

Manual Test Procedures

Introduction

The phone allows keypad and computer controlled testing of various digital test parameters.

This chapter includes the keypad/computer functions and recommended equipment setup to use when testing a phone manually.

Call-Processing Tests

Most communications analyzers can simulate a cell site in order to perform automatic call-processing tests. Automatic call processing tests can be performed while the phone is in standby mode.

Refer to the communications analyzer's manual for details about performing call-processing tests. The following call-processing test sequence is recommended:

1. GSM Mobile Originated Call
2. WCDMA Mobile Originated Call
3. GSM handover
4. DCS handover
5. PCS handover

Non-Signalling Test Measurements

In an event that the phone exhibits RF failures that prevent call processing, the service technician may need to perform some non-signalling tests. These tests will provide information regarding which stage of the phone is failing prior to opening the phone for troubleshooting. The following tests will be described in this chapter.

- GSM/DCS/PCS TX Power Output
- GSM RSSI
- WCDMA TX Power Output

The digital phasing parameters are stored in a EPROM on the Transceiver Board. Each transceiver is shipped from the factory with these parameters already calibrated. However, if a board is repaired, these parameters should be measured and, if necessary, adjusted with the GP-Gate System. Checking and adjusting calibration parameters is also useful as a troubleshooting/diagnostic tool to isolate defective assemblies.

GSM/DCS/PCS Call Processing

GSM/DCS/PCS Call Processing

In order to successfully complete a GSM call processing procedure, a test USIM card needs to be available. Test USIM cards have default call parameters that allow users to perform call processing tests through GSM base station simulators. This allows service technicians to perform simulations without accessing the customer's cellular account.

Hardware Requirements

There are various hardware configurations to perform manual call processing procedures. Below, is a list of the various options. All options require the battery to be attached. A GP-gate system can also be used for manual testing. Refer to the GP-gate user's manual for details.

Power Options

- Fully Charged Battery (SNN5639B¹ or equivalent)
- Full-Rate Power Supply (PSM5049A¹)
- Battery Eliminator (5-00-3F-10000²) with 2-Wire Adapter (2-00-68-10000²)
Note: Requires a single output power supply

Control Interface Options (PCS Only)

- USB Cable (SKN6311A¹)
- Serial Cable (SKN6315A¹) with CE converter (SYN0279B¹)

Note: If handset test commands are being used, a control interface is not needed.

¹Contact your local Motorola dealer for ordering

²Contact AMS Software and Elektronik GmbH for ordering

RF Interface (Everything listed is required)

- SMA/N-type Adapter (0-00-00-40042²)
- SMA Cable 0.5m (0-00-00-40047²)
- Repair Fixture (5-00-4T-10000²)
- USIM (0-00-00-40810²)

Software Requirements (PCS only)

If PCS call processing procedures are necessary, the user will need to send a test command to the phone prior to beginning the test. The command can be initiated through handset test commands or computer test commands. Software requirements for each method is listed below.

Handset Test Command

- No software needed

Computer Test Command

- Radio Comm (latest release)

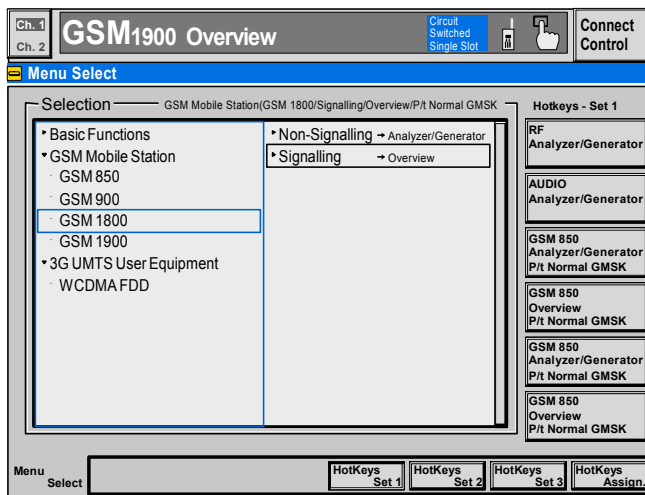
Call Origination (GSM and DCS only)

Use the following procedures for call processing. The screen shots are from a Rohde and Schwarz CMU 200. The procedures can be adopted to any other test box that will be used to perform call processing.

1. Install the test USIM in phone.
2. Connect hardware as illustrated in figure 13.

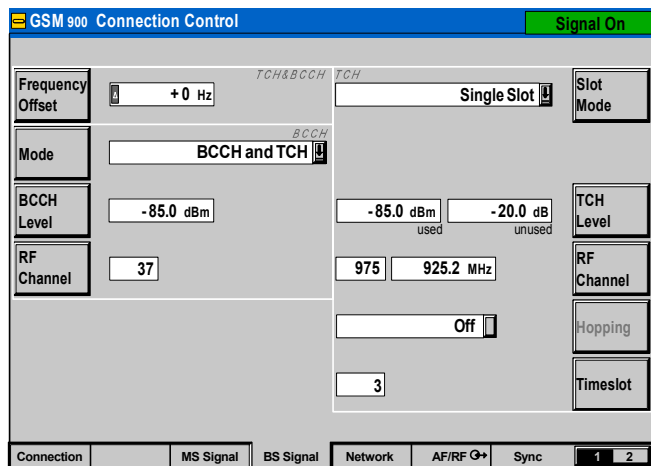
Note: Control interface doesn't need to be connected at this time.
3. Setup up the test box for GSM or DCS Signalling

Figure 10. GSM Signalling Setup



4. Set Broadcast Channel (BCH) to 120 (GSM) or 700 (DCS)
5. Set Broadcast channel level to -85dBm
6. Set Traffic Channel (TCH) to 38 (GSM) or 512 (DCS)
7. Set Traffic channel level to -85dBm

Figure 11. GSM Connection Control



8. Wait until the phone indicates a receive signal
9. Dial a number from the phone and press the send button.
10. The phone is now connected.

Figure 12. GSM Call Connected

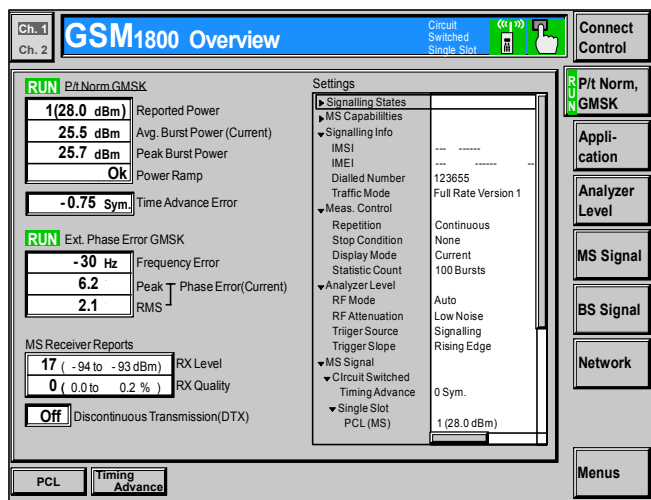
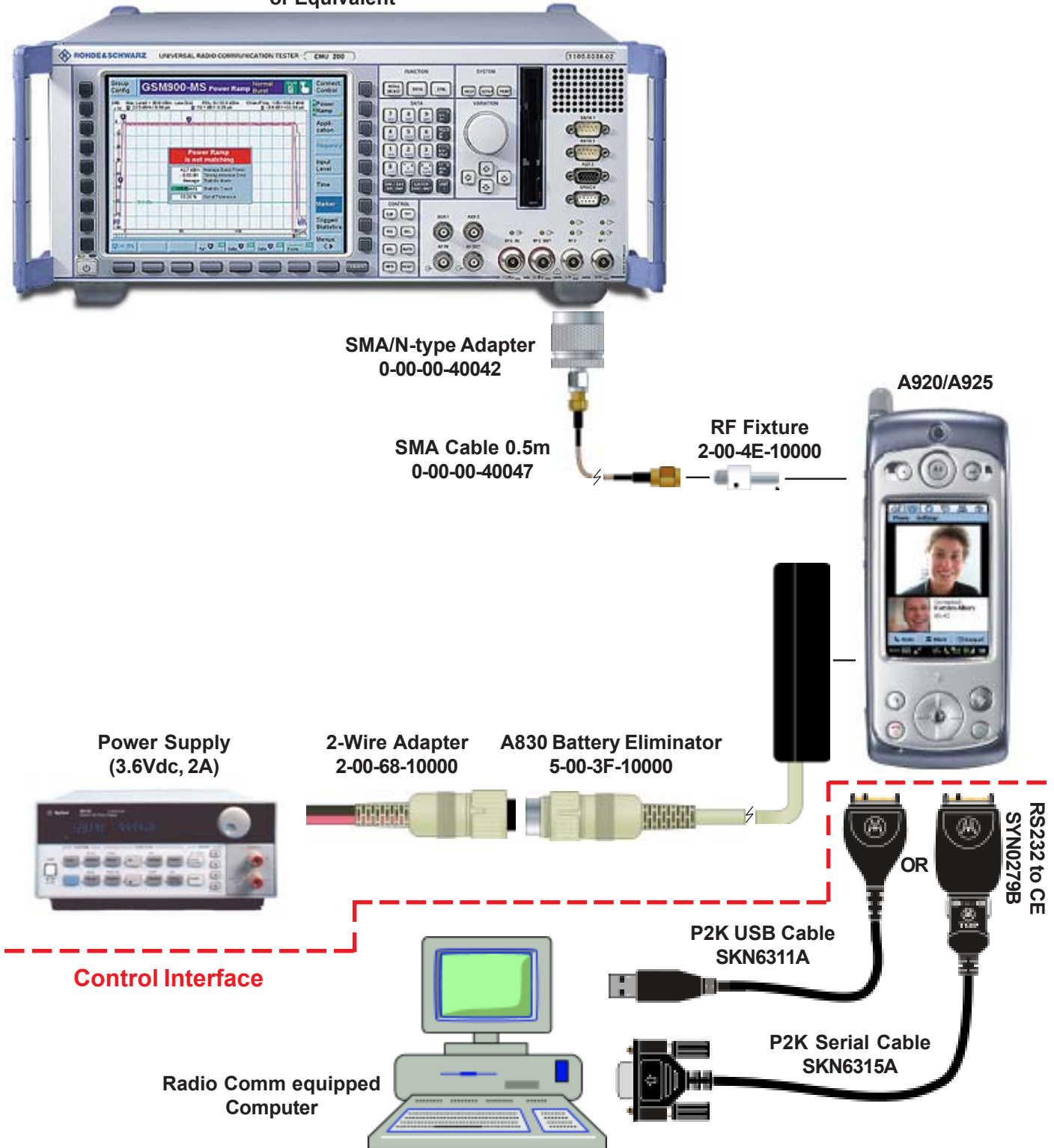


Figure 13. A920 Manual Test Hardware Configuration

CMU200 Test Box
or Equivalent



Call Origination (PCS Only)

Before beginning, one of the following test command procedures needs to be completed.

Handset Test Command

- Power up phone
- Enter the following key sequence
- Menu 0 H T C M D *

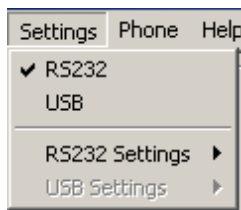


- Enter the following test commands in the Opcode screen
- 54 ok SUSPEND
- 10*0*5 CPLOAD, GSM 1900
- Power cycle phone

RadioComm Test Command

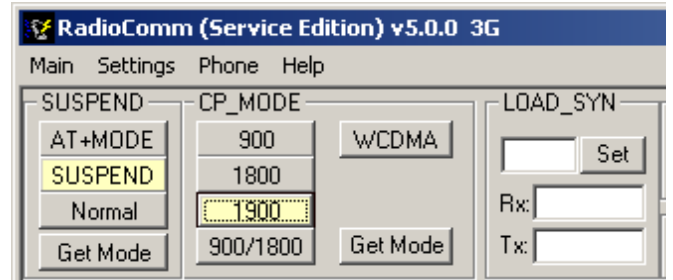
- Connect as illustrated in figure 13
- Power up phone
- Start RadioComm application
- Correctly select Settings option for USB or serial

Figure 14. RadioComm COM Port



- Click on AT+mode, suspend, CP_Mode 1900, respectfully

Figure 15. Radio Comm Screen



- Power cycle phone

Repeat steps 1 through 10 in the ,“Call Origination (GSM and DCS only),” section with the following modifications,

- Set PCS Signalling
- BCH = 661
- TCH = 512

Once PCS call processing is complete, return the phone to its original state by performing the following procedure,

Handset Test Command

- 54 ok SUSPEND
- 10*0*10 CPLOAD, Dual mode
- Power cycle phone

Computer Test Command (Radio Comm)

- Click on AT+mode, Suspend, CP_Mode 900/1800, respectfully
- Power cycle phone

GSM/DCS/PCS Call Processing

Call Test Parameters (GSM/DCS/PCS)

While the phone under test is in an active call, the parameters for each band should be verified as described.

Table 4. GSM Call Parameters

Parameter	Low Limit	High Limit	Unit
Burst Avg Power Out ¹	31	33	dBm
Burst Output Shape	1	1	P/F
Time Advance Error	-1	1	bit/sym
RMS Phase Error	0	5	deg
Peak Phase Error	-20	20	deg
Frequency Error	-90	90	Hz
RX Level Error@-105 dBm ²	1	9	
RX Quality @-105 dBm ²	0	4	
BER @-105, 10k bits ³	0	2	%

¹Power Level = 5

²Set BS TCH level to -105 dBm

³Set BER TCH level to -105 dBm with 10k bits or 128 Frames

Table 5. DCS Call Parameters

Parameter	Low Limit	High Limit	Unit
Burst Avg Power Out ¹	28	32	dBm
Burst Output Shape	1	1	P/F
Time Advance Error	-1	1	bit/sym
RMS Phase Error	0	5	deg
Peak Phase Error	-20	20	deg
Frequency Error	-180	180	Hz
RX Level Error@-103 dBm ²	3	11	
RX Quality @-103 dBm ²	0	4	
BER @-103, 10k bits ³	0	2	%

¹Power Level = 0

²Set BS TCH level to -103 dBm

³Set BER TCH level to -103 dBm with 10k bits or 128 Frames

Table 6. PCS Call Parameters

Parameter	Low Limit	High Limit	Unit
Burst Avg Power Out ¹	28	32	dBm
Burst Output Shape	1	1	P/F
Time Advance Error	-1	1	bit/sym
RMS Phase Error	0	5	deg
Peak Phase Error	-20	20	deg
Frequency Error	-190	190	Hz
RX Level Error@-104 dBm ²	2	10	
RX Quality @-104 dBm ²	0	4	
BER @-104, 10k bits ³	0	2	%

¹Power Level = 0

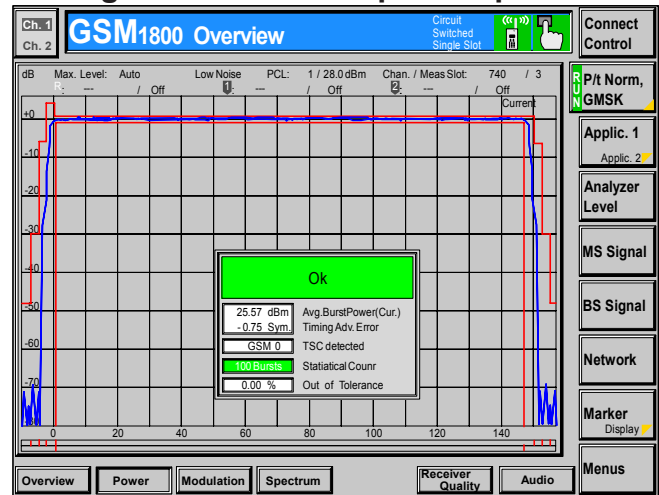
²Set BS TCH level to -104 dBm

³Set BER TCH level to -104 dBm with 10k bits or 128 Frames

Burst Output Shape should fall within the standard limits of the Power Ramp.

BER measurements is only required if RX Quality reads a value of 4 or greater.

Figure 16. Burst Output Shape



It is recommended that handover procedures be performed as shown in the following table.

Table 7. GSM/DCS/PCS Handover

Band	From		To	
	Traffic Channel	Power Control	Traffic Channel	Power Control
GSM	975	5	124	19
DCS	512	0	885	15
PCS	512	0	810	15

WCDMA Call Processing

In order to successfully complete a GSM call processing procedure, a test USIM card needs to be available. Test USIM cards have default call parameters that allow users to perform call processing tests through GSM base station simulators. This allows service technicians perform simulations without accessing the customer’s cellular account.

Hardware Requirements

Refer to , “Hardware requirements,” under, “GSM/DCS/PCS Call Processing.” Also Refer to Figure 13.

Software Requirements

None.

Call Origination (WCDMA)

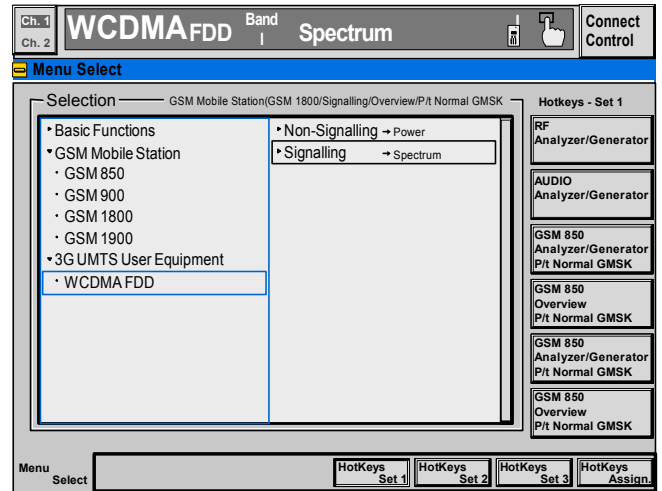
Use the following procedures for call processing. The screen shots are from a Rohde and Schwarz CMU 200 with WCDMA signalling options installed. The procedures can be adopted to any other test box that will be used to perform call processing.

1. Install the test USIM in phone.
2. Connect hardware as illustrated in figure 4.

Note: Control interface doesn’t need to be connected at this time.

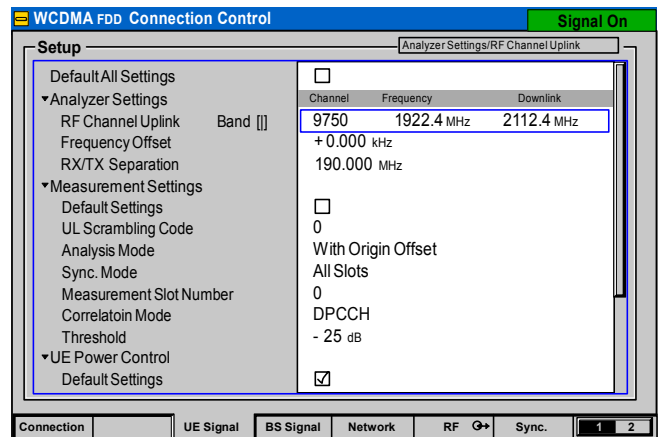
3. Setup up the test box for WCDMA FDD Signalling

Figure 17. WCDMA Signalling Setup



4. Set UE Signal, RF Channel Uplink to 9750

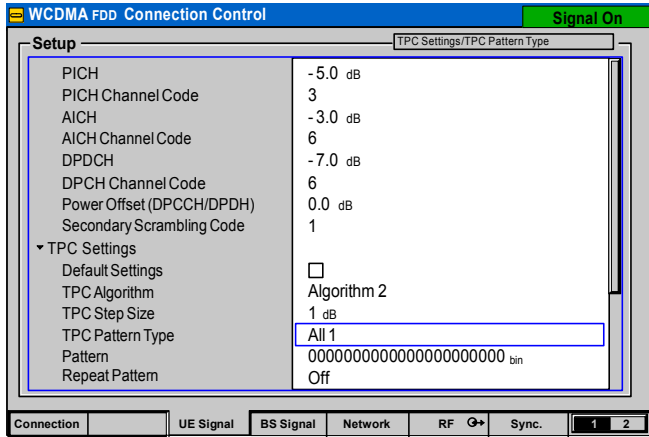
Figure 18. Channel Uplink(UE Signal)



WCDMA Call Processing

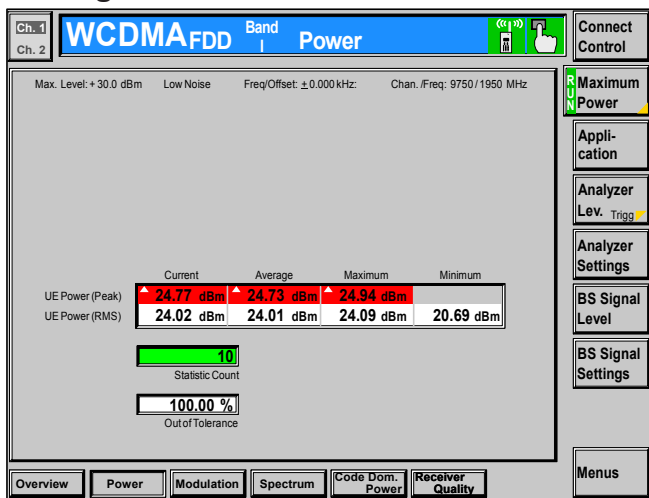
- Set TPC Pattern Type to All 1

Figure 19. TPC Pattern Type(UE Signal)



- Wait until the phone indicates a signal
- Dial a number from the phone and press the send button.
- The phone is now connected.

Figure 20. WCDMA Call Connected



WCDMA Call Test Parameters

While the phone under test is in an active call, the parameters for each band should be verified as described.

Table 5. WCDMA Call Parameters

Parameter	Low Limit	High Limit	Unit
Avg. RMS Power Out ¹	20.5	21.5	dBm
Avg. Frequency Error ²	-195	195	Hz
Avg. RMS EVM ²	0	13.5	%
Avg. RMS ACLR - 2 ³	-100	-43	dB
Avg. RMS ACLR - 1 ³	-100	-33	dB
Avg. RMS ACLR + 1 ³	-100	-33	dB
Avg. RMS ACLR + 2 ³	-100	-43	dB

¹Refer to Figure 10

²Refer to Figure 11

³Refer to Figure 12

Figure 21. WCDMA Modulation

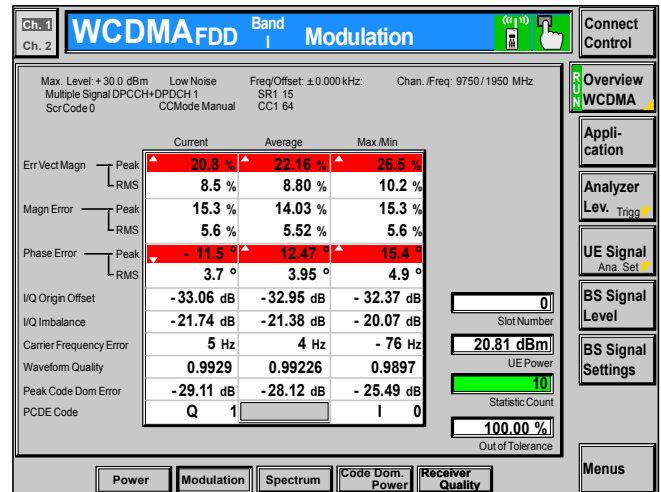
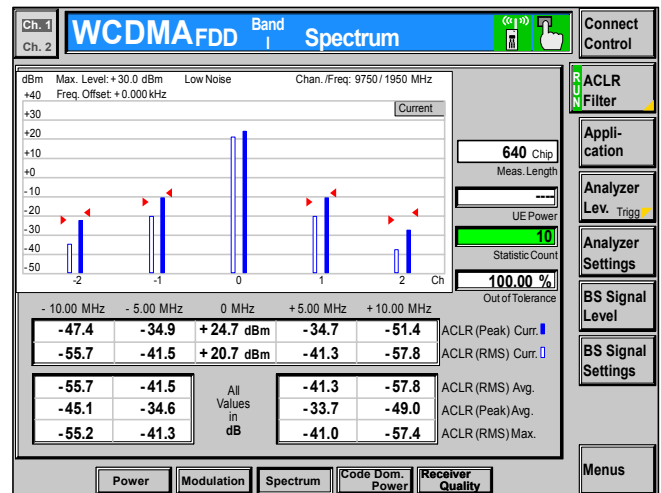


Figure 22. ACLR Screen



Non-Signalling Test Procedures (GSM/DCS/PCS)

Non-Signalling Test Procedures (GSM/DCS/PCS)

To perform non-signalling test procedures, the user is required to be familiarized with sending test commands to the phone under test. The test commands can be sent using the Handset test command interface or through a computer. Please refer to section, "Handset Test commands," for details on how to send test commands through phone keypad entry.

In order to successfully send test commands to the phone under test, the phone needs to be in suspend mode. Follow the listed procedure to place the phone in suspend mode.

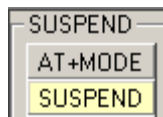
Handset Test Commands

54 ok Suspend

Radio Comm Test Commands

Click AT+MODE then SUSPEND (Serial Only)

Click PST Initialize and click SUSPEND when initialization is complete (USB Only)



Hardware Requirements

Refer to page 3-2 for a list of Hardware. Refer to Figure 13 for a configuration illustration.

Software Requirements

Handset Test Command

- No software needed

Computer Test Command

- Radio Comm (latest release)

Verify TX Power Output (GSM/DCS/PCS)

Verify the TX Power output by initiating the commands in this section. Verify that the results fall within the following limits.

Table 8. TX Power Limits

Parameter	Low Limit	High Limit	Unit
GSM TX Power Out	31	33	dBm
DCS TX Power Out	28	29.5	dBm
PCS TX Power Out	28	29.5	dBm

Handset Test Commands

54 Suspend
 10*0*10¹ WCDMA/GSM/DCS mode
 20*38*0² Set Channel 38
 45*5³ Set GSM Power Level 5
 7*6*1 Enable Carrier

¹10*0*5 for PCS mode

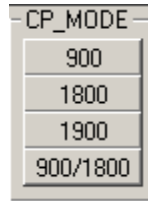
²20*700*0 for DCS Channel 700; 20*661*0 for PCS Channel 661

³45*0 for DCS/PCS Power level 0

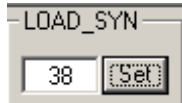
Non-Signalling Test Procedures (GSM/DCS/PCS)

Radio Comm Test Commands

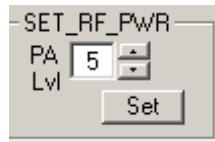
Click on 900/1800 (GSM/DCS) or 1900 (PCS)



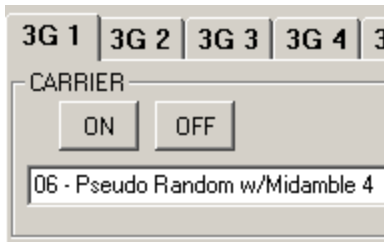
Enter 38 (GSM), 700 (DCS), or 661 (PCS) and then click Set



Enter 5 (GSM) or 0 (DCS/PCS) and then click Set



Select 06 and then click ON



GSM RSSI

Verify GSM RSSI by initiating the commands in this section. Verify that the RSSI results are equal to the Broadcast Channel (BCH) level. The user will need to set the RF generator with the following parameters.

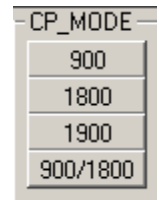
Broadcast Channel (BCH): 20
 Broadcast Channel (BCH) Level: -105 dBm

Handset Test Commands

No supported test commands

Radio Comm Test Commands

Click on 900/1800 (GSM/DCS) or 1900 (PCS)



Enter Channel 20
 Click INIT



Click Execute
 Verify return data is approximately -105 dBm



Non-signalling Test Procedures (WCDMA)

Non-signalling Test Procedures (WCDMA)

To perform non-signalling test procedures, the user is required to be familiarized with sending test commands to the phone under test. The test commands can be sent using the Handset test command interface or through a computer. Please refer to section, "Handset Test commands," for details on how to send test commands through phone keypad entry. Also, refer to, "Computer Test Commands," for details on how to send test commands through the computer.

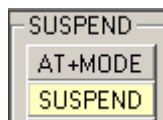
In order to successfully send test commands to the phone under test, the phone needs to be in suspend mode. Follow the listed procedure to place the phone in suspend mode.

Handset Test Commands

54 ok Suspend

Radio Comm Test Commands

Click AT+MODE then SUSPEND (Serial Only)
 Click PST Initialize and click SUSPEND when initialization is complete (USB Only)



Hardware Requirements

Refer to page 2 for a list of Hardware. Refer to Figure 4 for a configuration illustration.

Software Requirements

Handset Test Command

- No software needed

Computer Test Command

- Radio Comm (latest release)

Verify TX Power Output (WCDMA)

Verify the TX Power output by initiating the commands in this section. Verify that the results fall within the following limits.

Table 9. WCDMA TX Power Output

Parameter	Low Limit	High Limit	Unit
WCDMA Power Out	20.5	21.5	dBm

Handset Test Commands

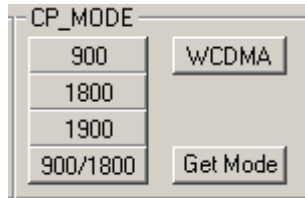
54		Suspend
3086		W_CARRIER
	Field 1	9750 Set Channel
	Field 2	0 Enable Carrier
	Field 3	023 Max Power Out
	Field 4	027 Max TX Power
	Field 5	206 Min TX power
	Field 6	002 PN9 Data pattern
	Field 7	1 Enable spreading
	Field 8	01 Long scrambling
	Field 9	000 SF256, Slot format 0
	Field 10	000 SF256, Slot format 0
	Field 11	000 Channelization Code
	Field 12	000000000 Scrambling Code

Note: Enter 1 in field 2 to disable carrier

Audio/Vibrator Test Procedures

Radio Comm Test Commands

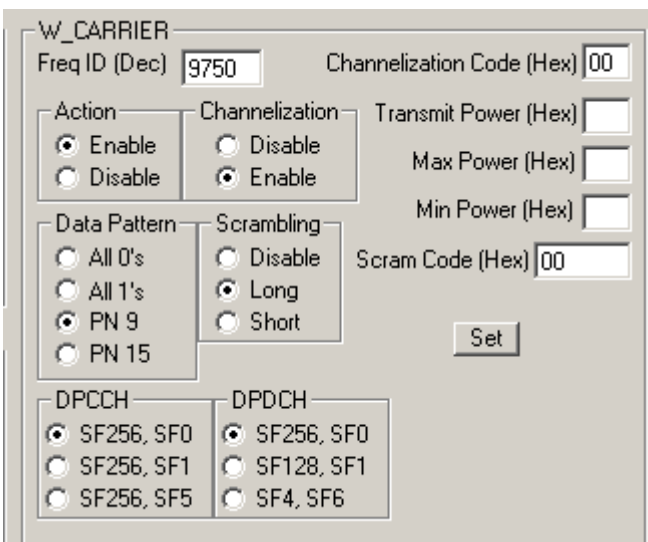
Click on WCDMA



For W_CARRIER assign these actions to each field

Freq ID (Dec)	9750
Action	Enable
Channelization	Enable
Data Pattern	PN 9
Scrambling	Long
DPCCH	SF256, SF0
DPDCH	SF256, SF0
Channelization Code	00
Transmit Power	15 ¹
Max Power	15 ¹
Min Power	80 ²
Scram Code	00

¹0x0015 -> 21 dec -> +21dBm
²0x0080 -> 128 dec -> (128-256 = -128 dBm)



Audio/Vibrator Test Procedures

This section describes how to use test commands to verify audio and vibrate functions.

In order to successfully send test commands to the phone under test, the phone needs to be in suspend mode. Follow the listed procedure to place the phone in suspend mode.

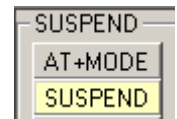
Handset Test Commands

54 ok Suspend

Radio Comm Test Commands

Click AT+MODE then SUSPEND (Serial Only)

Click PST Initialize and click SUSPEND when initialization is complete (USB Only)



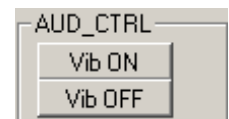
Vibrator Test

Handset Test Commands

3*0*1 Enable Vibrator
 3*0*0 Disable Vibrator

Radio Comm Test Commands

Enable or Disable Vibrator



Verification

Verify vibration function when enabled.

Handset Mic/Speaker test

Handset Test Commands

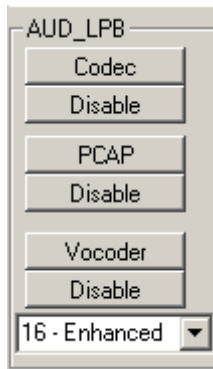
- 6*2*2 Enable internal mic and handset speaker
- 4*7*1*16 Enable VOCODER loopback at Enhanced Full Rate

Radio Comm Test Commands

Enable internal mic and headset speaker



Enable Vocoder loopback at Enhanced Full Rate



Verification

Speak into the handset mic and listen for undistorted speech in the handset speaker.

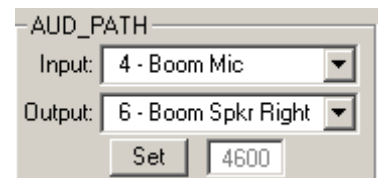
Mono Headset Mic/Speaker test

Handset Test Commands

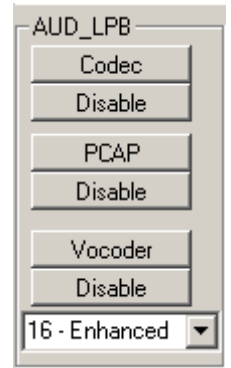
- 6*4*6 Enable headset mic and headset speaker
- 4*7*1*16 Enable VOCODER loopback at Enhanced Full Rate

RadioComm Test Commands

Enable headset mic and headset speaker



Enable Vocoder loopback at Enhanced Full Rate



Verification

Speak into the headset mic and listen for undistorted speech in the headset speaker.

Software Version Check

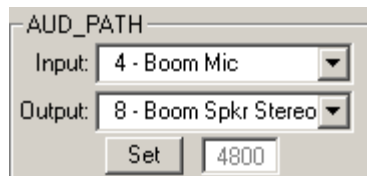
Stereo Headset Mic/Speaker test

Handset Test Commands

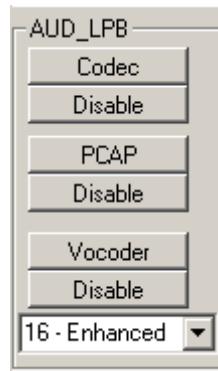
6*4*8 Enable headset mic and headset speaker
4*7*1*16 Enable VOCODER loopback at Enhanced Full Rate

RadioComm Test Commands

Enable headset mic and headset speaker



Enable Vocoder loopback at Enhanced Full Rate



Verification

Speak into the headset mic and listen for undistorted speech in the headset speaker.

Melody Speaker test

Handset Test Commands

0*1*245 Play BACH_INVENTION_1
0*0*245 Stop BACH_INVENTION_1

NOTE: DO NOT issue a Suspend command (54 ok) for this test.

RadioComm Test Commands

Currently not supported

Verification

Listen for undistorted audio.

Software Version Check

Use the following procedures to retrieve software information. Software information can also be retrieved from the phone’s customer User Interface. Refer to the phone’s user manual for details.

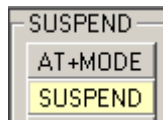
In order to successfully send test commands to the phone under test, the phone doesn’t need to be in suspend mode. Follow the listed procedure to configure the phone to accept test commands

Handset Test Commands

None

Radio Comm Test Commands

Click AT+MODE (Serial Only)
Click PST Initialize (USB Only)

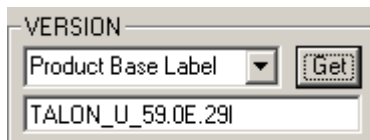


Test Commands

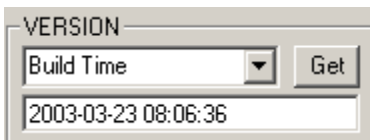
57*017003 Read Software Version
57*017001 Read Build Date

RadioComm Test Commands

Select Product Base Label and click “Get” to retrieve software version



Select Build Time and click “Get” to retrieve Build Date



Display Test Procedures

This section will describe the proper test procedures to determine the functionality of the color display. Any tests that involve displaying a predefined pattern can be returned to the Opcode screen by pressing the right softkey of the phone.

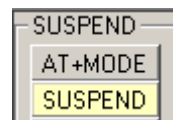
In order to successfully send test commands to the phone under test, the phone needs to be in suspend mode. Follow the listed procedure to place the phone in suspend mode.

Handset Test Commands

54 ok Suspend

Radio Comm Test Commands

Click AT+MODE then SUSPEND (Serial Only)
Click PST Initialize and click SUSPEND when initialization is complete (USB Only)



Display Backlight Test

Handset Test Commands

55*9*000 Backlight Off
55*9*001 Backlight On, full intensity

RadioComm Test Commands

Click “FL Off” to disable backlight
Click “FL On-Full” to enable backlight



Verification

Verify that the backlights respond for each issued command.

Display Test Procedures

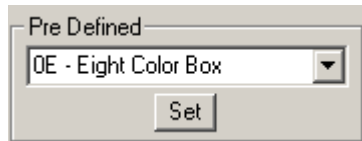
Display Color Test

Handset Test Commands

55*2*014 Eight Color Box Pattern

RadioComm Test Commands

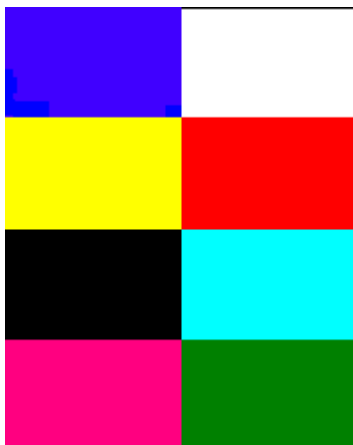
Select Eight Color Box and click “Set”



Verification

Verify that the color pattern on the phone’s display matches the color box in figure 23. Also verify edges (uniform/smooth).

Figure 23. Eight Color Box Pattern



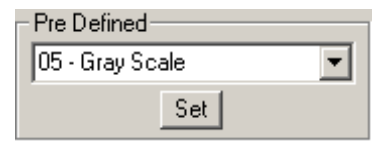
Display Linearity Test

Handset Test Commands

55*2*005 Grey Scale Block

RadioComm Test Commands

Select Grey Scale and click “Set”



Verification

Verify that the Grey scale block on the phone’s display matches the Grey scale block in figure 14. This test can also be used to confirm that the color intensity is linear.

Figure 24. Grey Scale Block



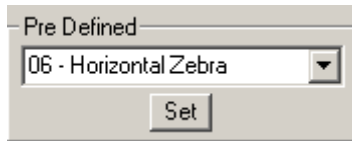
Display Flicker Test

Handset Test Command

55*2*006 Horizontal Zebra Line

RadioComm Test Commands

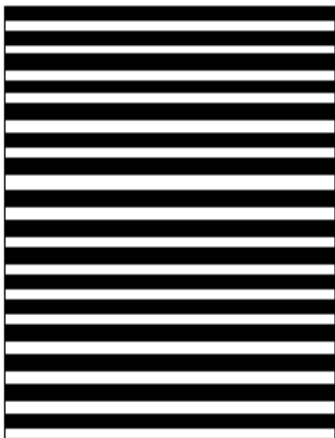
Select Horizontal Zebra and click “Set”



Verification

Verify that no noticeable flicker exists.

Figure 25. Zebra Pattern



Display Pixel Defect (Bright)

Handset Test Commands

55*2*001 All pixels on (all white)

RadioComm Test Commands

Select All Pixels Off and click “Set”



Verification

Verify that no greater than two pixels are off.

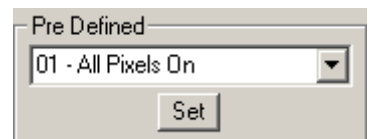
Display Pixel Defect (Dark)

Handset Test Commands

55*2*000 All pixels off (all black)

RadioComm Test Commands

Select All Pixels On and click “Set”



Verification

Verify that no greater than two pixels are on.

LEDS and Keypad Backlight

Use the following procedures to verify status LED and keypad backlight.

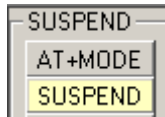
In order to successfully send test commands to the phone under test, the phone doesn't need to be in suspend mode. Follow the listed procedure to configure the phone to accept test commands.

Handset Test Commands

None

Radio Comm Test Commands

Click AT+MODE then SUSPEND (Serial Only)
Click PST Initialize and click SUSPEND when initialization is complete (USB Only)



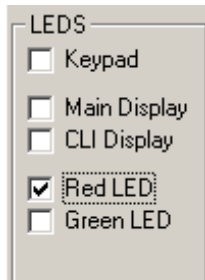
Status LEDS

Handset Test Commands

62*3*3*012¹ Enable Red LED
62*4*3*012¹ Enable Green LED
¹000 to disable

RadioComm Test Commands

Select Red LED or Green LED to enable. Deselect Red LED or Green LED to disable.



Verification

Verify that the Red and Green status LEDS activate.

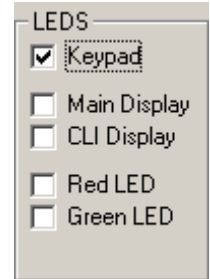
Keypad Backlight

Handset Test Commands

62*0*1¹ Enable Keypad Backlight
62*0*0¹ Disable Keypad Backlight
¹Leave field 3 blank and press OK

RadioComm Test Commands

Select Keypad to enable. Deselect Keypad to disable.



Verification

Verify that all keypad backlight LEDs activate.