



Triplets Manual Test Procedures

Level 3
Preliminary

MOTOROLATM

DIGITAL WIRELESS TELEPHONE



Model V600/V500/V300

PCS 1900MHz/DCS 1800MHz/GSM 900MHz/GSM 850MHz

Manual Test Procedures

Introduction

The phone allows keypad controlled testing of various analog/digital operating parameters. For repair stations equipped with PC's, RadioComm, software package is available to send test commands to the radio under test.

This chapter includes the keypad button functions and recommended equipment setup to use when testing a phone manually. The RadioComm command sequence will also be listed as an alternative to user's equipped with a PC.

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 its standby mode. However, it is useful to do the tests with the phone in Test 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. GSM850 handover
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 further troubleshooting. The following tests will be described in this chapter.

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

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. Checking and adjusting calibration parameters is also useful as a troubleshooting/diagnostic tool to isolate defective assemblies.

GSM/DCS/PCS Call Processing

In order to successfully complete a GSM call processing procedure, a test SIM card needs to be available. Test SIM cards have default call parameters that allow users to perform call processing tests through GSM basestation simulators. This allows service technicians 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.

Power Options

- Fully Charged Battery (SNN5704A¹ or equivalent)
- Full-Rate Power Supply (SPN5049A¹ or equivalent)
- Battery Eliminator (2-00-31-12000²) with 2-Wire Adapter (2-00-68-10000²)
Note: Requires a single output power supply

Control Interface Options

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

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

RF Interface (Everything listed is required)

- SMA/N-type Adapter (0-00-00-40042²)
- SMA Cable 0.5m (0-00-00-40047²)
- Repair Fixture (TBD)
- USIM (0-00-00-40810²)

Call Origination

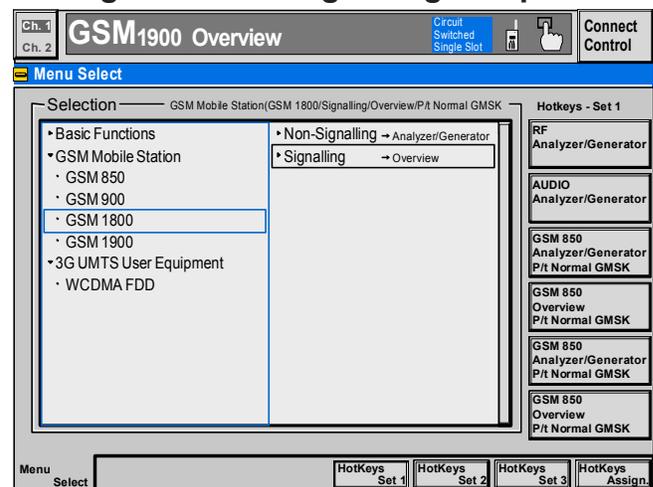
Use the following procedures for call processing. The screen shots are from a Rohde and Schwarz CMU 200. The procedures can be adopted to any other test box that will be used to perform call processing.

1. Install the test SIM 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 GSM850, GSM, DCS or PCS Signalling

Figure 1. GSM Signalling Setup

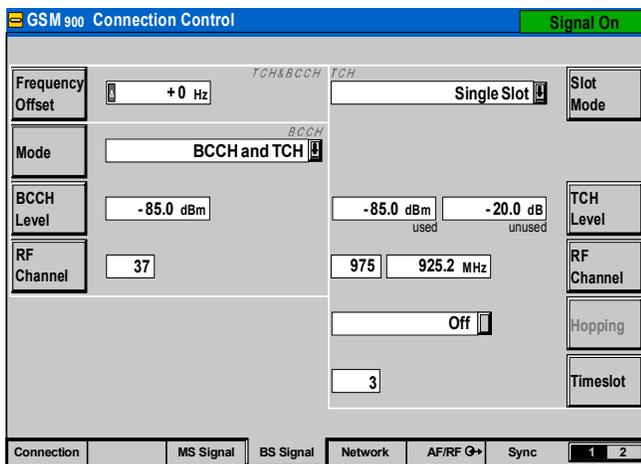


¹Contact your local Motorola dealer for ordering

²Contact AMS Software and Elektronik GmbH for ordering

4. Set Broadcast Channel(BCH) to 189(GSM850), 120(GSM), 700(DCS), or 661(PCS)
5. Set Broadcast channel level to -85dBm
6. Set Traffic Channel(TCH) to 128(EGSM), 38(GSM), or 512(DCS/PCS)

Figure 2. GSM Connection Control



7. Set Traffic channel level to -85dBm
8. Wait until the phone indicates a signal
9. Dial a number from the phone and press the send button.
10. The phone is now connected.

Figure 3. GSM Call Connected

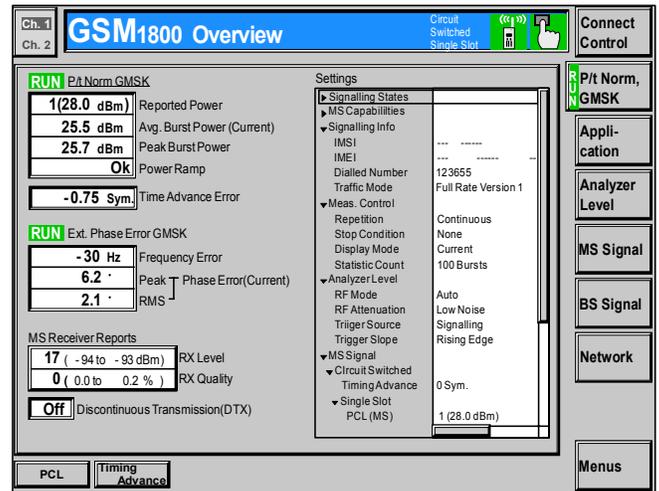
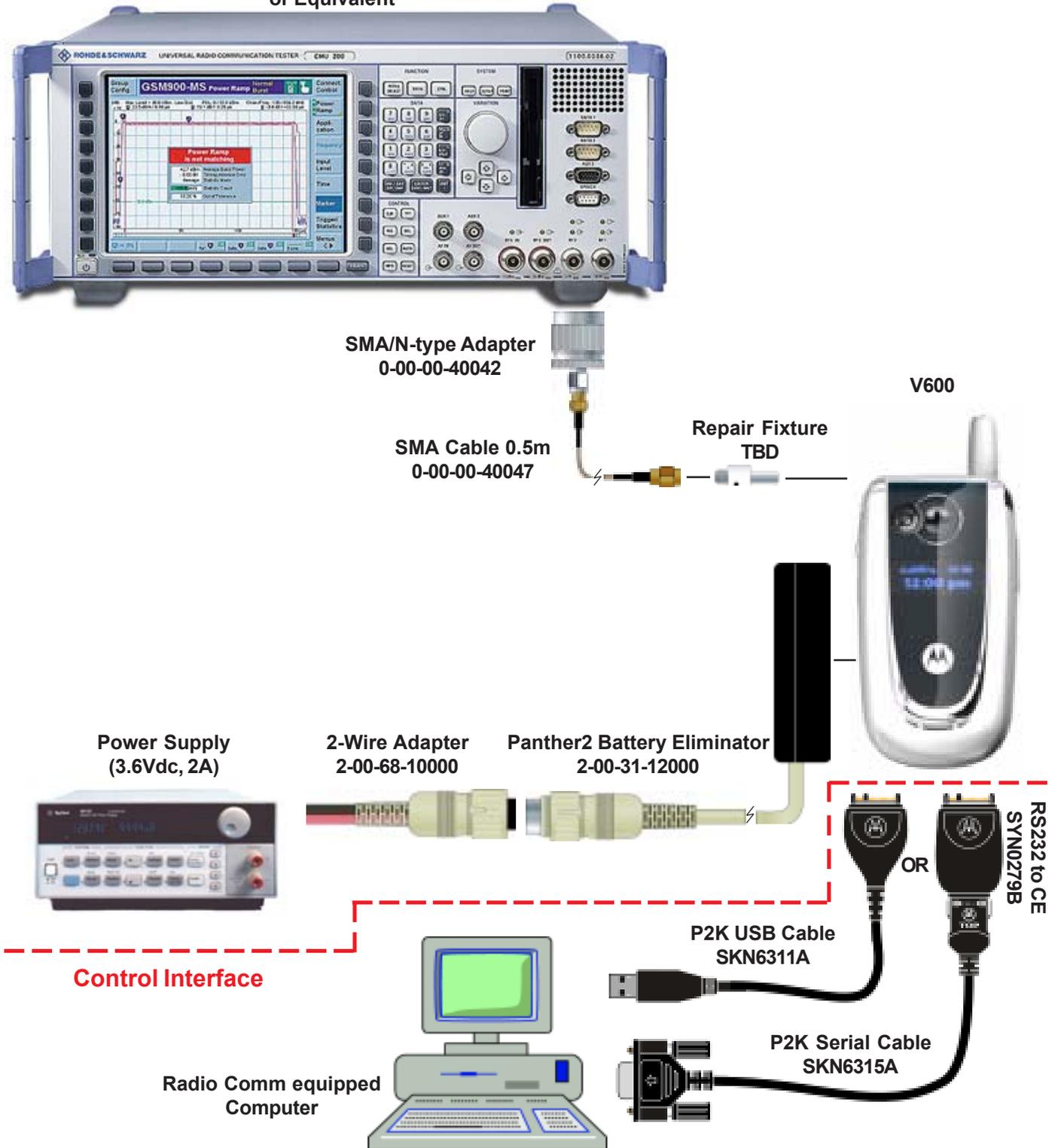


Figure 4. V300/V500/V600 Manual Test Hardware Configuration

CMU200 Test Box
or Equivalent



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.

All RF losses need to be considered when verifying the parameters of the phone. Uncalibrated hardware will result in false readings. Maintain calibration schedules as recommended by the manufacturer, for cables, interfaces, and test equipment.

Table 1. GSM/GSM850 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	4	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 2. DCS Call Parameters

Parameter	Low Limit	High Limit	Unit
Burst Avg Power Out ¹	28	30	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@-105 dBm ²	4	9	
RX Quality @-105 dBm ²	0	4	
BER @-105, 10k bits ³	0	2	%

¹Power Level = 0
²Set BS TCH level to -105 dBm
³Set BER TCH level to -105 dBm with 10k bits or 128 Frames

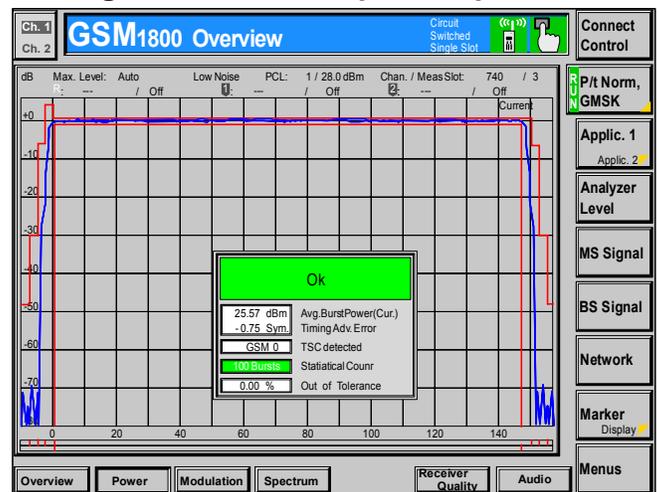
Table 3. PCS Call Parameters

Parameter	Low Limit	High Limit	Unit
Burst Avg Power Out ¹	28	30	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@-105 dBm ²	4	9	
RX Quality @-105 dBm ²	0	4	
BER @-105, 10k bits ³	0	2	%

¹Power Level = 0
²Set BS TCH level to -105 dBm
³Set BER TCH level to -105 dBm with 10k bits or 128 Frames

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

Figure 6. Burst Output Shape



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

Table 4. GSM/DCS/PCS Handover

Band	From		To	
	Traffic Channel	Power Control	Traffic Channel	Power Control
GSM	975	5	124	19
GSM850	128	7	251	19
DCS	512	0	885	15
PCS	512	0	810	15

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

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. 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.

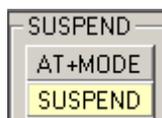
Handset Test Commands

54 ok Suspend

Radio Comm Test Commands

Click AT+MODE then SUSPEND (Serial Only)

Click USB 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 (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 6. TX Power Limits

Parameter	Low Limit	High Limit	Unit
GSM TX Power Out ¹	31	33	dBm
DCS TX Power Out	28	29.5	dBm
PCS TX Power Out	28	29.5	dBm

¹Same limits for GSM850

Handset Test Commands

54 Suspend
 10*0*6¹ GSM/DCS mode
 20*38*0² Set Channel 38
 45*5³ Set GSM/GSM850 Power Level 5
 7*6*1 Enable Carrier

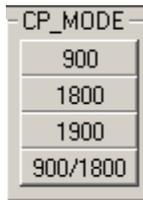
¹10*0*7 for GSM850/PCS mode

²20*700*0 = DCS Ch. 700; 20*661*0 = PCS Ch. 661; 20*128*0 = GSM850 Ch. 128

³45*0 for DCS/PCS Power level 0

Radio Comm Test Commands

Click on 900/1800 (GSM/DCS) or 850/1900 (PCS)



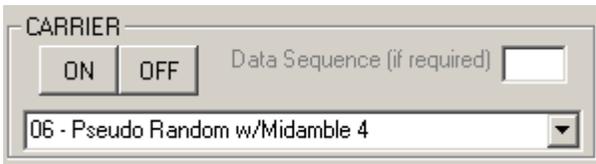
Enter 38 (GSM), 700 (DCS), 661 (PCS), or 128 (GSM850) and then click Set



Enter 5 (GSM/GSM850) or 0 (DCS/PCS) and then click Set

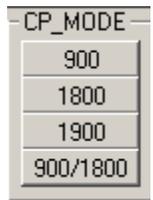


Select 06 and then click ON



Radio Comm Test Commands

Click on 900/1800 (GSM/DCS) or 850/1900 (PCS)



Enter Channel 20
Click INIT



Click Execute
Verify return data is approximately -105 dBm



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

Audio/Vibrator Test Procedures

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

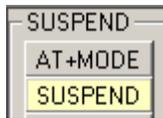
In order to successfully send test commands to the phone under test, the phone needs to be in suspend mode. Follow the listed procedure to place the phone in suspend mode.

Handset Test Commands

54 ok Suspend

Radio Comm Test Commands

Click AT+MODE then SUSPEND (Serial Only)
 Click USB 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

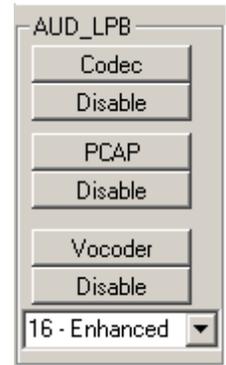
6*2*2*0*0 Enable internal mic and handset speaker
 4*4*1 Enable VOCODER loopback at Enhanced Full Rate

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.

Headset Mic/Speaker test

Handset Test Commands

6*4*6*0*0 Enable headset mic and headset speaker
 4*4*1 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.

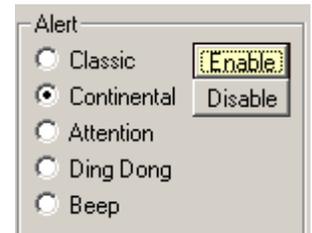
Melody Speaker test

Handset Test Commands

6*0*3*0*0 Enable Polyphonic speaker
 0*0*014 Play CONTINENTAL alert style
 0*1*014 Stop CONTINENTAL alert style

RadioComm Test Commands

Select Continental and click Enable



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

Normal Mode (User Interface short cut)

*#9999#

RadioComm Test Commands

Click on Version for SW version



Click on Get for Flex version



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.

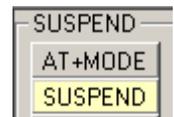
In order to successfully send test commands to the phone under test, the phone needs to be in suspend mode. Follow the listed procedure to place the phone in suspend mode.

Handset Test Commands

54 ok Suspend

Radio Comm Test Commands

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



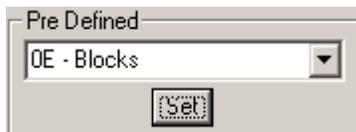
Display Color Test

Handset Test Commands

55*2*014¹ Eight Color Box Pattern

RadioComm Test Commands

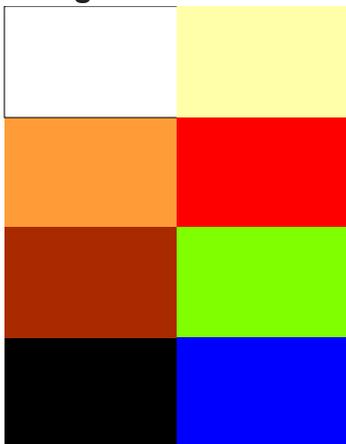
Select Eight Color Box and click “Set”



Verification

Verify that the color pattern on the phone’s display matches the color box in figure 6. Also verify edges (uniform/smooth).

Figure 6. Eight Color Box Pattern



Display Linearity Test

Handset Test Commands

55*2*005¹ Grey Scale Pattern

RadioComm Test Commands

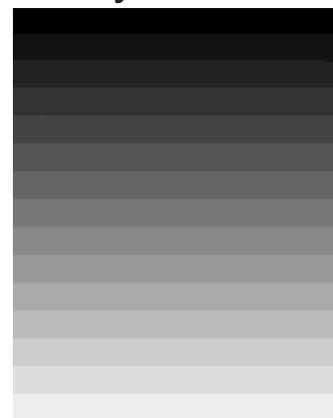
Select Grey Scale and click “Set”



Verification

Verify that the Grey scale block on the phone’s display matches the Grey scale block in figure 7. This test can also be used to confirm that the color intensity is linear.

Figure 7. Grey Scale Block



¹Press the right soft key to return to opcode screen

Display Flicker Test

Handset Test Command

55*2*006¹ Horizontal Zebra Line

RadioComm Test Commands

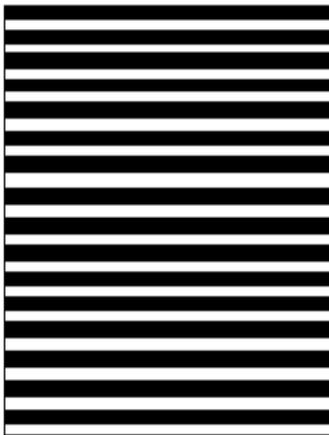
Select Horizontal Zebra and click "Set"



Verification

Verify that no noticeable flicker exists.

Figure 8. Zebra Pattern



Display Pixel Defect (Bright)

Handset Test Commands

55*2*001¹ 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*000¹ 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.

¹Press the right soft key to return to opcode screen

Backlight Test Procedures

Use the following procedures to verify backlights for the main display, CLI display and keypad.

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.

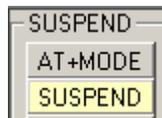
Handset Test Commands

None

Radio Comm Test Commands

Click AT+MODE then SUSPEND (Serial Only)

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



Backlights

Handset Test Commands

62*1*1¹ Enable Main Display Backlights
 62*1*0¹ Disable Main Display Backlights

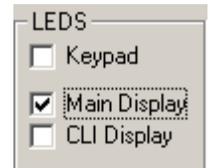
62*2*1¹ Enable Main CLI Backlights
 62*2*0¹ Disable Main CLI Backlights

62*3*1¹ Enable Keypad Backlights
 62*3*0¹ Disable Keypad Backlights

¹Leave field 3 blank and press OK

RadioComm Test Commands

Select Keypad, Main Display, or CLI Display to enable the backlights. Deselect the item to disable



Verification

Verify that the backlights activate.

Bluetooth Tests (V500/V600 only)

Use the following procedures to verify functionality of the Bluetooth device integrated in the phone.

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.

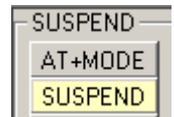
Handset Test Commands

None

Radio Comm Test Commands

Click AT+MODE then SUSPEND (Serial Only)

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



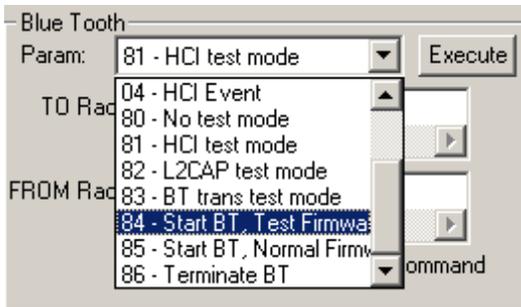
Unmodulated CW TX test

Handset Test Commands

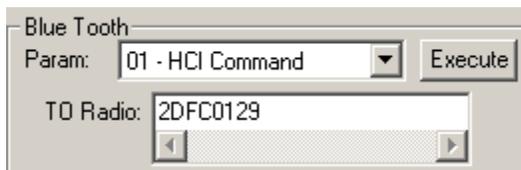
Not Supported

RadioComm Test Commands

Under Bluetooth, select parameter 84 and click execute, then select 81 and click execute.



Under Bluetooth, select parameter 01 and enter 2DFC0129 in the “TO Radio” field. Click Execute.



NOTE: The Bluetooth TX signal will activate momentarily once the HCI command is issued. You must have the RF probe positioned for measurement once you click execute.

Verification

Verify that a 2441MHz signal is present. If the phone is closed, use a RF probe to sniff the strongest signal around the “7” key of the keypad. If the phone is open (shields off), verify that -2dBm to +4dBm is read from R320. An high impedance RF probe is required to read this range. Use of lower quality RF probes will result in signal level differences.

Audio Loopback Test

Software Requirements

RadioComm (Full Edition)
 RadioComm (Service Edition) not supported
 SimpleParserW.exe

This procedure can only be performed by running a RadioComm Script. Use the following procedures to prepare the script and configure a button in RadioComm

From Windows OS, open any text editing application such as notebook. Copy the following string in the text editor.

```
BT,81,
WAIT,500,
BT,0124FC0101,
WAIT,500,
AUD_PATH,7B00,
WAIT,100,
AUD_TN_GEN,015A830100000000000000000000,
WAIT,100,
BT,0124FC0101,
AUD_SAMP,0814,
```

DO NOT deviate from this script. Insure that there are no empty spaces. Delete any empty lines following “AUD_SAMP,0814,”. Place the cursor at the end of the last line and hit “Enter” on the keyboard. This is needed for RadioComm to read the script correctly.

Save the document using a “.tcs” extension.

Create Audio Loopback shortcut

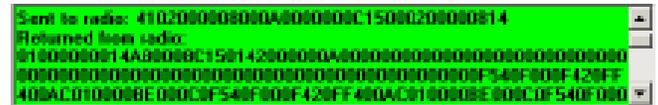
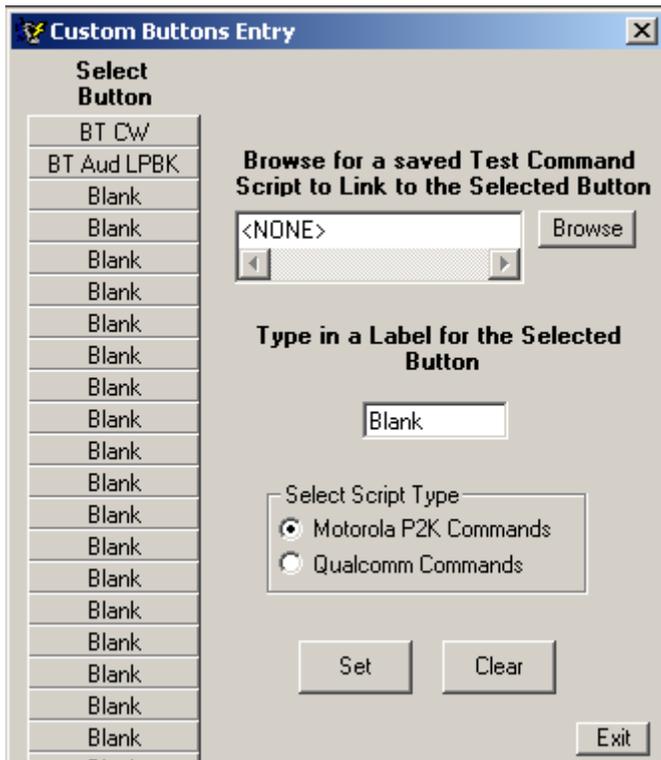
Open RadioComm and choose Setup Buttons



Click on the shortcut button that was created for Audio Loopback



Select a “Blank” button
 click on “Browse” and locate the script created above.
 Type a label for the button in the Label field.
 Click on “Set”



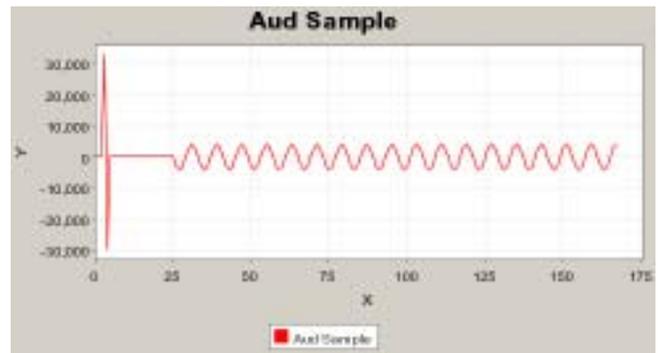
Highlight and copy all the “Returned from radio” data
 Run the application called, “SimpleParser.exe.”



Paste in the data in the first field and click Run

Verification

Verify that a 1kHz sine wave is displayed in the Aud



Handset Test Commands

Not Supported

RadioComm Test Commands

Under Bluetooth, select parameter 84 and click execute



Sample plot. Note the X and Y levels.

Camera Testing

NOTE: These procedures are currently not supported by the Service Edition of RadioComm.

This document is intended to describe the procedures that will determine whether the camera function of a Motorola terminal is under normal operating conditions.

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.

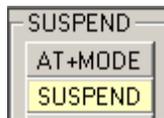
Handset Test Commands

Not supported

Radio Comm Test Commands

Click AT+MODE then SUSPEND
(Serial Only)

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



Hardware Requirements

The following hardware will be required to properly test the camera function of the phone.

1. Desktop Charger (SPN5032A or equivalent)
2. USB or RS232 control interface (refer to figure 4)
3. Fast Rate Charger (SPN5049A or equivalent)
4. Hardcopy of Macbeth Color Chart
5. Hardcopy of Focus Chart

6. Hardcopy of Grey Chart

Camera Test Configuration

Use any color printer to print a hardcopy of the Macbeth color chart. The Focus chart and Grey chart can be printed using any B/W printer.

For best results follow this recommended setup,

1. Attach chart to a flat vertical surface (wall)
2. Attach the phone to the desktop charger
3. Attach the control interface to desktop charger
4. If necessary, attach power supply to control interface.
5. Turn on phone.
6. Select Camera option in phone
7. Position Desktop charger so that the camera test chart completely fills the viewfinder.

Assign a permanent space in the test lab for these test procedures. Always use the same lighting conditions. Also, it's recommended that a "golden picture" is saved and used for comparison.

There is a variety of ways the camera test charts can be attached to a vertical flat surface. They can be taped, tacked, attached to flip charts, etc. Use your best judgment.

The desktop charger is being used as a fixture to position the phone for test, therefore, it's recommended that the desktop charger is attached to a countertop to prevent any movement.

Figure 9. Camera Test Configuration

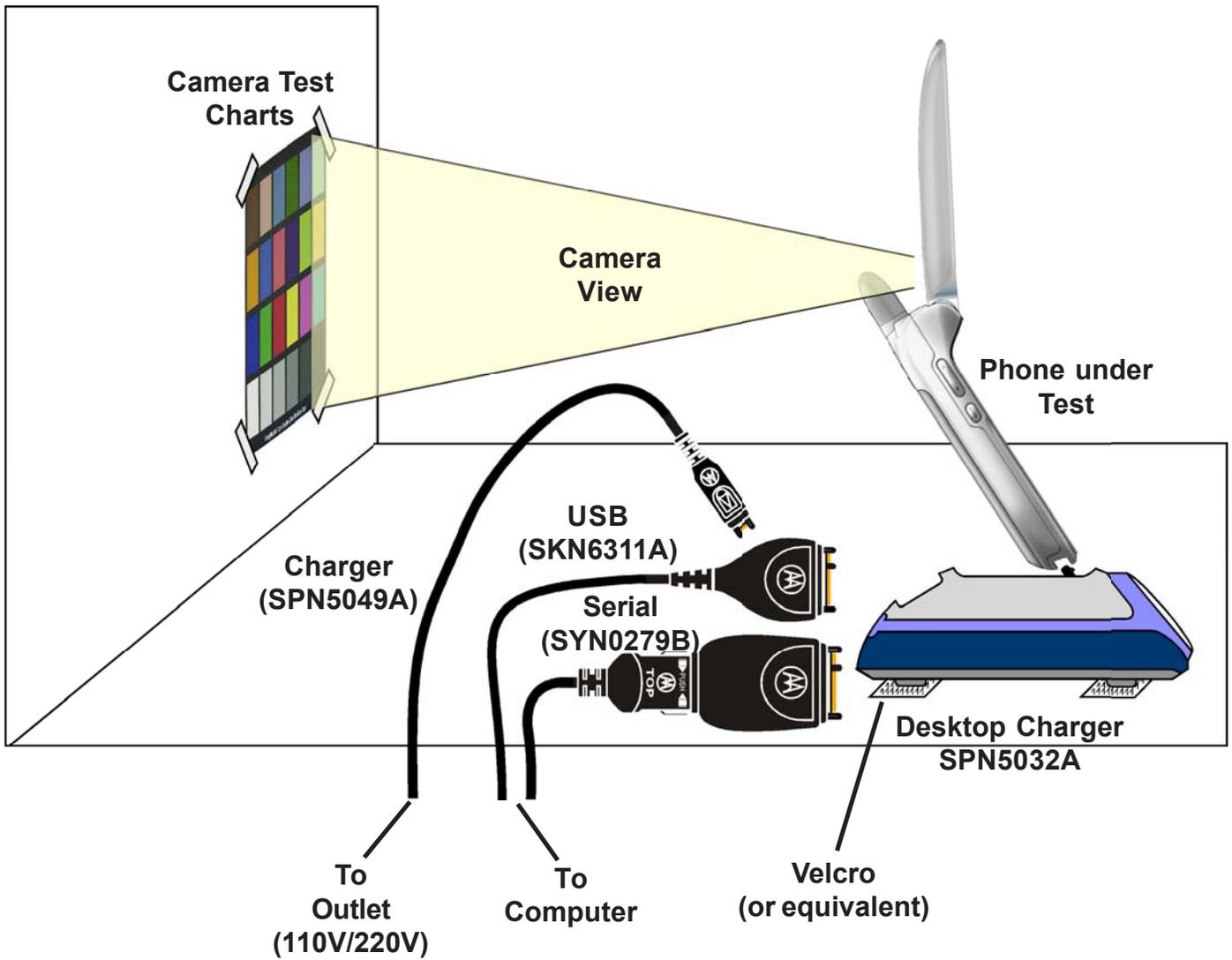


Image Capture

The listed steps should be followed to capture three images (1) the Macbeth color chart, (2) the focus chart, and (3) the grey scale chart. The user will be required to print all images found in Appendix A.

Once the picture is captured, it'll be displayed on the screen. Click "Save To File"

Handset Test Commands

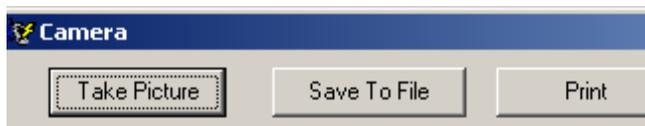
Not supported

Radio Comm Test Commands

Under "Common Features" select Camera

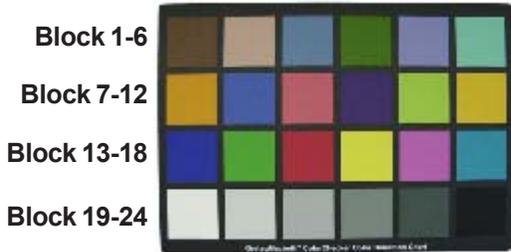


Click "Take Picture"



Macbeth Color Chart

1. From the computer, open the captured color chart image.
2. Compare, the color blocks of the printed Macbeth color chart to the captured image.

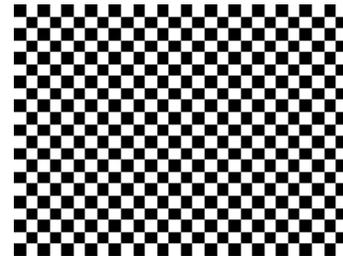


Follow the listed verifications to determine the quality of the image.

1. Minimal noise level for Blue, Green and Red on blocks 19 through 24.
2. Uniformity for grey scale blocks 19 through 24.
3. Good white balance on blocks 19 through 24.
4. Good color reproduction on blocks 13 through 18.

Focus Chart

1. From the computer, open the captured focus chart image.



Verify the focus quality at the center, top-left corner, bottom-left corner, top-right corner, and bottom-right corner.

Grey Scale Chart (Shading Test)

1. From the computer, open the captured grey scale chart image.



Verify that there is minimal shading deviations on all four corners when compared to the center of the image.