Willtek

Getting Started Manual

4400 Mobile Phone Tester Series

For serial numbers 1111001 and higher

boosting wireless efficiency

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Ordering information This guide is a product of Willtek Communications, issued as part of the Willtek 4400 Mobile Phone Tester Series. The ordering number for a published guide is M 295 011. The ordering number for the product depends on the exact model as follows:

Table 1 ***4400 Series models and ordering numbers***

Model	Ordering number
4403 Mobile Phone Tester	M 101 105
4405 Mobile Phone Tester	M 101 104

EMC Directive Compliance This product was tested and conforms to the EMC Directive, 89/336/EEC as amended by 92/31/EEC and 93/68/EEC for electromagnetic compatibility. A copy of the Declaration of Conformity is provided with this manual.

Low Voltage Directive Compliance This product was tested and conforms to the Low Voltage Directive, 73/23/EEC as amended by 93/68/EEC. A copy of the Declaration of Conformity is provided with this manual.

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About This Guide

This section contains the following basic information:

– "Purpose and scope" on page vi
– "Assumptions" on page vi
– "Related information" on page vi
– "Technical assistance" on page vii
– "Conventions" on page viii

Purpose and scope

The purpose of this guide is to help you successfully use the 4400 features and capabilities. This guide includes task-based instructions that describe how to install, configure and use the 4400. Additionally, this guide provides a description of Willtek's warranty, services and repair information.

Assumptions

This guide is intended for novice users who want to use the 4400 effectively and efficiently. We are assuming that you have basic computer experience and are familiar with basic telecommunication concepts and terminology.

Related information

Use this guide in conjunction with the following information:

M 290 011: GSM and EDGE Options user's guide

M 293 016: GSM/GPRS and EDGE Options user's guide

M 294 249: WCDMA Options user's guide

M 292 010: CDMA2000 Options user's guide

M 294 287: 1xEV-DO Options user's guide

M 294 251: TD-SCDMA Options user's guide

M 292 018: Bluetooth Connectivity Test Products user's guide

M 294 001: 7201 Update Utility

Technical assistance

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

Table 1 ***Technical support contacts***

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 **`typeface`**.	Type: **`a:\set.exe`** in the dialog box.
Variables appear in this **<typeface>**.	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 4400. Topics discussed in this chapter include the following:

– "Safety class" on page xii
– "Taking into account before startup" on page xii
– "Operating the 4400" on page xii
– "During maintenance and repair" on page xiii
– "Shutdown when defective" on page xiii
– "Declaration of EU Conformity" on page xiv

Safety class

The 4400 is built and tested in line with DIN 57411 part 1 (protective measures for electronic test equipment). The instrument complies with safety class I; it left the factory in a perfectly safe condition for operation. To make sure it stays this way and can be operated without any risk, please note the following instructions, which are based on section 17 of DIN 57411 part 1 a.

Taking into account before startup

Before powering on, ensure that the operating voltage which is permitted for 4400 (90 to 140 V AC, 200 to 250 V AC) is the same as your power source. 4400 adjusts itself automatically to the applied (permissible) line voltage.

The power plug must only be inserted in an outlet with a ground contact. Do not endanger the unit by using an extension cable without a protective conductor.

Operating the 4400

Do not interrupt protective conductor!
Risk of electric shock

Any interruption of the protective conductor inside or outside the instrument may result in electric shock.

Do not attempt to service this product yourself!
Risk of electric shock

Opening or removing covers may expose you to dangerous, high voltage points and other hazards. Refer all servicing to qualified service personnel.

During maintenance and repair

Maintenance and repair is only allowed to specially trained service technicians. Opening a unit without permission causes loss of warranty.

Live parts can be exposed when you open covers or remove components. Connecting parts can also be live.

Capacitors in the power supply can still be charged, even though the instrument has been separated from all voltage sources.

Only use fuses with identical specifications to the replaced ones. You should never patch fuses or short the fuse holder.

Shutdown when defective

If you think that it is unsafe to continue operating the 4400, shut it down immediately and contact your nearest Willtek service center.

In the following cases, safe operation is very likely to be no longer possible:

- if the instrument exhibits visible damage
- if the instrument will no longer work
- if stored under the wrong conditions
- following transport under adverse conditions

Declaration of EU Conformity

Manufacturer	Willtek Communications GmbH Gutenbergstr. 2 – 4 85737 Ismaning, Germany
Product designation	4400 Series
	The designated products conform to the following European directives:
Low voltage directive	**73/23/EEC,** has been superseded by the directive 93/68/EEC
EMC directive	**89/336/EEC**
	The conformity of these products to the above directives is demonstrated by application of the following standards:
EMC	**EN 61326** (Class A)
Safety	**EN 61010, Part 1**
Ismaning, January 30, 2003	 J. Schwarzhuber, R&D Director
	This declaration is not a guarantee of features. Pay attention to the safety instructions in the product documentation.

4400 Overview

1

This chapter provides a general description of the 4400. Topics discussed in this chapter include the following:

– "About the 4400" on page 2
– "Features and capabilities" on page 2
– "Options" on page 2
– "Physical description" on page 3

About the 4400

The instruments from the Willtek 4400 series are high-precision RF communication testers for transmitter and receiver testing. The 4400's capabilities can be extended by options for audio testing, spectrum measurements and many more.

This manual refers to all variants (e.g. 4405) of the Willtek 4400 Mobile Phone Tester series. Throughout this manual, all members of the Willtek 4400 series are simply referenced as the 4400.

Features and capabilities

The 4400 is a modular mobile phone tester for digital radio communication systems. The respective system option determines the radio test features. Typical features include:

- Transmitter measurements of the RF power and modulation characteristics
- Receiver tests based upon bit error rate measurements
- Spectrum measurements
- Remote control via GPIB, USB or TCP/IP, based on SCPI commands
- Integrated programming environment RAPID!

Options

With additional hardware and software options you can extend your 4400's application range to provide audio signals and measurements or measure the current consumption of the mobile. Available options include, but are not restricted to, the following items:

- Options (also referred to as system options) for the cellular standards GSM, GPRS, EDGE, WCDMA (UMTS FDD), HSDPA, CDMA2000 including AMPS, 1xEV-DO, TD-SCDMA
- Bluetooth Connectivity Test Package
- Audio Generator/Analyzer, Codec Options
- MS Power Supply Option, Current Measurement Option
- ACPM (ORFS) Option for GSM, GSM/GPRS and EDGE

Additional accessories and software products support your tests and can increase your productivity, such as SIM cards, an RF coupler, a complete RF shielding solution and the Lector and Scriptor family of wireless testing products.

Also, there is a free software tool available, easing the software update and installation of new software options. Please search Willtek's website at www.willtek.com or the accompanying CD for the 7201 Update Utility.

Physical description

When unpacking the 4400, ensure that you do not miss any of the items listed in section "Standard delivery" on page 10.

The user-accessible parts of the 4400 can be broken down into several sections:

- Front panel with screen, softkeys, numerical, cursor and function keys; RF, audio, MS power and USB connectors
- Rear panel with connectors for mains power, synchronization, external monitor and control (USB, GPIB, TCP/IP, RS-232)

See the user's guide(s) for your system option(s) to learn how to use the 4400 in detail.

Installation

2

This chapter describes how to set up the 4400. The topics discussed in this chapter are as follows:

– "Scope of delivery" on page 6
– "Power connector" on page 6

Scope of delivery

When unpacking the 4400, ensure that you do not miss any of the following items:

- an instrument from the 4400 series (4403 or 4405)
- the manual pack including this getting started manual
- the calibration report
- a USB flash drive
- a power cable

Options

If you ordered the 4400 together with options, these options are already installed and ready for use when you switch on the instrument.

Cardboard box

Keep the cardboard box for shipping the 4400 back to Willtek e.g. for factory calibration or a model upgrade.

Power connector

Supply voltage

Before powering on, ensure that the operating voltage at your location is permitted for 4400 (90 to 140 V AV or 200 to 250 V AC).

The 4400 adjusts itself automatically to the applied (permissible) line voltage.

Connect the supplied power cable to the line socket of the power supply module (rear of 4400) and then to a power outlet with a ground contact.

Switch on the 4400. The power switch is located on the rear of the 4400, above the socket of the power cable. The 4400 is in standby mode now.

Operation

3

This chapter describes the functionality of the instrument. Topics discussed in this chapter are as follows:

– "Connecting the RF" on page 8
– "Connecting the audio parts" on page 9
– "Powering the unit" on page 10
– "Navigating the user interface" on page 11
– "Performing radio frequency (RF) measurements" on page 14

Connecting the RF

There are two ways of connecting a mobile to a tester:

– Cable connection
– Off-air connection

Both have their advantages and disadvantages.

Cable connection

With a cable connection, the RF socket of the tester is connected to the RF socket of the mobile (typically an antenna connector, e.g. for car-mount adapters). A shielded cable contributes to very accurate measurements.

However, if you need to test many different types of mobile phones, you will need many different cables or adapters, which increases test costs. Also, many new types of mobile phones do not have an RF socket anymore.

Off-air connection

With an off-air connection, the RF socket of the tester is connected to the mobile phone through an RF coupling device such as the Willtek 4916 Antenna Coupler. This makes testing easy and fast. The mobile transmits via the antenna. No further test adapters are needed.

The coupling loss depends on factors such as device orientation, distance and frequency. This can be compensated with a coupling loss table.

Connecting the audio parts

Requires Audio Option

Any audio tests with the Willtek 4400 require the 4470 Audio Option to be installed.

The audio connection is used for testing the mobile's audio quality. The signal follows the path shown below: the analog audio signal from the mobile phone is fed to the AF in connector of the 4400; the analog audio signal from the AF out connector of the 4400 can be fed to the microphone input of the mobile phone. For best performance you will want to use shielded coax cables.

One example of an audio signal path is a sine wave generated by the 4400 which is fed to the headset connector of the phone, passes through both the encoder and decoder of the mobile and leaves the earphone.

The speech quality can be evaluated by comparing the two signals, either by ear, or in a more quantitative approach by the audio analyzer.

Powering the unit

Ensure that the 4400 is switched on. The power switch is located on the rear of the 4400, above the socket of the power cable. When switched on, the 4400 is in stand-by mode; the light below the stand-by button on the front panel lights yellow.

Push the stand-by button to put the 4400 into operation mode. The stand-by light turns green.

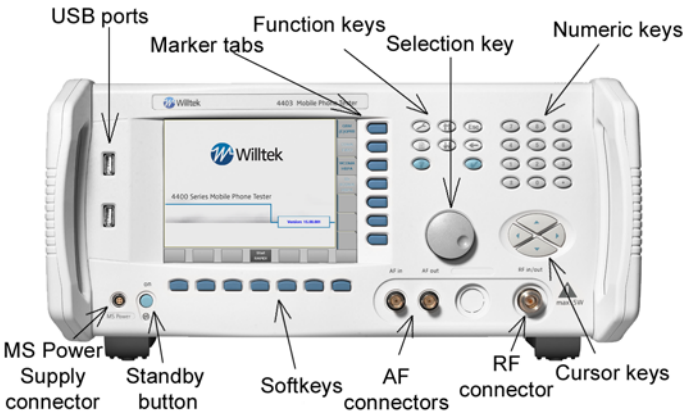
At the end of the startup sequence, the start or Welcome menu appears.

In the Welcome menu, you can immediately start testing GSM mobiles in call mode by pressing the **Calls & Meas.** softkey below the TFT display.

Other sytems can be selected using the marker tabs on the right side of the TFT display, provided the options are installed.

Navigating the user interface

This is a short description of the front panel of the 4400.



Standby button This button switches the 4400 from stand-by mode to operating mode. The light below the button lights yellow in stand-by mode and green in operating mode.

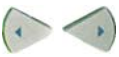
MS Power connector This connector can be used to feed the supply voltage to a mobile under test. It requires the MS Power Supply Option to be installed.

Numeric keys Used for entering numerical values into entry fields.

Function keys With these important keys you get general control of the 4400.

	Shows the 4400 tools menu. Here you can start any 4400 tool such as the spectrum analyzer, RAPID! etc.
	Selects the first entry field of the previous/next group.
	This key brings you one menu level up.
	Deletes the value left of the cursor in an entry field.
	Accepts a newly entered value in an entry field.
	Displays contact information for support issues.
	Prints the screen contents on paper or stores it in a bmp file on floppy disk, depending on the printer setting under **Tools > Config > I/O**.

Cursor keys

	To get from one entry field to the previous or next one.
	To change the value of a numeric field or the setting of a selection field (scroll variable).

Selection key

Turning the selection key changes values in entry fields.

Softkeys

The softkeys are the keys below the screen. Their individual functions depend on the state of the software and are described by the text at the lower end of the screen.

From the Welcome menu, use the softkeys to select one of the available test modes (e.g. Calls & Measurements) or to start a test.

Marker tabs Press a marker tab to select the communication system (e.g. GSM or GSM/GPRS) or to jump from one test menu to another. The function of the marker tab is shown on the TFT display next to the buttons. It will change on every new entered level.

RF socket (RF in/out) Connect your mobile to this N-type socket.

Performing radio frequency (RF) measurements

RF measurements can be divided into measurements on the transmitter and on the receiver.

Transmitter measurements

A transmitter test is carried out to evaluate the performance of the mobile's transmitter. These measurements can be divided into two main groups:

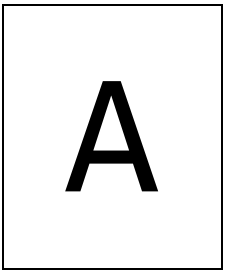
- **Power measurements:** Here the focus is on transmit power levels and level changes. In GSM, for example, the peak power measurement and the power/time template check are common examples.
- **Modulation quality checks:** In these measurements, the focus lies on the modulator. In GSM, phase and frequency error are measured.

Receiver measurements

Receiver measurements are also referred to as RX tests. In order to transfer speech and data correctly, the received bits must be detected properly. The common method in radio communication systems to test the receiver performance is the bit error rate measurement, often based on a signal loopback.

An additional method is to look at the mobile's internally generated evaluation of its received signal strength and quality. In many systems, the mobile reports these data to the network and hence can be displayed by the 4400 when it simulates a network to the mobile phone.

Warranty and Repair



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

– "Warranty information" on page 16
– "Equipment return instructions" on page 17

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 (US customers), or reference number (European customers).

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.

Publication History

Revision	Changes
9907-263-B	Initial revision.
0005-100-A	Power LED became yellow.
0101-100-B	Formal changes.
0112-110-A	MS Power Supply connector added. New Welcome screen.
0201-110-A	Blank page 18.
0208-120-A	New company name and layout.
0302-130-A	New declaration of EU conformity.
0603-090-A	New interfaces.
0710-100-A	New options, license agreement and warranty terms added.
0907-110-A	Modified instrument design (e.g. new front panel).

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