

4916 Antenna Coupler



User's guide
Version 1.10

boosting wireless efficiency

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Patents The Willtek 4916 Antenna Coupler is an application of a pending United States patent.

Ordering information This guide is issued as part of the **4916 Antenna Coupler**. The ordering number for a published guide is M 292 015. The ordering number for the coupler is as follows:

Table 1 Ordering numbers for the 4916 Antenna Coupler

Description	Ordering number
Willtek 4916 Antenna Coupler Coupler with plate and standard shuttle; does not include RF cable.	M 248 641
Willtek 4916 Antenna Coupler Coupler with plate and standard shuttle, RF cable QMA to TNC (1.5 m), Adapter TNC to N	M 248 642

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Safety Notes

This chapter provides the safety notes for the 4916 Antenna Coupler. Topics discussed in this chapter include the following:

- “Safety advice” on page vi

Safety advice



Be careful with the RF connector

Do not apply physical stress to the RF connector; the connector may otherwise break.

About This Guide

- "Purpose and scope" on page viii
- "Assumptions" on page viii
- "Technical assistance" on page viii
- "Conventions" on page ix

Purpose and scope

The purpose of this guide is to help you successfully use the 4916 Antenna Coupler features and capabilities. This guide includes task-based instructions that describe how to install, use, and troubleshoot the 4916 Antenna Coupler.

Assumptions

This guide is intended for novice users who want to use the 4916 Antenna Coupler 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

If you are using the Willtek 4916 Antenna Coupler with a Willtek instrument, please also refer to the user's guide for that instrument.

Technical assistance

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

Table 1 Technical assistance centers

Region	Phone number	Fax number
Europe, Middle East, Asia, Africa	+49 (0) 89 996 41 386	+49 (0) 89 996 41 440
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 <code>typeface</code> .	All results okay
Text you must type exactly as shown appears in this typeface .	Type: <code>a : \set.exe</code> in the dialog box.
Variables appear in this <code><typeface></code> .	Type the new <code><hostname></code> .
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.

Overview

1

This chapter provides a general description of the 4916 Antenna Coupler. Topics discussed in this chapter include the following:

- ["About the 4916 Antenna Coupler" on page 2](#)
- ["Features and capabilities" on page 2](#)
- ["Options" on page 3](#)

About the 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. The Antenna Coupler works with all the RF testers from Willtek (3100 Mobile Fault Finder, 4100 Series, 4200 Series, 4300 Series, 4350 Series, 4400 Series, 4032).

Willtek also offers a shielded box, the Willtek 4921 RF Shield, which provides additional protection against interference from base stations and nearby test stations.

Features and capabilities

- 3G-ready solution for all mobile phone types
- Wide frequency range from 700 MHz to 2.7 GHz
- Precise results with excellent RF match (VSWR < 2.0)
- Unique moving shuttle ensures best coupling position (sweet spot)
- Mobiles in best sweet spot have good coupling values, flat frequency response and high repeatability in measured results
- High repeatability using five snap-in (preset) positions as they are accurately repositioned in the sweet spot
- Replaceable shuttle for standard, large and unique sized phones (e.g. PDA phones, modules)
- Works on all polarization radiated from flat built-in antennas (vertical, diagonal, horizontal)

Willtek's new 4916 Antenna Coupler moves mobile phone testing into a new dimension by introducing three new objectives:

- Testing mobile phones with a good RF connection independent of size and antenna location
- A wide frequency range covering current and upcoming 3G and 4G frequency bands
- An RF match, as yet unachieved in the market, for measuring accuracy and high certainty

The 4916 Antenna Coupler achieves all three objectives without compromising on state-of-the-art performance. It ensures an enhanced level in mobile phone testing to service shops, repair centers, manufactures and R&D labs.

The diversity in mobile phone design is ever increasing. The age of the simple rectangular phone with a top-located antenna has passed. Today's phones are made in all kinds of shapes and sizes with varying antenna positions.

A testing device such as the 4916 Antenna Coupler reflects this. Its flexible shuttle allows every phone antenna to be moved above the "sweet spot" (center point of reception) to provide precise and repeatable measurements. The shuttle snaps in five locations, ensuring sustained accuracy of measured results.

The standard shuttle carries a universal mobile phone cradle suitable for most standard phones. Phones can be placed on or removed from the 4916 Antenna Coupler using only one hand.

To test large phones like PDAs, this standard shuttle can be replaced by a shuttle with a PDA cradle.

Move the shuttle down while pressing the unlock latch, remove the shuttle from the 4916's coupling plate, place the PDA shuttle on the plate and move it up. That's it! 4916's PDA shuttle carries a universal cradle for all types of wide phones and wireless PDAs. For special phones, Willtek provides shuttles with specific phone frames on request.

Options

The following options and accessories are available for the Antenna Coupler:

Table 1 Available cables

Description	Ordering number
Standard shuttle for 4916	M 248 691
PDA shuttle for 4916	M 248 692
RF connecting cable (1.5 m), QMA to TNC Cable to connect the 4916 Antenna Coupler to Willtek 4100, 4300 and 4350 Series	M 382 843
RF connecting cable (1.5 m), QMA to N Cable to connect the 4916 Antenna Coupler to the Willtek 3100 or the 4200 and 4400 Series	M 382 844

Operation

2

This chapter describes the functionality of the 4916 Antenna Coupler. Topics discussed in this chapter are as follows:

- "Connecting the 4916 Antenna Coupler" on page 6
- "Installing and uninstalling the shuttle" on page 6
- "Adapting the shuttle position to specific mobile phones" on page 7
- "Compensating the coupling loss" on page 7
- "Using the 4916 Antenna Coupler with the 4100 and 4200 Series" on page 7
- "Using the 4916 Antenna Coupler with the 4300 and 4350 Series" on page 9
- "Using the 4916 Antenna Coupler with the 4400 Series" on page 10
- "Using the 4916 Antenna Coupler with the 3100 Mobile Fault Finder" on page 12
- "Using the 4916 Antenna Coupler with the STABLOCK 4032" on page 12
- "Evaluating the attenuation values" on page 13

Connecting the 4916 Antenna Coupler

The 4916 Antenna Coupler is equipped with a Quick SMA (QMA) connector (female) at the upper end. In conjunction with a double-shielded RF cable, this connector provides RF connections at low attenuation up to 2.5 GHz.



Be careful with the RF connector

Do not apply physical stress to the RF connector; the connector may otherwise break.

If the coupler is to be connected directly to the instrument, you will need an appropriate cable from the list shown in [Table 1 on page 3](#).

If the coupler is ordered with the Willtek 4921 RF Shield, the coupler should be mounted and connected in the RF Shield before being used. The RF Shield in turn needs to be connected to the instrument.

- 1 Plug the QMA connector of the RF cable inside the 4921 RF Shield into the QMA plug at the rear of the 4916 Antenna Coupler.
- 2 Use an appropriate RF cable (see [Table 1 on page 3](#)) and tightly connect the N connector of the 4921 RF Shield with the RF connector at the instrument. The tests can now begin. Please bear in mind that the RF coupling attenuates the power transmitted between the instrument and the unit under test; see section "[Compensating the coupling loss](#)" on [page 7](#) to learn how this attenuation can be taken into account.

Installing and uninstalling the shuttle

The phone cradle is mounted on a shuttle that can be easily replaced, for example by a shuttle with a PDA cradle or a shuttle with a phone-specific frame.

To uninstall the phone shuttle:

- 1 Draw the shuttle down to the lowest position, below the position marked 1.
- 2 Lift the shuttle from the coupler.

To install a new phone shuttle:

- 1 Place the shuttle on the lower end of the coupler.
- 2 Press the shuttle towards the upper end so that it reaches position 1 or higher.
The shuttle is in a fixed position and cannot be lifted from the coupler.

Adapting the shuttle position to specific mobile phones

Prior to testing, the mobile phone should be placed so that the end of the antenna is over the "sweet spot", that means over the center of the circles drawn on the coupler plate. For optimum repeatability of measurements, use one of the five positions (marked 1 thru 5) in which the shuttle locks.

Compensating the coupling loss

For precise power and sensitivity measurements, the antenna coupling factor should be taken into account when setting an RF power level at the instrument and when interpreting power measurement results. A table of coupling loss factors (attenuation values) for many GSM and CDMA mobile phone types is available from Willtek on request; please search www.willtek.com for "coupling loss".

Working with any instrument

In this table, attenuation values in the direction from the instrument to the unit under test (the mobile phone) are indicated in the RX column. The attenuation in the direction from the unit under test to the instrument can be found in the TX column. All these values are measured in dB.

To achieve a certain power level at the mobile under test, just add the RX attenuation value to the desired power level and enter the result in the RF output power level field of the instrument.

The real transmit power level of the phone under test can be calculated by subtracting the TX attenuation value from the power measured by the instrument.

Working with a Willtek instrument

The instruments from Willtek's terminal test product line can be set up to automatically compensate for the antenna coupling loss by entering the coupling factor or even by selecting the mobile phone type. Please see the sections below for more details on how to use the 4916 Antenna Coupler with individual types of Willtek testers.

Using the 4916 Antenna Coupler with the 4100 and 4200 Series

Preparing a test

The 4916 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 and 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 and 4200 Series using the Willtek 4916 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 mobile phone on the 4916 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 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 4921 RF Shield to reduce base station interference.

Note

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

- 4 Set the correct shuttle position (see section ["Adapting the shuttle position to specific mobile phones"](#) on page 7).
- 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 that is available from Willtek.
- 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 on letters and numerals

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.

Note on decimal points

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.

- 10 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 10.

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 13](#).

Using the 4916 Antenna Coupler with the 4300 and 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> and search for "coupling loss".

To test a mobile phone with the 4350 Series using the 4916 Antenna Coupler, follow this procedure (for more details refer to the 4350 Series user's guide):

- 1 Press the power switch to start the tester.
- 2 Place the mobile phone on the 4916 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 coupler. Adjust the clamp to secure the mobile phone in the proper position. Willtek strongly recommends the use of the Willtek 4921 RF Shield to reduce base station interference.

Note

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

- 3 Select the network: Press the **Sel New Network** button and move the cursor to choose the network. Press the **Done** button.
- 4 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.
- 5 Set the correct shuttle position (see section ["Adapting the shuttle position to specific mobile phones"](#) on page 7).
- 6 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 4916 Antenna Coupler with the 4400 Series

The 4916 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.

Using a stored coupling loss profile

To test a mobile phone already stored in the tester using the 4916 Antenna Coupler, proceed as follows:

- 1 Press the power switch to turn the tester on.
The start-up screen appears.
- 2 Place the mobile phone on the 4916 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 coupler. Adjust the clamp to secure the mobile phone in the proper position. Willtek strongly recommends using the shield box to reduce base station interference.

Note

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

- 3 Press the **TOOLS** key and select **Config > Coupling Loss**.
The Coupling Loss menu with the current coupling loss settings appears.
- 4 Select the file corresponding to the mobile phone type under test from the **File name** scroll list. If the desired file cannot be found then move to another directory using the Directory scroll field to search for the file in another directory (folder)
The screen displays a frequency diagram showing the coupling loss within one of the frequency bands supported. Observe possible special handling instructions in the **Comment Line**.

- 5 Press the **ON** softkey to set the coupling loss.
- 6 Press the **Esc** softkey to return to the Welcome menu.
The headline indicates that the coupling loss is properly set.
- 7 Set the correct shuttle position (see section ["Adapting the shuttle position to specific mobile phones" on page 7](#)).
- 8 Select **Calls & Meas.** and 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.

Creating a new coupling loss profile

If the attenuation values for the mobile phone to be tested are not available from Willtek, you can evaluate them experimentally as described in ["Evaluating the attenuation values" on page 13](#). 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 in the Coupling Loss menu.

- 1 Press the power switch to turn the tester on.
The start-up screen appears.
- 2 Start RAPID! by pressing the **TOOLS** key.
The File Manager appears.
- 3 Using the File Manager, navigate to directory `/rapid/cpl`.
- 4 Select the file to be edited.
- 5 Press the **Open** softkey to edit a file.
- 6 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`
- 7 Press the **Save** softkey to save the file.
- 8 Press the **File** marker tab to return to the File Manager.
- 9 Press the **Close** softkey.
- 10 Press the **Exit** marker tab.
The start-up screen appears.

Using the 4916 Antenna Coupler with the 3100 Mobile Fault Finder

The 3100 Mobile Fault Finder can be controlled from a PC, either through Willtek's 7310 Lector software or a user-defined program for remote control.

There are several applications delivered with Lector. Lector also includes a data-base with coupling factors for many wireless devices. Please see the 7310 Lector user's guide for more information on how to compensate the coupling loss between the phone and the coupler.

Using the 4916 Antenna Coupler with the STABILOCK 4032

To test a mobile phone with the Willtek STABILOCK 4032 tester using the Willtek 4916 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 mobile phone on the 4916 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 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 4921 RF Shield to reduce base station interference.

Note

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

- 3 Press the **AUX** button and subsequently the **DATA** softkey.
The basic GSM mask appears.
- 4 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.

- 5 Press the **RETURN** softkey to return to the basic GSM mask.
- 6 Press the **RETURN** softkey and subsequently the **DEF.PAR.** softkey.
A screen appears displaying general parameters.
- 7 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.

- 8 Press the **RETURN** softkey and subsequently the **DATA** softkey to return to the basic GSM mask.
- 9 Set the correct shuttle position (see section "Adapting the shuttle position to specific mobile phones" on page 7).
- 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 STABLOCK 4032 Operating Manual.

Evaluating the attenuation values

Willtek provides the attenuation values necessary for testing mobile phones using the 4916 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 guide. 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 QMA to TNC cable (Willtek accessory order no. M 382 843) for the 4100/4300 Series and the QMA to N cable (Willtek accessory order no. M 382 844) for the 4200/4400 Series, the 3100 Mobile Fault Finder and the 4032 STABLOCK.
- 2 Set the preattenuation 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 4916 Antenna Coupler to the tester using the same RF cable.
- 7 Place the mobile phone on the 4916 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 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 4921 RF Shield 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 4916 Antenna Coupler and the cable as follows:

loss due to coupler = peak power measured with cable – peak power with coupler
total loss = transmission loss due to coupler + 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.

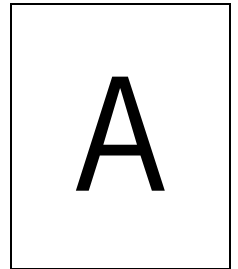
11 Enter the calculated total transmission loss as the preattenuation value in the tester.

Note

The calculated preattenuation 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 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 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.

Publication History

Revision	Comment
0407-100-A	First edition
0609-110-A	Connection to the 4920 RF Shield Box replaced by the 4921 RF Shield description, accessory list modified.

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English

Willtek Communications GmbH
85737 Ismaning
Germany
Tel: +49 (0) 89 996 41-0
Fax: +49 (0) 89 996 41-440
info@willtek.com

Willtek Communications UK
Cheadle Hulme
United Kingdom
Tel: +44 (0) 161 486 3353
Fax: +44 (0) 161 486 3354
willtek.uk@willtek.com

Willtek Communications SARL
Roissy
France
Tel: +33 (0) 1 72 02 30 30
Fax: +33 (0) 1 49 38 01 06
willtek.fr@willtek.com

Willtek Communications Inc.
Parsippany
USA
Tel: +1 973 386 9696
Fax: +1 973 386 9191
willtek.cala@willtek.com
sales.us@willtek.com

Willtek Communications
Singapore
Asia Pacific
Tel: +65 943 63 766
willtek.ap@willtek.com

Willtek Communications Ltd.
Shanghai
China
Tel: +86 21 5835 8039
Fax: +86 21 5835 5238
willtek.cn@willtek.com

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