

Level 3 Service Manual

# **Dual Band Personal Communicator**



Motorola V200 CDMA 800/1900 MHz Technology

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## Introduction

Motorola<sup>®</sup> Inc. maintains a worldwide organization that is dedicated to provide responsive, full-service customer support. Motorola products are serviced by an international network of company-operated product care centers as well as authorized independent service firms.

Available on a contract basis, Motorola Inc. offers comprehensive maintenance and installation programs which enable customers to meet requirements for reliable, continuous communications.

To learn more about the wide range of Motorola service programs, contact your local Motorola products representative or the nearest Customer Service Manager.

#### **Product Identification**

Motorola products are identified by the model number on the housing. Use the entire model number when inquiring about the product. Numbers are also assigned to chassis and kits. Use these numbers when requesting information or ordering replacement parts.

## **Product Names**

Product names included in V200 Personal Communicators are listed on the front cover. Product names are subject to change without notice. Some product names, as well as some frequency bands, are available only in certain markets.

## **Product Changes**

When electrical, mechanical, or production changes are incorporated into Motorola products, a revision letter is assigned to the chassis or kit affected, for example; -A, -B, or -C, and so on.

The chassis or kit number, complete with revision number, is imprinted during production. The revision letter is an integral part of the chassis or kit number and is also listed on schematic diagrams and printed circuit board layouts.

## **Regulatory Agency Compliance**

This device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions:

- 1. This device may not cause any harmful interference, and
- 2. this device must accept interference received, including interference that may cause undesired operation.

This class B device also complies with all requirements of the Canadian Interference-Causing Equipment Regulations (ICES-003).

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

## **Computer Program Copyrights**

The Motorola products described in this manual may include Motorola computer programs stored in semiconductor memories or other media that are copyrighted with all rights reserved worldwide to Motorola. Laws in the United States and other countries preserve for Motorola, Inc. certain exclusive rights to the copyrighted computer programs, including the exclusive right to copy, reproduce, modify, decompile, disassemble, and reverse-engineer the Motorola computer programs in any manner or form without Motorola's prior written consent. Furthermore, the purchase of Motorola products shall not be deemed to grant either directly or by implication, estoppel, or otherwise, any license or rights under the copyrights, patents, or patent applications of Motorola, except for a nonexclusive license to use the Motorola product and the Motorola computer programs with the Motorola product.

## **About This Service Manual**

Using this service manual and the many suggestions contained in it assures proper installation, operation, and maintenance of CDMA V200 communicators. Refer any questions about this manual to the nearest Customer Service Manager.

A product family is the group of products having the same Account Product Code (APC). To locate the APC on a device, refer to the "Mechanical Serial Number (MSN)" section in the CDMA V200 Level 2 Service manual.

#### Audience

This document provides assistance to service personnel in testing and repairing CDMA V200 communicators. Service personnel should be familiar with electronic assembly, testing, and troubleshooting methods, and with the operation and use of associated test equipment.

Use of this document assures proper installation, operation, and maintenance of Motorola products and equipment. It contains all service information required for the equipment described and is current as of the printing date.

#### Scope

The scope of this document is to provide the reader with basic information relating to CDMA V200 communicators, and also to provide procedures and processes for repairing the units at Level 3 service centers including:

- · Component-level troubleshooting
- Limited PCB component repair requiring unsoldering and soldering
- Testing and verification of unit functionality
- Initiating warranty claims and sending faulty modules to Level 4 repair centers.

#### Conventions

Special characters and typefaces, listed and described below, are used in this publication to emphasize certain types of information.



Note: Emphasizes additional information pertinent to the subject matter.



Caution: Emphasizes information about actions which may result in equipment damage.



Warning: Emphasizes information about actions which may result in personal injury.



Keys to be pressed are represented graphically. For example, instead of "Press the Enter Key", you will see "Press Enter".

Information from a screen is shown in text as similar as possible to what appears in the display. For example, **ALERTS** or **ALERTS** or **ALERTS**.

Information that you need to type is printed in **boldface type** 

#### Revisions

Any changes that occur after manuals are printed are described in publication revision bulletins (PMRs). These bulletins provide change information that can include new parts listing data, schematic diagrams, and printed board layouts.

## **Warranty Service Policy**

The product will be sold with the standard 12 months warranty terms and conditions. Accidental damage, misuse, and extended warranties offered by retailers are not supported under warranty. Non warranty repairs are available at agreed fixed repair prices.

#### **Out of Box Failure Policy**

The standard out of box failure criteria applies. Customer units that fail very early on, after the date of sale, are to be returned to Manufacturing for root cause analysis, to guard against epidemic criteria. Manufacturing to bear the costs of early life failure.

#### **Product Support**

Customer's original units will be repaired but not refurbished as standard. Appointed Motorola Service Hubs will perform warranty and non-warranty field service for level 2 (assemblies) and level 3 (limited PCB component). The Motorola Hi-Tech Centers will perform level 4 (full component) repairs.

#### **Customer Support**

Customer support is available through dedicated call centers and in-country help desks. Product service training should be arranged through the local Motorola Support Center.

## **Parts Replacement**

When ordering replacement parts or equipment, include the Motorola part number and description used in the service manual or supplement.

When ordering crystals or channel elements, specify the Motorola part number, description, crystal frequency, and operating frequency desired.

When the Motorola part number of a component is not known, use the product model number or other related major assembly along with a description of the related major assembly and of the component in question.

In the U.S.A., to contact Motorola, Inc. on your TTY, call: 800-793-7834

#### Accessories and Aftermarket Division (AAD)

Replacement parts, test equipment, and manuals can be ordered from AAD.

 U.S.A
 Outside U.S.A.

 Phone: 800-422-4210
 Phone: 847-538-8023

 FAX: 800-622-6210
 FAX: 847-576-3023

## **Circuit Description**

## Overview

### **Controller (Audio/Logic Circuit)**

The CDMA V200 Personal Communicator chip set includes Motorola proprietary call processor and audio/power controller ICs, with on-board flash EEPROM and SRAM memory. See Figure 1 for a functional block diagram.

The 32-bit call processor IC includes the functionality of CPU, DSP, CSP, and CIA. The audio/power controller IC works in buck mode with no 5V supply, controls the 32Khz crystal, and interfaces with the call processor over an 8-bit parallel bus. Communication with accessories is through the CE bus connector through the audio/power controller IC. Audio through the external connector is analog.

The V200 has an integrated speakerphone that also serves as the alert transducer. The audio/power controller IC handles all the audio functions including alert/ speakerphone and headset speaker/microphone.

Key features of the Motorola call processor IC include:

- Motorola proprietary integer processor with 32-bit RISC architecture,
- 56600 NDE-UL DSP core running at up to 70 Mhz @ 1.8V,
- MCU-DSP interface,
- CDMA signal processor (CSP3) ASIC,
- 16-bit external memory interface for the MCU,
- 8-bit parallel interface for the audio/power controller IC,
- 32-input interrupt controller for the MCU,
- internal MCU ROM and RAM,
- special modules for CDMA mode (all are MCU peripherals),
- dual 9.8304 Msamples/sec 4-bit ADCs (RX I/Q with Receive AGC),
- dual 4.9152 Msamples/sec 9-bit DACs,
- 13-bit linear CODEC,
- 1 8-bit, 2 10-bit, and 1 12-bit measurement DAC,
- 8-bit measurement ADC with 6 multiplexed inputs,
- 10-bit AOC loop control ADC and DAC (DSP peripheral),
- a UART with auto baud detection,
- universal serial bus (USB) interface module, and
- serial audio port interface.

Key features of the audio/power controller IC include:

- 8-bit parallel interface from the call processor IC,
- buck and boost converters,
- 8 Linear voltage regulators,
- 2 high end linear regulators with common reference (PA drain regulators),
- external B+ clamp regulator,
- 3 microphone amplifiers,
- differential audio interfaces to and from the call processor IC,
- audio amplifiers, multiplexers, and speaker and alert drivers,
- headset and send/end key detection,
- battery charger,
- 6-input 8-bit ADC,

- real time clock (RTC) with coin cell backup supply and coin cell charger,
- timer circuits,
- CE bus interface, and
- vibrator and backlight regulator inside the IC.

The external memory consists of

- 32Mb 1.8V flash EEPROM and
- 4Mb 1.8V SRAM.

Additional V200 controller features include:

- a 17-pin CE bus connector (butt plug) supporting USB and RS232 serial communications and running at 2.7V,
- 32 Khz crystal controlled by the audio/power controller IC for RTC and slotted mode operation,
- fast charge battery charging circuit, and
- all controller parts and ICs placed on one board and all RF parts and ICs placed on another PCB.



Figure 1. V200 simplified block diagram

#### **Transceiver (RF Circuit)**

The V200 transceiver chip set includes Motorola front-end (FE), mixer/exciter (ME), and RF transceiver ICs. Refer to Figure 1.

Switching between the antenna and accessory antenna port is mechanical, having a normally-closed circuit with the antenna connector. When an accessory RF plug is inserted, the switch opens the antenna circuit and closes the accessory port circuit.

The receiver contains two complete receiver paths. An 800 Mhz path is used for 800 Mhz cellular signals and a 1900 Mhz path for PCS signals. The two paths have different RF, LO, and IF frequencies.

The FE IC contains LNAs, interstage filtering, and mixers. Switching and gain of the LNAs are controlled by control signals from the call processor IC on the controller board.

The RF transceiver IC extracts the broadband signal from the IF, demodulates the analog signal, and sends it to the controller for further processing.

The RF transceiver IC controls the main LO, the second LO, and the transmit offset VCO. The main LO uses 2 VCO modules, one for the 800 MHz cellular band and the other for the 1900 MHz PCS band. The output is split into receive LO and transmit LO signals for both bands.

During transmit, the ME IC controls the RF output power. The ME IC requires two LOs, one for 1900 MHz PCS band and the other for the 800 MHz cellular band. The IF pins (input to the ME IC) are the same for both bands. A control signal at the AGC pins control the gain of the ME IC. An external interstage RF filter exists between the mixer and exciter. From the mixer, the outputs take 2 different paths, one for PCS 1900 MHz band and another for 800 MHz cellular band.

The ME IC has 50 dB of attenuator control (input IF level= -23dBm, maximum output transmit level= 25dBm). Band pass filters are used at the output of the ME IC and, in the PCS path, two split-band filters are used.

The power amplifier (PA) consists of two stages in 800 MHz cellular band and three stages in the 1900 MHz PCS band. The PA operates in enhanced mode which requires a positive gate voltage. Because the PA has adjustable bias for both the gate and drain, its output power can be regulated by control signals from the audio/ power controller IC, the call processor IC, and the mixer/exciter IC.

## Controller



Detailed functional block diagrams, schematics, and parts lists for the controller board are provided in the Supplement listed in Related Publications section of this manual.

#### Receive

The baseband signal from RF transceiver IC *U700* on lines RXIP, RXIM, RXQP, and RXQM, is applied to call processor IC *U1100* where it is digitized to produce a 1.2288 Mb/sec Rx data stream. The data stream is decoded by the CSP inside *U1100* to generate a signal containing only the desired data. The digital speech data is further decoded by the CELP vocoder, a part of DSP within *U1100*, and then converted back into analog receive audio which is routed to audio/power controller

IC **U1200** via signals AUDIO\_P and AUDIO\_M. **U1200** amplifies and routes the received audio signal to the speakerphone or headset.

The alert tone originates in call processor IC *U1100* and follows the same path as the receive audio, except it is sent only to the speakerphone.



Figure 2. V200 controller block diagram

#### Transmit

Audio from the internal speakerphone microphone or headset microphone is routed through, and amplified by, audio/power controller IC *U1200*. From *U1200*, the transmit audio is sent to call processor IC *U1100* on the MIC1 and MICREF lines. MIC1 and MICREF signals are digitized by the CODEC inside *U1100*, then processed by the DSP CELP variable rate vocoder, and then processed further by the modem (CSP), all also within the call processor IC *U1100*, to produce the

1.2288Mb/sec CDMA data stream. This stream is then converted to analog signals and sent to RF transceiver IC *U700* as TXIP, TXIM, TXQP, and TXQM.

#### **Keyboard Interface**

The keypad interface consists of 7 8-row and 2 3-column input pins.

The keypad port generates a CPU interrupt any time a key press is detected. This interrupt is capable of taking the processor out of low power mode.

For each key press, 2 GPIO will be asserted. At least 1 of the 2 GPIO will be an interruptible ROW control line. The key is derived from the interrupt and the identification of the 2 control lines that are pulled low.

Glitch suppression circuit qualifies the keypad input to prevent noise from inadvertently interrupting the CPU.

The circuit is a 4-state synchronizer clocked at 32kHz. An interrupt is not generated until all 4 synchronizer stages have latched a valid key assertion, effectively filtering out any noise less 122 us in duration. The debounce time is about 32 ms.

Figure 3 is a simplified diagram of the keypad logic.





The keys on the PCB use a three contact design. One of the contacts is tied to ground while the other two are pulled high (2.7 V) and connected to the rows and columns inputs. When a key is pressed, all three of its pads are shorted and therefore grounded. Each key is uniquely distinguished by the two lines pulled low. No strobing of the keypad is necessary.

Unshifted	Shifted	Phone	U1100	Keycode	COL ROW
Keyname	Keyname	Mode	INPUT	HEX	76543210 76543210
q w e r t y u i o p a s s d f f g h j k l ; z z x c v b n m ; k l ; z z x c v b n m ; k l ; z z x c v b n m ; s s d f f g h j k l ; z z x c v b n m ; s s d f f s pace Joystick_Left Joystick_Left Joystick_Cup Joystick_Cup Joystick_Cup Joystick_Cup Joystick_Down End Send Softkey_L Menu Softkey_R Volume_Down Volume_Down Volume_Down Volume_Down Volume_Down Volume_Down Volume_Down Volume_Down Volume_Cup VA/VR Smart CAPSLOCK HOME NUMLOCK 1 2 3 4 5 6 7 7 8 9 0 0 #	QWERTYUHOPASDFGHJKL::ZXCVBNM@= !AAAAA/(  AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA	123 456 789 #0*	ROW2,ROW4 ROW2,ROW3 ROW2,COL1 ROW2,ROW5 ROW2,COL0 ROW2,ROW6 ROW2,ROW6 ROW2,ROW7 ROW2,ROW7 ROW2,COL5 ROW4,ROW3 ROW4,COL1 ROW4,ROW1 ROW4,ROW0 ROW4,ROW1 ROW4,ROW0 ROW4,ROW7 ROW4,COL5 ROW3,COL0 ROW3,ROW7 ROW3,COL5 ROW3,COL1 ROW3,ROW5 ROW3,ROW7 ROW3,ROW7 ROW3,ROW7 ROW3,ROW7 ROW3,ROW7 ROW3,ROW7 ROW3,ROW7 ROW3,ROW7 ROW3,ROW7 ROW3,ROW7 ROW3,ROW7 ROW3,ROW7 ROW3,ROW7 ROW3,ROW7 ROW3,ROW7 ROW3,ROW7 ROW3,ROW7 ROW3,ROW7 ROW5,COL5 COL1,ROW7 ROW5,ROW1 ROW5,ROW0 ROW5,ROW7 ROW5,ROW7 ROW5,ROW7 ROW5,COL5 COL0,ROW7 ROW1,COL5 ROW1,ROW6 ROW7,COL5 ROW1,ROW6 ROW7,COL5 ROW1,ROW7 ROW1,COL5 ROW1,ROW7 ROW1,COL5 ROW1,ROW7 ROW1,COL5 ROW1,COL5 ROW7,COL5 ROW7,COL5	Oxffeb Oxffdb Oxffdb Oxffdb Oxffdb Oxffdb Oxffdb Oxffef	11111111         1110011           11111111         1110011           1111111         1101011           1111111         1101011           1111111         1011011           1111111         1011011           1111111         1011011           1111111         1011011           1111111         1011011           1111111         1011011           1111111         1011011           1111111         11100111           1111111         1100111           1111111         1100111           1111111         1100111           1111111         1100111           1111111         1100111           1111111         1100111           1111111         1100111           1111111         1110111           1111111         1110111           1111111         1110111           1111111         1110111           1111111         1111011           1111111         1111011           1111111         1111111           1111111         1111111           1111111         1111111           1111111         1111111           1111111

The Figure 4 shows The V200 keypad mapping.

0109950

Figure 4. V200 keypad mapping

#### **Memory Interface**

The call processor IC *U1100* has access, via its parallel data bus, to 1 SRAM (256k X 16) *U1400* in a 48-ball uBGA and 1 32 Mbit (2 Mbit x 16) Read-While-Write capable burst flash EPROM *U1300* in a 56-ball uBGA/FBGA (this part combines EEPROM and Flash ROM functionality). Each of these devices is assigned specific chip selects from the call processor IC. Within the call processor IC chip select control register, the wait states are defined for each device. Each wait state is the equivalent of one clock cycle; i.e., 1/16.8 MHz = 59.5 ns. The burst flash can read sequential data at a maximum clock rate of 34.5 MHz. (29 nS). The SRAM operates at a maximum rate of 11.76 MHz (85 nS).

#### **Board-to-Board Interface**

Interface between the controller and transceiver boards is through connectors *JBB1* and *P1* (controller and transceiver board, respectively). Table 1 provides a description of the signals on these connectors. Refer to Table 25 for detailed connector pinouts.

Pin(s)	Signal Name	Function
1,3,5	RX_2.75V / RX_2.75V_UN	2.75V supply voltage.
2,4,6,8,10	PAH_B+	PA high (PCS) B+ voltage.
7,11,13,15,25,26, 27,28,33,34,35, 36,39,43,47,48, 50,51,53,57,59, 60,61,62,67,68, 69,70,71,72,74, 75,76,79	Ground / RF_GND	Ground.
9	REF_WARP	Analog output from AFC DAC to control the 16.8 MHz reference oscillator.
12,14,16,18,20	PAL_B+	PA low (CDMA) B+ voltage.
17	BAND	RF band select.
19	MODE	Analog/digital mode selection. Always digital.
21	FEIC_G1	Receive supply control.
22	PA_BIAS	Controls negative bias for PA.
23	FEIC_G2	GPIO for PA bypass (controlled by MCU or DSP).
24	RF_DETECT	Analog signal from transmit power diode.
29	RXQM	Differential inputs of RX baseband analog Q-channel (-).
30	RXIM	Differential inputs of RX baseband analog I-channel (-).
31	RXQP	Differential inputs of RX baseband analog Q-channel (+).
32	RXIP	Differential inputs of RX baseband analog I-channel (+).
37	RSSI	Receive signal strength indicator.
38	TX_2.75V	2.75V supply voltage.
40	TX_2.75V	2.75V supply voltage.
41	RF_SLEEP	Control of RF circuits in slotted sleep mode.
42	TX_2.75V	2.75V supply voltage.
44	ME_VCA	Analog control voltage for voltage-controlled attenuator in Mixer/Exciter IC.

able 1. Board-to-Board	Interface Signal	Functions
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Pin(s)	Signal Name	Function
45	AFC_ANALOGST EERING	GPIO or analog steering sense (AFC out).
46	PA_ENABLE	Enable control signal for TX PA.
49	DISC	Discriminator input for analog mode.
52	LOCK_DETECT	Spare GPIO or timer input capture.
54	RF_SPI(2)	SPI clock in.
55	16.8MHZ	Reference clock (16.8 MHz square wave).
56	RF_SPI(0)	SPI data in.
58	RF_SPI(1)	SPI data out.
63	TXQM	Digital mode, TX baseband analog Q-channel (-).
64	TXIP	Digital mode, TX baseband analog I-channel (-).
65	TXQP	Digital mode, TX baseband analog Q-channel (+).
66	TXIM	Digital mode, TX baseband analog I-channel (+).
73	ZIF_VCA	Analog control voltage for voltage-controlled attenuator in RF Transceiver IC.
77	FM	Frequency modulation output from Call Processor IC to Call Processor IC. Held at ground during CDMA.
78	OSCEN_b	Enable control signal for reference oscillator.
80	TEMP_SENSE	Input to the measurement ADC from thermistor.

able 1. Board-to-Board Interfac	e Signal Functions	(Continued)
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### **CE Bus Connector**

V200 Personal Communicators have the Motorola CE Bus interface. The bus incorporates RS232 serial communication and universal serial bus (USB) into one connector.

The CE Bus supports connection to accessories, personal computers, and test systems. The bus connector has a total of 17 pins, 9 of which have multiple functions.

For signal name and function details, refer to Table 27 in this manual and the V200Level 3 Supplement listed in the Related Publication section, later in this manual.

The bus has six basic modes of operation:

- Normal (also No Accessory Connected),
- USB Mode,
- Analog Audio Mode,
- Phone Powered USB Mode,
- RS-232 Mode, and
- RS-232/SSI Mode.

There are also three additional non-standard modes, DSC, FLASH, and JTAG, which are used only for development, factory programming, and debugging.

Eight of the 17 pins have different functions depending on which mode is selected. The other nine pins always have the same function regardless of mode. The mode is selected by applying appropriate logic levels to the Option Select pins, named OPTION1 and OPTION2. Some of the modes listed above are selected by the additional application of a level on the USB POWER and AUDIO-IN pins as well.

USB and RS232 (3 wire) communications take place through the audio/power controller IC. For V200 phones, USB mode is used for flashing. USB requires a Motorola USB accessory cable to interface with a personal computer (PC). RS232 is used for testing, phasing, and flashing the phone. RS232 requires a Motorola RS232 data head to interface to a PC.

In the V200 CE Bus pin 2 serves the dual functions of BATTFDBK and MANTST. BATTFDBK is used for controlled power dissipation by the charger. MANTST is used to detect the type of charger (Full rate, Mid rate, and Invalid). Initially, the audio/power controller IC reads the voltage on this pin to determine the charger type, then the BATTFDBK signal is active.

## Transceiver



Detailed functional block diagrams, schematics, and parts lists for the transceiver board are provided in the Supplement listed in Related Publications section of this manual.

#### Receive CDMA Cellular 800 MHz (PCS 1900 MHz)

The communicator receives the RF signal from antenna connector **J9001** or RF test port **J9000**. The received RF signal is routed through diplexer **FL53** to mono-block duplex SAW filter **FL51** (mono-block duplex ceramic filter **FL50** for PCS 1900 MHz). The RF signal is then routed to the front-end (FE) IC **U9917**, which contains LNAs providing three stages of gain to the received RF signal based on its strength, and interstage filtering. **U9917** also contains a mixer which down converts the signal to an IF of 109.8 MHz. FE IC **U9917** is controlled by the call processor IC **U1100** on the controller board via signals FEIC\_G1, FEIC\_G2, and MODE. The local oscillator signal RX\_LO\_800 (RX\_LO\_PCS for PCS 1900 MHz) is 978 – 1004 MHz (2039-2100 MHz for PCS 1900 MHz). VCO module **U626** is controlled by the RF transceiver IC **U700**. The 109.8 MHz IF signal out of the mixer is routed through IF filter **FL150** into the RF transceiver IC **U700** for mixing with the second LO, filtering and demodulation. The received QPSK data is gain-controlled and converted to a digital baseband signal within RF transceiver IC **U700**. The baseband signal



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is output from U700 to call processor IC U1100 via signals RXIP, RXIM, RXQP, and RXQM.

#### Figure 5. V200 transceiver block diagram

#### Transmit CDMA Cellular 800 MHz (PCS 1900 MHz)

TXIP, TXIM, TXQP, and TXQM from call processor IC U1100 modulate the transmit offset VCO (Q652) signal which is external to, but controlled by, RF transceiver IC U700. The transmit IF modulated TX\_MIX\_IN1 signal of 154.8MHz (TX\_MIX\_IN2, 189.8 MHz for PCS 1900 MHz) is input to the mixer/exciter (ME) IC **U400** where it is mixed with TX\_LO\_800, the 979-1004 MHz (TX\_LO\_PCS, 2039-2100 MHz for PCS 1900 MHz) local oscillator signal. The transmit signal EXCITE\_OUT\_CELL is then passed through bandpass filter FL404 (EXCITE\_OUT\_PCS, split-band SAW filter FL401 for PCS 1900 MHz) into power amplifier (PA) U501 (U500 for PCS 1900 MHz). The output of the PA is passed through isolator U550 (U551 for PCS 1900 MHz), through transmit bandpass monoblock duplex SAW filter *FL51* (bandpass mono-block duplex ceramic filter *FL50* for PCS 1900 MHz) and, finally, through diplexer FL53 to the antenna or RF test port.

### Frequency Synthesizer Circuitry

V200 transceivers contain 4 oscillators controlled by 3 PLLs located within RF transceiver IC *U700*. All the PLLs obtain their reference frequency from the 16.8 MHz reference oscillator.

- Main LO consists of 2 VCO modules external to U700.
  - A PLL controls a tunable 979-1004 MHz main LO *U626*, which is active during cellular 800 MHz operation.
  - The same PLL controls a tunable 2039-2100 MHz main LO *U636*, which is active during PCS 1900 MHz operation.
- Second LO. The second local oscillator uses a single external tank circuit operating at 219.8 MHz for both cellular 800 MHz and PCS 1900 MHz bands. Its output is divided by 2 before being fed into the mixer.
- Transmit offset VCO. This oscillator (**Q652**), also controlled by a PLL internal to **U700**, operates on two different frequencies depending on the band of operation. Its output frequency is divided by 2 before being fed into the mixer. The transmit offset VCO has two external tank circuits as follows:
  - 309.6 MHz frequency for cellular 800 MHz and
  - 379.6 MHz frequency for PCS 1900 MHz.

#### Transmit Power Control Circuitry

RF output power is controlled by the three control signals

- ZIF\_VCA from call processor IC *U1100*,
- ME\_VCA also from call processor IC U1100, and
- PA\_BIAS from audio/power controller IC U1200.

Output power is controlled at three places:

- RF transceiver IC U700 which has a maximum gain control of 40 dB,
- mixer/exciter (ME) IC U400 which has a total maximum gain of 36 dB, and
- Power amplifier IC *U501* (cellular) and *U500* (PCS) have a maximum gain of 27-32 dB.

The RF power range is from -50~dBm to +23~dBm with power control operating in both open-loop and closed-loop modes.

In open-loop mode (when first registering with the cell site – access probe) the power level is proportional to the received signal level. In closed-loop mode, the power level is controlled by the CDMA cell based on the received signal strength at the cell site.

## **Tools and Test Equipment**

The following table lists the tools and test equipment used to test and troubleshoot V200 communicators. Use either the listed items or equivalent.

Motorola Model Number <sup>1</sup>	Description	Application
_2	<ul> <li>Personal Computer with the following minimum specifications:</li> <li>1. Operating system: Windows 98SE, NT4.0 SP5, and 2000 Professional.</li> <li>2. CPU speed: 133 MHz.</li> <li>3. Memory/system RAM: 64 MB.</li> <li>4. Hard disk space: 35 MB available space.</li> <li>5. CD-ROM drive.</li> <li>6. Related application: Microsoft Access</li> <li>7. Communication ports: LPT1 parallel port, serial port, one available USB port.</li> <li>8. Display/user interface: VGA graphics, Mouse or equivalent pointing device.</li> </ul>	Runs PST and/or CDMACOMM software for testing and setup of UUT. USB interconnect cable for PST, serial cable for CDMACOMM.
99-97529L01	Software, Motorola PST application (CDROM)	Used for NAM programming and flashing. Runs on PC. Requires WIBU key.
01-09742L73	WIBU key (external dongle)	<ul> <li>Parallel port security key for PST software. Allows following tasks:</li> <li>1. Datalog non-Motorola confidential proprietary information.</li> <li>2. Program NAM.</li> <li>3. Program phonebook</li> <li>4. Flash 2 code groups (not the boot loader).</li> <li>5. Test command interface.</li> </ul>
4	Software, Motorola CDMACOMM	Computer test mode software for audio and RF test and setup. Runs on PC.
SYN8400	Test interface adapter (junior box)	Interconnects UUT with test equipment. Used with CDMACOMM.
SPN4029	Wall transformer	Powers junior box interface. Used with CDMACOMM.
2	Power supply, 4.2V @ 1.5A	Powers unit under test. Used with CDMACOMM.
HP8924C <sup>3</sup>	Test set, communications analyzer	Used for RF and audio test and setup. Used with CDMACOMM.
SKN6304	CE bus data and audio cable	Connects UUT to junior box interface. Used with CDMACOMM.
SKN4996	Power supply cable	Connects power supply to junior box interface. Used with CDMACOMM.

1. To order in North America, contact Motorola Aftermarket and Accessories Division (AAD) by phone at (800) 422-4210 or

FAX (800) 622-6210; Internationally, AAD can be reached by calling (847) 538-8023 or faxing (847) 576-3023. 2. Not available from Motorola.

3. Not available from Motorola. To order, contact Hewlett Packard at 1-800-452-4844.

4. Download from Motorola Global CDMA Service Support Engineering web site http://cdmawwss.css.mot.com/.

Motorola Model Number <sup>1</sup>	Description	Application
2888482K03	RF cable	Connects UUT to communications analyzer. Used with CDMACOMM.
2	Serial cable	Connects PC to junior box interface. Used with CDMACOMM.
SKN6311	USB cable, type B	Connects UUT to PC and wall power supply. Used with PST.
SPN4716	Wall power supply	Powers UUT. Used with PST.

To order in North America, contact Motorola Aftermarket and Accessories Division (AAD) by phone at (800) 422-4210 or FAX (800) 622-6210; Internationally, AAD can be reached by calling (847) 538-8023 or faxing (847) 576-3023.
 Not available from Motorola.
 Not available from Motorola. To order, contact Hewlett Packard at 1-800-452-4844.
 Download from Motorola Global CDMA Service Support Engineering web site http://cdmawwss.css.mot.com/.

## Programming

#### Number Assignment Module (NAM) Programming

The NAM is a portion of the communicator's non-volatile memory (NVM) containing user and network-specific settings. NAM programming can be performed at all levels of service authorization including the carrier and, in some cases, the user.

NAM programming can be done via the programming menu (manual test mode) through the unit's keyboard or by use of Product Support Tool (PST) software.

#### Flashing

V200 communicator's operating system (OS) software can be upgraded by programming (flashing) the flash electrically-erasable programmable read-only memory (flash EEPROM). Flashing is authorized at Level 3 and higher service centers and carriers.

Motorola PST software is used for flashing at Level 3.

#### Phasing

Phasing is performed at Level 3 and above service centers and by carriers. It includes alignment of the communicator's RF circuitry.

The computer test mode via Motorola CDMACOMM software is used by Level 3 centers for phasing V200 communicators.

#### Flexing

Flexing involves configuring the communicator's features and functionality. Since flexing is performed only at Motorola factory service centers, any unit requiring this programming should be referred to a factory service center.

## **Test Methods**

#### Manual Test Mode (Handset Test Commands)

Handset test commands are used by all levels of service authorization to check audio and RF functionality and for NAM programing. All tests are performed directly from the communicator's keyboard without need for additional test equipment.

For detailed information about manual test mode, refer to the V200 Level 2 Service Manual listed in the Related Publications section toward the end of this manual.

## **Product Support Tool (PST)**

The PST (also referred to as a flashing station) is used by Level 3 and up authorized service facilities to perform NAM programming and to flash the communicator. A personal computer (PC) running Motorola PST software enables data logging of certain (non-proprietary) information, NAM and phonebook programming, flashing (excluding boot loader), and test command interface.

A WIBU security key (parallel-port dongle), power supply, and interconnect cables are required with the PST.

Detailed instructions for use of the PST are provided in the PST User's Guide listed in the Related Publications section toward the end of this manual.

## **Computer Test Mode (Computer Test Commands)**

Audio and RF characteristics are tested and adjusted by use of computer test mode. Level 3 or higher service authorization is required to perform these tests. A PC with Motorola CDMACOMM software, a communications analyzer, bench power supply, wall transformer, junior box test interface adapter (TIA), serial cable, and butt plug cable are needed to set up computer test mode.

Refer to the Troubleshooting section, later in this manual, for computer test mode procedures.

## GATE24

The generic automated test environment (GATE) system is used at Motorola factory service centers to perform flashing, flexing, and phasing of V200 communicators. Use of the GATE system is beyond the scope of this publication. Refer questions to the nearest Motorola Service Support Engineer.

## Troubleshooting

## Introduction

Known good replacement parts and assemblies should be available for troubleshooting by substitution, and for replacement of defective parts or assemblies. Defective circuit boards should be forwarded to the appropriate Motorola service facility for repair. Refer to the V200 Level 3 Supplements listed in the Related Publications section of this manual for a list of replacement part descriptions and part numbers.

Refer to the disassembly instructions located in the V200 Level 2 Service Manual, listed in the Related Publications section of this manual, for instructions on removing parts and assemblies.



Many of the integrated devices used in this equipment are vulnerable to damage from electrostatic discharge (ESD). Ensure adequate static protection is in place when handling, shipping, and servicing the internal components of this equipment.

## **Testing After Repair**

After any repair work, the unit should be thoroughly tested to ensure that it operates correctly. This is especially important if the controller or transceiver boards are replaced.

For general repairs which do not include replacing the controller or transceiver boards, simply placing a call and checking signal strength, and transmit and receive audio quality is normally sufficient.

When a controller or transceiver board is replaced, the unit must have a comprehensive test on a CDMA cellular/PCS compatible communications analyzer. See the following section of this manual for further details. Placing a call on air is usually carried out at this stage to complete the testing procedure.

## **Computer Test Mode**

#### Initial Setup

- Connect RF and CE BUS connectors to UUT and set power supply to level specified in the individual procedures.
- Refer to Figure 6 for computer test mode equipment setup.
- Before selecting Suspend or other suspended commands for the communicator, Data Mode must be selected first. Select Data Mode. If Data Mode step was successful, a message displaying "Returned From Radio: data stream xxx" will appear in the status window. Only then, can you proceed with entering the Suspend command.
- Select the Suspend command. If the Suspend command was successful, the status window will turn green and display data sent and returned from the UUT. The window will also display a message "P2K HEAD COMMAND =SUSPEND = = >SUCCESSFUL".
- If the SUSPEND command was unsuccessful, the status window will turn red and display "Failed. Response = 0000,0". If any subsequent suspended commands sent to the UUT fail, the status window will turn red and display a failed message.

• After the successful entry of Data Mode and Suspend, select and/or set the fields highlighted in yellow (white) as shown in the screen image corresponding to the procedure being performed.



Figure 6. Computer test mode equipment setup

#### Loopback (Boom Mic Speaker)

- Select the SUSPEND button to put the phone into Suspend Mode.
- Select CDMA 800 button under CP\_MODE to put the UUT in 800 CDMA Mode.
- Under AUD\_PATH command, set Input to 4 and Output to 6 to route Audio to/ from Headset Jack. Under the AUD\_LPB heading, select Vocoder 13K (CDMA) button to put the phone into full rate loopback mode.
- Set AUD\_LVL to level 3.
- See Figure 7.
- Connect the audio out (boom speaker) of the boom/audio plug through a 32 Ohm resistor to boom ground.
- Inject an audio tone of 1004Hz at 2.2 mVrms into the audio in (boom mic). within the specifications listed in Table 3.

#### Table 3. Loopback Test Values

Parameter	Lower Limit	Upper limit
Mic bias	2.0 Vdc	2.6 Vdc
Loopback	28.2 mVac	56.4 mVac
Jack sense	1	1
Headset jack ground sense	1	1

• Set test set to 50Hz High Pass, 15KHz Low Pass filtering with de-emphasis turned OFF. Measure the RMS audio signal at the audio out (boom speaker). The result should be within the specifications listed in Table 3.

TX Power -30.76 RF Channel 350 Amplitude Amplitude AfGen AfGen AfGen AfGen AfGen AfGen AfGen AfGen August AfGen August AfGen August AfGen August AfGen August AfGen August AfGen AfGen August AfGen A	AF Freq 1.00350 1.00350 1.00350 NT Freq AF Anl In 0.040 KHz NT To Screen 0 CDMA CALL CNTL SOHZ HPF Filter 1 50Hz HPF Filter 2 MV 0 UT 0 Detector 0 Out 0 Out 0 Detector 0 Out 0 Out 0 Detector 0 CDMA CALL CNTL SMS 0 CDMA CALL CNTL CONFIS
RF Channel 350 Amplitude Amplitude Amplitude Audit AFGer Audit AFGer Audit 230 kHz Ext TX Key On Off RF Output Port RF Output only ACOD	n1 Free AF Anl In 0040 AF Anl In kHz n1 To Filter 1 0 Out Filter 2 mV 15kHz LPF 0 out Detector Config 0 Out BASE AF Anl In 0 CDMA 0
CDMAComm v2.0.1           Main Settings Help           SUSPEND         CP_MODE           Data Mode         C           SUSPEND         C           C         CDMA 800           C         CDMA 1900           VERSION         Get Unid	Conversions
COMA       AMPS       Direct Access       CIT         AUD_CTRL       AUD_PBK.       C       CARRIER       SET_RF_PWR       AFC Ph         © Vibrator DNF       © Vocoder 13K.       C       ON       Power 0       128         © Vibrator DFF       © Vocoder 13K.       C       OFF       Set       © Anal         © Sidetone DN       © Disable        A/D       A/D       A/D         AUD_VVL       COMPD       Data       © Data       PHASE       Phase Parameter         Set       © Compander DFF        Select FHASE Parameter       © Set       Select PHASE Parameter         AUD_PATH          Set       C       C         Mutrue       Set       46000        Set       C       C         SildTONE       SAT       DTMF       C       Enable       C       Enable       C	ase Analog AOC Force (Analog ME Force) a Set 150 - 2/F (0.3) alog Location 150 - 2/F (4.5) MA Location 150 - 2/F (4.5) Force AOC RSSI SSI Parameter Select RSSI Parameter V Execute Data Force PA Force PA Force PA Force PA FN_BIAS_03 FN_BIAS_45 PA_BIAS_03 Sate PA_BIAS_03 PA_BIAS_45 PA_BIAS_67 PA_BIAS_67 PA_BIAS_67 PA_BIAS_67

#### Figure 7. Loopback

#### **DTMF** Deviation

This phasing procedure is used to phase the deviation that results from normal audio levels.

Table 4.	DTMF	Deviation	Test	Values
----------	------	-----------	------	--------

Parameter	Value
Test Voltage at Battery Terminals	3.60V
Test Voltage at Acc. Connector	4.40V
TEST_CHANNEL	350
MINIMUM_GAIN_SETTING	0
MAXIMUM_GAIN_SETTING	15
LOW_LIMIT	8.60kHz
TARGET	9.00kHz
HIGH_LIMIT	9.50kHz

- Select the SUSPEND button to put the phone into Suspend Mode.
- Under CP\_MODE, select the AMPS button to place the transceiver into Analog call processing mode.
- Under the LOAD\_SYN heading, enter desired channel and select the Set Chan button to tune the UUT to the TEST\_CHANNEL
- Under AUD\_PATH heading, set Input to 1 and Output to 1, TX MUTE, RX MUTE and select SET.
- Set AUD\_LVL to level 3.
- Under AUD\_CTRL, select Sidetone OFF.
- Under COMPD, select Compander OFF.
- Under DTMF, select Enable and choose DTMF tone 5.
- Under SET\_RF\_PWR, set transceiver to power step 2.
- Under CARRIER, select ON to enable the analog carrier.
- See Figure 8.
- The test set should be configured as follows: 50 Hz HPF, 15 kHz LPF, 750  $\mu Sec$  de-emphasis. Set equipment to measure FM Deviation.
- Measure the peak frequency deviation in kHz.

TX TEST	
TX Freq Error KHZ FM Deviation -0.080 9.280	kHz
TX Power 28.06 AF Freq 1.3331	7 7
RF Channel       IF Filter       AF Anl In       AFGen1 Freq         230 kHz       Filter 1       AFGen1 Lvl         350       Filter 2       AFGen1 Lvl         TX Pwr Zero       Ext TX Key       De-Emphasis         Zero       On 20ff       Detector         Min Inp Lvl       Pk+=/2       If Key	To Screen O CDMA GALL CNTL SMS HUTHEN O Analog RX TEST Config TESTS
CDMAComm v2.0.1  Main Settings Hep  SUSPEND CP_MODE C_MAMPS C_CDMA 800 C_CDMA 1900 Set Chan UPID Conversions C_COnversions C_CO	F Istory Natus
CDMA AMPS Direct Access CIT	
AUD_CTRL       AUD_LPEK         C Vibrator ON       C Codec         C Vibrator OFF       C Codec         C Vibrator OFF       C Codec         C Sidetone ON       C DFF         Sidetone OFF       C Compander ON         AUD_LVL       C Compander OFF         AUD_PATH       Input:         Input:       1-Mute Input Path         Dutput:       1-Mute Input Path         C Enable       C Strole         C Sidelone       C DTF         Set       C Compander OFF	Execute Force PA Drain N_BIAS_03 M_BIAS_03 M_BIAS_45 M_BIAS_67 Gate PA_BIAS_67 M_BIAS_67

Figure 8. DTMF deviation

#### **Maximum Deviation**

This phasing procedure is used to insure that the communicator will produce an FM deviation no greater than a specified amount, even in the event that the communicator modulator is presented with a large audio signal.

**Table 5. Maximum Deviation Test Values** 

Parameter	Value
Test Voltage at Battery Terminals	3.60V
Test Voltage at Acc. Connector	4.40V
TEST_CHANNEL	350
MINIMUM_GAIN_SETTING	0
MAXIMUM_GAIN_SETTING	15
LOW_LIMIT	10.5kHz
TARGET	11.0kHz
HIGH_LIMIT	11.5kHz

- Select the SUSPEND button to put the phone into Suspend Mode.
- Under CP\_MODE, select the AMPS button to place the transceiver into Analog call processing mode.
- Under the LOAD\_SYN heading, enter desired channel and select the Set Chan button to tune the UUT to the TEST\_CHANNEL.
- Under AUD\_PATH heading, set Input to 3 and Output to 1, RX MUTE and select SET.
- Set AUD\_LVL to level 3.
- Under AUD\_CTRL, select Sidetone OFF.
- Under COMPD, select Compander ON.
- Under SET\_RF\_PWR, set transceiver to power step 2.
- Under CARRIER, select ON to enable the analog carrier.
- See Figure 9.
- The test set should be configured as follows: 15 kHz LPF, 50Hz HPF, 750  $\mu Sec$  de-emphasis. Inject a 1004 Hz, 2.5V rms audio signal into the audio in pin of the accessory connector. Set equipment to measure FM deviation.
- Measure the peak frequency deviation in kHz (deviation).

TX Freq Eri -0	.175	FM Deviat	10.93	z
2:	8.33		00377	Z
RF Channel 350 TX Pwr Zero Zero Min Inp Lvl -10.0 dBm	AF A FM 0 230 kHz Ext TX Key 0n≠ <u>0ff</u> Det¢ Pk+	Anl In Demod ;er 1 AFGer 2 HPF 2 HPF 2 PF 3 mphasis us 0ff ector	To S 1 Frea 1040 KHZ 1 Lv1 50 V AUTH V An RX Conf TEST	creen MA CNTL EN alog EST ig S
巅: CDMAComm v2.0.1				
Main Settings Help SUSPEND CP_MODE Data Mode SUSPEND C VERSION Version	LDAD_SYN 350 Set Chan UPID Get Upid Set	Upid Conversions	F Single C Keep History	
CDMA AMPS Direct Access AUD_CTRL AUD_LP8K C Vibrator DNF C Codec Vibrator DFF C Vocoder 13K (CDMA) C Sidetone DN	CARRIER SET_RF_PWR AFC	Phase Analog AOC Force (Ar 8 Set 150 A ZIF (C Inalog Location 150 A ZIF (C DMA Location 150 A ZIF (C RSSI	Nalog ME Force) 13] 350 = 15] Force AOC 57]	
AUD_LVL COMPD Compander ON Set Compander OFF AUD_PATH Input: 3-External Audio (CE Bus )	A/D Parameter Select AD Parameter Data PHASE Phase Parameter: Select PHASE Parameter © Set Execute	Execute RSSI Parameter Data	Select RSSI Parameter  Execut Force PA  Force PA  Fin_BIAS_0 FIN_BIAS_0	e 3. 4. 5. 4. 4. 7. 4.
1 Output: 1 Mute Output Path		Clear	Gate PA_BIAS_0	3 <u>_</u> ±

Figure 9. Maximum deviation

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#### **Microphone Audio Deviation**

This phasing procedure is used to phase the deviation that results from normal audio levels.

#### **Table 6. Microphone Audio Deviation Test Values**

Parameter	Value
Test Voltage at Battery Terminals	3.60V
Test Voltage at Acc. Connector	4.40V
TEST_CHANNEL	350
MINIMUM_GAIN_SETTING	0
MAXIMUM_GAIN_SETTING	15
LOW_LIMIT	2.8kHz
TARGET	2.95kHz
HIGH_LIMIT	3.1kHz

- Select the SUSPEND button to put the phone into Suspend Mode.
- Under CP\_MODE, select the AMPS button to place the transceiver into Analog call processing mode.
- Under the LOAD\_SYN heading, enter desired channel and select the Set Chan button to tune the UUT to the TEST\_CHANNEL
- Under AUD\_PATH heading, set Input to 3 and Output to 1, RX MUTE and select SET.
- Set AUD\_LVL to level 3.
- Under AUD\_CTRL, select Sidetone OFF.
- Under COMPD, select Compander ON.
- Under SET\_RF\_PWR, set transceiver to power step 2.
- Under CARRIER, select ON to enable the analog carrier.
- See Figure 10.
- The test set should be configured as follows: 300 Hz HPF, 3 kHz LPF, deemphasis OFF. Inject a 1004 Hz, 43.5 mV rms audio signal in to the audio in pin on the accessory connector. Set equipment to measure FM deviation.
- Measure the peak frequency deviation in kHz.

TX Freq Err -0. TX Power 28	Î99 <sup>⊮∺z</sup> 8.32 <sup>dem</sup>	TX TEST FM	Deviation 2.98 Frea 1.004	81 81 400
RF Channel 250 TX Pwr Zero Zero Min Inp Lv1 -10.0 dBm	F Filter 30 kHz xt TX Key 7/0ff	AF Anl In FM Demod Filter 1 300Hz HPF Filter 2 3kHz LPF De-Emphasis 750 us/ <u>Off</u> Detector Pk+-/2	AFGen1 Fre 1.0040 kH AFGen1 Lv1 43.5 M	To Screen CDMA CALL CNTL SMS AUTHEN V Analog RX TEST Config TESTS
Imain       Settings       Help         SUSPEND       CP_MODE         Data Mode       C       AMPS         SUSPEND       C       CDMA 800         SUSPEND       C       CDMA 1900	OAD_SYN 350 Set Chan		e V F	<ul> <li>C Single</li> <li>C Keep History</li> <li>C lear Status</li> </ul>
VERSION Version CDMA AMPS Direct Access ( AUD_CTRL C Vibrator 0N C Vibrator 0FF C Sidetone 0N C Sidetone 0FF	UPID Get Upid CARRIER CARRIER COFF Step 2 = Set A/D A/D A/D Parameter Set CAR Para	Set Upid Conversions Conversions Conversions Conversions Conversions AFC Phase And 128 Set 1 C Analog Location 1 C CDMA Location 1 meter Execute	Jog AOC Force (Analog ME Force)           50 + ZIF (0.3)           50 + ZIF (4.5)           50 + ZIF (4.5)           50 + ZIF (6.7)           50 + ZIF (6.7)           50 + ZIF (6.7)           51 Parameter           Select RSSI Pa	350 ± Force ADIC
AUD_LVL COMPD 3 ± © Compander DN Set © Compander OFF - AUD_PATH Input 3 - External Audio (CE Bus • Output 1 - Mute Output Path • TX:MUTE Set 3100	Data PHASE Phase Parameter: Select PHASE Parameter C Set Execute	Clear	Data Data	Force PA Plain FIN_BIAS_03 FIN_BIAS_45 FIN_BIAS_45 FIN_BIAS_67 Bate PA_BIAS_03 PA_BIAS_45 PA_
SIGTONE SAT DTM C Enable C 5970 Hz C Disable C 6000 Hz C C 6030 Hz C Disable C Disable	Sisable			PA_BIAS_67

Figure 10. Microphone audio deviation

#### **RX Audio Gain**

This phasing procedure is used to phase the deviation that results from normal audio levels.

Table 7. RX Audio Ga	in Test Values
----------------------	----------------

Parameter	Value
Test Voltage at Battery Terminals	3.60V
Test Voltage at Acc. Connector	4.40V
TEST_CHANNEL	350
MINIMUM_GAIN_SETTING	0
MAXIMUM_GAIN_SETTING	7
LOW_LIMIT	34.4mV
TARGET	40mV
HIGH_LIMIT	45.6mV

- Select the SUSPEND button to put the phone into Suspend Mode.
- Under CP\_MODE, select the AMPS button to place the transceiver into Analog call processing mode.
- Under the LOAD\_SYN heading, enter desired channel and select the Set Chan button to tune the UUT to the TEST\_CHANNEL
- Under AUD\_PATH heading, set Input to 1 and Output to 4, RX MUTE and select SET.
- Set AUD\_LVL to level 3.
- Under AUD\_CTRL, select Sidetone OFF.
- Under COMPD, select Compander ON.
- Under SET\_RF\_PWR, set transceiver to power step 2.
- Under CARRIER, select ON to enable the analog carrier.
- See Figure 11.
- The test set should be configured as follows: 15 kHz LPF, 50 Hz HPF, 750  $\mu Sec$  de-emphasis. Input a -50 dBm signal modulated with a 1 kHz audio tone at 2.9 kHz peak deviation into the UUT receiver. Set the audio analyzer to measure RMS audio input
- Measure the audio level from the audio out pin of the accessory connector.
| TX Freq Er  | аг ана<br>ror <b>кн</b> и  | AC Level   | 260  |
|---|--|--|--|
| TX Power 2  | 8.02   | SINAD 31.3   | 31   |
| AF Anl In<br>Audio In<br>Filter 1<br>50Hz HPF<br>Filter 2<br>ISKHZ LPF<br>De-Emphasis<br>750 us/0ff<br>Detector   | Settling Gain<br>Slow/Fast Futo<br>Pk Det To<br>Filters 40 df<br>Scope To<br>Filters 10 df<br>Speaker Vol<br>Speaker ALC Notcl<br>Dn/Off | Cntl Audio In I<br>ZHOLd Gnd Ext Load I<br>B B A A A A A A A A A A A A A A A A A A   | To Screen<br>O CDMA<br>CALL CNTL<br>SMS<br>AUTHEN<br>CALA CNTL<br>SMS<br>AUTHEN<br>CONTIS<br>Confis<br>TESTS           |
| <b>≨s.CDMAComm v2.0.1</b><br>Main Settings Help   |  |  |  |
| SUSPEND CP_MODE<br>Data Mode<br>SUSPEND C CDMA 800<br>CDMA 1900<br>VERSION  | LOAD_SYN<br>350<br>Set Chan<br>Get Upid<br>Set U   | pid Conversions  | Clear Status   |
| CDMA     AMPS     Direct Access       AUD_CTRL     AUD_LPBK       C     Vibrator ON     C       C     Vibrator OFF     C       C     Sidetone ON     C       G     Sidetone OFF     Disable   | CIT<br>CARRIER SET_RF_PWR AFC PH<br>CON<br>Step 2 - 128<br>COFF Set CARRIER<br>A/D<br>A/D Parameter Select AD Parameter<br>Data          | Analog AOC Force (Analog ME Force<br>Set 150 - ZIF (0.3)<br>alog Location 150 - ZIF (4-5)<br>MA Location 150 - ZIF (6-7)<br>RSSI<br>Execute RSSI Parameter Select RSSI F<br>Data | 350 - Force ADC  |
| 3     •     •     Compander DN       Set     •     •     Compander OFF       -AUD_PATH     •     •     •       Input     1 - Mute Input Path     •       Output     4 - External Audio (CE Bus •       •     TX MUTE     Set     1401 | PHASE<br>Phase Parameter:<br>(Manual Entry)<br>C Set<br>C Set<br>Execute   |  | Force PA<br>Drain<br>FIN_BIAS_03 ***<br>FIN_BIAS_45 ***<br>FIN_BIAS_67 ***<br>Gate<br>PA_BIAS_03 ***<br>PA_BIAS_03 *** |
| SIGTONE SAT D<br>C Enable C 5970 Hz C<br>C Disable C 6000 Hz 6  | TMF<br>1 Enable<br>0 Disable   |  | PA_BIAS_45 -   |

0110020

Figure 11. RX audio gain

# **RX Audio Muting**

### Table 8. RX Audio Muting Test Values

Test Limits	Level (dB)
Upper limit	-40.0
Lower limit	-90.0

- Select the SUSPEND button to put the phone into Suspend Mode.
- Under CP\_MODE, select the AMPS button to place the transceiver into Analog call processing mode.
- Under the LOAD\_SYN heading, enter desired channel and select the Set Chan button to tune the UUT to the TEST\_CHANNEL.
- Under AUD\_PATH heading, set Input to 1 and Output to 4, TX MUTE and select SET.
- Set AUD\_LVL to level 4.
- Under AUD\_CTRL, select Sidetone OFF.
- Under COMPD, select Compander ON.
- Under SET\_RF\_PWR, set transceiver to power step 2.
- Under CARRIER, select ON to enable the analog carrier.
- See Figure 12.
- Set up the test set as follows: apply an analog RF input signal at -50 dBm modulated with a 1004 Hz tone at 8 kHz peak deviation. Set the audio analyzer for 15 kHz LPF, C-message filtering, de-emphasis OFF, and RMS detector.
- Measure the received audio signal at the audio out pin of the accessory connector. Reference the audio analyzer to the 1004 Hz tone. Use AUD\_PATH to select path "1103h". Measure the change in received audio level in dB with respect to the reference. The measured change in signal level must meet specifications in Table 8.

	RX TES	ST	
<sup>SNR</sup> 65	.53		
RF Channel 350 Amplitude 50.0 dBm Atten Hold Ont <u>Pit</u> Output Port RF Out/only	AFGen1 Frea 1.0040 kHz AFGen1 To FM 8.00 kHz AFGen2 FM 0f	Frea OO kHz To f f Ext Load Filter 1 C MESSAGE MESSAGE Filter 2 S.OO	To Screen O CDMA CALL CNTL SMS AUTHEN Analog RX TEST Ω Config TESTS
Alin Settings Help SUSPEND CP_MODE Data Mode SUSPEND CP_MODE CDMA 800 CDMA 1900 VERSION	LOAD_SYN 360 Set Chan	<u>Conversions</u>	Clear Status
	Get Upid Set Upid	Conversions	
AUD_LTRL AUD_LPBK C Vibrator ON C Vibrator OFF C Sidetone ON C Sidetone OFF AUD_LVL COMPD C Compander ON Set C Compander OFF AUD_PATH	CARRIER SET_RF_PWR AFC Phase C OFF Step 2 + C OFF Step 2 + C CDMA Lo A/D A/D Parameter Select AD Parameter Data PHASE Phase Parameter: Select PHASE Parameter	Analog ADC Force (Analog ME For Set 150 + ZIF (0.3) 150 - ZIF (4-5) cation 150 - ZIF (6-7) V Execute RSSI Data	Se) 350 Force AOC IParameter ▼ Execute Force PA Drain FIN_BIAS_03 FIN_BIAS_45 FIN_BIAS_67 T

0110030

Figure 12. RX audio muting

## **RX** Distortion

### Table 9. RX Distortion Test Values

Test Limits	Distortion Level (%)	Distortion Level (dB)
Upper limit	5.0	-26.0
Lower limit	0.1	-60.0

- Select the SUSPEND button to put the phone into Suspend Mode.
- Under CP\_MODE, select the AMPS button to place the transceiver into Analog call processing mode.
- Under the LOAD\_SYN heading, enter desired channel and select the Set Chan button to tune the UUT to the TEST\_CHANNEL.
- Under AUD\_PATH heading, set Input to 1 and Output to 4, TX MUTE and select SET.
- Set AUD\_LVL to level 4.
- Under AUD\_CTRL, select Sidetone OFF.
- Under COMPD, select Compander ON.
- Under SET\_RF\_PWR, set transceiver to power step 2.
- Under CARRIER, select ON to enable the analog carrier.
- See Figure 13.
- Set up the test set as follows: apply an analog RF input signal at -50 dBm modulated with a 1004 Hz tone at 8 kHz peak deviation. Set the audio analyzer for 15 kHz LPF, C-message filtering, de-emphasis OFF, and RMS detector. Measure the distortion of the received audio signal at the audio out pin on the accessory connector. Distortion must not exceed the specifications defined in Table 9.

Bistn       RC Level       MV         1.1       490.3         RF Channel       RF Gen1 Freq kHz       RF Gen2 Freq kHz       Filter 1 CMESSAGE       To Screen O CDMA CHL CNTL MESSAGE         Amplitude Btten Hold Untput Port RF Out 2 only       RF Gen1 To H 8 + 00 kHz       RF Gen2 To H 8 + 00 kHz       Filter 2 SkHz LPF       To Screen O CDMA CHL CNTL SkHz LPF         Atten Hold Untput Port RF Out 2 only       RF Gen2 To H 8 + 00 kHz       RF Gen2 To H 8 + 00 kHz       Filter 2 SkHz Load R R 8 + 00 x       Filter 2 SkHz Load R R 8 + 00 x       Comment SkHz Load R R 8 + 00 x	Bissin       Arceland       Arceland       Arcenta         RF Channel       AFGen1 Free       Filter 1       To Screen         Solo       Arcenta       AFGen1 Free       Filter 1       O CDMA         Arcenta       AFGen1 To       AFGen2 Free       Filter 1       O CDMA         Arton Hold       Mission       Arcenta       AFGen2 To       Filter 2         Matten Hold       Mission       Arcenta       Arcenta       Arcenta         Solo       KHz       AFGen2 To       Filter 2       Arcenta         Matten Hold       Mission       Arcenta       Arcenta       Arcenta         Solo       KHz       AFGen2 To       Filter 2       Arcenta       Arcenta         Matten Hold       Mission       Arcenta       Arcenta <td< th=""><th>Bistr     AFGen1 Free     AFGen2 Free     Filter 1       Bronnel     AFGen1 Free     AFGen2 Free     Filter 1       Bronnel     AFGen1 To     Filter 2     Filter 1       Bronnel     AFGen1 To     Filter 2     Filter 2       Arten Hold     Bronnel     KHz       Atten Hold     Bronnel     Bronnel       Atten Hold     Bronnel     Bronnel       Atten Hold     Bronnel     Bronnel       Atten Hold     Bronnel     Bronnel       Bronnel     Bronnel     Bronnel       Atten Hold     Bronnel     Bronnel</th><th></th><th> RX 1</th><th>'EST</th><th></th><th></th></td<>	Bistr     AFGen1 Free     AFGen2 Free     Filter 1       Bronnel     AFGen1 Free     AFGen2 Free     Filter 1       Bronnel     AFGen1 To     Filter 2     Filter 1       Bronnel     AFGen1 To     Filter 2     Filter 2       Arten Hold     Bronnel     KHz       Atten Hold     Bronnel     Bronnel       Atten Hold     Bronnel     Bronnel       Atten Hold     Bronnel     Bronnel       Atten Hold     Bronnel     Bronnel       Bronnel     Bronnel     Bronnel       Atten Hold     Bronnel     Bronnel		RX 1	'EST		
RF Channel       AFGen1 Freq       AFGen2 Freq       Filter 1       O CDMA         Anplitude       AFGen1 To       FM       AFGen2 To       Filter 2       Filter 2         Atten Hold       BR       Atten Hold       BKHz       AFGen2 To       Filter 2       Filter 2         Atten Hold       BK       BK       BK       Off       Ext Load R       Analos         RKTEST       BK       BK       BK       BK       BK       BK       BK         State of the	RF Channel       AFGen1 Freq I+00040 kHz       AFGen2 Freq I+00000 kHz       Filter 1 CMESSAGE kHz       O CDMA Filter 2 IskHz LPF         Anelitude Store Hold Onzular Hold Onzular Port       AFGen1 To FN       FREGen2 To FN       Filter 2 IskHz LPF       Analog RX=TEST         Atten Hold Onzular Port       Store No       Store No       FILE CNTE         Output Port       Store No       FILE CNTE         Store Hold Onzular Port       Store No       FILE CNTE         Store No       Store No       Store No         Store No       Store No	RF Channel       AFGeni Frea       AFGeni Frea       AFGeni Frea       AFGeni Frea       Filter i         Anplitude       Stode0       KHz       AFGeni To       Filter 2       Filter 2       Filter 2         Arbon Hold       AFGeni To       Filter 2       Filter 2       Filter 2       Filter 2       Filter 2         Arbon Hold       AFGeni To       Filter 2       Filter 2       Filter 2       Filter 2         Arbon Hold       AFGeni To       Filter 2       Filter 2       Filter 2         Arbon Hold       AFGeni To       Filter 2       Filter 2       Filter 2         Arbon Hold       AFGeni To       Filter 2       Filter 2       Filter 2         Arbon Hold       AFGeni To       Filter 2       Filter 2       Filter 2         Arbon Marbon Marbo	Distn	1	AC Level 4	90.3	
SuSPEND       CP_MODE       LOAD_SYN         Data Mode       C       AMPS         SUSPEND       C       DOMA 800         Set Chan       C       Conversions         VERSION       Get Upid       Set Upid         Version       Get Upid       Set Upid         Version       C       Coder 13K         C       Vorator ON       C         Version       C       Coder 13K         C       Steletone DFF       Set OFF         A/D       Aralog Location       150 ±       ZIF (45)         Force ADC       Aralog Location       150 ±       ZIF (6-7)         A/D       Aralog Location       150 ±       ZIF (6-7)         A/D       Aralog Location       150 ±       ZIF (6-7)         A/D       Aralog Location       TO       ZISI Parameter       Select RSSI Para	e CDMACcount v2.0.1          Main       Settings         SUSPEND       CP_MODE         Juan Mode       C         C       CDMA 800         SUSPEND       C         C       Data Mode         C       CDMA 800         Set Upid       Set Upid         Version       Get Upid         Version       Get Upid         Set Upid       Set Upid         CDMA       AMPS         Direct Access       CTT         AUD_CTRL       Conversions         CDMA       AMPS         Direct Access       CTT         AUD_CTRL       Conversions         CDMA       AMPS         Direct Access       CTT         AUD_UTRL       CARRIER         Set Upid       Set Upid         C Variator DF       Codec         OF       Set         C Stature DN       Codec         OF       Set         AUD_UV       COMPO         AUD_VAT       Data         AUD_VAT       Force PA         Phase Parameter       Set         Phase Parameter       Set         Set       Exe	Image: CDMAComm V2.0.1           Main: Settings: Help           Image: CDMA B000           Set Char           Set Char           CDMA B000           CDMA Code           CDMA B000	RF Channel AF 350 Amplitude AF 50.0 dBm Atten Hold Ontput Port RF Out only	FGen1 Freq 1.0040 kHz FGen1 To 4 8.00 kHz	n2 Freq 0000 kHz n2 To 0ff Ext L 8	or 1 SAGE CALU SMS CALU SMS AUTH CALU SMS AUTH CALU SMS AUTH CON RX Conf TES	Screen DMA CNTL HEN Malog FEST Sig
SUSPEND       C       CDMA 800       Set Chan       Image: Conversions         VERSION       UPID       Conversions       Conversions         CDMA       AMPS       Direct Access       CIT         AUD_CTRL       AUD_LPBK       CARBIER       Set T_RF_PWR       AFC Phase       Analog A0C Force (Analog ME Force)         C Vibrator ON       C       Codec       ON       Stet       150       21F (0.3)       350       350         C Sidetone ON       C       Disable       C       OFF       Set       C Analog Location       150       21F (6-7)       Force A0C         A/D       A/D       A/D       RSSI       RSSI       RSSI Parameter       Execute	SUSPEND       C       DDMA 800       Set Chan       Image: Conversions         VERSION       Clear Status       Image: Conversions       Image: Conversions         CDMA       AMPS       Direct Access       CIT         AUD_CTRL       AUD_LPBK       Codec       Image: Conversions         C Version       C       Codec       Image: Conversions         C Version ON       C       Codec       Image: Codec         C Version ON       C Codec       Image: Codec       Image: Codec         C Sidetone ONF       C ONF       Set       C ODA Location       Image: Select AD Parameter       Execute         AUD_LVL       C Compander ON       Set       Select AD Parameter       Execute       Data         Phase Parameter       Select Phase Parameter       Select Phase Parameter       Fin_Blas_03       Image: Select Phase Parameter         Set       Execute       Data       Fin_Blas_45;       Image: Select Phase Parameter       Image: Select Phase Parameter       Image: Select Phase Parameter	SUSPEND       C       DMA.1900       Set Chan       UPD         Version       UPD       Conversions         CDMA       AMPS       Direct Access       CIT         AUD_CTRL       AUD_LPBK       C       Conversions         ©       Version       Codec       C         ©       Version       C       Codec         ©       Version       C       Codec         ©       Version       C       Codec         ©       Version       Dirable       C         ©       Version       Dirable       C         Ø       Version       Dirable       C         Ø       Compander DN       Set       Compander IN         Set       Compander IN       Set       Set       Proce PA         Phase Parameter       Set       Data       PN_BIAS_03       PN_BIAS_03         Phase Parameter       Set       Decode       Data       PA_BIAS_03       PA_BIAS_03 </td <th>CDMAComm v2.0.1 Main Settings Help SUSPEND CP_MODE Data Model</th> <td>LOAD_SYN</td> <td></td> <td>© Single</td> <td> ×</td>	CDMAComm v2.0.1 Main Settings Help SUSPEND CP_MODE Data Model	LOAD_SYN		© Single	×
AUD_CTRL       AUD_PBK       CARRIER       SET_RF_PWR       AFC Phase       Analog ADC Force (Analog ME Force)         © Vibrator 0N       © Codec       © N       Power [2 ±]       128 ±]       Set       150 ±]       ZIF (0-3)         © Vibrator 0FF       © Disable       © OFF       Set       © Analog Location       150 ±]       ZIF (6-7)       Force ADC         © Sidetone 0N       © Disable       A/D       A/D       RSSI       RSSI Parameter       Execute	AUD_CTRL       AUD_LPBK.         C Vibrator DN       C Codec         C Sidetone DN       C DF         Set       Disable         AUD_LVL       COMPD         OM       C Compander ON         Set       C compander ON         Set       C compander OFF         AUD_PATH       Input:         Input:       1-Mute Input Path         Output:       4-External Audio (CE Bus v)	AUD_CTRL       AUD_LPBK         C Vibrator ON       C Codec         C Vibrator OFF       C Vocoder 13K         C UCDMA1       C DFF         Sidetone ON       Disable         C Sidetone OFF       C OMPO         AUD_LVL       COMPO         G Compander ON       Set         Set       C Compander OFF         AUD_PATH       Dutput:         Input:       1-Mule Input Path         Output:       4-External Audio (CE Bus)         SilGTONE       Saft         C Enable       C Sidele         C Enable       C Enable	VERSION Version CDMA AMPS Direct Access	Set Chan UPID Get Upid Set L CIT	Ipid Conversions	Clear Status	
	AUD_PATH     Data       Input     1 - Mute Input Path       Output     4 - External Audio (CE Bus	AUD_LVL     Odwrb       Image: Set     Compander OFF       AUD_PATH     Compander OFF       Input:     1- Mute Input Path       Output:     4 - External Audio (CE Bus ~       Image: Set     1401	AUD_CTRL AUD_LPBK C Vibrator DN Vibrator DFF C Codec Vibrator DFF C Codec Vibrator DFF C Disable Sidetone DFF AUD_LPBK	CARRIER SET_RF_PWR AFC F C OFF Set C Ar A/D A/D Parameter Select AD Parameter	hase Analog AOC Force (An Set 150 4 ZF (0 MA Location 150 2 ZF (0 MA Location 150 2 ZF (6 RSSI RSSI RSSI Parameter	alog ME Force) +3 350 == +5 Force ADC -7 Select RSSI Parameter Exect	.te

0110040

Figure 13. RX distortion

## **RX Hum and Noise**

### Table 10. RX Hum and Noise Test Values

RX Hum & Noise	Level (dB)
Upper limit	-38
Lower limit	-99

- Select the SUSPEND button to put the phone into Suspend Mode.
- Under CP\_MODE, select the AMPS button to place the transceiver into Analog call processing mode.
- Under the LOAD\_SYN heading, enter desired channel and select the Set Chan button to tune the UUT to the TEST\_CHANNEL
- Under AUD\_PATH heading, set Input to 3 and Output to 4, and select SET.
- Set AUD\_LVL to level 4.
- Under AUD\_CTRL, select Sidetone OFF.
- Under COMPD, select Compander OFF.
- Under SET\_RF\_PWR, set transceiver to power step 2.
- Under CARRIER, select ON to enable the analog carrier.
- See Figure 14.
- Set up the test set as follows: apply an analog RF input signal at -50 dBm modulated with a 1004 Hz at 8 kHz deviation. Set the audio analyzer for 15 kHz LPF, C-message filtering, de-emphasis OFF, and RMS detector.
- Measure the received audio signal at the audio out pin of the accessory connector. Reference the audio analyzer to the 1004 Hz tone. Remove the 1004Hz modulated tone from the RF input signal. Measure the change in received audio level in dB with respect to the reference. The measured change in signal level must meet the specifications defined in Table 10.



Figure 14. RX hum and noise

## **RX** Response

### Table 11. RX Response Test Values

Test Limits	Level at 300 Hz	Level at 300 kHz
Upper limit	11.5	-8.5
Lower limit	4.4	-15.6

- Select the SUSPEND button to put the phone into Suspend Mode.
- Under CP\_MODE, select the AMPS button to place the transceiver into Analog call processing mode.
- Under the LOAD\_SYN heading, enter desired channel and select the Set Chan button to tune the UUT to the TEST\_CHANNEL
- Under AUD\_PATH heading, set Input to 1 and Output to 4, TX MUTE and select SET.
- Set AUD\_LVL to level 4.
- Under AUD\_CTRL, select Sidetone OFF.
- Under COMPD, select Compander OFF.
- Under SET\_RF\_PWR, set transceiver to power step 2.
- Under CARRIER, select ON to enable the analog carrier.
- See Figure 15.
- Set up the test set as follows: apply an analog RF input signal at amplitude -50 dBm modulated with a 1004 Hz tone at 2.9 kHz peak deviation. Set the audio analyzer for 15 kHz LPF, 20 Hz HPF, de-emphasis OFF, and RMS Detector.
- Measure the received audio at the audio out pin on the accessory connector. Reference the audio analyzer to the 1004 Hz tone. Vary the RF input signal modulation frequency to 300 Hz and 3 kHz. Measure the change in received signal level with respect to the reference. The measured change in signal level must be within the specifications defined in Table 11.

TX Freq Error -0.157	
28.31	28.95
IF Filter Ext TX Key DN/Qff	Gen1 Freq AF Anl In AF Anl In AUDIO IN AHZ Gen1 To KHZ Gen1 To KHZ AF Anl In AUDIO IN COMA
CDMAComm v2.0.1  Main Settings Help  SUSPEND CP_MODE  Data Mode  C CDMA 800  C CDMA 800	C Keep History
VERSION UPID Version Get Upid Get Upid COMA AMPS Direct Access CIT	Set Upid Conversions
AUD_CTRL AUD_LPBK CARRIER SET_RF_PWR A C Vibrator ON C Codec Vibrator OFF C Vocoder 13K (CDMA) C Sidetone ON C Disable	FC Phase         Analog AOC Force (Analog ME Force)           128
AUD_LVL COMPD Data DAta DAta DAta DAta DAta DAta DAt	RSSI RSSI Parameter Select RSSI Parameter Execute Data Force PA Drain FIN_BIAS_03
AUD_PATH Input 1-Mule Input Path Output 4-External Audio (CE Bus V TX MUTE Set 1401	Clear         FIN_BIAS_45         FIN_BIAS_45           Clear         FIN_BIAS_67         FIN_BIAS_67           PA_BIAS_03         FIN_BIAS_45         FIN_BIAS_45
SIGTONE SAT DTMF C Enable C Disable C 6030 Hz C bisable C bisable C Disable	PA_BIAS_57.

Figure 15. RX response

## **SAT** Deviation

This phasing procedure is used to phase the deviation that results from normal audio levels.

Table 12	SAT	Deviation	Test	Values
----------	-----	-----------	------	--------

Parameter	Value
Test Voltage at Battery Terminals	3.60V
Test Voltage at Acc. Connector	4.40V
TEST_CHANNEL	350
MINIMUM_GAIN_SETTING	0
MAXIMUM_GAIN_SETTING	15
LOW_LIMIT	1.9kHz
TARGET	2.0kHz
HIGH_LIMIT	2.1kHz

- Select the SUSPEND button to put the phone into Suspend Mode.
- Under CP\_MODE, select the AMPS button to place the transceiver into Analog call processing mode.
- Under the LOAD\_SYN heading, enter desired channel and select the Set Chan button to tune the UUT to the TEST\_CHANNEL
- Under AUD\_PATH heading, set Input to 1 and Output to 1, TX MUTE, RX MUTE and select SET.
- Set AUD\_LVL to level 3.
- Under AUD\_CTRL, select Sidetone OFF.
- Under COMPD, select Compander OFF.
- Under SAT heading, select 6000 Hz SAT Tone.
- Under SET\_RF\_PWR, set transceiver to power step 2.
- Under CARRIER, select ON to enable the analog carrier.
- See Figure 16.
- The test set should be configured as follows: 6 kHz BPF filtering, de-emphasis OFF. Input a -50 dBm signal modulated with a 6kHz tone at 2 kHz peak deviation into the audio-in pin of the UUT. Measure the peak frequency deviation in kHz.



Different test sets may require different filter settings for this test due to their internal filtering. The HP8924 requires calibration for this test due to the tolerances of the 6 kHz BPF.

TX Freq Error <b>kHz</b>	FM Deviation kHz
28.29	AF Freq kHz 6.00036
RF Channel 350 TX Pwr Zero Zero Min Inp Lvl -10.0 dBM	AF Anl In FM Demod Filter 1 SOHz HPF Filter 2 15kHz LPF Detector RX TEST AFGen1 Freq 6.0000 kHz AFGen1 Freq 0 CDMA CALL CNTL SMS 047 047 CALL CNTL SMS 047 CALL CNTL SMS 047 CALL CNTL SMS 047 CALL CNTL SMS AUTHEN CALL CNTL SMS AUTHEN CALL CNTL SMS AUTHEN CALL CNTL SMS AUTHEN CALL CNTL SMS AUTHEN CALL CNTL SMS AUTHEN CALL CNTL SMS CALL CNTL SMS AUTHEN CALL CNTL SMS CALL CNTL SMS AUTHEN CALL CNTL SMS AUTHEN CALL CNTL SMS AUTHEN CALL CNTL SMS AUTHEN CALL CNTL SMS AUTHEN CALL CNTL SMS CALL CNTL SMS AUTHEN CALL CNTL SMS CALL CNTL SMS CALL CNTL SMS CALL CNTL SMS CALL CNTL SMS CALL CNTL SMS AUTHEN CALL CNTL SMS AUTHEN CALL CNTL SMS AUTHEN CALL CNTL SMS AUTHEN CALL CNTL SMS AUTHEN CALL CNTL SMS AUTHEN CALL CNTL SMS AUTHEN CALL CNTL SMS AUTHEN CALL CNTL SMS AUTHEN COT SMS COT COT SMS COT COT SMS COT COT SMS COT COT SMS COT COT COT SMS COT COT COT COT COT COT COT COT
S CDMAComm v2.0.1 Main Settings Help:	
SUSPEND         CP_MODE         LOAD_SYN           Data Mode         C         AMPS         350           SUSPEND         C         CDMA 800         Set Chan           VERSION         UPID         Get Upid         Get Upid	Conversions
CDMA     AMPS     Direct Access     CIT       AUD_CTRL     AUD_LPBK     CARRIER     SET_RF_F       Vibrator OFF     Codec     ON     Power 2       Vibrator OFF     COdec     OFF     Step 2       C     Sidetone ON     Disable     A/D       A/D     A/D     A/D	PWR     AFC Phase     Analog ADC Force (Analog ME Force)       128     Set     150     21F (0-3)       C Analog Location     150     21F (6-7)     50       C CDMA Location     150     21F (6-7)     Force ADC
AUD_LVL COMPD 3	Data  Force PA  Fin_BiAs_03  Fin_BiAs_45  Fin_BiAs_67  Fin_BiAs_6  Fin_BiAs_67  Fin
Image: Non-state state     Set     1103       SIGTONE     SAT     DTMF       C     Enable     C     5970 Hz       C     Disable     C     Enable       C     Disable     C     Disable	PA_BIAS_03

Figure 16. SAT deviation

# **Signaling Tone Deviation**

This phasing procedure is used to phase the deviation that results from normal audio levels.

### **Table 13. Signaling Tone Deviation Test Values**

Parameter	Value
Test Voltage at Battery Terminals	3.60V
Test Voltage at Acc. Connector	4.40V
TEST_CHANNEL	350
MINIMUM_GAIN_SETTING	0
MAXIMUM_GAIN_SETTING	15
LOW_LIMIT	7.6kHz
TARGET	8.0kHz
HIGH_LIMIT	8.4kHz

- Select the SUSPEND button to put the phone into Suspend Mode.
- Under CP\_MODE, select the AMPS button to place the transceiver into Analog call processing mode.
- Under the LOAD\_SYN heading, enter desired channel and select the Set Chan button to tune the UUT to the TEST\_CHANNEL.
- Under AUD\_PATH heading, set Input to 1 and Output to 1, TX MUTE RX MUTE and select SET.
- Set AUD\_LVL to level 3.
- Under AUD\_CTRL, select Sidetone OFF.
- Under COMPD, select Compander OFF.
- Under SIGTONE heading, select Enable.
- Under SET\_RF\_PWR, set transceiver to power step 2.
- Under CARRIER, select ON to enable the analog carrier.
- See Figure 17.
- The test set should be configured as follows: 15 kHz LPF, 50Hz HPF, 750  $\mu Sec$  de-emphasis. Set equipment to measure FM deviation.
- Measure the peak frequency deviation in kHz.

In Four     28.33     9.999999       RF Channel     IF Filter     AF Anl In       Sigo     IF Filter     AF Anl In       Sigo     RF Gen1 Lv1       Sigo     Ext TX Key       Barbard     Ext TX Key       Sigo     Ext TX Key       Sigo <td< th=""><th>TX Freq Er -0</th><th>.217</th><th>FM Deviation 7.827</th></td<>	TX Freq Er -0	.217	FM Deviation 7.827
RF Channel       IF Filter         BF Channel       IF Filter         SS00       Filter 1         SOUTHER       Filter 1         SOUTHER       Filter 1         SUBTOR       Filter 2         ISKHZ       PP         SS00       Filter 2         ISKHZ       PP         SUBTOR       Filter 2         ISKHZ       PP         SUBTOR       Filter 2         SUBTOR	2	8.33	9.99999
Add Cold Account v2.0.1       Image: Setting: Help         Substring: Help       Image: Setting: Help         Substring: Cold Adds       Cold Adds         Version       Cold Adds         Version       Cold Adds         Cold Adds       Cold Adds         Version       Cold Adds         Cold Adds       Cold Adds         Version       Cold Adds         Cold Adds       Cold Adds	RF Channel 350 TX Pwr Zero Zero Min Inp Lyl -10.0 dBm	AF FM 230 kHz Ext TX Key 0n≠ <u>0ff</u> Det Pk+	Anl In Demod Demod Cer 1 Cer 1 Cer 2 Cer 2 Cer 2 Cer 2 Cor 2
Audo Junton       AMPS       Electron       Image: Conversions         SUSPEND       C       DAta AMOS       Single       Keep History         SUSPEND       C       DDMA 800       Set Upid       Set Upid       Set Upid         Version       Set Upid       Set Upid       Set Upid       Set Upid       Set Upid         Version       Set Upid       Set Upid       Set Upid       Set Upid       Set Upid         COMA AMPS       Direct Access       CIT       Conversions       Set Upid       Set Upid       Set Upid         COMA AMPS       Direct Access       CIT       Conversions       Set Upid       Set Upid       Set Upid         COMA AMPS       Direct Access       CIT       Conversions       Set Set One	∰ CDMAC.onm v2.0.1		
Data Mode       C       AMPS       350         SUSPEND       C       CDMA 800       Set Chan         VERSION       UPD       Conversions         Version       Get Upid       Set Upid       Conversions         CDMA       AMPS       Direct Access       CIT         AUD_CTRL       AUD_LPBK       Conversions       Get Upid       Set Upid         C Version ON       C Codec       F       Set       150       216(25)         C Version ON       C Codec       O       Set       150       216(25)       Porce ADC         C Version OFF       C Compande ON       O       Diable       C Compande OFF       A/D       A/D       Parameter       Setoct AD Parameter       Setoct AD Parameter       Setoct AD Parameter       Setoct PLASE       Parameter       Setoct PLASE       Parameter       Setoct PLASE       Phase       Phase Parameter       Setoct PLASE Parameter       PLASE       Phase Parameter       Setoct PLASE Parameter       PLASE       PALING, 45       PLASE       PALING, 45       PLASE       PALING, 45       PLASE       PLASE       PLASE       PLASE       PLASE       PLASE       PLASE, 45       PLASE       PLASE, 45       PLASE       PLASE, 45       PLASE, 45       PLASE, 45	Main Settings Help	LOAD_SYN	
VERSION Version CDMA AMPS Direct Access CIT CDMA AMPS Direct Access CIT AUD_CTRL C Vibrator OF C Vibrator OF C Vibrator OF C Vibrator OF C Vibrator OF C Vibrator OF C Vibrator OFF AUD_LVL C Sidetone OFF AUD_LVL C compander ON Set C compander OF Set C compander OF C compander OF Set C compander OF C compander O	Data Mode @AMPS	350	Single
CDMA AMPS Direct Access CIT AUD_CTRL C Violator OF C Violator O	SUSPEND C CDMA 800 CDMA 1900	Set Chan	
C       Vibrator ON       Codec       <	VERSION	Set Chan UPID Get Upid	Upid Conversions
C Sidetone DI C Sidetone OFF AUD_LVL COMPD 3 - C Compander ONF AUD_LVL C Compander OFF AUD_PATH Input 1 - Mude Input Path Dutput 1 - Mude Output Path C Set Execute C Inable C Strone E A Disable C Strone E A Disable C Set Execute Clear C Strone E A C Set C Set	SUSPEND         C         CDMA 800           VERSION         CDMA 1900           Version         Direct Access           CDMA         AMPS         Direct Access	Set Chan UPID Get Upid Se s   CIT	Upid Conversions
AUD_LVL       COMPD         3       Compander ON         Set       Compander OFF         AUD_PATH       Phase Parameter         Input       1-Mule Input Path         Output       1-Mule Output Path         © Set       Compander OFF         Ø Set       Compander OFF         AUD_PATH       Select APLASE Parameter         Uniput       1-Mule Output Path         © Get       Execute         Clear       PA_BIAS_03         PA_BIAS_03       PA_BIAS_03         PA_BIAS_03       PA_BIAS_67         PA_BIAS_67       PA_BIAS_67         PA_BIAS_03       PA_BIAS_67         PA_BIAS_03       PA_BIAS_67         PA_BIAS_03       PA_BIAS_67         PA_BIAS_04       PA_BIAS_67         PA_BIAS_057       PA_BIAS_67         PA_BIAS_67       PA_BI	SUSPEND         C         CDMA 800           VERSION         CDMA 1900           VERSION         Direct Access           AUD_CTRL         AUD_LPBK           C         Vibrator 0N           C         Codec           C         Vibrator 0FF           C         Vocoder 13K	Set Chan UPID Get Upid Se CIT CARBIER CARBIER Step 2 1 Step 3 1 St	Upid     Conversions       Upid     Conversions       Phase     Analog AOC Force (Analog ME Force)       8     Set       150     ZIF (0.3)       150     ZIF (4.5)
3       C       Compander ON         Set       C       Compander OFF         AUD_PATH       Fhase Parameter:       Select PHASE Parameter         Input       1       Mule Input Path       Select PHASE Parameter         Cutput       1       Mule Duput Path       Select PHASE Parameter         Vitik       Set       Execute       Dear         Vitik       Set       Toto       Select PHASE Parameter         Vitik       Set       Execute       Dear         Vitik       Set       Toto       Select PHASE Parameter         Vitik       Set       Disable       Dear       PA_BIAS_03         Vitik       Set       Disable       Disable       PA_BIAS_167         Vitik       Set       Disable       Disable       Note         Vitik       Set       Set       Set       Set	SUSPEND     C     CDMA 800       VERSION     C     CDMA 1900       Version     Direct Access       AUD_CTRL     AUD_LPBK       C     Vibrator DN       C     Vibrator OFF       C     Sidetone DN       C     Sidetone ON	Set Chan UPID Get Upid Se CIT CARRIER CON Step 2 1 Set C OFF Set C	Upid     Conversions       Upid     Conversions       Phase     Analog AOC Force (Analog ME Force)       8     Set       150     ZIF (0.3)       150     ZIF (4.5)       Force AOC
AUD_PATH Input 1 - Mute Input Path Dutput 1 - Mute Dutput Path FIN_BIAS_45 C Set Execute Clear FIN_BIAS_45 FIN_BIAS_45 FIN_BIAS_67 C Set Execute Clear FIN_BIAS_67 C Set Execute Clear FIN_BIAS_67 C Set Execute FIN_BIAS_67	C CDMA 800 C CDMA 1900 C COMA 1900 C DISAU C DIS	Set Chan UPID Get Upid Se CIT CARRIER CARRIER COFF Set COFF Set COFF Set COFF Set COFF Set COFF Set COFF Set COFF Set	Upid       Conversions         Upid       Conversions         Phase       Analog AOC Force (Analog ME Force)         8       •         8       •         150       •         2IF (0-3)       350         150       •         2IF (4-5)       Force ADC         DMA Location       150       •         V       Execute       RSSI         Parameter       Select RSSI Parameter       Execute
Output     1 - Mute Output Path     Image: Construction of the construc	SUSPEND     C     CDMA 800       VERSION     C     CDMA 1900       Version     Image: Comparison of the second se	Set Chan UPID Get Upid Set CIT COFF COFF COFF COFF COFF COFF COFF COF	Unid       Conversions         Upid       Conversions         Phase       Analog ADC Force (Analog ME Force)         8 * Set       150 * 21F (0.3)         150 * 21F (4.5)       Force ADC         DMA Location       150 * 21F (6.7)         Force ADC       RSSI         Phase       RSSI Parameter         Execute       RSSI Parameter         Execute       Data
Find     Find     Find       Find     Find	SUSPEND     C     CDMA 800       VERSION     C     CDMA 1900       VERSION     C     COMA 1900       CDMA     AMPS     Direct Access       AUD_CTRL     AUD_LPBK     C       C Vibrator ON     C     Codec       C Vibrator ON     C     Codec       C Sidetone ON     C     Disable       AUD_LVL     COMPD     C       3     C     Compander ON       Set     C     Compander ON       AUD_PATH     Invite Input Path     V	Set Chan UPID Get Upid Set CIT C OFF C OFF C OFF C OFF C OFF C OFF C OFF Step C OFF C OFF	Unid       Conversions         Upid       Conversions         Phase       Analog ADC Force (Analog ME Force)         8       Set         150       ZIF (4-5)         150       ZIF (4-5)         Force ADC         DMA Location       150         Y       Execute         RSSI         Parameter       Select RSSI Parameter         Parameter       Execute         Data         Force PA         Data
C     Enable     C     5970 Hz     C     Enable       C     Disable     C     5000 Hz     C     Disable       C     6030 Hz     C     Disable     Tone: 5 = 1	SUSPEND     C     CDMA 800       CDMA 1900     C     CDMA 1900       VERSION     C     CDMA 1900       Version     Image: Comparison of the second sec	Set Chan UPID Get Upid Set CIT COFF Set COFF SET	Unid       Conversions         Upid       Conversions         Phase       Analog ADC Force (Analog ME Force)         8 **       Set         150 **       ZIF (4-5)         150 **       ZIF (4-5)         Force ADC         DMA Location       150 **         Y       Execute         RSSI         Parameter       Select RSSI Parameter *         Execute       RSSI Parameter         Force PA       Drain         FIN_BIAS_03.       FIN_BIAS_257.         Gate       Gate
C Disable	SUSPEND       C       CDMA 800         VERSION       C       CDMA 1300         VERSION       C       CDMA 1300         Version       C       CDMA 1300         CDMA       AMPS       Direct Access         AUD_CTRL       AUD_LP8K       C         C       Vibrator 0N       C       Codec         C       Vibrator 0FF       C       Codec         C       Vibrator 0FF       C       Codec         C       Vibrator 0FF       C       Disable         C       Sidetone 0N       C       Disable         Sidetone 0FF       C       Compander 0N         Set       C       Compander 0FF         AUD_PATH       Indue nput Path       Output         Invite       Invite Output Path       T         VEX       Set       1103         SIGTONE       SAT       D	Set Chan UPID Get Upid Set Upid Set Upid Set ON Step 2 Set C OFF Set C A/D A/D Parameter Select AD Parameter Data PHASE Phase Parameter Select PHASE Parameter Select PHASE Parameter Set C Set Execute	Unid Conversions Unid Conversions Unid Conversions Unid Conversions  Phase Analog ADC Force (Analog ME Force) 8 - Set 150 - ZIF (0-3) 350 -  Inalog Location 150 - ZIF (4-5) Force ADC  To - ZIF (4-5) Force ADC  To - ZIF (6-7) Force ADC  To - ZIF (6-7) Force PA Fin_BlaS_03 Fin_BlaS_0
	SUSPEND     C     CDMA 800       VERSION     C     CDMA 1300       VERSION     C     CDMA 1300       Version     C     COMA 1300       CDMA     AMPS     Direct Access       AUD_CTRL     AUD_LPBK     C       C     Vibrator ON     C       C     Vibrator ONF     C       C     Sidetone ON     C       C     Sidetone OFF     C       AUD_LVL     COMPD     C       Sidetone OFF     C     Compander ON       Set     C     Compander ON       Set     C     Compander ON       Set     C     Compander ON       Set     C     Sompander OFF       AUD_PATH     Indue Input Path     Y       Output     1 - Mute Output Path     Y       VERSIONE     SAT     C       SigTONE     SAT     C       C     Disable     C       G     Enable     C       G     SigTONE     SAT       C     Disable     C	Set Chan UPID Get Upid Set Upid Set CIT C CARRIER ON Step 2 Set C A/D A/D Parameter Select AD Parameter Data PHASE Phase Parameter Select PHASE Parameter	Unid Conversions Unid Conversions Unid Conversions Unid Conversions Phase Set T50 # ZIF (0.3) 350 # T50 # ZIF (4-5) Force ADC DMA Location T50 # ZIF (6-7) Force ADC FIN_BIAS_03 FIN_BIAS_03 FIN_BIAS_65 FIN_BIAS_

0110080

Figure 17. Signaling tone deviation

# **RX Sensitivity (SINAD)**

### Table 14. RX Sensitivity (SINAD) Test Values

Parameter	Value
Lower limit	12
Upper limit	35
Channel (1)	991
Channel (2)	350
Channel (3)	799

- Select the SUSPEND button to put the phone into Suspend Mode.
- Under CP\_MODE, select the AMPS button to place the transceiver into Analog call processing mode.
- Under the LOAD\_SYN heading, enter desired channel and select the Set Chan button to tune the UUT to the TEST\_CHANNEL.
- Under AUD\_PATH heading, set Input to 1 and Output to 4, TX MUTE and select SET.
- Set AUD\_LVL to level 4.
- Under AUD\_CTRL, select Sidetone OFF.
- Under COMPD, select Compander ON.
- Under SET\_RF\_PWR, set transceiver to power step 2.
- Under CARRIER, select ON to enable the analog carrier.
- See Figure 18.
- Set up the test set as follows: apply an analog RF input signal at -116 dBm modulated with a 1004 Hz tone at 8 kHz peak deviation. Set the audio analyzer for 15 kHz LPF, C-message filtering, de-emphasis OFF, and RMS detector.
- Measure SINAD of the received audio signal at the audio out pin on the accessory connector. The measured SINAD must meet the specifications defined in Table 14.

TX Freq Err -0.	°r 230	AC Le	0.502	6
TX Power 28	8.20 dBm	SINAD	23.22	
IF Filter 230 kHz Ext TX Key On/ <u>Off</u>	F Channel AFG 350 AFG mplitude dBm -116.0 dBm tten Hold FM vtput Port Aud F Out only AC	en1 Freq F .0040 F .0040 F .0040 F .0040 F .004 F	F Anl In udio In ilter 1 MESSAGE ilter 2 SkHz LPF e-Emphasis 50 us <u>Off</u> etector MS	To Screer O CDMA CALL CNTL SMS AUTHEN AUTHEN Analog RX TEST Config TESTS
Si CDMAComm v2.0.1 Main Settings Help SUSPEND CP_MODE Data Mode CAMPS	LOAD_SYN			ngle
VERSION	Set Chan UPID Get Upid Se	t Upid Conversions		ar Status
CDMA AMPS Direct Access AUD_CTRL C Vibrator DN Vibrator DFF C Sidetone DN C Sidetone DN C Dirable	CIT	Phase Analog A0 28 - Set 150 - Analog Location 150 - CDMA Location 150 - RSSI	C Force (Analog ME Force) ZIF (0-3) ZIF (4-5) Force 4 ZIF (6-7)	:: :::::::::::::::::::::::::::::::::::
AUD_LVL COMPD	A/D Parameter Select AD Parameter Data PHASE Phase Parameter: Select PHASE Parameter	Execute RSSI	Parameter Select RSSI Parameter	Execute  Force PA  Drain  FIN_BIAS_03  FIN_BIAS_0
Input 1 - Mute Input Path	Get Execute	Clear		FIN_BIAS_45
C Enable C 59/0 Hz C C Disable C 6000 Hz C C 6030 Hz Torr C Disable Torr				Read Set

Figure 18. RX sensitivity (SINAD)

# TX Audio Muting

### Table 15. TX Audio Muting Test Values

Test Limits	Level (dB)
Upper limit	-40.0
Lower limit	-90.0

- Select the SUSPEND button to put the phone into Suspend Mode.
- Under CP\_MODE, select the AMPS button to place the transceiver into Analog call processing mode.
- Under the LOAD\_SYN heading, enter desired channel and select the Set Chan button to tune the UUT to the TEST\_CHANNEL.
- Under AUD\_PATH heading, set Input to 3 and Output to1, RX MUTE and select SET.
- Set AUD\_LVL to level 3.
- Under AUD\_CTRL, select Sidetone OFF.
- Under COMPD, select Compander ON.
- Under SET\_RF\_PWR, set transceiver to power step 2.
- Under CARRIER, select ON to enable the analog carrier.
- See Figure 19.
- Set up the test set as follows: set the analyzer to 750  $\mu Sec$  de-emphasis, 15 kHz LP filtering.
- Detector: Peak (+/-) /2
- Input a 1004 Hz TX modulation signal to the audio in pin of the accessory connector at a level to get 8 kHz peak deviation. Set the audio analyzer for C-message filtering and RMS detector.
- Measure the demodulated output from the modulation analyzer. Reference the audio analyzer to the 1004 Hz tone.
- Use AUD\_PATH to select path "1103h".
- Measure the change in dB level on the audio analyzer with respect to the reference. Measured change must meet the specification defined in Table 15.

TX Frea Erro	253 <b>***</b>	FM Deviation 8.0	57
28	3.02 <sup>38</sup>	AF Freq 1.003	398
RF Channel 350 TX Pwr Zero Zero Min Inp Lvl -10.0 dBm	AF A FM D SO kHz SO kHz Filt SO kHz Filt SC D P C P C P C P C C C C C C C C C C C C	nl In emod er 1 HPF er 2 z LPF mphasis ug/Off ctor	To Screen C CDMA CALL CNTL SMS AUTHEN W Analog RX TEST Config TESTS
<b>≨a:CDMAComm v2.0.1</b> Main Settings Help			
SUSPEND CP_MODE  Data Mode C CDMA 800 C CDMA 1900 Version Version	LOAD_SYN 350 Set Chan UPID Get Upid Set L	P Tpid Conversions	C Single C Keep History Clear Status
CDMA AMPS Direct Access ( AUD_CTRL AUD_LPBK C Vibrator 0N C Vibrator 0FF C Sidetone 0N	CARRIER SET_RF_PWR - AFC P C ON Power 2 - 128 C OFF Step C AR C OFF C C	hase Analog AOC Force (Analog ME Force Set 150 + ZIF (0-3) alog Location 150 + ZIF (4-5) MA Location 150 + ZIF (6-7) BSS 1	350 -
Compander ON	A/D Parameter Select AD Parameter Data	Execute RSSI Parameter Select RSSI F Data	arameter  Execute Force PA
Set     Compander OFF       AUD_PATH     Input:       Input:     3 - External Audio (CE Bus •       Output:     1 - Mute Output Path •       TXMUTE     Set	Phase Parameter: Select PHASE Parameter C Set Execute	Clear	Drain           FIN_BIAS_03
BX MUTE 3102	F		PA_BIAS_45

Figure 19. TX audio muting

# **TX** Distortion

### Table 16. TX Distortion Test Values

Test Limits	Distortion Level (%)	Distortion Level (dB)
Upper limit	5.0	-26.0
Lower limit	0.1	-60.0

- Select the SUSPEND button to put the phone into Suspend Mode.
- Under CP\_MODE, select the AMPS button to place the transceiver into Analog call processing mode.
- Under the LOAD\_SYN heading, enter desired channel and select the Set Chan button to tune the UUT to the TEST\_CHANNEL.
- Under AUD\_PATH heading, set Input to 3 and Output to 4 and select SET.
- Set AUD\_LVL to level 3.
- Under AUD\_CTRL, select Sidetone OFF.
- Under COMPD, select Compander ON.
- Under SET\_RF\_PWR, set transceiver to power step 2.
- Under CARRIER, select ON to enable the analog carrier.
- See Figure 20.
- Set up the test set as follows: Set the Analyzer for 50 Hz HPF, 15 kHz LPF, and 750  $\mu Sec$  de-emphasis.
- Detector: Peak (+/-) /2
- Input a 1004 Hz modulating signal to the audio in pin of the Accessory connector at a level to get 8 kHz peak deviation. Set the analyzer to C-message filtering and the detector to RMS. Measure the distortion.
- The measured distortion must be less than the specifications defined in Table 16.

	0.236	Z FM	Deviation 8.06	kHz 
TX Power	26.20	m Di.	0.9	X
RF Channel 350 TX Pwr Zero Zero Min Inp Lv1 -10.0 dBm	IF Filter 230 kHz Ext TX Key On/Off	AF Anl In FM Demod Filter 1 50Hz HPF Filter 2 15kHz PF De-Emphasis 750 ug/0ff Detector Pk+-2	AFGen1 Freq kHz AFGen1 Lv1 mV	To Screen O CDMA CALL CNTL SMS AUTHEN • Analos RX TEST Confis TESTS
-10.0 dBm		Pk+=72		TESTS
Se CDMAComm v2.0.1				
SUSPEND CP_MODE Data Mode SUSPEND C CDMA 80 C CDMA 90 C CDMA 190	LOAD_SYN 350 Set Chan			Single Keep History Ilear Status
VERSION		Conversions	-	
VERSION Version CDMA AMPS Direct Ar	CCESS CIT CARRIER SET_R	E_PWR _ AFC Phase Ar	alog AOC Force (Analog ME Force)	
VERSION Version CDMA AMPS Direct Au AUD_CTRL AUD_CTRL C Vibrator DN C C Coc C Vibrator OFF C Vibrator OFF	CCCESS CTT CCCESS CTT CCCES CTT CCCES CTT CCCES CTT CCCESS CTT CCCESS CTT CCCESS CTT CCC	F_PWR AFC Phase Ar 2 + 128 + Set Conversions	alog AOC Force (Analog ME Force) 150 1 21F (0-3) 150 21F (4-5) 150 1 21F (4-5) 150 1 21F (6-7)	0 1 2049
VERSION Version CDMA AMPS Direct Au AUD_CTRL C Vibrator ON C Vibrator OFF C Sidetone ON C Sidetone OFF	CARRIER SET_R CARRIER SET_R Power 13K COFF Step A/D A/D Parameter Select A	Set Upid     Conversions       F_PwR     AFC Phase     Ar       2     128     Set       et     © Analog Location     Conversions       CDMA Location     CDMA Location     D	Halog AOC Force (Analog ME Force) 150 ZIF (0-3) 150 ZIF (4-5) 150 ZIF (4-5) 150 ZIF (6-7) RSSI RSSI RSSI Parameter Select RSSI Parameter	0 == e AOC
VERSION Version CDMA AMPS Direct Au AUD_CTRL C Vibrator DN C Vibrator OFF C Vibrator OFF C Sidetone OFF AUD_LVL C CMPD 3C Compande SetC Compande	CARRIER SET R COFF	Enversions Set Upid Conversions F_PWR AFC Phase t 128 s Set C Analog Location C CDMA Location D Parameter Execute	alog ADC Force (Analog ME Force) 150 2 ZIF (0-3) 150 2 ZIF (4-5) 150 2 ZIF (4-5) 150 2 ZIF (6-7) RSSI RSSI RSSI Parameter Select RSSI Parame Data	e AOC
VERSION Version CDMA AMPS Direct Au AUD_CTRL C Vibrator DN C Sidetone DN C Sidetone OF AUD_LVL C CMPD 3 # C Compande Set C Compande C Compande Set C Compande C Compande C Compande C Compande Set C Compande C C Compande C C Compande C C Compande C C Compande C C C C C C C C C C C C C C C C C C C	CARRIER SET R CARRIER SET R Step A/D A/D Parameter Select A Data PHASE Phase Parameter: Select PHASE Parameter: Select PHASE Parameter: Select PHASE Parameter:	E-PWR AFC Phase Ar 2 - 128 Set. et Conversions Conversions AFC Phase Ar 2 - Conversion C CDMA Location D Parameter Execute	alog AOC Force (Analog ME Force) 150 2JF (0-3) 150 2JF (4-5) 150 2JF (6-7) RSSI RSSI Parameter Select RSSI Parameter Data	0 :: e ADC Force PA Dain FIN_BIAS_03: ::
VERSION Version CDMA AMPS Direct Av AUD_CTRL Vibrator DN Vibrator DFF C Vibrator	CARRIER SET R CARRIER SET R CARRIER SET R Step A/D A/D Parameter Select A Data PHASE Phase Parameter: Select PHASE PARAMETER: Select PHA	Enversions Set Upid Conversions F_PWR AFC Phase at Conversions Conversions F_CARAING Location CDMA Location D Parameter Execute Clear	alog AOC Force (Analog ME Force) 150 21F (0-3) 150 21F (4-5) 150 21F (6-7) RSSI RSSI Parameter Select RSSI Parameter Date	
VERSION Version CDMA AMPS Direct Au AUD_CTRL Vbrator DN Vbrator OFF Sidetone DN Sidetone ON Sidetone OFF AUD_LVL COMPD 3 ± Compande Set Compande Set Compande Set Compande Set Compande Set Compande Set Compande Set Signone Set Signone Set Signone Sat Compande Set Compande Compande Set Compande Compande Set Compande Set Compande Set Compande Set Compande Set Compande Set Compande Set Compande Compande Set Compande Set Compande Set Compande Set Compande Set Compande Set Compande Set Compande Set Compande Set Compande Set Compande Set Compande Set Compande Set Compande Set Set Set Set Set Set Set Set Set Se	CARRIER SET R CARRIER SET R CARRIER SET R COFF S A/D A/D Parameter Select A Data PHASE Phase Parameter: Select PHASE PARAMETER: Select P	Set Upid Conversions F_PWR AFC Phase Ar 2 - 128 - Set et Conversions CDMA Location D Parameter Execute Clear	alog ADC Force (Analog ME Force) 150 21F (0-3) 150 21F (4-5) 150 21F (4-5) 150 21F (6-7) RSSI RSSI Parameter Data	0

Figure 20. TX distortion

# TX Hum and Noise

### Table 17. TX Hum and Noise Test Values

TX Hum and Noise	Level (dB)
Upper limit	-38
Lower limit	-90

- Select the SUSPEND button to put the phone into Suspend Mode.
- Under CP\_MODE, select the AMPS button to place the transceiver into Analog call processing mode.
- Under the LOAD\_SYN heading, enter desired channel and select the Set Chan button to tune the UUT to the TEST\_CHANNEL.
- Under AUD\_PATH heading, set Input to 3 and Output to 4 and select SET.
- Set AUD\_LVL to level 3.
- Under AUD\_CTRL, select Sidetone OFF.
- Under COMPD, select Compander OFF.
- Under SET\_RF\_PWR, set transceiver to power step 2.
- Under CARRIER, select ON to enable the analog carrier.
- See Figure 21.
- Set up the test set as follows: 750 µSec de-emphasis, 50 Hz HPF, 15 kHz LPF
- Detector: Peak (+/-) /2.
- Input a 1004Hz modulation signal to the audio-in pin of the accessory connector at a level to get 8 kHz peak deviation.
- Change the analyzer for C-message filtering and RMS detector.
- Measure the FM deviation. Reference the audio analyzer to the 1004 Hz tone. Remove the TX modulation signal from the audio in pin of the accessory connector and measure the change in dB level on the audio analyzer with respect to the reference. The measured change in signal level must meet the specifications defined in Table 17.

TX Power       28.02       4.02         28.02       AFGeni Free       4.02         IF Filter       AFGeni Free       AF Anl In         Amplitude       AFGeni Free       Filter 1         AffGeni To       AffGeni To         Atten Hold       AffGeni To         Onzdfri       Output Port         Output Port       FM Coupling         Ext TX Key       Output Port         Output Port       Eucloc         Wais Seting       Convertion         Subscription       Set Upd         Subscrint       Set Upd	TX Freq Error -0.22	3	B.090	Ηz
RF Channel       AFGeni Freq 3500       AFGeni Freq 1.00040       AFG Ani In FM Demod       To Screer         IF Filter       Amplitude       Argeni To Budio Out       Argeni To Budio Out       FM Demod       Filter 1         SUBRE       Atten Hold       Atten Hold       Audio Out       FM Coupling       Bestury Officer         Ext TX Key       Atten Hold       On 2014       FM Coupling       Bestury Officer       Config         Mai Setting:       FM Coupling       BC DOC       Bestury Officer       Config       Config         SUSPEND       COMA MPS       SSC Con       Pk+-/2       FM Coupling       State         SUSPEND       COMA MOD       Sector       State       State       State         SUSPEND       COMA MOD       Sector       State       State       State         Version       Genuid       SetUpd       Conversions       State       State         COMA AMPS       Direct Access CTT       Compared Ni       State       State       State       State         AD_UTIC       Compared Ni       Compared Ni       Compared Ni       State       State       State       State       State         State       Compared Ni       Compared Ni       Compared Ni       St	<sup>TX Power</sup> 28.0	2	4.02	
Set EDMAComm v2.0.1       Image: Compander 0PF         Main       Settings       Help         SUSPEND       CP_MODE       LOAD_SYN         Data Mode       C	IF Filter 230 kHz Ext TX Key On/Off RF Ou	annel AFGen1 Freq 1.0040 KHz AFGen1 To Audio Out ff Hold f Hold f AC/DC AFGen1 To MHz MV Audio Out 111 MV AC/DC	AF Anl In FM Demod Filter 1 SOHZ HPF Filter 2 ISKHZ LPF De-Emphasis 750 ug/0ff Detector Pk+-/2 TES	Goreen DMA CONTL HEN halog TEST fig TS
VERSION Version UPD Conversions CDMA AMPS Direct Access CIT AUD_CTRL AUD_CTRL AUD_PBK C Codec Vibrator DN C Codec Vibrator DN C Codec Vibrator DF C Vibrator DF C Vibrator DF C Vibrator DF C Sidetone DN C Sidetone DF AUD_VL C Compander DF C C Compander DF C	CDMAComm v2.0.1           Main Settings Help           SUSPEND         CP_MODE           Data Mode         C           SUSPEND         CDMA 800           SUSPEND         CDMA 1900	/N	C Keep History	
AUD_CTRL       AUD_LPBK         C       Vibrator DN         C       Vibrator OFF         C       Vibrator OFF         C       Vibrator OFF         C       Step 2         C       Sidetone DN         C       Disable         AUD_LVL       COMPD         Sidetone DFF       Set         AUD_LVL       COMPD         Sat       C         C       Compander DFF         AUD_LVL       Compander DFF         PHASE       Force PA	VERSION	UPID Conversion Get Upid Set Upid Conversio	s Liear Status	
	AUD_CTRL     AUD_LPBK     CAR       C     Vbrator DN     C     Codec       C     Vbrator OFF     C     Codec       C     Sidetone DN     Disable     A/D       AUD_LVL     COMPD     A/D       3     C     Compander DNF       Set     C     Compander DFF	RIER SET_RF_PWR AFC Phase ON Power 2 + 128 - Set 128 -	Analog ADC Force (Analog ME Force)       150     2IF (0-3)       150     2IF (4-5)       150     2IF (6-7)         RSSI         RSSI         Parameter         Select RSSI Parameter         Force PA         Proce PA	ute

Figure 21. TX hum and noise

## **TX Response**

### Table 18. TX Response Test Values

Test Limits	Level at 300 Hz (dB)	Level at 3 kHz (dB)
Upper limit		10.5
Lower limit	-13.5	4.9

- Select the SUSPEND button to put the phone into Suspend Mode.
- Under CP\_MODE, select the AMPS button to place the transceiver into Analog call processing mode.
- Under the LOAD\_SYN heading, enter desired channel and select the Set Chan button to tune the UUT to the TEST\_CHANNEL.
- Under AUD\_PATH heading, set Input to 3 and Output to 1, RX MUTE and select SET.
- Set AUD\_LVL to level 3.
- Under AUD\_CTRL, select Sidetone OFF.Under COMPD, select Compander OFF.
- Under SET\_RF\_PWR, set transceiver to power step 2.
- Under CARRIER, select ON to enable the analog carrier.
- See Figure 22.
- Set up the test set as follows: set the analyzer for 50 Hz HPF and 15 kHz LPF
- Detector: Peak (+/-) /2.
- Input a 1004Hz modulating signal to the audio in pin of the accessory connector at a level to get 2.9 kHz peak deviation. Measure the FM deviation.
- Change the analyzer detector to RMS.
- Reference the audio analyzer to the 1004 Hz tone. Vary the TX modulation frequency to 300 Hz and 3 kHz.
- Measure the change in dB level on the audio analyzer with respect to the reference. The measured change must meet the specifications defined in Table 18.

	).160	2	.958
TX Power	28.01	1.0	0409
RF Channel 350 TX Pwr Zero Zero Min Inp Lvl -10.0 dBm	IF Filter 230 kHz Ext TX Key 0n×0ff Filt Filt 50Hz Filt 15kH 0n×0ff Pk+	nl In emod er 1 HPF er 2 Z PF mphasis us/Off ctor	Freq 40 40 kHz Lv1 MV MV Analos RX TESTS TESTS
<b>S CDMAComm v2.0.1</b> Main Settings Help			
SUSPEND CP_MODE Data Mode SUSPEND C CDMA 800 CDMA 1900 VERSION Version	LQAD_SYN 350 Set Chan UPID Get Upid Set 1	Jpid Conversions	Clear Status
CDMA AMPS Direct Acce AUD_CTRL AUD_LPBK C Vibrator 0N C Codec Vibrator 0FF C Codec C Codec C Codec C Codec C Codec C Codec C Codec C Codec C Codec C C Codec C C Codec C C Codec C C C C C C C C C C C C C C C C C C C	K	Phase         Analog ADC Force (Analog	ME Force)
AUD_LVL COMPD	A/D Parameter Select AD Parameter Data PHASE Phase Parameter: Select PHASE Parameter	Execute	Execute Force PA Fine BIAS_03
AUD_PATH Input: 3 - External Audio (CE Bus Output: 1 - Multe Output Path TX:MUTE Set 3102 00000000000000000000000000000000000	Set Execute	Clear	FIN_BIAS_45 FIN_BIAS_67 Bate PA_BIAS_03 PA_BIAS_45
SIGTONE SAT C Enable C 5970 Hz C Disable C 6000 Hz	DTMF C Enable C Disable		PA_BIAS_67:

Figure 22. TX response

# **Receiver Sensitivity (FER)**

### Table 19. Receiver Sensitivity (FER) Test Values

Parameter	CDMA	PCS
LOW_CHANNEL	1013	25
MID_CHANNEL	350	650
HIGH_CHANNEL	735	1175
13K_DATA_TRAF_LEVEL	-12.3 dB	-12.3 dB
RX_LEVEL	-104 dBm (-102 dBm @ HOT thermal)	-104 dBm (-102 dBm @ HOT thermal)
FER_LIMIT	0.5% FER	0.5% FER

• Phone should be powered on and in a 13K/RateSet1 CDMA Full Rate Data Call.

• Depending on which Data Rate, set the Traffic Level accordingly to either 13KDATA\_TRAF\_LEVEL.

• See Figure 23, Screen 1.

• When the call is established, reduce the RF amplitude to RX\_LEVEL.

• See Figure 23, Screen 2.

- Measure FER over a maximum of 10000 frames to a confidence level of 95%.
- The Frame Error Rate (FER) may not exceed FER\_LIMIT as specified in Table 19.



Figure 23. Receiver sensitivity (FER)

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# **Receiver Sensitivity in the Presence of Noise (FER in AWGN)**

The test channels are given below.

Parameter	CDMA	PCS
Test voltage at battery terminals	3.60V	3.60V
Test voltage at accessory connector	4.40V	4.40V
FER_LIMIT	0.5% FER	0.5% FER
RX_TEST_LEVEL	-55 dBm	-55 dBm
AWGN_LEVEL	-54 dBM	-54 dBm
13KDATA_TRAF_LEVEL	-12.4 dB	-12.3 dB
Low test channel	1013	25
Middle test channel	350	650
High test channel	735	1175

• Phone should be powered on and in a 13K/RateSet1 CDMA Full Rate Data Call.

• Depending on which Data Rate, set the Traffic Level accordingly to either 13KDATA\_TRAF\_LEVEL.

- See Figure 24, Screen 1.
- Set the total Forward CDMA Channel power to RX\_TEST\_LEVEL.
- Set the AWGN generator power to AWGN\_LEVEL.
- See Figure 24, Screen 2.
- Measure FER over a maximum of 10000 frames to a confidence level of 95%.
- Measured FER must be within the limits defined above in table 20.

Call Status	CDMA CALL CON	TROL	
Access Probe Connected		-16.	70
Softer Handoff	ff Ideo	1 Mobile Power:	-18.0 dBm
RF Channel Hat 222 Sy	ndoff Traffic ecute Data Mode stem Type Suc Opt	MS ID FURIOR	To Screen CDMA
Protocol SB-74	annel Data Rate	MS Database	CHLL CNTL SMS Authen
RF Chan Std 59 MS AMPS Pw	70Hz r Level 24 Power Med	Sctr A Pwr	O Analos EX TEST
800 FER AWGN Screen 2	2010	dBm/BW	Lonf 19
CDI	MA CELLULAR MOBILE F	RECEIVER TEST	
Svc Opt 2. Testing	/9	0.00	
D Passed Failed Max Frame	s	Errors Counted Frames Counted	0 243
Meas Cotl Max Single from	x Frames Traffic Data Mode	Sctr A Pwr	To Screen
FE	R Spec Data Rate	dBm/BW Traffic	CALL CNTE SMS AUTHEN
Dis	splay terim Eb/Nt	dB AWGN	O Analos
Re: ¥e	sults 4.47 SANCE dB	dBm/BW	Config TESTS
PCS FER AWGN Screen 1	CDMA CALL CON	TROL	
<ul> <li>Transmitting</li> <li>Registering</li> <li>Page Sent</li> </ul>		Ave Power -18	31
Connected Softer Handoff	ff	1 Mobile Power:	-21.0 dBm
RF Channel Ha	ndoff Traffic ecute Data Mode	MS ID Auto	To Screen
Register: AM Chr	stem Type PS annel Date Bate	MS Database	CDMA CALL GNTE SMS
J-STD-008 RF Chan Std 59 US PCS Pw	T 70Hz r Level	FFFFFFF	O Analos RX TEST
	4 Power Med	AS Sctr A Pwr SSSS dBm/BW	Config 1935
PCS FER AWGN Screen 2	MA CELLULAR MOBILE F	RECEIVER TEST	
Test Status Connected Svc Opt 2	/9	FER 0.00	
Testing Passed Failed Max Frame	5	Errors Counted	0
Meas Cntl Ma	x Frames Traffic		To Screen
Col	nfidence 95.00 2	Sctr A Pwr dBm/BW Traffic	CDMA CALL CNTL
FEI	R Spec Data Rate	dB	O Analos
	*		FOR STREET, STORE

Figure 24. Receiver sensitivity in the presence of noise

# Quality (Rho)

## Table 21. Quality (Rho) Test Values

Parameter	CDMA	PCS	
RF_LEVEL	-73 dBm	-76 dBm	
Upper limit	1.000	1.000	
Lower limit	0.944	0.944	

- Phone should be powered on and in a 13K/RateSet2 CDMA Full Rate Data Call.
- Use an RF communications test system to provide a CDMA RF channel at amplitude RF\_LEVEL.
- See Figure 25, Screen 1.
- Measure the transmitter waveform quality (Rho).
- The transmitter quality should be within the limits given in Table 21.
- See Figure 25, Screen 2.



Figure 25. Quality (Rho)

0110160

# Splatter at Maximum Output Power

### Table 22. Splatter Test Values

Parameter	CDMA	PCS
Test voltage at battery terminals	3.60V	3.60V
Test voltage at accessory connector	4.40V	4.40V
RX_LEVEL	-104 dBm	-104 dBm
SPLATTER_LIMIT	-42 dBc / 30 kHz	-42 dBc / 30 kHz
FREQUENCY_OFFSET_HIGH	+0.885 MHz	+1.25 MHz
FREQUENCY_OFFSET_LOW	-0.885 MHz	-1.25 MHz
Test channel 1	1013	25
Test channel 2	350	600
Test channel 3	777	1175

- Phone should be powered on and in a 13K/RateSet2 CDMA Full Rate Data Call.
- See Figure 26, Screen 1.

For a CMD80 test set which does not have a built in spectrum analyzer and cannot do splatter measurements while in a call, the UUT can be in Test Mode. The receiver is forced by using a Force RSSI\_C\_FILT to RX\_LEVEL.

- Set the RX\_ALG\_CTL by using the PHASE command, Parameter "28" with data 0x0010. Then use the PHASE command, Parameter "21" with data RX\_LEVEL in 11.4 format.
- Set the channel to TEST\_CHANNEL.
- Adjust the RX level into the UUT to RX\_LEVEL.
- Force the UUT to transmit full output power by sending power-control-up bits continuously.
- Begin by measuring the total output power in a 1.23 MHz bandwidth. The total output power is then REFERENCE\_POWER.
- Check to make sure that REFERENCE\_POWER > MAX\_POWER.
- Switch the power measurement instrument to measure in a 30 kHz bandwidth.
- Offset by FREQUENCY\_OFFSET\_HIGH and FREQUENCY\_OFFSET\_LOW and measure the power at each.
- ADJ\_CHANNEL\_POWER is the higher of the two measured powers in dBm.
- See Figure 26, Screen 2.



Figure 26. Splatter

0110170

# **Troubleshooting Procedures**

The goal in troubleshooting is to quickly narrow down the possibilities to isolate a failure to a single faulty component. This is especially important before deciding to replace a multi-pin IC, filter, or other component that is difficult or risky to replace. Sometimes the problem will be visually obvious; such as a cold solder joint, cracked chip, or tombstone. At other times, it will be necessary to measure a voltage. Board-level repair requires the equipment specified in Table 2.

# No Turn-On

- 1. Turn on failed.
- 2. Visually check for damaged parts.
- 3. Check for shorts.
  - Apply 4.4V with 1A current limiting to CE bus connector *J1000 pin 3*.
    - If the UUT draws more than 0.5A, check all **U1200** regulators. Make sure they are not shorted to ground.
    - If problem still exists, go to step 4.
- 4. Switch **R9972** to **R9952** to force WDG high.
- 5. Check for the power route for *U1200* B+.
  - If B+ is present, go to step 6.
  - If problem still exists, check VR1202 pin 1.
  - If there isn't 4.4V on *VR1202 pin 1*, check *J1000* and make sure it is placed correctly.
  - If there isn't a 4.4V on *CR1050 pin 2*, replace *Q1305* or reflow *U1200* if needed.
  - If problem still exists, check *CR1050* and *Q1306*. Make sure they are placed correctly.
- 6. Check U1200 regulator output voltages.
  - If the voltages on the following regulators are correct, go to step 7.
    - ANALOG\_1.8V = 1.875V
    - DIGITAL\_1.8V = 1.875V
    - MEMORY\_VCC = 1.875V
    - LOGIC\_2.75V = 2.775V
    - V4 = 2.775V
    - $RX_{2.75V} = 2.775V$
  - If problem still exists, reflow *U1200*, or replace *U1200* if reflow does not work.
- 7. Check the RTC clock from *U1200*.
  - If there is a 32.768 KHz clock on *U326 pin 2*, go to step 8.
  - If there is no clock on *U326 pin 2*, reflow *U1200*.
  - If problem still exists (the phone's internal clock is running at 32.768 kHz +/- 50%), check the RTC crystal *Y***1170**
  - If there is no 32 KHz sine wave on *Y1170*, check *C1171* and *C1172*, make sure they are placed correctly before replacing *Y1170*.
  - If problem still exists, go to step 8.
- 8. Check the 16.8 MHz clock going into *U1100 pin M1*.
  - If there is a 16.8 MHz clock at *C1173*, go to step 9.
  - If problem still exists, make sure the voltage on *Q325 pin 2* and *pin 3* are both 2.75V.
- 9. Flash EEPORM troubleshooting.
  - If the Flash\_CS is toggling, go to step 10.
  - If problem still exists, reflow flash *U1300*, or replace *U1300* if reflow

- does not work.
- 10. SRAM troubleshooting.
  - IF SRAM\_CS is toggling, go to step 11.
  - If problem still exists, reflow SRAM *U1400*, or replace *U1400* if reflow does not work.
- 11. Audio/power controller IC *U1200* troubleshooting.
  - If CCAP\_CS is toggling, reflow call processor IC *U1100*, or replace *U1100* if reflow does not work.
  - If problem still exists, reflow *U1200*, or replace *U1200* if reflow does not work.
- 12. Switch R9952 back to R9972.



If the UUT turns on the first time during the debug process, wait 30 seconds to insure the software has fully initialized the flash SEEM.

# **General Charging Failures**

The following tips may be helpful for troubleshooting charging problems.

### Charging icon not flashing

- *J1000 pins 1*, *2*, or *3* not connected.
- EXTB+ pin of audio/power controller IC U1200 pin D1 not making contact.
- Q1305 may be missing or misplaced.
- EXTBDRV pin of audio/power controller IC U1200 pin E4 not making contact.

### Charging icon flashing but no charge current

- R1052, Q1050, or CR1051 misplaced, missing, or defective.
- CHRGC U1200 pin A2 not making connection.
- ISENSE U1200 pin B2 shorted or not connected.
- Battery connector BATT+terminal *J870 pin 4* intermittent.

## Charging icon flashing but charge current always greater than 500 mA

- *R1052* or *Q1050* shorted, misplaced or defective.
- CHRGC *U1200 pin A2* not making connection or shorted to ground.
- ISENSE *U1200 pin B2* shorted or not connected.
- *U1200* charge current register always > 90 hex. Replace *U1200*.

### Charging icon flashing but charge current unstable

- Q1306, R20214, or Q1309 misplaced, shorted, or defective.
- CHRGC *U1200 pin A2* not making connection or shorted.
- ISENSE *U1200 pin B2* shorted or not connected.

### Charging Icon always shows fully charged

- Battery connector BATT+terminal J870 pin 4 not connected properly.
- MAINBATT pin U1200 pin C3 not connected properly.

### No battery/charging lcon

- Battery connector BATT+terminal *J870 pin 4* or ground terminal *J870 pin 1* not connected properly.
- MAINBATT pin *U1200 pin C3* not connected properly.
- MAINTEMP pin U1200 pin D4 not connected properly.

- TEMPBIAS pin *U1200 pin B1* not connected properly.
- R9976 or R1244 not connected properly.

### Invalid battery message

- BATT\_SERIAL\_DATA *J870 pin 3* not connected properly.
- GPIO8\_OWIRE U1100 pin C9 not connected properly.
- R1155 or R9917 not connected properly.
- BATT+ or ground *J870 pins 4* or *1* not connected properly.
- MAINBATT pin *U1200 pin C3* not connected properly.

## Troubleshooting the Internal Speaker

### No Receive Audio.

• Test commands: Suspend, Internal speaker, Volume level, Speakerphone tone.

300000900000360001000000

300000A000006000200002200

300000900000050001000003

300000B00000000030000002A

- Send the above test commands to generate a speakerphone tone to the speaker. If there is no audio, probe *J7000 pin 1* and *J7000 pin 2*. If the signal is there yet no audio then check the speaker.
- No signal at the *J7000 pin 1* and *J7000 pin 2*. Check signal at *C1221* and *C1212*.
- If signal is coming out of AUDIOOUTP and AUDIOOUTM, then check *U1200* and the parts associated with internal *U1200* speaker amplifiers.
- If no signal is present at *C1221* and *C1212* then either defective *U1100* or cold solder / missing power supply to *U1100*.

### Tones present but no voice

• Send the following test commands: 13K Loop back with internal speaker and internal Mic (suspend, CP mode CDMA, AUD\_LPB, Handset path UN-muted, Aud\_Lvl 3).

300000900000360001000000

3000009000000A0001000001

300000900000040001000003

300000A000006000200003200

300000900000050001000003

- Inject 43.5 mVrms, 1kHz signal to the CE bus connector analog audio input J1000 pin 16. Check U1100 pins P14 and N15 AUDIOOUTP and AUDIOOUTM.
- If no signal, check *U1100* (ensure *U1100 pin P15* MIC1 has the same signal as the CE bus AUDIO\_IN).
- If there is signal (+/-19 mVrms) and the tone can be heard through the speaker, place the UUT into call with test set (HP8924) with service option 1 with 1Khz tone enabled. If there is no tone, it could be defective *U1100* CSP or RF section.

## **Troubleshooting the Headset Speaker**

Prior to troubleshooting, make sure headset is working. Check headset jack **J600**, call processor IC INT1 **U1100 pin E8**, and **R20212**.

### No Receive Audio.

• Test commands: Suspend, Headset speaker, Volume level, Speakerphone tone. 30000009000000360001000000

300000A000006000200004600

300000900000050001000003

300000B00000000030000002A

- Send the above test commands to generate a tone to the headset speaker. If there is no audio, probe *J600 pin 3*. If the signal is there yet no audio, replace *J600*.
- No signal at the *J600 Pin 3*, check signal at *C1221* and *C1212*.
- If the signal is coming out of AUDIOOUTP and AUDIOOUTM, check *U1200* and the parts associated with A0A, A0B, A3 *U1200* amplifiers.
- If no signal is present at C1221 and C1212, either defective U1100 or cold solder / missing power supply to U1100.

#### **Tones Present but No Voice**

• Send the following test commands. 13K Loop back with internal speaker and internal Mic (suspend, CP mode CDMA, AUD\_LPB, Headset path UN-muted, Aud\_Lvl 3)

30000090000036000100000

3000009000000A0001000001

300000900000040001000003

300000A000006000200003600

300000900000050001000003

- Inject 43.5 mVrms, 1kHz signal to the CE bus connector analog audio input *J1000 pin 16*. Check *U1100 pins P14* and *N15* AUDIOOUTP and AUDIOOUTM.
- If no signal, check *U1100* (ensure *U1100 pin P15* MIC1 has the same signal as the CE bus AUDIO\_IN).
- If there is signal (+/-19 mVrms) and the tone can be heard through the speaker, place the UUT into call with test set (HP8924) with service option 1 with 1Khz tone enabled. If there is no tone, it could be defective *U1100* CSP or RF section.

## Troubleshooting the CE Bus AUDIO\_OUT

#### No Receive Audio on the Hands-Free Device



Prior to troubleshooting, make sure the accessory is working.

• Test commands: Suspend, Headset speaker, Volume level, Speakerphone tone.

300000900000360001000000

300000A000006000200003400

300000900000050001000003

300000B00000000030000002A

• Send the above test commands to generate a tone to CE bus connector AUDIO\_OUT J1000 pin 15. If the signal is present on J1000 pin 15 but no audio, J1000 may be defective.

• No signal at the J1000 pin 15, check signal at C1221 and C1212.

- If the signal is coming out of AUDIOOUTP and AUDIOOUTM, check *U1200* and the parts associated with A0A, A1 and A4 *U1200* amplifiers.
- If no signal is present at *C1221* and *C1212*, either defective *U1100* or cold solder / missing power supply to *U1100*.

### **Tones Present but No Voice**

• Send the following test commands. 13K Loop back with internal speaker and internal Mic (suspend, CP mode CDMA, AUD\_LPB, Headset path UN-muted, Aud\_Lvl 3).

300000900000360001000000

3000009000000A0001000001

300000900000040001000003

300000A000006000200003400

300000900000050001000003

- Inject 43.5 mVrms, 1kHz signal to the CE bus connector analog audio input *J1000 pin 16*. Check *U1100 pins P14* and *N15* AUDIOOUTP and AUDIOOUTM.
- If no signal, check *U1100* (ensure *U1100 pin P15* MIC1 has the same signal as the CE bus AUDIO\_IN).
- If there is signal (+/-17 mVrms) and the tone is present on the CE bus AUDIO\_OUT, place the UUT into call with test set (HP8924) with service option 1 with 1kHz tone enabled. If there is no tone, it could be defective **U1100** CSP.

## **Troubleshooting the Speakerphone**

No or Low Speakerphone Tones

• Test commands: Suspend, Headset speaker, Volume level, Speakerphone tone.

300000900000360001000000

300000A000006000200002300

300000900000050001000007

300000B00000000030000002A

- Send the above test commands to generate a speakerphone tone to the speakerphone.
  - If the signal is on the **U9925** *pin 1*, but no audible speakerphone or low speakerphone, inspect the speakerphone connections and check **U9925** *pin 6* for DC voltage.
  - Otherwise, replace U9925.
- No signal at U9925 pin 1, check signal at C1221 and C1212.
- If signal is coming out of AUDIOOUTP and AUDIOOUTM, check *U1200* and the parts associated with A0A, A1 and A2 *U1200* amplifiers.
- If no signal is present at *C1221* and *C1212*, either defective *U1100* or cold solder / missing power supply to *U1100*.

#### **Troubleshooting the Internal Microphone**

No TX audio with Internal Microphone



Prior to troubleshooting, check the microphone for proper connection. Temporarily replace the microphone.

• Send the following test commands: 13K Loop back with internal speaker (suspend, CP mode CDMA, AUD\_LPB, Handset path, Audio\_Level 3).

30000090000036000100000 3000009000000A0001000001 300000900000040001000003 3000000A0000006000200002200

300000900000050001000003.



This is voice loop back enabling the internal microphone audio to be heard through the internal speaker.

- If this test is passed, originate CDMA voice loop back call with the test set.
- If voice can't be heard while talking in to the microphone, *U1100* or the modulator/demodulator may be defective.

#### **Troubleshooting the Headset Microphone**

No Tx audio with Headset Microphone



Check the headset and J600 for proper connection.

• Send the following test commands: 13K Loop back with internal speaker (suspend, CP mode CDMA, AUD\_LPB, Handset path, Audio\_Level 3)

300000900000360001000000

3000009000000A0001000001

300000900000040001000003

300000A000006000200004600

300000900000050001000003.



- If this test is passed originate CDMA voice loop back call with the test set.
- If voice can't be heard while talking in to the microphone, *U1100* or the modulator/demodulator may be defective.

# **Test Points**

#### **Controller Board**

Refer to Table 23, Table 24, and the appropriate V200 Level 3 Supplement for test point locations and functions.

Test Point	Name	Description
TPWD001	WATCHDOG	Watchdog
TPINT4	INT	Audio/Power Controller IC interrupt
TPTCK1	TCK	JTAG (for Development purposes only)
TPTRSTB	TRST_B	JTAG (for Development purposes only)
TPTDI1	TDI	JTAG (for Development purposes only)
TPTDO1	TDO	JTAG (for Development purposes only)
TPTMS1	TMS	JTAG (for Development purposes only)
TPMCU1	MCU_DE_B	JTAG (for Development purposes only)
TPPWR1	PWR_1	JTAG power (for Development purposes only)
TPGND1	GND_1	JTAG ground (for Development purposes only)
TPRESETB1	RESETB	JTAG (for Development purposes only)
TPDIAG01	DIAGBUS0	CSP diagnostic bus output
TPDSP7	DIAGBUS1	CSP diagnostic bus output
TPDSP8	DIAGBUS2	CSP diagnostic bus output
TPDSP9	DIAGBUS3	CSP diagnostic bus output
TPDSP10	DIAGBUS4	CSP diagnostic bus output
TPDSP11	DIAGBUS5	CSP diagnostic bus output
TPDSP12	DIAGBUS6	CSP diagnostic bus output

Table 23. V200 Controller Board Test Points

#### Transceiver Board

#### Table 24. V200 Transceiver Board Test Points

Test Point	Name	Description
TP11	RF_SPI(1)	SPI data out.
TP12	RF_SPI(2)	SPI clock in.
TP13	AFC_ANALOGSTEER ING	GPIO or analog steering sense (AFC out).
TP14	LOCK_DETECT	Spare GPIO or timer input capture.
TP15	RSSI	Receive signal strength indicator.
TP16	RF_SLEEP	Control of RF circuits in slotted sleep mode.
TP17	TXIM	Digital mode, TX baseband analog I-ch (+).
TP18	TXIP	Digital mode, TX baseband analog I-ch (-).
TP19	TXQM	Digital mode, TX baseband analog Q-ch (-).

Test Point	Name	Description
TP20	TXQP	Digital mode, TX baseband analog Q-ch (+).
TP21	RXIM	Differential inputs of RX baseband analog I-ch (-).
TP22	RXIP	Differential inputs of RX baseband analog I-ch (+).
TP23	RXQP	Differential inputs of RX baseband analog Q-ch (+).
TP24	RXQM	Differential inputs of RX baseband analog Q-ch (-).
TP25	FM	Frequency modulation output from Call Processor IC to Call Processor IC. Held at ground during CDMA.
TP26	DISC	Discriminator input for analog mode.
TP27	ZIF_VCA	Analog control voltage for voltage-controlled attenuating in RF Transceiver IC.
TP31	RX_2.75V	2.75V supply voltage.
TP34	ME_VCA	Analog control voltage for voltage-controlled attenuating in Mixer/Exciter IC.
TP35	PA_ENABLE	Enable control signal for TX PA.
TP38	RF_DETECT	Analog signal from transmit power diode.
TP39	RF_SPI(0)	SPI data in.
TP40	FEIC_G1	Receive supply control.
TP41	FEIC_G2	GPIO for PA bypass (controlled by MCU or DSP).
TP42	MODE	Analog/digital mode selection. Always digital.
TP43	BAND	RF band select.
TP44	PA_BIAS	Controls negative bias for PA.
TP45	OSCEN_b	Enable control signal for reference oscillator.
TP46	TEMP_SENSE	Input to the measurement ADC from thermistor.
TP47	REF_WARP	Analog output from AFC DAC to control the 16.8 MHz reference oscillator.
TP48	TX_2.75V	2.75V supply voltage.
TP49	PAH_B+	PA high (PCS) B+ voltage.
TP50	PAL_B+	PA low (CDMA) B+ voltage.
TP51	16.8MHZ	Reference clock (16.8 MHz square wave).

Table 24. V200 Transceiver Board Test Points (Cor	tinued)
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# **Connector Signals and Pin Assignments**

#### Board-to-Board Connectors JBB1 and P1

Interface between the controller and transceiver boards is through connectors **JBB1** and **P1** (controller and transceiver board, respectively). Table 25 shows the signal associated with each connector pin. For connector and pin locations, refer to the V200 Level 3 Supplement listed in the Related Publications section toward

the end of this manual. Refer to Table 1 for a description of the signal names shown in Table 25.

Pin	Controller JBB1	Transceiver P1	Pin	Controller JBB1	Transceiver P1
1	RX_2.75V	RX_2.75V_UN	2	PAH	_B+
3	RX_2.75V RX_2.75V_UN		4	PAH	_ B+
5	RX_ 2.75V	RX_ 2.75V_UN	6	PAH	_ B+
7	Ground	RF_GND	8	PAH	_ B+
9	REF_	WARP	10	PAH	_B+
11	Ground	RF_GND	12	PAL	_ B+
13	Ground	RF_GND	14	PAL	_B+
15	Ground	RF_GND	16	PAL	_B+
17	BA	ND	18	PAL	_B+
19	MC	DDE	20	PAL	_ B+
21	FEIC	C_G1	22	PA_	BIAS
23	FEIC	C_ G2	24	RF_D	ETECT
25	Ground	RF_GND	26	Ground	RF_GND
27	Ground	RF_GND	28	Ground	RF_GND
29	RXQM		30	RX	IM
31	RXQP		32	Rک	(IP
33	Ground	RF_GND	34	Ground	RF_GND
35	Ground	RF_GND	36	Ground	RF_GND
37	RSSI		38	TX_2	2.75V
39	Ground RF_GND		40	TX_2	2.75V
41	RF_ SLEEP		42	TX_2	2.75V
43	Ground RF_GND		44	ME_	VCA
45	AFC_ ANALOGSTEERING		46	PA_ EI	NABLE
47	Ground	RF_GND	48	Ground	RF_GND
49	DI	SC	50	Ground	RF_GND
51	Ground	RF_GND	52	LOCK_	DETECT
53	Ground	RF_GND	54	RF_S	SPI(2)
55	16.8MHZ		56	RF_S	SPI(0)
57	Ground RF_GND		58	RF_S	SPI(1)
59	Ground	RF_GND	60	Ground	RF_GND
61	Ground	RF_GND	62	Ground	RF_GND
63	TXQM		64	Tک	(IP
65	TXQP		66	TX	IM
67	Ground	RF_GND	68	Ground	RF_GND
69	Ground	RF_GND	70	Ground	RF_GND
71	Ground	RF_GND	72	Ground	RF_GND
73	ZIF_VCA		74	Ground	RF_GND

Table 25. Board-to-Board Interface Pin Assignments

Table 25. Board-to-Board Interface Pin A	ssignments (Continued)
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Pin	Controller JBB1	Transceiver P1	Pin	Controller JBB1	Transceiver P1
75	Ground	RF_GND	76	Ground	RF_GND
77	FM		78	OSC	EN_b
79	Ground	RF_GND	80	TEMP_	SENSE

#### Controller Board Connectors JDIS1, J1000, J600, J870, and J7000

Tables 26 through 30 show signals associated with the connectors located on the controller board. For connector and pin locations, refer to the Level 3 Supplement listed in the related Publications section later in this manual.

Pin(s)	Signal Name	Function
1	—	No connection
2	G2	Ground
3	LOGIC_2.75V	
4	LCD_CS	
5	RESET_B	
6	SERIAL_LCD_A0	
7	G2	Ground
8	LOGIC_2.75V	
9	_	No connection
10	_	No connection
11	_	No connection
12	—	No connection
13	—	No connection
14	_	No connection
15	SERIAL_LCD_CLK	
16	SERIAL_LCD_MOSI	
17	LOGIC_2.75V	
18	LOGIC_2.75V	
19	G2	Ground
20	LOGIC_2.75V	
21	—	No connection
22	—	No connection
23	—	No connection
24		No connection
25		No connection
26	G2	Ground
27	BACKLIGHT_LED	

#### Table 26. Display Connector JDIS1 (Flex) Pin Assignments

Pin(s)	s) Signal Name Function	
1	BATT_ GND	Power ground
2	BATT_FDBK RTS	Default, battery feedback USB / RS232 (6 wire)
3	RAWEXTB+	External power
4	USB+ TXD (D+) TDO	Default USB, RS232 (8 wire), USB / RS232 (6 wire), Smart Audio JTAG
5	USB- RXD (D-) TDI	Default USB, RS232 (8 wire), USB / RS232 (6 wire), Smart Audio JTAG
6	RTS USB_PWR RESET_IN	RS232 (8 wire), Smart Audio USB, USB / RS232 (6 wire) JTAG FM radio headset send/end
7	SWB+	Switched battery
8	CTS FM_DATA HKSW Mcu_DE	RS232 (8 wire), USB / RS232 (6 wire), Smart Audio FM radio headset USB hookswitch JTAG
9	DCD FS MUTE* Dsp_DE	RS232 (8 wire), USB / RS232 (6 wire) Smart Audio (DAI test box) FM radio headset, Smart Audio (Telematics) JTAG
10	DSCEN RI TXD DSEL2 SCK TCK	Default, USB RS232 (8 wire) USB / RS232 (6 wire) FM radio headset, Smart Audio Smart Audio (DAI test box) JTAG
11	DTR DSEL1 FM_CLK SRDA TMS	RS232 (8 wire), USB / RS232 (6 wire) FM radio headset, Smart Audio FM radio headset Smart Audio (DAI test box) JTAG
12	DSR RXD DSEL0 FM_EN STDA TRST	RS232 (8 wire) USB / RS232 (6 wire) FM radio headset, Smart Audio FM radio headset Smart Audio (DAI test box) JTAG
13	UPLink OPT1 OPT2	Default, USB RS232 (8 wire), USB / RS232 (6 wire), JTAG, FM radio headset Smart Audio
14	DNLink OPT2 OPT1	Default, USB RS232 (8 wire), USB / RS232 (6 wire), JTAG, FM radio headset Smart Audio
15	AUDIO_OUT	Audio out on / off
16	AUDIO_IN	Audio In
17	AUD_GND	Audio ground

Table 27. CE Bus Connector J1000 Pin Assignments

#### Table 28. Headset Jack J600 Pin Assignments

Pin(s)	Signal Name	Function
1	GND	Ground
2	SWI	
3	SP	Speaker
4	MIC	Microphone
5	BRK	

#### Table 29. Battery Connector J870 Pin Assignments

Pin(s)	Signal Name	Function
1		Ground
2	BATT_TEMP	
3	BATT_SERIAL_DATA	
4	BATT+	

#### Table 30. Speaker Connector J7000 Pin Assignments

Pin(s)	Signal Name	Function
1	SPKPH+	Speakerphone speaker positive terminal
2	SPKPH-	Speakerphone speaker negative terminal

#### Transceiver Board J9001 and J9000

#### Table 31. SMT Coax Connector J9001 Pin Assignments

Pin(s)	Name	Function
1		Antenna
2	RF_GND	RF ground
3	RF_GND	RF ground

#### Table 32. Accessory Antenna Connector J9000 Pin Assignments

Pin(s)	Name	Function
1	IN	To transceiver circuitry
2	OUT	To SMT antenna connector
3	RF_GND	RF ground
4	RF_GND	RF ground

# **Part Numbers**

The following charts show the transceivers and related publications associated with V200 communicator models currently available.

# **Related Publications**

V200 Level 1 and 2 Service Manual	6881039B05
V200 Level 3 Controller Supplement	6881104B88
V200 Level 3 Transceiver Supplement	6881111B09
V200 Personal Communicator User Guide	6881039B35
P2K Product Support Tool (PST) User's Guide	6881038B76
SYN8400A Test Interface Adapter Instructional Guide	SJN9779

# Model Chart

Use Table 33 to identify the specific board assemblies used in each model V200 communicator.

Table 33. V200 Perso	onal Communicator Model	Chart
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															MODEL		
													1	82701GHESA V20	0 CDMA Sales Model		
	Γ.												{	82702GHESA V20	0 CDMA Sales Model (replace with S9619 Field Replacement Unit)		
		Γ.											1	82703GHESA V20	0 CDMA Sales Model (replace with S9622 Field Replacement Unit)		
													{	82704GHESA V20	0 CDMA Sales Model (replace with S9620 Field Replacement Unit)		
			[										1	82705GHESA V20	0 CDMA Sales Model (replace with S9621 Field Replacement Unit)		
				¦ [									;	S9619 V200 CDMA Field Replacement Unit (FRU) (replaces 82702GHESA)			
													!	S9620 V200 CDMA Field Replacement Unit (FRU) (replaces 82704GHESA)			
													;	S9621 V200 CDM/	A Field Replacement Unit (FRU) (replaces 82705GHESA)		
													{	S9622 V200 CDM/	A Field Replacement Unit (FRU) (replaces 82703GHESA)		
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Х	Х	Х	Х	Х	Х	Х	Х	Х						SYN9426	Transceiver board		
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