

1209 Downconverter for the 4400 Series and 3100



User's guide  
Version 1

boosting wireless efficiency



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# About This Guide

- This section contains the following basic information:
- ["Purpose and scope" on page vi](#)
- ["Assumptions" on page vi](#)
- ["Technical assistance" on page vi](#)
- ["Conventions" on page vii](#)

## Purpose and scope

The purpose of this guide is to help you successfully use the 1209 Downconverter features and capabilities. This guide includes task-based instructions that describe how to install, configure, use, and troubleshoot the 1209 Downconverter. Additionally, this guide provides a description of Willtek's warranty, services, and repair information.

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## Assumptions

This guide is intended for novice, intermediate, and experienced users who want to use the 1209 Downconverter 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.

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## 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](mailto: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 <b>typeface</b> .	On the Status bar, click <b>Start</b> .
Buttons or switches that you press on a unit appear in this <b>TYPEFACE</b> .	Press the <b>ON</b> switch.
Code and output messages appear in this typeface.	All results okay
Text you must type exactly as shown appears in this <b>typeface</b> .	Type: <b>a : \set.exe</b> in the dialog box.
Variables appear in this <typeface>.	Type the new <hostname>.
Book references appear in this <b>typeface</b> .	Refer to <b>Newton's Telecom Dictionary</b>
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 <b>Ctrl+s</b>
A comma indicates consecutive keystrokes.	Press <b>Alt+f,s</b>
A slanted bracket indicates choosing a submenu from menu.	On the menu bar, click <b>Start &gt; Program Files</b> .

Table 4 Symbol conventions






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

Table 5 Safety definitions

	<b>WARNING</b> Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
	<b>CAUTION</b> 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 1209 Downconverter. Topics discussed in this chapter include the following:

- ["Maximum ratings" on page x](#)

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## Maximum ratings

Table 6 Maximum ratings

Parameter	Specification
Maximum supply voltage	+7 V
Maximum input power	+27 dBm while the downconverter is turned on (green LED lits) +33 dBm while the downconverter is not being operated (green LED off)

# Overview

# 1

This chapter provides a general description of the 1209 Downconverter. Topics discussed in this chapter include the following:

- ["About the 1209 Downconverter" on page 2](#)
- ["Features and capabilities" on page 2](#)
- ["Features and capabilities" on page 2](#)
- ["Physical description" on page 2](#)

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## About the 1209 Downconverter

The 1209 Downconverter is an accessory for the 4400 Series Mobile Phone Testers and the 3100 Mobile Fault Finder. It extends the frequency range available in both the transmit and the receive direction. This way, testing of signals is facilitated in frequency bands other than those already supported by the instrument.



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## Features and capabilities

The 1209 Downconverter covers the following capabilities:

- Converts signals in both directions between the instrument's frequencies and the following bands:
  - 529.6 MHz to 729.6 MHz (1209 band 1)
  - 600.0 MHz to 800.0 MHz (1209 band 2)
  - 1564.8 MHz to 1764.8 MHz (1209 band 3)
  - 2329.6 MHz to 2529.6 MHz (1209 band 4)
  - 2400.0 MHz to 2600.0 MHz (1209 band 5)
- Supports normal operation at the instrument's frequencies at very low attenuation (about 0.2 dB)
- Enables basic tests for Wireless LAN, Bluetooth, GPS and Mobile TV

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## Physical description

The 1209 Downconverter is an accessory that goes between the instrument and the mobile phone. It is powered by the MS Power Supply Option of the instrument; this option is a prerequisite which both powers and controls the 1209 Downconverter.

# Installation

## 2

This chapter describes how to install the 1209 Downconverter. The topics discussed in this chapter are as follows:

- ["Scope of delivery" on page 4](#)
- ["Software requirements" on page 4](#)
- ["Hardware requirements" on page 4](#)
- ["Setting up the hardware" on page 5](#)

## Scope of delivery

When unpacking the 1209 Downconverter, ensure that you do not miss any of the following items:

- 1209 Downconverter
- Power cable (MS Power connector of the 4400 to 1209 Downconverter)
- Manual pack with CD containing this manual

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## Software requirements

The 1209 Downconverter can be used in conjunction with either a Mobile Phone Tester from the 4400 series, or a 3100 Mobile Fault Finder.

### 4400 Series Mobile Phone Tester

For using the 1209 Downconverter in conjunction with a 4400 Series Mobile Phone Tester under remote control, software version 12.30 or higher is required.

The 4400 series currently does not fully support the 1209 Downconverter in manual mode, but [Chapter 3](#) explains a workaround to set up channels with the downconverter.

### 3100 Mobile Fault Finder

For using the 1209 Downconverter in conjunction with a 3100 Mobile Fault Finder, software version 12.30 or higher is required. Note that you will also need your own remote control application since the 1209 Downconverter is currently not supported by Lector or Scriptor.

### Updating the instrument software

Software updates for the 4400 series and the 3100 are available through [www.willtek.com](http://www.willtek.com) or through Willtek's customer support organization (see ["Technical assistance" on page vi](#)).

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## Hardware requirements

The 1209 Downconverter can be used in conjunction with either a Mobile Phone Tester from the 4400 series, or a 3100 Mobile Fault Finder. In either case, the MS Power Supply Option must be installed in the instrument. The 4400 must be serial number 0911001 or higher, or the FEX hardware must be installed (see **TOOLS > Config > Service** menu).



## Setting up the hardware

In order to set up the tester and the 1209 Downconverter:

- 1 Tightly screw the downconverter's male N connector to the N plug of the instrument (3100 Mobile Fault Finder or 4400 Series Mobile Phone Tester).
- 2 Plug in the power cable at the MS Power plug of the instrument.
- 3 Plug the other end of the power cable into the MS Power Connector at the 1209 Downconverter.

The instrument with the 1209 Downconverter should now look as shown in the following picture:



Figure 1 Connection to the 4400 Series Mobile Phone Tester

- 4 Plug the cable to the device under test (or antenna coupler) to the Mobile Phone connector of the 1209 Downconverter instead of the RF in/out connector of the instrument.



# Operation

## 3

This chapter describes the functionality of the 1209 Downconverter. Topics discussed in this chapter are as follows:

- ["Introduction" on page 8](#)
- ["Using the 1209 Downconverter with RAPID! or under remote control" on page 8](#)
- ["Using the 1209 Downconverter in manual mode" on page 8](#)

## Introduction

The 1209 Downconverter can either be used in manual operation with the 4400, or under remote control using software running on an external computer.

## Using the 1209 Downconverter with RAPID! or under remote control

The 1209 Downconverter extends the capabilities of the 4400 series and the 3100 in terms of frequency bands and hence in terms of applications. Both instruments allow operation under remote control over GPIB, USB or LAN.

See [Chapter 4 "Operating the 1209 Downconverter under remote control"](#) for the remote control commands.

### Note

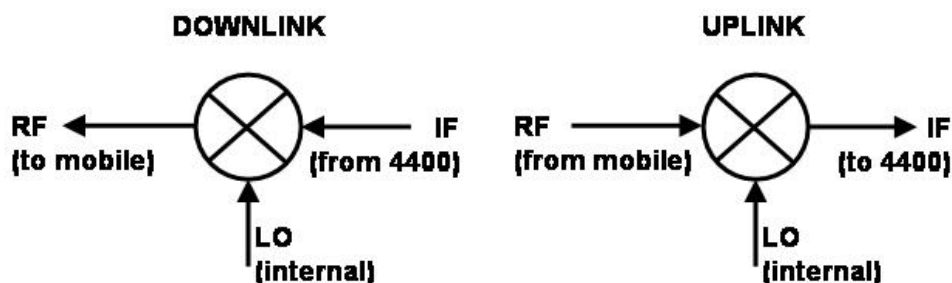
When you are using the 1209 Downconverter, the available input and output power ranges change! The respective power range for the each of various frequency bands is specified in the 1209 Downconverter data sheet.

## Using the 1209 Downconverter in manual mode

The user interface of the 4400 currently does not support the 1209 Downconverter. There is, however, a way to set up the downconverter and the 4400 so that transmission and reception becomes feasible in the desired frequency band.

### Background

The 1209 Downconverter essentially consists of voltage-controlled mixers for both directions. The following figure shows block diagrams, one for each signal direction.



The resulting signal frequency for the downlink is  $f_{RF} = |f_{LO} \pm f_{IF}|$ .

In the uplink, the resulting frequency is  $f_{IF} = |f_{LO} \pm f_{RF}|$ .

## Controlling the frequency

The 1209 Downconverter converts the receive and transmit signals between one of the bands supported by the 4400 and one of the bands supported by the mobile phone under test. The 1209 Downconverter is controlled by setting a specific voltage at the MS Power output of the 4400.

Table 1 lists the available frequency bands, the voltage to set up with the MS Power supply and the formulas to set up the 4400 depending on the desired frequencies at the mobile phone.

Table 1 1209 Downconverter frequency bands

Band no.	Frequency range	Local oscillator frequency $f_{LO}$	Voltage	Formula set
0	430.0 – 495.0 MHz 800.0 – 1000.0 MHz 1700.0 – 2300.0 MHz	–	0	no conversion
1	529.6 – 729.6 MHz	1529.6 MHz	6.6 V	A
2	600.0 – 800.0 MHz	1600.0 MHz	7.0 V	A
3	1564.8 – 1764.8 MHz	764.8 MHz	6.2 V	B
4	2329.6 – 2529.6 MHz	1529.6 MHz	6.6 V	B
5	2400.0 – 2600.0 MHz	1600.0 MHz	7.0 V	B

Formula set A:  $f_{RFout} = f_{LO} - f_{MS}$ ,  $f_{RFin} = f_{LO} - f_{MS}$

Formula set B:  $f_{RFout} = f_{MS} - f_{LO}$ ,  $f_{RFin} = f_{MS} - f_{LO}$

In order to set the voltage for the desired frequency band, enter the Power Supply menu of the 4400 by pushing **TOOLS > Utilities > Power Supply**.

## Considering the coupling factor

The 1209 Downconverter adds a coupling loss to the signal, so if you want to achieve a power level of, say, –104 dBm at the mobile phone's input, you will have to set a higher power level at the 4400. Similarly, in the other direction, the transmit power of the phone is the 4400 measurement result plus the coupling factor.

Table 2 shows the average coupling factor for each of the frequency bands. In manual mode, the coupling factor has to be manually added or subtracted.

Table 2 Coupling factors

Band no.	Frequency range	Coupling factor
0	430.0 – 495.0 MHz 800.0 – 1000.0 MHz 1700.0 – 2300.0 MHz	0.2 dB
1	529.6 – 729.6 MHz	26.0 dB

**Table 2** Coupling factors

Band no.	Frequency range	Coupling factor
2	600.0 – 800.0 MHz	26.0 dB
3	1564.8 – 1764.8 MHz	29.5 dB
4	2329.6 – 2529.6 MHz	29.4 dB
5	2400.0 – 2600.0 MHz	29.0 dB

**Examples** Two examples are given: one for a downlink signal and one for an uplink signal.

**Downlink signal to be generated**

A CW signal at the GPS frequency (e.g.  $f = f_{RFout} = 1575.42$  MHz) with a power level of  $-90$  dBm is required. Band 1 can be used for this, so a voltage of  $6.2$  V is required at the MS Power connector. Push the **TOOLS** button, then use the soft-keys to select **Utilities > Power Supply**. Enter  $6.2$  V; this sets the oscillator frequency in the 1209 Downconverter to  $f_{LO} = 764.8$  MHz.

$$\text{The required 4400 output frequency is } f_{RFout} = |764.8 \text{ MHz} \pm f_{MS}| = |764.8 \text{ MHz} \pm 1575.42 \text{ MHz}| = 810.62 \text{ MHz.}$$

Select one of the Generator/Analyzer modes, e.g. WCDMA Non-Call Mode Option. In the Generator menu, enter the frequency of  $810.62$  MHz, and activate the generator.

An important thing, to get the right power level, is to the coupling loss. The coupling loss is different for the specific modes and frequency ranges the 1209 Downconverter supports. The same applies for analyzing a signal.

For the power level, the coupling factor needs to be considered. According to [Table 2](#), the factor is  $29.5$  dB. This needs to be added to the desired  $-90$  dBm at the Mobile Phone output of the 1209 Downconverter, so enter  $60.5$  dBm in the Generator menu for the output power level.

**Uplink signal to be measured**

A signal on a WLAN frequency should be analyzed, for example at  $2400.00$  MHz. For this reason, the voltage needs to be set to  $6.2$  V (band 4) where the oscillator frequency is  $1529.6$  MHz.

$$fIF = |1529.6 \text{ MHz} \pm 2400.0 \text{ MHz}| = |-870.4 \text{ MHz}| = 870.4 \text{ MHz}$$

The formula above gives you the results  $870.4$  MHz and  $3929.6$  MHz. The result of this calculation must be in one of the standard frequency ranges that the 4400 supports. Therefore the frequency which needs to be entered in the 4400 to analyze this signal is  $870.4$  MHz.

The coupling loss to be considered is  $29.4$  dB as can be seen from [Table 2](#). So if the 4400 measures a signal power of  $-62$  dBm, this should be interpreted as  $-32.6$  dBm.

# Operating the 1209 Downconverter under remote control

## 4

This chapter shows you how to take advantage of the 1209 Downconverter under remote control. Topics discussed in this chapter are as follows:

- ["Overview" on page 12](#)
- ["SCPI commands for the 1209 Downconverter" on page 12](#)
- ["Bluetooth example" on page 13](#)
- ["WLAN example" on page 14](#)
- ["GPS example" on page 14](#)

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## Overview

In order to make use of the additional capabilities of your instrument that the 1209 Downconverter brings about, your remote control application software needs to be amended. For a detailed description of the basic principles and usage of SCPI commands, please refer to the user's guide of your 3100 or your 4400 series instrument.

The following sections provide the additional SCPI commands necessary to control the 1209 Downconverter, and also examples of how to apply them for measurements at devices for Bluetooth and other systems.

---

## SCPI commands for the 1209 Downconverter

### **:CONFigure:COUPloss:DCONverter:DETECT**

<b>Syntax</b>	<code>:CONFigure:COUPloss:DCONverter:DETECT &lt;PredefExp&gt;</code>
<b>Parameters</b>	PredefExp is one of the following predefined expressions: NO   YES. Default is NO.
<b>Description</b>	This command enables or disables use of the 1209 Downconverter. It informs the instrument if the downconverter is installed (int=YES) or not (int=NO) (the 1209 Downconverter is mounted externally, so the instrument cannot detect whether it is present or not).
<b>Query</b>	The query form of this command will return the current setting. The string delivered back will contain one predefined expression as explained above.
<b>Example</b>	<code>:CONFigure:COUPloss:DCONverter:DETECT ON</code> <code>:CONF:COUP:DCON:DET?</code> Value returned in this example: "ON"

### **:CONFigure:COUPloss:DCONverter:BAND**

<b>Syntax</b>	<code>:CONFigure:COUPloss:DCONverter:BAND &lt;Int&gt;</code>
<b>Parameters</b>	Int is an integer value in the range from 0 to 5. Default is 0.



<b>Description</b>	<p>This command allows you to select the frequency band to be measured while using the 1209 Downconverter. The list below explains which value for the parameter <code>Int</code> to choose for what frequency range:</p> <p><code>Int = 0</code>: Normal instrument operation without frequency conversion.  <code>Int = 1</code>: 529.6 MHz &lt; frequency &lt; 729.6 MHz  <code>Int = 2</code>: 600.0 MHz &lt; frequency &lt; 800.0 MHz  <code>Int = 3</code>: 1564.8 MHz &lt; frequency &lt; 1764.8 MHz  <code>Int = 4</code>: 2329.6 MHz &lt; frequency &lt; 2529.6 MHz  <code>Int = 5</code>: 2400.0 MHz &lt; frequency &lt; 2600.0 MHz</p> <p><b>Notes</b>  The band limits relate to the measurement frequency range, not to the carrier (center) frequency.  The 1209 Downconverter must be installed and the instrument must be informed about it with the <code>CONF:COUP:DCON:DET</code> command.</p>
<b>Query</b>	<p>The query form of this command will return the current setting. The string delivered back will contain one predefined expression as explained above.</p>
<b>Example</b>	<pre>:CONF:COUP:DCON:DET YES :CONF:COUP:DCON:BAND 4 :CONF:COUP:DCON:BAND? Value returned in this example: " 4 "</pre>

## Bluetooth example

The following example shows how a Bluetooth transmitter could be tested. It is assumed that the center frequency is 2.441 GHz. The test consists of a spectrum measurement where the frequency and power level of the highest power emission is checked.

```
:CONF:CSYS:GCG           The GSM asynchronous measurement mode
                           is selected for this measurement.

:CONF:COUP:DCON:DET YES  The 1209 Downconverter is connected to the
                           instrument.

:CONF:COUP:DCON:BAND 5   The frequency band from 2.4 to 2.6 GHz is
                           selected.

:RFAN:GSM:FREQ 2441000000 The center frequency is set to 2.441 GHz.

:MEAS:BLOC:MSP:AVG 20    20 spectrum measurements are taken and
                           averaged.

CALC:RFSP:MSP:MAXP?      The maximum is detected and returned in
                           the following format:
                           <Frequency Offset [Hz]>, <Power [dBm]>
```

---

## WLAN example

In the following example, a power measurement is taken on a Wireless LAN transmitter signal at 2.4 GHz:

```
:CONF:CSYS:WCG           The WCDMA asynchronous measurement
                           mode is selected for this measurement.

:CONF:COUP:DCON:DET YES  The 1209 Downconverter is connected to the
                           instrument.

:CONF:COUP:DCON:BAND 4   The frequency band from 2.33 to 2.53 GHz is
                           selected.

:RFAN:GSM:FREQ 2400000000 The center frequency is set to 2.4 GHz.

:MEAS:WCDM:WLAN:POW?    A power measurement is performed and the
                           result is returned in dBm.
```

---

## GPS example

In the following example, the instrument is set up to transmit a GPS transmitter signal at 1.57542 GHz:

```
*RST                       Instrument reset

:CONF:CSYS WCG            The WCDMA asynchronous measurement
                           mode is selected for this measurement.

*OPC?                     Wait until operation is completed.

:CONF:COUP:DCON:DET YES  The 1209 Downconverter is connected.

*OPC?                     Wait until operation is completed.

:CONF:COUP:DCON:BAND 3   Select frequency band from 1564.8 to
                           1764.8 MHz.

*OPC?                     Wait until operation is completed.

:RFG:WCDM:STAT?         Check if the RF generator is switched off.

:RFG:WCDM:FREQ 1575420000 Select the GPS center frequency of
                           1575.42 MHz.

*OPC?                     Wait until operation is completed.

:RFG:WCDM:LEV -90.0     Set instrument output power to -90 dBm.

*OPC?                     Wait until operation is completed.
```

:RFG:WCDM:STAT ON      Turn generator on.



# 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.





# Publication History

Revision	Comment
0711-100-A	First revision

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