Phasing/Performance Test Tool (PPT) for the i.200-20, i.250-20, and i.250-21 Platforms

User's Manual

I250PPTUM/D
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Contents

About This Book

This document describes how to use the Phasing/Performance Tool (PPT) for the i.200-20, i.250-20, and i.250-21 platforms for fine tuning and testing phone performance.

Audience

This manual is intended for engineers using the PPT to fine tune and conduct performance tests on mobile phone handsets during product development.

Organization

This manual describes the PPT system requirements and installation procedures. It also describes the PPT user interface and operation. Section 6, “Test Descriptions,” discusses the various aspects of phasing tests and regression tests and the resulting measurements. Separate chapters are devoted to manual phasing and a description of the phasing tool database. The document also includes an appendix to summarize error messages encountered during the PPT usage.

Revision History

The following table summarizes revisions to this document since the previous release (Rev. 10).

Revision History

Location	Revision
Table 2 on page 2	The Host System information was updated.
Section 7.12, “Bluetooth Manual Phasing,” on page 97	This is a new section.

Conventions

This document uses the following notational conventions:

- `Courier monospaced` type indicates code examples and file names. All source code examples are in C.
- **Bold** type indicates GUI control names.

Definitions, Acronyms, and Abbreviations

The following list defines the acronyms and abbreviations used in this document.

ADC	Analog-to-Digital Converter
AFC	Automatic Frequency Control
AGC	Automatic Gain Control
BCH	Broadcast Channel
BER	Bit Error Rate
BPL	bad pixel locations
BS	Base Station
CSV	Comma Separated Value file format

DAC	Digital-to-Analog Converter
DCR	Direct Conversion Receiver architecture
FBER	Fast Bit Error Rate
GPIB	General Purpose Interface Bus (IEEE488 bus)
GSM	Global System for Mobile Communications
IMEI	International Mobile Equipment Identifier
LNA	Low Noise Amplifier
MO	Mobile Originated
MS	Mobile Station
MT	Mobile Terminated
MTE	Manufacturing Test Environment
ORFS	Output RF Spectrum
PA	Power Amplifier
PGSM	Primary GSM (standard GSM frequency range)
PST	Product Support Toolkit
RTE	Radio Test Environment
RF	Radio Frequency
Rx	Receive
SIM	Subscriber Identity Module
TCH	Traffic Channel
Tx	Transmit
USB	Universal Serial Bus
VLIF	Very Low Intermediate Frequency receiver architecture

References

The following sources were referenced to produce this book:

[1] Product Support Tool (PST) User's Manual

[2] Integrated Development Environment (IDE) User's Manual

[3] Radio Test Environment (RTE) User's Manual

1 Overview

The Phasing/Performance Test Tool (PPT) for the i.200-20, i.250-20, and i.250-21 platforms is a software suite that provides functions for fine-tuning hardware and measuring phone performance. It includes phasing functions for hardware tuning, diagnostic functions for physical layer conformance test, and measurement functions for platform-competitiveness analysis. For a list of PPT functions, see Table 1.

Table 1. PPT Functions

Function	Details
Phasing	• Battery Sense • Automatic Frequency Control (AFC) • Power Amplifier (PA) • Time Mask • Dual Port Gain • IQ balance • Automatic Gain Control (AGC)
Manual Phasing	• AFC • PA • IQ balance • AGC • Camera (phasing and test)
Performance	• Regression Test – Phase/Frequency error – Time/Power mask – Fast Bit Error Rate (FBER) – Handover – Output RF Spectrum (ORFS)
Measurement	• DRX current measurement • Desense measurement • GPRS 2TX measurement

NOTE

Depending on the platform version licensed, not all functionality documented in this publication may be available. In addition, specific platform names that appear in file names, path names, related code/data elements, or interface elements are examples and may or may not reflect the licensed platform version.

2 System Requirements

To use the Phasing/Performance Test Tool (PPT), it is necessary to have the components listed in Table 2.

Table 2. System Requirements

Item	Requirements
Host system	• IBM-compatible PC • 366 MHz Pentium 2 processor (minimum) • Windows 2000 with Service Pack 1 or Windows XP Professional with Service Pack 1 • 192 Mbyte RAM • 5 Mbyte hard disk space available • VGA graphics monitor and adapter • One available USB port (for connection to phone)
Software	• Product Support Tool (PST) (included with RTE)—Install before using the PPT.
Interface	• National Instruments GPIB interface card and associated drivers
Transceiver test set(s)	• CMU200 or Agilent 8960 (for GSM, EGSM, DCS, PCS, GSM850, and GPRS) • HP8922M with HP83220 (for GSM, EGSM, 1800 DCS and 1900 PCS)
Power supplies	• 1 programmable DC power supply (HP663xx) 0-6 V, 2A (for battery phasing) • 1 programmable power supply (HP66309, HP66319) (for DRX current measurement)
Accessories	• Test SIM (for performance tests and measurements) • USB cable for phone connection (to PC) • Antenna connector and cable

NOTE

Unless otherwise specified, Freescale Semiconductor does not provide the items listed in Table 2.

3 Software Installation

The PPT is included in the Radio Test Environment (RTE) tools set installation package. The PPT can be installed in either of the following two ways:

1. The PPT can be automatically installed during Radio Test Environment (RTE) installation. For the installation procedures, refer to the RTE release notes, the *Radio Test Environment (RTE) User's Manual*, and to the `readme.txt` file in the RTE installation package.
2. The PPT can be installed separately by running the *setup.exe*. Additional step-by-step procedures are provided during the installation process.

4 Hardware Setup

To install the hardware, perform the following steps:

1. Install the NI GPIB card and its associated software on the PC.
2. Power off the PC and the test set. Connect a GPIB cable between the PC and the test set.
3. Connect the reference phone to the RF IN/OUT port of the test set using the antenna cable.
4. Power up the PC and the test set.
5. Power up the reference phone.

6. Launch the PPT application on the PC.
7. Connect a USB cable between the phone and the PC.

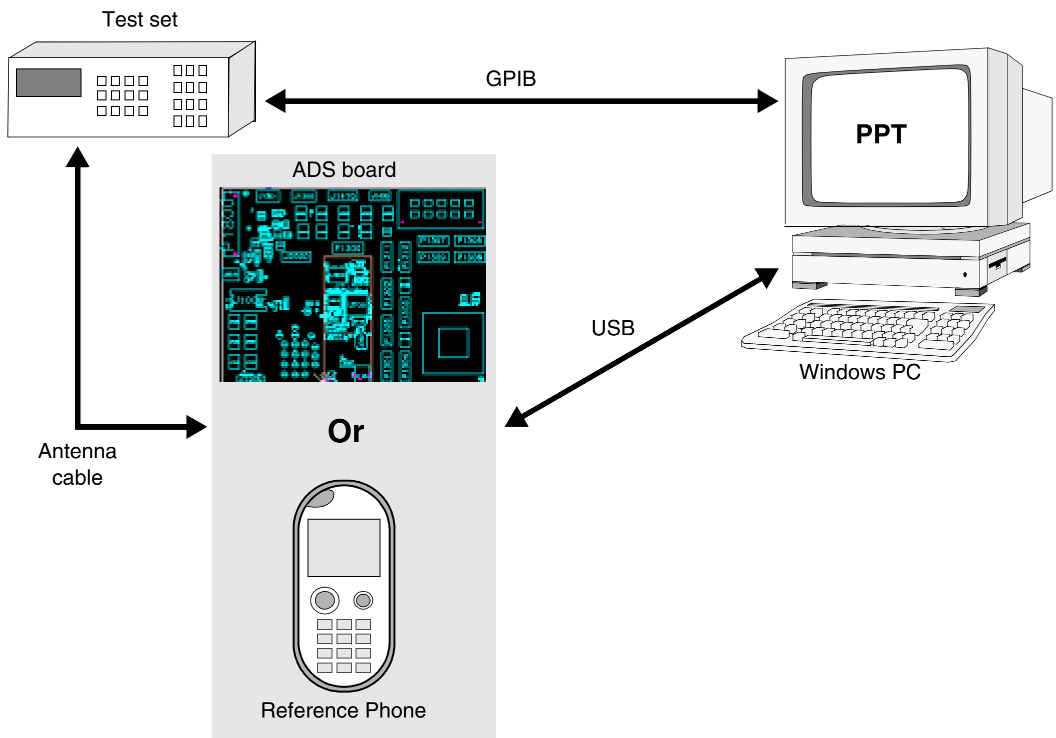


Figure 1. Typical Hardware Setup

5 PPT Application

This section describes the PPT application and the typical operating procedure.

5.1 User Interface Description

The menu bar contains three main menus.

- **File** menu
- **Configure** menu
- **Help** menu

The menus and menu items are summarized and described in Table 3, Table 4, and Table 5.

Table 3. PPT File Menu Items

File Menu Item	Description
Save Phasing Data	Saves the selected phasing data to a file. The phone must be detected before the data can be saved to the file (with HS extension, which is supported by the PST configuration). Phasing data includes EGSM900, DCS1800, PCS1900, and GSM850 bands data, and two band independent phasing data, namely AFC and Battery. These data can be saved separately.
Exit	Exits the program

Use the **Configure** menu items described in Table 4 to configure the hardware setting and phasing options.

Table 4. PPT Configure Menu Items

Configure Menu Item	Description
PA Phasing Option	PA auto/manual phasing option with selecting the tables of phone s/w versions and with optional combination of Time Mask phasing and/or Dual Port Gain phasing. Select from the following options: • PA only: Only PA phasing is done when PA phasing is selected. • PA + DP: PA phasing and Dual Port Gain phasing is done together when PA phasing is selected. • PA + TM: PA phasing and Time Mask phasing are done together when PA phasing is selected. • PA + DP + TM: PA phasing, Dual Port Gain phasing and Time Mask phasing is done together when PA phasing is selected.
Verification Option	Provides verification options for auto phasing • Post Phasing Verification: Verification is performed after auto phasing. • Pre + Post Phasing Verification: Verification is performed at the start of phasing after default table is loaded onto the phone, and after phasing. • Verification only: Run verification only without phasing • No Verification: Run phasing only
Default Table Option	Options for selecting the phasing table in the database • Auto Phasing Defaults: The default table to be used in auto phasing • Manual Phasing Defaults: The manual phasing default table to be used in auto phasing. • User Defined Defaults: The user-defined default table to be used in auto phasing

Table 4. PPT Configure Menu Items (continued)

Configure Menu Item	Description
Test Set Selection	Selects the mobile network test equipment for auto/manual phasing HP8922: • Selects test set Agilent HP8922 CMU200: • Selects test set R&S CMU200 HP8960 (E1960A): • Selects test set Agilent HP8960 (with GSM Mobile Test Application E1960A) HP8960 (E1968A): • Selects test set Agilent HP8960 (with GSM Mobile Test Application E1968A)
Battery Power Supply Selection	Selects the power supply equipment for battery sense phasing • HP663xx: Selects the power supply HP663xx models • HPE3632A: Selects the power supply HPE3632A • K2306: Selects the power supply K2306 • K2303 Selects the power supply K2303
GPIB Address of Battery Power Supply	Sets the GPIB address for power supply (default value: 12)
GPIB Address of Test Set	Sets the GPIB address for test set (default value: 14)
Cable Loss	Defines the cable losses for different frequency bands, for example, EGSM900, DCS1800, PCS1900, and EGSM850
Preference	Sets up the testing preference: • PA Version: Selects a Power Amplifier (PA) version available in the database (LCAGSMTEST.MDB) file that matches the phone hardware (IC version and PCB layout) to be phased • ORFS: Enables/disables ORFS verification option in PA phasing for each platform

Table 5. PPT Help Menu Items

Help Menu Item	Description
About	Displays the phasing software version and database version
Factory Info	For reading/writing factory information from/to phone. Up to 128 characters can be stored.

There are four areas on the main window, as shown in Figure 2:

- **Menu**
- **Handset info**
- **Cable Loss (dB)**
- **Instrument**

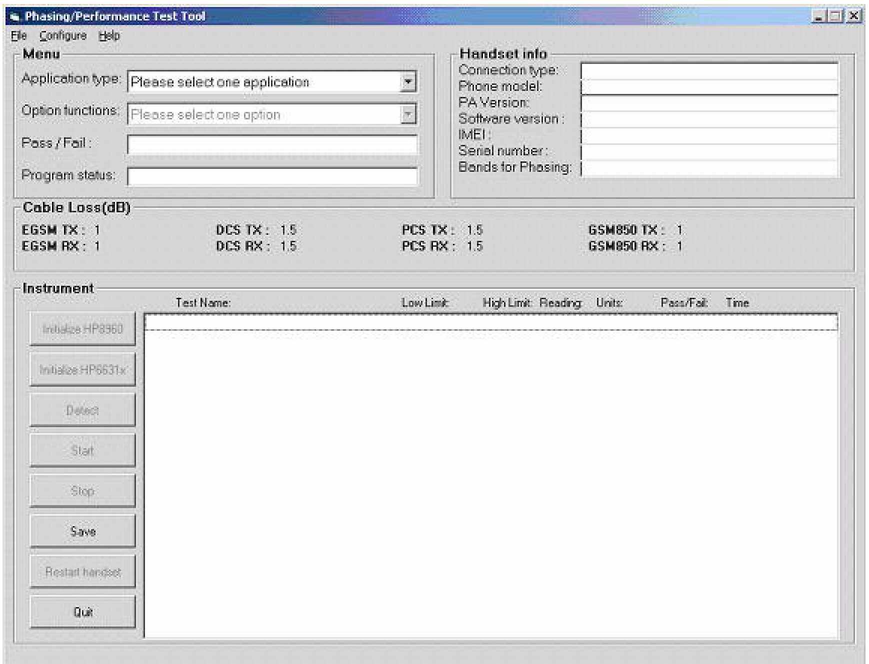


Figure 2. PPT Main User Interface

For more information about the user interface, refer to Table 6.

Table 6. Main Areas of PPT Window

Area	Item	Description
Menu	Application Type	Selects the application
	Option Functions	Selects the sub-function
	Pass/Fail	Displays the pass or fail status of the sub-function execution
	Program status	Displays the running status of the selected sub-function
Handset info	Connection type	Displays the selected PC-Phone communication protocol
	Phone model	Displays the selected phone model for phasing
	PA version	Displays the PA phasing database being used
	Software version	Displays the detected phone software version
	IMEI	Displays the detected IMEI number
	Serial number	Displays the detected phone serial number
	Bands for phasing	Displays the selected band(s) for phasing

Table 6. Main Areas of PPT Window (continued)

Area	Item	Description
Cable Loss	EGSM TX	Displays the transmit (Tx) path cable loss setting in dB for EGSM900 band.
	EGSM RX	Displays the receive (Rx) path cable loss setting in dB for EGSM900 band.
	DCS TX	Displays the transmit (Tx) path cable loss setting in dB for DCS1800 band.
	DCS RX	Displays the receive (Rx) path cable loss setting in dB for DCS1800 band.
	PCS TX	Displays the transmit (Tx) path cable loss setting in dB for PCS1900 band.
	PCS RX	Displays the receive (Rx) path cable loss setting in dB for PCS1900 band.
	GSM850 TX	Displays the transmit (Tx) path cable loss setting in dB for GSM850 band.
	GSM850 RX	Displays the receive (Rx) path cable loss setting in dB for GSM850 band.
Instrument	Initialize <Test Set Model>	Initializes the test set. The displayed test set name on the button changes according to the selection in the configure menu.
	Initialize <Power Supply Model>	Initializes the programmable power supply (for battery sense phasing). The displayed power supply name on the button changes according to the selection in the configure menu.
	Detect	Sets up the communication between PC and phone. Also gets phone information, selects band(s) for phasing and reads the database according to the default table option in the configure menu. Whenever the default table is changed, the **Detect** button should be clicked to reload the correct table into the memory.
	Start	Starts the selected sub-function
	Stop	Stops the execution of the selected sub-function
	Save	Saves the messages in the display window to a file
	Restart handset	Puts the phone back to normal mode (from suspend mode)
	Quit	Closes the program

5.1.1 Set Cable Loss User Interface

The **Set Cable Loss** user interface displays when you select **Cable Loss** from the **Configure** menu. Set the RF cable loss for different frequency bands for the values to be configured into the test set when performing auto-phasing. Figure 3 on page 8 shows an example of the **Set Cable Loss** user interface.

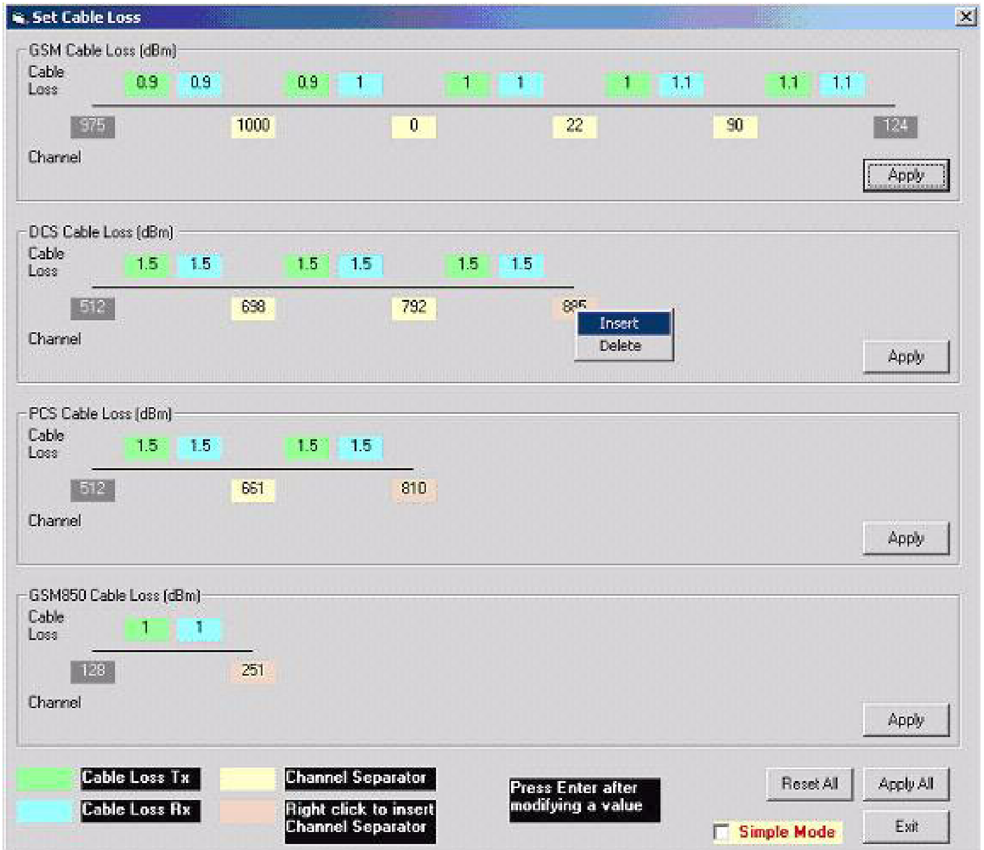


Figure 3. Set Cable Loss User Interface

In **Simple Mode** (when the **Simple Mode** check box is selected), you can only set one Tx cable loss value (green box), and one Rx cable loss value (light blue box) for each band. The same value would be used across the entire frequency band.

For a more accurate, channel-dependent cable loss setting, you can divide each frequency band into a maximum of five channel groups, and set the Tx and Rx cable loss values for each group.

To update the cable loss settings, do the following:

1. (Optional) To set up channel-dependent cable loss, right-click on the last channel label (in pale orange) for the band and select Add. A new channel separator box will be added.
2. Click on a channel separator box (in yellow) to modify the channel number for a divider.
3. Click on a **Tx cable loss** box or a **Rx cable loss** box to modify the **Tx** or **Rx path cable loss** for a channel group.
4. Click **Apply** to commit the updated cable loss values for a frequency band; or select **Apply All** to commit the values for all four bands. The values will be written into the PPT database (`lcagsmtest.mdb`).

You can remove channel separators by right-clicking on the last channel label (in pale orange or gray) and then selecting Delete from the drop-down menu.

To revert to simple mode, check the **Simple Mode** check box and click on **Apply All**.

5.2 Typical Operating Procedure

The following is the typical operating procedure for running the Phasing Performance Test Tool:

1. Connect the radio handset to the PC and the test set according to the hardware setup procedures described in Section 4, "Hardware Setup," on page 2.
2. Launch the PPT application. The main application window should be similar to the one shown in Figure 2 on page 6.
3. From the menu bar on the PPT main UI:
   a) Select **Configure** to set the GPIB address of the test set (**GPIB Address of Test Set** menu item) to match the address setting in the test set.
   b) Select **Configure** to set the GPIB address of the power supply (**GPIB Address of Battery Power Supply** menu item) to match the setting in the power supply.
   c) Select **Configure** to set the PA version for the phone to be tested (**Preference** menu item, **PA Version** tab). Ensure that the word selected is displayed next to the name of the PA version chosen.
   d) Select **Configure** to perform ORFS verification when PA phasing (**Preference** menu item, **ORFS** tab), if needed.
   e) Select **Configure** to set the Tx and Rx RF path cable loss for the different frequency bands (**Cable Loss** menu item).
4. From the **Menu** area in the main UI, select a PPT application from the **Application type** drop-down list.
5. From the **Menu** area, select a PPT function from the **Option functions** drop-down list.
6. To initialize the test set, click **Initialize Test Set** in the **Instrument** area.
7. To set up the PC and phone connection, click **Detect** in the **Instrument** area. Select the phone model and the frequency band (or bands), when prompted. The phone software version and the IMEI number is reported when the setup is finished.
8. To start the selected test case (in **Option functions**), click **Start** in the **Instrument** area. In the **Menu** area, **Program Status** shows the running status, and **Pass/Fail** shows the result of the test.

   During each test, occasionally you may be prompted for action.
9. Some of the tests place the phone in test mode and the display on the phone goes blank. In *test mode*, the phone only responds to test commands issued by the phasing tool. To put the phone back into normal mode, click **Restart handset** (in the **Instrument** area).
10. To exit the program after the test has finished, click **Quit** (in the **Instrument** area).

5.3 Some Tips for Running Consecutive Tests

The following are tips for running test cases consecutively:

- Consecutive test cases can be carried out without quitting the PPT application.
- At the beginning of consecutive tests, the phone only has to be detected once.
- If there is no change in the **Application type** for consecutive tests, you do not have to redo the test set initialization.

- When running diagnostics after phasing, you must restart the phone. To restart the phone, click **Restart handset** in the **Instrument** area.
- If the PPT application cannot detect the phone after clicking **Detect**, briefly disconnect the USB connector on the PC (or on the phone) and try again.
- Restarting the handset may not work well on some phone software versions. The phone may not be switched to SUSPEND mode if the **Detect** button is pressed again. It is recommended to briefly disconnect the USB connector on the PC or the phone, and to try again. Avoid using the **Detect** and **Restart** buttons more than once during consecutive tests.

6 Test Descriptions

The following subsections describe phasing tests, regression tests, and measurement procedures.

6.1 Phasing Tests

The phasing tests fine tune the phone hardware using the PPT software running on a host computer. Tuning the phone hardware is necessary because phones behave slightly differently due to different tolerances in RF circuit components and A/D converters. The listed phasing functions in Table 7 are required to completely tune a phone. To optimize the phasing speed, a selectable “ALL Phasing” function in the **Application type** of the **Menu** area is available for executing phasing functions in one click.

Table 7. Complete Phone Tuning Procedure

Recommended Sequence	Test	Refer to
Step 1	Battery Sense Phasing	Section 6.1.1, “Battery Sense Phasing”
Step 2	AFC Phasing	Section 6.1.2, “AFC Phasing”
Step 3	PA Phasing	Section 6.1.3, “PA Phasing”
Step 4	Time Mask Phasing	Section 6.1.4, “Time Mask Phasing”
Step 5	Dual Port Gain Phasing	Section 6.1.5, “Dual Port Gain Phasing”
Step 6	IQ Balance Phasing	Section 6.1.6, “IQ Balance Phasing”
Step 7	AGC Phasing	Section 6.1.7, “AGC Phasing”

In each phasing test, the phone performance is measured using the test set, and the result is compared against the predefined test limits set in the database. The deviations from the expected performance are measured and are converted into numerical parameters and stored in the phone’s flash memory. When the phone is powered up again, the phone software adjusts the hardware accordingly to compensate for the errors. At the end of each phasing routine, a verification test is done to verify the correctness of the phasing (unless **No Verification** was selected in the **Verification Option** of the **Configure** menu).

The test limits for the phasing and verification are stored in the database. The name of the limits can be found in the limit tables in the following sections for each phasing.

NOTE

The test limits have great implication on the quality of the product, yield, and test time. In most cases, the test limits must be fine-tuned to get the right balance among these factors for each hardware platform. The test limits outlined in this release are strictly for reference only.

6.1.1 Battery Sense Phasing

Use battery sense phasing to correlate the voltage A/D outputs with voltage values. The A/D converter is used for low voltage shutdown and for battery indicators on the display.

The goal of battery sense phasing is to find out the conversion gain and the DC offset value of the A/D converter. They are found by setting different voltages at the battery contact and measuring the ADC values of these different voltages. During phasing, the gain and intercept of the ADC transfer function are estimated.

Two variable DC power supplies are required for the battery sense phasing test. You only need to perform battery sense phasing at one frequency of the frequency band.

6.1.1.1 Battery Sense Phasing Procedure

The following are the Battery Sense Phasing procedures:

1. Run the PPT application with the standard hardware configuration.
2. Connect the battery contacts (B+ / GND) of the phone with a programmable power supply (for example, HP663x2).
3. Click **Initialize Power Supply** and set the battery input voltage to 3.8 V and the current limit to 2 A to power up the phone.
4. Select Phasing at **Application type**, and select Battery Sense Phasing at **Option functions**.
5. Click **Initialize Test Set** to initialize the test set.
6. Click **Detect** to set up the PC–phone connection, and select the phone type and any frequency band.
7. Click **Start** to start phasing.
8. Follow the instructions when you are prompted to adjust the DC power supplies voltage.
9. The Gain and Intercept of the ADC transfer functions are estimated.
10. The phasing result is then tested.
11. Click **Restart** to restart the phone when the test is finished.

6.1.1.2 Display during Battery Sense Phasing

During phasing, the voltage at the battery contacts is measured and displayed, together with the pre-phase limits defined in the battery phasing database. Pass or fail results are displayed depending whether the result is within the limits. See Table 8.

Testing is performed after phasing to verify the phasing result if post verification is selected in the menu. See Table 9.

Table 8. Test Limits

Parameter	Low Limit	High Limit	Unit	Comment
A/D1	529 (VOLTS1_DAC_L[1])	761 (VOLTS1_DAC_H[1])	Nil	Limits of ADC Value[3] for the voltage input (Volts1[2])
Volts1	2.9 Volts1[2] - VOLTS1_L[1])	3.5 (Volts1[2] + VOLTS1_H[1])	V	Limits of the voltage input (Volts1[2])
A/D4	753 (VOLTS4_DAC_L[1])	1023 (VOLTS4_DAC_H[1])	Nil	Limits of ADC Value[3] for the voltage input (Volts4[2])
Volts4	3.95 (Volts4[2] - VOLTS4_L[1])	4.55 (Volts4[2] + VOLTS4_H[1])	V	Limits of the voltage input (Volts4[3])
Gain	108 (BAT_GAIN_L[1])	148 (BAT_GAIN_H[1])	Nil	
Intercept	-30 (BAT_INTP_L[1])	30 (BAT_INTP_H[1])	Nil	

1 Parameters defined in the table of `i2xx_TestLimits` of `lcagsmtest.mdb`

2 Parameters defined in the table of `i2xx_BATTMPBPHASE` of `lcagsmtest.mdb`

3 Relationship between A/D value (ADC) and battery input voltage (Vin) is given by:
ADC = (Vin / 2 -0.2) * 1024 / 2.25

Table 9. Verification

Parameter	Low Limit	High Limit	Unit	Comment
Voltage Reading	(`Ver_Voltage` - `BAT_V_V_L`)	(`Ver_Voltage` + `BAT_V_V_H`)	V	Estimated battery input voltage after phasing (`Ver_Voltage`)

6.1.2 AFC Phasing

AFC phasing relates the values from the AFC DAC to measured frequency offsets. The frequency offset versus the DAC curve for the product is linear, so AFC phasing determines a correct offset for the AFC DAC.

In AFC phasing, the phone generates a test tone at the selected channel. The frequency error of the tone is measured by the test set, and the result is sent to the phasing program. The program then converts the frequency error into a frequency correction factor ((frequency error)/8 and the reference channel) and then store the factor in the phone for the AFC control compensation. Refer to Table 10.

Table 10. Frequency Correction Factor

Byte	Contents
0, 1	Frequency offset/8 (integer)
2, 3	Reference channel

Only the GSM band requires AFC phasing.

6.1.2.1 AFC Phasing Procedure

1. Power up the phone.
2. Run the PPT application with the standard hardware configuration.
3. Select Phasing at **Application type**, and AFC Phasing at the **Option functions**.
4. Click **Initialize Test Set** to initialize the test set.
5. Click **Detect** to set up the PC–phone connection, and select the phone type and the test frequency band. Use the EGSM frequency band.
6. Click **Start** to start phasing.
7. The frequency error is measured, converted into a frequency correction factor and then stored in the phone.
8. The phasing result is then tested.
9. Click **Restart** to restart the phone when the test is finished.

6.1.2.2 Display during AFC Phasing

During phasing, the frequency error of the phone's transmitted signal based on the default frequency offset value defined in the AFC phasing database at reference channel is measured and displayed, together with the pre-phase limits defined in the database.

If post verification is selected in the verification option of the **Configure** menu, testing is performed after phasing to verify the phasing result. The frequency error based on the phased result are measured and displayed.

Table 11. EGSM AFC Phasing Test Limits

Parameter	Low Limit	High Limit	Unit	Comment
Pre-phase frequency error	-27,000 (-900M*AFC_PPM_L)	27,000 (900M*AFC_PPM_H)	Hz	Initial frequency error

Table 12. EGSM AFC Phasing Verification

Parameter	Low Limit	High Limit	Unit	Comment
Phased frequency error	-90 (-900M*AFC_V_PPM)	90 (900M*AFC_V_PPM)	Hz	Frequency error after phasing

Table 13. DCS AFC Phasing Test Limits

Parameter	Low Limit	High Limit	Unit	Comment
Pre-phase frequency error	-54,000 (-1800M*AFC_PPM_L)	54,000 (1800M*AFC_PPM_H)	Hz	Initial frequency error

Table 14. DCS AFC Phasing Verification

Parameter	Low Limit	High Limit	Unit	Comment
Phased frequency error	-180 (-1800M*AFC_V_PPM)	180 (1800M*AFC_V_PPM)	Hz	Frequency error after phasing

6.1.3 PA Phasing

Power Amplifier (PA) phasing determines the appropriate values to program the output RF DAC values to, to get the desired output power for each PA level. It also determines and writes appropriate band multiplier and offset values, which correct for power variations across the frequency bands.

PA phasing is done at four steps for the following: low power range, mid-power range, high power range, and frequency variation. The first three steps are to characterize the power levels (low, middle, and high power ranges) at the reference channel, and the last step is to find the gain and offset adjustment for interpolation within each sub-band across the frequency band.

The OFS values, the initial target power level of power ramping are also phased for each power range during PA phasing.

NOTE (for HP8922M test sets only)

At each power measurement, the path loss from the antenna connector to the test set “RF IN/OUT” port must be accounted for by setting the test set input attenuation. This helps ensure that the power input expected by the test set is within 3 dBm of the actual power it measures. The power expected by the test set must be within 3 dBm of the actual power measured for maximum accuracy.

6.1.3.1 PA Phasing Procedure

The following is the PA Phasing procedure:

1. Power up the phone.
2. Run the PPT application with the standard hardware configuration.
3. Select Phasing in **Application type**, and PA Phasing at **Option functions**.
4. Click **Initialize Test Set** to initialize the test set.
5. Click **Detect** to set up the PC–phone connection, and select the phone type and the test frequency band (or bands).
6. Click **Start** to start phasing.
7. During phasing, the phone sends out bursts of signal at pre-determined power levels. The transmit power (minus the loss in the cable) is measured by the test set. The correlation between the power level and the actual transmit power is found.
8. The test is repeated at different frequencies to find out the frequency dependencies.
9. The phase result is then stored in the phone.
10. A test is performed on the phone after phasing to check the specification conformance.

11. Click **Restart** to restart the phone when the test is finished.

6.1.3.2 Display during PA Phasing

During phasing, the phone's output power (based on the default DAC values defined in the PA phasing database) at three power levels in each Power Range (Low, Mid, and High) are measured and displayed, together with the pre-phase limits. Measurements are also done at selected channels for channel variation compensation across the band.

Pass or fail results are displayed depending whether the result is within the limits. These limits are designed to be more stringent than what are required by the GSM specifications. They are usually meaningful only for the manufacturing phase in the Manufacturing Test Environment (MTE), since post-phasing verification is omitted to significantly reduce testing time. Therefore, these tight limits during the pre-phasing stage give better indications on the quality of the phone. In the Radio Test Environment (RTE) phase, it might be preferable to focus on the post verification results, and those limits are near the GSM specifications.

If the post verification option is selected in the verification option of the **Configure** menu, verification testing is carried out after phasing to verify the phasing result at each power level. The output power based on the phased result is measured and displayed.

After PA phasing, you are prompted to accept or not accept the phasing results. You have the option to accept the results and save the phased values in the phasing table on the phone, or not accept the results and restore the original values in the phasing table on the phone.

Table 15. EGSM PA Phasing Test Limit

Parameter	Low Limit	High Limit	Unit	Comment
High Power Range 1	29 (AnTargets+ PA_PS_L)	33 (AnTargets+ PA_PS_H)	dBm	PL5 (TXLevels for RefChan)
High Power Range 2	23.5	29.5	dBm	PL6
High Power Range 3	20	24	dBm	PL7
Mid Power Range 1	21	25	dBm	PL10
Mid Power Range 2	15.5	19.5	dBm	PL11
Mid Power Range 3	10	14	dBm	PL12
Low Power Range 1	12	16	dBm	PL15
Low Power Range 2	7	11	dBm	PL16
Low Power Range 3	2	6	dBm	PL17
Channel Power @xxx	23.5 (AnTargets+ PA_PS_L)	29.5 (AnTargets+ PA_PS_H)	dBm	PL6
Phased AOC DAC@PL0-19	0 (PA_DAC_L)	1023 (PA_DAC_H)		Calculated DAC value for each PL

Table 15. EGSM PA Phasing Test Limit (continued)

Parameter	Low Limit	High Limit	Unit	Comment
Phased OFS High/Mid/Low DAC	0 (PA_OFS_L)	255 (PA_OFS_H)		Calculated OFS Value for each Power Range
Phased Sub-band1-5 slope	-32767 (PA_RBGAIN_L)	32767 (PA_RBGAIN_H)		Sub-band linear interpolation slope
Phased Sub-band1-5 offset	-32767 (PA_RBOFFSET_L)	32767 (PA_RBOFFSET_H)		Sub-band linear interpolation slope

Table 16. PCS PA Phasing Test Limit

Parameter	Low Limit	High Limit	Unit	Comment
High Power Range 1	26 (AnTargets+ PA_PS_L)	30 (AnTargets+ PA_PS_H)	dBm	PL0 (TXLevels for RefChan)
High Power Range 2	20.5	26.5	dBm	PL1
High Power Range 3	17	21	dBm	PL2
Mid Power Range 1	19	23	dBm	PL5
Mid Power Range 2	13	17	dBm	PL6
Mid Power Range 3	7	11	dBm	PL7
Low Power Range 1	9	13	dBm	PL10
Low Power Range 2	3	7	dBm	PL11
Low Power Range 3	-2	2	dBm	PL12
Channel Power @xxx	20.5 (AnTargets+ PA_PS_L)	26.5 (AnTargets+ PA_PS_H)	dBm	PL1
Phased AOC DAC@PL0-19	0 (PA_DAC_L)	1023 (PA_DAC_H)		Calculated DAC value for each PL
Phased OFS High/Mid/Low DAC	0 (PA_OFS_L)	255 (PA_OFS_H)		Calculated OFS Value for each Power Range
Phased Sub-band1-5 slope	-32767 (PA_RBGAIN_L)	32767 (PA_RBGAIN_H)		sub-band linear interpolation slope
Phased Sub-band1-5 offset	-32767 (PA_RBOFFSET_L)	32767 (PA_RBOFFSET_H)		sub-band linear interpolation slope

Table 17. EGSM/GSM850 PA Phasing Verification

Parameter	Low Limit	High Limit	Unit	Comment
Power Level 0	31 (PA_PL_L)	35 (PA_PL_H)	dBm	PL0 (RefChan)
Power Level 1	31	35	dBm	PL1
Power Level 2	31	35	dBm	PL2

Table 17. EGSM/GSM850 PA Phasing Verification (continued)

Parameter	Low Limit	High Limit	Unit	Comment
Power Level 3	31	35	dBm	PL3
Power Level 4	31	35	dBm	PL4
Power Level 5	31	35	dBm	PL5
Power Level 6	28	34	dBm	PL6
Power Level 7	26	32	dBm	PL7
Power Level 8	24	30	dBm	PL8
Power Level 9	22	28	dBm	PL9
Power Level 10	20	26	dBm	PL10
Power Level 11	18	24	dBm	PL11
Power Level 12	16	22	dBm	PL12
Power Level 13	14	20	dBm	PL13
Power Level 14	12	18	dBm	PL14
Power Level 15	10	16	dBm	PL15
Power Level 16	6	16	dBm	PL16
Power Level 17	4	14	dBm	PL17
Power Level 18	2	12	dBm	PL18
Power Level 19	0	10	dBm	PL19
Channel Power @Chxxxx	28	34	dBm	PL6 (Test_Ch)

Table 18. DCS PA Phasing Test Limit

Parameter	Low Limit	High Limit	Unit	Comment
High Power Range 1	26 (AnTargets+ PA_PS_L)	30 (AnTargets+ PA_PS_H)	dBm	PL0 (TXLevels for RefChan)
High Power Range 2	20.5	26.5	dBm	PL1
High Power Range 3	17	21	dBm	PL2
Mid Power Range 1	19	23	dBm	PL5
Mid Power Range 2	13	17	dBm	PL6
Mid Power Range 3	7	11	dBm	PL7
Low Power Range 1	9	13	dBm	PL10
Low Power Range 2	3	7	dBm	PL11
Low Power Range 3	-2	2	dBm	PL12

Table 18. DCS PA Phasing Test Limit (continued)

Parameter	Low Limit	High Limit	Unit	Comment
Channel Power @xxx	20.5 (AnTargets+ PA_PS_L)	26.5 (AnTargets+ PA_PS_H)	dBm	PL1
Phased AOC DAC@PL0-19	0 (PA_DAC_L)	1023 (PA_DAC_H_		Calculated DAC value for each PL
Phased OFS High/Mid/Low DAC	0 (PA_OFS_L)	255 (PA_OFS_H)		Calculated OFS Value for each Power Range
Phased Sub-band1-5 slope	-32767 (PA_RBGAIN_L)	32767 (PA_RBGAIN_H)		sub-band linear interpolation slope
Phased Sub-band1-5 offset	-32767 (PA_RBOFFSET_L)	32767 (PA_RBOFFSET_H)		sub-band linear interpolation slope

Table 19. GSM850 PA Phasing Test Limit

Parameter	Low Limit	High Limit	Unit	Comment
High Power Range 1	28 (AnTargets+ PA_PS_L)	32 (AnTargets+ PA_PS_H)	dBm	PL5 (TXLevels for RefChan)
High Power Range 2	23	29	dBm	PL6
High Power Range 3	20	24	dBm	PL7
Mid Power Range 1	21	25	dBm	PL10
Mid Power Range 2	15.5	19.5	dBm	PL11
Mid Power Range 3	10	14	dBm	PL12
Low Power Range 1	12	16	dBm	PL15
Low Power Range 2	7	11	dBm	PL16
Low Power Range 3	2	6	dBm	PL17
Channel Power @xxx	23 (AnTargets+ PA_PS_L)	29.5 (AnTargets+ PA_PS_H)	dBm	PL6
Phased AOC DAC@PL0-19	0 (PA_DAC_L)	1023 (PA_DAC_H)		Calculated DAC value for each PL
Phased OFS High/Mid/Low DAC	0 (PA_OFS_L)	255 (PA_OFS_H)		Calculated OFS Value for each Power Range
Phased Sub-band1-5 slope	-32767 (PA_RBGAIN_L)	32767 (PA_RBGAIN_H)		Sub-band linear interpolation slope
Phased Sub-band1-5 offset	-32767 (PA_RBOFFSET_L)	32767 (PA_RBOFFSET_H)		Sub-band linear interpolation slope

Table 20. DCS/PCS PA Phasing Verification

Parameter	Low Limit	High Limit	Unit	Comment
Power Level 0	28 (PA_PL_L)	32 (PA_PL_H)	dBm	PL0 (RefChan)
Power Level 1	25	31	dBm	PL1
Power Level 2	23	29	dBm	PL2
Power Level 3	21	27	dBm	PL3
Power Level 4	19	25	dBm	PL4
Power Level 5	17	23	dBm	PL5
Power Level 6	15	21	dBm	PL6
Power Level 7	13	19	dBm	PL7
Power Level 8	11	17	dBm	PL8
Power Level 9	8	16	dBm	PL9
Power Level 10	6	14	dBm	PL10
Power Level 11	4	12	dBm	PL11
Power Level 12	2	10	dBm	PL12
Power Level 13	0	8	dBm	PL13
Power Level 14	-3	7	dBm	PL14
Power Level 15	-5	5	dBm	PL15
Power Level 16	-5	5	dBm	PL16
Power Level 17	-5	5	dBm	PL17
Power Level 18	-5	5	dBm	PL18
Power Level 19	-5	5	dBm	PL19
Channel Power @Chxxxx	25	31	dBm	PL1 (Test_Ch)

6.1.4 Time Mask Phasing

Time Mask phasing is performed to obtain an optimal Error/Proportional Gain control applied in the PAC closed loop system. An optimal Error/Proportional Gains results in generating a smooth PA ramp with minimal switching transient. A Control Gain (PS) is first calculated from the ratio between the PWR slope and PWRDAC (the DAC controlling the PWR) slope. Then the product of PS and Error/Proportional Gain should be bounded by a scalar K, where K is pre-set to an optimal value for a best time mask.

Two sets of Error/Proportional Gain (Error1/Prop1 and Error2/Prop2) are derived during phasing at the reference channel. Error1/Prop1 Gain setting is used for power ramping. Error2/Prop2 Gain is used after ramping.

Time Mask phasing also determines the ACC_INIT values applied in each power range. ACC_INIT is the initial accumulator value for the PAC when enabled. ACC_INIT is calculated as the offset coefficient obtained from a 2nd order polynomial equation and scaled by a scalar K_{ACC}.

6.1.4.1 Time Mask Phasing Procedure

1. Power up the phone.
2. Run the PPT application with the standard hardware configuration.
3. Select Phasing in **Application type**, and **Time Mask Phasing** at Option functions.
4. Click **Initialize Test Set** to initialize the test set.
5. Click **Detect** to set up the PC–phone connection, and select the phone type and the test frequency band (or bands).
6. Click **Start** to start phasing.
7. During phasing, the phone sends out bursts of signal at pre-determined power levels. The transmitted power (minus the loss in the cable) is measured by the test set. The best Error1 Gain, Prop1 Gain, Error2 Gain, and Prop2 Gain are calculated for each power level.
8. The phase result is then stored in the phone.
9. Click **Restart** to restart the phone when the test is finished.

6.1.4.2 Display During Time Mask Phasing

When Time Mask phasing starts, it first backs up the PA phasing table on the phone before loading the phone with the default PA table in the database. Then the output power of the phone at three power levels in each of the High, Middle, and Low Power Range are measured based on the default DAC values and displayed together with the test limits.

ACC_INIT HIGH/MID/LOW as well as ERROR1/PROP1/ERROR2/PROP2 Gain at each power level are calculated and displayed.

After Time Mask phasing, you are prompted to accept or not accept the phasing results. If your reject the result, the original PA phasing table is restored onto the phone. If you accept the phased result, the original PA phasing table with the parameters associated with Time Mask phasing updated is stored.

Table 21. EGSM Time Mask Phasing Test Limit

Parameter	Low Limit	High Limit	Unit	Comment
High Power Range 1	29 (AnTargets+ PA_PS_L)	33 (AnTargets+ PA_PS_H)	dBm	PL5 (TXLevels for RefChan)
High Power Range 2	23.5	29.5	dBm	PL6
High Power Range 3	20	24	dBm	PL7
Mid Power Range 1	21	25	dBm	PL10
Mid Power Range 2	15.5	19.5	dBm	PL11
Mid Power Range 3	10	14	dBm	PL12

Table 21. EGSM Time Mask Phasing Test Limit (continued)

Parameter	Low Limit	High Limit	Unit	Comment
Low Power Range 1	12	16	dBm	PL15
Low Power Range 2	7	11	dBm	PL16
Low Power Range 3	2	6	dBm	PL17
High Range 1 PWRDAC	0 (PA_PWRDAC_L)	1023 (PA_PWRDAC_H)		PWRDAC value
High Range 2 PWRDAC	0	1023		
High Range 3 PWRDAC	0	1023		
Mid Range 1 PWRDAC	0	1023		
Mid Range 2 PWRDAC	0	1023		
Mid Range 3 PWRDAC	0	1023		
Low Range 1 PWRDAC	0	1023		
Low Range 2 PWRDAC	0	1023		
Low Range 3 PWRDAC	0	1023		
Channel Power @xxx	23.5 (AnTargets+ PA_PS_L)	29.5 (AnTargets+ PA_PS_H)	dBm	PL6
Phased ACC INIT HIGH/MID/LOW	0 (PA_ACC_L)	1023 (PA_ACC_H)		The calculated ACC INIT value for each range
Phased ERROR1/2 Gain @PL0-19	0 (PA_ERR1/2_L)	12 (PA_ERR1/2_H)		The calculated Error1,Error2 Gain for each power level
Phased Prop1/2 Gain @PL0-19	0 (PA_PROP1/2_L)	12 (PA_PROP1/2_H)		The calculated Prop1,Prop2 Gain for each power level

Table 22. GSM850 Time Mask Phasing Test Limit

Parameter	Low Limit	High Limit	Unit	Comment
High Power Range 1	28 (AnTargets+ PA_PS_L)	32 (AnTargets+ PA_PS_H)	dBm	PL5 (TXLevels for RefChan)
High Power Range 2	23	29	dBm	PL6
High Power Range 3	20	24	dBm	PL7
Mid Power Range 1	21	25	dBm	PL10
Mid Power Range 2	15.5	19.5	dBm	PL11
Mid Power Range 3	10	14	dBm	PL12
Low Power Range 1	12	16	dBm	PL15
Low Power Range 2	7	11	dBm	PL16

Table 22. GSM850 Time Mask Phasing Test Limit (continued)

Parameter	Low Limit	High Limit	Unit	Comment
Low Power Range 3	2	6	dBm	PL17
High Range 1 PWRDAC	0 (PA_PWRDAC_L)	1023 (PA_PWRDAC_H)		PWRDAC value
High Range 2 PWRDAC	0	1023		
High Range 3 PWRDAC	0	1023		
Mid Range 1 PWRDAC	0	1023		
Mid Range 2 PWRDAC	0	1023		
Mid Range 3 PWRDAC	0	1023		
Low Range 1 PWRDAC	0	1023		
Low Range 2 PWRDAC	0	1023		
Low Range 3 PWRDAC	0	1023		
Channel Power @xxx	23 (AnTargets+ PA_PS_L)	29 (AnTargets+ PA_PS_H)	dBm	PL6
Phased ACC INIT HIGH/MID/LOW	0 (PA_ACC_L)	1023 (PA_ACC_H)		The calculated ACC INIT value for each range
Phased ERROR1/2 Gain @PL0-19	0 (PA_ERR1/2_L)	12 (PA_ERR1/2_H)		The calculated Error1,Error2 Gain for each power level
Phased Prop1/2 Gain @PL0-19	0 (PA_PROP1/2_L)	12 (PA_PROP1/2_H)		The calculated Prop1,Prop2 Gain for each power level

Table 23. DCS/PCS Time Mask Phasing Test Limit

Parameter	Low Limit	High Limit	Unit	Comment
High Power Range 1	26 (AnTargets+ PA_PS_L)	30 (AnTargets+ PA_PS_H)	dBm	PL0 (TXLevels for RefChan)
High Power Range 2	20.5	26.5	dBm	PL1
High Power Range 3	17	21	dBm	PL2
Mid Power Range 1	19	23	dBm	PL5
Mid Power Range 2	13	17	dBm	PL6
Mid Power Range 3	7	11	dBm	PL7
Low Power Range 1	9	13	dBm	PL10
Low Power Range 2	3	7	dBm	PL11
Low Power Range 3	-2	2	dBm	PL12

Table 23. DCS/PCS Time Mask Phasing Test Limit (continued)

Parameter	Low Limit	High Limit	Unit	Comment
High Range 1 PWRDAC	0 (PA_PWRDAC_L)	1023 (PA_PWRDAC_H)		PWRDAC value
High Range 2 PWRDAC	0	1023		
High Range 3 PWRDAC	0	1023		
Mid Range 1 PWRDAC	0	1023		
Mid Range 2 PWRDAC	0	1023		
Mid Range 3 PWRDAC	0	1023		
Low Range 1 PWRDAC	0	1023		
Low Range 2 PWRDAC	0	1023		
Low Range 3 PWRDAC	0	1023		
Channel Power @xxx	20.5 (AnTargets+ PA_PS_L)	26.5 (AnTargets+ PA_PS_H)	dBm	PL6
Phased ACC INIT HIGH/MID/LOW	0 (PA_ACC_L)	1023 (PA_ACC_H)		The calculated ACC INIT value for each range
Phased ERROR1/2 Gain @PL0-19	0 (PA_ERR1/2_L)	12 (PA_ERR1/2_H)		The calculated Error1,Error2 Gain for each power level
Phased Prop1/2 Gain @PL0-19	0 (PA_PROP1/2_L)	12 (PA_PROP1/2_H)		The calculated Prop1,Prop2 Gain for each power level

Table 24. EGSM/GSM850/DCS/PCS Time Mask Phasing Test Limit

Parameter	Low Limit	High Limit	Unit	Comment
TimeMask@startPL-stopPL	0 (High Low limits are specified for each PL across the time axis)	0 (In case of failure, the high/low limit of the failure point is reported)		Check the TimeMask against the specification in `i2xx_TestLimits` TM_xxxxx
TimeMask@CHxxx	0	0		Check the Timemask across frequency

Note: For EGSM, startPL = 5, stopPL =19
For GSM850 (Power Class 5), startPL = 7, stopPL =19
For DCS/PCS, startPL = 0, stopPL =15

6.1.5 Dual Port Gain Phasing

Dual Port Gain phasing determines values for the Dual Port Gain (DP GAIN) settings in the PA table that results in acceptable phase error performance. The variation in RMS phase error across each band is known, as well as the shape of the RMS phase error versus DP GAIN Value curve for each band. However, the ideal DP GAIN value varies between phones. The dual port phasing procedure is to write approximate values to the phone and measure RMS phase error. Default DP GAIN values are written to sub-bands across the frequency band. After measuring the RMS phase error across the band, the best DP GAIN value/channel combination is found, and phased values for each sub-band are calculated based on the known phone performance in each band.

6.1.5.1 Dual Port Gain Phasing Procedure

1. Power up the phone.
2. Run the PPT application with the standard hardware configuration.
3. Select Phasing in **Application type**, and **Dual Port Gain Phasing** at **Option** functions.
4. Click **Initialize Test Set** to initialize the test set.
5. Click **Detect** to set up the PC–phone connection, and select the phone type and the test frequency band (or bands).
6. Click **Start** to start phasing.
7. During phasing, the phone sends out bursts of signal at pre-determined power levels. The transmitted power (minus the loss in the cable) is measured by the test set. The best Error1 Gain, Prop1 Gain, Error2 Gain, and Prop2 Gain are calculated for each power level.
8. The phase result is then stored in the phone.
9. Click **Restart** to restart the phone when the test is finished.

6.1.5.2 Display during Dual Port Gain Phasing

When Dual Port Gain phasing starts, it first backs up the PA phasing table on the phone before loading the phone with the default PA table in the database. The RMS phase error of the MS transmitted signal at various channels is measured and displayed together with the test limits.

Dual Port Gain for each of the sub-bands is calculated and displayed.

If verification is selected, the residual RMS phase error is measured after phasing.

After Time Mask phasing, you are prompted to accept or not accept the phasing results. If the result is rejected, the original PA phasing table is restored onto the phone. If the phased result is accepted, the original PA phasing table with the parameters associated with Dual Port Gain phasing updated is stored.

NOTE

It is possible to measure very high RMS phase error, or to fail taking any measurement, in one or more sub-bands and still be able to phase the phone properly.

Table 25. EGSM Dual Port Gain Phasing Test Limit

Parameter	Low Limit	High Limit	Unit	Comment
RMS Phase Error @ CHxx	0 (2*PA_PhaseErr_L)	10 (2*PA_PhaseErr_H)	Degree	Measured RMS phase error at the reference channel of each sub-band (Channels)
Phased DP Gain @sub-band1-5	0 (PA_DP_L)	63 (PA_DP_H)		Calculated Dual Port Gain for each sub-band

Table 26. EGSM Dual Port Gain Phasing Verification

Parameter	Low Limit	High Limit	Unit	Comment
RMS Phase Error @ CHxx	0 (PA_PhaseErr_L)	5 (PA_PhaseErr_H)	Degree	Residual RMS phase error after phasing (Test_Ch)

Table 27. DCS Dual Port Gain Phasing Test Limit

Parameter	Low Limit	High Limit	Unit	Comment
RMS Phase Error @ CHxx	0 (2*PA_PhaseErr_L)	10 (2*PA_PhaseErr_H)	Degree	measured RMS phase error at the reference channel of each sub-band (Channels)
Phased DP Gain @sub-band1-5	0 (PA_DP_L)	63 (PA_DP_H)		calculated Dual Port Gain for each sub-band

Table 28. DCS Dual Port Gain Phasing Verification

Parameter	Low Limit	High Limit	Unit	Comment
rms Phase Error @ CHxx	0 (PA_PhaseErr_L)	5 (PA_PhaseErr_H)	Degree	Residual RMS phase error after phasing (Test_Ch)

6.1.6 IQ Balance Phasing

The purpose of IQ Balance phasing is to find out the gain and phase mismatch at one or two frequencies in the I and Q signal in the analog part of the IF section in the receiver. This result can be used by the on-chip gain/phase correction circuit to even out the gain and phase mismatch.

I and Q balancing is necessary for a VLIF/DCR type receiver. The gain and phase mismatch can create image signals which blocks the receiver in some cases. The IQ imbalance estimation is based on the image rejection ratio measured at one or two frequencies.

6.1.6.1 IQ Balance Phasing Procedure

1. Power up the phone.
2. Run the PPT application with the standard hardware configuration.

3. Select Phasing at the **Application type**, and IQ Balance Phasing at the **Option functions**.
4. Click **Initialize Test Set** to initialize the test set.
5. Click **Detect** to set up the PC–phone connection, and select the phone type and the test frequency band (or bands).
6. Click **Start** to start phasing.
7. During the phasing, the test set sends out carrier signals at various frequencies. The wanted signal power and the image signal power at these frequencies are measured by the phone and reported to the phasing tool. The image rejection ratios are calculated.
8. The gain and phase mismatch are calculated and stored in the phone.
9. Click **Restart** to restart the phone when the test is finished.

6.1.6.2 Display during IQ Balance Phasing

During IQ Balance phasing, two offset carriers, one from high sub-band and one from low sub-band are generated at the test set consequently, and the gain and phase mismatches in the receiver are estimated and displayed for the two sub-bands.

No verification is supported in this release for IQ Balance phasing.

Table 29. EGSM IQ Balance Test Limit

Parameter	Low Limit	High Limit	Unit	Comment
Phase mismatch	-10 (IQ_PHASE_L)	10 (IQ_PHASE_H)	Degree	Estimated phase mismatch
Gain mismatch	0.5 (IQ_GAIN_L)	1.5 (IQ_GAIN_H)		Estimated gain mismatch

Table 30. DCS IQ Balance Test Limit

Parameter	Low Limit	High Limit	Unit	Comment
Phase mismatch	-10 (IQ_PHASE_L)	10 (IQ_PHASE_H)	Degree	Estimated phase mismatch
Gain mismatch	0.5 (IQ_GAIN_L)	1.5 (IQ_GAIN_H)		Estimated gain mismatch

6.1.7 AGC Phasing

Automatic Gain Control (AGC) adjusts the receiver amplifier gain automatically based on the input signal amplitude, allowing the input signal level of the receiver amplifier to be maintained within an allowable dynamic range. It also allows the phone software to determine the strength of the received signal.

The AGC control in the platform is distributed over several stages in the receiver front end including the LNA gain. In the current AGC scheme, the gain for each stage is fixed at several values, and they are switched according to the input signal level in order to maintain the signal within an allowable dynamic range.

In AGC phasing, the LNA gain characteristic is modeled by a polynomial while other gain stages are assumed to be linear. The AGC phasing process is used to find out the coefficient of the polynomial. Test tones at different power levels are fed into the receiver from the test set for the DAC value calibration. The frequency variation of the AGC is compensated by a DAC offset value, which is also found while doing the AGC phasing.

6.1.7.1 AGC Phasing Procedure

1. Power up the phone.
2. Run the PPT application with the standard hardware configuration.
3. Select Phasing at the **Application type**, and AGC Phasing at the **Option functions**.
4. Click **Initialize Test Set** to initialize the test set.
5. Click **Detect** to set up the PC–phone connection and select the phone type and the test frequency band (or bands).
6. Click **Start** to start phasing.
7. The phone first camps on the test set, and the test set generates a signal at some pre-determined power level. The phone measures the power and report it to the phasing software.
8. The phasing software calculates the gain characteristic and then stores it in the phone.
9. The phasing result is then tested.
10. Click **Restart** to restart the phone when the test is finished.

6.1.7.2 Display during AGC Phasing

During phasing, the received power level is measured at four input power ranges (0/1, 2, 3, and 4) at the reference channel based on the default DAC values defined in the database. Based on the difference between the input power and the measured power, the DAC programming code which is controlling the LNA gain is then calculated for each power range. The programming code for range 0/1 is always zero and is not displayed. There is also an offset code associated with each programming code to compensate the quantization error in the programming code. There is an offset code for each selected test channel to compensate the channel variation across the band.

If the post verification is selected in the verification option of the **Configure** menu, testing is performed after phasing to verify the phasing result. The errors in the reported receive power at selected power levels are displayed. Pass or fail results are shown depending whether the result is within the limits.

Table 31. EGSM AGC Phasing Test Limit

Parameter	Low Limit	High Limit	Unit	Comment
Baseband Power	(RF_Input_Power - AGC_PWR_ERR_L)	(RF_Input_Power + AGC_PWR_ERR_H)	dBm	Estimated antenna input power (RF_Input_Power)
Programming code 2	0 (AGC_PGC2_L)	63 (AGC_PGC2_H)	DAC	DAC value for range 2
Programming code 3	0 (AGC_PGC3_L)	63 (AGC_PGC3_H)	DAC	DAC value for range 3

Table 31. EGSM AGC Phasing Test Limit (continued)

Parameter	Low Limit	High Limit	Unit	Comment
Programming code 4	0 (AGC_PGC4_L)	63 (AGC_PGC4_H)	DAC	DAC value for range 4
Offset code 0/1	0 (AGC_OFC1_L)	255 (AGC_OFC1_H)		Offset value for range 0/1
Offset code 2	0 (AGC_OFC2_L)	255 (AGC_OFC2_H)		Offset value for range 2
Offset code 3	0 (AGC_OFC3_L)	255 (AGC_OFC3_H)		Offset value for range 3
Offset code 4	0 (AGC_OFC4_L)	255 (AGC_OFC4_H)		Offset value for range 4
Channel Power xxxx	(RF_Input_Power[Ch_Var_Power_Index] - AGC_PWR_ERR_L)	(RF_Input_Power[Ch_Var_Power_Index] + AGC_PWR_ERR_H)	dBm	Estimated power at channel xxxx (AGCCalcChannels, RF_Input_Power[Ch_Var_Power_Index])
Channel xxxx offset	0 (AGC_CH_OFC_L)	255 (AGC_CH_OFC_H)		Offset value for ch xxxx (AGCCalcChannels)

Table 32. EGSM AGC Phasing Verification

Parameter	Low Limit	High Limit	Unit	Comment
Estimate Power	input power -2 (AGC_V_P0_L)	input power +2 (AGC_V_P0_H)	dBm	Estimated antenna input power (Test_Start_Power+ n*Test_Step) (for input power >AGC_V_P0)
Estimate Power	input power -3 (AGC_V_P1_L)	input power +2 (AGC_V_P1_H)	dBm	Estimated antenna input power (Test_Start_Power+ n*Test_Step) (for AGC_V_P0>= input power > AGC_V_P1)
Estimate Power	input power - 4 (AGC_V_P2_L)	input power +2 (AGC_V_P2_H)	dBm	Estimated antenna input power (Test_Start_Power+ n*Test_Step) (for AGC_V_P1>= input power > AGC_V_P2)

Table 33. DCS AGC Phasing Test Limit

Parameter	Low Limit	High Limit	Unit	Comment
Baseband Power	(RF_Input_Power - AGC_PWR_ERR_L)	(RF_Input_Power + AGC_PWR_ERR_H)	dBm	Estimated antenna input power (RF_Input_Power)
Programming code 2	0 (AGC_PGC2_L)	63 (AGC_PGC2_H)	DAC	DAC value for range 2
Programming code 3	0 (AGC_PGC3_L)	63 (AGC_PGC3_H)	DAC	DAC value for range 3

Table 33. DCS AGC Phasing Test Limit (continued)

Parameter	Low Limit	High Limit	Unit	Comment
Programming code 4	0 (AGC_PGC4_L)	63 (AGC_PGC4_H)	DAC	DAC value for range 4
Offset code 0/1	0 (AGC_OFC1_L)	255 (AGC_OFC1_H)		Offset value for range 0/1
Offset code 2	0 (AGC_OFC2_L)	255 (AGC_OFC2_H)		Offset value for range 2
Offset code 3	0 (AGC_OFC3_L)	255 (AGC_OFC3_H)		Offset value for range 3
Offset code 4	0 (AGC_OFC4_L)	255 (AGC_OFC4_H)		Offset value for range 4
Channel Power xxxx	(RF_Input_Power[Ch_Var_Power_Index] - AGC_PWR_ERR_L)	(RF_Input_Power[Ch_Var_Power_Index] + AGC_PWR_ERR_H)	dBm	Estimated power at channel xxxx (AGCCalcChannels, RF_Input_Power[Ch_Var_Power_Index])
Channel xxxx offset	0 (AGC_CH_OFC_L)	255 (AGC_CH_OFC_H)		Offset value for ch xxxx (AGCCalcChannels)

Table 34. DCS AGC Phasing Verification

Parameter	Low Limit	High Limit	Unit	Comment
Estimate Power	input power -2 (AGC_V_P0_L)	input power +2 (AGC_V_P0_H)	dBm	Estimated antenna input power (Test_Start_Power+ n*Test_Step) (for input power >AGC_V_P0)
Estimate Power	input power -3 (AGC_V_P1_L)	input power +2 (AGC_V_P1_H)	dBm	Estimated antenna input power (Test_Start_Power+ n*Test_Step) (for AGC_V_P0>= input power > AGC_V_P1)
Estimate Power	input power - 4 (AGC_V_P2_L)	input power +2 (AGC_V_P2_H)	dBm	Estimated antenna input power (Test_Start_Power+ n*Test_Step) (for AGC_V_P1>= input power > AGC_V_P2)

6.2 Regression Tests

Regression tests are performance tests that measure the performance of the phone while it is engaged in a call. In general, the emphasis for regression tests is on hardware performance and the reliability of the phones.

6.2.1 Regression Test User Interface

Figure 4 shows the main user interface for the regression tests.

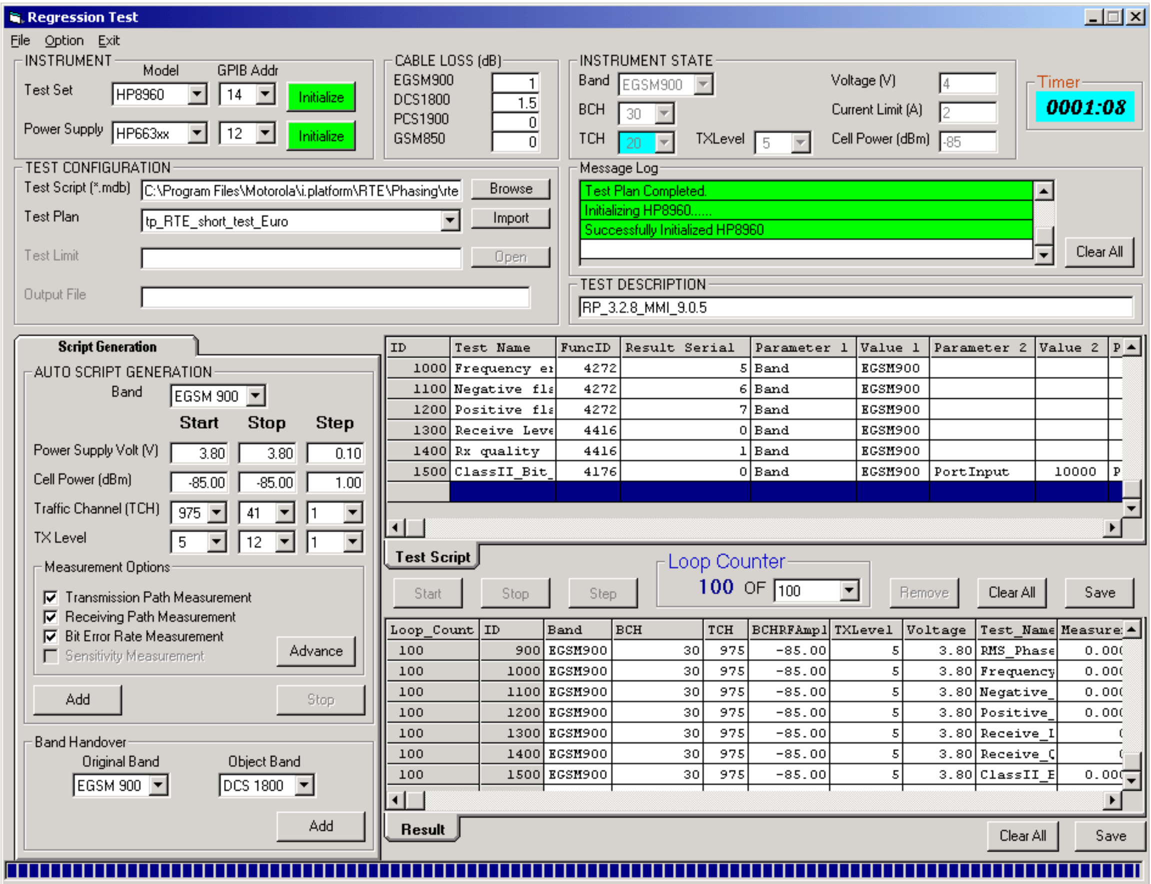


Figure 4. Regression Test User Interface

6.2.2 Pull-Down Menu

Table 35. Regression Test Pull-Down Menu

Item	Pull-Down Item	Function
File	Open database	Select a pre-saved test script (file extension is `.mdb`) to load into memory.
	Export result	Convert the saved result to an EXCEL-friendly format for plotting multiple TXLevel/Cell Power against channels. Click **Browse** to select a CSV (comma separated values list) file saved in regression test. Enter an output filename prefix in the textbox. It then reads the input CSV file and generate up to 42 output files, depending on the number of measurement items and bands in the input file. The output filenames are in the format of `[PREFIX]_[MEASUREMENT]_[BAND].csv`. These output files are ready for EXCEL to plot different types of graphs for analysis.

Table 35. Regression Test Pull-Down Menu (continued)

Item	Pull-Down Item	Function
Option	Settings	**General Settings**: To customize the script generation to enable MO/MT call and pause during regression test. Also, to customize each measurement batch (TX, RX, BER) to represent multiple selectable unit-measurements. **Equipment Initial Settings (Voice Call)**: To customize the equipment settings, for example, frequency band, base station power, broadcast channel, traffic channel, cable losses, etc., when the equipment is being initialized. Cable losses are in decibels (dB) for each frequency band. Positive values indicate attenuation of the cable; for example, if cable loss at EGSM band is 1.2 dB, the cable loss setting is entered as “1.2”.
Exit	Not available	Exit and close the Regression Test session.

Figure 5 shows an example of an export result output graph for a GSM peak power against Channel (with all 15 TX levels in different series).

Figure 6 shows an example of an export result output graph for a DCS frequency error against Channel (with all 16 TX levels in different series).

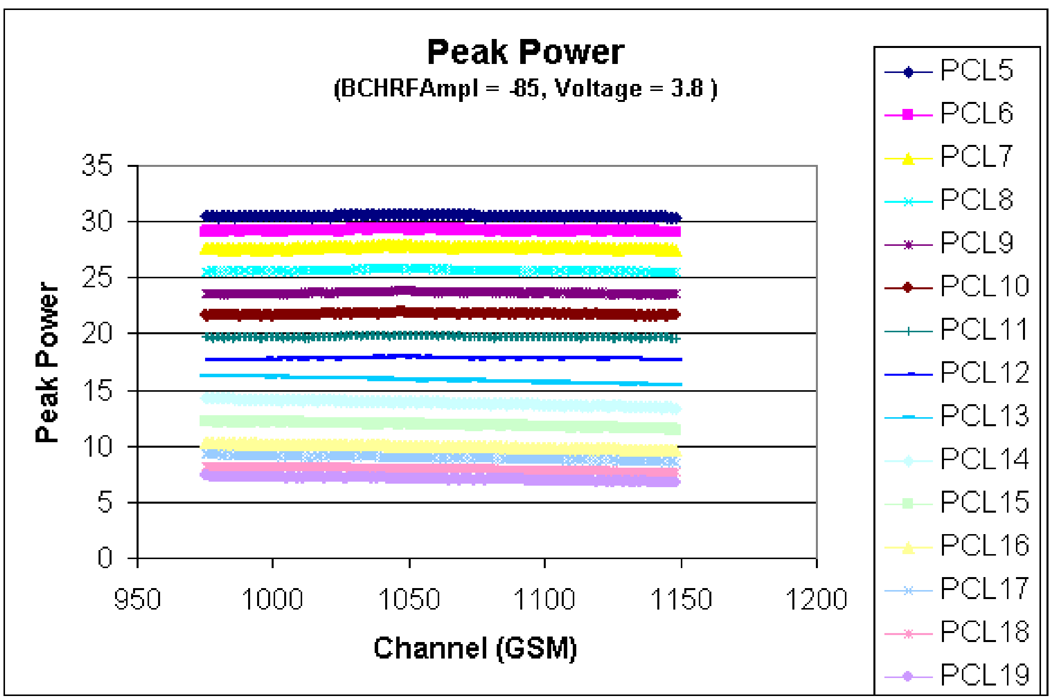


Figure 5. Example Output Graph—GSM Peak Power

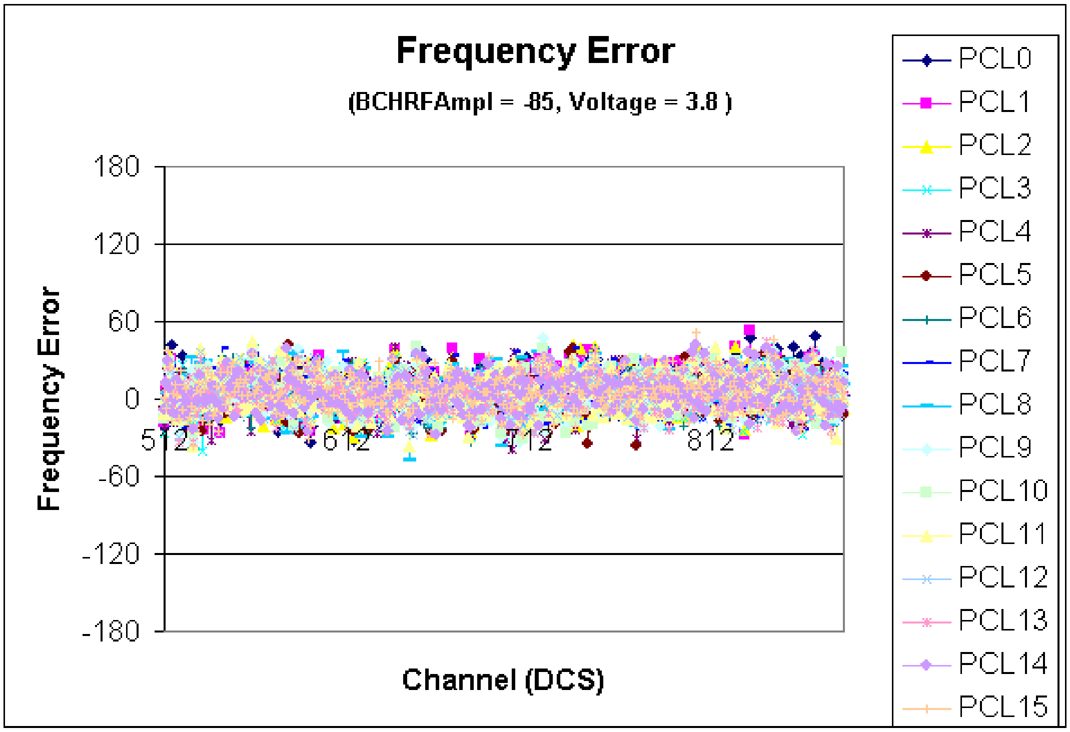


Figure 6. Example Output Graph—DCS Frequency Error

6.2.3 Instrument Area

- Test Set
  — A GSM communication test set must be initialized before the Regression Test can remotely control the configuration of the GSM environment. The test set model and the GPIB address shown should match the test set before initialization.
- Power Supply
  — The initialization of the power supply is only required when the test case of the voltage control is added in the regression test. The power supply model and the GPIB address shown should match with the power supply before initialization.

6.2.4 Cable Loss Area

The Cable Loss area displays the cable loss of the each frequency band. Cable losses are set through the **Option** item in the pull-down menu. For details, refer to Section 6.2.2, “Pull-Down Menu,” on page 30. Cable losses are displayed in decibel (dB). Positive values indicate attenuation of the cable. For example, if the cable loss at the EGSM band is 1.2 dB, the cable loss setting should be entered as “1.2”.

6.2.5 Instrument State Area

The information shows the state of the power supply (if initialized) and the test set. The data updates according to the change state commands executed in the test script window (see later section). The information shown is read-only.

6.2.6 Test Configuration Area

- Test Script
  — The test script allows the input of a Microsoft Access database file, which usually comes with .mdb as the extension. It usually collects one or more tables as the test plans (see the Test Plan description below) for regression test. The test script file format is compatible to the .mdb file used in the Reference Final Test bundled in the Manufacturing Test Environment (MTE).
- Test Plan
  — The test plan allows the selection of the test plan in the MS Access table of the test script file. After loading the test script, the tool finds out all the appropriate test plans (tables), which is named with the prefix of `tp_`, for example, `tp_RTE_Short_Test`. This is a collection of unit test cases which are the commands to modify the test set BCH/TCH channels, to request for measurement data, or to adjust the power supply voltage.
  The regression test follows every command in the test plan to automatically finish all the equipment settings and measurements. Measurement results are shown in the Result area. The test plan table format is compatible with the Reference Final Test (RFT) bundled in the Manufacturing Test Environment (MTE). However, not every unit test case supported by RFT is available in the RTE regression test.
- Test Limit
  — This loads an external file, which defines the pass/fail criteria for each test measurement. (*This function is currently not available*).
- Output File
  — The output file defines the output filename of the measured data output file (in raw format). Raw data files are to be imported by MS Excel for graphical analysis. (*This feature is currently not available*).

6.2.7 Message Log Area

The **Message Log** area displays the current status of the regression test. Error messages are highlighted red.

6.2.8 Script Generation Area

The Script Generation area provides a simple way to automatically generate test cases based on the predefined criteria. These criteria include the following items:

- Frequency band
- Power supply voltage

- Base station power
- Traffic channel
- Transmit power level

Table 36. Specifications of Auto Script Generation Parameters

Specifications, Criteria	Supported Range				Min. step size	Unit
	EGSM900	DCS1800	PCS1900	GSM850		
Power supply voltage	0.00 to 5.00				±0.01	Volt
Base station power	–120.00 to –50.00				±0.01	dBm
Traffic Channel	975 to 1023, 0 to 124	512 to 885	512 to 810	128 to 251	1	
Transmit power level	0 to 15	5 to 19	0 to 15	7 to 19	1	

With different combinations of starting and stopping values, and the step size of the above parameters, you can automatically generate a scanning mechanism over the entire EGSM and DCS bands. Figure 7 shows a simplified flow chart of the auto script generation process for reference.

In the measurement option, the following items are available.

- Transmission path
- Receiving path
- Bit Error Rate (BER)
- Sensitivity (*currently not available*)

Any combinations of the above items can be included in the measurement part, but at least one of them must be selected. Table 37 summarizes the results available from each of the measurement options.

Table 37. Regression Test Measurement Options

Options	Measurement results
Transmission path	Peak power (dBm) Time mask error (%) Time mask positive flatness (dB) Time mask negative flatness (dB) Frequency error (Hz) Peak phase error (degree) RMS phase error (degree) Timing error (symbol) ORFS (0=pass / 1=fail)
Receiving path	Receive power level Receive quality
Bit Error Rate	Class II BER (%) Class Ib BER (%) Cyclic Redundancy Check (%)
Sensitivity	• Sensitivity (***currently not available***)

After selection of band, start/stop/step criteria, and the measurement options, press the **Add** button to generate all the required scripts.

NOTE

The **Add** button only appends newly generated test cases to the end of those test scripts listed in memory.

When script generation is in progress, the **Stop** button can be used to cancel the generation progress. In the **Band Handover** frame, it allows you to append a band handover test case to the test scripts; thus, allowing the test scripts to extend the coverage from one frequency band to another one without loading another test script for another band.

After the execution of the band handover test case, the traffic channel of the object band is defined in the **Equipment Settings** in the pull-down menu, or the last used channel in the object band if the channel is modified after test set initialization. After appending this band handover test case, you can append test scripts for the object band through the **Auto Script Generation** frame; thus, making the test scripts continue across more than one frequency band.

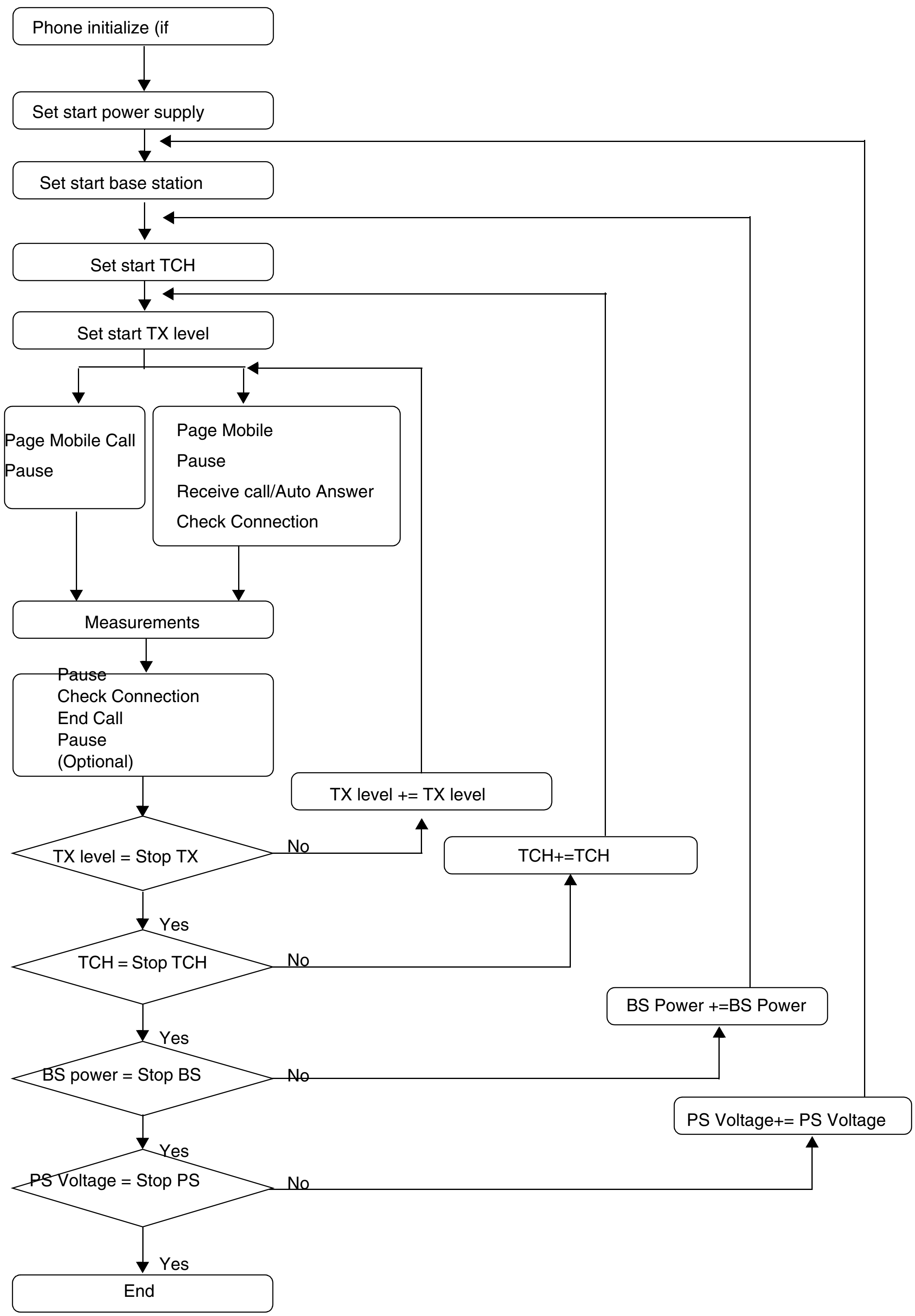


Figure 7. Autoscript Generation Process Regression Test Flowchart

6.2.9 Test Script Data Grid

After you load the test script (.mdb) file, and import the test case (table), the data grid is updated with the unit test cases (defined by a unique function ID), which display as rows of data. You can highlight each row can so the **Step** button can be clicked to immediately execute the function defined by its function ID.

Press the **Start** button to reset the loop counter to 1 and reset the timer to 0000:00. It then initiates an automatic execution of unit test cases from the current highlighted test case to the last one. After the last test case is executed, the loop counter is increased by 1, and the next test case to be executed becomes the previously highlighted one when the **Start** button was pressed. This process continues until the loop counter equals the user's preset counter. The timer takes the elapsed time until the last test case of the last loop is completed (unless you press the **Stop** button). The row being executed is highlighted during the processing, and the instrument state area updates accordingly.

When you press the **Stop** button, regression test control returns to you after the current unit test case is finished.

The Loop Counter defines the number of loops for the test script to run. Press the **Remove** button to erase the currently selected unit test case from the memory. Right-clicking the **Remove** button erases the unit test cases from the currently selected to the last one.

Press the **Clear All** button to clear all unit test cases loaded in the memory.

Press the **Save** button to save all test scripts listed in the memory to a selected `.mdb` file as a table. The name of the table shall have the prefix of `tp_` so that it is recognized as a test plan for the regression test.

NOTE

To enable a new `.mdb` file to be read by the regression test, the following steps to modify the properties of the file are required.

1. Open a new database (`*.mdb`) using Microsoft Access.
2. On the **Tools** menu, click **Options**.
3. On the **View** tab, check the **System objects** box.
4. Click **OK** to finish.
5. From the **Tools** menu, choose **Security**, then click **User and Group Permissions**.
6. On the **Permissions** tab, select **MsysObjects** in **Object name**, then check the **Read Design** box.
7. Click **OK** to finish.

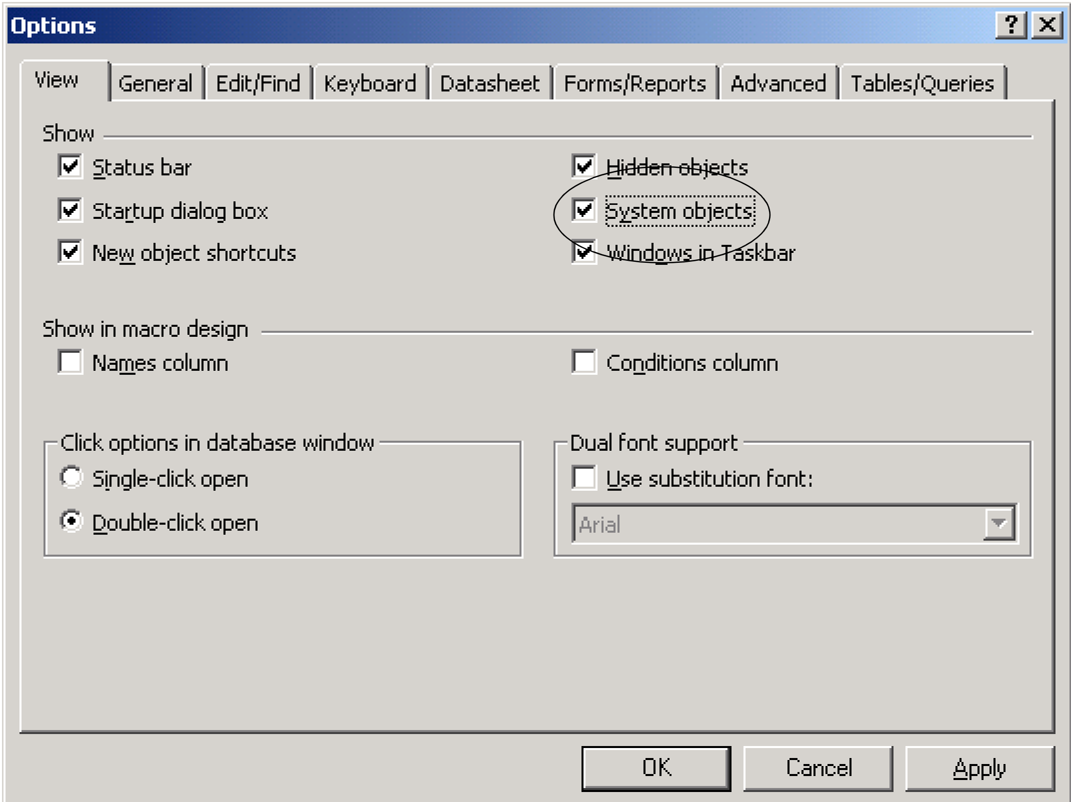


Figure 8. New .mdb File Property Setting—Options

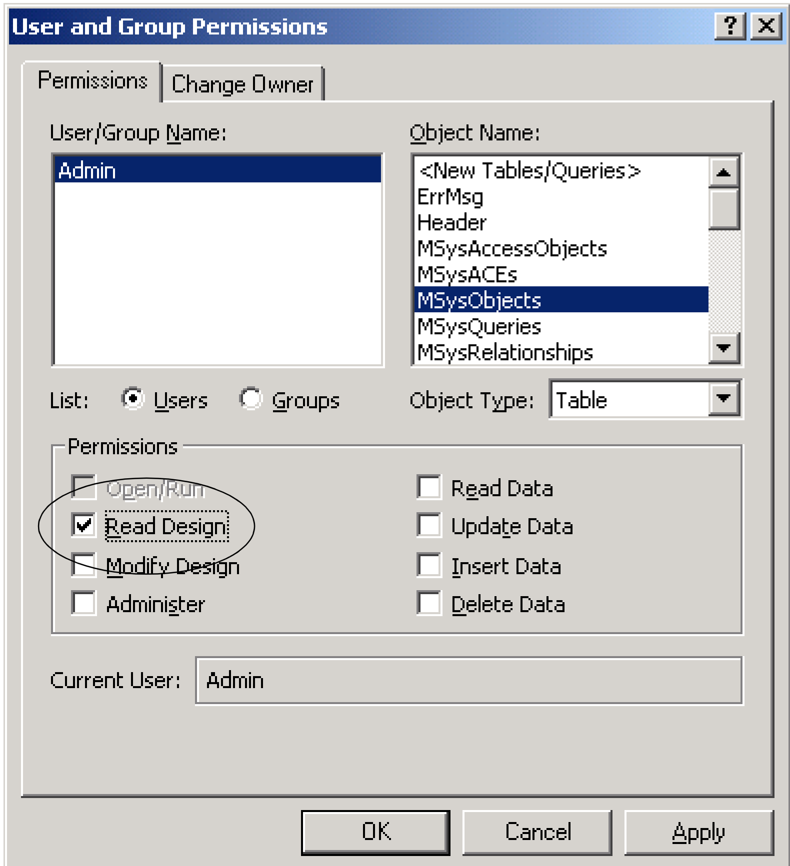


Figure 9. New .mdb File Property Setting (User and Group Permissions)

6.2.10 Result Data Grid

The measurement results generated by the unit test cases are shown in this area. However, some unit test cases do not appear, such as set channel. Only some of the unit test cases return data and appear in this result area.

The **Save** button is used to save all the measurement results to a Comma Separated Value (CSV) file, which consists of rows of data separated by commas. This file can be directly imported into MS Excel for further data analysis. Each column shown in the result data grid is a separate column in Excel. A Microsoft Excel auto-filter function can be used to help categorize and plot a group of data, such as peak power, for graphical analysis.

Press the **Clear All** button to clear the measurement results from the memory.

6.2.11 Recommended Procedures to Run the Regression Test

1. Specify the GSM test set model and GPIB address to initialize the test set.
2. Set appropriate cable loss for required frequency bands.
3. [*Optional*] If the unit test cases in the regression test involve the change of power supply voltage, specify the programmable power supply model and GPIB address to initialize the power supply.

4. Browse to specify the test script file name (`.mdb` file).
5. Select the appropriate test plan (table in `.mdb` file prefixed with `tp_`) and import.
6. Test script is loaded into the memory and the test script data grid is updated (may take up to several minutes depending on the length of test script and PC processing power).
7. Insert a test SIM into the phone.
8. Power up the phone and connect it to the test set through an RF cable.
9. Wait for the phone to be camped with the test set.
10. Establish a call from the phone to the test set.
11. Highlight any unit test case for step-by-step execution, or start automatic execution. After the regression test, measurement results can be saved to a CSV file which can be opened in Microsoft Excel.
12. Access the auto-filter function in Excel: On the **Data** menu, select **Filter**, then click **Auto-filter**.

    The measurement results can be categorized by different criteria. Therefore, graphical analysis can be customized to plot graphs such as peak power at certain power levels against channel.

6.2.12 Recommended Procedures to Run Call Cycling Test in Regression Test

The Call Cycling Test is one of the test cases to evaluate the phone stability performance by means of making a large number of call set-ups and disconnections. This test must be accomplished by using test commands through the USB cable that connects the PC and the mobile phone, so the mobile can dial, receive, and end calls automatically without the manual intervention.

1. Specify the GSM test set model and GPIB address to initialize the test set.
2. Set the appropriate cable loss for the required frequency bands.
3. [*Optional*] If this applies to the unit test cases in the regression test that involve changing power supply voltage, specify the programmable power supply model and GPIB address to initialize the power supply.
4. Set the appropriate band, power supply voltage, cell power, TCH, and TX level in the **AUTO SCRIPT GENERATION** area.
5. Select one or more measurements (in the measurement option).
6. Click the **Advance** button to enable an MO/MT (Mobile Originated/Mobile Terminated) call, then select the appropriate options, such as the following:

    MO—Mobile originated: Initiates a call from the mobile side. Calls can be emergency calls (without a SIM card) or arbitrary numbers dialed.

    MT—Mobile terminated: Initiates a call from the test set side.

    f) Receive the call key code (for MT call setup only) or the auto-answer is handled by a mobile MMI. Key codes can be determined using the Test Command Tool (TCT).
    g) End the call key code (for call disconnection at the mobile side).
    h) Delay before the MT call is established (such as how long to wait while alerting).

i) Delay before measurements start (for example, the desired parameters need time to stabilize after call setup).

j) Delay between the time the measurements complete and when the call ends (for example, setting the desired call duration before call disconnection).

7. Click **OK** to confirm the settings.
8. Click **Add** to start the script generation. (This might take several minutes, depending on the length of the test script and PC processing power.)
9. [*Optional*] For non-emergency MO calls and MT call setup, insert the test SIM into the phone.
10. Turn on the phone, and connect it to the test set.
11. Wait for the phone to be camped with the test set.
12. Connect the phone and the PC using a USB cable.
13. Set the desired number of loops in the loop counter.
14. Highlight the first unit test case and start the automatic test execution.
15. After the regression test, save measurement results to a CSV file that can be opened by Microsoft Excel.
16. Access the auto-filter function in Excel: On the **Data** menu, select **Filter**, then click **Auto-filter**.

    The measurement results can be categorized by different criteria. Therefore, graphical analysis can be customized to plot graphs such as peak power at certain power levels against channel.

6.2.13 Sample Test Script

A sample test script is included in the PPT installation folder and the file name is `rte_rgt_testplan.mdb`.

6.2.14 Sample Test Plan

The following sample test plans (tables in `.mdb` file) are included in the sample test script (`.mdb`) file:

- tp_RTE_EGSM900_TchStep5
  - Measure across the EGSM900 band by stepping 5 channels.
- tp_RTE_DCS1800_TchStep10
  - Measure across the DCS1800 band by stepping 10 channels.
- tp_RTE_PCS1900_TchStep10
  - Measure across the PCS1900 band by stepping 10 channels.
- tp_RTE_GSM850_TchStep5
  - Measure across the GSM850 band by stepping 5 channels.
- tp_RTE_short_test_Euro
  - Quick test on EGSM900 (channels 2 and 122) and DCS1800 (channels 514 and 883) with band handover.
- tp_RTE_short_test_US

— Quick test on GSM850 (channels 250 and 130) and PCS1900 (channels 514 and 808) with band handover.

6.2.15 Customizing the Test Plan

Test plan editing features include the following:

- Loading/appending test plans
- Generating/appending test scripts by auto script generator
- Remove one test case from the test script
- Clear all test cases from the test script

The test plan (the table in the `.mdb` file) is compatible with the Reference Final Test bundled in MTE, and the specifications to define the unit test case can be referenced to the RFT user's manual.

You can also refer to the sample test plans discussed in previous sections. These include all the available function IDs. You should use the sample test plans as a basis for modifying your own test plans in Microsoft Access and Microsoft Excel. You can copy and insert unit test cases in an appropriate sequence to reflect customer needs. You might also need to change certain parameters for some function IDs to work properly, such as setting traffic channel number as a parameter for the set TCH function.

6.3 Measurements

Two measurement tests, listed in Table 38, are provided to gauge the competitiveness of the platform. Note that some tests require a special hardware setup.

Table 38. Measurement Tests

Test	Description	Refer to
DRX current measurement	Measures the current consumption of the phone in different operation modes.	Section 6.3.1, "DRX Current Measurement," on page 42
Desense measurement	Measures the sensitivity of the phone across the entire spectrum of the operation band(s).	Section 6.3.2, "De-sense Measurement," on page 55
GPRS 2TX measurement	Measures the ***Power*** versus ***Time*** waveform for all GPRS class mobile which is able to send 2 consecutive time slots within a frame.	Section 6.3.3, "GPRS 2TX Measurement," on page 60

6.3.1 DRX Current Measurement

The DRX current measurement test measures the current consumption of the phone in different operation modes, including current consumption in standby mode at DRX2 to DRX9, as well as current consumption in active mode with audio traffic at different transmit and receive power levels. The measurement yields a rough calculation of the standby time and talk time of the phone sustained by a battery. The DRX current measurement test can also capture the current waveform in standby mode or active mode.

6.3.1.1 DRX Current Measurement Hardware Setup

The hardware setup shown in Figure 10 is as follows:

1. Connect the GPIB cable between the GSM test set, power supply, and the PC. (The GPIB cable is not needed between the GSM test set and the PC if the GSM test set is to be operated manually.)
2. Connect the power line of the power supply to the battery connector of the phone.
3. Connect the coaxial cable between the GSM test set and shielded chamber (with antenna coupler).
4. Couple the phone to the GSM test set by putting it in the shielded chamber.

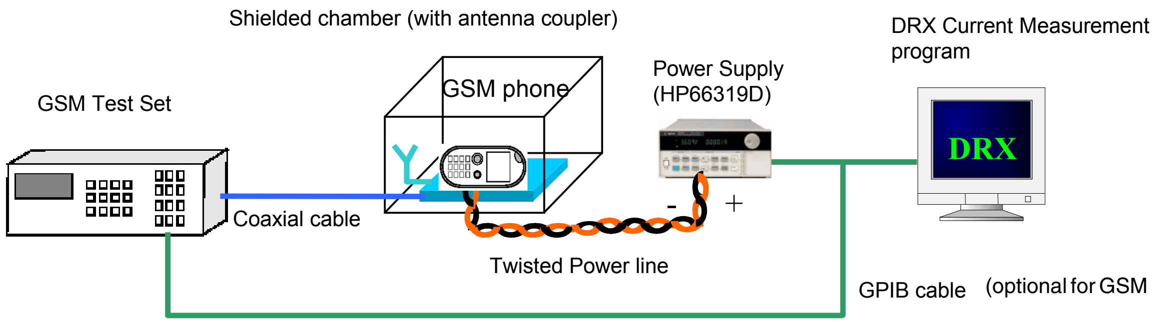


Figure 10. DRX Current Measurement Hardware Setup

6.3.1.2 DRX Current Measurement User Interface

Figure 11, Figure 12, and Figure 13 show the windows of each function of the DRX Current Measurement. Most parameter items are common to the three functions, but with some particular items dedicated for particular functions. For example, item 19: **Call Setting** is only available for the **Talk Current Measurement** function. Item 20: **Waveform Trigger Function** is only available for the **Current Waveform Capture** function.

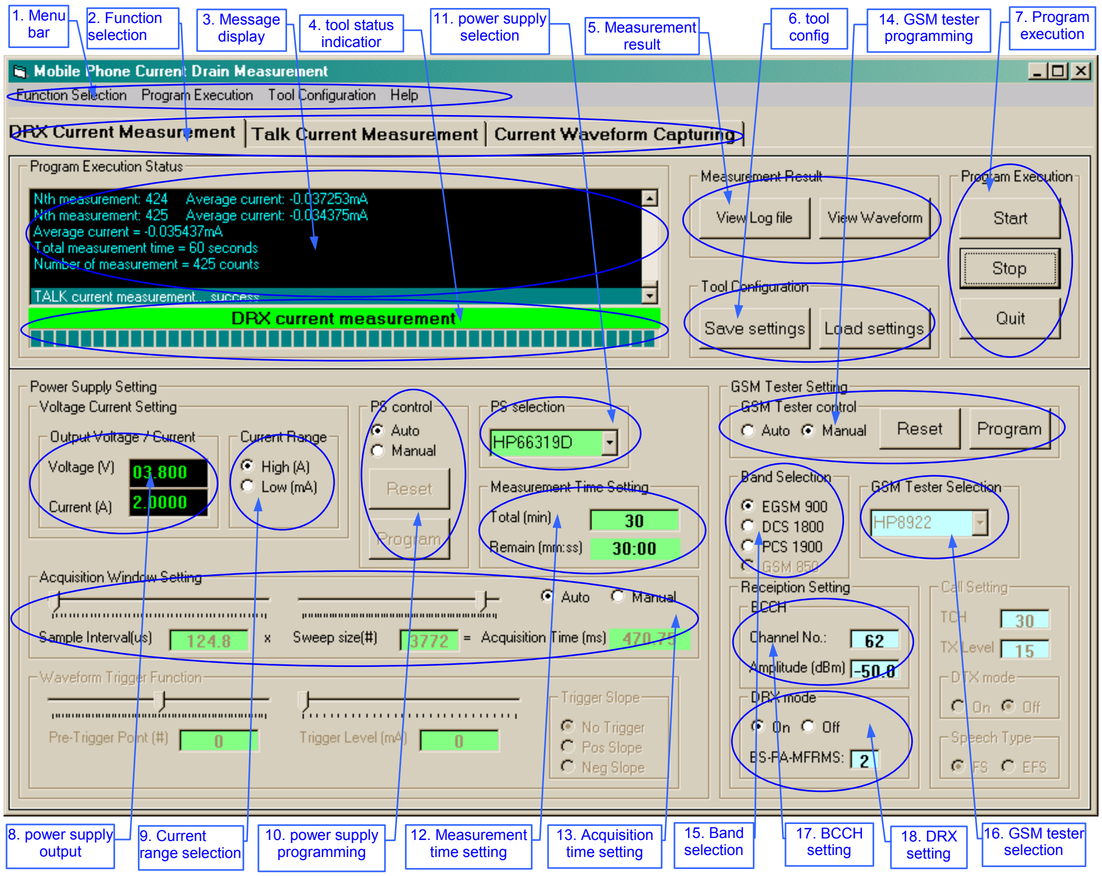


Figure 11. Standby Current Measurement User Interface

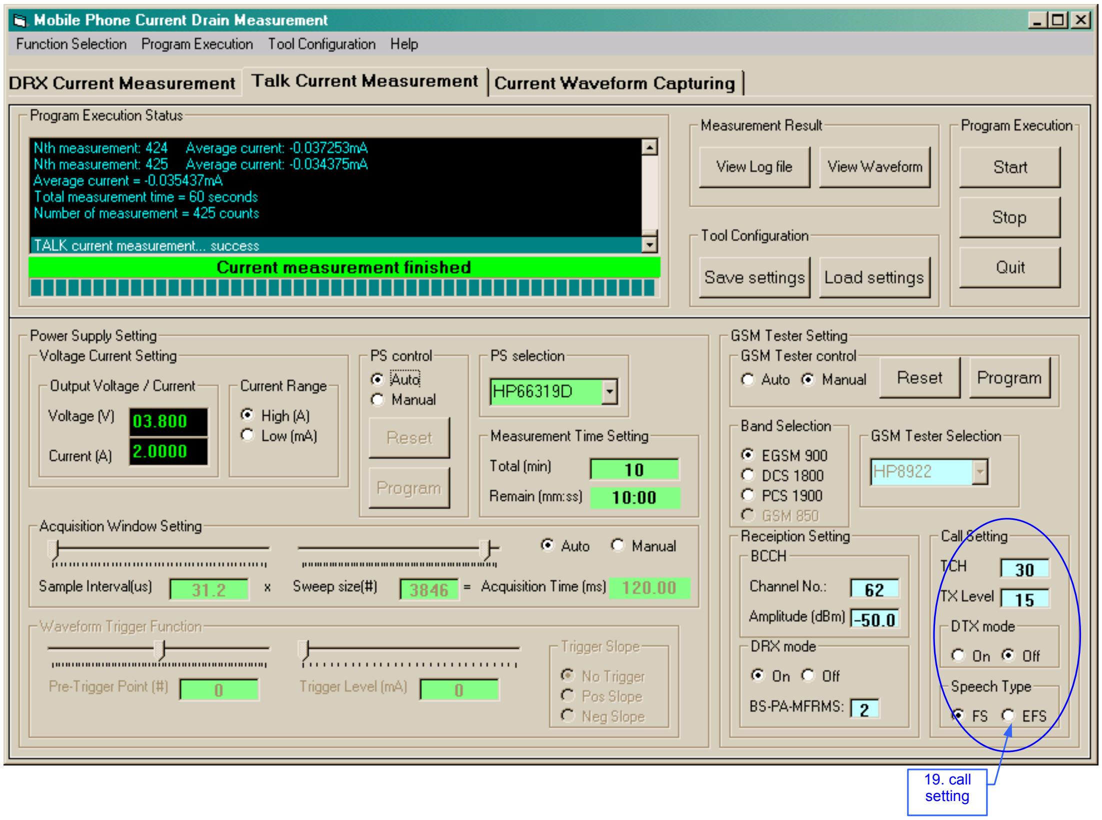


Figure 12. Talk Current Measurement User Interface

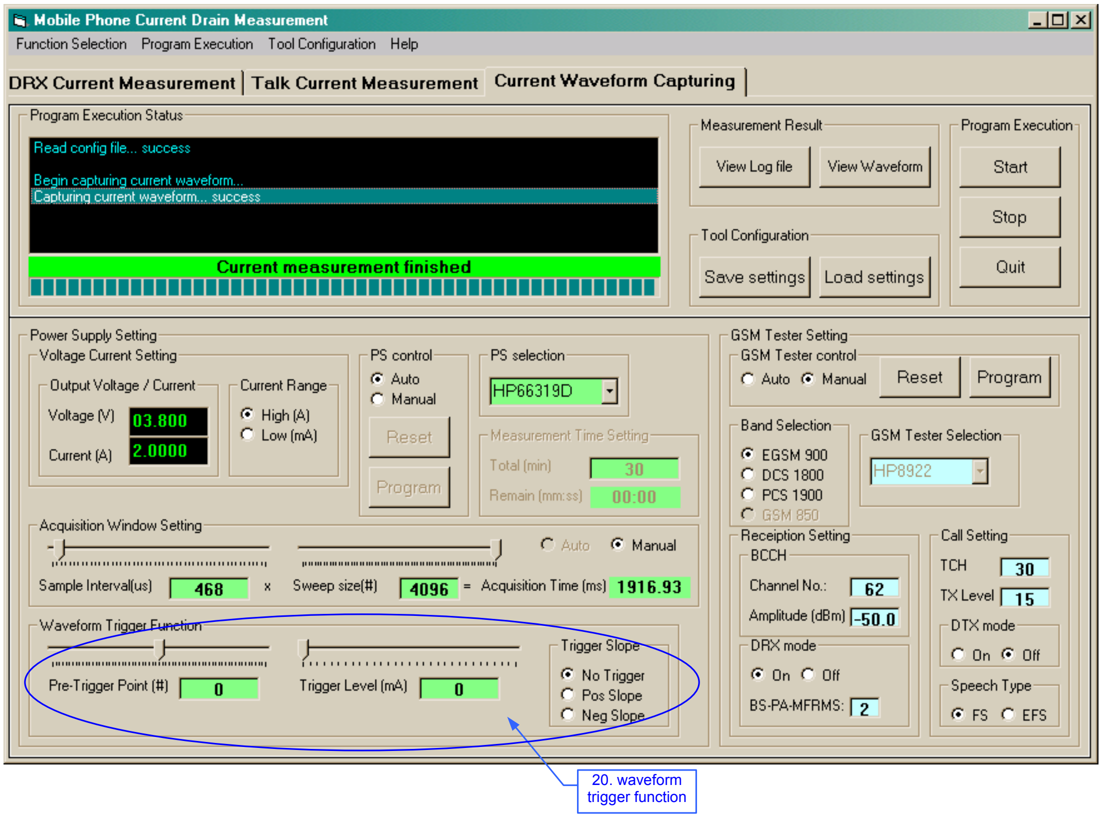


Figure 13. Current Waveform Capture User Interface

Figure 14 and Figure 15 show the sub-function windows of the three functions. For more details about the DRX Current Measurement windows, refer to Table 39 on page 48 through Table 43.

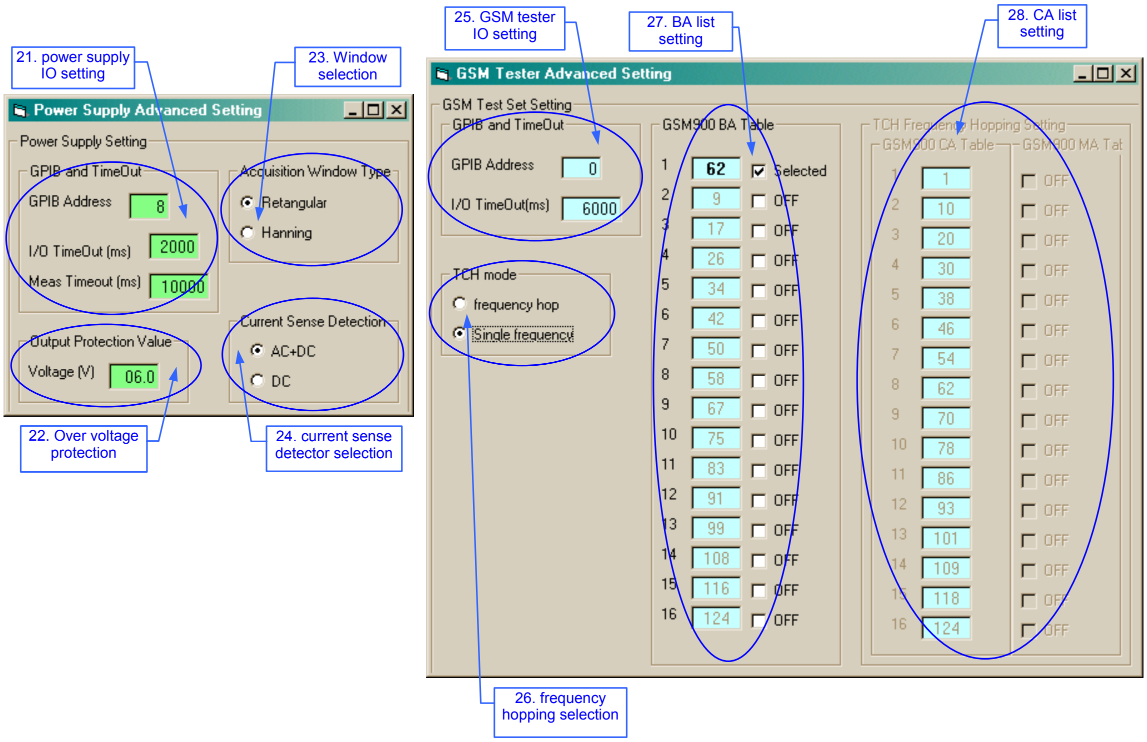


Figure 14. Advanced Setting User Interface

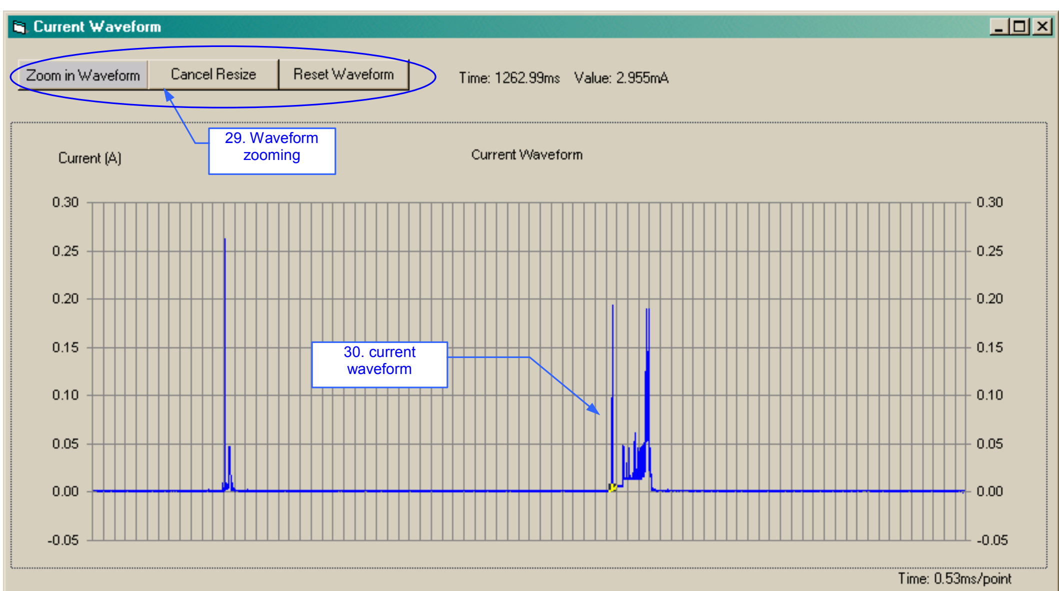


Figure 15. Current Waveform Viewer User Interface

Table 39. Standby Current Measurement Window

In Figure 11	Item	Description
1	**Menu Bar**	DRX Current Measurement contains four main menus: • Function Selection • Program Execution • Tool Configuration • Help The main menus also have commands, which are described next.
	Function Selection • DRX current measurement • Talk current measurement • Current waveform capture	Select the 3 main functions. Same as item 2: **Function Selection**.
	Program Execution • Start • Stop • Quit	Execute, stop or quit the measurement tool. Same as item 7: **Program execution**.
	Tool Configuration • Save Tool Setting • Load Tool Setting	Save Tool Setting — saves the value of all items of the tool to a file. Load Tool Setting — loads the settings from a file to the tool. Same as item 6: **Tool Configuration**.
	• Power Supply Advanced Setting • Power Supply Default Setting	Power Supply Advanced Setting — opens the Power Supply Advanced Setting window. Power Supply Default Setting — reset the items of the power supply on the tool with the pre-defined values.
	• GSM Tester Advanced Setting • GSM Tester Default Setting	GSM Tester Advanced Setting — opens the GSM Tester Advanced Setting window. GSM Tester Default Setting — resets the items of the GSM tester on the tool with the pre-defined values.
	Help • Content • Index • About Current Drain Measurement	Content — Opens the help content window (Not available yet). Index — Opens the help index window (Not available yet). About Current Drain Measurement — Opens the Current Drain Measurement version window.
2	**Function selection**	Select the three main functions: • DRX current measurement • Talk current measurement • Current waveform capture Same as Function Selection in item 1: **Menu Bar**.
3	**Message display**	Contain message including the measurement result during measurement.
4	**Tool Status Indicator**	Display status message and progress of the program during measurement.
5	**Measurement Result** Log file viewer	Open the **Logfile Viewer** window using Notepad. The window contains current measurement result.
	Waveform viewer	Open the **Waveform Viewer** window. Note that the waveform will only be updated after current waveform is captured successfully.

Table 39. Standby Current Measurement Window (continued)

In Figure 11	Item	Description
6	**Tool Config** Save Settings	Open a window to allow you to save the current settings of the tool to a file. Same as Save Tool Setting in Tool Configuration in item 1: **Menu Bar**.
	Load Settings	Open a window to allow you to choose other settings from a file. Same as Load Tool Setting in Tool Configuration in item 1: **Menu Bar**.
7	**Program execution** Start	Start the Standby Current Measurement, Talk Current Measurement or Current Waveform Capture as specified by item 2: **Function selection**. Note that all settings on the tool will be saved automatically after the Start button is pressed.
	Stop	Stop the program execution.
	Quit	Quit the DRX Current Measurement program. Note that you will be prompted to save the tool settings if the settings have not been saved.
8	**Power Supply Output** Output voltage setting	Set Power supply output voltage (0 – 15.53 V)
	Output current setting	Set Power supply output current (0 – 3.0712 A).
9	**Current range selection**	Select **High** to set the current range of the power supply to **A** (Ampere), select **Low** to set to **mA** (milli-Ampere).
10	**Power Supply Programming** Auto	Select this **Auto** option, the power supply will be programmed automatically when the tool is executed by pressing the **Start** button in item 7: **Program Execution**.
	Manual	Select this option the power supply will not be programmed automatically when the **Start** button in item 7: **Program Execution** is pressed. Manually reset or program the power supply by pressing the **Reset** or **Program** buttons in item 10: **Power Supply Programming**.
	Reset	Press this button will reset the power supply. (Available when **Auto** is selected in item 10: **Power Supply Programming**.)
	Program	Press this button will send the power supply settings on the tool to the power supply. (Available when **Auto** is selected in item 10: **Power Supply Programming.**)
11	**Power Supply Selection**	The measurement tool supports 3 kinds of power supply: • HP66309D • HP66319D • HP66311B Make sure the power supply selection in this item matches the power supply in the hardware setup in Figure 10 on page 43.
12	**Measurement Time Setting**	Set the total measurement time and display the time remain to finish the measurement (Not available for Current Waveform Capturing function).

Table 39. Standby Current Measurement Window (continued)

In Figure 11	Item	Description
13	**Acquisition time setting** Auto	The acquisition time is the power supply setting which is used to average the sampling points of a waveform. In the current drain measurement of GSM mobile phone, we set the acquisition time to exactly cover one DRX period (for **Standby Current Measurement**) or one 26-TDMA frame period (for **Talk Current Measurement**) because the current waveform of the phone will repeat in one DRX period (in idle mode) or one 26-TDMA frame period (in talk mode) respectively. When this **Auto** option is selected, the acquisition time will be automatically calculated according to the **BS-PA-MFRMS** number set in **item 18: DRX Setting**, or 120 ms (26-frame multi-frame) when Talk current is to be measured. Set the **BS-PA-MFRMS** number correctly when measuring standby current in different DRX mode.
	Manual	Select this option to adjust the acquisition time manually. Note that the measurement accuracy may vary when the acquisition time is not set automatically.
	Sample interval setting	Set the sampling interval between sampling points (available in manual acquisition time setting).
	Window size setting	Set the window size for the measurement (available in manual acquisition time setting).
	Acquisition time display	Display the corresponding sampling interval, window size value and the calculated acquisition time.
14	**GSM Tester Programming** Auto	Similar to item 10: **Power Supply Programming**. It is used to select whether program the GSM tester through PC or manually. If **Auto** is selected, the GSM tester will be programmed automatically when the **Start** button is pressed in item 7: **Program Execution**.
	Manual	If this option is selected, the GSM tester can be programmed manually.
	Reset	Press this button will reset the GSM tester. (Available when **Auto** is selected in item 14: **GSM Tester Programming.**)
	Program	Press this button will send the GSM tester settings on the tool to the GSM tester. (Available when **Auto** is selected in item 14: **GSM Tester Programming.**)
15	**Band Selection**	Select the different radio band of the GSM Tester: • EGSM 900 • DCS 1800 • PCS 1900 (GSM 850 is not available currently.)
16	**GSM Tester Selection**	Select different kind of GSM tester: • HP8922 • HP8960 • CMU200 (Only HP8922 available currently.)

Table 39. Standby Current Measurement Window (continued)

In Figure 11	Item	Description
17	**BCCH Setting**	Set the BCCH number and its amplitude of the GSM Test Set.
18	**DRX Setting**	Set the DRX on / off and the DRX number (2 – 9) of the GSM Test Set. (Note the DRX number here is used to calculate the acquisition time of the power supply for current measurement in item 13: Acquisition time setting, so make sure the DRX number setting here match the DRX number setting of GSM tester.)

Table 40. Talk Current Measurement Window

In Figure 12	Item	Description
19	**Call Setting** TCH	Set the TCH channel number.
	TX Level	Set the TCH TX power level
	Speech type	Select the TCH speech type.
	DTX setting	Set the DTX on/off

Table 41. Current Waveform Capture Window

In Figure 13	Item	Description
20	**Waveform Trigger Function** Pre trigger point setting	Set the number of points before or after the trigger point.
	Trigger level setting	Set the trigger current level in mA.
	Trigger slope selection	Select the trigger slope: • No slope • Positive slope, or • Negative slope

Table 42. Advanced Setting Window

In Figure 14	Item	Description
21	**Power supply IO setting** GPIB Address	Set the Power supply GPIB address.
	I/O Timeout	Set the Power supply I/O timeout value.
	Measurement Timeout	Set the Power supply measurement timeout value.
22	Over voltage protection	Set the Power supply output voltage limit.
23	Window selection	Select different type of window of the Power supply for measurement.

Table 42. Advanced Setting Window (continued)

In Figure 14	Item	Description
24	Current sense detector selection	Select the different current sense detector of the Power supply for measurement.
25	**GSM Test Set IO setting** GPIB Address	Set the GSM Test Set GPIB address.
	I/O Timeout	Set the GSM Test Set I/O timeout value.
26	Frequency hopping selection	Select frequency hopping / single in Talk Current Measurement.
27	BA list setting	Set the BA (BCCH Allocation) list. (To select the BA, simply check the box on the right hand side of the BA channel.)
28	CA list setting	Set the CA list. This is only available when the frequency is set to **Hopping** in item 26. (To select the CA, simply check the box on the right hand side of the CA channel.)

Table 43. Current Waveform Viewer Window

In Figure 14	Item	Description
29	**Waveform Zooming** Zoom in waveform	Zoom in the current waveform (by selecting two points on the displayed waveform).
	Cancel zoom in	Cancel the zoom in.
	Reset waveform	Re-paint the waveform (after have been zoomed in).
30	**Current Waveform**	Current waveform of the phone. (Note: this waveform will only be updated after successfully execute the Current Waveform Capture function.)

6.3.1.3 DRX Current Measurement Procedures

The following sections detail typical procedures for DRX Current Measurement.

6.3.1.3.1 Standby Current Measurement Procedure

The following is the typical procedure for Standby Current Measurement:

1. Verify all hardware connections and that the test SIM is inserted into the phone.
2. Switch on the HP8922 GSM Test Set and HP66319D Power Supply.
3. Open the DRX Current Measurement window from the Phasing Tools and select the Standby Current Measurement function. Verify the GPIB addresses of the HP8922 and HP66319D are set correctly.
4. In the window, verify all parameters are set correctly. For example, set the output voltage and current for the phone, enter the expected measurement time (typically, 30 minutes), acquisition time (select auto-mode for normal measurement), and specify which DRX mode is to be used for measuring (by setting DRX number), and so on. There are pre-saved parameter settings for simple

current measurement (the BA list contains only serving cell) and ECTEL compliant current measurement (the BA list contains 16 adjacent cells) in the files: `drx_simple_requirement.txt` and `drx_ectel_requirement.txt` respectively. You can load this file by pressing the **Load Settings** button in item 6: **Tool Config** and find the file in the working directory of the tool.

5. Run the tool by pressing the **Start** button in item 7: **Program Execution**. A window will popup to prompt the user to make sure the phone has already camped on the GSM tester and entered sleep mode before start measuring. Do not close this window until the step below has been done properly.
6. Now there are several things the user have to do before the measurement can start:

- If the GSM tester is selected to be operated manually — by item 14: **GSM Tester Programming**, the user have to set the GSM tester manually with the same setting on the tool.
- If the phone has not been powered on already, then power it on.
- Wait about 30 seconds and make sure the phone is camped and entered into sleep mode. (You should be able to know whether the phone is camped or not by looking at the phone display. Also if the phone already entered into sleep mode, the real-time current measurement reported by the power supply front panel will display several mA and several ten mA alternatively)

7. Press **OK** to close the popup window to start Standby current measurement
8. After finished current measurement successfully, you can click on the **View Log File** button in item 5: **Measurement Result** to view the result.

6.3.1.3.2 Talk Current Measurement Procedure

The following is the typical procedure for Talk Current Measurement:

1. If you have already setup the hardware in step 1 and 2 as described in Standby Current Measurement Procedure and the phone is already camped on the GSM tester, you can simply switch to Talk Current Measurement function to measure talk current.
2. In the Talk Current Measurement window, set up parameters in item 19: Call Setting on the tool in the GSM tester. Then enter the expected measurement time (typically, 10 minutes). There are pre-saved parameter settings for simple current measurement (the BA list contains only serving cell) and ECTEL compliant current measurement (the BA list contains 16 adjacent cells) in the files: `drx_simple_requirement.txt` and `drx_ectel_requirement.txt`, respectively. You can load this file by pressing the **Load Settings** button in item 6: **Tool Config** and find the file in the same directory of the tool.
3. Run the tool by pressing the **Start** button in item 7: **Program Execution**. A window will pop up to tell you to make sure that a call has already established between the phone and the GSM tester. Do not close this window until the step below has been done properly.
4. Now there are several things to do before the measurement can start:

- If the GSM tester is selected to be operated manually — by item 14: **GSM Tester Programming**, set the GSM tester manually with the same setting on the tool.
- If a call has not been established between the phone and the GSM tester, then establish a call.
- Wait about 30 seconds to let the phone current consumption become stable.

5. Press **OK** to close the popup window to start Talk current measurement.

6. After finished current measurement successfully, click on the **View Log File** button in item 5: **Measurement Result** to view the result.

6.3.1.3.3 Current Waveform Capture Procedure

The following is the typical procedure for Current Waveform Capture:

1. You can capture current waveform by simply switching to the Current Waveform Capture function on the tool.
2. Then setup the waveform trigger settings in item 20: **Waveform Trigger Function**.
3. Press **Start** button in item 7: **Program Execution** to begin current waveform capturing.
4. After finished current waveform capture successfully, click on the **View Waveform** button in item 5: **Measurement Result** to view the waveform.

6.3.1.3.4 Measurement Requirement Settings

There are two types of phone current drain requirements we are using: 1. Simple Requirement and ECTEL Requirement:

- **Simple Requirement**—Simple settings for measuring standby current with DRX2 and DRX9, and talk current with maximum, minimum power levels and DTX on and off. The detail settings are listed as below. The file: `drx_simple_requirement.txt` can be loaded for this requirement by pressing **Load Setting** button in item 6: **Tool Config**.
- **ECTEL Requirement—**The phone current measurement requirement described by ECTEL. Which measure standby current with DRX5, and talk current with power level 7 and DTX off. The detail settings are listed as below. The file: `drx_ectel_requirement.txt` can be loaded for this requirement by pressing **Load Setting** button in item 6: **Tool Config**.

Table 44. List of settings for Simple and ECTEL Requirement

Parameters	Simple Requirement Settings	ECTEL Requirement Settings
Common Settings		
Speech Codec	GSM FR	
BCCH	GSM900: ARFCN 62 GSM1800: ARFCN 710 GSM1900: ARFCN 660	
PLMN	HPLMN	
RX Level	- 82 dBm	
Speech	None	
Volume	Max	
Backlight	Default	
Temperature	18-25 C	
Keypad	No extra pressing	
Idle Mode Settings		

Table 44. List of settings for Simple and ECTEL Requirement (continued)

Parameters	Simple Requirement Settings	ECTEL Requirement Settings
SIM	Phase 2 with clock stop, supporting the appropriate voltage of the MS under test.	Phase 2 with clock stop, supporting the appropriate voltage of the MS under test.
Cell re-selection	No	No
BA list	Serving cell only	16 frequencies as follows • GSM900:1, 9, 17, 26, 34, 42, 50, 58, 67, 75, 83, 91, 99, 108, 116, 124. • GSM1800:512, 530, 560, 580, 610, 640, 670, 700, 720, 740, 760, 790, 810, 840, 860, 885. • GSM1900: 512, 530, 550, 570, 590, 610, 630, 650, 670, 690, 710, 730, 750, 770, 790, 810.
SMS CB	OFF	OFF
DRX BS_PA_MFRMS	2 and 9 multi-frames	5 multi-frames
Dedicated Mode Settings		
Hopping		ON, 5 frequencies GSM900: 1, 30, 62, 93, 124 GSM1800: 512, 600, 690, 780, 885. GSM1900: 512, 590, 670, 750, 810.
Handover	No	No
MS-Tx-Lev	power level 15 for GSM900 power level 10 for GSM1800	29 dBm GSM900 (power level 7) 28 dBm GSM1800 (power level 1)
BA List	Serving cell only	16 frequencies as follows • GSM900:1, 9, 17, 26, 34, 42, 50, 58, 67, 75, 83, 91, 99, 108, 116, 124. • GSM1800:512, 530, 560, 580, 610, 640, 670, 700, 720, 740, 760, 790, 810, 840, 860, 885. • GSM1900: 512, 530, 550, 570, 590, 610, 630, 650, 670, 690, 710, 730, 750, 770, 790, 810.
Uplink-DTX	OFF and ON	OFF
Call	Continuous	Continuous

6.3.2 De-sense Measurement

The desense measurement test measures the sensitivity of the phone across the entire spectrum of the operation band(s). The communication between the phone and the test set is through the air, unlike the sensitivity test in the Performance Test, which is through the antenna cable.

In the test setup, the phone is put on one end inside an RF chamber, while the other end hosts an antenna that is connected to the test set. The entire setup together with the RF chamber should be put inside a shielded room. You can select the channels to be tested by inputting a data file.

To invoke the Desense Measurement application:

1. At **Application type**, select **Measurement**.
2. At **Option functions**, select **Desense**.

6.3.2.1 Desense Calibration and Measurement User Interface

Figure 16 shows an example of the Desense Calibration and Measurement user interface.

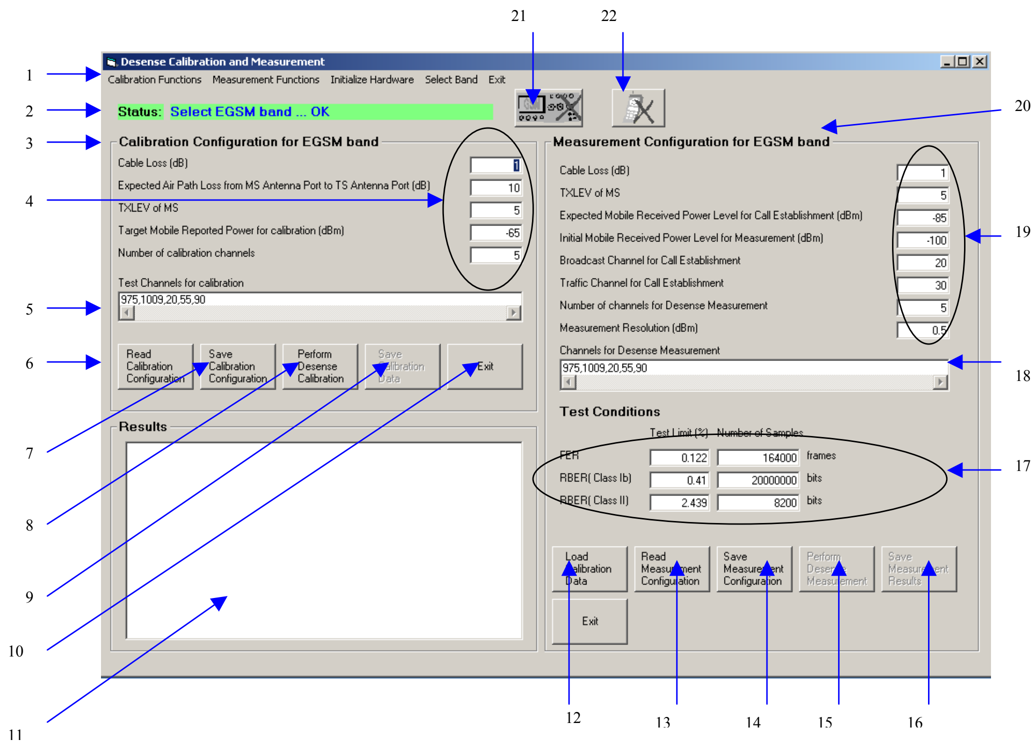


Figure 16. Desense Calibration and Measurement Window

6.3.2.1.1 Desense Calibration and Measurement Window Descriptions

This section details the enumerated items in Figure 16.

1. Menu items: The menu contains five items: Calibration Functions, Measurement Functions, Initialize Hardware, Select Band and Exit. Their functions are described below:
   — **Calibration Functions**
   - **Read Calibration Configuration**:
     Read Calibration Configuration setting from file and display in Calibration Frame.
   - **Save Calibration Configuration**:
     Save Calibration Configuration setting displayed on screen to file.
   - **Perform Desense Calibration**:
     Perform Desense Calibration based on the setting displayed in the calibration frame.
   - **Save Calibration Data**:
     Save the calibration data. This file is used in the desense measurement.

- **Measurement Functions**
  - **Load Calibration Data**:
    Load the calibration data which is used in the desense measurement to compensate the air path loss.
  - **Read Measurement Configuration**:
    Read Measurement Configuration setting for desense measurement and display the setting in Measurement frame.
  - **Measurement Functions > Save Measurement Configuration**:
    Save the Measurement Configuration setting to a file.
  - **Perform Desense Measurement**:
    Perform Desense Measurement based on the Measurement Configuration setting displayed in the Measurement frame.
- **Initialize Hardware**
  - **Initialize Test Set**: Perform Test Set initialization.
- **Hardware Initialize**
  - **Detect Phone**: Perform Phone connection detection.
- **Select Band**
  - **EGSM**: Select the EGSM band.
  - **DCS**: Select the DCS band.
  - **PCS**: Select the PCS band.
  - **GSM850**: Select the GSM850 band.
- **Exit**: Quit

2. Operation Status Display: Display the status of the last operation.
3. Calibration Configuration Frame: Display Calibration Configuration setting. You can change the parameters for calibration in this frame.
4. Calibration Configuration Setting 1: Display calibration configuration for desense calibration.
   - **Cable Loss**:
     Power Loss of the cable connecting the test antenna to the Test Set RF port.
   - **Expected Air Path Loss**:
     Expected air path loss between the mobile antenna port and the TS test antenna port. (excluding the cable loss)
   - **TxLev**:
     Mobile Transmit Power Level used in calibration process.
   - **Target Mobile Reported Power for Calibration**:
     The reported power in which the calibration process takes place.
   - **Number of Calibration Channels**:
     The total number of channels for calibration.
5. **Test Channels for calibration**:
   The total number of channels specified in this field should be equal to the **Number of Calibration Channels**. Use a comma (,) to separate multiple values.

6. **Read Calibration Configuration**:
   Same as Calibration Functions > Read Calibration Configuration
7. **Save Calibration Configuration**:
   Same as Calibration Functions > Save Calibration Configuration
8. **Perform Desense Calibration**:
   Same as Calibration Functions > Save Desense Calibration
9. **Save Calibration Data**:
   Same as Calibration Functions > Save Calibration Data
10. **Exit**: Quit
11. **Results** Frame: Display messages and results during Desense Calibration and Desense Measurement
12. **Load Calibration Data**:
    Same as Measurement Functions > Load Calibration Data
13. **Read Measurement Configuration**:
    Same as Measurement Functions > Read Measurement Configuration
14. **Save Measurement Configuration**:
    Same as Measurement Functions > Save Measurement Configuration
15. **Perform Desense Measurement**:
    Same as Measurement Functions > Perform Desense Measurement.
16. **Save Measurement Results**:
    Same as Measurement Functions > Save Measurement Results
17. **Test Conditions**:
    Specify the test limit and number of samples for the FER, RBER (class Ib) and RBER (class II) tests.
18. **Channels for Desense Measurement**:
    Specify the channels for desense measurement. The format is similar to item 5.
19. Measurement Configuration Setting: Display measurement configuration for desense measurement.
    — **Cable Loss**:
    Power Loss of the cable connecting the test antenna to the Test Set RF port.
    — **TxLev**:
    Mobile Transmit Power Level used in measurement process.
    — **Expected Mobile Received Power for call Establishment**:
    Expected Mobile Received Power for call Establishment in dBm
    — **Initial Mobile Received Power Level for Measurement**:
    Initial Mobile Received Power Level for Measurement in dBm
    — **Broadcast Channel for Call Establishment**:
    Broadcast Channel for Call Establishment
    — **Traffic Channel for Call Establishment**:
    Traffic Channel for Call Establishment

— **Number of Calibration Channels**:
The total number of channels for measurement

— **Measurement Resolution**:
Specify the target resolution of the sensitivity measured.

20. **Measurement Configuration** frame: Display the parameters for Desense Measurement.
21. Test Set Initialization Button and Indicator: This button is the same function of the Initialize Hardware > Initialize TestSet.
22. Phone Detection Button and Indicator: This button is the same function of the: Initialize Hardware > Detect Phone.

6.3.2.2 Typical Operating Procedure for Desense Calibration

The following is the typical desense calibration operating procedure. Number references refer to Figure 16 on page 56.

1. Detect phone
   — On the **Initialize Hardware** menu (1), select **Detect Phone**, or
   — Click the Phone Detection Button and Indicator (22).
2. Initialize HP8922
   — On the **Initialize Hardware** menu, select **Initialize Test Set** (1), or
   — Click the Test Set Initialization Button and Indicator (21).
3. Select band
   — On the **Select Band** menu, click **EGSM** or **DCS** (1), or
   — Select PCS to select EGSM band or DCS band or PCS band.
4. Calibration Configuration setting
   — Adjust the default displayed calibration settings (3), or
   — Press the **Read Calibration Configuration** button (6) to load calibration settings from a file.
5. Save Calibration Configuration
   — Press the **Save Calibration Configuration** button (7) to save the calibration settings.
6. Perform Desense Calibration
   — Press the **Perform Desense Calibration** button (8) to perform desense calibration.
7. Save Calibration Data
   — Press the **Save Calibration Data** button (9) to save calibration data for desense measurement.

6.3.2.3 Typical Operating Procedure for Desense Measurement

The following is the typical desense measurement operating procedure:

1. Select band
   — On the **Select Band** menu (1), click **EGSM** or **DCS**, or
   — Select PCS to select EGSM band or DCS band or PCS band.
2. Load Calibration Data

— Click the **Load Calibration Data** button (12) to load previously calculated calibration data.

3. Measurement Configuration and Test Conditions setting
   — Adjust the displayed default measurement configuration settings (20), or
   — Press the **Read Measurement Configuration** button (13) to read configuration settings from a file.
4. Save Measurement Configuration and Test Conditions Setting
   — Press the **Save Measurement Configuration** button (14) to save the calibration settings.
5. Perform Desense Measurement
   — Press the **Perform Desense Measurement** button (15) to perform desense measurement.
6. Save Measurement Results
   — Press the **Save Measurement Results** button (16) to save desense measurement results.

6.3.3 GPRS 2TX Measurement

The **GPRS 2TX Measurement** function measures the Power versus Time waveform—for GPRS-class mobile phones—which is able to send two consecutive time slots within a frame. Similar to the usual equipment setup in the PPT, the phone being tested is connected to the Test-Set through a 50-ohm coaxial cable, and a USB cable to the PC.

To invoke the GPRS 2TX Measurement application, do the following:

1. In **Application type**, select **Measurement**.
2. In **Option functions**, select **GPRS 2TX Measurement**.

6.3.3.1 GPRS 2TX Measurement User Interface

Figure 17 shows the window of the GPRS 2TX Measurement user interface.

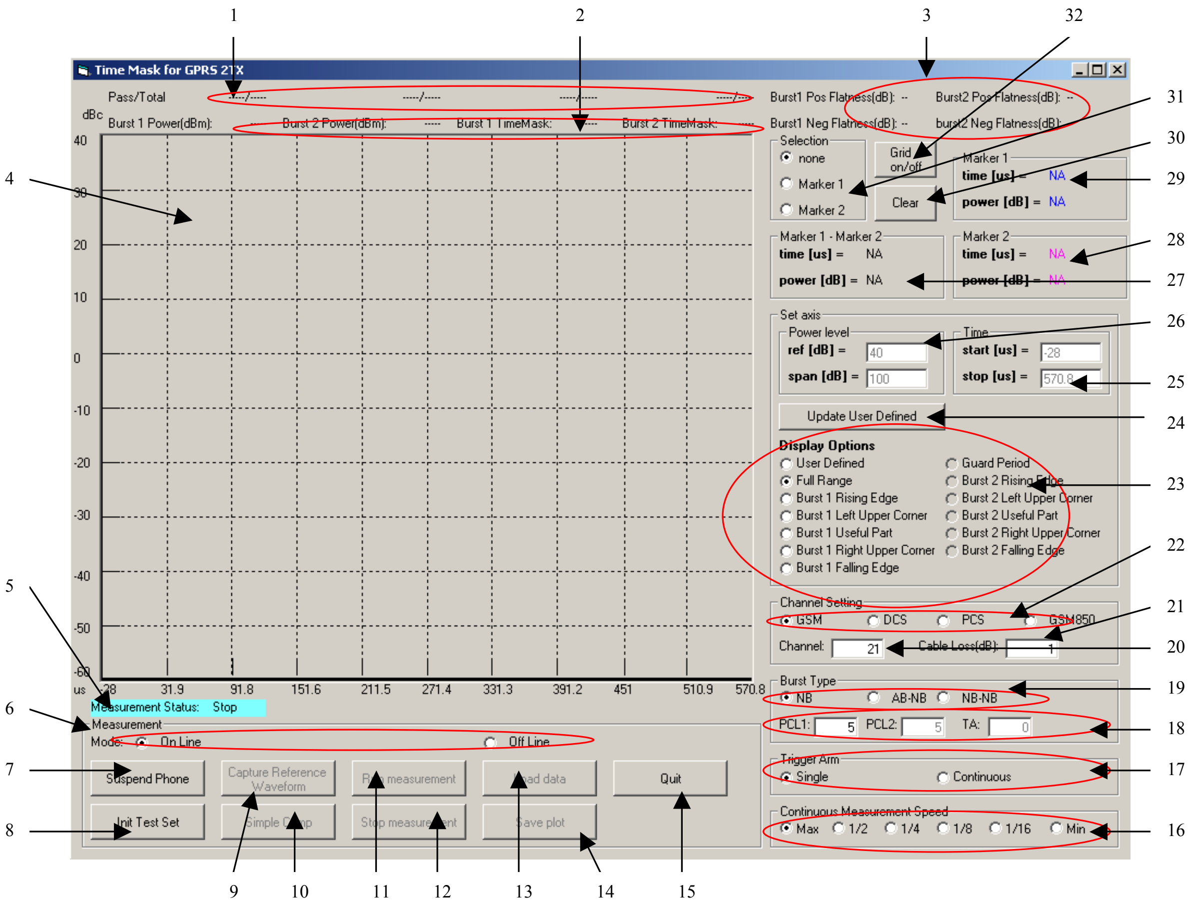


Figure 17. GPRS 2TX Measurement Window

6.3.3.1.1 GPRS 2TX Measurement Window Descriptions

This section details the enumerated items in Figure 17.

1. **Pass/Total counter**: The item contains 4 parts (in the order from left to right): pass counter for Burst 1 power measurement, pass counter for Burst 2 power measurement, pass counter for Burst 1 Time-Mask, pass counter for Burst 2 Time-Mask. Their functions are described below:

   Pass/Total Counter for Burst 1/2 Power: In Continuous Trigger Arm mode, burst power is continuously captured by the Test-Set and compared to PCL requirement in GSM specification. The total number of bursts measured as well as the number of pass are recorded and displayed in this item. In case of single burst, "----/----" will be displayed.

   Pass/Total Counter for Burst 1/2 Time-Mask: In Continuous Trigger Arm mode, burst power is continuously captured by the Test-Set and compared to Time-Mask requirement in GSM specification. The total number of bursts measured as well as the number of pass are recorded and displayed in this item. In case of single burst, "----/----" will be displayed.

2. **Current Power and Time-Mask Measurements:** The item consists of four current measurements (in the order from left to right): Burst 1 Power Measurement, Burst 2 Power Measurement, Burst 1 Time-Mask, Burst 2 Time-Mask. They are functioned as follows:

Burst 1/2 Power Measurement: The current useful part average power of burst 1 or 2 is displayed. If the power fails the PCL requirement in GSM specification, the value will be highlighted with red color, otherwise green color is shown. In case of single burst, "----/----" will be displayed.

Burst 1/2 Time-Mask: The current burst 1 or 2 is compared to the Time-Mask requirement in GSM specification. If it fails, "Fail" will be shown and highlighted with Red color, otherwise "Pass" is displayed in Green color. In case of single burst, "----/----" will be displayed.

3. **Current Positive and Negative Flatness Measurements:** The item contains four parts: Burst 1 Pos Flatness, Burst 1 Neg Flatness, Burst 2 Pos Flatness and Burst 2 Neg Flatness. They are described below:

   Burst 1/2 Pos/Neg Flatness: The positive/negative flatness in the useful part of current burst 1/2 is displayed. If the power fails the flatness requirement in GSM specification, the value will be highlighted with red color, otherwise green color is shown.
4. **Power vs. Time Display Frame:** Display current measured Power vs. Time waveform or loaded waveform from a file.
5. **Measurement Status:** Display measurement status, either "Run" or "Stop".
6. **Measurement Mode:** Select the mode of operation of this application. "On line" mode enables the measurement of GPRS 2TX in real time while "Off-line" mode loads a saved waveform file and displays on the Power vs. Time Display Frame. Some of the buttons are disabled under different modes of operation.
7. **Suspend Phone**: In On-Line mode, press this button to put the phone in suspend mode.
8. **Init Test Set**: In On-Line mode, press this button to initialize the Test-Set.
9. **Capture Reference Waveform**: Enabled in On-line mode only. Since the power and Time-Mask are calculated and compared to GSM specification in PC, time axis and power level synchronization are required. Press this button to capture the reference waveform.
10. **Simple Camp:** To enable the mobile to send bursts in loopback mode for 2TX measurement, it must be simple camped to the Base Station. Press this button to perform simple camp. In between, mobile is required to power cycle.
11. **Run measurement:** If the mobile successfully camped to a network, press this button to measure the power vs. time waveform. The button will turn green if successful otherwise turn red. During the measurement, the input parameters are disabled.
12. **Stop measurement:** Stop current measurement and enable input parameter entering.
13. **Load Data:** In Off-line mode only, load a pre-saved 2TX waveform.
14. **Save plot:** save current displayed waveform to a file, either operate in On-Line or Off-line mode.
15. **Quit:** Quit GPRS2TX Measurement Application.
16. **Continuous Measurement Speed**: In Continuous Trigger Arm mode, bursts are captured continuously and its display speed is controlled by these options. There are 6 speed options with "Max" the fastest and "Min" the slowest. The speed is increased by taking less points in the useful part of the burst.
17. **Trigger Arm**: Select the mode of measurement, "Single" only measures once while "Continuous" measures continuously.
18. **PCL and Time Advance**:

PCL1: power control level for burst 1

PCL2: power control level for burst 2 in case of multi-slot transmission.

TA: time advance for Access burst-normal-burst combination.

19. **Burst type**: Select the burst type for single slot and multi-slot transmission.
20. **Channel**: TX channel number.
21. **Cable Loss**: Cable loss at the frequency of the TX channel.
22. **Band**: Select the band of operation.
23. **Display Options**: Select different portions of the waveform to be displayed. The waveform will be updated automatically once any of the options is selected, except the “User Defined” option, “Update User Defined” button must be pressed to update the waveform.
24. **Update User Defined button**: If “User Defined” option is selected, the user can enter desired values in the “Set axis” frame and then press this button to display the preset scale.
25. **Time scale**: The start time and stop time of the display waveform. 0 micro-second (?s) means the beginning of the useful part of first burst.
26. **Power Level**: Y-axis scale. “Ref” sets the maximum power level to be displayed while the “span” item sets the Y-axis span. Power Level is relative to the average power of the useful portion of first burst.
27. **Marker1-Marker2**: Delta between marker 1 and marker 2 if Marker option is selected.
28. **Marker2**: Absolute values of Marker 2.
29. **Marker1**: Absolute values of Marker 1.
30. **Clear**: clear current Power vs. Time display waveform.
31. **Marker Selection**: Select which Marker to be activated. If “none” is selected, both markers will disappear.
32. **Grid on/off**: Turn on/off the grid.

6.3.3.2 Typical Operation Procedure for On-Line Measurement

The following is the typical GPRS 2TX Measurement under On-Line Mode. Number references refer to Figure 17.

1. Select On-Line Mode

   Select On-Line option in item 6**.**
2. Suspend Phone

   Press item 7 to put phone into suspend mode**.**
3. Initialize Test Set

   Press item 8 to initialize Test Set.
4. Select band

   In item 22, select Operating Band.
5. Select channel

   In item 20, set TX channel.

6. Set Cable loss

   In item 21, set cable loss at the frequency of the TX channel.
7. Select Burst Type

   In item 19, select TX burst type.
8. Set PCL

   In item 18, set PCL for burst 1, burst 2 and Time Advance. Burst 2 and Time Advance will be enabled only when appropriate burst type is selected.
9. Select Trigger Arm Mode

   In item 17, select the measurement mode.
10. Set Continuous Measurement speed

    In item 16, select the measurement speed if “Continuous” mode is selected.
11. Capture Reference waveform

    Press item 9 to capture reference waveform for current TX channel. The reference waveform for all PLs at the current TX channel will be captured for synchronization. So if the measured waveform is changed, it is required to do “capture Reference waveform” again.
12. Perform simple camp

    To enable proper burst type to be sent, press the button in item 10 to perform simple camp to Test Set.
13. Run Measurement

    Press item 11 to perform GPRS2TX measurement. Upon completion, the waveform is displayed to the screen automatically.
14. Stop Measurement

    If the user wants to stop current measurement, press button in item 12 to stop. As a reminder, all parameter entries are disabled during “Run Measurement” mode and can be resumed by pressing the **Stop Measurement** button.
15. Save plot

    Press item 14 to save current measured waveform.

7 Manual Phasing

Manual phasing allows you to phase the phone manually. This feature is particularly useful during the platform development phase when the hardware performance is not up to the level for normal phasing. The function when invoked brings up the phasing table for the phasing function selected. It allows you to upload the phasing parameters from a database or the phone, modify them, and then save them back to the database or phone, and carry out testing immediately based on the new set of phasing parameters. A sample database file for PA phasing and AFC phasing is shown in Figure 18 and Figure 19.

The manual phasing function includes:

- AFC Phasing
- PA Phasing
- IQ Balance Phasing

- AGC Phasing

7.1 Starting Manual Phasing

To start manual phasing, choose **Manual Phasing** in **Application type**, and select the desired phasing function in **Option functions**. Click **Start** and a new window opens. The phasing table for the selected function is shown in the new window as are the action buttons.

7.2 Database Tables For Manual Phasing

For a description of a database table for Manual PA Phasing, refer to Figure 18. For a description of a database table for Manual AFC Phasing, refer to Figure 19. For a description of a database table for Manual AGC Phasing, refer to Figure 20.

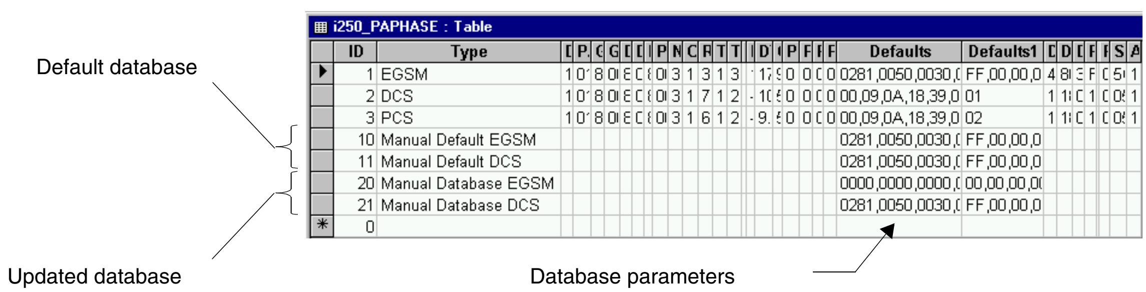
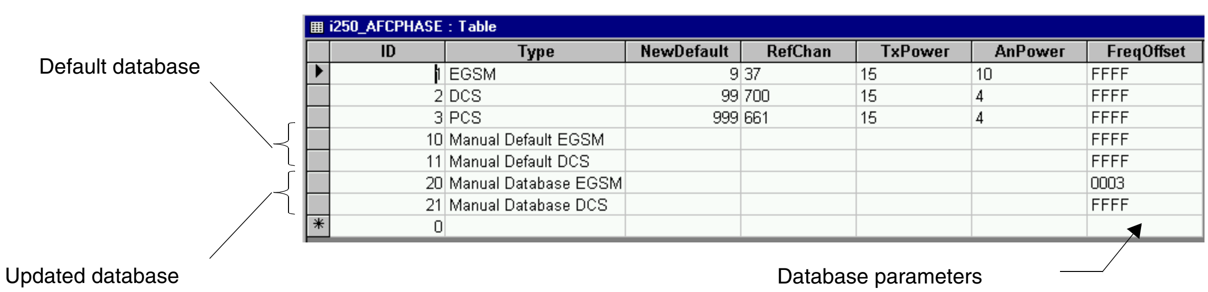


Figure 18. Database Table for Manual PA Phasing



ID	Type	NewDefault	RefChan	TxPower	AnPower	FreqOffset
1	EGSM	9	37	15	10	FFFF
2	DCS	99	700	15	4	FFFF
3	PCS	999	661	15	4	FFFF
10	Manual Default EGSM					FFFF
11	Manual Default DCS					FFFF
20	Manual Database EGSM					0003
21	Manual Database DCS					FFFF
0						

Figure 19. Database Table for Manual AFC Phasing

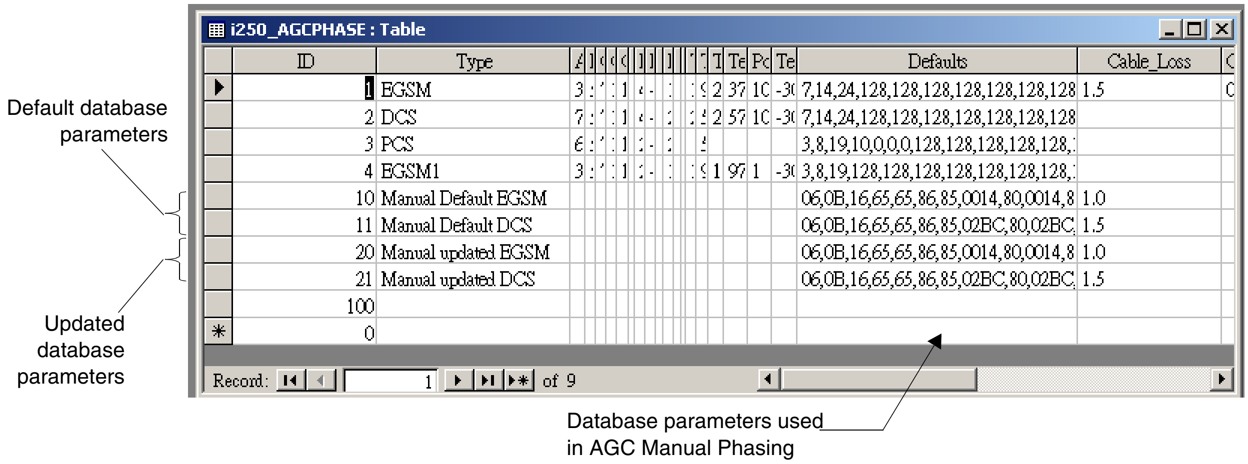


Figure 20. Database Table for Manual AGC Phasing

Figure 18 shows the `i2xx_PAPHASE` table, which contains the parameters used for Manual PA Phasing. Row ID 10 and 11 are the default parameters and are read-only. ID 10 is for the EGSM band and ID 11 is for the DCS band. Row ID 20 and 21 are the updated parameters. You can read and write to these rows. Row ID 20 is for the EGSM band and ID 21 is for the DCS band. The data in the **Defaults** column are the parameters used for phasing the phone.

Figure 19 shows the `i2xx_AFCPHASE` table, which contains the parameters used for Manual AFC Phasing. Row ID 10 and 11 are the default parameters used for phasing the phone and are read-only. ID 10 is for the EGSM band and ID 11 is for the DCS band. Row ID 20 and 21 are the updated parameters. You can read and write to these rows. Row ID 20 is for the EGSM band and ID 21 is for the DCS band. The **FreqOffset** column shows the parameters used for phasing the phone.

Figure 20 shows the `i2xx_AGCPHASE` table, which contains the parameters used for Manual AGC Phasing. Row ID 10 and 11 are the default parameters used for phasing the phone and are read-only. ID 10 is for the EGSM band and ID 11 is for the DCS band. Row ID 20 and 21 are the updated parameters. You can read and write to these rows. Row ID 20 is for the EGSM band and ID 21 is for the DCS band. The **Defaults** column shows the parameters used for phasing the phone.

After you install the phasing tool on your PC, the database tables can be found in the application directory with the database file name `LCAGSMTest.mdb`. This file can be viewed and edited using Microsoft Access database application software.

NOTE

It is recommended to close the Microsoft Access application after editing the database to let the PPT tool access the database correctly.

7.3 Manual AFC Phasing User Interface

Figure 21 shows the window of the Manual AFC Phasing. For more details about the Manual AFC Phasing window, refer to Table 45.

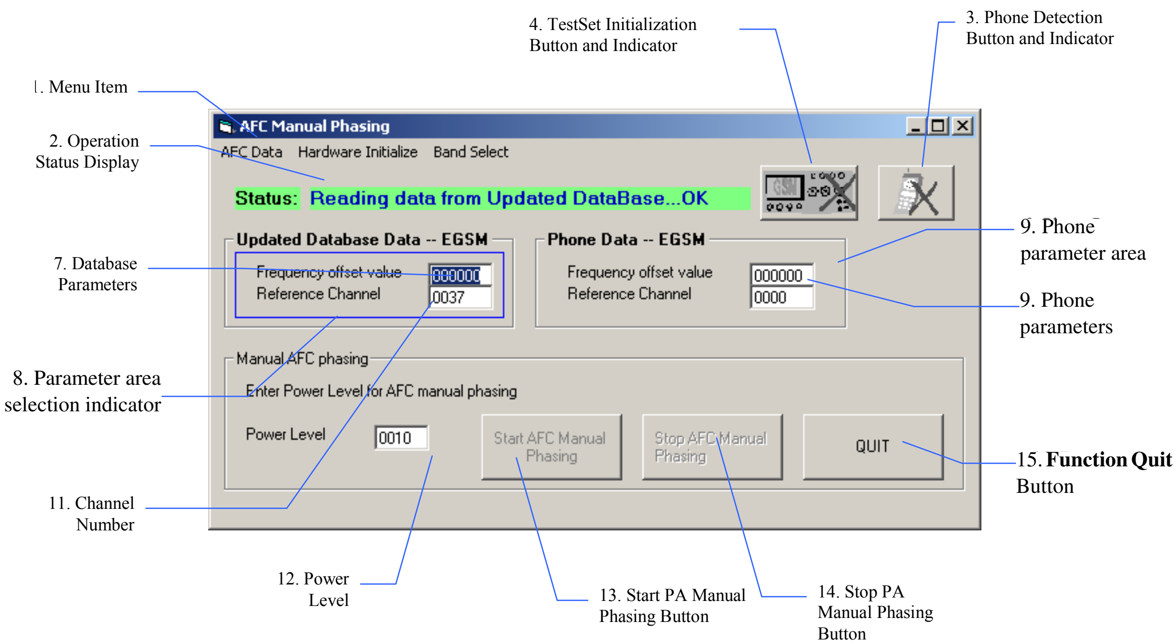


Figure 21. Manual AFC Phasing Window

Table 45. Manual AFC Phasing Window

In Figure 21	Item	Description
1	Menu bar	AFC Manual Phasing contains three main menus: • AFC Data • Hardware Initialize • Band Select. The main menus also have commands, which are described in the following rows.
	AFC Data	
	Read AFC Table From Default	Reads parameters from the Default Database ID 10 or ID 11 (depending on EGSM or DCS band) and displays them in the Database Parameter Area (7).
	Read AFC Table From Database	Reads parameters from the Updated Database ID 20 or ID 21 (depending on EGSM or DCS band) and displays them in the Database Parameter Area (7).
	Read AFC Table From Phone	Reads parameters from the Phone and display them in the Phone Parameter Area (9).
	Save Selected AFC Table To Database	Saves the parameters of the selected Parameter Area shown in the Parameter Area Selection Indicator (8) to the Updated Database ID 20 or ID 21 (depending on EGSM or DCS band). The parameters in the FreqOffset column are overwritten.
	Save Selected AFC Table To Phone	Sends the parameters of the selected Parameter Area shown in the Parameter Area Selection Indicator (8) to the Phone.
	Hardware Initialize	
	Initialize Test Set	Performs test set initialization.
	Detect Phone	Performs phone connection detection.
	Band Select	
	EGSM	Selects the EGSM band, the Database Parameter Area (7) shows the parameters read from the Updated Database ID 20. The Phone Parameter Area (9) shows 0000.
	DCS	Selects the DCS band, the Database Parameter Area (7) shows the parameters read from the Updated Database ID 21. The Phone Parameter Area (9) shows 0000.
2	**Operation Status** Display	Displays the status of the last operation. For example, if you successfully read from the Updated Database, the Operation Status Display shows the string “Reading Data from Updated Database … OK”.
3	**Phone Detection** Button & Indicator	Performs the same function as Hardware Initialize > Detect Phone.
4	**Test Set Initializatio**n Button and Indicator	Performs the same function as Hardware Initialize > Initialize TestSet.
Number references refer to Figure 21 on page 67.		

Table 45. Manual AFC Phasing Window (continued)

In Figure 21	Item	Description
7	Database parameters	Parameters from the Default Database or Updated Database, which are decimal numbers for the frequency offset and reference channel number. You can modify these parameters, and then save the modified parameters to the Updated Database or to the phone. Uppercase and lowercase inputs are treated the same.
8	Parameter area selection indicator	A blue rectangle that indicates which parameter areas [Database Parameter Area (7) or Phone Parameter Area (9)] are selected and is also used for saving the parameters to the database or to the phone.
9	Phone parameter area	The table on the right contains parameters read from the phone.
10	Phone parameters	Parameters read from the phone, which are decimal numbers for the frequency offset and reference channel number. You can modify these parameters, and then save the modified parameters to the Updated Database or back to the phone. Uppercase and lowercase inputs are treated the same.
11	Channel number	Reference channel number of AFC phasing, which is a 4-digit decimal number. You can modify this parameter and then 'Send' the modified parameter to the phone with the Power Level (12) by pressing the **Start AFC Manual Phasing** button (13).
12	Power level	Power level of the phone. It is a 4-digit decimal number. You can modify this parameter and then 'Send' the modified parameter to the phone with the Reference Channel Number (11) and frequency offset by pressing the **Start AFC Manual Phasing** button (14).
13	**Start AFC Manual Phasing** button	Starts sending the Reference Channel Number (11), frequency offset and Power Level (12) to the phone and begins the phone AFC phasing.
14	**Stop AFC Manual Phasing** button	Stops the phone AFC phasing.
15	**Quit** button	Quits the AFC phasing function.
Number references refer to Figure 21 on page 67.		

Typical Procedure for AFC Manual Phasing

1. Detect phone
   On the **Hardware Initialize** menu, select **Detect Phone**.
2. Initialize Test Set
   On the **Hardware Initialize** menu, select **Initialize TestSet**.
3. Select band
   On the **Band Select** menu, select **EGSM** or **DCS** to select EGSM band or DCS band.
4. Load the left phasing table from default/database
   On the **AFC Data** menu, select **Read AFC Table**, then click **From Default** or **From Database**.
5. Load the right phasing table from phone
   On the **AFC Data** menu, select **Read AFC Table**, then click **From Phone**.

6. Make changes to the left table
   Modify the original Database Parameter (7) values by entering a decimal value.
7. Set phone Start AFC Manual Phasing channel number and power level
   Modify the original values of the **Reference Channel** number (11) and **Power Level** (12) by entering a decimal value. After the test set configuration is complete, frequency and phase error are shown on the test set screen. (For the HP8922M test set, you can repeat the test by pressing the **LOCAL** button followed by the **MEAS ARM** button on the panel. For other test equipment, you might need to change to the appropriate page to read the frequency error on the screen.)
8. Save the AFC phasing value
   Read the frequency error on the test set and enter it into the left table. Click **Start AFC Manual Phasing** again to check the residue frequency error. You do not need to press **Stop** in between those steps. Repeat the steps until the error is within the specification. Then, click the area of the left table to select the table. On the **AFC Data** menu, select **Save Selected AFC Data**, then **To Phone** to save the AFC phasing data to the phone.

NOTE

To change any values on the AFC Manual Phasing window during AFC manual phasing, you must click **Start AFC Manual Phasing** again, but you do not need to click the **Stop AFC Manual Phasing** in between steps.

7.4 Manual PA Phasing User Interface

Figure 22 shows the window of Manual PA Phasing. For more details about the Manual PA Phasing window, refer to Table 46 on page 72.

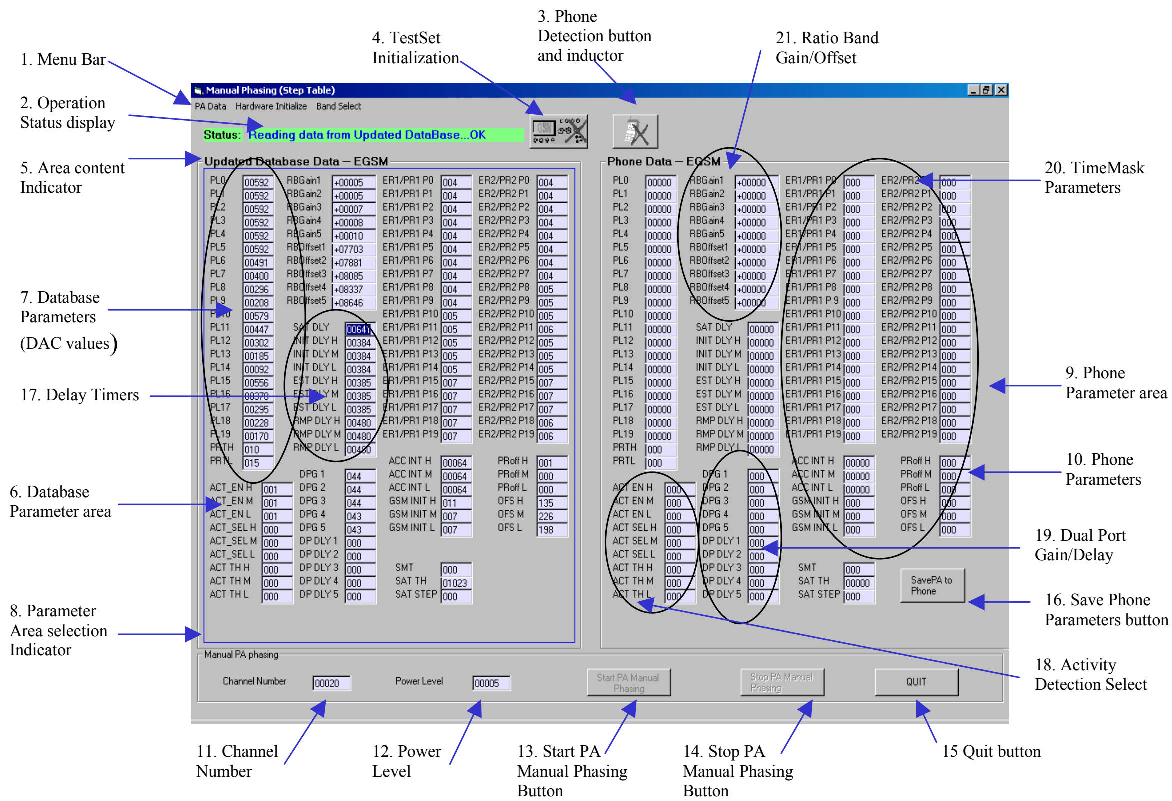


Figure 22. Manual PA Phasing Window

Table 46. Manual PA Phasing Window

In Figure 22	Item	Description
1	Menu bar	Manual PA Phasing contains three main menus: • PA Data • Hardware Initialize • Band Select The main menus also have commands, which are described next.
	PA Data	
	Read PA Table From Auto Default	Reads parameters from the Auto Phasing default (see Figure 18 on page 65) ID 1 – 4 (depending on EGSM, DCS, PCS, or GSM850 band), and displays them in the Database Parameter Area (6).
	Read PA Table From Manual Default	Reads parameters from the Default Database (see Figure 18 on page 65) ID 10 – 13 (depending on EGSM, DCS, PCS or GSM850 band), and displays them in the Database Parameter Area (6).
	Read PA Table From User-Defined	Reads parameters from the Updated Database (see Figure 18 on page 65) ID 20 – 23 (depending on EGSM, DCS, PCS, or GSM850 band), and displays them in the Database Parameter Area (6).
	Read PA Table From Phone	Reads parameters from the Phone and displays them in the Phone Parameter Area (9).
	Save Selected PA Table To Auto Default	Saves parameters of selected Parameter Area shown in the Parameter Area Selection Indicator (8) to the Auto Phasing Default (see Figure 18 on page 65) ID 1 – 4 (depending on EGSM, DCS, PCS, or GSM850 band). **Note:** The parameters in the **Default** and the **Default1** column (see Figure 18) are overwritten.
	Save Selected PA Table To User-Defined	Saves parameters of selected Parameter Area shown in the Parameter Area Selection Indicator (8) to the Updated Database (see Figure 18 on page 65) ID 20 – 23 (depending on EGSM, DCS, PCS, or GSM850 band). **Note:** The parameters in the **Defaults** and **Defaults1** column (see Figure 18) are overwritten.
	Save Selected PA Table To Phone	Sends the parameters of the selected Parameter Area shown in the Parameter Area Selection Indicator (8) to the Phone.
	Hardware Initialize	
	Initialize TestSet	Initializes the test set hardware. This is the same function as the **TestSet Initialization** button and Indicator (4).
	Detect Phone	Performs phone connection detection. This is the same function as the **Phone Detection** button and Indicator (3).
Number references refer to Figure 22 on page 71.		

Table 46. Manual PA Phasing Window (continued)

In Figure 22	Item	Description
1 (Cont.)	**Band Select**	
	EGSM	Selects the EGSM band. The Database Parameter Area (6) shows parameters read from the Updated Database ID 20 (see Figure 18), while the Phone Parameter Area (9) shows 0000.
	DCS	Selects the DCS band. The Database Parameter Area (6) shows parameters read from the Updated Database ID 21 (see Figure 18), while the Phone Parameter Area (9) shows 0000.
	Band Select PCS	Selects the PCS band. The Database Parameter Area (6) shows parameters read from the Updated Database ID 22 (see Figure 18), while the Phone Parameter Area (9) shows 0000.
	Band Select GSM850	Selects the GSM850 band. The Database Parameter Area (6) shows parameters read from the Updated Database ID 23 (see Figure 18), while the Phone Parameter Area (9) shows 0000.
2	Operation status display	Displays the status of the last operation. For example, if the Updated Database is read successfully, the Operation Status Display shows the string “Reading Data from Updated Database … OK”.
3	**Phone Detection** button and indicator	Performs the same function as Hardware Initialize > Detect Phone.
4	**TestSet Initialization** button and indicator	Performs the same function as Hardware Initialize > Initialize TestSet.
5	Area content indicator	Indicates what the parameters in the Parameter Area belong to. For example, if the parameters in the Database Parameter Area (6) are from the Updated Database EGSM band, then the Area Content Indicator shows “Updated Database Data --- EGSM”.
6	Database parameter area	The table on the left contains parameters from the Default Database or Updated Database.
7	Database parameters	Parameters from the Default Database or Updated Database, which are either 5- or 3-digit numbers for PA table. PA parameters include DAC, TimeMask, Delays, Ratio Band Gain/Offset, Dual Port Gain/Delay, and so on. You can modify these parameters and then save the modified parameters to the Updated Database or back to the phone. Uppercase and lower case inputs are treated the same.
8	Parameter area selection Indicator	A blue rectangle that indicates which parameter areas [Database Parameter Area (6) or Phone Parameter Area (9)] are selected and is also used for saving the parameters to the database or to the phone.
9	Phone parameter area	The table on the right contains parameters read from the phone.
10	Phone parameters	Parameters from the phone, which are either 5- or 3-digit numbers for PA table. PA parameters include DAC, TimeMask, Delays, Ratio Band Gain/Offset, Dual Port Gain/Delay, and so on. You can modify these parameters and then save the modified parameters to the Updated Database or back to the phone. Uppercase and lower case inputs are treated the same.
Number references refer to Figure 22 on page 71.		

Table 46. Manual PA Phasing Window (continued)

In Figure 22	Item	Description
11	Channel number	Channel number of the phone. It is a 4-digit decimal number. You can modify this parameter and then send the modified parameter to the phone with the Power Level (12) by pressing the **Start PA Manual Phasing** button (13).
12	Power level	Power level of the phone. It is a 4-digit decimal number. You can modify this parameter and then 'Send' the modified parameter to the phone with the Reference Channel Number (11) and frequency offset by pressing the **Start PA Manual Phasing** button (13).
13	**Start PA Manual Phasing** button	Starts sending the Reference Channel Number (11), frequency offset and Power Level (12) to the phone and begin the phone PA phasing.
14	**Stop PA Manual Phasing** button	Stops the phone PA phasing.
15	**Quit** button	Quits the PA phasing function.
16	**Save Phone Parameters** button	Store modified phone parameters back to the phone. It is equivalent to the menu bar function: PA Data > Save Selected PA Table > To Phone. It functions as a single click button for updating the phone PA table during manual PA phasing.
17	Delay Timers	Timers to control ramp up
18	Activity Detection Select	Switches to control activity detection mode
19	Dual Port Gain/Delay	Control Dual Port Gain and Delay
20	TimeMask Parameters	Control TimeMask
21	Ratio Band Gain/Offset	Compensation for frequency variation
Number references refer to Figure 22 on page 71.		

Typical Procedure for PA Manual Phasing

1. Detect phone
   On the **Hardware Initialize** menu, select **Detect Phone**, or press the phone detection button and indicator (3).
2. Initialize Test Set
   On the **Hardware Initialize** menu, select **Initialize TestSet**, or press the TestSet Initialization button and Indicator (4).
3. Select band
   On the **Band Select** menu, select **EGSM** or **DCS** to select EGSM band or DCS band.
4. Load the left phasing table from default/database
   On the **PA Data** menu, select **Read PA Table**, then click **From Default**, or **From Database**.
5. Load the right phasing table from phone
   On the **PA Data** menu, select **Read PA Table**, then click **From Phone**.
6. Make changes to the RIGHT table

Modify the original Phone Parameters (10) values by entering decimal values. Then, update the mobile PA table: On the **PA Data** menu, select **Save Selected PA Table**, then click **To Phone** or click the **Save PA to Phone** button (16).

7. Set phone channel number and power level
   Modify the original Channel Number (11) and Power Level (12) values by entering decimal values.
8. Set phone to Start PA Manual Phasing
   Click the **Start PA Manual Phasing** button (13) once to command mobile transmitting bursts with midamble 0 at desired Channel Number (11) and Power Level (12).
9. Measured Mobile PA output, TimeMask, and RMS Phase Error
   Configure the Test Set to display the PA, TimeMask, or RMS Phase Error of the mobile phone and take the measurement. If TimeMask or measured power level does not meet expected requirements, repeat Step 6, "Make changes to the RIGHT table," until good TimeMask and power level are obtained.
10. Set phone to Stop PA Manual Phasing
    Click the **Stop PA Manual Phasing** button (14) once to command mobile stop transmitting bursts.
11. Save Manual Phased PA Table to Updated Database
    Click the Phone Parameter Area (9), then save the manual phased PA table to the Updated Database: On the **PA Data** menu, select **Save Selected PA Table**, then click **To Database**.

NOTE

Users are required to set the configuration of the test set to display the results. If the setting is not correct, errors such as "Invalid Channel Number" are reported.

7.5 Manual AGC Phasing User Interface

Figure 23 shows the window of Manual AGC Phasing. For more details about the Manual AGC Phasing window, refer to Table 47.

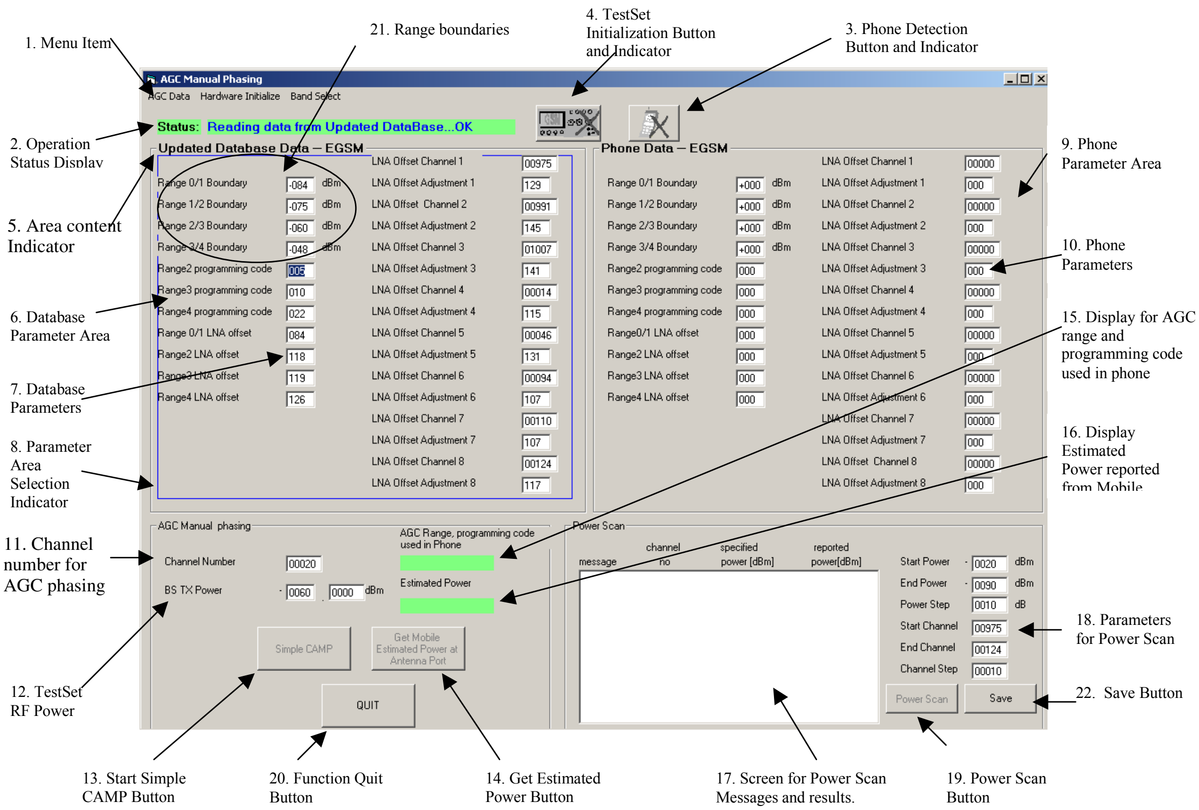


Figure 23. Manual AGC Phasing Window

Table 47. Manual AGC Phasing Window

In Figure 23	Item	Description
1	Menu bar	Manual AGC Phasing contains three main menus: • AGC Data • Hardware Initialize • Band Select These functions are described in the following rows.
	AGC Data	
	Read AGC Table From Default	Reads parameters from the Default Database ID 10 or ID 11 (depending on EGSM or DCS band) and displays them in the Database Parameter Area (6).
	Read AGC Table From Database	Reads parameters from the Updated Database ID 20 or ID 21 (depending on EGSM or DCS band) and displays them in the Database Parameter Area (6).
	Read AGC Table From Phone	Reads parameters from the Phone and displays them in the Phone Parameter Area (9).
	Save Selected AGC Table To Database	Saves the parameters of the selected Parameter Area, shown in the Parameter Area Selection Indicator (8), to the Updated Database (see Figure 20) ID 20 or ID 21 (depending on EGSM or DCS band). **Note:** The parameters in the **Defaults** column are overwritten.
	Save Selected AGC Table To Phone	Sends the parameters of the selected Parameter Area, shown in the Parameter Area Selection Indicator (8), to the Phone.
	Hardware Initialize	
	Initialize TestSet	Initializes the test set hardware. This is the same function as the TestSet Initialization button and Indicator (4).
	Detect Phone	Performs phone connection detection. This is the same function as the Phone Detection button and Indicator (3).
	Band Select	
	EGSM	Selects the EGSM band. The Database Parameter Area (6) shows the parameters read from the Updated Database ID 20. The Phone Parameter Area (9) shows 0.
	DCS	Selects the DCS band. The Database Parameter Area (6) shows parameters read from the Updated Database ID 21, while the Phone Parameter Area (9) shows 700.
2	Operation status display	Displays the status of the last operation. For example, if the Updated Database is successfully read, the Operation Status Display shows the string "Reading Data from Updated Database … OK".
3	Phone detection Button and Indicator	Performs the same function as Hardware Initialize > Detect Phone.
4	TestSet Initialization Button and Indicator	Performs the same function as Hardware Initialize > Initialize TestSet.
Number references refer to Figure 23 on page 76.		

Table 47. Manual AGC Phasing Window (continued)

In Figure 23	Item	Description
5	Area content indicator	Indicates from which database the parameters in the Parameter Area belong. For example, if the parameters in the Database Parameter Area (6) are from the Updated Database EGSM band, the Area Content Indicator shows “Updated Database Data—EGSM”.
6	Database parameter area	The table on the left contains parameters from the Default Database or Updated Database.
7	Database parameters	Parameters from the Default Database or Updated Database. It is a 2-digit decimal number. You can modify these parameters, and then save the modified parameters to the Updated Database or to the phone. Uppercase and lowercase inputs are treated the same.
8	Parameter area selection Indicator	A blue rectangle that indicates which parameter areas are selected, such as the Database Parameter Area (6) or the Phone Parameter Area (9). It is also used for saving parameters to the database or to the phone.
9	Phone parameter area	The table on the right contains parameters read from the phone.
10	Phone parameters	Parameters read from the phone. You can modify these parameters, and then save the modified parameters to the Updated Database or back to the phone. Uppercase and lowercase inputs are treated the same.
11	Channel number for AGC Phasing	Channel number to be used for SIMPLE CAMP. You can modify this parameter, which is sent to the phone and TestSet when pressing the **Simple CAMP** button.
12	Test Set RF Power	BS TX RF Power of the Channel used in the Test Set. The first 4-digit decimal number shows the integral part of the RF power. The second 4-digit decimal number shows the fractional part. This parameter can be modified. It is used in both “Simple CAMP” and “Get Estimated Power at Antenna Port.”
13	Start **Simple CAMP** button	Starts Simple CAMP using Channel Number (11) and BS TX Power (12).
14	**Get Estimated Power** Button	After performing Simple CAMP, press this button to set the Test Set RF power and command the phone to report the estimated power at antenna port. If the channel number is changed, you must perform Simple CAMP again.
15	Display for AGC range and programming code used in phone	Displays the actual AGC range and programming code used in the current Get Estimated Power Command.
16	Display estimated power reported from mobile	Displays the estimated power reported from the phone.
17	Screen for power scan messages and results	Displays messages and antenna power versus reported power during power scan.
18	Parameters for power scan	“Start Power” specifies the starting power for the power scan. “End Power” specifies the ending power for the power scan. Generally, “Start Power” should be larger than “End Power.” “Power Step” specifies the step for each scan. “Channel Number” in decimal format would be used for initial Simple CAMP.
Number references refer to Figure 23 on page 76.		

Table 47. Manual AGC Phasing Window (continued)

In Figure 23	Item	Description
19	**Power Scan** button	Starts Power Scan function. The parameters in item 18 would be used to command the Test Set and Phone. The phone would perform simple CAMP before getting the estimated power for each power set.
20	Function **Quit** button	Quits the AGC phasing function.
21	Range boundaries	Defines the range boundaries for ranges 0/1, 1/2, 2/3, and 3/4.
22	**Save** button	Saves power scan results to file.
Number references refer to Figure 23 on page 76.		

7.5.1 AGC Manual Phasing Procedures

The following are the typical procedures for AGC Manual Phasing.

1. Detect phone
   On the **Hardware Initialize** menu, select **Detect Phone**, or press the Phone Detection button and Indicator (3).
2. Initialize Test Set
   On the **Hardware Initialize** menu, select **Initialize TestSet**, or press the TestSet Initialization button and Indicator (4).
3. Select band
   On the **Band Select** menu, select **EGSM** or **DCS** to select EGSM band or DCS band.
4. Load the left phasing table from default/database
   On the **AGC Data** menu, select **Read AGC Table**, then click **From Default** or **From Database**.
5. Load the right phasing table from phone
   On the **AGC Data** menu, select **Read AGC Table**, then click **From Phone**.
6. Make changes to the left table

   Modify the original Database Parameter (7) values and save them to the phone: On the **AGC Data** menu, select **Save AGC Data**, then click **To Phone**.
7. Set channel number and power level
   Set the BS Channel Number (11) and Power Level (12).
8. Initiate Simple Camp
   Set the phone camped to the BS by clicking the **Simple CAMP** button.
9. Click **Get Mobile Estimated Power at Antenna Port** to get phone estimated receiver power.
10. Repeat steps starting with Step 6, “Make changes to the left table,” until the phone estimated receiver power is satisfactory.
11. **Save** phasing table to database
    On the **AGC Data** menu, select **Save AGC Data**, then click **To Database**.

7.6 IQ Balance Manual Phasing User Interface

Figure 24 shows the windows of Manual IQ Balance Phasing. For more details about the Manual IQ Balance Phasing window, refer to Table 48.

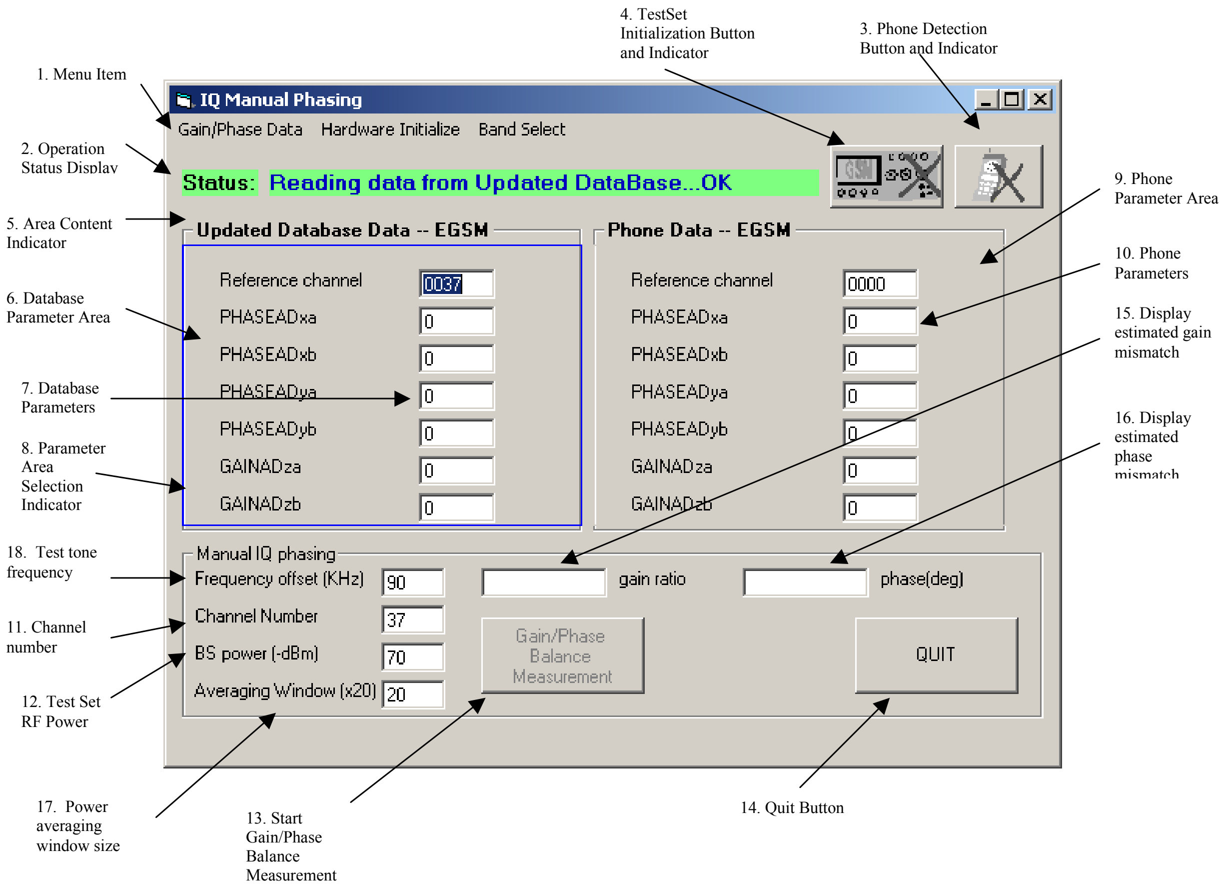


Figure 24. IQ Balance Manual Phasing Window

Table 48. IQ Balance Manual Phasing Window Descriptions

In Figure 24	Item	Description
1	Menu bar	Manual IQ Balance Phasing contains three main menus: • Gain/Phase Data • Hardware Initialize • Band Select These functions are described in the following rows.
	Gain/Phase Data	
	Read Gain/Phase Data From Default	Reads parameters from the Default ID 10 or ID 11 (depending on EGSM or DCS band) and displays them in the Database Parameter Area (6).
	Read Gain/Phase Data From Database	Reads parameters from the Updated Database ID 20 or ID 21 (depending on EGSM or DCS band) and displays them in the Database Parameter Area (6).
	Read Gain/Phase Data From Phone	Reads parameters from the Phone and displays them in the Phone Parameter Area (9).
	Save Selected Gain/Phase Data To Database	Saves the parameters of the selected Parameter Area (indicated by the Parameter Area Selection Indicator (8)) to the Updated Database ID 20 or ID 21 (depending on EGSM or DCS band). **Note:** The parameters in the **Defaults** column are overwritten.
	Save Selected Gain/Phase Data To Phone	Sends the parameters of the selected Parameter Area, shown in the Parameter Area Selection Indicator (8), to the Phone.
	Hardware Initialize	
	Initialize Test Set	Initializes the test set hardware. This is the same function as the Test Set Initialization button and Indicator (4).
	Detect Phone	Performs phone connection detection. This is the same function as the Phone Detection button and Indicator (3).
	Band Select	
	EGSM	Selects the EGSM band. The Database Parameter Area (6) shows parameters read from the Updated Database ID 20, while the Phone Parameter Area (9) shows 0.
	DCS	Selects the DCS band. The Database Parameter Area (6) shows parameters read from the Updated Database ID 21, while the Phone Parameter Area (9) shows 700.
2	Operation status display	Displays the status of the last operation. For example, if a read from the Updated Database performs successfully, then the Operation Status Display displays the string “Reading Data from Updated Database …. OK”.
3	Phone detection button and indicator	Performs the same function as Hardware Initialize > Detect Phone.
4	Test Set initialization button and indicator	Performs the same function as Hardware Initialize > Initialize Test Set.
Number references refer to Figure 24 on page 80.		

Table 48. IQ Balance Manual Phasing Window Descriptions (continued)

In Figure 24	Item	Description
5	Area content indicator	Indicates what the parameters in the Parameter Area belong to. For example, if the parameters in the Database Parameter Area (6) are from the Updated Database EGSM band, then the Area Content Indicator shows “Updated Database Data --- EGSM”.
6	Database parameter area	The table on the left contains parameters from the Default Database or Updated Database.
7	Database parameters	Parameters from the Default Database or Updated Database. It is a 2-digit decimal number. You can modify these parameters and then save the modified parameters to the Updated Database or to the phone. Uppercase and lowercase inputs are treated the same.
8	Parameter area selection indicator	A blue color rectangle that indicates which parameter areas (Database Parameter Area (6) or Phone parameter Area (9)) are selected and is also used for saving the parameters to the database or to the phone.
9	Phone parameter area	The table on the right contains parameters read from the phone.
10	Phone parameters	Parameters read from the phone. You can modify these parameters and then save the modified parameters to the Updated Database or back to the phone. Uppercase and lowercase inputs are treated the same.
11	Channel number	Channel number to be used for IQ balance measurement. You can modify this parameter, which is sent to the phone and Test Set when pressing the **Start** button.
12	Test Set RF Power	BS TX RF Power of the Channel used in the Test Set.
13	Start Gain/Phase Balance Measurement	Starts gain/phase balance measurement using the test tone frequency, channel number and BS TX Power specified in item 18, 11, and 12.
14	**Quit** button	Quits the application.
15	Display estimated gain mismatch	Displays the estimated I/Q magnitude ratio.
16	Display estimated phase mismatch	Displays the estimated phase shift in Q in degrees.
17	Power averaging window size	The number of windows, each of them 20 TS, to be used for the gain/phase mismatch estimation.
18	Test tone frequency	The test tone frequency offset from the carrier for the gain/phase mismatch estimation.
Number references refer to Figure 24 on page 80.		

7.6.1 IQ Balance Manual Phasing Procedures

The following are the typical procedures for IQ Manual Phasing:

1. Detect phone
   On the **Hardware Initialize** menu, click **Detect Phone**, or press the Phone Detection button and Indicator (3).
2. Initialize Test Set
   On the **Hardware Initialize** menu, click **Initialize TestSet**, or press the TestSet Initialization button and Indicator (4).
3. Select band
   On the **Band Select** menu, click **EGSM** or **DCS** to select EGSM band or DCS band.
4. Load the left phasing table from default/database
   On the **Gain/Phase Data** menu, select **Read Gain/Phase Data**, then click **From Default**, or **From Database**.
5. Load the right phasing table from phone
   On the **Gain/Phase Data** menu, select **Read Gain/Phase Data**, then click **From Phone**.
6. Make changes to the left table
   Modify the original Database Parameter (7) values. Save them to the phone: On the **Gain/Phase Data** menu, select **Save Gain/Phase Data**, then click **To Phone**.
7. Set channel number, test tone frequency and power level
   Enter values for BS Channel Number (11), Power Level (12), and test tone frequency (18).
8. Click the **Gain/Phase Balance Measurement** button to get the estimated gain and phase mismatch in the receiver front end before the gain/phase correction circuitry in the baseband processor.

NOTE

The parameters in the phasing table do not effect the Gain/Phase Balance measurement because the gain/phase correction circuitry is bypassed when the measurement is done. There is currently no direct method to verify the tuned parameters.

7.7 AFC Manual Phasing

AFC phasing relates the values from the AFC DAC to measured frequency offsets. The frequency offset versus DAC curve for the product is linear, therefore AFC phasing consists of one offset value for the AFC DAC and must only be done in the GSM band.

In AFC manual phasing, the phone generates transmit bursts at the selected channel with the frequency offset adjustment (which is shown in Hertz in the table on the left of the AFC manual phasing window). The resultant frequency error of the burst can be measured on the test set. You can adjust the frequency offset value accordingly to reduce the measured frequency error.

NOTE

In AFC manual phasing, the frequency offset values are stored in 8 Hz resolution (Hz/8).

According to the GSM 05.05 specification, the errors should conform to the Phase and Frequency errors listed in Table 49.

Table 49. GSM 05.05 Phase and Frequency Errors

Error	GSM 900	GSM 1800	GSM 1900
Peak Phase Error	20°	-	-
RMS Phase Error	5°	-	-
Freq Error	0.1 ppm	-	-

7.7.1 AFC Manual Phasing Procedure

The following is the suggested AFC Manual Phasing procedure:

1. Detect phone.
2. Initialize the test set.
3. Load the left phasing table from default/database.
4. Load the right phasing table from the phone for reference. The frequency offset value shown in the table is hexadecimal data in Hertz.
5. Make changes to the left table if necessary. The Frequency Offset value is a decimal value in Hertz. The Reference Channel is a decimal value to specify the reference channel to be phased. To adjust the phone synthesizer, click **Start Manual Phasing**. This Frequency Offset value is typically set to zero when the phone is first phased.
6. Set phone Tx power level in decimal format.
7. Click **Start AFC Manual Phasing**. The offset value in the left table is used to adjust the phone's carrier frequency.
8. Take a measurement on the test set for frequency offset.
9. Enter the frequency offset to the left phasing table.
10. Repeat Step 8 to Step 10 until the frequency offset measurement is satisfactory.
11. Click **Stop AFC Manual Phasing** to stop testing.
12. Save the frequency offset value to the database/phone.
13. Click **QUIT** to leave the application.

7.8 PA Manual Phasing

Use Manual PA Phasing to manually calibrate the transmit power of the radio to help meet pre-FTA specification requirements. PA Phasing is done by programming the PA RF DAC values to the desired power for each PA level, and writing appropriate RatioBandGain and RatioBandOffset values to correct the power variation across the frequency bands. Each GSM frequency band has its own power levels, target powers and tolerance definitions. Table 50 and Table 51 show the power targets for different GSM standards.

NOTE

PA manual phasing is limited; other parameters that affect burst shaping are not included.

Table 50. EGSM Power Targets

Power Level	Target Power (dBm)	Spec Power (dBm)
5	33	33+/-2
6	31	31+/-3
7	29	29+/-3
8	27	27+/-3
9	25	25+/-3
10	23	23+/-3
11	21	21+/-3
12	19	19+/-3
13	17	17+/-3
14	15	15+/-3
15	13	13+/-3
16	11	11+/-3
17	9	9+/-5
18	7	7+/-5
19	5	5+/-5

Table 51. DCS Power Targets

Power Level	Target Power (dBm)	Spec Power (dBm)
0	30	30+/-2
1	28	28+/-3
2	26	26+/-3
3	24	24+/-3
4	22	22+/-3
5	20	20+/-3
6	18	18+/-3
7	16	16+/-3
8	14	14+/-3
9	12	12+/-4
10	10	10+/-4

Table 51. DCS Power Targets (continued)

Power Level	Target Power (dBm)	Spec Power (dBm)
11	8	8+/-4
12	6	6+/-4
13	4	4+/-4
14	2	2+/-5
15	0	0+/-5

The Power Amplifier (PA) operates in three power ranges: high, middle, and low. Phasing should be done in three power ranges individually. Power ranges for different GSM standards are shown in Table 52.

Table 52. GSM Power Ranges

GSM Band	Power Range	Power Level
PGSM/EGSM	High	5 - 9
	Middle	10 - 14
	Low	15 - 19
DCS	High	0 - 4
	Middle	5 - 9
	Low	10 - 15

In all three ranges, the output RF power (in dBm) is proportional to the PA RF DAC value. For example, if the PA RF DAC value is 0x0000 (zero), the RF PA power is set to the minimum of that range. If the PA RF DAC value is set to 0x03FF, the RF PA power should be set to the maximum power of that range.

You can adjust the PA RF DAC value and monitor the PA RF power by the test set until the RF power for that power level meets the GSM specification. In general, PL5 of the GSM band has the largest PA RF DAC value in the high range while the PA RF DAC value for PL9 should be the smallest in the high range. The same principle applies for middle and low ranges. You can adjust the PA RF DAC value and monitor the RF power on the test set screen to tune the PA RF output power according to the GSM specification.

For a fixed PA RF DAC setting, the PA output power varies across frequency channels. Each GSM spectrum is divided into five sub-bands. The RatioBandGain and RatioBandOffset are used to compensate the power offset created by the frequency shift. The band definition for each GSM standard is shown in Table 53 on page 87. The recommended test channels for calculating RatioBandGain and RatioBandOffset values for each band are shown in Table 54.

Table 53. GSM Band Channels[1]

Band	Sub-band 1	Sub-band 2	Sub-band 3	Sub-band 4	Sub-band 5
EGSM	975 - 1008	1009 - 1023, 0 - 19	20 - 54	55 - 89	90 - 124
DCS	512 - 585	586 - 661	662 - 735	736 - 810	811 - 885

[1] Band channels are shown in decimal.

Table 54. GSM Band Test Channels[1]

Band	Sub-band 1	Sub-band 2	Sub-band 3	Sub-band 4	Sub-band 5
EGSM	975,1008	1009,19	20,54	55,89	90,124
DCS	512,585	586,661	662,735	736,810	811,885

[1] Test channels are shown in decimal.

If the power level is less than 13 in the GSM850/GSM900 bands *or* less than 8 in the DCS/PCS bands, the actual PA_RF_DAC value in each sub-band is proportional to the sub-band multiplier approximated by a linear equation, with its slope and intercept being the RatioBandGain and RatioBandOffset, respectively. Therefore, the sub-band multiplier of the first channel in each sub-band is equal to the RatioBandOffset.

7.8.1 Suggested Manual PA Phasing Procedure

The following is the suggested Manual PA Phasing procedure:

1. Select the desired band (for example, EGSM).
2. Initialize Test Set.
3. Detect Phone.
4. Read PA table from Phone (for comparison).
5. Read PA table from database.
6. Fine tune Band 3:
   a) Set the channel number for sub-band 3 chosen from the Band Channels Table (numbers are shown in decimal format).
   b) Set the power level (PL).
   c) Save PA table to phone.
   d) Click **Start PA Manual Phasing**.
   e) Check the power measured by the test set.
   f) Click **Stop PA Manual Phasing**.
   g) If the measured power is less than the GSM specification for that power level, increase the "DAC value." Otherwise, decrease the DAC value.
   h) Repeat steps Step c through Step f until the measured power meets the required GSM specification.
   i) Repeat steps Step b to Step h for the remaining power levels.

7. Fine tune Band 1:
   a) Set the channel number (in decimal format) for sub-band 1 chosen from the Band Channels Table.
   b) Set the power level (PL).
   c) Save PA table to phone.
   d) Click **Start PA Manual Phasing**.
   e) Check the power measured by the test set.
   f) Click **Stop PA Manual Phasing**.
   g) If the measured power is lower than the GSM specification for that band, increase the "RatioBandGain" or "RatioBandOffset" value. Otherwise, decrease these values.
   h) Repeat Step c to Step f until the measured power meets the required GSM specification.
8. To fine tune sub-band 2, set the channel number for Band 2 chosen from the Band Channels Table.
9. To fine tune sub-band 4, set the channel number for sub-band 4 chosen from the Band Channels Table.
10. To fine tune Band 5, set the channel number for sub-band 5 chosen from the Band Channels Table.
11. Save the tuned values to the database.

7.9 AGC Manual Phasing

The AGC table contains information for the receiver amplifier to allow phone software to determine RF power received from the base station. The whole power range is divided into five ranges: range 0 to range 4. Depending on the Estimated RF power at the Antenna port, parameters for that range are used. The table below shows the detailed range definitions.

Table 55. Range Definitions

Range	Definition
0	[-107 dBm, -84 dBm]
1	[-84 dBm, -75 dBm]
2	[-75 dBm, -60 dBm]
3	[-60 dBm, -48 dBm]
4	[-48 dBm,-10 dBm]

The relation between the programming code, LNA offset, and Channel offset can be best described by Equation 1:

$$\text{Estimated Power} = f(\text{code}_n) - \text{offset}^{\text{reference}}{}_n + \text{offset}^{\text{channel}} \qquad \textit{Eqn. 1}$$

Where:

- n: 0, 1, 2, 3 or 4
- code_n: the programming code for range n

- offset $^{reference}{}_{n}$: reference channel offset for range n
- offset^{channel}: interpolated channel offset calculated from the 8 selected channels

NOTE

The channel offset is not ready yet and should be set to 0x80 (that is, 0).

7.9.1 Suggested AGC Manual Phasing (Reference Channel) Procedure

The following is the suggested AGC Manual Phasing (Reference Channel) procedure:

1. Select the EGSM/DCS band.
2. Initialize the TestSet.
3. Detect the phone.
4. Read the AGC table from the phone. (Record the data for comparison if necessary.)
5. Read the AGC table from the database.
6. Set the Channel number in the AGC Manual phasing frame. The default channel number is 20 or 700.
7. Set BS TX Power in the AGC Manual phasing frame to a value within the range of interest.
8. Press **Simple CAMP**.
9. Press **Get Mobile Estimated Power at Antenna Port** to get the estimated power. Note that after activating this function, the AGC phone table parameters are automatically updated with the latest parameters stored in the phone.
10. Verify the AGC range and programming code used.
11. Verify the estimated power with the BS TX Power set.
12. Adjust the programming code for that range until the reported power is closest to the BS TX Power. After each change, you should save the AGC table to the phone and then press **Get Mobile Estimated Power at Antenna Port** again to read the reported power. Once this button is pressed, the old AGC table in the Phone Data is erased and automatically updated with the latest Phone AGC table.
13. Adjust the reference LNA offset for that range until the report power equals the BS TX power. After each change, you should save the AGC table to the phone, and then press **Get Mobile Estimated Power at Antenna Port** again to read the reported power.
14. Save the AGC table to the database.
15. Click **Quit**.

7.9.1.1 Suggested AGC Manual Phasing (Offset Channel) Procedure

The following is the suggested AGC Manual Phasing (Offset Channel) procedure:

1. Select the EGSM/DCS band.
2. Initialize the TestSet.
3. Detect the phone.
4. Read the AGC table from phone. Record the data for comparison if necessary.)

5. Read the AGC table from the database.
6. Set the Channel number in the AGC Manual phasing frame.
7. Set BS TX Power in the AGC Manual phasing frame to a value within the range of interest.
8. Press **Simple CAMP**.
9. Press **Get Mobile Estimated Power at Antenna Port** to get estimated power. Note that after activating this function, the AGC phone table parameters are automatically updated with the latest parameters stored in the phone.
10. Verify the AGC range and programming code used.
11. Verify the estimated power with the BS TX Power set.
12. Adjust the LNA Offset channel 1–8 and LNA Offset Adjustment 1–8 until the reported power equals the BS TX power. After each change, you should save the AGC table to the phone and then press **Get Mobile Estimated Power at Antenna Port** again to read the reported power.

NOTE

The actual channel offset adjustment for a non-specific channel (not included in the 8 offset channels) is obtained by interpolation between the two nearest offset channels among the 8 chosen offset channels.

13. Save the AGC table to the database.
14. Click **Quit**.

7.9.1.2 Suggested Procedure for Power Scan

The following is the suggested Power Scan procedure:

1. Select the EGSM/DCS band.
2. Initialize the TestSet.
3. Detect the phone.
4. Read the AGC table from Phone (record the data for comparison if necessary).
5. Read the AGC table from the database.
6. Change the AGC table and save to the phone if necessary.
7. Set the Channel number in the Power Scan frame.
8. Set Start Power, End Power, Start Channel, End Channel, Channel Step, and Power Step.
9. Press **Power Scan** to start.
10. Click **Quit**.

7.10 IQ Balance Manual Phasing

IQ balance manual phasing supports reading and alternating the parameters in the IQ balance phasing table on the phone, measuring the gain and phase imbalance in the receiver front end IC before the RXCOPR in the baseband processor IC. However, it does not support direct verification of the tuned parameters. For verification of the parameters, use the setup for radio blocking measurement and evaluate the performance through the improvement in immunity to interference in the receiver.

The IQ balance phasing table consists of 8 bytes. The first 2 bytes are the reference channel. It divides the channel band into two halves: low band and high band. The channels in low band and high band use different sets of phase correction parameters.

The next 2 bytes are the phase correction parameters for high band (PHASEADxa and PHASEADxb). PHASEADxb is reserved and should be set to zero.

The following 2 bytes are the phase correction parameters for low band (PHASEADya and PHASEADyb). PHASEADyb is reserved and should be set to zero.

The last 2 bytes are the gain correction parameters for both high and low band (GAINADza and GAINADzb). GAINADzb is reserved and should be set to zero.

Table 56. IQ Balance Manual Phasing Table

Reference Channel	Reference Channel to Divide Band into High and Low
PHASEADxa	Phase correction DAC for high band
PHASEADxb	Reserved
PHASEADya	Phase correction DAC for low band
PHASEADyb	Reserved
GAINADza	Gain correction DAC for high and low band
GAINADzb	Reserved

The following are the formulas for converting the gain and phase imbalance values into DAC values for the phasing table.

$$PHASEAD = round(\frac{1024}{180} * Phase\_Error)$$

$$GAINAD = round[128 * (\frac{1}{GainRatio} - 1)]$$

where `Phase_Error` is the reading obtained from the "phase" window and `GainRatio` is the reading from the "gain ratio" window.

NOTE

Both GAINAD and PHASEAD are signed integers.

7.10.1 IQ Balance Manual Phasing Procedure

The following is the suggested IQ Balance Manual Phasing Procedure:

1. Select the desired band (for example, EGSM).
2. Initialize Test Set.
3. Detect Phone.

4. Read IQ balance table from Phone (for comparison).
5. Read IQ balance table from database.
6. Set the channel number in high band, test tone frequency, the power level and the window size for averaging.
7. Click Gain/Phase Balance Measurement to estimate the gain and phase mismatch at the selected channel and frequency.
8. Convert the gain and phase reading into DAC value and input it to the left table.
9. Repeat Step 6 to Step 8 for low band.
10. Save left table to phone.
11. Power cycle the phone and carry out measurement on the radio blocking performance.
12. Use the manual phasing tool to fine-tune the phasing table to get optimum radio blocking performance.

7.11 Manual Camera Test

This section details the camera quality test processes, which include focus, grayscale, white-balance, contrast, shading, noise, and color tests.

7.11.1 Camera Quality Tests

Based on JPEG images taken from a test chart, camera-related quality parameters are measured based on two color models, namely RGB and LAB.

Different camera tests evaluate the quality of different camera components. Test limits can be adjusted depending on off-line subjective test and yields.

7.11.2 Manual Camera Test GUI

Figure 25 on page 93 shows the main window of the manual camera test (in single-image display mode). Note that both Camera 1 and 2 tabs are displayed. Some of the buttons (e.g., **Capture** and **Upload**) and menu functions are the same as the camera phasing case in Figure 25 on page 93. Only the camera test-specific buttons and menu functions are shown, and their details are described in Table 57 on page 94. The **Camera Test Parameter** window display is shown in Figure 26 on page 95 and its details are described in Table 58 on page 96.

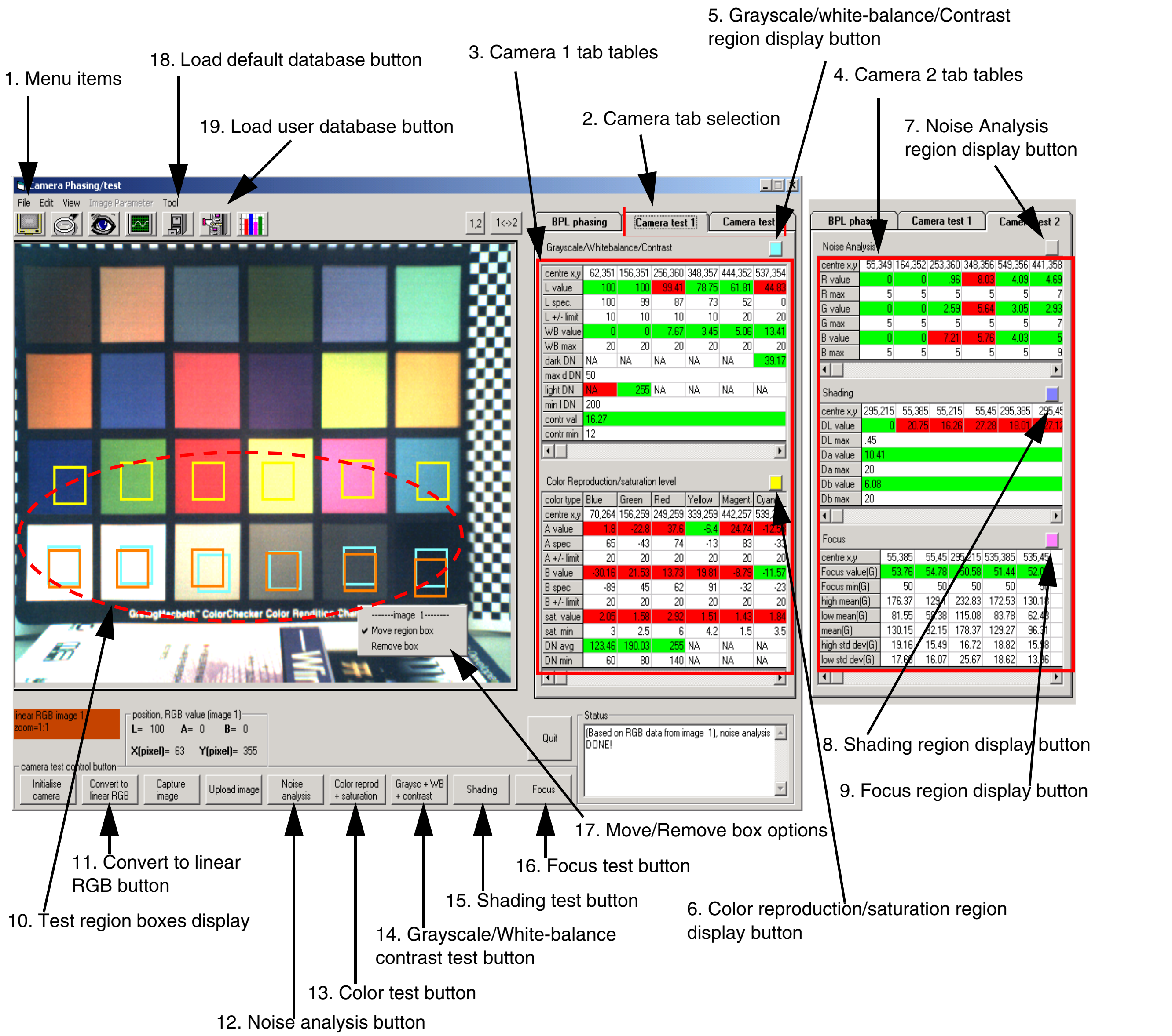


Figure 25. Manual Camera Test Window

Figure 25 shows a single-image display of a *Macbeth* chart with both camera 1 and 2 tabs.

Table 57. Camera Test Window Descriptions

Item no.	Item	Description
1	File -> Load camera test parameters -> from default DB	From the default database, loads camera test parameters to the corresponding display window, and loads camera test limits/region centers in camera test tables in (3) and (4)
	File -> Load camera test parameters -> from user DB	From the user database, loads camera test parameters to the corresponding display window, and loads camera test limits/region centers in camera test tables in (3) and (4)
	File -> Save camera test parameter to user DB	Camera test parameters based on Figure 26 on page 95, and test tables in (3) and (4) are saved to user database.
	File -> Save camera test result	Data from camera test tables in (3) and (4) are saved into a user-specified text file. Note that if no camera tests are performed, only test region centers and test limits are saved.
2	Camera tab selection	By activating camera tab 1 or 2, camera test function buttons (11)-(16) are enabled. Clicking on camera tab 1 and 2 display its corresponding tables in (3) and (4) respectively
3	Camera 1 tab tables	It displays camera test tables for grayscale/white-balance/contrast, and color reproduction/saturation.
4	Camera 2 tab tables	It displays camera test tables for noise analysis, shading, and focus.
5	Grayscale/ white-balance/ contrast region display button	This button toggles the display of test region squares for grayscale/ white-balance/contrast test.
6	Color reproduction/ saturation region display button	This button toggles the display of test region squares for color reproduction/ saturation test.
7	Noise analysis region display button	This button toggles the display of test region squares for noise analysis test.
8	Shading region display button	This button toggles the display of test region squares for shading test.
9	Focus region display button	This button toggles the display of test region squares for focus test.
10	Test region boxes display	This square display represents the test region boxes for various camera test. Note that the color of each box corresponds to the color of region display button (5)-(9).
11	Convert to linear RGB button	If the input image is a JPEG, this button converts the input image to linear RGB by removing gamma correction based on the parameters in Figure 26 on page 95. If the input image is Bayer raw type, this button performs a white-balance and interpolates to the full RGB image. Note that input image 1 or 2 is selected based on image selection indicator (30) in Figure 25 on page 93.
12	Noise analysis button	This button performs the noise analysis test and updates the results in its table in (4). Test results are compared with test limits, and pass/fail results are highlighted in green/red, respectively.

Table 57. Camera Test Window Descriptions (continued)

Item no.	Item	Description
13	Color test button	This button performs the color reproduction/saturation test, and updates the result in its table in (3). Test results are compared with test limits, and pass/fail results are highlighted in green/red, respectively.
14	Grayscale/ white-balance/contrast test button	This button performs grayscale/ white-balance/contrast tests, and updates the result in its table in (3). Test results are compared with test limits, and pass/fail results are highlighted in green/red, respectively.
15	Shading test button	This button performs shading test, and updates the result in its table in (4). Test results are compared with test limits, and pass/fail results are highlighted in green/red, respectively.
16	Focus test button	This button performs the focus test, and updates the result in its table in (4). Test results are compared with test limits, and pass/fail results are highlighted in green/red, respectively.
17	Move/remove box options	Enabled by clicking the right mouse button over the image display area. Two options are available, one is to enable the move mode for the region box display in (10), another is to remove all displayed region boxes.
18	Load default database button	Performs the same functions as File -> Load camera test parameters -> from default DB
19	Load user database button	Performs the same functions as File -> Load camera test parameters -> from user DB

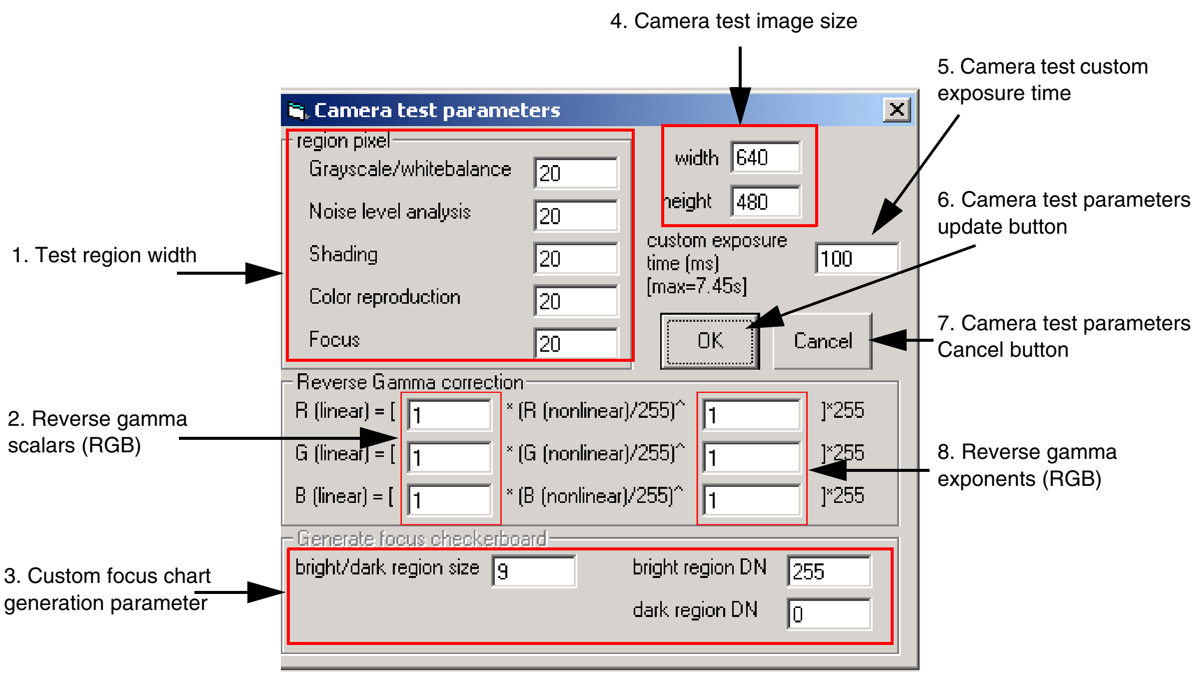


Figure 26. Camera Test Parameter Window Display

Table 58. Camera Test Parameter Window Descriptions

Item no.	Item	Description
1	Test region width	Width of each camera test region square
2	Reverse gamma scalars (RGB)	Scaling factors for RGB used for reverse gamma correction
3	Custom focus chart generation parameter	Parameters used to generate custom focus chart [***currently not used***]
4	Camera test image size	Width/height of displayed image for camera test
5	Camera test custom exposure time	It sets the custom exposure time [ms] (range is 114 μs to 7.45 s) for camera test.
6	Camera test parameters update button	Quits the camera test parameter window and updates any changes
7	Camera test parameters cancel button	Quits the camera test parameter window and discards any changes
8	Reverse gamma exponents (RGB)	This is the inverse of gamma correction exponent used in the input image.

7.11.3 Recommended Manual Camera Test Procedures

The following are the recommended manual camera test procedures:

1. Set the JPEG image capture quality to “fine” or to the highest quality available. To do this, choose the applicable MMI menu options and then power cycle the phone unit.
2. Set up the light-box.
3. Initialize the camera, and ensure that capture/uploaded image type is set to JPEG.
4. Load the default camera test parameters.
5. Place the *Macbeth* chart at slightly larger than 30 cm away from the camera.
6. Capture the JPEG image.
7. Upload the JPEG image.
8. Convert updated JPEG into a linear RGB image.
9. Display test region boxes for grayscale/white-balance/contrast, color, and noise tests ((5)-(7) in Figure 25 on page 93). If necessary, move test region boxes to align with test chart (using move option in (17) in Figure 25).
10. Perform grayscale/white-balance/contrast, color, and noise tests.
11. Repeat Steps 4 to 7 using a 18% gray chart (display shading test region box using (8) in Figure 25), move test region boxes if necessary, then perform shading test.
12. Repeat Steps 4 to 7 using a custom focus chart (display focus region box using (9) in Figure 25), move test region boxes if necessary, then perform focus test.
13. [*Optional*] Save the camera test result to a text file.

7.12 Bluetooth Manual Phasing

Bluetooth™ phasing modifies the Bluetooth crystal trim value to ensure that the frequency error of the Bluetooth output signal meets the Bluetooth specifications. The frequency-versus-trim value curve for the product is linear. Therefore, only one Bluetooth crystal trim value at a specific Bluetooth channel is needed to calculate the frequency offset compensation across the Bluetooth spectrum.

In Bluetooth manual phasing, the phone generates Bluetooth transmit bursts at a user-specified channel plus a user-specified frequency offset adjustment. The resulting frequency error of the burst can be measured on the test set. Users can then adjust the frequency offset value accordingly to reduce the output frequency error.

According to the Bluetooth Specification v1.2, the transmitted initial centre frequency should be within +/- 75 kHz of the channel's specified center frequency.

7.12.1 Bluetooth Manual Phasing Procedures

The following is the suggested Bluetooth Manual Phasing procedure:

1. Detect the Phone.
2. Load the Bluetooth data from the phone to the Bluetooth Manual Phasing GUI, using the Read from Phone feature.
3. Make changes to the Bluetooth address and crystal trim (Xtrim) value if necessary. Both values are in Little-Endian byte order.
4. Make changes to the transmitted Bluetooth frequency in the **BT Frequency** box, if necessary (default: 2441 MHz).
5. Click **Start BT Manual Phasing**. The phone will transmit a burst at the specified frequency and crystal trim value.
6. Take a measurement on the test set for the frequency offset.
7. Update the crystal trim value. Increasing the crystal trim value will reduce the transmit frequency. Note that there is an upper bound to the crystal trim value (approximately 0x003F for some models of Bluetooth modules tested).
8. Repeat Step 5 to Step 7 until the frequency offset measurement is satisfactory.
9. Click **Stop BT Manual Phasing** to stop testing.
10. Save the Bluetooth address and crystal trim value to the phone using the Write To Phone feature.
11. Click **QUIT** to exit the application.

8 Database Description

This chapter describes the structure of the phasing tool database and summarizes the database table parameters.

8.1 Database Structure

You can access the phasing tool database (`LCAGSMTest.mdb`) in Microsoft Access format through the Windows ODBC library. When the phasing tool is first run, the path of the database is registered in the User DSN of the ODBC data source administrator. The database serves the following four purposes:

- Stores the default settings for test environment
- Stores the phasing default parameters and test limits
- Configures phasing options for customization
- Stores the results of manual phasing

The database includes the following tables:

- CABLELOSS—Stores the Tx/Rx path cable loss values, which are configured into the test sets when performing auto-phasing and verification.
- RADIOMODELS—Stores the phone ID, band capability, band ID, supported phasing functions, database version number, and the name of the table used in PA phasing. This is the first table to be accessed by the phasing tool when running auto phasing.
- i2xx_TestLimits—Stores all the test limits used during phasing and verification
- i2xx_BATTMPBPHASE—Used by Battery Sense phasing
- i2xx_AFCPHASE—Used by AFC phasing
- i2xx_PAPHASE_xxxx—Used by the PA, Time Mask and Dual Port Gain phasing. The xxxx extension distinguishes the different phone models and/or PA version for which the table is tuned.
- i2xx_AGCPHASE—Used by AGC phasing
- i2xx_IQPHASE—Used by IQ balance phasing

In each of the tables used by phasing, except `i2xx_BATTMPBPHASE`, the table is divided into three sections distinguished by their IDs:

- ID < 10
  Rows with ID less than 10 are for auto phasing.
- 10 ≤ ID < 20
  Rows with ID from 10 to 19 are defaults values for manual phasing.
- 20 ≤ ID < 30
  Rows with ID from 20 to 29 are user-defined defaults for manual phasing.

Within each section, each row carries parameters for each frequency band.

You can update some of the data in the user-defined defaults using manual phasing. However, it is recommended that you do not change anything in the auto-phasing defaults and manual phasing defaults. Incorrectly set values can impede phasing result accuracy, or cause damage to the phone and test equipment in extreme cases.

On the phasing tool menu bar, you can select which defaults to use for auto-phasing. Use caution when using user-defined defaults for auto-phasing.

8.2 Parameter List

The following is the listing of the parameters in each of the tables in the database.

Table 59. RADIOMODELS

Parameter	Description
Product	Product name
PhoneModel	Phone model name
Band	Supported band
ID	Band ID
System	GSM system
Priority	dummy
SW	Phone s/w version, dummy
BsattMpbPhase	Reference ID for supported band for Battery Sense phasing
FastChargerPhase	dummy
PAPhase	Reference ID for supported band for PA phasing
AFCPhase	Reference ID for supported band for AFC phasing
AGCPhase	Reference ID for supported band for AGC phasing
IQPhase	Reference ID for supported band for IQ balance phasing
CallProc	dummy
Voltage	dummy
Current	dummy
CableLoss	Cable loss setting
DbVer	This data base version
PAVer	The extension of the name of `i2xx_PAPhase` table to be used for PA phasing

Table 60. i.2xx_PAPHASE

Parameter	Description
Common Parameters for PA, TM, DP	
ID	Reference ID
Type	Reference Band Type
CableLoss	Cable loss for cable connecting the Mobile and Test Set. Positive value, unit in dB. Used by manual PA phasing.
RefChan	Reference channel for PA power level phasing and TimeMask phasing. Should be any channel in radio sub-band 3. By default, set to first channel of sub-band3. (In **PhaseAll** mode, this overrides the `RefChan` in the AFC database.)

Table 60. i.2xx_PAPHASE (continued)

Parameter	Description
TXLevels	Power Control level (0 – 19) used for samples in high range, mid range, and low range measurement. Notation: L1, L2, L3, M1, M2, M3, H1, H2, H3 (In **PhaseAll** mode, H1 replaces the `TXLevel` specified in AFC database.)
AnTargets	Expected output power for the above `TXLevels`, unit in dBm
Ch_Len	Total number of channel for PA frequency variation phasing and DP phasing Min = 3, Max = 10. Typically set to 6
Channels	Channels for PA and DP phasing. Must include the `RefChan`. For better performance, follow the steps below: • If `Ch_Len` = 3, set channels to first channel of sub-band1, `RefChan`, and last channel of sub-band5. • If `Ch_Len` = 6 (recommended), set channels to the first channel of each sub-band and last channel of sub-band5. • If `Ch_Len` > 6, you must include at least one channel at each sub-band. For PA Frequency Variation phasing, these channels are used to approximate the frequency response of the whole radio band.
Test_Ch_Len	Total number of channels for verification
Test_Ch	Channels for verification
Verification	No effect. Always set to one.
Defaults	Common default table (Refer to Manual Phasing for Defaults details.)
Defaults1	Obsolete
Defaults2	Default table for SW1
NewPATable	Obsolete
Version	Version type
PA Specific Parameters	
PRTL	Threshold low Power Control level. Must be the same as the corresponding entry in default table. Use Manual Phasing to verify.
PRTH	Threshold high Power Control level. Must be the same as the corresponding entry in default table. Use Manual Phasing to verify. Boundaries for three ranges: • High Range: PL < PRTH • Mid Range: PRTH =< PL < PRTL • Low Range: PL >= PRTL
Freq_Var_Order	Order of equation to model the frequency variation characteristics across the whole band. Must be <= (`Ch_Len` –1)
PowerLMS	Select Least Mean Square model for High, Mid and low range approximation. Notation: H,M,L. 0 = do not use LMS in approximation; 1 = use LMS in approximation. This flag is in effect only if the order of approximation (`HRangeOrder` or `MRangeOrder`) is equal to one.
HRangeOrder	Order of approximation for High Range. 1 or 2

Table 60. i.2xx_PAPHASE (continued)

Parameter	Description
MRangeOrder	Order of approximation for Mid Range. 1 or 2. Remarks: Order of approximation for low range is always 2.
Targets	Targets for PL0 – 19. unit in dBm.
DTLTarget	OFS target for low range, unit in dBm
DTMTarget	OFS target for mid range, unit in dBm
DTHTarget	OFS target for high range, unit in dBm
DAC_Max	Maximum DAC value for PA closed loop control. Notation: High range, Mid range, low range
TimeMask Specific Parameters	
ACC_INITscalar	Scaling factor for ACC INIT calculation. Notation: High Range, Mid Range, Low Range
K1PS/K2PS	Scaling factor for Error Gain1/2 calculation. This factor controls the calculated Error Gain 1/2 for various loop response. Typically: • 1: critical damping • < 1: over damp • > 1: under damp. In other words, increase K1PS/K2PS => decrease phased Error1/2 gain. Notation: PL0,PL1,...,PL19 If any entry is set to 99, then the error1 gain for that PL is not phased and the default error1 gain value in PA default table is written to the phone.
DP Specific Parameters	
DP_BAdjust	Estimated optimum DP Gain difference between sub-bands. Total 25 entries, 5 entries per group. The first group is used if the phase error for sub-band1 is found to be the optimum value during phasing and so on. Finally, if the phase error for sub-band5 is found to be minimum, then the 5th group is used to adjust the phased DPG. The phased DPG is as follows: • Phased DPG for sub-bandx = optimum DPG + `DP_Adjust` for sub-bandx found in the optimum group of `DP_BAdjust`. For example, if default DPG = 48,49,50,51,52 and `DP_BAdjust` = 0,0,0,0,0,1,0,1,1,1,2,2,0,2,2,3,3,3,0,3,4,4,4,4,0 During phasing, the phase error for sub-band3 is found to be minimum, optimum group = 2,2,0,2,2 phased DPG for sub-band1 = 50 + 2 = 52 phase DPG for sub-band2 = 50 + 2 = 52 phase DPG for sub-band3 = 50 + 0 = 50 phase DPG for sub-band4 = 50 + 2 = 52 phase DPG for sub-band5 = 50 + 2 = 52
Est_Gain_Pwr	Estimated highest and lowest PA output power

Table 61. i2xx_AFCPHASE

Parameter	Description
ID	Reference ID
Type	Reference Band Type
Defaults	AFC Defaults, 4 bytes hex. First 4 characters refer to AFC DAC value, last 4 characters refer to Ref channel number.
RefChan	Reference channel for AFC phasing
TxPower	Reference power control level for AFC phasing
AnPower	Expected power received by Test set.
Init_PPM	Initial PPM (Parts Per Million) of the Tx carrier before phasing, dummy
PPM	PPM after phasing, dummy, still being used by pre-verification. To be replaced.
Osc	Crystal Frequency in MHz, dummy
FreqOffset	Initial Frequency Offset for pre-offsetting the MS LO, in 2byte hex, not used yet
Verification	
Ver	Verification flag, dummy Verification flag: 0 = phasing without verification 1 = verification after phasing 2 = verification before (using database default table) and after (using phased table) phasing. 3 = verification using mobile stored table without phasing

Table 62. i2xx_AGCPHASE

Parameter	Description
ID	Reference ID
Type	Reference Band Type
Defaults	AGC Defaults value used for s/w before MMI R7.0.x, 31 bytes hex.
Defaults_35	AGC Defaults value used for s/w MMI R7.0.x and after, 35 bytes hex.
Cable_Loss	The antenna cable loss, being used by manual AGC phasing, to be replaced.
NewAGCTable	For selecting MCU s/w version, dummy, 0 = before MMI R7.0.x, 1 = MMI R7.0.x and after
Reference Channel Phasing	
AGCRefChan	Reference channel for AGC phasing
Num_Range	Number of power range defined in AGC
Gpma	PMA gain setting for each power range
Gamp	AMP gain setting for each power range
Gtarget	LNA gain setting for each power range presumed by MCU code

Table 62. i2xx_AGCPHASE (continued)

Parameter	Description
Range_Def	Definition of the power ranges
Num_Test_Pairs	Number of input test power (`RF_Input_Power`) and LNA DAC value (`AGC_DAC`)
RF_Input_Power	The RF input test power, should be chosen as 1 power for each power range
AGC_DAC	The LNA DAC value for the corresponding `RF_Input_Power`
Gtarget_Test	Target LNA gain setting for each power range, for LNA gain modeling
Num_Test_Chan	Number of test channels to be used for channel variation modeling
Mid_Band_Power	The middle power level for each power range, used by dummy code
LNA_Gain_Order	The order of polynomial to be used to model the gain/DAC behavior of the LNA
LNA_Model_Len	The number of power range in `LNA_Model_Index` to be used for creating the model
LNA_Model_Index	The indexed power range is used to create the gain/DAC polynomial, index represents power range 0/1, 1 represents power range 2, and so on
LNA_Include_0	Whether the LNA gain be modeled by the gain/DAC polynomial for power range 0/1, 0 = no, 1 = yes
Ref_Ch_Model_Check_Limit	The check limits for reference channel phasing modeling
Gain_Comp	Value in dB to compensate the variation in the attenuation in the receiver lineup
Average_win	The outer averaging loop for MS power measurement
Power_rx_win	The inner averaging loop for MS power measurement
Power_Stability_Check_Limit	The power estimation stability check limit
Channel Variation Phasing	
AGCCalcChannels	The channel number for the channels used for channel variation modeling
Test_Ch_Band_Len	Number of test channels in `Test_Ch_Band`, used by dummy code
Test_Ch_Band	Test channel, used by dummy code
Int_Ch_Len	The number of channels in `Int_Ch` to be used for interpolation
Int_Ch	The channels to be used for doing interpolation from to get 8 best candidate for the phasing table
Ch_Var_Order	The order of the polynomial for modeling channel variation
Ch_Var_Power_Index	The indexed power in `RF_Input_Power` to be used in channel variation phasing
Ch_Var_Model_Check_Limit	The check limits for channel variation phasing modeling
User_Input_Ref_Power	Option for using the `User_Ref_Power`, 0 = not using, 1 = using
User_Ref_Power	User defined reference power which is the difference in dB between the two power measurement methods used by reference channel phasing and channel variation phasing
Ref_Power_Comp	The compensation in dB for the reference power
Verification	

Table 62. i2xx_AGCPHASE (continued)

Parameter	Description
Test_Ch_Len	The number of channels in `Test_Ch` for doing verification
Test_Ch	The channels where the verification is done
Test_Power	The test set output level for the MS initial camping when doing verification
Test_Start_Power	The start input power level for verification, in dBm
Test_End_Power	The end input power level for verification, in dBm
Test_Step	The step change in the input power level for verification, in dB
Ver	Verification flag, dummy Verification flag: 0 = phasing without verification 1 = verification after phasing 2 = verification before (using database default table) and after (using phased table) phasing. 3 = verification using mobile stored table without phasing

Table 63. i2xx_IQPHASE

Parameter	Description
ID	Reference ID
Type	Reference Band Type
Defaults	Defaults for IQ phasing. Please refer to Table 56 for the definition of each parameter
Single_dual	Single tone or dual tone for phasing, dummy. 1 = single, 2 = dual tone
Length	The number of channels to be used in `Test_ch` for phasing
Test_ch	The channel number used for phasing
Off_freq	The test tone frequency for phasing in Hz
BS_power	The power of the test tone generated by test set
Average_win	The outer loop of the power estimation
Power_rx_win	The inner loop of the power estimation
Option	Select different algorithm, for debugging, to be removed in the future
Obsolete	
Test_limit	obsolete
Phase_table_offset	obsolete
AGC	obsolete

Table 64. i2xx_BATTMPBPHASE

Parameter	Description
ID	Reference ID
Type	Reference Band Type
BattDefaults	Defaults for Battery Sense phasing.
Battery Sense Phasing	
NormVolt	The nominal battery power supply voltage for the phone
Current	Nominal current limit for battery power supply
Volts1	Battery sense phasing lo volt input
Volts4	Battery sense phasing hi volt input
Full_Scale_Volt_Comp	Scaling factor for adjusting the ADC input full scale voltage
Offset_Volt_Comp	Compensating voltage offset value for the ADC input
Charger Test	
Volts2	Battery power supply voltage for charger test
Volts3	Battery power supply voltage for charger test
Ext_volts1	Charger power supply voltage for charger test
Ext_volts2	Charger power supply voltage for charger over-voltage test
chrgCurrent	Charger power supply current limit
Verification	
Ver_Number	No of voltage setting for verification in `Ver_Voltage`
Ver_Voltage	The voltage settings for verification (in V)
Ver	Verification flag, dummy Verification flag: 0 = phasing without verification 1 = verification after phasing 2 = verification before (using database default table) and after (using phased table) phasing. 3 = verification using mobile stored table without phasing
Obsolete	
HighVolt	dummy
LowVolt	dummy
Hi_Volt_Limit_Hi	dummy
Hi_Volt_Limit_Lo	dummy
Lo_Volt_Limit_Hi	dummy
Lo_Volt_Limit_Lo	dummy
Gain_Hi_Limit	dummy

Table 64. i2xx_BATTMPBPHASE (continued)

Parameter	Description
Gain_Lo_Limit	dummy
Intcp_Hi_Limit	dummy
Intcp_Lo_Limit	dummy
Ver_Volt_Hi_Limit	dummy
Ver_Volt_Lo_Limit	dummy

Table 65. i2xx_TestLimits

Parameter	Description
ID	Reference ID
Type	Band name
Battery Sense Phasing	
BAT_ADC1_H	High volt ADC reading high limit
BAT_ADC1_L	High volt ADC reading low limit
BAT_HI_V_H	High volt ADC converted voltage high limit (V)
BAT_HI_V_L	High volt ADC converted voltage low limit (V)
BAT_ADC2_H	Low volt ADC reading high limit
BAT_ADC2_L	Low volt ADC reading low limit
BAT_LO_V_H	Low volt ADC converted voltage high limit (V)
BAT_LO_V_L	Low volt ADC converted voltage low limit (V)
BAT_GAIN_H	Slope high limit
BAT_GAIN_L	Slope low limit
BAT_INTP_H	Intercept high limit
BAT_INTP_L	Intercept low limit
VOLTS1_DAC_H	DAC test high limit for Volts1 input
VOLTS1_DAC_L	DAC test low limit for Volts1 input
VOLTS1_H	Voltage test high limit for Volts1 input
VOLTS1_L	Voltage test low limit for Volts1 input
VOLTS4_DAC_H	DAC test high limit for Volts4 input
VOLTS4_DAC_L	DAC test low limit for Volts4 input
VOLTS4_H	Voltage test high limit for Volts4 input
VOLTS4_L	Voltage test low limit for Volts4 input
VOLTS1_I_H	Current test high limit for Volts1 input
VOLTS1_I_L	Current test low limit for Volts1 input

Table 65. i2xx_TestLimits (continued)

Parameter	Description
VOLTS2_I_H	Current test high limit for Volts2 input
VOLTS2_I_L	Current test low limit for Volts2 input
CHRG_DIS_I_H	Charger disabled current test high limit
CHRG_DIS_I_L	Charger disabled current test low limit
CHRG_CHARGING_I_H	Charger enabled current test high limit
CHRG_CHARGING_I_L	Charger enabled current test low limit
AFC Phasing	
AFC_PPM_H	AFC pre-phase frequency error high limit (PPM)
AFC_PPM_L	AFC pre-phase frequency error low limit (PPM)
PA Phasing	
PA_PS_H	relative limits to the target sample power, PS1,....PS9
PA_PS_L	relative limits to the target sample power, PS1,....PS9
PA_DAC_H	phased DAC value high limit, DAC0, ... DAC19
PA_DAC_L	phased DAC value low limit, DAC0, ... DAC19
PA_OFS_H	phased OFS high limit, OFSH, ... OFSL
PA_OFS_L	phased OFS low limit, OFSH, ... OFSL
PA_RBGAIN_H	phased RBGAIN high limit, RB1,...RB5
PA_RBGAIN_L	phased RBGAIN low limit, RB1,...RB5
PA_RBOFFSET_H	phased RBOFFSET high limit, RB1,...RB5
PA_RBOFFSET_L	phased RBOFFSET low limit, RB1,...RB5
Time Mask Phasing	
PA_ACC_H	phased ACC INIT high limit
PA_ACC_L	phased ACC INIT low limit
PA_ERR1_H	phased ERROR1 gain high limit
PA_ERR1_L	phased ERROR1 gain low limit
PA_ERR2_H	phased ERROR2 gain high limit
PA_ERR2_L	phased ERROR2 gain low limit
PA_PROP1_H	phased PROP1 gain high limit
PA_PROP1_L	phased PROP1 gain low limit
PA_PROP2_H	phased PROP2 gain high limit
PA_PROP2_L	phased PROP2 gain low limit
Dual Port Gain Phasing	

Table 65. i2xx_TestLimits (continued)

Parameter	Description
PA_DP_H	phased DP gain high limit, RB1, ... RB5
PA_DP_L	phased DP gain low limit, RB1, ... RB5
PA_PhaseErr_H	phased phase error high limit
PA_PhaseErr_L	phased phase error low limit
AGC Phasing	
AGC_PWR_ERR_H	AGC EGSM pre-phase receive power error high limit (dB)
AGC_PWR_ERR_L	AGC EGSM pre-phase receive power error low limit (dB)
AGC_PGC2_H	AGC programming code 2 high limit
AGC_PGC2_L	AGC programming code 2 low limit
AGC_PGC3_H	AGC programming code 3 high limit
AGC_PGC3_L	AGC programming code 3 low limit
AGC_PGC4_H	AGC programming code 4 high limit
AGC_PGC4_L	AGC programming code 4 low limit
AGC_OFC1_H	AGC offset code 0/1 high limit
AGC_OFC1_L	AGC offset code 0/1 low limit
AGC_OFC2_H	AGC offset code 2 high limit
AGC_OFC2_L	AGC offset code 2 low limit
AGC_OFC3_H	AGC offset code 3 high limit
AGC_OFC3_L	AGC offset code 3 low limit
AGC_OFC4_H	AGC offset code 4 high limit
AGC_OFC4_L	AGC offset code 4 low limit
AGC_CH_PWR_ERR_H	AGC channel variation power error high limit (dB)
AGC_CH_PWR_ERR_L	AGC channel variation power error low limit (dB)
AGC_CH_OFC_H	AGC channel variation offset code high limit
AGC_CH_OFC_L	AGC channel variation offset code low limit
IQ Balance Phasing	
IQ_PHASE_H	IQ phase imbalance high limit (deg)
IQ_PHASE_L	IQ phase imbalance low limit (deg)
IQ_GAIN_H	IQ gain mismatch high limit
IQ_GAIN_L	IQ gain mismatch low limit
Battery Sense Phasing Verification	
BAT_V_V_H	Battery sense phased voltage high limit for verification

Table 65. i2xx_TestLimits (continued)

Parameter	Description
BAT_V_V_L	low limit
AFC Phasing Verification	
AFC_V_PPM	AFC phased PPM for verification
PA Phasing Verification	
PA_PL_H	absolute GSM High limits, PL0, ... PL 19
PA_PL_L	absolute GSM Low limits, PL0, ... PL 19
PA_PWRDAC_H	upper limits for 9 PWRDAC measurements
PA_PWRDAC_l	lower limits for 9 PWRDAC measurements
AGC Phasing Verification	
AGC_V_P0	defining the input power range 0 for power estimation tolerance
AGC_V_P1	defining the input power range 1 for power estimation tolerance
AGC_V_P2	defining the input power range 2 for power estimation tolerance
AGC_V_P3	defining the input power range 3 for power estimation tolerance
AGC_V_P0_H	the high power limit for input power rang 0
AGC_V_P0_L	the low power limit for input power rang 0
AGC_V_P1_H	the high power limit for input power rang 1
AGC_V_P1_L	the low power limit for input power rang 1
AGC_V_P2_H	the high power limit for input power rang 2
AGC_V_P2_L	the low power limit for input power rang 2
AGC_V_P3_H	the high power limit for input power rang 3
AGC_V_P3_L	the low power limit for input power rang 3

Appendix A
Error Messages

This appendix gives brief descriptions of various error messages that may appear during the execution of the PPT software.

A.1 Error Message for AFC Phasing

Default value out of range – Default AFC value out of range (–203125 Hz – 203119 Hz).

A.2 Error Messages for PA Phasing

Unable to phase low power range - Function calculated not monotonic increasing in the low power range. Low power range cannot be phased.

Calculated DTH value negative, set to zero - High range threshold is < 0. It is clamped at 0.

Calculated DTH value overflow, set to 255 - High range threshold is > 255. It is clamped at 255.

Calculated DTM value negative, set to zero - Mid range threshold is < 0. It is clamped at 0.

Calculated DTM value overflow, set to 255 - Mid range threshold is > 255. It is clamped at 255.

Calculated DTL value negative, set to zero - Low range threshold is < 0. It is clamped at 0.

Calculated DTL value overflow, set to 255 - Low range threshold is > 255. It is clamped at 255.

Calculated Band 1 Gain value too negative, set to min - Band 1 gain < min. Clamped at min.

Calculated Band 1 Gain value overflow, set to max - Band 1 gain > max. Clamped at max.

Calculated Band 1 Offset value too negative, set to min - Band 1 offset < min. Clamped at min.

Calculated Band 1 Offset value overflow, set to max - Band 1 offset > max. Clamped at max.

Calculated Band 2 Gain value too negative, set to min - Band 2 gain < min. Clamped at min.

Calculated Band 2 Gain value overflow, set to max - Band 2 gain > max. Clamped at max.

Calculated Band 2 Offset value too negative, set to min - Band 2 offset < min. Clamped at min.

Calculated Band 2 Offset value overflow, set to max - Band 2 offset > max. Clamped at max.

Calculated Band 3 Gain value too negative, set to min - Band 3 gain < min. Clamped at min.

Calculated Band 3 Gain value overflow, set to max - Band 3 gain > max. Clamped at max.

Calculated Band 3 Offset value too negative, set to min - Band 3 offset < min. Clamped at min.

Calculated Band 3 Offset value overflow, set to max - Band 3 offset > max. Clamped at max.

Calculated Band 4 Gain value too negative, set to min - Band 4 gain < min. Clamped at min.

Calculated Band 4 Gain value overflow, set to max - Band 4 gain > max. Clamped at max.

Calculated Band 4 Offset value too negative, set to min - Band 4 offset < min. Clamped at min.

Calculated Band 4 Offset value overflow, set to max - Band 4 offset > max. Clamped at max.

Calculated Band 5 Gain value too negative, set to min - Band 5 gain < min. Clamped at min.

Calculated Band 5 Gain value overflow, set to max - Band 5 gain > max. Clamped at max.

Calculated Band 5 Offset value too negative, set to min - Band 5 offset < min. Clamped at min.

Calculated Band 5 Offset value overflow, set to max - Band 5 offset > max. Clamped at max.

A.3 Error Messages for PA Phasing Verification

High Power Range not tested because of power measurement error. Unable to phase high power range. - High power range is not going to be verified because high power range was not able to phase.

Mid Power Range not tested because of power measurement error. Unable to phase mid power range. - Mid power range is not going to be verified because high power range was not able to phase.

Low Power Range not tested because of power measurement error. Unable to phase low power range. - Low power range is not going to be verified because high power range was not able to phase.

CH x Power not tested because of power measurement error. Unable to phase Band Multiplier for CH x - Channel x is not going to be verified because Channel x was not able to phase.

A.4 Error Messages for AGC Phasing

Camp failed - fail to camp

Power not stable - measurement power fluctuated

Lost Camp - lost camp

Camp failed @ channel x - fail to camp to channel x

Lost Camp @ channel x - lost camp at channel x

A.5 Error Codes

1 = Phone control error

2 = Test equipment error

3 = Data base error