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Willtek

4910

Universal Antenna Coupler with RF Shield Box



user's guide

RF Shield III

上海垦泰科技有限公司

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Patents The Willtek 4910 Universal Antenna Coupler and the Willtek 4911 Universal Antenna Coupler PDA are applications of United States patent 6,229,490 held by Willtek Communications GmbH.

The Willtek RF Shield Box is an application of United States design patent 429,470 held by Willtek Communications GmbH.

Ordering information This guide is issued as part of the Universal Antenna Coupler with RF Shield Box. The ordering number for a published guide is M 290 083. The ordering number for the product depends on the exact model as shown in the table below.

Table 1 Ordering information

Description	Order number
Willtek RF Shield Box (TNC) Package for 4100, 4350, and 4300	M 248 399
Willtek RF Shield Box (N) Package for 4200 and 4400	M 248 343
Willtek RF Shield Box (N) Audio Package, incl. Antenna Coupler	M 248 419
Willtek 4910 Universal Antenna Coupler	M 248 330
Willtek 4911 Universal Antenna Coupler PDA	M 248 341
Willtek 4920 RF Shield Box (N) for 4200 and 4400	M 248 342
Willtek 4924 RF Shield Box (TNC) for 4100, 4350, and 4300	M 248 340
Willtek 4923 RF Shield Audio Option	M 248 420

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About This Guide

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Purpose and scope

The purpose of this guide is to help you successfully use the Universal Antenna Coupler with RF Shield Box features and capabilities. This guide includes task-based instructions that describe how to install, configure, use, and troubleshoot the Universal Antenna Coupler with RF Shield Box. Additionally, this guide provides repair information.

Assumptions

This guide is intended for novice users who want to use the Universal Antenna Coupler with RF Shield Box 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.

Technical assistance

If you need assistance or have questions related to the use of this product, call or e-mail one of Willtek's technical assistance centers.

Table 1 Technical assistance centers

Region	Phone number	Fax number, e-mail address
UK	+44 (0) 20 8408 5720	+44 (0) 20 8397 6286 support.uk@willtek.com
Europe, Middle East, Asia, Africa	+49 (0) 89 996 41 386 +49 (0) 89 996 41 227	+49 (0) 89 996 41 440 support.eu@willtek.com
Americas	+1 317 595 2021 +1 866 WILLTEK	+1 317 595 2023 support.us@willtek.com

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

Table 2 Typographical conventions (Continued)

Description	Example
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 key strokes.	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.

Overview

1

This chapter provides a general description of the Universal Antenna Coupler with RF Shield Box. Topics discussed in this chapter include the following:

- "About the Universal Antenna Coupler with RF Shield Box" on page 2
- "What's new in version 3.00" on page 2
- "Features and capabilities" on page 2
- "Options" on page 3

About the Universal Antenna Coupler with RF Shield Box

The Willtek 4910 Universal Antenna Coupler is a precise and flexible coupling device for testing mobile phones. All models can be tested quickly and with high accuracy, without any cable adapters. The Universal Antenna Coupler works with all the RF testers from Willtek (4100 Series, 4200 Series, 4300 Series, 4350 Series, 4400 Series, 4032).

With the 4100 Series of Willtek Mobile Fault Finders or the 4200 Series of Willtek Mobile Service Testers the attenuation values of the Universal Antenna Coupler for each mobile phone model need to be entered only once. The stored data can then be used whenever the test is repeated. The 4200 Series can store the attenuation values of up to 100 mobile phones, the 4100 Series those of up to 20 mobile phones. The 4350 Series of Willtek Mobile Fault Finders allows storing up to 20 mobile phone settings. The 4400 Series of Mobile Phone Testers is delivered with data already stored for the most common types of mobile phones.

Willtek also offers a shielded box, the Willtek 4920 RF Shield Box, which provides additional protection against interference from base stations and nearby test stations.

What's new in version 3.00

The RF Shield III has improved shielding, an improved mechanical design for better handling and supports the Willtek 4923 RF Shield Box Audio Option. This new option is also described in this manual.

Features and capabilities

- Universal usability
- Suitable for most standard tests of GSM 900/1800/1900, TDMA, CDMA, and AMPS mobile phones
- No cable adapters necessary
- Antenna coupling technique makes cable adapters unnecessary
- Attenuation values provided by Willtek
- Attenuation values for common mobile phone models stored in the testers and available for download
- Very good protection against base station interference due to the Willtek 4920 RF Shield Box

Options

The following cables are available for the Universal Antenna Coupler and the RF Shield Box:

Table 1 Available cables

Description	Order number
TNC-RF Click RF cable, 60 cm Cable to connect the Universal Antenna Coupler to 4100, 4300 and 4350 Series	M 860 408
TNC-RF Click RF cable, 150 cm ^a Cable to connect the Universal Antenna Coupler to 4100, 4300 and 4350 Series	M 860 409
N-RF Click RF cable, 150 cm ^b Cable to connect the Universal Antenna Coupler to 4200S and 4400 Series	M 860 407
TNC-TNC RF cable, 150 cm ^c Cable to connect the RF Shield Box to 4100, 4300 and 4350 Series	M 382 190
N-TNC RF cable, 150 cm ^d Cable to connect the RF Shield Box to 4200S and 4400 Series	M 382 189

- a. Standard accessory with the 4100 Series
- b. Standard accessory with the 4200 Series
- c. Standard accessory with the 4300 Series and the RF Shield Box (TNC)
- d. Standard accessory with the RF Shield Box (N)

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Operation

2

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

- "Using the Universal Antenna Coupler with the 4100/4200 Series" on page 6
- "Using the Universal Antenna Coupler with the 4300/4350 Series" on page 9
- "Using the Universal Antenna Coupler with the 4400 Series" on page 10
- "Using the Universal Antenna Coupler with the RF Shield Box and the RF Shield Audio Option" on page 12
- "Using the Universal Antenna Coupler with the STABLOCK 4032" on page 14
- "Evaluating the attenuation values" on page 15

Using the Universal Antenna Coupler with the 4100/4200 Series

Preparing a test

The Universal Antenna Coupler introduces attenuation (coupling loss) between the coupler and the tested mobile phone's antenna. Each mobile phone model has its own specific attenuation that has to be taken into consideration to get accurate testing results. The Willtek 4100/4200 Series of testers allow the attenuation values of different mobile phones to be entered and stored. Before testing a mobile phone with the 4100/4200 Series using the Willtek Universal Antenna Coupler, check whether the attenuation values of the mobile phone to be tested are stored in the tester:

1 Press the power switch to turn the tester on.

2 Press **AUTOTEST**.

The MS TYPE list of the mobile phone models already stored appears.

If the list includes the mobile phone model to be tested, select its name and proceed as follows:

3 Place the Universal Antenna Coupler into the RF Shield Box:

Attach the supplied cable from the Universal Antenna Coupler to the inside of the box and connect the RF cable. Connect the RF cable to the Universal Antenna Coupler (this cable is already attached to the RF shield box).



The maximum input RF power must not exceed 5 W.

4 Place the mobile phone into the Universal Antenna Coupler:

Release the jaws of the clamp by pressing the small button and insert the mobile phone in such a way that its bottom touches the restraint of the Universal Antenna Coupler. Press the jaws of the clamp together firmly to adjust and fix the mobile phone in the proper position. Willtek strongly recommends the use of the Willtek RF Shield Box to reduce base station interference.

Note

Make sure that the mobile phone's battery is fully charged.

5 Press **ENTER** or **START** to start the test.

Entering attenuation values

If the list does not include the mobile phone model to be tested, enter the attenuation values as follows:

- 1 Check the attenuation values for your mobile phone in the table on Willtek's web pages. A comprehensive list is available in the Products & Services section for the Universal Antenna Coupler at www.willtek.com. Examples from the attenuation table can be found on [page 8](#).
- 2 Press the **F3/F5** CONFIG key.
- 3 To enter data for a new mobile phone, press the **F2/F3** INSERT key.

- 4 Enter the name of the mobile phone in the **Assign Name** field of the tester and press **ENTER**.

The mobile phone name may consist of maximum 15 characters.

Note

The alphanumerical keys are multifunctional keys. By pressing e.g. the **1** key repeatedly, you can enter the letters A, B or C depending on how many times you press the key.

- 5 If there are handling instructions specific to certain mobile phones, they are listed in the **Note** field of the attenuation table. To enter special handling instructions:
Move the cursor to the **User advice** field by the direction keys, enter the text (two lines, maximum 15 characters each) from the Attenuation Table and press the **F3/F5 NEXT** key.
- 6 Select the cellular mobile radio system:
Move the cursor to the **Assign system** field, select the relevant cellular mobile radio system and press **ENTER**.
- 7 Select the coupling type:
Move the cursor to the **Assign connection** field, select **COUPLER** and press **ENTER**. After the selection has been completed, press the **F3/F5 NEXT** key.
- 8 Select the AUTOTEST sequence:
Move the cursor to the **Assign AUTOTEST** field showing the AUTOTEST sequences available. Select the AUTOTEST sequence to be used, press **ENTER** and press the **F3 NEXT** key for the next menu.
- 9 Enter the RX and TX values according to the attenuation table:
Move the cursor to the **Assign pre attenuation** field. Enter RX and TX values for each preset channel. Finish every entry by pressing **ENTER** and move the cursor to the next value.
- 10 Note: With the 4100 Series use the **F3 DP** key to enter the decimal point. The 4200 Series has a special button for the decimal point.
- 11 Store the values entered by pressing the **F3/F5 OK** key.

To continue entering data for another mobile phone model, press the **F3/F5 CONFIG** key and repeat steps 3 to 11.

For testing the mobile phone, select its name and follow the relevant instructions in the previous section.

If the Attenuation Table does not include the mobile phone to be tested, evaluate the attenuation values experimentally as described on [page 15](#).

The table below is an excerpt from the attenuation table available from the Internet.

The latest version of the table is available for download from the Internet at <http://www.willtek.com>.

Table 2 Attenuation table (excerpt)

Name	Band	Channel	RX	TX
Nokia 9110i	900 MHz			
		63	14.0	15.7
		3	13.0	15.4
		45	14.0	15.7
		123	12.0	14.5
Siemens C35i	900 MHz			
		63	9.0	6.2
		3	6.0	5.9
		45	9.0	6.2
		123	8.0	7.1
	1800 MHz			
		598	15.0	11.7
		514	16.0	11.8
		528	15.0	11.7
		884	16.0	13.5
Sony CMD-C1	900 MHz			
		63	8.0	7.6
		3	10.0	6.6
		45	8.0	7.6
		123	8.0	9.1

Using the Universal Antenna Coupler with the 4300/4350 Series

The 4350 Series is delivered with default network settings and mobile phone connection parameters that allow the testing of many different mobile phone models. To get the most out of the 4300 Series, it is sometimes more convenient to use custom settings, though. Some examples for customizable settings are network type, network control channel, and model names for different mobile phones.

Custom settings for the 4350 Series can be obtained from Willtek. To do this, go to <http://www.willtek.com>.

On the right-hand side, under "Related information", click on "Customized Settings" and follow the instructions.

To test a mobile phone with the 4350 Series using the Universal Antenna Coupler, follow this procedure (for more details refer to the 4350 Series' manual):

- 1 Place the Universal Antenna Coupler into the RF Shield Box:
Attach the supplied cable from the Universal Antenna Coupler to the inside of the box and connect the RF cable. Connect the RF cable to the Universal Antenna Coupler (this cable is already attached to the RF shield box).
- 2 Attach an RF cable from the RF shield box to the front panel mobile connector.
- 3 Press the power switch to start the tester.
- 4 Place the mobile phone into the Universal Antenna Coupler:
Release the jaws of the clamp by pressing the small button and insert the mobile phone so that its bottom touches the restraint of the Universal Antenna Coupler. Adjust the clamp to secure the mobile phone in the proper position. Willtek strongly recommends the use of the Willtek RF Shield Box to reduce base station interference.
Note: Make sure that the mobile phone's battery is fully charged.
- 5 Select the network: Press the **Sel New Network** button and move the cursor to choose the network. Press the **Done** button.
- 6 Select the mobile phone: Press the **Sel New Phone** button and move the cursor to the mobile phone you want to test. Afterwards press the **Done** button.
- 7 Start the test: Select a specific test, e.g. the **Guided Test** and press the **Start** button. Switch the mobile phone on and follow the instructions on the tester's screen.

Using the Universal Antenna Coupler with the 4400 Series

The Universal Antenna Coupler introduces attenuation (coupling loss) between the coupler and the tested mobile phone's antenna. Each mobile phone model has its own specific attenuation that has to be taken into consideration to get accurate testing results. Willtek delivers the 4400 Series of testers complete with stored attenuation values for common mobile phone models.

To test a mobile phone already stored in the tester using the Willtek Universal Antenna Coupler, proceed as follows:

- 1 Press the power switch to turn the tester on.
The start-up screen appears.
- 2 Place the Universal Antenna Coupler into the Willtek RF shield box: Attach the supplied cable from the Universal Antenna Coupler to the inside of the box and connect the RF cable. Connect the RF cable to the Universal Antenna Coupler (this cable is already attached to the RF Shield Box).

The maximum input RF power must not exceed 5 W.

- 3 Place the mobile phone into the Universal Antenna Coupler:
Release the jaws of the clamp by pressing the small button and insert the mobile phone so that its bottom touches the restraint of the Universal Antenna Coupler. Adjust the clamp to secure the mobile phone in the proper position. Willtek strongly recommends the use of the RF Shield Box to reduce base station interference.

Note

Make sure that the mobile phone's battery is fully charged.

- 4 Select the system, e.g. **GSM** or **GSM/GPRS**.
- 5 Press **Calls & Meas.**
The basic mask appears.
- 6 Press the **Param ...** softkey.
A screen appears displaying the basic system parameters.
- 7 Press the **Coupling Loss** marker tab.
A screen appears displaying the coupling loss setting.
- 8 Select the file corresponding to the mobile phone type under test from the **File name** scroll list.
The screen displays two frequency diagrams showing the coupling loss within the 800 to 1000 MHz and 1700 to 2000 MHz bands. Observe possible special handling instructions in the **Comment Line**.
- 9 Press the **ON** softkey to set the coupling loss.
- 10 Press the **ESC** softkey to return to the basic mask screen.
The headline indicates that the coupling loss is properly set.
- 11 Start the test by pressing e.g. the **BS Call** or the **MS Call** softkey.
For information on the tester's operation, see the 4400 User's Guide.

If the attenuation values for the mobile phone to be tested are not available

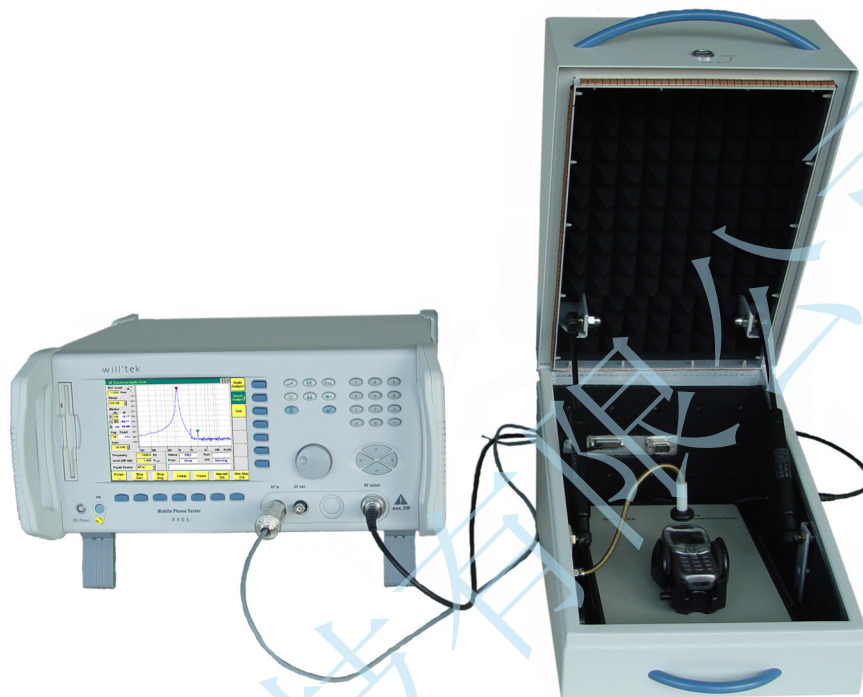
via Internet, evaluate them experimentally as described in ["Evaluating the attenuation values" on page 15](#). Subsequently, enter the measured values by editing a *.cpl file stored in the tester as follows:

Note

You can also enter coupling loss values manually after pushing the **Manual Entry** softkey on the Coupling Loss display (4400 software version 3.0 and higher). This replaces steps 12 through 21.

- 12 Press the power switch to turn the tester on.
The start-up screen appears.
- 13 Start RAPID! by pressing the **TOOLS** key.
The File Manager appears.
- 14 Using the File Manager, navigate to directory /rapid/cpl.
- 15 Select the file to be edited.
- 16 Press the **Open** softkey to edit a file.
- 17 Press the **Edit** marker tab to edit the file.
The *.cpl files are stored in the following format:
//comment
frequency in MHz, coupling loss in dB
The comment in the first line is optional, frequency and coupling loss values are real numbers, there must be minimum one pair of values and maximum ten pairs of values within each of the 800 to 1000 MHz and 1700 to 2000 MHz bands.
Example:
//Motorola P7389
825.0, 15.0
1750.0, 19.0
- 18 Press the **Save** softkey to save the file.
- 19 Press the **File** marker tab to return to the File Manager.
- 20 Press the **Close** softkey.
- 21 Press the **Exit** marker tab.
The start-up screen appears.

Using the Universal Antenna Coupler with the RF Shield Box and the RF Shield Audio Option



The RF Shield Box Audio Option allows you to perform audio measurements in parallel with radio tests. These measurements lead to consistent Go/NoGo verdicts for the audio parts, based on objective facts rather than personal opinion.

In addition to the steps in ["Using the Universal Antenna Coupler with the 4400 Series" on page 10](#), take the following measures before starting a test:

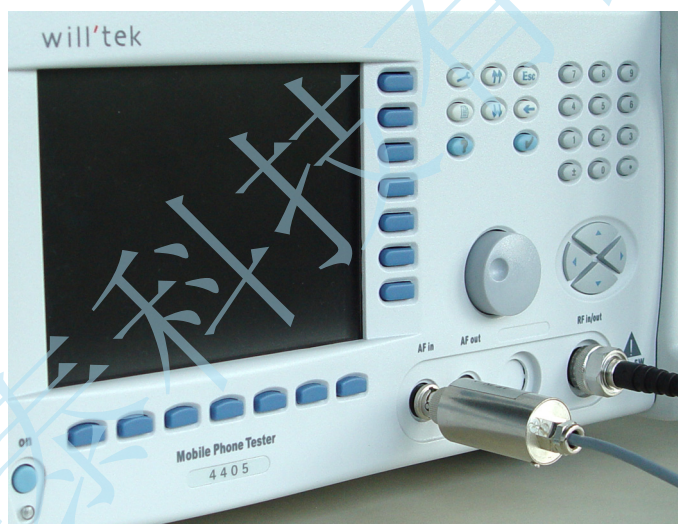
- 1 Plug the audio connector with two cables into the "Audio" socket at the rear of the RF Shield Box.



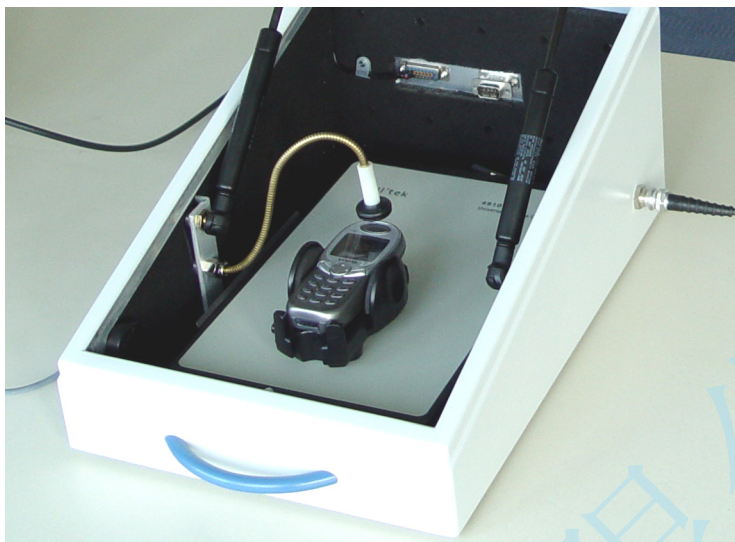
- 2 One of the two cable ends with two connectors labeled "AUX3" and "AUX4"; plug them into the respective sockets on the rear of the 4400.



- 3 Plug the connector at the end of the other cable (with the metal cylinder) into the "AF in" BNC socket on the 4400 front panel.



- 4 When the mobile phone is secured on the Universal Antenna Coupler, place the microphone at its swinging arm over the speaker of the mobile phone, about 1 cm from the phone.

**Note**

For information on audio measurements with the 4400, please consult the user's guide for the respective system option of your 4400.

Note

With the RF Shield Box Audio Option, you can also automate dialing or going off-hook by using a data connection to the mobile phone. Connect the mobile's data interface to the 9-pin D-sub socket inside the RF Shield Box, and the Data socket at the rear of the box to the 4400 or a PC controlling the mobile phone.

Using the Universal Antenna Coupler with the STABILOCK 4032

To test a mobile phone with the Willtek STABILOCK 4032 tester using the Willtek Universal Antenna Coupler, proceed as follows:

- 1 Press the power switch to turn the tester on.
The start-up screen appears.

Note

For GSM cellular mobile radio system measurements the corresponding hardware and software must be installed. For information on how to install them see the Willtek STABILOCK 4032 Operating Manual.

- 2 Place the Universal Antenna Coupler into the Willtek RF shield box: Attach the supplied cable from the Universal Antenna Coupler to the inside of the box and connect the RF cable. Connect the RF cable to the Universal Antenna Coupler (this cable is already attached to the RF shield box).
- 3 Place the mobile phone into the Universal Antenna Coupler:
Release the jaws of the clamp by pressing the small button and insert the mobile phone in such a way that its bottom touches the restraint of the Universal Antenna Coupler. Press the jaws of the clamp together firmly to

adjust and fix the mobile phone in the proper position. Willtek strongly recommends the use of the RF Shield Box to reduce base station interference.

Note

Make sure that the mobile phone's battery is fully charged.

- 4 Press the **AUX** button and subsequently the **DATA** softkey. The basic GSM mask appears.
- 5 Press the **DEF-PAR** softkey and select the GSM 900, GSM 1800 or GSM 1900 cellular mobile radio system using the **UNIT/SCROLL** button.

Note

Dual-band measurements are only possible when the GSM 1800/1900 system is selected.

- 6 Press the **RETURN** softkey to return to the basic GSM mask.
- 7 Press the **RETURN** softkey and subsequently the **DEF.PAR.** softkey. A screen appears displaying general parameters.
- 8 Set the attenuation value and press **ENTER**.
For the attenuation values of common mobile phone models, download the Attenuation Table from the Internet: <http://www.willtek.com>. If the table does not include the attenuation values for the mobile phone to be tested, evaluate them experimentally as described in the section below.
- 9 Press the **RETURN** softkey and subsequently the **DATA** softkey to return to the basic GSM mask.
- 10 Start the test by pressing e.g. the **BS Call** or the **MS Call** softkey.

For information on the tester's operation, see the STABILOCK 4032 Operating Manual.

Evaluating the attenuation values

Willtek provides the attenuation values necessary for testing mobile phones using the Universal Antenna Coupler via Internet for updating and completing the data stored in the testers. The attenuation values for mobile phone models not found there can be evaluated experimentally using any of Willtek's testers. For the tester specific information see the respective User's Manual. To measure the attenuation values, proceed as follows:

- 1 Connect the mobile phone under test to the tester's RF in/out socket using a cable with known attenuation.
Willtek recommends using the TNC-RF Click cable (Willtek accessory order no. M 860 409) for the 4100/4300 Series and the N-RF Click cable (Willtek accessory order no. M 860 407) for the 4200/4400 Series and the STABILOCK 4032.
- 2 Set the pre-attenuation value on the tester to 0 dB.
- 3 Choose a traffic channel and MS power level.

Note

For reliable results, set an intermediate power level. The recommended power level is 9 in both 900 MHz and 1800/1900 MHz bands.

- 4 Set up a connection between the mobile phone and the tester.
- 5 Note the peak power measured by the tester.
- 6 Stop the connection and connect the Universal Antenna Coupler to the tester using the same RF cable.
- 7 Place the mobile phone into the Universal Antenna Coupler:
Release the jaws of the clamp by pressing the small button and insert the mobile phone in such a way that its bottom touches the restraint of the Universal Antenna Coupler. Press the jaws of the clamp together firmly to adjust and fix the mobile phone in the proper position. Willtek strongly recommends the use of the Willtek RF Shield Box to reduce base station interference.

Note

Make sure that the mobile phone's battery is fully charged.

- 8 Set up a connection with the tester using the same traffic channel and MS power level.
- 9 Note the peak power measured by the tester.
- 10 Calculate the total transmission loss due to the Universal Antenna Coupler and the cable as follows:
 $\text{loss due to coupler} = \text{peak power measured with cable} - \text{peak power with coupler}$
 $\text{total loss} = \text{transmission loss due to coupler} + \text{cable attenuation}$

Note

Since the measurements are relative measurements made with the same phone on the same level, the TX level error of the mobile phone is eliminated. The attenuation of the recommended cables (Willtek accessories order no. M 860 407 and M 860 409) is 1 to 1.5 dB in the 900 MHz band and 2 dB in the 1800/1900 MHz band.

- 11 Enter the calculated total transmission loss as the pre-attenuation value in the tester.

Note

The calculated pre-attenuation value applies only to the particular traffic channel.

- 12 Repeat the above steps for other traffic channels.

Warranty and Repair



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

- "Warranty information" on page 18
- "Equipment return instructions" on page 19

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.

上海垦泰科技有限公司

Publication History

Revision	Comment
0010-100-A	First edition
0111-100-A	WWG changed to Acterna, more specific instructions for the use with different testers
0207-100-A	Changed to Willtek
0306-300-A	RF Shield Audio Option added

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