Willtek

User's Guide

2201

ProLock

Firmware version 1.20

boosting wireless efficiency

Notice

Every effort was made to ensure that the information in this document was accurate at the time of printing. However, information is subject to change without notice, and Willtek reserves the right to provide an addendum to this document with information not available at the time this document was created.

For remote control operation, please refer to the Lector and Scriptor user's guide, and to the SCPI reference manual for the 2201 ProLock.

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Ordering information

This guide is issued as part of the 2201 ProLock. The ordering number for a published guide is M 290 003. The ordering number for the product is M 100 301.

Table of Contents

About This Guide

Purpose and scope

The purpose of this guide is to help you successfully use the 2201 ProLock features and capabilities. This guide includes task-based instructions that describe how to configure, use, and troubleshoot the 2201 ProLock. Additionally, this guide provides a description of Willtek's warranty, services, and repair information, including terms and conditions of the licensing agreement.

Assumptions

This guide is intended for novice, intermediate, and experienced users who want to use the 2201 ProLock effectively and efficiently. We are assuming that you have basic computer and mouse/track ball experience and are familiar with basic telecommunication concepts and terminology.

Related information

Use this guide in conjunction with the following information:

2201 ProLock: Getting started manual, ordering number M 295 003

7311 Lector Basic, 7312 Lector Enhanced, 7315 Scriptor: User's guide, ordering number M 294 309

Technical assistance

If you need assistance or have questions related to the use of this product, call Willtek's support. You can also contact Willtek by e-mail at customer.support@willtek.com.

Table 1 Technical support contact

Region	Phone number	Fax number
Europe, Middle East, Asia, Africa	+49 (0)89 99641 311	+49 (0)89 99641 440
Americas	+1 973 386 9696	+1 973 386 9191
China	+86 21 5836 6669	+86 21 5835 5238

Conventions

This guide uses naming conventions and symbols, as described in the following tables.

Table 2 Typographical conventions

Description	Example
User interface actions appear in this **typeface**.	On the Status bar, click **Start**.
Buttons or switches that you press on a unit appear in this **TYPEFACE**.	Press the **ON** switch.
Code and output messages appear in this `typeface`.	`All results okay`
Text you must type exactly as shown appears in this **`type-face`**.	Type: **`a:\set.exe`** in the dialog box.
Variables appear in this <type-face>.	Type the new <hostname>.
Book references appear in this typeface.	Refer to Newton’s Telecom Dictionary
A vertical bar | means “or”: only one option can appear in a single command.	`platform [a|b|e]`
Square brackets [ ] indicate an optional argument.	`login [platform name]`
Slanted brackets < > group required arguments.	`<password>`

Table 3 Keyboard and menu conventions

Description	Example
A plus sign + indicates simultaneous keystrokes.	Press **Ctrl+s**
A comma indicates consecutive keystrokes.	Press **Alt+f,s**
A slanted bracket indicates choosing a submenu from menu.	On the menu bar, click **Start > Program Files**.

Table 4 Symbol conventions

	This symbol represents a general hazard.
	This symbol represents a risk of electrical shock.
	NOTE This symbol represents a note indicating related information or tip.

Table 5 Safety definitions

	WARNING Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
	CAUTION Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

Safety Notes

This chapter provides the safety notes for the 2201 ProLock. Topics discussed in this chapter include the following:

Safety class

For the safety class of your 2201 ProLock, please refer to the Getting Started Manual that was delivered with your 2201 both as a hardcopy and as a PDF file on a CD.

Safety warnings

This product is designed for indoor use. As exposure to water may damage the instrument it has to be protected against moisture when used outdoors.

WARNING

Only use a 50 Ω N-type connector to connect to the RF IN/OUT port of the 2201 ProLock. Use of any other connector may result in damage of the instrument.

WARNING

Do not cover the ventilation slits (on the left and right-hand side of the instrument). Covering them may result in serious damage and fire.

WARNING

The maximum input power level at the RF IN/OUT connector is 3.5 W (35 dBm) continuous or burst level. Higher input levels may result in serious damage of the instrument.

WARNING

Operate the instrument within the temperature range from 5°C (40°F) to 40°C (104°F) only. Operation outside this range will lead to invalid results.

Overview

1

This chapter provides a general description of the 2201 ProLock. Topics discussed in this chapter include the following:

About the 2201 ProLock

Willtek’s 2201 ProLock is a reasonably priced test instrument for 3G mobile phones and wireless data cards. Level 1 and level 2 service shops use ProLock to quickly test wireless devices, perform smaller repairs and bill manufacturers for warranty claims.

The 2201 ProLock is similar to the 4100 and 4200 series instruments because it is small, easy to use and affordable to large mobile phone retailers with a repair shop in the back office. ProLock, however, supports both GSM and WCDMA phones and wireless devices. Many mobile phones today include WCDMA functionality; manufacturers start to demand WCDMA testing in case of warranty claims from repair shops. ProLock fills the gap between the cheap GSM-only testers and sophisticated 3G test sets.

What’s new

What’s new in firmware version 1.20

New features:

– EDGE support
– Multilingual user interface

What’s new in firmware version 1.10

New features:

– Now supports 1489 Bluetooth Connectivity Test Option
– Adjustable speech loopback delay for GSM
– Loopback authentication can be switched off/on for WCDMA

Improvements:

– Problems with BER measurement on GSM solved
– Position of XY Shuttle is displayed in manual mode

– Enhanced sensitivity on GSM
– Minor changes in user interface
– Easier firmware update procedure

Features and capabilities

– Affordable mobile phone test set for point-of-return and service tests
– Separates defective from faultless phones
– RF connector on the back for clear and tidy work bench
– Includes remote control software from a PC through 7311 Lector Basic
– Lector test protocols prove which phone has been tested, with serial number, date and time, and results
– GSM, GPRS, EDGE, WCDMA options available
– Includes SIM card and 7311 Lector Basic
– Easy-to-use Go/NoGo testing from a PC with the Lector software
– Manual mode for fault finding
– Standard transmitter and receiver measurements
– Lector-generated test protocol equivalent to those generated with higher-level testers
– Four GSM frequency bands supported
– Ten WCDMA frequency bands supported
– Complete system available for smooth and reliable testing

Options and accessories

2231 GSM Option

The 2231 GSM Option performs the necessary GSM call processing and measurements on a voice channel or a test (loopback) channel. Measurements include output power, power vs. time, RMS and peak phase error, frequency error, burst length, BER and Reported RSSI.

2232 GPRS Option

The 2232 GPRS Option is an extension of the 2231 GSM Option, adding the necessary protocol for the GPRS Attach and to set up a test channel. The measurements are the same as with the GSM Option, with BLER measurements in addition. Protocol and measurements support data traffic on one timeslot in either the uplink or the downlink.

2233 EDGE Option

The 2233 EDGE Option enables 8PSK transmitter measurements to ensure that the EDGE transmitter functions correctly. For the purpose of the measurements, a data connection is established. The 2231 GSM Option is a prerequisite of the EDGE option.

2234 WCDMA Option

The 2234 WCDMA Option per

forms the necessary WCDMA call processing and measurements on a voice channel or a test channel (RMC). Measurements include:

- Minimum and maximum output power
- Open loop and inner loop power control
- RMS and peak error vector magnitude
- RMS and peak magnitude error
- RMS and peak phase error
- Frequency error
- Rho
- I/Q offset
- I/Q imbalance
- ACLR
- BER and BLER
- Reported RSCP

1103 USIM and GSM Test SIM card

This test SIM card supports the necessary features and elementary fields to allow testing of a WCDMA/UMTS phone (3G) and a GSM/GPRS/EDGE phone only (2G/2.5G). The test SIM comes in the credit card ISO size, with the possibility to break a plug-in size SIM card out. This enables testing of all commercially available WCDMA/UMTS phones and GSM/GPRS/EDGE mobile phones.

7360 Coupling Factor Update License

With tests over the antenna, good power and receiver measurement accuracy is only achieved with the exact knowledge of the antenna coupling factor, which depends on the phone model and the coupling device. A list of coupling factors for a number of phone models is already delivered with Lector and Scriptor, but does not cover all the phone models available on the market. Willtek offers an update service of the coupling factors for the latest models. These coupling factors are valid for the antenna connection between the phone and the Willtek 4916 Antenna Coupler installed in a 4921 RF Shield.

The 7360 Coupling Factor Update License is available as an option to 7312 Lector Enhanced and 7315 Scriptor. The option enables both applications to download actual coupling factors from the Internet. The update service is available for one year and can be renewed.

4916 Antenna Coupler

The Willtek 4916 Antenna Coupler is an essential extension to all mobile phone testers. The coupler supports extended frequency ranges for 3G mobile phone testing in addition to WLAN and Bluetooth. Using RF coupling, the 4916 allows non-wired connection mobile phone testing. The mobile phone antenna is also verified when the 4916 Antenna Coupler is used, resulting in a complete functional check of all mobile phone parts.

4921 RF Shield

Willtek's 4921 RF Shield is a new RF shielding solution for testing 3G mobile phones, as well as data cards and WLAN equipment in large service centres and production lines. The 4921 is the optimum solution for service centres and manufacturers with high volume phone testing because it can endure the high open/close rates involved. The RF Shield is designed to eliminate interference from any adjacent mobile phones, the local base station, and to isolate the environment from the RF emitted from the phone (or other device under test).

7310 Lector and Scriptor family of test automation products

Willtek's 7310 Lector software is a well-established and economic test solution for service centres and repair shops testing returned mobile phones with the 3100 Mobile Fault Finder or the 4400 Mobile Phone Tester Series.

Willtek's family of test automation programs now has additional members for enhanced ease of use. The family provides a scalable test solution for different applications around wireless device testing. It fits the needs of test operators and administrators in large service centres as well as in small repair shops. The software provides an easy-to-use interface to the 3100 Mobile Fault Finder and the 4400 Mobile Phone Tester Series.

1488 Bluetooth Connectivity Test Option

This option performs a Go/NoGo test of the Bluetooth functionality of the mobile device under test. The test is controlled from Lector or Scriptor and requires the 4941 Bluetooth Hardware. This option is also part of 1489 Bluetooth Connectivity Test Package.

1489 Bluetooth Connectivity Test Package

The 1489 Bluetooth Connectivity Test Package contains those additional parts you need to perform Go/NoGo tests of the Bluetooth functionality within the mobile device under test. The package includes the 4941 Bluetooth Hardware, cables, a modified RF Shield rear panel, the 1488 Bluetooth Connectivity Test Option and RAPID software required to perform normal phone testing along with a Bluetooth Go/NoGo tests on a Bluetooth-enabled mobile. Results may be printed and saved on a single test report. Additionally requires the 4921 RF Shield.

Instrument Setup and General Operation

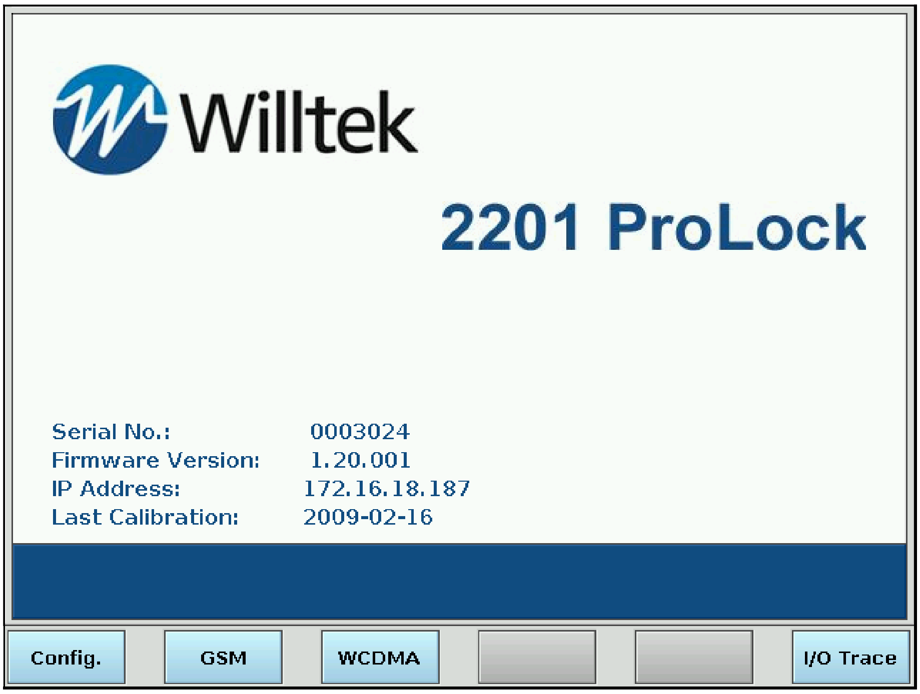
2

This chapter describes how the instrument and measurement parameters are set up. Topics discussed in this chapter are as follows:

Starting the instrument

Please read the Getting Started manual for the 2201 ProLock to learn how to power ProLock up. Once the firmware is booted, the start menu appears (see below). Explanations in this user's guide typically start from this start menu.

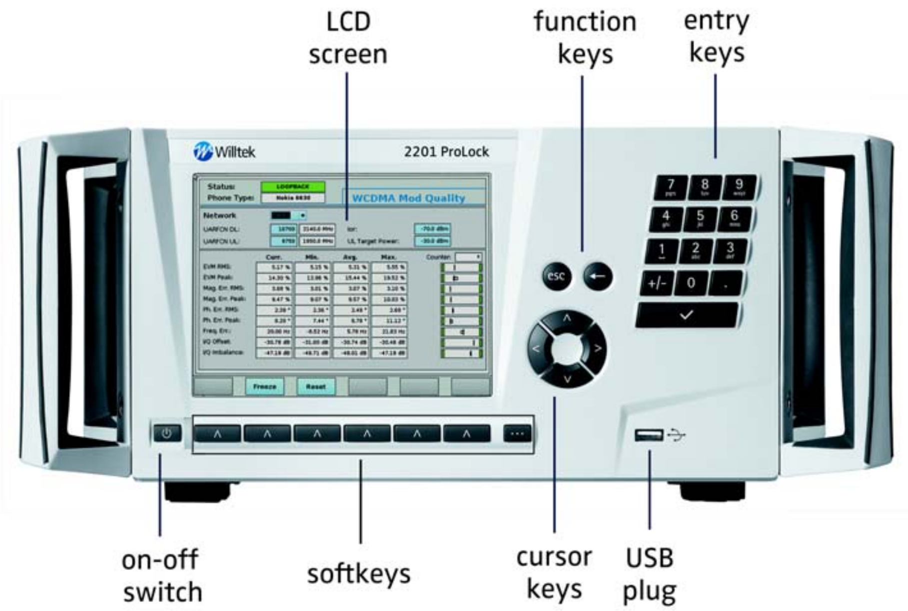
For a general description of the front panel elements and how to navigate the menus, see section "Basic concepts of operation" below. See also "Connecting the device under test" on page 14 to learn different possibilities how to connect mobile phones and wireless data cards to the 2201 ProLock.



Basic concepts of operation

The 2201 ProLock can be operated either through the front panel or via remote control, either via Lector or custom test software. The latter allows automation of test sequences and is explained in more detail in Chapter 6 "Automation Through Remote Control". For operation through Lector and Scriptor, Willtek's family of test automation products, please also refer to the user's guide for this software.

In manual mode, the 2201 ProLock is operated through the front panel elements. The basic elements and functions are explained in the Getting Started Manual.



Menus and softkeys

The most important elements are the menus displayed on the LCD screen, and the six softkeys below the screen. The screen always displays a menu with either input fields or results or both, and a description of the current functions of each of the six softkeys.

Depending on the current meaning of the softkeys, each softkey starts or stops a function, provides access to parameters or initiates the display of another menu.

While you can go to a new menu level by pressing a softkey, you can return to the next lower menu level with the **ESC** function key.

Some menus contain more than six softkey functions. In this case, the following text is displayed above the right-most softkey: "More 1/2" or "More 2/2". Press the **...** (More) key to get access to the remaining softkey functions.

Entry fields

Most menus contain one or more entry fields where you can change test or control parameters. At any stage, the 2201 ProLock is in one of two modes: the menu mode (where you can select an entry field or move to a different menu) and the entry mode (where the 2201 ProLock is ready to accept your input for a parameter field).

In menu mode, you can move between the entry fields with the cursor keys: Press the **RIGHT** key to jump to the next entry field, or the **LEFT** key to jump to the previous entry field. The entry field currently selected is highlighted. Push the **ESC** key to move one menu level up.

Entry mode is selected by either pressing the **ENTER** key [✓], by pressing the **UP** or **DOWN** key, or by pressing one of the entry keys (0...9, +/-, .) directly.

In entry mode, you can either enter numerical values or alphanumerical values, or select an entry from a defined list (list field). What you can actually enter here, depends on the type of input field.

– Numerical input fields allow you to enter a new numerical value using the entry keys, or change the value currently displayed with the **UP** and **DOWN** cursor keys.
  When you change to entry mode in a numerical input field, the cursor is placed in front of the right-most digit. The **LEFT** and **RIGHT** keys can be used to change the location of the cursor within a multi-digit input field. The **UP** and **DOWN** cursor keys can be used to increment the respective digit.
– Alphanumerical input fields allow you to enter new text using the entry keys. Press an entry key repeatedly to select the desired letter. The **LEFT** and **RIGHT** keys can be used to change the location of the cursor within the text string.
– List fields allow you to scroll through the list with the **UP** and **DOWN** cursor keys.

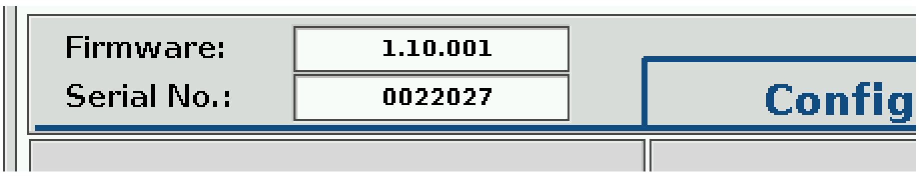
While in entry mode, your input can be undone by pressing the **BACKSPACE** key [←]. The character or numerical digit before the current cursor position is deleted.

To close an input field and accept the selected input, press the **ENTER** key.

To close an input field and leave the previous input unchanged, press the **LEFT** or **RIGHT** key. If you are in a numerical or alphanumerical input field, this holds valid if the cursor is already at the respective end of the input field.

Symbols used on the display

At the top of the display, ProLock displays either instrument-specific information (in the Configuration and Service menus), or the signaling status and the phone model of the unit under test (in the GSM and WCDMA menus).
Examples:



On the right-hand side, ProLock displays the name of the menu. Example:

Understanding the presentation of measurement results

Numerical results

Most measurement results are displayed as a numerical value along with a unit. Examples:
"25.02 dBm" are 25.02 decibel relative to 1 mW (or 318 mW in total).
A peak phase error of "5.46 °" means 5.46 degrees.

Graphical representation

Some parameters have a statistics bar along with the numerical results, graphically representing the statistics. The elements of this bar are as follows (see Figure 1).

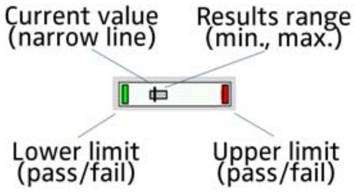


Figure 1 Components of statistics bar

- The left and right-hand ends of the statistics bar denote the lower and upper limits, respectively. A green field indicates that all the results were within the limit; a red field indicates that the limit (upper or lower) has been exceeded.
- The narrow black line indicates the position of the last measurement result (current value).
- The grey bar within the statistics field indicates the range of measurement results relative to the limits. If the grey bar approaches the upper or lower limit, at least one of the results is close to fail the test.

Numerical results with statistics

This type of measurement result presentation displays the most recent result with average, minimum and maximum values since the start of the measurements. The best example for this type is the BER Test menu.

Bits	Curr.	Min.	Avg.	Max.
1950	0.00 %	0.00 %	0.00 %	0.00 %
5086	0.00 %	0.00 %	0.00 %	0.00 %
2964	0.49 %	0.00 %	0.47 %	3.32 %

Bits

The first column of the table displays the number of bits of each class over which the measurement has been performed.

Curr. This column displays the current (i.e. most recent) measurement result.

Min. This column shows the minimum (i.e. lowest) result for the respective bit class since the test was started.
The statistical evaluation can be restarted by pushing the **Reset** softkey.

Avg. This column indicates the average result for the respective bit class since the test was started.
The statistical evaluation can be restarted by pushing the **Reset** softkey.

Max. This column shows the maximum (i.e. highest) result for the respective bit class since the test was started.
The statistical evaluation can be restarted by pushing the **Reset** softkey.

Affecting the results presentation

The test limits can be altered in the Limits menu which can be accessed from the respective basic system menu (i.e. either the GSM Tests menu or the WCDMA Tests menu) by pushing **Param > Limits**.

The statistics can be reset by pushing the **Reset** softkey. The stored minimum, maximum and average values are then deleted and the statistical evaluation is restarted.

You can pause the measurement results update by pushing the **Freeze** softkey. The results update is halted, the last measurement results remain onscreen and the softkey turns into the Unfreeze softkey.
Push **Unfreeze** to resume the measurements.

Connecting the device under test

General observations

There are two ways of connecting the 2201 ProLock with the wireless device (mobile phone or wireless data card): either with a proper RF cable or with an antenna coupler. Both methods have their advantages, but a cable connection is not always possible because some many phones are lacking an RF connector or because there is no RF cable with an appropriate connector available.

If you connect the device under test with the 2201 ProLock using a double-shielded RF cable you can test the transmitter and receiver with the most accurate results. This is because the connection is least affected by loss of signal strength or distortion through other radiated signals. The drawback of this method is that one component of the mobile phone is not included in the tests, and that is the antenna, usually including the antenna connector.

If you use an antenna coupler to connect the phone with the instrument, you will be able to test the complete device including the antenna. Also you do not need different RF cables for various types of mobile mobiles in store, so testing over an antenna coupler eases test handling.
On the other hand, only a small fraction of the signal transmitted from both sides reaches the other end, and this small fraction may be distorted by other signals on the air as long you do not take any precautions. If you use an RF shielding device such as Willtek's 4921 RF Shield, the problem of signal distortion can be avoided. With the knowledge of the exact attenuation of the signal in a given shielding solution and at a specified position relative to the antenna coupler, the signal attenuation at the antenna coupler can be compensated.

Willtek recommends any of the following useful coupling combinations:

– Cable connection
– 4916 Antenna Coupler, no shielding device
– 4916 Antenna Coupler with 4921 RF Shield using the standard shuttle
– 4916 Antenna Coupler with 4921 RF Shield using the XY Shuttle

If a coupler is used, the RF coupling loss between the phone and the coupler is automatically compensated in the measurement results, provided that the type of mobile phone is stored in the coupling factor database. The database is frequently updated on the Internet and available to subscribers of the 7360 Coupling Factor Upgrade License. See section "Working with the built-in coupling factor database" on page 31 and the Lector and Scriptor user's guide for more details.

Using a cable connection

1 Use a double-shielded RF cable with an N-type connector at one end and the appropriate connector for the mobile phone under test at the other end.

2 Plug the N-type connector into the N-type jack **RF IN/OUT** at the rear of the 2201 ProLock.

3 Plug the other end of the cable into the RF jack of the mobile phone, or use an appropriate adapter to connect the other end of the cable with the phone.

4 In the **Configuration** menu in the Coupling Type section, ensure that **Coupler** is set to ‘‘Cable’’.

Using an antenna coupler

1 Connect the 2201 ProLock with the coupler using a double-shielded RF cable with appropriate connectors:

a Plug the N-type connector into the N-type jack **RF IN/OUT** at the rear of the 2201 ProLock.

b The next step depends on whether or not you want to use an RF shielding device:

– If you are not using an RF shielding device, plug the other end of the cable into the RF plug of the antenna coupler.

– If you are using an RF shielding device, plug the other end of the cable into the external RF plug of the shielding device. Use another cable to connect the RF plug inside the shielding device with the antenna coupler inside the shielding device.

2 Mount the wireless device on the antenna coupler.

3 If you are using an RF shielding device: Once a connection has been set up, close the shielding device to avoid the RF signals to be distorted by other signals in the environment.

4 In the **Configuration** menu, ensure that the Coupling Type settings are properly set.
   - In the Coupler selection field, select 4916.
   - In the Shield Box selection field, select 4921 if the coupler is installed in the 4921 RF Shield.
   - If you are using the 4921 RF Shield, select the shuttle being used (XY Shuttle or standard shuttle).

Before starting a test

Modes of operation

There are different modes available in which to operate the instrument:

- Manual mode: See the next sections and chapters to learn how to set up and perform measurements from ProLock's front panel, and how to interpret test results.
- Lector-driven: Willtek offers a family of software products for test automation. 7311 Lector Basic and 7312 Lector Enhanced can be used to drive tests with the 2201 ProLock, while 7315 Scriptor can also be used to create and maintain test scripts. See the Lector and Scriptor user's guide for more information.
- Remote mode: The instrument can be operated from a computer through a built-for-purpose operating software. Chapter 6 "Automation Through Remote Control" is written for test engineers who want to write their own control software for ProLock.

Communication systems

2201 ProLock supports GSM, GPRS (as an extension of GSM) and WCDMA. (Note that these are options; at least one is installed on your ProLock).

Each of these communication systems has its own parameters that need to be set up prior to a test. These parameters are explained in the respective chapters (Chapter 3 "Performing Manual Tests and Measurements in GSM Mode", Chapter 4 "Performing Tests and Measurements in WCDMA Mode").

Using 2201 ProLock with peripherals

Connecting and using an external keyboard

The 2201 ProLock can be operated conveniently through its front panel elements. However, if you need to enter a lot of data an external keyboard may be useful. The 2201 ProLock supports standard keyboards with USB interface; the keyboard layout for France, Germany, the UK and the USA are automatically recognized.

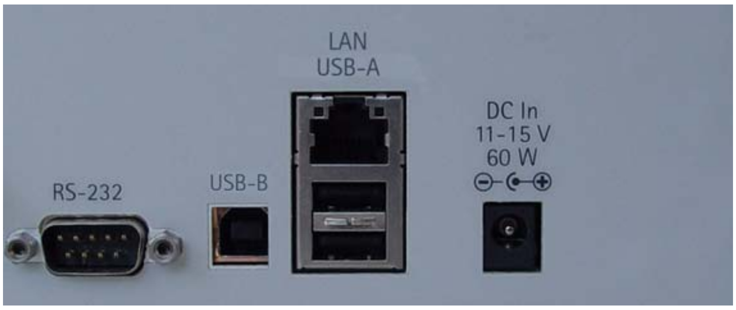
The softkeys are assigned to function keys F1 through F6, with the **...** key being assigned to F7.
To enter negative numbers, just press the **–** key in the numeric block (the Num Lock function must be active).

Connecting and using a flash drive

A USB flash drive can be connected to the 2201 ProLock to install firmware updates and to store screenshots. Please use the flash drive delivered with ProLock.

Connect the USB flash drive to a USB port either on the front or on the rear panel (USB-A).

Connecting the instrument to the LAN



In addition to operating the 2201 ProLock through its front panel elements, it can also be controlled remotely from a PC through the serial (RS-232) interface, a USB port or the LAN (local area network).

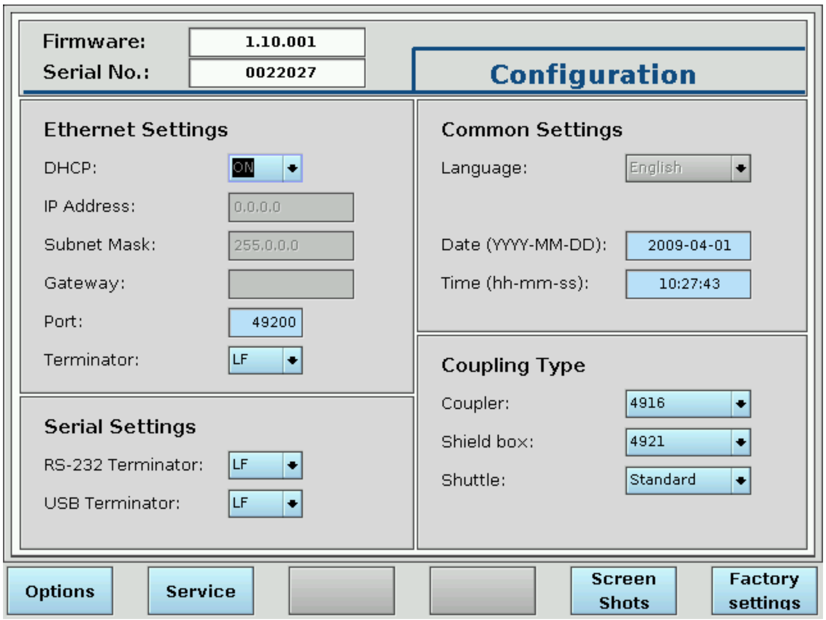
The LAN interface of the 2201 supports 10 or 100 Mbps connections (10BASE-T or 100BASE-TX) over a Cat5 cable (with RJ-45 connectors at both ends).
Simply plug one end of the cable into the LAN socket on the rear panel of the 2201 and the other into the socket of your LAN.

If you do not have a LAN but a PC with a LAN socket, you can connect the instrument to the PC directly using a cross-connect LAN cable. This cable type is available in computer shops or from Willtek.

In order to set up the IP address parameters of the 2201 ProLock, you can either enter them directly or activate DHCP (Dynamic Host Configuration Protocol). DHCP is a protocol that automates the configuration of TCP/IP devices on a local area network; the IP address and subnet mask are assigned by a DHCP server that must be available on the LAN.

To enable DHCP, proceed as follows:

1 From the start menu, select **Config.**
The Configuration menu appears.



2 In the DHCP list field, select **On**.
DHCP is activated; if a DHCP server is available on the LAN, the 2201 will obtain its IP address, subnet mask and gateway address from that server during the start sequence. They will be displayed in the Configuration menu. The IP address is also displayed in the start menu.

To disable DHCP and enter the IP parameters manually, proceed as follows:

1 From the Start menu, select **Config.**
The Configuration menu appears.

2 In the DHCP list field, select **Off**.
DHCP is de-activated.

3 In the IP Address field, enter an IP address that is not already being used on the LAN.

4 In the Subnetmask field, enter the mask for the subnet that the 2201 belongs to.

5 Optional: For communication between ProLock and a computer outside the subnet, enter a gateway address in the Gateway input field.

6 The Port input field allows you to select a port number for remote control. The default is port number 49200; change this only if needed and ensure that the remote control software uses the same port number to address the 2201 ProLock!

7 The Terminator selection field allows you choose a command or request line terminating identifier. The default is LF for line feed, but you can select CR (carriage return) or CRLF (a combination of the two) instead if the remote control software requires this. Ensure that the remote software uses the same command line terminator!

Note

If DHCP is already enabled, but ProLock was not connected to a TCP/IP network at startup:

1 Connect ProLock to a computer or computer network via TCP/IP.

2 Open the **Configuration** menu.

3 Disable DHCP (**Off**) and enable it again (**On**).
This will trigger a new network search. ProLock will try to obtain an IP address and display the IP settings.

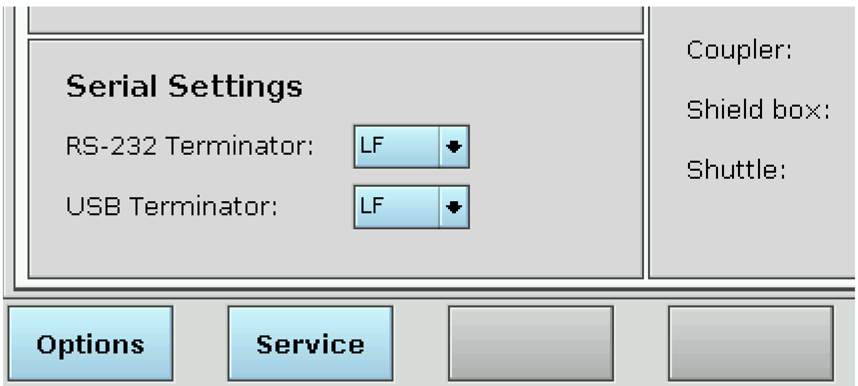
Using the RS-232 or the USB-B interface

In addition to operating the 2201 ProLock through its front panel elements or the LAN, it can also be controlled remotely from a PC through the serial (RS-232) or a USB interface (USB-B).

1 For RS-232 remote control, use an RS-232 cable with 9-pin female connectors at both ends to connect the RS-232 socket on ProLock's rear panel to the RS-232 socket of the PC.
For remote control through USB, use a standard USB cable to connect the USB 3 socket on ProLock's rear panel to the USB socket on the PC.

2 From the start menu, select **Config.**
The Configuration menu appears.

3 The RS-232 Terminator selection field allows you choose a command or query line terminating identifier for remote control over an RS-232 line. The default is LF for line feed, but you can select CR (carriage return) or CRLF (a combination of the two) instead if the remote control software requires this. Ensure that the remote software uses the same command line terminator!



4 Similarly, the USB Terminator selection field defines the terminating character or character combination for remote control over the USB.

5 For a USB connection, install the USB driver for ProLock from the Lector CD on the PC.

6 For the RS-232 connection, set the interface parameters on the PC as follows:

– Bit rate: 115,200 bps
– Data bits: 8
– Stop bits: 1
– Parity: None
– RTS, CTS: not active (no hardware handshake)

7 Connect the PC to ProLock through either the RS-232 plug or the USB-B plug.

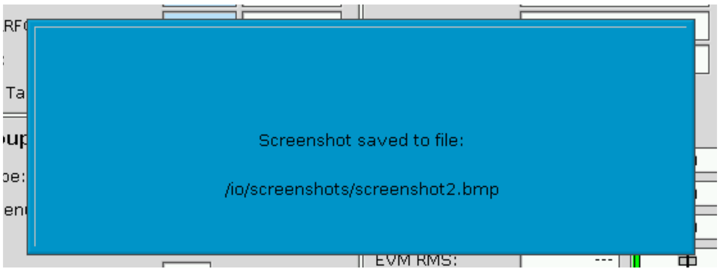
Using an external time base

In order to improve the absolute frequency accuracy of the 2201 ProLock, you can connect a reference oscillator to the **REF IN 10 MHZ** BNC plug on the rear panel. The clock rate must be10 MHz and the power level of the signal should exceed 0 dBm (1 mW) into 50 Ω, but fall below 17 dBm (50 mW).

Copying the screen contents to a file

The screen contents can be copied to a file. The file will be saved on the local hard disk and can then be copied to a USB flash drive. The file format is Windows Bitmap (BMP).

1 Very quickly push the **...** key twice, followed by the **ENTER** key.
The current screen contents will be saved to a file on the internal hard disk. A pop-up box will appear, informing you that the screenshot was taken successfully.



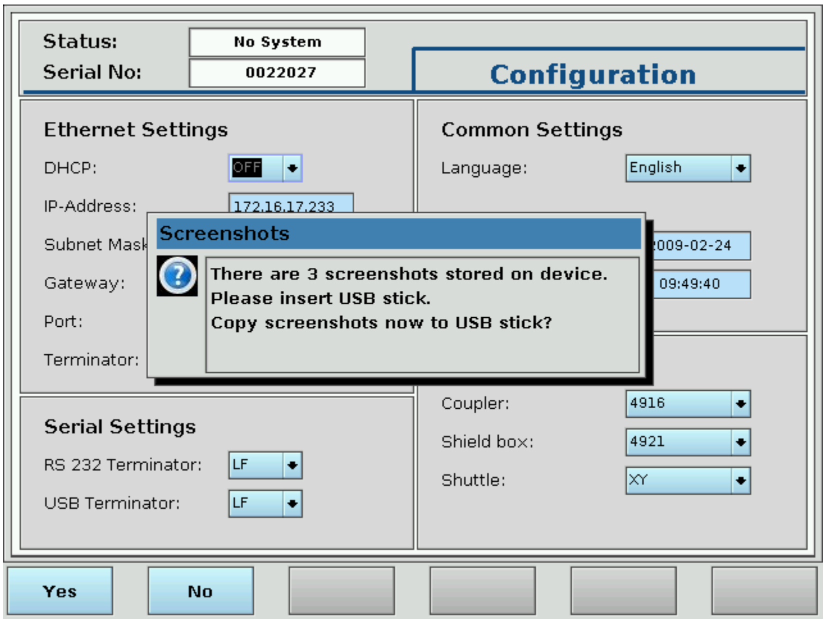
2 Push the **OK** softkey to confirm the message.

3 Repeat steps 1 and 2 whenever you want to record the current screen contents.

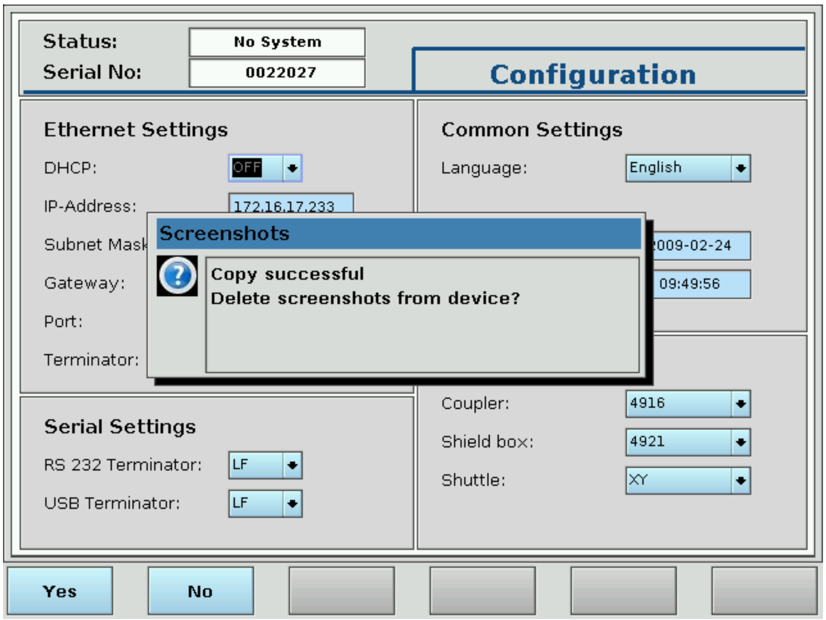
4 In order to display the screenshots on a PC, include them in your documentation or file them away:

a Insert a USB flash drive into either the USB slot on the front panel or one of the USB master slots (USB1 or USB2) on the rear panel.

b From the start menu, press **Config. > Screen shots**.
ProLock will inform you about the number of screenshots and ask if they should be copied to the USB flash drive.



c Press the **Yes** softkey to copy them to the USB device.
Once the files are copied to the USB flash drive, another pop-up menu will ask if the screenshot files on the internal disk should be deleted.



d Press **Yes** to delete them, or **No** to leave them on the hard disk.

e Remove the USB flash drive from ProLock. You can now insert it in a USB slot on a PC to copy the files onto the PC hard disk.

Setting up general parameters of the 2201 ProLock

Setting up the language

The default language of the user interface is English, i.e. all text is displayed in this language. Other languages supported in addition are French, German, Italian and Spanish.
In order to select a language, push **Config.** from the Start menu, then choose a language (English, Deutsch, Français, Italiano, Español) from the Language selection field.

Setting the date and time

The date and time can be entered in the **Configuration** menu, in the Common Settings section.

Entering the date

The date should be entered in the year-month-day format. You can use either the **+/-** key or the decimal point '**.**' as a separator.

Entering the time

The time should be entered in the 24-hour format. You can use either the **+/-** key or the decimal point '**.**' as a separator.

Performing Manual Tests and Measurements in GSM Mode

3

This chapter provides task-based instructions for using the 2201 ProLock features in manual operation. Topics discussed in this chapter are as follows:

Introduction

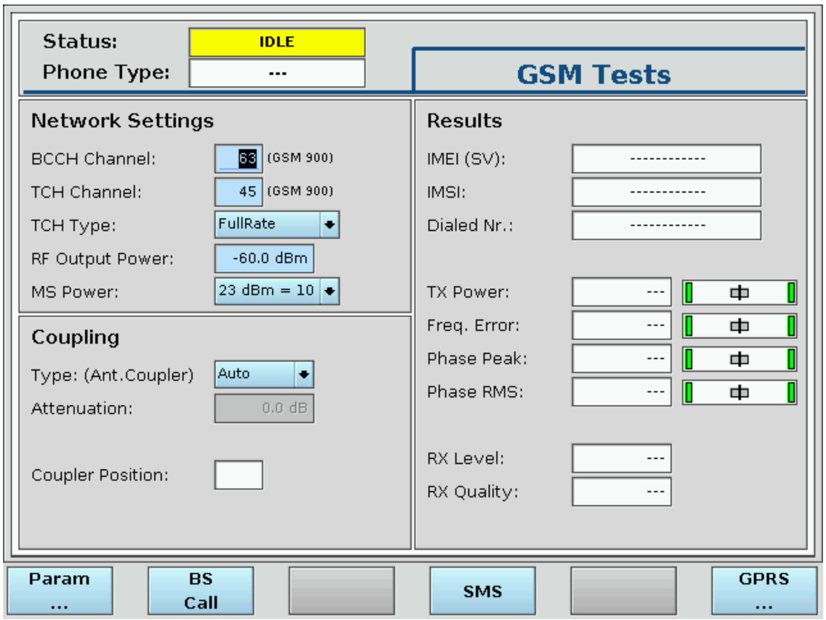
The 2201 ProLock with the 2231 GSM Option allows tests and measurements at GSM mobile phones, or in the GSM mode of multi-standard phones.

Setting up network and test parameters

This section makes you familiar with the ProLock parameters necessary to successfully perform standard measurements.

Defining the main network settings

From the start menu, press the **GSM** softkey to enter the GSM Tests menu. The Network Settings section in that menu provides access to some basic parameters such as the frequency channels being used by the ProLock and the mobile phone.



BCCH Channel

In this field, enter the channel number of the base channel carrying the broadcast information and which is used to set up a communication between the mobile phone and the base station (simulated by the ProLock). See Table 1 on page 25 for valid channel numbers and frequency bands.

Note

The base channel number cannot be changed during a call.

Note

The ProLock uses the channel number to determine the frequency band. However, GSM 1800 and GSM 1900 partly use the same channel numbers. The ProLock indicates next to the channel number entered which band it refers to. Use the **Upper GSM Band** selection field in the GSM/GPRS Parameters menu to select between the GSM 1800 and GSM 1900 bands.

Note

Only select channel numbers from a frequency band that the mobile phone under test is supposed to support, otherwise the test will fail.

Table 1 ***Channel numbers and frequency bands for GSM***

Band	Channel numbers	Uplink carrier frequencies	Downlink carrier frequencies
GSM 850 (Americas)	128 ... 251	824.2 MHz ... 848.8 MHz	869.2 MHz ... 893.8 MHz
GSM 900	955 ... 1023 0 ... 124	876.2 MHz ... 889.8 MHz 890.0 MHz ... 914.8 MHz	921.2 MHz ... 934.8 MHz 935.0 MHz ... 959.8 MHz
GSM 1800	512 ... 885	1710.2 MHz ... 1784.8 MHz	1805.2 MHz ... 1879.8 MHz
GSM 1900 (Americas)	512 ... 810	1850.2 MHz ... 1909.8 MHz	1930.2 MHz ... 1989.8 MHz

TCH Channel

In this field, enter the channel number of the traffic channel carrying any voice or data. See Table 1 for valid channel numbers and frequency bands.

See notes on frequency bands above.

Note

The traffic channel number can be changed during a call, causing a handover. If you select a channel in a different frequency band this is call inter-band handover.

TCH Type

This selection field allows you to select the type of voice channel for the test call to be set up. You can choose between two full-rate speech types: Full rate speech and enhanced full speech.

> ***Note***
> The type of voice channel cannot be changed during a call.

RF Output Power

This is the radiated signal power of the 2201 ProLock plus the currently selected coupling factor. In other words, it is the input signal power of the mobile phone under test if the coupling loss is compensated correctly.

For the purpose of receiver tests, the power level will be decreased until the call drops (below –100 dBm). In order to set up a call, however, it may be necessary to turn up the output power to a sufficiently high level, e.g. –60 dBm).

Valid inputs are in the range from –120 to –20 dBm.

MS Power

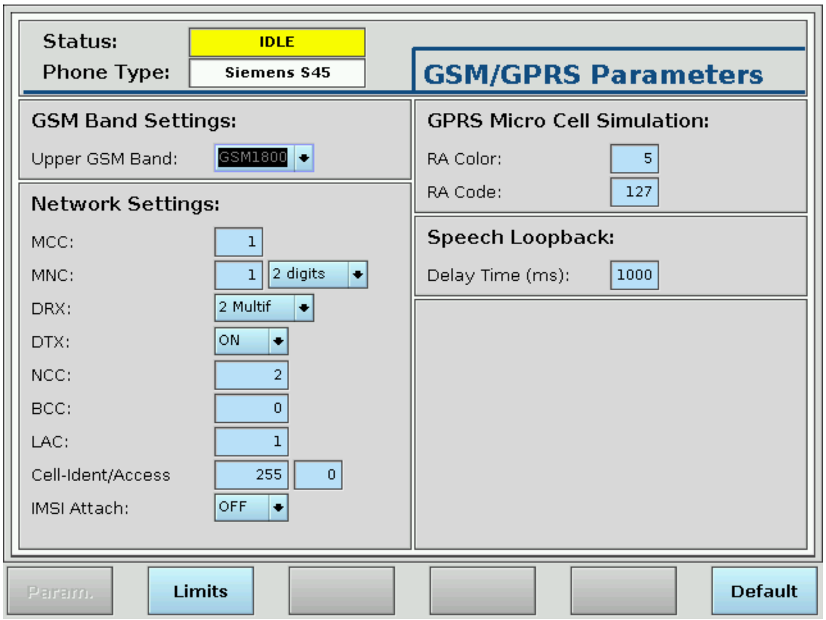
While on a traffic channel, the base station typically commands the mobile phone to transmit at a dedicated power level. For the purpose of transmitter and power tests, you can select the power level of the phone here. The allowable values depend on the frequency band as shown in Table 2.

Table 2 ***Nominal MS power levels by frequency band***

Band	Power control step	MS power level
GSM 850	0 to 2 3 to 31	39 dBm 37 to 5 dBm in 2-dB steps
GSM 900	0 to 2 3 to 31	39 dBm 37 to 5 dBm in 2-dB steps
GSM 1800	0 to 15 29 to 31	30 to 0 dBm in 2-dB steps 36 to 32 dBm in 2-dB steps
GSM 1900	0 to 15 30 31	30 to 0 dBm in 2-dB steps 33 dBm 32 dBm

Setting up advanced network parameters

The ProLock allows you to define a few network parameters that you do not normally want to change. From the start menu, push **GSM > Param** to access them in the GSM/GPRS Parameters menu.



Defining the upper frequency band

This selection field determines if the ProLock identifies frequencies in the GSM 1800 or in the GSM 1900 band if a channel number of 512 or above is entered for the BCCH or TCH. If you are living in North America, you may want to test in the GSM 1900 band only because this is being used in the region. On other continents, you may want to test on GSM 1800 channels only because the GSM 1900 band is not used there.

MCC

The Mobile Country Code (MCC) identifies the country where the network is located. The MCC is a three-digit number coded according to an international standard (CCITT Rec. E .212, Annex A) and is unique for every country.

If you want to test mobile phones using a standard test SIM in accordance to GSM testing standards, set the MCC to 1 (this is the default setting). However if you want to simulate a particular network, you can enter a different country code here.

Entry range: 0...1000. Default value: 1

MNC

In conjunction with the MCC, the Mobile Network Code (MNC) indicates the national network. The MNC is coded by national authorities, usually starting from 01.

The MNC is a two-digit code, except for US networks which use three-digit coding.

If you want to test mobile phones using a standard test SIM in accordance to GSM testing standards, set the MNC to 1 (this is the default setting). However if you want to simulate a particular network, you can enter a different country code here.

Entry range: 0…100. Default value: 1

DRX Discontinuous Reception (DRX) is a parameter broadcast by the network (simulated by the ProLock). DRX tells the mobile not to listen to the paging channel in every multiframe but only e.g. to every second or third. The mobile is assigned to one of several 'paging groups', depending on its IMSI (International Mobile Subscriber Identity). Paging groups allow the network to handle a higher amount of mobiles within a cell, while the mobiles save battery power. The number of multiframes over which the paging groups are spread is broadcast with the BS_PA_MFRMS parameter in the System Information messages. The BS_PA_MFRMS is equivalent to the DRX parameter and allows spreading over 2 to 9 multiframes.

Note: A multiframe is a period of 51 TDMA frames and equals roughly 235 ms in time.

Entry range: 2 Multif … 9 Multif. Default value: 2 Multif

DTX Discontinuous Transmission (DTX) is a parameter broadcast by the network (simulated by the ProLock). While on a voice channel, it allows the mobile phone to seize transmission in certrain frames if no voice is detected. DTX is a method to save power from the battery.

Using this selection field, DTX can be switched either on or off. The default is OFF.

NCC The Network Colour Code (NCC) is transmitted by the base station on its synchronization channel SCH. The NCC allows the mobile to identify base stations belonging to different (national) networks.

Entry range: 0…7. Default value: 2

BCC The Base station Colour Code (BCC) makes it easy for the mobile to clearly separate between several neighboring base stations. Furthermore, the BCC is identical with the training sequence code.

Entry range: 0…7. Default value: 0

LAC

The Location Area Code (LAC) is the number of the base station within the network. Several base stations together may form a cell.

Entry range: 0...65535. Default value: 1

Cell Ident/Access

The first input field defines the number of the cell within the network (the cell identity).

Entry range: 0...255. Default value: 255

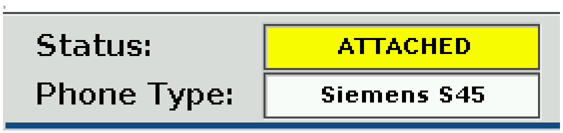
The second inupt field refers to the Cell Barred Access parameter. With Access set to 0, the mobile phone will be allowed to access the simulated network. An entry of 1 will block the network for access by the phone.

Entry range: 0 or 1. Default value: 0

IMSI Attach

This selection field enables or disables the Attach/Detach procedure. When enabled, you will get a visible notification when the mobile is camping on the cell simulated by the ProLock.

If this box is selected, the ProLock will initially indicate the Idle signaling status. The ProLock signals to the mobile phone to apply the IMSI Attach/Detach procedure. This means that when the mobile is turned on and has selected the cell simulated by the ProLock, it will register with the ProLock. This way, the ProLock can notify the user when the mobile is ready for a call; the ProLock then displays "Attached" in the Status field at the top of the GSM and GPRS menus. This way, you will know when the mobile is ready for testing.
Similarly, when the mobile is turned off (or when it selects a different cell), it will de-register with the ProLock. The Status field will change to Idle, indicating that no mobile is ready for testing.



If IMSI Attach is deselected, the IMSI Attach/Detach procedure will not be performed; this is the default state and should be used to speed up testing, especially under remote control.

Entry range: On or Off. Default value: Off

RA Color

In GPRS mode, the Routing Area (RA) color code is broadcast by the base station and used by the mobile phone to differentiate between base stations of adjacent cells belonging to different routing areas. While on a GPRS channel and moving from one cell to another, the phone should select a new cell with the same RA color code only if possible.

Entry range: 1 to 7. Default value: 5

RA Code

In GPRS mode, the full Routing Area (RA) code is broadcast by the base station.

Entry range: 0 to 255. Default value: 127

Delay Time

Input field defining the time lag of the mobile's voice signal when looped back to the mobile. The voice is looped back as long as no receiver (BER) measurements are being performed. The delay is defined in milliseconds.

Entry range: 100 to 1000. Default value: 1000

Setting up the coupling in the ProLock

If you are using an antenna coupler rather than a direct cable connection, a part of the signal will be lossed over the air. Only a certain fraction of the radiated signal power will arrive at the antenna, in both directions. For precision measurements at the power transmitter and the receiver, however, it is important to transmit and receive correctly, i.e. the attenuation must be known. The attenuation depends on both the type of mobile under test and the environment. When the coupler is mounted in Willtek's 4921 RF Shield, for example, this will give measurement different from an open environment.

Manually adjusting the coupling loss

One way of compensating this coupling loss attenuation is to manually enter the attenuation (if known). This can be accomplished with a table of coupling factors for each type of mobile, taking also into account which coupling and shielding device (if any) are applicable to the respective coupling factor.

For manual attenuation input, proceed as follows:

1 In the GSM Tests menu, go to the Type: (Ant. Coupler) selection field and choose ''Manual''.

2 In the Attenuation input field, enter the attenuation value (coupling factor) in dB.

> ***Note***
>
> The coupling attenuation is frequency-dependent, so when you change the frequency band or the technology, ensure that you adapt the coupling attenuation accordingly.

Working with the built-in coupling factor database

A more elegant way of compensating the coupling loss is by using the built-in database of coupling factors for many popular mobile phone models.

1 Ensure that the coupler, the RF shielding device and the shuttle on the shielding device (if applicable) are selected correctly in the Configuration menu.

2 In the GSM Tests menu, go to the Type: (Ant. Coupler) selection field and choose ''Auto''.
Once the mobile phone is registered on the network simulated by the ProLock, the correct coupler position is shown in the Coupler Position field provided that coupling factors are available for this combination of coupler, shielding device and shuttle.

3 Adjust the coupler position according to the display.

Updating the built-in coupling factor database

The database can be updated over the Internet or from a file server with 7312 Lector Enhanced (or 7315 Scriptor) and the 7360 Coupling Factor Update License. Please refer to the user's guide for Lector and Scriptor for more information.

Testing multiband phones

Typical mobile phone today support three or four GSM frequency bands: GSM 900, GSM 1800, GSM 850 and GSM 1900. GSM 900 and GSM 850 can be selected by simply entering a channel number that falls into these bands because their channel numbers are associated with the band. See Table 1 on page 25 for a list of bands and frequencies.

GSM 1800 and GSM 1900, however, use the same channel numbers in different bands. Therefore you should select one of these "upper bands" before starting a test. This is done in the GSM/GPRS Parameters menu as explained in section "Defining the upper frequency band" on page 27.

You can change the frequency band during the call, without the need to release the call and set up a new one, provided that you do not change the upper frequency band.

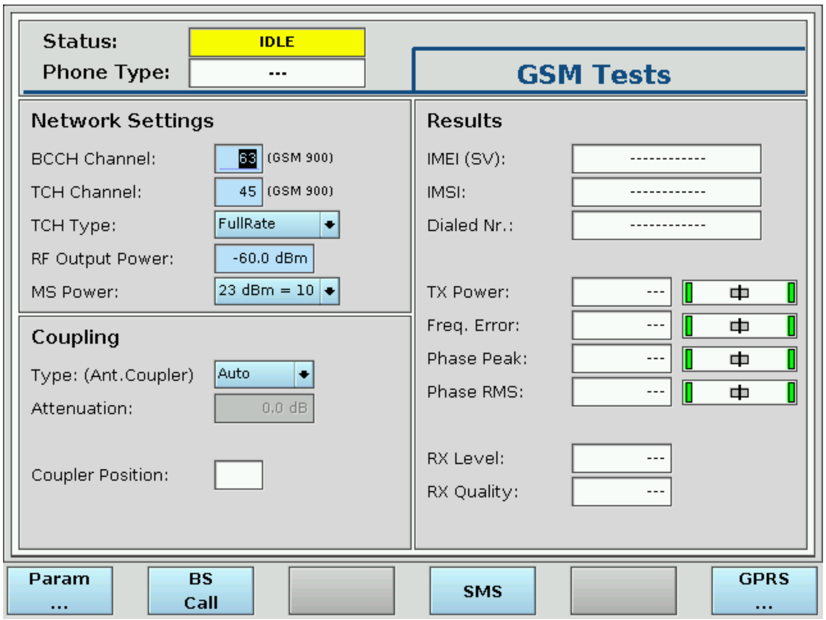
Example: If you have a phone supporting four bands and you want to test it in all four bands, you can, for example, select the BCCH in one of the upper bands (say, GSM 1800) and choose a TCH number in that same band, and set up a call to perform measurements in the upper band. In the next step, you may change the TCH to a channel in the GSM 900 band (without releasing the call), perform measurements there, and then change the TCH again to a channel in the GSM 850 for measurements in that band. Finally you will release the call, change the upper band (to GSM 1900 in this case), set the BCCH and TCH to channel numbers from that band and set up a call for your measurements in this fourth band.

Testing the incoming (mobile-terminated) call

This test checks if the mobile is capable of receiving a call and alerting the user. It is also a typical way to start measurements.

1 Insert a Test SIM in the mobile phone and connect the phone to the ProLock as depicted in section "Connecting the device under test" on page 14.

2 From the start menu,select **GSM**.
The GSM Tests menu appears.



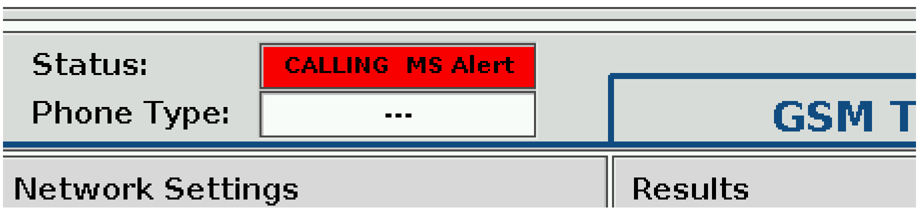
3 Select a base channel (BCCH) and a traffic channel (TCH) in the frequency band of interest (see Table 1 on page 25).

4 Select an RF output power in the ProLock that is sufficiently high to allow the mobile phone to find the carrier, which is typically well above –100 dBm.

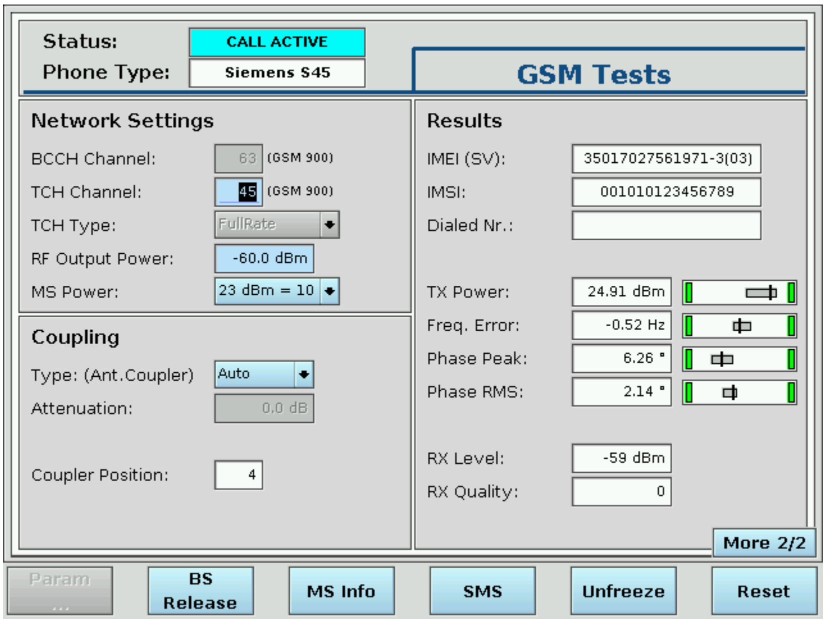
5 Ensure that the coupling is selected properly. Refer to "Setting up the coupling in the ProLock" on page 31 for more information.

6 Switch on the mobile phone, and wait until it indicates that it has found a base station.

7 Push the **BS Call** softkey.
The phone is paged and starts ringing. The ProLock displays the signaling status as follows:



8 Accept the call at the phone.
The phone stops ringing and a voice channel is set up. The signaling status changes and measurements are performed.



9 You can now perform transmitter and receiver measurements if you like.

10 If you are testing a mobile phone (as opposed to a wireless data card) you may now perform a qualitative audio test by speaking into the microphone and listening to the audio in the receiver because the ProLock loops the voice signal back to the phone.

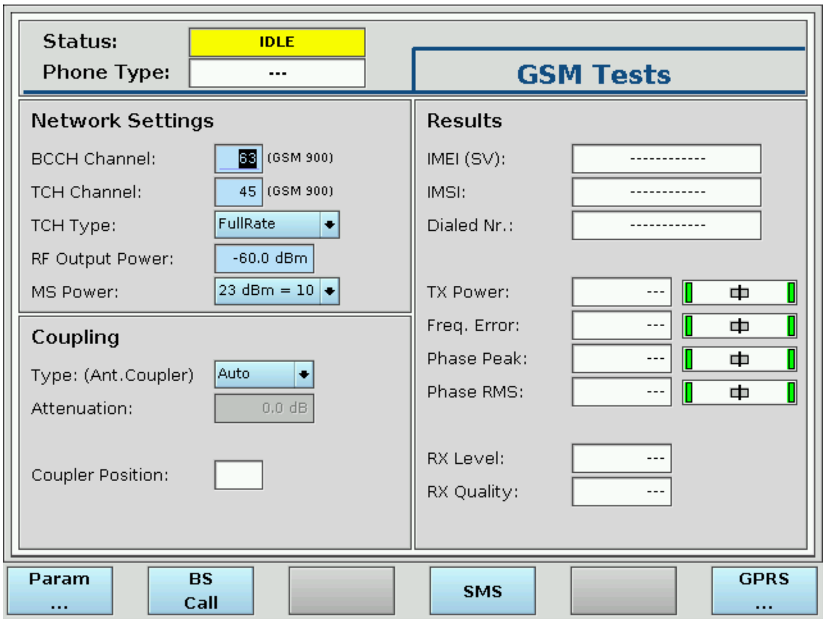
11 Release the call either on the phone or on the ProLock (using the **BS Release** softkey).

Testing the outgoing (mobile-originated) call

This test checks if the mobile is capable of correctly accepting dialed digits (i.e. the keypad is tested) and if it can initiate a call. It is also a typical way to start measurements.

1 Insert a Test SIM in the mobile phone and connect the phone to the ProLock as depicted in section "Connecting the device under test" on page 14.

2 From the start menu,select **GSM**.
The GSM Tests menu appears.



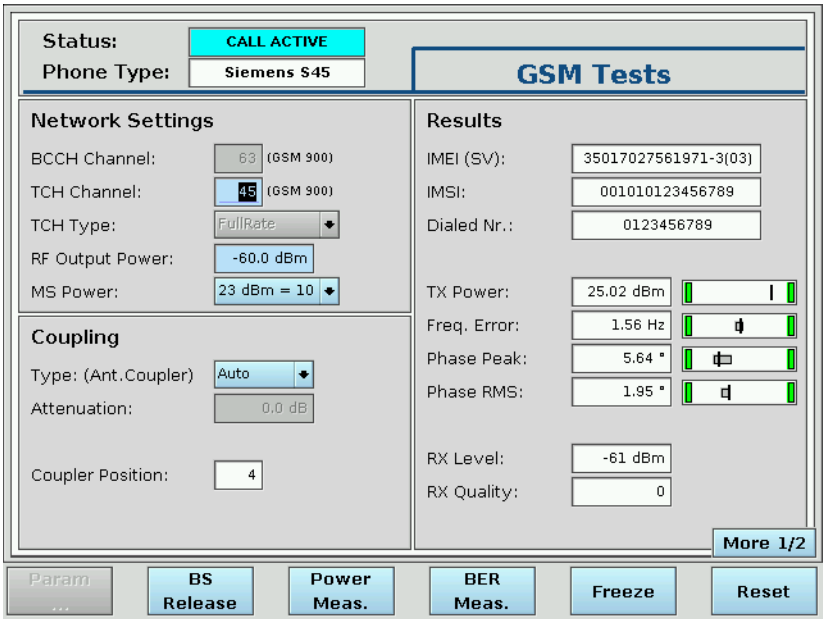
3 Select a base channel (BCCH) and a traffic channel (TCH) in the frequency band of interest (see Table 1 on page 25).

4 Select an RF output power in the ProLock that is sufficiently high to allow the mobile phone to find the carrier, which is typically well above –100 dBm.

5 Ensure that the coupling is selected properly. Refer to "Setting up the coupling in the ProLock" on page 31 for more information.

6 Switch on the mobile phone, and wait until it indicates that it has found a base station.

7 Enter a number on the phone that comprises all the numerical digits (e.g. "0123456789*#"), and push the Call button on the phone.
The phone sets up a call with the ProLock. The signaling status changes and measurements are performed.



8 Compare the number dialed on the phone with the number shown in the Results section on the right-hand side of the GSM Tests menu, in the Dialed No. field. It should be the same.

9 You can now perform transmitter and receiver measurements if you like.

10 If you are testing a mobile phone (as opposed to a wireless data card) you may now perform a qualitative audio test by speaking into the microphone and listening to the audio in the receiver because the ProLock loops the voice signal back to the phone.

11 Release the call either on the phone or on the ProLock (using the **BS Release** softkey).

Reading the capabilities of the mobile phone

Mobile phone parameters

The ProLock can show the following information about the phone under test:

Phone type

The phone model is indicated at the top-left of the GSM measurement menus, provided that the Type Approval Code (TAC) is found in its internal database of phone models. the TAC is part of the IMEI (see below).

IMEI (SV)

The ProLock displays the International Mobile Equipment Identity (IMEI) as indicated by the mobile. The IMEI is the registration number of the mobile hardware which identifies it internationally. The IMEI is stored inside the mobile's electronics and can only be read out by the ProLock through the radio interface.

The IMEI consists of 15 digits; the last one is not transferred over the radio interface but calculated from the other 14 digits. The additional two digits shown in brackets indicate the software version in the mobile phone which has been transferred to the ProLock along with the IMEI.

IMSI

The International Mobile Subscriber Identity (IMSI) is the individual identity number of the subscriber in the network. The mobile reads the IMSI from the SIM (Subscriber Identity Module) card.

The IMSI consists of up to 15 digits. The first three digits are called the MCC and give the code of the country in which the mobile subscriber is registered.
The next two digits (the so-called MNC) are the code of the national network the mobile subscriber is registered in. Please note that there are three digits being used for the MNC in North America.
The remaining ten digits (nine in North America) are the registration number of the subscriber within the network.

For testing purposes, identical test SIM cards are typically being used, with the MCC and MNC set to 1. The bit error rate measurement may only be supported if such a test SIM is being used.

MS power class

The power class of the mobile phone is indicated as MS Class. The power class gives the maximum RF output power a mobile is able to transmit on.

Power classes for the GSM 850 and GSM 900 bands differ from those in the GSM 1800 and GSM 1900 bands, so the ProLock usually shows two power classes. See Table 3 for the nominal maximum power level in each class.

Table 3 ***GSM power classes and maximum power levels***

Power class	GSM 850, GSM 900	GSM 1800, GSM 1900
1	43 dBm (20 W)	30 dBm (1 W)
2	39 dBm (8 W)	24 dBm (250 mW)
3	37 dBm (5 W)	36 dBm (4 W)[a]
4	33 dBm (2 W)	–
5	29 dBm (800 mW)	–

a. 33 dBm (2 W) for GSM 1900

GSM revision level

The GSM revision level is shown as Rev. Level and indicates the protocol capabilities and features of the GSM phones. GSM phase 1 covers mobile phones approved until the later 90s only; all newer phones are phase 2 mobiles.

Voice coding capability

For all mobile phones with a vocoder supporting the Enhanced Full Rate (EFR) algorithm, the ProLock shows Yes in the EFR field.

SMS capability

The SMS field indicates if the mobile phone supports transmission and reception of short messages according to the Short Messages Services (SMS) substandard of GSM.

Dualband capability

The Dualband field indicates if the phone can operate in both the GSM 900 and GSM 1800 bands.

E-GSM 900 capability

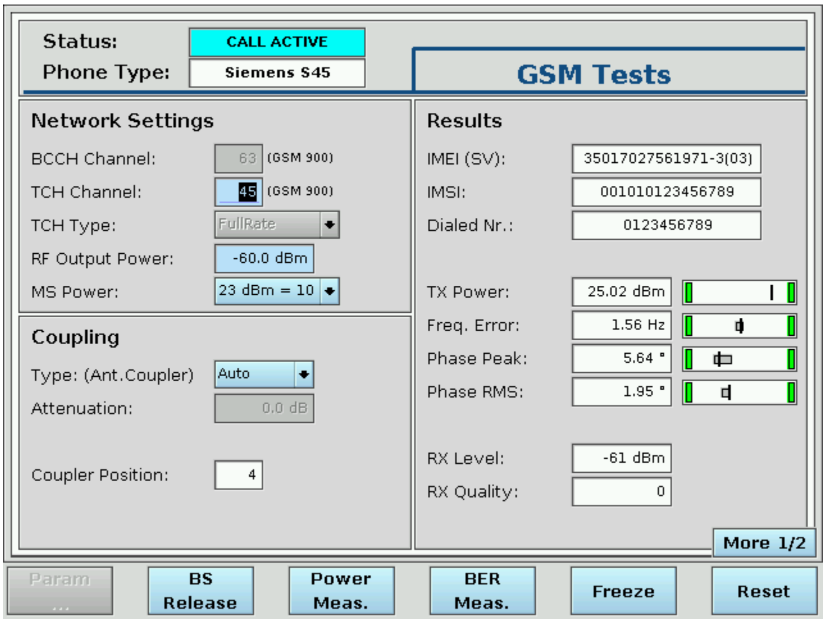
In the Ext. Freq. field, the ProLock informs you whether the mobile is able to use the extended frequency range (E-GSM) spanning channel numbers 955 to 1023 and 0.

Ciphering algorithm

In the A5 Ciphering field, the ProLock displays the A5 cyphering key supported by the mobile.

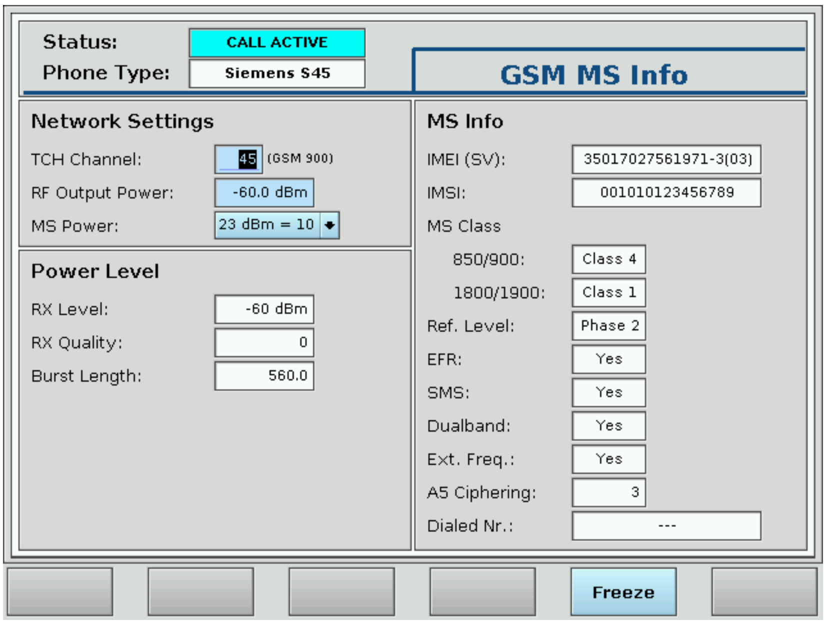
Procedure

1 Set up a call as shown on page 34 or on page 36.



2 Read the phone type, the IMSI and the IMEI from the GSM Tests menu.

3 Press **... > MS Info**.
The GSM MS Info menu appears.



4 Read the MS power class, the GSM revision level, the voice coding capability, the SMS capability, the dualband and the E-GSM 900 capabilities, and the ciphering capability from the right-hand side of the GSM MS Info menu.

Testing the SMS capabilities

The SMS field in the MS Info section of the GSM MS Info menu shows if the Short Message Service (SMS) capability is implemented.

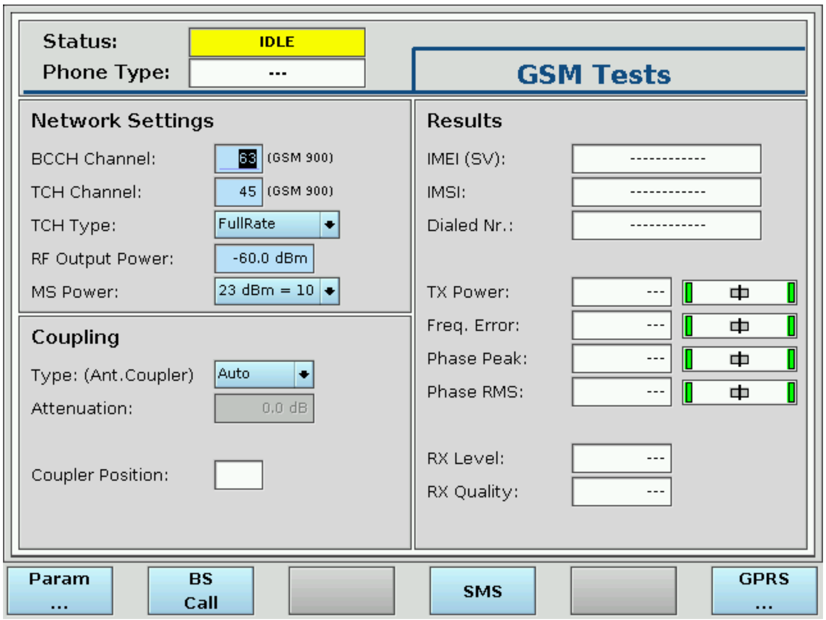
You can test the actual capability in both directions, i.e. you can send a short message from the ProLock to the mobile phone or vice versa. Both can be done either in idle mode or while engaged in a call.

Testing the SMS capabilities in idle mode

You can test the mobile phone's capability to send, or to receive and display a short message while the phone is not engaged in a call.

1 Ensure that a Test SIM is plugged into the mobile phone and connect the phone to the ProLock as depicted in section "Connecting the device under test" on page 14.

2 From the start menu,select **GSM**.
The GSM Tests menu appears.

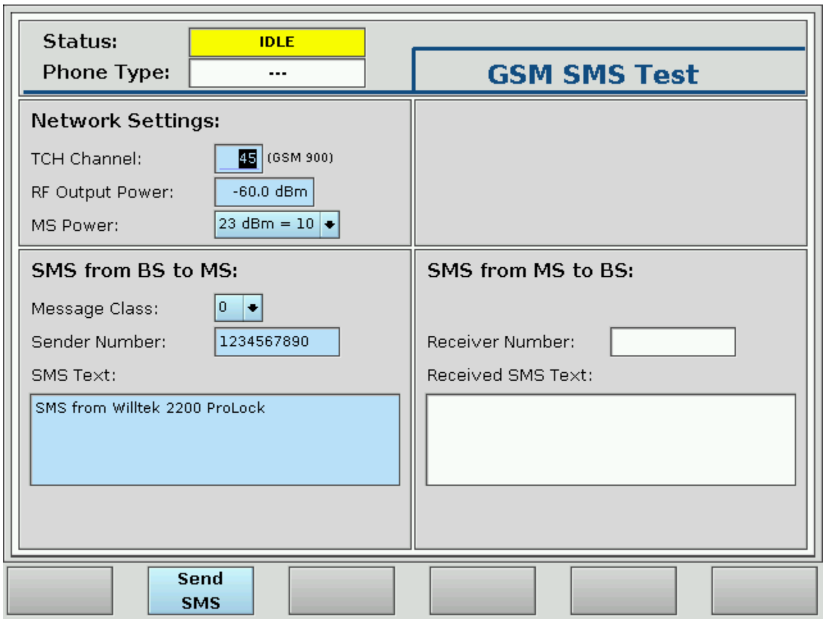


3 Select a base channel (BCCH) and a traffic channel (TCH) in the frequency band of interest (see Table 1 on page 25).

4 Select an RF output power in the ProLock that is sufficiently high to allow the mobile phone to find the carrier, which is typically well above –100 dBm.

5 Switch on the mobile phone, and wait until it indicates that it has found a base station.

6 Push the **SMS** softkey.
The GSM SMS Test menu appears.

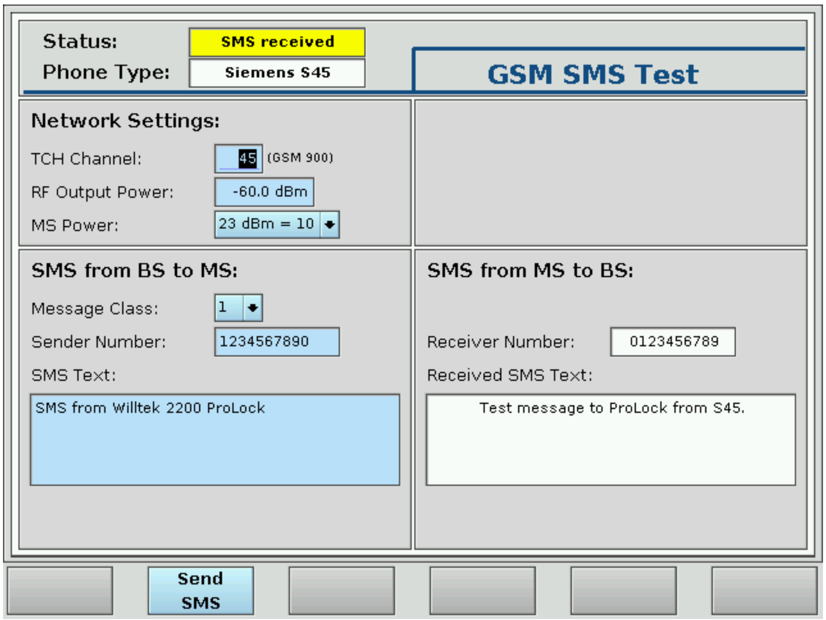


7 In order to send a message from the phone to the ProLock:

a Create a new short message on the mobile phone, and enter text.

b Send it to a random number.

c Check if the receiver number and the text entered appear on the right-hand side of the menu, and that the status field indicates "SMS received".



8 In order to send a message from the ProLock to the phone:

a Select a message class. Valid message classes are in the range 0 to 3 as follows:
0: Show message on display.
1: Store message in working memory.
2: Store message on SIM.
3: Store message on external device (e.g. PDA).

b Enter a phone number from which the message seems to come from (this number will be displayed in the phone under test as sender number).

c Enter a text to be sent to the phone under test. (You may also keep the text example already given).

d Push the **Send** softkey.

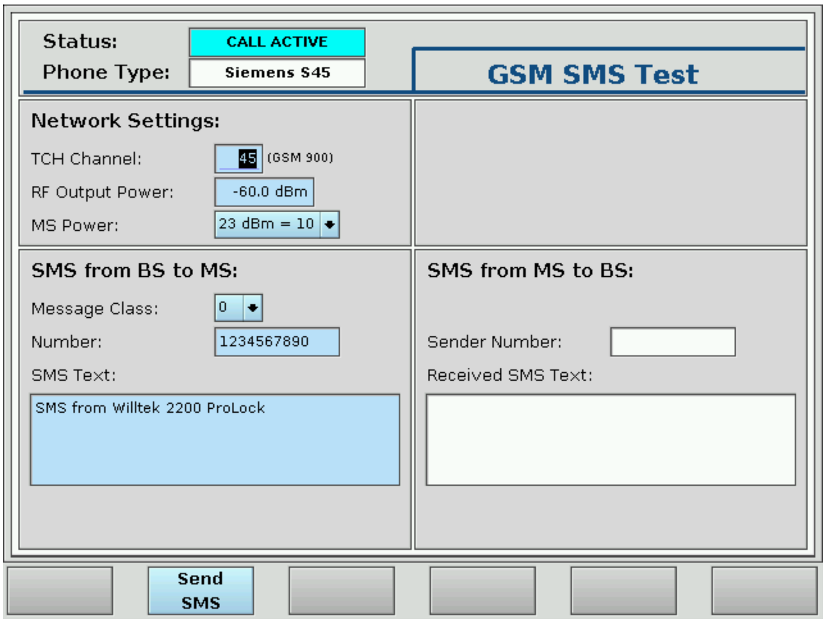
e Check if the message text, along with the sender number, has been received by the mobile phone: Depending on the choice of message class, the contents is either displayed directly or can be fetched from memory.

Testing the SMS capabilities during a call

You can also test the mobile phone's capability to receive and display a short message while it is engaged in a call.

1 Set up a call as explained on page 34 or on page 36.

2 Push the **SMS** softkey.
The GSM SMS Test menu appears.

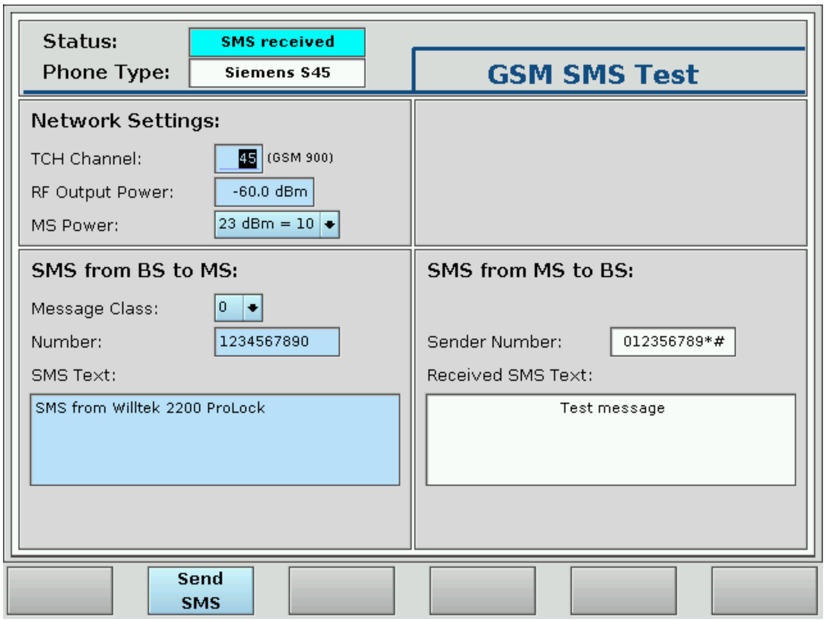


3 In order to send a message from the phone to the ProLock:

a Create a new short message on the mobile phone, and enter text.

b Send it to a random number.

c Check if the number and the text entered appear on the right-hand side of the menu, and that the status field indicates "SMS received".



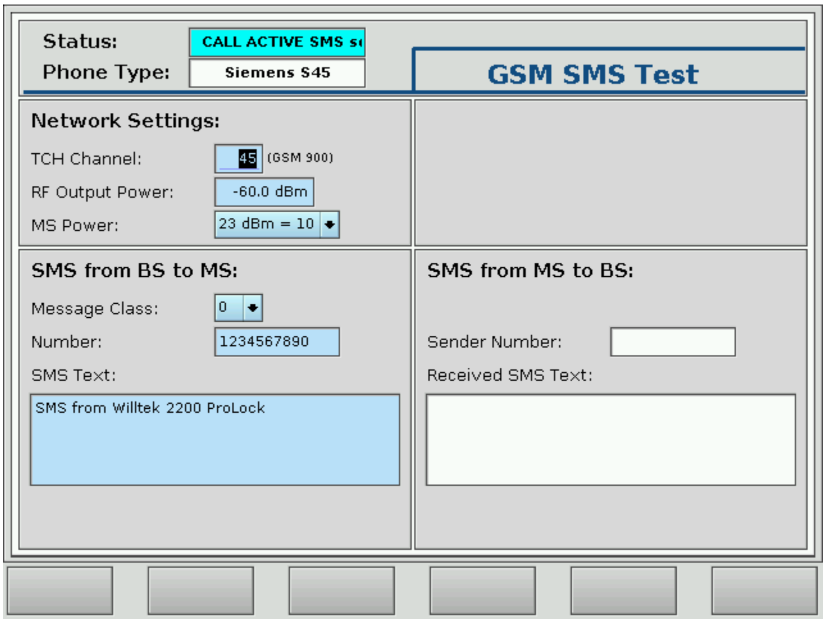
4 In order to send a message from the ProLock to the phone:

a Select a message class. Valid message classes are in the range 0 to 3 as follows:
0: Show message on display.
1: Store message in working memory.
2: Store message on SIM.
3: Store message on external device (e.g. PDA).

b Enter a phone number from which the message seems to come from (this number will be displayed in the phone under test as sender number).

c Enter a text to be sent to the phone under test. (You may also keep the text example already given).

d Push the **Send** softkey.
The status field at the top of the ProLock display reads "CALL ACTIVE SMS sent".



e Check if the message text, along with the sender number, has been received by the mobile phone: Depending on the choice of message class, the contents is either displayed directly or can be fetched from memory.

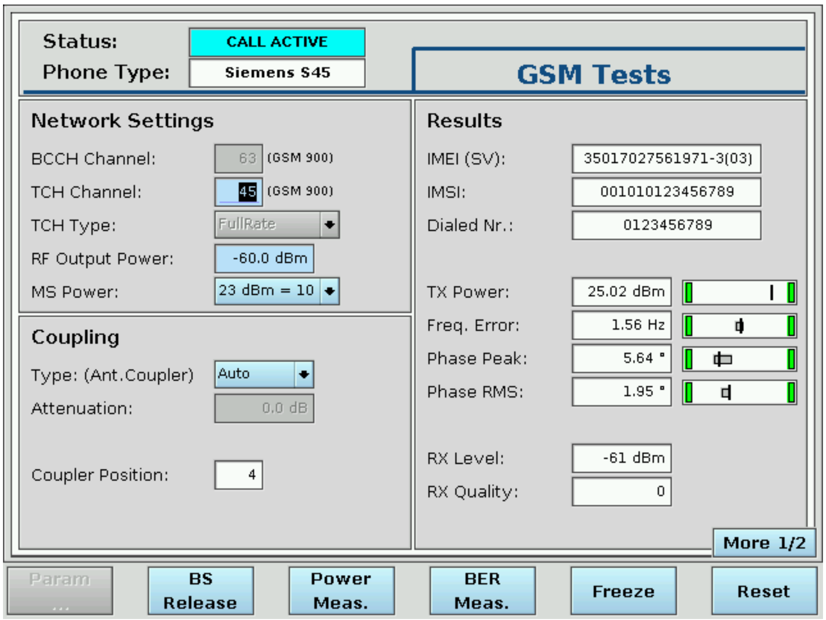
5 Press **ESC** to return to the GSM Tests menu.

Performing standard transmitter tests

This section shows how to read and interpret the transmitter measurement results after a call has been set up.

In order to set up a call, follow the instructions on either page 34 or page 36.

The GSM Tests menu and the GSM Power menu present the following transmitter measurement parameters with results. The latter menu can be accessed from the GSM Tests menu by pushing the **Power Meas.** softkey while a call is active.



TX Power

This result field shows the measured transmit power of the mobile phone under test. Ideally it equates the MS Power value entered. The tolerance values depend on the power level, see "Power control levels and tolerances" on page 102.

Freq. Error

This result field indicates how the actual carrier frequency deviates from the nominal frequency. It is measured in hertz. According to the specifications, the maximum allowable relative error is 10^{-7}, i.e. ca. ±90 Hz in the GSM 850 and GSM 900 bands, ±180 Hz in the GSM 1800 band and ±190 Hz in the GSM 1900 band.

Phase Peak

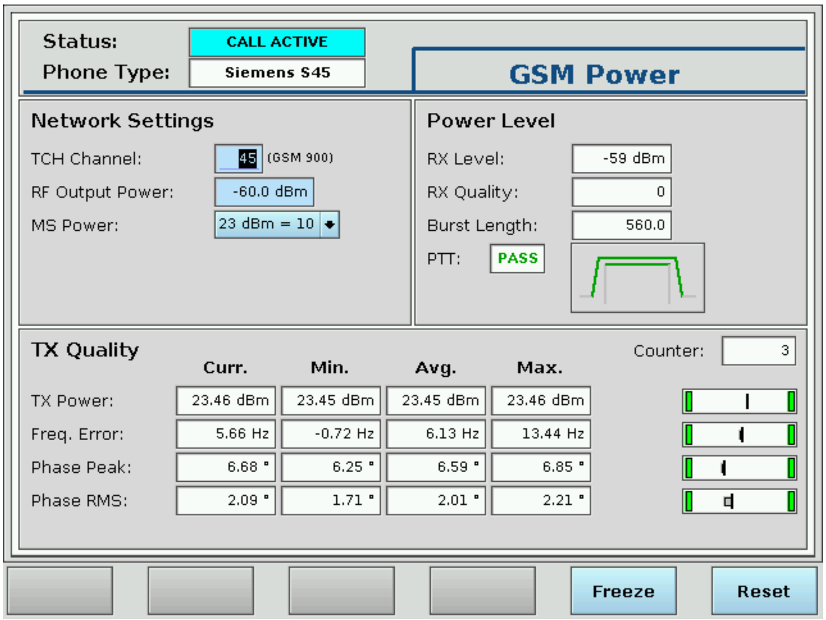
The peak phase error is the magnitude of the maximum phase error that occurred within a single burst. This value is always positive.

According to the specifications, the peak phase error within a GSM burst must not exceed 20°.

Phase RMS

The RMS phase error is calculated from the phase errors of all bits within a burst, by root-mean-square-averaging them. This value is always positive.

According to the specifications, the RMS phase error within a GSM burst must not exceed 5°.



Burst length

This result field shows the length of the burst (between the –3 dB points).

The length of a burst is critical in GSM. If a burst is too short, not all data transmitted by the mobile can be received. If it is too long, interference will be caused in the subsequent time slot.

A normal GSM burst contains 148 bits, with a bit period of 48/13 μs. Consequently, a normal burst is about 546.5 μs long (minimum) and has to fit into a time slot with a duration of 577 μs (maximum).

PTT

This result field provides an overall evaluation of the burst profile against the power-time template. The limits are according to the specifications, taking into account the individual power level and frequency band, and cannot be altered. The result is either PASS or FAIL.

Performing receiver measurements in the mobile phone

The receiver of the mobile phone includes different components to measure the received signal strength and to demodulate the signal. It also decodes the received bit stream and, based on the relative number of bit errors found in the decoding process, provides an estimate of the signal quality.

Once a traffic channel has been set up (see instructions on either page 34 or page 36), the results of the receiver measurements can be viewed in the GSM Tests menu and also in the GSM BER Test menu (accessible from the GSM Tests menu by pushing the **BER Meas.** softkey). They are as follows.

RX Level

This is the received power level estimated by the mobile phone, in dBm. The phone can report its input power level back to the base station (or tester) in the range from –110 dBm to –48 dBm, in 1 dB steps. It should be as close as possible to the RF output power, provided that the coupling factor has been selected correctly.

RX Quality

Based on the number of bits corrected by its own channel decoder, the mobile estimates the BER. The result is reported to the base station (or tester) as a numerical value in the range from 0 to 7. The lower the value, the better the reception quality. The exact meaning of the RX quality value is given in the table below.

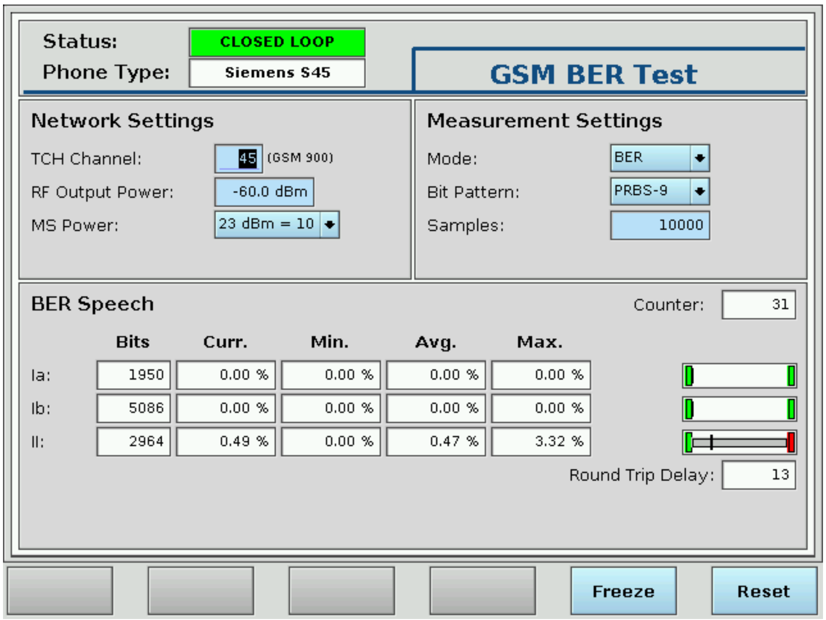
Table 4 ***Coding of RX Quality***

RX Quality value	Estimated BER
0	< 0.2%
1	0.2 to 0.4%
2	0.4 to 0.8%
3	0.8 to 1.6%
4	1.6 to 3.2%
5	3.2 to 6.4%
6	6.4 to 12.8%
7	> 12.8%

Performing ProLock-based receiver measurements

The ProLock supports three different types of statistical measurements of the receiver performance: bit error rate, residual bit error rate and fast bit error rate measurements. All of them allow you to judge the quality of the mobile's receiver, but in different ways.

Once a traffic channel has been set up (see instructions on either page 34 or page 36), push the **BER Meas.** softkey to start the measurements, to change test parameters and to review the results of the receiver measurements. – The GSM BER Test menu will appear.



For the purposes of these measurements, the ProLock commands the mobile phone to return all the bits received back to the ProLock. For the time when the GSM BER Test menu is displayed, the speech loopback is therefore disabled and a test loop is closed.

These measurements are typically performed at a very low power level at the mobile phone RF input, so the RF Output Power should be set to – 104 dBm for the measurements.

Bit error rate (BER) measurements are based on a statistical analysis over all the coded (and uncoded) bits. The bit error rate is the number of the bits decoded incorrectly by the mobile relative to all bits received by it. The BER is tested for all the different classes of speech and data bits; these are class Ia, class Ib and class II bits. Class Ia bits are best protected against corruption on the air interface whereas class II bits are completely unprotected.

The residual bit error ratio (RBER) is similar to the BER, except that all frames that the mobile detects an error in, are rejected and not used for the RBER. Thus, only those frames are included in the RBER measurement that were accepted by the mobile. The RBER is calculated for bit classes Ib and II only.
In addition, the frame erasure ratio (FER) is measured. This is defined as the ratio of the frames rejected by the mobile in relation to all frames trans-

mitted. A frame is marked as 'erased' and rejected by the mobile when its error detector finds an error. To do so, the mobile will use the checksum provided with the class Ia bits.

The Fast BER is similar to a BER measurement on the class II bits. The main difference is that in Fast BER, all bits are unprotected. To measure the FBER, a special loop function is used (the so-called type C loop).

A counter indicates how many results have already been produced since the start of the measurement, and indicates the activity of the measurement.

Setting up the test parameters

Willtek proposes to leave the test parameters at their default values if you are unsure about their meaning.

Measurement Mode

The Mode selection field allows you to choose between the different measurement methods. Available entries are BER, FER and FBER. The default is BER.

Bit Pattern

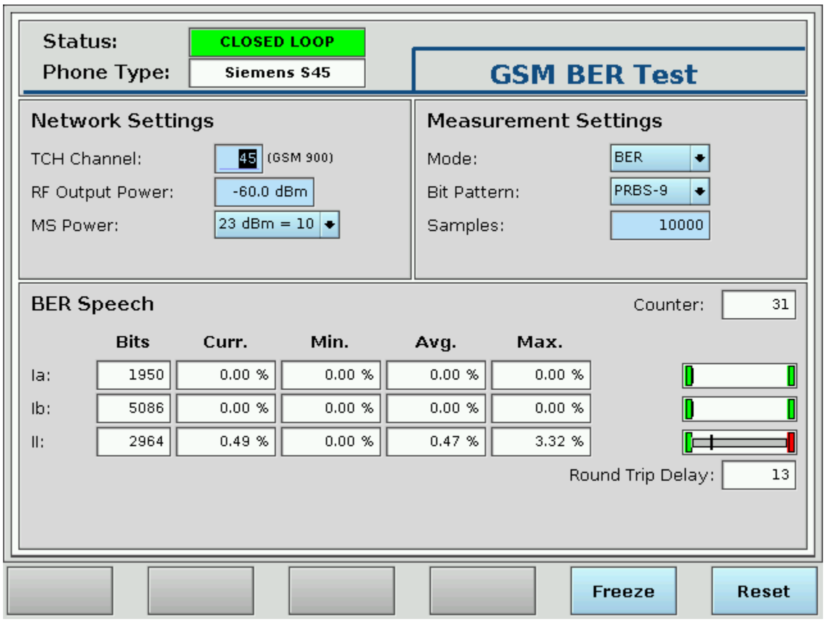
This selection field lets you choose the bit pattern that is sent to the mobile phone. Available patterns are:
0000... (all zeros)
1111... (all ones)
1010... (bit reversals starting with 1)
0101... (bit reversals starting with 0)
PRBS-9 (PN-9 pseudo-random bit sequence), this is the default
PRBS-15 (PN-15 pseudo-random bit sequence)
PRBS-23 (PN-23 pseudo-random bit sequence)

Samples

This entry field allows you to select the number of samples (normally bits) that make up a measurement. Allowable entries are in the range from 2,000 to 10,000. The default value is 10,000.

Interpreting BER measurement results

The bit error rate (BER) is tested for all the different classes of speech and data bits; these are class Ia, class Ib and class II bits. Class Ia bits are best protected against corruption on the air interface whereas class II bits are completely unprotected.



Class Ia, Ib, II

The BER Speech section displays the results for the class Ia, class Ib and class II bits.

The limits can be defined in the GSM/GPRS Limits menu. Typical limits can be found in Table 5.

Table 5 ***BER limits on a GSM voice channel***

	Receive level > –80 dBm	Receive level < –80 dBm
Class 1a bits	0	0
Class Ib bits	0.01%	0.41%
Class II bits	0.1%	2.0%

Round Trip Delay

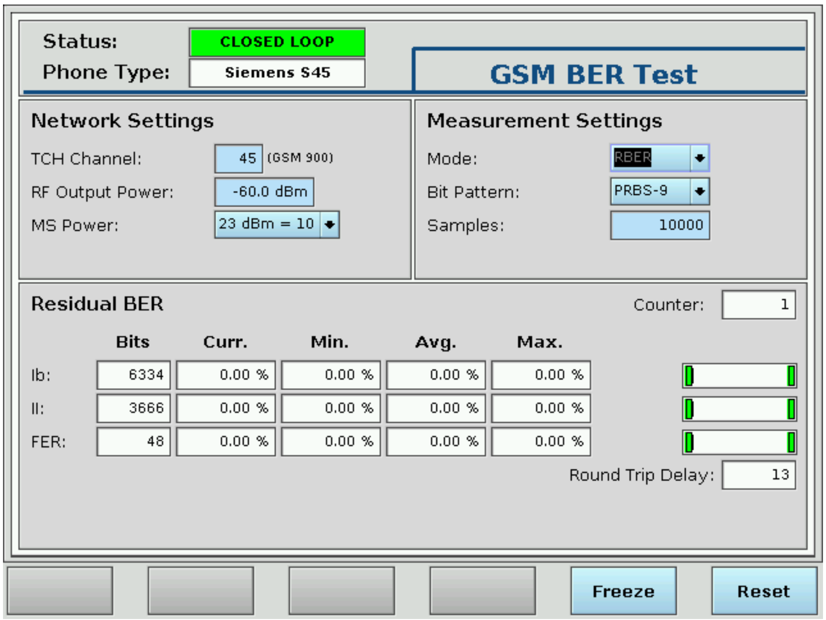
This is the number of frames that the mobile phone takes to return a speech frame.
This value is for information purposes only. It is not a required test with any test limits.

Note

The round trip delay may differ between the types of statistical measurements, but should be stable within one measurement type.

Interpreting RBER measurement results

The residual bit error ratio (RBER) is similar to the BER, except that all frames that the mobile detects an error in, are rejected and not used for the RBER. Thus, only those frames are included in the RBER measurement that were accepted by the mobile. The RBER is calculated for bit classes Ib and II only.



Class Ib, II

The Residual BER section displays the results for the class Ib and class II bits. The limits can be defined in the GSM/GPRS Limits menu.

FER

In addition to the class Ib and class II bits, the frame erasure ratio (FER) is measured. This is defined as the ratio of the frames rejected by the mobile in relation to all frames transmitted. A frame is marked as ‘erased’ and rejected by the mobile when its error detector finds an error. To do so, the mobile will use the checksum provided with the class Ia bits.

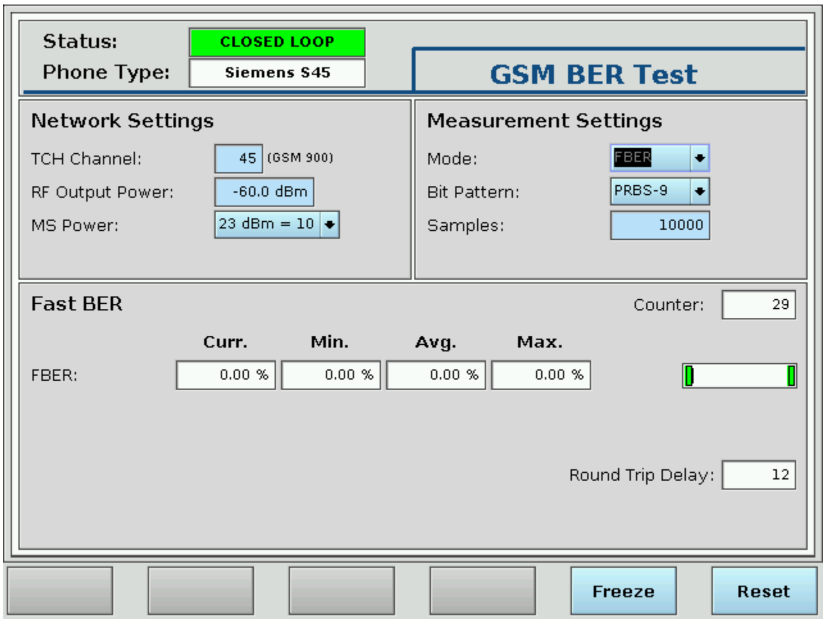
Round Trip Delay

This is the number of frames that the mobile phone takes to return a speech frame.
This value is for information purposes only. It is not a required test with any test limits.

> ***Note***
>
> The round trip delay may differ between the types of statistical measurements, but should be stable within one measurement type.

Interpreting FBER measurement results

In the Fast BER measurement, the bit stream is not encoded and decoded at all, so all the bits are unprotected as the class II bits in the BER measurement. This is a fast way to measure the true bit rate (without the effect of channel decoding) over a larger number of samples.



FBER

The Fast BER section displays the results for all the bits being sent to the mobile phone and returned to the ProLock.
The limits can be defined in the GSM/GPRS Limits menu. It is advisable to use the same limits as for the class II bits in the BER Speech measurements.

Round Trip Delay

This is the number of frames that the mobile phone takes to return a speech frame.
This value is for information purposes only. It is not a required test with any test limits.

Note

The round trip delay may differ between the types of statistical measurements, but should be stable within one measurement type.

Performing GPRS measurements

Introduction

GPRS is an extension of the GSM protocol, enabling packet-oriented data transmission between the network (and, for example, the Internet) and the mobile phone. In addition to a different protocol, it can also combine several time slots for one user to increase the data rate.

GPRS measurements with the ProLock require both the 2231 GSM Option and the 2232 GPRS Option.

The GPRS measurements consist of two types of receiver measurements: the BLER-USF and the BLER-BCS measurements. They can be performed on a single or on multiple slots per TDMA frame.

Measuring the USF-based BLER

The BLER-USF (BLock Error Rate based on the Uplink State Flag) receiver test is a standardized test method.

Setting up the measurements

In order to start a test, proceed as follows:

1 Insert a Test SIM in the mobile phone and connect the GSM/GPRS-enabled phone to the ProLock as depicted in section "Connecting the device under test" on page 14.

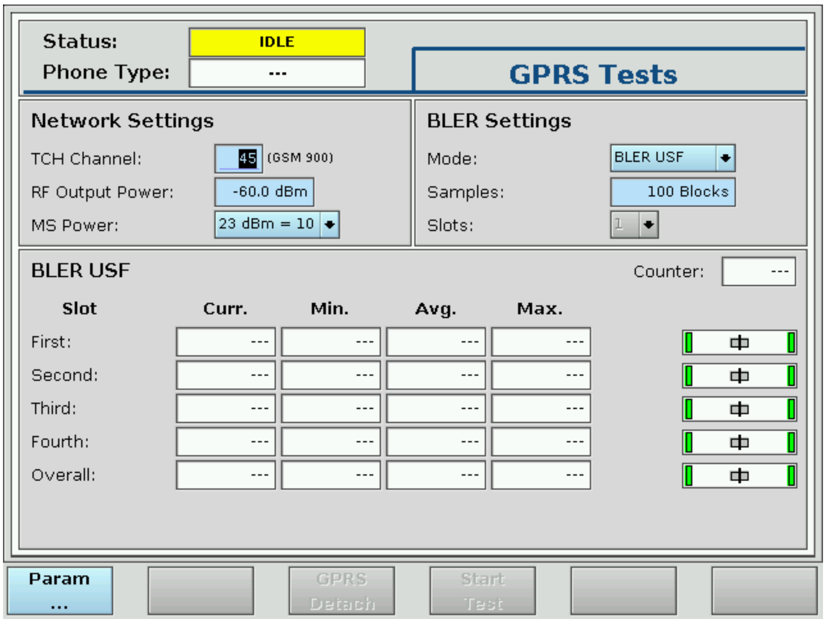
2 From the start menu, select **GSM.**
The GSM Tests menu appears.

3 Select a base channel (BCCH) and a traffic channel (TCH) in the frequency band of interest (see Table 1 on page 25).

4 Select an RF output power in the ProLock that is sufficiently high to allow the mobile phone to find the carrier, which is typically well above –100 dBm.

5 Ensure that the coupling is selected properly. Refer to "Setting up the coupling in the ProLock" on page 31 for more information.

6 Push the **GPRS** softkey.
The GPRS Tests menu appears.



7 Switch on the mobile phone, and wait until it indicates that it has found a base station.

> ***Note***
>
> Ensure that you keep this sequence of steps, there may be restrictions in the test capabilities otherwise.

8 If the mobile phone does not perform a GPRS Attach automatically, enable the GPRS mode in the phone so that it registers with the GPRS routing area.
The status field displays GPRS Attached, and the GPRS Detach and Start Test softkeys are accessible.

9 In the Mode selection field, select BLER USF.

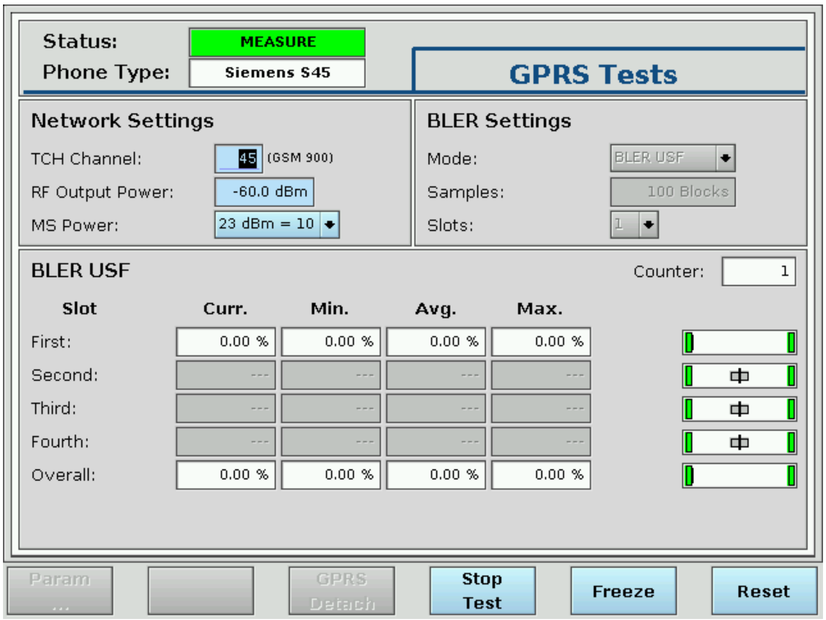
10 You may want to select a different number of samples in the range from 1 to 10,000 blocks; the default is 100.

> ***Note***
>
> A sample in case of the BLER-USF measurement is a data block, which in the worst case of one time slot assigned in the uplink, takes 20 ms to transmit. So if you select 200 samples and one uplink time slot, a measurement result will be returned every 4 seconds.

11 From the Slots selection field, select the number of time slots per frame that you want to test. The ProLock allows you to select only as many time slots per frame as the mobile phone is capable of transmitting.

12 In the RF Output Power entry field, select the power level at which you want to perform the receiver measurement.

13 Push the **Start Test** softkey.
The measurements are started, and the menu is frequently updated with results.
Section "Interpreting the results" on page 56 explains how the results should be read.



14 When you are finished, push the Stop Test softkey.
The measurements stop, and the status indication returns to GPRS Attached.

15 Push the GPRS Detach softkey to finish the GPRS mode.

Interpreting the results

GPRS Tests menu produces a statistical evaluation of the results of the BLER-USF for each time slot and in addition over all the time slots measured. The BLER-USF is measured as a percentage.

The BLER-USF measurement is typically performed at an RF output power level of –104 dBm. The result must not exceed 2% according to the GPRS specifications.

The results representation on the right-hand side includes a graphical Pass/Fail statement. This verdict depends on the limits defined in the GSM/GPRS Limits menu. (The limit value for BLER-USF refers to the upper limit because the lower limit is 0% by nature.)

Measuring the BCS-based BLER

In the BLER-BCS (BLock Error Rate based on the Block Check Sequence) measurement, the mobile receives a lot of data blocks but transmits only occasionally (when polled).

For the BLER-BCS measurement, the ProLock establishes a Downlink TBF and transmits blocks of data (filled with random data) to the mobile phone. Every 50 blocks or so, the ProLock requests, just like a real network, an indication from the mobile whether or not the data have been received correctly by the mobile phone. It acknowledges the proper reception or reports which blocks have been received in error. The phone can detect reception errors – after channel decoding – by comparing the transmitted Block Check Sequence (a checksum included with each block) with the calculated one. Finally, the block error rate is the number of reported errors compared to the whole number of received blocks.

Setting up the measurements

In order to start a test, proceed as follows:

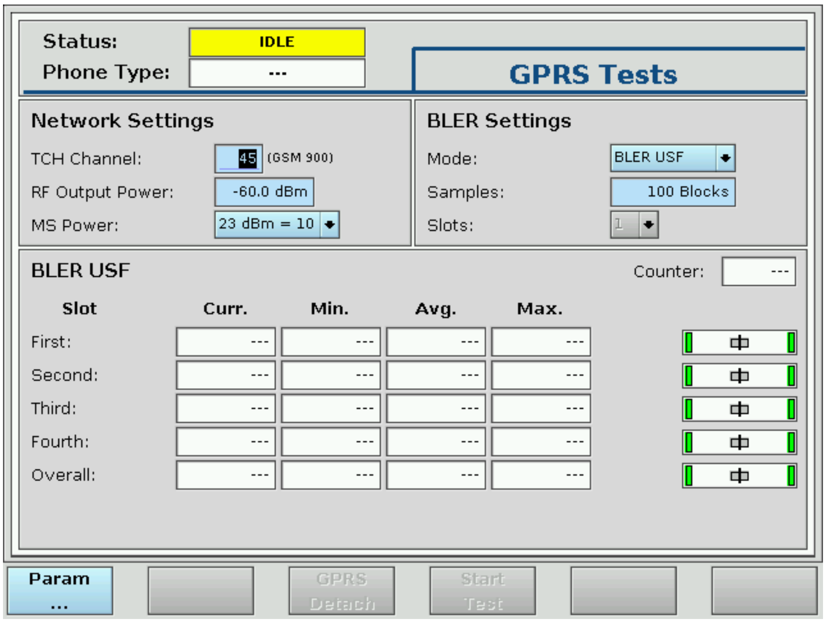
1 Insert a Test SIM in the mobile phone and connect the GSM/GPRS-enabled phone to the ProLock as depicted in section "Connecting the device under test" on page 14.

2 From the start menu, select **GSM.**
The GSM Tests menu appears.

3 Select a base channel (BCCH) and a traffic channel (TCH) in the frequency band of interest (see Table 1 on page 25).

4 Select an RF output power in the ProLock that is sufficiently high to allow the mobile phone to find the carrier, which is typically well above –100 dBm.

5 Push the **GPRS** softkey.
The GPRS Tests menu appears.



6 Switch on the mobile phone, and wait until it indicates that it has found a base station.

> ***Note***
>
> Ensure that you keep this sequence of steps, there may be restrictions in the test capabilities otherwise.

7 If the mobile phone does not perform a GPRS Attach automatically, enable the GPRS mode in the phone so that it registers with the GPRS routing area.
The status field displays GPRS Attached, and the GPRS Detach and Start Test softkeys are accessible.

8 In the Mode selection field, select BLER BCS.

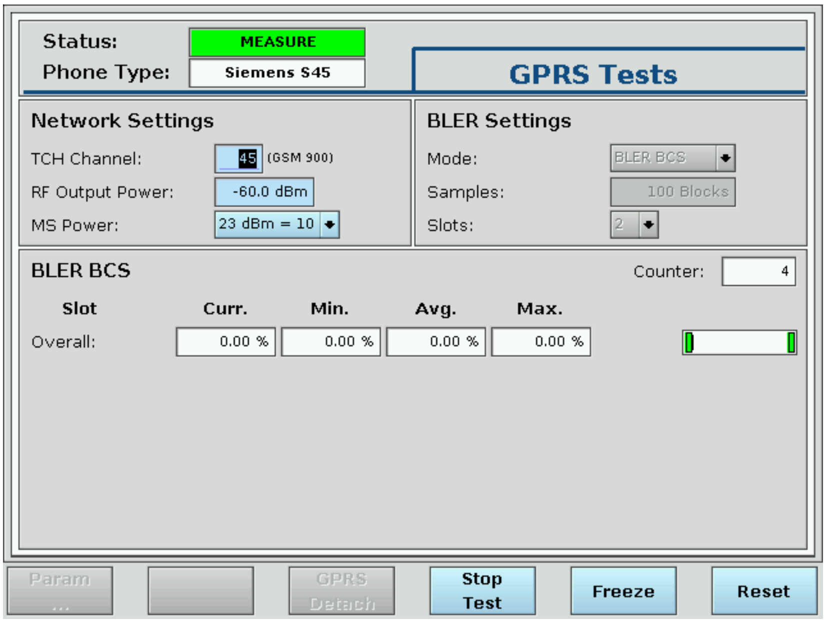
9 You may want to select a different number of samples in the range from 1 to 10,000 blocks; the default is 100.

> ***Note***
>
> The BLER is calculated over all time slots selected. Each measurement result is generated from a user-defined number of samples. A sample in case of the BLER-BCS measurement is a block, which in the worst case of one time slot assigned in the downlink, takes 20 ms. So if you select 200 samples, a measurement result will be returned every 4 seconds.

10 From the Slots selection field, select the number of time slots per frame that you want to test. The ProLock allows you to select only as many time slots per frame as the mobile phone is capable of transmitting.

11 In the RF Output Power entry field, select the power level at which you want to perform the receiver measurement.

12 Push the **Start Test** softkey.
The measurements are started, and the menu is frequently updated with results.
Section "Interpreting the results" on page 59 explains how the results should be read.



13 When you are finished, push the Stop Test softkey.
The measurements stop, and the status indication returns to GPRS Attached.

14 Push the GPRS Detach softkey to finish the GPRS mode.

Interpreting the results

GPRS Tests menu produces a statistical evaluation of the results of the BLER-BCS for each time slot and in addition over all the time slots measured. The BLER-BCS is measured as a percentage.

The BLER-USF measurement is typically performed at an RF output power level of –104 dBm. The result must not exceed 2% according to the GPRS specifications.

The results representation on the right-hand side includes a graphical Pass/Fail statement. This verdict depends on the limits defined in the GSM/GPRS Limits menu. (The limit value for BLER-BCS refers to the upper limit because the lower limit is 0% by nature.)

Performing EDGE (EGPRS) measurements

Introduction

EDGE is an extension of the GSM and GPRS protocols, enabling packet-oriented data transmission between the network (and, for example, the Internet) and the mobile phone, at advanced data rates. In addition to a different protocol, it can also use a more complex and efficient modulation format (8-PSK), and combine several time slots for one user to increase the data rate.

EDGE measurements with the ProLock require both the 2231 GSM Option and the 2233 EDGE Option. The 2232 GPRS Option is not required.

The ProLock offers RF power and modulation measurements with 8-PSK modulation, and two types of receiver measurements (BLER-USF and BLER-BCS measurements). All the measurements can be performed on a single time slot per TDMA frame.

> ***Note***
> The Downlink Slot and Uplink Slot input fields in the EDGE Tests menu have no function and should be ignored.

Setting up the measurements

Any transmitter and receiver measurements in EDGE mode require that the mobile device under test is registered on a simulated network (i.e. simulated by the ProLock), being ready to transmit or receive data blocks. This can be achieved as follows:

1 Insert a Test SIM in the mobile phone and connect the GSM/EDGE-enabled phone to the ProLock as depicted in section “Connecting the device under test” on page 14.

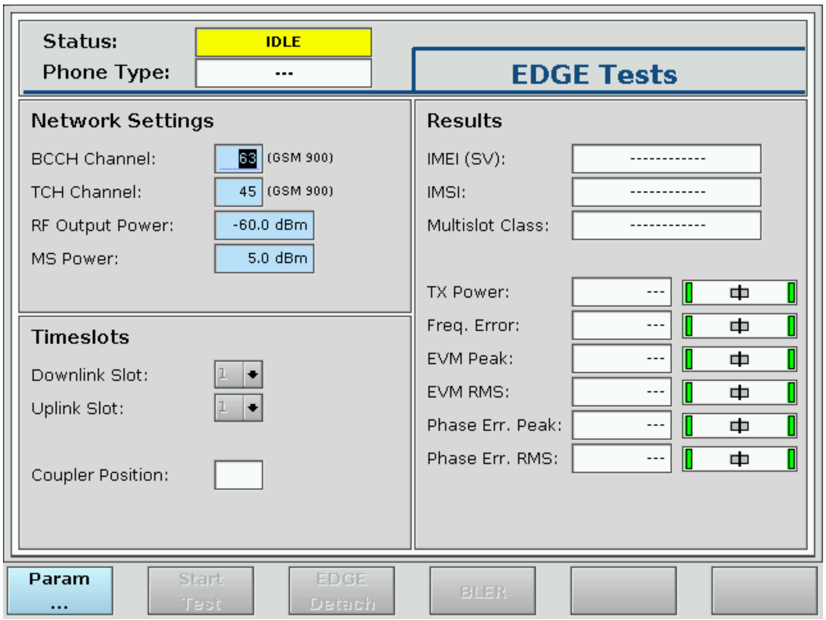
2 From the start menu, select **GSM.**
The GSM Tests menu appears.

3 Select a base channel (BCCH) and a traffic channel (TCH) in the frequency band of interest (see Table 1 on page 25).

4 Select an RF output power in the ProLock that is sufficiently high to allow the mobile phone to find the carrier, which is typically well above –100 dBm.

5 Ensure that the coupling is selected properly. Refer to “Setting up the coupling in the ProLock” on page 31 for more information.

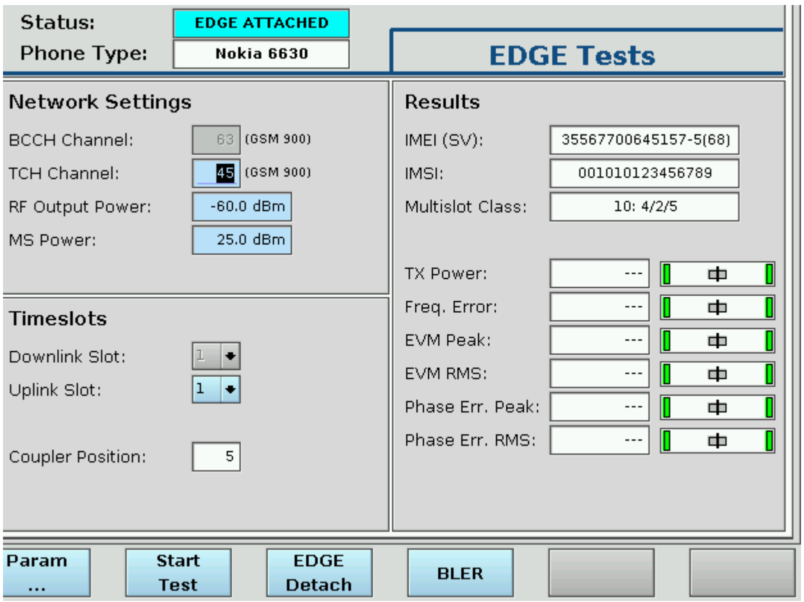
6 Push the **EDGE** softkey.
The EDGE Tests menu appears.



7 Switch on the mobile phone, and wait until it indicates that it has found a base station.

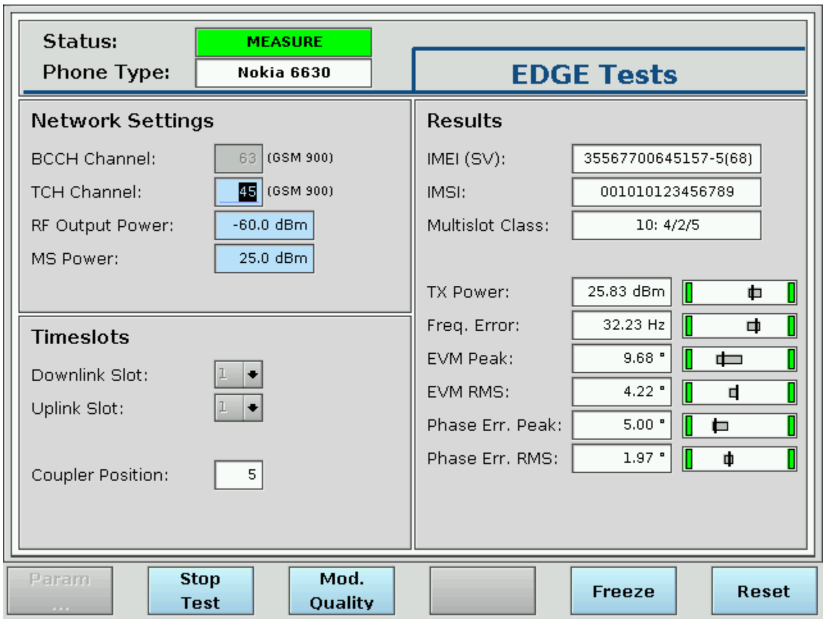
> ***Note***
>
> Ensure that you keep this sequence of steps, there may be restrictions in the test capabilities otherwise.

8 If the mobile phone does not perform an EDGE Attach automatically, enable the GPRS/EDGE mode in the phone so that it registers with the GPRS routing area.
The status field displays EDGE Attached, and the Start Test, EDGE Detach and BLER softkeys are accessible.

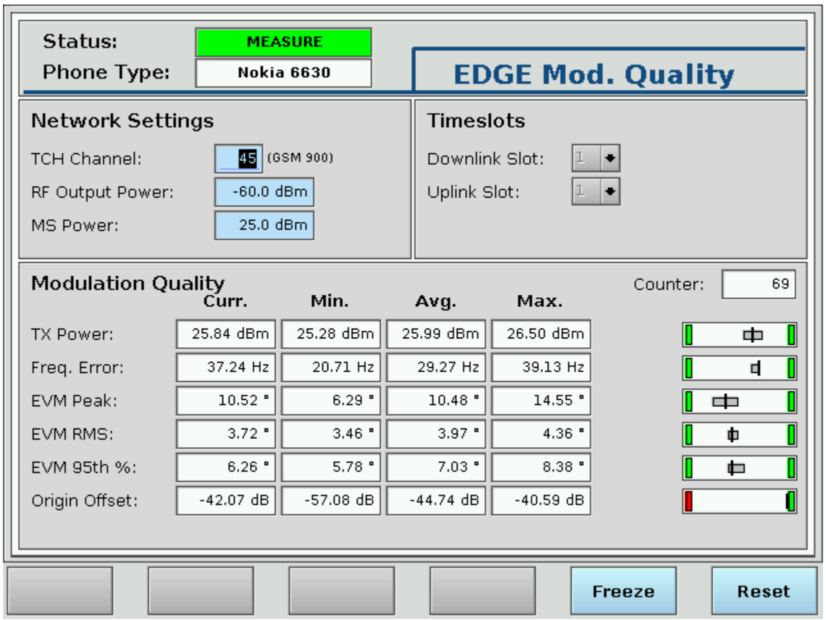


Performing EDGE transmitter measurements

1 Once the mobile device is EDGE-attached (see previous section), push the **Start Test** softkey.
A test channel is set up in uplink and the mobile device transmits random data. This enables the ProLock to perform modulation measurements.



2 Push the **Mod. Quality** softkey to get more detailed results on the EDGE Mod. Quality menu.



3 Push the **ESC** key and the **Stop Test** softkey to return from the menu and stop the measurements.

TX Power
This result field shows the measured transmit power of the mobile phone under test. Ideally it equates the MS Power value entered. The tolerance values depend on the power level, see "Power control levels and tolerances" on page 102.

Freq. Error
This result field indicates how the actual carrier frequency deviates from the nominal frequency. It is measured in hertz. According to the specifications, the maximum allowable relative error is 10^{-7}, i.e. ca. ±90 Hz in the GSM 850 and GSM 900 bands, ±180 Hz in the GSM 1800 band and ±190 Hz in the GSM 1900 band.

EVM Peak
The key measurement for EDGE modulation is the error vector magnitude or EVM for short, which is the distance in the I/Q diagram between the measured signal and the ideal one, relative to the ideal signal vector magnitude; the EVM is measured separately for each symbol. The peak EVM measurement determines the maximum EVM within the burst. The result is expressed as a percentage and always positive.

EVM RMS
The RMS EVM is the RMS-averaged value over all symbols of a burst. The result is expressed as a percentage.

Phase Err. Peak
The peak phase error is the magnitude of the maximum phase error that occurred within a single burst. This value is always positive.

Phase Err. RMS
The RMS phase error is calculated from the phase errors of all bits within a burst, by root-mean-square-averaging them. This value is always positive.

EVM 95th %
The 95th percentile EVM is the error vector magnitude that is not exceeded by 95% of the symbols of the burst. The 95th percentile EVM is expressed in %.

Origin Offset
The origin offset indicates the accuracy of the I/Q modulator's DC setup; it usually is an undesired leakage produced due to a DC offset in the phone's I/Q modulator. It is measured in dBc.

Multislot Class
This field indicates the multislot class number, along its meaning. The multislot class indicates the maximum number of downlink slots, the maximum number of uplink slots and the maximum number of concurrent downlink and uplink slots.

Performing receiver measurements in EDGE mode

The 2201 ProLock supports two types of (E)GPRS receiver measurements: BLER-USF and BLER-BCS. The ProLock transmits the downlink information using GMSK modulation.

Measuring the USF-based BLER

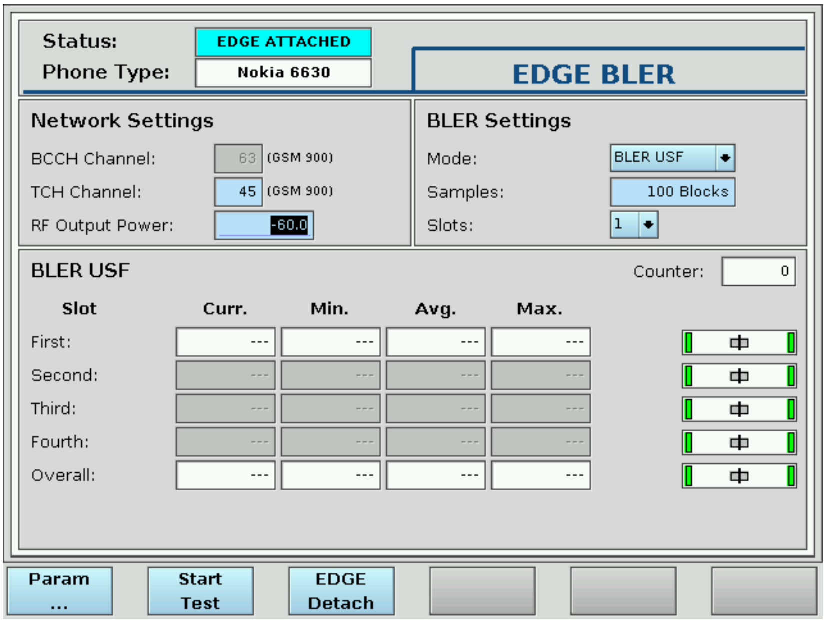
The BLER-USF (BLock Error Rate based on the Uplink State Flag) receiver test is a standardized test method.

Procedure

1 Ensure that the wireless device is in the EDGE Attached mode (see "Setting up the measurements" on page 60).

2 Push the **BLER** softkey.
The EDGE BLER menu appears.

3 In the Mode selection field, select BLER USF.



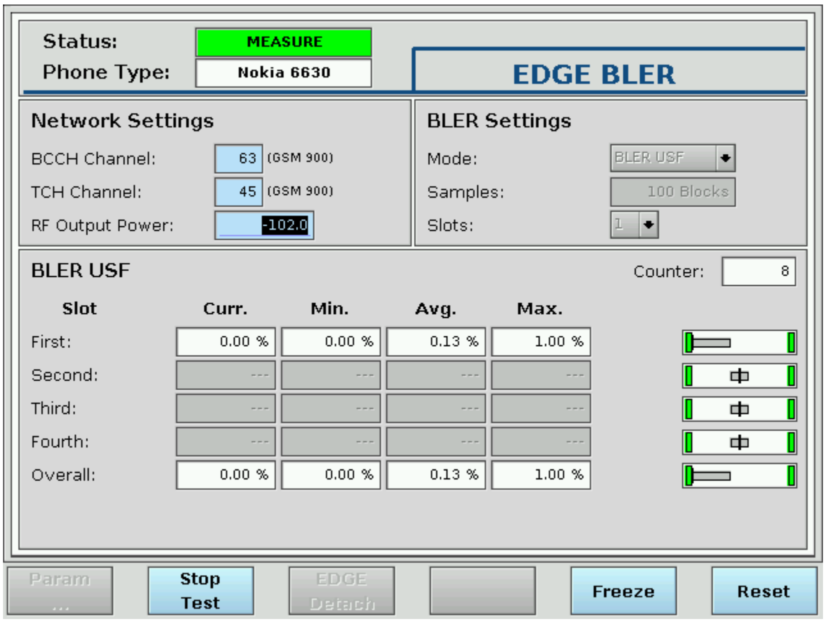
4 You may want to select a different number of samples in the range from 1 to 10,000 blocks; the default is 100.

> **Note**
> A sample in case of the BLER-USF measurement is a data block, which takes 20 ms to transmit. So if you select 200 samples, a measurement result will be returned every 4 seconds.

> **Note**
> The Slots input field is not relevant in the context of EDGE BLER measurements. The measurement is performed on a single time slot.

5 In the RF Output Power entry field, select the power level at which you want to perform the receiver measurement.

6 Push the **Start Test** softkey.
The measurements are started, and the menu is frequently updated with results.
Section "Interpreting the results" on page 65 explains how the results should be read.



7 When you are finished, push the **Stop Test** softkey.
The measurements stop, and the status indication returns to EDGE Attached.

8 Push the **EDGE Detach** softkey to finish the EDGE mode.

Interpreting the results

The EDGE BLER menu produces a statistical evaluation of the results of the BLER-USF. The BLER-USF is measured as a percentage.

The BLER-USF measurement is typically performed at an RF output power level of –104 dBm. The result must not exceed 2% according to the EDGE specifications.

The results representation on the right-hand side includes a graphical Pass/Fail statement. This verdict depends on the limits defined in the GSM/GPRS Limits menu. (The limit value for BLER-USF refers to the upper limit because the lower limit is 0% by nature.)

Measuring the BCS-based BLER

In the BLER-BCS (BLock Error Rate based on the Block Check Sequence) measurement, the mobile receives a lot of data blocks but transmits only occasionally (when polled).

For the BLER-BCS measurement, the ProLock establishes a Downlink TBF and transmits blocks of data (filled with random data) to the mobile phone. Every 50 blocks or so, the ProLock requests, just like a real network, an indication from the mobile whether or not the data have been received correctly by the mobile phone. It acknowledges the proper reception or reports which blocks have been received in error. The phone can detect reception errors – after channel decoding – by comparing the transmitted Block Check Sequence (a checksum included with each block) with the calculated one. Finally, the block error rate is the number of reported errors compared to the whole number of received blocks.

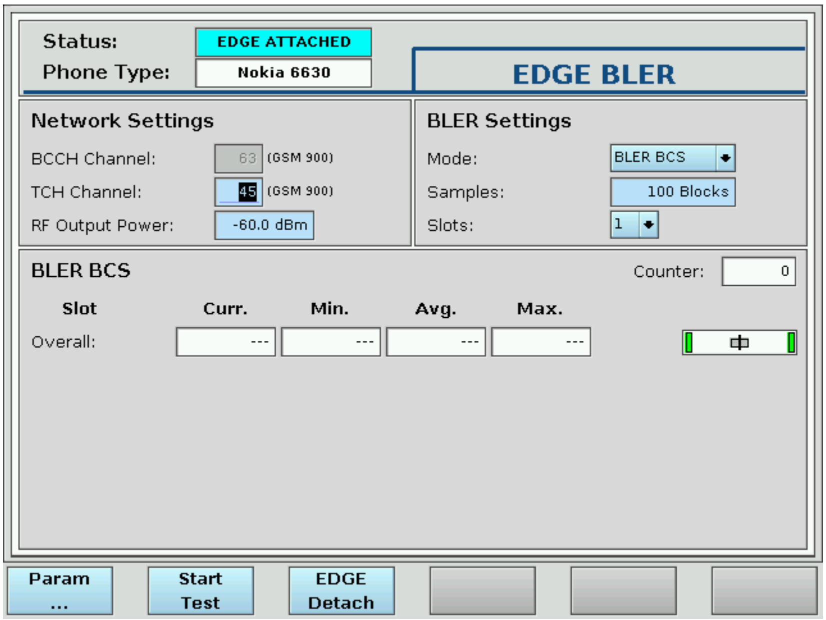
Procedure

In order to start a test, proceed as follows:

1 Ensure that the wireless device is in the EDGE Attached mode (see "Setting up the measurements" on page 60).

2 Push the **BLER** softkey.
The EDGE BLER menu appears.

3 In the Mode selection field, select BLER BCS.

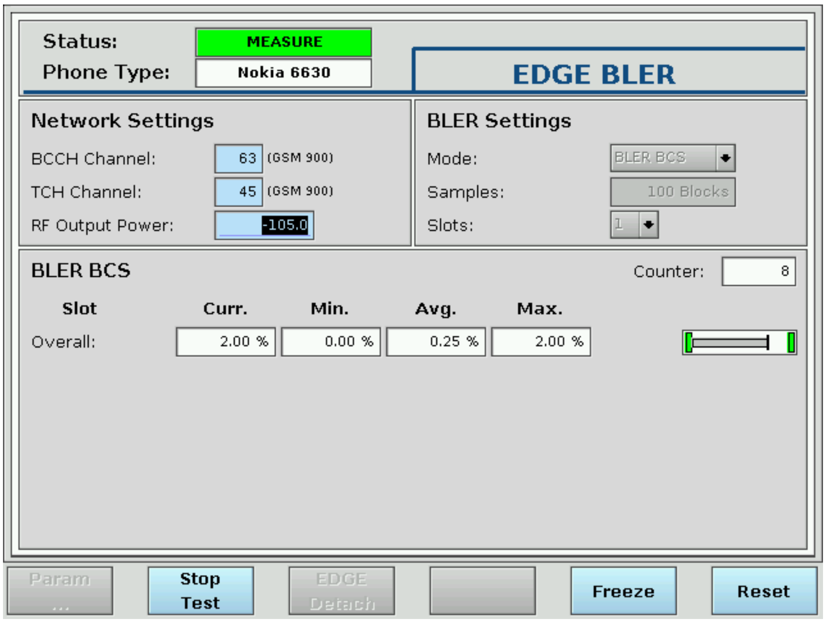


4 You may want to select a different number of samples in the range from 1 to 10,000 blocks; the default is 100.

> ***Note***
>
> The BLER is performed over a single time slot, independent of the setting in the Slots input field. Each measurement result is generated from a user-defined number of samples. A sample in case of the BLER-BCS measurement is a block, which takes 20 ms to send. So if you select 200 samples, a measurement result will be returned every 4 seconds.

5 In the RF Output Power entry field, select the power level at which you want to perform the receiver measurement.

6 Push the **Start Test** softkey.
The measurements are started, and the menu is frequently updated with results.
Section "Interpreting the results" on page 67 explains how the results should be read.



7 When you are finished, push the **Stop Test** softkey.
The measurements stop, and the status indication returns to EDGE Attached.

8 Push the **EDGE Detach** softkey to finish the EDGE mode.

Interpreting the results

GPRS Tests menu produces a statistical evaluation of the results of the BLER-BCS. The BLER-BCS is measured as a percentage.

The BLER-USF measurement is typically performed at an RF output power level of –104 dBm. The result must not exceed 2% according to the EDGE specifications.

The results representation on the right-hand side includes a graphical Pass/Fail statement. This verdict depends on the limits defined in the GSM/GPRS Limits menu. (The limit value for BLER-BCS refers to the upper limit because the lower limit is 0% by nature.)

Performing Tests and Measurements in WCDMA Mode

4

This chapter provides task-based instructions for using the 2201 ProLock to test the WCDMA performance of mobile phones and wireless data cards. Topics discussed in this chapter are as follows:

Introduction

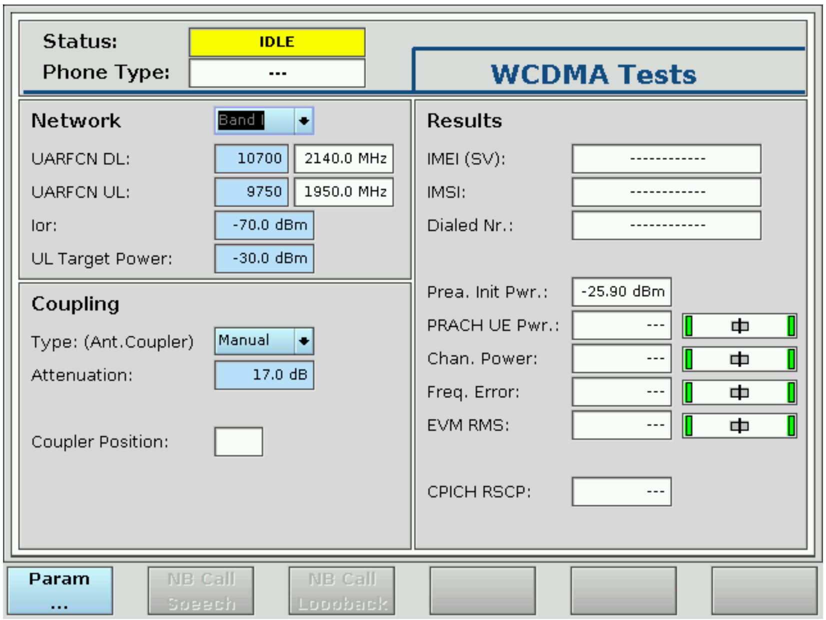
The 2201 ProLock with the 2234 WCDMA Option allows tests and measurements at WCDMA-enabled mobile phones and data cards.

Setting up network and test parameters

This section makes you familiar with the ProLock parameters necessary to successfully perform standard measurements.

Defining the main network settings

From the start menu, press the **WCDMA** softkey to enter the WCDMA Tests menu. The Network section in that menu provides access to some basic parameters such as the frequency channels being used by ProLock and the mobile phone.



Band Select the WCDMA frequency band here. "WCDMA channel numbers and frequency bands" on page 105 lists the frequency bands available.
If the previous UARFCN DL and UL entries are invalid for the selected band, they will be updated with a valid entry.

> Note
>
> Only select a frequency band that the mobile phone under test supports, otherwise the test will fail.

> Note
>
> The frequency band cannot be changed during a test.

UARFCN DL

In this field, enter the channel number of the WCDMA carrier number to be used in the downlink (transmission from base station to mobile phone). See "WCDMA channel numbers and frequency bands" on page 105 for valid channel numbers and frequency bands.
As a result, the corresponding carrier frequency wll be displayed in the field next to the entry field. The uplink channel number (mobile phone transmit carrier) will automatically be updated in the UARFCN UL entry field.

> Note
>
> The channel number can be changed during a call, causing a handover.

UARFCN UL

In this input field, enter the channel number of the WCDMA carrier number to be used in the uplink (transmission by mobile phone). See "WCDMA channel numbers and frequency bands" on page 105 for valid channel numbers and frequency bands.
As a result, the corresponding carrier frequency wll be displayed in the field next to the entry field. The downlink channel number will automatically be updated in the UARFCN UL entry field.

Ior

Entry field for ProLock's output power, i.e. the power level received in the mobile phone. Setting higher or lower power levels simulates a different distance between the mobile phone and the base station.

Without coupling loss the entry range for the output power is –120 dBm to –50 dBm. However, coupling attenuation (CA) has to be taken into account for measurements. Thus, the following formula applies to the valid input range for this field: Ior + CA ≤ –50 dBm
If you define a coupling loss of 15 dB for example, the formula would read:
Ior + 15 dB ≤ –50 dBm
The default for this field is –70 dBm.

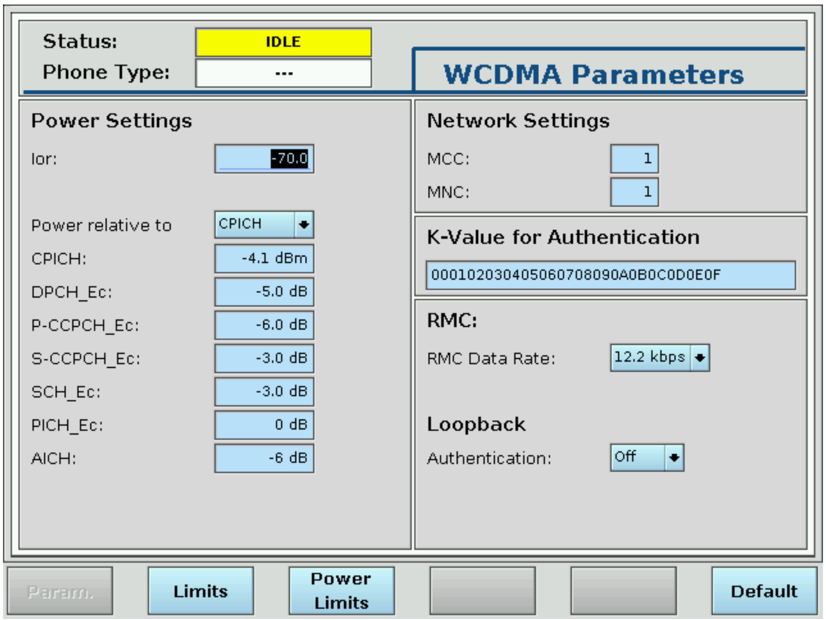
UL Target Power

Entry field for the uplink target power. This is similar to the power level at which the phone should transmit. ProLock will control the phone's output power level using power commands in order to achieve this target value.
This is especially useful for measurements requiring higher power values.

Valid inputs are in the range from –55 to +33 dBm. The default is –30 dBm.

Setting up advanced network parameters

ProLock allows you to define a few network parameters that you do not normally want to change. From the start menu, push **WCDMA > Param** to access them in the WCDMA Parameters menu.



Power relative to

This selection field determines if the power values in the subsequent input fields shall be relative to the absolute power level defined for CPICH or for Ior. The CPICH power level refers to the Common Pilot Channel (CPICH) and can be entered in this menu. The Ior is the input level to the mobile phone as explainedon page 71.

CPICH

The absolute power level of the CPICH (Common Pilot Channel) as received in the mobile phone can be entered here. The power level must not exceed the total power Ior.

Valid range: –35.0 to 0 dBm. Default value: –4.1 dBm.

DPCH_Ec

The Dedicated Physical Channel (DPCH) is used in both the uplink and downlink to carry the DPDCH (Dedicated Physical Data Channel) and the DPCCH (Dedicated Physical Control Channel).

The DPDCH transmits the user data whereas the DPCCH transports the pilot symbols, the control commands for fast power control as well as rate information (TFCI, Transport Format Combination Indicator).

Valid range: –35.0 to 0 dB. Default value: –5.0 dB.

P-CCPCH_Ec The Primary Common Control Channel (P-CCPCH) transports synchronization and broadcast information for users. Within a cell there is only one P-CCPCH. Its frame structure differs from the downlink DPCH (Dedicated Physical Channel) in that no TPC (Transmit Power Control) commands, no TFCI (Transport Format Combination Indicator) and no pilot bits are transmitted.

Entry range: –35.0 to 0 dB. Default value: –6.0 dB.

S-CCPCH_Ec The Secondary Common Control Physical Channel (S-CCPCH) carries the FACH (Forward Access Channel) and the PCH (Paging Channel).

Entry range: –35.0 to 0 dB. Default value: –3.0 dB.

SCH_Ec The Synchronization Channel is used for cell search in DL. Furthermore it transmitts synchronization information.

Entry range: –35.0 to 0 dB. Default value: –3.0 dB.

PICH_Ec The Paging Indicator Channel (PICH) is a physical channel with a fixed rate and a spreading factor of 256. On the PICH upcoming paging messages on the S-CCPCH are displayed. The wireless device must „listen“ to the PICH in order to determine whether there is an incoming call. If a positive paging announcement is recognized, the device begins to read the S-CCPCH expecting a paging message.

Entry range: –35 to 0 dB. Default value: 0 dB.

AICH The Acquisition Indicator Channel is a physical channel with a fixed rate and a spreading factor of 256 equating to 32 kbps. It transports the acquisition indicators which correspond to signatures on the Physical Random Access Channel (PRACH).

Entry range: –35 to 0 dB. Default value: –6 dB.

MCC The Mobile Country Code (MCC) identifies the country where the network is located. The MCC is a three-digit number coded according to an international standard (CCITT Rec. E .212, Annex A) and is unique for every country.

If you want to test mobile phones using a standard test SIM in accordance to GSM testing standards, set the MCC to 1 (this is the default setting). However if you want to simulate a particular network, you can enter a different country code here.

Entry range: 0…1000. Default value: 1

MNC

In conjunction with the MCC, the Mobile Network Code (MNC) indicates the national network. The MNC is coded by national authorities, usually starting from 01.

The MNC is a two-digit code, except for US networks which use three-digit coding.

If you want to test mobile phones using a standard test SIM in accordance to WCDMA testing standards, set the MNC to 1 (this is the default setting). However if you want to simulate a particular network, you can enter a different country code here.

Entry range: 0...100. Default value: 1

K-Value for authentication

During the registration process, the MS and the network usually authenticate each other by showing knowledge of a pre-shared secret "K-value for Authentication" that is only available in the USIM of the MS and the Authentication Center of the network.

RMC Data Rate

Selection field for the data bit rate on the Reference Measurement Channel (RMC).

Possible entries: 12.2 kbps, 64 kbps, 144 kbps, 384 kbps. The default is 12.2 kbps.

Authentication

Selection field to force or to disable authentication of the mobile phone.

Setting up the coupling in ProLock

If you are using an antenna coupler rather than a direct cable connection, a part of the signal will be lossed over the air. Only a certain fraction of the radiated signal power will arrive at the antenna, in both directions. For precision measurements at the power transmitter and the receiver, however, it is important to transmit and receive correctly, i.e. the attenuation must be known. The attenuation depends on both the type of mobile under test and the environment. When the coupler is mounted in Willtek's 4921 RF Shield, for example, this will give measurement different from an open environment.

Manually adjusting the coupling loss

One way of compensating this coupling loss attenuation is to manually enter the attenuation (if known). This can be accomplished with a table of coupling factors for each type of mobile, taking also into account which coupling and shielding device (if any) are applicable to the respective coupling factor.

For manual attenuation input, proceed as follows:

1 In the WCDMA Tests menu, go to the Type selection field and choose ''Manual''.

2 In the Attenuation input field, enter the attenuation value (coupling factor) in dB.

> Note
>
> The coupling attenuation is frequency-dependent, so when you change the frequency band or the technology, ensure that you adapt the coupling attenuation accordingly.

Working with the built-in coupling factor database

A more elegant way of compensating the coupling loss is by using the built-in database of coupling factors for many popular mobile phone models.

1 Ensure that the coupler, the RF shielding device and the shuttle on the shielding device (if applicable) are selected correctly in the Configuration menu.

2 In the WCDMA Tests menu, go to the Type: (Ant. Coupler) selection field and choose ''Auto''.
Once the mobile phone is registered on the network simulated by ProLock, the correct coupler position is shown in the Coupler Position field provided that coupling factors are available for this combination of coupler, shielding device and shuttle.

3 Adjust the coupler position according to the display.

Updating the built-in coupling factor database

The database can be updated over the Internet or from a file server with 7312 Lector Enhanced (or 7315 Scriptor) and the 7360 Coupling Factor Update License. Please refer to the user's guide for Lector and Scriptor for more information.

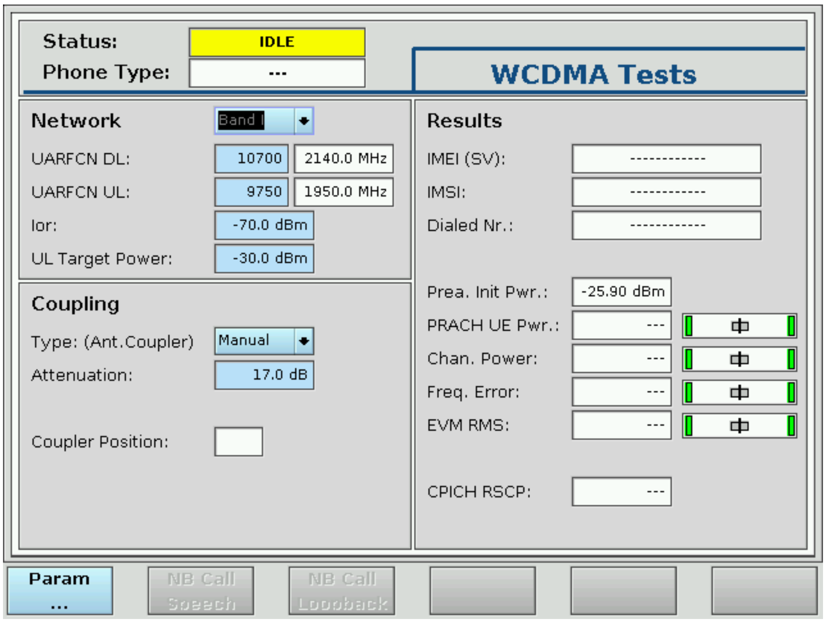
Testing the incoming (mobile-terminated) call

This test checks if the mobile is capable of receiving a call and alerting the user. It is also a typical way to start transmitter measurements.

> Note
>
> This procedure can also be used to initiate transmitter measurements. Receiver (BER) measurements, however, require the loopback mode described in "Performing receiver measurements" on page 89.

1 Insert a Test SIM in the mobile phone and connect the phone to ProLock as depicted in section "Connecting the device under test" on page 14.

2 From the start menu,select **WCDMA**.
The WCDMA Tests menu appears.

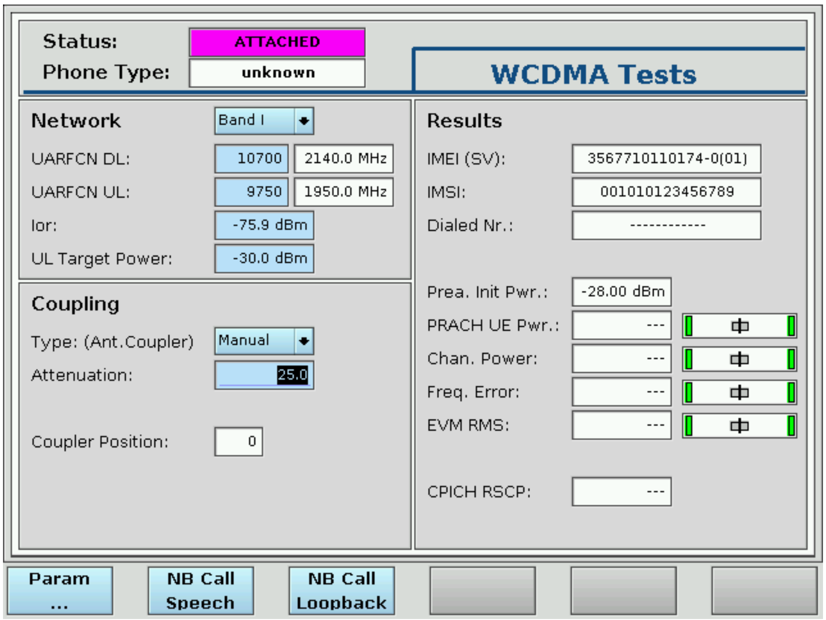


3 Select a frequency band and uplink or downlink carrier number of interest (see "WCDMA channel numbers and frequency bands" on page 105).

4 Select an Ior (RF output power) in the ProLock that is sufficiently high to allow the mobile phone to find the carrier, which is typically well above –100 dBm.

5 Ensure that the coupling is selected properly. Refer to "Setting up the coupling in ProLock" on page 75 for more information.

6 Switch on the mobile phone, and wait until it is registered on the simulated network (attached).



7 Push the **NB Call Speech** softkey.
The phone is paged and starts ringing.

8 Accept the call at the phone.
The phone stops ringing and a voice channel is set up. The signaling status changes and measurements are performed.

9 You can now perform transmitter measurements if you like.

10 Release the call either on the phone or on ProLock (using the **Release** softkey).

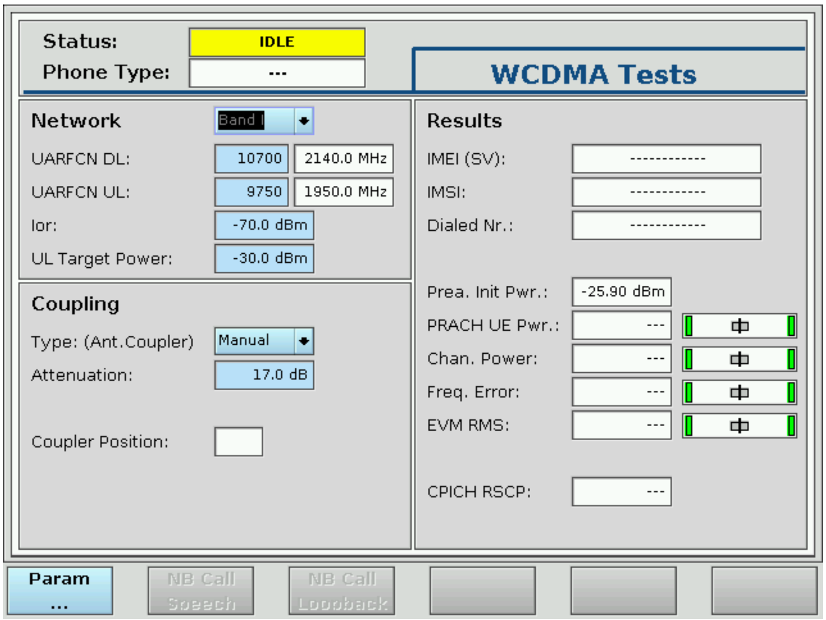
Testing the outgoing (mobile-originated) call

This test checks if the mobile is capable of correctly accepting dialed digits (i.e. the keypad is tested) and if it can initiate a call. It is also a typical way to start measurements.

> **Note**
>
> This procedure can also be used to initiate transmitter measurements. Receiver (BER) measurements, however, require the loopback mode described in "Performing receiver measurements" on page 89.

1 Insert a Test SIM in the mobile phone and connect the phone to ProLock as depicted in section "Connecting the device under test" on page 14.

2 From the start menu,select **WCDMA**.
The WCDMA Tests menu appears.

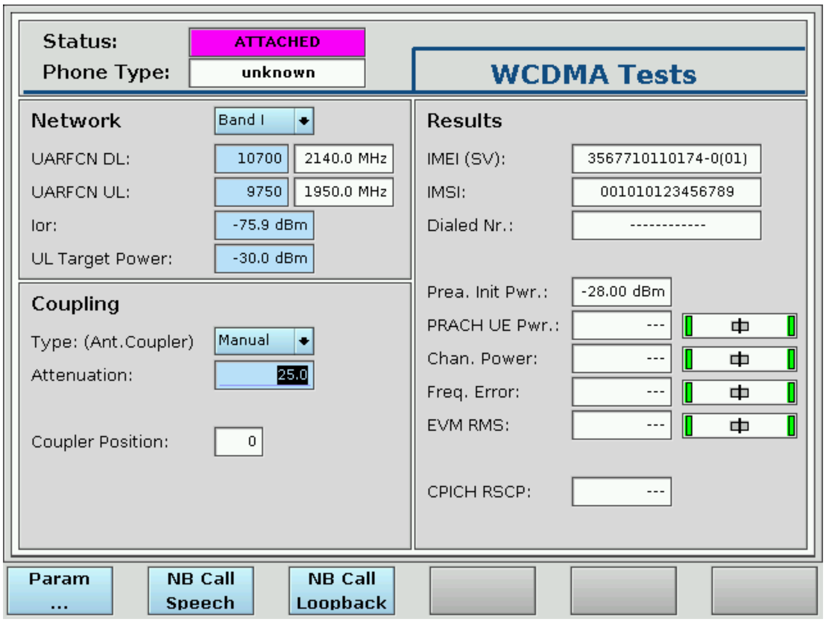


3 Select a frequency band and uplink or downlink carrier number of interest (see "WCDMA channel numbers and frequency bands" on page 105).

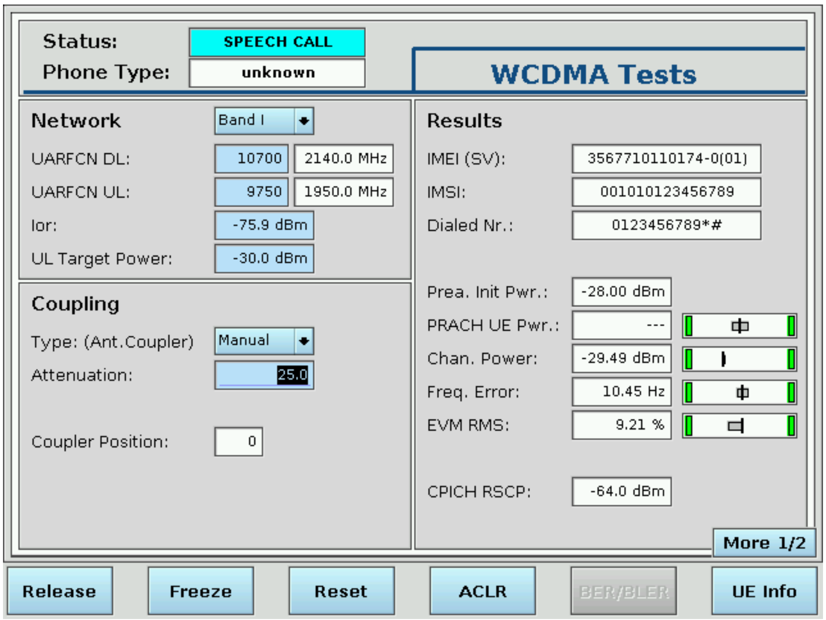
4 Select an Ior (RF output power) in the ProLock that is sufficiently high to allow the mobile phone to find the carrier, which is typically well above –100 dBm.

5 Ensure that the coupling is selected properly. Refer to "Setting up the coupling in ProLock" on page 75 for more information.

6 Switch on the mobile phone, and wait until it is registered on the simulated network (attached).



7 Enter a number on the phone that comprises all the numerical digits (e.g. "0123456789*#"), and push the Call button on the phone.
The phone sets up a call with ProLock. The signaling status changes and measurements are performed.



8 Compare the number dialed on the phone with the number shown in the Results section on the right-hand side of the WCDMA Tests menu, in the Dialed No. field. It should be the same.

9 You can now perform transmitter measurements if you like.

10 If you are testing a mobile phone (as opposed to a wireless data card) you may now perform a qualitative audio test by speaking into the microphone and listening to the audio in the receiver because ProLock loops the voice signal back to the phone.

11 Release the call either on the phone (on-hook key) or on ProLock (using the **Release** softkey).

Reading the capabilities of the mobile phone

Mobile phone parameters

ProLock can show the following information about the phone under test:

Phone type

The phone model is indicated at the top-left of the WCDMA measurement menus, provided that the Type Approval Code (TAC) is found in its internal database of phone models. the TAC is part of the IMEI (see below).

IMEI (SV)

ProLock displays the International Mobile Equipment Identity (IMEI) as indicated by the mobile. The IMEI is the registration number of the mobile hardware which identifies it internationally. The IMEI is stored inside the mobile's electronics and can only be read out by ProLock through the radio interface.

The IMEI consists of 15 digits; the last one is not transferred over the radio interface but calculated from the other 14 digits. The additional two digits shown in brackets indicate the software version in the mobile phone which has been transferred to ProLock along with the IMEI.

IMSI

The International Mobile Subscriber Identity (IMSI) is the individual identity number of the subscriber in the network. The mobile reads the IMSI from the SIM (Subscriber Identity Module) card.

The IMSI consists of up to 15 digits. The first three digits are called the MCC and give the code of the country in which the mobile subscriber is registered.
The next two digits (the so-called MNC) are the code of the national network the mobile subscriber is registered in. Please note that there are three digits being used for the MNC in North America.
The remaining ten digits (nine in North America) are the registration number of the subscriber within the network.

For testing purposes, identical test SIM cards are typically being used, with the MCC and MNC set to 1.

MS power class

The power class of the mobile phone is indicated as Power Class. The power class gives the maximum RF output power a mobile is able to transmit on. See Table 6 for the nominal maximum power level in each class.

Table 6 ***WCDMA power classes and maximum power levels***

Power class	Band I	Band II to Band X
1	33 dBm (2 W)	-
2	27 dBm (0.5 W)	-
3	24 dBm (250 mW)	24 dBm (250 mW)
4	21 dBm (125 mW)	21 dBm (125 mW)

Multi RAT This field indicates whether the wireless device supports more than one Radio Access Technology (RAT), e.g. WCDMA and GSM. If this is the case, the additional technology standard supported is displayed here.

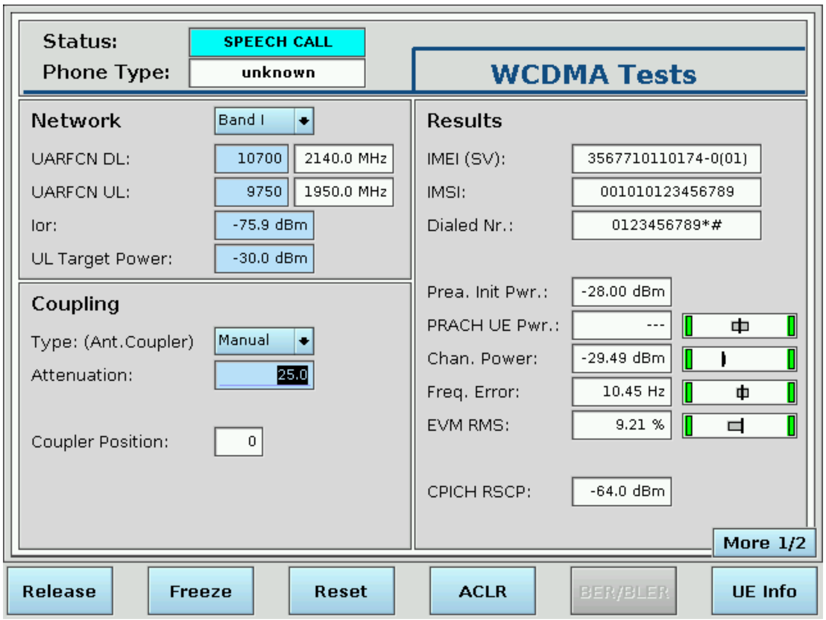
Measurement If the wireless device supports more than one RAT as explained above, this field indicates whether compressed mode is needed for UL and DL. In compressed mode signaling is stopped when searching for a GSM cell for example.

Positioning Indicates the positioning system used: GPS, Network or None.

Ciphering algorithm Indicates the encryption method used.

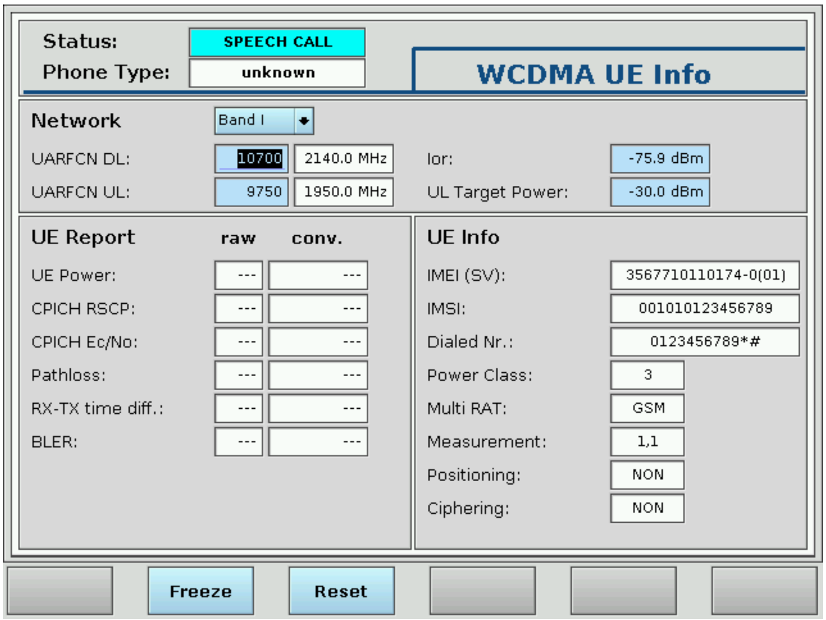
Procedure

1 Set up a call as shown on page 76 or on page 78.



2 Read the phone type, the IMSI and the IMEI from the WCDMA Tests menu.

3 Push **... > UE Info**.
The WCDMA UE Info menu appears.



4 Read the MS power class, the Multi-RAT capability, the measurement, positioning and ciphering capabilities from the right-hand side of the WCDMA UE Info menu.

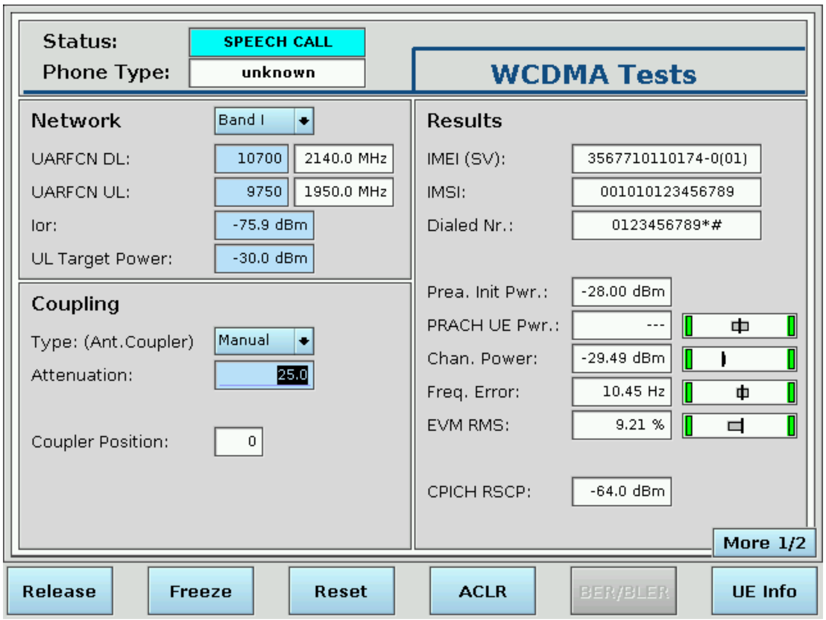
Performing standard transmitter tests

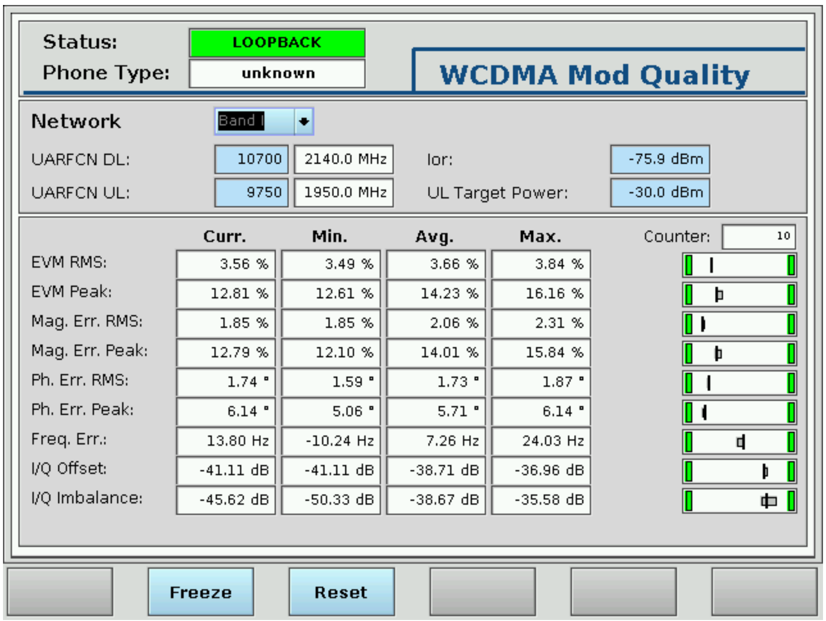
This section shows how to read and interpret the transmitter measurement results after a call has been set up.

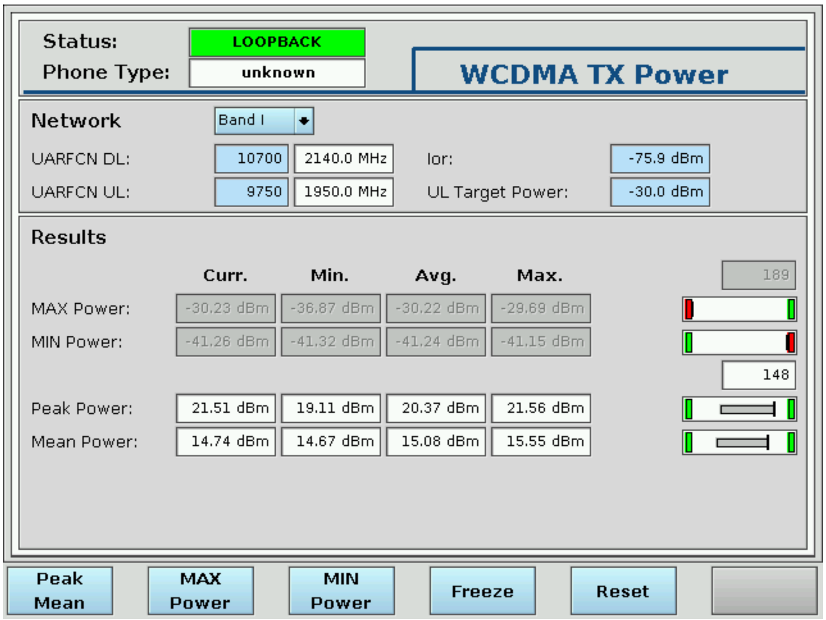
Setting up a connection for transmitter tests

In order to set up a call, follow the instructions on either page 76 or page 78.

The WCDMA Tests menu, the WCDMA Mod Quality menu and the WCDMA TX Power menu present the following transmitter measurement parameters with results. From the WCDMA Tests menu, push (the **MORE** key and then) the **Mod Quality** or the **Power** softkey to access the related menus while a call is active.







Affecting the measurements

You can change some important test parameters while a call is active.

– In order to test on a different frequency, change the frequency band and the channel number in the Network section of the test menu. The measurements will be halted, the frequency will be changed and the measurements will be restarted.

– In order to test with a different input level at the mobile phone's antenna, change the Ior value in the Network section of the test menu. The measurements will be halted, ProLock will change its output power level and the measurements will be restarted.

– In order test the mobile phone's transmitter quality at a different output power, change the UL Target Power value in the Network section of the test menu.
The measurements will be halted, ProLock will direct the wireless device to the new output power level and the measurements will be restarted.

Understanding transmitter measurement parameters

Preamble initial power

The Prea. Init Pwr. output field displays the power level (in dBm) at which the mobile phone or wireless data card transmits first to the base station (or ProLock in this case). ProLock will use this power as a basis for power control, just like a real network does.

PRACH UE power

During a mobile-originated call setup, the PRACH UE Pwr. field shows the power level of the device on the PRACH (Physical Random Access Channel), in dBm.

Channel power

The Chan. Power field displays the measured channel power during the call, in dBm. The result depends on the power level set in the UL Target Power input field.

Frequency error

In the Freq. Error field, ProLock displays the results of the frequency error measurements. The result is given in hertz. According to WCDMA specifications the carrier frequency of the wireless device shall not deviate from the assigned frequency by more than ±0.1 ppm, thus in the case of measurements in frequency band I, the value displayed in this field shall be in the range of ±200 Hz.

RMS error vector magnitude

The EVM RMS field indicates the average of all the decision points (symbols) across a whole measurement interval.

Limit value according to WCDMA specifications: 17.5 %

Peak error vector magnitude

The EVM Peak field indicates the maximum difference between the measured vectors and the ideal vectors, expressed as a percentage value.

Limit value according to WCDMA specifications: 50 %

RMS magnitude error

The root mean squared magnitude error is a measurement of the error in the mobile’s transmit signal size (magnitude) at the decision points. The result is shown in the Mag. Err. RMS field.

Limit value according to WCDMA specifications: 17.5 %

Peak magnitude error

The peak magnitude error value indicates the difference between the measured vector’s and the ideal vector’s magnitude, also expressed as a percentage value in the Mag. Err. Peak field.

Limit value range according to WCDMA specifications: ±50 %

RMS phase error

The root mean squared phase error is a measurement of the phase component of the vector error of the wireless device’s transmit signal at the decision points. The result is shown in the Ph. Err. RMS field.

Limit value range according to WCDMA specifications: ±10°

Peak phase error

The peak phase error indicates the phase difference, i.e. the angle difference, between the signal vector measured and the ideal signal vector. The result is indicated in the Ph. Err. Peak field.

Limit value range according to WCDMA specifications: ±45°

I/Q offset

The I/Q offset value is the determined ratio between the magnitude of the I/Q offset vector and the magnitude of the average signal vector corrected by the offset vector. It is expressed in dB.

Limit value according to WCDMA specifications: –15 dB

I/Q imbalance

The I/Q imbalance value is the determined ratio between the I/Q offset vector and the average signal vector corrected by offset. It is expressed in dB.

Limit value according to WCDMA specifications: –15 dB

Maximum power

The maximum power measurement is performed after the mobile phone is directed to transmit at its highest possible power level. The result is shown in the MAX Power field of the WCDMA TX Power menu, after a push of the **MAX Power** softkey.

Minimum power

The minimum power measurement is performed after the mobile phone is directed to transmit at its lowest possible power level. The result is shown in the MIN Power field of the WCDMA TX Power menu, after a push of the **MIN Power** softkey.

Peak power

The peak power is the maximum power of the modulated WCDMA signal (measured in the time domain).

Mean power

The mean power is the average power of the modulated WCDMA signal (in the time or frequency domain). It is equal to the channel power and is lower than the peak power due to the dedicated crest factor of a WCDMA-modulated signal.

Measuring adjacent channel power (ACLR)

This measurement determines the spectral power in the neighboring channels relative to the power in the allocated channel. The purpose of this measurement is to verify that the Adjacent Channel Power Ratio (ACLR) does not exceed the WCDMA limits and to ensure thereby that the mobile’s modulator does not create sideband emissions that would then disturb transmission on adjacent traffic channels.

The measurement is performed in a 5 MHz bandwidth on the first and second channel below and above the active channel. The graphical statistics display shows the measurement results relative to limit values which can be defined in the WCDMA Power Limits menu; push **WCDMA > Param. > Limits > Power** to access the menu.

Measuring inner loop power

Inner loop power control takes place between the unit under test andthe base station, 1500 times per second (corresponding to the time slot length of 667 µs). Inner loop power control requires accurate measurement of the level changes in the final test or incoming inspection. This measurement verifies that the step is within the limits (right size) and was performed at the correct time. On the Inner Loop menu 20 steps of the inner loop power control can be displayed, in remote mode it is possible to do even more. Furthermore the menu provides a Passed or Failed test verdict.

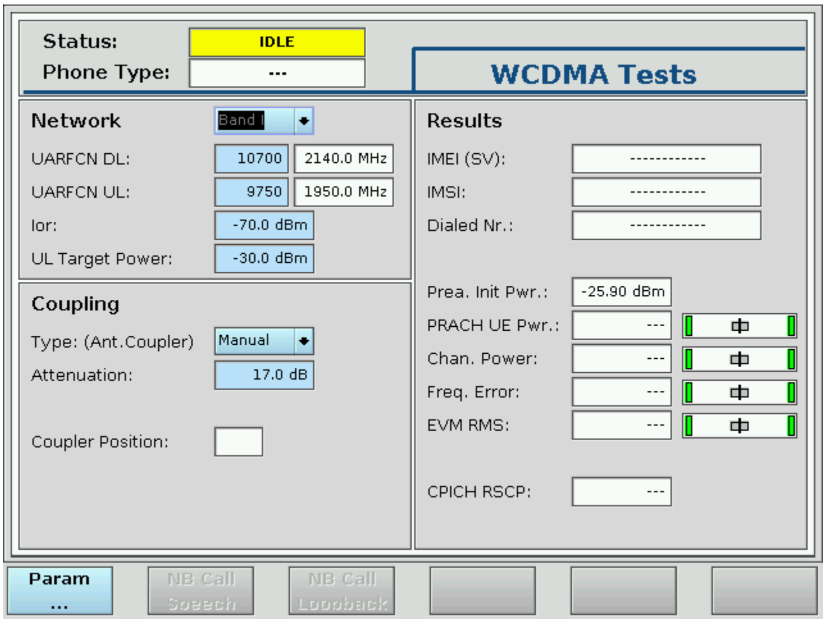
Performing receiver measurements

The receiver of the mobile phone includes different components to measure the received signal strength and to demodulate the signal. It also decodes the received bit stream and, based on the relative number of bit errors found in the decoding process, provides an estimate of the signal quality.

Setting up a connection for receiver measurements

1 Insert a Test SIM in the mobile phone and connect the phone to ProLock as depicted in section "Connecting the device under test" on page 14.

2 From the start menu,select **WCDMA**.
The WCDMA Tests menu appears.

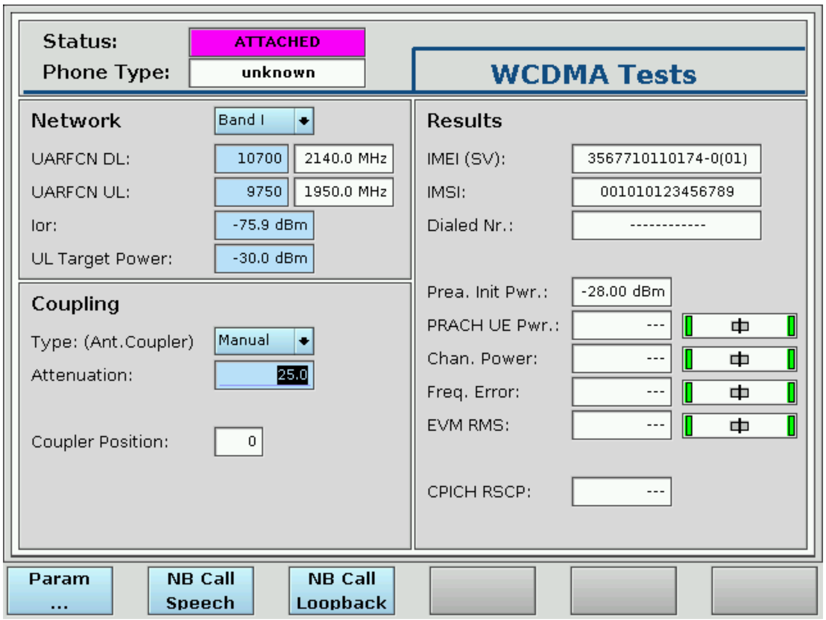


3 Select a frequency band and uplink or downlink carrier number of interest (see "WCDMA channel numbers and frequency bands" on page 105).

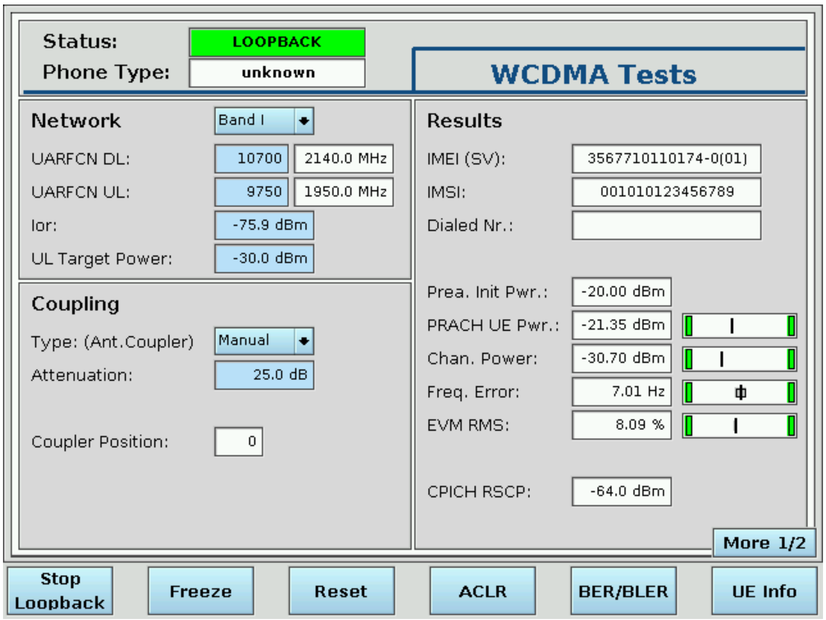
4 Select an Ior (RF output power) in the ProLock that is sufficiently high to allow the mobile phone to find the carrier, which is typically well above –100 dBm.

5 Ensure that the coupling is selected properly. Refer to "Setting up the coupling in ProLock" on page 75 for more information.

6 Switch on the mobile phone, and wait until it is registered on the simulated network (attached).



7 Push the **NB Call Loopback** softkey.
The phone is paged and automatically answers the call. The loopback mode is activated.



8 You can now go through the receiver measurements. Some of the measurement results are displayed in the WCDMA BER/BLER menu; push the **BER/BLER** softkey to access this menu.

9 Release the connection by pushing the **Stop Looopback** softkey. Both wireless device and ProLock assume the Idle state.

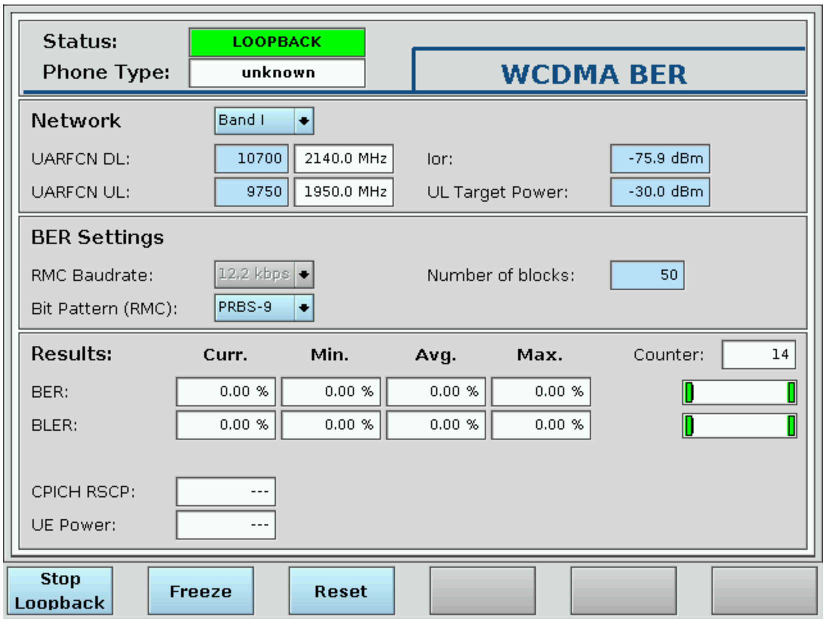
Affecting the measurements

You can change some important test parameters while a call is active.

- In order to test on a different frequency, change the **frequency band** and the **channel number** in the Network section of the test menu.
  The measurements will be halted, the frequency will be changed and the measurements will be restarted.
- In order to test the mobile phone's receiver quality at a different input power level, change the **Ior** value in the Network section of the test menu.
  The measurements will be halted, ProLock will change its output level and the measurements will be restarted.
- The bit rate on the RMC (**RMC Data Rate**) affects how well the data can be recovered. The parameter cannot be changed while the loopback is active; in order to change the bit rate, push **Stop Loopback**, change the parameter (e.g. in the WCDMA BER/BLER menu), and restart the NB Loopback.
- The **bit pattern** used for the BER or BLER measurement may or may not affect the measurement result. The pattern typically used for statistical measurements is a pseudo-random bit sequence (PRBS) with a length of $2^9 - 1$ (PRBS-9) or $2^{15} - 1$ (PRBS-15), but other patterns can be chosen instead, such as bit reversals.
- The **number of blocks** determines both the statistical quality of the measurement (estimate) and the duration of the measurement. The more blocks are taken into account for one measurement, the more accurate the result is. On the other hand, the higher the number of blocks is, the longer it takes to perform one measurement.

Understanding receiver measurement parameters

ProLock displays the following receiver-related measurement results on the WCDMA Tests menu and the WCDMA BER/BLER menu.



CPICH received signal code power

The CPICH RSCP field indicates the Common Pilot Channel Received Signal Code Power, which is the average power of the received signal after despreading and combining the signal. It is important how the wireless device received the CPICH transmitted by Node B. Based on this value the Preamble Initial Power is calculated. This value indicates the accuracy of the device's CPICH RSCP measurement.

BER

The BER measurement provides the ratio (as a percentage) between erroneous bits and the total number of bits sent within a data transmission. In order to determine the error ratio, ProLock sends a known data pattern (see Bit Pattern entry parameter above) to the UE (i.e. the user equipment or simply the mobile device) in loopback mode on a Reference Measurement Channel (RMC). The UE decodes the data and sends it back to the 2201 ProLock. The uplink data transmitted by the UE are then compared to the data originally sent.

For reference sensitivity measurements, the sensitivity level is the power received at the UE's antenna port at which the BER value does not exceed 0.1 %.

BLER

The BLER measurement provides the ratio (as a percentage) between faulty data blocks and the total number of blocks sent within a data transmission. In order to determine the error ratio, ProLock sends data to the UE in loopback mode on a reference measurement channel. Depending on the data rate, the tester determines passed or failed blocks either through the looped-back CRC or through the (positive or negative) acknowledgement from the wireless device.

Maintenance and Troubleshooting

5

This chapter describes how to identify and correct problems related to the 2201 ProLock. Topics discussed in this chapter are as follows:

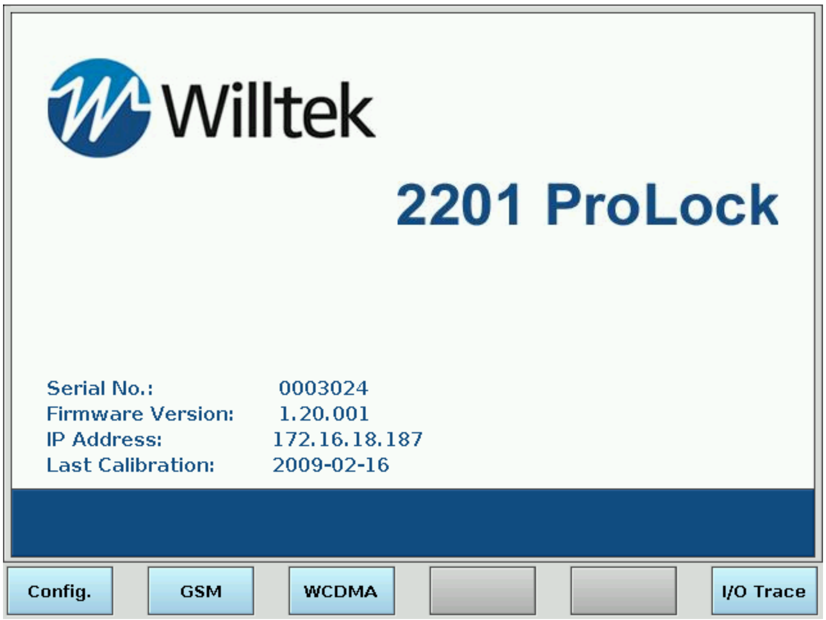
Calibration and adjustment

The 2201 ProLock is a measurement device. As with all such instruments, ProLock should be calibrated on a regular basis to ensure accuracy. Willtek recommends calibration of the 2201 at yearly intervals.

Obtaining the instrument status

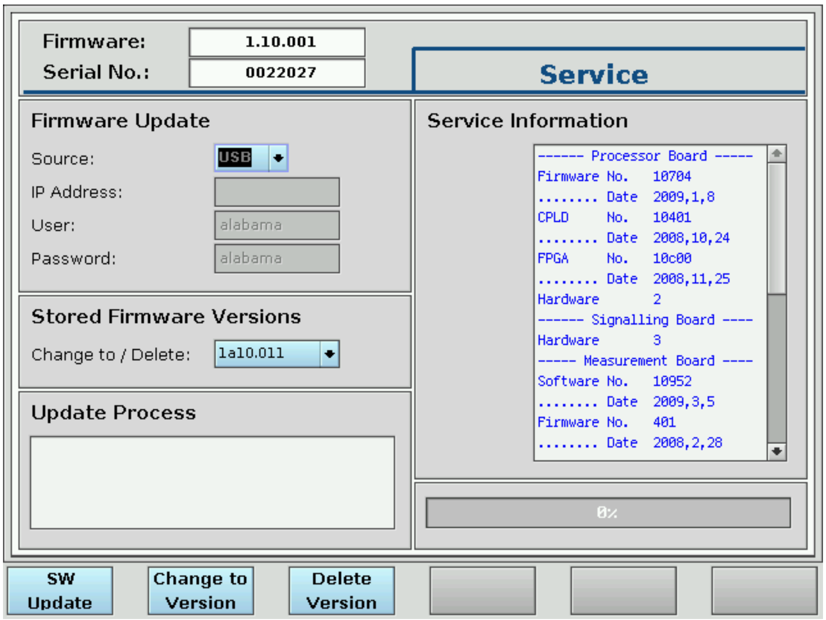
For service and support purposes, it may be useful to see the instrument status in terms of firmware and hardware.

1 The serial number, the firmware version and the date of the last calibration can be found on the start menu.



2 For an additional list of the hardware revisions, press **Config. > Service**. The hardware revisions are listed in the Service Information scroll box.

3 Move the cursor to the Service Information scroll box and use the **UP** and **DOWN** cursor keys to navigate through the list.



Changing the firmware version

Willtek seeks to permanently improve its products. Firmware updates are available on the Internet at www.willtek.com.

ProLock allows you to install a new firmware version from a USB flash drive or an FTP server, change between several versions stored on the hard disk, or delete a stored version.

Installing a new firmware

Firmware updates via USB flash drive

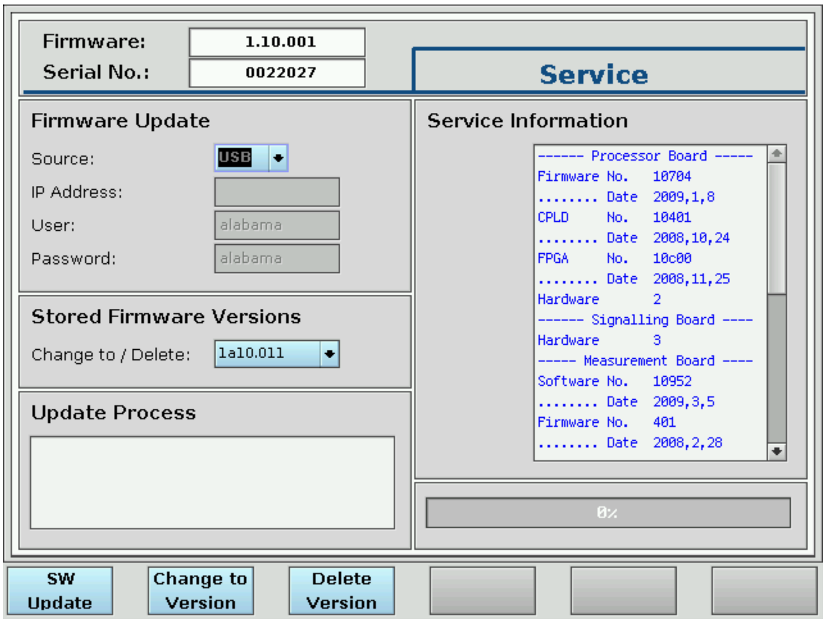
In order to replace Firmware version 1.20 by another (typically newer) one, proceed as follows for an update via USB flash drive:

1 Download the firmware from Willtek's website.

2 Copy the firmware into the root directory of a USB flash drive.

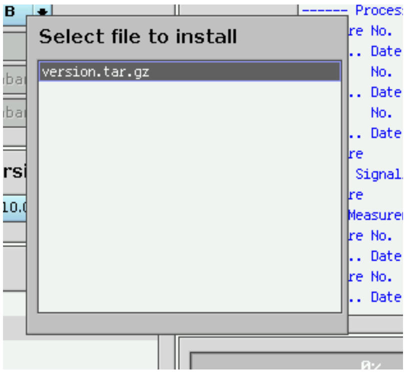
3 Connect the USB flash drive to a USB port of the 2201 ProLock.

4 From the start menu, select **Config. > Service**.
The Service menu appears.



5 In the **Source** selection field, select **USB**.

6 Select **SW Update**.
ProLock displays a pop-up box with firmware files found in the root folder of the USB flash drive.



7 Select the file of the firmware version you want to install, and push **Install**.
The file is copied from the USB flash drive to ProLock's internal hard disk, and the installation is started. At the end of the update, the softkey description will change to "Reboot".

8 Select **Reboot**.
The instrument is rebooted and the new firmware is ready to be used.

Firmware updates via FTP server

Instead of copying files from a USB flash drive, you can use an internal FTP server to update the firmware of your ProLocks.

> **Note**
>
> ProLock can only store five firmware versions. So if you want to install a new version, make sure that there are only four versions stored on ProLock's hard disk, including the version currently running. See "Loading a different firmware version" on page 98 and "Deleting an unused firmware" on page 98 for more details.

1 Ensure that the 2201 ProLock is connected via LAN to a computer running FTP server software. A username and password must be set up, and a folder must be defined as the root directory of that FTP server for the user.

2 Select **Config. > Service**.
The Service menu appears.

3 In the **Source** selection field, select **FTP**.

4 Select **SW Update**.
ProLock displays a pop-up box with firmware files (*.tar.gz) found in the virtual root directory and any subdirectory of the FTP server.

5 Select the file of the firmware version you want to install, and push **Install**.
The file is copied from the FTP server to ProLock's internal hard disk, and the installation is started. At the end of the update, the softkey description will change to "Reboot".

6 Select **Reboot**.
The instrument is rebooted and the new firmware is ready to be used.

Loading a different firmware version

The following steps can be taken to run a different firmware version that is already stored on ProLock's hard disk.

1 From the start menu, push **Config. > Service**.
The Service menu appears. In the Stored Firmware Versions section, the selection field indicates all the available firmware versions except for version currently running, which is displayed at the top of the menu.

2 Select the firmware version that you want to run from the Change to/ Delete selection field within the Stored Firmware Versions section.

3 Push the **Change to Version** softkey.
The selected version is prepared for loading. When finished the Reboot softkey appears.

4 Push **Reboot**.
The instrument is restarted with the alternative instrument firmware.

Deleting an unused firmware

If you do not want to keep an old, unused firmware version on ProLock's hard disk anymore:

1 From the start menu, push **Config. > Service**.
The Service menu appears. The firmware version currrently running is displayed at the top of the menu.

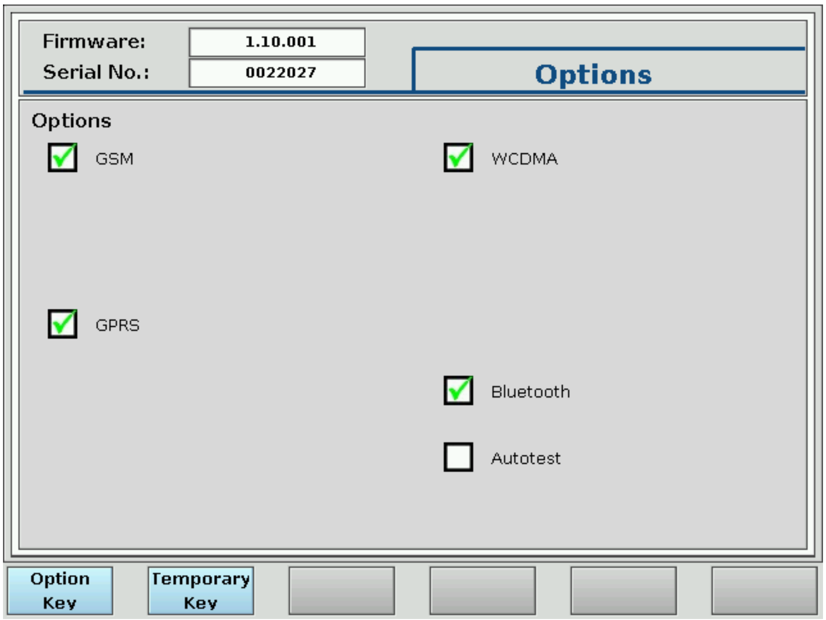
2 In the Change to/Delete selection field within the Stored Firmware Versions section, select the firmware version that you want to delete.

> Note
>
> You cannot delete a version that is currrently running. Change to another version first, then delete the version that was running previously.

3 Push the **Delete Version** softkey.
The selected version is removed from the hard disk.

Installing software options

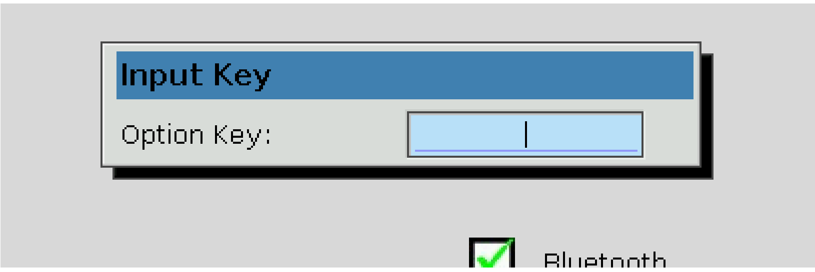
You can check which options are installed by pressing **Config. > Options** from the start menu.
The Options menu appears.



If you purchase a new software option as an upgrade, you will receive an option key. This key is a sequence of alphanumericals that allow you to install the option quickly on your workbench, without the need to ship it to a Willtek service center.

1 Ensure that ProLock is running the latest firmware. (The version number of the firmware installed can be checked on the start menu. The latest firmware is available from Willtek's website at www.willtek.com.)

2 To permanently install a new software option, push **Option Key**. Or push **Temporary Key** to install a temporary key, e.g. for evaluation purposes. A pop-up box prompts you to enter the code.



3 Enter the code in the Option Key input field and hit **RETURN**. ProLock checks if the option key is valid for this instrument (depending on its serial number), and enable the functionality for immediate use.

Troubleshooting

If you are unable to resolve problems related to the 2201 ProLock,please refer to "Technical assistance" on page x.

Tables

A

This appendix lists various parameter tables that the other chapters refer to, as follows:

Power control levels and tolerances

GSM 850 and GSM 900 systems

Power control level	Nominal output power (dBm)	Tolerance (dB)
0	43 (GSM phase 1 only)	±2
1	41 (GSM phase 1 only)	±2
0…2	39	±2
3	37	±3
4	35	±3
5	33	±3
6	31	±3
7	29	±3
8	27	±3
9	25	±3
10	23	±3
11	21	±3
12	19	±3
13	17	±3
14	15	±3
15	13	±3
16	11	±5
17	9	±5
18	7	±5
19…31	5	±5

GSM 1800 systems

Power control level	Nominal output power (dBm)	Tolerance (dB)
29	36	±2
30	34	±3
31	32	±3
0	30	±3

1	28	±3
2	26	±3
3	24	±3
4	22	±3
5	20	±3
6	18	±3
7	16	±3
8	14	±3
9	12	±4
10	10	±4
11	8	±4
12	6	±4
13	4	±4
14	2	±5
15…28	0	±5

GSM 1900 systems

Power control level	Nominal output power (dBm)	Tolerance (dB)
22…29	reserved	reserved
30	33	±2
31	32	±2
0	30	±3
1	28	±3
2	26	±3
3	24	±3
4	22	±3
5	20	±3
6	18	±3
7	16	±3
8	14	±3
9	12	±4
10	10	±4

11	8	±4
12	6	±4
13	4	±4
14	2	±5
15	0	±5
16…21	reserved	reserved

WCDMA channel numbers and frequency bands

"..." indicates that all integer numbers in between can be used, with the carrier frequencies spaced 0.2 MHz apart from each other.

Frequency band	Downlink channel numbers	Uplink channel numbers	Downlink carrier frequencies	Uplink carrier frequencies
Band I	10562	9612	2112.4 MHz	1922.4 MHz
	...	...	...	...
	10838	9888	2167.6 MHz	1977.6 MHz
Band II	412	12	1932.5	1582.5
	437	37	1937.5	1857.5
	462	62	1942.5	1862.5
	487	87	1947.5	1867.5
	512	112	1952.5	1872.5
	537	137	1957.5	1877.5
	562	162	1962.5	1882.5
	587	187	1967.5	1887.5
	612	212	1972.5	1892.5
	637	237	1977.5	1897.5
	662	262	1982.5	1902.5
	687	287	1987.5	1907.5
	9662	9262	1932.4	1852.4
	9663	9263	1932.6	1852.6
	...	...	...	...
	9938	9538	1987.6	1907.6
Band III	1162	937	1807.4	1712.4
	...	...	...	...
	1513	1288	1887.6	1782.6
Band IV	1537	1312	2112.4	1712.4
	1538	1313	2112.6	1712.6
	...	...	...	...
	1738	1513	2152.6	1752.6
	1887	1662	2112.5	1712.5
	1912	1687	2117.5	1717.5
	1937	1712	2122.5	1722.5
	1962	1737	2127.5	1727.5
	1987	1762	2132.5	1732.5
	2012	1787	2137.5	1737.5
	2037	1812	2142.5	1742.5
	2062	1837	2147.5	1747.5
	2087	1862	2152.5	1752.5

Frequency band	Downlink channel numbers	Uplink channel numbers	Downlink carrier frequencies	Uplink carrier frequencies
Band V	1007	782	871.5	826.5
	1012	787	872.5	827.5
	1032	807	876.5	831.5
	1037	812	877.5	832.5
	1062	837	882.5	837.5
	1087	862	887.5	842.5
	4357	4132	871.4	826.4
	...	...	...	...
	4458	4233	891.6	846.6
Band V/VI	1037	812	877.5	832.5
	1062	837	882.5	837.5
	4387	4162	877.4	832.4
	...	...	...	...
	4413	4188	882.6	837.6
Band VII	2237	2012	2622.4	2502.4
	...	...	...	...
	2563	2338	2687.6	2567.6
	2587	2362	2622.5	2502.5
	2612	2387	2627.5	2507.5
	2637	2412	2632.5	2512.5
	2662	2437	2637.5	2517.5
	2687	2462	2642.5	2522.5
	2712	2487	2647.5	2527.5
	2737	2512	2652.5	2532.5
	2762	2537	2657.5	2537.5
	2787	2562	2662.5	2542.5
	2812	2587	2667.5	2547.5
	2837	2612	2672.5	2552.5
	2862	2637	2677.5	2557.5
	2887	2662	2682.5	2562.5
	2912	2687	2687.5	2567.5
Band VIII	2937	2712	927.4	882.4
	...	...	...	...
	3088	2863	957.6	912.6
Band IX	9237	8762	1847.4	1752.4
	...	...	...	...
	9387	8912	1877.4	1782.4

Frequency band	Downlink channel numbers	Uplink channel numbers	Downlink carrier frequencies	Uplink carrier frequencies
Band X	3112	2887	2112.4	1712.4
	...	...	...	...
	3388	3163	2167.6	1767.6
	3412	3187	2112.5	1712.5
	3437	3212	2117.5	1717.5
	3462	3237	2122.5	1722.5
	3487	3262	2127.5	1727.5
	3512	3287	2132.5	1732.5
	3537	3312	2137.5	1737.5
	3562	3337	2142.5	1742.5
	3587	3362	2147.5	1747.5
	3612	3387	2152.5	1752.5
	3637	3412	2157.5	1757.5
	3662	3437	2162.5	1762.5
	3687	3462	2167.5	1767.5

Warranty and Repair

B

This chapter describes the customer services available through Willtek. Topics discussed in this chapter include the following:

Warranty information

Willtek warrants that all of its products conform to Willtek's published specifications and are free from defects in materials and workmanship for a period of one year from the date of delivery to the original buyer, when used under normal operating conditions and within the service conditions for which they were designed. This warranty is not transferable and does not apply to used or demonstration products.

In case of a warranty claim, Willtek's obligation shall be limited to repairing, or at its option, replacing without charge, any assembly or component (except batteries) which in Willtek's sole opinion proves to be defective within the scope of the warranty. In the event Willtek is not able to modify, repair or replace nonconforming defective parts or components to a condition as warranted within a reasonable time after receipt thereof, the buyer shall receive credit in the amount of the original invoiced price of the product.

It is the buyer's responsibility to notify Willtek in writing of the defect or nonconformity within the warranty period and to return the affected product to Willtek's factory, designated service provider, or authorized service center within thirty (30) days after discovery of such defect or nonconformity. The buyer shall prepay shipping charges and insurance for products returned to Willtek or its designated service provider for warranty service. Willtek or its designated service provider shall pay costs for return of products to the buyer.

Willtek's obligation and the customer's sole remedy under this hardware warranty is limited to the repair or replacement, at Willtek's option, of the defective product. Willtek shall have no obligation to remedy any such defect if it can be shown: (a) that the product was altered, repaired, or reworked by any party other than Willtek without Willtek's written consent; (b) that such defects were the result of customer's improper storage, mishandling, abuse, or misuse of the product; (c) that such defects were the result of customer's use of the product in conjunction with equipment electronically or mechanically incompatible or of an inferior quality; or (d) that the defect was the result of damage by fire, explosion, power failure, or any act of nature.

The warranty described above is the buyer's sole and exclusive remedy and no other warranty, whether written or oral, expressed or implied by statute or course of dealing shall apply. Willtek specifically disclaims the implied warranties of merchantability and fitness for a particular purpose. No statement, representation, agreement, or understanding, oral or written, made by an agent, distributor, or employee of Willtek, which is not contained in the foregoing warranty will be binding upon Willtek, unless made in writing and executed by an authorized representative of Willtek. Under no circumstances shall Willtek be liable for any direct, indirect, special, incidental, or consequential damages, expenses, or losses, including loss of profits, based on contract, tort, or any other legal theory.

Equipment return instructions

Please contact your local service center for Willtek products via telephone or web site for return or reference authorization to accompany your equipment. For each piece of equipment returned for repair, attach a tag that includes the following information:

- Owner's name, address, and telephone number.
- Serial number, product type, and model.
- Warranty status. (If you are unsure of the warranty status of your instrument, include a copy of the invoice or delivery note.)
- Detailed description of the problem or service requested.
- Name and telephone number of the person to contact regarding questions about the repair.
- Return authorization (RA) number or reference number.

If possible, return the equipment using the original shipping container and material. Additional Willtek shipping containers are available from Willtek on request. If the original container is not available, the unit should be carefully packed so that it will not be damaged in transit. Willtek is not liable for any damage that may occur during shipping. The customer should clearly mark the Willtek-issued RA or reference number on the outside of the package and ship it prepaid and insured to Willtek.

End-User License Agreement

C

This appendix describes the conditions for using the instrument software (firmware).

All copyrights in and to the software product are owned by Willtek Communications or its licensors. The software is protected by copyright laws and international copyright treaties, as well as other intellectual property laws and treaties.

This end-user license agreement grants you the right to use the software contained in this product subject to the following restrictions. You may not:

(i) use the software and/or any copy of the software in different computers concurrently, unless the software is an update that has been downloaded from the Internet at www.willtek.com;

(ii) copy the software, except for archive purposes consistent with your standard archive procedures;

(iii) transfer the software to a third party apart from the entire product;

(iv) modify, decompile, disassemble, reverse engineer or otherwise attempt to derive the source code of the software;

(v) export the software in contravention of applicable export laws and regulations of the country of purchase;

(vi) use the software other than in connection with operation of the product.

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Willtek Communications shall not be held liable for any damages suffered or incurred by you or any other third party (including, but not limited to, general, special, consequential or incidental damages including damages for loss of business profits, business interruption, loss of business information and the like), arising out of or in connection with the delivery, use or performance of the software.

Publication History

Revision	Comment
0904-110-A	First version.
0907-120-A	Revised edition for ProLock firmware version 1.20.

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Note: Specifications, terms and conditions are subject to change without prior notice.

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