MOTOROLA
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Detailed Service Manual

Detailed Test Procedures

i425e ***i425t*** ***i290***

Digital Multi-Service, Data-Capable Portable

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MOTOROLA
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iDEN

i425e, i425t & i290

Digital Multi-Service, Data-Capable Portable

Detailed Service Manual

Detailed Test Procedures

August 2007

Manual Revisions

Changes that occur after this manual is printed are described in the Field Manual Revisions (FMRs). The FMRs provide the most current instructions and component information.

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SAFETY AND GENERAL INFORMATION

This section contains important information on the safe and efficient operation of your mobile device. Read this information before using your integrated multi-service portable radio.*

Exposure to Radio Frequency (RF) Energy

Your phone contains a transmiter and receiver. When it is ON, it receives and transmits RF energy. When you communicate with your phone, the system handling your call controls the power level at which your phone transmits. Your Motorola phone is designed to comply with local regulatory requirements in your country concerning exposure of human beings to RF energy.

Portable Radio Product Operation and EME Exposure

Your Motorola radio product is designed to comply with the following national and international standards and guidelines regarding exposure of human beings to radio frequency electromagnetic energy (EME):

- United States Federal Communications Commission, Code of Federal Regulations; 47 CFR part 2 sub-part J.
- American National Standards Institute (ANSI) / Institute of Electrical and Electronics Engineers (IEEE). C95. 1-1992.
- Institute of Electrical and Electronics Engineers (IEEE). C95. 1-2005 Edition.*
- International Commission on Non-Ionizing Radiation Protection (ICNIRP) 1998.
- Ministry of Health (Canada). Safety Code 6. Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz, 1999.
- Australian Communications Authority Radio communications (Electromagnetic Radiation - Human Exposure) Standard 2003.
- ANATEL, Brazil Regulatory Authority, Resolution 303 (July 2, 2002) "Regulation of the limitation of exposure to electrical, magnetic, and electromagnetic fields in the

* The information provided in this document supersedes the general safety information in user's guides published prior to May 1, 2006

radio frequency range between 9 kHz and 300 GHz." "Attachment to Resolution 303 from July 2, 2002.

Operational Precautions

To assure optimal radio product performance and to be sure that human exposure to RF does not exceed the guidelines set forth in the relevant standards, always follow these instructions and precautions :

Two-way radio operation

Your radio product has been designed and tested to comply with national and international standards and guidelines regarding human exposure to RF electromagnetic energy, when operated in the two-way mode (at the face, or at the abdomen when using an audio accessory) at usage factors of up to 50% talk/50% listen.
Transmit no more than the rated duty factor of 50% of the time. To transmit (talk), push the Walkie-Talkie (WT) button. To receive calls, release the WT button. Transmitting 50% of the time or less, is important because this radio generates measurable RF energy only when transmitting (in terms of measuring for standards compliance).

When using your radio product as a traditional two-way radio, hold the radio product in a vertical position with the microphone one to two inches (2.5 to 5 cm) away from the lips.

Product Operation

When placing or receiving a phone call, hold your radio product as you would a wireline telephone. Speak directly into the microphone.

If you wear a radio product on your body when transmitting, always place the radio product in a Motorola approved clip, holder, holster, case or body harness. If you do not use a body-worn accessory supplied or approved by Motorola and are not using the radio product in the intended use positions along side the head in the phone mode or in front of the face in the two-way radio mode—or if you hang your device from a lanyard around your neck—keep the device at least 2.5 centimeters (1 inch) from your body when transmitting.

ALL MODELS WITH FCC ID IHDT56HH1 and IHDT56HG1

MEET THE GOVERNMENT'S REQUIREMENTS FOR EXPOSURE TO RADIO WAVES.

Your wireless phone is a radio transmitter and receiver. It is designed and manufactured not to exceed the emission limits for exposure to radiofrequency (RF) energy set by the Federal Communications Commission of the U.S. Government. These limits are part of comprehensive guidelines and establish permitted levels of RF energy for the general population. The guidelines are based on standards that were developed by independent scientific organizations through periodic and thorough evaluation of scientific studies. The standards include a substantial safety margin designed to assure the safety of all persons, regardless of age and health.

The exposure standard for wireless mobile phones employs a unit of measurement known as the Specific Absorption Rate, or SAR. The SAR limit set by the FCC is 1.6W/kg.[1] Tests for SAR are conducted using standard operating positions reviewed by the FCC with the phone transmitting at its highest certified power level in all tested frequency bands. Although the SAR is determined at the highest certified power level, the actual SAR level of the phone while operating can be well below the maximum value. This is because the phone is designed to operate at multiple power levels so as to use only the power required to reach the network. In general, the closer you are

to a wireless base station antenna, the lower the power output.

Before a phone model is available for sale to the public, it must be tested and certified to the FCC that is does not exceed the limit established by the government-adopted requirement for safe exposure. The tests are performed in positions and locations (e.g., at the ear and worn on the body) as required by the FCC for each model. The highest SAR value for this model phone when tested for use at the ear is (1.35 W/kg for i425) (1.30 W/kg for i290) and when tested on the body, as described in this user guide, is (1.41 W/kg for i425) (1.57 W/kg for i290) during packet data transmission. (Body-worn measurements differ among phone models, depending upon available accessories and FCC requirements.)[2]

While there may be differences between the SAR levels of various phones and at various positions, they all meet the government requirement for safe exposure.

The FCC has granted an Equipment Authorization for this model phone with all reported SAR levels evaluated as in compliance with the FCC RF exposure guidelines. SAR information on this model phone is on file with the FCC and can be found under the Display Grant section of http://www.fcc.gov/oet/fccid after searching on FCC ID IHDT56HH1 (i425) andIHDT56HG1 (i290).

Additional information on Specific Absorption Rates (SAR) can be found on the Cellular Telecommunications Industry Association (CTIA) web-site at http://www.wow-com.com.

1 In the United States and Canada, the SAR limit for mobile phones used by the public is 1.6 watts/kg (W/kg) averaged over one gram of tissue. The standard incorporates a substantial margin of safety to give additional protection for the public and to account for any variations in measurements.
2 The SAR information reported to the FCC includes the FCC-accepted Motorola testing protocol, assessment procedure, and measurement uncertainty range for this product.

Approved Accessories

For a list of approved Motorola accessories call 1 -800-453-0920, or visit our website at www.motorola.com/iden.

RF Energy Interference/Compatibility

Nearly every electronic device is subject to RF energy interference from external sources if inadequately shielded, designed or otherwise configured for RF energy compatibility. In some circumstances your handset may cause interference with other devices.

Follow Instructions to Avoid Interference Problems

Turn OFF your radio product where posted notices instruct you to do so.

In an aircraft, turn off your radio product whenever instructed to do so by airline staff. If your radio product offers an airplane mode or similar feature, consult airline staff about using it in flight.

Implantable Medical Devices

If you have an implantable medical devices, such as a pacemaker or defibrillator, consult your physician before using this radio product.
Persons with implantable medical devices should observe the following precautions:

- ALWAYS keep the phone more than 20 centimeters (8 inches) from the implantable medical device when the phone is turned ON.
- DO NOT carry the phone in a breast pocket;
- Use the ear opposite the implantable medical device to minimize the potential for interference.
- Turn OFF the phone immediately if you have any reason to suspect that the interference is taking place.

Read and follow the directions from the manufacturer of your implantable medical device. If you have any questions about using your wireless phone with your implantable medical device, consult your health care provider

Hearing Aids

Some mobile devices may interfere with some hearing aids. In the event of such interference, you may want to consult your hearing aid manufacturer or physician to discuss alternatives.

Other Medical Devices and Health Care Facilities

If you use any other personal medical devices, consult your physician or the manufacturer or your device to determine if it is adequately shielded from RF energy. Turn off your radio product when instructed to do so in hospitals or health care facilities that may be using equipment that is sensitive to external RF energy.

Driving Precautions

Check the laws and regulations on the use of radio products in the area where you drive. Always obey them.
When using your radio product while driving, please:

- Give full attention to driving and to the road. Using a mobile device may be distracting. Discontinue a call if you can't concentrate on driving.
- Use hands free operation, if available.
- Pull off the road and park before making or answering a call if driving conditions so require.

- Do not place a handset in the airbag deployment area.

Responsible driving practices can be found in the "Smart Practices While Driving" section at the end of this guide and/or at the Motorola Web site: www.motorola.com/callsmart.

Note: The use of wireless phones while driving may cause distraction. Discontinue a call if you can't concentrate on driving. Additionally, the use of wireless devices and their accessories may be prohibited or restricted in certain areas. Always obey the laws and regulations on the use of these products.

Operational Warnings

Obey all posted signs when using mobile devices in public areas.

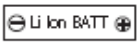
Potentially Explosive Atmospheres

Areas with potentially explosive atmospheres are often but not always posted, and can include fueling areas such as below decks on boats, fuel or chemical transfer or storage facilities, or areas where the air contains chemicals or particles, such as grain, dust or metal powders.
When you are in such area, turn off your handset, and do not remove, install, or charge batteries unless it is a radio product type especially qualified for use in such areas as "Intrinsically Safe" (for example, Factory Mutual, CSA, or UL approved). In such areas, sparks can occur and cause an explosion or fire

Batteries and Chargers

Caution: Improper treatment or use of batteries may present a danger of fire, explosion, leakage, or other hazard. For more information, see the "Battery Use and Battery Safety" section in this user's guide.

Your battery, charger, or portable radio may contain symbols, defined as follows:

Symbol	Definition
	Important safety information follows.
	Do not dispose of your battery or mobile device in a fire.
	Your battery or mobile device may require recycling in accordance with local laws. Contact your local regulatory authorities for more information.
	Do not throw your battery or mobile device in the trash.
	Your mobile device an internal lithium ion battery
	Do not let your battery, charger, or mobile device get wet.
	Listening at full volume to music or voice through a headset may damage your hearing

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Choking Hazards

Your portable radio or its accessories may include detachable parts, which may present a choking hazard to small children. Keep your device and its accessories away from small children.

Glass Parts

Some parts of your mobile device may be made of glass. This glass could break if the product is dropped on a hard surface or receives a substantial impact. If glass breaks, do not touch or attempt to remove. Stop using your mobile device until the glass is replaced by a qualified service center.

Seizures/Blackouts

Some people may be susceptible to epileptic seizures or blackouts when exposed to flashing lights, such as when playing video games. These may occur even if a person has never had a previous seizure or blackout

If you have experienced seizures or blackouts, or if you have a family history of such occurrences, please consult with your physician before playing video games or enabling a flashing-lights feature (if available) on your mobile device. Discontinue use and consult a physician if any of the following symptoms occur: convulsion, eye or muscle twitching, loss of awareness, involuntary movements, or disorientation. It is always a good idea to hold the screen away from your eyes, leave the lights on in the room, take a 15-minute break every hour, and stop use if you are very tired.

Caution About High Volume Usage

Listening at full volume to music or voice through a headset may damage your hearing.

Repetitive Motion

When you repetitively perform actions such as pressing keys or entering finger-written characters, you may experience occasional discomfort in your hands, arms, shoulders, neck, or other parts of your body. If you continue to have discomfort during or after such use, stop use and see a physician.

Service & Repairs

If you have questions or need assistance, we're here to help.

Go to www.motorola.com/iden/support, where you can select from a number of customer care options. You can also contact the Motorola Customer Support Center at 1 -800-453-0920 (United States), 1-877-483-2840 (TTY/TDD United States for hearing impaired)

Battery Use & Battery Safety

- **Motorola recommends you always use Motorola-branded batteries and chargers.** The warranty does not cover damage caused by non-Motorola batteries and/or chargers. **Caution:** Use of an unqualified battery or charger may present a risk of fire, explosion, leakage, or other hazard. Improper battery use, or use of a damaged battery, may result in a fire, explosion, or other hazard.
- Battery usage by children should be supervised.
- **Important:** Motorola mobile devices are designed to work best with qualified batteries. If you see a message on your display such as Invalid Battery or Unable to Charge, take the following steps:
  - Remove the battery and inspect it to confirm that it bears a Motorola "Original Equipment" hologram;
  - If there is no hologram, the battery is not a qualified battery;
  - If there is a hologram, replace the battery and retry charging it;
  - If the message remains, contact a Motorola Authorized Service Center.
  - New batteries or batteries stored for a long time may take more time to charge.

  Charging precautions: When charging your battery, keep it near room temperature. Never expose batteries to temperatures below 0°C (32°F) or above 45°C (113°F) when charging. Always take your mobile device with you when you leave your vehicle
- When storing your battery, keep it in a cool, dry place.
- It is normal over time for battery life to decrease, and for the battery to exhibit shorter runtime between charges or require more frequent or longer charging times.
- **Avoid damage to battery and mobile device.** Do not disassemble, open, crush, bend, deform, puncture, shred, or submerge the battery or mobile device. Avoid dropping the battery or mobile device, especially on a hard surface. If your battery or mobile device has been subjected to such damage, take it to a Motorola Authorized Service Center before using. Do **not** attempt to dry it with an appliance or heat source, such as a hair dryer or microwave oven.
- **Use care when handling a charged battery**—particularly when placing it inside a pocket, purse, or other container with metal objects. Contact with metal objects (e.g., jewelry, keys, beaded chains) could complete an electrical circuit (short circuit), causing the battery to become very hot, which could cause damage or injury.

Promptly dispose of used batteries in accordance with local regulation

Contact your local recycling center for proper battery disposal.

Warning: Never dispose of batteries in a fire because they may explode.

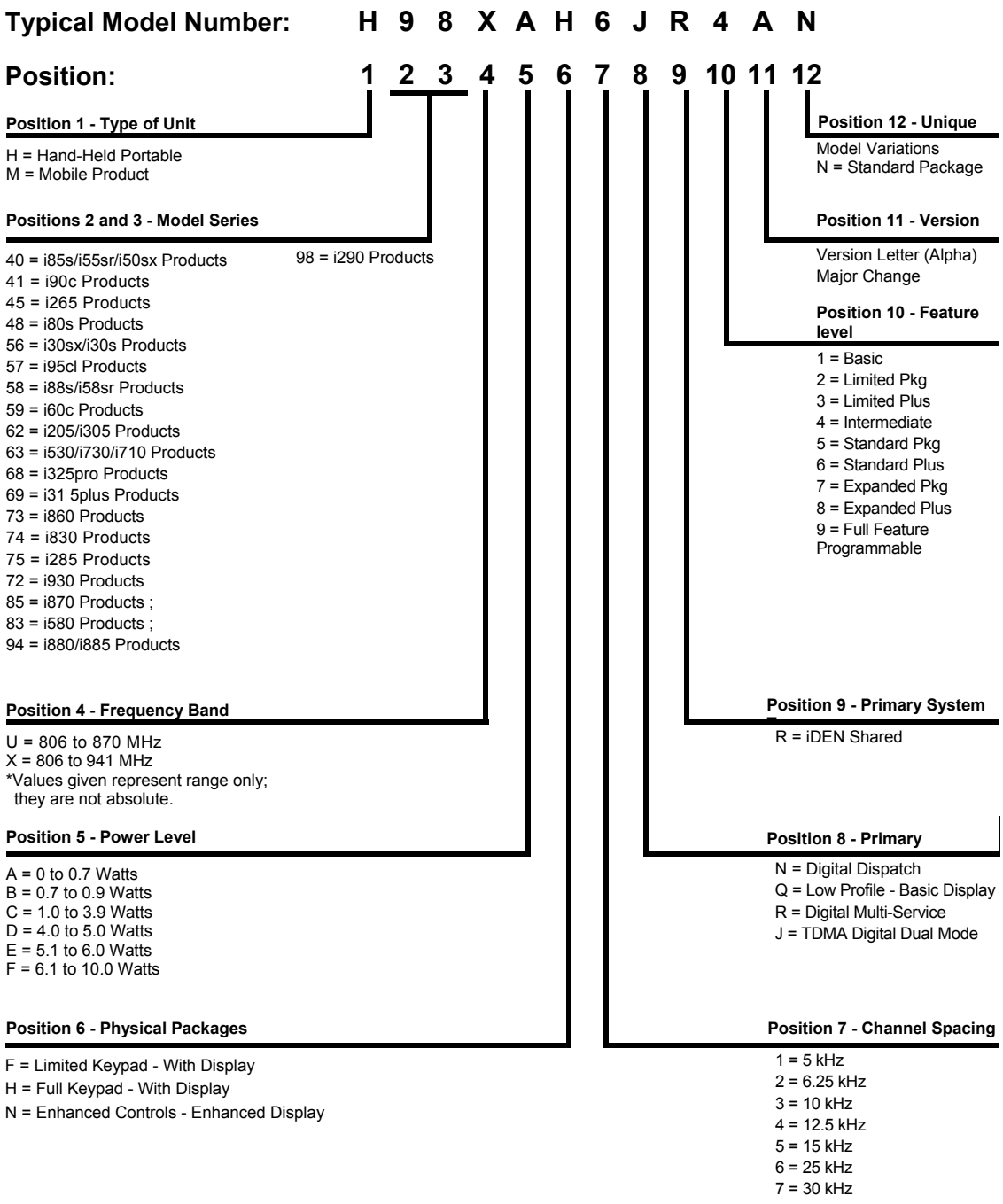
MODEL INFORMATION

This manual applies to the following iDEN Digital Portable models:

i425 = **H98XAH6JR5AN** iDEN: 806- 940 MHz/ Multi-Service, Data-Capable Portable

i290 = **H98XAH6JR4AN** iDEN: 806- 940 MHz/ Multi-Service, Data-Capable Portable

MODEL NUMBERING SYSTEM



MODEL SPECIFICATIONS

GENERAL

i425 FCC #	IHDT56HH1
i290 FCC #	IHDT56HG1
Operational Modes	Phone
	Private
	Group
	Circuit Data
	Packet Data
	Moto Talk
Temperature Range	
Operating	–10°C to +60°
Storage (w/o battery)	–40°C to +85°C
Battery Type	Lithium Ion
Recommended Battery	SNN5784A SNN5758A
Battery Voltage	
Nominal	3.6 Vdc
Range	3.0 to 4. 2 Vdc
Dimensions (HxWxD)	**i425**
w/950mAh	125 x 48
battery door	x 13 mm
Weight: (without battery)	67.0 g
All specifications	+/- 5%.
Dimensions (HxWxD)	**i290**
w/950mAh	125 x 48
battery door	x 13 mm
Weight: (without battery)	66.0 g
All specifications	+/- 5%.

RECEIVER

Receiver Type	Direct Conversion
Frequency Range	851-870 MHz
	935-940 MHz
	902-928 MHz
Channel Spacing:	
iDEN	25kHz
MotoTalk	50kHz
Frequency Stability Referenced to base station	0.4 ppm
Sensitivity (10%)BER (M-16 QAM)	-111 dBm
MotoTalk (3%)BER (FSK) (i290 ONLY)	-119 dBm
Spurious Response Immunity:	-51 dBm
Spurious Radiation	
Above 960 M	<500µV/m
216–960 MHz	<200µV/m
88–216 MHz	<150µV/m
30–88 MHz	<100µV/m
Audio Output Power &Speakerphone Rating (Private and Group Modes only) into 8 ohms at maximum volume (nominal battery voltage)	500mW
Distortion at Rated Audio:	
Electrical Acoustical	5% Max
Acoustical	10% Max

TRANMITTER

Transmitter Type	Single Conversion
Frequency Range	806-825 MHz
	896-901 MHz
	902-928 MHz
Emission Designator	18K3D7W
Modulation Type	Quad 16QAM Quad 64QAM Quad QPSK FSK
Frequency Stability: Referenced to base Station	0.4 ppm
Spurious Emissions:	
Conducted	-13 dBm
Radiated	-13 dBm
MotoTalk Radiated	-41.2 dBm
RF Pulse Avg Power:	
iDEN (dynamically adjusted)	-6 to +28 dBm
MotoTalk	22.6 to +28.82 dBm
Adjacent Channel Power	
iDEN (at ±25 kHz in 18 kHz BW)	-55 dB
MotoTalk (at ±50 kHz in 26 kHz BW)	-55dB

Note: All Mototalk specifications are applicable for i290 Only

PREFACE

The i425/*i*290 *Digital Multi-Service, Data-Capable Portable Field Service Manual* contains the information necessary to identify and fix problems in the Motorola i425/*i*290 Digital Portable. This unit is based on digital technology and is designed to operate on *i*DEN systems.

Basic and field-level service for this unit as described in this manual includes troubleshooting, testing, board swapping, and maintenance.

Service for this unit is based on the substitution method: a faulty part is replaced by a working one, providing quicker service to the customer. For example, if the battery is faulty, it is replaced. If the unit requires more complete testing or service than is available at the basic level, it is sent to the field-level service facility, serviced, and returned to the *i*DEN Customer Care Center (ICC).

NOTE: Before operating or testing this unit, please read the **Safety and General Information** section in the front of this manual.

Who Should Use This Manual

This manual is intended for service technicians who should be familiar with the test equipment recommended in Appendix A. To help pinpoint basic problems with the unit, first perform the mechanical checks and self tests as described in Chapter 5; then proceed to field level troubleshooting and testing.

How This Manual Is Organized

This manual contains the following chapters and appendices:

Chapter 1 presents the theory and technology used by the iDEN system and unit.

Chapter 2 describes how to prepare test equipment setups for the iDEN system and how to operate the test equipment. It also contains disassembly and reassembly instructions.

Chapter 3 describes the troubleshooting procedures.

Chapter 4 contains the component board layouts, schematic diagrams and component lists.

Appendix A Provides information on ordering kits and replacement parts. It also contains lists of recommended test equipment.

Conventions Used in This Manual

The following conventions are used throughout this manual:

italics	Used for emphasis and new terms
bold	Defines menu items, fields, and buttons
code	Used for sample input and output

Related Publications

The following publications are available separately:

*i*DEN *i*425 *Digital Multi-Service Data-Capable Phone User's Guide*	**NNTN7302A**
*i*DEN *i*290 *Digital Multi-Service Data-Capable Phone User's Guide*	**NNTN7308A**
R-2660 Digital Communications System Analyzer Operator's Manual	**68P80386B72**

CONTENTS

Chapter 1
iDEN SYSTEM OVERVIEW

1.1 iDEN Digital Modulation Technology

The Integrated Digital Enhanced Network or iDEN of the i425/i290 operates in multiple modes: *phone, private, data,* and *group;* and uses two digital modulation technologies: Quad QAM, and Time Division Multiple Access (TDMA). *Quadrature Amplitude Modulation (QAM)* is a modulation technique that transmits information by altering the amplitude and phase of the radio frequency (RF) signal. Data is converted into complex symbols, which alter the RF signal and transmit the information. When the signal is received, the amplitude and phase are converted back into symbols and then into the original data.

The i425/i290 uses 16QAM only for voice and data applications. In 16QAM, there are 16 possible combinations of 4 bits. The traditional 25 kHz channel used for two-way radios is split into four QAM signals (sub-carriers) that are transmitted simultaneously. This technique can transmit 64 Kbps in a single 25 kHz channel.

The *i*DEN system requires approximately 10 Kbps to transmit a compressed voice; therefore, 64 Kbps can accommodate 6 voice channels or 3 voice channels in enhanced systems.

The signal spectrum of the Quad 16QAM is shown in Figure 2

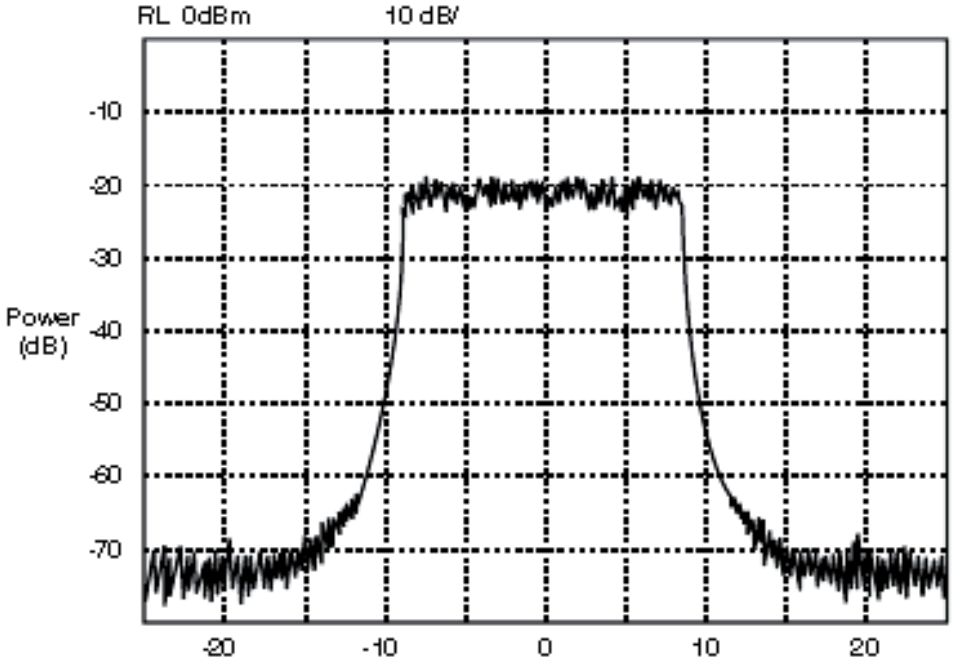


Figure:2. Spectrum of iDEN Quad 16QAM

Time Division Multiple Access (TDMA) is used to allocate portions of the RF signal by dividing time into 6 slots, one for each unit. Time allocation enables each unit to transmit its voice information without interference from another unit's transmission. Transmission from a unit or base station is accommodated in time-slot lengths of 15 milliseconds and frame lengths of 90 milliseconds. See Figure 3

Note that **RX** (outbound) indicates base-to subscriber transmissions, (forward link); **TX** (inbound) indicates subscriber-to-base transmissions, (reverse link). The RX and TX slots are paired and have a fixed offset of 19 milliseconds; their timings are synchronized by the *i*DEN system. The TDMA technique requires sophisticated algorithms and a digital-signal processor (DSP) to perform voice compression/decompression and RF modulation/demodulation.

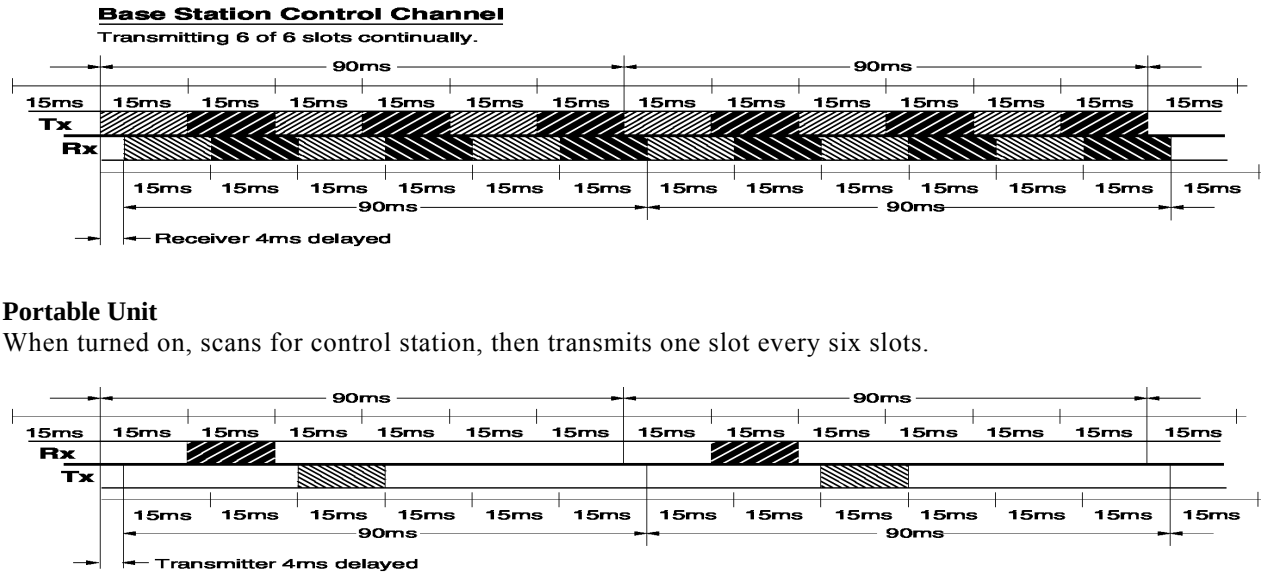


Figure 1 *i*DEN TDMA Format

1.2 iDEN Voice Compression Technology

Voice is converted into a digital bit stream by sampling the voice signal at a high rate and converting the samples into numbers, which are represented by bits. A sample consists of 8 bits. Approximately 8000 samples per second (64 Kbps) are required to maintain a reasonable quality.

Voice compression **reduces the number of bits per second while maintaining the voice at an acceptable quality level. The *i*DEN system uses a coding technique called *Vector Sum Excited Linear Prediction (VSELP)* to compress voice to 4.2 or 8.0 Kbps. The compressed voice-data bits modulate the RF signal. The compression rate is based on the type of call dispatch and the network configuration established by the local service provider.**

Adding error-correction bits to the coded-voice bits increases the required RF-transmission bit rate to approximately 7.4 Kbps for the 4.2 Kbps voice coder and 14.8 Kbps for the 8.0 Kbps voice coder.

RF Transmission Bursts

RF transmissions within an iDEN system occur in 15 millisecond blocks called bursts. An iDEN base station transmits bursts continuously on each RF frequency it uses. Transmission bursts from the stations are synchronized in time by signals received from the global positioning satellite (GPS) system. Each burst is numbered; the number is referred to as the slot number. All bursts occurring at a given time carry the same slot number.

Inbound transmission bursts (sent from the unit) are offset 19 milliseconds from the outbound burst; the inbound burst begins 4 milliseconds after the end of the outbound burst. See Figure 1. This offset in time allows the unit to appear capable of transmitting and receiving at the same time (it actually is switching rapidly back and forth between receiving and transmitting).

In i425 *i*DEN receive frequency range is 851-870 MHz and the transmit frequency range is 45 MHz below the receive band at 806 to 825 MHz.

An *i*DEN channel is created by grouping bursts, so their slot numbers differ by the repetition rate. For dispatch calls the i425/i290 uses a single frequency that can handle six calls using a 6:1 repetition rate with the 4.2 Kbps coder or a 3:1 repetition rate with the 8.0 kbps. The audio quality with the 3:1 repetition rate is superior to the 6:1 rate.

The dual band unit will power up in the 800 MHz band and will use control channels, Primary Control Channel (PCCH) and Broadcast Control Channel (BCCH). The *i*DEN system can operate three voice channels simultaneously in dispatch mode on a single RF carrier at 25 kHz bandwidth.

1.3 iDEN Power Management

The Roadrunner IC is a 223 I/O MAP BGA integrated circuit (IC) and provides the following DC distribution for the i425:

- V1 – 1.55 VDC. The V1_LDO is intended to power the external FLASH and SDRAM memories in a Zeus-based platform, and the INDY core itself in a low tier platform.
- V2 - 2.775 VDC at 350 mA. This supply is used to power most of the RF circuits.
- V3 – 1.875 VDC TRANSCEIVER digital supply
- V4 supplies 2.8 VDC at 50 mA. Dedicated supply for the the Thermistor Bias (Battery, Board ID) and TCXO.
- VSIM supplies 3.0 VDC at 15 mA to the SIM card
- VSBMASTER - (i425 not used)
- VHOLD - (i425 not used) 1.88 VDC
- VCO superfilter is used for the transceiver VCO's. The SF_OUT supply is intended as the power supply for the external VCO and the integrated Escort VCO on Sledgehammer. The input for the VCO superfilter is V2.
- VMMC – i425 not used. (2.8V)
- SW1 – i425 not used. (1.55V)
- VVIB- 3V at maximum current of 200mA. This supply is used for Vibrator motor operation.
- SW2 – 1.875 VDC at maximum current of 250mA. This switching supply is used for supplying Digital (Patriot, memory, Display) I/O section.
- SW3 – 5.1 VDC at maximum current of 200mA. This switching supply is used to supply for all backlighting system (Key Pad, Display, PTT and carrier logo LED) and Microphone biasing

The battery supplies the Raw_B+ and Filtered_B+. RAW_B+ supplies the RF PA. Filtered_B+ directly supplies Roadrunner and most of its cascaded regulators.

The unit operates with a low-level battery voltage of 3.0 VDC, nominal-level voltage of 3.6 VDC, and high-level voltage of 4.2 VDC.

Below is the Roadrunner IC for the DC Power Distribution in the i425/i290 unit:

- Analog/digital portions of a real-time clock (RTC)
- Battery charger
- 14-channel, 10-bit A/D converter
- Control logic
- SIM card level shifters
- USB/RS232 transceiver support
- Internal PMOS pass devices
- Serial peripheral interface (SPI) read/write interface
- Battery feedback switch

The Roadrunner IC is designed to support the needs of portable *i*DEN cellular telephone products. It provides the necessary control and regulator functions. The following functions are provided:

- Turn on control signals to properly activate the unit
- Turn off control signals to turn off the unit if an error is detected
- Band-gap reference voltage
- Linear regulation of DC voltages
- Operational amplifiers for use in the battery charger
- Internal D/A conversion for the battery charger
- 14-channel, 10-bit A/D conversion

Real-time clock

1.4 Digital Section

The digital section consists of Patriot/Bravo Dual Core Baseband Processor, Host memories (flash and PSRAM, and the iDEN power management (See Figure 4)

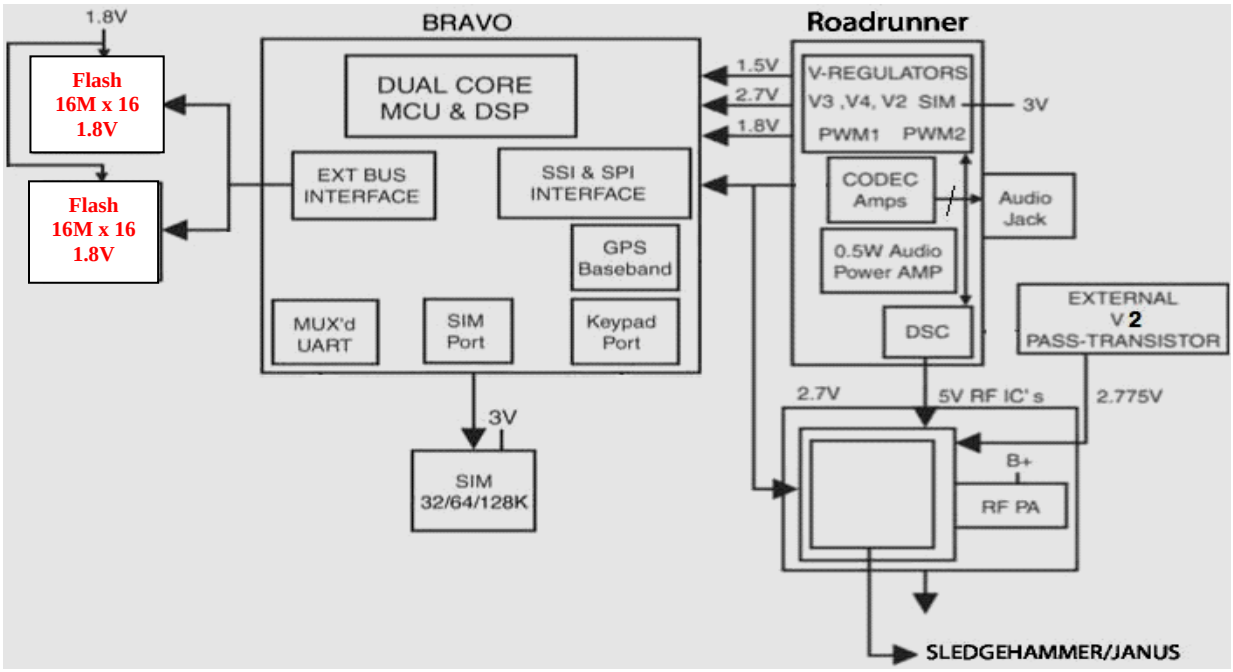


Figure 4: iDEN Digital Block Diagram

1.4.1 Patriot Processor

The Patriot Dual-Core Baseband Processor (U802) integrates a reduced instruction-set computer (RISC) microprocessor unit (MCU) and a general-purpose DSP on a single chip (See Figure 5)

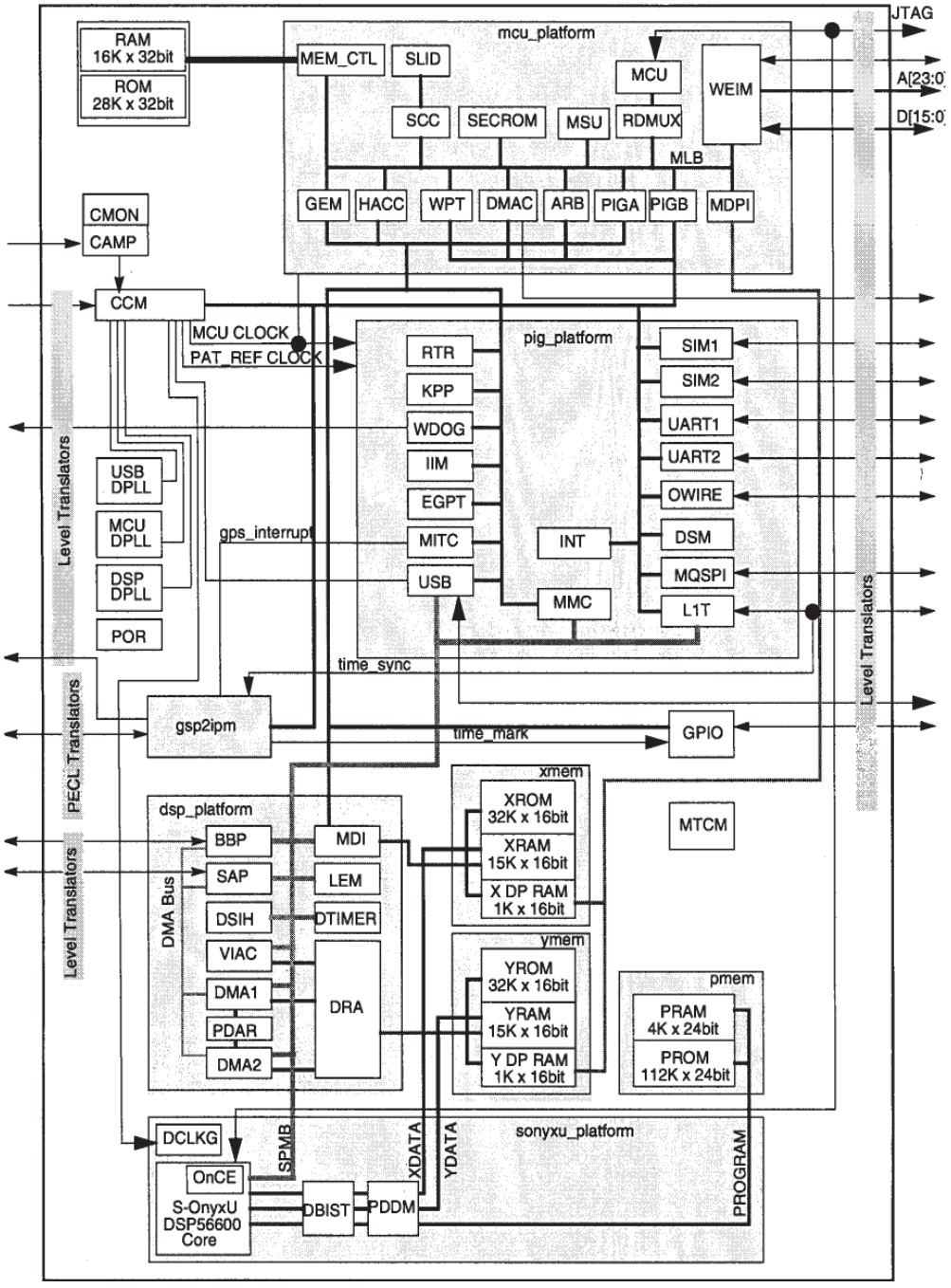


Figure 5: Patriot Functional Block Diagram

The following summarizes the key PATRIOT features:

- RISC integer processor capable of running at 52 MHz at Vcore of 1.55 VDC, a 32-bit RISC architecture, high performance and high code density
- ONYX 56600 DSP core running up to 133 MHz at Vcore of 1.55 VDC
- Fully-programmable PLL for system clock generation with low-output clock drivers
- 16 KB x 32 on-chip MCU RAM
- 4 KB x 24 DSP program RAM
- Multiple Queued serial peripheral interface (MQSPI) to communicate with external peripherals
- Serial communications interface with baud-rate generator
- On-chip Emulator (OnCE) integrated with JTAG port compliance
- Interrupt, general-purpose I/O, and keypad interface pins
- Very-low power CMOS design
- Wait, doze, stop, and deep sleep low-power standby modes

The Patriot performs the following tasks:

- Assists RoadRunner in the control of the power-up and power-down sequence of the unit.
- USB communication with the factory Automated Test Equipment.
- Accesses to the external flash memory and PSRAM.
- Communicates with the RF ICs (ROADRUNNER and SLEDGEHAMMER).
- Memory mappings and accesses Liquid Crystal Display.
- Monitors battery voltage, as well as RF power-amplifier and battery temperature.
- Modifies and stores user-selectable ergonomic preferences.
- Reads and writes iDEN radio-tuning parameters.
- Sends and receives commands with the base station through DSP.
- Re-channels the SLEDGEHAMMER synthesizer during hand off.

1.4.2 MCU Digital Phase Locked Loop (DPLL)

The MCU has a programmable, digital phase locked loop (DPLL) that uses the 16.8 MHz clock as a reference. The MCU initially runs from the external reference at power up. Software programs the MCU DPLL to 31 MHz and switches from the external reference to the MCU DPLL after lock is reached

1.4.3 Host System Clock Synthesizer

There are two iDEN system clocks that are generated by Roadrunner and Sledgehammer. The Roadrunner generates 32.768 kHz using the Roadrunner PLL, and the Sledgehammer generates 33.6 MHz. The MCU Programmable Interrupt Timer (PIT) is run by the 32.768 kHz oscillator. The 33.6 MHz is divided by 2 in the Roadrunner to yield a 16.8 MHz signal, which serves as reference frequency required by the MCU and DSP cores

1.4.4 PATRIOT Digital Signal Processor

The PATRIOT SPS 56600 digital signal processor contains the DSP Engine S_ONYXU, which is capable of executing an instruction on every clock cycle. The DSP56600 consists of the following:

- Data ALU
- Address generation unit
- Program controller
- Program patch detector
- Bus interface unit
- On-chip emulator

PLL-based clock generator

1.4.5 DSP Phase Locked Loop (PLL)

The DSP PLL is programmable and is used to generate a DSP internal clock that is synchronized to the 16.8 MHz reference frequency. In low power mode, the DSP PLL is disabled and the DSP operates directly from the 16.8 MHz clock. The DSP PLL runs at 110 MHz.

1.4.6 Serial Peripheral Interface (SPI)

- This interface communicates with RF chips using the SPI bus. This bus includes the following:
- Master Out Slave In (MOSI)
- Master In Slave Out (MISO)
- SPI clock
- Specific chip-select lines

Table 1:Below shows the Chip-Select Line States diagram.

IC	Chip-Select Line	Active State
ROADRUNNER Chip Enable	SPI CS0	Low
SLEDGEHAMMER Chip Enable	SPI CS6	Low
ROADRUNNER primary Chip	SPI CS7	Low

Table 1

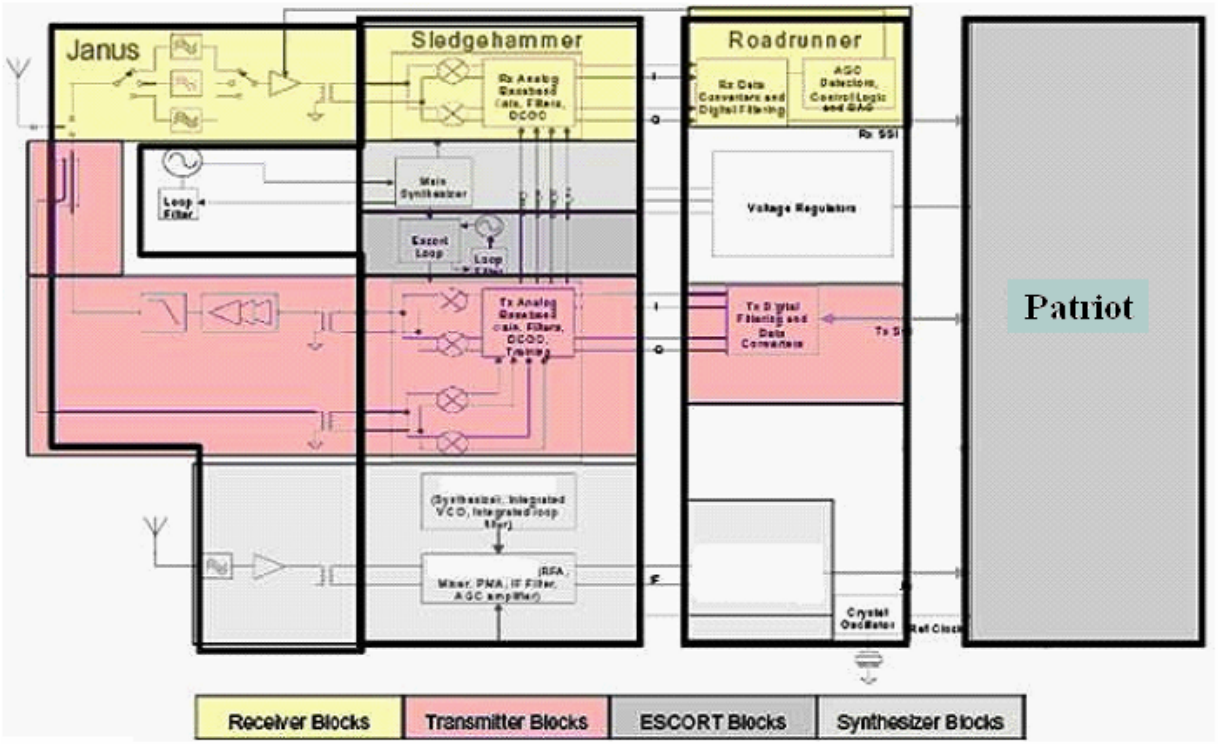
The MCU then sends data to the chip using MOSI and the SPI clock. The MCU also can receive data from all chips by clocking it into MISO using the SPI clock and appropriate chip select.

1.4.7 Host Memories

- The following types of host memories are available:
- 32 MB of flash memory used to store unit subscriber and DSP code. To read the flash, the MCU asserts CSO low and OE high and then drives EB1 high. For a write, EB1 is driven low and OE is driven high.
- 16MB Host P-SRAM memory used by the MCU to load code-plug information, program the flash, and store working parameters. To access SRAM memory, the MCU asserts both CS2 and OE low, and then drives EB1 high for reads. For a write, EB1 is driven low and OE is driven high

1.5 iDEN Transceiver Architecture

The i425/i290 radio is capable of iDEN 800 MHz and 900 MHz operation. The block diagram of the transceiver is shown in Figure 6.



The RX and TX front end consisting of the RF switches, SAW filters, LNA, RX balun, TX output stage (including the TX balum, power amplifier, low-pass filter, and antenna switch).

The Sledgehammer IC (U205-1) is a multi-band transceiver IC intended to support the iDEN/WiDEN protocols. The Sledgehammer IC contains the RF and analog baseband paths for iDEN receive and transmit, including two RF synthesizers required to generate LO signals for the iDEN RX/TX, as well as an ESCORT loop required to prevent re-modulation of the transmit signal. The Sledgehammer IC is used in conjunction with the Roadrunner IC (U701), which contains the transceiver signal path data up/down converters and digital filtering.

The Roadrunner provides the DC distribution and the digital portion of the iDEN transceiver. The DC distribution consists of linear mode regulators.

The receiver ROADRUNNER portion includes circuitry supporting AGC, receiver sequence management, signal path anti-aliasing filters, digital filtering and the RX serial data interface to the baseband Patriot processor.

The TX portion includes circuitry supporting pulse shaping FIR, TX DAC, smoothing filters, PA gain control DAC, and the TX serial data interface to the baseband Patriot processor. Roadrunner also includes circuitry to support additional features such as USB, etc

1.6 iDEN TX Path

The iDEN TX lineup consists of the Patriot/Bravo processor, Roadrunner for baseband D/A conversion, SledgeHammer IC for analog baseband to RF, and JANUS IC providing PA amplification for transmission.

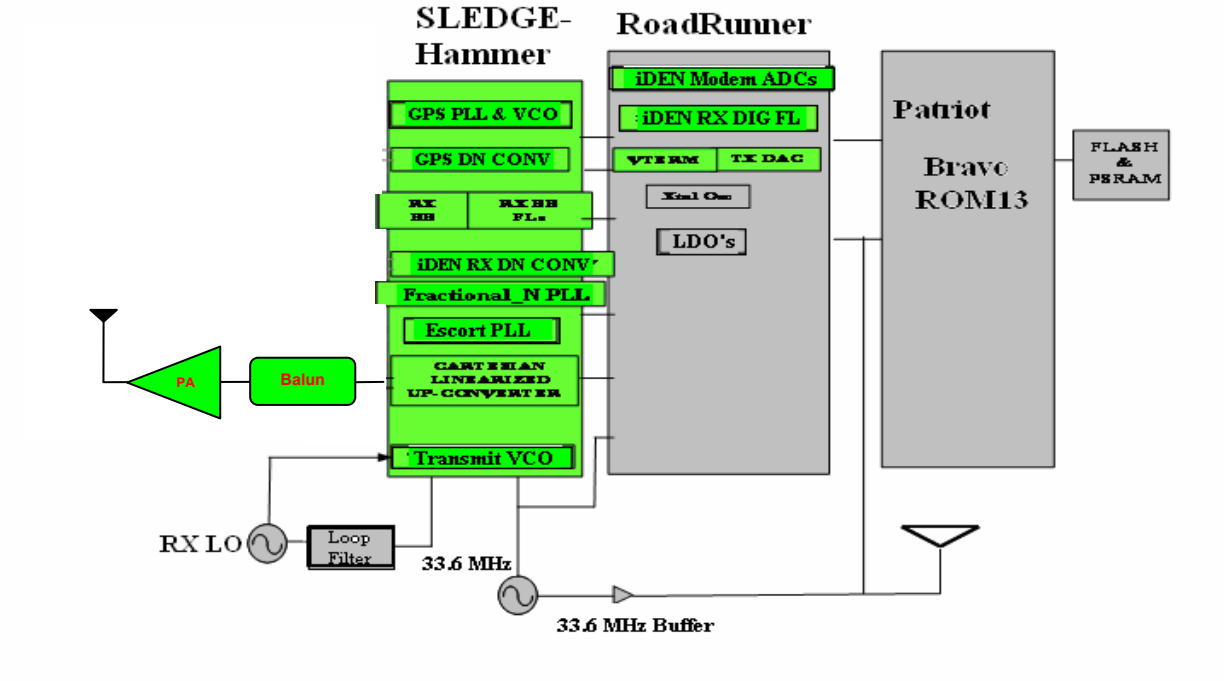


Figure 3 iDEN TX Path

1.6.1 ROADRUNNER

The ROADRUNNER IC includes the following blocks:

RX Blocks:

- ADC and Digital Filtering

TX Blocks:

- **Digital interface** The transmitter receives inputs from the SSI. The SSI has a single data line.
- **Pulse Shaping FIR** A programmable waveform generator "FIR" filter provides interpolation of the pre shaped input words.
- **TX DAC** The transmit DACs have eleven bit resolution and are capable of supporting 8.4 Mb/ s). Fine step TX attenuation (cutback).
- **Smoothing filters** Programmable RC smoothing filters limit the amount of far out quantization noise and images due to aliasing. The filters incorporate a dc offset correction block.

The Roadrunner transmitter implements a Direct Conversion Transmitter (DCT), whereby base band data is up-converted into RF using no IF section. The ICs that perform the transmit operations are Roadrunner and Sledgehammer. Power cutback control is shared between both ICs, whereby the fine cutback steps (1 - > 4dB) are performed by Roadrunner, and the coarse cutback steps (5 dB steps up to 35 dB) are performed by Sledgehammer.

To generate the RF signal, the Sledgehammer IC uses a TX_LO that is centered at the carrier frequency. This TX_LO is generated internally by the Sledgehammer. The digital samples are generated by the DSP and then sent to Roadrunner via Transmit SSI (TX_SSI). Roadrunner then implements the Digital-to-Analog Conversion function, which provides some power control function. The resulting I/Q analog signals are then sent to the Sledgehammer IC, which up-converts the base band signal to RF.

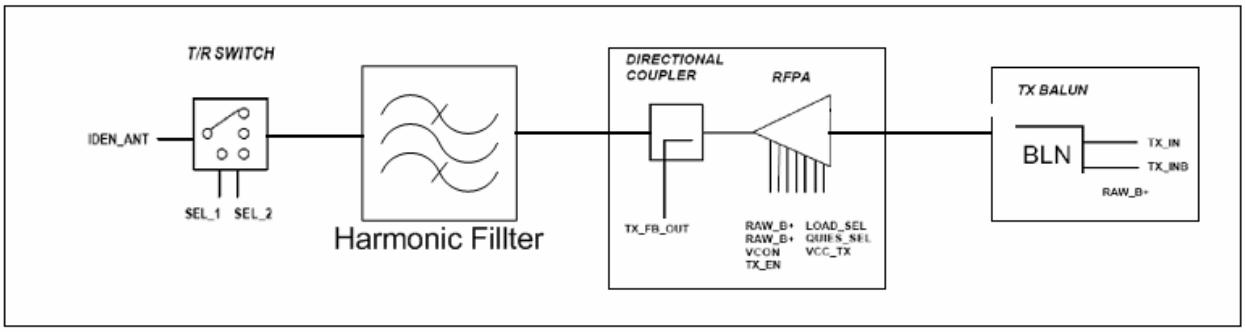
The "main" reconstruction filter for the I & Q paths is located within the Sledgehammer. The main reconstruction filter has a programmable bandwidth of 25, 50, and 100 KHz. The Roadrunner IC produces the baseband I and Q signals required for I & Q modulation within the Sledgehammer IC

1.6.2 SLEDGEHAMMER (TX)

The Sledgehammer incorporates all of the circuitry necessary to implement a Cartesian feedback closed-loop system. Differential baseband signals from the Roadrunner serve as inputs into the Sledgehammer. These signals pass through a variable attenuator and then are summed with the down-converted I & Q feedback. The baseband signal is then amplified and sent to the up mixers

1.6.3 BALUN

The differential RF signal is converted to a traditional single-ended (unbalanced) signal through the balance/unbalance circuitry. The balun is implemented using multilayer ceramic technology



1.6.4 RF Power Amplifier Module

The signal is then routed to the RF PA. The RF PA will be enabled when the ASW line goes low. The PA gain can be adjusted by the PA_BIAS_DAC from Roadrunner ADC. A wideband PA is used for 800/900/TA operation. The RF PA module includes a PA, coupler, low pass filter, and the antenna switch. At the output of the PA is a multilayer ceramic coupler that is used to sample the signal and provide the necessary feedback for the linearization. The sampled signal is input to the SLEDGEHAMMER and then is mixed down to baseband in the downmixer (a quadrature mixer). The resulting output is an I and a Q signal which are then summed with the input to create an error signal. This completes the closed loop. The antenna switch consists of two PIN diodes, one series and one shunt. The diodes are biased On in transmit mode and Off in receive mode. The bias voltage is VREG2 (5.0 Vdc pulsed)

1.6.5 Cartesian Feedback

The iDEN transmitters require a highly linear PA with wide dynamic range. Linear PAs are highly inefficient, so a Class AB PA is used for better efficiency and longer battery life. The Class AB PA is fairly linear, but can cause splatter in the RF spectrum around the transmitted frequency band. To reduce splattering into the adjacent channels, the transmitter uses Cartesian feedback to further linearize the PA and reduce adjacent channel splatter. Cartesian feedback is the process of down converting a feedback signal to baseband and summing it with the input signal in the I and Q paths separately. This allows for a 180° phase shift at baseband.

1.6.6 Level Set and Phase Training

Level-set training is performed to ensure that the RF PA is not driven into clip, which results in excessive splatter and out-of-band spurious emissions. During training, the DSP signal is disconnected from the forward path and an internal analog ramp generator is connected. The feedback is monitored and compared to the analog ramp. As the ramp amplitude increases and the RF PA begins to clip, the error voltage increases (See Figure 9 below).

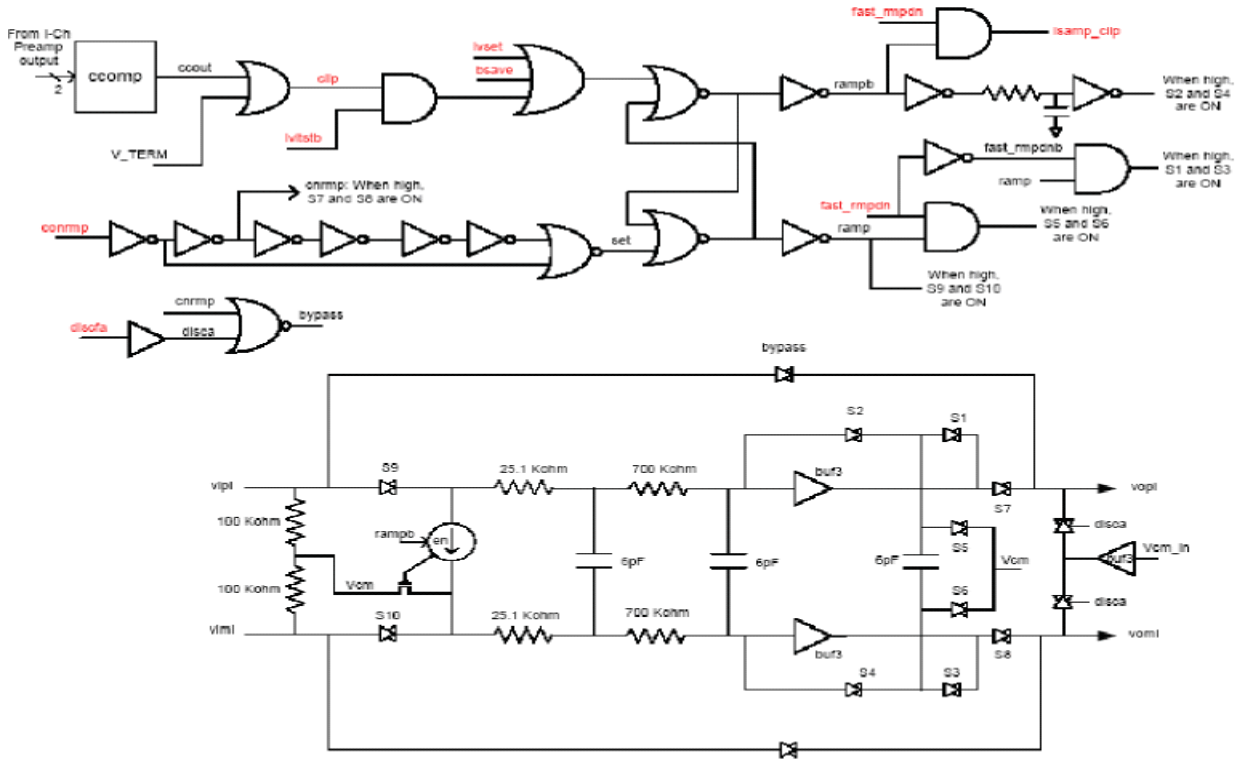


Figure 9: Sledgehammer Level Set Circuitry

The Javelin level set circuit topology was modified slightly for Sledgehammer. The modification removed switches used to select the I-channel training waveform to the Q-channel V-I input. The current level-set circuitry contains a programmable gain V-I on the I channel for boosting the reference signal level during level training. In this configuration, the control signal (cnrmp) is output from the level-set circuit to the I-channel V-I to control the point at which the gain is changed.

V_TERM is a new signal input that will be OR'ed with the clip comparator output. This signal causes a controlled signal to ramp down when the battery current exceeds 3A during level training.

V_TERM is OR'ed with the clip comparator output and sent back to the digital core to terminate the counter used for the LEVEL TRAIN read back value. Negative feedback is required to maintain system stability. Phase training is done to ensure that the feedback is negative (180°). The phase shift of the loop consists of the sum of the delays of several modules and components.

Operation of the Sledgehammer in a closed loop system requires the phase of the feedback path to be adjusted with respect to the forward path, such that the demodulated feedback signal is the correct phase at the summing junction. This adjustment needs to take place before the loop is closed and data is transmitted, and is referred to as the 'phase training period'.

The maximum peak input signal to Sledgehammer is also scaled via the Roadrunner/DSP to insure that the maximum input signal in the data will not cause clipping to occur in the PA output as a result of temperature/voltage gain variation in the forward path. The scaling of the input signal is a result of 'level training' which is performed in the transmit slot prior to data transmission.

The scaling of the input signal and the ramping is performed by the JANUS DSP. The ramp signal will be applied from the DSP, and then will go through the signal path of the Roadrunner IC with the gain set to maximum. The loop will be closed, but the slew rate limiter will be in a low gain (low slew) mode. A counter on the Sledgehammer will begin counting from the beginning of the timing event associated signal (LAGC) and its associated timing parameter "D". The loop will perform an AGC function in the beginning portion of the ramp in order to set the loop gain and then hold this gain value.

When the clip detect comparator determines that the loop can no longer compensate for the PA, it will disconnect the Roadrunner input and allow the slew rate limiter to ramp the signal down in a controlled manner to prevent splatter. After clip has been detected, and before the beginning of data, a SPI read is necessary for the DSP to find out at what point in time the clip occurred. Based on this information, a reference level will be set in the Roadrunner. Providing level set in this manner will require at least two SPI activities. The first activity is to read back the timing value "D" from the Sledgehammer IC. The second is to write the gain setting for the Roadrunner.

Both phase and level training are required at least once before transmission of the data in the first slot, but is not necessarily performed in every transmit slot. DC training will be performed at the start of every SLOT. All timer values associated with SLOT rising edge will be increased with respect to JANUS program values to account for the DC training time.

Sledgehammer provides the ability to terminate the level training ramp by either the internal Sledgehammer clip detector or an external control digital signal V_TERM. V_TERM indicates when the battery current exceeds 3 Amps, which is used to terminate the training ramp to avoid an early radio shutdown during level training. Shutdown is avoided by lowering the transmit power when V_TERM is detected. This signal goes directly to the level set circuitry.

1.7 iDEN Receiver Path

The receiver is a direct conversion receiver. It operates in the commercial portion of the land-mobile receiver band (851-870MHz and 935-940). It also operates in the ISM band (902-928MHz) using the MOTOTALK protocol.

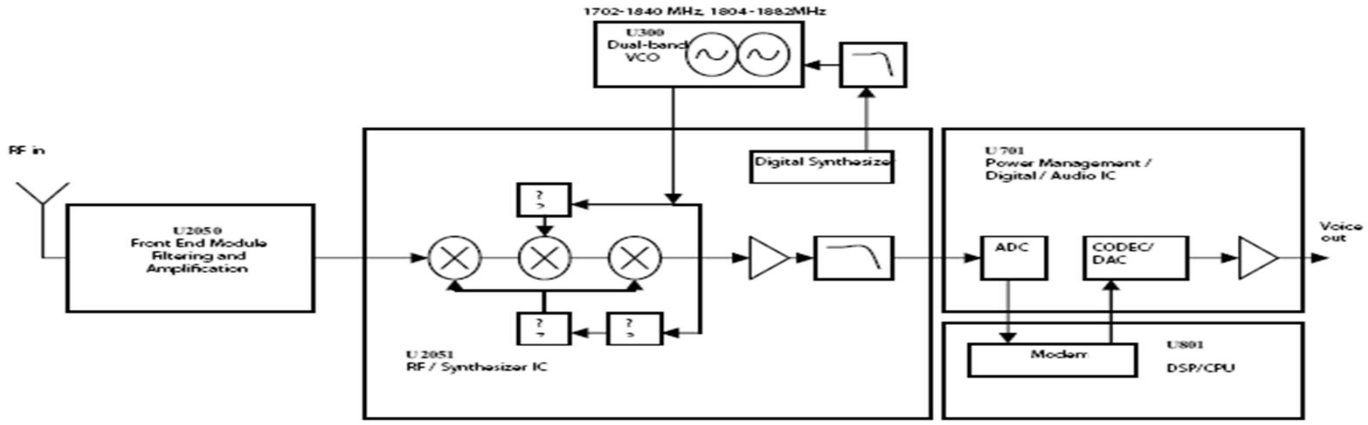


Figure 10 iDEN Receiver Path

The receiver takes an incoming RF signal, down-converts it to baseband where it is amplified, filtered, digitized and then provided to the DSP MODEM. The receiver has automatic gain control (AGC) to maintain linearity over a wide range of incoming signals. The AGC circuitry also prevents clippin

1.7.1 Rx Front End (RX Path)

The Rx Front End contains the two SP3T RF switches, the passive SAW filters, along with the active LNA and the balun. The antenna switch routes the received signal from the antenna pin input to the receiver front end. During transmit mode, this switch disconnects the receiver path and connects the antenna to the transmit path.

The pre-selector SAW filters protect the RF LNA from strong out-of band signals. There are two filters in each SAW filters (800MHz and 900MHz for one SAW filter and ISM and GPS band for the other SAW filter) that are appropriately selected by the SP3T RF switches, for the appropriate band of operation. The LNA RF amplifier contains three major blocks, a 20dB step attenuator, a LNA, and an AGC.

The low-noise amplifier provides the gain to achieve the necessary receiver system take over gain and the AGC stage provides continuous attenuation to avoid overload of the receiver backend. A balun is used to facilitate the conversion of the single ended LNA output to a differential signal that is necessary to feed the input block of the Sledgehammer IC.

1.7.2 Sledgehammer IC (RX Path)

The Sledgehammer IC contains the frequency synthesizers, down-conversion mixers, baseband amplification and filtering stages. The main function of the Sledgehammer IC is to translate the RF input signal in to the two I and Q baseband differential signals. The signal path has a fixed amount of gain and contains the DC offset correction circuitry. The IC contains basic analog anti-aliasing filtering and supplies a digital control line directly to the LNA module.

1.7.3 Roadrunner IC (RX Path)

The Roadrunner IC performs the digital conversion, digital filtering, and the AGC control of the radio. The main function of the IC, from an RX perspective is the A/D conversion performed by the Sigma Delta converter. This digitized output signal is processed by FIR and IIR filtering and then the final output is framed and sent to the Baseband Processor via the Receive Synchronous Serial Interface Bus.

The Roadrunner also controls both the RF step attenuators and the continuous AGC control lines. The RF step attenuator is enabled when the Roadrunner logic line signals the LNA module to enable the attenuator. This occurs when the unit receives a desired signal stronger than -50dBm. The continuous AGC functionality is controlled by an analog voltage line which feeds the LNA module. This voltage ranges from approximately 1.3875 V to 2.5 V and increases linearly for signals greater than ~-60dBm at the antenna input.

1.8 Frequency Generator (RF) Section

This section contains the following main components of the RF board:

- TCXO based reference oscillator circuit.
- Host system clock synthesizer.
- (Sledgehammer) Phase Locked Loop synthesizers (Main & Escort).
- Main/RX Voltage Controlled Oscillator (VCO).

Note: The main RX VCO output is used to source to main prescaler input of SLEDGEHAMMER main synthesizer PLL.

All iDEN frequencies in the i425/i290 originate from the 33.6 MHz reference frequency generated by Sledgehammer synthesizer and TCXO (Y600) reference oscillator circuit. The TCXO generates a 33.6 MHz signal, which is temperature compensated. **Error! Reference source not found.** illustrates the frequency generation circuitry path.

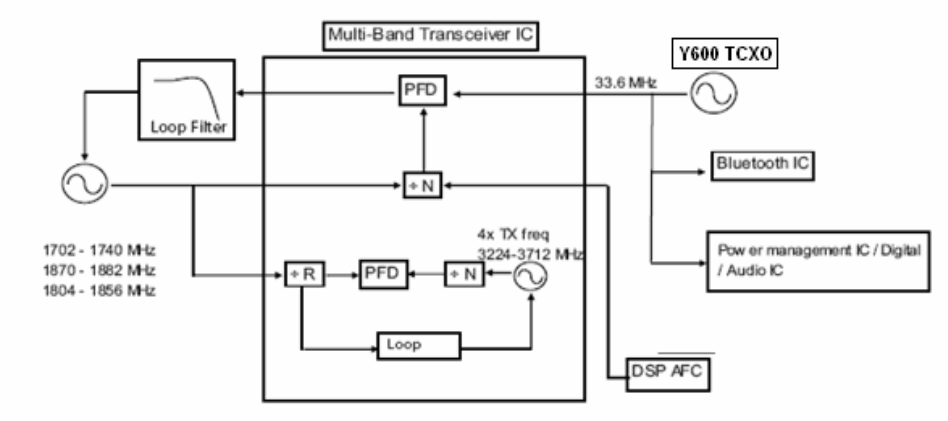


Figure 11: iDEN Frequency Generator Circuitry

Reference Oscillator

The 33.6 MHz reference is sourced to Sledgehammer to serve as a stable and accurate 33.6 MHz reference frequency for the internal synthesizers. This 33.6 MHz reference signal is additionally routed ROADRUNNER IC and is frequency divided down to a 4.2 MHz to serve as a reference for JANUS (TCLK).

1.9 MOTOtalk [Available ONLY on i290]

The purpose of the MOTOtalk feature is to allow simple, direct, simplex two-way radio-to-radio communications between subscriber units. It is also asynchronous in nature and requires no external source of synchronization for connections between units to be made. The basic features of MOTOtalk are as follows:

- Digital 2-Way radio, Push-to-Talk (PTT) operation.
- 2200 bps AMBE++ Vocoder (same as iDEN enhanced 12:1 vocoder).
- Frequency Hopping Spread Spectrum in the 902-928 MHz Industrial, Scientific, and medical (ISM) Band.
- Three-burst frequency diversity for all burst types.
- 10 User-selected Channels (actually hop-sets of 50 carriers each).
- 15 User-Selected Codes (plus "Receive All" acting as an open-squelch, open-receive mode).
- Private mode operation using target's 10-digit phone number as the ID.
- 1 Watt RF Power, 50 kHz carrier spacing, 500 kHz separation between adjacent carriers in any particular hop-set.
- 8-level Frequency Shift Keying (8FSK) modulation, 85.625-ms bursts at 90-ms intervals (hop intervals).
- Each on a pseudo-randomly selected frequency.
- Symbol Rate: 3200 baud.
-

Mototalk operates in the 900 MHz ISM band, frequency range (902 – 928 MHz). The modulation varies between 2FSK, 4FSK, 6FSK, or 8FSK. Traffic uses 8-level Frequency Shift Keying (8FSK) modulation with a 50 kHz bandwidth and symbol rate of 3200 symbols per second. 8FSK modulation results in a signal with 3 bits per symbol (raw). **Error! Reference source not found.**3 shows the MOTOtalk power spectrum for 8FSK modulation.

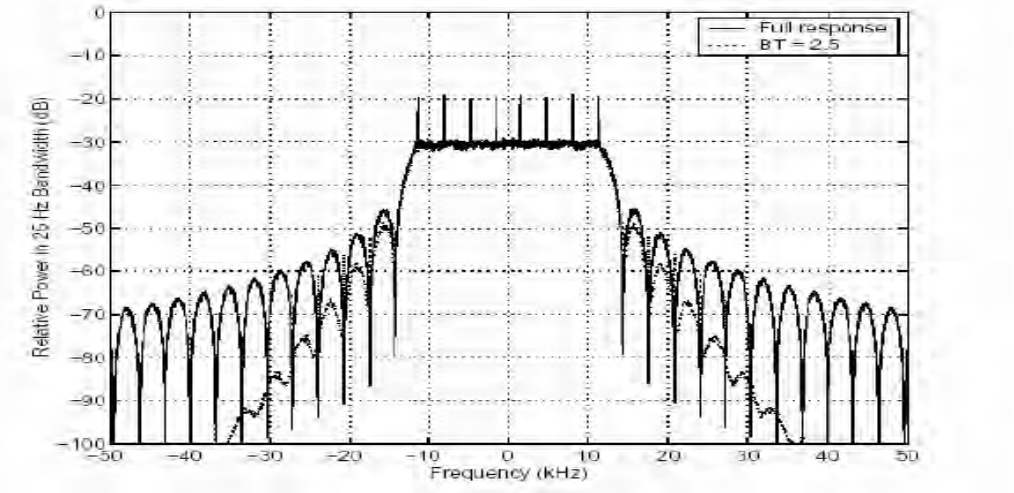


Figure 12: MOTOtalk 8FSk Spectrum

The asynchronous nature of MOTOtalk requires a constant scan of frequencies for an indication (known as preamble) of an upcoming transmission. Frequency scanning is further complicated by frequency hopping of the spread spectrum operation. Frequency hopping spread spectrum is used to provide both interference avoidance, and a powerful combination of time and frequency diversity. Many calls can also share the same channel (actually a hop-set of 50 frequencies) and hop "around" each other. Because MOTOtalk is deployed in the 900 MHz Industrial, Scientific and Medical **ISM**) Band, frequency hopping rules governed by the FCC are followed. Frequency hopping procedure highlights are as follows:

- A pseudorandom sequence is employed for frequency selection.
- Preamble and Sync Slot Bursts are **ALWAYS** sent in the **same order** and on the s**ame frequencies** each time. There are three of each, and they are always the first 6 bursts of any transmission.
- All other bursts are carried on frequencies determined by the pseudorandom sequence, and the first non-Preamble/Sync burst always picks up the sequence where the final burst of that transmitter's previous transmission left off. The seed sent in the Sync Slot ID Block indicates the position in the sequence.
- In order to ensure uniform distribution of frequencies, the pseudorandom sequence generator reduces the likelihood of selecting the preamble/sync-slot frequencies in a manner such that all frequencies are used equally on average

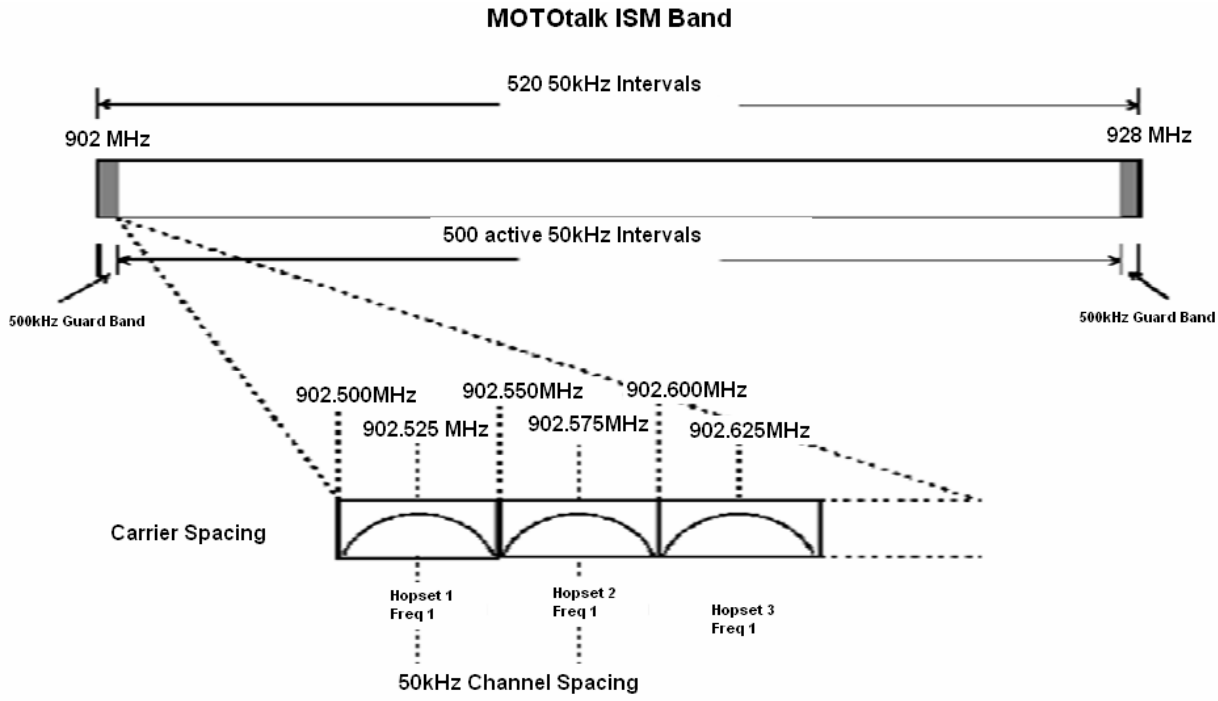


Figure 13 : MOTOtalk Channel Spectrum

The 902 - 928 MHz band is broken up into 10 hop-sets of 50 carriers, each separated by 50 kHz, for a sub-total of (500 carriers x 50 kHz) = 25 MHz, plus two 500 kHz guard bands yielding a total of 26 MHz. See **Error! Reference source not found.**. The hop-sets (50 carriers each) are interleaved such that adjacent members of any given hop-set are separated by 500 kHz. **Error! Reference source not found.** below lists the described frequency plan

Hopset	1st Frequency MHz	Progression (MHz)	Last (50th) Frequency
1	**902.525**	**903.025, 903.525, 904.025**	**927.025**
2	**902.575**	**903.075, 903.575, 904.075**	**927.075**
3	**902.625**	**903.125, 903.625, 904.125**	**927.125**
4	**902.675**	**903.175, 903.675, 904.175**	**927.175**
5	**902.725**	**903.225, 903.775, 904.275**	**927.225**
6	**902.775**	**903.275, 903.775, 904.275**	**927.275**
7	**902.825**	**903.325, 903.825, 904.325**	**927.325**
8	**902.875**	**903.375, 903.875, 904.375**	**927.375**
9	**902.925**	**903.425, 903.925, 904.425**	**927.425**
10	**902.975**	**903.475, 903.975, 904.475**	**927.475**

Table 3: MOTOtalk Frequency Plan

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Chapter 2

PREPARING FOR FIELD LEVEL TESTING

Field level testing requires external equipment and support. To conduct field level trouble-shooting and testing of an *i290* unit, you must become familiar with the screen readouts of the recommended test equipment.

Display screens provide information that is useful for troubleshooting purposes. Refer to Chapter 3 for information on the displays, errors, alert tones, and messages associated with this unit.

2.1 Preparing Equipment for Testing

To ensure accurate testing of an *i290* unit, it is important that the test equipment function properly.

2.1.1 Calibrating Equipment

Test equipment should be internally calibrated before being used for testing. Note that the internal calibration does not substitute for a factory calibration. For more information, refer to *R-2660 Digital Communications System Analyzer Operator's Manual.*

2.1.2 Checking the RF Cable

Check the cable connection and quality to ensure that the test results are true. Cable length is criti cal to consistent Rx sensitivity and Tx power measurements. Use a high-quality, shielded, 50-ohm, coaxial cable that is approximately 1.5 feet in length. Place the unit to be tested at least 6 inches from the call box. The cable loss should be less than 2 dB.

2.1.3 Strong-Signal Environments

When using the R-2660 Communications System Analyzer to test a unit in a strong-signal environment (–75 dBm or stronger), change the bandmap of the unit.

For Registration/Call testing: Power up the unit. Immediately after hearing the beep, press **Start** on the R-2660. The unit will lock onto the first strong signal.

2.1.4 Protecting Static-Sensitive Devices

This unit contains static-sensitive devices that must be protected when opening the unit, or storing and transporting any printed-circuit board. Consider the following information to create a proper ground:

- Ground the working surface of your service bench. If possible, use the Motorola Static Protection Assembly (P/N 01803 86A82) to ground your service bench. This assembly contains a wrist strap, two ground cords, a table mat, and a floor mat
- Wear a conductive wrist strap in series with a 100 kΩ resistor to ground.
- Do not wear nylon clothing when handling any printed-circuit board.
- Prior to touching any printed-circuit board, touch an electrical ground to remove any static charge that might have accumulated.

Refer to Service and Repair Note SRN-F 1052 for more information. This note is available through:

Motorola Literature Distribution Center 2290 Hammond Drive
Schaumburg, IL 60173
847-576-2826

The following should be considered when storing or transporting a circuit board:

- Place the printed-circuit board in conductive, anti-static material.
- Do not insert the printed-circuit board into conventional plastic "snow" trays used for transporting other devices.

2.1.5 Using RSS

Use *Radio Service Software (RSS)* to program a new software version or to update user information in the codeplug. Refer to "Connecting the Unit to the RSS Workstation" and the *Radio Service Software Read-Me's* for information on the setup and use of RSS.

NOTE: You can use the RSS online Help for locating specific information about RSS dialog boxes and fields. To access online Help, press **F1** while you are viewing an RSS screen.

If you are using the R-2660A Communications System Analyzer in the *i*DEN mode, which is 6:1 capable, use RSS to program an *i290* unit for **Full Rate** operation. Use the **6:1 Interconnect** softkey for all interconnect testing.

If you are using the R-2660B or later, which is 3:1 capable, use RSS to program an *i290* unit for **Half Rate** operation. Use the **3:1 Interconnect** softkey for all interconnect testing.

In the carrier version of RSS (but not the agent version), you can change interleave values. To access the fields where you can change these interleave values, go to the User Ergonomics dialog box, and then click on the **Interleave** tab.

NOTE: After servicing an *i290* unit, use RSS to reprogram the unit back to its original operating state.

Refer to the *R-2660 Digital Communications System Analyzer Operator's Manual* for more information on how to set up this equipment for *i*DEN mode testing.

2.2 Connecting an i290 Unit to the R-2660

The R-2660 Communications System Analyzer enables you to monitor and perform tests on an *i290* unit. Figure 7-1 shows the *i290*/R-2660 test setup.

Equipment Required: R-2660, reference SIM card, SMA to N-type RF coaxial cable, battery eliminator, 5.0-12.0 Vdc power supply.

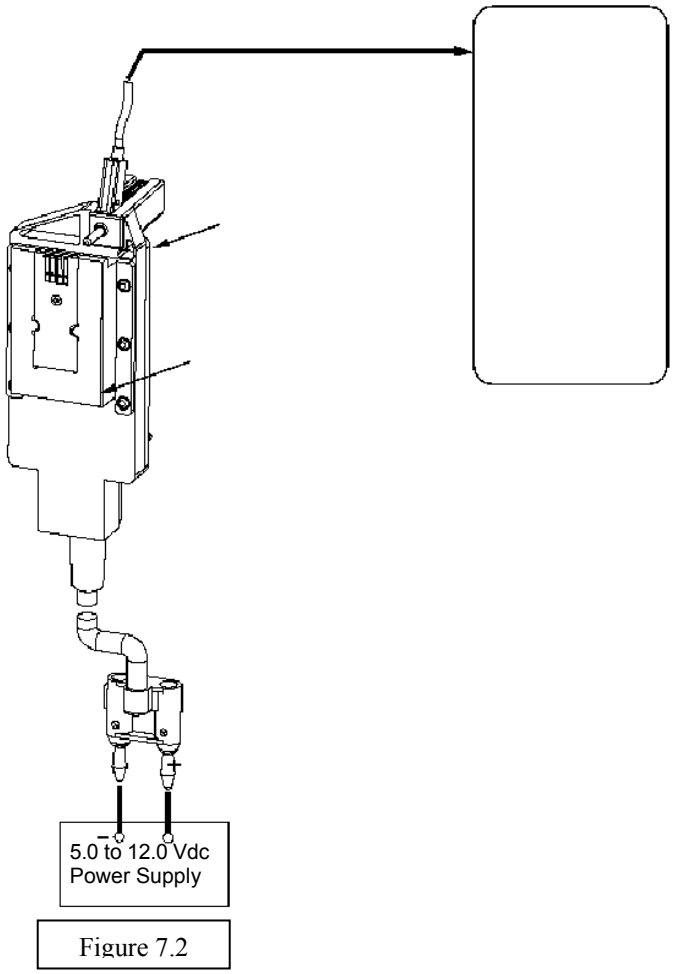


Figure 7.2

1. Ensure the unit is powered off, and then turn on the R-2660.
2. Remove the antenna from the unit. See page 7-6 for instructions.
3. Remove the battery cover and battery from the unit, and insert the reference SIM card.
4. Attach the battery eliminator to the back of the unit.
5. Connect the SMA connector of the RF cable to the RF connector on the battery eliminator.
6. Connect the N-type connector of the RF cable to the R-2660 RF In/Out connector.
7. Attach the power leads on the battery eliminator to the DC power supply.

CAUTION: Be very careful to observe polarity when connecting power to the battery eliminator. Also, be sure to protect the test setup from any potential overvoltage condition.

8. Turn on the power supply, and adjust it for an output between 5.0 Vdc and 12.0 Vdc.

NOTE: With the power supply voltage set between 5.0 Vdc and 12.0 Vdc, the battery eliminator will provide a regulated 4.0 Vdc to the unit.

9. Power up the unit.

2.3 Operating the R-2660

Most of the technician tests performed with the R-2660 Communications System Analyzer require that the analyzer use the Initial Registration test mode.

To enter Initial Registration mode:

1. Turn on the R-2660.
2. Press **DISP** to place the cursor in the Display zone portion of the screen.
3. Use the arrow keys to move the cursor to the **Mode** field.
4. Press **More** until *i*DEN **MOBILE** appears in the **Mode** field.
5. Press the *i*DEN **MOBILE** softkey. The RF zone displays **DUPLEX** in the **RF Control** field.
6. Use the arrow keys to move the cursor to the **Meter** field in the display zone.
7. Press **More** until **INITIAL REG** appears in the **Meter** field.
8. Press the **INITIAL REG** softkey. The display zone displays **DISPATCH** in the **Registration Type** field.
9. Press **RF** to move to the RF zone.
10. Enter the appropriate values in the following RF zone fields. These values might be different, depending on your bandmap. Use the arrow keys to move between fields and the keypad to enter values.

Table 7-1. RF Zone Fields and Values

Field	Value
Carr. #	Choose the appropriate carrier number from your bandmap. The **Mon. Freq.** field displays the associated frequency.
Mon. Freq	Choose the appropriate monitor frequency from your bandmap. The **Carr. #** field displays the associated carrier frequency.
Offset	800 MHz = +45 MHz; 900 MHz = +39 MHz
Format	iDEN
Mon.	40 dB RF I/O
Gen	-070 dBm RF I/O

2.4 i425e and i425t Disassembly Procedure

Motorola recommends the service technician follow a prescribed disassembly sequence to access specific items or components of the unit. This product is an efficiently designed package that incorporates the physical overlap and integration of some modular components. Refer to the Disassembly Sequence Flowchart for a suggested path to reach specific components.

NOTE: In some cases, the technician may not need to remove certain components to reach others.

NOTE: Screws used to assemble the i425 back housing are: 6 housing assembly screws, T-6 drive.

2.4.1 Disassembly Sequence Flowchart

Note: Units components include a Flex Connector ribbon which can be easily torn or damaged if not handled properly. Handle the Flex Ribbon with care especially when separating the keypad board from the main board.

NOTE: Screws used to assemble the i425 back housing are: 6 housing assembly screws, T-6 drive.

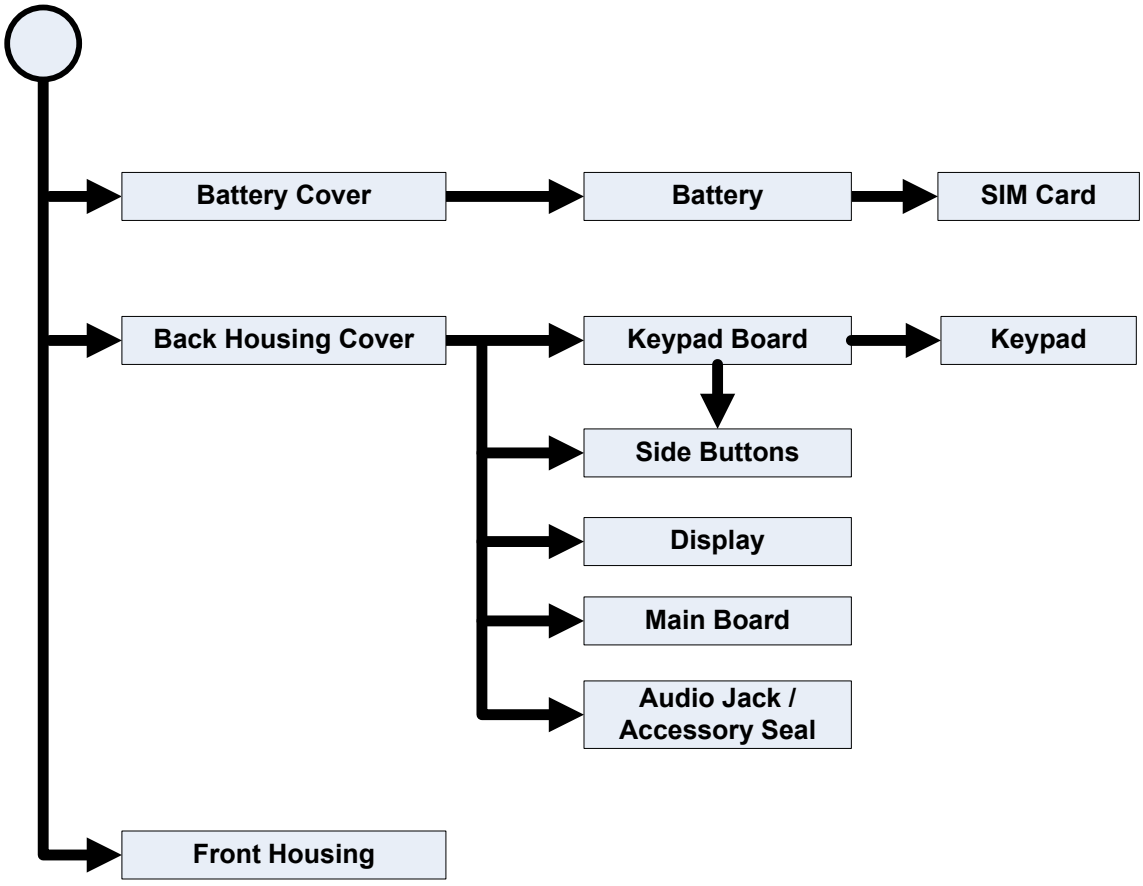
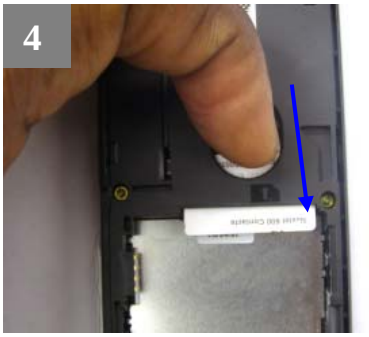


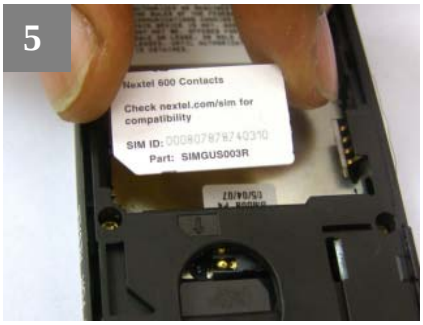
Figure 7.5.1

2.4.2 Battery Cover, Battery, and SIM Card Removal

Preparation: Remove Battery Cover.

1. Place Unit face down, insert finger nail between Lanyard Holder and Battery Cover.
2. Lift Battery cover off of unit.
3. Lift battery out of unit as a shown
4. Push SIM card from the back as a shown.
5. Grasp corners of SIM card to completely remove





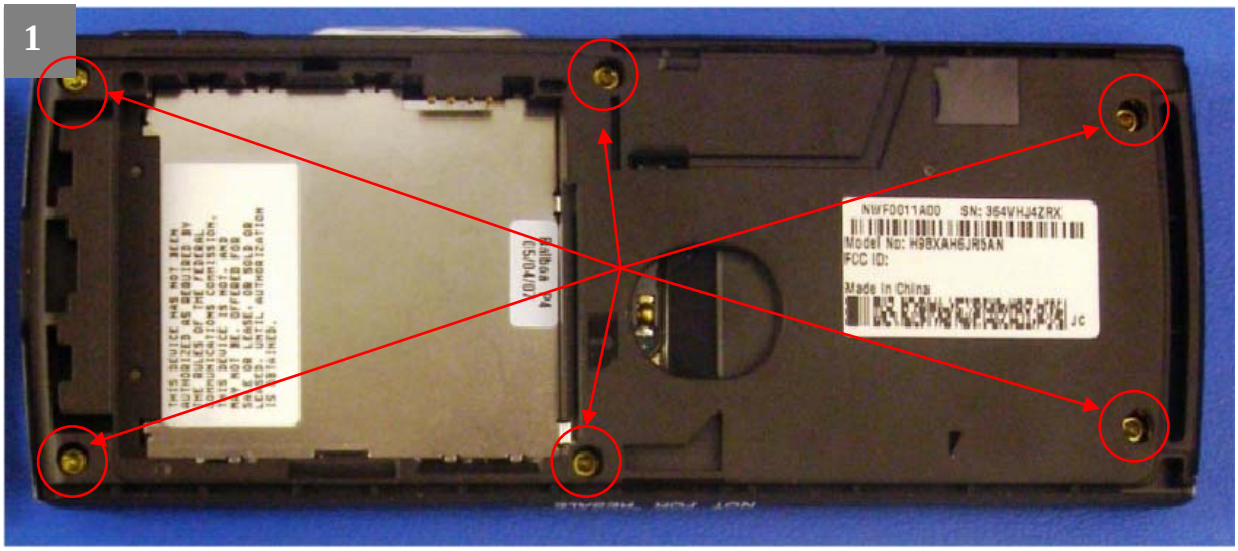
CAUTION: Do not touch the gold-colored area of the SIM card.

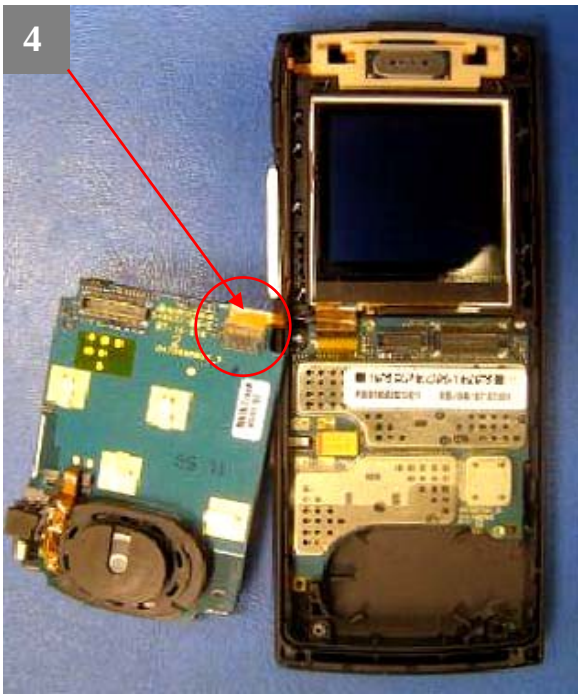
2.4.3 Opening Unit and removing the Keypad Board

Tools Required:

T-6 Torx bit, Black Stick, and a Pair of Plastic tweezers

1. Remove six (6) Torx screws from the back housing.
2. Separate the Front Housing gently from the Back Housing
3. Use the flat end of the black stick to disengage the keypad board from the main board in the corner shown.
4. Position keypad board to the left as shown and remove the side button flex from the keypad board by unlocking the Ziff connector with the black stick.



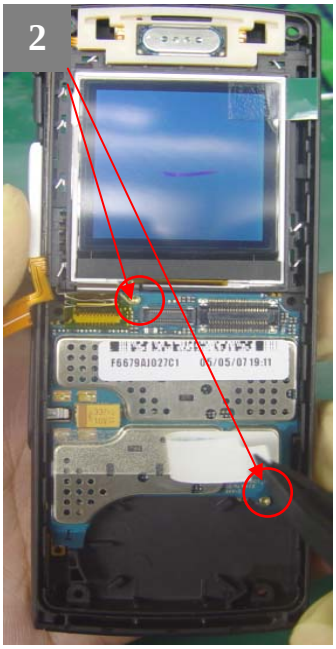


2.4.4 Removing Display and Main Board

Tools Required:

Black stick

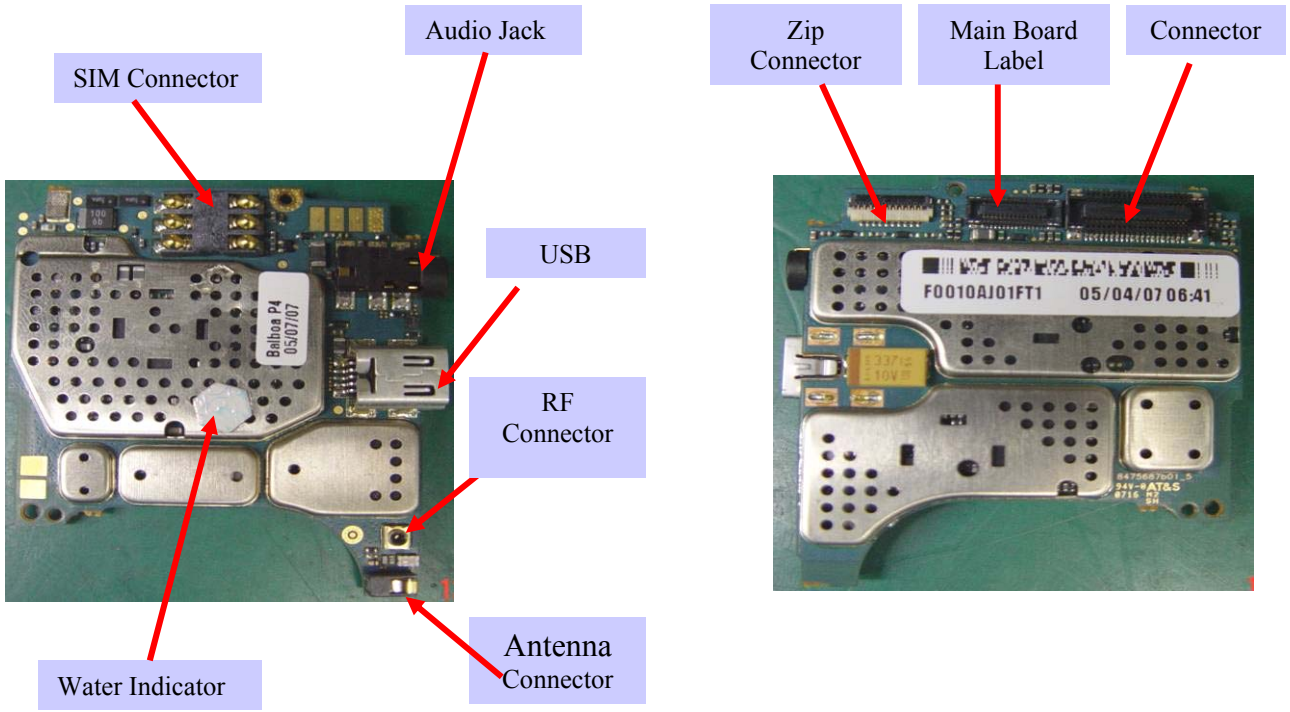
1. Using Tweezers remove the Kapton tape from the Display connector and using the black stick unlock and remove Display flex from the Main Board.
2. Remove the two Torx screws holding the Main Board.
3. Remove Display from Back Housing.
4. Remove Main Board from Back Housing

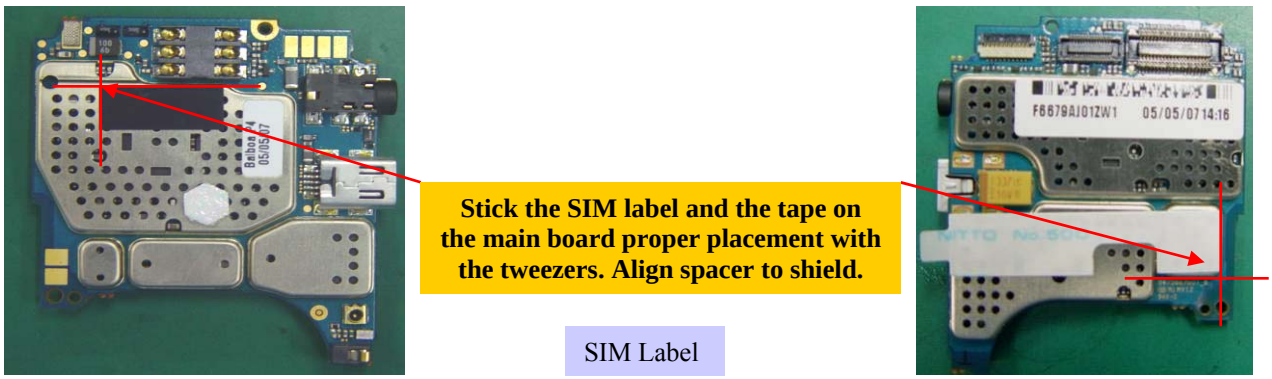


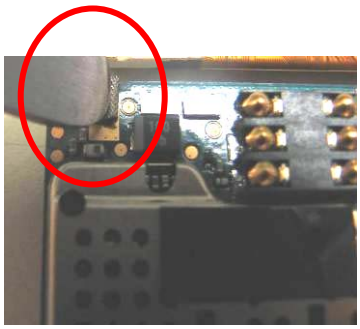
2.5 i425e and i425t Assembly Procedure

2.5.1 Main Board Inspection

Inspect the main board for the proper placement for the following parts. Verify that the parts are not damaged, bent or defective.







2.5.2 Back Housing Inspection

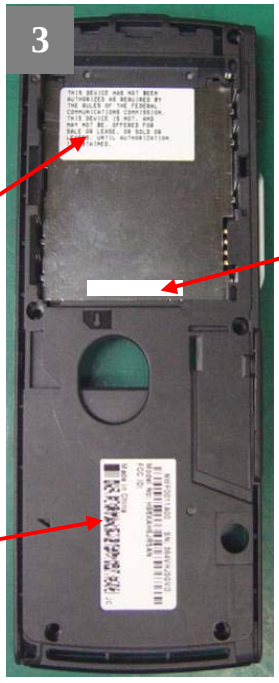
Inspect the back housing for damage or chipped paint

1. Ensure the transducer is placed properly
2. Ensure visible rib holes in the back housing
3. Check placement of serial number label and FCC label

The transducer housing is at proper location.

The two posts of the transducer housing must insert through these holes of the back housing

Rib Holes



FCC Label

Battery Floor Label

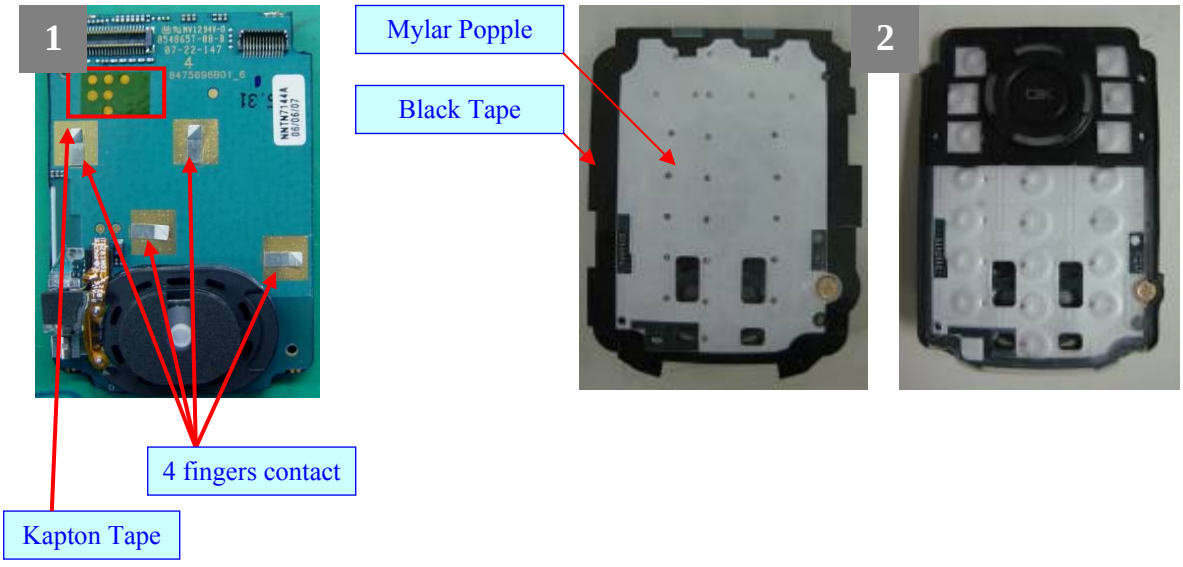
Serial number label

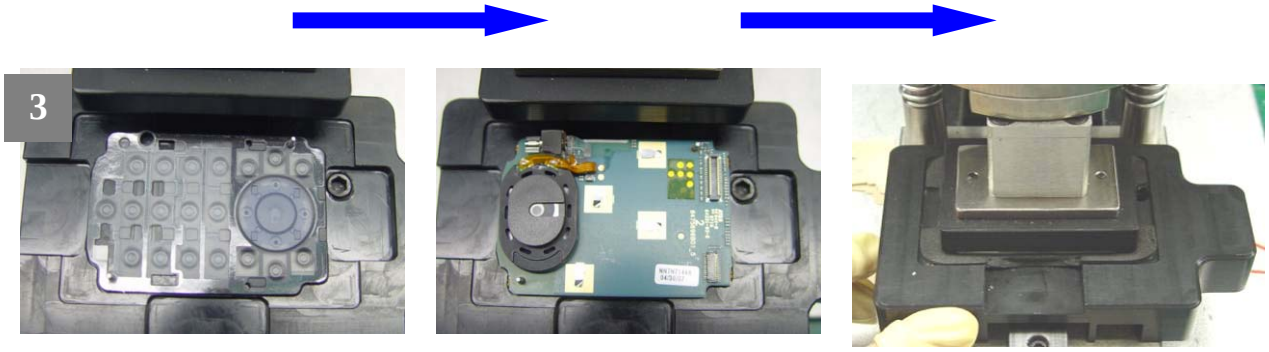
2.5.3 Keypad Board and Popple Installation

Equipment& Tool: Main Keypad Press Fixture # 130-1069

Inspect the keypad for print quality; ensure there are no defects

1. Check the placement of the 4 contact fingers for proper placement Check for the Kapton tape.
2. Apply Mylar Popple Assembly and Black tape onto keypad board.
3. Align the rubber keypad and keypad board into the fixture, then press it (Press time is 5 seconds)



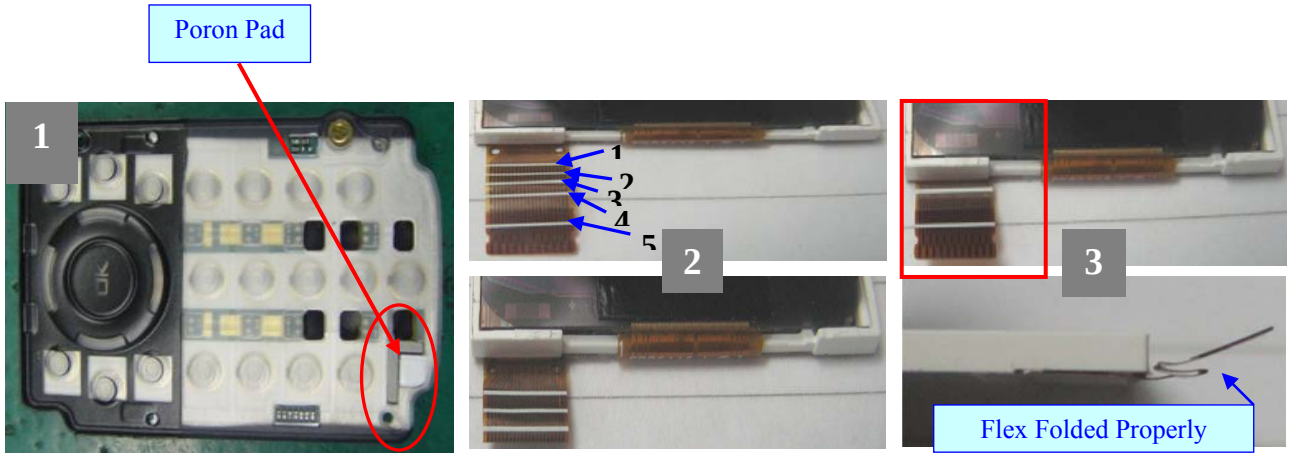


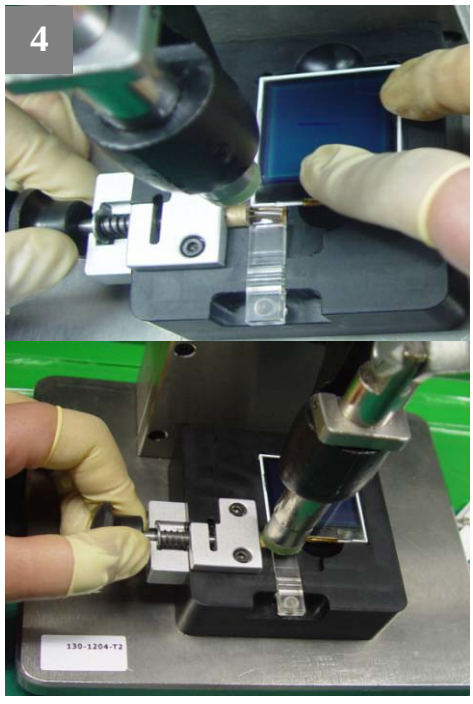
Avoid causing damage to battery contacts and RF contact

2.5.4 Keypad and Display Preparation

Equipment& Tool: LCD bend press fixture: 130-1204

1. Apply 1 Poron Pad onto the keypad.
   Note: Inspect the 5 silk print on the LCD flex
2. Fold the LCD flex silk between #2 and #3 lines.
3. Fold the LCD flex silk between #4 and #5 lines.
4. Place the Display and the flex into the fixture and press.
5. Place main board into back housing and insert 2 screws to secure main board to back housing
   Note: Use care not to damage battery contacts or antenna connection.
6. Place Display into back housing



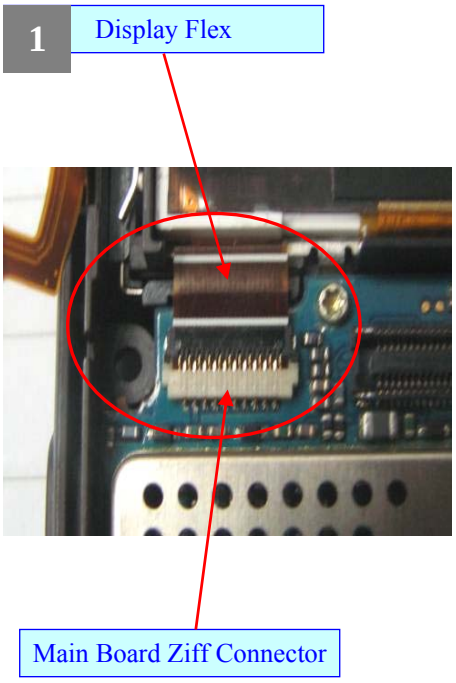


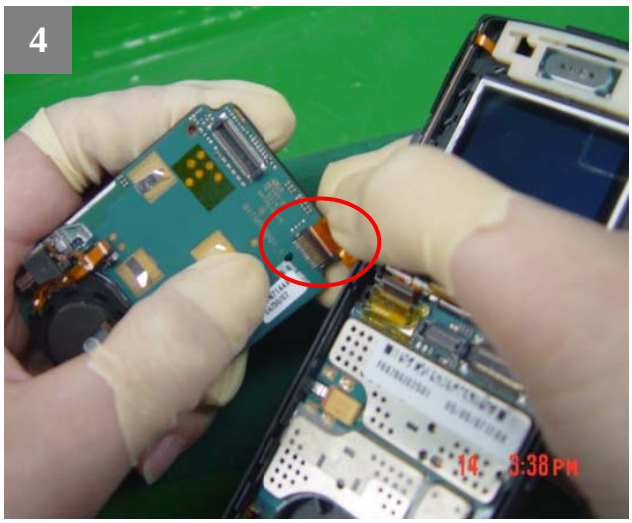
2.5.5 Assembly of Display and Keypad Board

Tools Required

1. Connect the Display flex to the Main board Ziff connector
2. Using a pair of tweezers apply the Kapton tape to the 21 pin ZIF connector.
3. Using a pair of tweezers remove the spacer adhesive liner on the main board
4. Connect the PTT flex to the keypad board Ziff connector.
5. Connect the keypad board to the main board and press to activate adhesive.

Note: Verify that the main board and keypad board are connected properly



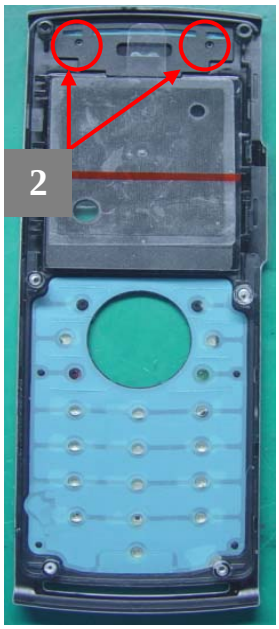


2.5.6 Assembly of Front Housing

Tools Required:

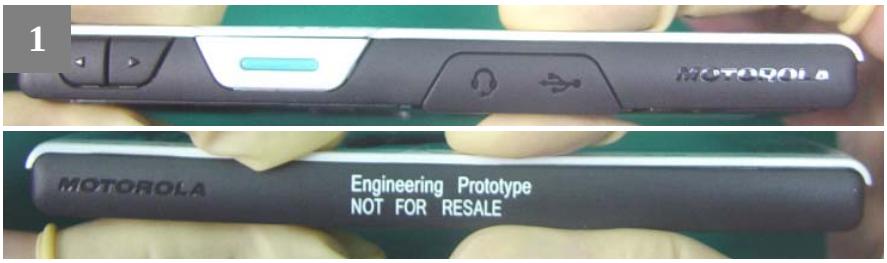
Popple Fixture

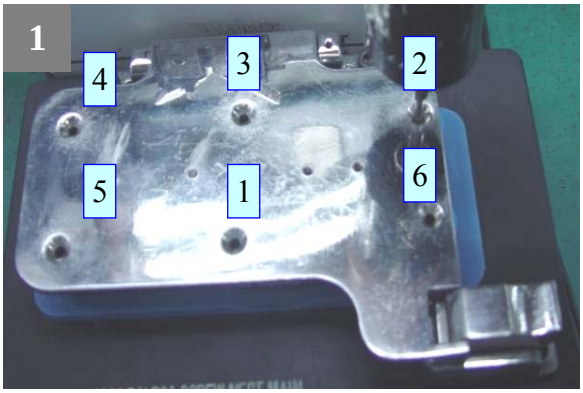
1. Inspect the front housing for any scratches, nicks, spot and paint defect.
2. Inspect for the two posts should insert through holes of the felt and the transducer felt is not damaged.
3. Remove the Pad of the lens and make sure is clean and no scratches.
4. Remove the liner of the Display and make sure is clean and has no scratches.
5. Assemble the front and back housing and verify that is assembled properly.



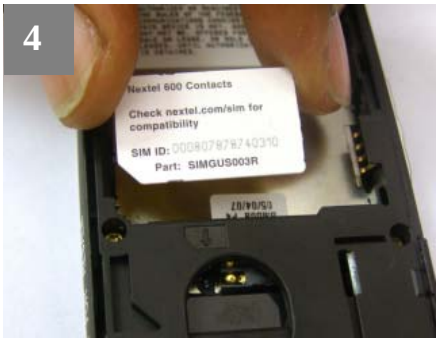
2.5.7 Closing the Unit

1. Press the Front Cover to the unit till is snapped.
2. Place the unit in screw nest fixture.
3. Place 6 screws on the unit in correct order.
4. Replace the SIM card
5. Replace the Battery
6. Replace the Battery Cover





Screw Nest Fixture: #130-1065 - Torque Settings: 1.4-/+0.1 in-lbs



2.6 i290 Disassembly Procedure

Motorola recommends the service technician follow a prescribed disassembly sequence to access specific items or components of the unit. This product is an efficiently designed package that incorporates the physical overlap and integration of some modular components. Refer to the Disassembly Sequence Flowchart for a suggested path to reach specific components.

NOTE: In some cases, the technician may not need to remove certain components to reach others.

2.6.1 Disassembly Sequence Flowchart

Note: Units components include a Flex Connector ribbon which can be easily torn or damaged if not handled properly. Handle the Flex Ribbon with care especially when separating the keypad board from the main board.

NOTE: Screws used to assemble the i290 back housing are: 6 housing assembly screws, T-6 drive.

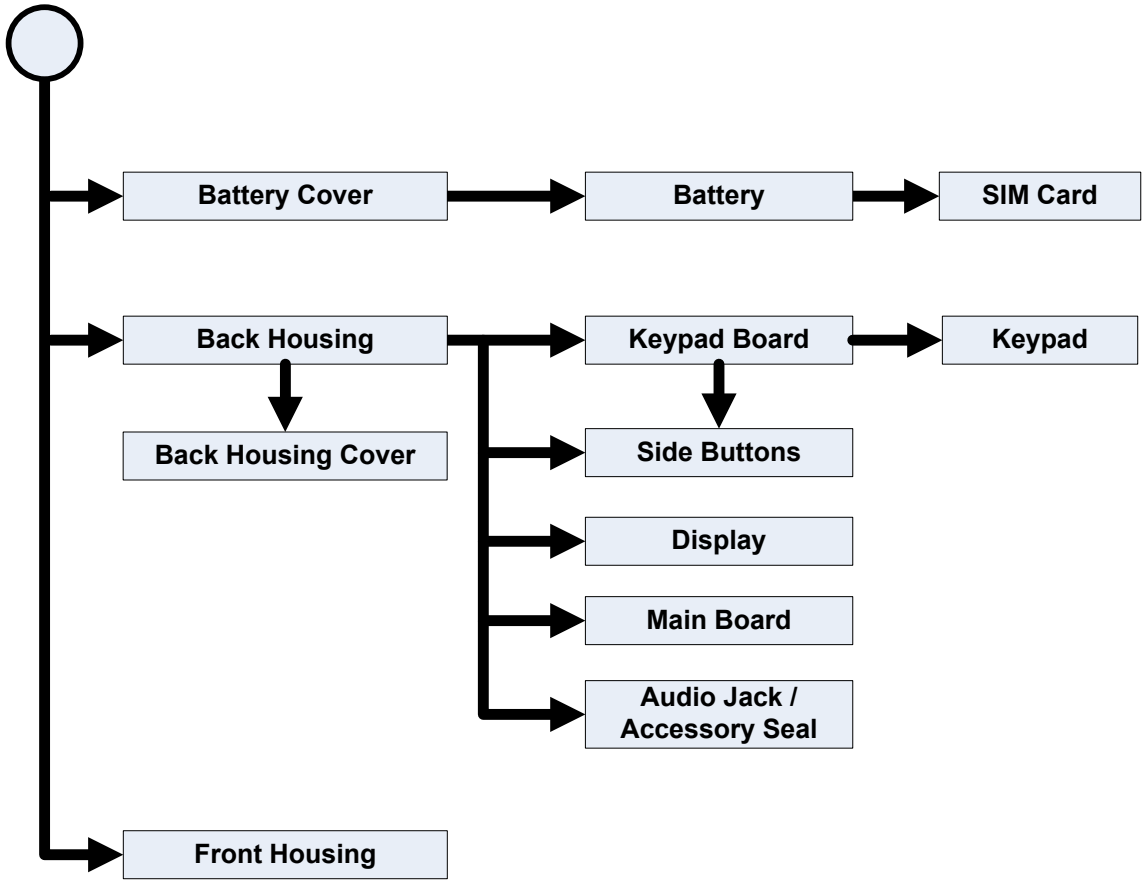
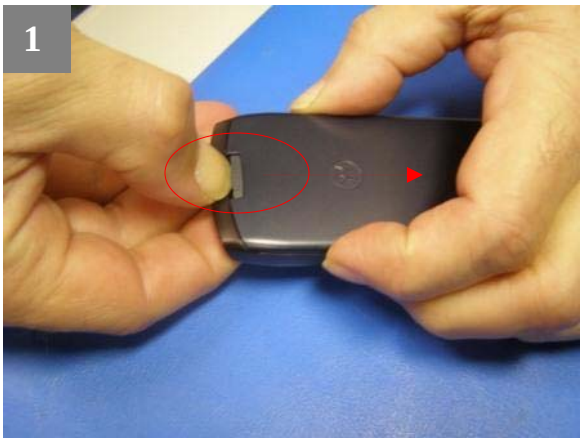


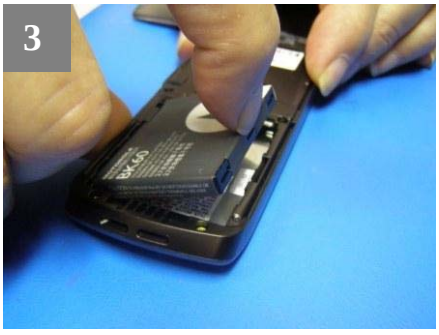
Figure 7.6.1

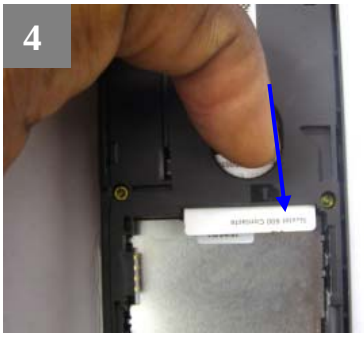
2.6.2 Battery Cover, Battery, and SIM Card Removal

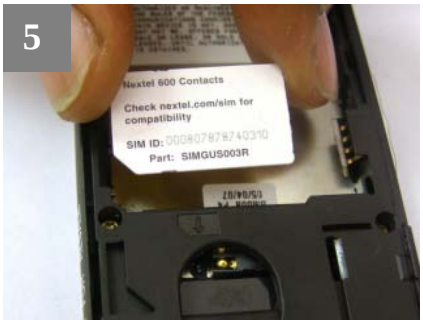
Preparation: Remove Battery Cover.

1. Place Unit face down, push battery latch with finger nail toward the top of unit.
2. Lift Battery cover off of the unit.
3. Lift battery out of unit as a shown
4. Push SIM card from the back as a shown.
5. Grasp corners of SIM card to completely remove









CAUTION: Do not touch the gold-colored area of the SIM card.

2.6.3 Opening Unit and removing the Keypad Board

Tools Required:

T-6 Torx bit, Black Stick, and a Pair of Plastic tweezers

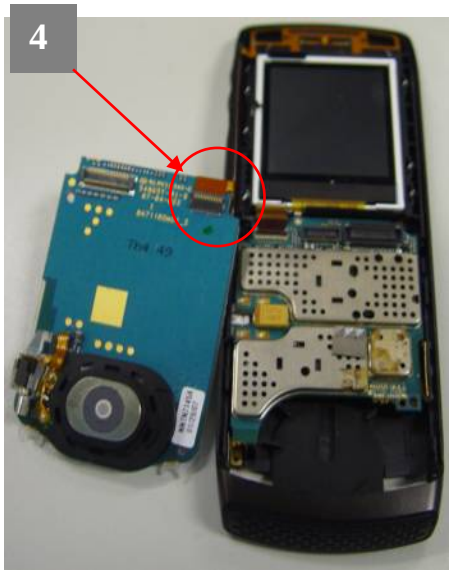
1. Remove six (6) Torx screws from the back housing.
2. Separate the Front Housing gently from the Back Housing
3. Use the flat end of the black stick to disengage the keypad board from the main board in the corner shown.
4. Position keypad board to the left as shown and remove the side button flex from the keypad board by unlocking the Ziff connector with the black stick.

1

2

3

4



2.6.4 Removing Display and Main Board

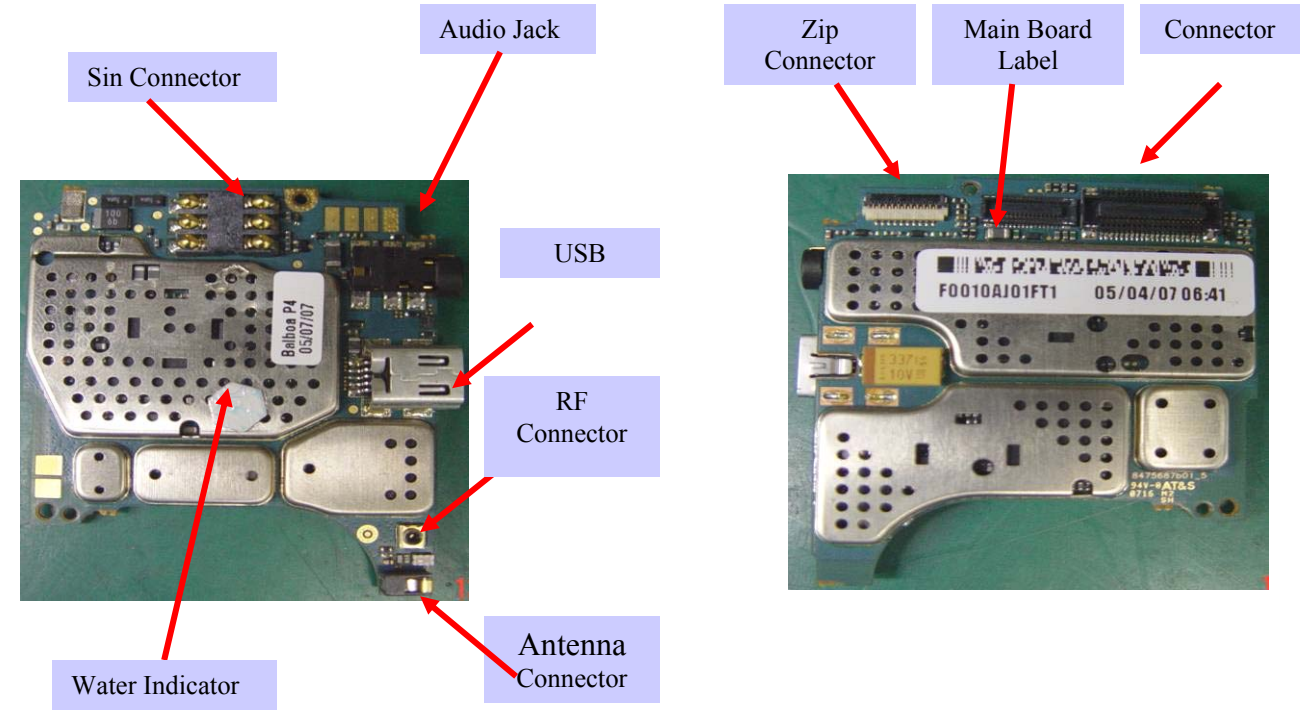
Tools Required:

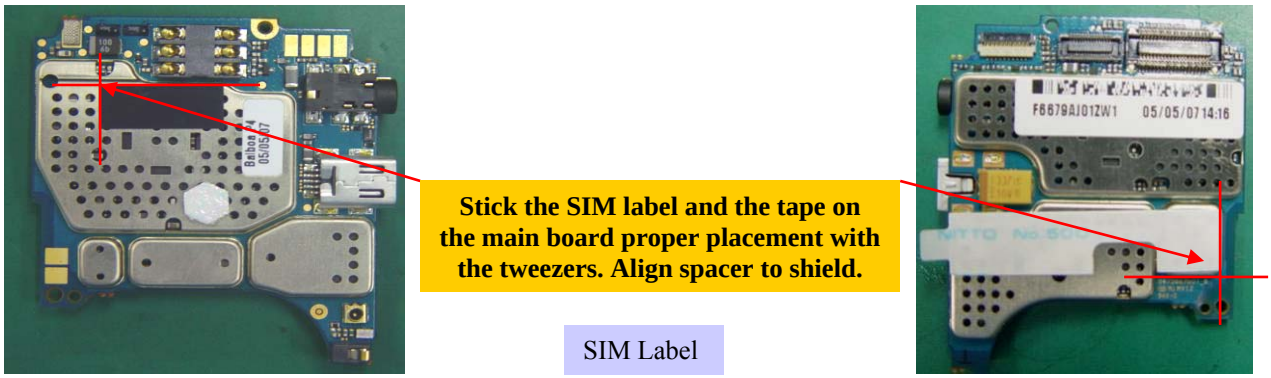
Black stick & Tweezers

1. Using Tweezers to remove the Kapton tape from the Display connector and use the black stick to unlock and remove Display flex from the Main board.
2. Remove the two Torx screws holding the main board.
3. Remove Display from back housing.
4. Remove Main board from back housing

2.7 i290 Assembly

2.7.1 Main Board Inspection

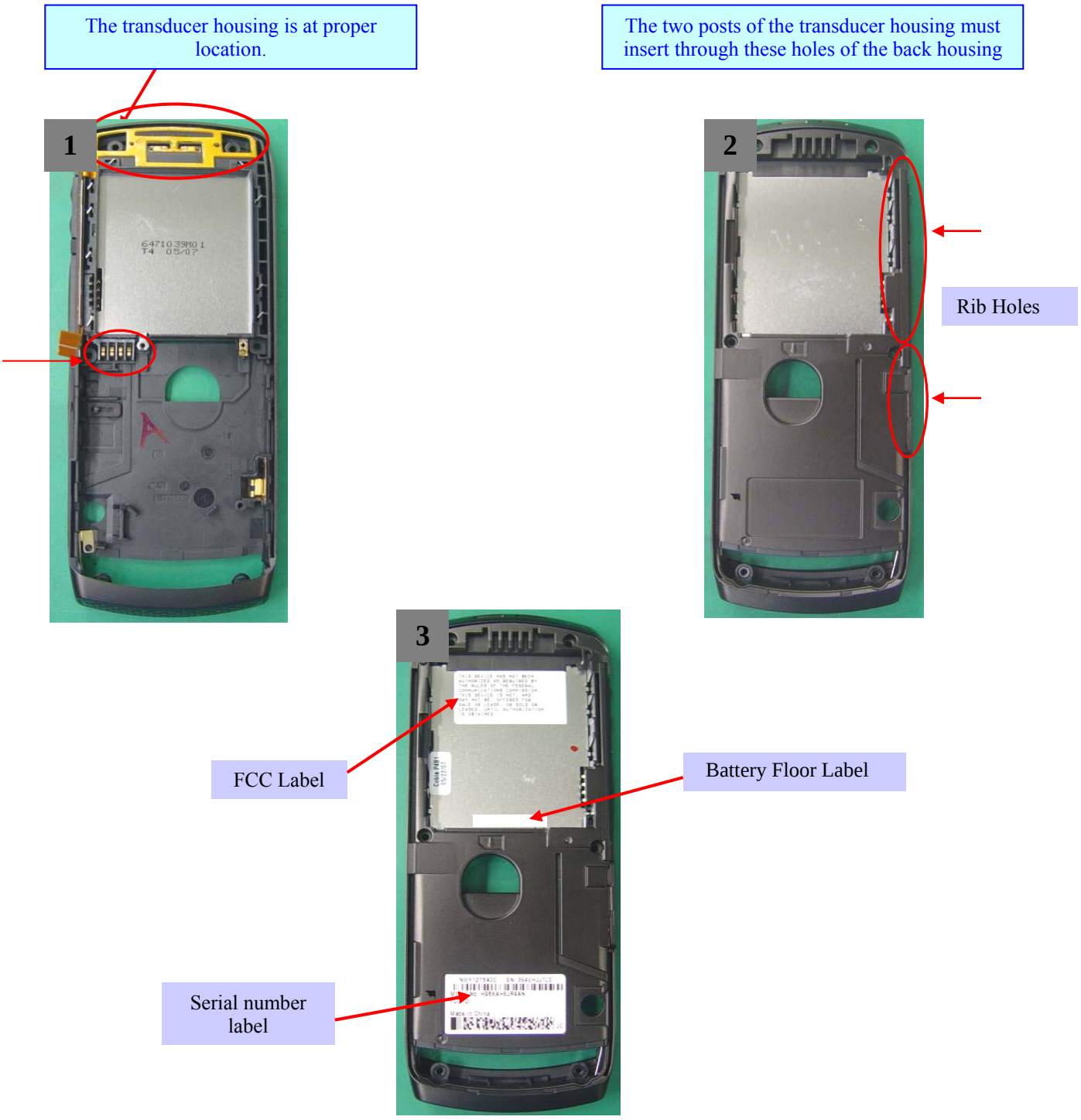




2.7.2 Back Housing Inspection

Inspect the back housing for damage or chipped paint

1. Ensure the transducer is placed properly
2. Ensure visible rib holes in the back housing
3. Check placement of serial number label and FCC label

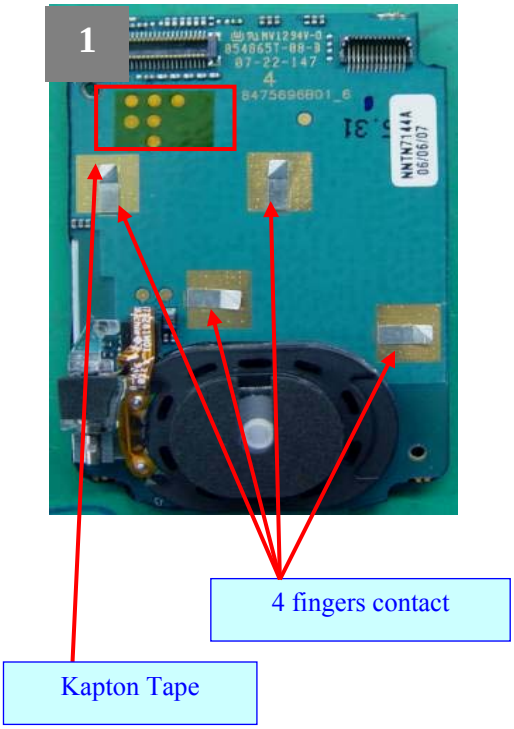


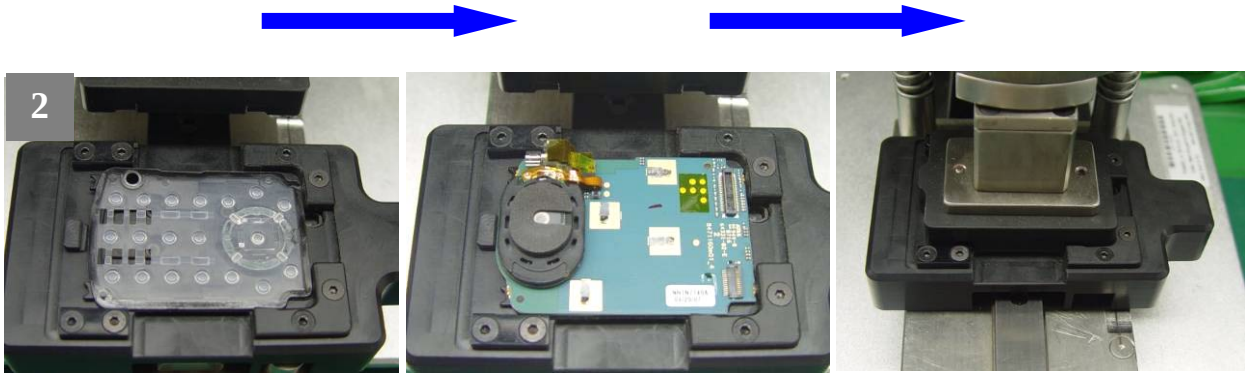
2.7.3 Keypad Board and Keypad Installation

Equipment& Tool: Main Keypad Press Fixture # 130-1069

Inspect the keypad for print quality; ensure there are no defects

1. Check the placement of the 4 contact fingers for proper placement Check for the Kapton tape.
2. Align the rubber keypad and keypad board into the fixture, then press it (Press time is 5 seconds)





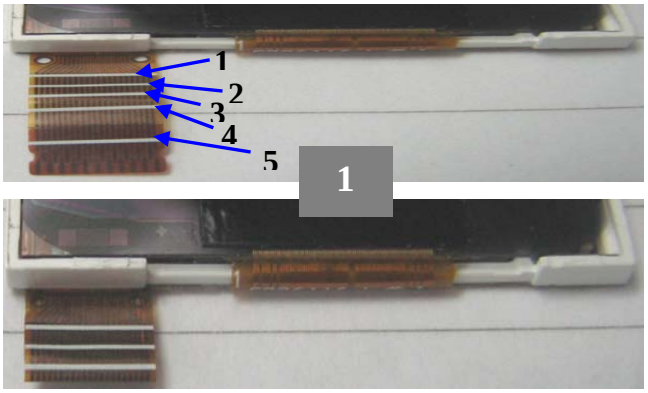
Avoid causing damage to battery contacts and RF contact

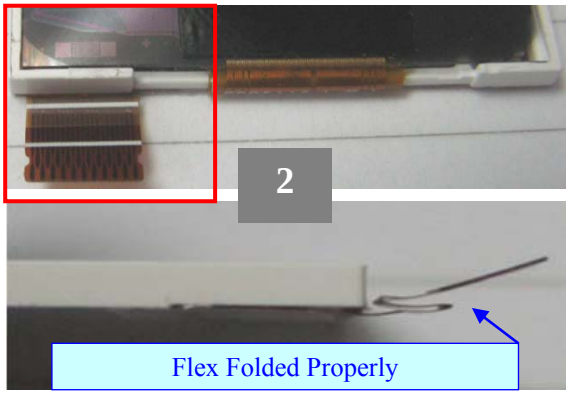
2.7.4 Keypad and Display Preparation

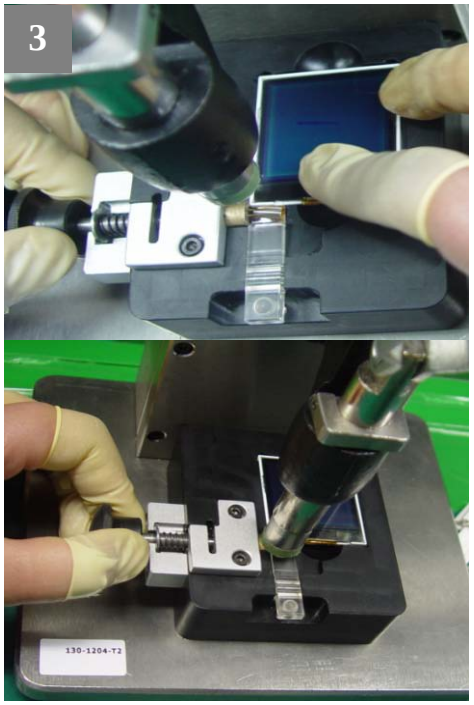
Equipment& Tool: LCD bend press fixture: 130-1204

Note: Inspect the 5 silk print on the LCD flex

1. Fold the LCD flex silk between #2 and #3 lines.
2. Fold the LCD flex silk between #4 and #5 lines.
3. Place the Display and the flex into the fixture and press
4. Place main board into back housing and insert 2 screws to secure main board to back housing
   Note: Use care not to damage battery contacts or antenna connection.
5. Place Display into back housing







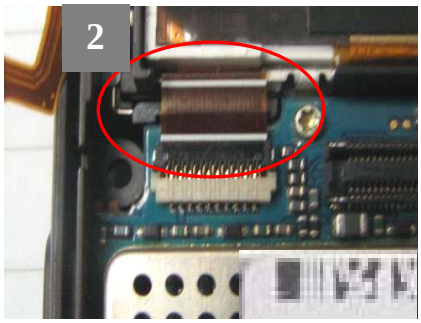
2.7.5 Assembly of Display and Keypad Board

Tools Required

Tweezers

1. Insert the display flex into Ziff connector on Main Board.
2. Lock the Ziff connector by closing the hinge door.
3. Using a pair of tweezers, apply the Kapton tape to the 21 pin ZIF connector.
4. Using a pair of tweezers, remove the spacer adhesive liner on the main board
5. Connect the PTT flex to the keypad board.
6. Assemble the keypad board to the main board.

Note: Verify that the main board and keypad board are connected properly



2.7.6 Assembly of Front Housing

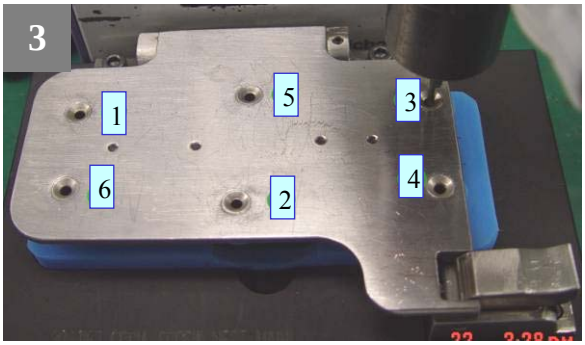
Tools Required:

Tweezers

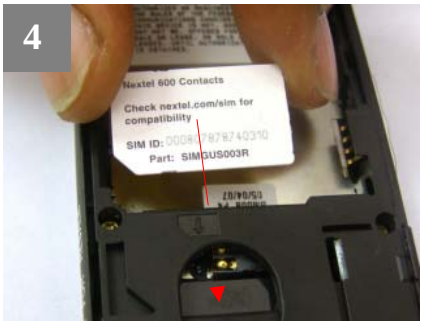
1. Inspect the front housing for any scratches, nicks, spot and paint defect.
2. Remove the Pad of the lens and ensure it is clean and has no scratches.
3. Remove the liner of the Display and make sure is clean and has no scratches.
4. Assemble the front and back housing and verify that it is assembled properly.
5. Assemble the Spring and Battery latch on to the rear housing cover
6. Place the rear housing cover to rear housing.

2.7.7 Closing the Unit

1. Press the Front Cover to the unit until the snaps engage.
2. Place the unit into the screw nest fixture.
3. Place 6 screws on the unit in correct orderand torque to 1.4 -/+ 0.1 in-lbs..
4. Replace the SIM card as shown below.
5. Replace the Battery as shown below.
6. Replace the Battery Cover By inserting the two hook at the top end of the battery cover into the corresponding slots on the back housing and snap closed..



Screw Nest Fixture: #130-1065 - Torque Settings: 1.4-/+0.1 in-lbs

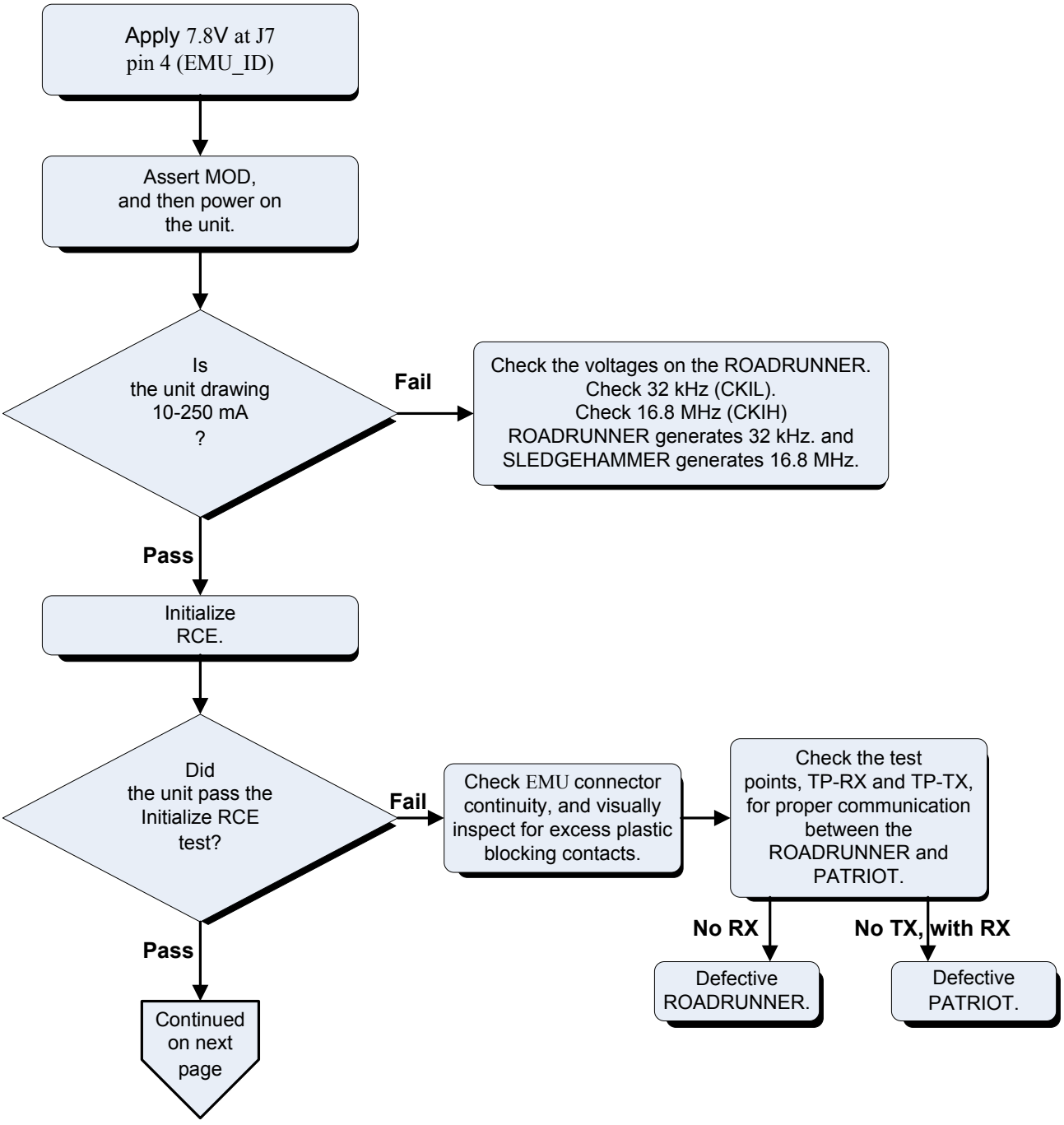


Chapter 3

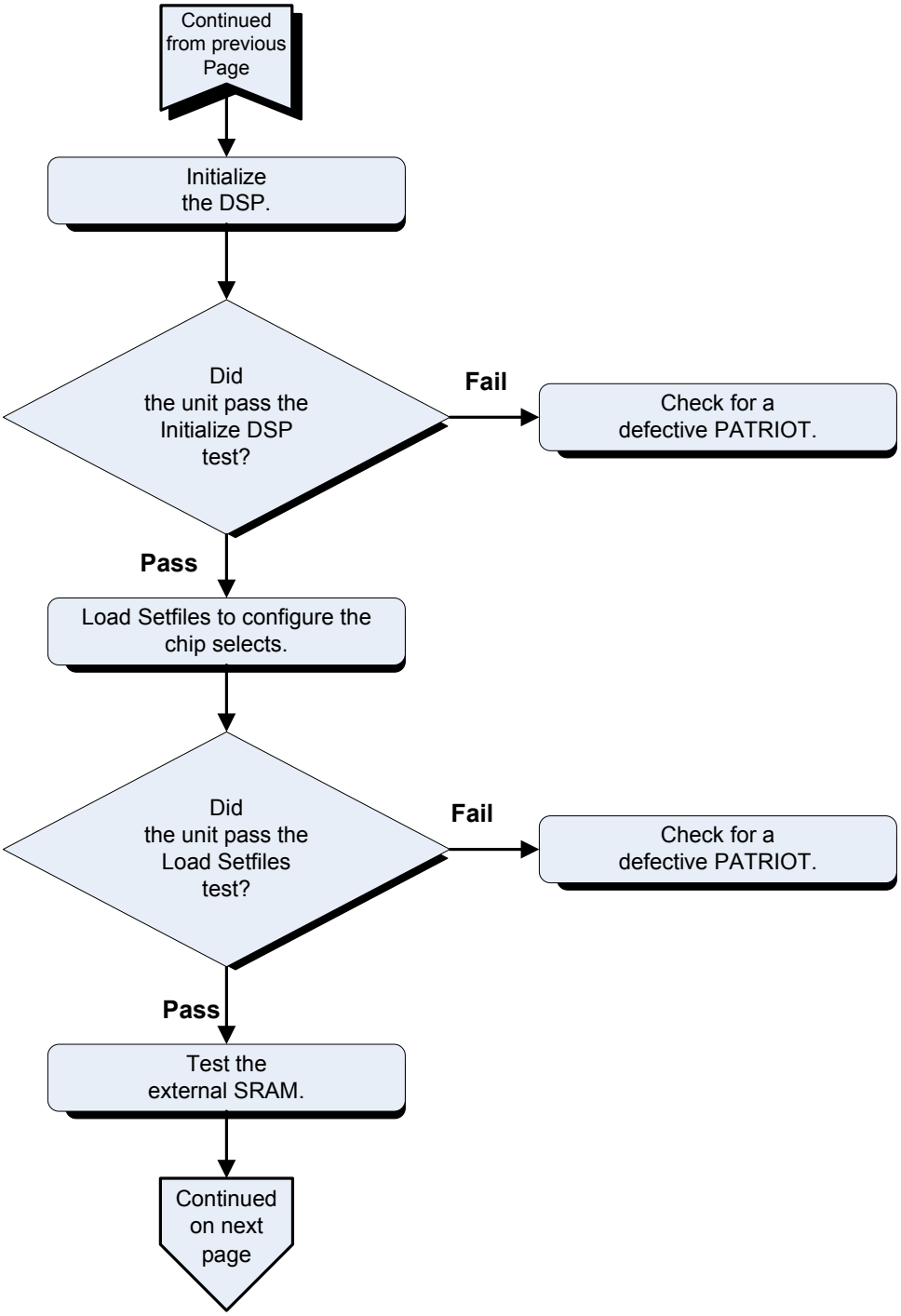
TROUBLESHOOTING

3.1 Digital Analysis Test

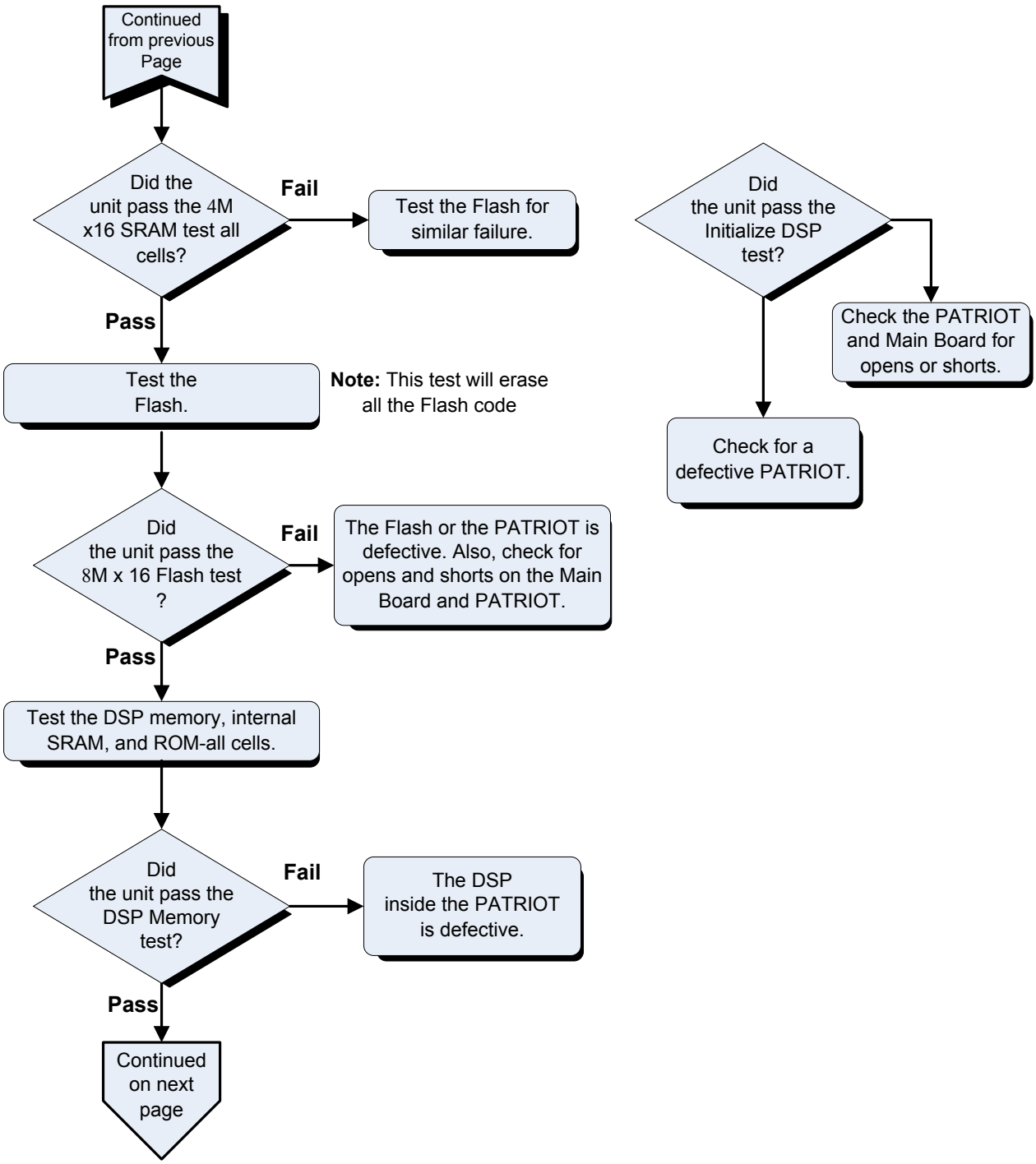
Use this test for troubleshooting the digital section.



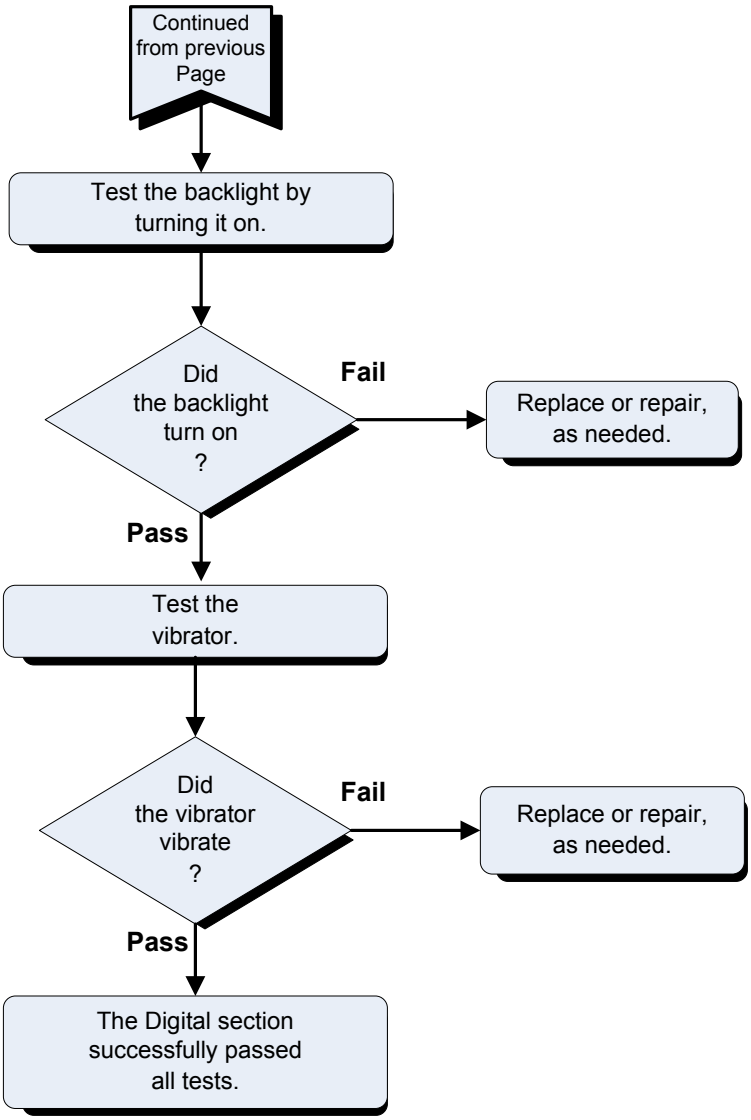
Digital Analysis Test (Continued)



Digital Analysis Test (Continued)

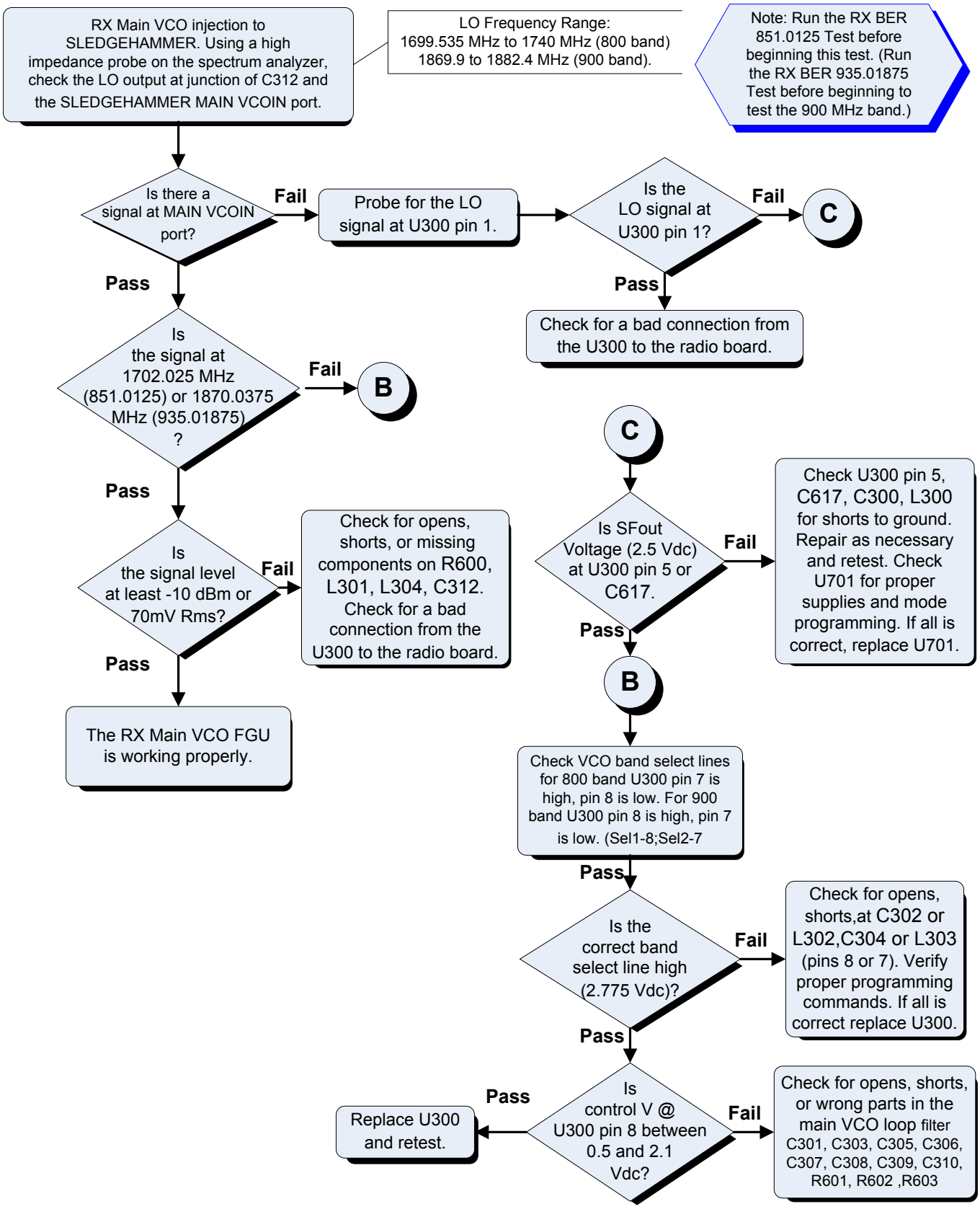


Digital Analysis Test (Continued)



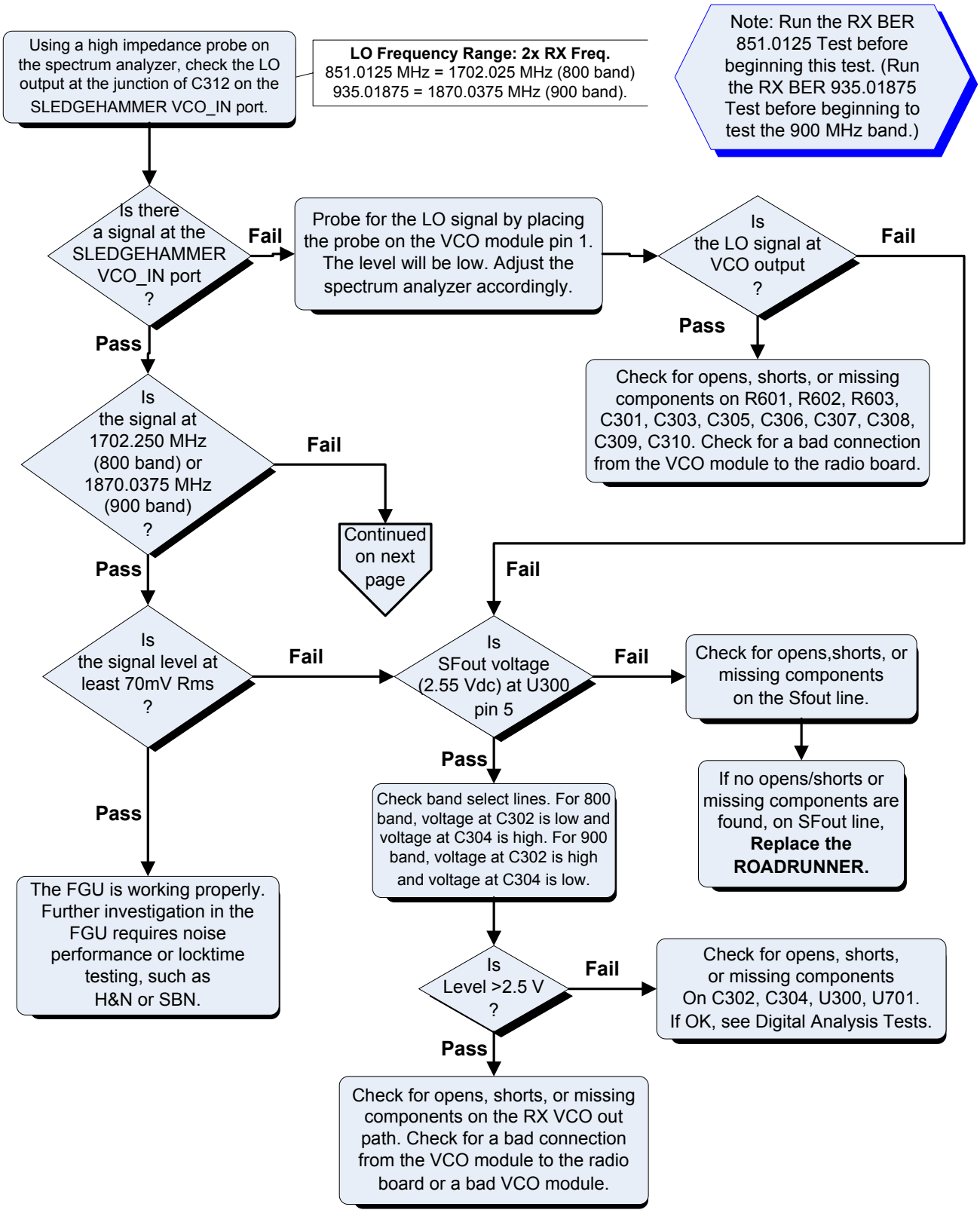
3.2 LO Output Test

Use this test on a unit with the following symptom: no RX.

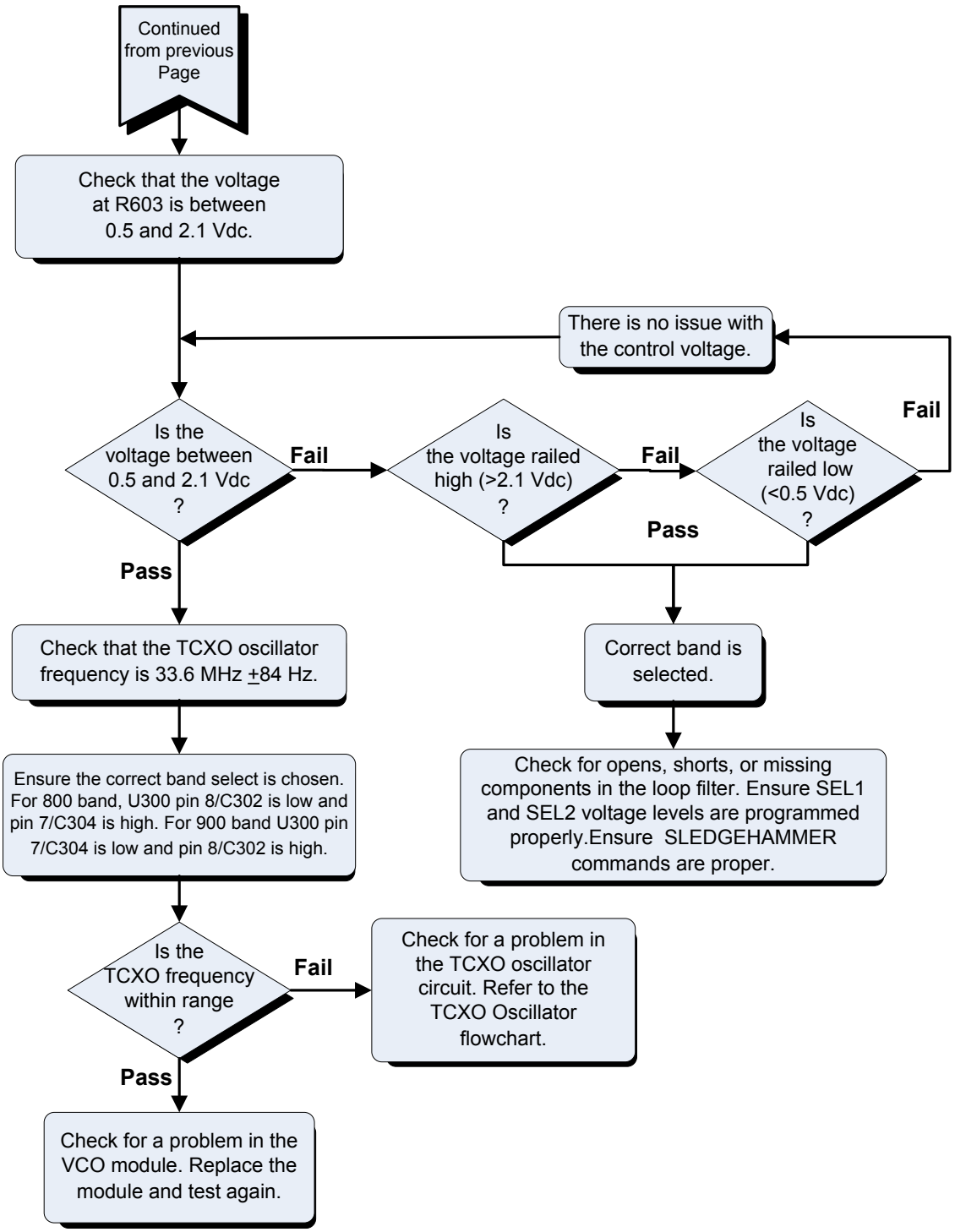


3.3 RX Main VCO Test

Use this test on a unit with the following symptom: no RX.



RX Main VCO Test (Continued)

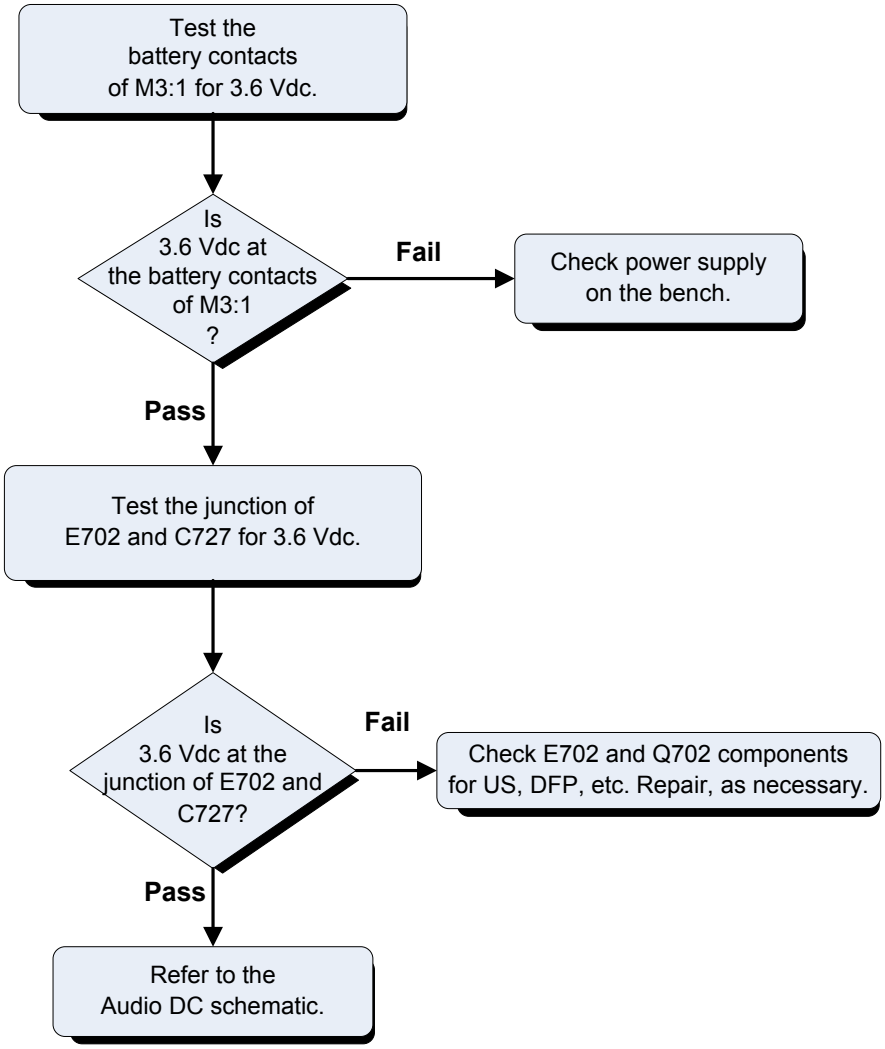


3.4 Power-Up Test (V6, FILT_B+)

Note: The following are the DC power distribution voltages with their correct values and the appropriate location to check the voltages:

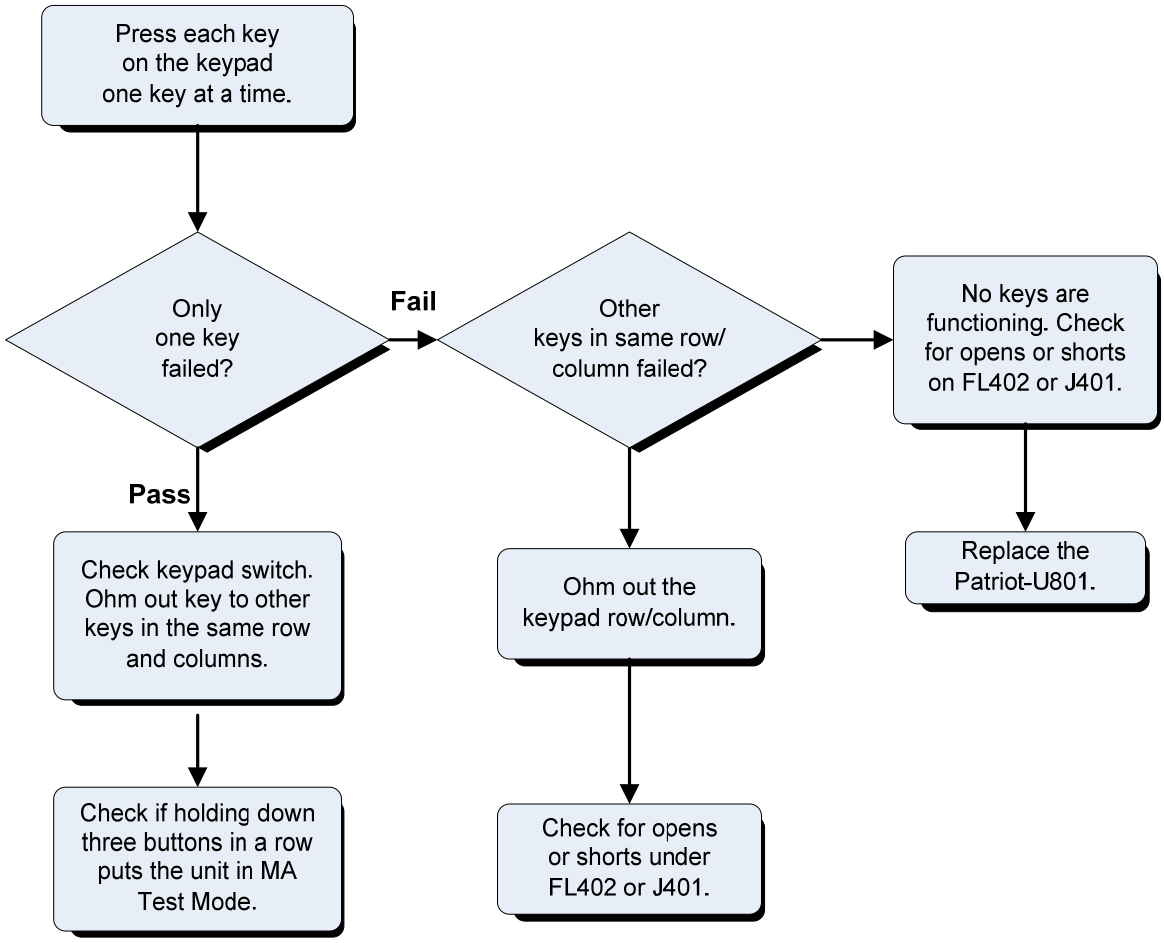
RAW_B+ (3.6 Vdc) @ M3 pin 1 battery contact
Filt_B+ (3.6 Vdc) @ C724
SW2 (1.875 Vdc) @ C702
SW3 (5.10 Vdc) @ C701
PA_B+ (3.0 Vdc) @ C539
V4 (2.775 Vdc) @C736
VSIM (3.0 Vdc) @ C714
V1 (1.55 Vdc @ C707 Vdc)
VIBOUT (3.0 Vdc)
V2 (2.775 Vdc) @ C704
USB_VCC (3.3 Vdc) @ C713
V3 (1.875 Vdc) @ C709

Refer to appropriate DC distribution test troubleshooting flowchart if one of these voltages is missing.



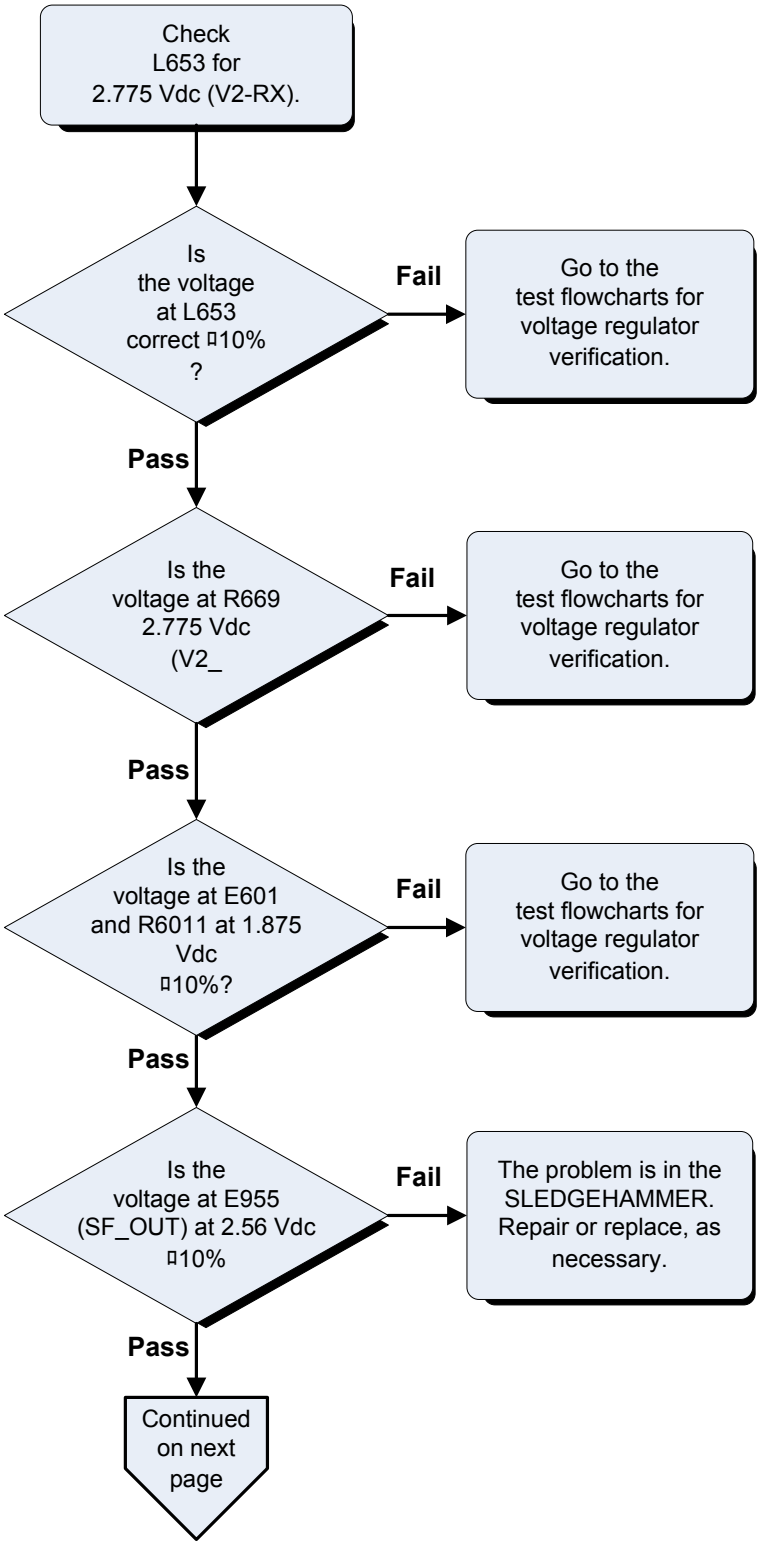
3.5 Keypad Failure Test.

Use this test on a unit with the following symptom: keypad failure.

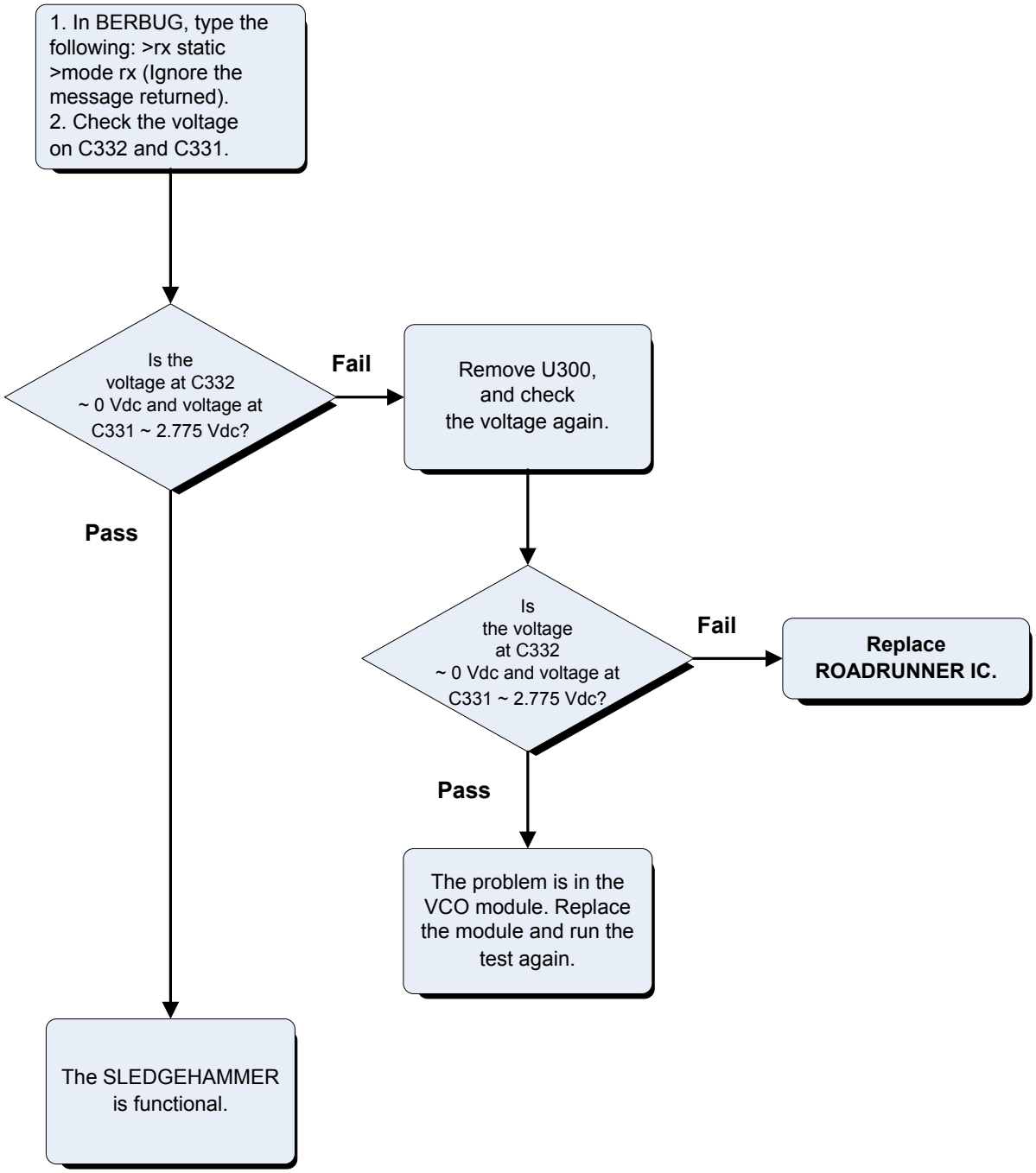


3.6 SLEDGEHAMMER Test

Use this test to check the SLEDGEHAMMER circuitry.



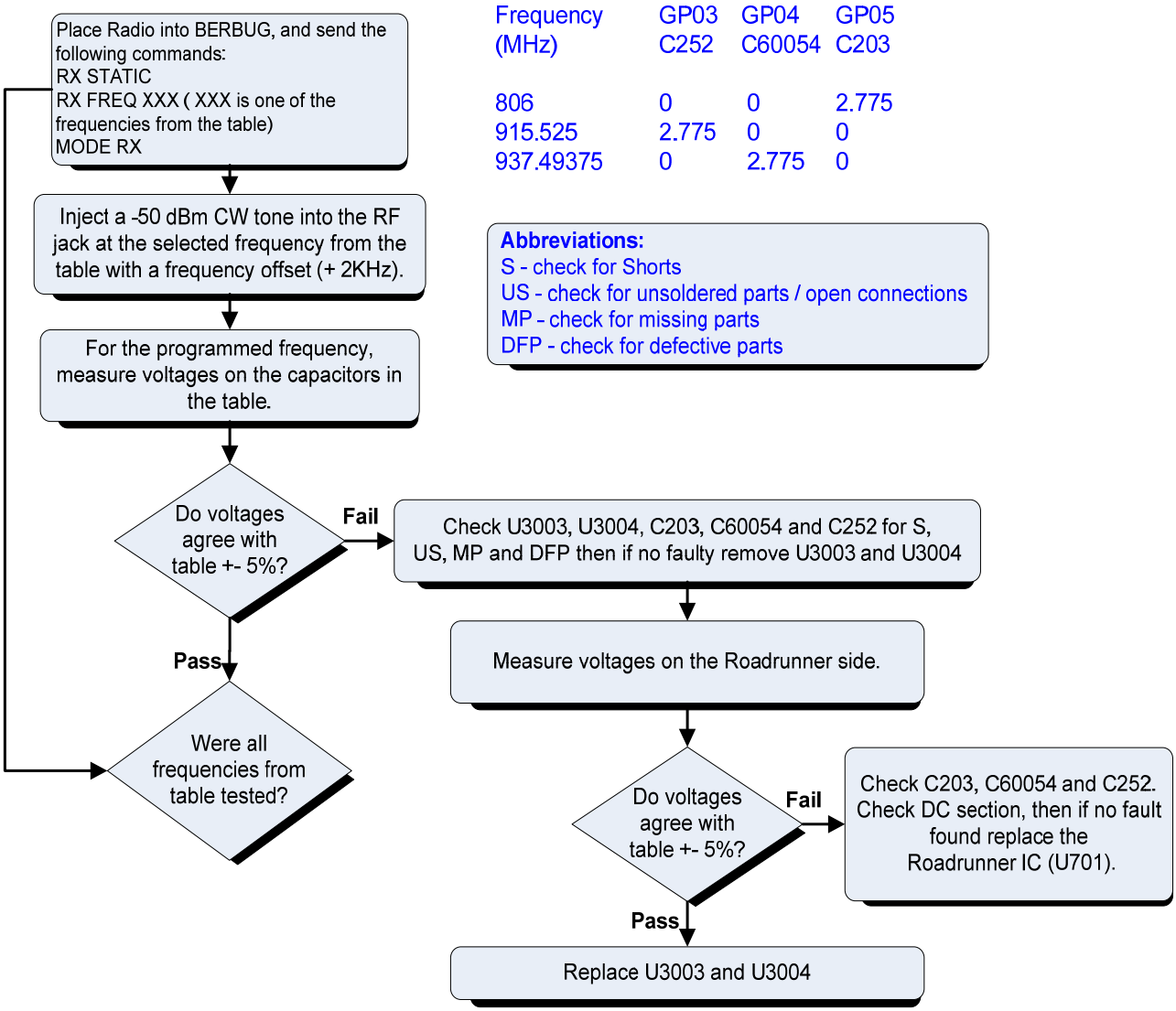
SLEDGEHAMMER Test (Continued)



3.7 RX Analysis Test

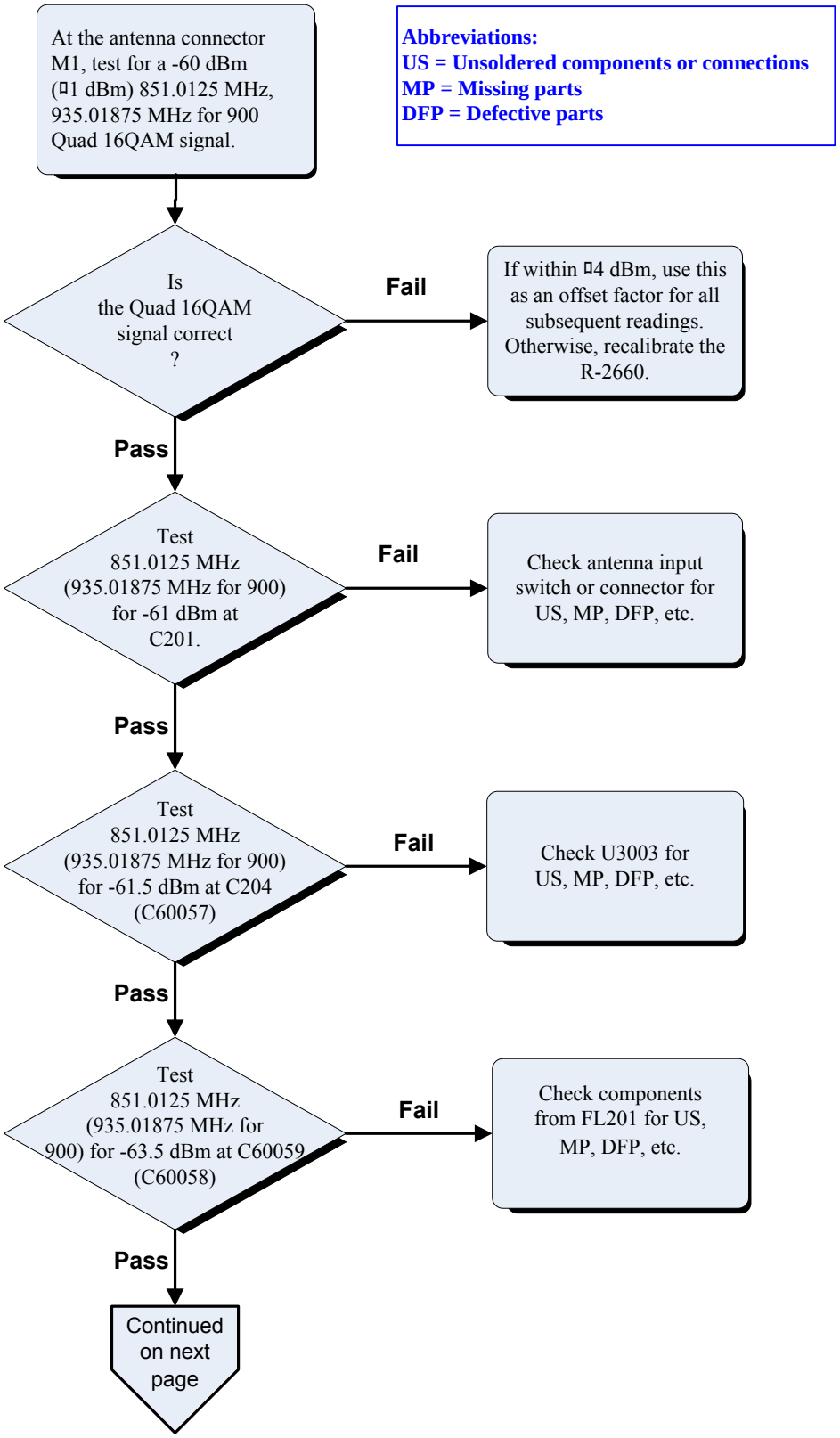
Use this test on a unit to perform a RX analysis in *i*DEN mode.

1. Set up the R-2660 as follows: Mode: iDEN Test, Meter: RF DISPLAY, RF Control: GENERATE, FREQ: (See Table) MHz, Gen: OUT6/6, Gen: -60 dBm, RF I/O.
2. Set the spectrum analyzer to Center Freq: 851.000 MHz (935.01875 MHz for 900), Span: 100 kHz, Amplitude: -30 dBm reference level. Set marker to test frequency, and use Trace and Max. Hold to obtain readings. Use Clear before taking each reading.
3. Except as noted, use a 50-ohm probe for all RF measurements. The probe ground must make contact with the board ground during the measurements.
4. Check that signal measurement levels are ±3dB at each test point, unless otherwise stated. A low RSSI level will result in higher BER as the signal becomes weaker.
5. The RF cable from the R-2660 to the unit under test (UUT) should be <18 inches for these measurements in this flowchart.
6. Be sure to check for any defects, such as unsoldered connections, shorts, broken or defective components.
7. Remove the antenna from the UUT before beginning these tests.

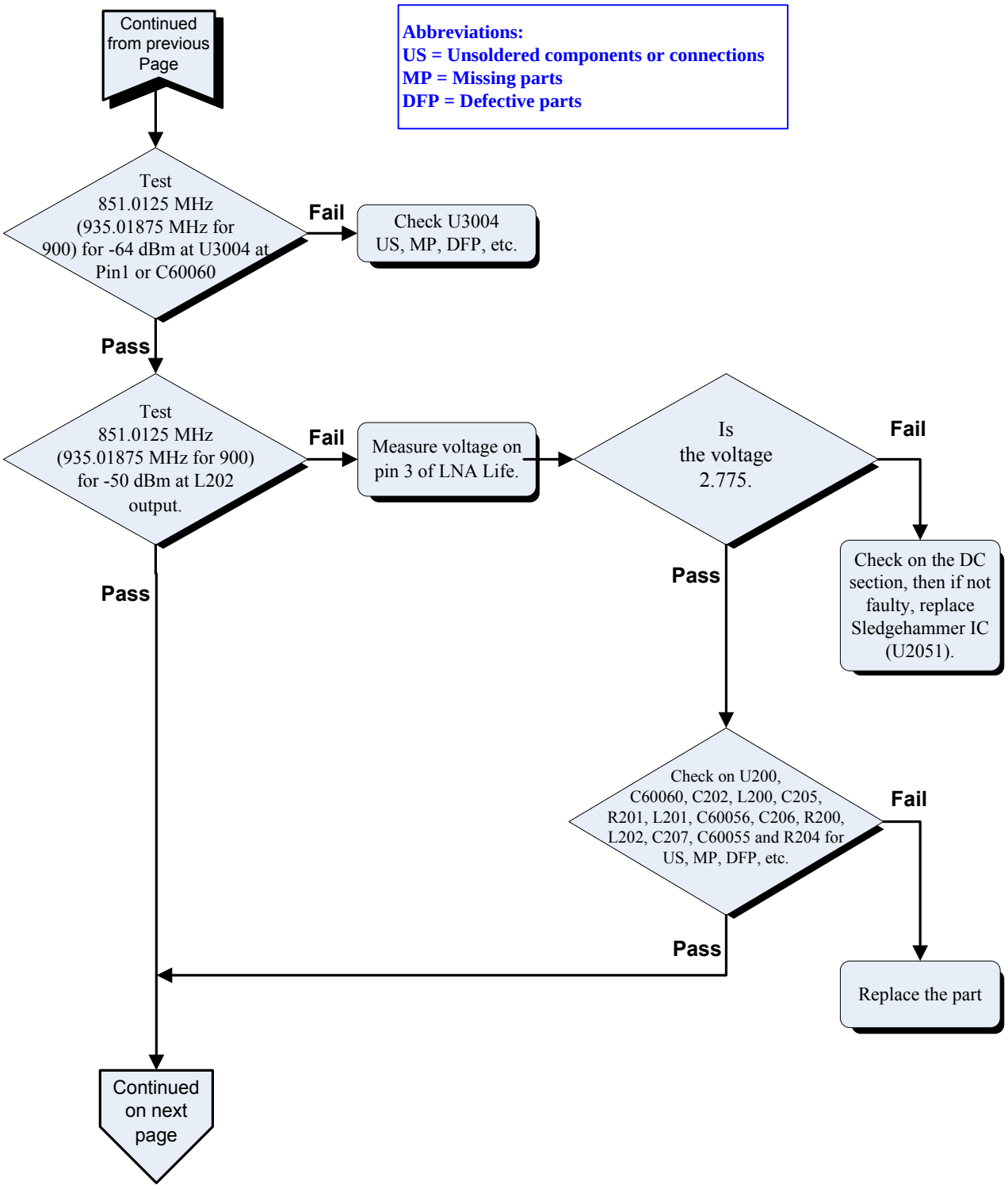


Frequency (MHz)	GP03 C252	GP04 C60054	GP05 C203
806	0	0	2.775
915.525	2.775	0	0
937.49375	0	2.775	0

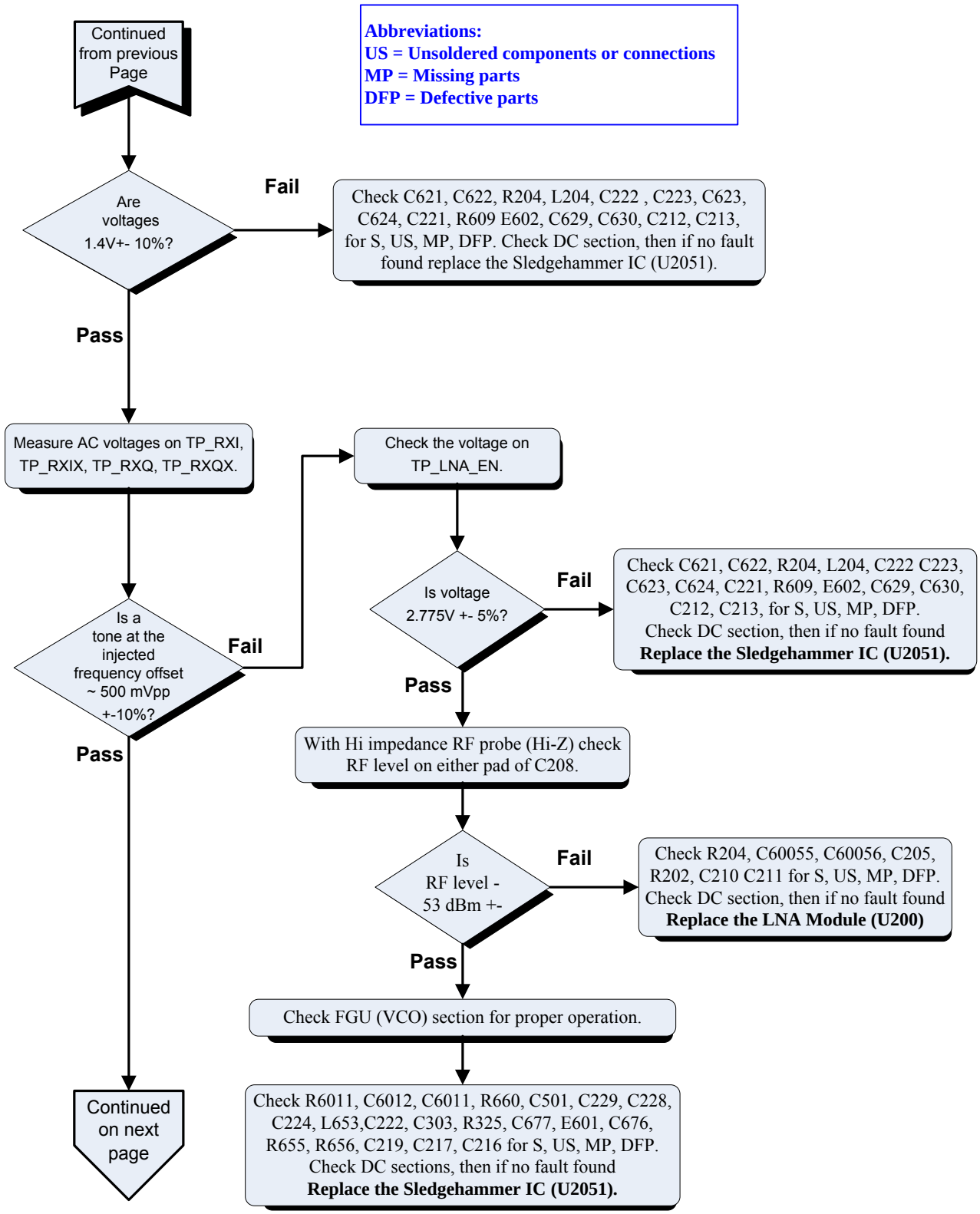
RX Analysis Test (Continued)



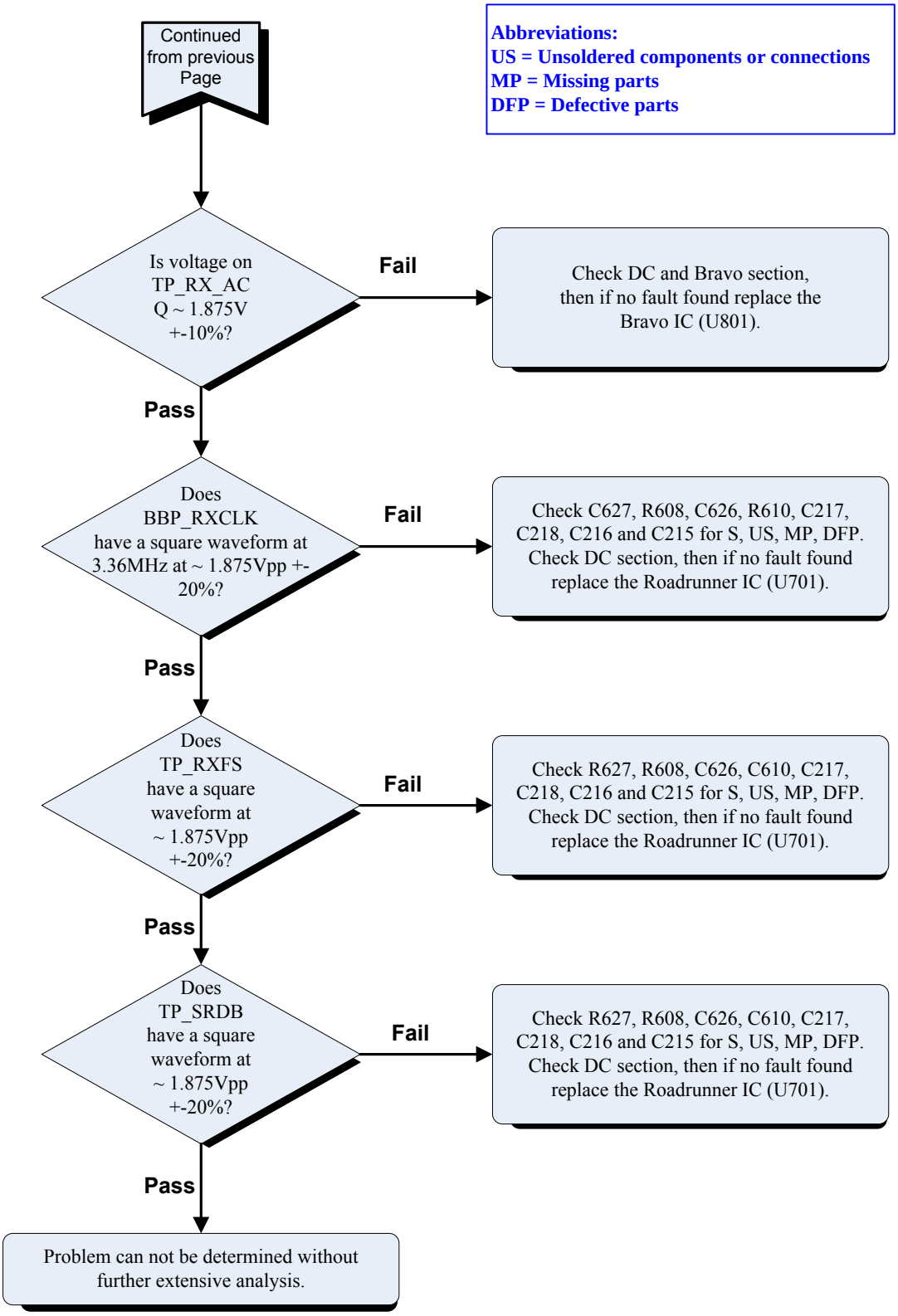
RX Analysis Test (Continued)



RX Analysis Test (Continued)

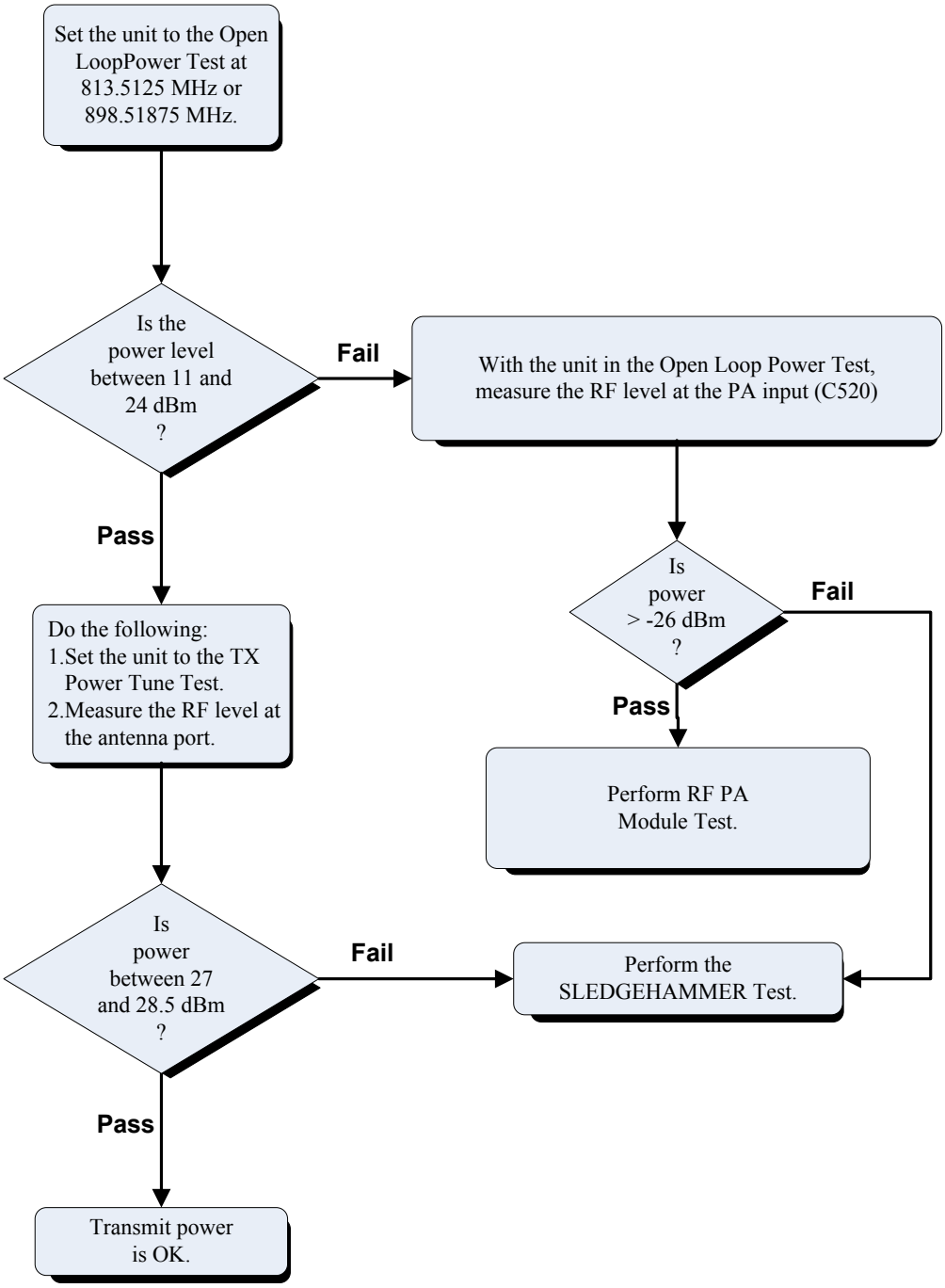


RX Analysis Test (Continued)



3.8 TX Power Test

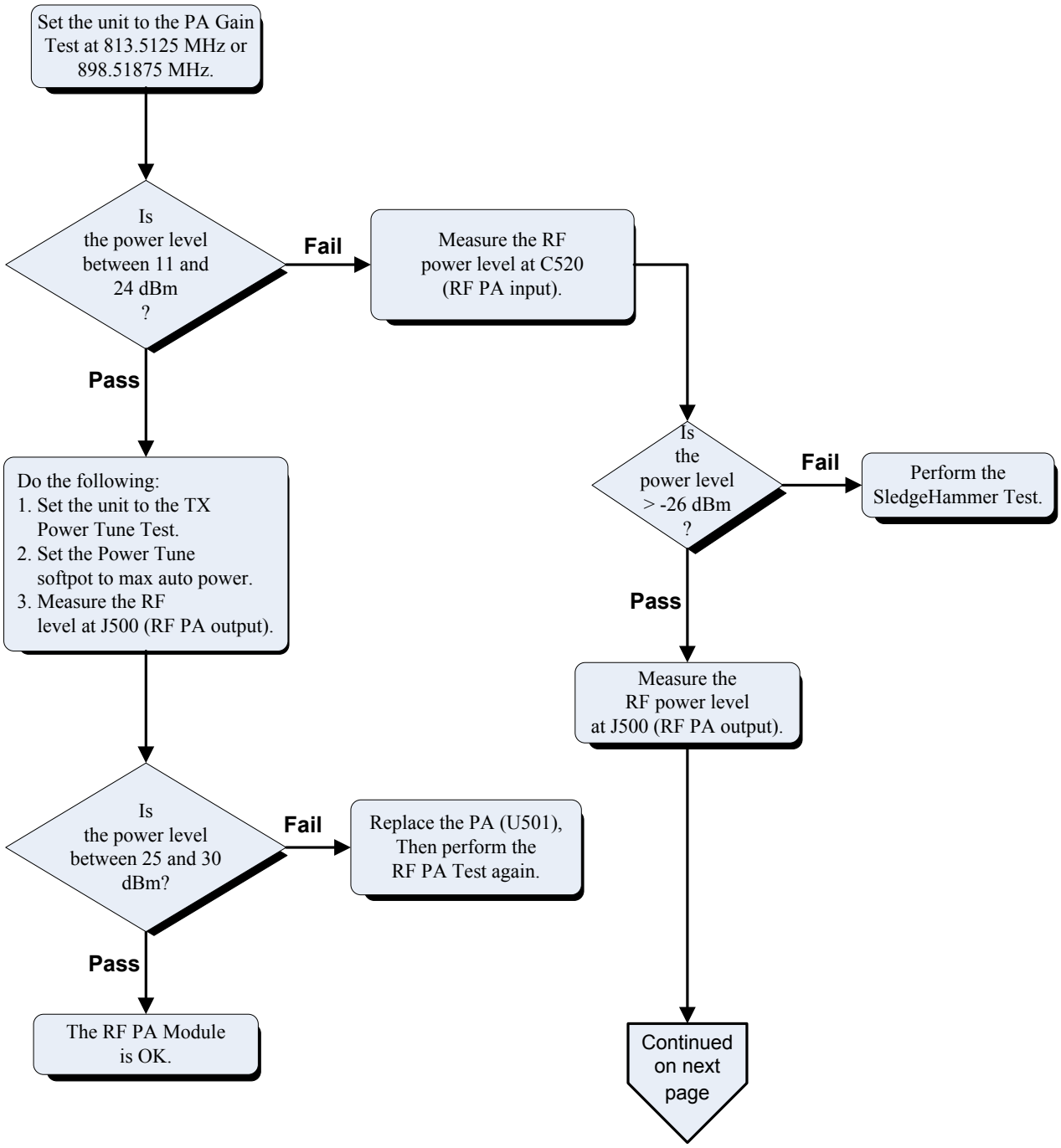
Use this test to check the transmit power circuitry.



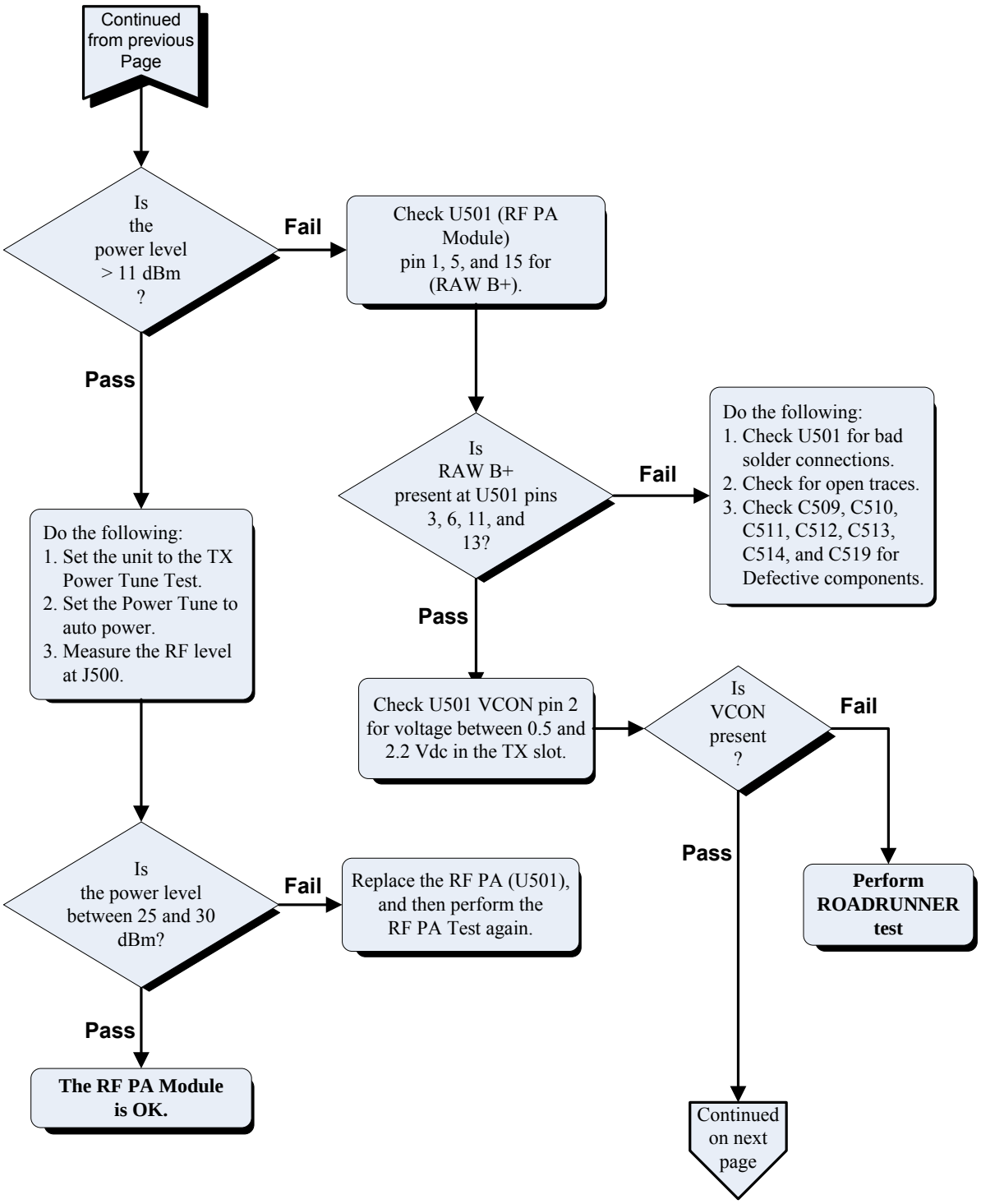
3.9 RF PA Module Test

Use this test to check the RF PA (Radio-Frequency Power Amplifier) circuitry.

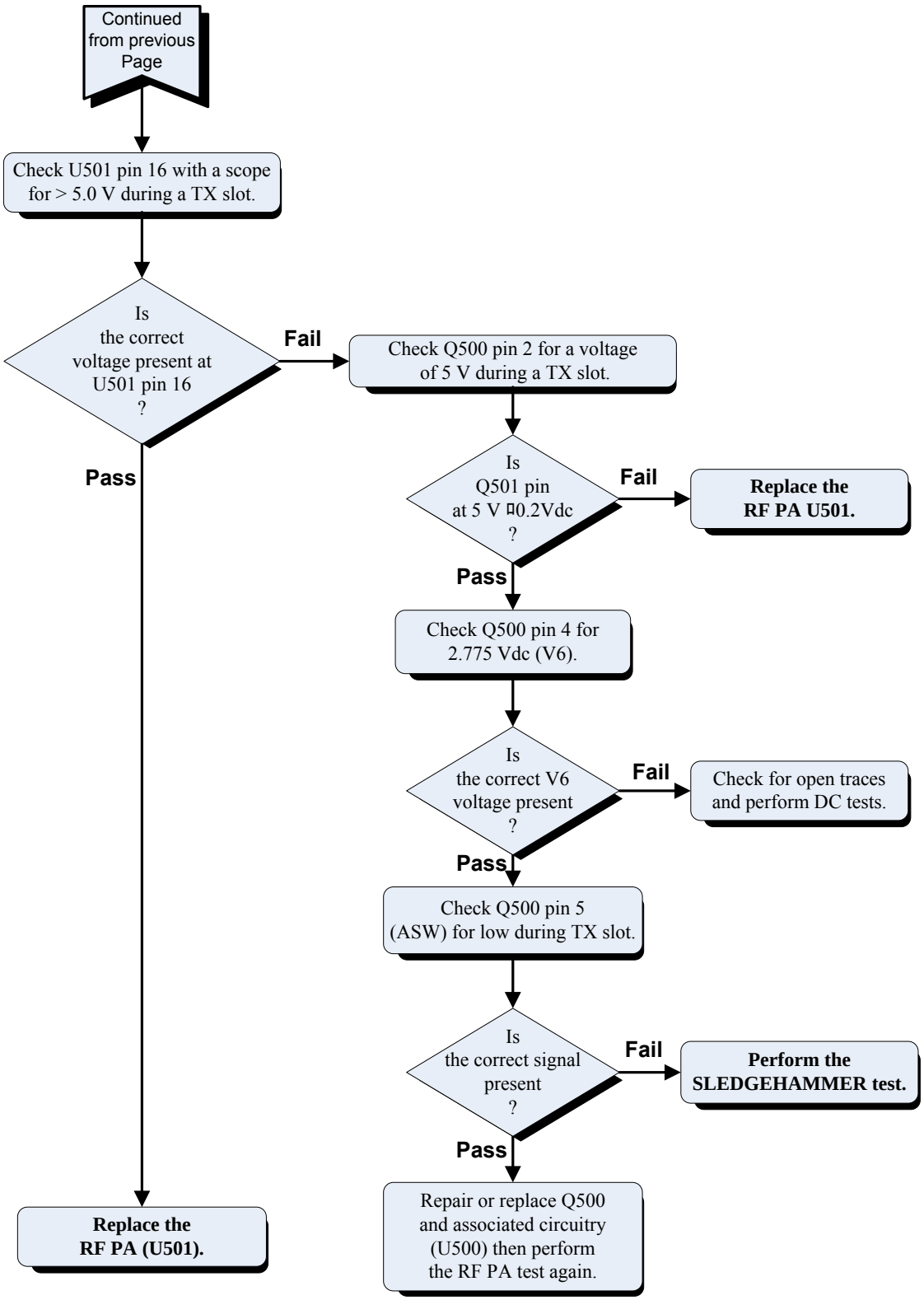
Note: Perform the Transmit Power Test before beginning the RF PA Module Test.



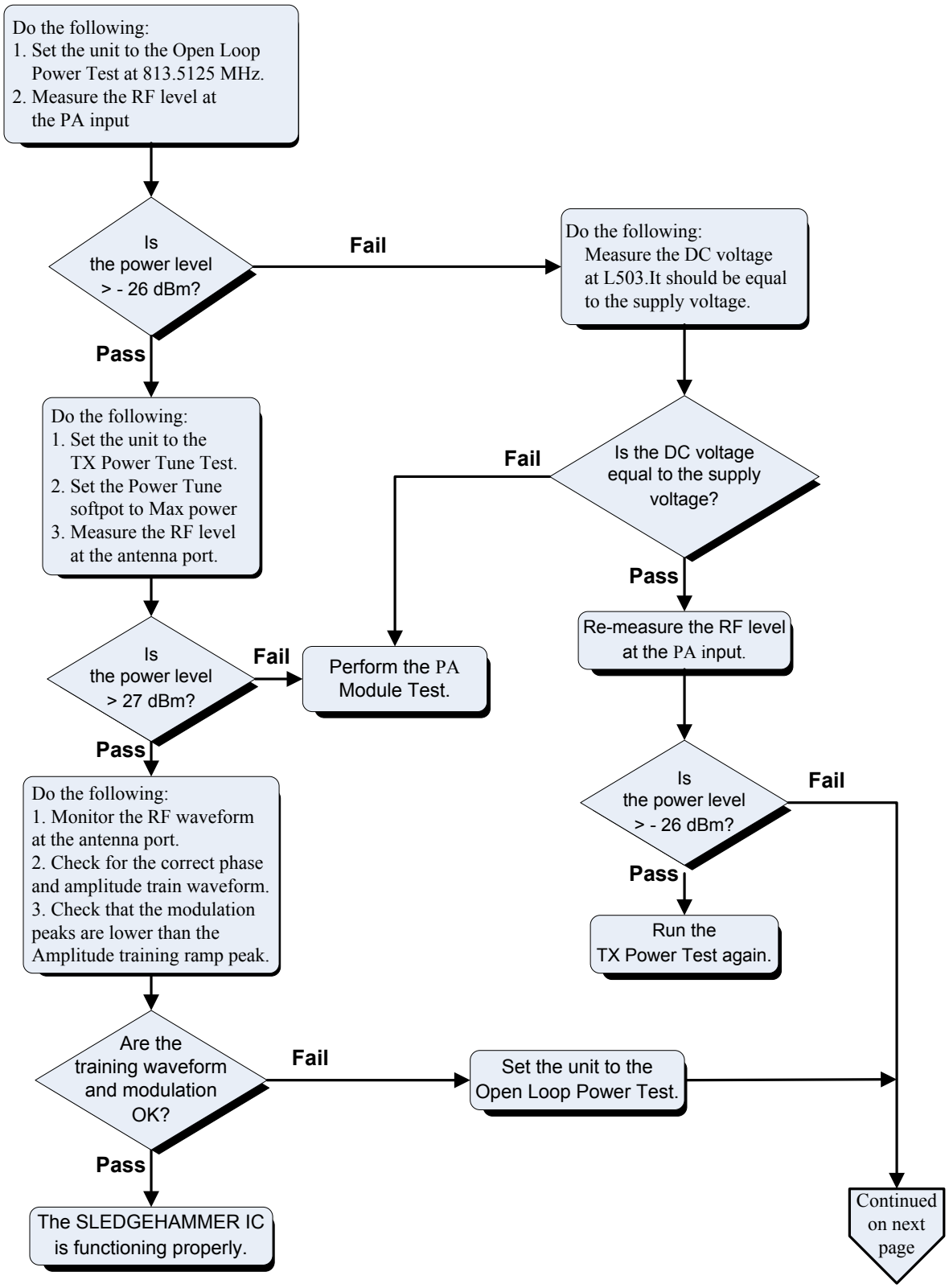
RF PA Module Test (Continued)



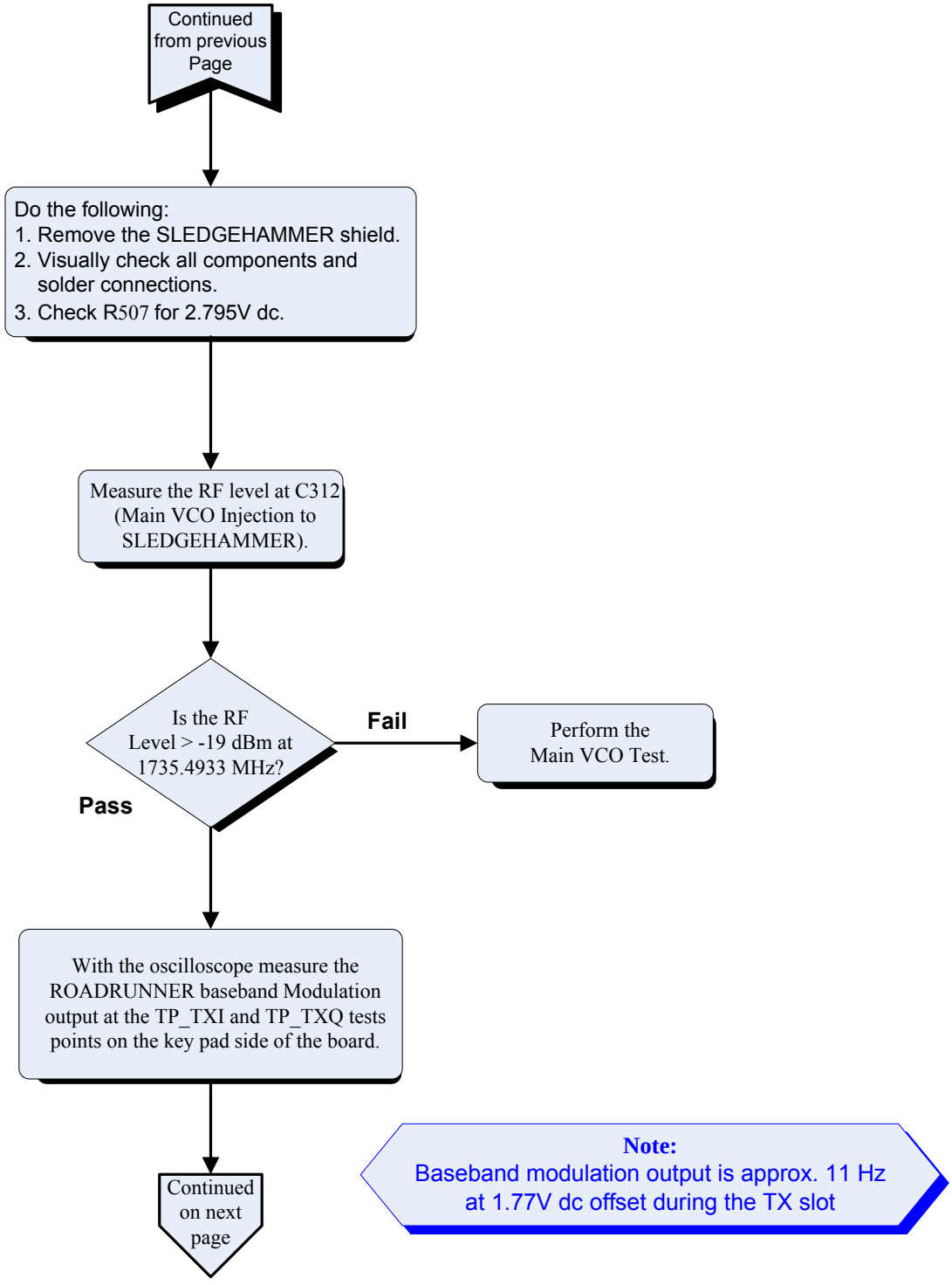
RF PA Module Test (Continued)



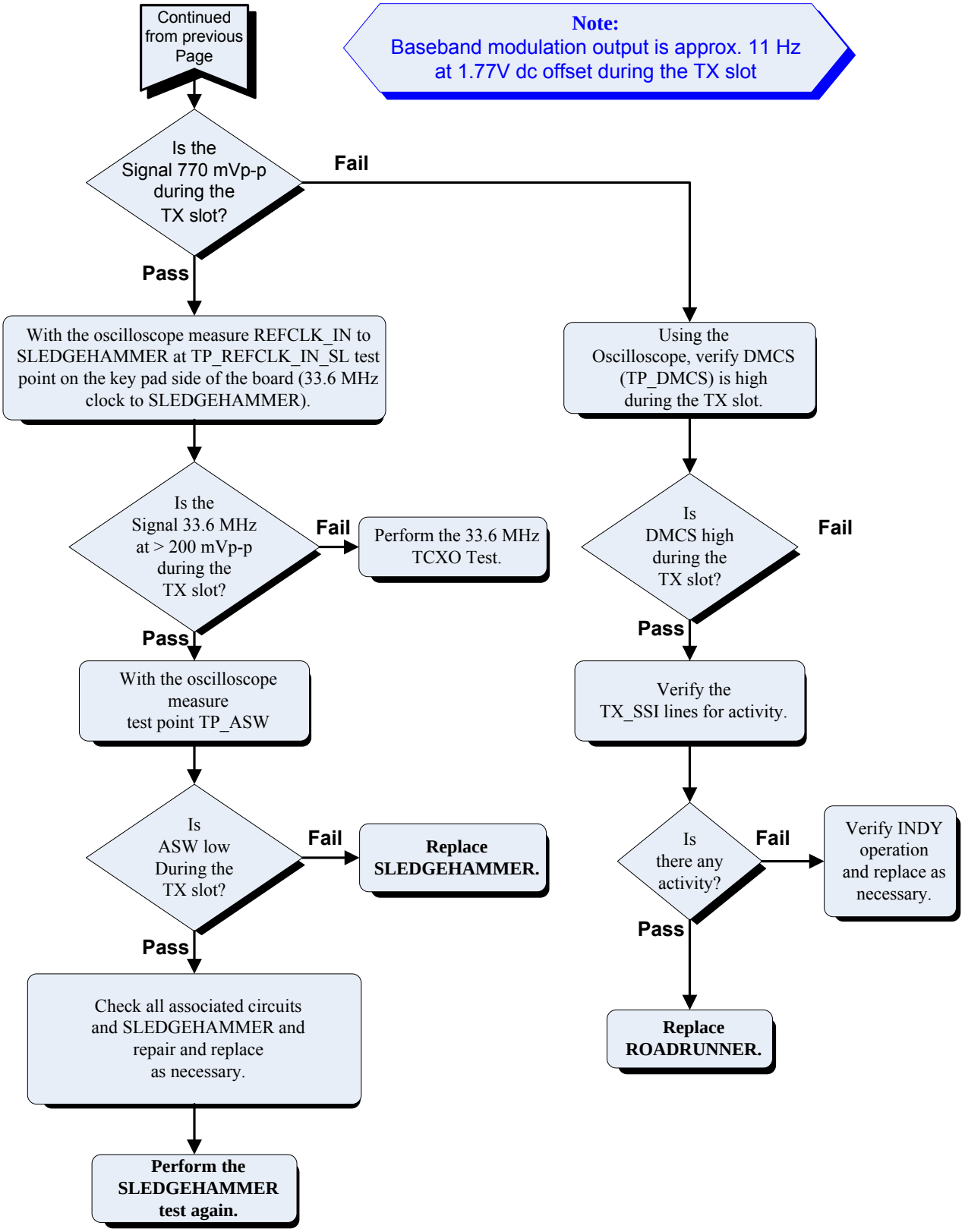
3.10 SLEDGEHAMMER TX Test



SLEDGEHAMMER TX Test (Continued)

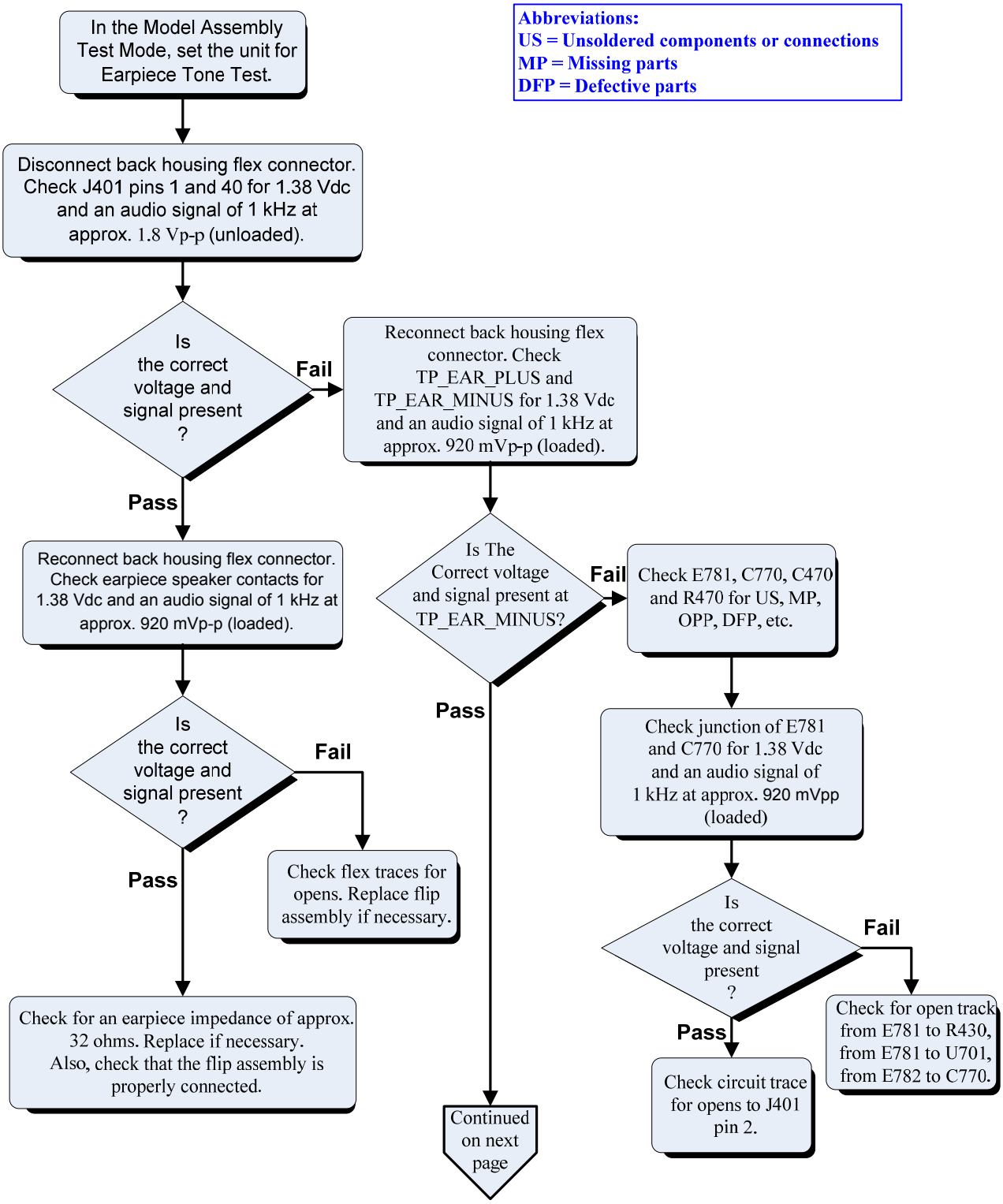


SLEDGEHAMMER TX Test (Continued)

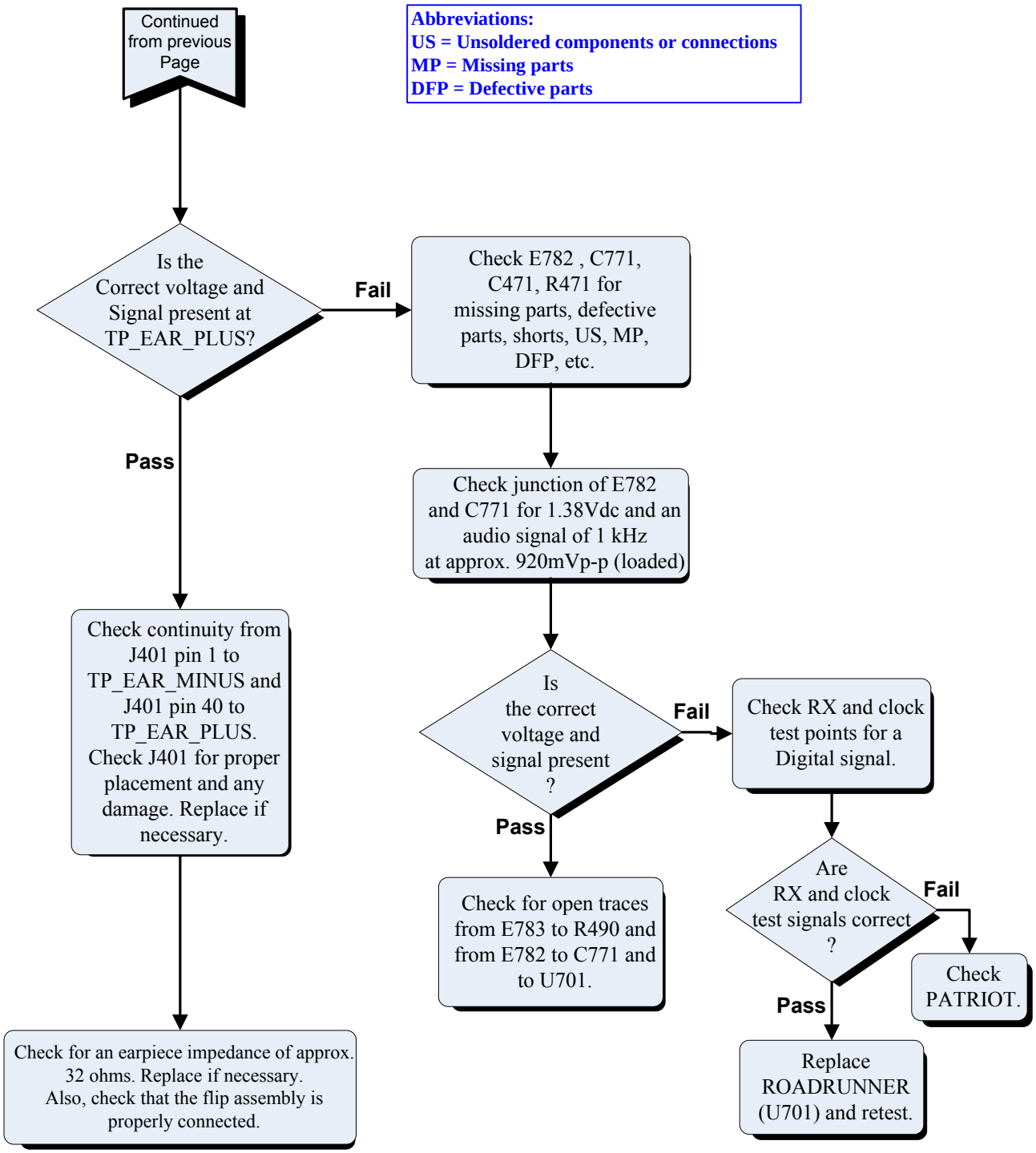


3.11 Earpiece Speaker Test

Use this test on a unit with the following symptom: no earpiece speaker audio.

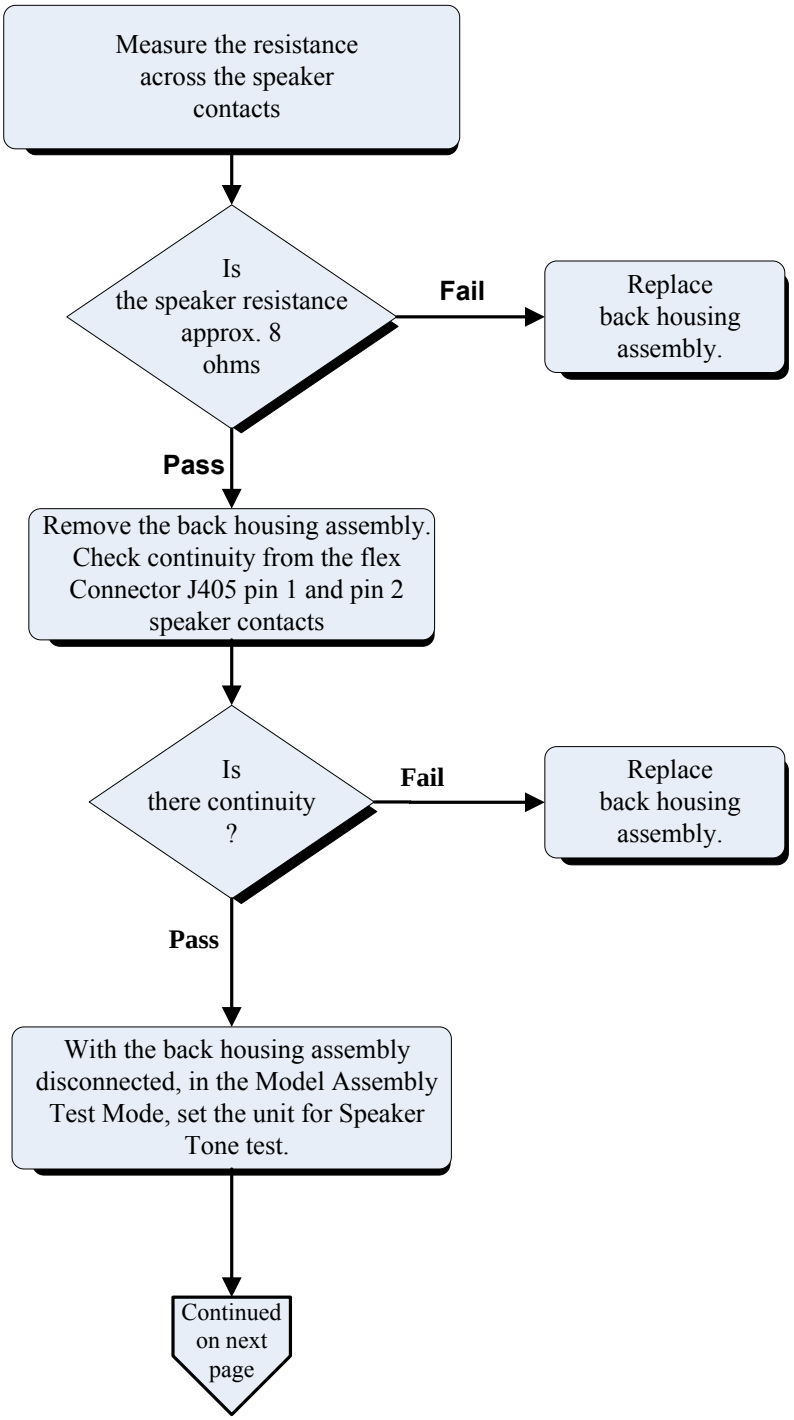


Earpiece Speaker Test (Continued)

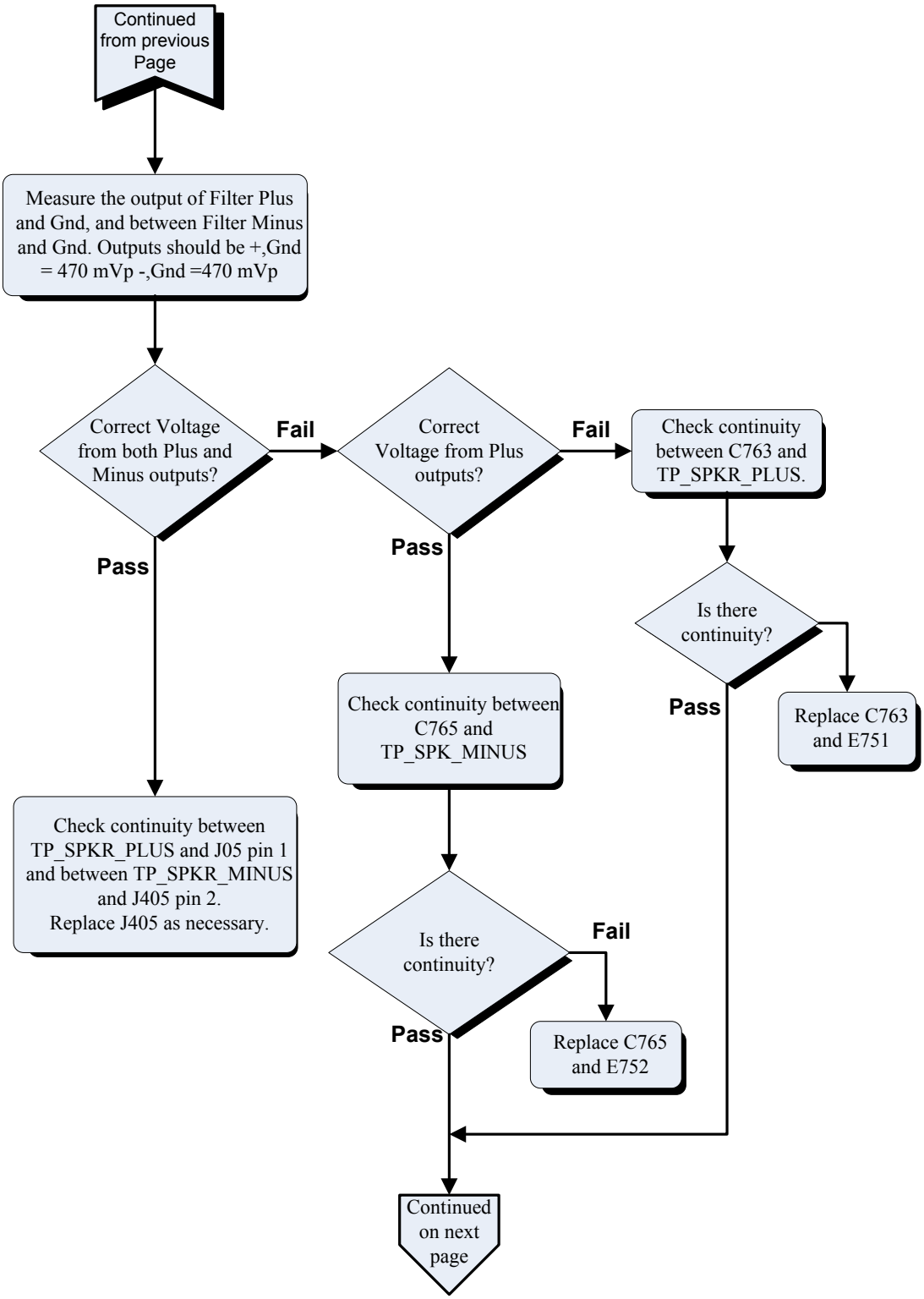


3.12 High Audio Speaker Test

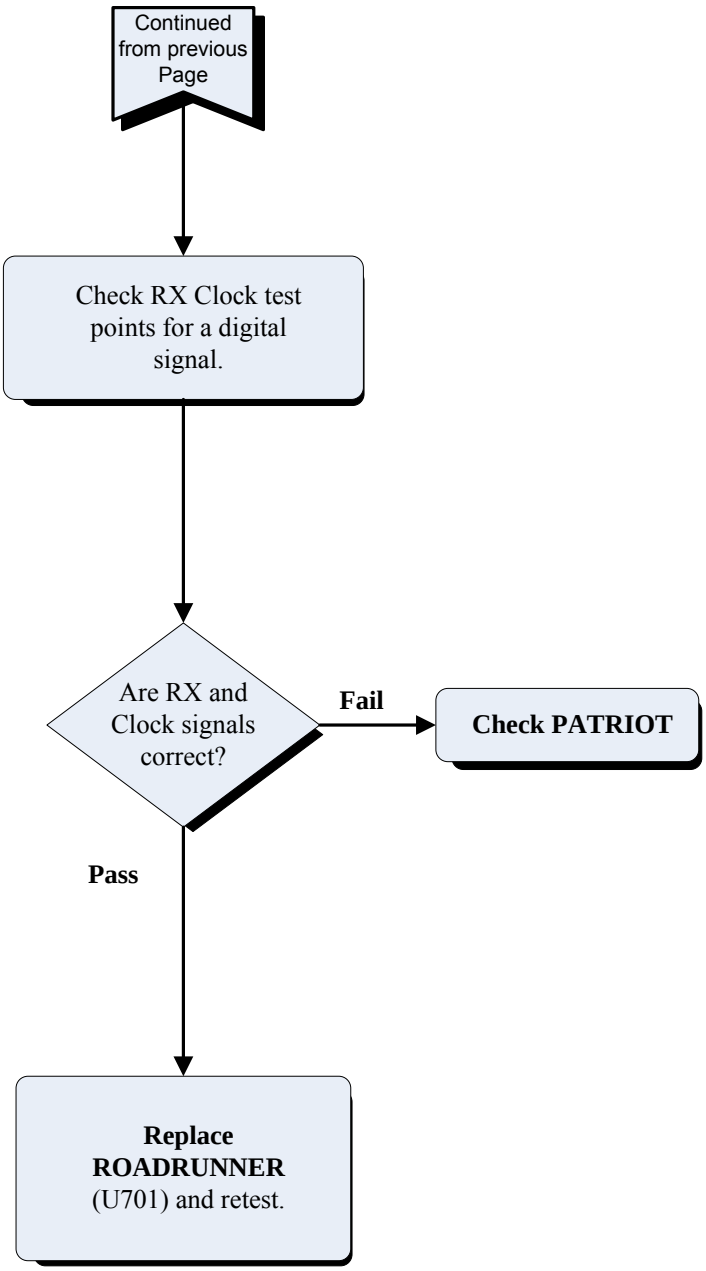
Use this test on a unit with the following symptoms: no high speaker audio



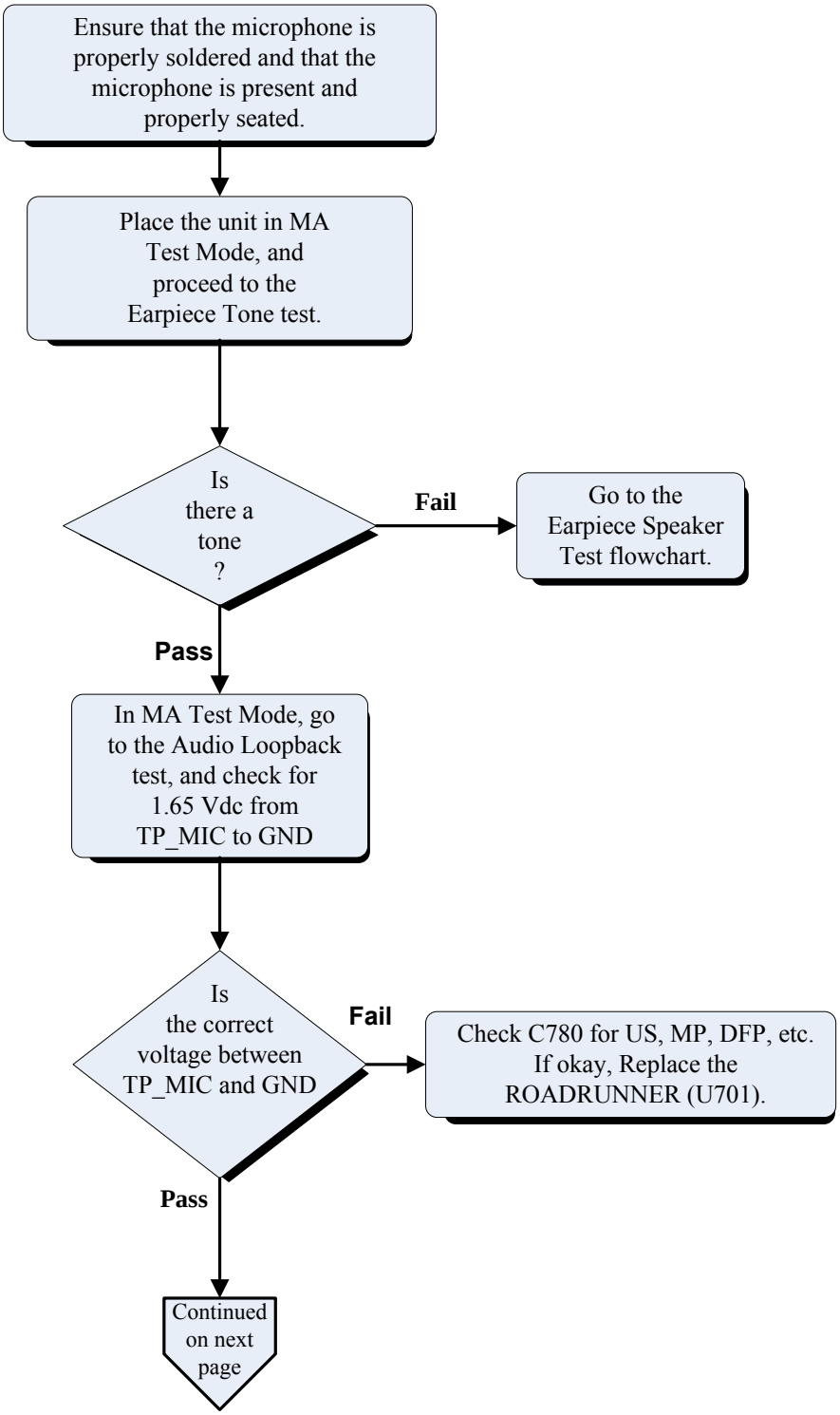
High Audio Speaker Test (Continued)



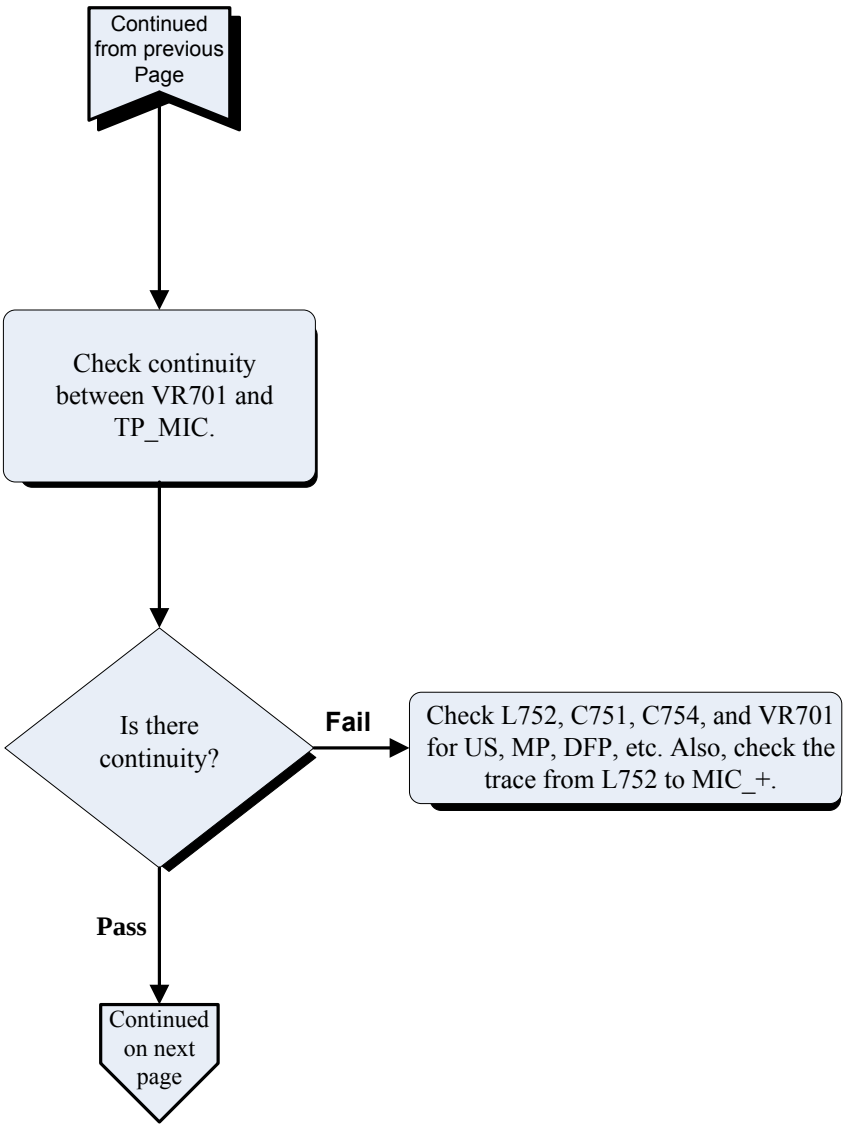
High Audio Speaker Test (Continued)



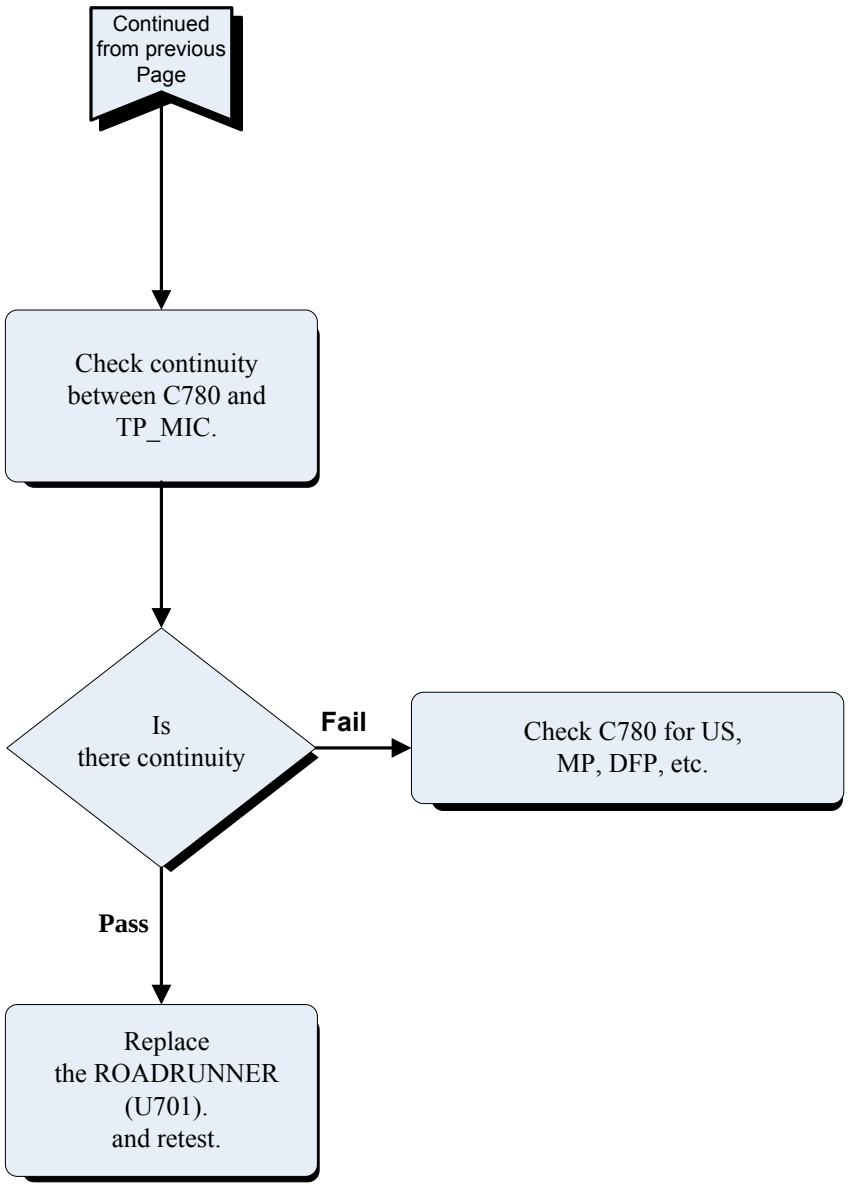
3.13 Audio Loopback Level Test



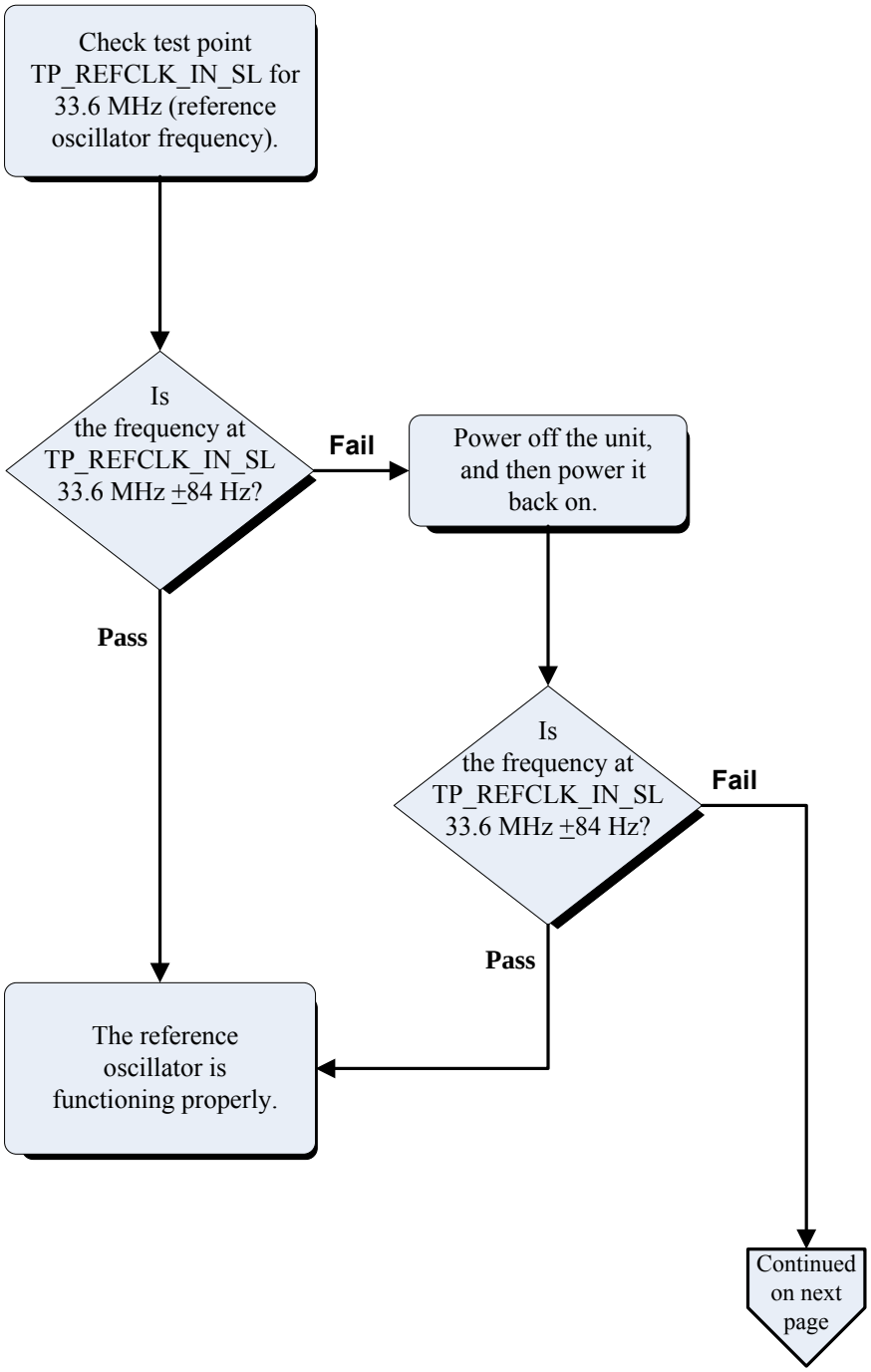
Audio Loopback Level Test (Continued)



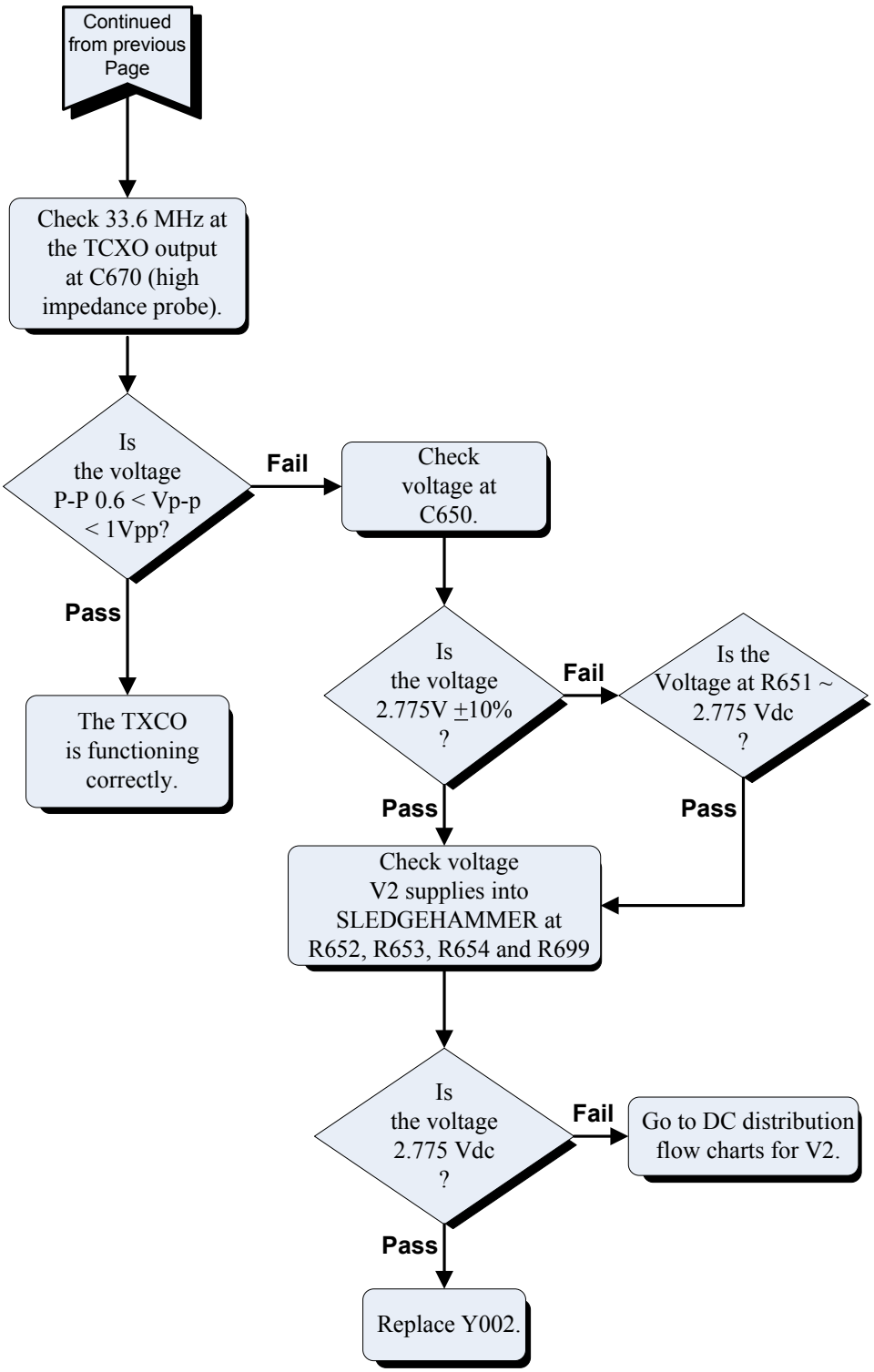
Audio Loopback Level Test (Continued)



3.14 Reference Oscillator Test

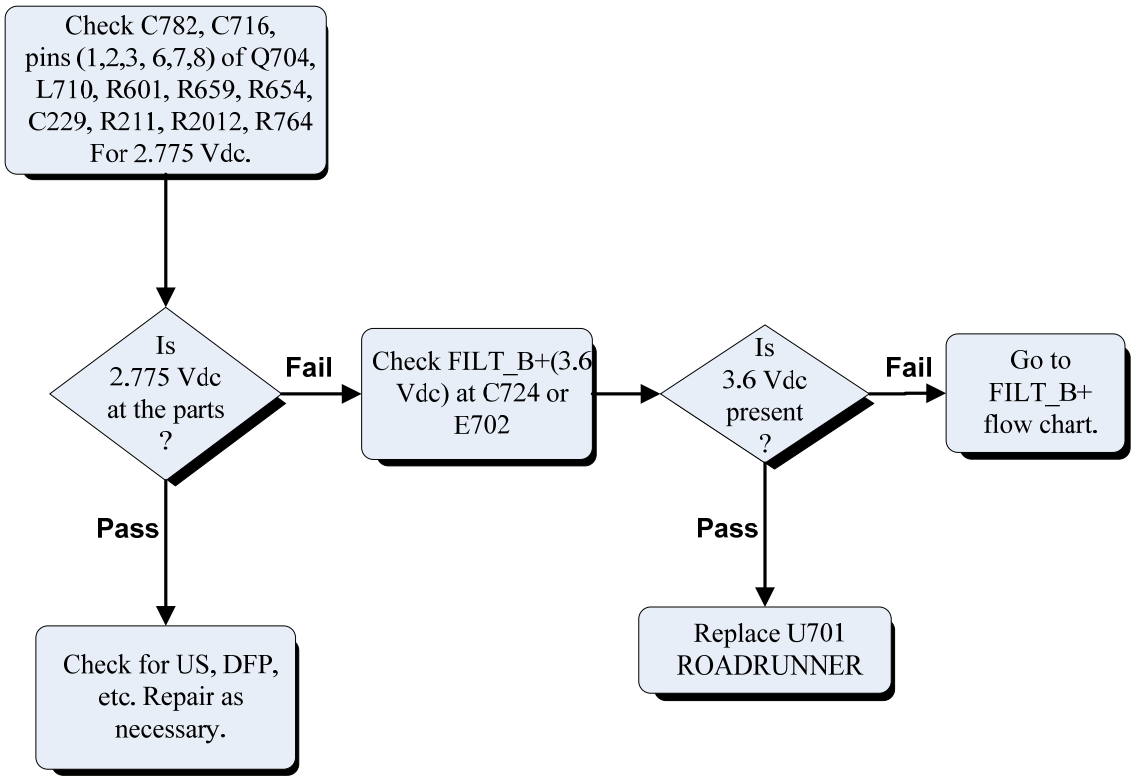


Reference Oscillator Test (Continued)



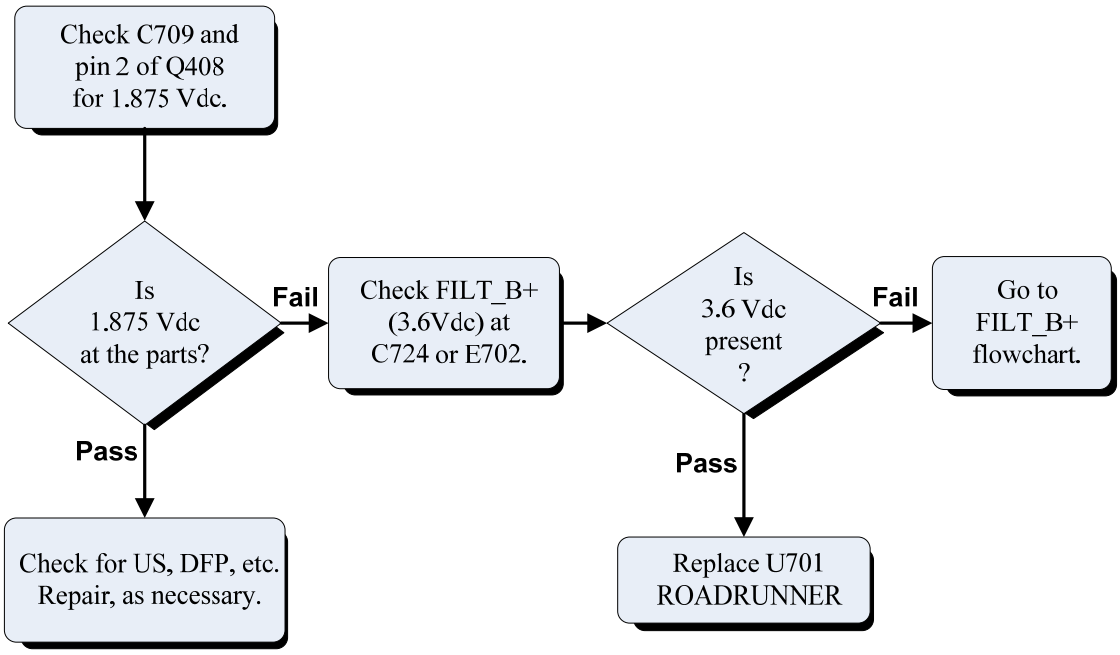
3.15 DC Distribution (V2) Test

Use this test on a unit with the following symptom: no V2 (2.775 Vdc).



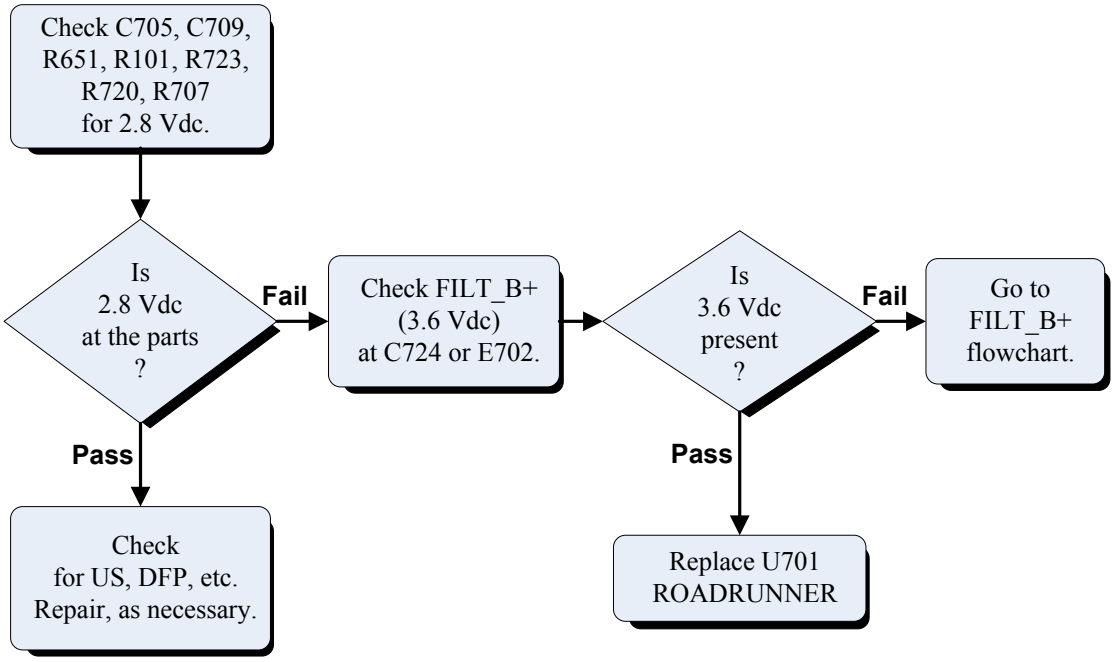
3.16 DC Distribution (V3) Test

Use this test on a unit with the following symptom: no V3 (1.875 Vdc).



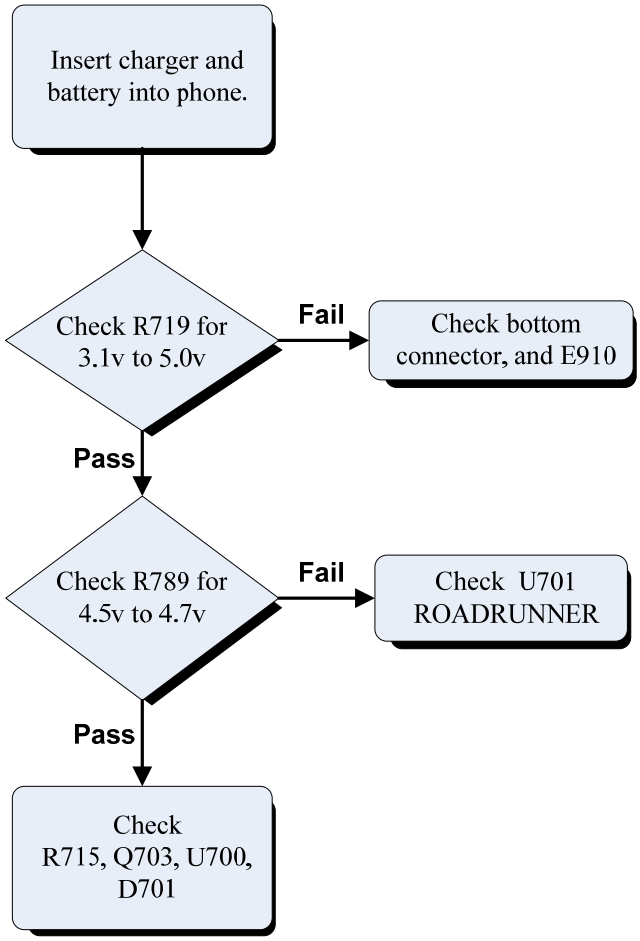
3.17 DC Distribution (V4) Test

Use this test on a unit with the following symptom: no V4 (2.8Vdc).



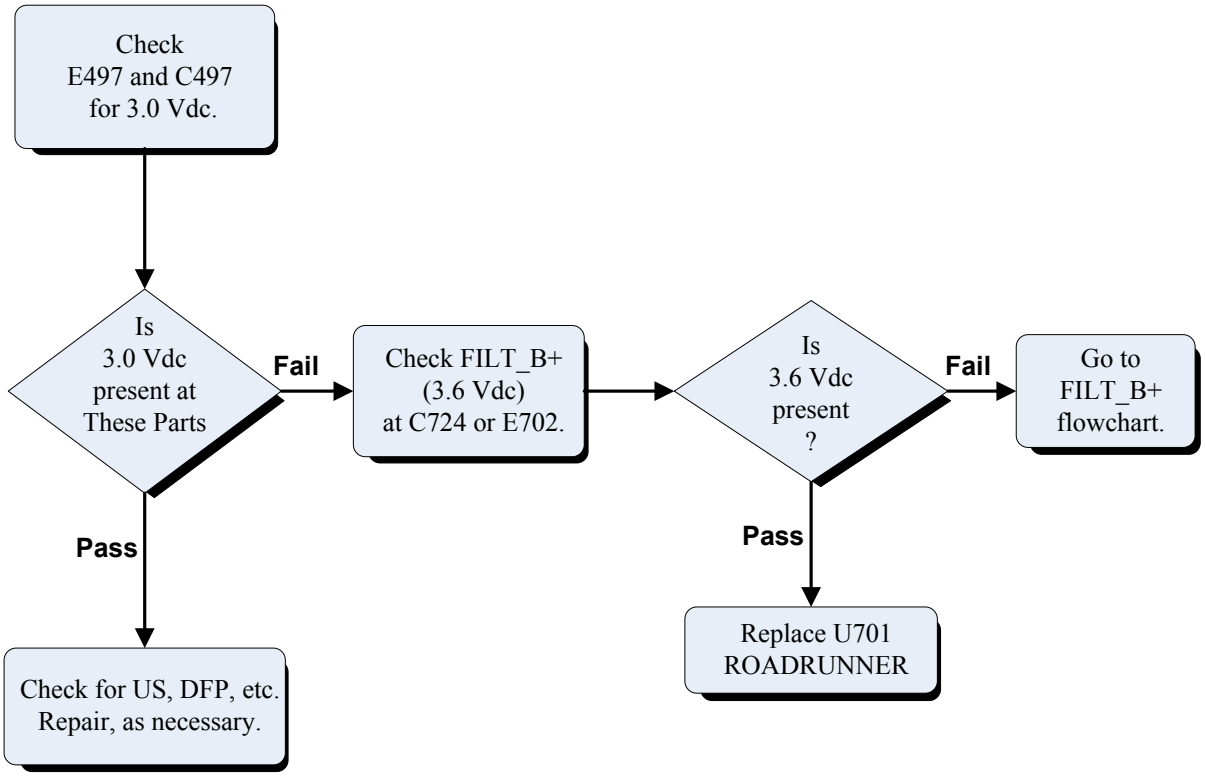
3.18 DC Distribution (4.5V Pre-Regulator) Test

Use this test on a unit with the following symptom: no charger.



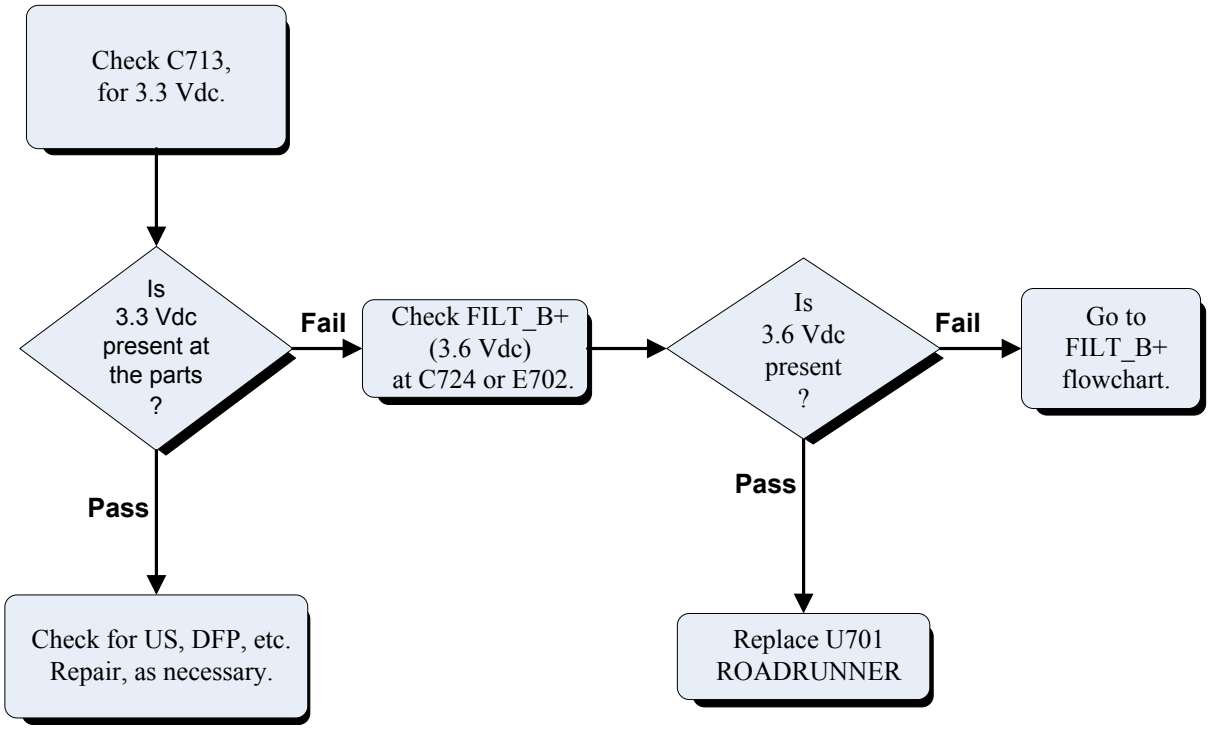
3.19 DC Distribution (V_VIB) Test

Use this test on a unit with the following symptom: no V_VIB (3.0 Vdc).



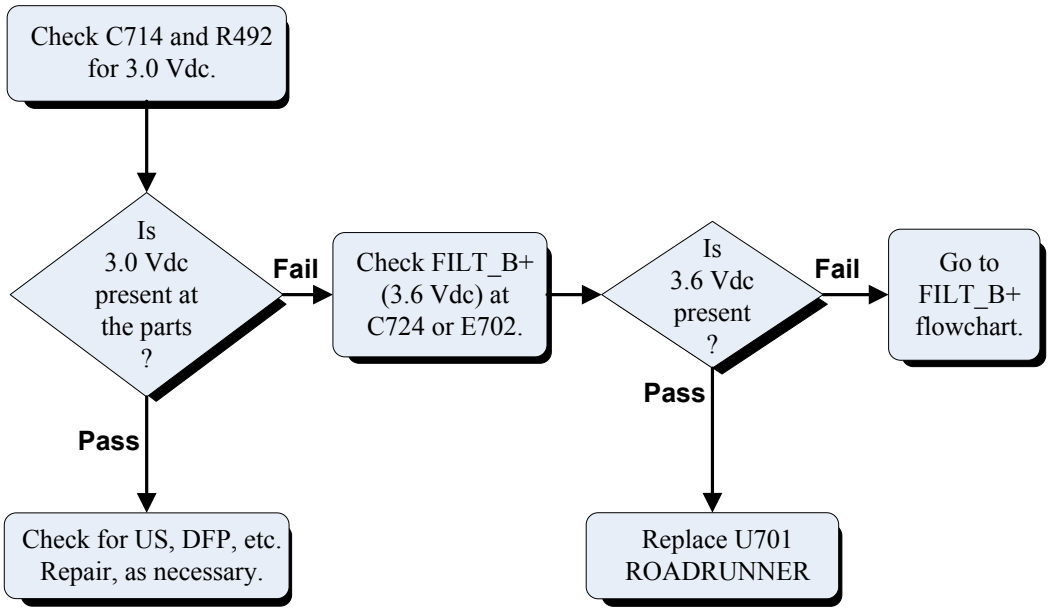
3.20 DC Distribution (VUSB) Test

Use this test on a unit with the following symptom: no VUSB (3.3 Vdc).



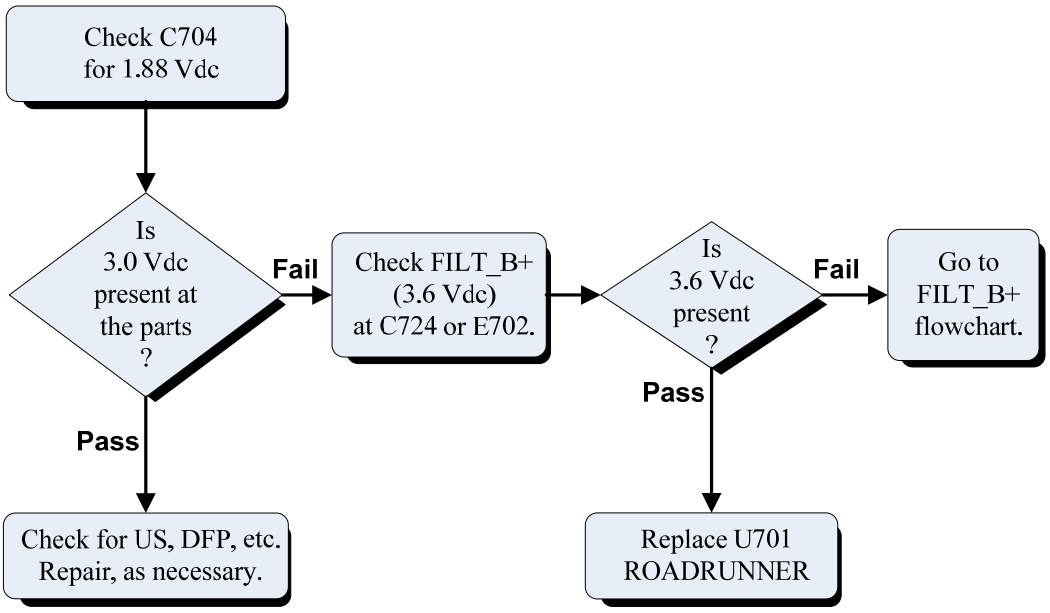
3.21 DC Distribution (VSIM) Test

Use this test on a unit with the following symptom: no VSIM (3.0 Vdc).



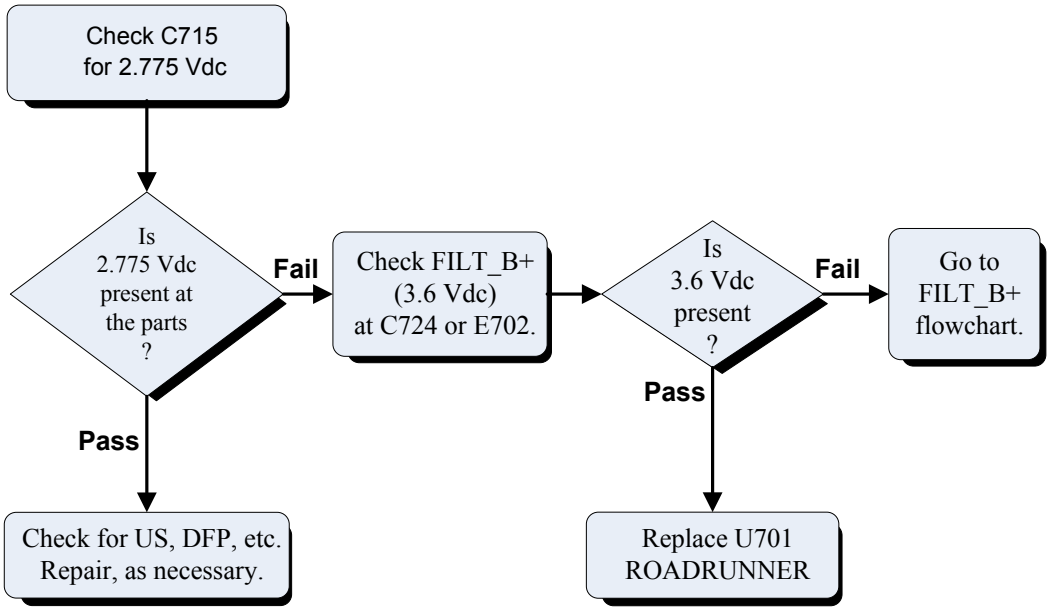
3.22 DC Distribution (VHOLD) Test

Use this test on a unit with the following symptom: no VHOLD (1.88 Vdc).



3.23 DC Distribution (VC Reg) Test

Use this test on a unit with the following symptom: no VC Reg (2.775 Vdc).



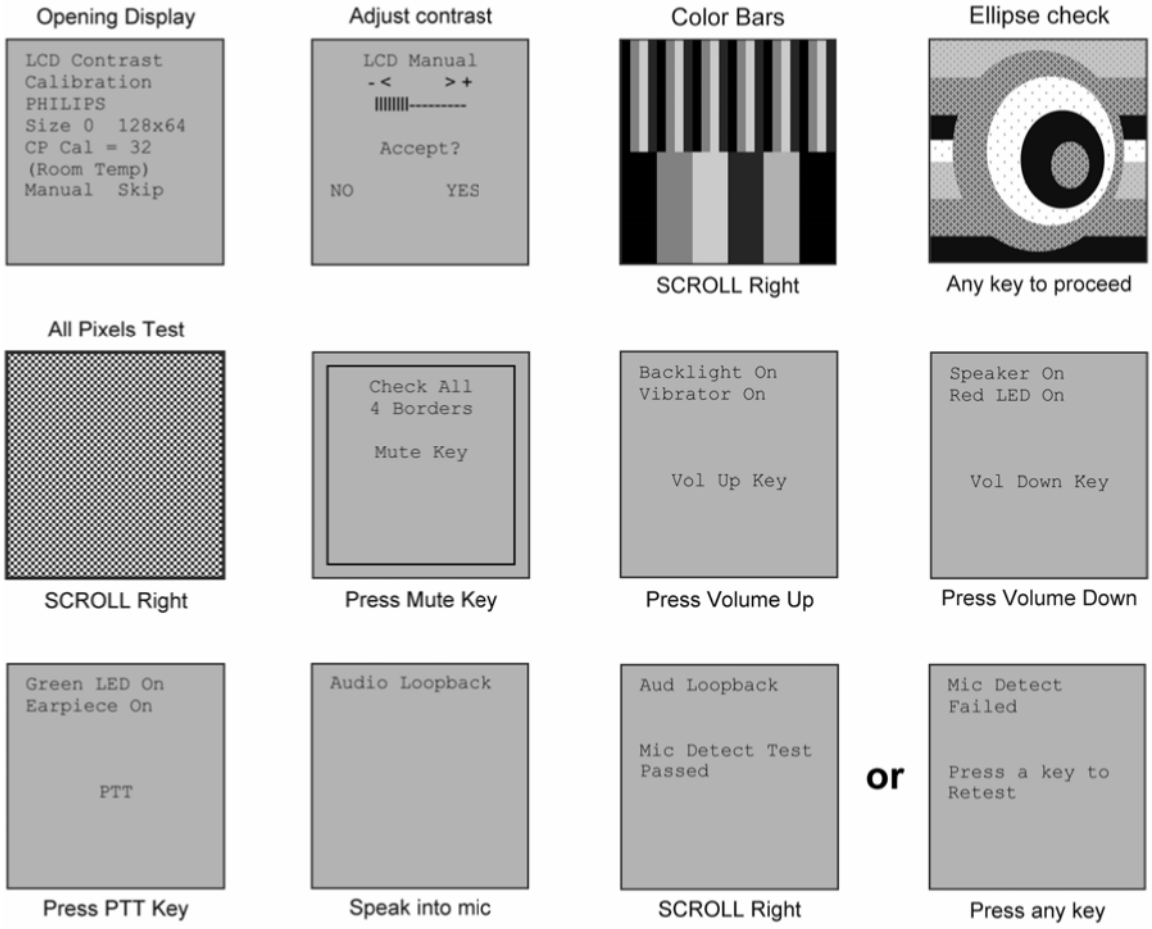
3.24 Model Assembly (MA) Test Mode Test

- Model Assembly Test Mode is an embedded series of operational tests of the unit's user interface and functional features.
- Motorola iDEN recommends MA Test Mode be performed after any servicing of the unit.
- An Audio Test Cable is required to complete test mode correctly. See the Required Tools section or contact Motorola's Aftermarket Accessories Division.

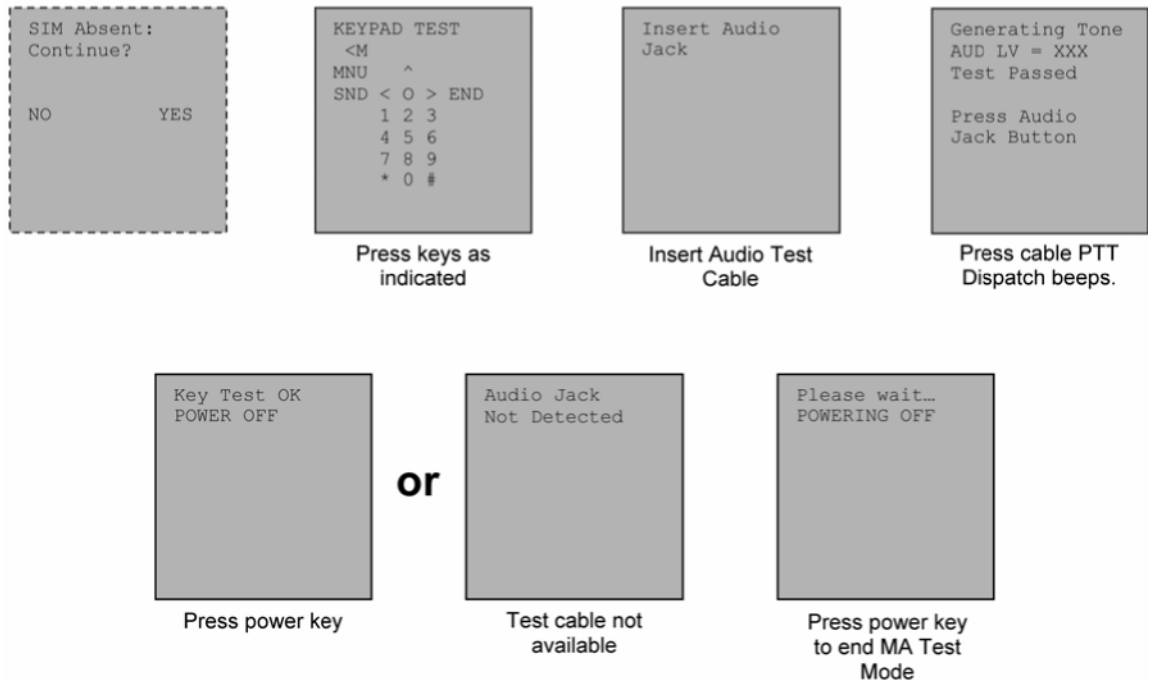
MA Test mode is achieved by starting from a power-down condition:

1. Press and hold three keys in a row such as 1-2-3, 4-5-6, 7-8-9, ÷-O-#. Simultaneously, press the Power key
2. Release all keys once the opening screen appears in the main display.
3. Follow instructions as they appear pressing the indicated keys.
4. No instruction? Press any key or Scroll right.
5. No reaction? Power down the unit, check battery condition, and start MA Test again.

Screen displays are depicted as follows:



Model Assembly (MA) Test Mode Test (cont.)



3.25 GPS Receiver Test

The Conducted signal testing described below can be performed to analyze or root cause an issue along the GPS RF subsystem, using a CW signal. The following tests are implemented in Factory Test Mode (BERBUG Mode).

Test Setup

1. Set up the CW generator as follows: Frequency = 1575.42 MHz, Amplitude level = -110 dBm. Amplitude levels above -105 dBm will compress the back end GRF2M RFIC.

2. Remove the antenna and replace it with a 50O coax. Power up the Unit Under Test (UUT), and connect the CW generator to the UUT.

3. Using Hyper Terminal, GPS is turned on as follows:

   BERBUG > gps on

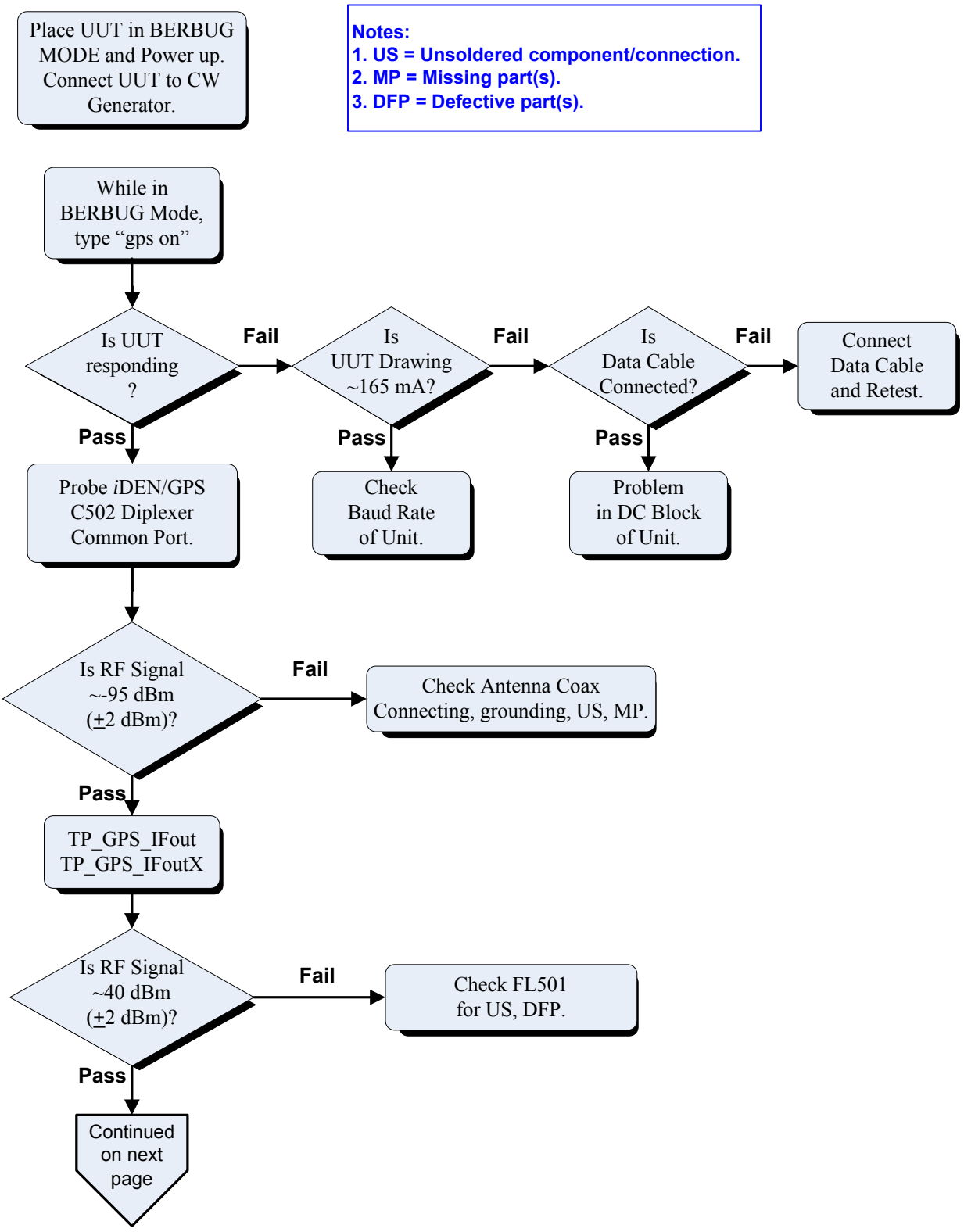
4. Set the Spectrum Analyzer to Center Frequency = 1575.42 MHz, Span = 1 MHz, Amplitude Reference Level = 50 dBm.

5. Use a High Impedance Probe to follow the signal flow along the GPS RF subsystem, block by block.

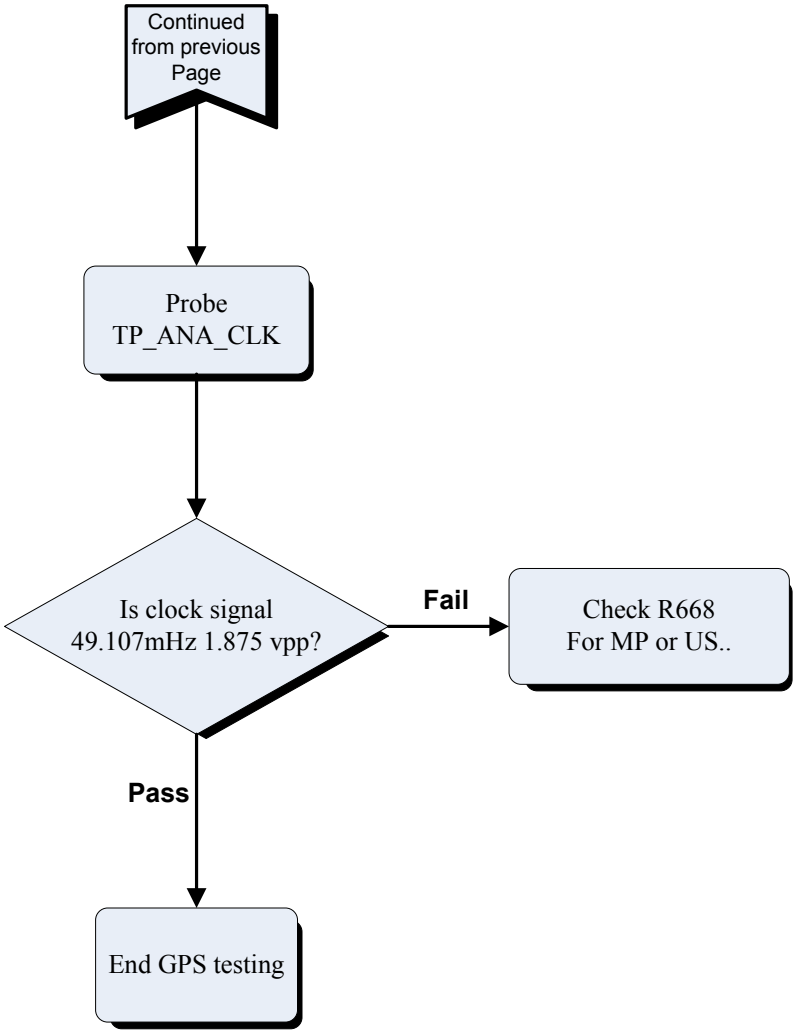
DC Power Supply

When testing, it is advisable to utilize an external DC Power supply set at 4 Volts and a current level of 2 Amps. In BERBUG Mode, the UUT is expected to draw 115 mA to 120 mA at power up. By entering “gps on” the UUT should draw 165 mA to 170 mA.

GPS Receiver Test (Continued)



GPS Receiver Test (Continued)



3.26 Mototalk (i290 ONLY)

Since the iDEN Receiver and Transmitter Hardware are used for Dispatch (PTT), Phone Call, and MOTOtalk modes of operation; Hardware failures that occur during MOTOtalk will also occur in Dispatch (PTT) and Phone Call modes. Therefore, the electrical troubleshooting guide for MOTOtalk, Dispatch (PTT), and Phone Call are the same.

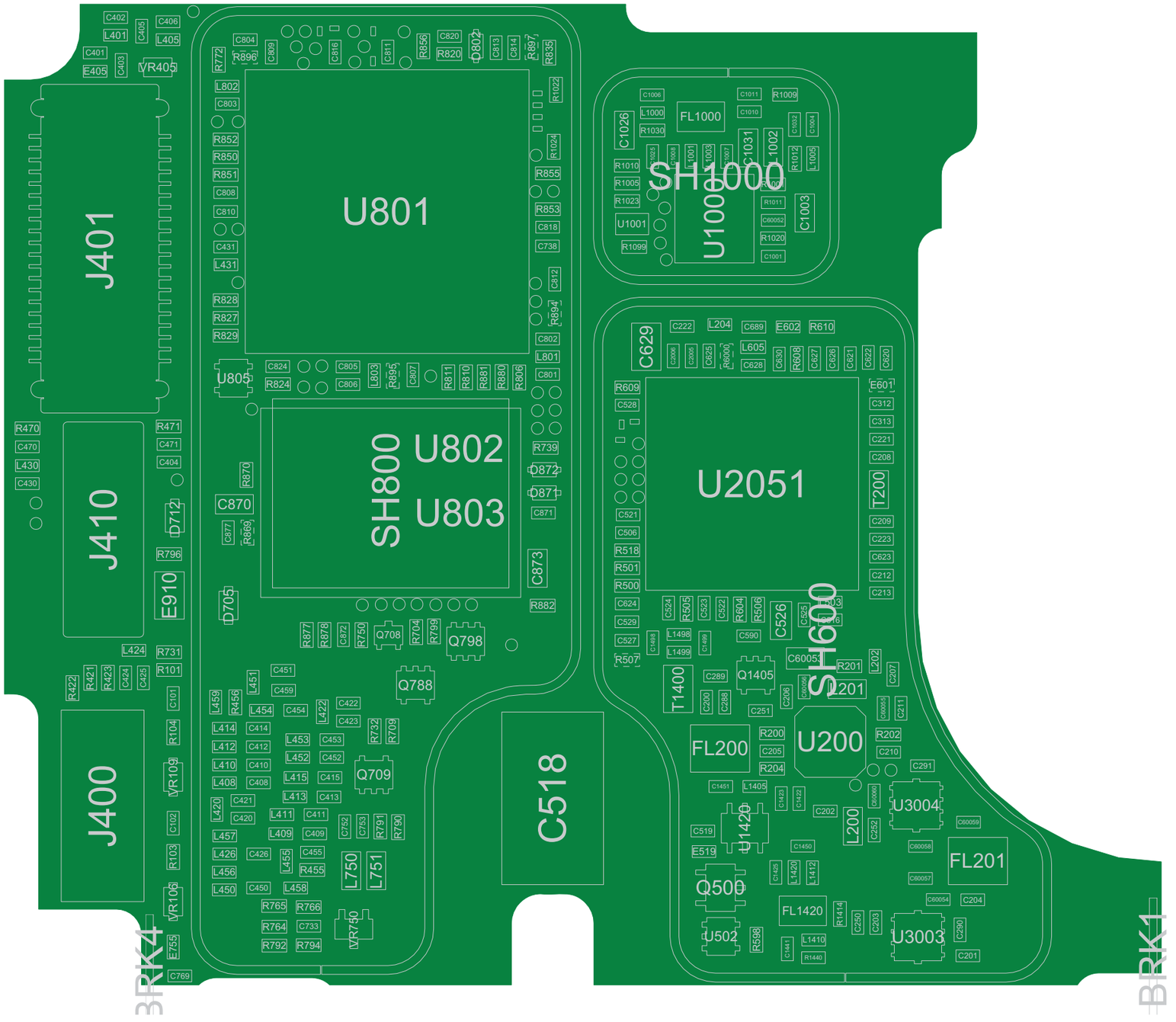
Chapter 4

SCHEMATIC DIAGRAMS AND COMPONENT LOCATION

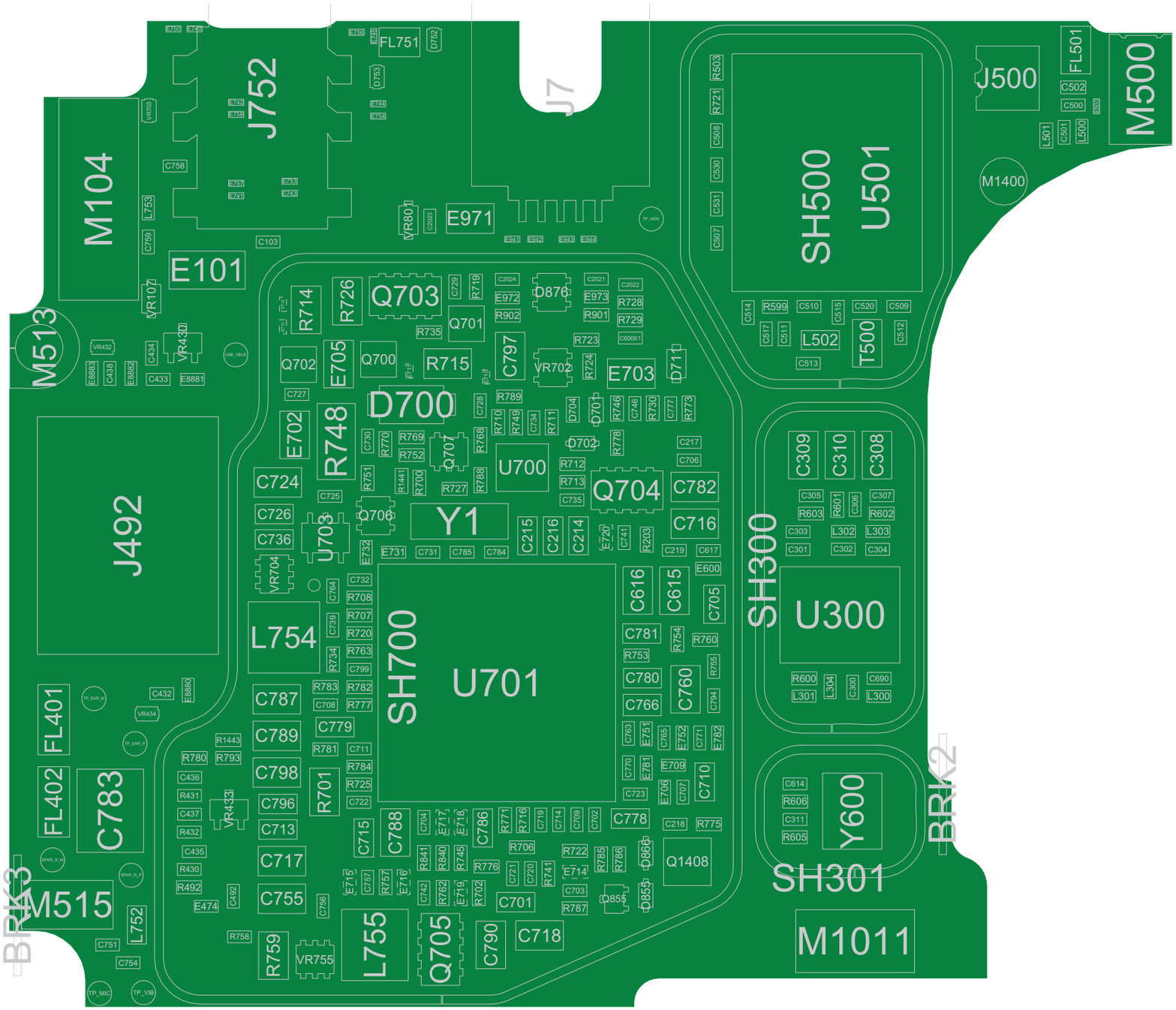
When ordering component parts, the part number and reference designator should be included.

If the correct numbers cannot be located, call Motorola Parts Identification at 1-847-538-0021.

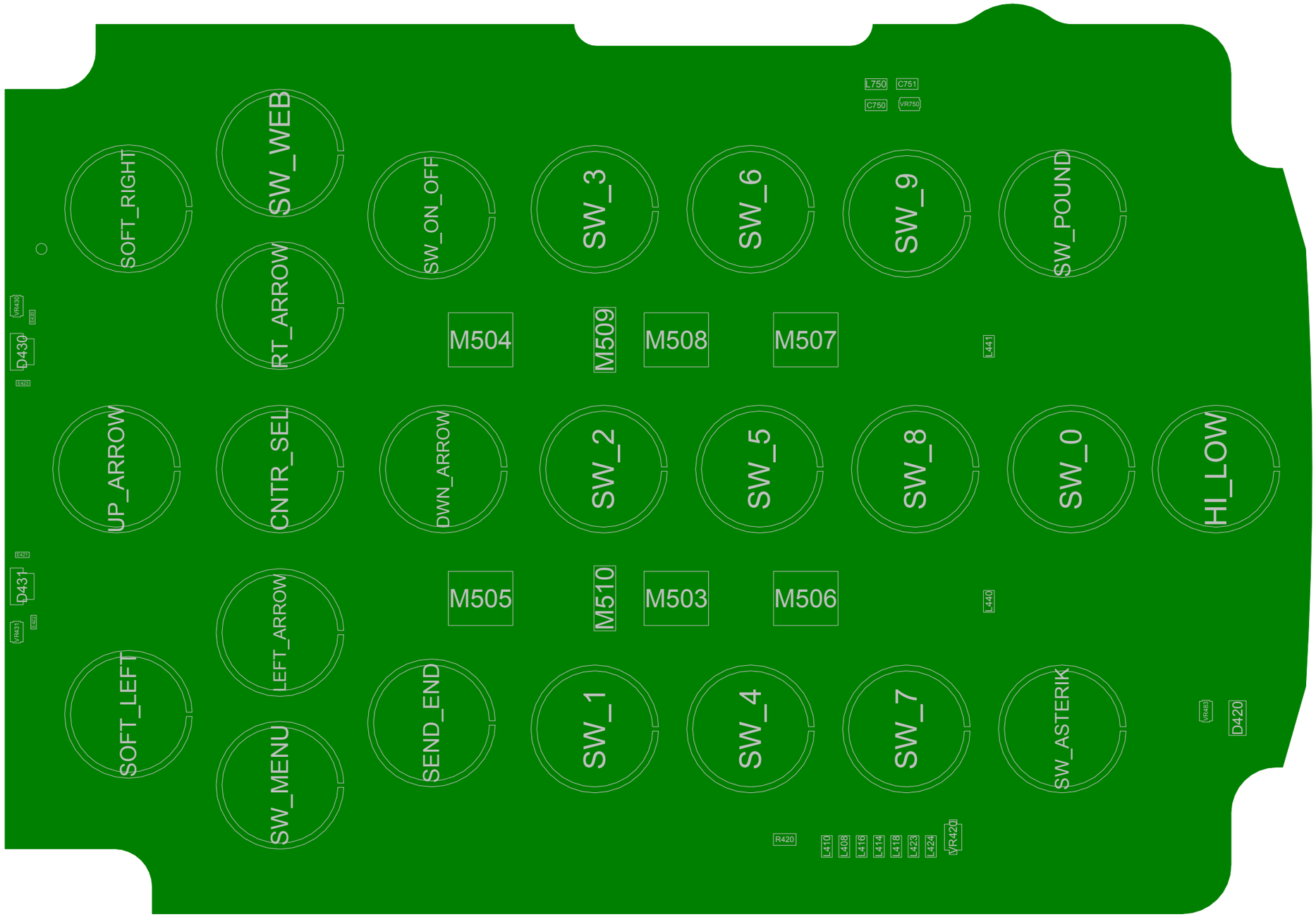
4.1 Component Layout Main Board – Front



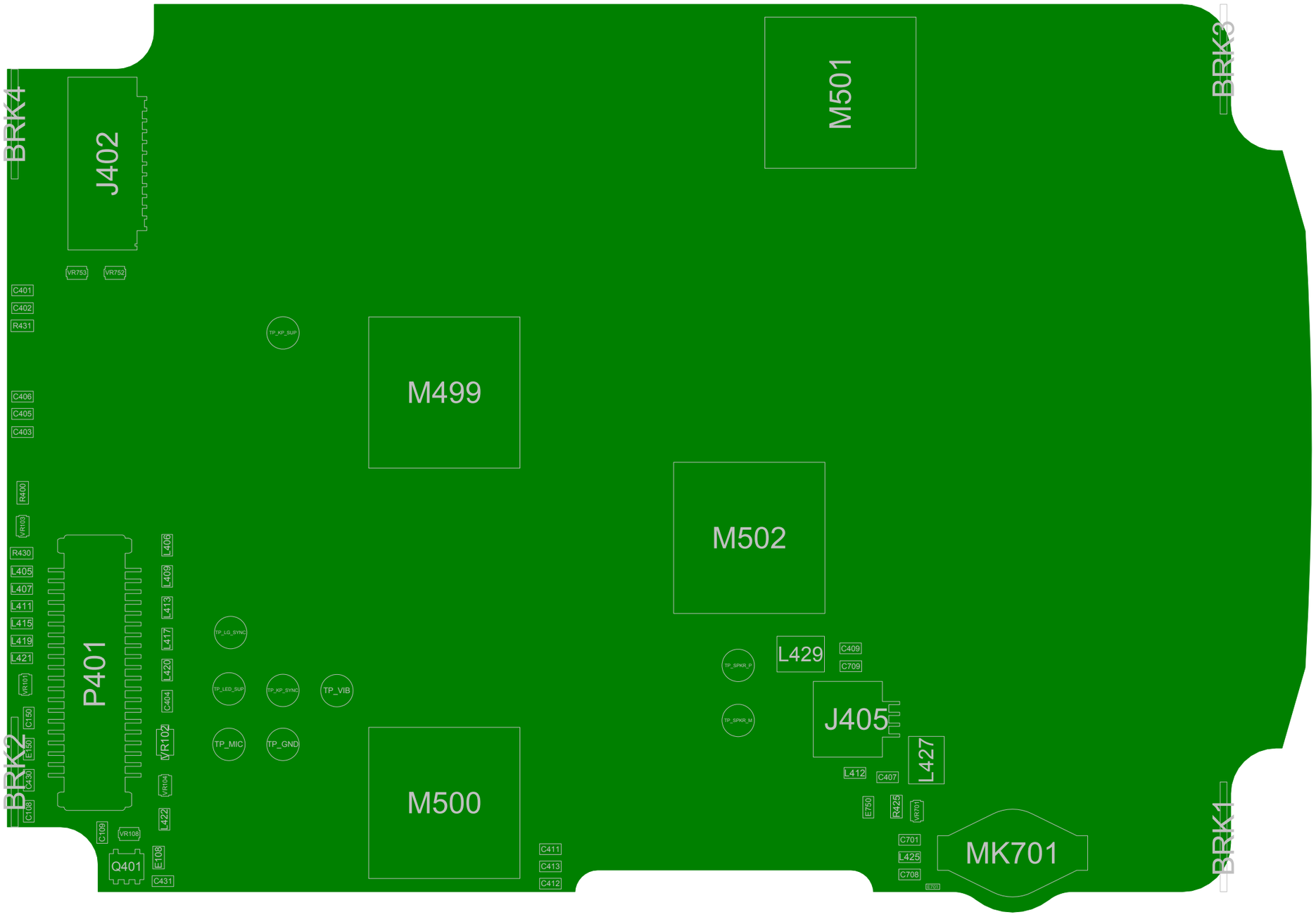
4.2 Component Layout Main Board – Back



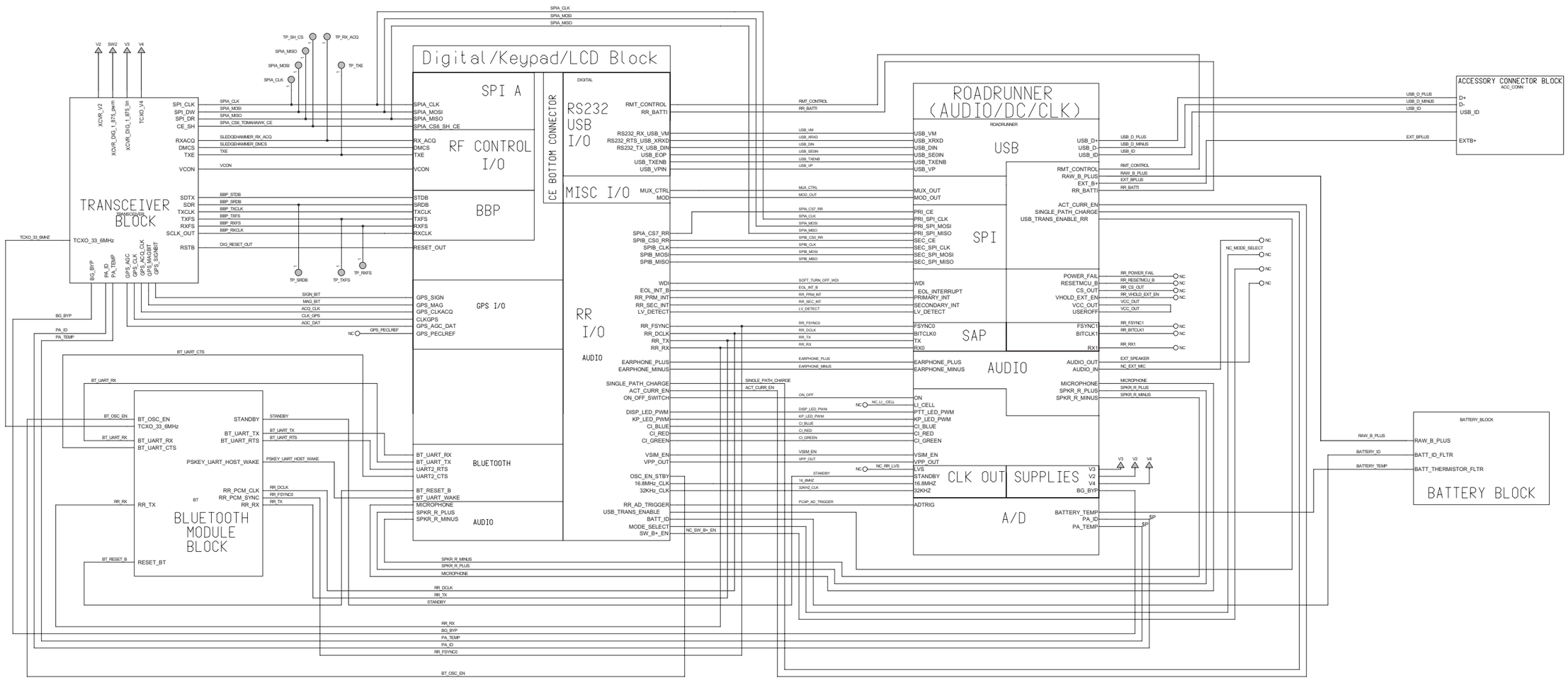
4.3 Component Layout Keypad Board – Front



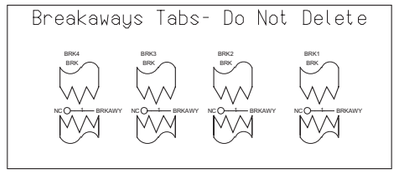
4.4 Component Layout Keypad Board – Back



4.5 MAIN PCB - Block Hierarchy

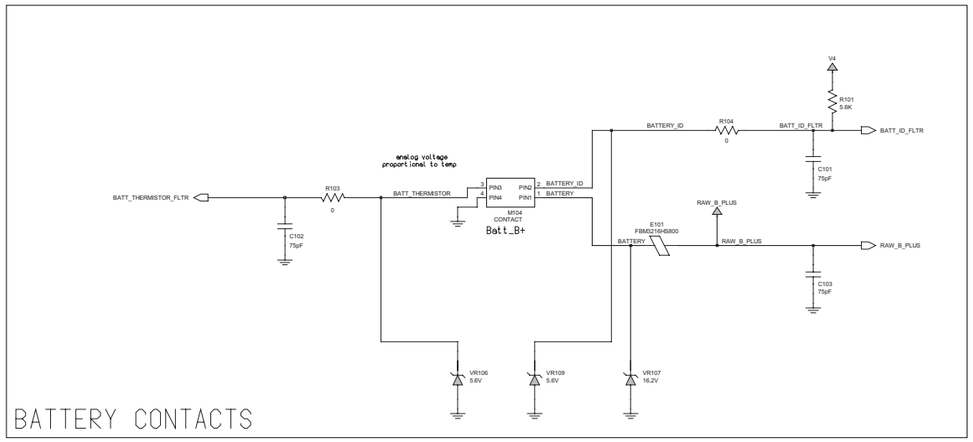


4.6 BATTERY_BLOCK - Battery Connections



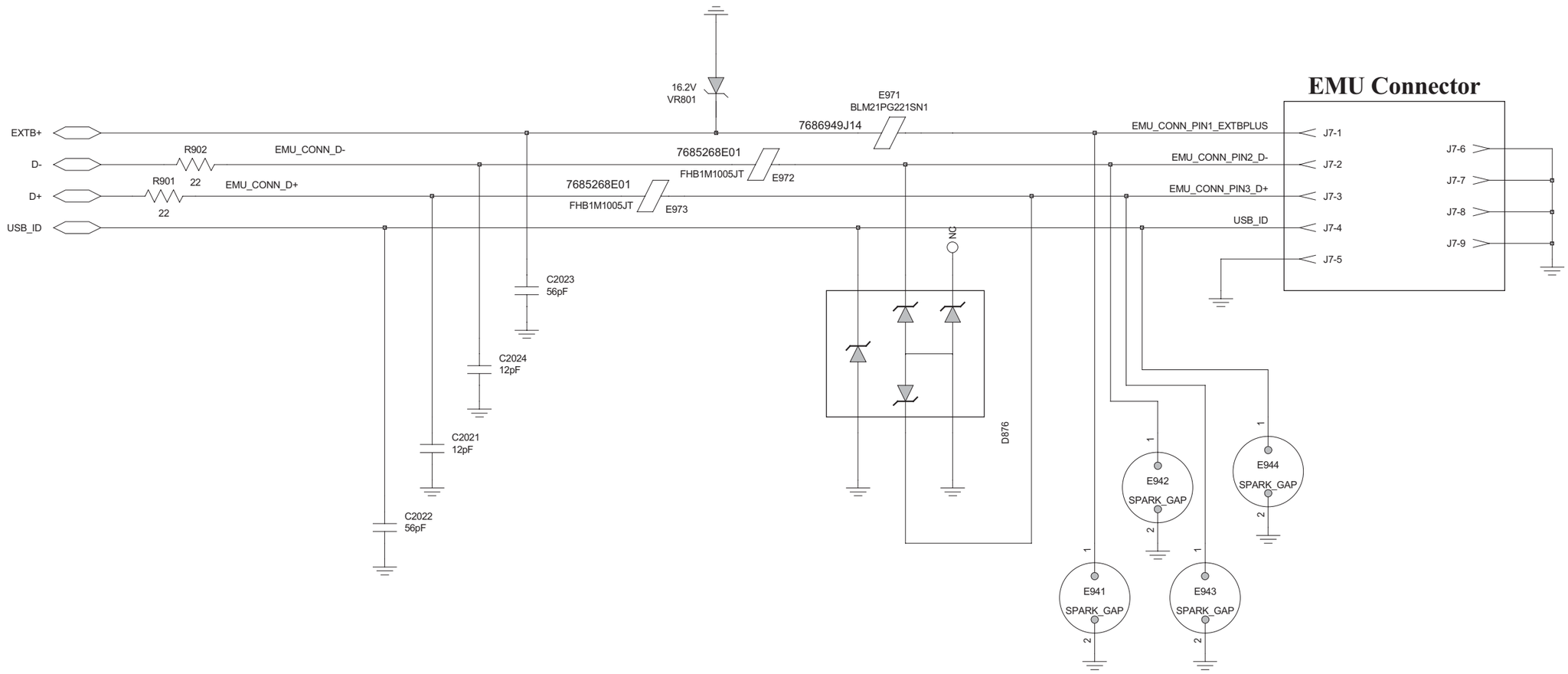
SHIELD CONNECTIONS

SPARK GAPS FOR AUDIO JACK
AND FOR ANTENNA

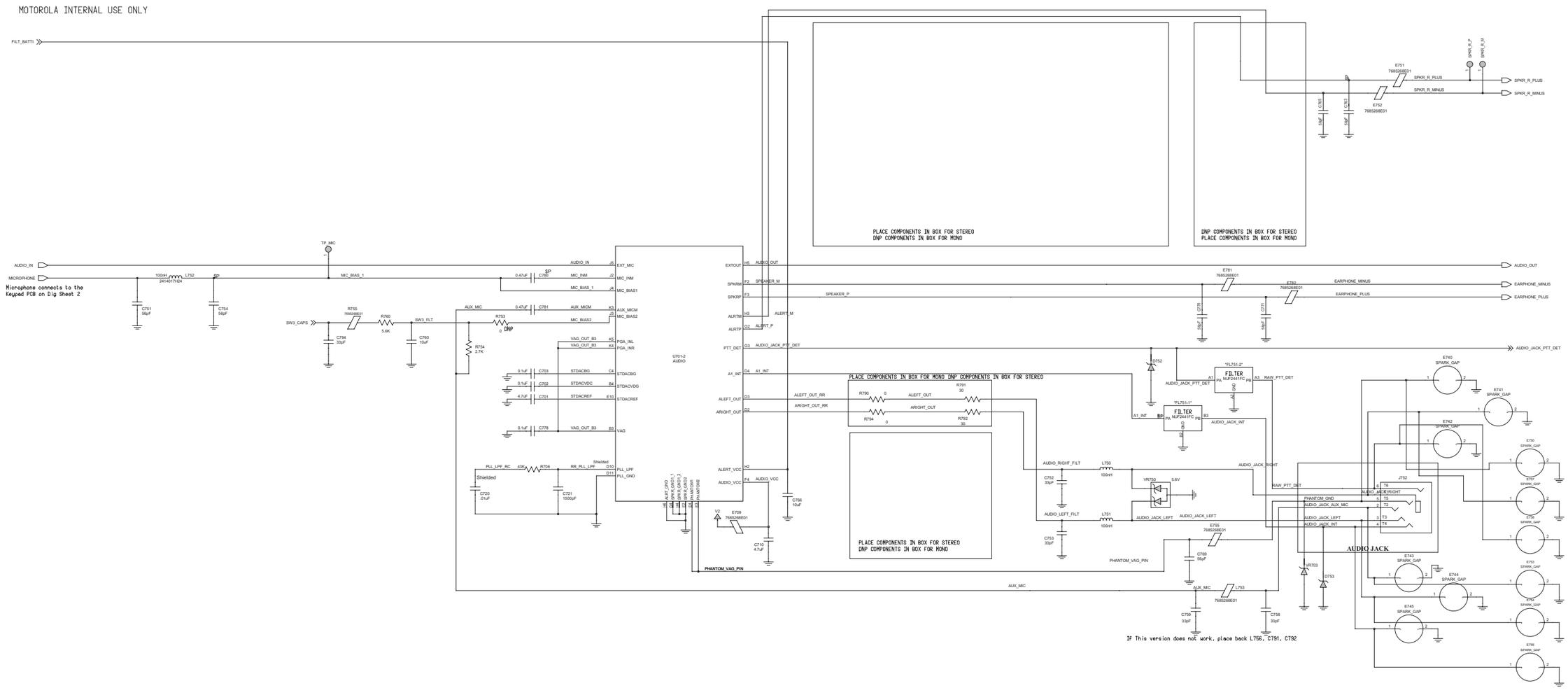


BATTERY CONTACTS

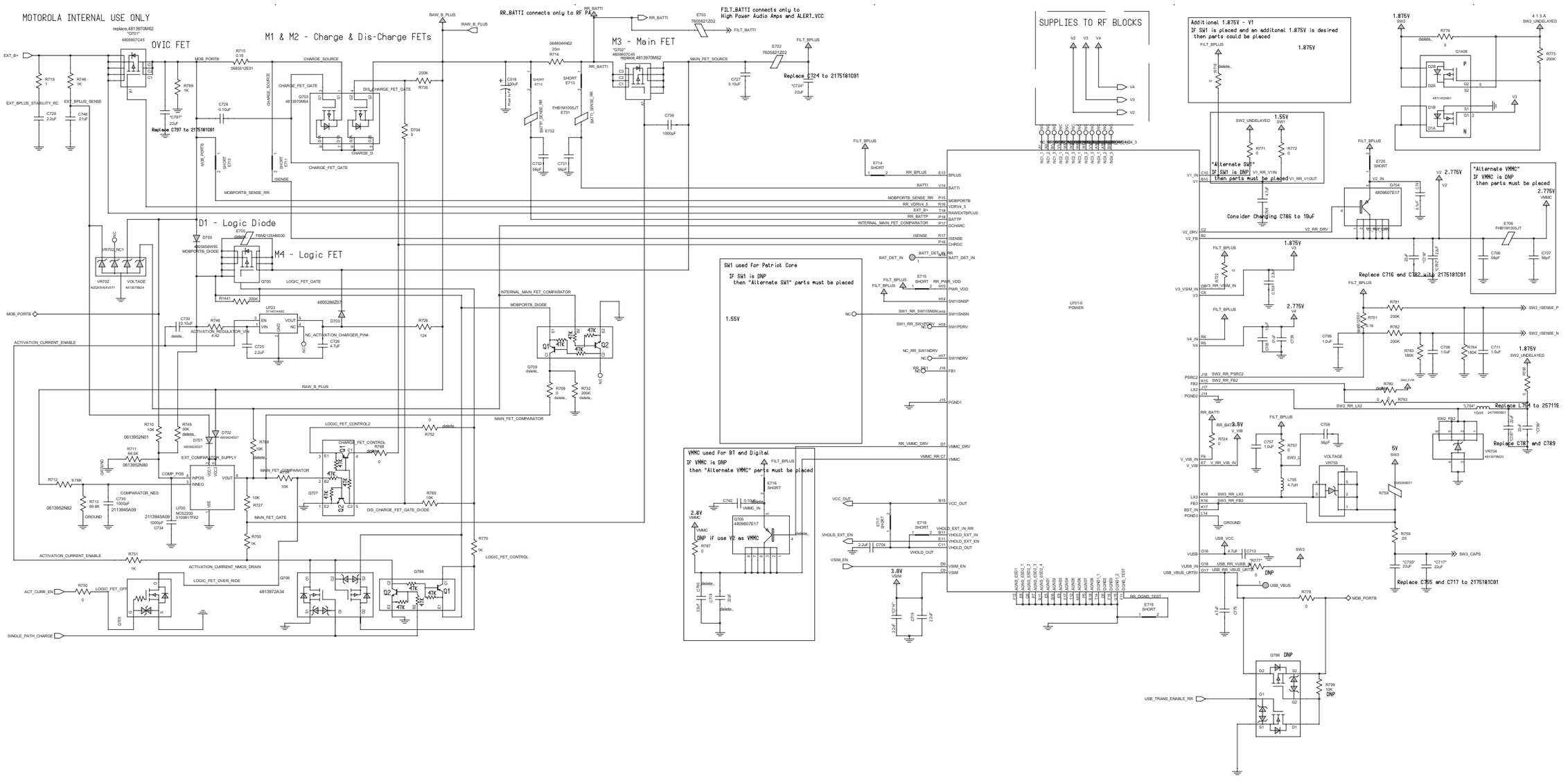
4.7 ACC_CONN_BLOCK - EMU Connector



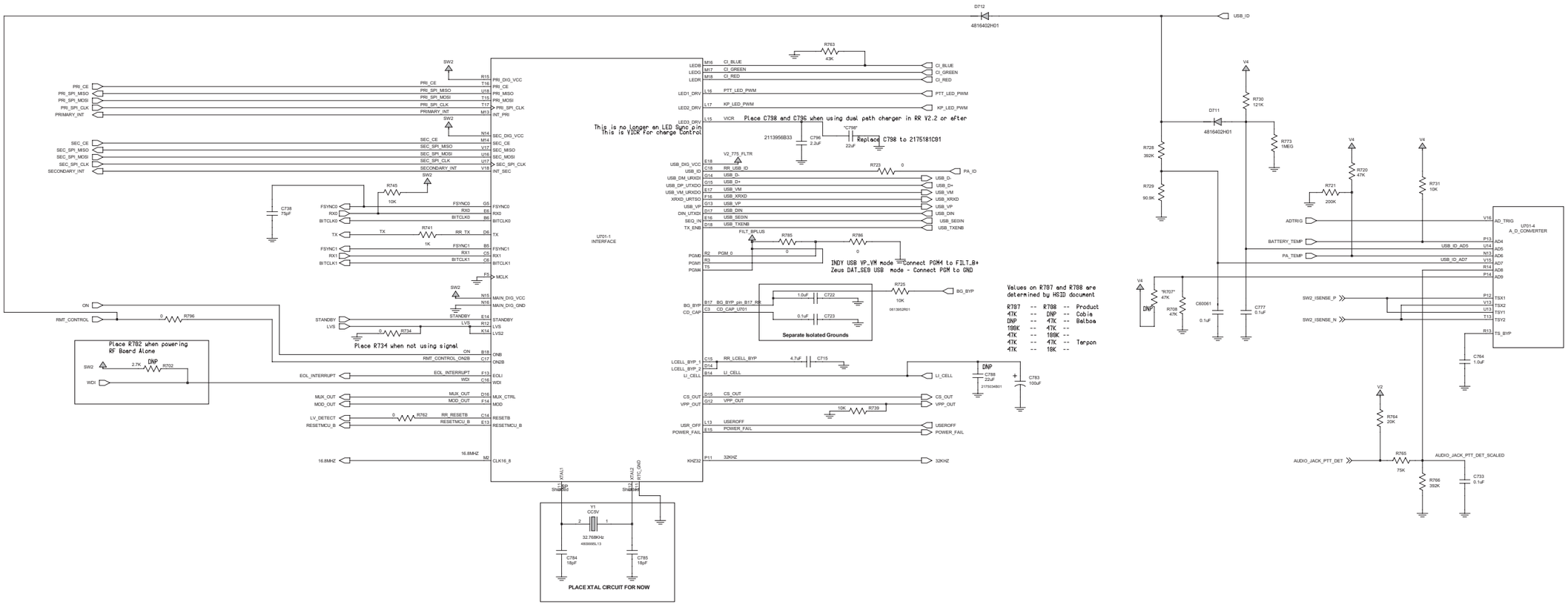
4.8 ROADRUNNER_BLOCK - Audio Section



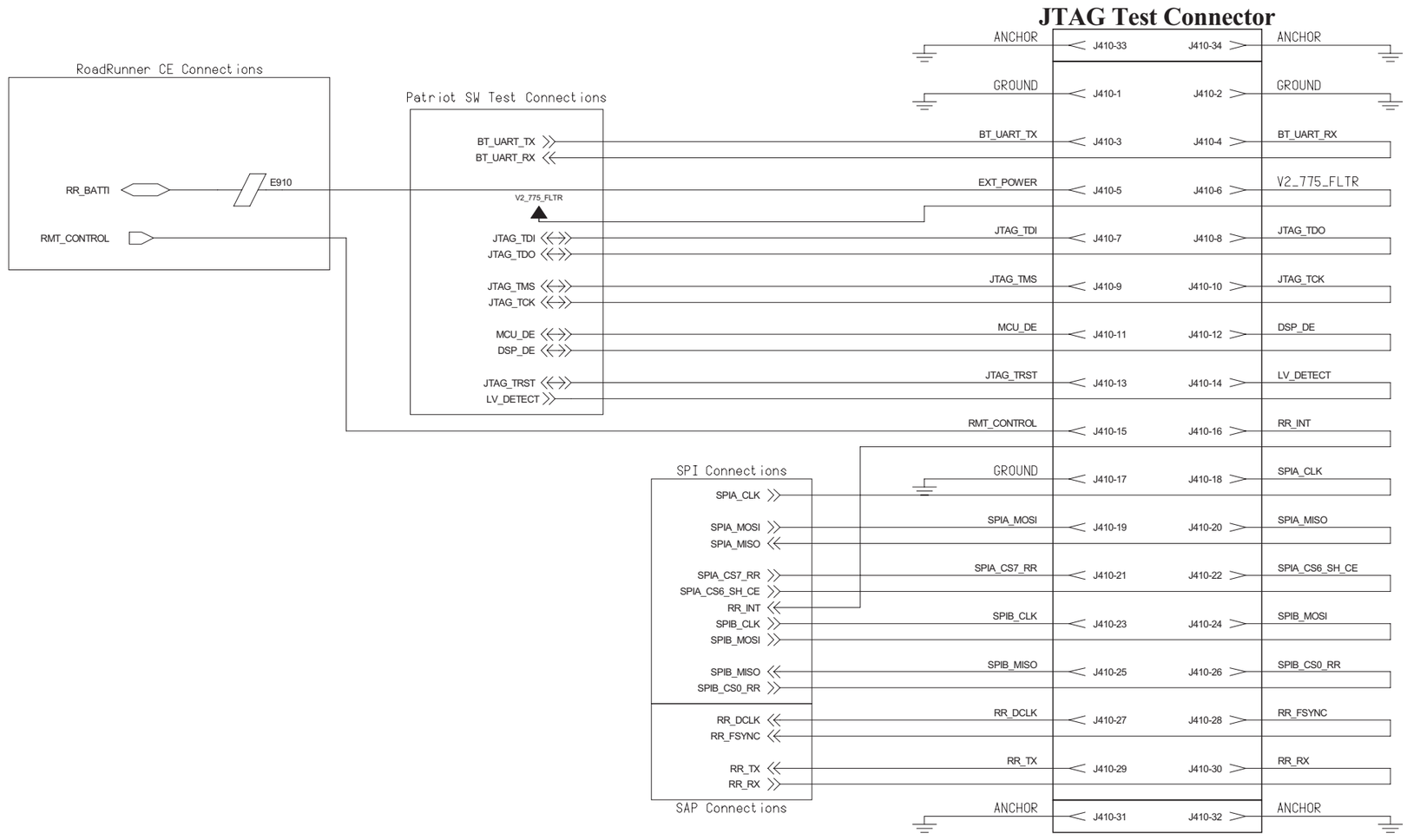
4.9 ROADRUNNER_BLOCK - Power Section



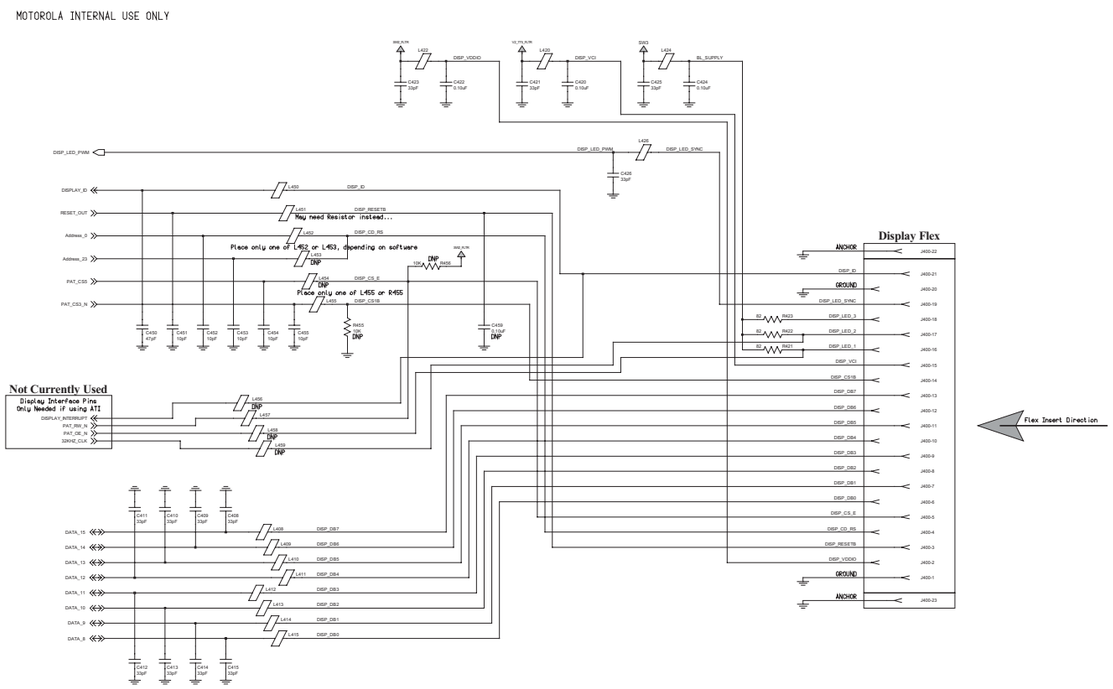
4.10 ROADRUNNER_BLOCK - Interface and A/D

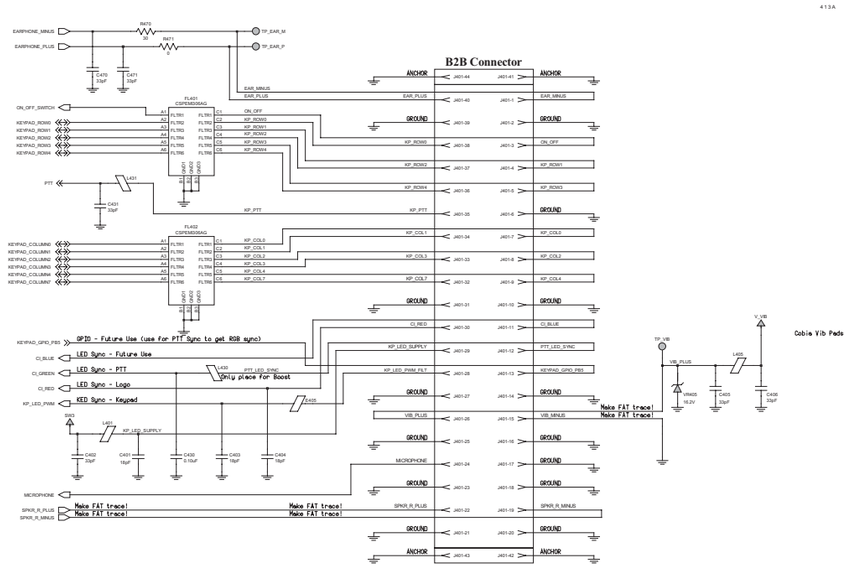


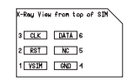
4.11 DIGITAL_BLOCK - JTAG Test Connector

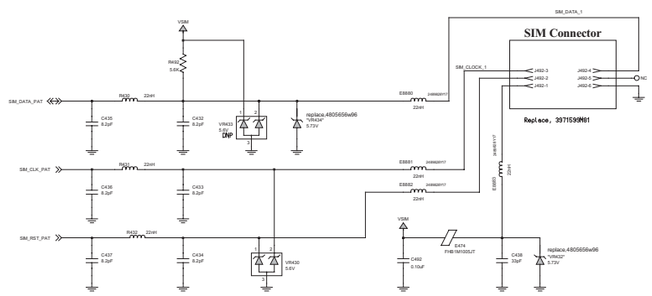


4.12 DIGITAL_BLOCK - Connectors, SIM, misc.

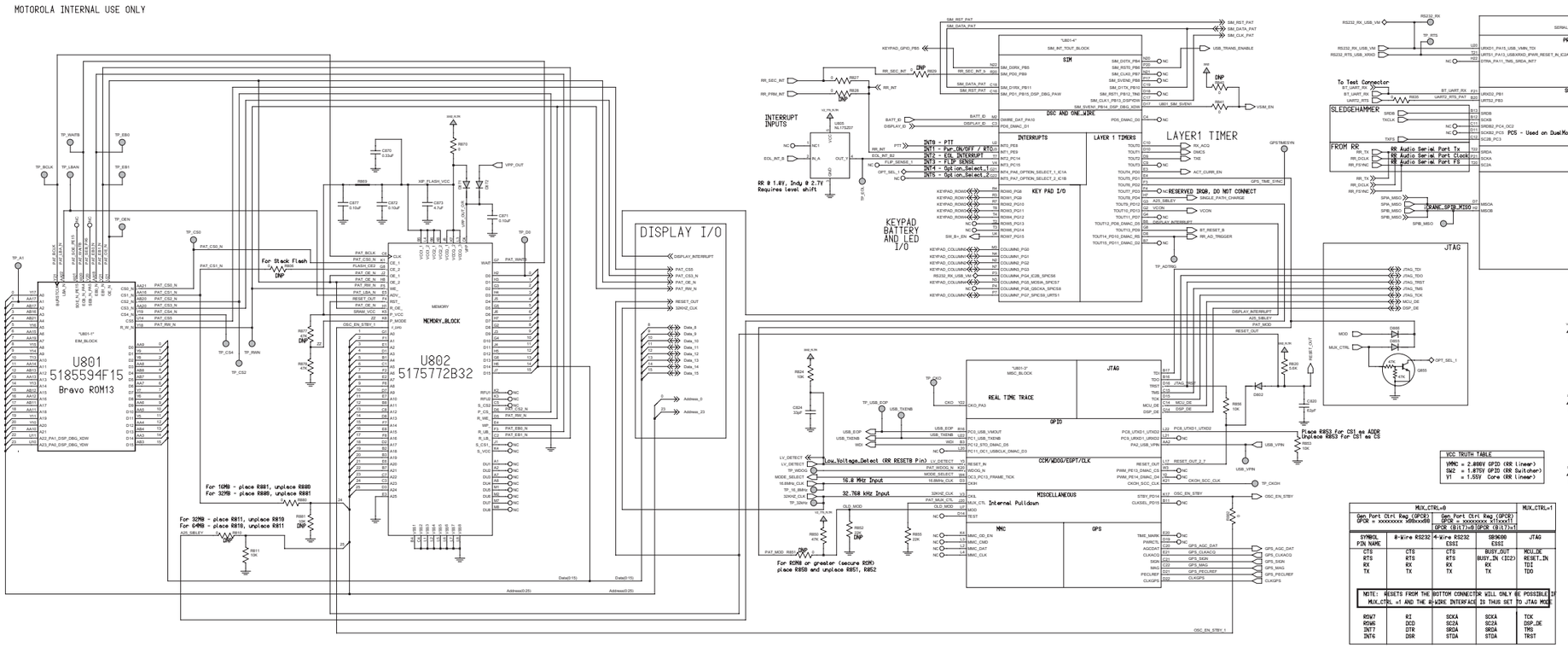






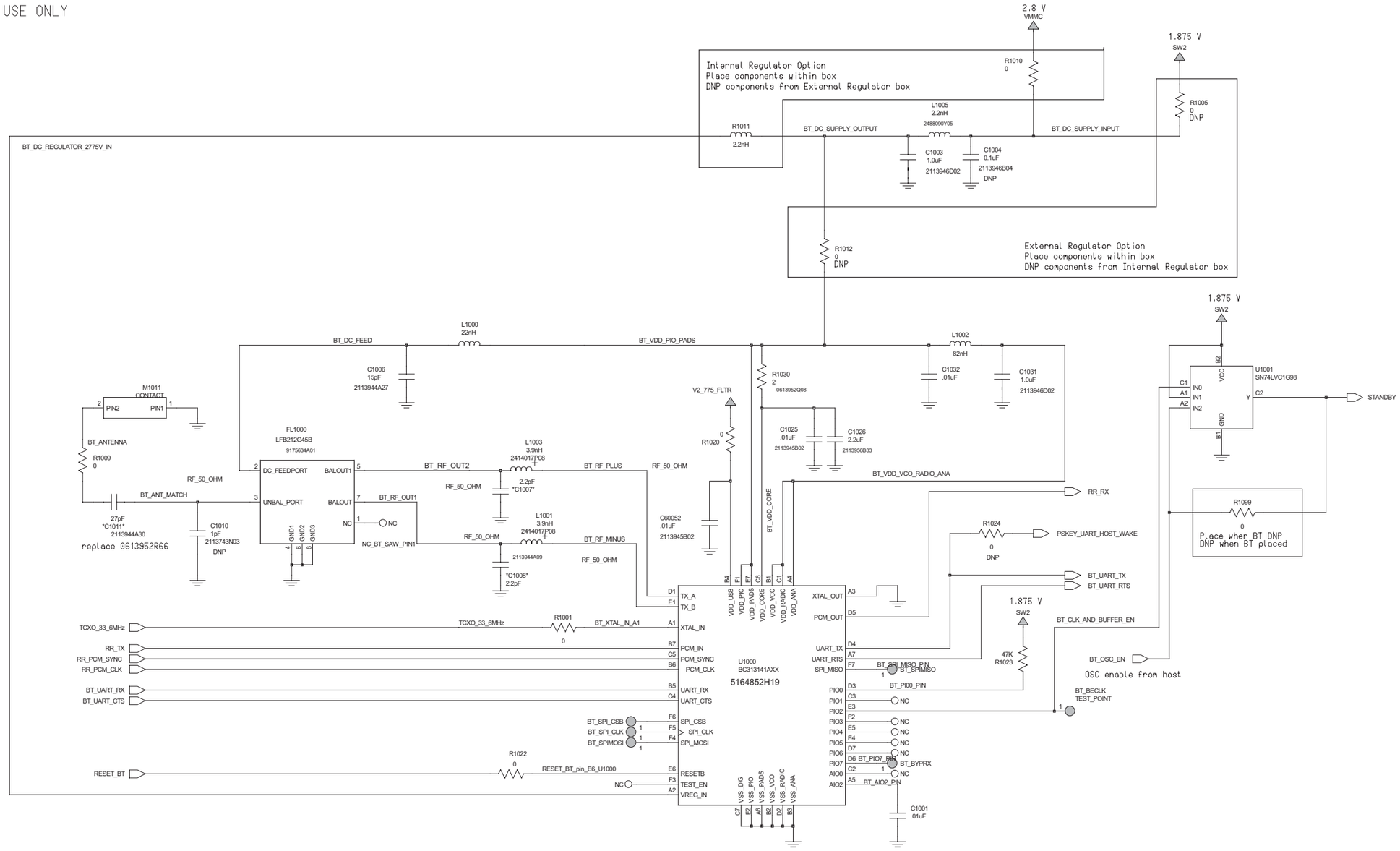


4.13 DIGITAL_BLOCK - Patriot and Memory

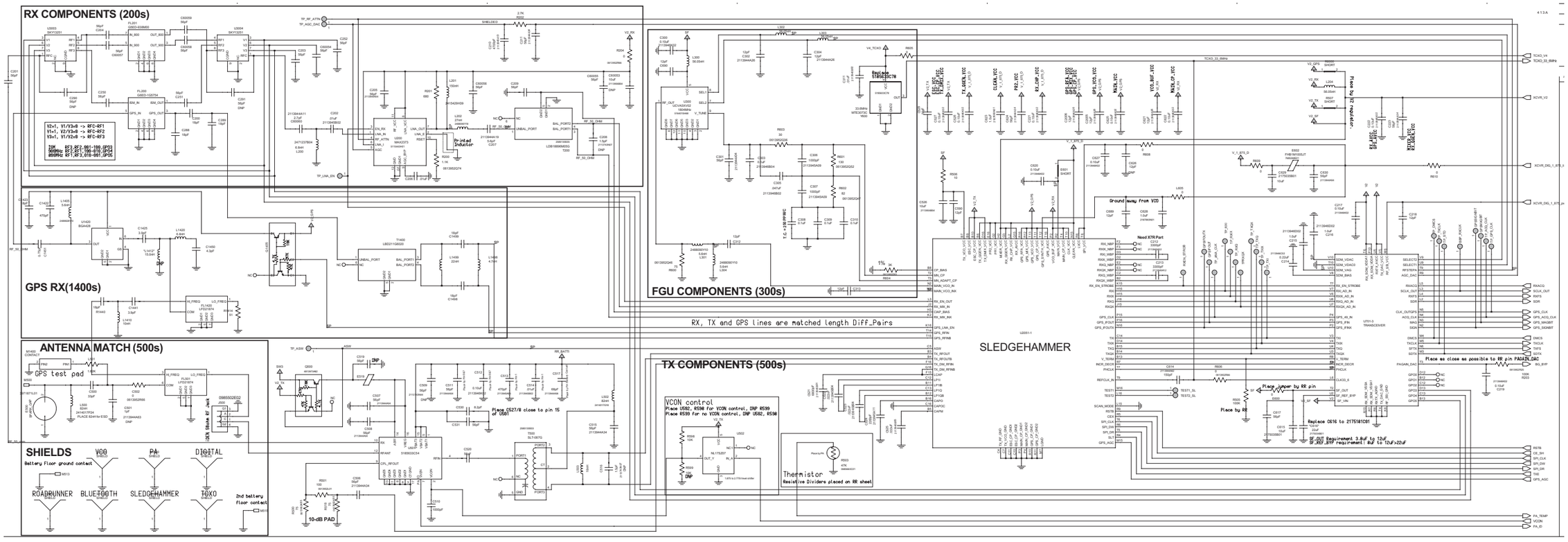


4.14 BLUETOOTH_BLOCK - Bluetooth Circuit

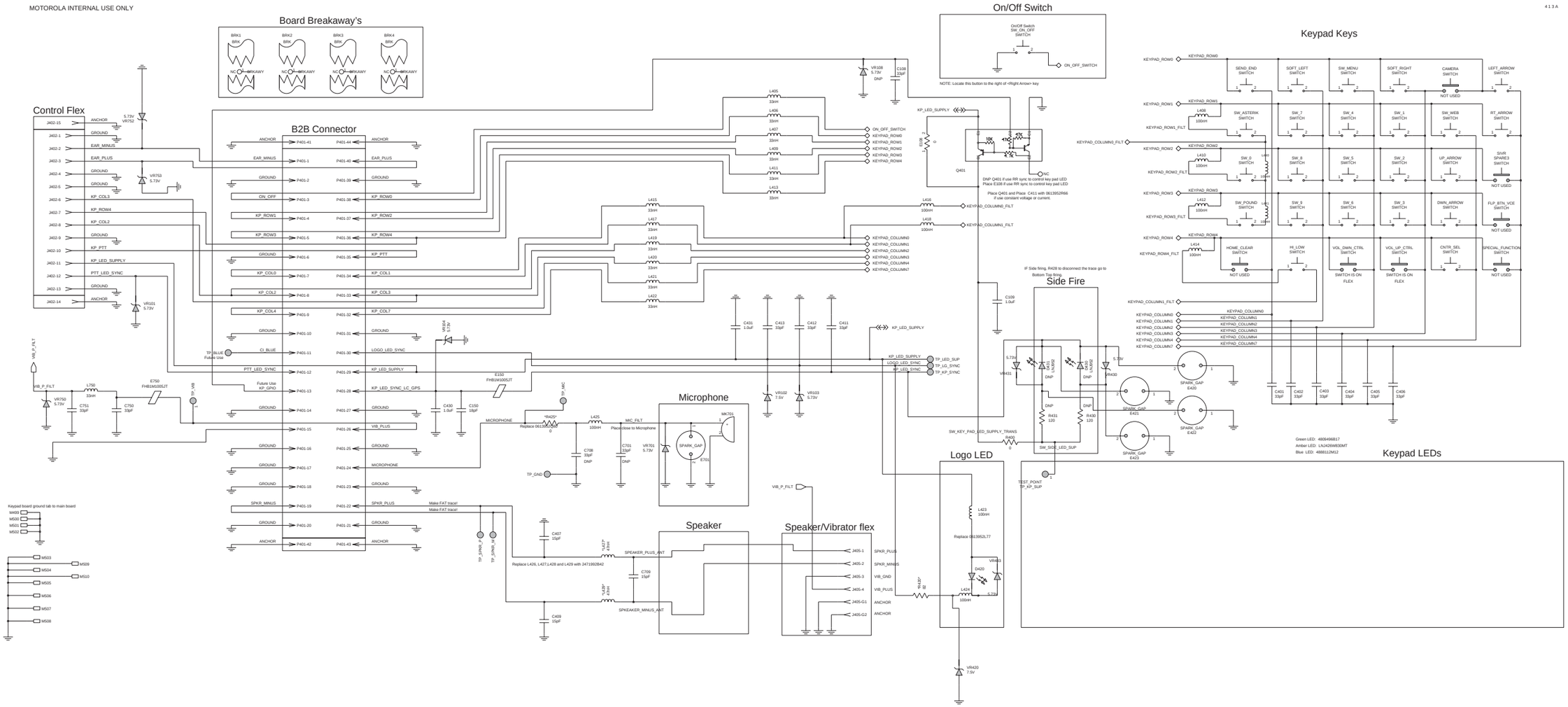
MOTOROLA INTERNAL USE ONLY



4.15 TRANSCEIVER - Xmit, Xcvr, VCO, TCXO



4.16 KEYPAD BOARD - Keypad, BL, Logo, Spkr, Mic, Vib, Flex



4.17 Component Locations

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
BAT_DET_IN	NOTPLACED	64AM DUMMY PART NUMBER	C103	2113944A37	CAP,CHIP,75PF,+5%,-5%,50V-DC,0	C208	NOTPLACED	64AM DUMMY PART NUMBER
BBP_RXCLK	NOTPLACED	64AM DUMMY PART NUMBER	C1031	NOTPLACED	64AM DUMMY PART NUMBER	C209	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0
BRK1	NOTPLACED	64AM DUMMY PART NUMBER	C1032	NOTPLACED	64AM DUMMY PART NUMBER	C210	2113945A13	CAP,CHIP,4700PF,+10%,-10%,50V-
BRK2	NOTPLACED	64AM DUMMY PART NUMBER	C1422	2113945A05	CAP,CHIP,470PF,+10%,-10%,50V-D	C211	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0
BRK3	NOTPLACED	64AM DUMMY PART NUMBER	C1423	2113944A28	CAP,CHIP,18PF,+5%,-5%,50V-DC,0	C212	2113945A12	CAP,CHIP,3300PF,+10%,-10%,50V-
BRK4	NOTPLACED	64AM DUMMY PART NUMBER	C1425	2115153H17	CAP,CER CHIP,3.9PF,.1PF+/-,+.1	C213	2113945A12	CAP,CHIP,3300PF,+10%,-10%,50V-
BT_BECLK	NOTPLACED	64AM DUMMY PART NUMBER	C1441	2115153H17	CAP,CER CHIP,3.9PF,.1PF+/-,+.1	C214	2113946C02	CAP,CHIP,.22UF,+10%,-10%,10V-D
BT_BYPRX	NOTPLACED	64AM DUMMY PART NUMBER	C1450	2115153H18	CAP,FXD,4.3PF,.1PF+/-,+.1%,-.1	C215	2113946D02	CAP,CHIP,1UF,+10%,-10%,6.3V-DC
BT_SPI_CLK	NOTPLACED	64AM DUMMY PART NUMBER	C1451	2115153H02	CAP,CER CHIP,.75PF,.1PF+/-,+.1	C216	2113946D02	CAP,CHIP,1UF,+10%,-10%,6.3V-DC
BT_SPI_CSB	NOTPLACED	64AM DUMMY PART NUMBER	C1498	2113944A28	CAP,CHIP,18PF,+5%,-5%,50V-DC,0	C217	2113946K02	CAP,CHIP,.1UF,+80%,-20%,16V-DC
BT_SPIMISO	NOTPLACED	64AM DUMMY PART NUMBER	C1499	2113944A28	CAP,CHIP,18PF,+5%,-5%,50V-DC,0	C218	2113944A26	CAP,CHIP,12PF,+5%,-5%,50V-DC,0
BT_SPIMOSI	NOTPLACED	64AM DUMMY PART NUMBER	C200	2113944A28	CAP,CHIP,18PF,+5%,-5%,50V-DC,0	C219	2113946K02	CAP,CHIP,.1UF,+80%,-20%,16V-DC
BT_UART_TX	NOTPLACED	64AM DUMMY PART NUMBER	C2005	2113944A26	CAP,CHIP,12PF,+5%,-5%,50V-DC,0	C221	2113946K02	CAP,CHIP,.1UF,+80%,-20%,16V-DC
C1001	NOTPLACED	64AM DUMMY PART NUMBER	C2006	2113944A26	CAP,CHIP,12PF,+5%,-5%,50V-DC,0	C222	2113946K02	CAP,CHIP,.1UF,+80%,-20%,16V-DC
C1003	NOTPLACED	64AM DUMMY PART NUMBER	C201	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0	C223	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0
C1004	NOTPLACED	64AM DUMMY PART NUMBER	C202	2113945B02	CAP,CHIP,.01UF,+10%,-10%,25V-D	C250	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0
C1006	NOTPLACED	64AM DUMMY PART NUMBER	C2021	2113944A26	CAP,CHIP,12PF,+5%,-5%,50V-DC,0	C251	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0
C1007	NOTPLACED	64AM DUMMY PART NUMBER	C2022	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0	C252	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0
C1008	NOTPLACED	64AM DUMMY PART NUMBER	C2023	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0	C288	NOTPLACED	64AM DUMMY PART NUMBER
C101	2113944A37	CAP,CHIP,75PF,+5%,-5%,50V-DC,0	C2024	2113944A26	CAP,CHIP,12PF,+5%,-5%,50V-DC,0	C289	NOTPLACED	64AM DUMMY PART NUMBER
C1010	NOTPLACED	64AM DUMMY PART NUMBER	C203	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0	C290	NOTPLACED	64AM DUMMY PART NUMBER
C1011	NOTPLACED	64AM DUMMY PART NUMBER	C204	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0	C291	NOTPLACED	64AM DUMMY PART NUMBER
C102	2113944A37	CAP,CHIP,75PF,+5%,-5%,50V-DC,0	C205	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0	C300	2113946K02	CAP,CHIP,.1UF,+80%,-20%,16V-DC
C1025	NOTPLACED	64AM DUMMY PART NUMBER	C206	2113945B02	CAP,CHIP,.01UF,+10%,-10%,25V-D	C301	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0
C1026	NOTPLACED	64AM DUMMY PART NUMBER	C207	2113944A19	CAP,CHIP,5.6PF,.5PF+/-,50V-DC,	C302	2113944A26	CAP,CHIP,12PF,+5%,-5%,50V-DC,0

Component Locations [Continued]

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
C303	2113946B04	CAP,CHIP,.1UF,+10%,-10%,10V-DC	C420	2113946K02	CAP,CHIP,.1UF,+80%,-20%,16V-DC	C492	2113946K02	CAP,CHIP,.1UF,+80%,-20%,16V-DC
C304	2113944A26	CAP,CHIP,12PF,+5%,-5%,50V-DC,0	C421	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	C500	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0
C305	2113946B02	CAP,CHIP,.047UF,+10%,-10%,10V-	C422	2113946K02	CAP,CHIP,.1UF,+80%,-20%,16V-DC	C501	NOTPLACED	64AM DUMMY PART NUMBER
C306	2113945A09	CAP,CHIP,1000PF,+10%,-10%,50V-	C423	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	C502	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,
C307	2113945A09	CAP,CHIP,1000PF,+10%,-10%,50V-	C424	2113946K02	CAP,CHIP,.1UF,+80%,-20%,16V-DC	C506	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0
C308	2185419D28	CAP,CHIP,.1UF,+10%,-10%,10V-DC	C425	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	C507	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0
C309	2185419D28	CAP,CHIP,.1UF,+10%,-10%,10V-DC	C426	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	C508	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0
C310	2185419D28	CAP,CHIP,.1UF,+10%,-10%,10V-DC	C430	2113946K02	CAP,CHIP,.1UF,+80%,-20%,16V-DC	C509	NOTPLACED	64AM DUMMY PART NUMBER
C311	2113945B02	CAP,CHIP,.01UF,+10%,-10%,25V-D	C431	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	C510	2113945A09	CAP,CHIP,1000PF,+10%,-10%,50V-
C312	2113944A26	CAP,CHIP,12PF,+5%,-5%,50V-DC,0	C432	2113944A23	CAP,CHIP,8.2PF,.5PF+/-,50V-DC,	C511	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0
C313	2113944A26	CAP,CHIP,12PF,+5%,-5%,50V-DC,0	C433	2113944A23	CAP,CHIP,8.2PF,.5PF+/-,50V-DC,	C512	2113946K02	CAP,CHIP,.1UF,+80%,-20%,16V-DC
C401	2113944A28	CAP,CHIP,18PF,+5%,-5%,50V-DC,0	C434	2113944A23	CAP,CHIP,8.2PF,.5PF+/-,50V-DC,	C513	2113945A05	CAP,CHIP,470PF,+10%,-10%,50V-D
C402	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	C435	2113944A23	CAP,CHIP,8.2PF,.5PF+/-,50V-DC,	C514	2113945B02	CAP,CHIP,.01UF,+10%,-10%,25V-D
C403	2113944A28	CAP,CHIP,18PF,+5%,-5%,50V-DC,0	C436	2113944A23	CAP,CHIP,8.2PF,.5PF+/-,50V-DC,	C515	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0
C404	2113944A28	CAP,CHIP,18PF,+5%,-5%,50V-DC,0	C437	2113944A23	CAP,CHIP,8.2PF,.5PF+/-,50V-DC,	C516	NOTPLACED	64AM DUMMY PART NUMBER
C405	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	C438	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	C517	2113944A36	CAP,CHIP,68PF,+5%,-5%,50V-DC,0
C406	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	C450	2113944A33	CAP,CHIP,47PF,+5%,-5%,50V-DC,0	C518	2360567A12	CAP,TANTALUM,330UF,+20%,-20%,1
C408	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	C451	2113944A25	CAP,CHIP,10PF,.5PF+/-,50V-DC,0	C519	NOTPLACED	64AM DUMMY PART NUMBER
C409	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	C452	NOTPLACED	64AM DUMMY PART NUMBER	C520	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0
C410	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	C453	NOTPLACED	64AM DUMMY PART NUMBER	C521	2113945B01	CAP,CHIP,6800PF,+10%,-10%,25V-
C411	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	C454	NOTPLACED	64AM DUMMY PART NUMBER	C522	2113945B04	CAP,FXD,.022UF,+10%,-10%,25V-D
C412	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	C455	NOTPLACED	64AM DUMMY PART NUMBER	C523	2113945B04	CAP,FXD,.022UF,+10%,-10%,25V-D
C413	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	C459	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	C524	2113945A11	CAP,CHIP,2200PF,+10%,-10%,50V-
C414	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	C470	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	C525	2113945B05	CAP,FXD,.033UF,+10%,-10%,25V-D
C415	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	C471	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	C526	2113956B54	CAP,FXD,10UF,+20%,-20%,6.3V-DC

Component Locations [Continued]

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
C527	2113946K02	CAP,CHIP,.1UF,+80%,-20%,16V-DC	C625	2113946K02	CAP,CHIP,.1UF,+80%,-20%,16V-DC	C719	2175511A01	CAP,CER,2.2UF,+20%,-20%,6.3V-D
C528	2113946K02	CAP,CHIP,.1UF,+80%,-20%,16V-DC	C626	NOTPLACED	64AM DUMMY PART NUMBER	C720	2113945B02	CAP,CHIP,.01UF,+10%,-10%,25V-D
C529	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0	C627	2113946K02	CAP,CHIP,.1UF,+80%,-20%,16V-DC	C721	2113945A10	CAP,CHIP,1500PF,+10%,-10%,50V-
C530	2113944A23	CAP,CHIP,8.2PF,.5PF+/-,50V-DC,	C628	2187893N01	CAP,CER,1UF,20PF+/-,+20%,-20%,	C722	2187893N01	CAP,CER,1UF,20PF+/-,+20%,-20%,
C531	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0	C629	2175035B01	CAP,CER CHIP,10UF,+20%,-20%,6.	C723	2113946B04	CAP,CHIP,.1UF,+10%,-10%,10V-DC
C590	2113944A26	CAP,CHIP,12PF,+5%,-5%,50V-DC,0	C630	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0	C724	2175181C01	CAP,CER CHIP,22UF,+20%,-20%,6.
C60052	NOTPLACED	64AM DUMMY PART NUMBER	C689	2113944A26	CAP,CHIP,12PF,+5%,-5%,50V-DC,0	C725	2175511A01	CAP,CER,2.2UF,+20%,-20%,6.3V-D
C60053	NOTPLACED	64AM DUMMY PART NUMBER	C690	2113944A26	CAP,CHIP,12PF,+5%,-5%,50V-DC,0	C726	2175036B01	CAP,CER CHIP,4.7UF,+20%,-20%,6
C60054	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0	C701	2187906N01	CAP,CHIP,4.7UF,940000PF+/-,+20	C727	2113946K02	CAP,CHIP,.1UF,+80%,-20%,16V-DC
C60055	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0	C702	2113946B04	CAP,CHIP,.1UF,+10%,-10%,10V-DC	C728	2113946K02	CAP,CHIP,.1UF,+80%,-20%,16V-DC
C60056	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0	C703	2113946B04	CAP,CHIP,.1UF,+10%,-10%,10V-DC	C729	2175511A01	CAP,CER,2.2UF,+20%,-20%,6.3V-D
C60057	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0	C704	2175511A01	CAP,CER,2.2UF,+20%,-20%,6.3V-D	C730	NOTPLACED	64AM DUMMY PART NUMBER
C60058	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0	C705	2113956B54	CAP,FXD,10UF,+20%,-20%,6.3V-DC	C731	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0
C60059	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0	C706	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0	C732	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0
C60060	2113944A11	CAP,CHIP,2.7PF,.25PF+/-,50V-DC	C707	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0	C733	2113946B04	CAP,CHIP,.1UF,+10%,-10%,10V-DC
C60061	2113946B04	CAP,CHIP,.1UF,+10%,-10%,10V-DC	C708	2187893N01	CAP,CER,1UF,20PF+/-,+20%,-20%,	C734	2113945A09	CAP,CHIP,1000PF,+10%,-10%,50V-
C614	2113944A42	CAP,CHIP,150PF,+5%,-5%,50V-DC,	C709	2175511A01	CAP,CER,2.2UF,+20%,-20%,6.3V-D	C735	2113945A09	CAP,CHIP,1000PF,+10%,-10%,50V-
C615	2175035B01	CAP,CER CHIP,10UF,+20%,-20%,6.	C710	2187906N01	CAP,CHIP,4.7UF,940000PF+/-,+20	C736	2113945C13	CAP,CHIP,1000PF,+10%,-10%,50V-
C616	2175181C01	CAP,CER CHIP,22UF,+20%,-20%,6.	C711	2187893N01	CAP,CER,1UF,20PF+/-,+20%,-20%,	C738	2113944A37	CAP,CHIP,75PF,+5%,-5%,50V-DC,0
C617	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0	C713	2175036B01	CAP,CER CHIP,4.7UF,+20%,-20%,6	C739	2113945B02	CAP,CHIP,.01UF,+10%,-10%,25V-D
C620	2113946K02	CAP,CHIP,.1UF,+80%,-20%,16V-DC	C714	2175511A01	CAP,CER,2.2UF,+20%,-20%,6.3V-D	C741	2113946B04	CAP,CHIP,.1UF,+10%,-10%,10V-DC
C621	2113944A26	CAP,CHIP,12PF,+5%,-5%,50V-DC,0	C715	2175036B01	CAP,CER CHIP,4.7UF,+20%,-20%,6	C742	NOTPLACED	64AM DUMMY PART NUMBER
C622	2113946K02	CAP,CHIP,.1UF,+80%,-20%,16V-DC	C716	2175181C01	CAP,CER CHIP,22UF,+20%,-20%,6.	C746	2113945B02	CAP,CHIP,.01UF,+10%,-10%,25V-D
C623	2187893N01	CAP,CER,1UF,20PF+/-,+20%,-20%,	C717	2175181C01	CAP,CER CHIP,22UF,+20%,-20%,6.	C751	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0
C624	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0	C718	NOTPLACED	64AM DUMMY PART NUMBER	C752	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0

Component Locations [Continued]

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
C753	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	C787	2175181C01	CAP,CER CHIP,22UF,+20%,-20%,6.	C820	2113944A35	CAP,CHIP,62PF,+5%,-5%,50V-DC,0
C754	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0	C788	NOTPLACED	64AM DUMMY PART NUMBER	C824	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0
C755	2175181C01	CAP,CER CHIP,22UF,+20%,-20%,6.	C789	2175181C01	CAP,CER CHIP,22UF,+20%,-20%,6.	C870	2113946L05	CAP,FXD,.33UF,+80%,-20%,16V-DC
C756	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0	C790	NOTPLACED	64AM DUMMY PART NUMBER	C871	2113946K02	CAP,CHIP,.1UF,+80%,-20%,16V-DC
C757	2187893N01	CAP,CER,1UF,20PF+/-,+20%,-20%,	C794	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	C872	2113946K02	CAP,CHIP,.1UF,+80%,-20%,16V-DC
C758	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	C796	2113956B33	CAP,FXD,2.2UF,+10%,-10%,16V-DC	C873	2175036B01	CAP,CER CHIP,4.7UF,+20%,-20%,6
C759	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	C797	2175181C01	CAP,CER CHIP,22UF,+20%,-20%,6.	C877	2113946K02	CAP,CHIP,.1UF,+80%,-20%,16V-DC
C760	2175035B01	CAP,CER CHIP,10UF,+20%,-20%,6.	C798	2175181C01	CAP,CER CHIP,22UF,+20%,-20%,6.	D700	4805656W95	DIODE,RSX101M-30,SOD-123,SOD-1
C763	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0	C799	2187893N01	CAP,CER,1UF,20PF+/-,+20%,-20%,	D701	4809924D27	DIODE,SHTK,RB521G-30,SM,100MA,
C764	2187893N01	CAP,CER,1UF,20PF+/-,+20%,-20%,	C801	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	D702	4809924D27	DIODE,SHTK,RB521G-30,SM,100MA,
C765	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0	C802	2187893N01	CAP,CER,1UF,20PF+/-,+20%,-20%,	D704	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,
C766	2113956B54	CAP,FXD,10UF,+20%,-20%,6.3V-DC	C803	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	D705	4805286Z07	DIODE,SWG,SOD-523/SC-79,SCHOTT
C769	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0	C804	2187893N01	CAP,CER,1UF,20PF+/-,+20%,-20%,	D711	4816402H01	DIODE,SWG,RB751S-40,SOD-523/SC
C770	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0	C805	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	D712	4816402H01	DIODE,SWG,RB751S-40,SOD-523/SC
C771	2113944A34	CAP,CHIP,56PF,+5%,-5%,50V-DC,0	C806	2187893N01	CAP,CER,1UF,20PF+/-,+20%,-20%,	D752	4805656W99	DIODE,ZEN,SM,5.6V,5.6V,.1W,ZEN
C777	2113946B04	CAP,CHIP,.1UF,+10%,-10%,10V-DC	C807	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	D753	4805656W99	DIODE,ZEN,SM,5.6V,5.6V,.1W,ZEN
C778	2113945C31	CAP,FXD,.1UF,+10%,-10%,50V-DC,	C808	2113946K02	CAP,CHIP,.1UF,+80%,-20%,16V-DC	D802	4809924D27	DIODE,SHTK,RB521G-30,SM,100MA,
C779	2175036B01	CAP,CER CHIP,4.7UF,+20%,-20%,6	C809	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	D855	4809924D27	DIODE,SHTK,RB521G-30,SM,100MA,
C780	2113946D01	CAP,CHIP,.47UF,+10%,-10%,6.3V-	C810	2113946K02	CAP,CHIP,.1UF,+80%,-20%,16V-DC	D866	4809924D27	DIODE,SHTK,RB521G-30,SM,100MA,
C781	2113946D01	CAP,CHIP,.47UF,+10%,-10%,6.3V-	C811	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	D871	4809924D27	DIODE,SHTK,RB521G-30,SM,100MA,
C782	2175181C01	CAP,CER CHIP,22UF,+20%,-20%,6.	C812	2113946K02	CAP,CHIP,.1UF,+80%,-20%,16V-DC	D872	4809924D27	DIODE,SHTK,RB521G-30,SM,100MA,
C783	2371735M01	CAP,TANTALUM,100UF,+20%,-20%,6	C813	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	D876	4875676A01	DIODE,SUPR,20W,V SUPR 4 LINE T
C784	2113944A28	CAP,CHIP,18PF,+5%,-5%,50V-DC,0	C814	2113946K02	CAP,CHIP,.1UF,+80%,-20%,16V-DC	E101	7605821Z03	FLTR,FERRITE BEAD,4A,SM,1206,C
C785	2113944A28	CAP,CHIP,18PF,+5%,-5%,50V-DC,0	C816	2113946K02	CAP,CHIP,.1UF,+80%,-20%,16V-DC	E405	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040
C786	2175036B01	CAP,CER CHIP,4.7UF,+20%,-20%,6	C818	2113944A31	CAP,CHIP,33PF,+5%,-5%,50V-DC,0	E474	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040

Component Locations [Continued]

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
E500	NOTPLACED	64AM DUMMY PART NUMBER	E742	NOTPLACED	64AM DUMMY PART NUMBER	E972	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040
E519	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	E743	NOTPLACED	64AM DUMMY PART NUMBER	E973	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040
E600	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,	E744	NOTPLACED	64AM DUMMY PART NUMBER	FL1000	NOTPLACED	64AM DUMMY PART NUMBER
E601	NOTPLACED	64AM DUMMY PART NUMBER	E745	NOTPLACED	64AM DUMMY PART NUMBER	FL1420	9185071F01	FLTR,DIPLEXER,PORT 1: 1575MHZ;
E602	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	E750	NOTPLACED	64AM DUMMY PART NUMBER	FL200	9105849W17	FLTR,SAW,BANDPASS,50OHM,SM,FLT
E702	7605821Z02	FLTR,FERRITE BEAD,4A,SM,0805,C	E751	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	FL201	9105849W18	FLTR,SAW,BANDPASS,50OHM,SM,FLT
E703	7605821Z02	FLTR,FERRITE BEAD,4A,SM,0805,C	E752	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	FL401	4889526L12	FLTR,SM,IPD ESD/EMI ARY 6CH PB
E705	NOTPLACED	64AM DUMMY PART NUMBER	E753	NOTPLACED	64AM DUMMY PART NUMBER	FL402	4889526L12	FLTR,SM,IPD ESD/EMI ARY 6CH PB
E706	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	E754	NOTPLACED	64AM DUMMY PART NUMBER	FL501	9185071F01	FLTR,DIPLEXER,PORT 1: 1575MHZ;
E709	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	E755	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	FL751	4813979A44	FLTR,PASSIVE,12MHZ MAX,FC,PB-F
E710	NOTPLACED	64AM DUMMY PART NUMBER	E756	NOTPLACED	64AM DUMMY PART NUMBER	GPSIFOUT	NOTPLACED	64AM DUMMY PART NUMBER
E711	NOTPLACED	64AM DUMMY PART NUMBER	E757	NOTPLACED	64AM DUMMY PART NUMBER	GPSIFOUTX	NOTPLACED	64AM DUMMY PART NUMBER
E712	NOTPLACED	64AM DUMMY PART NUMBER	E758	NOTPLACED	64AM DUMMY PART NUMBER	GPSMAGBIT	NOTPLACED	64AM DUMMY PART NUMBER
E713	NOTPLACED	64AM DUMMY PART NUMBER	E781	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	GPSSIGNBIT	NOTPLACED	64AM DUMMY PART NUMBER
E714	NOTPLACED	64AM DUMMY PART NUMBER	E782	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	GPSTIMESYN	NOTPLACED	64AM DUMMY PART NUMBER
E715	NOTPLACED	64AM DUMMY PART NUMBER	E8880	2489828Y17	CHIP INDUCTOR,RF,22NH,5%,200MA	ICRNE_CS	NOTPLACED	64AM DUMMY PART NUMBER
E716	NOTPLACED	64AM DUMMY PART NUMBER	E8881	2489828Y17	CHIP INDUCTOR,RF,22NH,5%,200MA	J400	0971961L01	CONN,FLXCKT,40CONT,GLD,CONN, 2
E717	NOTPLACED	64AM DUMMY PART NUMBER	E8882	2489828Y17	CHIP INDUCTOR,RF,22NH,5%,200MA	J401	0970312L03	CONN,BTB,0 ROW,F,40CONT,GLD,CO
E718	NOTPLACED	64AM DUMMY PART NUMBER	E8883	2489828Y17	CHIP INDUCTOR,RF,22NH,5%,200MA	J410	NOTPLACED	64AM DUMMY PART NUMBER
E719	NOTPLACED	64AM DUMMY PART NUMBER	E910	NOTPLACED	64AM DUMMY PART NUMBER	J492	3971599M01	CONTACT,PIN,CONN, SIM
E720	NOTPLACED	64AM DUMMY PART NUMBER	E941	NOTPLACED	64AM DUMMY PART NUMBER	J500	0985502E02	RF CONNECTOR,MISC,F,SM
E731	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	E942	NOTPLACED	64AM DUMMY PART NUMBER	J7	0975073B04	CONN ACSRY,RECEPTACLE,I/O USB
E732	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	E943	NOTPLACED	64AM DUMMY PART NUMBER	J752	0964372H01	CONN,BRD TO WR,RCPT,5CONT,GLD,
E740	NOTPLACED	64AM DUMMY PART NUMBER	E944	NOTPLACED	64AM DUMMY PART NUMBER	L1000	NOTPLACED	64AM DUMMY PART NUMBER
E741	NOTPLACED	64AM DUMMY PART NUMBER	E971	7686949J14	FLTR,FERRITE BEAD,2A,SM,0805,C	L1001	NOTPLACED	64AM DUMMY PART NUMBER

Component Locations [Continued]

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
L1002	NOTPLACED	64AM DUMMY PART NUMBER	L413	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	L751	2414017G19	IDCTR,CHIP,100NH,5%,300MA,2.5O
L1003	NOTPLACED	64AM DUMMY PART NUMBER	L414	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	L752	2414017H24	IDCTR,CHIP,100NH,5%,300MA,2.1O
L1005	NOTPLACED	64AM DUMMY PART NUMBER	L415	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	L753	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040
L1405	2489828Y10	CHIP INDUCTOR,RF,5.6NH,,30MA,.	L420	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	L754	2571104B10	IDCTR,PWR,10UH,20%,580MA,.355O
L1410	2489828Y13	CHIP INDUCTOR,RF,10NH,5%,250MA	L422	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	L755	2571104B04	IDCTR,WW,4.7UH,20%,850MA,.155O
L1412	NOTPLACED	64AM DUMMY PART NUMBER	L424	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	L801	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040
L1420	2488090Y11	IDCTR,CHIP,6.8NH,5%,300MA,,CER	L426	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	L802	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040
L1498	2489828Y09	CHIP INDUCTOR,RF,4.7NH,30MA,.2	L430	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	L803	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040
L1499	2489828Y17	CHIP INDUCTOR,RF,22NH,5%,200MA	L431	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	M1011	NOTPLACED	64AM DUMMY PART NUMBER
L200	2471237B04	IDCTR,6.8NH,5%,430MA,.2OHM,CER	L450	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	M104	NOTPLACED	64AM DUMMY PART NUMBER
L201	2415429H39	IDCTR,WW,150NH,5%,280MA,.92OHM	L451	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	M1400	NOTPLACED	64AM DUMMY PART NUMBER
L202	2488090Y18	IDCTR,CHIP,27NH,5%,300MA,CER,S	L452	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	M500	3971871L01	CONT,PAD,HOT LAUNCH ANT CONN P
L204	2414017P22	IDCTR,CHIP,56NH,5%,200MA,2OHM,	L453	NOTPLACED	64AM DUMMY PART NUMBER	M513	NOTPLACED	64AM DUMMY PART NUMBER
L300	2414017P22	IDCTR,CHIP,56NH,5%,200MA,2OHM,	L454	NOTPLACED	64AM DUMMY PART NUMBER	M515	NOTPLACED	64AM DUMMY PART NUMBER
L301	2488090Y10	IDCTR,CHIP,5.6NH,5%,300MA,CER,	L455	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	PWB	8475687B01	PWB,MN,PCB COBIA
L302	2414017P22	IDCTR,CHIP,56NH,5%,200MA,2OHM,	L456	NOTPLACED	64AM DUMMY PART NUMBER	Q1405	4885316E03	XSTR,BIP,SM,SOT-553,.5W,INTERN
L303	2414017P22	IDCTR,CHIP,56NH,5%,200MA,2OHM,	L457	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	Q1408	4871432M01	XSTR,FET GP PWR,N AND P CHANNE
L304	2488090Y10	IDCTR,CHIP,5.6NH,5%,300MA,CER,	L458	NOTPLACED	64AM DUMMY PART NUMBER	Q500	4813973A82	XSTR,BIP GP SS,DIG,NPN AND PNP
L401	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	L459	NOTPLACED	64AM DUMMY PART NUMBER	Q700	4809807C45	XSTR,FET GP PWR,MOSFET,P-CH,FD
L405	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	L500	2414017P24	IDCTR,CHIP,82NH,5%,150MA,2.5OH	Q701	4809807C45	XSTR,FET GP PWR,MOSFET,P-CH,FD
L408	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	L501	0613952M26	RES,MF,1.82KOHM,1%,.0625W,SM,0	Q702	4809807C45	XSTR,FET GP PWR,MOSFET,P-CH,FD
L409	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	L502	2414017G18	IDCTR,CHIP,82NH,5%,300MA,2OHM,	Q703	4813970M54	XSTR,FET GP PWR,MOSFET,P,ENHN,
L410	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	L503	2413954B16	IDCTR,FXD,18NH,5%,320MA,.6OHM,	Q704	4809607E17	XSTR,BIP GP POWER,PNP,NSS35200
L411	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	L605	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,	Q705	NOTPLACED	64AM DUMMY PART NUMBER
L412	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	L750	2414017G19	IDCTR,CHIP,100NH,5%,300MA,2.5O	Q706	4813972A34	XSTR,FET GP SS,MOSFET,N AND P,

Component Locations [Continued]

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
Q707	4885316E06	TRANSISTOR,BIP GENERAL PURPOSE	R200	0613952Q74	RES,MF,1.1KOHM,5%,.0625W,SM,04	R600	0613952Q46	RES,MF,75OHM,5%,.0625W,SM,0402
Q708	4885316E36	XSTR,FET GP PWR,N,SOT-723,20V,	R201	0613952Q69	RES,MF,680OHM,5%,.0625W,SM,040	R6000	NOTPLACED	64AM DUMMY PART NUMBER
Q709	NOTPLACED	64AM DUMMY PART NUMBER	R202	0613952Q83	RES,MF,2.7KOHM,5%,.0625W,SM,04	R601	0613952Q52	RES,MF,130OHM,5%,.0625W,SM,040
Q788	NOTPLACED	64AM DUMMY PART NUMBER	R203	0613952R25	RES,MF,100KOHM,5%,.0625W,SM,04	R602	0613952Q47	RES,MF,82OHM,5%,.0625W,SM,0402
Q798	NOTPLACED	64AM DUMMY PART NUMBER	R204	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,	R603	0613952Q36	RES,MF,30OHM,5%,.0625W,SM,0402
Q855	4885316E13	XSTR,BIP GP SS,NPN,DTC144,XSTR	R421	0613952Q47	RES,MF,82OHM,5%,.0625W,SM,0402	R604	0613952Z43	RES,MF,3KOHM,1%,.0625W,SM,0402
R1001	NOTPLACED	64AM DUMMY PART NUMBER	R422	0613952Q47	RES,MF,82OHM,5%,.0625W,SM,0402	R605	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,
R1005	NOTPLACED	64AM DUMMY PART NUMBER	R423	0613952Q47	RES,MF,82OHM,5%,.0625W,SM,0402	R606	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,
R1009	NOTPLACED	64AM DUMMY PART NUMBER	R430	2489828Y17	CHIP INDUCTOR,RF,22NH,5%,200MA	R608	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,
R101	0613952Q91	RES,MF,5.6KOHM,5%,.0625W,SM,04	R431	2489828Y17	CHIP INDUCTOR,RF,22NH,5%,200MA	R609	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,
R1010	NOTPLACED	64AM DUMMY PART NUMBER	R432	2489828Y17	CHIP INDUCTOR,RF,22NH,5%,200MA	R610	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,
R1011	NOTPLACED	64AM DUMMY PART NUMBER	R455	NOTPLACED	64AM DUMMY PART NUMBER	R700	0613952Q73	RES,MF,1KOHM,5%,.0625W,SM,0402
R1012	NOTPLACED	64AM DUMMY PART NUMBER	R456	NOTPLACED	64AM DUMMY PART NUMBER	R701	0685512E01	RES,CER,.16OHM,1%,.25W,SM,0805
R1020	NOTPLACED	64AM DUMMY PART NUMBER	R470	0613952Q36	RES,MF,30OHM,5%,.0625W,SM,0402	R702	NOTPLACED	64AM DUMMY PART NUMBER
R1022	NOTPLACED	64AM DUMMY PART NUMBER	R471	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,	R704	0613952R01	RES,MF,10KOHM,5%,.0625W,SM,040
R1023	NOTPLACED	64AM DUMMY PART NUMBER	R492	0613952Q91	RES,MF,5.6KOHM,5%,.0625W,SM,04	R706	0613952R16	RES,MF,43KOHM,5%,.0625W,SM,040
R1024	NOTPLACED	64AM DUMMY PART NUMBER	R500	0613952K85	RES,MF,75OHM,1%,.0625W,SM,0402	R707	NOTPLACED	64AM DUMMY PART NUMBER
R103	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,	R501	0613952L01	RES,MF,100OHM,1%,.0625W,SM,040	R708	0613952R17	RES,MF,47KOHM,5%,.0625W,SM,040
R1030	NOTPLACED	64AM DUMMY PART NUMBER	R503	0685660C01	RES,THRM,47KOHM,AT 25DEG C,3%,	R709	NOTPLACED	64AM DUMMY PART NUMBER
R104	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,	R505	0613952R25	RES,MF,100KOHM,5%,.0625W,SM,04	R710	0613952N01	RES,MF,10KOHM,1%,.0625W,SM,040
R1099	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,	R506	0613952Q25	RES,MF,10OHM,5%,.0625W,SM,0402	R711	0613952N80	RES,MF,66.5KOHM,1%,.0625W,SM,0
R1414	0613952Q42	RES,MF,51OHM,5%,.0625W,SM,0402	R507	NOTPLACED	64AM DUMMY PART NUMBER	R712	0613952M96	RES,MF,9.76KOHM,1%,.0625W,SM,0
R1440	2113944A28	CAP,CHIP,18PF,+5%,-5%,50V-DC,0	R518	0613952K85	RES,MF,75OHM,1%,.0625W,SM,0402	R713	0613952N82	RES,MF,69.8KOHM,1%,.0625W,SM,0
R1441	0613952R32	RES,MF,200KOHM,5%,.0625W,SM,04	R598	0613952R01	RES,MF,10KOHM,5%,.0625W,SM,040	R714	0688044N02	RES,METAL STRIP,.02OHM,1%,.125
R1443	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,	R599	NOTPLACED	64AM DUMMY PART NUMBER	R715	0685512E01	RES,CER,.16OHM,1%,.25W,SM,0805

Component Locations [Continued]

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
R716	NOTPLACED	64AM DUMMY PART NUMBER	R752	NOTPLACED	64AM DUMMY PART NUMBER	R782	0613952P30	RES,MF,200KOHM,1%,.0625W,SM,04
R719	0613952Q01	RES,MF,1OHM,5%,.0625W,SM,0402,	R753	NOTPLACED	64AM DUMMY PART NUMBER	R783	0613952Z75	RES,MF,180KOHM,1%,.0625W,SM,04
R720	0613952R17	RES,MF,47KOHM,5%,.0625W,SM,040	R754	0613952Q83	RES,MF,2.7KOHM,5%,.0625W,SM,04	R784	0613952Z75	RES,MF,180KOHM,1%,.0625W,SM,04
R721	0613952R32	RES,MF,200KOHM,5%,.0625W,SM,04	R755	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	R785	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,
R722	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,	R757	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,	R786	NOTPLACED	64AM DUMMY PART NUMBER
R723	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,	R758	7685268E01	FLTR,FERRITE BEAD,650MA,SM,040	R787	NOTPLACED	64AM DUMMY PART NUMBER
R724	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,	R759	0689057L01	RES,CHIP,.05OHM,1%,0805,2X1.27	R788	NOTPLACED	64AM DUMMY PART NUMBER
R725	0613952R01	RES,MF,10KOHM,5%,.0625W,SM,040	R760	0613952Q91	RES,MF,5.6KOHM,5%,.0625W,SM,04	R789	0613952Q73	RES,MF,1KOHM,5%,.0625W,SM,0402
R726	0613958C10	RES,MF,124OHM,1%,.125W,SM,0805	R762	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,	R790	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,
R727	0613952R01	RES,MF,10KOHM,5%,.0625W,SM,040	R763	0613952R16	RES,MF,43KOHM,5%,.0625W,SM,040	R791	0613952Q36	RES,MF,30OHM,5%,.0625W,SM,0402
R728	0613952P58	RES,MF,392KOHM,1%,.0625W,SM,04	R764	0613952N30	RES,MF,20KOHM,1%,.0625W,SM,040	R792	0613952Q36	RES,MF,30OHM,5%,.0625W,SM,0402
R729	0613952N93	RES,MF,90.9KOHM,1%,.0625W,SM,0	R765	0613952N85	RES,MF,75KOHM,1%,.0625W,SM,040	R793	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,
R730	0613952P09	RES,MF,121KOHM,1%,.0625W,SM,04	R766	0613952P58	RES,MF,392KOHM,1%,.0625W,SM,04	R794	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,
R731	0613952R01	RES,MF,10KOHM,5%,.0625W,SM,040	R768	NOTPLACED	64AM DUMMY PART NUMBER	R796	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,
R732	NOTPLACED	64AM DUMMY PART NUMBER	R769	0613952R01	RES,MF,10KOHM,5%,.0625W,SM,040	R799	NOTPLACED	64AM DUMMY PART NUMBER
R734	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,	R770	0613952Q73	RES,MF,1KOHM,5%,.0625W,SM,0402	R806	NOTPLACED	64AM DUMMY PART NUMBER
R735	0613952R32	RES,MF,200KOHM,5%,.0625W,SM,04	R771	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,	R810	NOTPLACED	64AM DUMMY PART NUMBER
R739	0613952R01	RES,MF,10KOHM,5%,.0625W,SM,040	R772	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,	R811	0613952R01	RES,MF,10KOHM,5%,.0625W,SM,040
R741	0613952Q73	RES,MF,1KOHM,5%,.0625W,SM,0402	R773	0613952P97	RES,MF,1MOHM,1%,.0625W,SM,0402	R820	0613952Q91	RES,MF,5.6KOHM,5%,.0625W,SM,04
R745	0613952R01	RES,MF,10KOHM,5%,.0625W,SM,040	R775	0613952P30	RES,MF,200KOHM,1%,.0625W,SM,04	R824	0613952R01	RES,MF,10KOHM,5%,.0625W,SM,040
R746	0613952Q73	RES,MF,1KOHM,5%,.0625W,SM,0402	R776	NOTPLACED	64AM DUMMY PART NUMBER	R827	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,
R748	0613958K63	RES,MF,4.42OHM,1%,.25W,SM,1206	R777	NOTPLACED	64AM DUMMY PART NUMBER	R828	NOTPLACED	64AM DUMMY PART NUMBER
R749	NOTPLACED	64AM DUMMY PART NUMBER	R778	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,	R829	NOTPLACED	64AM DUMMY PART NUMBER
R750	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,	R780	NOTPLACED	64AM DUMMY PART NUMBER	R835	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,
R751	0613952Q73	RES,MF,1KOHM,5%,.0625W,SM,0402	R781	0613952P30	RES,MF,200KOHM,1%,.0625W,SM,04	R840	NOTPLACED	64AM DUMMY PART NUMBER

Component Locations [Continued]

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
R841	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,	SH301	2671768L01	SHLD,MULTI CAVITY,SMOOTH,SHLD	TP_ASW	NOTPLACED	64AM DUMMY PART NUMBER
R850	0613952R17	RES,MF,47KOHM,5%,.0625W,SM,040	SH500	2671783L01	SHLD,MULTI CAVITY,SMOOTH,SHLD	TP_BCLK	NOTPLACED	64AM DUMMY PART NUMBER
R851	NOTPLACED	64AM DUMMY PART NUMBER	SH600	2671786L01	SHLD,MULTI CAVITY,SMOOTH,SHLD	TP_CKO	NOTPLACED	64AM DUMMY PART NUMBER
R852	NOTPLACED	64AM DUMMY PART NUMBER	SH700	2671767L01	SHLD,MULTI CAVITY,SMOOTH,SHLD	TP_CKOH	NOTPLACED	64AM DUMMY PART NUMBER
R853	0613952R01	RES,MF,10KOHM,5%,.0625W,SM,040	SH800	2671784L01	SHLD,MULTI CAVITY,SMOOTH,SHLD	TP_CS0	NOTPLACED	64AM DUMMY PART NUMBER
R855	0613952R09	RES,MF,22KOHM,5%,.0625W,SM,040	SPIA_CLK	NOTPLACED	64AM DUMMY PART NUMBER	TP_CS2	NOTPLACED	64AM DUMMY PART NUMBER
R856	0613952R01	RES,MF,10KOHM,5%,.0625W,SM,040	SPIA_MISO	NOTPLACED	64AM DUMMY PART NUMBER	TP_CS4	NOTPLACED	64AM DUMMY PART NUMBER
R869	NOTPLACED	64AM DUMMY PART NUMBER	SPIA_MOSI	NOTPLACED	64AM DUMMY PART NUMBER	TP_D0	NOTPLACED	64AM DUMMY PART NUMBER
R870	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,	SPIB_CLK	NOTPLACED	64AM DUMMY PART NUMBER	TP_DMCS	NOTPLACED	64AM DUMMY PART NUMBER
R877	NOTPLACED	64AM DUMMY PART NUMBER	SPIB_MISO	NOTPLACED	64AM DUMMY PART NUMBER	TP_EAR_M	NOTPLACED	64AM DUMMY PART NUMBER
R878	0613952R17	RES,MF,47KOHM,5%,.0625W,SM,040	SPIB_MOSI	NOTPLACED	64AM DUMMY PART NUMBER	TP_EAR_P	NOTPLACED	64AM DUMMY PART NUMBER
R880	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,	SPKR_R_M	NOTPLACED	64AM DUMMY PART NUMBER	TP_EB0	NOTPLACED	64AM DUMMY PART NUMBER
R881	NOTPLACED	64AM DUMMY PART NUMBER	SPKR_R_P	NOTPLACED	64AM DUMMY PART NUMBER	TP_EB1	NOTPLACED	64AM DUMMY PART NUMBER
R882	0613952R66	RES,MF,0OHM,5%,.0625W,SM,0402,	T1400	2585130E04	XFMR,BALUN,SM,BALUN 1500 MHZ 5	TP_EOL	NOTPLACED	64AM DUMMY PART NUMBER
R894	NOTPLACED	64AM DUMMY PART NUMBER	T200	2585130E05	XFMR,BALUN,SM,BALUN 800-900 MH	TP_GPS_CLK	NOTPLACED	64AM DUMMY PART NUMBER
R895	NOTPLACED	64AM DUMMY PART NUMBER	T500	2585130E03	XFMR,BALUN,XFMR RF BALUN	TP_LBAN	NOTPLACED	64AM DUMMY PART NUMBER
R896	NOTPLACED	64AM DUMMY PART NUMBER	TEST1_SL	NOTPLACED	64AM DUMMY PART NUMBER	TP_LNA_EN	NOTPLACED	64AM DUMMY PART NUMBER
R897	NOTPLACED	64AM DUMMY PART NUMBER	TEST2_SL	NOTPLACED	64AM DUMMY PART NUMBER	TP_MIC	NOTPLACED	64AM DUMMY PART NUMBER
R901	0613952Q33	RES,MF,22OHM,5%,.0625W,SM,0402	TP_16_8MHZ	NOTPLACED	64AM DUMMY PART NUMBER	TP_OEN	NOTPLACED	64AM DUMMY PART NUMBER
R902	0613952Q33	RES,MF,22OHM,5%,.0625W,SM,0402	TP_32KHZ	NOTPLACED	64AM DUMMY PART NUMBER	TP_RF_ATTN	NOTPLACED	64AM DUMMY PART NUMBER
RS232_RX	NOTPLACED	64AM DUMMY PART NUMBER	TP_A1	NOTPLACED	64AM DUMMY PART NUMBER	TP_RRA_CS	NOTPLACED	64AM DUMMY PART NUMBER
RS232_TX	NOTPLACED	64AM DUMMY PART NUMBER	TP_ACQ_CLK	NOTPLACED	64AM DUMMY PART NUMBER	TP_RTS	NOTPLACED	64AM DUMMY PART NUMBER
RXEN_STROB	NOTPLACED	64AM DUMMY PART NUMBER	TP_ADTRIG	NOTPLACED	64AM DUMMY PART NUMBER	TP_RWN	NOTPLACED	64AM DUMMY PART NUMBER
SH1000	2671785L01	SHLD,MULTI CAVITY,SMOOTH,SHLD	TP_AGC_DAC	NOTPLACED	64AM DUMMY PART NUMBER	TP_RX_ACQ	NOTPLACED	64AM DUMMY PART NUMBER
SH300	2671782L01	SHLD,MULTI CAVITY,SMOOTH,SHLD	TP_ANA_CLK	NOTPLACED	64AM DUMMY PART NUMBER	TP_RXFS	NOTPLACED	64AM DUMMY PART NUMBER

Component Locations [Continued]

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
TP_RXI	NOTPLACED	64AM DUMMY PART NUMBER	U3004	5171972L01	IC,SW,SP3T RF SW	VR755	4813978M23	DIODE,SWG,SM,SOT-563,1A,23V,.2
TP_RXIX	NOTPLACED	64AM DUMMY PART NUMBER	U501	5185633C54	IC,AMP,LOW TIER ADJUSTABLE GAI	VR801	4805656W46	DIODE,ZEN,SM,16V,SNGL
TP_RXQ	NOTPLACED	64AM DUMMY PART NUMBER	U502	5189153N01	IC,BUFFER AMPLIFIER,,N-I,,,OPE	Y1	4809995L13	RESON,QRTZ,.032768MHZ,,,,SM,,F
TP_SH_CS	NOTPLACED	64AM DUMMY PART NUMBER	U700	5109817F82	IC,COMPTR,NCS2200,SM,LOW V W18	Y600	5185633C78	OSCILLATOR,TEMP COMPENSATED CR
TP_SRDB	NOTPLACED	64AM DUMMY PART NUMBER	U701	5164015H10	IC,PWR MGMT,SM,IC, ROADRUNNER			
TP_STD	NOTPLACED	64AM DUMMY PART NUMBER	U703	5114014A82	IC,LNR V REGLTR,FXD,3.7V,100MA			
TP_TXCLK	NOTPLACED	64AM DUMMY PART NUMBER	U801	5185594F15	IC,CUST,DIGITAL PROCESSING,BAS			
TP_TXE	NOTPLACED	64AM DUMMY PART NUMBER	U802	5175772B32	IC,FLASH/PSRAM,256/64MBIT,QUAD			
TP_TXFS	NOTPLACED	64AM DUMMY PART NUMBER	U803	NOTPLACED	64AM DUMMY PART NUMBER			
TP_TXI	NOTPLACED	64AM DUMMY PART NUMBER	U805	5189153N01	IC,BUFFER AMPLIFIER,,N-I,,,OPE			
TP_TXIX	NOTPLACED	64AM DUMMY PART NUMBER	USB_TXENB	NOTPLACED	64AM DUMMY PART NUMBER			
TP_TXQ	NOTPLACED	64AM DUMMY PART NUMBER	USB_VBUS	NOTPLACED	64AM DUMMY PART NUMBER			
TP_TXQX	NOTPLACED	64AM DUMMY PART NUMBER	USB_VPIN	NOTPLACED	64AM DUMMY PART NUMBER			
TP_USB_EOP	NOTPLACED	64AM DUMMY PART NUMBER	VR106	4805656W76	DIODE,ZEN,SM,SOD-523,5.6V			
TP_VIB	NOTPLACED	64AM DUMMY PART NUMBER	VR107	4805656W46	DIODE,ZEN,SM,16V,SNGL			
TP_WAITB	NOTPLACED	64AM DUMMY PART NUMBER	VR109	4805656W76	DIODE,ZEN,SM,SOD-523,5.6V			
TP_WDOG	NOTPLACED	64AM DUMMY PART NUMBER	VR405	4805656W46	DIODE,ZEN,SM,16V,SNGL			
TPRXQX	NOTPLACED	64AM DUMMY PART NUMBER	VR430	4805656W65	DIODE,ZEN,SM,SC-89,5.6V,DL ZEN			
U1000	NOTPLACED	64AM DUMMY PART NUMBER	VR432	4805656W96	DIODE,SUPR,5V,10MA,.15W,SM,SOD			
U1001	NOTPLACED	64AM DUMMY PART NUMBER	VR433	NOTPLACED	64AM DUMMY PART NUMBER			
U1420	5105739X12	IC,AMP,SM	VR434	4805656W96	DIODE,SUPR,5V,10MA,.15W,SM,SOD			
U200	5115443H01	IC,RF AMPLIFIER,QFN12,QFN,15.5	VR702	4813979B24	DIODE ARRAY,TRANSIENT PROTECTI			
U2051	5164852H14	IC,CUST,RF TRANSCEIVER,BGA,IC,	VR703	4805656W99	DIODE,ZEN,SM,5.6V,5.6V,.1W,ZEN			
U300	5175772B65	OSC,VCO,1.8824GHZ MAX,1.6996GH	VR704	4813978M23	DIODE,SWG,SM,SOT-563,1A,23V,.2			
U3003	5171972L01	IC,SW,SP3T RF SW	VR750	4805656W65	DIODE,ZEN,SM,SC-89,5.6V,DL ZEN			

Component Locations [Continued]

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description	Ref. No.	Part No.	Description

APPENDIX A

ORDERING REPLACEMENT PARTS AND KITS

Parts should be replaced with identical replacement parts. Replacement parts and kits for i290 units can be ordered directly from the Motorola Accessories and Aftermarket Division (AAD) at 1-800-422-4210 and listen to the prompts; or FAX 800-622-6210.

A.1 Customer Service

For warranty and customer service assistance, call:

1-800-453-0920 U.S./Canada
1-954-723-3000 FAX
1-954-723-4910 International (outside U.S ./Canada)

A.2 Replacement Parts

When ordering replacement and accessory parts, the complete part number should be included. If the correct part number cannot be located, call Motorola Parts Identification at 1-800-422-4210.

A.3 Domestic Orders

Send written orders for replacement parts, test equipment, or manuals to:

Motorola, Inc.
Accessories and Aftermarket Division
Attn: Order Processing 1313 E.
Algonquin Road Schaumburg, IL
60196

Call, fax, or telex orders to:

1-800-422-4210
1-847-538-8198 FAX
280 127 TELEX

A.4 International Orders

For international orders:

Motorola, Inc.
Accessories and Aftermarket Division Attn:
International Order Processing 1313 E.
Algonquin Road
Schaumburg, IL 60196

Call, fax, or telex orders to:
1-847-538-8023
1-847-576-3023 FAX
403305 TELEX

A.5 Replacement Kits

When ordering replacement kits, the complete kit number should be included. If the correct number cannot be located, call Motorola Parts Identification at 1-800-422-4210. Refer to the exploded view and parts list in Chapter 7.

Table: A-1.

Description	Part Number	
	i425	i290
Batteries		
BK60 Standard Li-Ion Battery	SNN5784B	SNN5784A
Battery Doors		
Standard Battery Door w/ Boost branding (white)	NTN2425BA	
Standard Battery Door w/ Boost branding (grey)	NTN2447BA	
i290 Standard Battery Door w/ Nextel label		NTN2421NA
i290 Standard Battery Door -Jordan		NTN2421JORA
i290 Standard Battery Door -Saudi Arabia		NTN2421SAUA
i290 Standard Battery Door - Korea		NTN2421KORA
i290 Standard Battery Door – Southern Link		NTN2421SOLA
i290 Standard Battery Door – GTSS Harmony, Asia,& Int'l Generic		NTN2421MOTA
i290 Standard Battery Door - MIRS		NTN2421ISRA
i290 Standard Battery Door–Mexico, Peru, Argentina, Chile, Brazil		NTN2421NIIA
i290 Standard Battery Door - TELUS		NTN2421TELA
Carry Solutions (i290 ONLY)		
i290 Swivel Carry Holster		NNTN7138A
Rapid Travel Chargers		
EMU Rapid Wall-Charger (US)	SPN5397A	SPN5202C
EMU Midrate Wall-Charger (US)	SPN5316A	SPN5185B
Car Products		
EMU Rapid Vehicle Charger	SYN0847B	SYN0847B
EMU Midrate Vehicle Charger	SYN1630A	SYN1630A
EMU Loop Rapid Vehicle Charger (non-Latching)	SPN5401A	
Universal Dash Mount System	NNTN5113B	NNTN5113B
Data Products		
iDEN USB Data Cable	NNTN6531A	NNTN6531A
USB Data Cable	SKN6371C	SKN6371C
Wired Audio		
PTT Headset, Earbud	NNTN5330B	NNTN5330B
PTT headset, Over-the-Ear	NNTN5004B	NNTN5004B
PTT headset, Over-the-Head	NNTN5005B	NNTN5005B
PTT headset, Flexible Earwrap	NNTN5006B	NNTN5006B
2-Wire Surveillance Headset	NNTN5211B	NNTN5211B
3-Wire Surveillance Headset	NNTN6312A	NNTN6312A

A.6 Recommended Test Equipment and Tools

The following table lists the standard test equipment recommended for troubleshooting i290 units at the field level of service.

Table: A-2. Recommended Test Tools

Description	Part Number	
	i425	i290
Battery Eliminator, Regulated		
Black Stick	SLN7223A	SLN7223A
Cable, Audio Jack Test	NNTN5171A	NNTN5171A
Cable, SMA to N-Type RF	Contact Motorola	Contact Motorola
Communications System Analyzer	Motorola R-2660	Motorola R-2660
Data Cable, Flash	RJD2005A	RJD2005A
Data Cable, USB	SKN6371C	SKN6371C
Digital Volt-Ohm Meter	Keithly 2001 or equivalent	Keithly 2001 or equivalent
Power Supply, 0-15VDC, 0-3A	S1348D	S1348D
SIM Card, Reference	SIMGBK105R	SIMGBK105R
Torx Bit, T-4	Commercially available	Commercially available
Torx Bit, T-6	6680387A70	6680387A70
Torx Driver, calibrated	RSX4043	RSX4043
Wrist Strap, Static ground	NTN98 12	NTN98 12

A.7 Recommended Programming Equipment

The following tables list the programming equipment and software recommended for troubleshooting i290 units at the field level of service.

Table A-3. Recommended Programing Equipment

Name	Part Number	Description
Cable, Data, codeplug Cable, Data, USB	RJD2005A SKN6371C	Connects unit to the computer for monitoring the codeplug.

Table A-3. Recommended Programming Equipment (Continued)

Cable, Data (2.5mm)	TTY	Connects unit to a teletypewriter (TTY) device for making phone calls.
Cable, Data (for GPS interface)	GPS	Connects unit to a laptop or other device for sending location information.
Computer, IBM PC-Compatible (RSS Workstation)	N/A	Pentium microprocessor with: 32MB RAM min.; 4MB hard disk space min.; Two serial ports and one parallel port; network-capability; Microsoft Windows 2000, Windows 98, or Windows NT 3.5.1 or later

Table A-4. Recommended Software

Name	Part Number	Description
Radio Service Software (RSS) Carrier Version Super Agent Version	RVN4 121 RVN4 122	Monitors the unit's code plug parameters.
iDEN Wireless Data Services Software		Programs a laptop, handheld device, or desktop computer to use the i290 unit as a modem to transfer circuit or packet data.
Interactive Map Software (such as that made by DeLorme or Microsoft) that supports NEMA 3.0 format		Allows i290 unit's GPS feature to provide approximate location data to a laptop computer or other device.

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