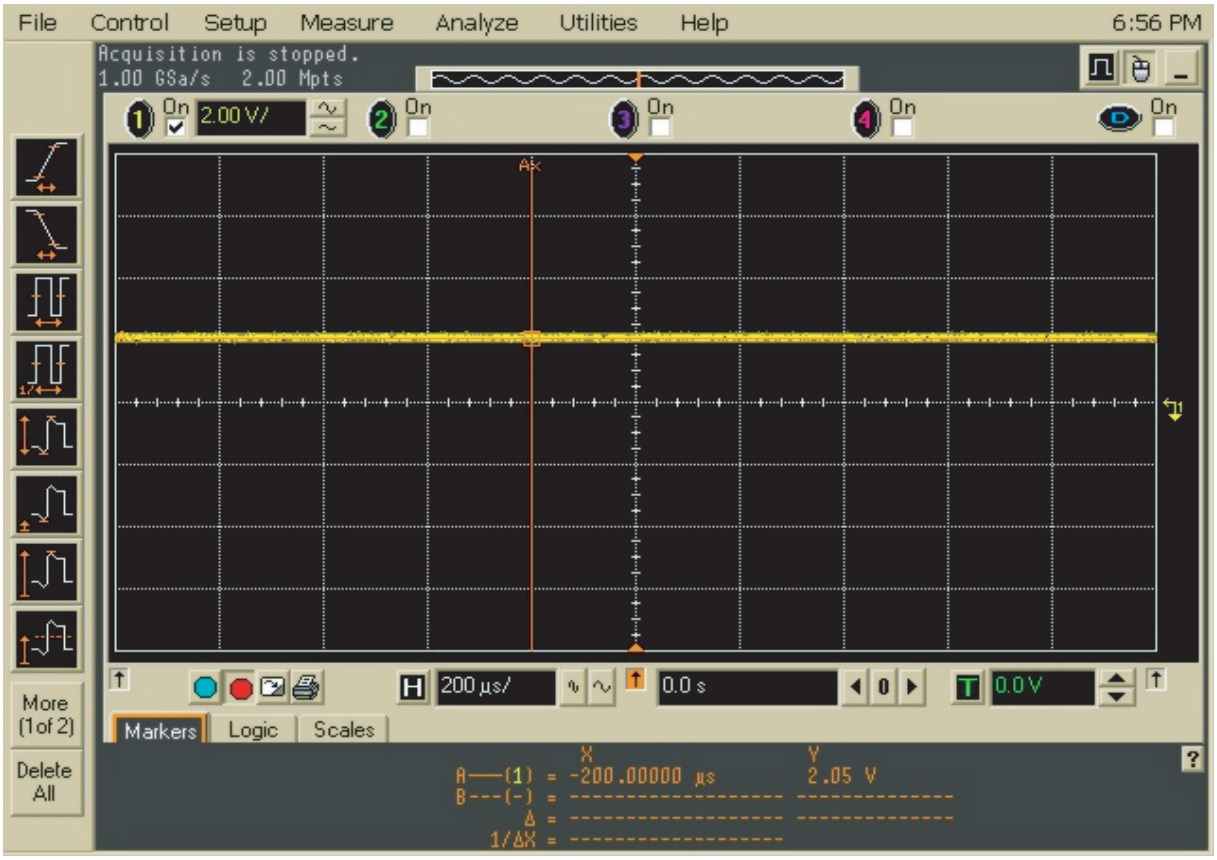
Probe point: L56.

7.29 PP28 Abacus Analog 3V



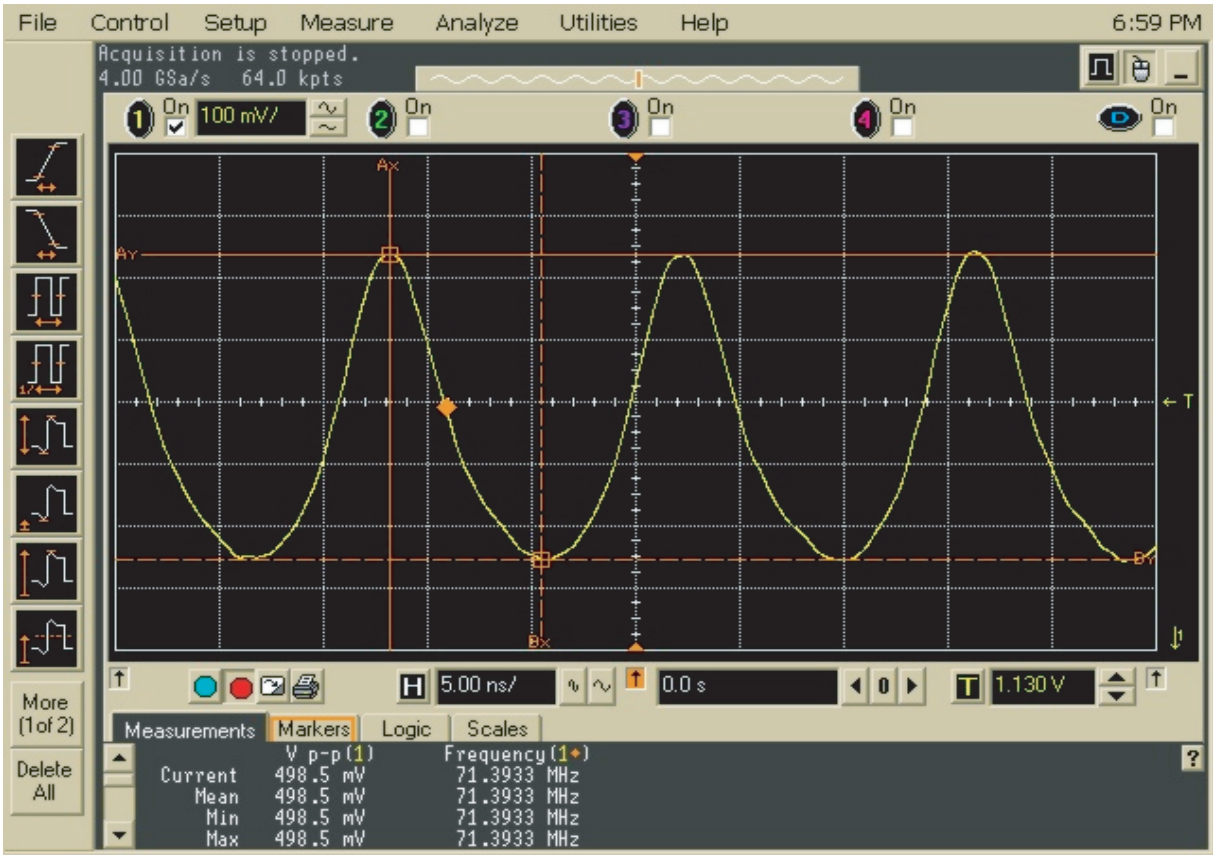
Probe point: U501, pin 5.

7.30 PP29 2nd LO Control Voltage



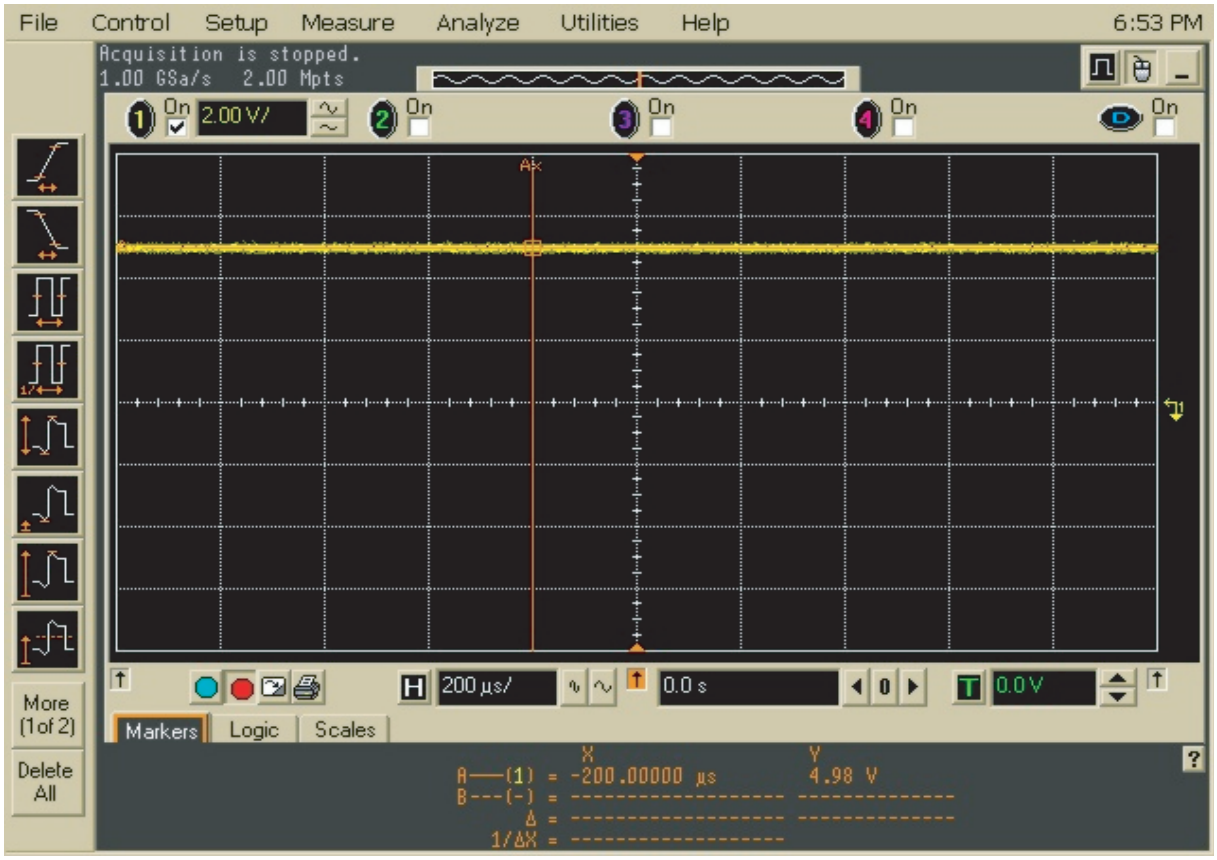
Probe point: U401, pin 38 (located under shield).

7.31 PP30 2nd LO VCO Buffer Output



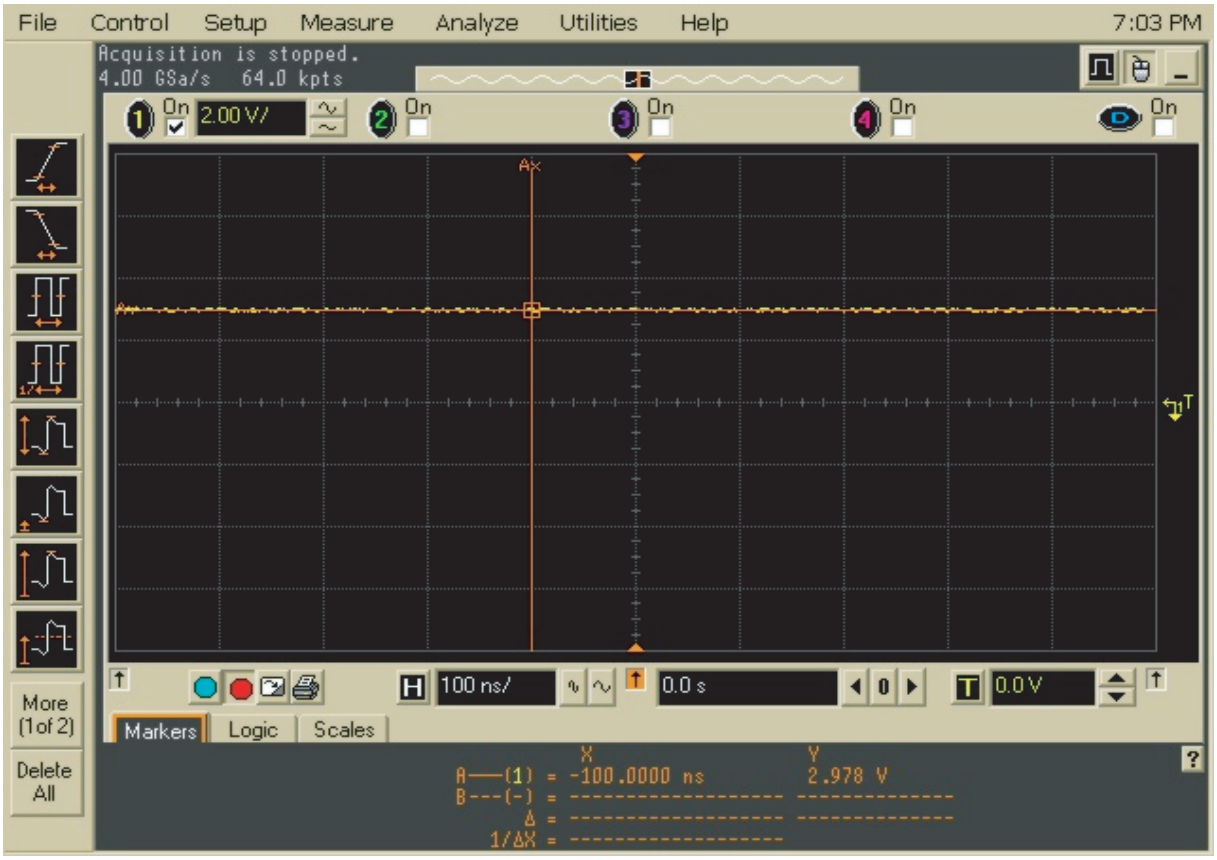
Probe point: C433.

7.32 PP31 Analog 5V DC



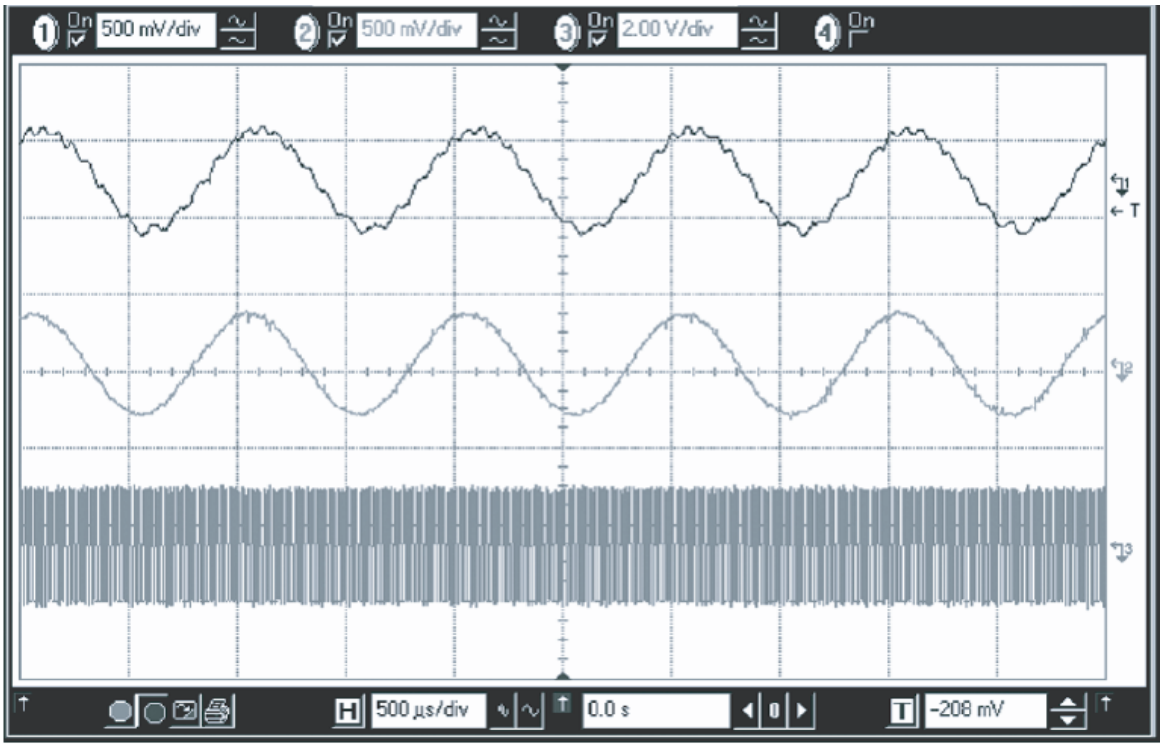
Probe point: U500, pin 5.

7.33 PP32 Abacus Digital 3V



Probe point: U502, pin 5.

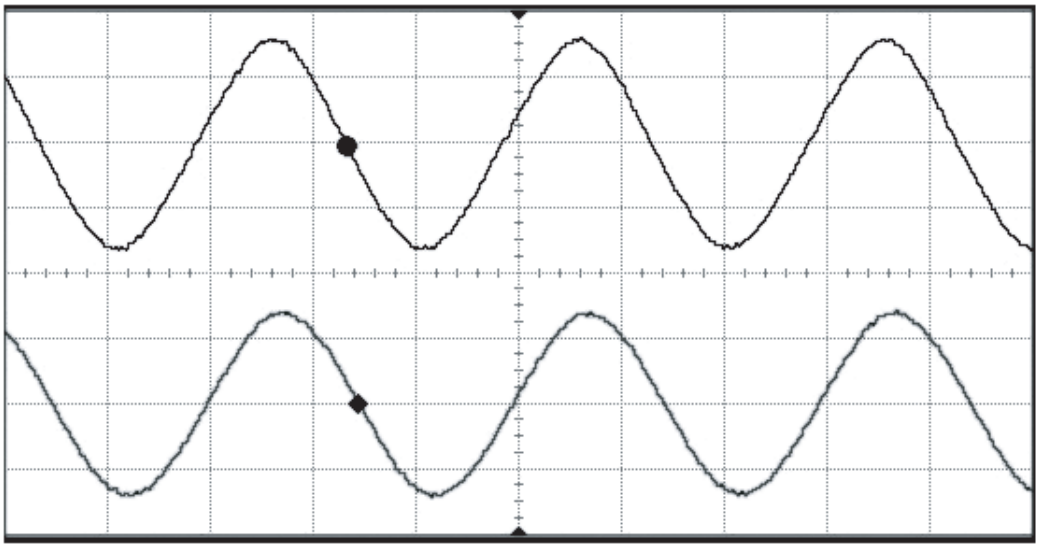
7.34 TX Audio 1 kHz Tone



Trace 1: TP23 Mod In (640 mVp-p 1 kHz tone 1.5 Vdc)
Trace 2: U201, pin 1 (620 mVp-p 1 kHz tone)
Trace 3: FL200, pin 8 (1.2 MHz square wave 0 to 3 V)

Note: Transmit audio 1 kHz tone, which provides 3 kHz deviation.

7.35 16.8 MHz Buffer Input and Output



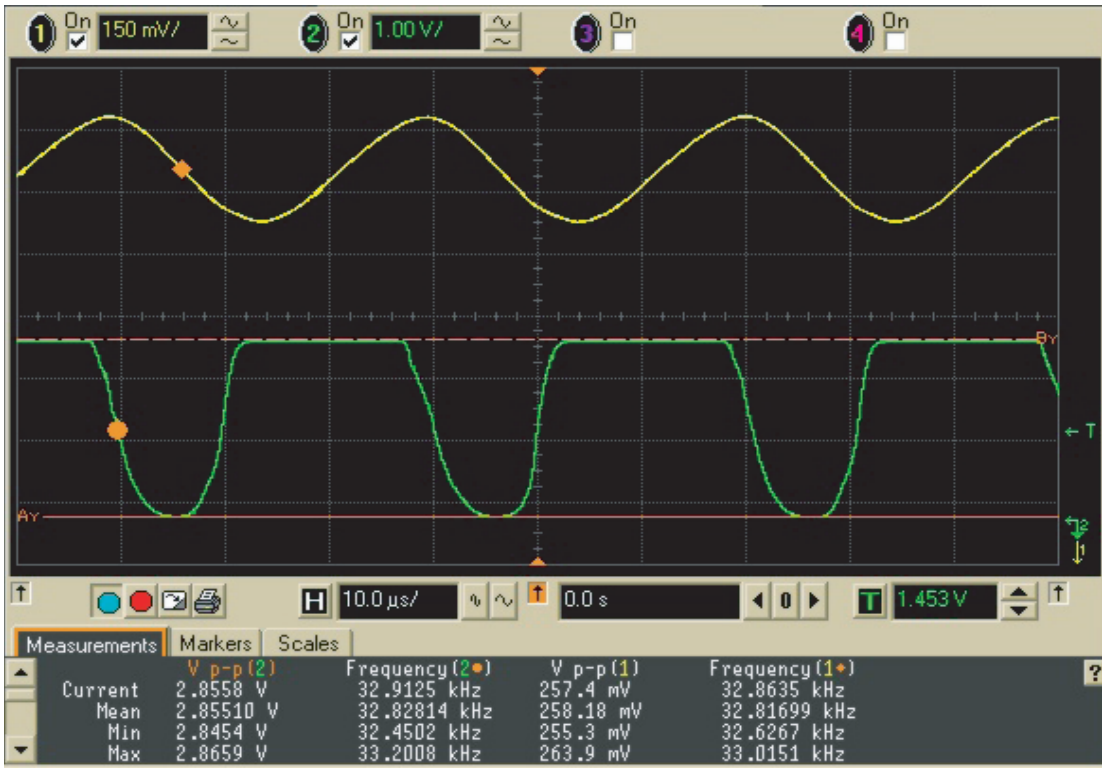
Acquisition	Sampling mode real time Normal Memory depth automatic 64000 pts Sampling rate automatic Sampling rate 4.00 GSa/s Averaging off Interpolation on
Channel 1	Scale 300 mV/ Offset 1.546 V Coupling DC Impedance 1M Ohm
Channel 4	Scale 400 mV/ Offset 2.154 V Coupling DC Impedance 1M Ohm
Time base	Scale 20.0 ns/ Position 0.0 s Reference center
Trigger	Mode edge Sweep auto Sensitivity normal Holdoff time 50 ns Coupling DC Source channel 4 Trigger level 1.354 V Slope rising

Measure

	V p-p(1)	Frequency(1●)	V p-p(4)	Frequency(4◆)
Current	983 mV	16.82001 MHz	1.137 V	16.83329 MHz
Mean	? 977.0 mV	? 16.815154 MHz	1.1378 V	16.802593 MHz
Min	? 57 mV	? 16.63969 MHz	1.008 V	16.65859 MHz
Max	? 993 mV	? 25.09409 MHz	1.237 V	16.94801 MHz
Range	? 936 mV	? 8.454399 MHz	229 mV	289.41886 kHz
Std Dev	? 39.6 mV	? 357.28113 kHz	14.5 mV	53.754484 kHz
# of Meas	551	551	553	553
Edge Dir		Falling		Falling

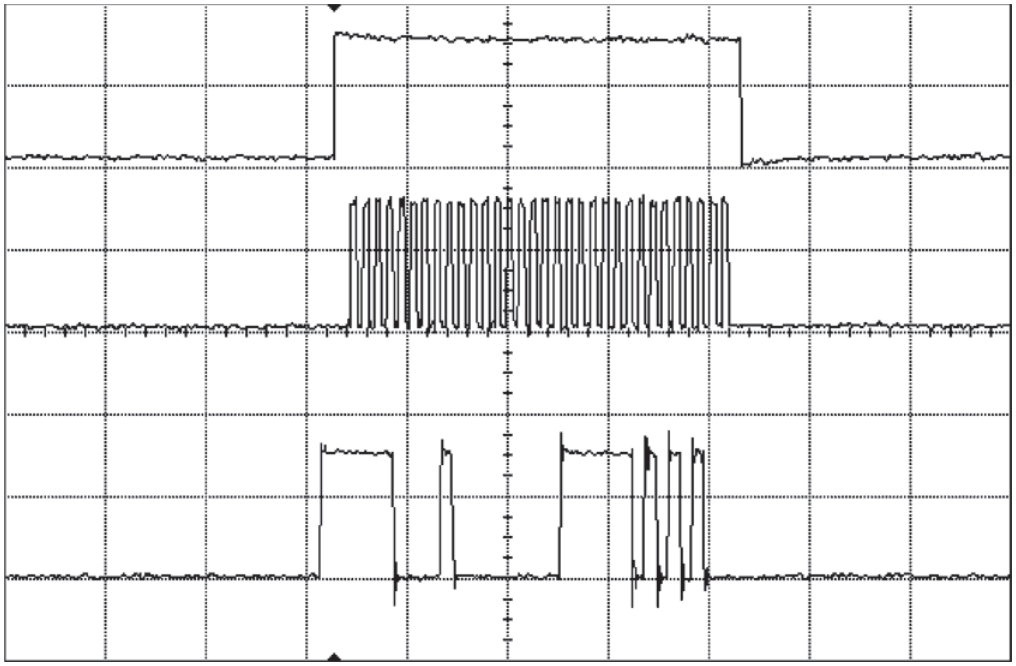
Trace 1: Buffer input at R729.
Trace 2: Buffer output at C726.

7.36 32.768 kHz Clock Outputs



Trace 1: Output at C743.
Trace 2: Output atU712, pin 4.

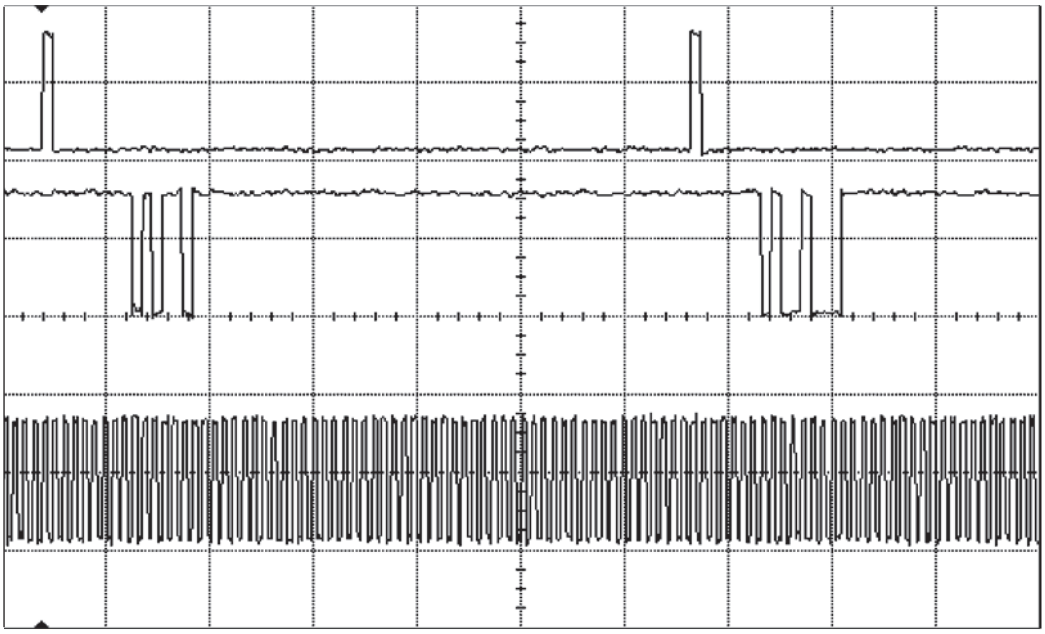
7.37 SPI B Data



Acquisition	Sampling mode real time Configuration 4GSa/s Memory depth automatic Memory depth 1004pts Sampling rate automatic Sampling rate 50.0 MSa/s Averaging off 9-bit BW Filter off Interpolation on
Channel 1	Scale 1.99 V/div Offset -4.21 V Coupling DC Impedance 1M Ohm Attenuation 10.00 : 1 Atten units ratio Skew 0.0 s Ext adapter None Ext coupler None Ext gain 1.00E+00 Ext offset 0.0E+00
Channel 2	Scale 2.00 V/div Offset -260 mV Coupling DC Impedance 1M Ohm Attenuation 10.00 : 1 Atten units ratio Skew 0.0 s Ext adapter None Ext coupler None Ext gain 1.00E+00 Ext offset 0.0E+00
Channel 3	Scale 2.00 V/div Offset 5.76 V Coupling DC Impedance 1M Ohm Attenuation 10.00 : 1 Atten units ratio Skew 0.0 s Ext adapter None Ext coupler None Ext gain 1.00E+00 Ext offset 0.0E+00
Time base	Scale 2.00 µs/div Position 3.454546 µs Reference center
Trigger	Mode edge Sweep auto Hysteresis normal Holdoff time 60 ns Coupling DC Source channel 1 Trigger level 810 mV Slope rising

Trace 1: MAKO chip enable, R767 (not active high)
Trace 2: SPI data clock, C619
Trace 3: SPI data to MAKO, C617.

7.38 RX Serial Audio Port (SAP)

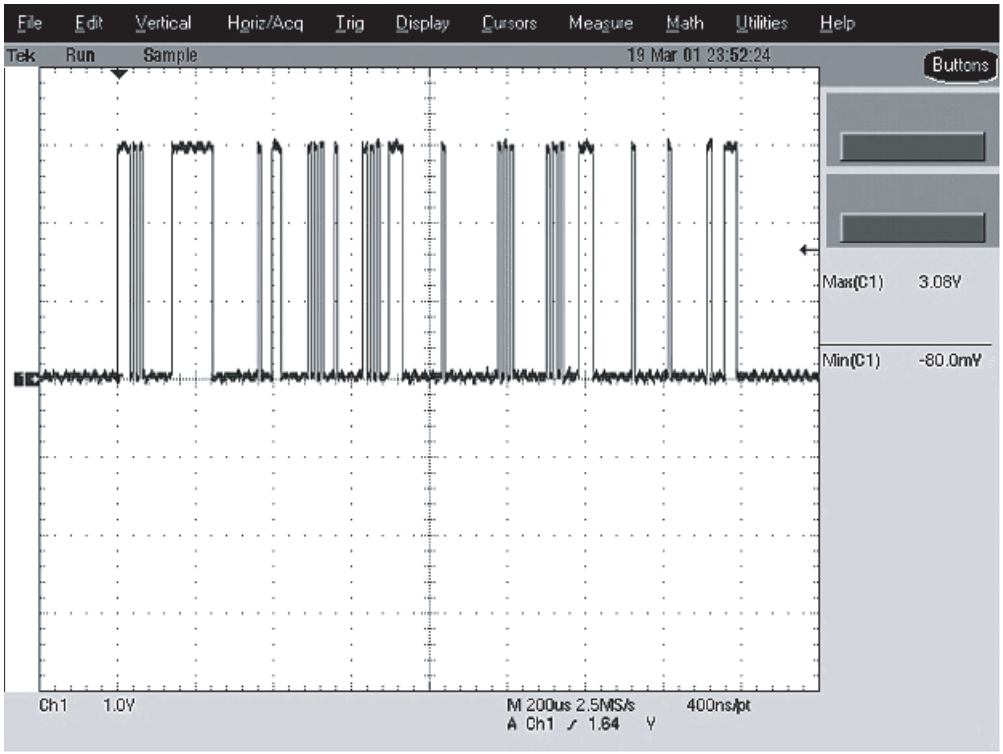


Acquisition	Sampling mode real time Configuration 4GSa/s Memory depth automatic Memory depth 1004pts Sampling rate automatic Sampling rate 5.00 MSa/s Averaging off 9-bit BW Filter off Interpolation on
Channel 1	Scale 1.99 V/div Offset -4.21 V Coupling DC Impedance 1M Ohm Attenuation 10.00 : 1 Atten units ratio Skew 0.0 s Ext adapter None Ext coupler None Ext gain 1.00E+00 Ext offset 0.0E+00
Channel 2	Scale 2.00 V/div Offset -210 mV Coupling DC Impedance 1M Ohm Attenuation 10.00 : 1 Atten units ratio Skew 0.0 s Ext adapter None Ext coupler None Ext gain 1.00E+00 Ext offset 0.0E+00
Channel 3	Scale 2.00 V/div Offset 5.55 V Coupling DC Impedance 1M Ohm Attenuation 10.00 : 1 Atten units ratio Skew 0.0 s Ext adapter None Ext coupler None Ext gain 1.00E+00 Ext offset 0.0E+00
Time base	Scale 20.0 µs/div Position 92.181816 µs Reference center
Trigger	Mode edge Sweep auto Hysteresis normal Holdoff time 60 ns Coupling DC Source channel 1 Trigger level 810 mV Slope rising

Note: TX is identical, except the data is probed at test point “TX”.

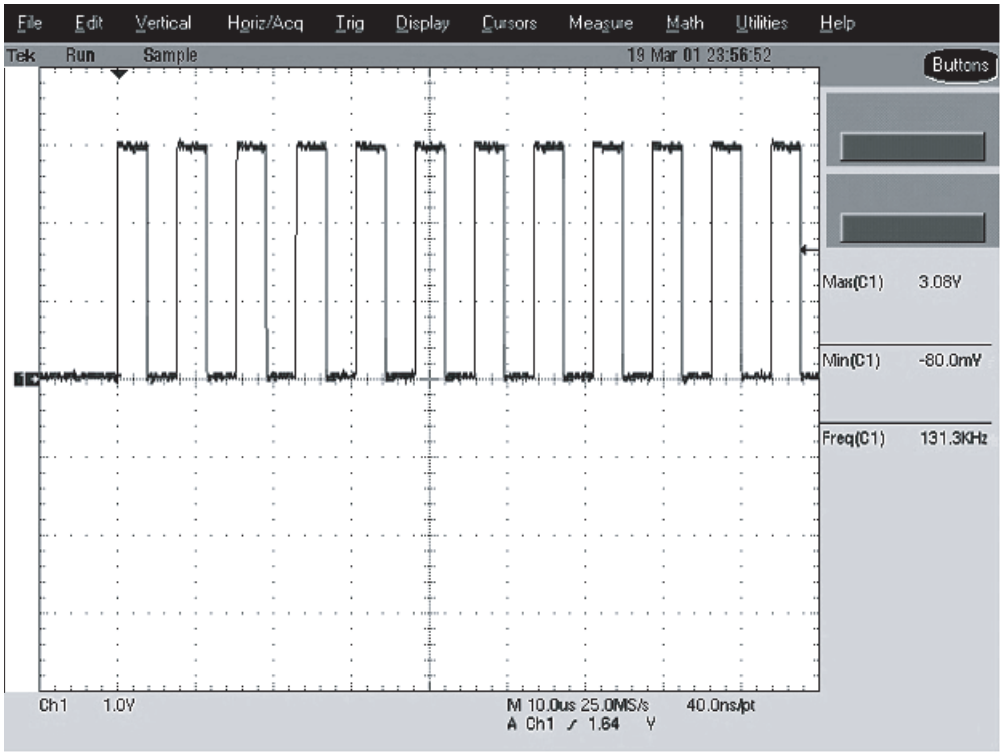
Trace 1: 8 kHz frame sync (each word is 13 bits after falling edge of FSYNC)
Trace 2: SAP data at R626 (audio data from MAKO CODEC to Patriot DSP)
Note: Transmit is identical, except data acquired at R625
Trace 3: 512kHz bit clock at R616. (Codec_DCLK).

7.39 PP33 SPI Data



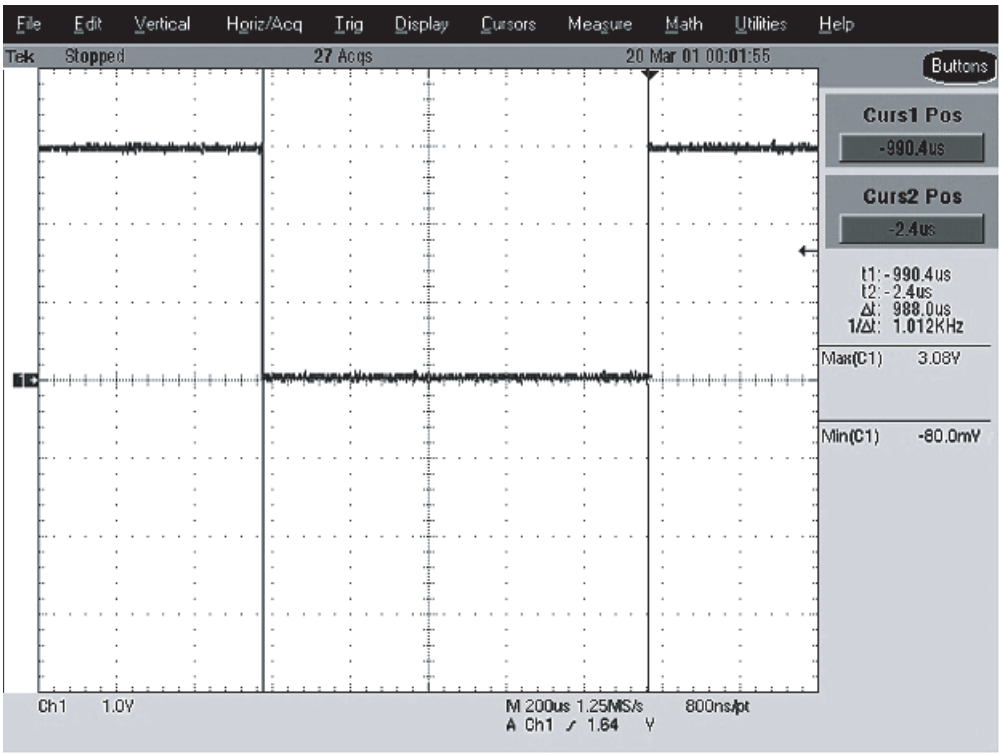
Probe Point: R802.

7.40 PP34 SPI CLK



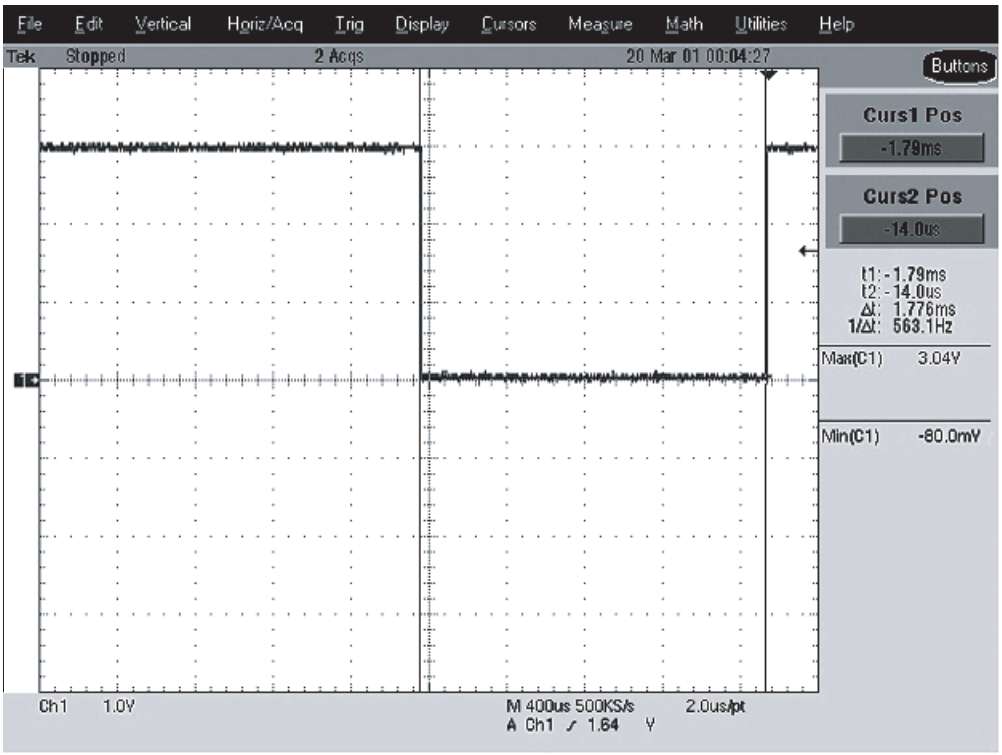
Probe Point: R803.

7.41 PP35 Universal Chip Select



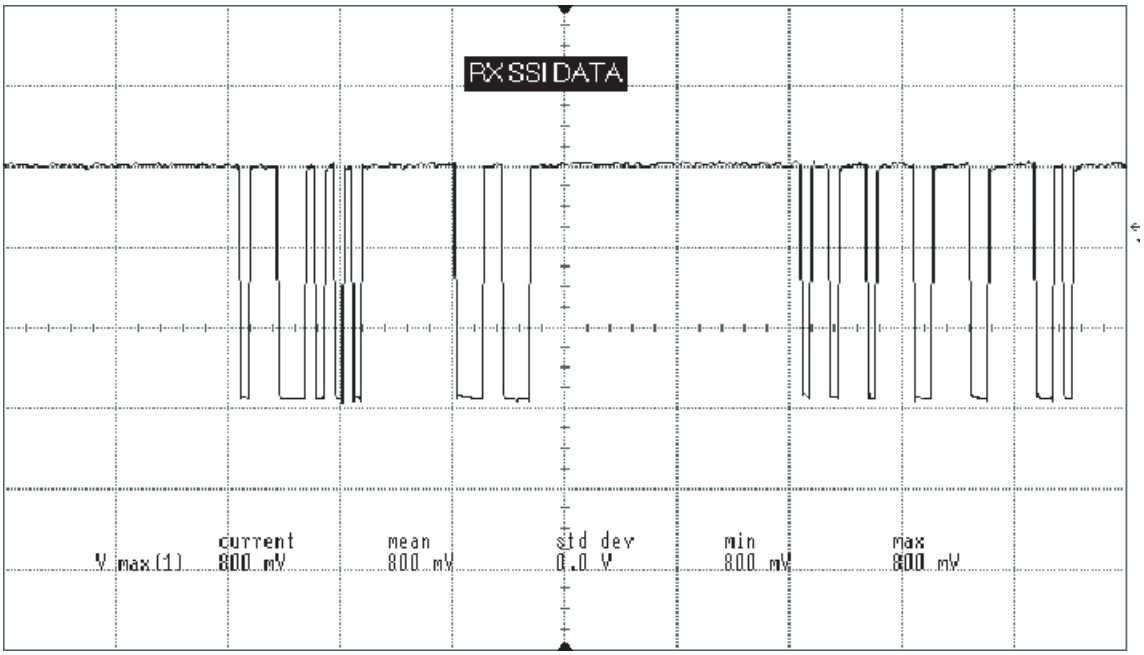
Probe Point: U102, pin 29 (located under shield).

7.42 PP36 Abacus Chip Select



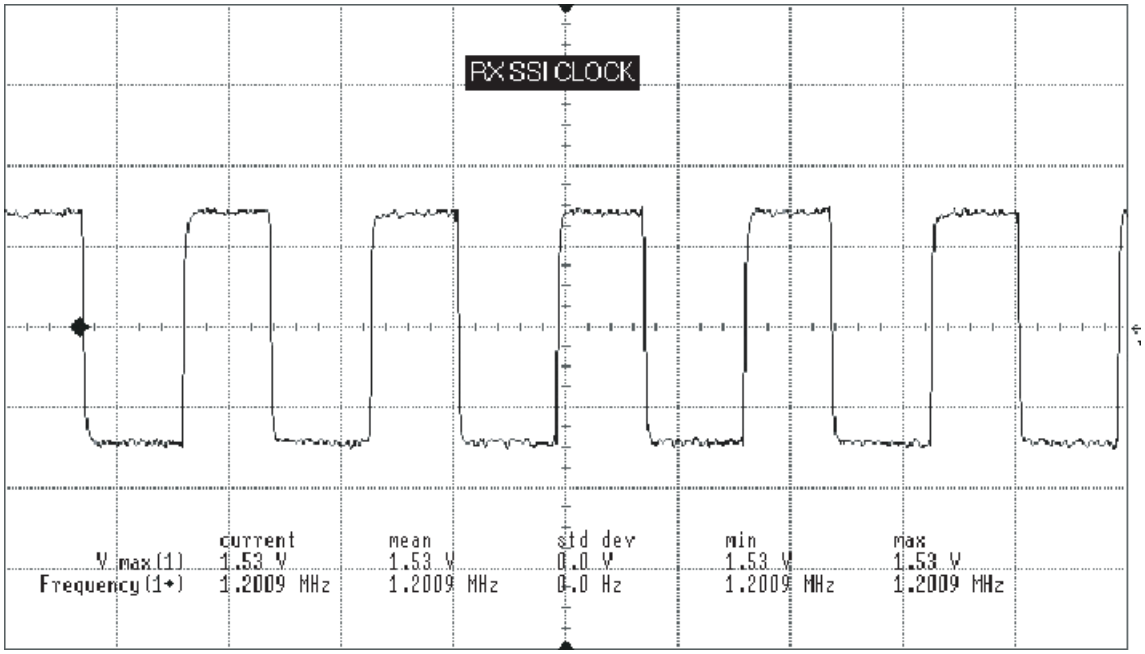
Probe Point: U401, pin 25 (located under shield).

7.43 TP37 RX SSI Data



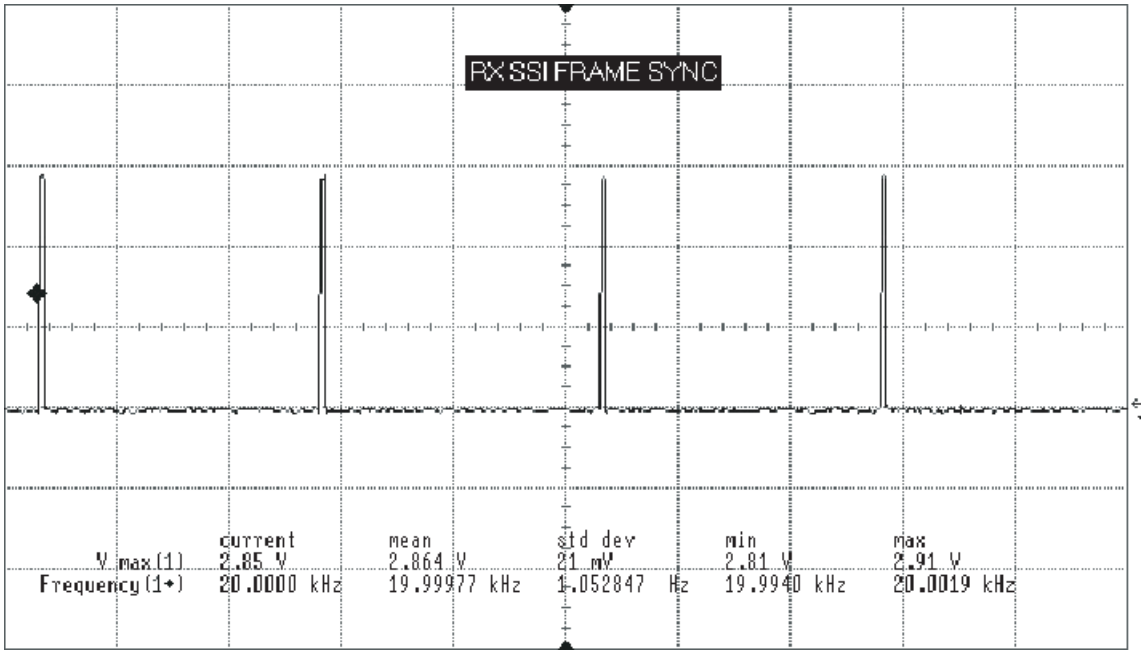
Test Point: SSI_D (Test Point).

7.44 TP38 RX SSI Clock



Test Point: SSI_CLK (Test Point).

7.45 TP39 RX SSI Frame Sync



Test Point: SSI_FS (Test Point).

Test Point: TP401.

Chapter 8 Troubleshooting Tables

8.1 Introduction

This chapter contains troubleshooting tables necessary to isolate a problem to the component level. Use these tables in conjunction with Chapter 4, Detailed Theories of Operation (page 4-1), Chapter 5, Troubleshooting Procedures (page 5-1), Chapter 6, Troubleshooting Charts (page 6-1), and Chapter 7, Troubleshooting Waveforms (page 7-1). This manual is to be used in conjunction with the ASTRO XTS 2500/XTS 2500l Digital Portable Radios Basic Service Manual (Motorola part number 6816984H01), which uses the pass/fail service approach to radio problems.

A blank entry in the “To/From” column of J601 indicates the signal is accessible only at J601.

8.2 Tables

Table 8-1. Main Board to Keypad Board Flex Assembly (J601)

J601 Pin Number	Description	To/From
1	V1.875	L703
2	V2.9	L704
3	UNSW_B+	R701
4	SW_B+	R708
5	HOST_WAKE	
6	WAKEUP	
7	REGISTER_SEL	
8	DISPLAY_SEL	
9	SCKB	R620
10	SPI_MOSI_B	R621
11	SPI_MISO_B	R622
12	SSI_CLK	R616
13	SSI_FSYNC	R617
14	CODEC_TX	R625
15	CODEC_RX	R626
16	KEYPAD_ROW0	
17	KEYPAD_ROW1	
18	KEYPAD_ROW2	
19	KEYPAD_ROW3	

Table 8-1. Main Board to Keypad Board Flex Assembly (J601) (Continued)

J601 Pin Number	Description	To/From
20	KEYPAD_ROW4	
21	KEYPAD_ROW5	
22	KEYPAD_ROW6	
23	KEYPAD_COL0	
24	KEYPAD_COL1	
25	KEYPAD_COL2	
26	DO	R637
27	D1	R638
28	D2	R639
29	D3	R640
30	D4	R641
31	D5	R642
32	D6	R643
33	D7	R644
34	KEYFAIL	
35	CKIH	C726
36	BOOT*	C726
37	TEST_TAMPER	
38	DISPLAY_RESET	R647
39	UCM_SPARE1	
40	ENC_RXD (BT_RX)	
41	ENC_TXD (BT_TX)	
42	ENC_RESET	
43	BL_EN	
44	UCM_SPARE2	
45	GROUND	
46	GROUND	
47	GROUND	

Table 8-2. Main Board to Universal (Side) Connector Flex Assembly (J650)

J650 Pin Number	Description	To/From	Side Connector Number
1	GND	GND (TP)	8
2	INT_SPKR+	C654	
3	INT_SPKR-	C653	
4	OPT_SEL1	R608	1
5	EXT_SPKR+	EXTSP+ (TP)	2
6	EXT_MIC	EXTMIC (TP)	3
7	OPT_B+_VPP	VPP (TP)	4
8	OPT_SEL2	R666	5
9	SPKR_COM	EXT_SP (TP)	6
10	RTS_USB_PWR	RTS1 (TP)	7
11	GND	GND(TP)	8
12	LH_BUSY	BUSY (TP)	9
13	CTS	CTS1 (TP)	10
14	RS232_TX_USB+	USB_D+ (TP)	11
15	RS232_RX_USB-	USB_D (TP)	12
16	LH_DATA_KEYFAIL	BUS (TP)	13
17	NOT USED		
18	INT_MIC	L652	
19	GND	GND (TP)	8
20	GND	GND(TP)	8

Table 8-3. FLASH (U803) Pinout

U402 Pin Number	Description	To/From	Comment	Accessible on Main Board?
B4	BURSTCLK			No
E7	CS0	TP_CS0	Active Low	Yes
F8	EN_OE			No
C5	EN_WE			No
D6	WRITE PROTECT			No
C4	ADV	ADV		Yes

Table 8-3. FLASH (U803) Pinout (Continued)

U402 Pin Number	Description	To/From	Comment	Accessible on Main Board?
B5	RESET	CR800, pin 2	1.875V	Yes
E8	ADDRESS 0			No
D8	ADDRESS 1			No
C8	ADDRESS 2			No
B8	ADDRESS 3			No
A8	ADDRESS 4			No
B7	ADDRESS 5			No
A7	ADDRESS 6			No
C7	ADDRESS 7			No
A2	ADDRESS 8			No
B2	ADDRESS 9			No
C2	ADDRESS 10			No
A1	ADDRESS 11			No
B1	ADDRESS 12			No
C1	ADDRESS 13			No
D2	ADDRESS 14			No
D1	ADDRESS 15			No
D4	ADDRESS 16			No
B6	ADDRESS 17			No
A6	ADDRESS 18			No
C6	ADDRESS 19			No
B3	ADDRESS 20			No
C3	ADDRESS 21			No
D7	ADDRESS 22	R814		Yes
A3	GROUND			No
F1	GROUND			No
G2	GROUND			No
G8	GROUND			No
E2	DATA 15			No
F2	DATA 14			No
F3	DATA 13			No

Table 8-3. FLASH (U803) Pinout (Continued)

U402 Pin Number	Description	To/From	Comment	Accessible on Main Board?
D5	DATA 12			No
F4	DATA 11			No
F5	DATA 10			No
F6	DATA 9			No
G7	DATA 8			No
G1	DATA 7			No
E3	DATA 6			No
G3	DATA 5			No
E4	DATA 4			No
G5	DATA 3			No
E5	DATA 2			No
E6	DATA 1			No
F7	DATA 0			No
A5	VPP	CR801, pin 2	1.875V	Yes
G6	V1.875	C850	1.875V	Yes
E1	V1.875	C850	1.875V	Yes
G4	V1.875	C850	1.875V	Yes
A4	V1.875	C850	1.875V	Yes

Table 8-4. SRAM (U804) Pinout

U403 Pin Number	Description	To/From	Comment	Accessible on Main Board?
A2	EN_OE			No
G5	EN_WE			Yes
A1	Byte Low Enable			No
B2	Byte High Enable			No
B5	CS2			No
A6	CE2			No
A3	ADDRESS 0			No
A4	ADDRESS 1			No
A5	ADDRESS 2			No
B3	ADDRESS 3			No
B4	ADDRESS 4			No
C3	ADDRESS 5			No
C4	ADDRESS 6			No
D4	ADDRESS 7			No
H2	ADDRESS 8			No
H3	ADDRESS 9			No
H4	ADDRESS 10			No
H5	ADDRESS 11			No
G3	ADDRESS 12			No
G4	ADDRESS 13			No
F3	ADDRESS 14			No
F4	ADDRESS 15			No
E4	ADDRESS 16			No
D3	ADDRESS 17			No
H1	ADDRESS 18			No
D1	GROUND			No
E6	GROUND			No
E3	GROUND			No
H6	NOT USED			No

Table 8-4. SRAM (U804) Pinout (Continued)

U403 Pin Number	Description	To/From	Comment	Accessible on Main Board?
G2	NOT USED			No
G1	DATA 15			No
F1	DATA 14			No
F2	DATA 13			No
E2	DATA 12			No
D2	DATA 11			No
C2	DATA 10			No
C1	DATA 9			No
B1	DATA 8			No
G6	DATA 7	R644		Yes
F6	DATA 6	R643		Yes
F5	DATA 5	R642		Yes
E5	DATA 4	R641		Yes
D5	DATA 3	R640		Yes
C6	DATA 2	R639		Yes
C5	DATA 1	R638		Yes
B6	DATA 0	R637		Yes
D6	VSW2	C818	1.875V	Yes
E1	VSW2	C818	1.875V	Yes

Table 8-5. Patriot MCU/DSP (U800) Pinout

U401 Pin Number	Description	To/From	Comment	Accessible on Main Board?
H10	NOT USED			Yes
J14	NOT USED			Yes
C14	NOT USED			Yes
B14	V2.9			No
F6	ONE-WIRE_UP			Yes
E5	32K_SEL	U712, pin 6	Active Low	Yes
J6	INT_PTT	R507	Active Low	Yes

Table 8-5. Patriot MCU/DSP (U800) Pinout (Continued)

U401 Pin Number	Description	To/From	Comment	Accessible on Main Board?
J5	MAKO_INT*	MAKO_INT (Test Point)		Yes
J4	OPT_SEL1	U201 pin 1		Yes
J3	NOT USED			No
C16	CODEC_FSYNC	SYNC	8 KHz Pulse	Yes
G11	OPT_SEL2_IN	U601 pin 1		Yes
F1	KEYPAD_ROW0	J601, pin 16		Yes
H4	KEYPAD_ROW1	J601, pin 17		Yes
H6	KEYPAD_ROW2	J601, pin 18		Yes
G2	KEYPAD_ROW3	J601, pin 19		Yes
G1	KEYPAD_ROW4	J601, pin 20		Yes
G7	KEYPAD_ROW5	J601, pin 21		Yes
H7	KEYPAD_ROW6	J601, pin22		Yes
H1	UCM_SPARE1	J601, pin 39		Yes
D1	KEYPAD_COL0	J601, pin 23		Yes
G5	KEYPAD_COL1	J601, pin 24		Yes
F3	KEYPAD_COL2	J601, pin 25		Yes
G4	ENC_RESET	J601, pin 42		Yes
F2	BOOT*			No
E1	WAKEUP	J601, pin 6		Yes
H6	SPARE2_ENC	J601, pin 44		Yes
G3	NOT USED			No
E7	NOT USED			No
A8	HAB_MOD			No
F8	MISOA_SEL	Q801, pin 1	Data Line	Yes
E8	SB3	R510		Yes
G8	SB2	R509		Yes
C3	SB1	R508		Yes
D4	LOCK_DET		Active Low	Yes
A2	NOT USED			No
B2	RTA3	VR508, PIN 2		Yes

Table 8-5. Patriot MCU/DSP (U800) Pinout (Continued)

U401 Pin Number	Description	To/From	Comment	Accessible on Main Board?
A3	RTA2	VR509, PIN 2		Yes
B3	RTA1	VR510, PIN 2		Yes
B4	RTA0	VR511, PIN 2		Yes
A7	V1.875	E801	1.875V	Yes
P3	V1.875	E801	1.875V	Yes
P6	V1.875	E801	1.875V	Yes
T9	V1.875	E801	1.875V	Yes
N10	V1.875	E801	1.875V	Yes
R16	V1.875	E801	1.875V	Yes
A1	V2.9	E800	3.0V	Yes
G9	V2.9	E800	3.0V	Yes
E15	V2.9	E800	3.0V	Yes
A16	V2.9	E800	3.0V	Yes
K10	V2.9	E800	3.0V	Yes
C12	V2.9	E800	3.0V	Yes
D8	V2.9	E800	3.0V	Yes
B7	V2.9	E800	3.0V	Yes
A4	V2.9	E800	3.0V	Yes
A16	V2.9	E800	3.0V	Yes
H2	V2.9	E800	3.0V	Yes
K3	V1.875	E801	1.875V	Yes
R8	V1.875	E801	1.875V	Yes
G15	V1.875	E801	1.875V	Yes
C10	V1.875	E801	1.875V	Yes
K12	URXD1_USB_VMI			No
L16	URTS1_XRXD			No
F13	ADTRIG			No
B16	P-URXD2			No
D14	P-URTS2			No
B12	RX_SSI_DATA	TP403	Data From Abacus to DSP	Yes

Table 8-5. Patriot MCU/DSP (U800) Pinout (Continued)

U401 Pin Number	Description	To/From	Comment	Accessible on Main Board?
C11	TX_SSI_CLK	R259	1.536 MHz	Yes
B10	RED_LED	Q501, pin 3	Active High	Yes
D10	GREEN_LED	Q501, pin 5	Active High	Yes
B11	TX_SSI_FSYNC	R251	48 KHz	Yes
J10	CODEC_TX	TX	MAKO to DSP Tx Audio Data	Yes
J15	CODEC_DCLK	DCLK	512 KHz	Yes
K16	CODEC_FSYNC	SYNC	8 KHz Pulse	Yes
D7	MISOA	U801, pin 4	SPI A Data Out	Yes
D3	MISOB	BMISO	SPI B Data Out	Yes
E6	NOT USED			No
F7	NOT USED			No
D6	NOT USED			No
C5	NOT USED			No
A9	NOT USED			No
B8	NOT USED			No
B9	NOT USED			No
A10	NOT USED			No
G6	NOT USED			No
D13	NOT USED			No
S15	BT_WAKE			No
F11	RX_SSI_CLK	SSI_CK		Yes
B15	OPT_SEL2_OUT	R666		Yes
J13	NOT USED			Yes
J16	NOT USED			Yes
J12	NOT USED			Yes
H11	NOT USED			Yes
A5	GROUND	GROUND		No
N6	GROUND	GROUND		No
P8	GROUND	GROUND		No

Table 8-5. Patriot MCU/DSP (U800) Pinout (Continued)

U401 Pin Number	Description	To/From	Comment	Accessible on Main Board?
P11	GROUND	GROUND		No
M11	GROUND	GROUND		No
L15	GROUND	GROUND		No
H16	GROUND	GROUND		No
F14	GROUND	GROUND		No
G14	GROUND	GROUND		No
E13	GROUND	GROUND		No
B13	GROUND	GROUND		No
K15	GROUND	GROUND		No
D9	GROUND	GROUND		No
C8	GROUND	GROUND		No
B5	GROUND	GROUND		No
C2	GROUND	GROUND		No
C1	GROUND	GROUND		No
H3	GROUND	GROUND		No
K15	GROUND	GROUND		No
T8	GROUND	GROUND		No
H15	GROUND	GROUND		No
C9	GROUND	GROUND		No
B6	ABACUS_CS*	U401, pin 25	Active Low	Yes
E2	UNIVERSAL_SPI_CS*		Active Low	Yes
D2	NOT USED			No
E3	MAKO_CE		Active High	No
E4	SCKB	B_CLK	SPI B Clock	Yes
B1	NOT USED			No
F4	NOT USED			No
F5	SPI_MOSI_B	BMOSI	SPI B Data (VOCON)	Yes
C7	SPI_CLK_A	SCKA	SPI A Clock	Yes
C6	MOSIA	R802	SPI A Data (RF Devices)	Yes
G10	USM_SS			No

Table 8-5. Patriot MCU/DSP (U800) Pinout (Continued)

U401 Pin Number	Description	To/From	Comment	Accessible on Main Board?
G16	NOT USED			No
J11	CODEC_RX	R775	DSP to MAKO Rx Audio Data	Yes
A12	RX_SSI_FSYNC	SSI_FS	20 KHz pulse	Yes
A11	RX_SSI_CLK	SSI_CK	1.2 MHz	Yes
E9	TX_SSI_DATA		Data From DSP to A/D	Yes
C15	BSY_OUT_CTS*			No
F12	UTXD2			No
D15	NOT USED			No
E14	BOOT_NORM*			No
D16	RS232_USB*			No
G12	UCTS1_USB_SPEED*			No
K11	UTXD1_USB_VPO			No
K14	USB_VMO			No
K13	USB_TX_EN			No
D5	8 KHZ_INT	SYNC	8 KHz Pulse	R406
H14	BL_EN	J601, pin 43		Yes
K4	LV_DETECT	D511, pin 1	3.0V	Yes
F9	NOT USED			No
J2	SC_FILT_EN	FL200, pin 7		No
A6	16_8MHZ	C726	16.8 MHz	Yes
J7	GATED_32_KHZ	U712, pin 4	32.768 KHz	Yes
G13	NOT USED			No
J1	MOD	R634	Bootstrap mode > 2.7V	Yes
A13	NOT USED			No
M6	NOT USED			No
R1	NOT USED			No
N3	NOT USED			No
M5	NOT USED			No
P2	NOT USED			No

Table 8-5. Patriot MCU/DSP (U800) Pinout (Continued)

U401 Pin Number	Description	To/From	Comment	Accessible on Main Board?
P1	NOT USED			No
N1	NOT USED			No
M4	NOT USED			No
M3	NOT USED			No
M2	NOT USED			No
M1	NOT USED			No
L4	NOT USED			No
L3	NOT USED			No
L1	NOT USED			No
L2	NOT USED			No
K2	NOT USED			No
T1	NOT USED			No
R2	NOT USED			No
T2	NOT USED			No
K7	NOT USED			No
N2	NOT USED			No
L5	NOT USED			No
L6	NOT USED			No
C4	NOT USED			No
L13	NOT USED			No
D11	NOT USED			No
E16	KVL_USB_DET*		Active Low	No
F15	16.8_MHZ_OUT	16out (TP)		No
K5	NOT USED			Yes
H8	USB_ENUM			No
F16	RESET	R808	Reset = 0V	Yes
K6	USB_VPI			No
H12	BL_FREQ			No
H13	NOT USED			No
E10	DSP_DE			No
F10	MCU_DE			No

Table 8-5. Patriot MCU/DSP (U800) Pinout (Continued)

U401 Pin Number	Description	To/From	Comment	Accessible on Main Board?
D12	TCK	TCK	ONCE/JTAG	Yes
C13	TMS	TMS	ONCE/JTAG	Yes
E11	TRST	TRST	ONCE/JTAG	Yes
A14	TDO	TDO	ONCE/JTAG	Yes
E12	TDI	TDI	ONCE/JTAG	Yes
M16	NOT USED			No
L14	NOT USED			No
P15	NOT USED			No
L11	NOT USED			No
M14	NOT USED			No
N16	NOT USED			No
L12	NOT USED			No
M12	CKO	CKO	Disabled	Yes
N15	NOT USED			No
M15	NOT USED			No
R12	ADDRESS 0	J601, pin 7		Yes
T13	ADDRESS 1			No
M10	ADDRESS 2			No
T12	ADDRESS 3			No
P13	ADDRESS 4			No
M9	ADDRESS 5			No
P10	ADDRESS 6			No
P12	ADDRESS 7			No
N9	ADDRESS 8			No
R10	ADDRESS 9			No
P9	ADDRESS 10			No
L10	ADDRESS 11			No
T10	ADDRESS 12			No
R9	ADDRESS 13			No
L9	ADDRESS 14			No
K9	ADDRESS 15			No

Table 8-5. Patriot MCU/DSP (U800) Pinout (Continued)

U401 Pin Number	Description	To/From	Comment	Accessible on Main Board?
J9	ADDRESS 16			No
L8	ADDRESS 17			No
M8	ADDRESS 18			No
N8	ADDRESS 19			No
K8	ADDRESS 20			No
L7	ADDRESS 21			No
T7	ADDRESS 22			No
R7	ADDRESS 23	R814		Yes
R3	DATA 15			No
T3	DATA 14			No
N4	DATA 13			No
P4	DATA 12			No
R4	DATA 11			No
J8	DATA 10			No
T4	DATA 9			No
N5	DATA 8			No
P5	DATA 7	R644		Yes
R5	DATA 6	R643		Yes
T5	DATA 5	R642		Yes
R6	DATA 4	R641		Yes
T6	DATA 3	R640		Yes
M7	DATA 2	R639		Yes
N7	DATA 1	R638		Yes
P7	DATA 0	R637		Yes
N11	R_W			No
T11	NOT USED			No
R14	NOT USED			No
N12	CS3*			No
T14	CS2			No
R11	NOT USED			No
R15	CS0	TP_CS0	Active Low	Yes

Table 8-5. Patriot MCU/DSP (U800) Pinout (Continued)

U401 Pin Number	Description	To/From	Comment	Accessible on Main Board?
P16	OE_EN			No
M13	EB1_N			No
R13	EBO_N			No
N14	NOT USED			No
T16	WAIT			No
P14	NOT USED			No
N13	ADV			No
T15	B_CLK			No

Table 8-6. MAKO (U701) Pinout

Pin Ref Number	U701 Pin Name	To/From	Comment	Accessible on Main Board?
A4	VREF	GND	1.231	Yes
N3	UCM_SS	UCM_SS	2.9	No
P9	ONE_WIRE_1	ONE_WIRE_OPT	2.9	Yes
A5	BBP_CLK	TX_SSI_CLK	1.536MHz	Yes
H4	VCM2	GND	1/2 B+ (3.75V)	Yes
J1	EXT_MIC_M	GND	3.3V	Yes
J2	EXT_MIC_P	EXT_MIC	3.3V	Yes
J3	VCM1	GND	3.3V	Yes
K1	INT_MIC_M	GND	3.3V	Yes
K2	INT_MIC_P	INT_MIC	3.3V	Yes
B5	BBP_SYNC	TX_SSI_FSYNC	48KHz	Yes
E7	VC_DCLK	CODEC_DCLK	520Hz	Yes
L10	VMES	GND	5V	Yes
L11	ATOD_2	EMERG	5V	Yes
L2	MIC_BIAS	EXT_MIC	5V	Yes
L6	USB_CONNECT	Q704	5V	Yes
L8	ONE_WIRE_BATT	BAT_STATUS	5V	Yes
M10	TXDO_BDI_5V	RS232_DO_USB+	5V	Yes

Table 8-6. MAKO (U701) Pinout (Continued)

Pin Ref Number	U701 Pin Name	To/From	Comment	Accessible on Main Board?
M11	RTS_FILLSEN_5V	RTS	5V	Yes
M12	ADC_VREF	GND	5V	Yes
M13	ATOD_1	VOLUME	5V	Yes
N12	RXDIN_5V	RS232_DI_USB-	5V	Yes
N13	SB96_BUS_BUSY	SB9600_BUSY	5V	Yes
N6	USB1_DP	RS232_D0_USB+	5V	Yes
N9	SB96_BDO_KF_5V	LHDATA_KEYFAIL	5V	Yes
P13	CTS_CABLE_DET_5V	CTS	5V	Yes
P7	USB1_DM	RS232_DI_USB-	5V	Yes
D7	VC_FSYNC	CODEC_FSYNC	8KHz	Yes
F1	INT_SPKR_P	INT_SPKR_POS	B+(7.5V)	Yes
F2	INT_SPKR_M	INT_SPKR_NEG	B+(7.5V)	Yes
G1	EXT_SPKR_M	EXT_SPKR_NEG	B+(7.5V)	Yes
G2	PA_IN_P	VC_OUT_P	B+(7.5V)	Yes
G3	PA_IN_M	VC_OUT_M	B+(7.5V)	Yes
H1	EXT_SPKR_P	EXT_SPKR_POS	B+(7.5V)	Yes
H2	VC_OUT_M	PA_IN_N	B+(7.5V)	Yes
H3	VC_OUT_P	PA_IN_P	B+(7.5V)	Yes
A3	TEST	GND	GND	No
C4	SCAN_EN	GND	GND	No
E8	VFUSE	GND	GND	No
B11	AD_TRIG	ADTRIG	NA	No
B6	SPI_DI	SPI_MOSIB	NA	No
C6	SPI_DO	SPI_MISOB	NA	No
A11	TX_RX	NC	NC	No
B12	OPTION_INTX	NC	NC	No
B7	VC_TX	NC	NC	No
C10	USB_INTX	NC	NC	No
C11	OPT_GPIO1	NC	NC	No
D11	OPT_GPIO3	NC	NC	No

Table 8-6. MAKO (U701) Pinout (Continued)

Pin Ref Number	U701 Pin Name	To/From	Comment	Accessible on Main Board?
F10	OPT_GPIO0	NC	NC	No
G10	OPT_GPIO2	NC	NC	No
J5	TXDO_BDI_UP_3V	TXDO_BDI_ENC_3V	NC	No
K12	ATOD_7	NC	NC	No
K13	ATOD_8	NC	NC	No
K6	TXDO_BDI_ENC_3V	TXDO_BDI_UP_3V	NC	No
K7	OPTA_SEL1	NC	NC	No
K8	OPTB_SEL1	NC	NC	No
L3	FE_TUNE1	NC	NC	No
M14	ATOD_3	NC	NC	No
M2	FE_TUNE2	NC	NC	No
M3	RTS_FILLSEN_3V	NC	NC	No
M8	ONE_WIRE_2	NC	NC	No
M9	OPTA_SEL2	NC	NC	No
N1	PWR_CTRL	NC	NC	No
N10	OPTA_SEL3	NC	NC	No
N11	OPTB_SEL3	NC	NC	No
N2	RXDIN_ENC_3V	RXDIN_3V	NC	No
N7	USB2_DP	NC	NC	No
N8	SB96D_BDO_KF_3V	UART2_RXD_OD	NC	No
P10	OPTA_SEL0	NC	NC	No
P11	OPTB_SEL0	NC	NC	No
P12	OPTB_SEL2	NC	NC	No
P2	RXDIN_3V	RXDIN_ENC_3V	NC	No
P8	USB2_DM	NC	NC	No
E1	PA_BPLUS	SW_B+	SW_B+(7.5V)	Yes
E3	BPLUS	BPLUS	UNSW_B+(7.5V)	No
A7	VC_RX	CODEC_RX	V1.55(1.6V)	Yes
A6	LOGIC_VDD	V2.9	V2.9	No
A8	RS232_USB_X	RS232_USB_X	V2.9	Yes

Table 8-6. MAKO (U701) Pinout (Continued)

Pin Ref Number	U701 Pin Name	To/From	Comment	Accessible on Main Board?
K11	ATOD_6	V2.9	V2.9	Yes
L13	ATOD_5	V2.9	V2.9	Yes
L5	APCO	V2.9	V2.9	Yes
M4	VC_TX3V	CODEC_TX	V2.9	Yes
N14	ATOD_0	V2.9	V2.9	No
L12	ATOD_4	BAT_STATUS	VCC5(5V)	Yes
A10	UART2_RXD_OD	SB96D_BDO_KF_3V/ V2.9/URXD3	VDD(1.65-3.6V)	Yes
A9	USB2_OE_RCV_RTS	URTS1_XRXD	VDD(1.65-3.6V)	Yes
B10	CTS_X	UCTS_USB_SPEED	VDD(1.65-3.6V)	Yes
B8	USB1_OE	USB_TXENAB	VDD(1.65-3.6V)	Yes
B9	USB2_DAT_VP	USB_VPI	VDD(1.65-3.6V)	Yes
C12	BUSY_IN	BUSY_IN_RTS	VDD(1.65-3.6V)	Yes
C7	BOOT_NORM_X	BOOT_NORM_X	VDD(1.65-3.6V)	Yes
C8	USB1_DAT_TXD	TXD1_USB_VPO	VDD(1.65-3.6V)	Yes
C9	USB2_SE0_VM_RXD	URXD1_USB_VMI	VDD(1.65-3.6V)	Yes
D10	CABLE_DET_3V	KVL_USB_DET	VDD(1.65-3.6V)	Yes
D6	SPI_CS	MAKO_CE	VDD(1.65-3.6V)	Yes
D8	USB1_SE0	USB_VMO	VDD(1.65-3.6V)	Yes
E11	BUSY_OUT	BUSY_OUT_CTS	VDD(1.65-3.6V)	Yes
E6	SPI_CLK	SCKB	VDD(1.65-3.6V)	Yes
E9	UART2_TXD	UTXD2	VDD(1.65-3.6V)	Yes
L7	ONE_WIRE_UP	ONE_WIRE_UP/V2.9	VDD(1.65-3.6V)	Yes
	POWER MANAGE-MENT BLOCK			
B2	BAT_TYPE	GND	0-5V	Yes
D2	BAT_3V6	GND	0-5V	Yes
D3	REG_3V6	GND	0-5V	Yes
G4	HV_BG	GND	1.2V	Yes
M1	TXCO_IN	16_8MHz	16.8MHz (2.5-3.3V)	Yes
J13	SW2_VOUT	GND	2.3V	Yes

Table 8-6. MAKO (U701) Pinout (Continued)

Pin Ref Number	U701 Pin Name	To/From	Comment	Accessible on Main Board?
J14	SW2_LX	GND	2.3V	Yes
A2	PGLD03	VSAVE	2.5V	Yes
C2	VSAVE	VSAVE	2.5V	Yes
E4	MECH_SW	MECH_SW	2.5V	Yes
N5	V04_O	GND	2.775V	Yes
P6	V07_O	GND	2.8V	Yes
A12	XOUT	XTAL FREQ	24.576MHz (3.3V)	Yes
A13	XIN	XTAL FREQ	24.576MHz (3.3V)	Yes
L1	V09_O	GND	3.3V	Yes
M6	V10_O	GND	3.3V	Yes
B1	XTAL32_OUT	32.768KHz	32.768MHz (2.5-3.3V)	Yes
C1	XTAL32_IN	32.768KHz	32.768MHz (2.5-3.3V)	Yes
F5	GATED_32K_CLK	MAKO_32KHZ	32KHZ(VDD)	Yes
K4	V08_O	VCC5 SUPPLY	5V	Yes
E2	FET_ENX	VPP_EN/UNSW_B+/ SW_B+	B+(7.5V)	Yes
F14	SW1_PHASE	VSW1	B+(7.5V)	Yes
F3	BAT_RTC	GND	B+(7.5V)	Yes
B3	SW_TYPE	GND	GND	No
C3	PGLDO2	GND	GND	No
D14	GND7	GND	GND	No
D4	TCXO_SEL_16_24	GND	GND	No
D9	GND9	GND	GND	No
G5	GND4	GND	GND	No
H14	SW1_GND	Q702	GND	No
H5	GND8	GND	GND	No
J4	GND3	GND	GND	No
K9	GND5	GND	GND	No
L14	SW2_GND	GND	GND	No
L4	GND6	GND	GND	No
L9	V10_GND	GND	GND	No

Table 8-6. MAKO (U701) Pinout (Continued)

Pin Ref Number	U701 Pin Name	To/From	Comment	Accessible on Main Board?
M7	GND2	GND	GND	No
P5	GND1	GND	GND	No
B13	VBUS_SUPPLY	NC	NC	No
B4	IGN_X	NC	NC	No
C13	VBUS2_CMD	NC	NC	No
C14	VBUS1_CMD	NC	NC	No
D12	VBUS2	NC	NC	No
D13	SW5_VDD	NC	NC	No
E12	VBUS1_SENS	NC	NC	No
E13	SW5_SUMCOMP	NC	NC	No
E14	SW5_VSENSE	NC	NC	No
F11	VBUS2_SENS	NC	NC	No
F12	SW5_VOUT	NC	NC	No
F13	SW5_VDDHV	NC	NC	No
F4	EMERG_PB	NC	NC	No
G11	SW5_PHASE	NC	NC	No
H10	VBUS1	NC	NC	No
H13	SW1_DH	NC	NC	No
J11	SW1_VSEN_BST	NC	NC	No
NC1	NC1	NC	NC	No
NC2	NC2	NC	NC	No
NC3	NC3	NC	NC	No
NC4	NC4	NC	NC	No
NC5	NC5	NC	NC	No
NC6	NC6	NC	NC	No
G12	SW1_VDDHV	SW_B+	SW_B+(7.5V)	Yes
H11	SW1_VSEN_BUK	SW_B+	SW_B+(7.5V)	Yes
K3	V08_I	SW_B+	SW_B+(7.5V)	Yes
D1	BAT_7V5	UNSW_B+	UNSW_B+(7.5V)	Yes
P4	V03_O	V1.55	V1.55(1.6V)	Yes

Table 8-6. MAKO (U701) Pinout (Continued)

Pin Ref Number	U701 Pin Name	To/From	Comment	Accessible on Main Board?
N4	V02_O	V1.875	V1.875	Yes
P3	V06_O	V2.9	V2.9	Yes
C5	RESETX	MAKO RESET	VDD(1.65-3.6V)	Yes
D5	INT_X	MAKO_INT_X	VDD(1.65-3.6V)	Yes
G13	SW1_VDD	Q702	VDD(1.65-3.6V)	Yes
G14	SW1_SUMCOMP_DL	Q702	VSW1 (3.6V)	Yes
H12	SW1_VOUT	VSW1	VSW1 (3.6V)	No
J10	V10_I	VSW1	VSW1 (3.6V)	Yes
J12	SW2_VCC	VSW1	VSW1 (3.6V)	Yes
K14	SW2_VCCS	VSW1	VSW1 (3.6V)	Yes

Chapter 9 Schematics, Board Overlays, and Parts Lists

9.1 Introduction

This chapter contains the schematics, board layouts, and parts lists for the XTS 2500/2500I/2250/1500 radios. Use them in conjunction with the theory of operation and the troubleshooting procedures, charts, and waveforms to isolate a problem to the component level.

Table 9-1. UHF2 Schematics, Board Overlays and Parts Lists

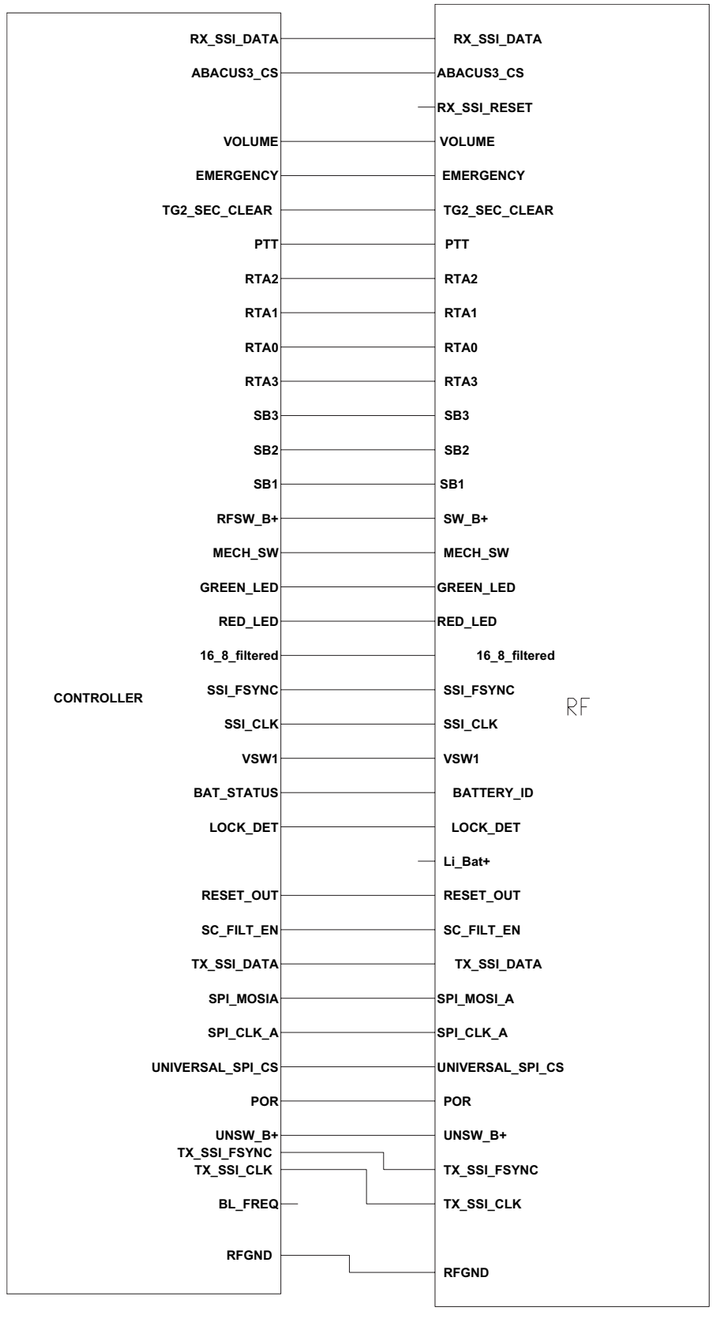


Figure 9-1. PMLE4427A (8416852H01_A)

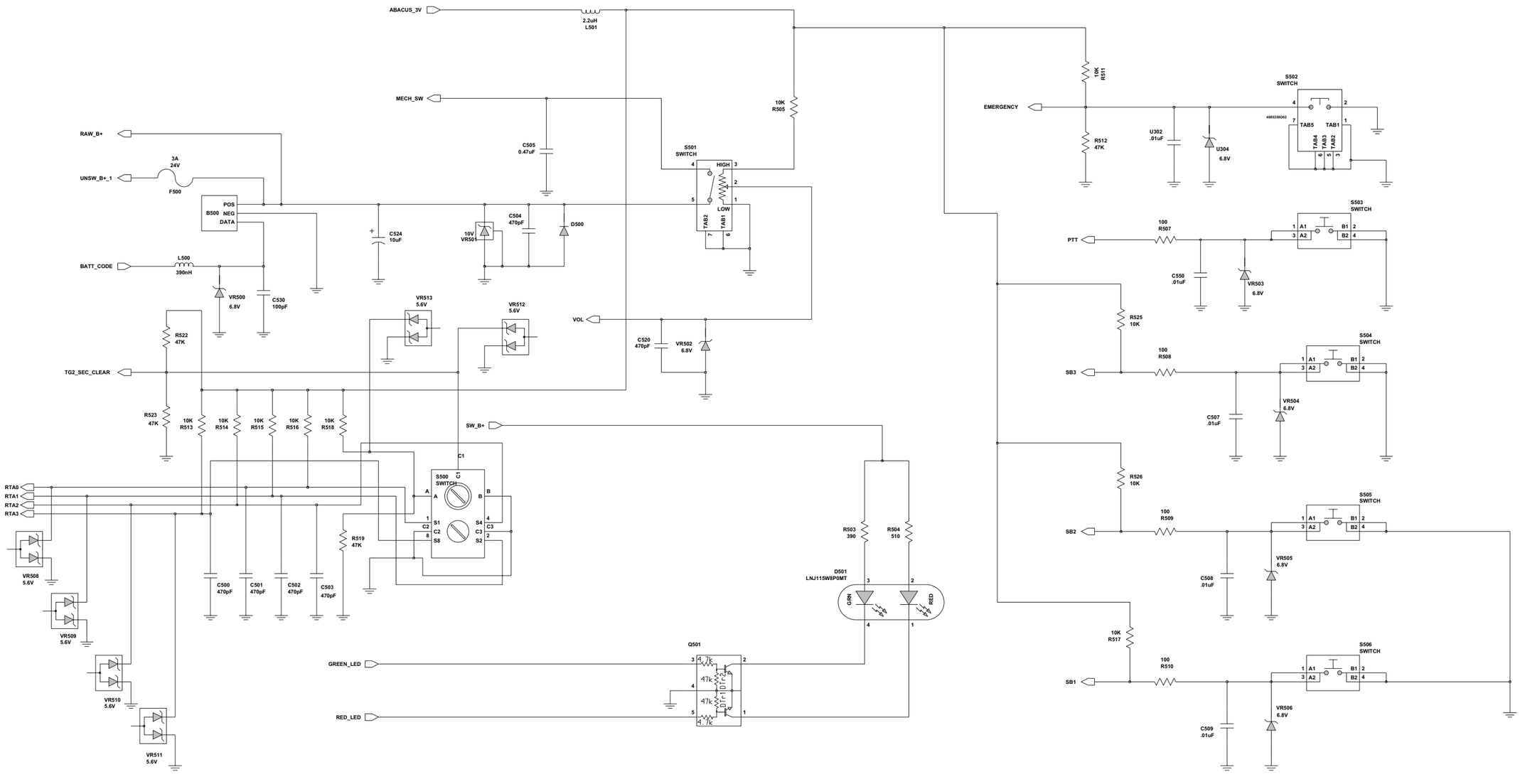


Figure 9-2. PMLE4427A Controls

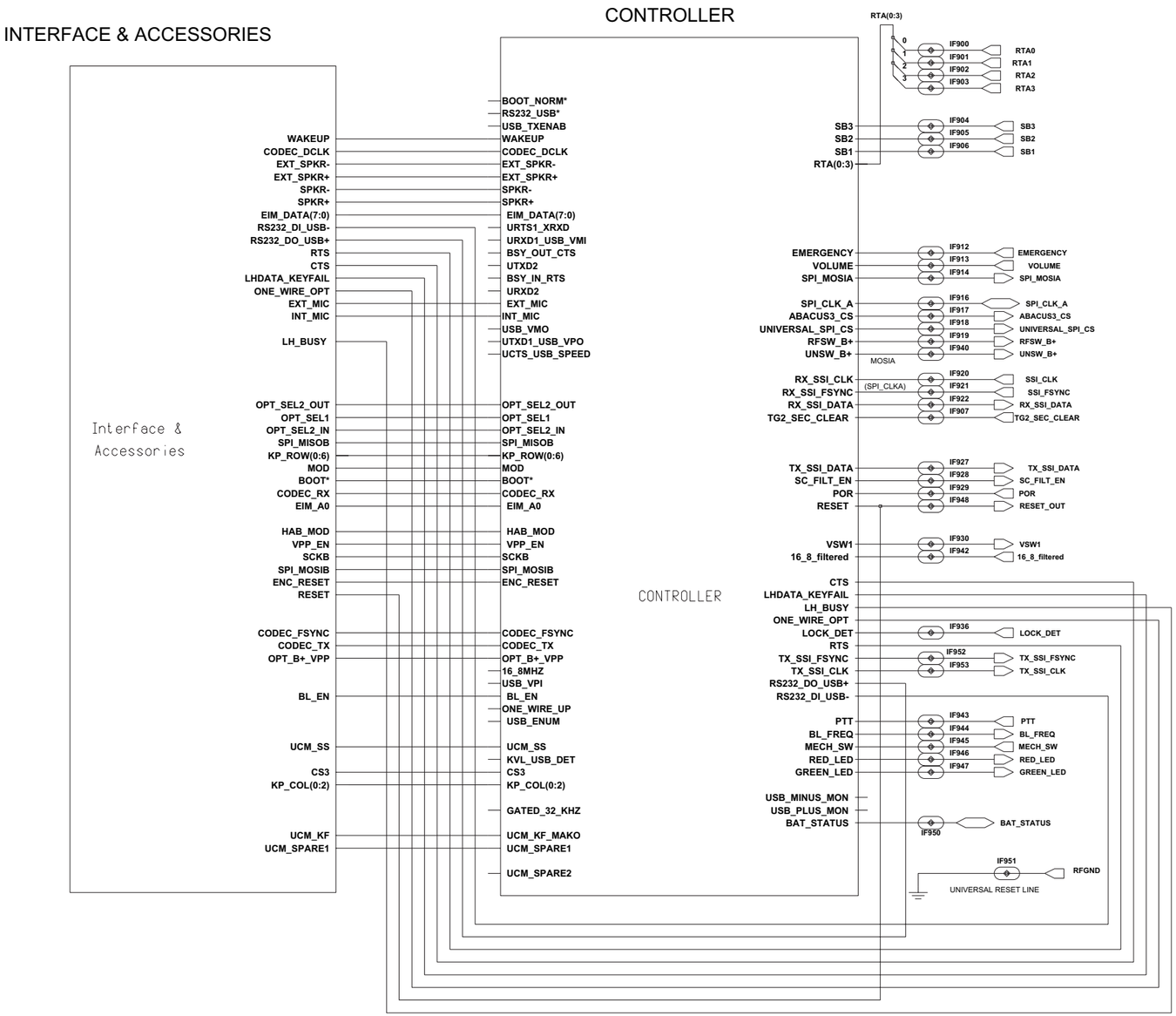


Figure 9-3. PMLE4427A Controller Interface Schematic

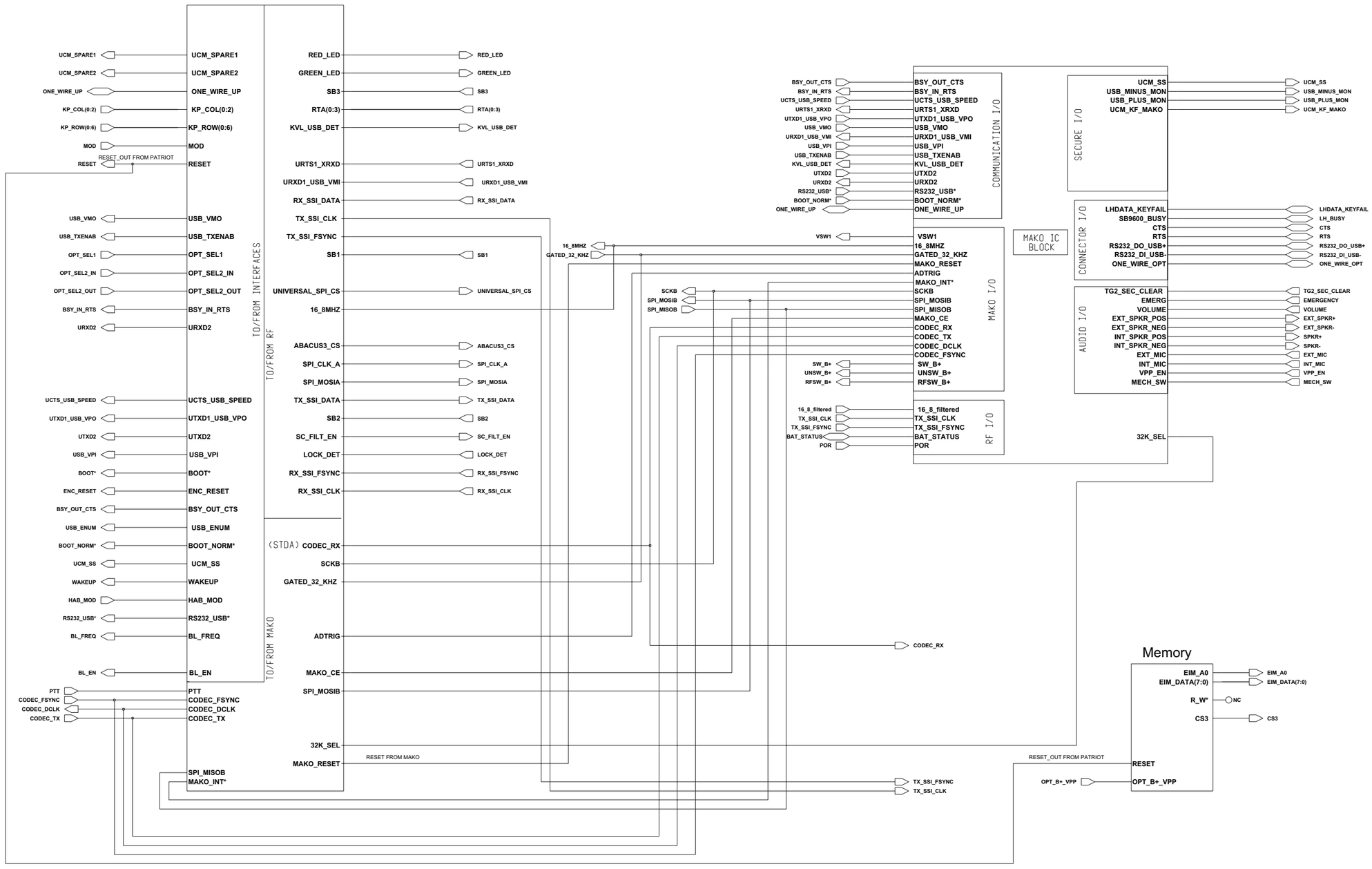


Figure 9-4. PMLE4427A Patriot Bravo Revision Schematic

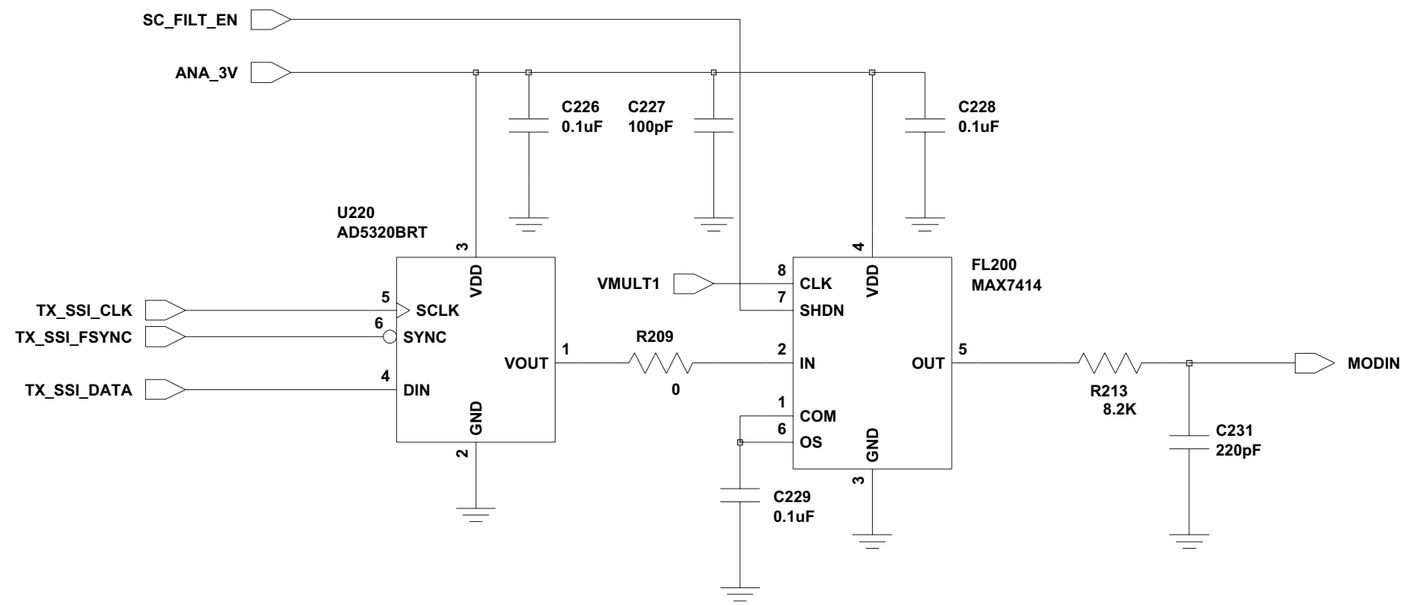


Figure 9-5. PMLE4427A Digital to Analog Schematic

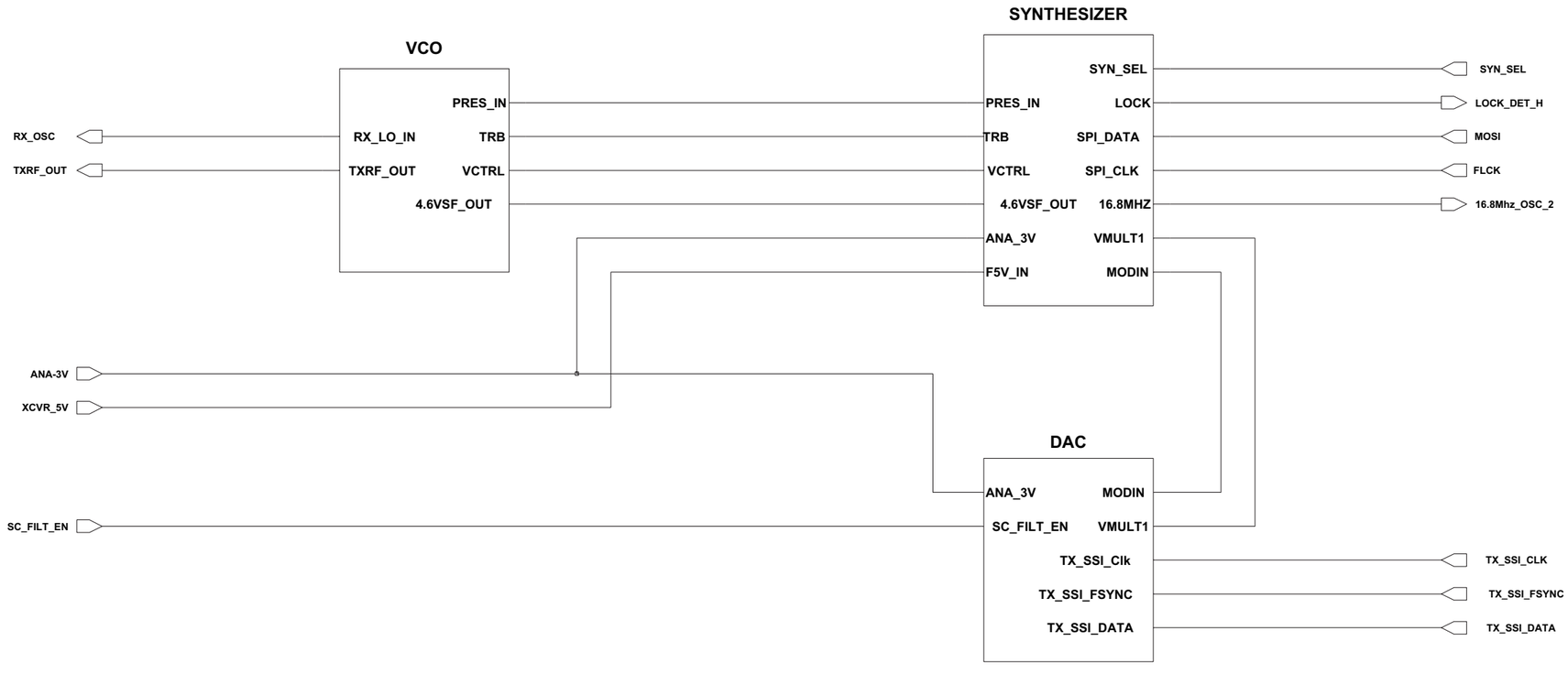


Figure 9-6. PMLE4427A Frequency Generation Unit (FGU) Schematic

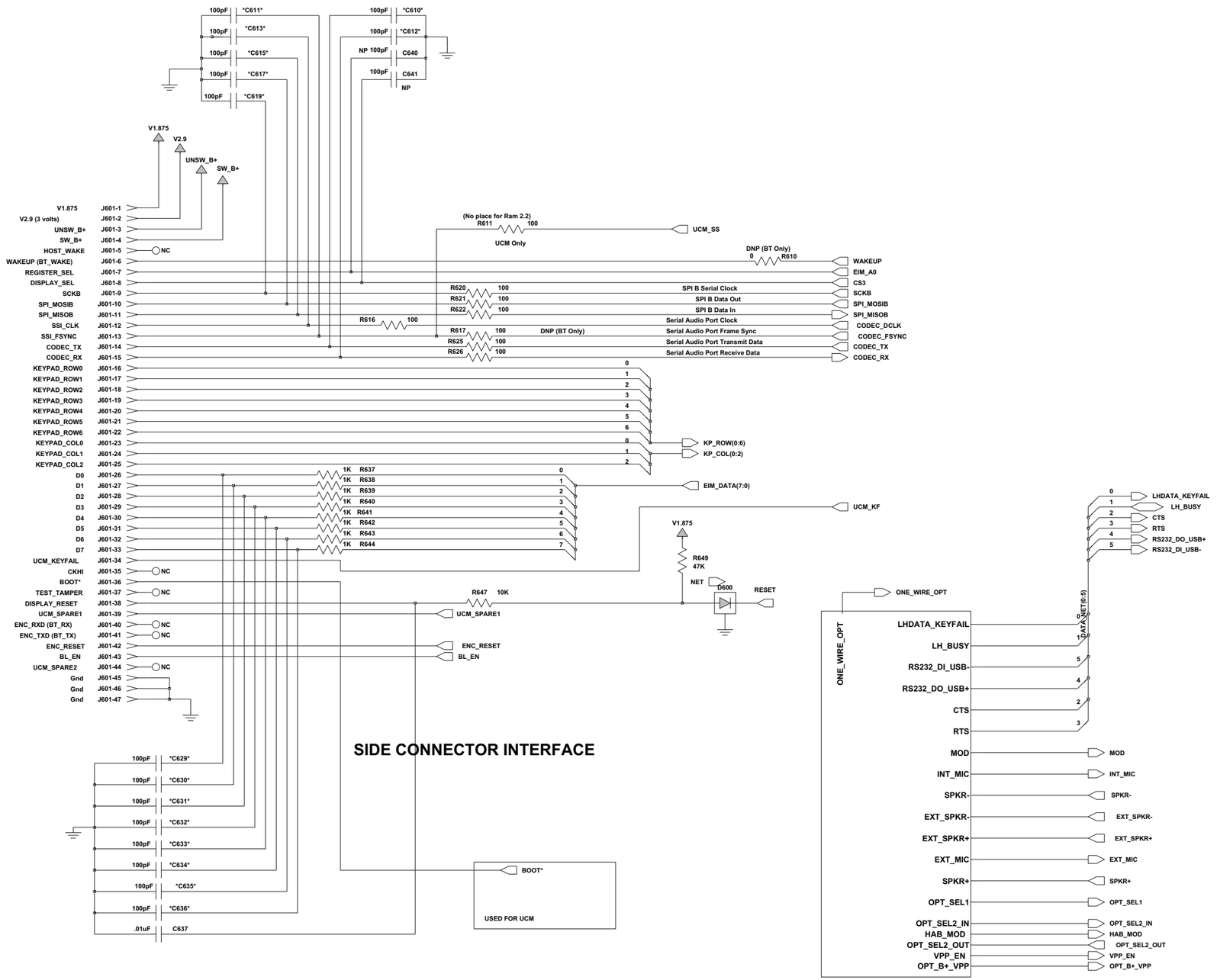


Figure 9-7. PMLE4427A Interface and Accessories Schematic

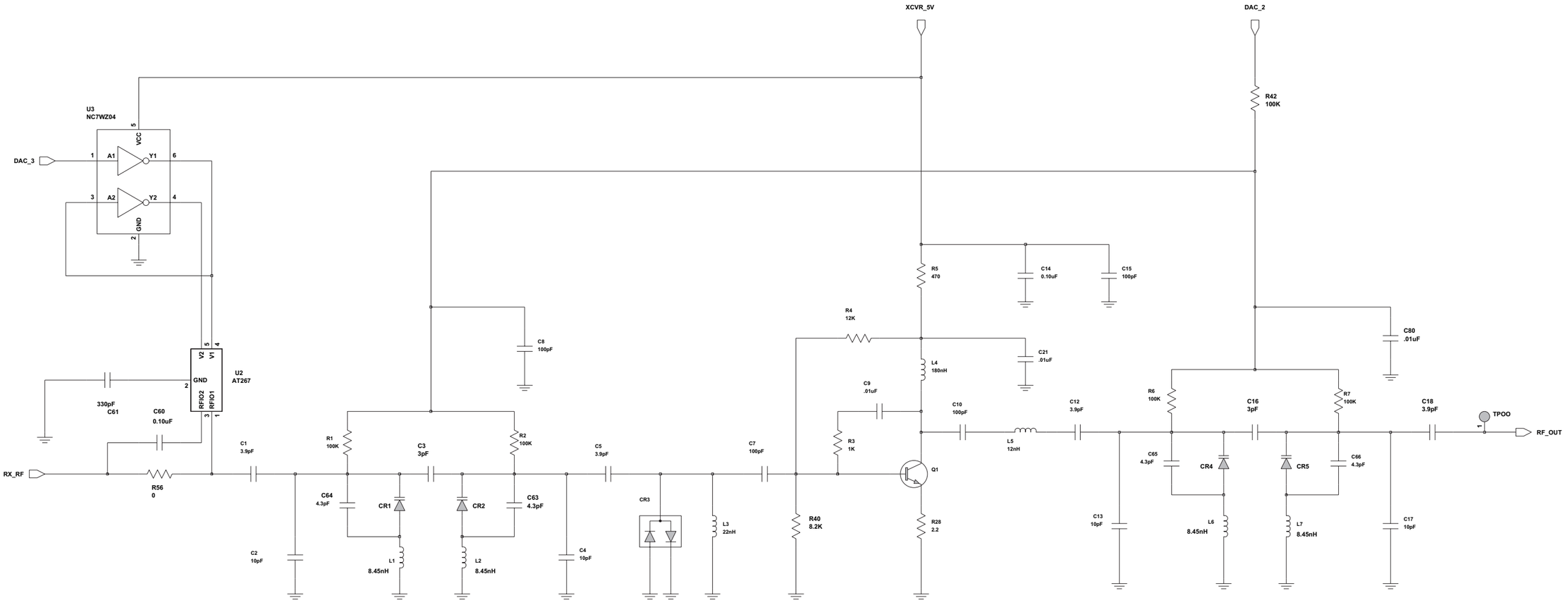


Figure 9-8. PMLE4427A LNA Schematic

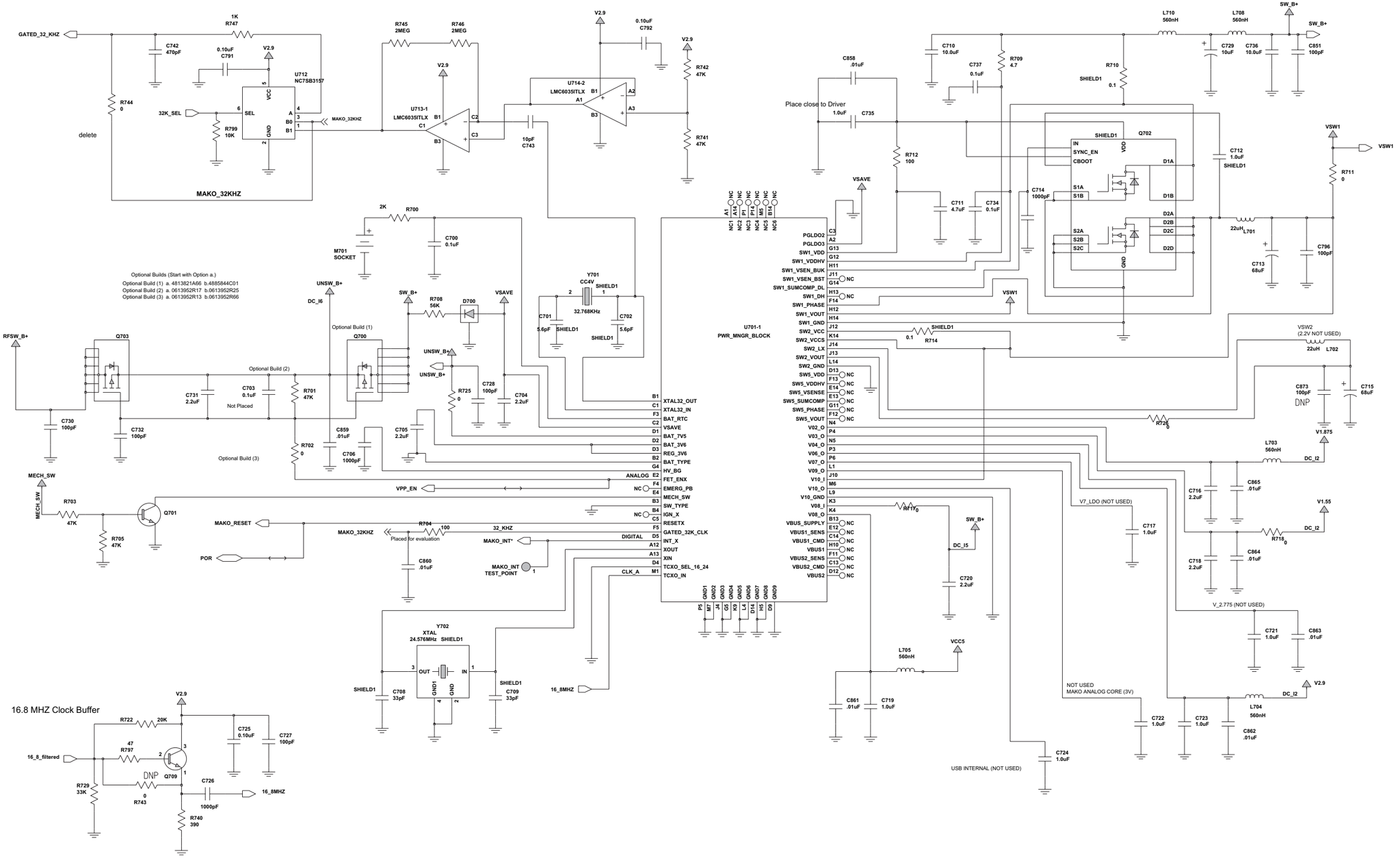


Figure 9-9. PMLE4427A MAKO Schematic Sheet 1 of 2

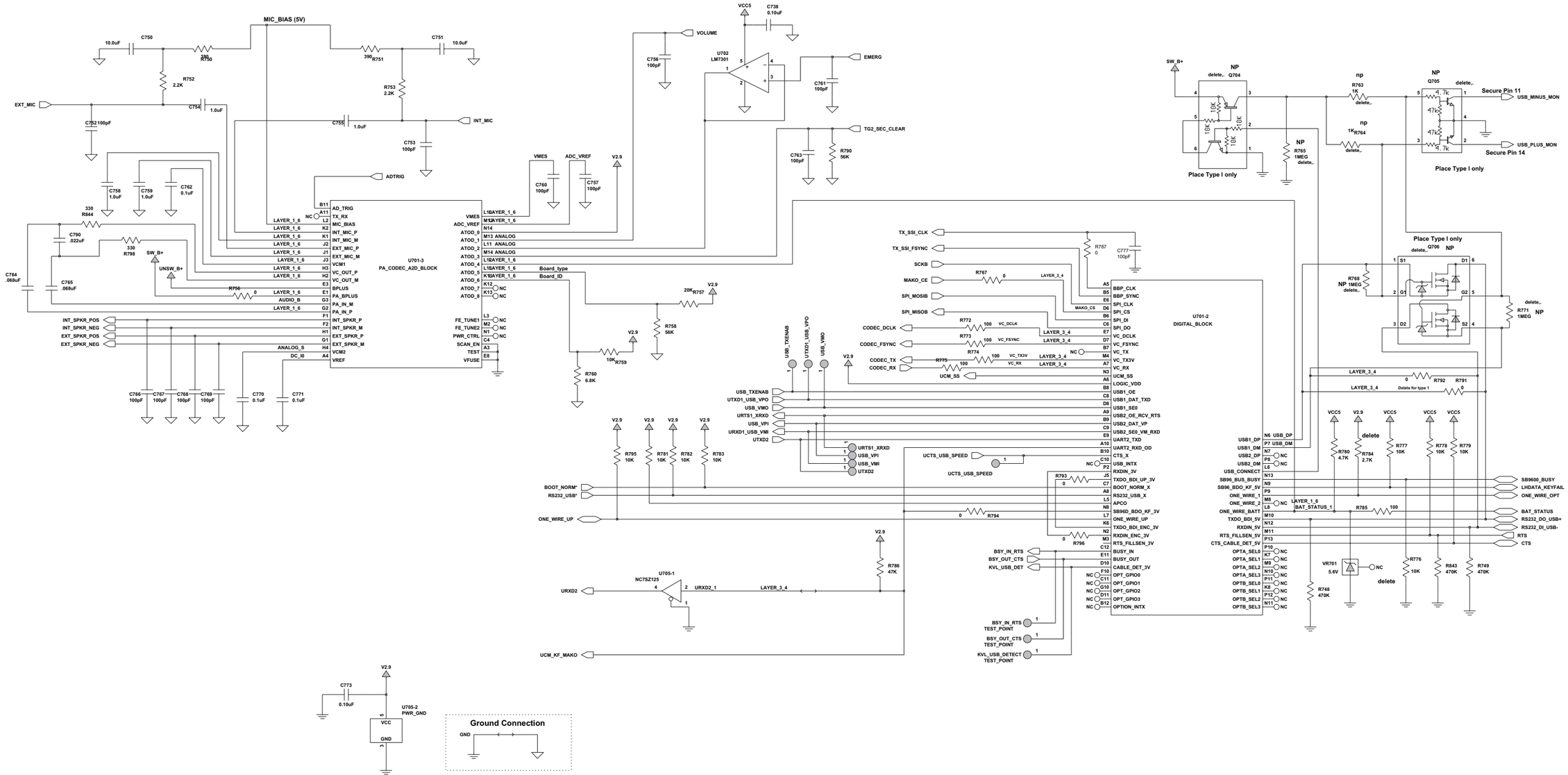


Figure 9-10. PMLE4427A MAKO Schematic Sheet 2 of 2

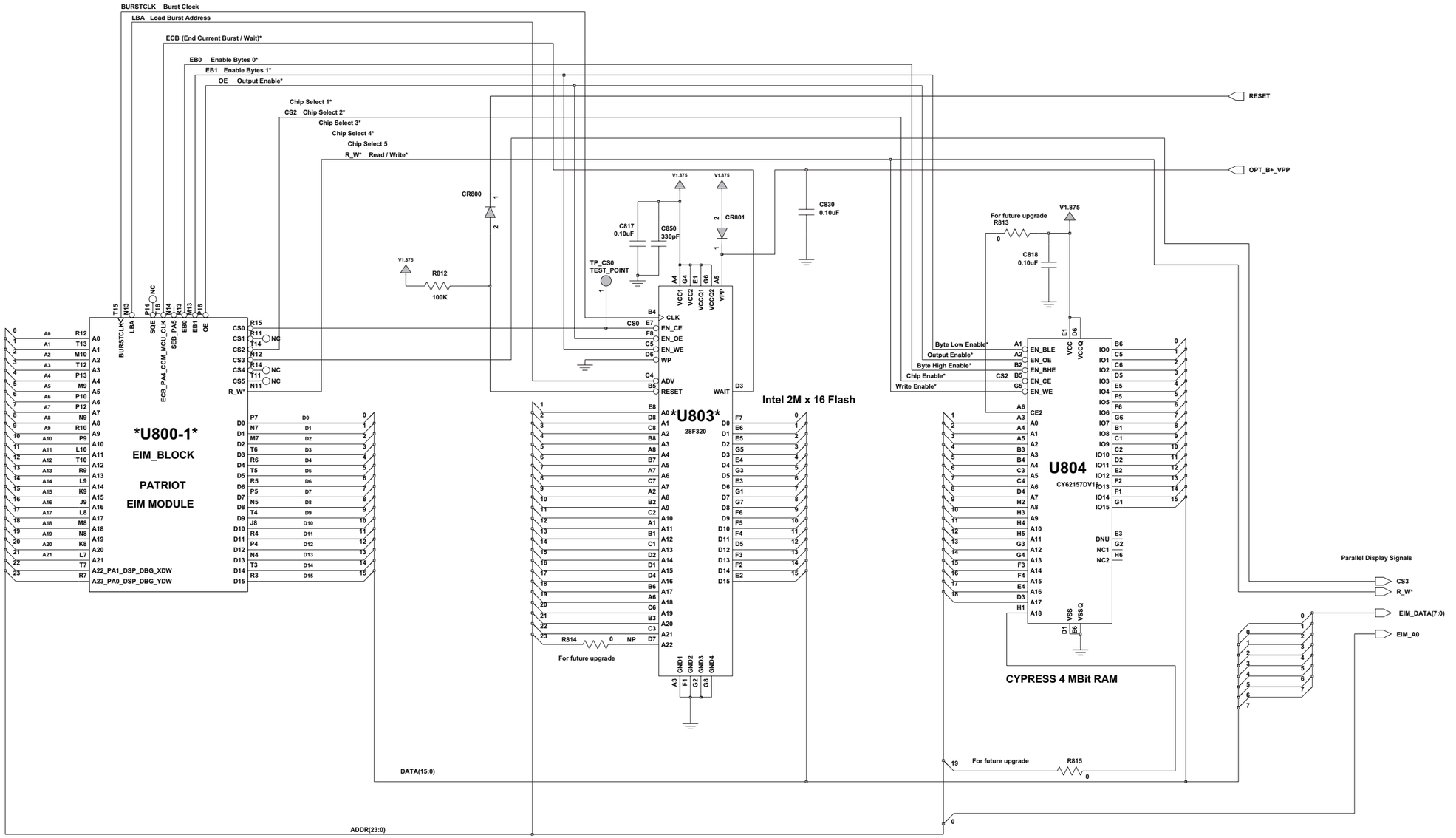


Figure 9-11. PMLE4427A Memory Schematic

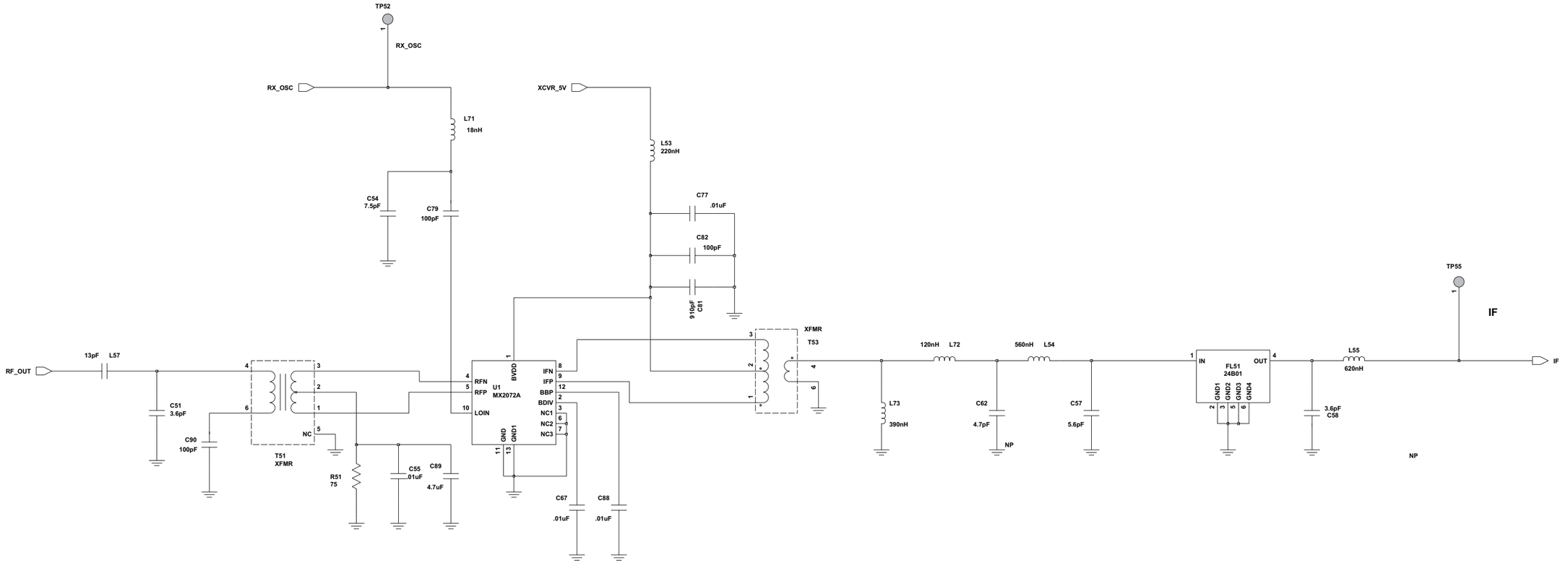


Figure 9-12. PMLE4427A Mixer Schematic

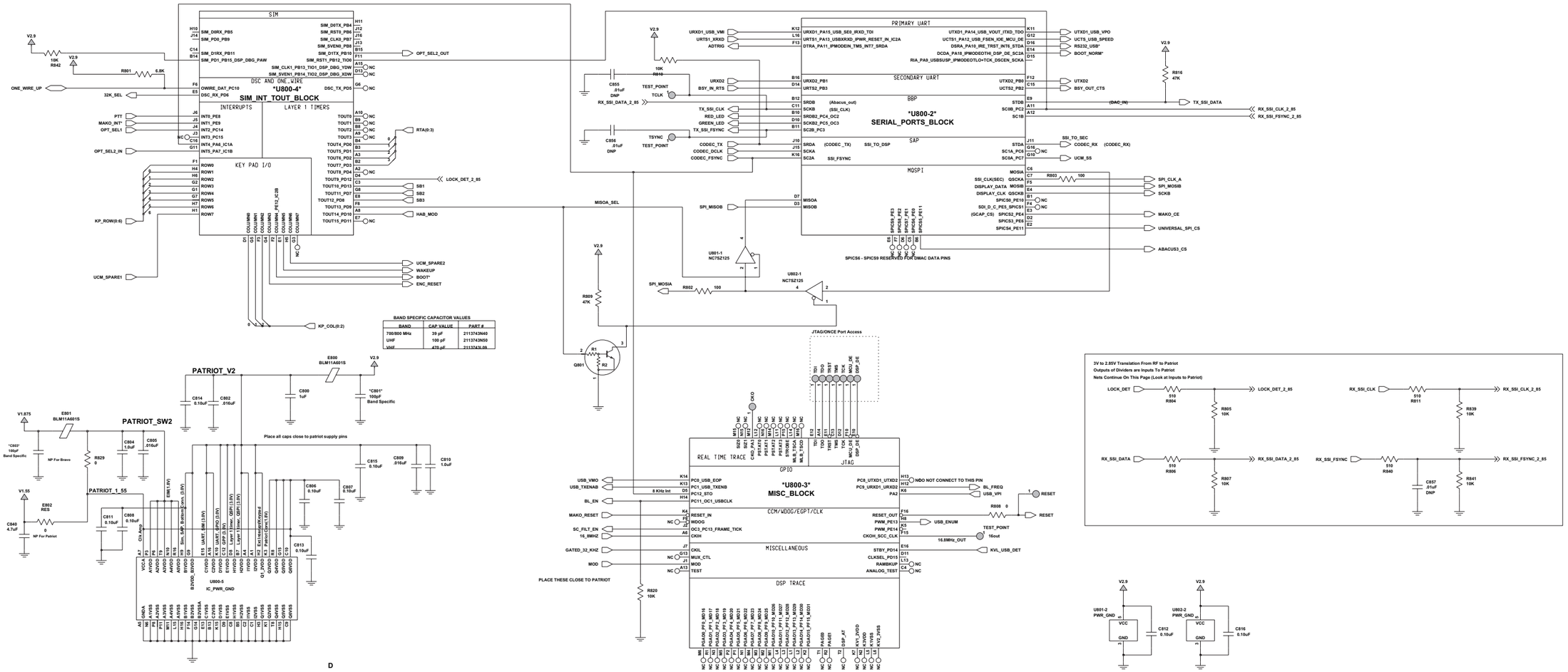


Figure 9-13. PMLE4427A Patriot Schematic

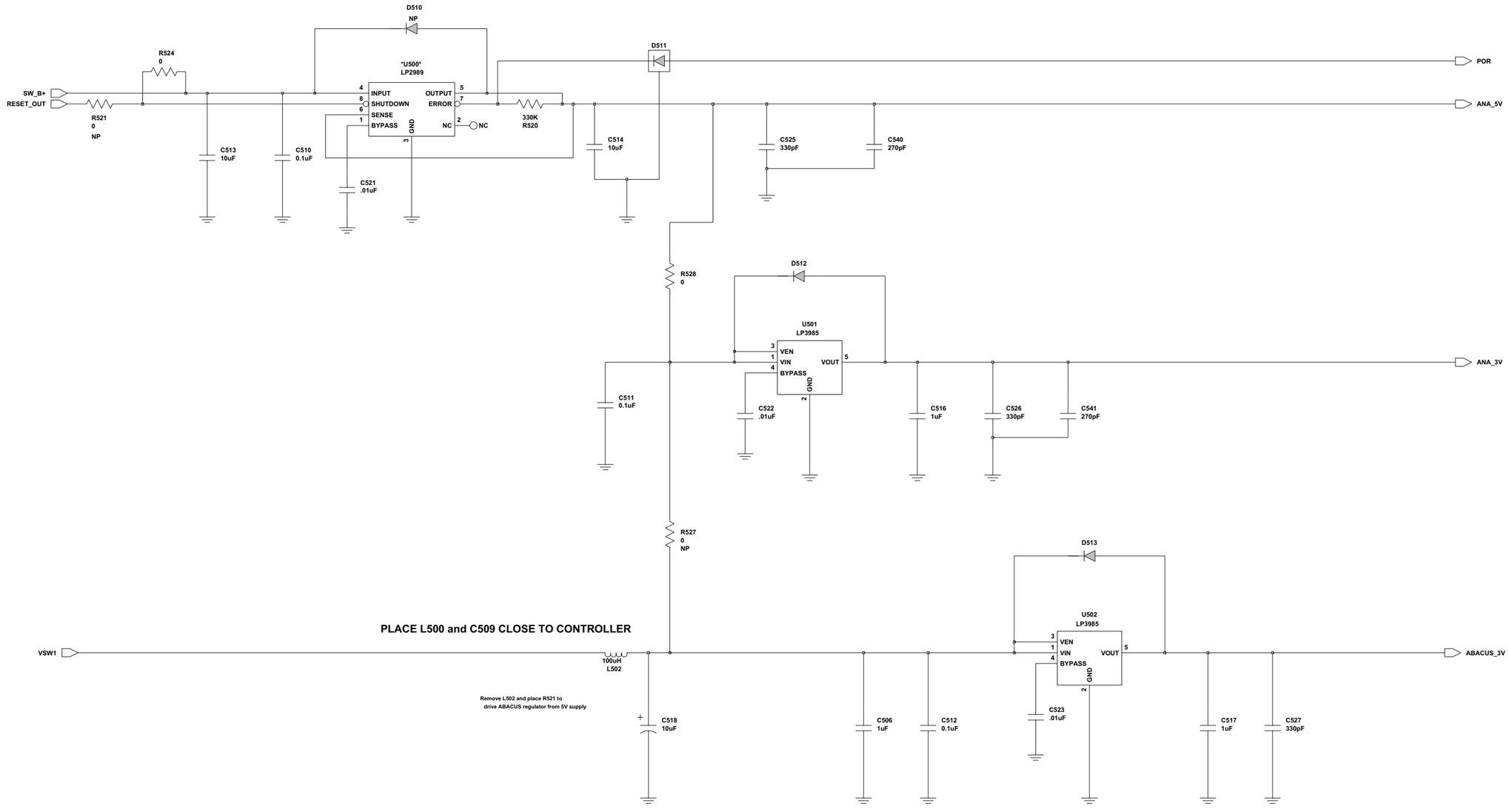


Figure 9-14. PMLE4427A Regulators Schematic

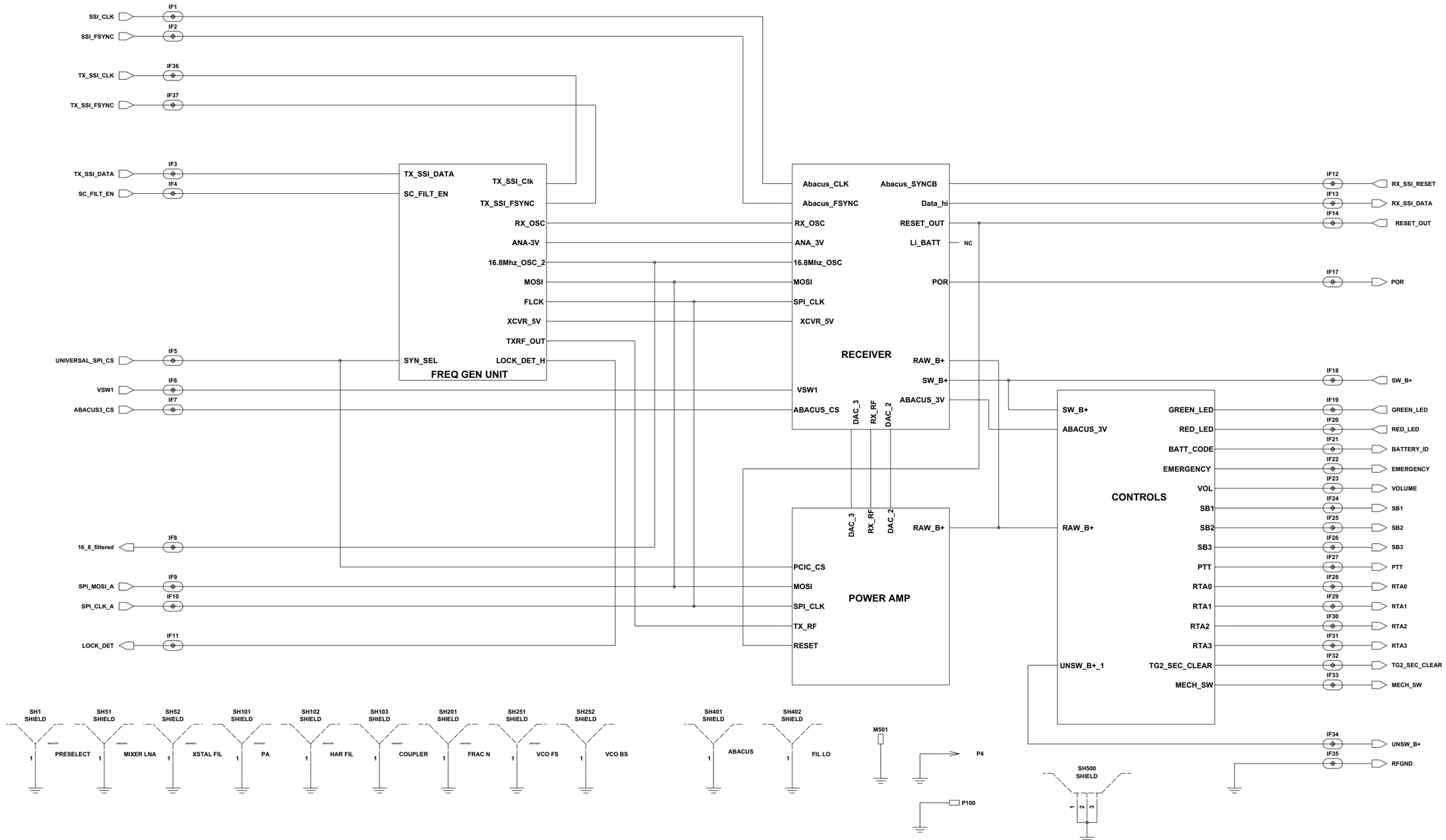


Figure 9-15. PMLE4427A RF Schematic

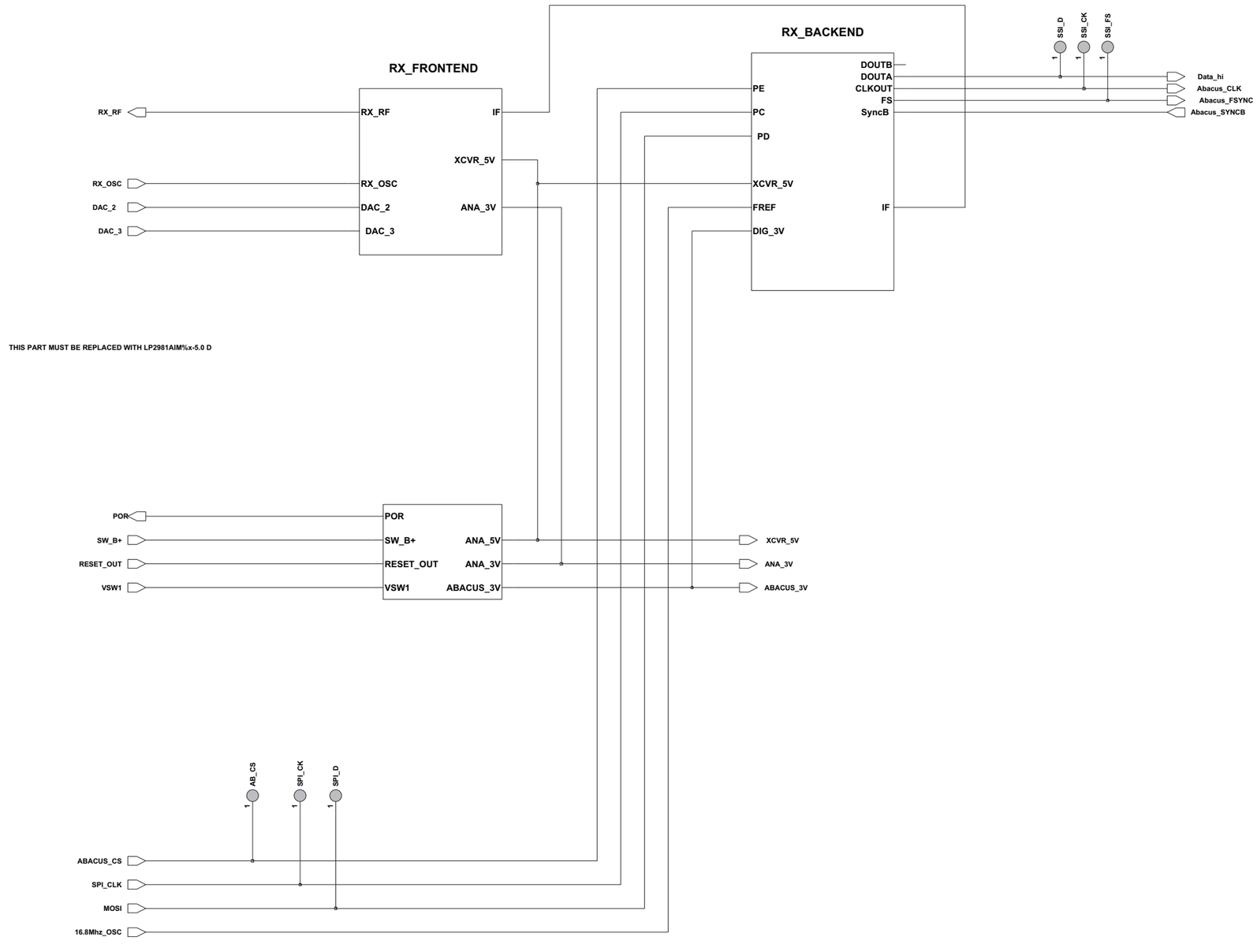


Figure 9-16. PMLE4427A RX Schematic

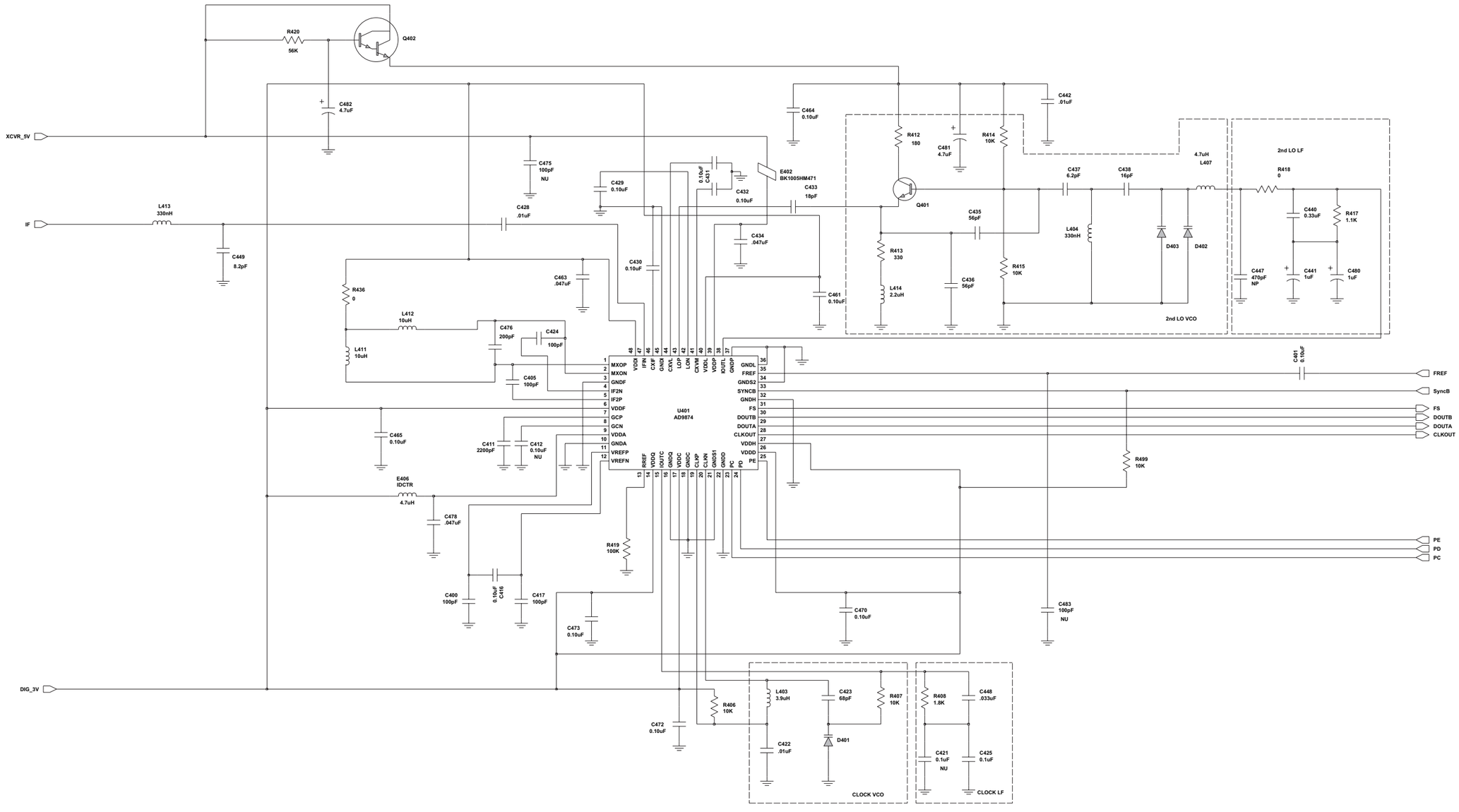


Figure 9-17. PMLE4427A RX (back-end) Schematic

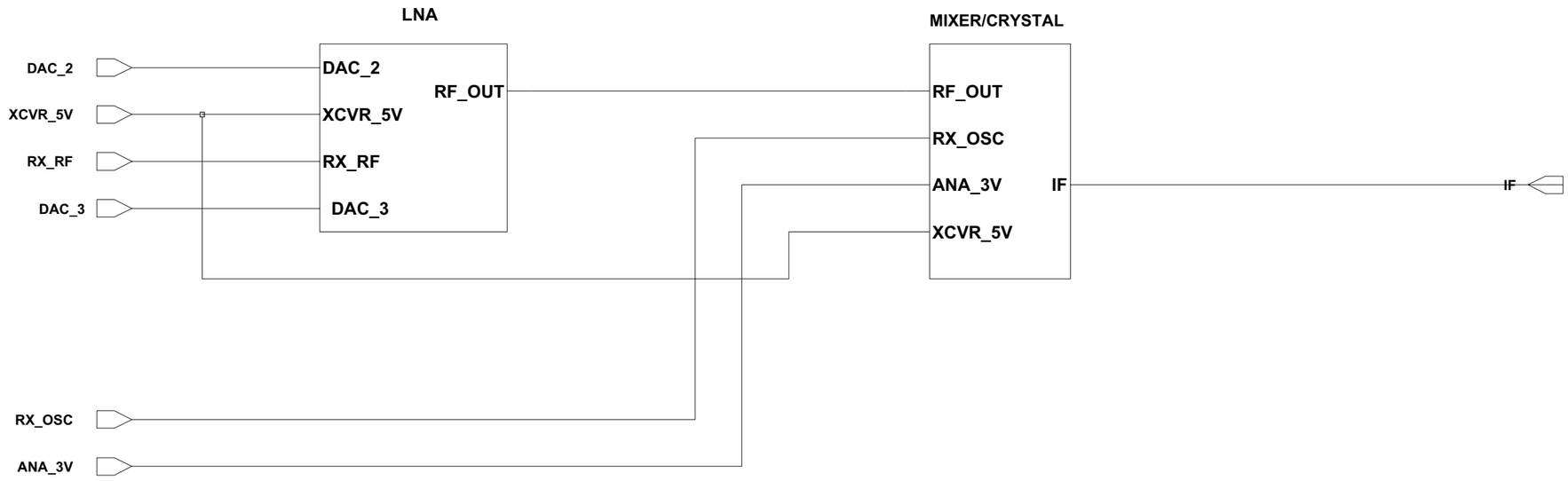


Figure 9-18. PMLE4427A RX (front-end) Schematic

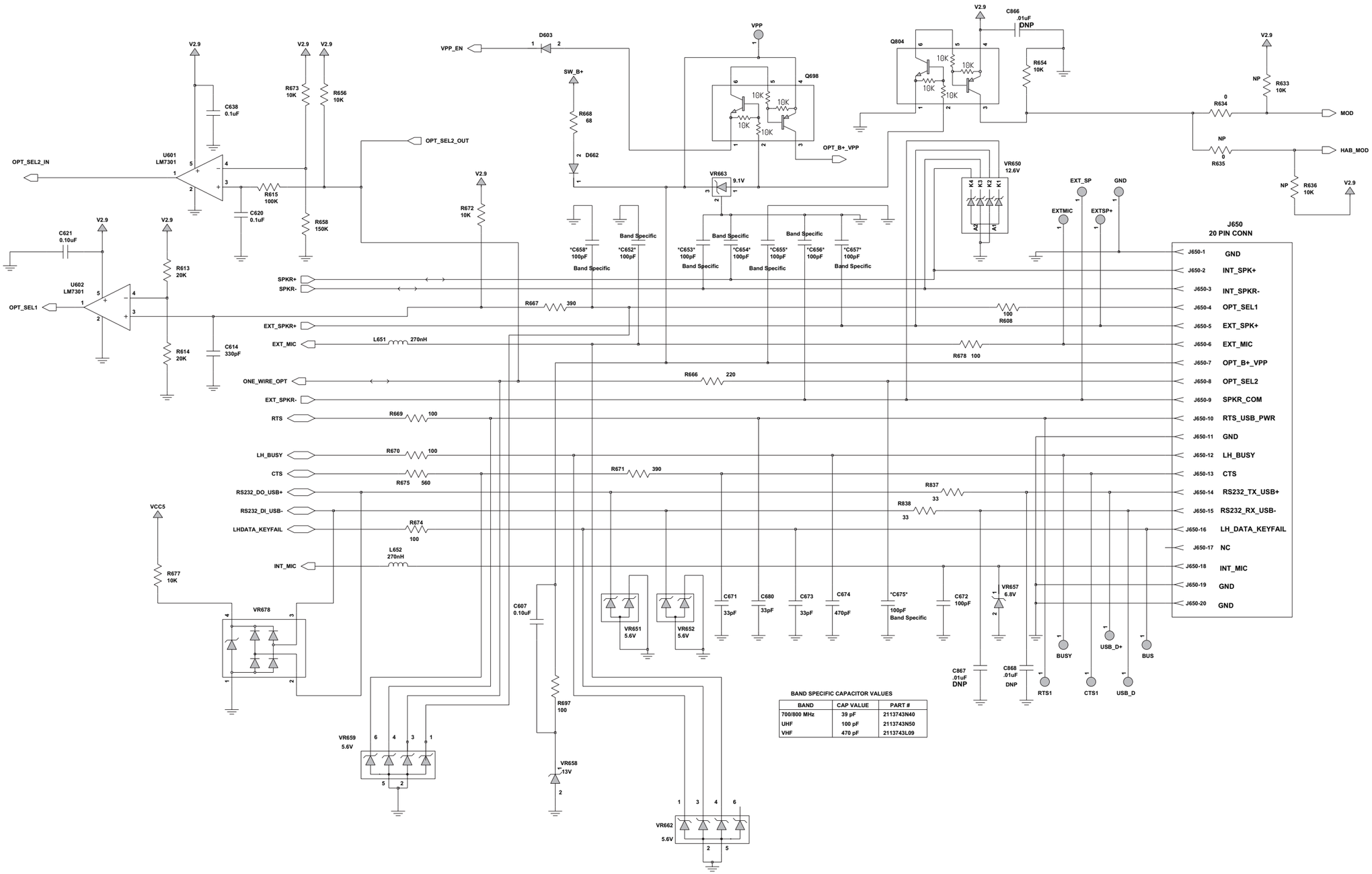


Figure 9-19. PMLE4427A Side Connector Schematic

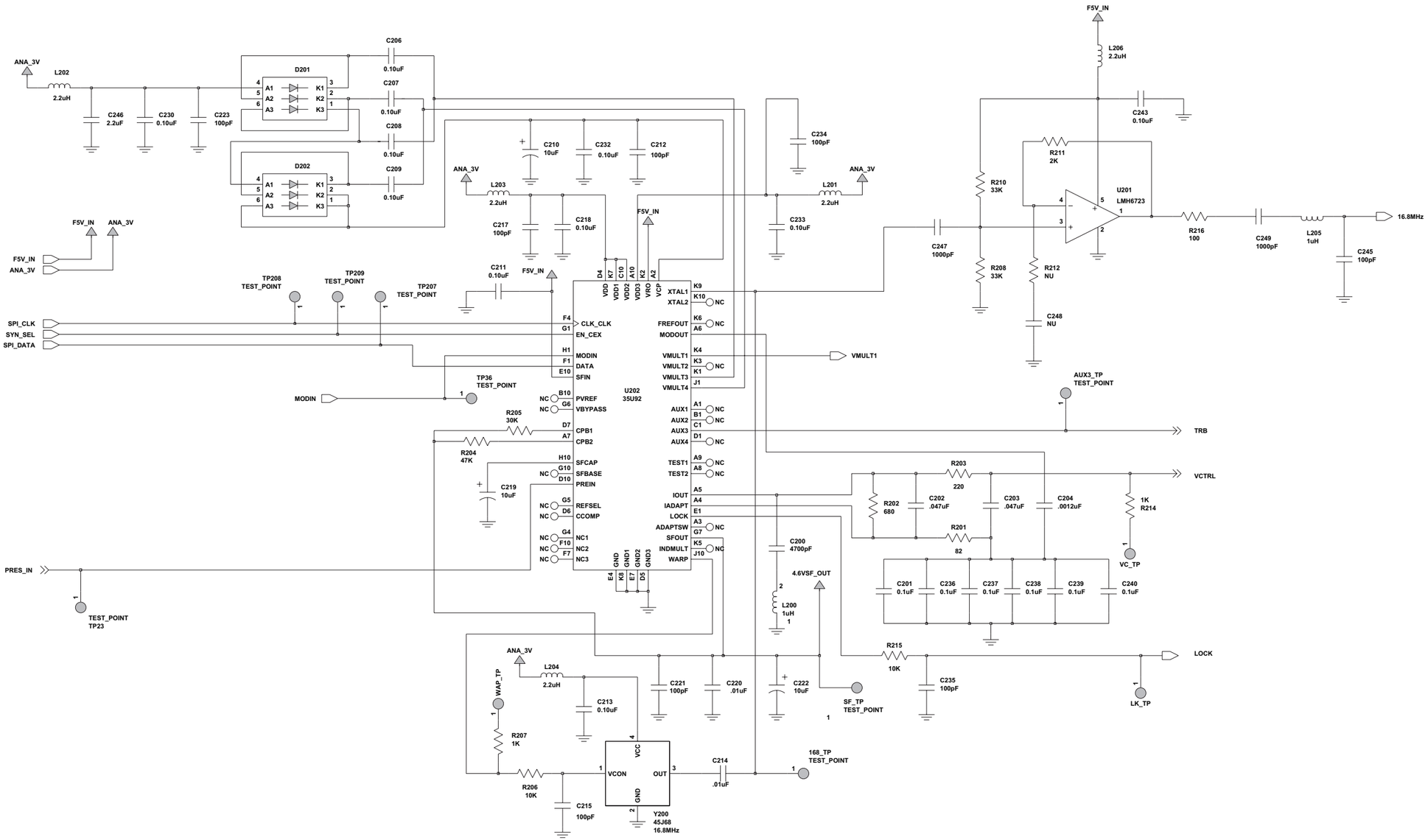


Figure 9-20. PMLE4427A Synthesizer Schematic

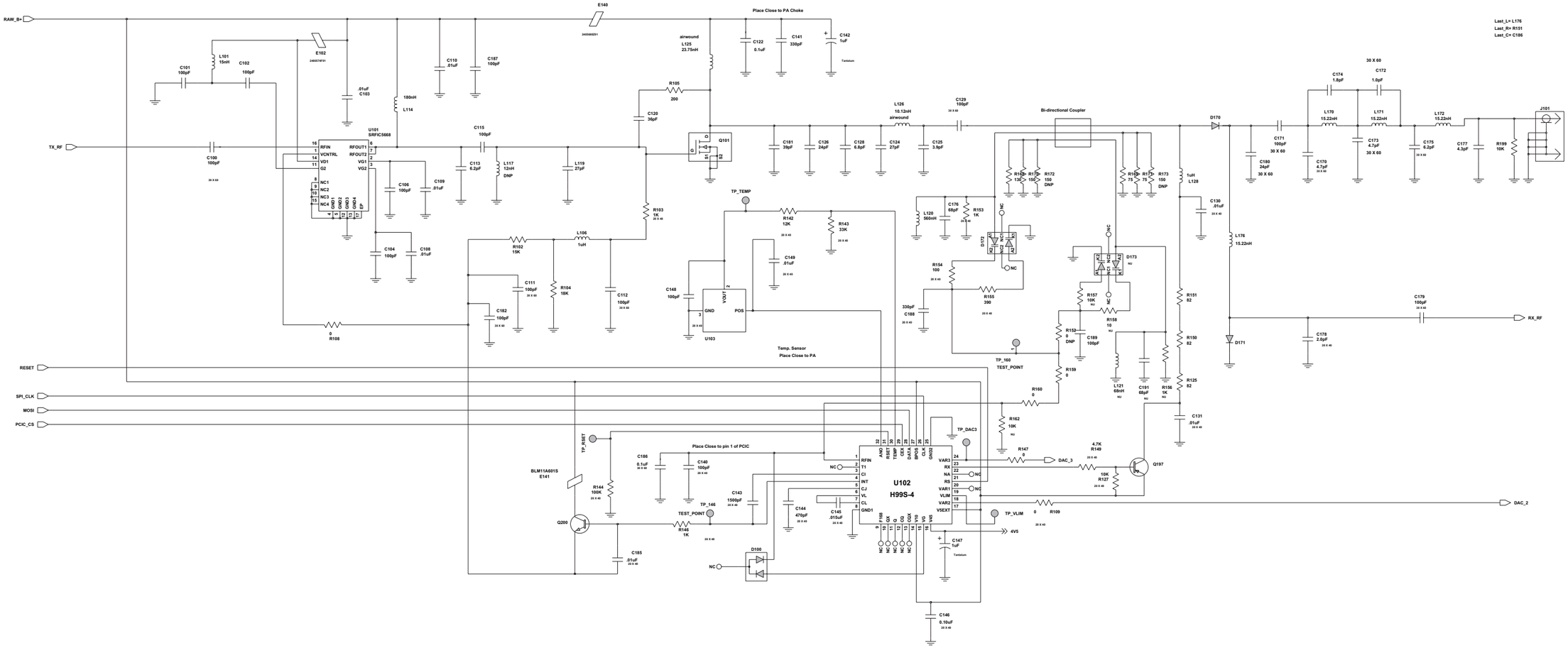


Figure 9-21. PMLE4427A TX Schematic

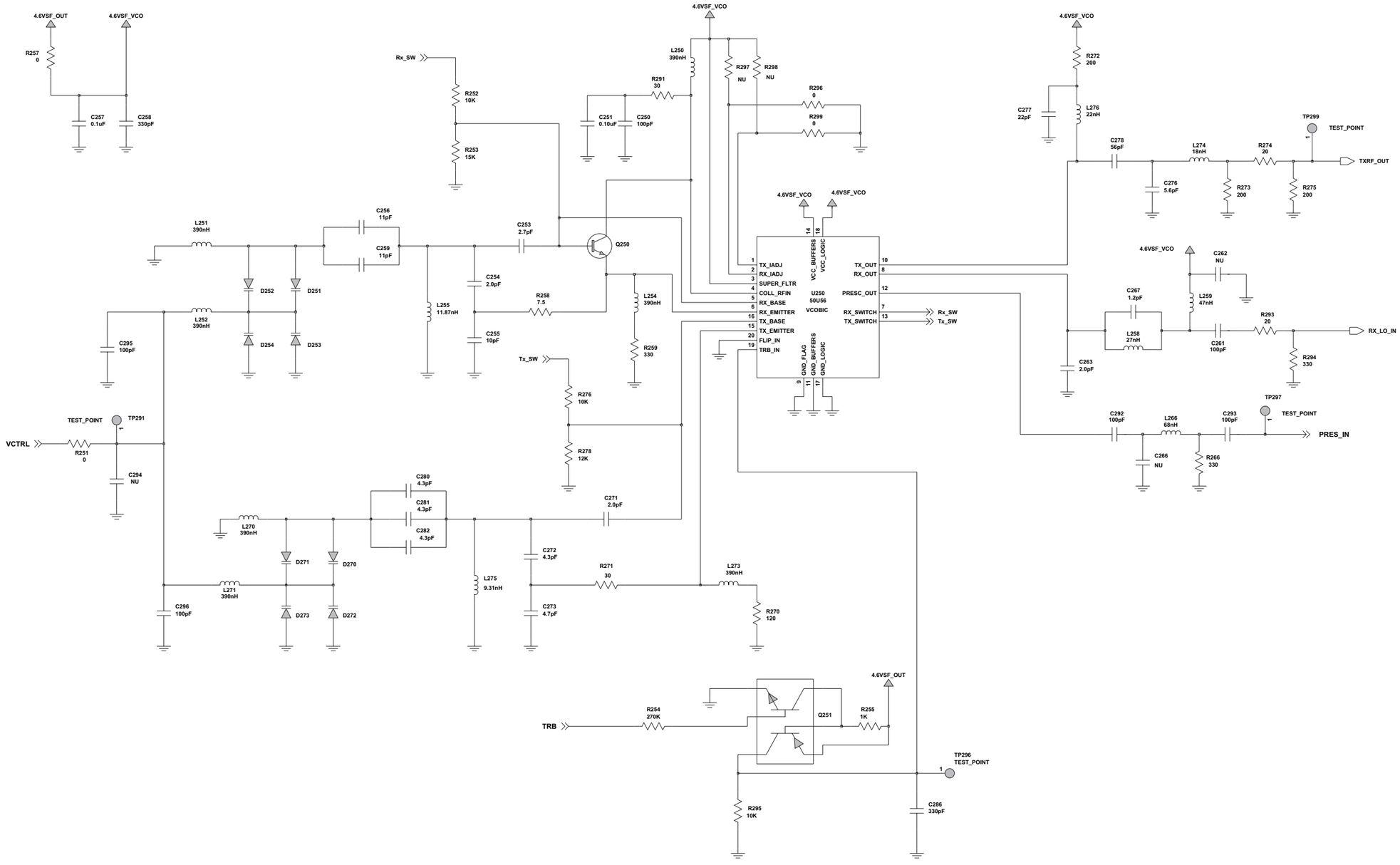


Figure 9-22. PMLE4427A VCO Schematic

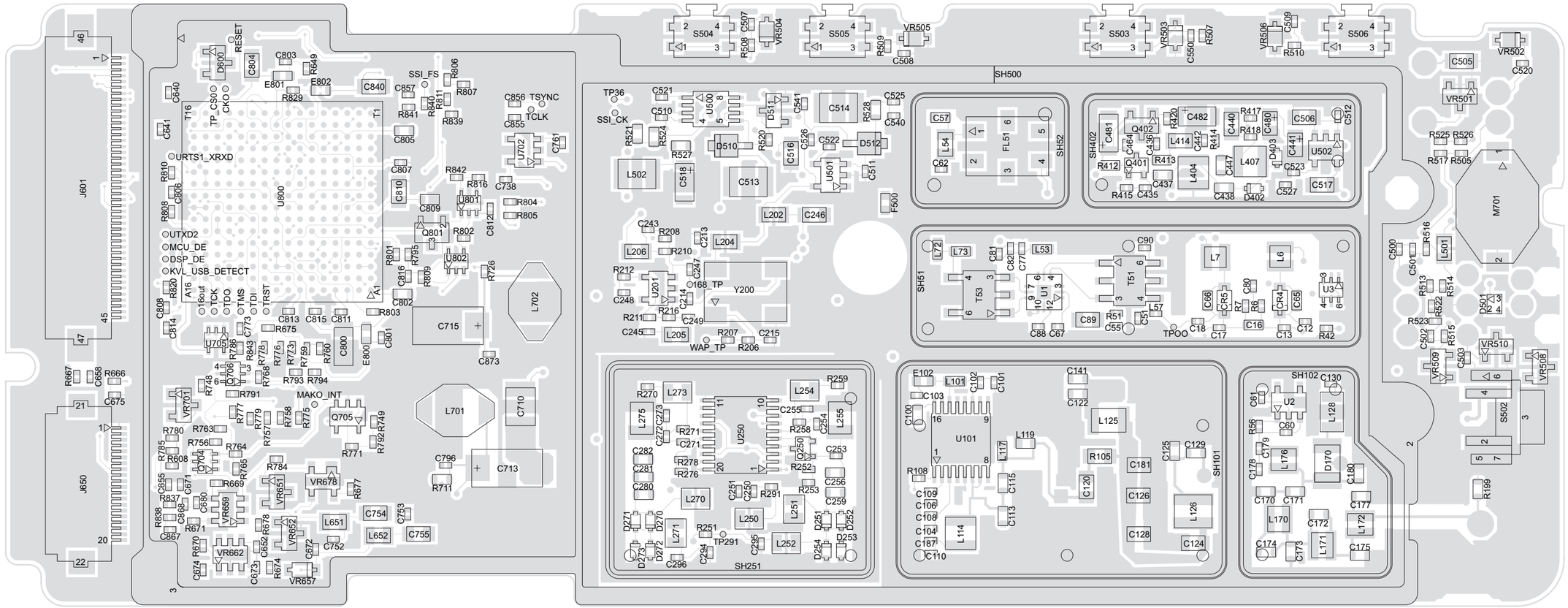


Figure 9-23. 8416852H01_A Top Overlay

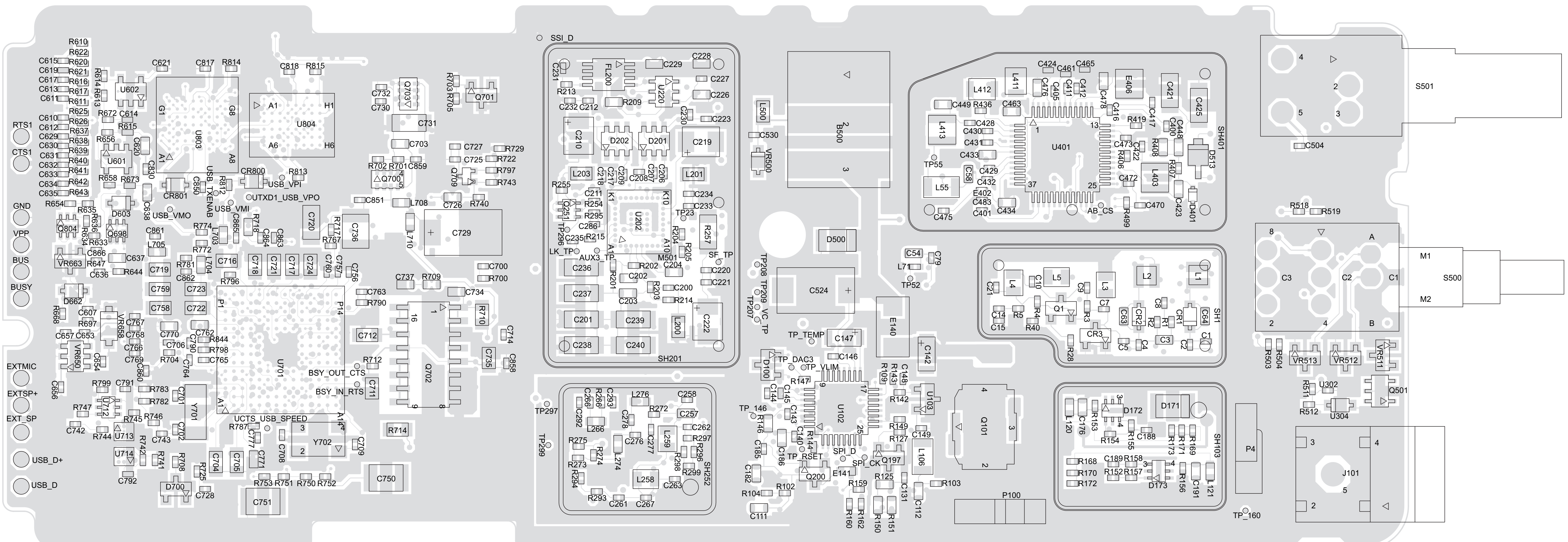


Figure 9-24. 8416852H01_A Bottom Overlay

PMLE4427A Main Circuit Board Electrical Parts List

ITEM	MOTOROLA PART NUMBER	DESCRIPTION
PCB	8416852H01	BOARD, PC, UHF BAND 2
B500	0986237A02	CONNECTOR (CONTACT BATTERY)
C1	2113944A15	CAP CER CHP 3.9PF 50V +/- 0.25PF
C2	2113944A23	CAP CER CHP 8.2PF 50V +/- 0.5PF
C3	2113740F14	CAP CHIP REEL CL1 +/-30 3.0
C4	2113944A23	CAP CER CHP 8.2PF 50V +/- 0.5PF
C5	2113944A15	CAP CER CHP 3.9PF 50V +/- 0.25PF
C7	2113944A40	CAP CER CHP 100.0PF 50V 5%
C8	2113944A40	CAP CER CHP 100.0PF 50V 5%
C9	2113945B02	CAP CER CHP 10,000PF 25V 10%
C10	2113944A40	CAP CER CHP 100.0PF 50V 5%
C12	2113944A15	CAP CER CHP 3.9PF 50V +/- 0.25PF
C13	2113944A24	CAP CER CHP 9.1PF 50V +/- 0.5PF
C14	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C15	2113944A40	CAP CER CHP 100.0PF 50V 5%
C16	2113740F14	CAP CHIP REEL CL1 +/-30 3.0
C17	2113944A24	CAP CER CHP 9.1PF 50V +/- 0.5PF
C18	2113944A15	CAP CER CHP 3.9PF 50V +/- 0.25PF
C21	2113945B02	CAP CER CHP 10,000PF 25V 10%
C51	2113944A14	CAP CER CHP 3.6PF 50V +/- 0.25PF
C54	2113740F24	CAP CHIP REEL C1 +/-30 7.5
C55	2113945B02	CAP CER CHP 10,000PF 25V 10%
C57	2113944M12	CAP,FXD,5.6PF,.1PF+/-,50V-DC,0603
C58	2113944M07	CAP,FXD,3.6PF,.1PF+/-,50V-DC,0603
C60	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C61	2113945A03	CAP CER CHP 330PF 50V 10%
C62	NOTPLACED	
C63	2113740F13	CAP CHIP REEL CL1 +/-30 2.7
C64	2113740F13	CAP CHIP REEL CL1 +/-30 2.7
C65	2113740F13	CAP CHIP REEL CL1 +/-30 2.7
C66	2113740F13	CAP CHIP REEL CL1 +/-30 2.7
C67	2113945B02	CAP CER CHP 10,000PF 25V 10%
C77	2113945B02	CAP CER CHP 10,000PF 25V 10%
C79	2113944A40	CAP CER CHP 100.0PF 50V 5%
C80	2113945B02	CAP CER CHP 10,000PF 25V 10%
C81	2113945A58	CAP,FXD,910PF,+10%,-10%,50V-DC,0402,X7R
C82	2113944A40	CAP CER CHP 100.0PF 50V 5%
C88	2113945B02	CAP CER CHP 10,000PF 25V 10%
C89	2113946F03	CAP CER CHP 4.7UF 6.3V 10%
C90	2113944A40	CAP CER CHP 100.0PF 50V 5%
C100	2113944C45	CAP CER CHP 100.0PF 50V 5%
C101	NOTPLACED	
C102	2113944A40	CAP CER CHP 100.0PF 50V 5%
C103	2113945B02	CAP CER CHP 10,000PF 25V 10%
C104	2113944A40	CAP CER CHP 100.0PF 50V 5%
C106	2113944A40	CAP CER CHP 100.0PF 50V 5%
C108	2113945B02	CAP CER CHP 10,000PF 25V 10%
C109	2113945B02	CAP CER CHP 10,000PF 25V 10%
C110	2113945B02	CAP CER CHP 10,000PF 25V 10%
C111	2113944C45	CAP CER CHP 100.0PF 50V 5%
C112	2113944C45	CAP CER CHP 100.0PF 50V 5%
C113	2113944C32	CAP CER CHP 15.0PF 50V 5%
C115	2113944C45	CAP CER CHP 100.0PF 50V 5%
C120	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R
C122	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R
C124	2113944F50	CAP,FXD,22PF,+5%,-5%,50V-DC,0805
C125	2113944C20	CAP CER CHP 3.9PF 50V +/- 0.25PF
C126	2113944F51	CAP,FXD,24PF,+5%,-5%,50V-DC,0805
C128	2113944F42	CAP,FXD,10PF,+5%,-5%,50V-DC,0805
C129	2113944C45	CAP CER CHP 100.0PF 50V 5%
C130	2113945B02	CAP CER CHP 10,000PF 25V 10%
C131	2113945B02	CAP CER CHP 10,000PF 25V 10%
C140	2113944A40	CAP CER CHP 100.0PF 50V 5%
C141	2113944C45	CAP CER CHP 100.0PF 50V 5%
C142	2313960A76	CAP,FXD,1UF,+10%,-10%,20V-DC
C143	2113945A10	CAP CER CHP 1500PF 50V 10%
C144	2113945A05	CAP CER CHP 470PF 50V 10%
C145	2113945B03	CAP,FXD,.015UF,+10%,-10%,25V-DC,0402,X7R
C146	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C147	2313960A76	CAP,FXD,1UF,+10%,-10%,20V-DC
C148	2113944A40	CAP CER CHP 100.0PF 50V 5%
C149	2113945B02	CAP CER CHP 10,000PF 25V 10%
C170	2113944M10	CAP,FXD,4.7PF,.1PF+/-,50V-DC,0603
C171	2113944C45	CAP CER CHP 100.0PF 50V 5%
C172	2113944C63	CAP,FXD,1PF,.1PF+/-,50V-DC,0603
C173	2113944M10	CAP,FXD,4.7PF,.1PF+/-,50V-DC,0603
C174	2113944C69	CAP,FXD,1.8PF,.1PF+/-,50V-DC,0603
C175	2113944M13	CAP,FXD,6.2PF,.1PF+/-,,,50V-DC,0603
C176	2113944C30	CAP CER CHP 10.0PF 50V +/- 0.5PF
C177	2113944M09	CAP,FXD,4.3PF,.1PF+/-,50V-DC,0603
C178	2113944A08	CAP CER CHP 2.0PF 50V +/- 0.25PF
C179	2113944A40	CAP CER CHP 100.0PF 50V 5%
C180	NOTPLACED	
C181	2113944F56	CAP,FXD,39PF,+5%,-5%,50V-DC,0805
C182	2113944C45	CAP CER CHP 100.0PF 50V 5%
C185	2113945B02	CAP CER CHP 10,000PF 25V 10%
C186	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R
C187	2113944A40	CAP CER CHP 100.0PF 50V 5%
C188	2113944A40	CAP CER CHP 100.0PF 50V 5%
C189	2113944A40	CAP CER CHP 100.0PF 50V 5%
C191	NOTPLACED	
C200	2113945A13	CAP CER CHP 4700PF 50V 10%
C201	2185419D06	CAP CER SUPER L/D 0.1UF
C202	2113945C27	CAP,FXD,.047UF,+10%,-10%,50V-DC,0603,X7R
C203	2113945C27	CAP,FXD,.047UF,+10%,-10%,50V-DC,0603,X7R
C204	2185419D08	CAP CER SUPER L/D 0.0012UF
C206	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C207	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C208	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C209	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C210	2313960D07	CAP,FXD,10,+10,-10,16,SM
C211	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C212	2113944A40	CAP CER CHP 100.0PF 50V 5%
C213	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C214	2113945B02	CAP CER CHP 10,000PF 25V 10%
C215	2113944A40	CAP CER CHP 100.0PF 50V 5%
C217	2113944A40	CAP CER CHP 100.0PF 50V 5%

ITEM	MOTOROLA PART NUMBER	DESCRIPTION
C218	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C219	2313960D07	CAP,FXD,10,+10,-10,16,SM
C220	2113945B02	CAP CER CHP 10,000PF 25V 10%
C221	2113944A40	CAP CER CHP 100.0PF 50V 5%
C222	2313960D07	CAP,FXD,10,+10,-10,16,SM
C223	2113944A40	CAP CER CHP 100.0PF 50V 5%
C226	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R
C227	2113944A40	CAP CER CHP 100.0PF 50V 5%
C228	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R
C229	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R
C230	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C231	2113945A01	CAP CER CHP 220PF 50V 10
C232	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C233	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C234	2113944A40	CAP CER CHP 100.0PF 50V 5%
C235	2113944A40	CAP CER CHP 100.0PF 50V 5%
C236	2185419D06	CAP CER SUPER L/D 0.1UF
C237	2185419D06	CAP CER SUPER L/D 0.1UF
C238	2185419D06	CAP CER SUPER L/D 0.1UF
C239	2185419D06	CAP CER SUPER L/D 0.1UF
C240	2185419D06	CAP CER SUPER L/D 0.1UF
C243	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C245	2113944A40	CAP CER CHP 100.0PF 50V 5%
C246	2113946N03	CAP CER CHP 2.2UF 16V
C247	2113945A09	CAP CER CHP 1000PF 50V 10%
C248	NOTPLACED	
C249	2113945A09	CAP CER CHP 1000PF 50V 10%
C250	2113944A40	CAP CER CHP 100.0PF 50V 5%
C251	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C253	2113944A11	CAP CER CHP 2.7PF 50V +/- 0.25PF

ITEM	MOTOROLA PART NUMBER	DESCRIPTION
C254	2113944A08	CAP CER CHP 2.0PF 50V +/- 0.25PF
C255	2113944A25	CAP CER CHP 10.0PF 50V +/- 0.5PF
C256	2113944C77	CAP,FXD,11PF,+5%,-5%,50V-DC,0603,C
C257	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R
C258	2113945A03	CAP CER CHP 330PF 50V 10%
C259	2113944C77	CAP,FXD,11PF,+5%,-5%,50V-DC,0603,C
C261	2113944A40	CAP CER CHP 100.0PF 50V 5%
C262	NOTPLACED	
C263	2113944A08	CAP CER CHP 2.0PF 50V +/- 0.25PF
C266	NOTPLACED	
C267	2113944A02	CAP CER CHP 1.2PF 50V +/- 0.25PF
C271	2113944A08	CAP CER CHP 2.0PF 50V +/- 0.25PF
C272	2113944A16	CAP CER CHP 4.3PF 50V +/- 0.25PF
C273	2113944A17	CAP CER CHP 4.7PF 50V +/- 0.25PF
C276	2113944A19	CAP CER CHP 5.6PF 50V +/- 0.5PF
C277	2113944A29	CAP CER CHP 22.0PF 50V 5%
C278	2113944A34	CAP CER CHP 56.0PF 50V 5%
C280	2113944C21	CAP CER CHP 4.3PF 50V +/- 0.25PF
C281	2113944C21	CAP CER CHP 4.3PF 50V +/- 0.25PF
C282	2113944C21	CAP CER CHP 4.3PF 50V +/- 0.25PF
C286	2113945A03	CAP CER CHP 330PF 50V 10%
C292	2113944A40	CAP CER CHP 100.0PF 50V 5%
C293	2113944A40	CAP CER CHP 100.0PF 50V 5%
C294	NOTPLACED	
C295	2113944A40	CAP CER CHP 100.0PF 50V 5%
C296	2113944A40	CAP CER CHP 100.0PF 50V 5%
C400	2113944A40	CAP CER CHP 100.0PF 50V 5%

ITEM	MOTOROLA PART NUMBER	DESCRIPTION
C401	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C405	2113944A40	CAP CER CHP 100.0PF 50V 5%
C411	2113945A11	CAP CER CHP 2200PF 50V 10%
C412	NOTPLACED	
C416	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C417	2113944A40	CAP CER CHP 100.0PF 50V 5%
C421	NOTPLACED	
C422	2113945B02	CAP CER CHP 10,000PF 25V 10%
C423	2113944C41	CAP CER CHP 68.0PF 50V 5%
C424	2113944A40	CAP CER CHP 100.0PF 50V 5%
C425	2113945H69	CAP,FXD,.1UF,+5%,-5%,50V-DC,1206,X7R
C428	2113945B02	CAP CER CHP 10,000PF 25V 10%
C429	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C430	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C431	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C432	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C433	2113944C33	CAP CER CHP 18.0PF 50V 5%
C434	2113945C27	CAP,FXD,.047UF,+10%,-10%,50V-DC,0603,X7R
C435	2113944A34	CAP CER CHP 56.0PF 50V 5%
C436	2113944A34	CAP CER CHP 56.0PF 50V 5%
C437	2113944C72	CAP,FXD,6.2PF,.25PF+/-,50V-DC,0603
C438	2113944C79	CAP,FXD,16PF,+5%,-5%,50V-DC,0603
C440	2113945G96	CAP,FXD,.33UF,+10%,-10%,50V-DC,0805,X7R
C441	2313960M26	CAP,FXD,1UF,+10%,-10%,10V-DC
C442	2113945B02	CAP CER CHP 10,000PF 25V 10%
C447	NOTPLACED	

ITEM	MOTOROLA PART NUMBER	DESCRIPTION
C448	2113945C25	CAP,FXD,.033UF,+10%,-10%,50V-DC,0603,X7R
C449	2113944C75	CAP,FXD,8.2PF,.25PF+/-,50V-DC,0603
C461	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C463	2113945C27	CAP,FXD,.047UF,+10%,-10%,50V-DC,0603,X7R
C464	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C465	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C470	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C472	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C473	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C475	NOTPLACED	
C476	2113944C89	CAP,FXD,200PF,+5%,-5%,50V-DC,0603
C478	2113945C27	CAP,FXD,.047UF,+10%,-10%,50V-DC,0603,X7R
C480	2313960M26	CAP,FXD,1UF,+10%,-10%,10V-DC
C481	2313960B30	CAP,FXD,4.7UF,+10%,-10%,10V-DC
C482	2313960B30	CAP,FXD,4.7UF,+10%,-10%,10V-DC
C483	NOTPLACED	
C500	2113945A05	CAP CER CHP 470PF 50V 10%
C501	2113945A05	CAP CER CHP 470PF 50V 10%
C502	2113945A05	CAP CER CHP 470PF 50V 10%
C503	2113945A05	CAP CER CHP 470PF 50V 10%
C504	2113945A05	CAP CER CHP 470PF 50V 10%
C505	2113945G98	CAP,FXD,.47UF,+10%,-10%,50V-DC,0805,X7R
C506	2113946E02	CAP CER CHP 1.0UF 16V 10%
C507	2113945B02	CAP CER CHP 10,000PF 25V 10%
C508	2113945B02	CAP CER CHP 10,000PF 25V 10%

ITEM	MOTOROLA PART NUMBER	DESCRIPTION
C509	2113945B02	CAP CER CHP 10,000PF 25V 10%
C510	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C511	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C512	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C513	2113955E37	CAP,FXD,10UF,+10%,-10%,16V-DC,1210,X7R
C514	2113955E37	CAP,FXD,10UF,+10%,-10%,16V-DC,1210,X7R
C516	2113946E02	CAP CER CHP 1.0UF 16V 10%
C517	2113946E02	CAP CER CHP 1.0UF 16V 10%
C518	2313960B57	CAP,FXD,10UF,+10%,-10%,6.3V-DC
C520	2113944A40	CAP CER CHP 100.0PF 50V 5%
C521	2113945B02	CAP CER CHP 10,000PF 25V 10%
C522	2113945B02	CAP CER CHP 10,000PF 25V 10%
C523	2113945B02	CAP CER CHP 10,000PF 25V 10%
C524	2314030U26	CAP,FXD,10UF,+10%,-10%,35V-DC
C525	2113944A38	CAP CER CHP 82.0PF 50V 5%
C526	2113944A38	CAP CER CHP 82.0PF 50V 5%
C527	2113944A40	CAP CER CHP 100.0PF 50V 5%
C530	2113944A40	CAP CER CHP 100.0PF 50V 5%
C540	2113944A45	CAP CER CHP 270.0 PF 50V 5%
C541	2113944A45	CAP CER CHP 270.0 PF 50V 5%
C550	2113945B02	CAP CER CHP 10,000PF 25V 10%
C607	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C610	2113944A32	CAP CER CHP 39.0PF 50V 5%
C611	2113944A32	CAP CER CHP 39.0PF 50V 5%
C612	2113944A32	CAP CER CHP 39.0PF 50V 5%
C613	2113944A32	CAP CER CHP 39.0PF 50V 5%
C614	2113945A03	CAP CER CHP 330PF 50V 10%
C615	2113944A32	CAP CER CHP 39.0PF 50V 5%

ITEM	MOTOROLA PART NUMBER	DESCRIPTION
C617	2113944A32	CAP CER CHP 39.0PF 50V 5%
C619	2113944A32	CAP CER CHP 39.0PF 50V 5%
C620	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R
C621	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C629	2113944A40	CAP CER CHP 100.0PF 50V 5%
C630	2113944A40	CAP CER CHP 100.0PF 50V 5%
C631	2113944A40	CAP CER CHP 100.0PF 50V 5%
C632	2113944A40	CAP CER CHP 100.0PF 50V 5%
C633	2113944A40	CAP CER CHP 100.0PF 50V 5%
C634	2113944A40	CAP CER CHP 100.0PF 50V 5%
C635	2113944A40	CAP CER CHP 100.0PF 50V 5%
C636	2113944A40	CAP CER CHP 100.0PF 50V 5%
C637	2113945L49	CAP,FXD,.01UF,+5%,-5%,50V-DC,0603,X7R
C638	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R
C640	NOTPLACED	
C641	NOTPLACED	
C652	2113944A40	CAP CER CHP 100.0PF 50V 5%
C653	2113944A40	CAP CER CHP 100.0PF 50V 5%
C654	2113944A40	CAP CER CHP 100.0PF 50V 5%
C655	2113944A40	CAP CER CHP 100.0PF 50V 5%
C656	2113944A40	CAP CER CHP 100.0PF 50V 5%
C657	2113944A40	CAP CER CHP 100.0PF 50V 5%
C658	2113944A40	CAP CER CHP 100.0PF 50V 5%
C671	2113944A31	CAP CER CHP 33.0PF 50V 5%
C672	2113944A40	CAP CER CHP 100.0PF 50V 5%
C673	2113944A31	CAP CER CHP 33.0PF 50V 5%
C674	2113945A05	CAP CER CHP 470PF 50V 10%
C675	2113944A40	CAP CER CHP 100.0PF 50V 5%
C680	2113944A31	CAP CER CHP 33.0PF 50V 5%
C700	2113946B04	CAP CER CHP 0.10UF 10V 10%
C701	2113944A19	CAP CER CHP 5.6PF 50V +/-0.5PF
C702	2113944A19	CAP CER CHP 5.6PF 50V +/-0.5PF
C703	NOTPLACED	

ITEM	MOTOROLA PART NUMBER	DESCRIPTION
C704	2113946F01	CAP CER CHP 2.2UF 6.3V 10%
C705	2113946F01	CAP CER CHP 2.2UF 6.3V 10%
C706	2113945A09	CAP CER CHP 1000PF 50V 10%
C708	2113944A31	CAP CER CHP 33.0PF 50V 5%
C709	2113944A31	CAP CER CHP 33.0PF 50V 5%
C710	2113946J03	CAP CER CHP 10.0UF 16V 10%
C711	2113946F03	CAP CER CHP 4.7UF 6.3V 10%
C712	2113946E02	CAP CER CHP 1.0UF 16V 10%
C713	2314030F31	CAP,FXD,68UF,+10%,-10%,10V-DC
C714	2113945A09	CAP CER CHP 1000PF 50V 10%
C715	2314030F31	CAP,FXD,68UF,+10%,-10%,10V-DC
C716	2113946F01	CAP CER CHP 2.2UF 6.3V 10%
C717	2113946E02	CAP CER CHP 1.0UF 16V 10%
C718	2113946F01	CAP CER CHP 2.2UF 6.3V 10%
C719	2113946E02	CAP CER CHP 1.0UF 16V 10%
C720	2113946G01	CAP CER CHP 2.2UF 16V 10%
C721	2113946E02	CAP CER CHP 1.0UF 16V 10%
C722	2113946E02	CAP CER CHP 1.0UF 16V 10%
C723	2113946E02	CAP CER CHP 1.0UF 16V 10%
C724	2113946E02	CAP CER CHP 1.0UF 16V 10%
C725	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C726	2113740A79	CAP CHIP REEL CL1 +/-30 1000
C727	2113944A40	CAP CER CHP 100.0PF 50V 5%
C728	2113944A40	CAP CER CHP 100.0PF 50V 5%
C729	2314030U26	CAP,FXD,10UF,+10%,-10%,35V-DC
C730	2113944A40	CAP CER CHP 100.0PF 50V 5%
C731	2113946G01	CAP CER CHP 2.2UF 16V 10%
C732	2113944A40	CAP CER CHP 100.0PF 50V 5%
C734	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R
C735	2113946E02	CAP CER CHP 1.0UF 16V 10%
C736	2113946J03	CAP CER CHP 10.0UF 16V 10%
C737	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R
C738	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R

ITEM	MOTOROLA PART NUMBER	DESCRIPTION
C742	2113945A05	CAP CER CHP 470PF 50V 10%
C743	2113944A25	CAP CER CHP 10.0PF 50V +/-0.5PF
C750	2113946J03	CAP CER CHP 10.0UF 16V 10%
C751	2113946J03	CAP CER CHP 10.0UF 16V 10%
C752	2113944A40	CAP CER CHP 100.0PF 50V 5%
C753	2113944A40	CAP CER CHP 100.0PF 50V 5%
C754	2113946E02	CAP CER CHP 1.0UF 16V 10%
C755	2113946E02	CAP CER CHP 1.0UF 16V 10%
C756	2113944A40	CAP CER CHP 100.0PF 50V 5%
C757	2113944A40	CAP CER CHP 100.0PF 50V 5%
C758	2113946E02	CAP CER CHP 1.0UF 16V 10%
C759	2113946E02	CAP CER CHP 1.0UF 16V 10%
C760	2113944A40	CAP CER CHP 100.0PF 50V 5%
C761	2113944A40	CAP CER CHP 100.0PF 50V 5%
C762	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R
C763	2113944A40	CAP CER CHP 100.0PF 50V 5%
C764	2113946B03	CAP CER CHP 0.068UF 10V 10
C765	2113946B03	CAP CER CHP 0.068UF 10V 10
C766	2113944A40	CAP CER CHP 100.0PF 50V 5%
C767	2113944A40	CAP CER CHP 100.0PF 50V 5%
C768	2113944A40	CAP CER CHP 100.0PF 50V 5%
C769	2113944A40	CAP CER CHP 100.0PF 50V 5%
C770	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R
C771	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R
C773	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C777	2113944A40	CAP CER CHP 100.0PF 50V 5%
C790	2113946A02	CAP CER CHP 0.022UF 16V 10
C791	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C792	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C796	2113944A40	CAP CER CHP 100.0PF 50V 5%
C800	2113955D31	CAP,FXD,1UF,+10%,-10%,16V-DC,1206,X7R
C801	2113944A40	CAP CER CHP 100.0PF 50V 5%

ITEM	MOTOROLA PART NUMBER	DESCRIPTION
C802	2113945C20	CAP,FXD,.016UF,+10%,-10%,50V-DC,0603,X7R
C803	2113944A40	CAP CER CHP 100.0PF 50V 5%
C804	2113946E02	CAP CER CHP 1.0UF 16V 10%
C805	2113945C20	CAP,FXD,.016UF,+10%,-10%,50V-DC,0603,X7R
C806	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C807	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C808	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C809	2113945C20	CAP,FXD,.016UF,+10%,-10%,50V-DC,0603,X7R
C810	2113946E02	CAP CER CHP 1.0UF 16V 10%
C811	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C812	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C813	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C814	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C815	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C816	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C817	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C818	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C830	2113945Y02	CAP,FXD,.1UF,+10%,-10%,16V-DC,0402,X7R
C840	2113946F03	CAP CER CHP 4.7UF 6.3V 10%
C850	2113945A03	CAP CER CHP 330PF 50V 10%
C851	2113944A40	CAP CER CHP 100.0PF 50V 5%
C855	NOTPLACED	
C856	NOTPLACED	
C857	NOTPLACED	
C858	2113945B02	CAP CER CHP 10,000PF 25V 10%
C859	2113945B02	CAP CER CHP 10,000PF 25V 10%

ITEM	MOTOROLA PART NUMBER	DESCRIPTION
C860	2113945B02	CAP CER CHP 10,000PF 25V 10%
C861	2113945B02	CAP CER CHP 10,000PF 25V 10%
C862	2113945B02	CAP CER CHP 10,000PF 25V 10%
C863	2113945B02	CAP CER CHP 10,000PF 25V 10%
C864	2113945B02	CAP CER CHP 10,000PF 25V 10%
C865	2113945B02	CAP CER CHP 10,000PF 25V 10%
C866	2113945B02	CAP CER CHP 10,000PF 25V 10%
C867	NOTPLACED	
C868	NOTPLACED	
C873	NOTPLACED	
CR1	4805656W90	DIODE V.1SV304(TPH3,F)SOD323 NOPB
CR2	4805656W90	DIODE V.1SV304(TPH3,F)SOD323 NOPB
CR3	4815048H01	SOT MMBD353 DIODE DUAL SCHT
CR4	4805656W90	DIODE V.1SV304(TPH3,F)SOD323 NOPB
CR5	4805656W90	DIODE V.1SV304(TPH3,F)SOD323 NOPB
CR800	4813978A25	SCHOTTKY 30V SOD-323 T&R PB FREE
CR801	4813978A25	SCHOTTKY 30V SOD-323 T&R PB FREE
D100	NOTPLACED	
D170	4802482J02	PIN DIODE SMD
D171	4802482J02	PIN DIODE SMD
D172	4813978A26	DIODE ARRAY,DET,SOT-363/SC-88,30V,.12W
D173	4813978A26	DIODE ARRAY,DET,SOT-363/SC-88,30V,.12W
D201	4815011H01	DIODE TRIPLE
D202	4815011H01	DIODE TRIPLE

ITEM	MOTOROLA PART NUMBER	DESCRIPTION
D251	4805656W87	DIODE,VCTR, @ 15V,1SV279,SOD-523/SC-79
D252	4805656W87	DIODE,VCTR, @ 15V,1SV279,SOD-523/SC-79
D253	4805656W87	DIODE,VCTR, @ 15V,1SV279,SOD-523/SC-79
D254	4805656W87	DIODE,VCTR, @ 15V,1SV279,SOD-523/SC-79
D270	4805656W87	DIODE,VCTR, @ 15V,1SV279,SOD-523/SC-79
D271	4805656W87	DIODE,VCTR, @ 15V,1SV279,SOD-523/SC-79
D272	4805656W87	DIODE,VCTR, @ 15V,1SV279,SOD-523/SC-79
D273	4805656W87	DIODE,VCTR, @ 15V,1SV279,SOD-523/SC-79
D401	4805656W87	DIODE,VCTR, @ 15V,1SV279,SOD-523/SC-79
D402	4815096H01	VARACTOR DIODE 1SV305
D403	4815096H01	VARACTOR DIODE 1SV305
D500	4815155H01	RECTIFIER
D501	4809118D02	LED BICOLOR LNJ115W8POMT
D510	4813978M15	DIODE,RECT,,,,1A,40V,,,PB-FREE, NOTCOMPLETELYENRICHED
D511	4813978B18	DIODE,SWG,BAT54,SM,SOT-23,200MA,30V,.2W,SHTK,PB-FREE
D512	4813978M15	DIODE,RECT,,,,1A,40V,,,PB-FREE, NOTCOMPLETELYENRICHED
D513	4813978M15	DIODE,RECT,,,,1A,40V,,,PB-FREE, NOTCOMPLETELYENRICHED
D600	4813978B18	DIODE,SWG,BAT54,SM,SOT-23,200MA,30V,.2W,SHTK,PB-FREE
D603	4813978A25	SCHOTTKY 30V SOD-323 T&R PB FREE
D662	4813978A25	SCHOTTKY 30V SOD-323 T&R PB FREE
D700	4813978B18	DIODE,SWG,BAT54,SM,SOT-23,200MA,30V,.2W,SHTK,PB-FREE
E102	2480574F01	IND FERRITE CHIP 60OHM 0603

ITEM	MOTOROLA PART NUMBER	DESCRIPTION
E140	2405688Z01	INDUCTOR FERRITE BEAD
E141	2480574F01	IND FERRITE CHIP 60OHM 0603
E402	2480640Z01	SURFACE MOUNT FERRITE BEAD
E406	2414032B76	IDCTR,WW,4.7UH,5%,330MA,4OHM,CER,,,,20 Q,60MHZ SRF,SM
E800	2480574F01	IND FERRITE CHIP 60OHM 0603
E801	2480574F01	IND FERRITE CHIP 60OHM 0603
E802	0613952G67	CER CHIP RES 0.0 +/-0.050 OHM
F500	6515076H01	FUSE CHIP SMT TR/1608FF 3A
FL200	9116848H01	FLTR SW CAP 3 POLE BUTTERW, W18
FL51	9185924B01	FILTER, 73.35 MHZ 3-POLE CRYST
J101	2880658Z08	CONNECTOR SMA
J601	0916287H01	CONN VERT 45 PIN ZIF
J650	0916287H02	CONN 20 PIN ZIF
L1	2471406L01	RF AIR WOUND COIL 8.9NH
L2	2471406L01	RF AIR WOUND COIL 8.9NH
L3	2414032F26	IDCTR,WW,22NH,5%,500MA,.22OHM,CER,45 Q,2.2GHZ SRF,SM,PB-FRE
L4	2414032F37	IDCTR,WW,180NH,5%,400MA,.64OHM,CER,35 Q,710MHZ SRF,SM,PB-FR
L5	2414032F23	IDCTR,WW,12NH,5%,600MA,.15OHM,CER,,,,45 Q,2.75GHZ SRF,SM
L6	2471406L01	RF AIR WOUND COIL 8.9NH
L7	2471406L01	RF AIR WOUND COIL 8.9NH
L53	2415429H43	CHIP INDUCTOR 220nH
L54	2414017K32	IDCTR,CHIP,560NH,5%,50MA,5OHM,CER,11Q,150MHZSRF,SM,0805,PB-F
L55	2414032D25	IDCTR,WW,620NH,5%,400MA,1.6OHM,CER,28Q,400MHZSRF,SM,LEAD-FR
L57	2113944A78	CAP,FXD,13PF,+5%,-5%,50V-DC,0402
L71	2414017P16	IDCTR,CHIP,18NH,5%,300MA,.76OHM,CER,9 Q,1.9GHZ SRF,SM,0402,P

ITEM	MOTOROLA PART NUMBER	DESCRIPTION
L72	2415429H38	CHIP INDUCTOR 120nH
L73	2415429H47	CHIP INDUCTOR 390nH
L101	2414017G09	IDCTR,CHIP,15NH,5%,300MA,.45OHM,CER,8Q,SM,0603,PB-FREE
L106	2414032D30	IDCTR,WW,1UH,5%,320MA,2.8OHM,CER,28 Q,340MHZ SRF,SM,LEAD-FR
L114	2414032B56	IDCTR,WW,180NH,5%,750MA,.77OHM,CER,25 Q,700MHZ SRF,SM
L117	NOTPLACED	
L119	2113944C35	CAP CER CHP 27.0PF 50V 5%
L120	2485930A10	IND 18.0NH 5%
L121	NOTPLACED	
L125	2479990C03	AIR WOUND COIL/GREEN COLOR 13.85NH
L126	2460591L05	COIL AIR WOUND INDUC 10.12
L128	2414032D30	IDCTR,WW,1UH,5%,320MA,2.8OHM,CER,28 Q,340MHZ SRF,SM,LEAD-FR
L170	2460591B48	COIL AIR WOUND INDUC 15.22
L171	2460591B48	COIL AIR WOUND INDUC 15.22
L172	2460591B48	COIL AIR WOUND INDUC 15.22
L176	2460591B48	COIL AIR WOUND INDUC 15.22
L200	2414017Q47	IDCTR,FXD,1UH,10%,50MA,.45OHM,FERR,45 Q,75MHZ SRF,SM,0805,PB
L201	2414017Q20	IDCTR,FXD,2.2UH,20%,30MA,.65OHM,FERR,45Q,50MHZSRF,SM,0805
L202	2414017Q20	IDCTR,FXD,2.2UH,20%,30MA,.65OHM,FERR,45Q,50MHZSRF,SM,0805
L203	2414017Q20	IDCTR,FXD,2.2UH,20%,30MA,.65OHM,FERR,45Q,50MHZSRF,SM,0805
L204	2414017Q20	IDCTR,FXD,2.2UH,20%,30MA,.65OHM,FERR,45Q,50MHZSRF,SM,0805
L205	2414017Q47	IDCTR,FXD,1UH,10%,50MA,.45OHM,FERR,45 Q,75MHZ SRF,SM,0805,PB

ITEM	MOTOROLA PART NUMBER	DESCRIPTION
L206	2414017Q20	IDCTR,FXD,2.2UH,20%,30MA,.65OHM,FERR,45Q,50MHZSRF,SM,0805
L250	2414032F41	IDCTR,WW,390NH,10%,200MA,1.5OHM,CER,40 Q,730MHZ SRF,SM,LEAD
L251	2414032F41	IDCTR,WW,390NH,10%,200MA,1.5OHM,CER,40 Q,730MHZ SRF,SM,LEAD
L252	2414032F41	IDCTR,WW,390NH,10%,200MA,1.5OHM,CER,40 Q,730MHZ SRF,SM,LEAD
L254	2414032F41	IDCTR,WW,390NH,10%,200MA,1.5OHM,CER,40 Q,730MHZ SRF,SM,LEAD
L255	2460591C03	COIL AIR WOUND INDUC 11.87
L258	2414032F27	IDCTR,FXD,27NH,5%,500MA,.25OHM,CER,,,,45 Q,2GHZ SRF,SM,0805
L259	2414032F30	IDCTR,WW,47NH,5%,500MA,.31OHM,CER,,,,40 Q,1.4GHZ SRF,SM,,,LE
L266	2414017N19	IDCTR,CHIP,39NH,5%,500MA,.74OHM,CER,15 Q,1GHZ SRF,SM,0603,PB
L270	2414032F41	IDCTR,WW,390NH,10%,200MA,1.5OHM,CER,40 Q,730MHZ SRF,SM,LEAD
L271	2414032F41	IDCTR,WW,390NH,10%,200MA,1.5OHM,CER,40 Q,730MHZ SRF,SM,LEAD
L273	2414032F41	IDCTR,WW,390NH,10%,200MA,1.5OHM,CER,40 Q,730MHZ SRF,SM,LEAD
L274	2415429H20	CHIP INDUCTOR 18nH
L275	2460591C02	COIL AIR WOUND INDUC 9.31
L276	2415429H21	CHIP INDUCTOR 22nH
L403	2414032B75	IDCTR,WW,3.9UH,5%,340MA,3.6OHM,CER,20Q,70MHZSRF,SM,LEAD-FRE
L404	2414032B59	IDCTR,WW,330NH,5%,690MA,1.05OHM,CER,30Q,500MHZSRF,SM,LEAD-F
L407	2414032B76	IDCTR,WW,4.7UH,5%,330MA,4OHM,CER,,,,20 Q,60MHZ SRF,SM
L411	2466505A01	COIL INDUCTOR 10uH

ITEM	MOTOROLA PART NUMBER	DESCRIPTION
L412	2466505A01	COIL INDUCTOR 10uH
L413	2414032B59	IDCTR,WW,330NH,5%,690MA,1.05OHM,CER,30Q,500MHZSRF,SM,LEAD-F
L414	2414017Q51	IDCTR,FXD,2.2UH,10%,30MA,.65OHM,FERR,45 Q,50MHZ SRF,SM,0805
L500	2414017Q42	IDCTR,FXD,390NH,10%,200MA,.65OHM,FERR,25Q,135MHZSRF,SM,0805
L501	2414017Q51	IDCTR,FXD,2.2UH,10%,30MA,.65OHM,FERR,45 Q,50MHZ SRF,SM,0805
L502	2489669V01	IDCTR,WW,100UH,5%,40MA,10OHM,20 Q,10MHZ SRF,SM,1210,PB-FREE
L651	2414032F75	IDCTR,WW,270NH,2%,350MA,1OHM,CER,48 Q,650MHZ SRF,SM,0805
L652	2414032F75	IDCTR,WW,270NH,2%,350MA,1OHM,CER,48 Q,650MHZ SRF,SM,0805
L701	2486085A01	COIL, POWER INDUCTOR
L702	2486085A01	COIL, POWER INDUCTOR
L703	2464675H01	IDCTR,WW,560NH,5%,550MA
L704	2464675H01	IDCTR,WW,560NH,5%,550MA
L705	2464675H01	IDCTR,WW,560NH,5%,550MA
L708	2416307H01	IDCTR,WW,680NH,5%,0603
L710	2416307H01	IDCTR,WW,680NH,5%,0603
M501	NOTPLACED	
M701	0985888K02	SKT RTC BTTY LEAP
P4	3905643V01	CONTACT ANT GRD
P100	3916333H02	GROUND CONTACT
Q1	4816531H01	NPN SILICON BIPOLAR TRANSISTOR
Q101	4816698H03	MITSUBISHI RD09MUP2-T112 UHF RFPA
Q197	4813973A13	XSTR,BIP GP SS,PNP,TO-236,SOT-23,SMT,40V,.225W,200MA,250M
Q200	4871674S01	XSTR,BIP GP SS
Q250	4805218N63	RF TRANS SOT 323 BFQ67W

ITEM	MOTOROLA PART NUMBER	DESCRIPTION
Q251	4816371H01	XSTR DUAL PNP W18 COMPLIANT
Q401	4805585Q28	TRANSISTOR RF NPN 8GHZ NOPB
Q402	4813973A04	XSTR,BIP GP SS,NPN,TA13,SM,SOT-23,SMT,30V,.225W,300MA,125MHZ
Q501	4805921T28	XSTR, DUAL NOPB
Q698	4813973A81	XSTR,BIP GP SS,DIG,NPN AND PNP,SOT-363,50V,.25W,100MA,BIAS
Q700	4813970A62	XSTR,FET GP PWR,MOSFET,P-CH,ENHN,CF,-20V,1.3W,PB-FREE
Q701	4813973M07	XSTR,BIP GP SS,NPN,TO-236,,,SMT,40V,.225W,200MA,300MHZ,PB-FREE
Q702	5185956E76	IC,CONV,SM,SO16,0-30 VINPUT RANGE,6.5A,3.8V,HI SPD SWTH DR
Q703	4813970A62	XSTR,FET GP PWR,MOSFET,P-CH,ENHN,CF,-20V,1.3W,PB-FREE
Q704	NOTPLACED	
Q705	NOTPLACED	
Q706	NOTPLACED	
Q709	4885061Y01	XSTR NPN 6V 30UA 12GHZ PB-FREE
Q801	4813973A42	XSTR,BIP GP SS,NPN,SM,SC-59,SMT,50V,.23W,,,BIAS RSTR. TRANS
Q804	4813973A81	XSTR,BIP GP SS,DIG,NPN AND PNP,SOT-363,50V,.25W,100MA,BIAS
R1	0613952R25	CER CHIP RES 100K OHM 5% 0402
R2	0613952R25	CER CHIP RES 100K OHM 5% 0402
R3	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R4	0613952R03	CER CHIP RES 12K OHM 5% 0402
R5	0613952Q65	CER CHIP RES 470 OHM 5 0402

ITEM	MOTOROLA PART NUMBER	DESCRIPTION
R6	0613952R25	CER CHIP RES 100K OHM 5% 0402
R7	0613952R25	CER CHIP RES 100K OHM 5% 0402
R28	0613952Q09	CER CHIP RES 2.2 OHM 5 0402
R40	0613952Q95	CER CHIP RES 8200 OHM 5 0402
R42	0613952R25	CER CHIP RES 100K OHM 5% 0402
R51	0613952Q46	CER CHIP RES 75.0 OHM 5 0402
R56	NOTPLACED	
R102	0613952R05	CER CHIP RES 15K OHM 5% 0402
R103	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R104	0613952R07	CER CHIP RES 18K OHM 5% 0402
R105	0613952H55	CER CHIP RES 180 OHM 5% 0603
R108	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R109	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R125	0613952H47	CER CHIP RES 82.0 OHM 5 0603
R127	0613952R01	CER CHIP RES 10K OHM 5% 0402
R142	0613952Z63	RES,MF,36KOHM,1%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R143	0613952Z64	RES,MF,39KOHM,1%,.0625W,SM,0402
R144	0613952R25	CER CHIP RES 100K OHM 5% 0402
R146	0613952H73	CER CHIP RES 1000 OHM 5% 0603
R147	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R149	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R150	0613952H47	CER CHIP RES 82.0 OHM 5 0603
R151	0613952H47	CER CHIP RES 82.0 OHM 5 0603

ITEM	MOTOROLA PART NUMBER	DESCRIPTION
R152	NOTPLACED	
R153	NOTPLACED	
R154	0613952Q49	CER CHIP RES 100 OHM 5 0402
R155	0613952Q68	CER CHIP RES 620 OHM 5 0402
R156	NOTPLACED	
R157	NOTPLACED	
R158	NOTPLACED	
R159	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R160	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R162	NOTPLACED	
R168	0613952Q52	CER CHIP RES 130 OHM 5 0402
R169	0613952Q46	CER CHIP RES 75.0 OHM 5 0402
R170	0613952Q53	CER CHIP RES 150 OHM 5 0402
R171	0613952Q46	CER CHIP RES 75.0 OHM 5 0402
R172	NOTPLACED	
R173	NOTPLACED	
R199	0613952J01	CER CHIP RES 10K OHM 5% 0603
R201	0613952Q47	CER CHIP RES 82.0 OHM 5% 0402
R202	0613952Q69	CER CHIP RES 680 OHM 5 0402
R203	0613952Q57	CER CHIP RES 220 OHM 5 0402
R204	0613952R17	CER CHIP RES 47K OHM 5% 0402
R205	0613952R12	CER CHIP RES 30K OHM 5 0402
R206	0613952R01	CER CHIP RES 10K OHM 5% 0402
R207	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R208	0613952R13	CER CHIP RES 33K OHM 5% 0402
R209	0613952G67	CER CHIP RES 0.0 +/-0.050 OHM
R210	0613952R13	CER CHIP RES 33K OHM 5% 0402
R211	0613952Q80	CER CHIP RES 2000 OHM 5 0402

ITEM	MOTOROLA PART NUMBER	DESCRIPTION
R212	NOTPLACED	
R213	0613952Q95	CER CHIP RES 8200 OHM 5 0402
R214	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R215	0613952R01	CER CHIP RES 10K OHM 5% 0402
R216	0613952Q49	CER CHIP RES 100 OHM 5 0402
R251	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R252	0613952R01	CER CHIP RES 10K OHM 5% 0402
R253	0613952R05	CER CHIP RES 15K OHM 5% 0402
R254	0613952R35	CER CHIP RES 270K OHM 5% 0402
R255	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R257	0613958T74	CER CHIP RES 0.0 OHM JMP 1206
R258	0613952Q22	CER CHIP RES 7.5 OHM 5 0402
R259	0613952Q61	CER CHIP RES 330 OHM 5 0402
R266	2113944V03	CAP,FXD,1PF,.1PF+/-,50V-DC,0402,C0G,-55DEG CMIN,125DEG CMAX,PB
R270	0613952Q51	CER CHIP RES 120 OHM 5 0402
R271	0613952Q36	CER CHIP RES 30.0 OHM 5 0402
R272	0613952Q56	CER CHIP RES 200 OHM 5 0402
R273	0613952Q56	CER CHIP RES 200 OHM 5 0402
R274	0613952Q32	CER CHIP RES 20.0 OHM 5 0402
R275	0613952Q56	CER CHIP RES 200 OHM 5 0402
R276	0613952R01	CER CHIP RES 10K OHM 5% 0402
R278	0613952R03	CER CHIP RES 12K OHM 5% 0402
R291	0613952Q36	CER CHIP RES 30.0 OHM 5 0402
R293	0613952Q32	CER CHIP RES 20.0 OHM 5 0402
R294	0613952Q61	CER CHIP RES 330 OHM 5 0402

ITEM	MOTOROLA PART NUMBER	DESCRIPTION
R295	0613952R01	CER CHIP RES 10K OHM 5% 0402
R296	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R297	NOTPLACED	
R298	NOTPLACED	
R299	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R406	0613952R01	CER CHIP RES 10K OHM 5% 0402
R407	0613952R01	CER CHIP RES 10K OHM 5% 0402
R408	0613952H79	CER CHIP RES 1800 OHM 5% 0603
R412	0613952H55	CER CHIP RES 180 OHM 5% 0603
R413	0613952H61	CER CHIP RES 330 OHM 5 0603
R414	0613952R01	CER CHIP RES 10K OHM 5% 0402
R415	0613952R01	CER CHIP RES 10K OHM 5% 0402
R417	0613952Q74	RES,MF,1.1KOHM,5%,.0625W,SM,0402,200PPM/CEL,PB-FREE
R418	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R419	0613952R25	CER CHIP RES 100K OHM 5% 0402
R420	0613952R19	CER CHIP RES 56K OHM 5% 0402
R436	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R499	0613952R01	CER CHIP RES 10K OHM 5% 0402
R503	0613952Q63	CER CHIP RES 390 OHM 5 0402
R504	0613952Q66	CER CHIP RES 510 OHM 5 0402
R505	0613952R01	CER CHIP RES 10K OHM 5% 0402
R507	0613952Q49	CER CHIP RES 100 OHM 5 0402
R508	0613952Q49	CER CHIP RES 100 OHM 5 0402
R509	0613952Q49	CER CHIP RES 100 OHM 5 0402
R510	0613952Q49	CER CHIP RES 100 OHM 5 0402
R511	0613952R01	CER CHIP RES 10K OHM 5% 0402

ITEM	MOTOROLA PART NUMBER	DESCRIPTION
R512	0613952R17	CER CHIP RES 47K OHM 5% 0402
R513	0613952R01	CER CHIP RES 10K OHM 5% 0402
R514	0613952R01	CER CHIP RES 10K OHM 5% 0402
R515	0613952R01	CER CHIP RES 10K OHM 5% 0402
R516	0613952R01	CER CHIP RES 10K OHM 5% 0402
R517	0613952R01	CER CHIP RES 10K OHM 5% 0402
R518	0613952R01	CER CHIP RES 10K OHM 5% 0402
R519	0613952R17	CER CHIP RES 47K OHM 5% 0402
R520	0613952R37	CER CHIP RES 330K OHM 5% 0402
R521	NOTPLACED	
R522	0613952R17	CER CHIP RES 47K OHM 5% 0402
R523	0613952R17	CER CHIP RES 47K OHM 5% 0402
R524	0613952G67	CER CHIP RES 0.0 +/-0.050 OHM
R525	0613952R01	CER CHIP RES 10K OHM 5% 0402
R526	0613952R01	CER CHIP RES 10K OHM 5% 0402
R527	NOTPLACED	
R528	0613952G67	CER CHIP RES 0.0 +/-0.050 OHM
R608	0613952Q49	CER CHIP RES 100 OHM 5 0402
R610	NOTPLACED	
R611	0613952Q49	CER CHIP RES 100 OHM 5 0402
R613	0613952R08	CER CHIP RES 20K OHM 5 0402
R614	0613952R08	CER CHIP RES 20K OHM 5 0402
R615	0613952R25	CER CHIP RES 100K OHM 5% 0402
R616	0613952Q49	CER CHIP RES 100 OHM 5 0402
R617	NOTPLACED	
R620	0613952Q49	CER CHIP RES 100 OHM 5 0402
R621	0613952Q49	CER CHIP RES 100 OHM 5 0402
R622	0613952Q49	CER CHIP RES 100 OHM 5 0402
R625	0613952Q49	CER CHIP RES 100 OHM 5 0402
R626	0613952Q49	CER CHIP RES 100 OHM 5 0402
R633	NOTPLACED	
R634	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R635	NOTPLACED	
R636	0613952R01	CER CHIP RES 10K OHM 5% 0402
R637	0613952Q49	CER CHIP RES 100 OHM 5 0402
R638	0613952Q49	CER CHIP RES 100 OHM 5 0402
R639	0613952Q49	CER CHIP RES 100 OHM 5 0402
R640	0613952Q49	CER CHIP RES 100 OHM 5 0402
R641	0613952Q49	CER CHIP RES 100 OHM 5 0402
R642	0613952Q49	CER CHIP RES 100 OHM 5 0402
R643	0613952Q49	CER CHIP RES 100 OHM 5 0402
R644	0613952Q49	CER CHIP RES 100 OHM 5 0402
R647	0613952R01	CER CHIP RES 10K OHM 5% 0402
R649	0613952R17	CER CHIP RES 47K OHM 5% 0402
R654	0613952R01	CER CHIP RES 10K OHM 5% 0402
R656	0613952R01	CER CHIP RES 10K OHM 5% 0402
R658	0613952P18	CER CHIP RES 150K OHM 1 0402
R666	0613952Q57	CER CHIP RES 220 OHM 5 0402
R667	0613952Q63	CER CHIP RES 390 OHM 5 0402
R668	0613952Q45	CER CHIP RES 68.0 OHM 5 0402
R669	0613952Q49	CER CHIP RES 100 OHM 5 0402
R670	0613952Q49	CER CHIP RES 100 OHM 5 0402
R671	0613952Q63	CER CHIP RES 390 OHM 5 0402
R672	0613952R01	CER CHIP RES 10K OHM 5% 0402
R673	0613952R01	CER CHIP RES 10K OHM 5% 0402
R674	0613952Q49	CER CHIP RES 100 OHM 5 0402
R675	0613952Q67	CER CHIP RES 560 OHM 5 0402
R677	0613952R01	CER CHIP RES 10K OHM 5% 0402
R678	0613952Q49	CER CHIP RES 100 OHM 5 0402
R697	0613952Q49	CER CHIP RES 100 OHM 5 0402
R700	0613952Q80	CER CHIP RES 2000 OHM 5 0402
R701	0613952R17	CER CHIP RES 47K OHM 5% 0402
R702	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R703	0613952R17	CER CHIP RES 47K OHM 5% 0402
R704	0613952Q49	CER CHIP RES 100 OHM 5 0402
R705	0613952R17	CER CHIP RES 47K OHM 5% 0402
R708	0613952R19	CER CHIP RES 56K OHM 5% 0402
R709	0613952H17	CER CHIP RES 4.7OHM 5%
R710	0688044N04	RES,METAL STRIP, 0.1 OHM,1%,0.125W,SMD,0805
R711	0613952G67	CER CHIP RES 0.0 +/-0.050 OHM
R712	0613952Q49	CER CHIP RES 100 OHM 5 0402
R714	0688044N04	RES,METAL STRIP, 0.1 OHM,1%,0.125W,SMD,0805
R717	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R718	0613952G67	CER CHIP RES 0.0 +/-0.050 OHM
R722	0613952R08	CER CHIP RES 20K OHM 5 0402
R725	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R726	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R729	0613952R13	CER CHIP RES 33K OHM 5% 0402
R740	0613952Q63	CER CHIP RES 390 OHM 5 0402
R741	0613952R17	CER CHIP RES 47K OHM 5% 0402
R742	0613952R17	CER CHIP RES 47K OHM 5% 0402
R743	NOTPLACED	
R744	NOTPLACED	
R745	0613952R56	CER CHIP RES 2.0M OHM 5 0402
R746	0613952R56	CER CHIP RES 2.0M OHM 5 0402
R747	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R748	0613952R41	CER CHIP RES 470K OHM 5% 0402
R749	0613952R41	CER CHIP RES 470K OHM 5% 0402
R750	0613952Q63	CER CHIP RES 390 OHM 5 0402
R751	0613952Q63	CER CHIP RES 390 OHM 5 0402
R752	0613952Q81	CER CHIP RES 2200 OHM 5 0402
R753	0613952Q81	CER CHIP RES 2200 OHM 5 0402
R756	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R757	0613952R08	CER CHIP RES 20K OHM 5 0402
R758	0613952R19	CER CHIP RES 56K OHM 5% 0402
R759	0613952R01	CER CHIP RES 10K OHM 5% 0402
R760	0613952Q93	CER CHIP RES 6800 OHM 5 0402
R763	NOTPLACED	
R764	NOTPLACED	
R765	NOTPLACED	
R767	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R768	NOTPLACED	
R771	NOTPLACED	
R772	0613952Q49	CER CHIP RES 100 OHM 5 0402
R773	0613952Q49	CER CHIP RES 100 OHM 5 0402
R774	0613952Q49	CER CHIP RES 100 OHM 5 0402
R775	0613952Q49	CER CHIP RES 100 OHM 5 0402
R776	NOTPLACED	
R777	0613952R01	CER CHIP RES 10K OHM 5% 0402
R778	0613952R01	CER CHIP RES 10K OHM 5% 0402

ITEM	MOTOROLA PART NUMBER	DESCRIPTION
R779	0613952R01	CER CHIP RES 10K OHM 5% 0402
R780	0613952Q89	CER CHIP RES 4700 OHM 5 0402
R781	0613952R01	CER CHIP RES 10K OHM 5% 0402
R782	0613952R01	CER CHIP RES 10K OHM 5% 0402
R783	0613952R01	CER CHIP RES 10K OHM 5% 0402
R784	NOTPLACED	
R785	0613952Q49	CER CHIP RES 100 OHM 5 0402
R786	0613952R17	CER CHIP RES 47K OHM 5% 0402
R787	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R790	0613952R19	CER CHIP RES 56K OHM 5% 0402
R791	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R792	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R793	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R794	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R795	0613952R01	CER CHIP RES 10K OHM 5% 0402
R796	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R797	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R798	0613952Q61	CER CHIP RES 330 OHM 5 0402
R799	0613952R01	CER CHIP RES 10K OHM 5% 0402
R801	0613952Q93	CER CHIP RES 6800 OHM 5 0402
R802	0613952Q49	CER CHIP RES 100 OHM 5 0402
R803	0613952Q49	CER CHIP RES 100 OHM 5 0402
R804	0613952Q66	CER CHIP RES 510 OHM 5 0402
R805	0613952R01	CER CHIP RES 10K OHM 5% 0402
R806	0613952Q66	CER CHIP RES 510 OHM 5 0402

ITEM	MOTOROLA PART NUMBER	DESCRIPTION
R807	0613952R01	CER CHIP RES 10K OHM 5% 0402
R808	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R809	0613952R17	CER CHIP RES 47K OHM 5% 0402
R810	0613952R01	CER CHIP RES 10K OHM 5% 0402
R811	0613952Q66	CER CHIP RES 510 OHM 5 0402
R812	0613952R25	CER CHIP RES 100K OHM 5% 0402
R813	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R814	NOTPLACED	
R815	0613952R66	CER CHIP RES 0.0 +/-0.050 OHM
R816	0613952R17	CER CHIP RES 47K OHM 5% 0402
R820	0613952R01	CER CHIP RES 10K OHM 5% 0402
R829	NOTPLACED	
R837	0613952Q37	CER CHIP RES 33.0 OHM 5 0402
R838	0613952Q37	CER CHIP RES 33.0 OHM 5 0402
R839	0613952R01	CER CHIP RES 10K OHM 5% 0402
R840	0613952Q66	CER CHIP RES 510 OHM 5 0402
R841	0613952R01	CER CHIP RES 10K OHM 5% 0402
R842	0613952R01	CER CHIP RES 10K OHM 5% 0402
R843	0613952R41	CER CHIP RES 470K OHM 5% 0402
R844	0613952Q61	CER CHIP RES 330 OHM 5 0402
S500	4085131E03	SWITCH FREQ DUAL FUNCTION
S501	1880619Z06	POTENTIOMETER, VOLUME
S502	4016618H01	SWITCH SURFACE MOUNT
S503	4070354A01	LIGHT TOUCH SWITCH-SMD
S504	4070354A01	LIGHT TOUCH SWITCH-SMD
S505	4070354A01	LIGHT TOUCH SWITCH-SMD

ITEM	MOTOROLA PART NUMBER	DESCRIPTION
S506	4070354A01	LIGHT TOUCH SWITCH-SMD
SH1	2686707Z02	SHIELD, SM SLDRD,CRS,PLTD
SH51	2686700Z02	SHIELD, SM SLDRD,CRS,PLTD
SH52	2686699Z02	SHIELD, SM SLDRD,CRS,PLTD
SH101	2686702Z02	SHIELD, SM SLDRD,CRS,PLTD
SH102	2686701Z02	SHIELD, SM SLDRD,CRS,PLTD
SH103	2686708Z02	SHIELD, SM SLDRD,CRS,PLTD
SH201	2686705Z02	SHIELD, SM SLDRD,CRS,PLTD
SH251	2616554H01	SHLD VCO TOP
SH252	2616559H01	SHLD PCIC
SH401	2686706Z02	SHIELD, SM SLDRD,CRS,PLTD
SH402	2686698Z02	SHIELD, SM SLDRD,CRS,PLTD
SH500	NOTPLACED	
T51	2515121H01	BALUN, TRANSFORMER W18 COMP
T53	2516320H01	XFMR SMALL SIGNAL SURFACE MT
U1	5164015H81	IC,MXR,DBL BAL GILBERT,CELL,,,SM
U2	5185941F45	ATTEN,VAR,14.4DBMIN,15.6DB MAX,0-2000 MHZFREQ,50OHM,PCMT
U3	5116349H01	DUAL INVERTER IC
U101	5115678H01	VHF/UHF/800/900 MHZ LDMOS DRIVER IC
U102	5185765B26	IC PWR CTRL IN MOS20
U103	5115022H01	IC TEMPERATURE SENSOR
U201	5116411H01	IC,OP AMP
U202	5116245H01	CC LVFRACN
U220	5185941F40	IC, 12 BIT DAC
U250	5105750U56	IC PKG DIE VCO BUFFER
U302	2113743L41	CAP CHIP 10000 PF 10 X7R
U304	4809788E21	DIODE, ZENER, SOD-323, SMD, W18 COMPLIANT
U401	5185963A85	IC-ABACUS III-LP
U500	5188493T01	IC,VREG/SWG,LP2989,SM,IC MINI SO-8 HI PRCN REG 5V
U501	5185941F35	IC, VREG, NOPB
U502	5185941F35	IC, VREG, NOPB

ITEM	MOTOROLA PART NUMBER	DESCRIPTION
U601	5185941F22	IC,OPAMP,SGL,OPA237,SOT23, NOPB
U602	5185941F22	IC,OPAMP,SGL,OPA237,SOT23, NOPB
U701	5185143E77	IC, MAKO ASIC, CMOS PWR MGMT
U702	5185941F22	IC,OPAMP,SGL,OPA237,SOT23, NOPB
U705	5114000B39	IC,BFR,1PER PKG,SM,SOT-353,PB-FREE
U712	5188691V01	IC,MUX/ DEMUX,NC7SB3157P6X,SM,SC 70-6,1PER PKG,BUS,PB FREE
U713	5115453H01	RAIL TO RAIL OUTPUT, 8 PIN BGA
U714	5115453H01	RAIL TO RAIL OUTPUT, 8 PIN BGA
U800	5185941F04	IC, PATRIOT BRAVO, 1.2.2,256BGA, PB-FREE
U801	5114000B39	IC,BFR,1PER PKG,SM,SOT-353,PB-FREE
U802	5114000B39	IC,BFR,1PER PKG,SM,SOT-353,PB-FREE
U803	5185956E69	IC,DRAM,64MB,60NS,,,,,,IC 1.8V 64
U804	5185941F03	IC,SRAM,8M,512KX16,70NS,SM, FBGA48,1.95V
VR500	4809788E21	DIODE, ZENER, SOD-323, SMD, W18 COMPLIANT
VR501	4813977M19	DIODE,ZEN,MBZ5240,SM,SOT-23,10V,10MA,.225W,ZEN,PB-FREE
VR502	4809788E21	DIODE, ZENER, SOD-323, SMD, W18 COMPLIANT
VR503	4809788E21	DIODE, ZENER, SOD-323, SMD, W18 COMPLIANT
VR504	4809788E21	DIODE, ZENER, SOD-323, SMD, W18 COMPLIANT
VR505	4809788E21	DIODE, ZENER, SOD-323, SMD, W18 COMPLIANT
VR506	4809788E21	DIODE, ZENER, SOD-323, SMD, W18 COMPLIANT
VR508	4813977A43	PB-FREE, NOTCOMPLETELYENRICHED

ITEM	MOTOROLA PART NUMBER	DESCRIPTION
VR509	4813977A43	PB-FREE, NOTCOMPLETELYENRICHED
VR510	4813977A43	PB-FREE, NOTCOMPLETELYENRICHED
VR511	4813977A43	PB-FREE, NOTCOMPLETELYENRICHED
VR512	4813977A43	PB-FREE, NOTCOMPLETELYENRICHED
VR513	4813977A43	PB-FREE, NOTCOMPLETELYENRICHED
VR650	4813979P12	DIODE ARRAY,TRANSIENT PROTECTION,SM,SOT-457,12V,.225W,ZEN,4,PB
VR651	4813977A43	PB-FREE, NOTCOMPLETELYENRICHED
VR652	4813977A43	PB-FREE, NOTCOMPLETELYENRICHED
VR657	4809788E21	DIODE, ZENER, SOD-323, SMD, W18 COMPLIANT
VR658	4813977C23	DIODE 13V 'H3' MMSZ5243BT1
VR659	4813979P10	DIODE ARRAY,TRANSIENT PROTECTION,SM,SOT-457,5.6V,.225W,ZEN,4,P
VR662	4813979P10	DIODE ARRAY,TRANSIENT PROTECTION,SM,SOT-457,5.6V,.225W,ZEN,4,P
VR663	4813977M18	DIODE,ZEN,,,SOT-23,9.1V,,,.225W,PB
VR678	4866544A01	DIODE ARRAY,ZEN,SR05.TCT,SM,,,5V,,,5,LOW CAPACITANCE TVS DIO
VR701	4813977M11	DIODE,ZEN,MBZ5232,SM,SOT-23,5.6V,10MA,.225W,ZEN,PB-FREE
Y200	4802245J68	OSC, REF 16.8 MHZ 1.5 PPM
Y701	4809995L05	XTAL QUARTZ 32.768KHZ CC4V-T1
Y702	4864005H01	RESONATOR, CRYSTAL 24.576 MHZ

Notes:

1. For optimum performance, order replacement diodes, transistors, and circuit modules by Motorola part number only.
2. When ordering crystals, specify carrier frequency, crystal frequency, crystal type number, and Motorola part number.
3. Part value notations:
   p=10^{-12}
   n=10^{-9}
   µ=10^{-6}
   m=10^{-3}
   k=10^{3}
   M=10^{6}
4. ITEM refers to the component reference designator. SIDE refers to the location of the component on the board; S1=Side 1, S2=Side 2.
5. The PMLD4303A RF Board uses a 6-layer printed circuit board.