will'tek

Series

Willtek 4200

4201S ■ 4201A ■ 4202S ■ 4202R ■ 4208

Mobile Service Tester

GSM 850/900 ■ E-GSM ■ GSM-R ■ GSM 1800 (PCN) ■ GSM 1900 (PCS)
Dual band GSM 850/900+1800/1900
Multiband GSM 850/900+1800+1900
GPRS ■ VGCS

User Guide

Manual Version: 0609-550-A

Designations such as utility names, company names and trade names are not specially indicated in this manual, as they are all widely known. Such names may, however, be the property of companies or other such bodies.

This manual is subject to change at any time without notice. Errors and omissions excepted.

Manual layout and text: Redaktion Interpreta, Munich, Germany

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Chapter 2: SETUP

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1

GETTING STARTED

Preface

Thank you for choosing a model in the *Willtek 4200 Mobile Service Tester* series. The equipment will give you valuable assistance in functional testing, alignment, tuning and troubleshooting of GSM mobile phones.

The series comprises the models shown in the table below:

Model	Frequency band	Network	
Willtek 4201S Willtek 4201A Willtek 4202S Willtek 4202R Willtek 4208	850 MHz (option) 900 MHz 1800 MHz 1900 MHz	GSM 850/900/1800/1900 E-GSM GSM-R (Willtek 4202R and 4201A only) GSM 850/900+1800 GSM 850/900+1900 GSM 850/900+1800+1900	Single band Single band Single band Dual band Dual band Multiband

Willtek 4201S Basic model for all standard tests on the service.

Willtek 4201A As 4201S, but with GSM-R frequencies and with SCPI commands for remote controlled data connections.

Willtek 4202S As 4201S, but with additional tests for GSM services such as data transfer and SMS (see also page 4-3).

Willtek 4202R As 4202S, but also featuring Voice Group Call Service for testing GSM-R equipment (R = Rail) for rail companies.

Willtek 4208 As 4201S, but with a higher performance RF output stage and a more sensitive RF input stage for wireless connection to the mobile phone over a distance of several meters.

■ Operating modes

AUTOTEST Fast and accurate full testing of a mobile phone with an overall assessment of *PASSED* (mobile phone OK) or *FAILED* (mobile phone defective). Largely automatic testing underwrites easy to operate.

FAULT FIND

Operating mode for error location on defective mobile phones. Selective performance of individual tests. Displays measurements for assessment by experienced users. Includes Asynchronous Mode for alignment and tuning of RF settings of mobile phones.

This User Guide is applicable to all models in the Willtek 4200 series. The generic name 4200 is used whenever the Guide refers to features which are not specific to a particular model.

Do you speak English?

The tester has a display which can show text either in English or in some other language. This Guide assumes that you have selected English, in which case the illustrations and instructions will match up with what you see on your tester's display.

If some other language is selected, the Guide and the display no longer match up. In that case either translate what the Guide says into the other language or switch the language to English for a short period (see also page 2-3).

Important instructions

Proper operation

AC power	Permissible line voltage: 90 V through 263 V (AC voltage; 47 Hz through 63 Hz). The power supply automatically adapts to the line voltage.
Use for intended purpose only	Use your Willtek 4200 only for its intended purpose for function testing, alignment and repairs on radio telephones of a GSM mobile radio system.
Permitted RF input level	Risk of destroying the unit! The maximum permitted value varies from model to model (see data sheet).
Ambient conditions	Store and operate your Willtek 4200 only in a dry and dust-free environment. Operate your Willtek 4200 only in the permissible temperature range of 15 °C through 35 °C. Observe the permissible storage temperatures (see Appendix: Technical data).
Air circulation	Keep the air vents free of obstruction.
Breakable display	Do not press on the display.
Electromagnetic compatibility	The device emits RF radiation. For this reason, do not operate it in EMC-sensitive environments if this might result in danger (e.g. when traveling in automobiles or during flights). The EMC and Safety directives to which the device conforms are listed in the Declaration of EU Conformity (see Chapter 6).
Do not open	Do not make technical modifications to the device or its accessories. Do not open the device. There are no parts inside it which require maintenance or disposal. Do not open the device, otherwise you will lose your claim to warranty.
Original accessories only	Use original accessories only.
No solvents	Do not use agents which contain solvents to clean the equipment casing.

Handling Avoid the following during operation and storage:
- strong direct sunlight
- vibrations, heavy impacts
- ingress of liquids or small objects into the device
- bending of the RF adapter cable
- contamination of the electrical contacts

After unpacking

- Do not throw the packaging of your Willtek 4200 away. It will make shipment easier for you in repair cases.
- Check that the delivery is complete:

Standard items supplied

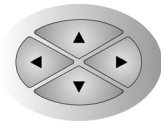
M 101 3XX	1 x	Willtek 4200
M 860 164	1 x	1103 USIM & GSM test SIM, plug-in format (4201S, 4202S and 4208)
M 295 013	1 x	Getting Started manual
	1 x	CD with User Guide in PDF format
M 860 603	1 x	Power cord
M 860 378	1 x	Centronics printer cable (4201S and 4202S)
M 860 379	1 x	RS-232-C cable (data transfer to PC)
M 382 780	1 x	RF adapter cable, N/TNC

Options/extra accessories For a list of useful options and extra accessories refer to Chapter 6.

- Check that the unit is undamaged:

Do not attempt to operate a Willtek 4200 if there is obvious damage to the device, the power cord or the accessories. Retain the packaging and contact the office who supplied the equipment.

Key functions



The cursor keys have two functions:

- selecting menu items
- when entering numbers/letters: moving to the required location

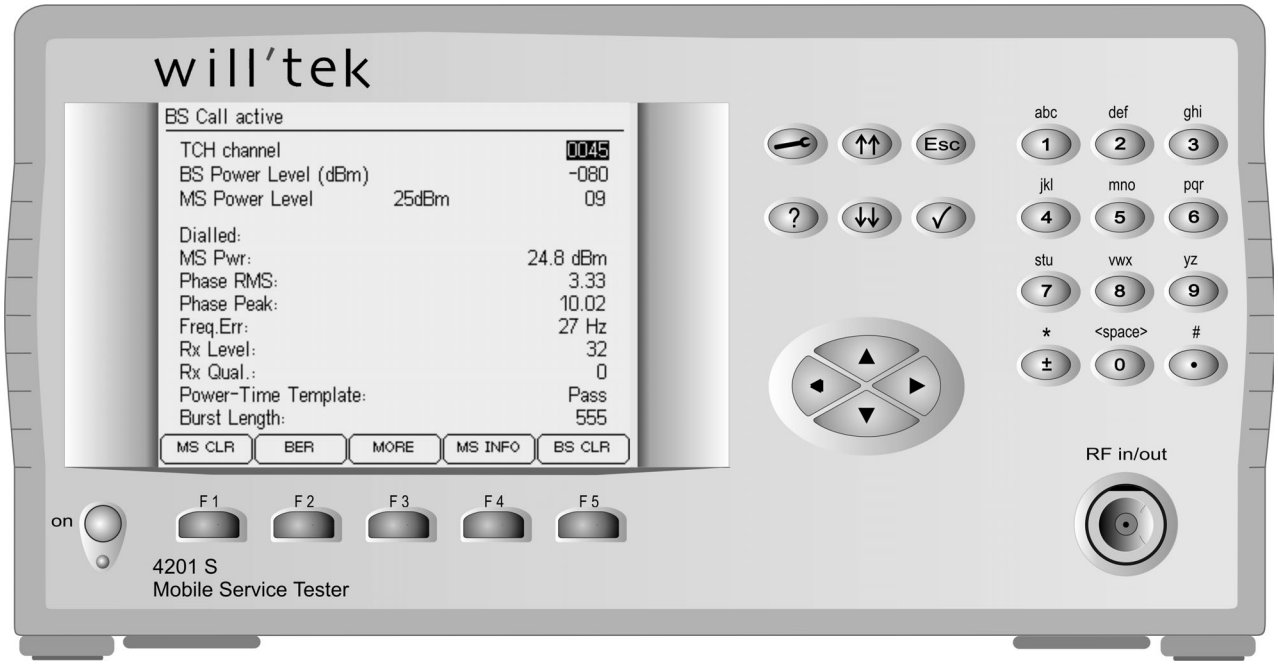
F1 F2 F3 F4 F5 Softkeys: The current function of a key is assigned by the currently visible menu. If no such assignment has been made, the softkey is irrelevant

Calls up the start menu to select the desired operation mode via softkeys

Online help: Explanations of the currently visible menu

and These keys have two functions:

- quick browsing (page by page) in lists shown on the screen (stored AUTOTEST logs and MS TYPE test parameter sets)



- Increments/decremts a value (+1/–1) entered in the entry fields for the RF power level (BS Power Level and MS Power Level) and for the channel numbers (BCCH and TCH). Holding the button down changes the value automatically (autorepeat).

Esc The Esc key has two functions:

- returning to the next menu up
- aborting the current test

✓ The ✓ key has three functions:

- confirming input
- opening a submenu
- launching a program

◯...◯ The number-and-letter keys have the following functions:

- entering the numbers 1 through 9 (e.g. phone numbers)
- entering the letters A through Z (e.g. comments)

* Enters the asterisk

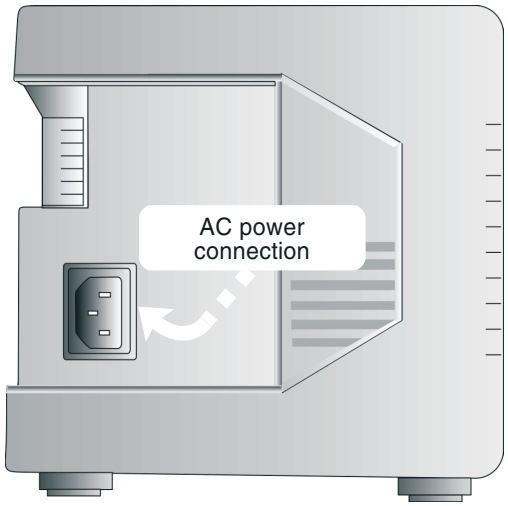
0 <...> Enters the digit 0 or a space (e.g. between two words in a comment)

• Enters a decimal point (e.g. 2.5 dB)

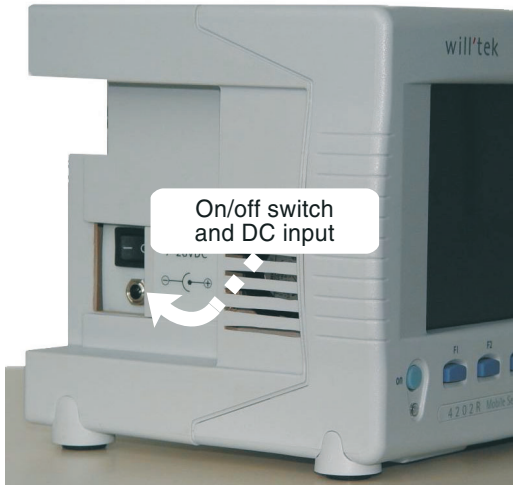
On/off button with power-on LED
Yellow: standby
Green: powered on

This on/off button has no effect when the tester is equipped with the DC option (power supplied by batteries). The tester is started up in this case using the toggle switch for the DC option that you will find on the tester in place of the AC power connection.

Initial startup



AC power operation



Battery operation

All you need to do to start up your Willtek 4200 the first time round is connect it to the power via the accompanying power cord.

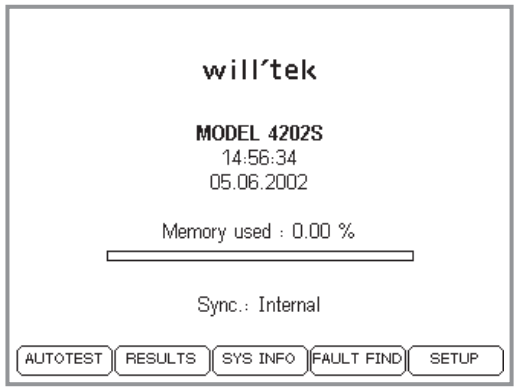
■ AC power operation

1. Plug the power connector into the matching socket on your Willtek 4200.
2. Connect the power cord to the wall power outlet.
3. Press the on/off button to switch your Willtek 4200 on.

■ Battery operation

If your Willtek 4200 is equipped with the DC option, a DC/DC converter with 7 V ... 28 V allowable DC input voltage replaces the standard AC power supply. An external AC/DC power supply is also provided for this purpose.

☞ When the DC option is installed, the on/off button on the front panel has no function. Switch on the tester using the toggle switch on the left side panel (photo).



Start menu of the Willtek 4202S.

Start menu

Immediately after being switched on, the Willtek 4200 briefly displays an initialization menu (in this period among other things the operability of the device is checked).

The tester is fitted with a maintenance-free fan in order to keep the semiconductor components cool. The level of noise produced by the fan is normal.

Once you see the start menu (picture on left), the device is ready for use.

The first time you start up the device, you should at this point press the (SETUP) key to adapt the basic configuration of your Willtek 4200 to match your specific requirements (see Chapter 2).

Memory used: see page 3-15
Sync.: see page 6-4

Meaning of the softkeys

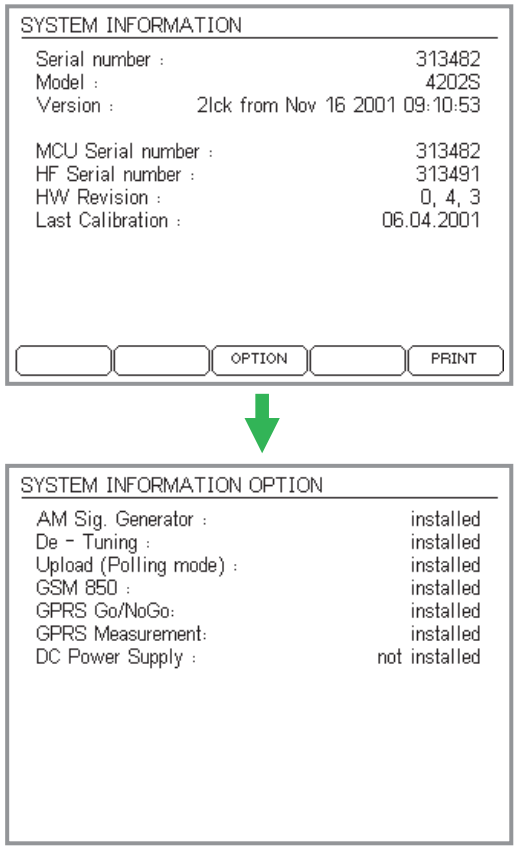
(AUTOTEST) Switches to AUTOTEST mode (quick test of mobile phones). Detailed instructions about this mode you will find in chapter 3.

(RESULTS) Displays a list of AUTOTEST logs you have stored (e.g. if you want to print a certain log). Detailed instructions about the log handling you will find in chapter 3.

(SYS INFO) Calls the *SYSTEM INFORMATION* menu (see page 1-18).

(FAULT FIND) Switches to FAULT FIND mode (alignment, troubleshooting). Detailed instructions about this mode you will find in chapter 4.

(SETUP) Calls the setup menu (for basic parameter settings such as language and contrast). Detailed instructions about the setup pocedure you will find in chapter 2.



System information

+ SYS INFO

The *SYSTEM INFORMATION* menu shows the following information:

- the serial number of the tester
- the model number
- the firmware version number
- the date and time of the creation of the firmware at Willtek
- details relating to the hardware level of the device
- date of last factory calibration

Please have the information on this menu ready when contacting Willtek for product support (Press PRINT to start printing the menu).

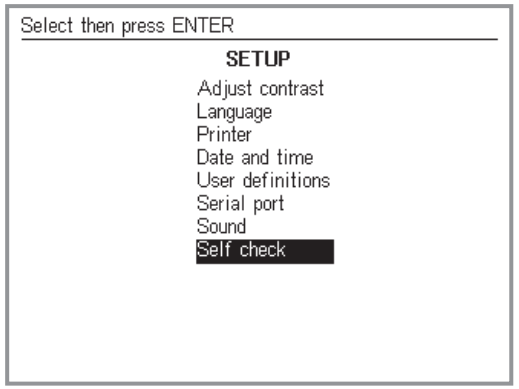
The OPTION softkey calls a submenu which lists all the options available for the tester:

installed	option is installed
not installed	option is not installed

Press Esc or to return to the start menu.

SETUP

Basic settings

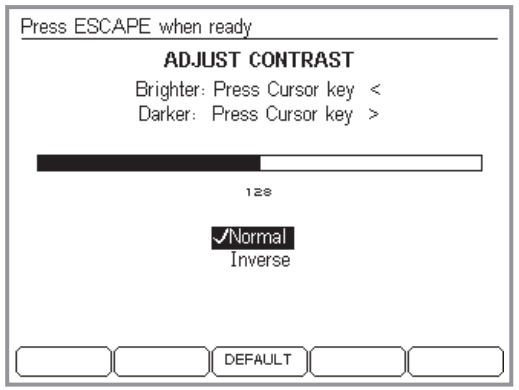


+ SETUP

As a rule, the basic settings need only be configured once during initial startup. A powerful capacitor ensures that the settings and the stored test result are preserved when your Willtek 4200 is off.

The tester need to be switched on for about 4 hours at least every 14 days (for capacitor charging) to ensure that no data is lost.

Contrast

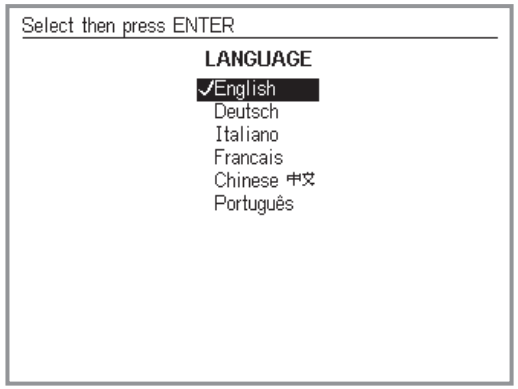


+ SETUP + *Adjust contrast* + ✓

To adjust the readability of the display to the ambient conditions.

1. Using the cursor keys, alter the contrast to produce optimum readability from the normal viewing angle (Holding the cursor down starts the autorepeat function).
2. Select one of the following entries using the cursor keys and confirm your selection with ✓:
   Normal Text = light, background = dark
   Inverse Text = dark, background = light
3. Return with Esc.

Language



Emergency exit: *If you have tried out one of the other language menu systems and have discovered that you are no longer able find your way around, you can use the following emergency exit: First select ⌐, then enter* ***4 2 0 0*** *on the numeric keypad. This switches you back to the English-language menu.*

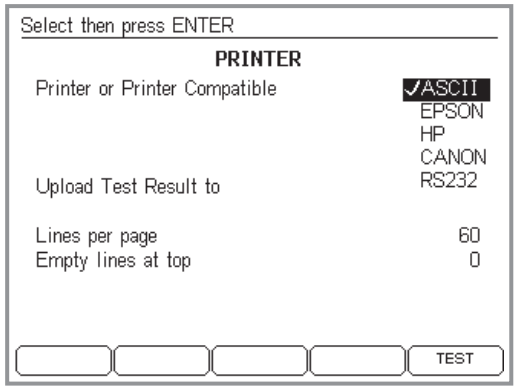
⇦ ⌐ + SETUP + *Language* + ✓

To select the language in which the display shows text.

1. Select one of the languages offered using the cursor keys.
2. Confirm your selection with ✓.
3. Return with Esc.

☞ The languages currently offered are English, German, Italian, French, Chinese and Portuguese. Other languages are being prepared, and these will be made available in the form of a firmware update (see page 6-26).

Printer



Example
Lines per page = 59
Empty lines at top = 9
Nine lines will remain blank at the top of the page. This means that a total of 50 lines will be available on each page for the test results (59 – 9). Whether these will fill the entire page or not depends to a large extent on the font settings on the printer.

The way in which the characters appear on the paper (font, size, line feeds) is determined by the printer on the basis of the settings made on the printer. This means that you can only change the appearance of the test results by changing the printer's settings.

Use (TEST) to check whether a connected printer is operating correctly (see also page 2-11).

Printing on the PC
You can transfer test logs to a PC using the Windows "4X00 Data Exchange" software and automatically output them on the PC printer or on a network printer (see page 6-16).

⇦ (↓) + (SETUP) + *Printer* + (✓)

To select a printer for outputting test results.

Select a printer

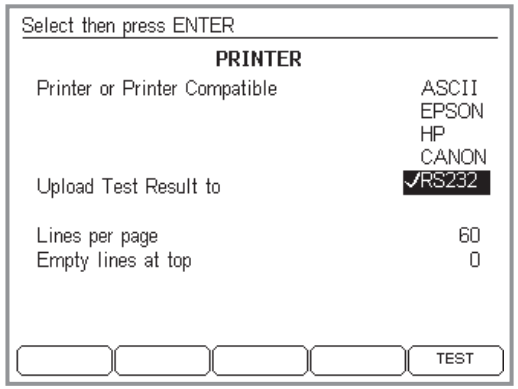
1. Using the cursor keys, select the manufacturer of your printer (*EPSON*, *HP* or *CANON*). Other printers are usable as well, provided they offer some kind of emulation (refer to your printer manual for information). Select *ASCII* if your printer is neither Epson nor HP or CANON-compatible.

   ☞ All printers which do *not* require the use of a driver under DOS can be used directly. More recent Windows printers are therefore generally unsuitable. Printers of this type can, however, be used to print exported test logs from the PC (see page 6-16).

2. Confirm your selection with (✓).

Setting the page length
The value you specify for *Lines per page* determines the number of printed lines per page (including blank lines at the top of the page) when you print test results. Once this number of lines is reached on the printout, the tester issues a form feed. The specification you make for *Empty lines at top* sets the number of blank lines at the top of the page (if, for instance you want to use sheets with a letter header).

1. Move to the entry fields with the cursor keys, enter the required value and confirm every entry with (✓).
2. Return with (Esc).



Upload instead of printout

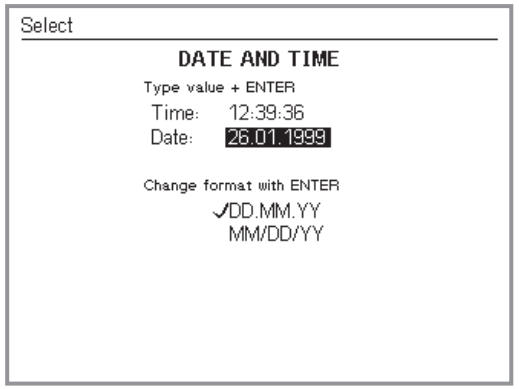
+ SETUP + *Printer* + ✓

If you don't want to print the test log, but instead want to transfer it to a PC, you must select the *RS232* entry (option) in place of a printer and confirm using ✓.

This selection will also affect other menus: the PRINT softkey will be replaced by the UPLOAD softkey. In order to be able to print test logs again, you must deselect the *RS232* entry in the *PRINTER* menu.

Use 4X00 Data Exchange (Version 3.00) to upload test logs to a PC (data polling). More information about this process can be found on page 6-21.

Date and time



Changes to the date format are reflected by swapping of the first two values in the "Date" line.

Each time you confirm a setting you can either go on to configure another setting or press Esc to quit the menu.

⇦ + SETUP + *Date and time* + ✓

To set the date and time (shown on the start menu and printed on test results).

Date format

1. Using the cursor keys, select the date format you require (shown at the bottom of the display):
   DD/MM/YY = day/month/year
   MM/DD/YY = month/day/year
2. Confirm your selection with ✓.

Time

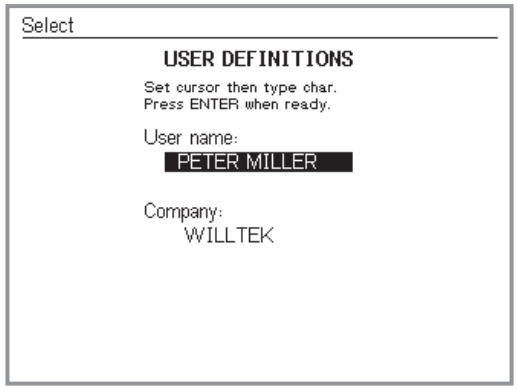
1. Using the cursor keys, select the "*Time*" line.
2. Enter the current time in 24-hour format (comparable to entering a 6-digit number on a pocket calculator).
   Example: 10:32
   Input: 103200
3. Confirm your input with ✓.

Date

1. Using the cursor keys, select the "*Date*" line.
2. Enter the current date in the selected date format (comparable to entering a 6-digit number on a pocket calculator).
   Example: June 14, 1997
   Input: 140697 or 061497
3. Confirm your input with ✓.

Return with Esc.

User definitions



Example (1) *abc*

Repeated pressing of the (1) abc key causes the following characters to be entered at the cursor position:

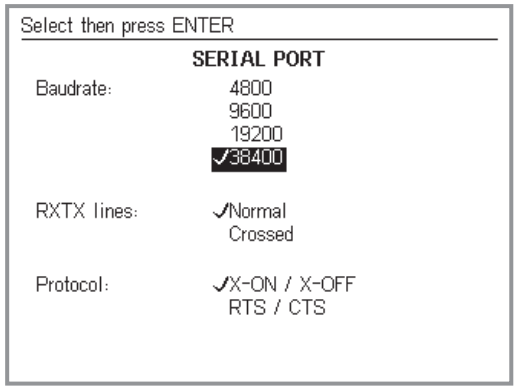
*1st press = **A***
*2nd press = **B***
*3rd press = **C***
*4th press = **1***
5th press = A
6th press = B
etc.

(✓) + (SETUP) + *User definitions* + (✓)

To enter the text that you want to appear in the header on printed test reports (e.g. user/company).

1. Using the cursor keys, select the required input line.
2. Enter text letter by letter (digits are also acceptable) using the keys on the numeric keypad. Repeated pressing of a number key first displays all the letters assigned to that key and then the digit. Special softkeys appear in the menu when you start entering text:
   - Automatic text entry: Avoid pauses between selecting characters. If you pause for more than approx. 1 second between selecting two characters, the character currently visible is used and the cursor moves to the next entry position.
   - Corrections: Use the left or right cursor key to position onto the incorrect character and then overwrite the character.
   - Delete characters with (DELETE).
   - Enter blanks with (INSERT).
   - Switch between uppercase and lowercase with (ABC abc) .
3. Confirm your input with (✓).
4. Using the cursor keys, move to the second input line and enter text – or return with (Esc).

PC interface



Why data communication?

Setting up a data communication link between a PC and your Willtek 4200 is not difficult, but it is really useful! For example, you are able to download the latest firmware versions from the Internet, and feed them into your Willtek 4200, or selectively upload user-specific AUTOTESTs and limit values that are geared to specific models of mobile phone. Willtek also has the right software for your data communication requirements (some of which are optionally available).

⇦ + SETUP + *Serial port* + ✓

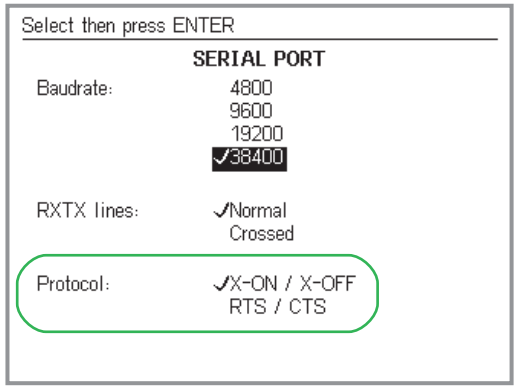
To set the baud rate (bit/s) for serial data communication between PC and Willtek 4200, and to select the type of communication line.

1. Using the cursor keys, select the required baud rate. The higher the baud rate, the shorter the transmission time. On older PCs it may be necessary to select one of the lower rates to ensure error-free data transmission. Further data communication parameters are permanently set (in the background) to:

   8 data bits – no parity – 1 stop bit

2. Confirm your selection with ✓.
3. If you are using the original cable for serial data communications (RS-232-C cable), please select the entry *Normal* under *RXTX lines* using the cursor keys. If you are using other cables (e.g. extension cables), lines RXD and TXD can be crossed (Pin 2 and Pin 3, see also page 6-3). In this case, please select *Crossed*.
4. Confirm your selection with ✓.
5. Return with Esc.

☞ The values set for the serial interface (COM port) on the PC must be the same as those set on the Willtek 4200. If the PC also asks you about the (transmission) protocol, select “NONE”. For instructions on setting the baud rate of the serial interfaces (RS-232-C) and the other parameters on your PC, refer to the manual for your operating system (DOS, Windows 3.xx, Windows 95/98).



■ Choose the protocol

When a Willtek 4200 is under remote control, the transfer protocol ensures error free transfer of data between the PC and the tester (handshaking). You can choose between one software protocol and one hardware protocol.

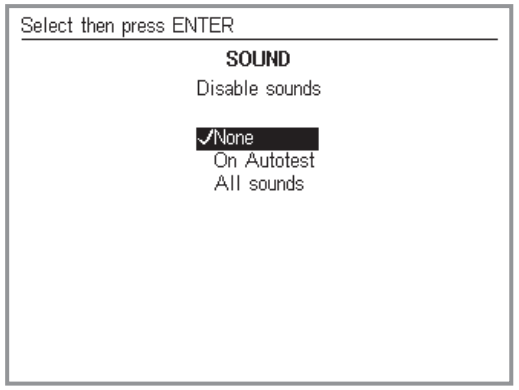
X-ON / X-OFF Choose this software protocol if the RTS and CTS lines are missing in the cable connecting the PC and the tester (see also page 6-3).

RTS / CTS If you are using a fully-wired cable (original Willtek accessories), you should choose this faster hardware protocol in preference to the software protocol.

☞ On the PC, the same protocol must be set for the serial interface (COM port) used as for the Willtek 4200.

The protocol you set only takes effect when the tester is under remote control and does not interfere with data transfer using other protocols (e.g. when loading a firmware update).

Sound



⇦ + SETUP + *Sound* + ✓

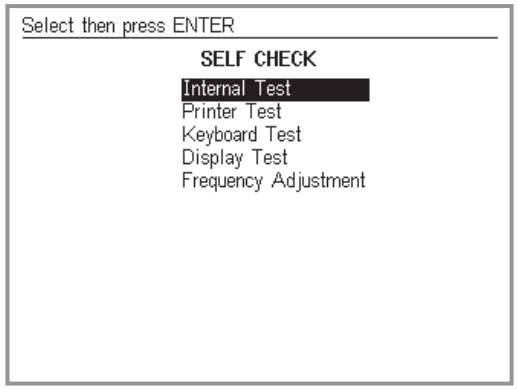
Enable or disable the sounds used by the Willtek 4200 to signal special operating status (e.g. when a key is pressed, when an error occurs or when the device is ready).

1 Using the cursor keys, select the required setting.

None	Sounds are always active.
On Autotest	Sounds are deactivated during an AUTOTEST.
All Sounds	Sounds are always deactivated.

2 Confirm your selection with ✓.

Self check



⇦ + SETUP + *Self check* + ✓

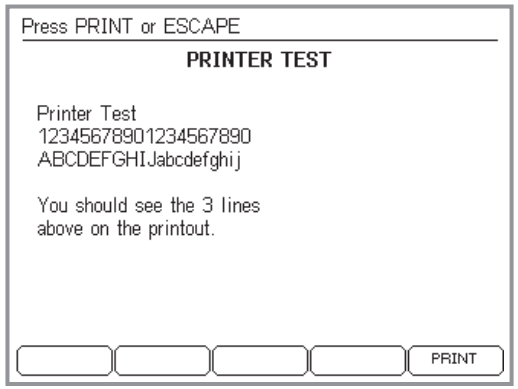
The Willtek 4200 checks its hardware modules and indicates whether they are working correctly. It also displays information on the version status of individual modules.

Accessing the menus

Once you see the *SELF CHECK* menu on the display, access to the submenus always follows the same pattern:

1. Use the cursor keys to select the menu you require.
2. Confirm your selection with ✓. The display then shows the menu you have selected. On some menus you can then use softkeys to start self-checks.
3. Return with Esc.

Printer test



⇦ + SETUP + *Self check* + ✓ + *Printer test* + ✓

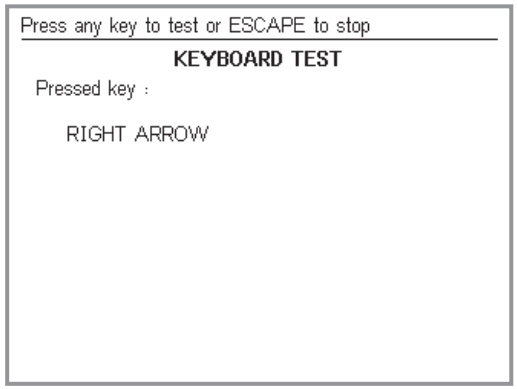
To test the printer.

1. Attach your Willtek 4200 (Centronics socket) to the printer, typically using the Centronics cable.
2. Press PRINT to start the printer test.

- If your printer outputs the three lines shown on the left, test results will also be printed correctly.
- Please refer to page 6-5 if the printer does not respond or responds incorrectly.

3. Return with Esc.

Keyboard test



(↵) + SETUP + *Self check* + (✓) + *Keyboard test* + (✓)

To test the keypad.

When you call this menu, the keyboard test starts automatically.

1. Press all the keys on your Willtek 4200 in succession.
   - If the display reports the designation of the key you press, the key is OK. Numbers are written out (e.g. *FIVE*).
   - If the display does not acknowledge a keypress, the key is defective (e.g. corroded contacts following ingress of liquid). In this case consult your local Willtek sales office.
2. Return with (Esc).

Display test

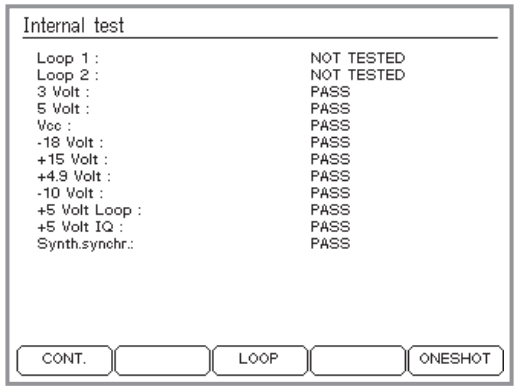
(↵) + SETUP + *Self check* + (✓) + *Display test* + (✓)

To test the liquid crystal display.

When you call this menu, the display test starts automatically.

- The display is divided into two areas which alternate between white, gray and black. These areas should show no obvious dots or stripes.
- If, for instance, you can see black dots or stripes in a white area, the display is faulty. In this case, consult your local Willtek sales office or authorized Distributor.

Return with (Esc).



Internal test

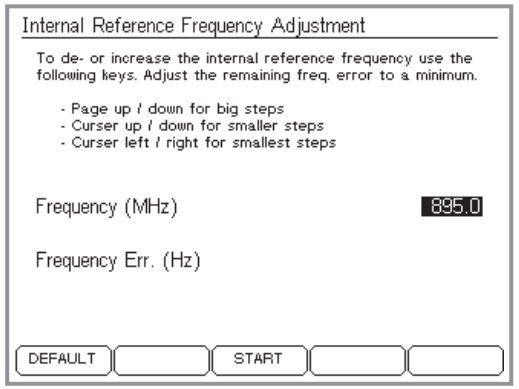
✓ + SETUP + *Self check* + ✓ + *Internal test* + ✓

To run an internal test on important modules and supply voltages.

1 Press the ONESHOT softkey to start a single test run or CONT. to start continuous testing (press STOP to abort). *PASS* indicates that a test has been passed, *FAIL* reports an error. With continuous testing, the number of tests carried out and the total number of errors detected are also reported.
The LOOP softkey (Willtek 4208 only) allows you to include both the GSM loops Loop 1 (GSM 900) and Loop 2 (GSM 1800) in the self-test. NO LOOP excludes the two loops from the self-test.

- Errors reported by tests may also be due to external factors (such as major glitches in the line voltage). In such cases repeat the test. If the errors recur, consult your Willtek sales office.

2 Return with Esc. Use STOP to abort continuous testing first.



Frequency Adjustment

( ) + SETUP + *Self check* + ✓ + *Frequency Adj...* + ✓

For particular applications, it may be necessary to alter the quartz-stabilized internal reference frequency of the tester.

⚠ Before calibrating the reference frequency, contact the Willtek service staff. Calibration is NOT necessary for regular service activities. Incorrect calibration will cause measurement errors.

Default resets the reference frequency to the factory setting.

Preparing the tests

Preparations are identical for the tests in AUTOTEST and FAULT FIND modes. They involve only two steps:

- insertion of the test SIM in the test unit,
- connection of the test unit to your Willtek 4200.

Installing the test SIM

Make sure that you insert the test SIM in the mobile phone before carrying out an AUTOTEST. This is because during the test, the Willtek 4200 will attempt to perform measurements which are not generally permitted by original SIMs. The test SIM is not absolutely necessary for FAULT FIND mode, although it is useful.

1 Make sure the mobile phone is switched off.

⚠ Observe the equipment manufacturer's handling instructions.

2 Replace the original SIM with the test SIM. Plug-in SIMs are usually hidden behind a small flap that you see when you take out the battery.

Do not forget to remove the test SIM before returning an intact mobile phone. With the test SIM in the phone, the customer will no longer be able to check into a radio network; so even though the phone is intact, it will be of no use to the customer.

Background information: SIM

The Subscriber Identity Module (SIM) contains the subscriber identity code and is an exchangeable component of any mobile phone. If there is no SIM, it is not possible to set up a connection (except for emergency calls). Some mobiles use smartcard-style SIMs (full size), while others use the plug-in format.

A full-size SIM (top) and a plug-in SIM.

⚠ Please note that the SIM card has an embedded chip and the contacts to this can become damaged with repeated flexing or a very large number of insertions and removals from a mobile phone.

Attaching the test unit

Wireless connection of the test unit via antenna. The orientation of the two antennas to each other is of no particular significance.

A Willtek 4200 supports three methods of attaching a mobile phone for testing:

- wireless connection via antenna (extra accessory).
- connection via the 4916 Antenna Coupler (extra accessory).
- Cable-based connection via RF adapter cable and an RF adapter which matches the phone (extra accessory).

Connection via antenna

Points in favor

- Very quick to set up.
- Any GSM mobile phone can be tested.
- The entire RF signal path of the phone is tested (antenna included).
- No RF adapter required.

Points to note

- Some tests call for clearly defined conditions (accurately known RF input level at the radio's antenna input). With a wireless connection, these particular test values cannot be correctly measured (refer also to page 3-20).
- In order to keep RF signal attenuation in the space between the devices to within reasonable bounds, the distance between the tester and the mobile phone must not exceed 50 cm (Exception: Willtek 4208).
- Make sure that no conductive objects are lying between the tester and the mobile phone (screening effect). The two devices must not be placed on a conductive surface.
- Nearby base stations of a GSM mobile radio network may cause the test results to be distorted.

- The radio is likely to get registered into a public mobile radio network (unintentionally). Additional measures must be taken at the start of a test run to ensure that this does not happen.

Connection

Select the correct antenna for the mobile radio system (extra accessory, see also page 6-42) which matches the mobile phone frequency range and secure it to the N connection of your Willtek 4200 by tightening the coupling ring.

☞ Do not use the wrong antenna, as this will falsify the results of the test. The antenna for GSM 850/900/E-GSM mobile phones has an overall length of approximately λ/4 = 165 mm (or 6.5") and has two yellow rings at the end. The antenna for GSM 1800/1900 mobile phones has an overall length of approximately λ/2 = 229 mm (9") and has no rings.

Connecting the Willtek 4208

The Willtek 4208 has separate input and output sockets on the rear (see the figure) instead of the common input/output socket on the front plate: the upper of the two N sockets is the input socket (RX) and the lower of the two sockets is the output socket (TX).

Recommendation: aligning the two antennas at 90° to each other has a favorable impact on decoupling the RX and TX signal paths.

Thanks to the higher performance RF output stage and the more sensitive RF input stage, a Willtek 4208 connected via antenna (without an additional amplifier) can cover distances of up to 20 meters to the mobile phone.

☞ In order to prevent interference with GSM base stations in the vicinity when using the unit at high transmission power, tests should only be carried out on unused channels (see "Checking channel usage" on page 4-4).

The important feature with the 4916 Antenna Coupler is that mobile phones of the same type are always placed in exactly the same position in the clamp.

Connection via the 4916 Antenna Coupler

■ Points in favor

The 4916 Antenna Coupler is suitable for all radio systems (GSM, PCN, PCS). It combines most of the benefits of wireless connection via antenna with those of cable-based connection. The more precisely defined test conditions mean that measurements and tests which were too inaccurate with the simple antenna connection method are more reliable (refer also to page 3-20).

■ Points to note

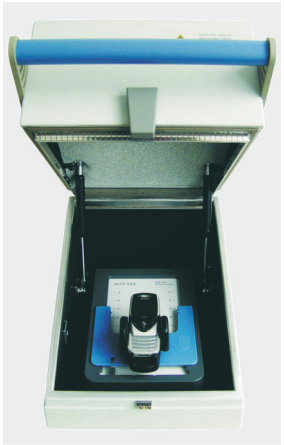
The 4916 Antenna Coupler can also react to changes in the environmental conditions (such as the proximity of a hand). Precision measurements can therefore still only be performed with a cable-based connection.
RF interference from nearby base stations can also create problems. To reduce these interferences (about approx. 50 dB) we strongly recommend to use the 4916 Antenna Coupler in common with the 4921 RF Shield (extra accessories).

■ Connection

Connect the 4916 Antenna Coupler to the Willtek 4200 with the RF adapter cable supplied.

Release the jaws of the clamp by pressing small button and insert the mobile phone in such a way that its display points to the Willtek logo and the housing touches the bottom restraint (see the figure lefthand). Press the jaws of the clamp together firmly.

☞ Make sure that mobile phones of one type are always mounted in exactly the same position. Only in this way can constant test conditions and appropriate test results be guaranteed. If you select an automatic start for an AUTOTEST, you must observe any special instructions for the test which may appear (e.g. fully extend the antenna or check size of battery pack).



An additional 4921 RF Shield (extra accessories) reduces interference with surrounding RF signals. It is recommended to use the shield in common with the 4916 Antenna Coupler.

Cable-based connection of the test unit is the ideal choice for precision measurements.

***Willtek 4208 – Risk of damaging the RF input stage**: A Willtek 4208 unit handles maximum RF signal levels of +19 dBm at the RX input. If a mobile phone is transmitting at maximum power (+33 dBm) and the unit is connected via cable, the RF input stage of the tester may be damaged. To avoid this, an attenuator (e.g. 20 dB) must be fitted in the RF signal path.*

Cable-based connection

Points in favor

- RF adapter with cable coupling guarantees a set of defined testing conditions. That means that all tests produce results which can be correctly evaluated against specifications.
- As all the tests are suitable for evaluation, the *PASS/FAIL* evaluation is more broadly based than with wireless connection.
- It is not possible for the test unit to (unintentionally) register in a public mobile radio network.
- There is no chance of interference from nearby GSM base stations.

Points to note

- Test preparation takes longer.
- Only mobile phones which have an RF connection socket can be tested with this method.
- Defects in the mobile phone's antenna circuit are not detected.

Connection

Select the RF adapter (extra accessory) which matches the mobile phone (see also page 6-45). First securely attach the RF adapter cable (1.5 m) to the N connection on the Willtek 4200 and to the RF adapter. Then attach the mobile phone to the RF adapter. Use original equipment only (otherwise you may risk false readings or damage of the mobile phone).

When attaching the RF adapter, take great care with the alignment of the contacts. Do not use force. If an adapter does not fit properly, you may have chosen the wrong one. Make sure that there is good contact on all plug-in connections (loose contacts lead to errors in test results).

3

AUTOTEST

Overview

An AUTOTEST performs a series of different measurements largely automatically. By comparing its measurements with stored target values, the Willtek 4200 detects faults in the mobile phone. The tolerances allowed with respect to the target values are used to decide *PASS* or *FAIL* of each measurement.

At the end of the AUTOTEST, an overall evaluation of *PASSED* or *FAILED* is derived from the evaluations of the individual tests.

AUTOTEST **PASSED** The mobile phone is within the tolerances, and is in full working order. There is no need for further measurements in FAULT FIND mode.

AUTOTEST **FAILED** The mobile phone is outside the tolerances. The test unit is defective. Further measurements in FAULT FIND mode can be used to identify the cause of the fault.

Testing without stress
A group of test parameters can be assigned to any model of mobile phone and then stored. Once the parameters have been stored for a given model, these preparatory steps are no longer required if a further test is carried out on the same model. The AUTOTEST can be started immediately. In these cases, the two steps of preparing and running an AUTOTEST are totally separate. The advantage is that the two tasks can be carried out at different times and by people with different levels of expertise.

The influence of the user

A Willtek 4200 incorporates five standard AUTOTESTs as supplied from the factory (one for each radio system). In addition, it is possible to read in user-defined AUTOTESTs. The user of a wIlltek 4200 cannot change the installed AUTOTEST program, but can change the **test parameters** (selection of channels, compensation of RF pre-attenuation etc.). This allows local GSM channel conflicts and model-specific RF measurement errors to be eliminated. The AUTOTEST thus provides a reliable evaluation of the mobile phone being tested.

Using the programming option “Utility Software” the user can create user-defined AUTOTESTs, including number, sequence or evaluation of the tests.

Available functions

Running an AUTOTEST

Running an AUTOTEST requires only a few actions, provided that the test specifications have been created and saved as an MS TYPE record.

1. Call up the list of stored MS TYPE records on the tester.
2. Select the appropriate record for the mobile phone. *Is this record missing?* Entering a new MS TYPE data record only takes a few minutes and is described as of page 3-16.
3. Connect the mobile phone to the tester and insert the test SIM.
4. Start the AUTOTEST and follow the instructions on the tester display.
5. Analyze the test results. In the event of an error, the tester does not just return *FAILED*, but also lists all the measured values outside the tolerance (page 3-9).

Subsequent use of the test logs

The log for a completed AUTOTEST can be printed, deleted or archived (in the tester's memory or externally on a PC, see page 3-14).

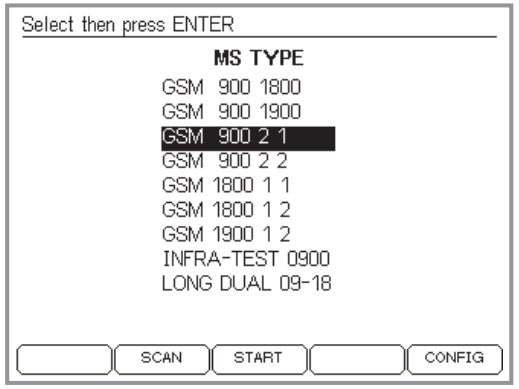
Copying MS TYPE records

It also only takes a few moments to import and export MS TYPE records. In this way, records can be protected against loss or copied from one tester to any number of other testers (page 6-14).

Finding free channels

If an AUTOTEST is repeated a number of times without producing reproducible results, it is very likely that a base station in the vicinity is using the same channels as the tester. You can check whether this is the case with the channel monitoring function, which the tester can run in conjunction with a functioning mobile phone (page 3-11).

Running an AUTOTEST



The more accurately an entry in the list characterizes a model, the less risk there is of making an error.

Be very careful to select the entry which matches the test unit exactly. It is possible that there are a number of entries for a single model. This can occur, for instance, if the test unit is to be connected via the 4916 Antenna Coupler and different battery packs are available for this model. Since the thickness of the battery pack has a considerable influence on the measurements, it is quite common for there to be a number of different entries for a model in a case of this type.

(SCAN): *see page 3-11.*
(CONFIG): *see page 3-16.*

(✓) + (AUTOTEST)

1 With the cursor keys, select from the list exactly the model you want to test (for details on adding a model to the list, refer to page 3-16ff).

Fast search function: pressing a number key repeatedly immediately places the cursor on the first entries which start with the letters assigned to the key (for instance, (7)*stu* places the cursor alternately on the first entry beginning with S, T or U).

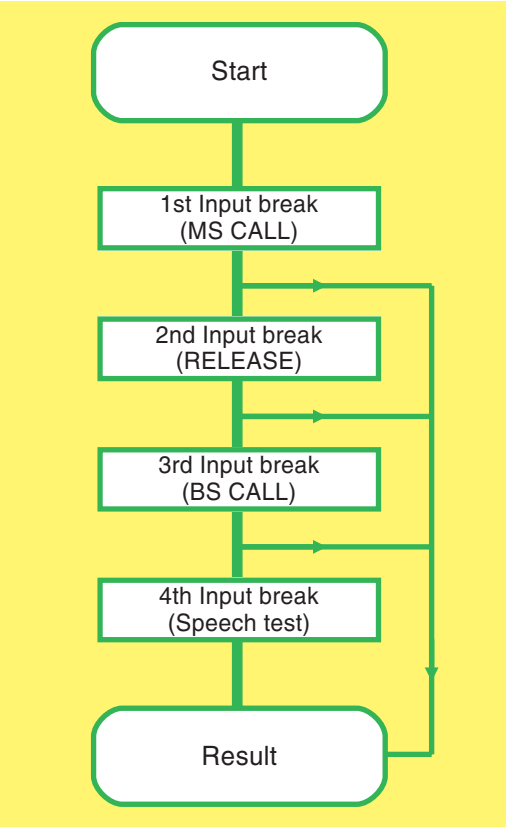
2 Switch off the mobile phone and install the test SIM (refer to page 2-15). If the name of the model as shown in the list already indicates the type of connection, then connect the test unit as indicated (refer to page 2-17).

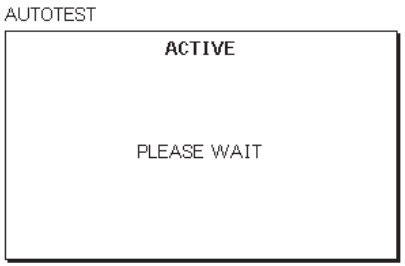
⚠ AUTOTEST only returns correct results if the appropriate connection is used (antenna, coupler or cable).

3 Start AUTOTEST by pressing (✓) or (START), switch on the mobile phone and wait until the display on the mobile phone shows the receiving signal strength or the ID of the test network (`11` or `00101`). Now follow the instructions on the display of the Willtek 4200. If the required connection type has not been clear up to now, it should be indicated at this point at the latest.

On page 3-5ff, you will find details about the entries you need to make.

A Standard AUTOTEST is carried out as follows





The following description is an example which applies to the basic standard AUTOTEST, *GSM 900 long* (available from the Willtek website). Other standard AUTOTESTs may differ considerably, and may be carried out a lot faster. User-defined AUTOTESTs are the sole responsibility of the programmers who created them. They may resemble the standard AUTOTEST in many ways, or differ quite considerably.

■ Be prepared for input breaks

A standard AUTOTEST will be interrupted some times by breaks in processing, during which the Willtek 4200 prompts you on its display to perform a certain action. The device waits as long as is necessary for you to respond (no time limit). The message *ACTIVE* displayed on the screen means that your Willtek 4200 is busy with the AUTOTEST and is not expecting an input from you.

■ When an AUTOTEST aborts

If you are quick with your inputs, a standard AUTOTEST takes around 1 minute. If the message *AUTOTEST FAILED* appears much earlier than this, it is likely that a serious error has occurred which is preventing further messages from being issued. An error of this nature (e.g. during connection setup) will result in the AUTOTEST aborting.

You can find out precisely which error led to the AUTOTEST aborting by using the tester's error analysis routine (see page 3-9).

If an AUTOTEST aborts with a message that there is not enough main memory left, you will need to delete some or all of the stored AUTOTESTs before running another test (see page 3-15).

Press Esc to cancel an AUTOTEST you have started.

The input breaks of a Standard AUTOTEST

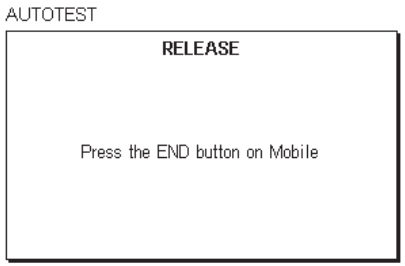
1st input During connection setup (MS CALL), the tester prompts you to dial a number on the mobile phone.

☞ Do not start to dial before the display on the mobile phone shows either the receiving signal strength or the ID of the test network (`11` or `00101`).

- Dial `1234567890` on the mobile phone (note the order!) and then press the button with function “Send”. The AUTOTEST now continues.

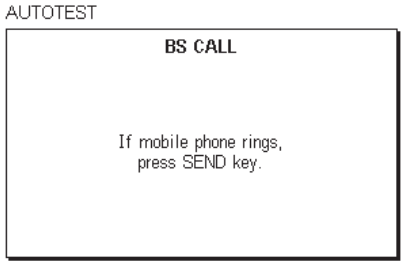
☞ Dial the number correctly. If you miss any numbers or enter them in the wrong order, the result of the test will be *FAILED*!

2nd input Provided the AUTOTEST was not aborted owing to a problem on the mobile telephone, another break occurs just before the test to see whether a connection has been set up correctly (hang up on mobile phone).

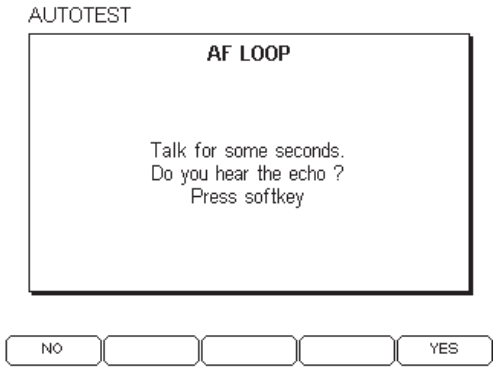


- Press the button with function “Disconnect” on the mobile phone (usually a button with a symbol of a “hung-up” receiver). The AUTOTEST continues.

3rd input Provided the AUTOTEST was not aborted owing to a problem on the mobile telephone, the tester – having again set up a connection (this time BS CALL) – now prompts you to take the call (incoming call from tester).



- When the mobile phone rings and/or displays an optical signal, press the button labeled CALL (usually the same as the key function “Call”). The AUTOTEST continues.



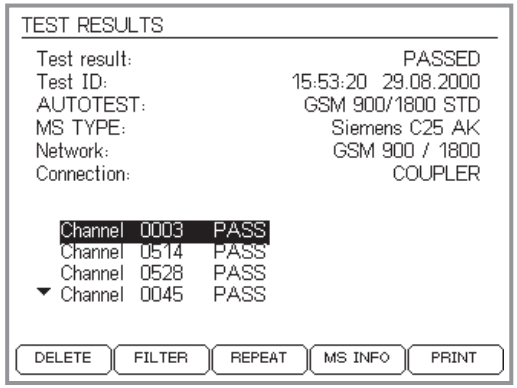
4th input Provided the AUTOTEST was not aborted owing to a problem on the mobile phone, the routine stops for the last time at the speech test. This test does not produce a positive result unless all the AF/RF components in the mobile phone's send and receive paths are in full working order.

Say a single word into the microphone of the phone. If you hear a good quality echo after approx. 1 second, press the (YES) softkey on the tester. If you do not hear anything or if the echo is distorted, press (NO). When you have pressed one of the two softkeys, the AUTOTEST proceeds without interruption to the end of the routine, where it displays the test results.

■ Lifting a tester block

In exceptional cases, defective mobile phones can result in the tester no longer responding in the course of an AUTOTEST. Should this happen, press (Esc) to cancel the test (a delay of up to 30 s is possible before anything happens). If this does not lift the block, switch off the tester briefly) and restart AUTOTEST.

Results of the AUTOTEST



Scroll arrows (▼ and ▲) on the left of the screen indicate that further results are available outside the scroll area (these can be accessed with the cursor keys).

At the end of an AUTOTEST, the tester outputs a *PASS/FAIL* assessment for each channel tested and the resultant overall assessment of *PASSED* or *FAILED*.

Test result	Overall evaluation of the AUTOTEST.
Test ID	Each log is stored and is automatically assigned an ID number (time of the test and IMEI). Pressing ⇧ + RESULTS allows you to subsequently find and evaluate a log using the ID (see also page 3-14).
AUTOTEST	Name of the AUTOTEST used.
MS TYPE	MS TYPE record used during the test.
Network	Radio system simulated.
Connection	Connection used during testing.

At the bottom of the display, the test results for each channel tested are displayed to give you an initial overview.

Softkey functions

DELETE Deletes the log of the AUTOTEST you have just run, then returns you to the *MS TYPE* menu.

FILTER Hides all non-errored test results during detailed evaluation (see page 3-9).

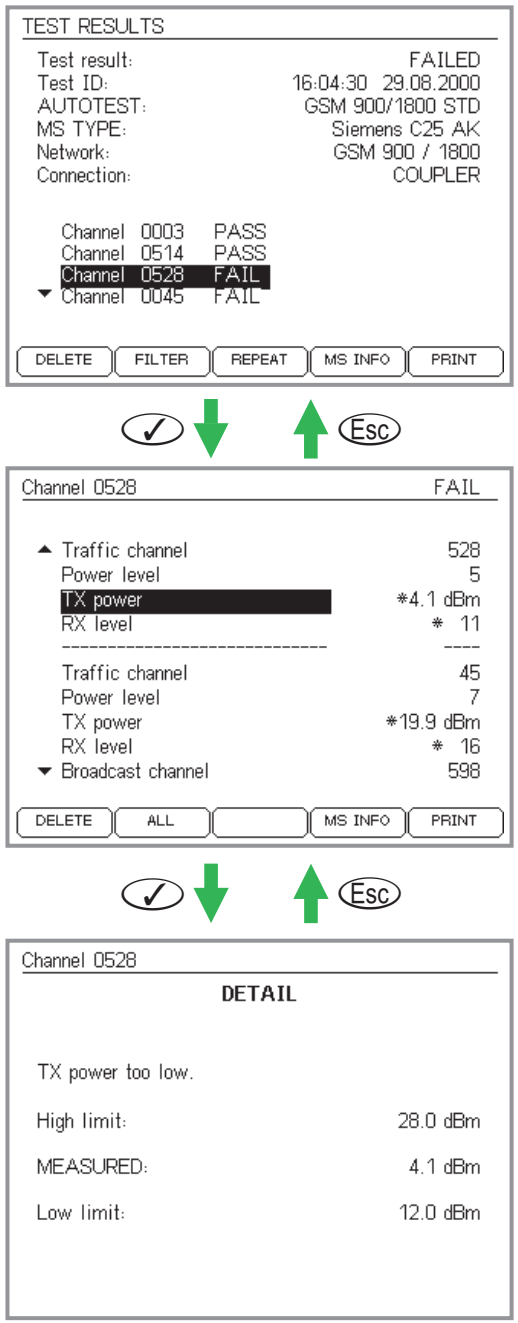
REPEAT Repeats the most recent AUTOTEST.

MS INFO Calls the *MS INFO* menu, which displays the identification data of the tested mobile phone (e.g. IMSI, IMEI, MS Power Class etc.); see also page 4-36.

PRINT Prints a log of the most recent AUTOTEST (see page 6-5 for general notes on printing and page 6-21 for uploading).

Return to the *MS TYPE* menu with Esc.

☞ *If the menu shows UPLOAD instead of PRINT you have specified that the results are to be uploaded to a PC and not sent to a printer in the Printer Setup menu (see page 2-5).*



Detailed evaluation

In addition to the overall *PASS/FAIL* evaluation of a channel, the tester also provides detailed information on the measured values underlying the evaluation. You can thus read from the display the same information as is contained in the printed AUTOTEST log.

■ Measured values and tolerance limits

1. Select any *PASS* or *FAIL* entry from the list using the cursor keys.
2. ✓ activates the first level of the detailed result display. The header line of the menu shows the number of the selected channel and the corresponding evaluation. Under this, all settings and tests (including the test result) which were run on this channel during the AUTOTEST are listed in chronological order. Test results which lie outside the permitted tolerance are marked with an asterisk ∗. For a clearer overview, choose FILTER to hide all test results which are within tolerance (ALL displays them again).
3. Use the cursor keys to select any test from the list of settings/tests.
4. ✓ activates the second level of the detailed result display if an evaluation is performed for the selected test (this is not the case for the *RX level* test, for instance). In addition to the test result (measured value), you will see the tolerance applied for the *PASS/FAIL* evaluation.
5. Esc returns you to the next menu level up.

Sample AUTOTEST log (excerpt)

```
Willtek 4201S Mobile Tester        Overall Test Result : FAILED
  AUTOTEST: GSM Standard   (GSM / E-GSM)
  Test ID : 09:58:42  17.04.99
  Mobile connection via : CABLE

  IMSI : 001011234567890        IMEI : 490125513271390
  MS Power Class : 4 (33 dBm)   Revision level : Phase 1
  Extended freq. : NO           SMS : YES   A5 : 1

  Pre attenuation : 1.5 dB
  RF output -60.0 dBm
  Broadcast channel 63
  Traffic channel 3
  Power level 9                                 (25dBm)

Call from Mobile        PASS
  Dialled number        PASS     1234567890    (1234567890)
Mobile release          PASS
  Broadcast channel 63
  Traffic channel 27
  Power level 5                                 (33dBm)

Call from Basestation   PASS
  Power Time template   PASS
  TX power              PASS       35.1 dBm    (29.0 - 37.0 dBm)
  RMS phase             PASS       3.63 deg    (0.00 - 8.50 deg)
  Peak phase            PASS       9.68 deg    (0.00 - 23.50 deg)
  Freq. error           PASS         12 Hz     (-140 - 140 Hz)
  Burst length          PASS        559 us     ( 543 - 563 us)
  RX level              FAIL  *      63        (  45 - 55)
  RX quality            PASS         0        (   0 - 0)
  RF output -80.0 dBm
  Power level 9                                 (25dBm)
  Power Time template   PASS
  TX power              PASS       26.9 dBm    (20.0 - 30.0 dBm)
  RMS phase             PASS       2.52 deg    (0.00 - 8.50 deg)
  Peak phase            PASS       7.76 deg    (0.00 - 23.50 deg)
  Freq. error           PASS        -12 Hz     (-140 - 140 Hz)
  RX level              FAIL  *      42        (  25 - 35)
  RX quality            PASS         0        (   0 - 0)
  RF output -96.0 dBm
  BER                   PASS       0.00 %      (0.00 - 0.30 %)
  RF output -102.0 dBm
  BER                   PASS       0.00 %      (0.00 - 2.44 %)
  RF output -80.0 dBm
  Power level 14                                (15dBm)
Traffic channel 123
  TX power              PASS       18.0 dBm    (10.0 - 20.0 dBm)
  RMS phase             PASS       2.58 deg    (0.00 - 8.50 deg)
  Peak phase            PASS       8.70 deg    (0.00 - 23.50 deg)
```

Checking channel usage

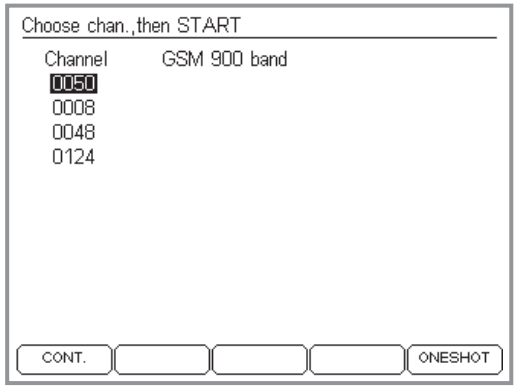
If base stations in the vicinity are using the same RF channels as a wIlltek 4200, this can lead to measurement errors or hinder the mobile phone from checking into the network provided by the tester.

Before starting an AUTOTEST, you should therefore use a functioning reference mobile phone as an RF probe to check whether the channels used by the tester are actually free.

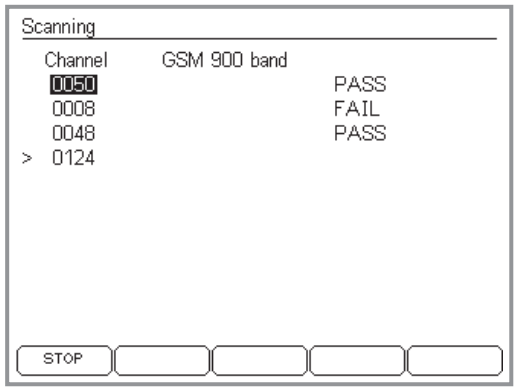
■ Preparation

- **Once only before commencing:** Create an MS TYPE record for the reference mobile phone (see page 3-16ff). When creating the record, choose the correct radio system (e.g. GSM 900) and the connection method (*CABLE* or *COUPLER*) which will subsequently be used during the AUTOTEST. Using the *ANTENNA* connection method is not suitable, as it is very susceptible to external influences. The other MS TYPE settings can be made as you wish, or they have no significance for channel checking.
- **Prior to each channel check:** Connect the reference mobile phone to the tester as specified in the MS TYPE record (described above). Do not switch on the mobile phone yet.

Channel monitoring



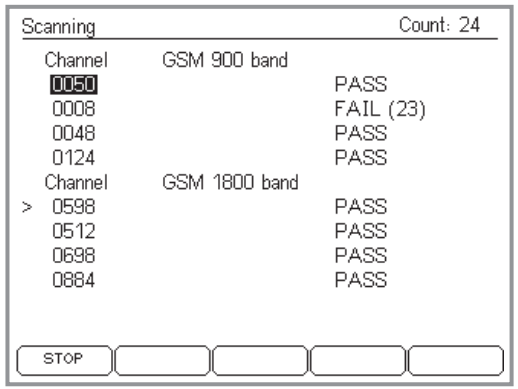
With GSM 900 or other single-band systems, four channel numbers are shown. With dual-band systems, four channels are shown for each band, e.g. four for GSM 900 and four for GSM 1800.



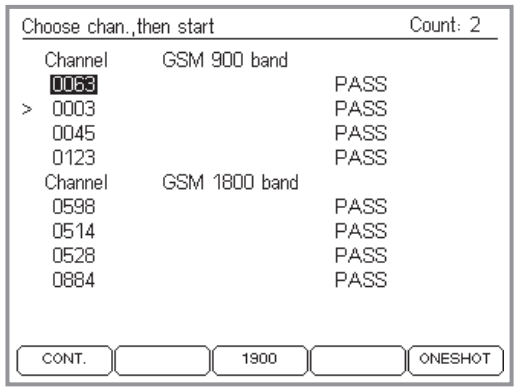
During the channel monitoring process, the tester rates free channels with PASS and occupied channels with FAIL.

(✓) + AUTOTEST + Select MS TYPE + SCAN

1. (✓) + AUTOTEST to call up the list of MS TYPE records and move the cursor to the record for the mobile phone which is to be tested (after channel checking has been completed). Do *not* confirm your selection with (✓).
2. Press SCAN.
   A menu appears which shows channel numbers in the *Channel* column. The values for these channel numbers have been taken from the MS TYPE record (BCCH signaling channel and TCH voice channels, see page 3-22). These are the numbers of the channels which are to be checked to identify whether they are occupied.
3. Make a note of the channel numbers displayed and press Esc to return to the MS TYPE list.
4. Now move the cursor to the MS TYPE record of the reference mobile phone. Do *not* confirm your selection with (✓).
5. Press SCAN.
   Move the cursor to the channel numbers in the *Channel* column, enter the values you noted previously (in any order) and confirm each of your entries with (✓).
6. Start the channel monitoring function:
   CONT. Continuous testing (press STOP to quit)
   ONESHOT Single test
   After the channel monitoring function has been started, the tester waits for an MS CALL (connection established by mobile phone).
7. Now switch on the reference mobile phone. As soon as the display shows the ID of the test network (`11` or `00101` or similar), enter any number and press the send key (establish connection).



In this example, the GSM 900/1800 band is being monitored. In the top right, you can see the total number of monitoring cycles. The value displayed beside FAIL shows the number of cycles for which the channel was occupied.



For multiband mobile phones: First use the softkey to set the correct band (900/1800, 1900) and then start channel monitoring using (CONT) *or* (ONESHOT).

8 The reference mobile phone now determines the RF receive level on each specified channel. The tester analyses these measurements and returns the result for each channel individually

PASS	Channel is free
FAIL	Channel is occupied

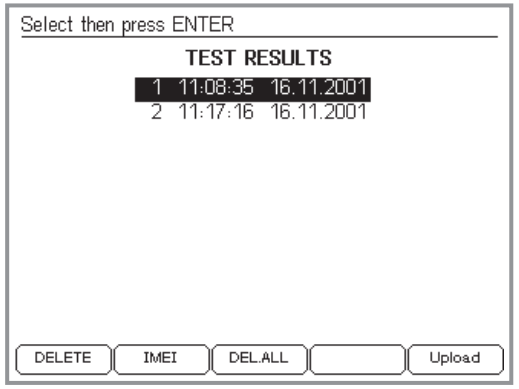
With respect to this analysis, it should be noted that base stations occupy more or less voice channels, depending on their current load and that for this reason, a channel which was free a moment ago can suddenly be occupied. Continuous monitoring over a longer period using (CONT) should clarify the issue. During continuous testing of this sort, the tester returns *FAIL* for any channel which was occupied at least once during the monitoring period.

■ Evaluation

☺ If the channel monitoring process results in *PASS* for all the monitored channels, the checked MS TYPE record can be used for starting AUTOTESTs without modification. Measurement errors caused by base stations in the vicinity are not to be expected..

☹ Where *FAIL* is returned, enter a new channel number (old value ±2) and repeat the channel monitoring process until no channels fail. Add any free channel numbers which are found to the MS TYPE record (see page 3-22).

Evaluating stored AUTOTESTs



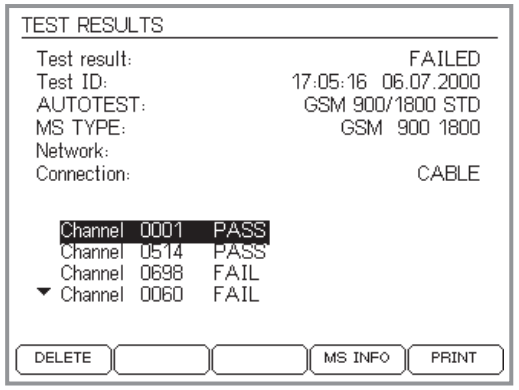
Using (IMEI)/(Date) you can also display the stored test logs sorted by the time of the test or by the IMEI.

⇦ (✓) + (RESULTS)

Provided you do not delete it the moment you have finished running the AUTOTEST, a log will be stored in your Willtek 4200 each time an AUTOTEST is run. For the purposes of identification (ID), the tester automatically uses the IMEI of the mobile phone and the time (time and date) at which the AUTOTEST was started. This ID appears at the bottom of each AUTOTEST, and will help you locate a specific log at a later point in time.

■ Selecting a stored log

1. Press (✓) + (RESULTS) to display a list of AUTOTEST logs you have stored.
2. Use the cursor keys to select the ID (AUTOTEST) you are looking for. A scroll arrow in the left-hand margin indicates that there are more IDs outside the visible area of the window. The [←] and [→] cursor keys place the cursor bar at the top and bottom of the list respectively. Use (↑↑) and (↓↓) to browse page-by-page.



⇦ (✓) + (RESULTS) + Select ID + (✓)

3. Press (✓) to display a profile of the chosen AUTOTEST log with its significant data. If this is the log you are looking for, you can now either delete it or print it out. Select (Esc) to return to the list.
4. Select (✓) + (AUTOTEST) or (✓) + (FAULT FIND) to return to the mode you require.

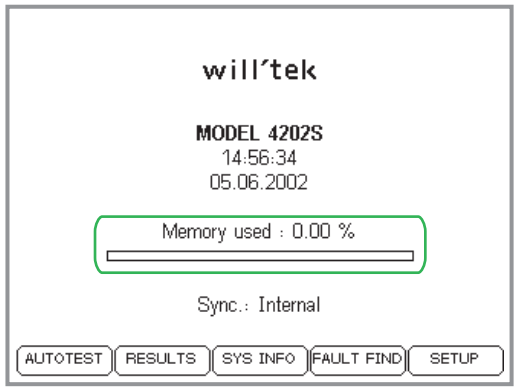
Softkey functions

(DELETE) Deletes the AUTOTEST log currently selected (after a confirmation prompt).

(IMEI)/(DATE) Displays the test logs sorted according to the IMEI of the tested object, or the time of the test (time and date).

(DEL . ALL) Deletes all stored AUTOTEST logs (after a confirmation prompt).

(PRINT) Prints the complete log of the AUTOTEST currently selected (see page 6-5 for general notes about printing). If the menu shows (UPLOAD) instead of (PRINT) you have specified that the results are to be uploaded to a PC and not sent to a printer in the Printer Setup menu (see page 2-5).



Available capacity for storing AUTOTESTs

There is space in the memory for approx. 300 standard AUTOTEST logs. The actual number might be considerably more or less than this in the case of user-defined AUTOTESTs, which can vary in size.

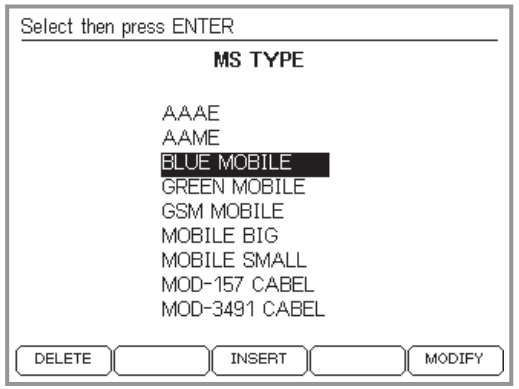
When the memory is full, an error message is issued the next time you attempt to run an AUTOTEST, or while an AUTOTEST is in progress. If this happens, you will need to free some capacity by deleting one or more stored logs.

Downloading logs to a PC

If you want to avoid losing any logs, or intend to archive logs for statistical evaluation at a later date, it is worthwhile transferring saved logs to a PC (see page 6-16 and page 6-21).

Creating MS TYPE records

Correct test specifications in the form of MS TYPE records are of decisive importance: On the one hand, they prepare an AUTOTEST in such a way that it can subsequently be started at the touch of a button. On the other hand, the test parameters can control an AUTOTEST in such a way that the test results do not give errors from either model-specific features or from local GSM channel conflicts.



(DELETE) *deletes the marked record from the list.*
(INSERT) *allows you to create a new record.*
(MODIFY) *allows you to edit the marked record.*

(key) + (AUTOTEST) + (CONFIG)

☞ The *MS TYPE* menu only shows entries for which test parameter records have been created.

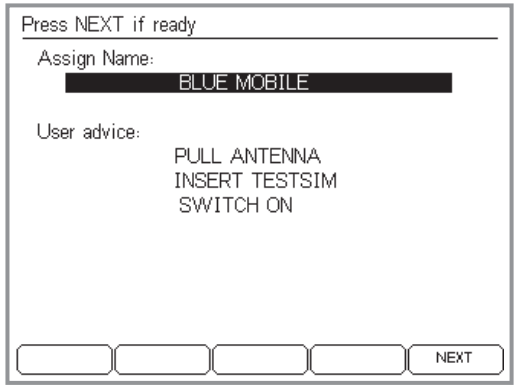
Entry of the test parameters involves only a few steps, described on the following pages:

- **Assigning a name to the record**
- **Selecting the radio system and the connection type**
- **Selecting the required AUTOTEST**
- **Entering the channel numbers and the compensation values for RF pre-attenuation**

As usual, the (Esc) key returns you to the previous menu while you are entering the test parameters.

☞ Please note that the test parameters are valid only for the type of mobile phone for which they were entered. Models which vary only in their construction (for example a different battery pack) may need a new set of test parameters to be created. This is particularly true for wireless connections with the 4916 Antenna Coupler.

1. Assigning a name to a record



One line is available for the name of the record (shown at the top) and up to four lines are available for user information (shown at the bottom).

If other persons subsequently run AUTOTESTs, you should always provide detailed information. Unclear or incomplete information can lead to an inappropriate AUTOTEST being started. If, for instance, the connection type is not clear without additional information, you should indicate the correct connection type, and it is best to do this in the record name.

It should be noted that battery packs of different thicknesses for mobile phones can affect the results. Depending on the model, these can cause considerable fluctuations in the measurements if the 4916 Antenna Coupler is used.

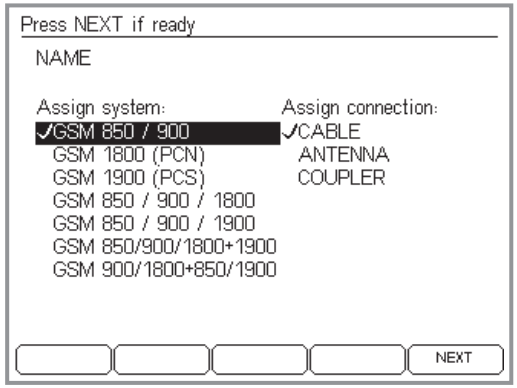
+ AUTOTEST + CONFIG + INSERT

All the test parameters are stored in a single record, which should be provided with a meaningful name (the type of mobile phone for which the parameters are valid). The name subsequently appears in alphabetical order in the *MS TYPE* menu where it serves to directly start model-specific AUTOTESTs.

In addition, you can enter a longer text which is subsequently displayed immediately before the AUTOTEST is started (for instance user information or advice which is important for correct execution of the test).

1. Use the cursor keys to select the required input line.
2. Enter the text letter by letter (digits are also allowed) using the keys of the numeric keypad. Automatic text entry also applies here (refer to page 2-7).
3. Press ✓ to confirm the text you have entered.
4. Use the cursor keys to move to the next input line and enter text or proceed by pressing NEXT.

2. Selecting the radio system

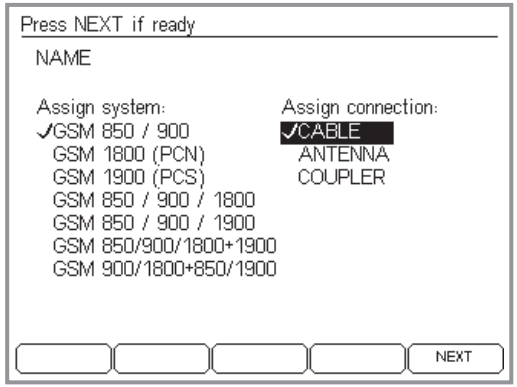


+ AUTOTEST + CONFIG + INSERT + NEXT

Select the radio system used by the mobile phone.

1. Use the cursor keys to select the required system. *GSM 850* is only available if this option has been installed (see page 1-18).
2. Press ✓ to confirm your selection.

3. Selecting the connection type

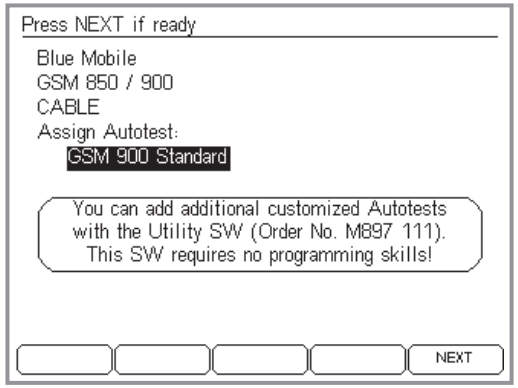


+ AUTOTEST + CONFIG + INSERT + NEXT

Select the type of connection to be used when the mobile phone is subsequently tested. Refer to page 2-17ff for information on choosing the right connection.

1. Use the cursor keys to select the required connection.
2. Press ✓ to confirm your selection.
3. Press NEXT to proceed.

4. Selecting the AUTOTEST



At the bottom of this menu only those AUTOTESTs are listed which match the test parameters listed at the top of the display.

Note regarding Utility software

If the tester has standard AUTOTESTs installed and nothing else, a message appears on the display indicating the availability of the Utility software (option). This Windows program can be used to write user-specific AUTOTESTs quickly and simply. No programming skills are required.

A WIlltek 4200 has at least six AUTOTESTs stored (one standard AUTOTEST for each supported radio system). Since the test specification "Radio system" in the example above is "GSM 900", only this standard AUTOTEST is displayed in the list.

⇦ + AUTOTEST + CONFIG + INSERT + 2 x NEXT

The top part of this menu shows a summary of the test parameters already set. This is important because the bottom part of the menu does not simply list all the AUTOTESTs stored in your Willtek 4200, but rather lists only those which match the parameters for the *radio system* and the *connection*. These two test parameters filter out the matching AUTOTESTs from those which are stored. The following section provides information on the standard AUTOTESTs available ex works. You will have to find the information on the tests and measurements performed by a user-defined AUTOTEST yourself.

1 Use the cursor keys to select the required AUTOTEST which will then be started when the mobile phone is tested.

2 Press NEXT to proceed.

■ At least one AUTOTEST

If the list does not display the AUTOTEST you are expecting, you should first check the two test parameters. The standard AUTOTESTs available ex works (one for each radio system and the dual-band systems) permit all three possible variants for the *connection* test parameter. For this reason, the list always shows at least the standard AUTOTEST which matches the radio system test parameter (e.g. *GSM 900 Standard*). The word *Standard* always follows the radio system in the names of standard AUTOTESTs.

Background: AUTOTEST

A WIlltek 4200 can store and run two variants of an AUTOTEST:

- Standard AUTOTESTs (installed at the factory)
- User-defined AUTOTESTs (using the Utility Software option)

Standard AUTOTESTs

To make the correct choice in selecting AUTOTESTs, you need to know what tests and measurements are carried out during the routine. The table below provides information on all the standard AUTOTESTs (depending on the radio system). Please note the effect of the connection type.

Applies only for standard AUTOTESTs				
Test/measurement		Wireless		Cable
		Antenna	Coupler	
1	RF output power		✓	✓
2	Bit error ratio (BER)			✓
3	Frame erasure ratio (FER)			✓
4	Phase error (RMS/peak)	✓	✓	✓
5	Frequency error	✓	✓	✓
6	RX level		✓	✓
7	RX quality			✓
8	Power/time template		✓	✓
9	IMSI/IMEI	✓	✓	✓
10	Antenna	✓	✓	
11	Keypad	✓	✓	✓
12	Call to/from mobile phone	✓	✓	✓
13	Connection release	✓	✓	✓
14	Audio loopback	✓	✓	✓

Depending on the connection type, certain tests are not carried out, either because they are not possible (antenna test for a cable-based connection) or because the result would be unreliable due to external influences.

PASS or FAIL
With standard AUTOTESTs, correct FAIL evaluation requires the GSM limits to be increased by the measurement tolerances caused by physical phenomena. This method is in common practice and means that a mobile phone which lies just outside the GSM limits will be passed. At the same time, it is not possible for a fully functional mobile phone to be failed.

In all standard AUTOTESTs, *PASS/FAIL* evaluation of the test results is based on the limits prescribed by ETSI (European Telecommunications Standards Institute) in its official “GSM Recommendations”. If, however, measurement tolerances are disregarded, it is possible that a mobile phone which lies just inside the limits may be failed incorrectly. To prevent this from happening, standard AUTOTESTs use slightly larger tolerance windows (GSM limits + measurement tolerance) during evaluation.

Measurement	Added Measurement Tolerances	
	GSM900/E-GSM	GSM1800/1900
RF Level	±1.0 dB	±1.0 dB
Peak Vector	±1.3°	±1.3°
RMS Vector	±1.3°	±1.3°
Frequency offset	±15 Hz	±30 Hz
Burst length	±0 µs	±0 µs
RX Sens	±1.0 dB	±1.0 dB

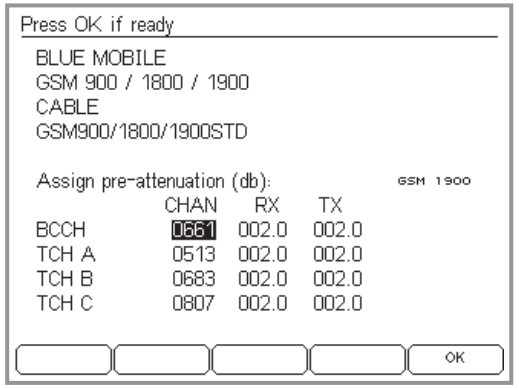
■ User-defined AUTOTESTs

User-defined AUTOTESTs can allow for design-specific features of mobile phones and thus make highly reliable PASS/FAIL decisions.

The Utility Software (option `897 110`) allows you to create user-defined AUTOTESTs and load them into the Willtek 4200 (see the User Guide for the Utility Software). Here you can modify the limits governing *PASS/FAIL* evaluation and the number and order of individual measurements. So-called “question boxes” allow queries or instructions to be directed at the user at any time during the execution of the test. The user must then react to the question box (by pressing a softkey) before the AUTOTEST continues.

A Willtek 4200 is able to store up to 20 user-defined AUTOTESTs.

5. Channel selection



Low – Middle – High

To ensure that frequency-dependent defects are not hidden, it is advisable to choose three TCH numbers which are evenly spread out across the frequency band.

Only for dual and multiband:

If, when selecting the radio system, you have already selected a dual or multiband system, the above menu will be shown separately for each band. (NEXT) *takes you to the next band and #Esc# takes you back to the previous one. In the line "Assign pre-attenuation" you can see which band is currently selected. When you reach the last band, the* (OK) *softkey will be displayed. Use* (OK) *to confirm all the entries you have made and pass the information to the tester. If you have selected a single band radio system, the* (OK) *softkey is displayed immediately.*

(⇦) + (AUTOTEST) + (CONFIG) + (INSERT) + 3 x (NEXT)

In this menu, you enter the numbers of the channels which your Willtek 4200 will subsequently use to test the mobile phone. One signaling channel (BCCH) and three voice channels (TCH) are tested. See page 3-11 for details on free channels.

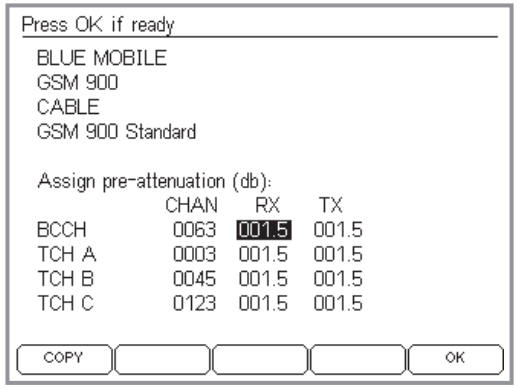
1. Use the cursor keys to select the line you require in the *CHAN* column (*BCCH, TCH A, TCH B*, or *TCH C*).
2. Enter the channel number. Make sure that you do not enter the same channel number twice.

Permissible channel numbers (BCCH and TCH)	
GSM 850 (option)	0128 through 0251
GSM 900	0001 through 0124
E-GSM	0000 through 0124 and 0975 through 1023
GSM-R (4202R only)	0000 through 0124 and 0955 through 1023
GSM 1800 (PCN)	0512 through 0885
GSM 1900 (PCS)	0512 through 0810

3. Press (✓) to confirm your input. Invalid channel numbers are detected and rejected.
4. Select the next channel and repeat the procedure. Do not leave the menu when you have finished, since the compensation values still have to be entered.

☞ **BCCH channel number:** To avoid malfunctions (particularly with wireless connection), do not use the signaling channels of nearby base stations.

6. Entering compensation values



Are you using original Willtek accessories for a cable-based connection? Then you can simply accept the factory settings for the compensation values.

If the cursor is in one of the columns RX or TX, the value at the current cursor position can be copied to all the fields below that field using (COPY)*. The* (COPY) *key only appears if this method of rapidly entering identical values is feasible.*

If you have selected the a dual-band or multiband system as the radio system, you can enter the compensation values separately for each band. (NEXT) *takes you on to the next band,* (Esc) *takes you to back to the previous one (see page 3-22).*

⚠ *Incorrect compensation values (which deviate from the actual attenuation values) distort those test results which are based on the value for the RF signal level.*

⇦ (↩) + (AUTOTEST) + (CONFIG) + (INSERT) + 3 x (NEXT)

The last parameters you need to enter are the values used to compensate for RF signal attenuation. To allow correct RF level measurements at different frequencies, this pre-attenuation can be compensated for separately on the RX and TX signal paths for each channel (refer to the section on “Background” for details).

1. Use the cursor keys to move to the required input field (*RX* or *TX*).
2. Use the number keys to enter the overall attenuation of the RF signal in decibels.
3. Press (✓) to confirm your entry.
4. Select the next field and repeat the procedure or use the (COPY) key.
5. Press (OK) to finish entering the test parameters. The record is saved under the specified name. The *MS TYPE* menu then appears in the display. Now you can create another record for a different model of mobile phone.

Background: signal attenuation

If a test unit is connected to the Willtek 4200, the connection (cable, RF adapter or linear distance between the antennas) will attenuate the RF signal. This means that the mobile phone receives a signal that is reduced by this attenuation, and the tester is unable to measure the phone’s actual output power. False readings such as these can be avoided by mathematically compensating for signal attenuation, provided the attenuation value is known.

Effect of the connection type

4916 Antenna Coupler

The test conditions can be calculated to a sufficient degree of accuracy to allow a meaningful compensation. However, since the attenuation of signals to and from the mobile and the coupler (signal attenuation) is frequency-dependent, you must take the receive and transmit paths into account. This is because GSM radio systems transmit and receive in different frequency bands (refer also to page 6-2). The signal attenuation values can therefore fluctuate considerably between the transmit and receive directions. Compensation allows you to take account of this by entering separate values for the RX and TX paths.

The RF signal paths RX and TX always refer to the mobile phone (rather than the tester):

`RX` Receive path of the mobile phone (corresponds to the transmit path of the tester).

`TX` Transmit path of the mobile phone (corresponds to the receive path of the tester).

Cable

Compensation is set to an optimum value for cable-based connection. This type of connection is nearly not frequency-dependent, so that it is not necessary to distinguish between the receive and send paths of the RF signal (RX/TX). The same compensation value is valid for both paths.

Antenna

Compensation is meaningless for a simple antenna connection. External influences have such a wide effect on RF signal attenuation that compensation does not improve the accuracy of measurements.

Determining compensation values

The 4916 Antenna Coupler can be used with other test equipment and also for analog phones.

Precautions are necessary to avoid interference, and the test equipment needs to have an RF power offset facility of at least 15 dB for displayed values to be valid after correction.

Since simple antenna connection is of no relevance here, we only need to consider compensation values for the remaining two connection types. If you are using a cable-based connection, it is very simple to determine the compensation values.

■ Cable-based connection

In this case, it is sufficient to enter a fixed compensation value in the RX and TX entry fields:

1.5 applies for GSM/E-GSM
2.0 applies for PCN (DCS1800)/PCS (DCS1900)

Values are identical for the RX and TX signal paths, since a cable-based connection is not frequency-dependent. Please note that these values only apply if you are using Willtek original accessories (cable, RF adapter).

■ 4916 Antenna Coupler

Deviations of up to 20 dB
Measurements performed in the Willtek laboratories have shown that the coupling attenuation of the 4916 Antenna Coupler depends to a large degree on the model of the mobile phone (deviations of up to 20 dB). Battery packs of different thicknesses and the degree to which the antenna is extended have a significant effect on the coupling attenuation value. For this reason, it is impossible to provide a compensation value which is valid for all types of phones, battery and antenna combinations.

Fortunately, you do not need an RF signal generator and monitoring decoder to derive the compensation values for the coupler. In practice, a Willtek 4200 and a **correctly functioning** mobile phone are sufficient for the job.

1. Secure the mobile phone in the clamp on the 4916 Antenna Coupler.
2. Create a record for the mobile phone with appropriate test parameters. For the connection method, select *COUPLER*, choose the standard AUTOTEST listed and enter the value 0 in all the entry fields for the RX and TX compensation values.
3. Start an AUTOTEST using the record you have just created and then print the test log. If *FAIL* comments appear, this is due to the 0 dB compensation values and should be disregarded.

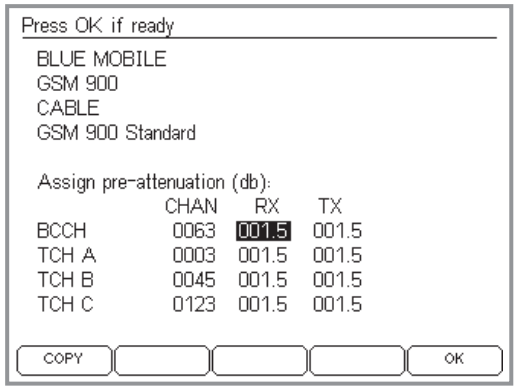
*Depending on the radio system and the type of connection, it is possible that the log will differ from the example shown on the right (GSM). The only important values are the **TX power** and **RX level** lines which appear in the log once for each traffic channel.*

Measurements

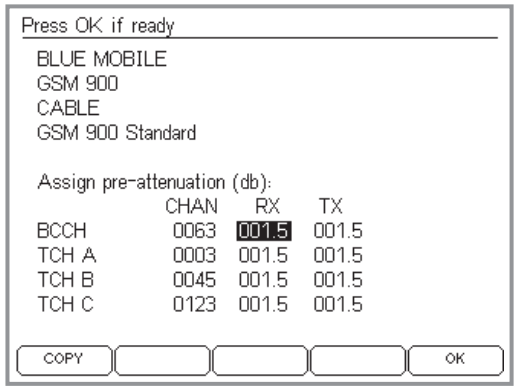
```
   Traffic channel 3
   Power level 9                                    (25dBm)

 Call from Mobile          PASS
   Dialled number          PASS      1234567890     (1234567890)
   Power Time template     PASS
A1 TX power                PASS       22.1 dBm      (20.0 - 30.0 dBm)
   RMS phase               PASS        3.63 deg     (0.00 - 7.50 deg)
   Peak phase              PASS        9.68 deg     (0.00 - 22.50 deg)
   Freq. error             PASS          12 Hz      (-115 - 115 Hz)
   Burst length            PASS         559 us      ( 543 - 563 us)
A2 RX level                PASS          26         (  25 - 35)
   RX quality              PASS           0         (   0 - 0)
 Mobile release            PASS
   Broadcast channel 63
   Traffic channel 27
   Power level 5                                    (33dBm)

 Call from Basestation     PASS
   RF output -80.0 dBm
   Power Time template     PASS
B1 TX power                PASS       29.4 dBm      (28.0 - 38.0 dBm)
   RMS phase               PASS        3.63 deg     (0.00 - 7.50 deg)
   Peak phase              PASS        9.68 deg     (0.00 - 22.50 deg)
   Freq. error             PASS          12 Hz      (-115 - 115 Hz)
   Burst length            PASS         559 us      ( 543 - 563 us)
B2 RX level                PASS          25         (  25 - 35)
   RX quality              PASS           0         (   0 - 0)
   RF output -96.0 dBm
   BER                     PASS        0.00 %       (0.00 - 0.30 %)
   RF output -102.0 dBm
   BER                     PASS        0.00 %       (0.00 - 1.50 %)
   FER                     PASS        0.08 %       (0.00 - 0.10 %)
   RF output -80.0 dBm
   Power level 14                                   (15dBm)
   Traffic channel 123
C1 TX power                PASS       12.6 dBm      (10.0 - 20.0 dBm)
   RMS phase               PASS        2.58 deg     (0.00 - 7.50 deg)
   Peak phase              PASS        8.70 deg     (0.00 - 22.50 deg)
   Freq. error             PASS         -52 Hz      (-115 - 115 Hz)
   AF loop                 PASS
C2 RX level                PASS          27         (  25 - 35)
 Basestation release       PASS
```

4 In your log, identify the six lines marked in the extract from the sample log shown above and make a note of the measurements (e.g. A1 = 22.1) and the corresponding TCH channel number.

5 Use the difference table below to derive the compensation values. Replace the values A1 through C2 with the relevant measurements. The table is structured in the same way as the menu in which you enter the compensation values. All you have to do is to enter the results in the corresponding fields.



	CHAN	RX	TX	
		GSM/PCN/PCS	GSM 900 only	PCN/PCS
BCCH				
TCH A		30 – A2	25 – A1	12 – A1
TCH B		30 – B2	33 – B1	20 – B1
TCH C		30 – C2	15 – C1	2 – C1



For the BCCH signaling channel, you should use the values of the nearest TCH channel (this approximation is permissible since no RF measurements are carried out on the BCCH channel).

⇦ + AUTOTEST + CONFIG + MODIFY + 3 x NEXT

6 In the *MS TYPE* menu, select the appropriate record for the mobile phone and correct the compensation values there. Then save the record by pressing OK. A Willtek 4200 can store up to 100 records of this type.

Copying records

The “Data Exchange” utility program allows you to copy all MS TYPE records and AUTOTESTs to a different Willtek 4200 (see also page 6-14). Alternatively, you can save a copy of the records on your PC’s hard disk, so that you can revert to this backup in the event of data loss.

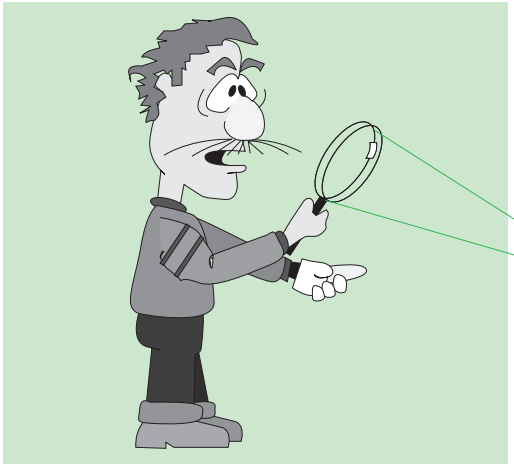
⚠ During the copy operation, all MS TYPE records and AUTOTESTs on the target tester will be overwritten!

4X00 Data Exchange (`de4X00.exe`) is provided on the accompanying CD. The current version of the program is available for downloading free of charge in the Internet:

http://www.willtek.com

FAULT FIND

Overview

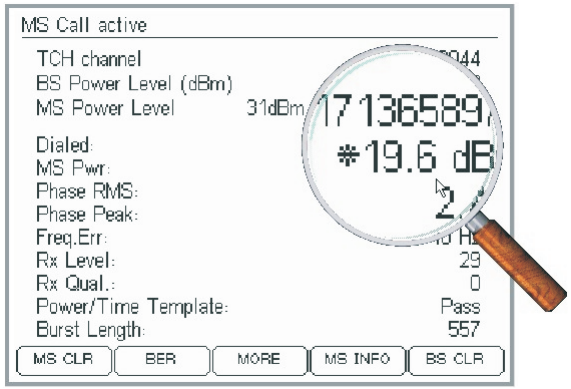


In FAULT FIND mode a Willtek 4200 shows its sophisticated test capability; but correct interpretation of the test results and measurements does demand a certain amount of expertise with GSM and measurement techniques.

In FAULT FIND mode you have access to all the tests that a Willtek 4200 is capable of performing. This includes those tests which are run automatically in AUTOTEST mode. You can also add further tests, and numerically displayed measurements help you to selectively identify important quality parameters of a mobile phone.

Expert mode

In the FAULT FIND operating mode, the measurements that lie outside the permitted tolerances are marked with a ✳. Unlike the AUTOTEST operating mode, FAULT FIND offers the user a way of individually specifying the tolerance limits for measurements (e.g. permitted frequency offset). That means that FAULT FIND tests are more suitable for experts who want to pinpoint the source of faults on the basis of individual test results and measurements or for alignment of mobile phones.



◀ *The asterisk in front of a measurement draws your attention to the fact that this measurement is outside the permitted tolerances (see page 4-13).*

Available modes

Depending on the precise model of the Willtek 4200 series, FAULT FIND mode provides the following modes for tests on mobile phones:

SPEECH
available in all Willtek 4200

The tester simulates transmit/receive voice operation of a base station by exchanging signals with the mobile phone depending on the situation. It is possible to carry out tests on unknown mobile phones.

GPRS
option for Willtek 4202S

The tester simulates the GPRS base station. The testing depth depends on the installed GPRS option (Go/NoGo or measurement). Tests in GPRS mode are described as of page 4-67.

VGCS (GSM-R)
available in Willtek 4202R

Tester simulates Voice Group Call Service functions of a GSM-R base station in transmit/receive mode. Tests in VGCS mode are described as of page 4-47.

DATA 9600
available in full in Willtek 4202S + 4202R + 4201A
partially available in Willtek 4201S

Identical to speech mode, but testing of data connections at 9600 bit/s and no voice test. Tests in speech/data mode are described as of page 4-4. Restrictions for Willtek 4201S: a) If user-specific AUTOTESTs contain data calls (programmed using the Utility software option), these will be ignored by the tester. b) No remote controlled data connections (see chapter 5).

SMS
available in Willtek 4202S + 4202R

The tester simulates the SMS function of a base station in transmit/receive mode by exchanging signals with the mobile phone depending on the situation. Tests in SMS mode are described as of page 4-50.

DE-TUNING
option for all Willtek 4200

Special mode which permits a defined frequency offset for the BCCH signaling channel. Tests in de-tuning mode are described as of page 4-65.

ANALYZER
available in all Willtek 4200

The mobile phone is in a special test mode. The tester evaluates RF signals from the mobile phone and does not send any signals. This is the factory service mode. Tests in asynchronous mode are described as of page 4-57.

RF GENerator
available in all Willtek 4200

The tester generates a defined RF carrier signal, unmodulated, GMSK or amplitude-modulated as required. Tests in RF GENerator mode are described on page 4-64.

Preparing speech/data mode

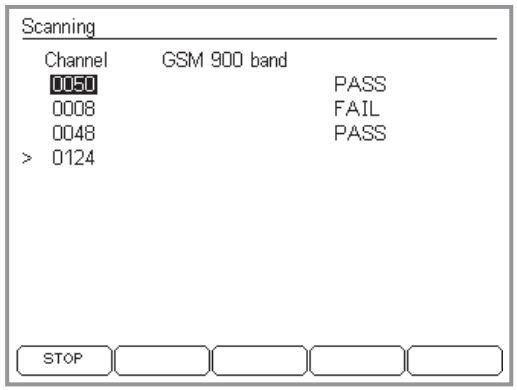
You only need to carry out preparations once

Once you have fully prepared speech/data mode, you can start testing immediately when you subsequently call speech/data mode. This is because all the settings you make on the tester during preparation are saved and apply until you make any changes.

Test preparation in speech/data mode involves a maximum of seven steps:

- Check channel usage.
- Choose radio system and call speech or data 9600 mode.
- Set channels/RF power.
- Compensate for signal attenuation.
- Connect mobile phone and insert test SIM.
- Set special parameters.
- Carry out location update.

Checking channel usage



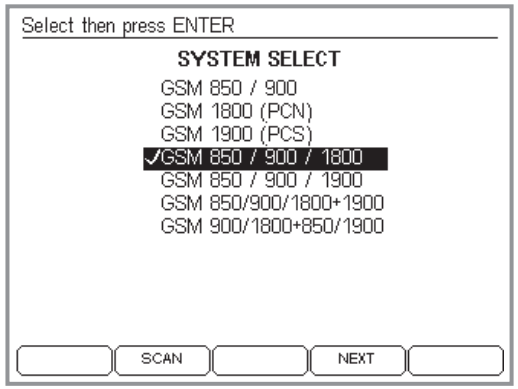
The appearance of this menu will depend on the radio system you have selected (in this case, GSM 900). When you call the function, the menu always shows the channel numbers last used in FAULT FIND mode.

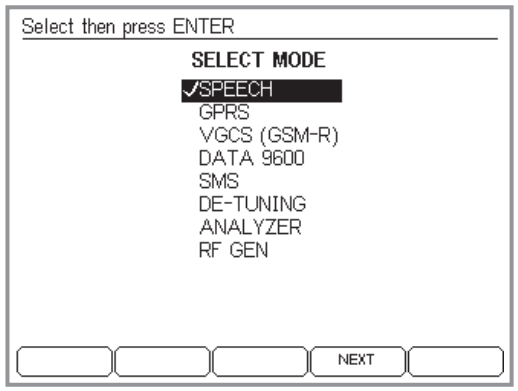
(key) + FAULT FIND + SCAN + ONESHOT

Checking current channel usage in the GSM band serves to check whether base stations in the vicinity could falsify the results. The procedure is described in detail for AUTOTEST mode as of page 3-11. Some of the steps are not required in FAULT FIND mode.

Brief instructions

1. Connect the reference mobile phone in the same way as the mobile to be tested will be connected (cable or antenna coupler).
2. Press (key) + FAULT FIND and then select the radio system (confirm choice with ✓), then press SCAN.
3. Under *Channel*, enter the numbers of the channels to be checked.
4. Start channel monitoring with CONT. or ONESHOT and repeat, changing the channel numbers if necessary, until the menu shows *PASS* for all channels.





Selecting the radio system/mode

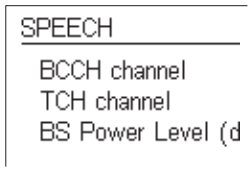
A Willtek 4200 is able to carry out tests on mobile phones using different GSM radio systems. Therefore test preparation in FAULT FIND mode starts with the selection of the radio system.

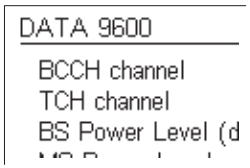
⇦ + FAULT FIND

1. Position the cursor on the radio network to which the mobile phone belongs. *GSM 850* is only available if this option as been installed (see page 1-18).
2. Press ✓ to confirm your selection.
3. Press ✓ or NEXT to proceed to the *SELECT MODE* menu.
4. Use the cursor keys to select *SPEECH* from the *SELECT MODE* menu (tests with a voice connection) or *DATA 9600* (tests with a data connection) and confirm your choice with ✓.

GPRS	see page 4-67
VGCS (GSM-R)	see page 4-47
SMS	see page 4-50
DE-TUNING	see page 4-65
ANALYZER	see page 4-57
RF GEN	see page 4-64

5. Press ✓ or NEXT to proceed to the entry of the test parameters (channels/RF power level etc.).



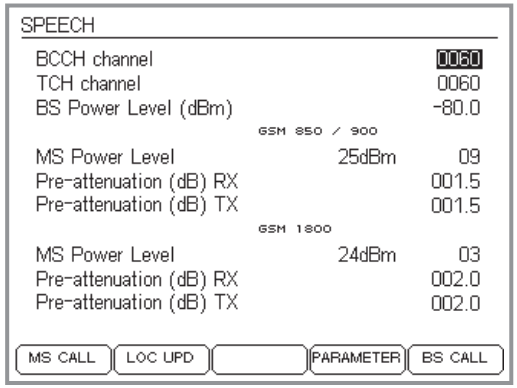


☞ **Is speech or data mode active?** The selected mode is displayed in the menu headers.

Selecting channels/RF power

In this stage you select:

- the channel on which signaling between tester and mobile phone is to take place (BCCH)
- the channel on which voice or data traffic between tester and mobile phone is to take place (TCH)
- the RF transmit power of the tester (BS Power Level)
- the RF transmit power of the mobile phone following connection setup (MS Power Level)



BCCH and TCH?

BCCH (Broadcast Control Channel): This is the channel via which the base station and the mobile phone exchange fundamental connection data such as the current location of the mobile phone and the network ID.

TCH (Traffic Channel): Channel carrying voice and data traffic.

☞ *If the GSM 850 option is installed, you can automatically select the system using the channel number (GSM 850 or GSM 900).*

⇦ + FAULT FIND + radio system selection + *SPEECH/DATA* 9600

For dual-band radio systems, see page 4-8.
For multiband radio systems, see page 4-9.

■ Entering channel numbers

1. Use the cursor keys to select the *BCCH channel* line.
2. Enter the number of the channel to be used for the voice or data traffic and confirm your entry with ✓. Or increment the values with ↑↑ and ↓↓ (keep button pressed down for autorepeat).
3. Use the cursor keys to select the *TCH channel* line.
4. Enter the number of the channel which is to be used for voice or data traffic and confirm your entry with ✓. Or increment the values with ↑↑ and ↓↓ (keep button pressed down for autorepeat).

Permissible channel numbers (BCCH and TCH)	
GSM 850 (option)	0128 through 0251
GSM 900	0001 through 0124
E-GSM	0000 through 0124 and 0975 through 1023
GSM-R (4202R/4201A)	0000 through 0124 and 0955 through 1023
GSM 1800 (PCN)	0512 through 0885
GSM 1900 (PCS)	0512 through 0810

Setting the RF power

1 Use the cursor keys to select the *BS Power Level* line.

2 Enter the value for the RF transmit power (in dBm) at which the Willtek 4200 is to send signals to the mobile phone (resolution: 0.1 dBm), and confirm your entry with ✓. Or increment the values with ↑↑ and ↓↓ (keep button pressed down for autorepeat).

☞ It is best to specify the maximum value to ensure that there are no complications with check-in attempts. You can always change the power again to some other value later.

RF transmit power of tester	
GSM 850/900/E-GSM	–117.0 dBm through –38.0 dBm
GSM 1800/1900	–117.0 dBm through –44.0 dBm
Different values apply to the Willtek 4208 model (see data sheet).	

The minus sign is added automatically.

☞ ***Invalid input***
Invalid input causes the message INPUT ERROR to be displayed along with a list of acceptable values.

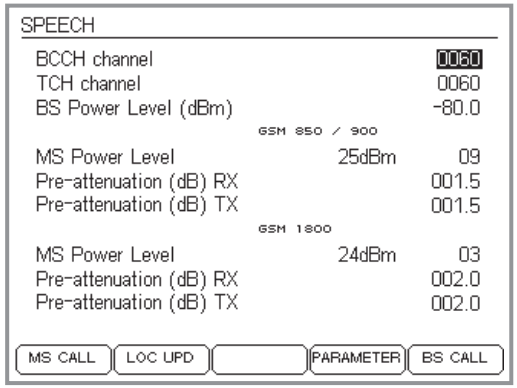
3 Use the cursor keys to select the *MS Power Level* line.

4 Enter the power level (corresponds to an RF transmit power value) at which the Willtek 4200 is to send signals to the mobile phone (see table), and confirm your entry with ✓. Or increment the values with ↑↑ and ↓↓ (keep button pressed down for autorepeat).

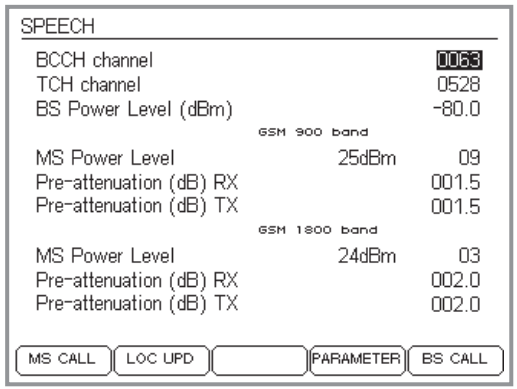
☞ On handportables (not car phones) the RF output power is limited to a maximum of 33 dBm. Bear this in mind when selecting the power level.

Permissible power levels and corresponding RF power in dBm

Power level	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	29	30	31
GSM 850/900/E-GSM	43	41	39	37	35	33	31	29	27	25	23	21	19	17	15	13	11	9	7	5	–	–	–
GSM 1800 (PCN)	30	28	26	24	22	20	18	16	14	12	10	8	6	4	2	0	–	–	–	–	36	34	32
GSM 1900 (PCS)	30	28	26	24	22	20	18	16	14	12	10	8	6	4	2	0	res	res	res	res	res	33	32



SPEECH/DATA 9600 menu when testing single-band mobile phones.



SPEECH/DATA 9600 menu when testing dual-band mobile phones.

Special considerations for dual-band systems

When single-band mobile phones are being tested, the Willtek 4200 displays the *SPEECH/DATA9600* menu in the form shown on the left. The meanings of the fields there are described on the following pages.

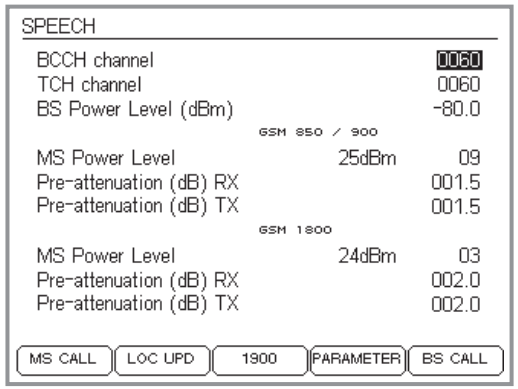
When dual-band mobile phones are being tested, the menu requires the same entries as for single-band systems, with the exception that certain entries need to be made twice, once for each band (see below).

☞ In the descriptions as of this page, the dual-band systems will no longer be mentioned separately, since all the descriptions also apply fully to these systems.

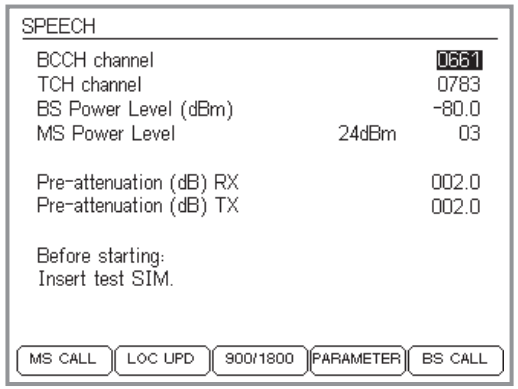
Separate entry fields for each band

As soon as a dual-band system (GSM 900+1800 or GSM 900+1900) has been set in the Willtek 4200, the *SPEECH/DATA 9600* menu assumes the form shown on the bottom left of this page. The *MS Power Level* and *Pre-attenuation (RX/TX)* fields are available separately for each band. In the case of *MS Power Level*, this has the advantage that both transmission branches of the mobile phone (900 MHz and 1800/1900 MHz) can be tested independently (for instance one band at power level 9 and the other at level 3).

The separate entry fields for *Pre-attenuation*, on the other hand, benefit the measuring precision. Since pre-attenuation (and hence the associated compensation) is frequency-dependent, compensation values which have been matched to each frequency band are of benefit. Please refer to pages 3-23 and 4-10 for more details on pre-attenuation and compensation values.



When testing multiband mobile phones, the SPEECH or DATA 9600 menu is available twice: Once you have entered the information for the lower and middle bands, the (1900) softkey takes you to the input fields for the upper band (see the diagram below).



Menu for the specification of MS Power Level and pre-attenuation for the upper band. The softkey (900/1800) takes you back to the input fields for the lower and middle bands.

■ Special features of multiband systems

If when selecting the radio system you have chosen a multiband system (GSM 900+1800+1900) the *SPEECH/ DATA 9600* menu first shows the input fields for the lower and middle bands. In a similar way to the menu for the dual-band systems you can first enter the required values for *MS Power Level* and *Pre-attenuation (RX,TX)* for each band (see page 4-8). Then press (1900) to call the menu for the upper band and enter the required values for *MS Power Level* and *Pre-attenuation (RX,TX)*. The (900/1800) softkey takes you back to the input menu for the lower and middle band.

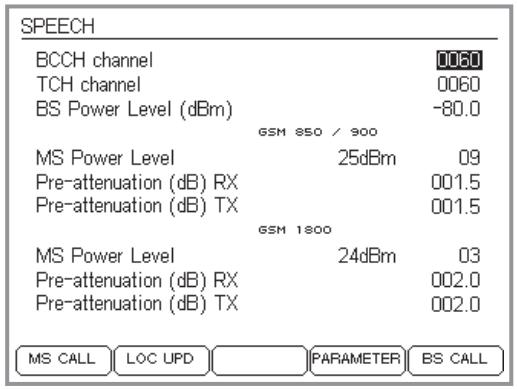
■ Testing multiband mobile phones

It is basically possible to test a multiband mobile phone on one band after another by simply setting the appropriate radio system on the tester and testing each one individually (see page 4-5). However, it is better to select the appropriate multiband and thus avoid having to keep going back to the *SYSTEM SELECT* menu. But because of the double assignment of channel numbers in the 1800 and 1900 bands you must bear the following in mind:

- It is not possible to change channels between the 900 and 1900 bands or between the 1800 and 1900 bands.
- If the mobile phone does not switch automatically from band to band, this must be done manually.
- To switch the tester from 900/1800 to 1900 you must:

1. Terminate the connection.
2. Switch band using (900/1800) or (1900).
3. Allow the mobile phone to register with the new band.
4. Establish a new connection and continue the test.

☞ The following pages will not mention multiband systems explicitly again, since all information without exception applies to these systems as well.



Each radio system has its own permitted compensation value which comes into force automatically the moment you select the system.

☞ *Any compensation configured in Speech mode has **no** bearing on the readings in AUTOTEST mode. Separately defined compensation values for individual models of mobile phones apply in AUTOTEST mode.*

Compensating for signal attenuation

You will find details on compensating for signal attenuation on page 3-23ff. The information given there for AUTOTESTs also applies to Speech mode with the following exceptions:

- Only one input field (lines *Pre-attenuation*) is available for each of the compensation values (RX and TX).
- The compensation values apply to both the TCH and the BCCH channels (this is valid because no measurements are performed for the BCCH channel).

☞ Speech mode provides the option of assigning other channel numbers to the TCH channel after the connection has been established. For this reason, when evaluating RF values (e.g. *MS Pwr* and *Rx Level*), make sure that the TCH channel number that is selected, is the one for which the compensation values apply. This restriction does not apply for cable-based connections, which are not frequency-dependent.

■ Compensation values

In the case of a cable-based connection, it is sufficient to specify a fixed compensation value which you enter in the RX and TX entry fields.

1.5 for GSM/E-GSM
2.0 for GSM1800 (PCN) and GSM1900 (PCS)

Values are identical for the RX and TX signal paths, since a cable-based connection is not frequency-dependent. Please note that these values only apply if you are using Willtek original accessories (cable, RF adapter). If this is not the case, or if you are using a wireless connection, other compensation values apply, which have to be determined on an individual basis.

Installing the test SIM

See page 2-15 for installation instructions.

It is not absolutely necessary to insert the test SIM for Speech mode. Apart from the bit/frame error rate measurements, all tests can also be carried out with the original SIM. There is, however, one important reason for installing the test SIM. With the test SIM installed, the mobile phone forgets all its information about its usual home network and instead considers the GSM network simulated by the tester to be its home network. The advantage of this is that as a rule no problems will be encountered when registering the mobile phone into the test network (see also page 4-19).

☞ Switch the SIMs back over again once testing of the mobile phone has finished!

Connecting the mobile phone

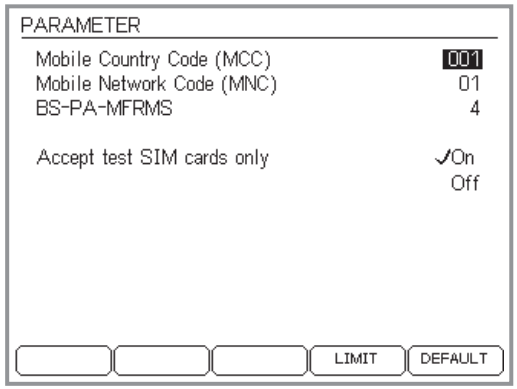
For notes on connection, see page 2-17.

⚠ **Risk of destroying the 4208 unit**: The sensitive RF input of a Willtek 4208 handles a maximum of +19 dBm! Input levels higher than this require an attenuator to be fitted in the signal path.

The correct connection type depends on the tests and measurements you want to perform. Cable-based connection provides the greatest testing depth, but requires suitable RF adapters.

☞ Please note that connections using the 4916 Antenna Coupler and in particular antenna connections result in RF measurements which are subject to a degree of uncertainty. The table on page 3-20 provides information on the tests and measurements which are affected.

Setting the special parameters



The settings in the *PARAMETER* menu allow you to deliberately change the GSM network that the Willtek 4200 offers to the mobile phone (test network).

1. Call the menu with (PARAMETER).
2. Select the required parameter with the cursor (see below) and set the new value.
3. Confirm your entry with (✓).
4. If necessary, you can press (DEFAULT) to set all parameters back to factory defaults.
5. Press (Esc) to return to the *SPEECH/DATA 9600* menu.

Mobile Country Code (MCC) Internationally standardized country code for a mobile radio network (3-digit). Default: 001.

Mobile Network Code (MNC) National code for a mobile radio network within a country (2-digit). Default: 01.

☞ After changes have been made to the MCC or MNC, you must perform a location update (see page 4-16).

BS-PA-MFRMS Base Station Paging Multiframes. This parameter specifies the number of multiframes the base station (tester) sends to the mobile phone between two Paging Requests. The higher the value, the less frequently the mobile phone has to activate its receiver (lower power consumption, longer standby time).

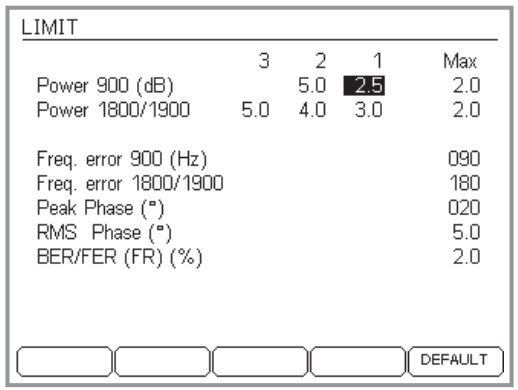
The value you enter has the following meaning:

Value 0 = 2 multiframes	Value 4 = 6 multiframes
Value 1 = 3 multiframes	Value 5 = 7 multiframes
Value 2 = 4 multiframes	Value 6 = 8 multiframes
Value 3 = 5 multiframes	Value 7 = 9 multiframes

Accept test SIM cards only

Applies to Willtek 4208 only: If this option is activated, the tester only accepts mobile phones fitted with a test SIM. All other mobile phones which attempt to establish a connection will be rejected. This ensures that any mobile telephones in real mobile phone networks can still be used without any interference even if they are within the coverage range of a Willtek 4208.

If the option is deactivated, the tester also accepts mobile phones with standard SIMs. In this case, it is the responsibility of the user to ensure that there is no interference with other mobile phones.



The LIMITS menu is called from the PARAMETER menu using (LIMITS) *(to return to the PARAMETER menu use* (Esc)*).*

Setting tolerance limits

The Willtek 4200 leaves the factory with the tolerance limits specified in the GSM Recommendations set for the evaluation of measurements in FAULT FIND operating mode. However, the *LIMITS* menu allows you to set some of the tolerance limits individually. These allow you to define the point at which a certain measured value (for example, frequency offset) is considered to be impermissible. These values are indicated by the asterisk symbol ✳ (see page 4-2).

☞ The tolerance limits for the evaluation of measurements as entered in the *LIMITS* menu are valid only in FAULT FIND operating mode (not in AUTOTEST).The values entered define whether a measurement is considered valid or invalid. When interpreting the measurements you should always know which tolerance limits are effective in the *LIMITS* menu.

Power 900 Limits for the permitted transmit power of the mobile phone in the 900 MHz band (in ±dB). You can enter three tolerance limits for different power levels:

- *Max.* Tolerance when the mobile phone is transmitting at maximum power, i.e. the power that corresponds to the power class of the phone (see also pages 4-24 and 4-37).
- *1* Tolerance when the mobile phone is transmitting at a lower power up to power level 15.
- *2* Tolerance when the mobile phone is transmitting at a power level of 16 to 19.

Example: *A normal GSM 900 mobile phone (power class 4) reaches maximum transmit power of 33 dBm at power level 5. The permitted tolerance value (for example, 2 dBm) must be entered under "Max.". The tolerance value for transmit powers between 31 dBm and 13 dBm (power levels 6 through 15) is entered under "1" and that for the lower power levels under "2".*
The tolerance value entered under "Max." is also valid even if the mobile phone tester switches the phone to a higher power level (in this case for example, 3) than is supported by its power class.

Overview of the power level assignment

Column ▶	3	2	1	Max.
Power 900	not applicable	19 through 16	up to ≤ 15	Maximum power
Power 1800/1900	28 through 14	13 through 09	up to ≤ 8 and 29 through 30	Maximum power

Power 1800/1900 Limits of the permitted transmit power of the mobile phone in the 1800 and 1900 MHz bands (in ±dB). You can enter four tolerance limits for different power levels:

- *Max.* see *Power 900*.
- *1* Tolerance when the mobile phone is transmitting at a weaker power level up to power level 8 or at power levels 29 and 30.
- *2* Tolerance when the mobile phone is transmitting at a power level of 9 to 13.
- *3* Tolerance when the mobile phone is transmitting at a power level of 14 to 28.

Background: *In Speech/Data mode the tester uses the MS Info data to automatically recognize the power class of the unit under test. Thus it can correctly assign the MS Power Limits itself even if a mobile phone is transmitting at full power. In asynchronous mode it is not able to do this since the MS Info data is not available in this mode. As a result, MS Power measurements are not evaluated in asynchronous mode (no asterisk symbol is shown next to values that are not permitted).*

Freq. error 900 Limit of the permitted frequency offset in the 900 MHz band (in Hz).

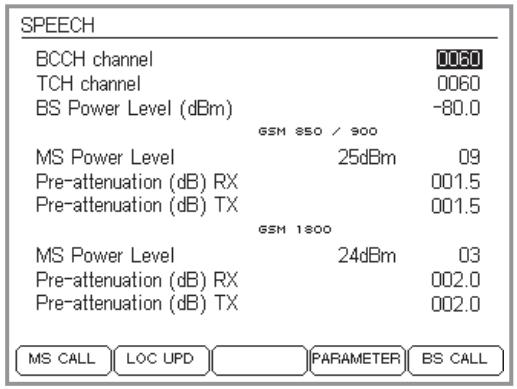
Freq. error 1800/1900 Limit of the permitted frequency offset in the 1800 and 1900 MHz bands (in Hz).

Peak Phase Limit for the permitted phase errors (peak value) of the GSM burst signal (in °).

RMS Phase Limit for the permitted phase errors (average) of the GSM burst signal (in °).

BER/FER (FR) Limit for the permitted BER/FER error rate (in %).

(DEFAULT) replaces all the individual entries of the *LIMITS* menu with the factory defaults (default limits as defined in GSM recommendations).



Location update?
When you switch on a mobile phone which is fitted with its original SIM, it immediately searches for receivable GSM base stations. Every base station identifies itself with a typical LAC (Location Area Code).

The LAC of the last base station used is stored on the SIM. If the phone again detects the last station it used (by comparing the LACs), it registers automatically. If this is not possible, e.g. after a change of location, a location update is performed. Here the mobile phone checks which base station on the home network it can receive best (home network: the GSM network that was activated on the SIM when the phone was purchased).

The phone stores the LAC of this base station on the SIM and at the same time registers into the home network. The phone acts in the same way if the test SIM is mounted, except that in this case the home network is held to be the GSM radio network simulated by the tester.

Location update

A location update is a preparatory step which is not required on a regular basis.

Generally, a mobile phone will only carry out a location update when it changes location (checks in to a new base station). You can, however, force the mobile phone to do this and, for instance, ensure that the mobile phone to be tested recognizes the GSM network simulated by the tester prior to the first test.

1. All previous preparatory steps have been carried out, the mobile phone is connected (but still switched off) and the tester is ready to carry out tests in speech mode.
2. First press (LOC UPD) and then switch on the mobile phone. The tester then instructs the mobile phone to carry out a location update.
3. A *WAIT* box is shown on the tester display until the mobile phone recognizes the test network and checks in with the tester. If check-in fails, cancel the operation with (Esc).

Failure during a location update and problems during check-in have the same causes (see page 4-19).

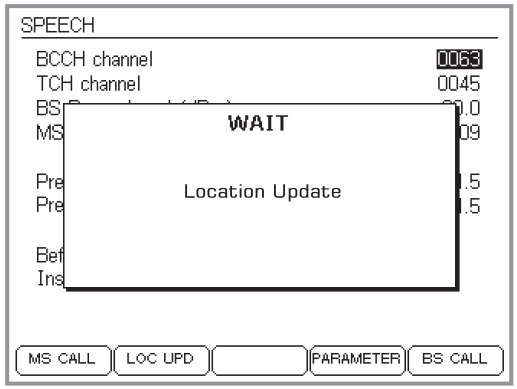
Tests in speech/data mode

This is what is tested

In speech/data mode you can test the following functions and quality-determining parameters of a mobile phone:

Function	Test no.	Speech	Data
Registration	Test 1.0	✓	✓
Outgoing call from mobile phone (connection setup)	Test 2.0	✓	✓
Incoming call (mobile phone)	Test 3.0	✓	✓
Response to TCH change	Test 4.1	✓	✓
Response to RF power change (tester)	Test 4.2	✓	✓
Response to power level change (mobile phone)	Test 4.3	✓	✓
Hang-up on mobile phone	Test 4.4	✓	✓
Hang-up on tester	Test 4.5	✓	✓
Correct transmission of IMEI/IMSI	Test 6.0	✓	✓
Correct interpretation of power class	Test 6.0	✓	✓
Mobile phone keypad	Test 2.0	✓	✓
Acoustic speech test (audio loopback)	Test 7.0	✓	–
Broadcast cell (display text messages)	Test 8.0	✓	✓
Parameters			
Mobile phone transmit power	Test 4.0	✓	✓
Phase error (RMS and peak)	Test 4.0	✓	✓
Phase error (profile, RMS and peak)	Test 11.0	✓	✓
Frequency error	Test 4.0	✓	✓
RX level	Test 4.0	✓	✓
RX quality	Test 4.0	✓	✓
Power/time template (Pass/Fail)	Test 4.0	✓	✓
Power/time template (graph)	Test 9.0	✓	✓
Bit/frame error rate (BER/FER)	Test 5.0	✓	✓
Burst spectrum	Test 10.0	✓	✓

Test 1.0: Network identification and registration



Tester display after (LOC UPD) *has been pressed.*

Selecting the test network

Depending on the type of mobile phone and how it is configured, widely differing actions are required to select the network. It may be that you first have to call functions like "Network selection" and "New search" manually. However you go about it, once the network has been found, the mobile must display the ID of the test network, which is as follows:

MCC:001 MNC:01

The mobile phone may show the ID in a slightly different format (e.g. 1 1 or 00101). The important point is that you do not make the mistake of selecting a public network.

Registering the mobile phone on the GSM radio network simulated by the Willtek 4200 is a fundamental test. If this initial test fails, there is something seriously wrong, and none of the other tests can be performed.

■ Preconditions for testing

- Test preparation completed (see page 4-4) and Willtek 4200 ready for use (*SPEECH* or *DATA 9600* menu on display)?
- Mobile phone switched off? If it is on, switch it off now.

■ Test 1.0 step by step

1. On the Willtek 4200 activate the (LOC UPD) softkey.
2. Switch on the mobile phone and (if asked to) enter the PIN (PIN for the test SIM = 0000).
3. It may now be necessary to select the test network, but only on a mobile phone with its original SIM (see the text on the left).
4. Observe how the mobile phone responds.

■ Test 1.0 result

☺ The mobile phone shows the ID of the test network (see the text on the left), the *WAIT* box on the tester disappears. Continue by running Test 2.

☹ The mobile phone does not show the ID of the test network, the *WAIT* box continues to be displayed on the tester. Use (Esc) to return to the *SPEECH/DATA 9600* menu.

Problems with registration

Even with an intact mobile phone, there is one problem which may arise – with an original SIM – when you attempt to register onto the test network:

- The mobile phone checks into a public network instead of the test network. This is typically likely to happen under the following conditions:
  - wireless connection between test unit and tester
  - signal from Willtek 4200 competing with strong base stations.

Problem solving

More tips...
If you are using the original SIM, it is sensible to carry out a location update before beginning the test (see page 4-16).

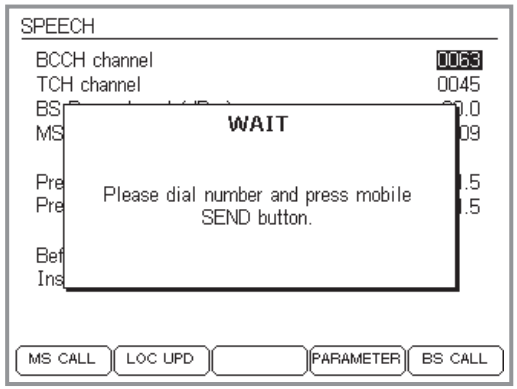
Do not start with Test 1, start with Test 2 (MS Call). The check-in process is carried out automatically at the same time. This is advantageous if you are using the original SIM or a new test SIM which does not yet have a "Location" stored on it.

Take the following steps and repeat them after each registration attempt (Test 1.0).

1. Set the RF output level of the tester to maximum.
2. Check that a valid channel number is set. For instance, channel numbers 955 through 1023 must not be set for a mobile phone which does not support E-GSM (see also page 4-6).
3. If the check-in attempt fails with the original SIM, switch off the mobile phone and install the test SIM (see also page 2-15).
4. Ensure that the channels (BCCH + TCH) set on the tester are free, i.e. are not also used by a base station in the vicinity (see page 4-4).
5. If the attempt fails with wireless connection, try again using the cable-based connection via the RF adapter.

Test 2.0: MS CALL connection setup

Test 2.0 checks whether the mobile phone is able to set up a telephone connection to the Willtek 4200. Once the connection has been established, many other functions and parameters of the mobile phone can be checked.

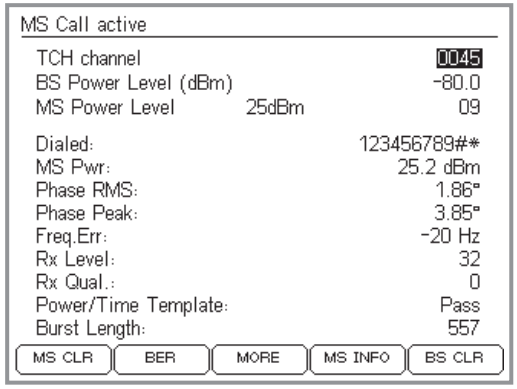


Preconditions for testing

- The phone has previously passed Test 1.0 and identified the radio network simulated by the tester.
- There is no existing telephone connection between the phone and the tester (if there is one, release it using Test 4.4 or 4.5).

Test 2.0 step by step

1. Press the (MS CALL) softkey on the Willtek 4200 (the tester waits for a call from the mobile phone and displays a *WAIT* menu). The display shows a prompt for action (see picture).
2. Enter any number (up to 20 digits) on the mobile phone. Include all the numbers from 0 through 9 so that you can read these later on the tester's display and identify any defective number keys.
3. On the mobile phone, press the key with the "Send" function to initiate connection setup.

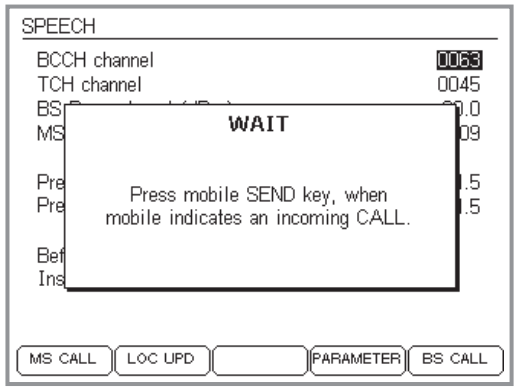


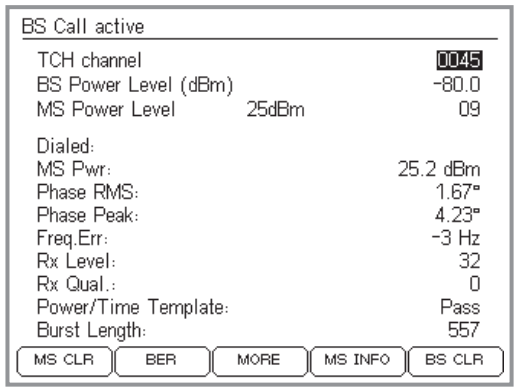
Test 2.0 result

☺ Connection setup was successful; the tester's display now shows the ***MS*** *CALL ACTIVE* menu (in subsequent tests, ***MS*** reminds you that connection setup was initiated by MS CALL). Go on to Test 4.0.

☹ Connection setup has failed; the tester's display continues to show the *WAIT* menu. The mobile phone failed the test. Press (Esc) to return to the *SPEECH* or *DATA 9600* menu.

Test 3.0: BS CALL connection setup





Test 3.0 checks whether the mobile phone is able to handle an incoming connection request from the Willtek 4200. Once the connection has been established, many other functions and parameters of the mobile phone can be checked.

■ Preconditions for testing

- The phone has previously passed Test 1.0 and identified the radio network simulated by the tester.
- There is no existing telephone connection between the phone and the tester (if there is one, release it using Test 4.4 or 4.5).

■ Test 3.0 step by step

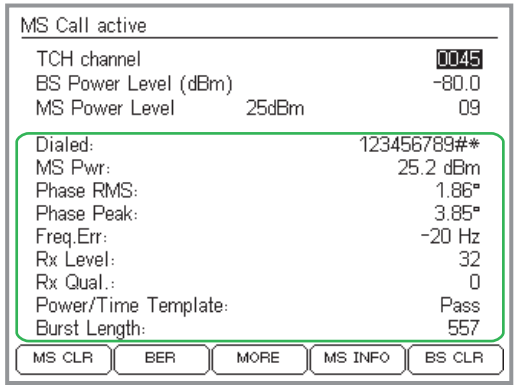
1. Press the (BS CALL) softkey on the Willtek 4200 (the tester call the mobile phone and displays a *WAIT* menu).
2. In response to a visual and/or audible calling signal on the mobile phone, press the “Send” on the mobile phone to answer the call.

■ Test 3.0 result

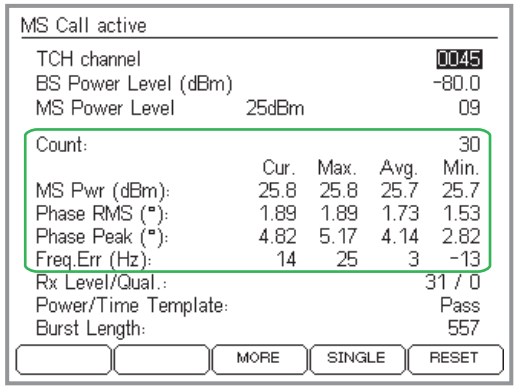
☺ Connection setup was successful; the tester’s display now shows the ***BS*** *CALL ACTIVE* menu (in subsequent tests, ***BS*** reminds you that connection setup was initiated by BS CALL). Go on to Test 4.0.

☹ Connection setup has failed; the tester’s display continues to show the *WAIT* menu. The mobile phone failed the test. Press (Esc) to return to the *SPEECH* or *DATA 9600* menu.

Test 4.0: Messages and measurements



Display of current values only.



You can show or hide the statistical evaluation.

On successful connection setup the display shows messages and quality-determining measurements directly on the *CALL ACTIVE* menu. The indications always apply to the test conditions described in the first three lines of the menu. The effect of modifying test conditions (see Tests 4.1 through 4.3) can be seen immediately.

☞ Please note that any RF level measurements are only correct if the signal attenuation has been correctly compensated (see also page 4-10).

■ Preconditions for testing

- There must be a valid telephone connection between the mobile phone and the tester, set up in Test 2.0 or 3.0.

■ Display of statistical values

The tester provides statistical evaluations (min/max values, average) as well as the current value for the measured values *MS Pwr*, *Phase RMS*, *Phase Peak* and *Freq Err*.

1. Press the softkey (MINIMAX) to start statistical evaluation. If the softkey does not appear, press (MORE).
   The display now shows the statistical values as well as the current value (in the *Cur.* column). *Count* shows the number of measured values evaluated for the statistics. (RESET) resets the counter and restarts the evaluation. Depending on the language set under SETUP, other results (such as *Dialed*) are not visible while the statistical values are displayed.
2. (SINGLE) cancels the statistical evaluation and displays the current values only.

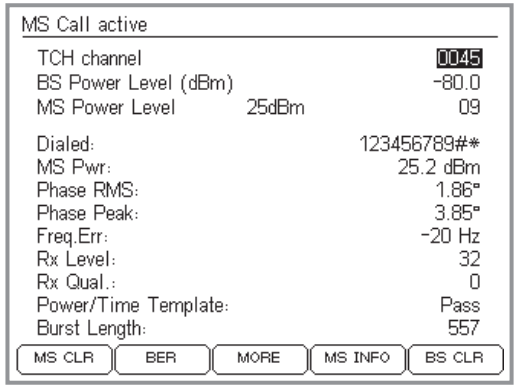
■ Test 4.0 interpreting the indications

Dialed Number dialed on the mobile phone in the course of Test 2.0 (MS CALL) (nothing is shown if the connection was set up with BS CALL).

☺ The value is the same as the number that was dialed.

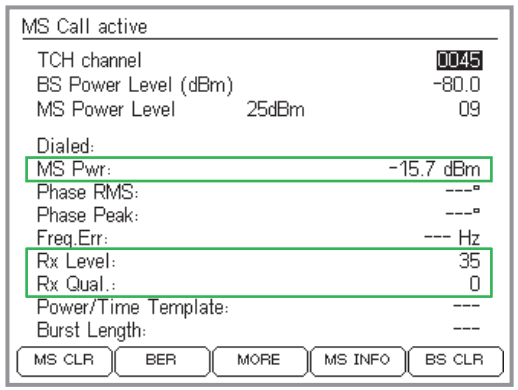
☹ If the value is different (digits missing or the same digit repeated several times in succession), there is something wrong with the numeric keypad (oxidized contacts, key bounce).

MS Pwr RF transmit power of the mobile phone.



☺ The value matches the currently applicable power level of the mobile phone (target value shown on the *MS Power Level* line). Allowable deviations from the target value are indicated in the table (as per GSM standard).

☹ The value is outside the permitted tolerances. This can lead to connection breakdown (value too low) or to interference with other subscribers (value too high). In the event of connection breakdown, press and hold down (BS CLR) until you hear the acknowledgment signal (this takes you back to the *SPEECH* or *DATA 9600* menu).



☞ **Applies to Willtek 4208 only**: Under unstable HF signal conditions the tester automatically abridges the measurement cycle (fast measurement). In this mode the tester only displays three measurement values: *MS Pwr*, *Rx Level* and *Rx Qual* (see bottom figure). As soon as RF signal conditions are stable again the tester automatically switches back to normal measurement mode and displays all measurement values (again).

Example

The tester reports a value of 24.8 dBm for MS Pwr. The MS Power Level line shows you the target value (here 25 dBm) and the associated power level (09). According to the table, on power level 9 the test unit is allowed to transmit at 25 dBm ±3 dB. That means that the measured value is within the permitted tolerances.

Power level/RF power/permissible tolerances

GSM 850/900/E-GSM			GSM 1800 (PCN)			GSM 1900 (PCS)		
0	43 dBm	±2 dB	29	36 dBm	±2 dB	29	res.	–
1	41 dBm	±3 dB	30	34 dBm	±3 dB	30	33 dBm	±2 dB
2	39 dBm	±3 dB	31	32 dBm	±3 dB	31	32 dBm	±3 dB
3	37 dBm	±3 dB	**0**	30 dBm	±3 dB	**0**	30 dBm	±3 dB
4	35 dBm	±3 dB	1	28 dBm	±3 dB	1	28 dBm	±3 dB
5	33 dBm	±3 dB	2	26 dBm	±3 dB	2	26 dBm	±3 dB
6	31 dBm	±3 dB	**3**	24 dBm	±3 dB	**3**	24 dBm	±3 dB
7	29 dBm	±3 dB	4	22 dBm	±3 dB	4	22 dBm	±3 dB
8	27 dBm	±3 dB	5	20 dBm	±3 dB	5	20 dBm	±3 dB
9	25 dBm	±3 dB	6	18 dBm	±3 dB	6	18 dBm	±3 dB
10	23 dBm	±3 dB	7	16 dBm	±3 dB	7	16 dBm	±3 dB
11	21 dBm	±3 dB	8	14 dBm	±3 dB	8	14 dBm	±3 dB
12	19 dBm	±3 dB	9	12 dBm	±4 dB	9	12 dBm	±4 dB
13	17 dBm	±3 dB	10	10 dBm	±4 dB	10	10 dBm	±4 dB
14	15 dBm	±3 dB	11	8 dBm	±4 dB	11	8 dBm	±4 dB
15	13 dBm	±3 dB	12	6 dBm	±4 dB	12	6 dBm	±4 dB
16	11 dBm	±5 dB	13	4 dBm	±4 dB	13	4 dBm	±4 dB
17	9 dBm	±5 dB	14	2 dBm	±5 dB	14	2 dBm	±5 dB
18	7 dBm	±5 dB	15	0 dBm	±5 dB	15	0 dBm	±5 dB
19	5 dBm	±5 dB	–	–	–	–	–	–

☞ **Highlighted values:** When the power level corresponds to the power class of the mobile phone, then the tolerances shall be ±2.0 dB.

Phase RMS, Peak Phase error in GSM burst signal (RMS value left, peak value right). The phase error is a quality indicator for correct adjustment of the modulator (see also test 11.0: Testing phase errors).

☺ The phase error is not outside the following limits (GSM standard, irrespective of radio system):
RMS: ≤ 5°
Peak: ≤ 20°

☹ The value is over the limits. Typical symptoms: problems with connection setup, problems with maintaining a connection, distortion of the voice signal.

Freq. Err Frequency error of mobile phone RF carrier signal compared to target value.

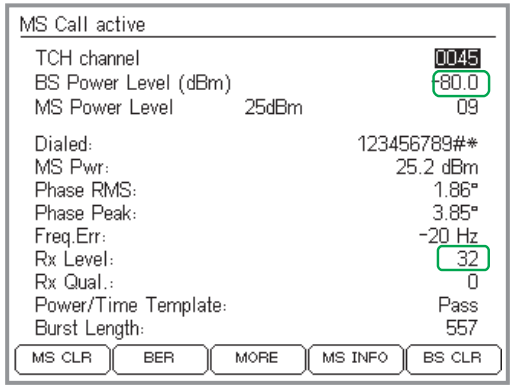
Permitted frequency error (GSM standard)		
GSM 850/900/E-GSM	GSM 1800 (PCN)	GSM 1900 (PCS)
≤ ±90 Hz	≤ ±180 Hz	≤ ±180 Hz

☺ Frequency error is within limits.

☹ Excessive frequency error may lead to interference with other subscribers on adjacent channels or exhibit the same symptoms as an unacceptable phase error.

RX Level Measure of the RF level at which the mobile phone receives the signal from the base station (here the tester). Mobile phones measure the RF receive level at regular intervals and report the measurement to the base station in the form of a code number (0 through 63). The higher the RF level measured, the higher the code number.

It is advisable to check the *Rx Level* code number for a variety of *BS Power Level* settings (high, medium and low value).



The reported Rx level must match the BS power level.

Formula for the nominal value of Rx Level:

Rx Level = 110 – | BS Power Level |

e.g. 110 – |–80| = 30

Equivalent code numbers/RF receive levels (dBm)					
0	< –110	22	–89 to –88	44	–67 to –66
1	–110 to –109	23	–88 to –87	45	–66 to –65
2	–109 to –108	24	–87 to –86	46	–65 to –64
3	–108 to –107	25	–86 to –85	47	–64 to –63
4	–107 to –106	26	–85 to –84	48	–63 to –62
5	–106 to –105	27	–84 to –83	49	–62 to –61
6	–105 to –104	28	–83 to –82	50	–61 to –60
7	–104 to –103	29	–82 to –81	51	–60 to –59
8	–103 to –102	30	–81 to –80	52	–59 to –58
9	–102 to –101	31	–80 to –79	53	–58 to –57
10	–101 to –100	32	–79 to –78	54	–57 to –56
11	–100 to –99	33	–78 to –77	55	–56 to –55
12	–99 to –98	34	–77 to –76	56	–55 to –54
13	–98 to –97	35	–76 to –75	57	–54 to –53
14	–97 to –96	36	–75 to –74	58	–53 to –52
15	–96 to –95	37	–74 to –73	59	–52 to –51
16	–95 to –94	38	–73 to –72	60	–51 to –50
17	–94 to –93	39	–72 to –71	61	–50 to –49
18	–93 to –92	40	–71 to –70	62	–49 to –48
19	–92 to –91	41	–70 to –69	63	> –48
20	–91 to –90	42	–69 to –68	–	–
21	–90 to –89	43	–68 to –67	–	–

☺ Under the GSM standard, the code number shown in the *Rx Level* field should match the RF output level set on the tester (value on *BS Power Level* line – see table for conversion).

☹ The RF receive level derived from the *Rx Level* code number deviates by an unacceptable amount from the target value (*BS Power Level*).

Rx Qual Measure of transmission quality at the current RF receive level. Mobile phones check the bit error rate (BER) of the decoded data at regular intervals and report the measurement to the base station in the form of a code digit (0 through 7). The higher the BER, the higher the code digit.

Equivalent code digits/BERs*			
0	< 0.2 %	1	0.2 % to 0.4 %
2	0.4 % to 0.8 %	3	0.8 % to 1.6 %
4	1.6 % to 3.2 %	5	3.2 % to 6.4 %
6	6.4 % to 12.8 %	7	> 12.8 %
**) BER measured by the mobile phone. Not to be confused with the tester's BER measurement.*			

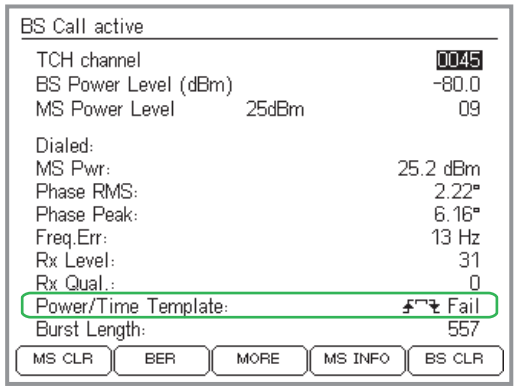
☺ At an RF receive level of –102 dBm the BER reported by the mobile phone must be < 2.44 % (equivalent code digit: 4).

☹ The BER is over the permitted limit. (The greater the overshoot, the greater the resulting distortion of the voice signal. For acoustic confimation run Test 7.0.)

Power/Time Template Under the GSM standard, the profile of the GSM burst signal over time must fit into a “template” which allocates defined tolerances zones to the signal pattern. A Willtek 4200 checks that the burst does not overshoot the tolerance limits at any point in the template and reports the result as *Pass* or *Fail* (see also test 9.0: Testing the burst profile).

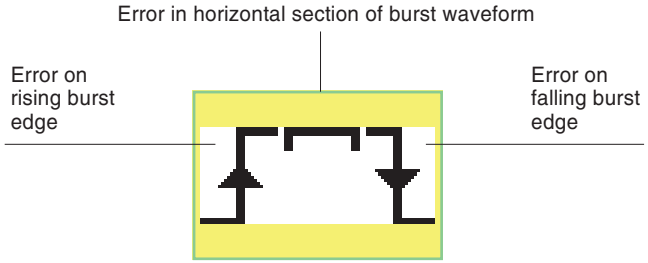
Pass The burst profile is acceptable.

Fail The burst goes outside the tolerance limits at one or more points. Typical symptom: interference with calls running on the same RF channel but in different time slots.

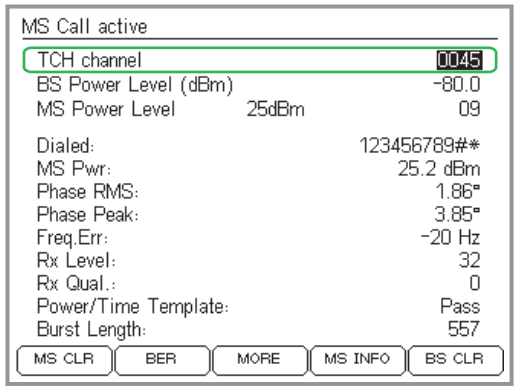


Symbols indicate the locations where the tolerance zones of the Power/Time template were exceeded.

Three symbols indicate the locations where the tolerance zones were exceeded. These symbols (the Burst Edge Failure Indication) can appear on their own or in combination with the other symbols.



Test 4.1: Changing the voice channel



While a telephone connection is in place, a mobile phone must be able to switch to another voice channel (TCH) allocated by the base station (in our case the Willtek 4200).

■ Preconditions for testing

- There must be a valid telephone connection between the mobile phone and the tester, set up in Test 2.0 or 3.0.
- The *BS CALL ACTIVE* or *MS CALL ACTIVE* menu must be visible (to get back to this menu from lower-level menus press (Esc)).

■ Test 4.1 step by step

1. Use the cursor keys to select the *TCH channel* line.
2. Enter a different valid channel number, and confirm your entry with (✓). Or increment the values with (↑↑) and (↓↓).

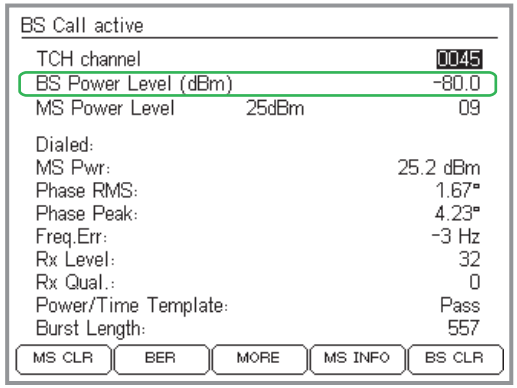
Permissible channel numbers (TCH)	
GSM 850 (option)	0128 through 0251
GSM 900	0001 through 0124
E-GSM	0000 through 0124 and 0975 through 1023
GSM-R (4202R/4201A)	0000 through 0124 and 0955 through 1023
GSM 1800 (PCN)	0512 through 0885
GSM 1900 (PCS)	0512 through 0810

■ Test 4.1 result

☺ The connection is maintained, the *CALL ACTIVE* menu continues to show acceptable measurements. Repeat the test with a different channel number or run the next test.

☹ The connection breaks down. The tester's display stops showing measurements. The mobile phone has failed the test. Press and hold down (BS CLR) until you hear the acknowledgment signal (back to the *SPEECH* or *DATA 9600* menu).

Test 4.2: Reducing the RF power (from the tester)



This test simulates harsh reality: the farther you are from the base station, the lower the RF received level by your mobile phone. As required by the GSM specification, a mobile phone should be able to maintain a connection without malfunctioning at a receive level at least as low as about –102 dBm (portables) or –104 dBm (car phones).

■ Preconditions for testing

- There must be a valid telephone connection between the mobile phone and the tester, set up in Test 2.0 or 3.0.
- The *BS CALL ACTIVE* or *MS CALL ACTIVE* menu must be visible (to get back to this menu from lower-level menus press (Esc)).

■ Test 4.2 step by step

1. Use the cursor keys to select the *BS Power Level* line.
2. Enter the tester's RF transmit level and confirm your entry with (✓). Or increment the values with (↑↑) and (↓↓).

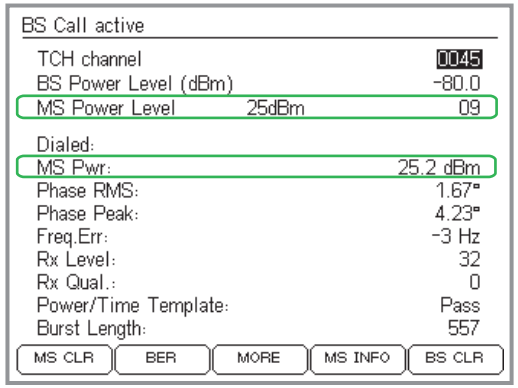
   According to the GSM standard this should be:
   –102 dBm for handportables
   –104 dBm for car phones

■ Test 4.2 result

☺ The connection is maintained, the *CALL ACTIVE* menu continues to show acceptable measurements. Repeat the test with a lower RF level or run the next test.

☹ The connection breaks down. The tester's display stops showing measurements. The RF sensitivity of the mobile phone is insufficient. Press and hold down (BS CLR) until you hear the acknowledgment signal (back to the *SPEECH/DATA 9600* menu). Restart the test (at a higher level, e.g. –90 dBm) and gradually determine the exact value of the RF level at which the connection breaks down.

Test 4.3: Changing power levels



Changes in the MS power level should have an immediate impact on the MS Pwr measurement.

While a telephone connection is in place, a mobile phone must be able to switch to another power level allocated to it by the base station (in our case the tester). This helps save battery power when approaching a base station and ensure that the connection is maintained when moving away from a base station.

■ Preconditions for testing

- There must be a valid telephone connection between the mobile phone and the tester, set up in Test 2.0 or 3.0.
- The *BS CALL ACTIVE* or *MS CALL ACTIVE* menu must be visible (to get back to this menu from lower-level menus press (Esc)).

☞ This test will only have correct and precise results when the tester and the mobile phone are connected by cable.

■ Test 4.3 step by step

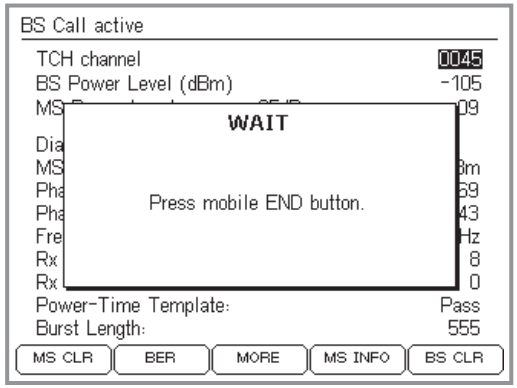
1. Use the cursor keys to select the *MS Power Level* line.
2. Enter a different power level and confirm your entry with (✓). Or increment the values with (↑↑) and (↓↓).

■ Test 4.3 result

☺ The connection is maintained, the *MS Pwr* measurement matches the selected power level on the *MS Power Level* line. Repeat the test with other power levels or run the next test.

☹ The connection breaks down or the *MS Pwr* measurement is outside the permitted tolerances (see the table on page 4-24). Press and hold down (BS CLR) until you hear the acknowledgment signal (back to the *SPEECH/DATA 9600* menu). The mobile phone has failed the test.

Test 4.4: Clear down on the mobile phone



MS CLR *makes the tester prompt you to press the "Release" button on the mobile phone.*

☞ *If this is the last test on the phone and you have installed the test SIM, please do not forget to remove the test SIM once the test is over!*

A telephone connection can be released by either party, either from the mobile phone or from the base station. This test determines whether the connection is released correctly if release is initiated from the mobile phone.

■ Preconditions for testing

- There must be a valid telephone connection between the mobile phone and the tester, set up in Test 2.0 or 3.0.
- The *BS CALL ACTIVE* or *MS CALL ACTIVE* menu must be visible (to get back to this menu from lower-level menus press Esc).

■ Test 4.4 step by step

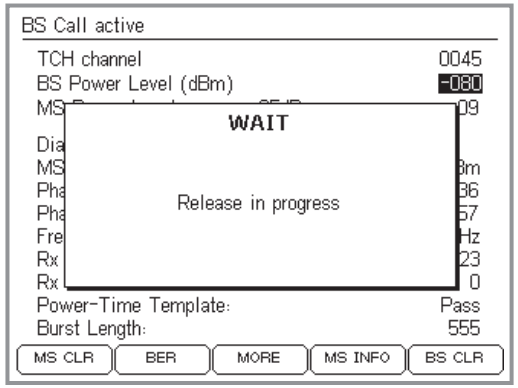
1. Press the MS CLR softkey. If this softkey is not shown: press MORE.
2. Press the key which has the “Release” function on the mobile.
3. Observe the tester’s display.

■ Test 4.4 result

☺ Following correct connection release, the Willtek 4200 shows the *SPEECH/DATA 9600* menu again. You can now start setting up a new connection with MS CALL or BS CALL or go back to the *SYSTEM SELECT* menu by pressing Esc.

☹ Error releasing connection, e.g. because the “Release” key on the mobile phone is defective. Press and hold down BS CLR until you hear the acknowledgment signal (back to the *SPEECH/DATA 9600* menu), or switch the device off for a short while. The mobile phone has failed the test.

Test 4.5: Clear down on the tester



If connection cleardown with (BS CLR) is completed correctly, the display shows the WAIT information box for only about 4 s.

☞ *If this is the last test on the phone and you have installed the test SIM, please do not forget to remove the test SIM once the test is over!*

A telephone connection can be released by either party, either from the mobile phone or from the base station. This test determines whether the connection is released correctly if release is initiated from the tester.

■ Preconditions for testing

- There must be a valid telephone connection between the mobile phone and the tester, set up in Test 2.0 or 3.0.
- The *BS CALL ACTIVE* or *MS CALL ACTIVE* menu must be visible (to get back to this menu from lower-level menus press (Esc)).

■ Test 4.5 step by step

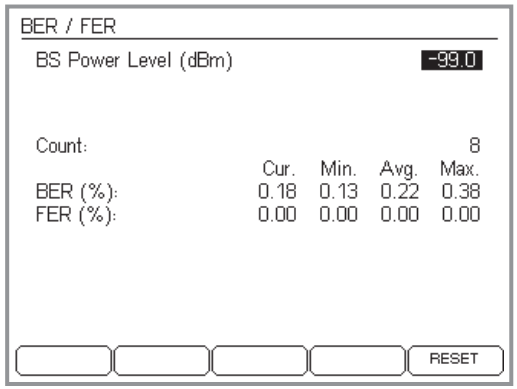
1. Press the (BS CLR) softkey. If this softkey is not shown: press (MORE).
2. Observe the tester's display.

■ Test 4.5 result

☺ Following correct connection release (duration: max. about 5 seconds), the Willtek 4200 shows the *SPEECH/DATA 9600* menu again. You can now start setting up a new connection with (MS CALL) or (BS CALL) or go back to the *SYSTEM SELECT* menu by pressing (Esc).

☹ Error releasing connection. If the tester is still showing the *WAIT* menu after about 20 seconds, switch the device off for a short while. The mobile phone has failed the test.

Test 5.0: Measuring the bit and frame error rate



The bit and frame error rate is a measure of the mobile phone's RF sensitivity.

☞ *This test can only be guaranteed to work if the mobile phone is fitted with the test SIM.*

The bit and frame error rate is a measure of the RF sensitivity of a mobile phone. Even at a low RF receive level, mobile phones should continue to offer acceptable voice transmission quality (low BER/FER values).

■ Preconditions for testing

- There must be a valid telephone connection between the mobile phone and the tester, set up in Test 2.0 or 3.0.
- This test cannot be guaranteed to run unless the test SIM has been installed in the mobile phone (for installation see page 2-15).
- The *BS CALL ACTIVE* or *MS CALL ACTIVE* menu must be visible (to get back to this menu from lower-level menus press (Esc)).

■ Test 5.0 step by step

1. Press the (BER) softkey. If this softkey is not shown: press (MORE).
2. Enter the tester's RF transmit level in the *BS Power Level* field (a delayed reaction from the tester when you start entering the value is normal as a number of signal bursts need to be measured to calculate the error performance). The GSM standard recommends three level settings for this test:

   –100 dBm (all GSM mobile phones)
   –104 dBm for car phones (P > 2 W).
   –102 dBm for handportables (P ≤ 2 W).

   Start with –100 dBm (Willtek 4208: –60 dBm).
3. Press (✓) to confirm your input.

   ☞ Changing the value in the *BS Power Level* field only affects the BER/FER measurement (there is no effect on the *BS Power Level* in the other menus).

4 The tester's display now shows measurements for BER (bit error rate) and FER (frame error rate).

The display shows statistical values (min/max values, average) as well as the current value (in the *Cur.* column). *Count* shows the number of measured values evaluated for the statistics. (RESET) resets the counter and restarts the evaluation.

Check that the values are below the permitted limits (the FER value is significant only if the RF transmit level is set to –102 dBm).

Depending on what RF transmit level is set, the following limits apply under the GSM standard:

Permissible limits for BER/FER			
RF level	Phone	BER	FER
–100 dBm	all	0.00 %	–
–104 dBm	P > 2 W	< 2.44 %	–
–102 dBm	P ≤ 2 W	< 2.44 %	0.10 %

5 Enter the second RF transmit level (see 2) in the *BS Power Level* field and confirm your entry with (✓). Or increment the values with (↑↑) and (↓↓).

6 Check measured values.

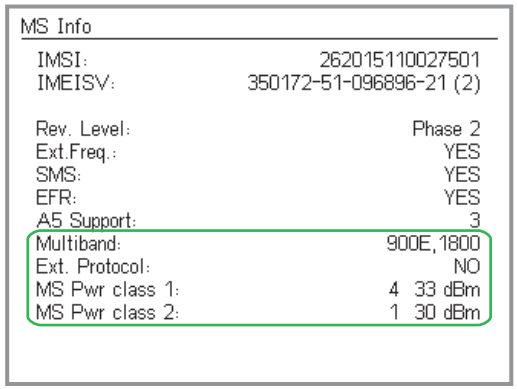
7 Terminate the test with (Esc).

■ Test 5.0 result

☺ The limits are not exceeded.

☹ The limits are exceeded. Typical symptom: the customer complains of poor speech quality or poor data connection when using a modem.

Test 6.0: Checking mobile phone identification



The characteristic information highlighted in the lower part of the display is only shown if the test unit is a dual-band mobile phone.

The identification data is a mobile phone's "ID card". It provides information about the test unit which is useful for interpreting measurements (Test 4.0) or for general classification purposes (e.g. E-GSM mobile phone or not?).

■ Preconditions for testing

- There must be a valid telephone connection between the mobile phone and the tester, set up in Test 2.0 or 3.0.
- The *BS CALL ACTIVE* or *MS CALL ACTIVE* menu must be visible (to get back to this menu from lower-level menus press (Esc)).

■ Test 6.0 step by step

1. Press the (MS INFO) softkey. If this softkey is not shown: press (MORE).
2. Check the identification data which is reported (see "Test 6.0 results").
3. Press the (Esc) key to return to the *CALL ACTIVE* menu and run some other tests there.

■ Test 6.0 results

IMSI International Mobile Subscriber Identity gives important subscriber data which is stored in the SIM. The IMSI displayed comes from the SIM which is currently installed in the mobile phone. The IMSI comprises the following data:

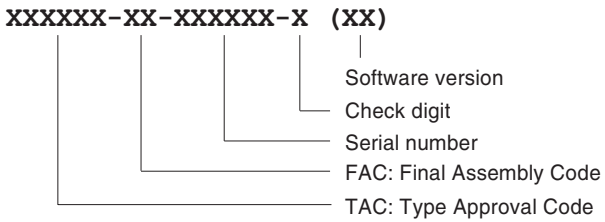
```
xxx xx xxxxxxxxxx
```

- Subscriber number within the net
- Code of home network
- Code of home country

The IMSI of the test SIM is: 001 01 0123456789
For older test SIMs: 001 01 1234567890

IMEI or IMEISV
The IMEI or IMEISV can be queried with a SCPI command (see chapter 5).

IMEISV International Mobile Equipment Identity and Software Version: Equipment ID of the mobile phone. The *IMEI* incorporates the type approval code, the manufacturer code, the serial number of the phone and a check digit. The *IMEISV* also returns the software version of the mobile phone.



☞ As from December 31th 2002 IMEIs start with an 8-digit TAC. As the number of mobile phone types manufactured surpassed one million, the FAC was abolished. However, it is not possible to differentiate between phones with an allocated TAC + FAC and phones which only have been assigned a TAC.

MS Pwr class RF power class of the mobile phone (code digit and absolute value for the maximum RF power in dBm; this is not displayed when testing dual-band mobile phones – see page 4-38).

RF power classes					
Code digit	1	2	3	4	5
GSM 850/900/E-GSM	43 dBm	39 dBm	37 dBm	33 dBm	29 dBm
GSM 1800 (PCN)	30 dBm	24 dBm	36 dBm	–	–
GSM 1900 (PCS)	30 dBm	24 dBm	33 dBm	–	–

Rev. Level Indicates the GSM revision level of the mobile phone's hardware and software. According to the GSM specification the value should be *Phase 1* or *Phase 2*.

Ext. Freq. Indicates whether the mobile phone supports the extended channel range (E-GSM): *YES* or *NO*.

SMS Indicates whether the mobile phone supports the GSM Short Message Service (SMS). *YES* or *NO*.

EFR Indicates whether the mobile phone supports Enhanced Full Rate mode (improved voice quality): *YES* or *NO* (mobile telephone only supports Full Rate mode).

A5 Support Code number of the A5 algorithm, stored in the mobile phone.
1 = A5/1 *2* = A5/2 *3* = A5/1+A5/2
For data protection reasons, speech and all traffic data are encrypted before transmission and decrypted again at the receiving end.

Dual-band mobile phones only

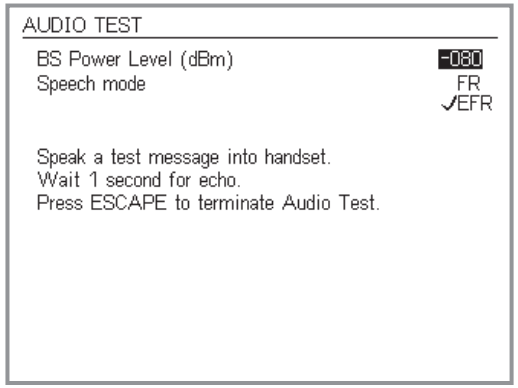
Multiband Indicates which frequency ranges the mobile phone supports: *900* (or *900E*) and *1800* or *1900*.

Ext. Protocol Indicates the status of the extension bit:
NO = 0, *YES* = 1.

MS Pwr class 1 Power class of the mobile phone for GSM/E-GSM.

MS Pwr class 2 Power class of the mobile phone for GSM 1800/1900.

Test 7.0: Speech testing



The speech mode EFR is only displayed if the mobile phone supports this mode (improved voice quality in the event of poor reception).

In speech testing the test signal runs through the entire transmission path from the mobile phone's mouthpiece to the base station (tester) and back to the mobile phone's earpiece. That means that the test is positive only if all the RF and audio signal paths in the mobile phone are intact. You can run this test as an initial function check or for selective testing of the AF signal paths.

■ Preconditions for testing

- There must be a valid telephone connection between the mobile phone and the tester, set up in Test 2.0 or 3.0.
- The *BS CALL ACTIVE* or *MS CALL ACTIVE* menu must be visible (to get back to this menu from lower-level menus press (Esc)).

■ Test 7.0 step by step

1. Press the (SPEECH) softkey (which calls the menu shown on the top left of this page). If this softkey is not shown: press (MORE).

   ☞ The speech test is not carried out if the tester is in *DATA 9600* mode (see page 4-3)

2. Enter the BS power level of the tester in the *BS Power Level* field (recommended initial value: –60 dBm).
3. If the voice codec of the mobile phone being tested supports Enhanced Full Rate (*EFR*) mode, this is displayed in addition to the standard Full Rate (*FR*) mode. Only if this is the case is it possible to select the required mode with the cursor keys and confirm your choice with (✓).
4. Speak a word into the mobile phone's mouthpiece.
5. After a delay of about a second you should hear the word in the mobile phone's earpiece (echo loop).

6 Repeat the speech test as many times as you like. Reduce the *BS power level* of the tester each time. You can also switch between EFR and FR modes during testing.

7 Press the Esc key to return to the *CALL ACTIVE* menu and run some other tests there.

Test 7.0 result

☺ Down to approx. –96 dBm, the echo should not be distorted, irrespective of whether EFR or FR mode is selected. At levels below this (approx. –102 dBm), distortions can first be heard in FR mode and if the level is further reduced, distortions will also be heard in EFR mode.

☹ No echo is heard or the echo is distorted at levels significantly above –96 dBm. If the mobile phone does not exhibit any other errors, the fault may be caused by defective audio signal processing (defective microphone or loudspeaker etc.).

Test 8.0: Cell Broadcast test

In Test 8.0, the Willtek 4200 sends a text message to the mobile phone. If the phone's decoder is in working order, the received text is displayed.

Cell Broadcast?
The Cell Broadcast service is not to be confused with the SMS (Short Message Service). SMS enables individually addressed messages to be sent across the TCH (see also page 4-50).

Cell Broadcast transmits public information (e.g. traffic reports or match results) on a cell's BCCH. However, the fact that a mobile phone is able to decode SMS texts (see test 6.0) does not automatically mean that it will also support the Cell Broadcast service.

Willtek - THE wireless solution provider - Cell Broadcast Channel Message

■ Preconditions for testing

- The Cell Broadcast test can only be run on test units capable of receiving messages such as these. Unfortunately, a standard procedure for ascertaining this state does not exist. If you cannot find any menu items on your mobile phone entitled Cell Broadcast or Broadcast Call, it is highly likely that the device does not support the service.
- If you succeed in finding an appropriate menu item, switch on the Cell Broadcast function on your mobile phone.
- Switch off your mobile phone.
- Carry out the usual test preparations (see page 4-4). Your choice of TCH channel number is of no significance. Make sure that the Willtek 4200 is displaying the *SPEECH/DATA 9600* menu (this means that the tester is already broadcasting on the BCCH).

■ Test 8.0 step by step

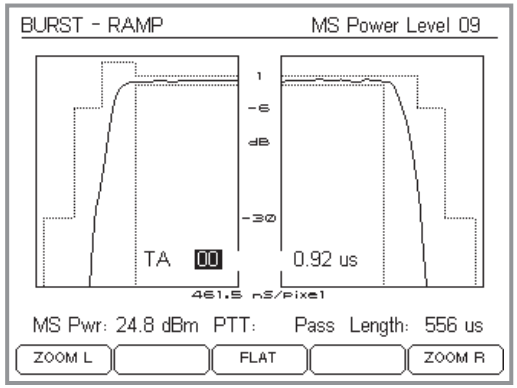
Switch on your mobile phone and look at the display.

■ Test 8.0 result

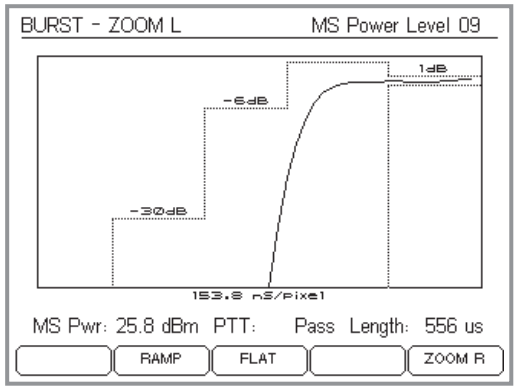
☺ The text on the left appears on the phone the moment it connects to the service (the appearance of the text may differ from model to model).

☹ The text does not appear at all or is distorted.

Test 9.0: Testing the burst profile



Graphical representation of the burst profile with alphanumeric display of the RF transmit power of the mobile phone (MS Pwr), the quality rating (PTT: Pass or PTT: Fail) and the burst duration (Length).



Zoomed representation of the rising burst edge.

In addition to the PASS/FAIL rating of the power/time template (Test 4.0), the tester can also display the measured GSM burst profile and the error tolerance zone in accordance with the GSM specification. In the event of an error, a zoom display helps localize the points at which the bursts move outside the tolerance zone.

■ Preconditions for testing

- There must be a valid telephone connection between the mobile phone and the tester, set up in Test 2.0 or 3.0.
- The *BS CALL ACTIVE* or *MS CALL ACTIVE* menu must be visible (to get back to this menu from lower-level menus press (Esc)).

■ Test 9.0 step by step

1 Press the (BURST) softkey. If this softkey is not shown: press (MORE).
The display now shows the power/time template (PTT) of the measured GSM bursts in the *BURST RAMP* menu together with the permissible tolerances. The display is refreshed every 0.5 s.

2 The softkeys can now be used to magnify important areas of the burst:

(ZOOM L)	Rising edge
(FLAT)	Top
(ZOOM R)	Falling edge

Press (RAMP) in these menus to return to the *BURST RAMP* menu.

3 Set RF transmit power of the mobile phone (*MS Power Level*) to the required level with (↑↑) and (↓↓) (see also page 4-7).

4 Terminate the test with (Esc).

Movable tolerance zones

According to the GSM specification, the tolerance boundaries in the power/time template are not specified at fixed levels, but depend on the current power level of the mobile phone (MS Power Level). In addition, the position of the –30 dB boundary depends on the measured RF transmit power of the mobile phone (MS Pwr). The Willtek 4200 takes account of these factors and displays tolerance zones which reflect the current situation.

■ Test 9.0 result

☺ If the Willtek 4200 returns *PTT: Pass*, the bursts are fully within tolerance. You can double check whether the bursts only just fall within tolerance at critical locations.

☹ The message *PTT: Fail* is followed by a symbolic indication of the section of the burst where the tolerance zone was exceeded (see also page 4-28). Indications of the cause can be obtained by zooming these sections.

The *PTT: Fail* assessment always applies to the entire burst, even if only a magnified section of the burst (which may be within tolerance) is visible.

Background to Timing Advance

Depending how far a mobile telephone is located from its base station (BTS), the RF signal will have a longer or a shorter travel time. In order to ensure that the RF signal of mobile telephones that are varying distances away still reach the BTS within a specified time slot, the Timing Advance feature of the BTS regulates the send time of the mobile telephones. Otherwise the phones would cause mutual interference.

If a mobile telephone is located in the immediate vicinity of the BTS, it need not send early. The TA value is specified in bits, and in this case would remain at 0 bit. At the edge of the cell the value may be a maximum of 63 bits, which correspond to a distance of 35 km.

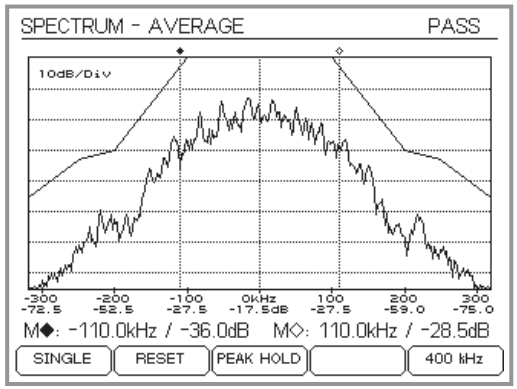
In order to avoid interference, the mobile telephone must be capable of accurately maintaining the TA value (transmission time offset) as specified by the BTS. The timing errors on the mobile telephone will be displayed by the tester.

■ Timing Advance

In the *TA* field (Timing Advance) of the *BURST RAMP* menu you can enter values ranging from 00 through to 63 bit. The display field located on the right next to this field indicates, on the basis of the current TA value, the timing error that the mobile telephone shows when transmitting bursts.

An maximum error of ±3.69 µs is permitted, this is a tolerance of ±1 bit in relation to the target time (see text on the left).

Test 10.0: Testing the burst spectrum



For the AVERAGE display, the tester first collects a number of bursts, calculates an average burst profile and then displays this profile. Then the oldest burst is removed, a new burst is measured, the average is again calculated and displayed and so on.

Threshold curve

If the burst spectrum is always below the displayed threshold curve, the header of the menu shows the evaluation PASS.

The threshold curve is the result of a linear interpolation between the following key values:

Frequency offset	Key value
0 through ±100 kHz	+0,5 dB
±200 kHz	–30 dB
±250 kHz	–33 dB
±400 kHz	–60 dB

From the graphical display of the modulation spectrum, specialists can, for instance, identify a faulty modulator causing interference in neighboring channels.

Preconditions for testing

- There must be a valid telephone connection between the mobile phone and the tester, set up in Test 2.0 or 3.0.
- The *BS CALL ACTIVE* or *MS CALL ACTIVE* menu must be visible (to get back to this menu from lower-level menus press (Esc)).

Test 10.0 step by step

1 Press the (SPECTRUM) softkey. If this softkey is not shown: press (MORE).
The display shows the most recently active *SPECTRUM* menu (e.g. *AVERAGE*) and the currently measured burst spectrum appropriate to the menu including the permitted threshold curve.

2 You can use the following softkeys to call up different representation modes for the burst spectrum:

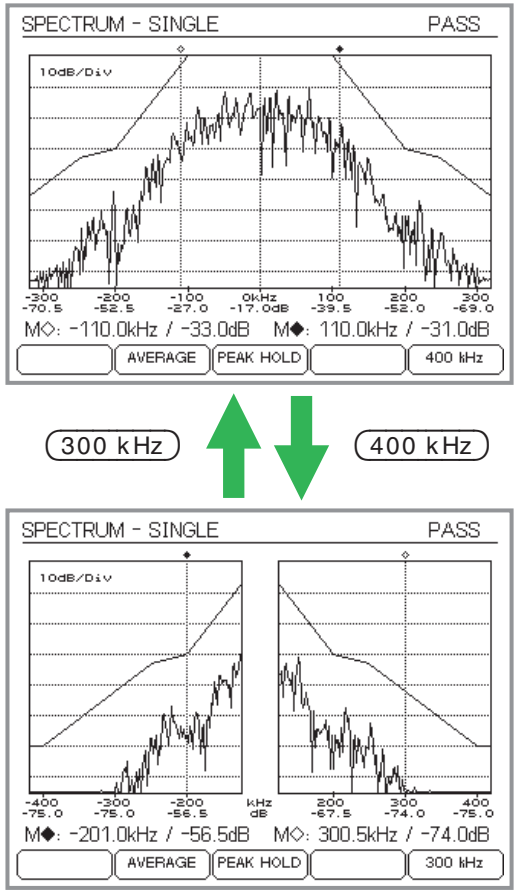
(SINGLE) The display is based on the measurement of individual bursts (measurement frequency: approx. 0.5 s).

(AVERAGE) The display is based on average values from the last 5 measured bursts (measurement frequency: approx. 0.5 s).

(PEAK HOLD) The display is based on peak values only. After you press the softkey, all incoming bursts are evaluated (measurement frequency: unlimited).

(RESET) Resets the display to its initial status (in AVERAGE and PEAK HOLD modes).

(300 kHz) Representation of the burst spectrum in the ±300 kHz frequency range (relative to the channel-dependent carrier frequency). Used primarily for power measurements



in spectral bands close to the carrier frequency.

(400 kHz) Representation of the burst spectrum in the ±400 kHz frequency range, where the inner spectral range (±127 kHz) is not shown. Instead, the outer range is shown. Used primarily for power measurements in spectral bands distant from the carrier frequency.

3 Two markers are available to allow specific power measurements. These markers can be selected and moved independently using the keys of the cursor block:

▲ or ▼ Select the marker to be moved.
M◆ = Marker selected
M◇ = Marker not selected

◀ or ▶ Move selected marker to the left or right. Speed of movement increases if the key is held down.

The measurements determined at the intersection between the marker and the spectrum (frequency, relative power to center of band) are displayed separately for each marker. The x-axis has a dual scale and, independently of the markers, gives a rapid overview of the dB value the current spectrum has for the displayed kHz values.

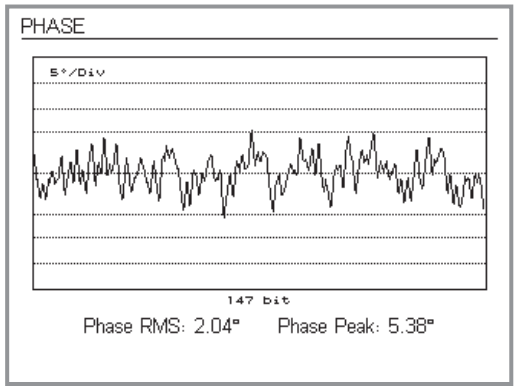
4 Terminate the test with (Esc).

■ Test 10.0 result

☺ *PASS:* The threshold curve as per the GSM specification is not exceeded at any point.

☹ *FAIL:* The threshold curve is exceeded.

Test 11.0: Checking phase errors



From the graphical display of the phase errors, specialists can, for instance, draw conclusions about the quality of the modulator or identify a superposed frequency error.

■ Preconditions for testing

- There must be a valid telephone connection between the mobile phone and the tester, set up in Test 2.0 or 3.0.
- The *BS CALL ACTIVE* or *MS CALL ACTIVE* menu must be visible (to get back to this menu from lower-level menus press (Esc)).

■ Test 11.0 step by step

1 Press the (PHASE) softkey. If this softkey is not shown: press (MORE).
The display now shows *PHASE* menu containing the profile of the phase error plotted against the duration of a burst (vertical scale: 5° per tic). The display is refreshed approximately every 0.5 s.

The following numerical measurements for the phase error are shown for the profile displayed:

Phase RMS Average (1 burst)
Phase Peak Peak value (1 burst)

2 Terminate the test with (Esc).

■ Test 11.0 result

☺ No peak outside the display window (±20°), average value < 5°.

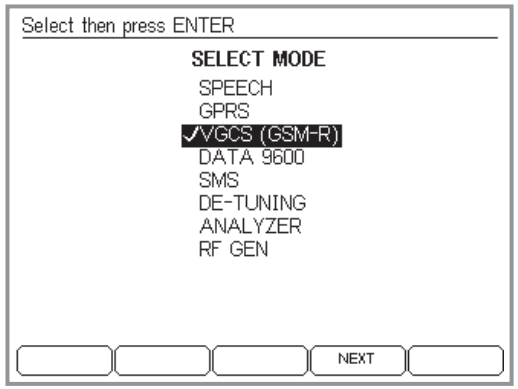
☹ Peak value ≥ ±20°, average value ≥ 5°.

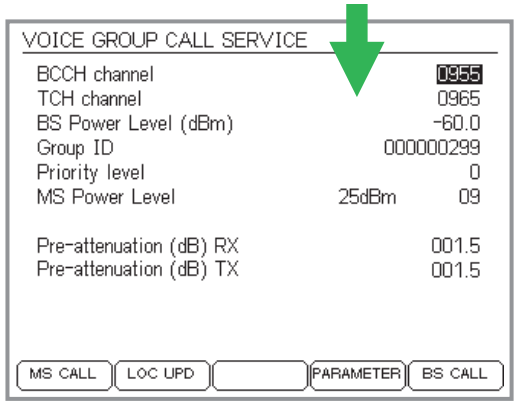
Voice Group Call Service (VGCS)

☞ *Note that tests for the GSM-R function "VGCS" are only available on the 4202R model of the Willtek 4200 series.*

In VGCS mode (GSM-R), a Willtek 4202R can transmit and receive prioritized group calls (Voice Group Call Service). Group calls are one of the advanced speech call services available in GSM-R networks (ASCI: Advanced Speech Call Items). Prioritization of group calls defines, among other things, whether a given group call is permitted to interrupt a group call with a lower priority.

Preparing a group call





⇦ + FAULT FIND + radio system selection + NEXT

VGCS (GSM-R) is only available on the Willtek 4202R.

■ Setting the test parameters

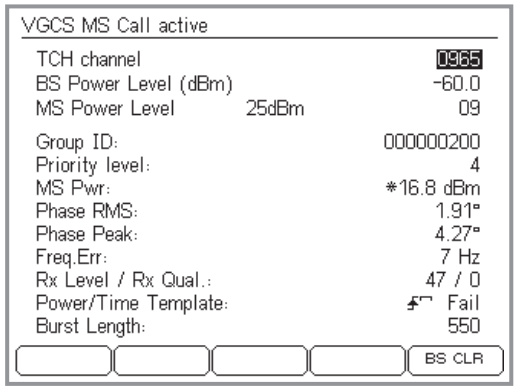
1. Check that the mobile phone is fitted with a SIM from the rail operator which permits group calls. The test SIM from Willtek does not currently support group calls (function currently in preparation).
2. Switch off the mobile phone and connect it to the tester (see also chapter 2).
3. Choose *SELECT MODE* from the tester menu (see the top figure), select the entry *VGCS (GSM-R)* with the cursor keys and confirm your choice with ✓.
4. Set the standard test parameters (channel numbers etc) as described on pages 4-6 ff for speech/data mode. If you have not previously selected a single-band radio system, make sure you observe the notes on page 4-8. Refer to the following descriptions for the test preparations available on the softkeys.
   LOC UPD page 4-16
   PARAMETER page 4-12

5 Entering the group call test parameters:

Group ID (up to 9 digits)
Priority level (0 through 4, A or B)

The group call test parameters are only used by the tester if a group call is initiated by the tester (BS CALL). When a group call is received (MS CALL), the tester displays the values for *Group ID* and *Priority level* as reported by the mobile phone.

Group call MS CALL



In remote operation, listener/talker mode can be queried with the signaling register. See page 5-74, Quick reference, Signalling status register, bit 4.

1 Set tester to receive mode with (MS CALL). The tester now waits for a group call to arrive (press (Esc) to cancel).

2 Switch on the mobile phone and initiate a group call, either with speed dial function or by selecting a menu item, depending on the model.

☞ The PTT key (push-to-talk) must remain depressed for the duration of the test. If the PTT key is released, the mobile phone automatically switches from transmit to receive mode. If the PTT key is pressed again, the connection to the tester is established again and the measurement starts from the beginning.

3 In addition to the normal measurements, the tester now displays the *Group ID* and the *Priority level* as they were transmitted by the mobile phone.

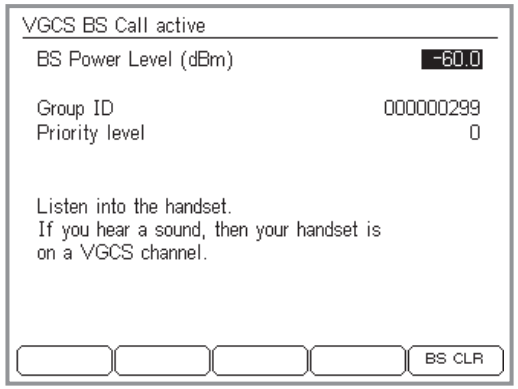
4 Stop the test by pressing (BS CLR).

■ Test results

☺ The group call parameters queried by the mobile phone have the expected nominal values.

☹ No group call parameters are displayed or the parameters do not have the expected nominal values.

Group call BS CALL



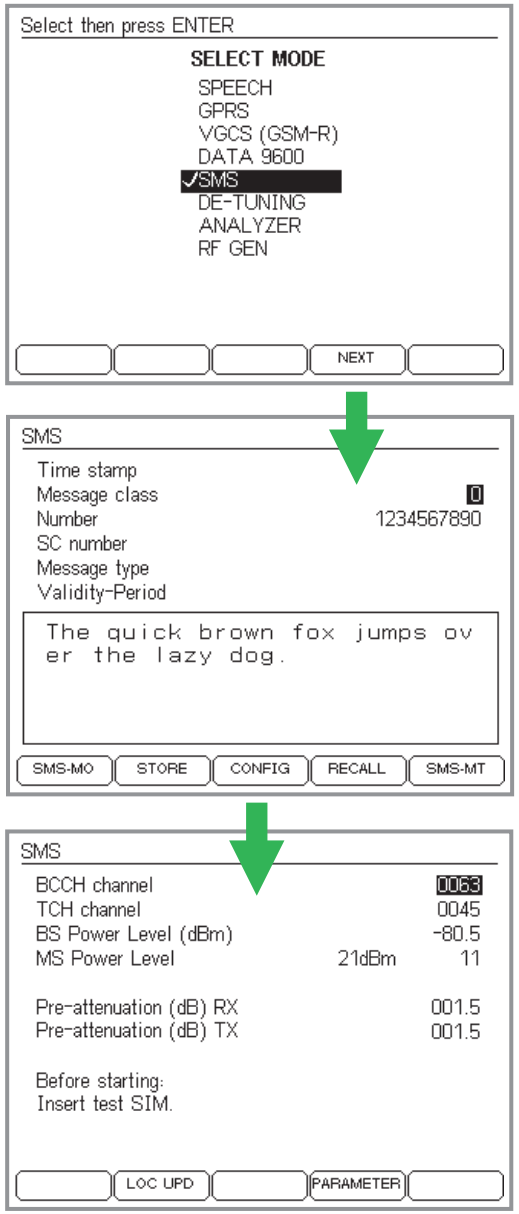
1. Press (BS CALL) to initiate a group call from the tester. The tester now displays the *VGCS BS CALL active* menu. This menu shows the group call test parameters used to transmit the group call to the mobile phone.
2. Switch on the mobile phone and check whether a continuous 1-kHz tone can be heard.
3. Stop the test by pressing (BS CLR). To perform further tests, go back to the *SELECT MODE* menu and select the required mode (e.g. *SPEECH*).

■ Test results

☺ The mobile phone reacts in the correct way for the group of which it is a member. The continuous tone may only be heard if the group ID transferred by the tester matches the group membership data for the mobile phone (stored on the SIM). The call priority is specific to the network and can therefore cause different reactions such as special ringtones on the mobile phone or the interruption of a lower priority call and/or triggering signal lights in the driver's cab of the train.

☹ The mobile phone does not issue the continuous tone, even though it is a member of the correct group. The contrasting error is unlikely, namely that the continuous tone can be heard on the mobile phone, although it should be suppressed, as the mobile phone is not a member of the relevant group.

Preparing SMS mode



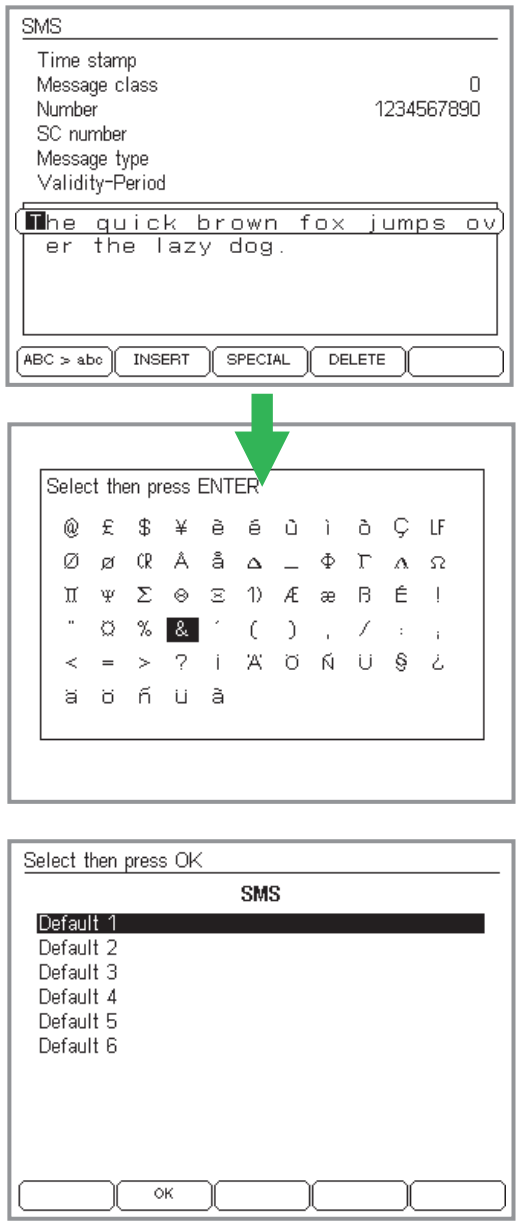
If a mobile phone supports the GSM service SMS (Short Message Service), it is able to receive and send personally addressed text messages (see also *MS INFO* menu on page 4-38 and Cell-Broadcast on page 4-41). With a Willtek 4202 you can test the SMS function on mobile phones in both transmit and receive directions.

⇦ ✓ + FAULT FIND + radio system selection + NEXT

SMS is only available on the Willtek 4202 models.

■ Setting the RF test parameters

1. Connect the mobile phone to the tester and switch it on (see also chapter 2).
2. Call the *SELECT MODE* menu (see the top figure), select the entry SMS with the cursor keys and confirm your choice with ✓.
3. Proceed to the main SMS menu with ✓ or NEXT (see the middle figure).
4. Use CONFIG to proceed to the SMS configuration menu (see bottom figure, valid for single band radio systems; for dual-band or multiband models: see page 4-8).
5. The SMS configuration menu allows you to set the RF test parameters which are to be used for the SMS tests. When it is first called, the menu displays the values which were most recently used in speech/data mode. Leave these values as they are or change them according to your requirements (see description as of page 4-6).
6. Return to the SMS main menu with Esc.



For each SMS receive test you can write any new message on the tester or adopt the faster method of using prepared messages. Such preparation is not necessary for SMS transmit tests.

■ Entering/storing message texts

1 Use the cursor keys to select the text box displayed in a frame in the SMS main menu. The softkeys are assigned new functions for switching between uppercase and lowercase and for editing operations (see top figure).

2 Enter the message line by line or edit it using (INSERT) and (DELETE) (see also page 2-7). Press (✓) at the end of a line to go to the next line. The total length of the message must not exceed 140 characters. (SPECIAL) calls a menu containing special characters (see middle figure). Here you select the required character using the cursor keys. (✓) inserts the special character in the text at the current insertion point. You can press (Esc) to cancel the operation.

You can also enter additional special characters by proceeding as follows: select special character *1*) on the display and press (✓) to enter it into the message text. Now select the relevant control character from the table below and press (✓) to add it to the message text.

Special character	Control character	String on display
€	e	1)e
{	(	1)(
}	)	1))
[	<	1)<
]	>	1)>
~	=	1)=
\	/	1)/

Special characters can only be shown on the mobile phone's display, if the mobile phone supports the display of special characters.

3 Press ✓ when you have completed the text.

4 Press STORE in the SMS main menu. This calls the menu for storing the message text (see bottom figure).

5 Select the required storage location *Default X* with the cursor keys, change the name if necessary (see also page 2-7) and press OK to save the text.

■ Loading a message text

1 Press RECALL in the SMS main menu.

2 Select the required storage location with the cursor keys and load the assigned message text with ✓ or alternatively load the default message text *The quick brown fox ...* with DEFAULT (this text contains all the alphabetic characters of the standard ASCII character set).

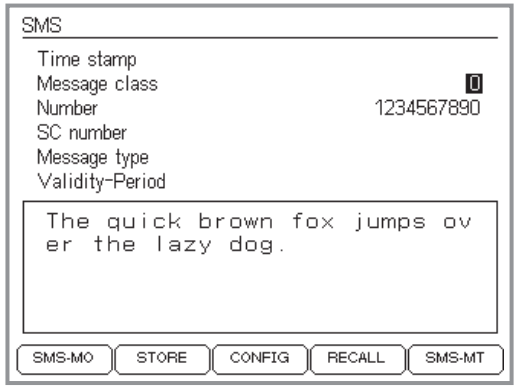
Tests in SMS mode

Testing with the original SIM
Some SMS parameters (e.g. data type) can be set on the mobile phone and are then stored on the original SIM. To allow these particular parameters to be queried by the tester (SMS transmit test), it is recommended that the original SIM is inserted in the mobile phone.

This is what is tested

Receive (Willtek 4202 ➔ mobile phone)	**Field**
Timestamp of the message	*Time stamp*
Message class of the message	*Message class*
Transmitted telephone number (SMS sender)	*Number*
Message text (GSM standard character set)	Text box
Transmit (mobile phone ➔ Willtek 4202)	**Field**
Transmitted telephone number (SMS sender)	*Number*
Identification number of the service center (SC)	*SC number*
Data type of the message	*Message type*
Validity period of the message	*Valitity-Period*
Message text (GSM standard character set)	Text box

SMS receive test



SMS main menu.

During the receive test, the mobile phone receives a message text sent by the tester.

Preconditions for testing

- The mobile phone must support SMS (see page 4-38).
- The preparations for testing must have been completed (see page 4-50).

Test step by step

1 In the SMS main menu, select the *Message class* field with the cursor keys, enter the required value and confirm your choice with ✓.

Message class	Meaning for the message
0	Show on display
1	Store in working memory
2	Store on SIM
3	Store on external device (e.g. PDA)

2 Use the cursor keys to select the *Number* field, enter any number (SMS sender) and confirm your entry with ✓.

3 Move to the text box displayed in a frame with the cursor keys and enter the message text (see page 4-51) or press RECALL to load one of the prepared texts (see page 4-51).

4 Press SMS-MT to send the message (Mobile Terminated) and watch the reaction on the mobile phone.

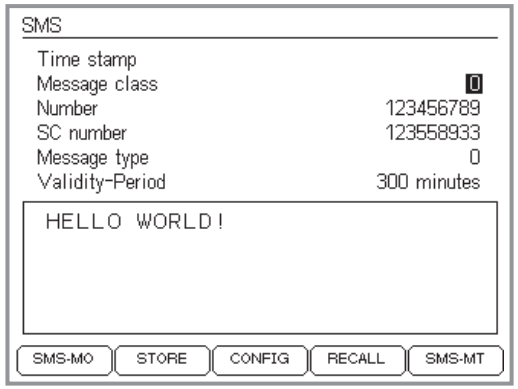
The *Time stamp* field is filled in when the message is sent by the tester. This provides the message with the normal SMS timestamp (date and time).

■ Test results

☺ The mobile phone receives the message and displays the text, number (SMS sender) and timestamp without errors.

☹ If the mobile phone does not receive the message, check whether all the preconditions for testing have been fulfilled and that the correct telephone number is entered. If you have doubts as to whether a connection is established reliably with a wireless connection, double check the channel assignments (see page 4-4). If the timestamp is incorrect, check the time and date settings on the tester (see page 2-6).

SMS transmit test



During the transmit test, the mobile phone sends a message text to the tester. The tester evaluates the message and displays the message text (GSM standard character set) in addition to important SMS parameters.

Preconditions for testing

- The mobile phone must support SMS (see page 4-38).
- The preparations for testing must have been completed (see page 4-50).

Test step by step

1. In the SMS main menu, switch the tester to SMS reception mode with SMS-MO (Mobile Originated).
2. Enter a message on the mobile phone and sent it to any number. Observe the reaction at the tester.

Meaning of the result fields

Time stamp SMS timestamp of the message.

Number Number to which the mobile phone sent the message (not the SMS sender).

SC number Identification of the service center. This identification depends on the network operator. It can be entered on the mobile phone (the first time the phone is used) and is stored on the SIM. If the ID is incorrect, messages do not reach the recipient or only do so unreliably.

Message type Data type of the message. The table below shows a small excerpt from the wide range of data types permitted by the GSM specification. *Message type* = 0 is usual.

Message type	Data type
0	Text
1	Telex
2 or 3	Fax (Group 3 or Group 4)
18	eMail

Number field
During the SMS receive test, any number can be entered in the Number field. This then appears on the mobile phone as the SMS sender. In the case of the SMS transmit test, the Number field is a result field showing the number to which the mobile phone sent the message.

Background: *The mobile phone does not know its own number but only the IMSI (stored on the SIM), which has nothing to do with the phone number. The number is only assigned to the IMSI by the MSC in the network. The advantage is that if the mobile phone is lost, the owner only has to lock the lost SIM and request a new one. The current assignment is then used for the new IMSI in the MSC, with the result that the old phone number is retained.*

The data type can be entered on the mobile phone and is stored on the SIM.

Validity-Period Validity period of the message before it is deleted by the network operator in the service center. A message is lost if the recipient does not sign on to the GSM network during the validity period of the SMS message. The *Validity Period* can be entered on the mobile phone and is stored on the SIM.

Text box Text of the message if this has been entered using the standard GSM character set. For other character sets, the character set type and the number of characters received are displayed (up to 140 bytes).

■ Test results

☺ The result fields show the expected values.

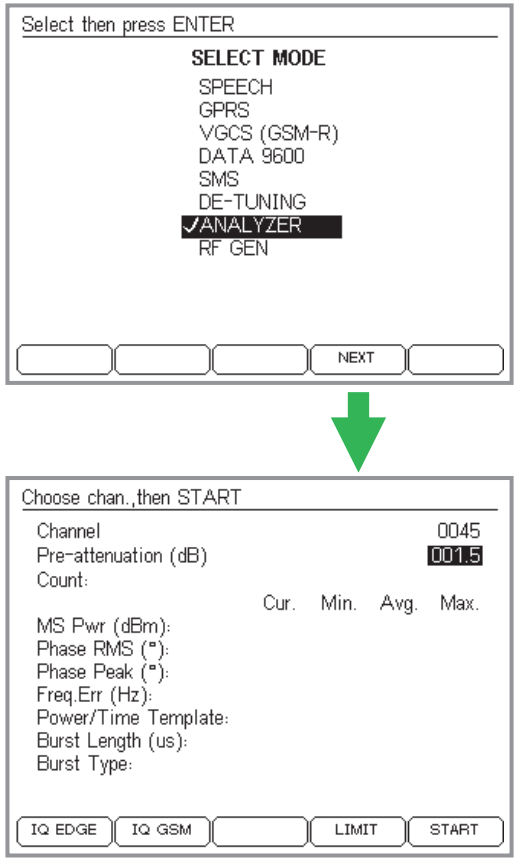
Tip: If the text box does not display the message text (for instance for Chinese characters), the message text can still be saved using (STORE). This message can then be sent to a mobile phone equipped with the appropriate character set using an SMS receive test, where it can be read.

☹ If the tester does not receive the message, check that the mobile phone is fundamentally operational in speech/data mode. If you have doubts as to whether a connection is established reliably with a wireless connection, double check the channel assignments (see page 4-4).

■ Storing a received message text

Received message texts can also be stored with (STORE) and recalled with (RECALL) (see page 4-51).

Preparing asynchronous mode



Any GSM mobile phone can be set to “test mode”. Except of other settings the test mode allows to align and tune the basic RF parameters of a mobile phone. How this is achieved and what features are available on a mobile phone in test mode vary from manufacturer to manufacturer. It is therefore not possible to provide generally valid instructions in this document.

Operation step by step

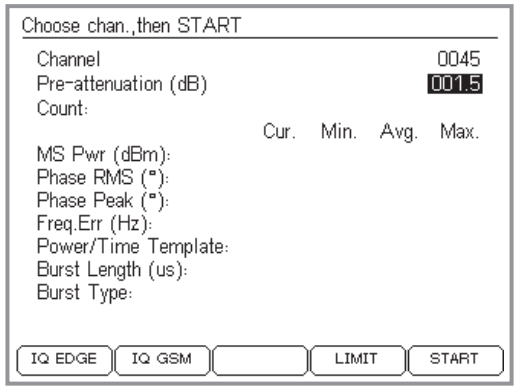
1. Connect the mobile phone to the tester (see chapter 2), and set it to test mode according to the manufacturer’s instructions.
2. Set the required test parameters (e.g. channel number, power level) on the mobile phone according to the manufacturer’s instructions.

⇦ + FAULT FIND + radio system selection + NEXT

3. Choose *ANALYZER* from the *SELECT MODE* menu and confirm your choice with ✓.
4. Press ✓ or NEXT to proceed to enter the test parameters.
5. Enter the channel number you set on the mobile phone in the *Channel* input field and confirm your entry with ✓. You do not have to distinguish between TCH and BCCH as the channel number is only used to tune the receiver in the Willtek 4200.
6. Enter the value used to compensate for RF pre-attenuation in the *Pre-attenuation* field (for details see page 3-23) and confirm your entry with ✓.
7. If necessary, choose LIMIT to call the menu of the same name and enter individual tolerance limits for measurement evaluation (see page 4-13).
8. Start the test using the softkeys as shown in the table on page 4-59.

Once a mobile phone has been set to test mode, it will generally no longer react to normal signals. This means that settings have to be carried out on the mobile phone itself (either manually or under Remote Control). In Asynchronous Mode, the Willtek 4200 and the mobile phone do not exchange signals. Instead, the tester is permanently set to receive and is able to evaluate the RF signals from the mobile phone.

Tests in asynchronous mode



Test mode must be terminated on the mobile phone after the measurements have been completed or before FAULT FIND mode is called or RF Gen, for example.

This is what is tested

In asynchronous mode, a Willtek 4200 displays the measured RF parameters in numerical and graphical form:

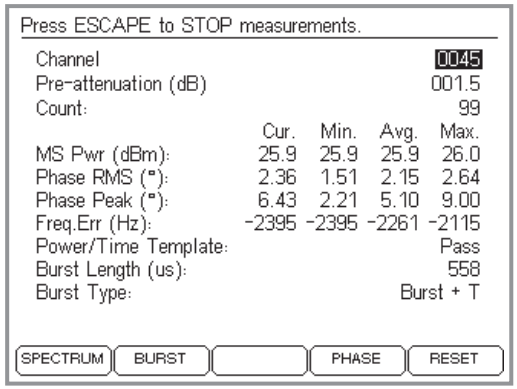
RF parameters (numeric display)	START
Mobile phone transmit power	–
Phase error (RMS and peak)	–
Frequency error	–
Power/time template (Pass/Fail)	–
Burst duration	–
RF parameters (graphical display)	START +
Burst spectrum	SPECTRUM
Power/time template (graphical, Pass/Fail)	BURST
Phase error (graphical, RMS and peak)	PHASE
Special functions	–
Spectral bands ±50.81 kHz relative to carrier	IQ EDGE
Spectral bands ±67.71 kHz relative to carrier	IQ GSM

Changing bands on multiband devices

If you want to change between the 900/1800 and 1900 bands when testing a multiband phone, proceed as follows:

1. Terminate the current measurement (e.g. in the 900/1800 band) by pressing Esc.
2. Terminate test mode on the mobile phone.
3. Switch the tester to the new band (e.g. the 1900 band) using the softkey.
4. Set the mobile phone to test mode again and set the new band.
5. Set the new channel number on the mobile phone and on the tester and press START to continue the measurement.

RF parameters (numeric)



After you press START, the tester will measure continuously, updating every 2.5 seconds. The channel number cannot be changed during measurement. Measurements displayed in numeric form are available immediately. You can call up the measurements displayed in graphical form with the new softkeys.

Press Esc to terminate continuous measurement.

Measurements

MS Pwr RF transmit power of the mobile phone.

Phase RMS Phase errors of the GSM burst signal (average value).

Phase Peak Phase errors of the GSM burst signal (peak value).

Freq.Err Frequency error of the RF carrier signal.

Power/Time-Template Assessment of whether the GSM burst signal lies within the tolerance zones of the template (for details, see page 4-28).

Burst Length Duration of the GSM burst.

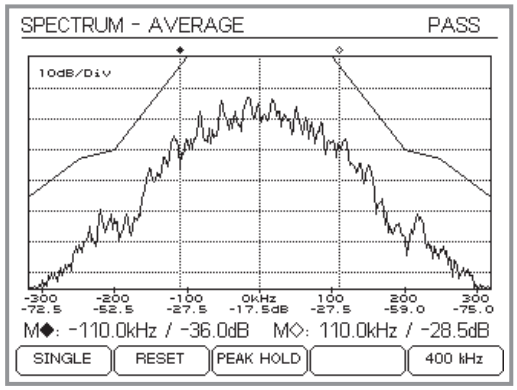
Burst Type Detailed information on the characteristics of the GSM burst. The tester derives this information by comparing the received bursts with stored reference patterns. The following messages may appear, depending on the result:

Burst + T	Burst with training sequence.
Cont.	The mobile phone transmits a continuous GMSK modulated RF signal rather than bursts.
–-	No detailed information available on the signal.

Display of statistical values

The display shows statistical values (min/max values, average) as well as the current value (in the *Cur.* column). *Count* shows the number of measured values evaluated for the statistics. (RESET) resets the counter and restarts the evaluation.

RF parameters (graphical)



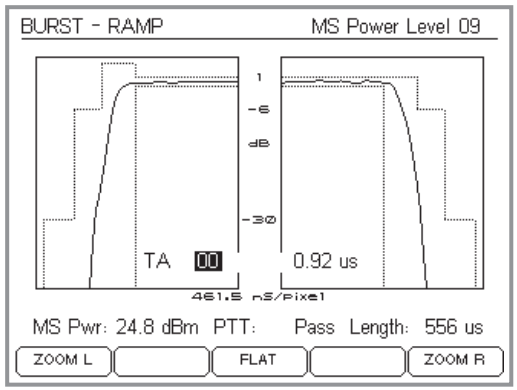
Burst spectrum

Call by pressing (SPECTRUM).

The menu and method of operation are the same as in the corresponding test in speech mode (refer to page 4-44 for a detailed description).

Sideband adjustment at minimum: see page 4-63.

Press (Esc) to return to the numerical display of measurements.

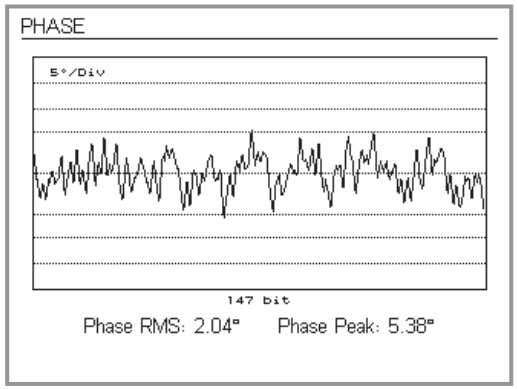


Power/time template

Call by pressing (BURST).

The menu and method of operation are the same as in the corresponding test in speech mode (refer to page 4-42 for a detailed description).

Press (Esc) to return to the numerical display of measurements.



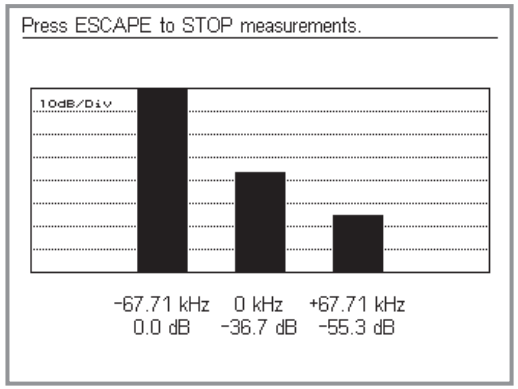
Phase error

Call by pressing (PHASE).

The menu and method of operation are the same as in the corresponding test in speech mode (refer to page 4-46 for a detailed description).

Press (Esc) to return to the numerical display of measurements.

IQ tuning



Call by pressing (IQ GSM) or (IQ EDGE).

For the purposes of adjustment, a Willtek 4200 can display the special form of the burst spectrum as shown on the left. Here, the representation of the relative power dependent on the frequency is reduced to the carrier and two sidebands. IQ GSM and IQ EDGE differ only in the offset of the sidebands to the carrier frequency.

IQ GSM	Offset = ±67,71 kHz
IQ EDGE	Offset = ±50,81 kHz

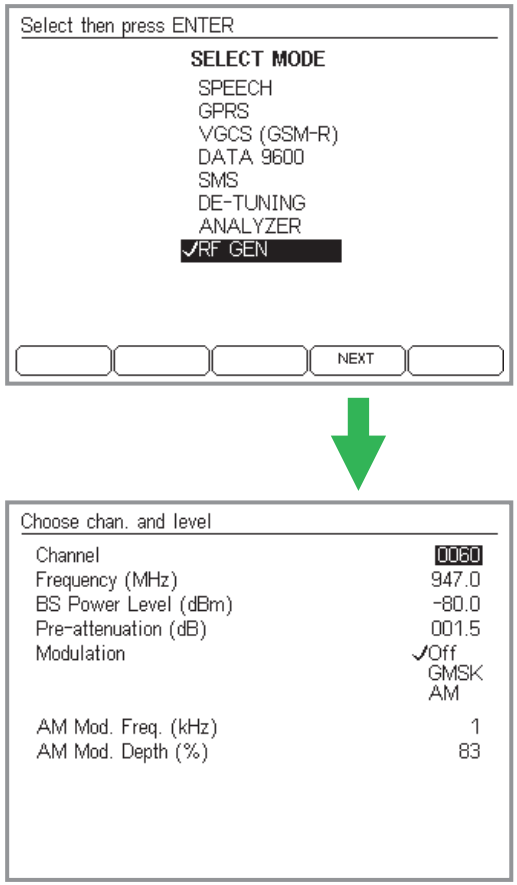
Press (Esc) to cancel.

The aim of IQ tuning is to adjust the IQ modulator of the mobile phone (DC offset, amplitude balance, phase position). To do this, the mobile phone must transmit a special bit sequence test signal (maximum power in one of the sidebands).

Example for IQ GSM (with special test signal)

–67,71 kHz	Maximum value (reference point 0 dB).
0 kHz	Minimize bar height by adjusting the DC offset.
+67,71 kHz	Minimize bar height by adjusting the amplitude balance and phase position.

RF generator



Calculating the transmit frequency

Lower band frequency + 0.2 MHz (channel spacing) x n (channel number). Thus, for GSM 900, for example:

f = 935 MHz + 0.2 MHz x n

It may be appropriate to feed a defined carrier signal into the mobile phone for test and adjustment purposes. This function is available if you select *RF GEN* in the *SELECT MODE* menu. As soon as the RF generator menu appears, the Willtek 4200 sends a carrier signal defined by the values entered in the menu.

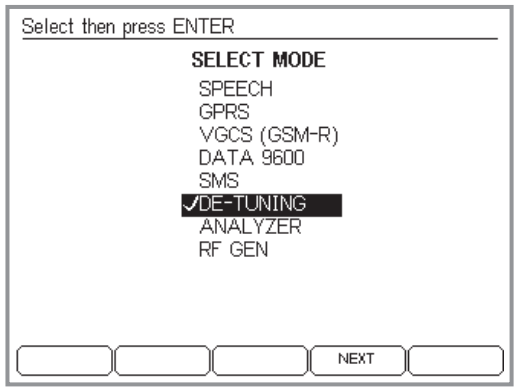
When Modulation is set to *GMSK*, the frequency of the carrier signal is offset by +67.71 kHz (relative to the current channel frequency). This corresponds to a digital modulation signal in the form 000000...

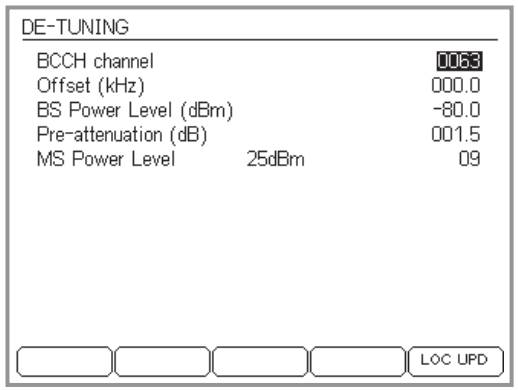
AM modulation causes amplitude modulation of the carrier with a low-frequency signal. The modulation frequency (*AM Mod Freq.*) and the modulation depth (*AM Mod. Depth*) can be set.

☞ The input fields for amplitude modulation are only available if the tester has the AM modulation option fitted (this can be checked in the *SYSTEM INFORMATION* menu (see page 1-18).

Press Esc to cancel.

De-tuning test





If the de-tuning option is fitted, a Willtek 4200 can transmit the signal on the BCCH with a frequency offset. In practice, frequency shifts of this type occur when the distance between a carphone and the base station changes very rapidly (Doppler shift). A mobile phone must be able to sign on without problems even under these circumstances.

Operation step by step

1 Connect the mobile phone to the tester (see chapter 2) but do not switch on yet.

⇦ + FAULT FIND + select radio system + NEXT

Only available with the de-tuning option.

2 Use the cursor keys to select the entry *DE-TUNING* from the *SELECT MODE* menu (shown on the left) and confirm your choice with ✓.

3 Press ✓ or NEXT to proceed to entry of the test parameters.

4 Use the cursor keys to select the input fields, enter the test parameters and confirm each entry with ✓.

- *BCCH channel*: Number of the signaling channel to be de-tuned.
- *Offset*: Required frequency offset for the BCCH (max. ±75,0 kHz).
- *BS Power Level*: RF transmit power of the tester.
- *Pre-attenuation*: Compensation for RF signal attenuation over the transmission route (see page 3-25).
- *MS Power Level*: Power level with which the mobile phone is to send RF signals to the tester (see page 4-7).

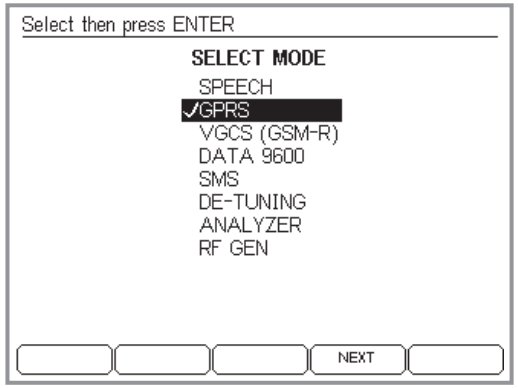
5 First press LOC UPD, then switch on the mobile phone. The tester now instructs the mobile phone to perform a location update.

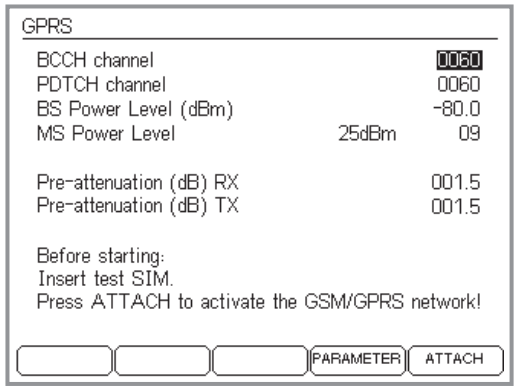
Test result

☺ A *WAIT* box is shown on the tester display until the mobile phone has recognized the test network (ID: `001 01`) and signed on with the tester.

☹ If the mobile phone does not sign on successfully, cancel the test with Esc. Repeat the test without a frequency offset. If the location update is then successful, repeat the test, gradually increasing the frequency offset.

Testing GPRS mobile phones





If the GPRS (General Packet Radio System) option is available on your Willtek 4202S, you can also test a phone's GPRS function. The type of GPRS option installed (Go/NoGo or Measurement, see page 6-18), determines what tests are possible.

■ Preparing GPRS tests

1 Connect the mobile phone to the tester (see chapter 2).

⇦ + FAULT FIND + radio system selection + NEXT

Only available with Willtek 4202S + GPRS option.

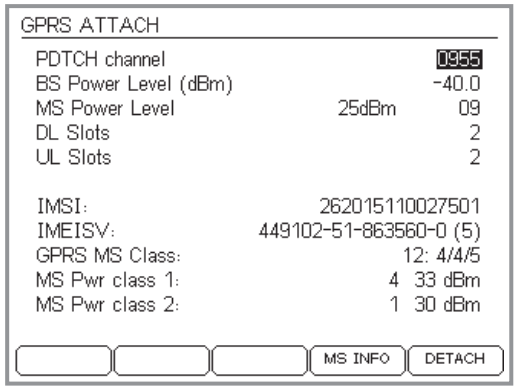
2 In the *SELECT MODE* menu, select *GPRS* using the cursor keys and confirm with ✓. Use ✓ or NEXT to proceed to test parameter entry.

3 The content of the *GPRS* menu is largely determined by the radio system that has been selected (single, dual or multiband system, see also page 4-8). Enter the normal *BCCH channel*, *BS Power Level*, *MS Power Level* and *Pre-attenuation RX/TX* test parameters as described for the Speech/Data mode as of page 4-6.

4 *PDTCH* stands for Packed Data Traffic Channel. Assign any channel number suitable for the radio system to this test parameter. The GPRS connection between the tester and the mobile phone will later be established on this channel. For some mobile phones it is necessary to set PDTCH and BCCH to the same channel number so that the BLER measurements can be taken without any interference (see also page 4-72).

5 You can access and modify a range of network parameters with PARAMETER (see also page 4-12).

Go/NoGo test in GPRS mode



The GPRS ATTACH menu after a mobile phone has checked into the tester's GPRS network.

(MS INFO) *calls up a complete list of all the mobile phone's identification data.* (DETACH) *causes the mobile phone to check out and returns to the GPRS menu.*

If the "GPRS Go/NoGo" option is available, the tester can check whether a mobile phone checks into / out of (attach/detach) the GPRS network correctly (simulated here by the tester).

Preconditions for testing

- Willtek 4202S + GPRS Go/NoGo option.
- The mobile phone must support GPRS.
- The preparations for testing must have been completed (see page 4-67).

Test step by step

1. Prepare the tester to receive an attach request from the mobile phone. To do this, hit (ATTACH) in the *GPRS* menu.
2. Switch on the mobile phone and switch to GPRS mode (if necessary).
3. If the mobile phone checks in successfully to the tester's simulated GPRS network, the display shows the *GPRS ATTACH* menu (see figure).

   ☞ **The phone does not check in**: Some mobile phones only check in successfully to the simulated network, if the BCCH and the PDTCH channels are within the same frequency band.

The two new entry fields, *DL Slots* and *UL Slots* (downlink/uplink slots) relate only to tests with the GPRS Measurement option.

The lower half of the *GPRS ATTACH* menu displays the most important identification data of the mobile phone as the test result. Additional identification data can be called with (MS INFO) (back with (Esc)). The meaning of the *GPRS MS Class* can be found on page 4-70, all other identification data, such as *IMSI*, and *IMEISV*, is described on page 4-36.

4 (DETACH) causes the mobile phone to check out and returns to the *GPRS* menu. Check-in can now be repeated with modified test parameters. (Esc) closes the Go/NoGo test and returns to the *SELECT MODE* menu.

■ Test results

☺ The mobile telephone checks into the tester's GPRS network; if successful, the test unit's identification data is displayed in the *GPRS ATTACH* menu. If check-out (DETACH) was completed correctly, the tester shows the *GPRS* menu again.

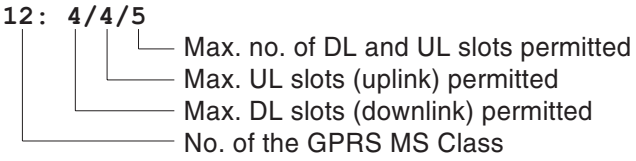
☹ Check-in/out failed. Cancel with (Esc).

GPRS multislot classes				
Class	Max. no. of time slots permitted			Duplex type
	Downlink	Uplink	Total	
1	2	1	3	semi
2	1	1	2	semi
3	2	2	3	semi
4	3	1	4	semi
5	2	2	4	semi
6	3	2	4	semi
7	3	3	4	semi
8	4	1	5	semi
9	3	2	5	semi
10	4	2	5	semi
11	4	3	5	semi
12	4	4	5	semi
13	3	3	–	full
14	4	4	–	full
15	5	5	–	full
16	6	6	–	full
17	7	7	–	full
18	8	8	–	full
19	6	2	–	semi
20	6	3	–	semi
21	6	4	–	semi
22	6	4	–	semi
23	6	6	–	semi
24	8	2	–	semi
25	8	3	–	semi
26	8	4	–	semi
27	8	4	–	semi
28	8	6	–	semi
29	8	8	–	semi

GPRS MS Class

The multislot class of a GPRS mobile phone informs the base station of the maximum number of time slots the mobile phone can use in the downlink/uplink directions.

Example of a GPRS MS Class display



The maximum number of slots permitted refers to the number of time slots that a mobile phone can receive (DL slots) or transmit (UP slots) per TDMA frame.

In addition to the maximum number of DL and UL slots, the total of DL and UL slots per TDMA frame is limited for classes 1 through 12. The DL and UL slots that are actually used by the mobile phone cannot exceed this maximum value. Thus, for class 12, a downlink with four time slots and an uplink with three time slots is not possible because the mobile phone – in accordance with its class (see the table) – can only use a maximum of five (rather than seven) time slots. But any desired combination of time slots is permitted, such as 3 DL + 2 UL or 4 UL + 1 DL, as long as:
$1 \leq DL + UL \leq total$.

☞ The purpose of the *GPRS MS Class* display is, in particular, to determine the permissible threshold values for the *DL Slots* and *UL Slots* input fields for more exhaustive tests with the GPRS Measurement option. Note, however, that the maximum value is limited to 4 for both input fields on the tester.

Measurements in the GPRS mode

Background: BLER-BCS
When taking a measurement the tester sends data blocks to the mobile phone in up to a maximum of four downlink time slots (adjustable). A PDTCH is used to accomplish this. The mobile phone checks every data block received to see if it is intact and if any data blocks have been lost based on the check sequence.

After a certain number of data blocks have been sent, the tester on the mobile phone asks how many data blocks were received in total and how many of these were intact. The mobile phone also passes the desired information to the tester on the PDTCH, although in a time slot in the uplink direction.

The tester calculates the ratio of faulty data blocks or of the number of data blocks missing to the total number of data blocks sent from the information returned and displays the result as a BLER-BCS percentage value. The more sensitive the receiver of the mobile phone, the smaller the HF signal level required to reach the allowable BLER-BCS value.

When equipped with the "GPRS Measurement" option (requires the "GPRS Go/NoGo" option), a Willtek 4202S can take the following measurements on GPRS mobile phones in addition to the Go/NoGo test:

Block error rate (BLER)
Quality assessment of the GPRS receiver in the mobile phone by measuring the block error rate (BLER). This measurement can be performed in the BCS (Block Check Sequence) and USF (Uplink State Flag) variants intended for use by the ETSI. In both cases the CS-1 coding scheme is used. The tester displays the results including a statistical evaluation (e.g. the maximum value).

TX measurement
Transmitter measurements on the selected channel (PDTCH) with graphic diagrams of the burst spectrum, of the burst profile and of the phase error profile.

BLER-BCS

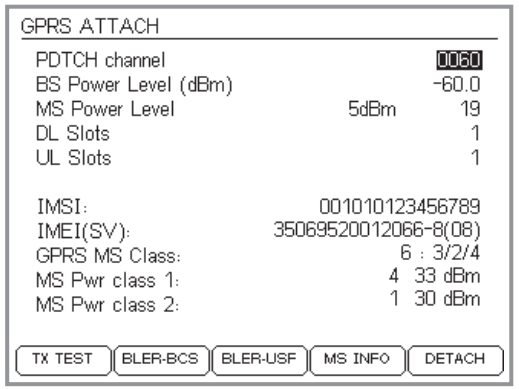
The measurement of the block error rate with the help of the block check sequence utilizes the standard GPRS functions and is therefore suitable for all GPRS mobile phones.

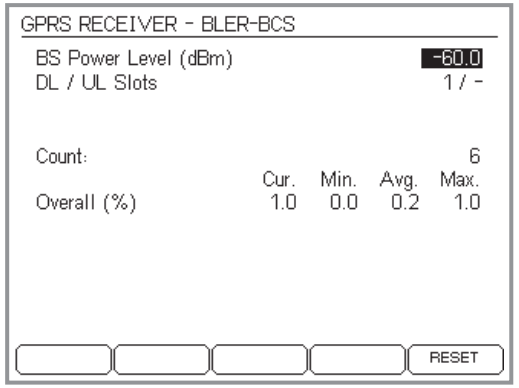
■ Preconditions for testing

- Willtek 4202S + GPRS Measurement option.
- The mobile phone must support GPRS.
- The preparations for testing must have been completed (see page 4-67).

■ Test step by step

1 Prepare the tester for the reception of an Attach request from the mobile phone. To do this, press (ATTACH) inthe *GPRS* menu.





Strongly fluctuating measurement values?
On some mobile phones the value measured for Cur. can increase from 0 % to 100 % at the beginning of a measurement cycle after only a few measurements (Count) without having changed the BS Power Level.
This effect can be avoided for BLER-BCS measurements as well as for BLER-USF measurements by assigning BCCH and PDTCH the same channel number.

2 Switch on the mobile phone and (if necessary) place it in the GPRS mode.

3 When the mobile phone successfully checks in to the simulated GPRS network of the tester, the display shows the *GPRS ATTACH* menu (see the figure).

4 Enter the number of downlink time slots in which the BLER-BCS measurement is to take place in the *DL Slots* field. The number allowed is determined by the *GPRS MS Class* of the mobile phone that was detected (see page 4-70). The tester does not permit values > 4 for technical reasons.

5 Start measuring with (BLER-BCS). The tester now shows the *GPRS RECEIVER – BLER-BCS* menu with constantly updated measurement values. The number of detectable DL slots participating in the measurement is shown at the top.

Count	Number of measurements performed (1 measurement = 100 blocks).
Cur.	Block error rate of the last 100 blocks measured in percent.
Min.	Minimum value in the measurement cycle.
Avg.	Average value in the measurement cycle.
Max.	Maximum value in the measurement cycle.

(RESET) resets the *Count* counter and all measurement values to 0 and starts a new measurement cycle

6 In the *BS Power Level* field reduce the HF output level of the tester and observe the measurement values. The sensitivity limit of conventional receivers is reached at about –100 dBm, and the BLER measurement values increase rapidly.

7 Return to the *GPRS ATTACH* menu with (Esc). There you can set the number of DL slots to a different value to take a new BLER-BCS measurement or call up one of the other measurements.

■ Test results

☺ At the intended RF signal level the BLER-BCS measurement values remain below the permissible thresholds. According to the ETSI specification, a BLER-BCS value of at most 10% is permitted at –102 dBm.

☹ BLER-BCS value exceeds the permissible threshold at the intended RF signal level.

BLER-USF

The measurement of the block error rate with the help of the uplink state flag uses special GPRS functions and is therefore not suitable for all GPRS mobile phones.

■ Preconditions for testing

- Willtek 4202S + GPRS Measurement option.
- The mobile phone must support GPRS in test mode.
- The mobile phone must react to the USF signaling.
- The preparations for testing must have been completed (see page 4-67).

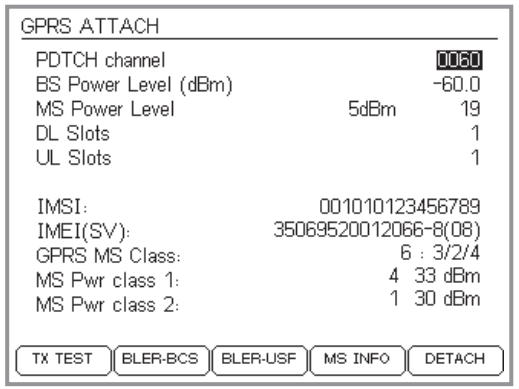
■ Test step by step

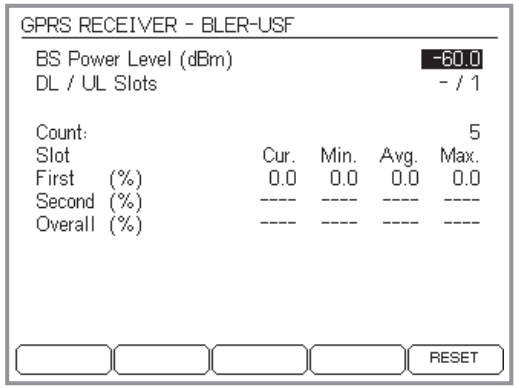
1. Prepare the tester for the reception of an Attach request from the mobile phone. To do this, press (ATTACH) in the *GPRS* menu.
2. Switch on the mobile phone and (if necessary) place it in the GPRS test mode according to the manufacturer's instructions.
3. When the mobile phone successfully checks in to the simulated GPRS network of the tester, the display shows the *GPRS ATTACH* menu (see the figure).
4. Enter the number of uplink time slots in which the BLER-USF measurement is to take place in the *UL Slots* field. The number allowed is determined by the *GPRS MS Class* of the mobile phone that was detected (see page 4-70). The tester does not permit values > 2 for technical reasons for BLER-USF.

Background: BLER-BCS
When taking a measurement the tester sends a fixed number of data blocks in the PDTCH (1 or 2 DL slots). The uplink state flag is set in these data blocks. If the mobile phone detects that USF is set, then it reacts by immediately sending a data block in the uplink path of the PDTCH. The number of UL slots used is always the same as the number of DL slots used.

If no data block is received by the tester from the mobile phone after sending a data block, then this is considered a block error because it assumes that the mobile phone was not able to detect the USF anymore and did not react because the HF signal was too weak.

The ratio of missing UL data blocks to the total number of DL data blocks sent is shown as the BLER-USF measurement value in percent. In contrast to the BCS measurement variant, the BLER for each time slot used is shown in addition to the average overall BLER.





5 Start measuring with (BLER-USF). The tester now shows the *GPRS RECEIVER – BLER-USF* menu with constantly updated measurement values. The number of detectable UL slots participating in the measurement is shown at the top.

Count Number of measurements performed (1 measurement = 100 blocks).

The display of the measured values corresponds to that for BLER-BCS, but the individual value of each time slot used is shown in addition to the overall average value (calculated for all participating time slots).

Note the information on page 4-72 when inexplicably strong fluctuations in the measurements arise.

(RESET) resets the *Count* counter and all measurement values to 0 and starts a new measurement cycle.

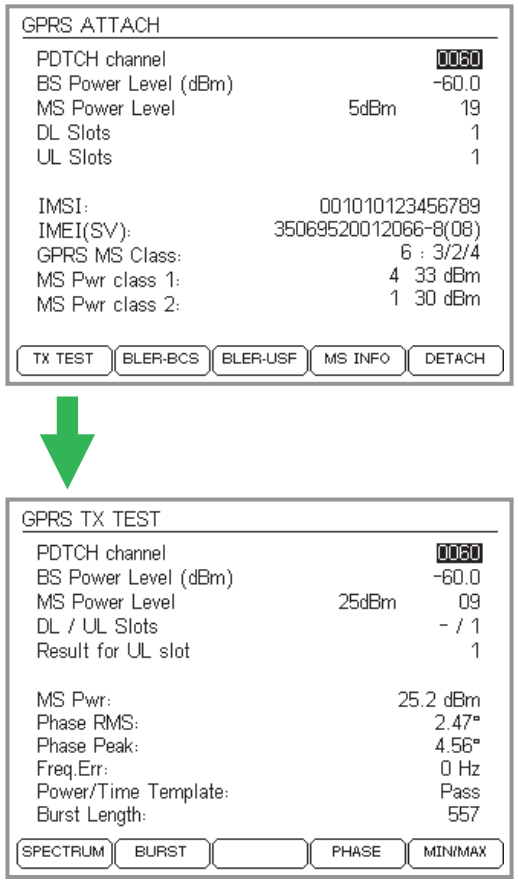
6 In the *BS Power Level* field reduce the HF output level of the tester and observe the BLER measurement values. The sensitivity limit of conventional receivers is reached at about –100 dBm, and the BLER measurement values increase rapidly.

7 Return to the *GPRS ATTACH* menu with (Esc). There you can set the number of UL slots to a different value to take a new BLER-USF measurement or call up one of the other measurements.

Test results

☺ At the intended HF signal level the BLER-USF measurement values remain below the permissible thresholds. According to the ETSI specification, a BLER-USF value of at most 10% is permitted at –102 dBm.

☹ BLER-USF value exceeds the permissible threshold at the intended HF signal level.



TX measurement

The TX measurement provides information on the properties of the transmitter of the mobile phone. This TX measurement is not any different technically from those measurements described in detail in the "Tests in the Speech/Data Mode" section. The PDTCH is used instead of the speech or data channel. Note that the mobile phone must react to the USF signal since this is used to stimulate the mobile phone to transmit.

Preconditions for testing

- Willtek 4202S + GPRS Measurement option.
- The mobile phone must support GPRS in test mode.
- The mobile phone must react to the USF signal.
- The preparations for testing must have been completed (see page 4-67).

Test step by step

1. Prepare the tester for the reception of an Attach request from the mobile phone. To do this, press (ATTACH) in the *GPRS* menu.
2. Switch on the mobile phone and place it in the GPRS test mode according to the manufacturer's instructions.
3. When the mobile phone successfully checks in to the simulated GPRS network of the tester, the display shows the *GPRS ATTACH* menu (see the figure).
4. Enter the number of uplink time slots in which TX measurements are to be taken in the *UL Slots* field. The number allowed is determined by the *GPRS MS Class* of the mobile phone that was detected (see page 4-70). The tester does not permit values > 2 for technical reasons.
5. Start measuring with (TX TEST). The tester now shows the *GPRS TX TEST* menu with constantly updated measurement values in the lower half of the screen. Please see the explanations of the measurement values starting on page 4-22.

Note that the measurement values displayed are the values for the UL slot selected in the upper half of the screen:

DL / UL Slots Specifies the number of UL slots as entered earlier in the *GPRS ATTACH* menu (maximum value: 2).

Result for UL-Slot Enter here the number of the UL slot on which the measurement is to be taken. All TX measurement values displayed apply to the UL slot entered here.

The softkeys take additional measurements that you have already met in the speech/data mode of the tester (see below).

6 Return to the *GPRS ATTACH* menu with Esc.

■ Softkey functions

SPECTRUM Graphic display of the modulation spectrum (see also page 4-44.

BURST Graphic display of the burst profile with zoom function (see also page 4-42). The "Timing Advance" measurement function is not available under GPRS.

PHASE Graphic display of the phase errors occurring during a burst (see also page 4-46).

MIN/MAX Statistical evaluation of the numerical measurement values displayed in the *GPRS TX TEST* menu (see also page 4-22).

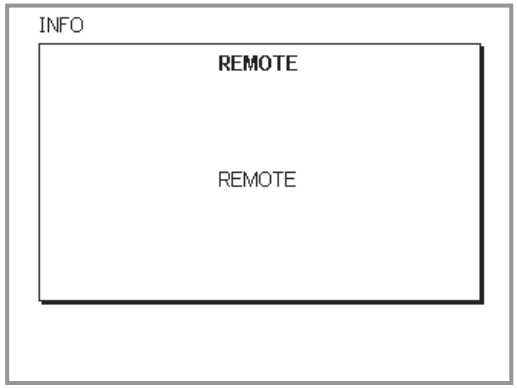
REMOTE CONTROL

Introduction

Any Willtek 4200 can be controlled remotely via the (RS-232-C) interface (remote mode). The sections below describe the SCPI (Standard Commands for Programmable Instruments, pronounced *skipi*) commands required to do this. SCPI is a command language for communication between measuring instruments and control computers.

Preparation

1. Connect the serial interface socket on the Willtek 4200 to a free COM port on the control computer (PC). A suitable cable is the RS-232-C cable (860 379).
2. From the *SERIAL PORT* menu of the Willtek 4200, select the baud rate, protocol and line type to match the settings for the COM port (see also page 2-8).
3. On the control computer, start the software used for writing or executing the control program (e.g. Visual Basic, C, Pascal). For initial trials, it is also possible to issue SCPI commands directly using a terminal program (e.g. HyperTerminal under Windows 95/98).



■ Starting remote mode

A Willtek 4200 automatically switches to remote mode when a SCPI command is received (the information text *REMOTE* appears on the display).

■ Stopping remote mode

Esc stops remote mode. You must press this button twice if any signaling operations are active in Call mode at the time you stop remote mode.

Special characters in SCPI

Colon **:** A colon precedes all SCPI commands. A colon at the start of a command line, i.e. before the first command, is optional.

Semicolon **;** The semicolon is used to separate complete commands to be issued together.

Terminator ↵ Termination character (e.g. CR), marks the end of the SCPI command or command sequence.

SCPI syntax

The definition of the SCPI command sets use a number of text symbols which have a special meaning:

Angle brackets **< >** Angle brackets contain placeholders for which current values are to be substituted. If you see the placeholder `<system>`, replace it with the name of the required radio system (for a list of the names of the radio systems, refer to page 5-37).

Example for GSM1800

CONFigure:<system>**:MS:TCH:PLEV**el

↓

CONFigure:GSM1800**:MS:TCH:PLEV**el

Square brackets **[ ]** Optional commands are enclosed in square brackets.

Abbreviations

Numeric values shown in this chapter are corresponding to the decimal system. In case of exceptions you will see a hint to the corresponding numerativ system.

Keywords can be written out in full or abbreviated. Uppercase and lowercase characters are not distinguished. No blanks are permitted within a keyword. Abbreviations are indicated by bold type in this manual (e.g. **CONF**igure).

Command indicators

All SCPI commands can be preceded by a colon, although this is not always the case. Every colon within a command causes a further branch down the command hierarchy.

Example: **CONF**igure**:GSM:BS:TCH:ARFC**n 120↵

Semicolons (;) separate a number of commands in the same line. Commands are executed from left to right.

Example: **RFG**enerator**:GSM:LEV**el?**;:SYST**em**:ERR**or?↵

Composite commands

Commands from one command set can be joined together and written in a single line, separated by semicolons. Composite commands are executed from left to right.

Composite command: **SYST:DATE** 1997,10,13**;TIME** 15,0,0↵

means the same as: **SYST:DATE** 1997,10,13↵
SYST:TIME 15,0,0↵

DATE and **TIME** are commands from the same level. This approach is therefore permitted.

Parameters

Three types of parameters are permitted. The command and the parameter must always be separated by a **blank**:

Text

Strings which can also contain numeric characters.

Example: **AUT:MSTY:STAR**? "Standard GSM"

Numeric

Numeric parameters (integer, floating point, exponent) can be specified together with a unit. Measurements and return values from parameters are passed in exponential form by default.

Example: Setting: **RFG**enerator**:GSM:LEV**el -60.5dBm
Query: **RFG**enerator**:GSM:LEV**el?

Return value in dBm: -6.05e1

Boolean

The "labels" OFF and ON are permitted. The values 0 or 1 are returned for queries. Every parameter has a maximum value, a minimum value and a factory-set value. These three values can be set by specifying 'MAX', 'MIN' or 'DEF' in place of a numeric value.

Example: **RFG:GSM:LEV**el MIN

Queries

Result formats

Measurements are output in exponential format. The formats of other queries correspond to the value concerned.

Query

Queries are indicated by appending a question mark to the end of the command. Certain commands are only permitted with a question mark. Any exceptions are described. Responses to queries are always terminated with a CR+LF pair (↵).

Example: Measure burst length
MEAS:RFTR:LENG?

Example: **SYST:TIME**?;***ESR**?
Response e.g.: 17,40,55↵4↵
The system time is 17:40:55 and the event status of the tester is 4.

Settings and queries

If queries are combined in a single line with commands which make settings for a parameter, the response to the query will depend on any changes made to the parameter.

Example: Composite command
RFG:GSM:LEV?;**LEV** -80;**LEV**?
Response: -6.0e1↵-8.0e1↵

Multiple measurement

If a multiple measurement is started, the return values for the measurements (responses) are separated by semicolons.

Compatibility

Two ways of identifying the various radio systems are permitted within a SCPI command (see also page 5-37):

GSM	or	GSM900
PCN	or	GSM1800
PCS	or	GSM1900
GSM,PCN	or	GSM900,GSM1800
GSM,PCS	or	GSM900,GSM1900

Example: **`RFG:GSM:LEV?`** = **`RFG:GSM900:LEV?`**

Entering textual special characters via SCPI

You can enter special characters via SCIP using escape sequences (see Appendix, page 6-46).

SCPI command sets

The SCPI commands for the Willtek 4200 fall into the following command sets:

MEASure	Start single and multiple measurements.
RFGenerator	Set output power of the RF generator.
CONFigure	Set all system-related parameters (GSM, PCS, PCN).
CALL	Start all signaling routines.
STATus	Query internal statuses.
SYSTem	Set all device-related parameters (interfaces, system time, user details etc.).
CALibration	Start calibration prior to TX measurements.

The quick reference section at the end of this chapter gives a concise overview of all the SCPI instructions sorted by instruction sets.

Overview SCPI commands

MEASure command set

Transmitter measurement completed

■ Single measurement

Command: **MEAS**ure**:RFTR**ansmit**:GRO**up**:ALL**?

Parameters: None

Response: <PPEak>,<PRMS>,<FREQuency>,<LENGth>,<POWer>
PPEak: Peak phase error in degrees
PRMS: RMS phase error in degrees
FREQuency: Frequency error in Hz
LENGth: Burst length in μs
POWer: Power in dBm

Comment: Query only

■ Single measurement with assessment

Command: **MEAS**ure**:RFTR**ansmit**:GRO**up**:ALL:LIM**it**:FAIL**?

Parameters: <PPEak limu>,<PPEak liml>,
<PRMS limu>,<PRMS liml>,
<FREQuency limu>,<FREQuency liml>,
<LENGth limu>,<LENGth liml>,
<POWer limu>,<POWer liml>
limu: Upper limit
liml: Lower limit

Response: <PPEak Pass/Fail>,
<PRMS Pass/Fail>,
<FREQuency Pass/Fail>,
<LENGth Pass/Fail>,
<POWer Pass/Fail>
0 = PASS 1 = FAIL

Comment: Query only

Multiple measurement

Command: **MEAS**ure:**ARR**ay:**RFTR**ansmit:**GRO**up:**ALL**?

Parameters: <n> Number of measurements (up to 10)

Response: <PPEak measurement 1>,<PRMS measurement 1>,
<FREQuency measurement 1>,<LENGth measurement 1>,
<POWer measurement 1>;...<PPEak measurement n>,
<PRMS measurement n>,<FREQuency measurement n>,
<LENGth measurement n>,<POWer measurement n>

Comment: Query only

Multiple measurement - average

Command: **MEAS**ure:**ARR**ay:**RFTR**ansmit:**GRO**up:**ALL**:**MAV**erage?

Parameters: <n> Number of measurements (up to 10)

Response: <PPEak average>,
<PRMS average>,
<FREQuency average>,
<LENGth average>,
<POWer average>

Comment: Query only

Multiple measurement with assessment

Command: **MEAS**ure:**ARR**ay:**RFTR**ansmit:**GRO**up:**ALL**:**LIM**it:**FAIL**?

Parameters: <n>,
<PPEak limu>,<PPEak liml>,
<PRMS limu>,<PRMS liml>,
<FREQuency limu>,<FREQuency liml>,
<LENGth limu>,<LENGth liml>,
<POWer limu>,<POWer liml>
n: Number of measurements (up to 10)
limu: Upper limit
liml: Lower limit

Response: <PPEak Pass/Fail 1>,<PRMS Pass/Fail 1>,
<FREQuency Pass/Fail 1>,<LENGth Pass/Fail 1>,
<POWer Pass/Fail 1>;...<PPEak Pass/Fail n>,
<PRMS Pass/Fail n>,<FREQuency Pass/Fail n>,
<LENGth Pass/Fail n>,<POWer Pass/Fail n>
0 = PASS 1 = FAIL

Comment: Query only

■ Multiple measurement with assessment - average

Command: **MEAS**ure**:ARR**ay**:RFTR**ansmit**:GRO**up**:ALL:MAV**erage
:LIMit**:FAIL**?

Parameters: <n> Number of measurements (up to 10)
<PPEak limu>,<PPEak liml>,
<PRMS limu>,<PRMS liml>,
<FREQuency limu>,<FREQuency liml>,
<LENGth limu>,<LENGth liml>,
<POWer limu>,<POWer liml>
limu: Upper limit
liml: Lower limit

Response: <PPEak Pass/Fail>,
<PRMS Pass/Fail>,
<FREQuency Pass/Fail>,
<LENGth Pass/Fail>,
<POWer Pass/Fail>
0 = PASS 1 = FAIL

Comment: Query only

Frequency errors

Single measurement

Command: **MEAS**ure**:RFTR**ansmit**:FREQ**uency?
Parameters: None
Response: Frequency error in Hz
Comment: Query only

Single measurement with assessment

Command: **MEAS**ure**:RFTR**ansmit**:FREQ**uency**:LIM**it**:FAIL**?
Parameters: <limu>,<liml>
limu: Upper limit in Hz
liml: Lower limit in Hz
Response: <Pass/Fail> 0 = PASS 1 = FAIL
Comment: Query only

Query unit

Command: **MEAS**ure**:RFTR**ansmit**:FREQ**uency**:UNIT**?
Parameters: None
Response: Hz
Comment: Query only

Multiple measurement

Command: **MEAS**ure**:ARR**ay**:RFTR**ansmit**:FREQ**uency?
Parameters: <n> Number of measurements (up to 10)
Response: <measurement 1>;<measurement 2>...<measurement n>
Comment: Query only

Multiple measurement - average

Command: **MEAS**ure**:ARR**ay**:RFTR**ansmit**:FREQ**uency**:MAV**erage?

Parameters: <n> Number of measurements (up to 10)

Response: Average value in Hz

Comment: Query only

Multiple measurement with assessment

Command: **MEAS**ure**:ARR**ay**:RFTR**ansmit**:FREQ**uency**:LIM**it**:FAIL**?

Parameters: <n>,<limu>,<liml>
n: Number of measurements (up to 10)
limu: Upper limit in Hz
liml: Lower limit in Hz

Response: <Pass/Fail 1>;<Pass/Fail 2>...<Pass/Fail n>
0 = PASS 1 = FAIL

Comment: Query only

Multiple measurement with assessment - average

Command: **MEAS**ure**:ARR**ay**:RFTR**ansmit**:FREQ**uency**:MAV**erage
:LIMit**:FAIL**?

Parameters: <n>,<limu>;<liml>
n: Number of measurements (up to 10)
limu: Upper limit in Hz
liml: Lower limit in Hz

Response: <Pass/Fail> 0 = PASS 1 = FAIL

Comment: Query only

Peak phase error

■ Single measurement

Command: **MEAS**ure**:RFTR**ansmit**:PPE**ak?
Parameters: None
Response: Peak phase error in degrees
Comment: Query only

■ Single measurement with assessment

Command: **MEAS**ure**:RFTR**ansmit**:PPE**ak**:LIM**it**:FAIL**?
Parameters: <limu>,<liml>
limu: Upper limit in degrees
liml: Lower limit in degrees
Response: <Pass/Fail> 0 = PASS 1 = FAIL
Comment: Query only

■ Query unit

Command: **MEAS**ure**:RFTR**ansmit**:PPE**ak**:UNIT**?
Parameters: None
Response: deg
Comment: Query only

■ Multiple measurement

Command: **MEAS**ure**:ARR**ay**:RFTR**ansmit**:PPE**ak?
Parameters: <n> Number of measurements (up to 10)
Response: <measurement 1>;<measurement 2>...<measurement n>
Comment: Query only

Multiple measurement - average

Command: **MEAS**ure**:ARR**ay**:RFTR**ansmit**:PPE**ak**:MAV**erage?

Parameters: <n> Number of measurements (up to 10)

Response: Average value in degrees

Comment: Query only

Multiple measurement with assessment

Command: **MEAS**ure**:ARR**ay**:RFTR**ansmit**:PPE**ak**:LIM**it**:FAIL**?

Parameters: <n>,<limu>,<liml>
n: Number of measurements (up to 10)
limu: Upper limit in degrees
liml: Lower limit in degrees

Response: <Pass/Fail 1>;<Pass/Fail 2>...<Pass/Fail n>
0 = PASS 1 = FAIL

Comment: Query only

Multiple measurement with assessment - average

Command: **MEAS**ure**:ARR**ay**:RFTR**ansmit**:PPE**ak**:MAV**erage
:LIMit**:FAIL**?

Parameters: <n>,<limu>,<liml>
n: Number of measurements (up to 10)
limu: Upper limit in degrees
liml: Lower limit in degrees

Response: <Pass/Fail> 0 = PASS 1 = FAIL

Comment: Query only

RMS phase errors

Single measurement

Command: **MEAS**ure**:RFTR**ansmit**:PRMS**?

Parameters: None

Response: RMS phase error in degrees

Comment: Query only

Single measurement with assessment

Command: **MEAS**ure**:RFTR**ansmit**:PRMS:LIM**it**:FAIL**?

Parameters: <limu>,<liml>
limu: Upper limit in degrees
liml: Lower limit in degrees

Response: <Pass/Fail> 0 = PASS 1 = FAIL

Comment: Query only

Query unit

Command: **MEAS**ure**:RFTR**ansmit**:PRMS:UNIT**?

Parameters: None

Response: deg

Comment: Query only

Multiple measurement

Command: **MEAS**ure**:ARR**ay**:RFTR**ansmit**:PRMS**?

Parameters: <n> Number of measurements (up to 10)

Response: <measurement 1>;<measurement 2>...<measurement n>

Comment: Query only

Multiple measurement - average

Command: **MEAS**ure**:ARR**ay**:RFTR**ansmit**:PRMS:MAV**erage?

Parameters: <n> Number of measurements (up to 10)

Response: Average value in degrees

Comment: Query only

Multiple measurement with assessment

Command: **MEAS**ure**:ARR**ay**:RFTR**ansmit**:PRMS**:LIMit**:FAIL**?

Parameters: <n>,<limu>,<liml>
n: Number of measurements (up to 10)
limu: Upper limit in degrees
liml: Lower limit in degrees

Response: <Pass/Fail 1>;<Pass/Fail 2>...<Pass/Fail n>
0 = PASS 1 = FAIL

Comment: Query only

Multiple measurement with assessment - average

Command: **MEAS**ure**:ARR**ay**:RFTR**ansmit**:PRMS:MAV**erage
:LIMit**:FAIL**?

Parameters: <n>,<limu>,<liml>
n: Number of measurements (up to 10)
limu: Upper limit in degrees
liml: Lower limit in degrees

Response: <Pass/Fail> 0 = PASS 1 = FAIL

Comment: Query only

Transmit power

Single measurement

Command: **MEAS**ure**:RFTR**ansmit**:POW**er?

Parameters: None

Response: TX power in dBm

Comment: Query only

Single measurement with assessment

Command: **MEAS**ure**:RFTR**ansmit**:POW**er**:LIM**it**:FAIL**?

Parameters: <limu>,<liml>
limu: Upper limit in dBm
liml: Lower limit in dBm

Response: <Pass/Fail> 0 = PASS 1 = FAIL

Comment: Query only

Query unit

Command: **MEAS**ure**:RFTR**ansmit**:POW**er:UNIT?

Parameters: None

Response: dBm

Comment: Query only

Multiple measurement

Command: **MEAS**ure**:ARR**ay**:RFTR**ansmit**:POW**er?

Parameters: <n> Number of measurements (up to 10)

Response: <measurement 1>;<measurement 2>...<measurement n>

Comment: Query only

Multiple measurement - average

Command: **MEAS**ure**:ARR**ay**:RFTR**ansmit**:POW**er**:MAV**erage?

Parameters: <n> Number of measurements (up to 10)

Response: Average value in dBm

Comment: Query only

Multiple measurement with assessment

Command: **MEAS**ure**:ARR**ay**:RFTR**ansmit**:POW**er**:LIM**it**:FAIL**?

Parameters: <n>,<limu>,<liml>
n: Number of measurements (up to 10)
limu: Upper limit in dBm
liml: Lower limit in dBm

Response: <Pass/Fail 1>;<Pass/Fail 2>...<Pass/Fail n>
0 = PASS 1 = FAIL

Comment: Query only

Multiple measurement with assessment - average

Command: **MEAS**ure**:ARR**ay**:RFTR**ansmit**:POW**er**:MAV**erage
:LIMit**:FAIL**?

Parameters: <n>,<limu>,<liml>
n: Number of measurements (up to 10)
limu: Upper limit in dBm
liml: Lower limit in dBm

Response: <Pass/Fail> 0 = PASS 1 = FAIL

Comment: Query only

Burst length

Single measurement

Command: **MEAS**ure**:RFTR**ansmit**:LENG**th?
Parameters: None
Response: Burst length in μs
Comment: Query only

Single measurement with assessment

Command: **MEAS**ure**:RFTR**ansmit**:LENG**th**:LIM**it**:FAIL**?
Parameters: <limu>,<liml>
limu: Upper limit in μs
liml: Lower limit in μs
Response: <Pass/Fail> 0 = PASS 1 = FAIL
Comment: Query only

Query unit

Command: **MEAS**ure**:RFTR**ansmit**:LENG**th**:UNIT**?
Parameters: None
Response: us
Comment: Query only

Multiple measurement

Command: **MEAS**ure**:ARR**ay**:RFTR**ansmit**:LENG**th?
Parameters: <n> Number of measurements (up to 10)
Response: <measurement 1>;<measurement 2>...<measurement n>
Comment: Query only

Multiple measurement - average

Command: **MEAS**ure**:ARR**ay**:RFTR**ansmit**:LENG**th**:MAV**erage?

Parameters: <n> Number of measurements (up to 10)

Response: Average value in μs

Comment: Query only

Multiple measurement with assessment

Command: **MEAS**ure**:ARR**ay**:RFTR**ansmit**:LENG**th**:LIM**it**:FAIL**?

Parameters: <n>,<limu>,<liml>
n: Number of measurements (up to 10)
limu: Upper limit in μs
liml: Lower limit in μs

Response: <Pass/Fail 1>;<Pass/Fail 2>...<Pass/Fail n>
0 = PASS 1 = FAIL

Comment: Query only

Multiple measurement with assessment - average

Command: **MEAS**ure**:ARR**ay**:RFTR**ansmit**:LENG**th**:MAV**erage
:LIMit**:FAIL**?

Parameters: <n>,<limu>,<liml>
n: Number of measurements (up to 10)
limu: Upper limit in μs
liml: Lower limit in μs

Response: <Pass/Fail> 0 = PASS 1 = FAIL

Comment: Query only

Power/Time Template

■ Single measurement

Command: **MEAS**ure**:RFTR**ansmit**:TEMP**late?

Parameters: None

Response: <Pass/Fail overall>,
<Pass/Fail rising edge>,
<Pass/Fail mid range>,
<Pass/Fail falling edge>,
0 = PASS 1 = FAIL

<Async. Burst Information>
0 = No information
1 = Burst with training sequence
2 = Burst without training sequence
3 = Continuous output

Comment: Query only

■ Multiple measurement

Command: **MEAS**ure**:ARR**ay**:RFTR**ansmit**:TEMP**late?

Parameters: <n> Number of measurements (up to 10)

Response: <Pass/Fail 1 overall>,
<Pass/Fail 1 rising edge>,
<Pass/Fail 1 mid-range>,
<Pass/Fail 1 falling edge>,
<Async. Burst Information>**;**
...
<Pass/Fail n overall>,
<Pass/Fail n rising edge>,
<Pass/Fail n mid-range>,
<Pass/Fail n falling edge>,
<Async. Burst Information>
0 = PASS 1 = FAIL
Async. Burst Information: see single measurement

Comment: Query only

Measure Timing Advance

Command: **MEAS**ure**:RFTR**ansmit**:UTIM**e?

Parameters: None

Response: <measured value> in µs

Comment: Query only. The measurement takes longer, because an initial measurement is carried out 10 times using TA = 0, in order to obtain a reference value (average value) for the actual measurement.
Setting the TA value: see page 5-40.
Background information about TA measurement: see page 4-43.

BER

Single measurement

Command: **MEAS**ure**:RFR**eceive**:RBER:C2**?

Parameters: None

Response: Bit Error Ratio in %

Comment: Query only

Single measurement with assessment

Command: **MEAS**ure**:RFR**eceive**:RBER:C2:LIM**it**:FAIL**?

Parameters: <limu>,<liml>
limu: Upper limit in %
liml: Lower limit in %

Response: <Pass/Fail> 0 = PASS 1 = FAIL

Comment: Query only

Query unit

Command: **MEAS**ure**:RFR**eceive**:RBER:C2:UNIT**?

Parameters: None

Response: %

Comment: Query only

Multiple measurement

Command: **MEAS**ure**:ARR**ay**:RFR**eceive**:RBER:C2**?

Parameters: <n> Number of measurements (up to 10)

Response: <measurement 1>;<measurement 2>...<measurement n>

Comment: Query only

■ Multiple measurement with assessment

Command: **MEAS**ure**:ARR**ay**:RFR**eceive**:RBER:C2:LIM**it**:FAIL**?

Parameters: <n>,<limu>,<liml>
n: Number of measurements (up to 10)
limu: Upper limit in %
liml: Lower limit in %

Response: <Pass/Fail 1>;<Pass/Fail 2>...<Pass/Fail n>
0 = PASS 1 = FAIL

Comment: Query only

FER

Single measurement

Command: **MEAS**ure**:RFR**eceive**:RBER:FER**?

Parameters: None

Response: Frame Erasure Ratio in %

Comment: Query only

Single measurement with assessment

Command: **MEAS**ure**:RFR**eceive**:RBER:FER:LIM**it**:FAIL**?

Parameters: <limu>,<liml>
limu: Upper limit in %
liml: Lower limit in %

Response: <Pass/Fail> 0 = PASS 1 = FAIL

Comment: Query only

Query unit

Command: **MEAS**ure**:RFR**eceive**:RBER:FER:UNIT**?

Parameters: None

Response: %

Comment: Query only

Multiple measurement

Command: **MEAS**ure**:ARR**ay**:RFR**eceive**:RBER:FER**?

Parameters: <n> Number of measurements (up to 10)

Response: <measurement 1>;<measurement 2>...<measurement n>

Comment: Query only

■ Multiple measurement with assessment

Command: **MEAS**ure**:ARR**ay**:RFR**eceive**:RBER:FER:LIM**it**:FAIL**?

Parameters: <n>,<limu>,<liml>
n: Number of measurements (up to 10)
limu: Upper limit in %
liml: Lower limit in %

Response: <Pass/Fail 1>;<Pass/Fail 2>...<Pass/Fail n>
0 = PASS 1 = FAIL

Comment: Query only

Burst spectrum

Query graphical data of measured burst spectra (see also page 4-44).

■ Single measurement

Command: **MEAS**ure[**:SCAL**ar]**:RFTR**ansmit[**:ONLY**]**:BLOC**kdata **:MSP**ectrum[**:MCUR**rent]?

Parameters: [<Offset>] Measurement range in kHz relative to center of band.
permitted range: ±50 kHz...±500 kHz
Offset is optional. If the value is not specified, the default value of ±135 kHz is used.

Response: Offset, MaxYdB, MinYdB, MaxYPixel, MinYPixel, XLen, X_1...X_n

Offset:	Measurement range in ± kHz
MaxYdB	Maximum value in dB
MinYdB	Minimum value in dB
MaxYPixel	Maximum value in Pixel
MinYPixel	Minimum value in Pixel
XLen	Length of graphical data
X_n	Graphical data

Comment: Query only

■ Peak value capture

This measurement job executes one single measurement each time it is called. The result is compared with the result of the previous call with regard to peak values. The most recent result always shows the highest peak values of all preceding calls. Exception: If a different measurement job was sent between two calls, peak value capture is restarted.

Command: **MEAS**ure**:ARR**ay**:RFTR**ansmit[**:ONLY**]**:BLOC**kdata
:MSPectrum**:PHOL**d?

Parameters: [<Offset>]

Offset:	See "Single measurement". Capture is restarted whenever the value is changed.

Response: Offset, MaxYdB, MinYdB, MaxYPixel, MinYPixel, XLen, $X_1 ... X_n$

Offset:	Measurement range in ± kHz
MaxYdB	Maximum value in dB
MinYdB	Minimum value in dB
MaxYPixel	Maximum value in Pixel
MinYPixel	Minimum value in Pixel
XLen	Length of graphical data
X_n	Graphical data

Comment: Query only

Averaging

Outputs the average values for the last n measurements. After each new measurement, the oldest measurement values are removed and the averages are recalculated. Exception: If a different measurement job was sent between two calls, averaging is restarted.

Command: **MEAS**ure**:ARR**ay**:RFTR**ansmit[**:ONLY**]**:BLOC**kdata **:MSP**ectrum**:MAV**erage?

Parameters: n, [<Offset>]

n:	Number of measurements (1...100) to be used for averaging. Measurement is restarted whenever the number is changed
Offset:	See "Single measurement". Measurement is restarted whenever the number is changed.

Response: Offset, MaxYdB, MinYdB, MaxYPixel, MinYPixel, XLen, $X_1...X_n$

Offset:	Measurement range in ± kHz
MaxYdB	Maximum value in dB
MinYdB	Minimum value in dB
MaxYPixel	Maximum value in Pixel
MinYPixel	Minimum value in Pixel
XLen	Length of graphical data
X_n	Graphical data

Comment: Query only

Burst profile

Query graphical data of measured burst spectra (see also page 4-42).

Overall profile

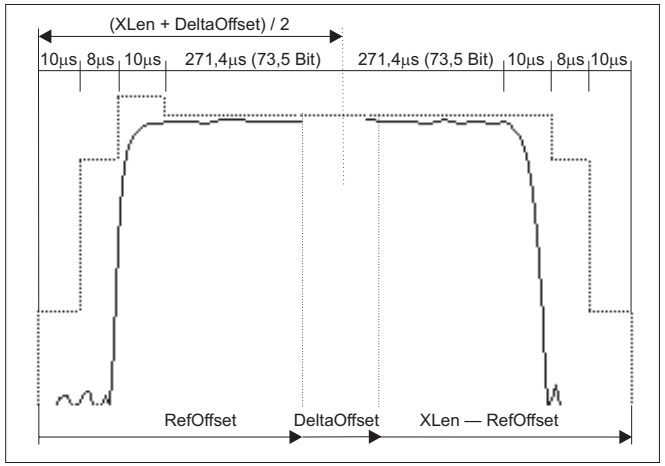
Command: **MEAS**ure[**:SCAL**ar]**:RFTR**ansmit[**:ONLY**]**:BLOC**kdata **:BURS**tshape[**:MCUR**rent]?

Parameters: None

Response: RefOffset, DeltaOffset, SampleTime, MaxYdB, MinYdB, MaxYPixel, MinYPixel, XLen, X_1...X_n

RefOffset:	Time units, leading edge
DeltaOffset:	Time units to start of trailing edge
SampleTime:	Sampling time in ns (nanoseconds)
MaxYdB	Maximum value in dB
MinYdB	Minimum value in dB
MaxYPixel	Maximum value in Pixel
MinYPixel	Minimum value in Pixel
XLen	Length of graphical data
Xn	Graphical data

The diagram shows the meaning of RefOffset and DeltaOffset for temporal assignment of the burst data.



Comment: Query only

Edge region

Command: **MEAS**ure[**:SCAL**ar]**:RFTR**ansmit[**:ONLY**]**:BLOC**kdata **:BURS**tshape**:RAMP**?

Parameters: None

Response: RefOffset, DeltaOffset, SampleTime, MaxYdB, MinYdB, MaxYPixel, MinYPixel, XLen, X_1...X_n

RefOffset:	Time units, leading edge
DeltaOffset:	Time units to start of trailing edge
SampleTime:	Sampling time in ns (nanoseconds)
MaxYdB	Maximum value in dB
MinYdB	Minimum value in dB
MaxYPixel	Maximum value in Pixel
MinYPixel	Minimum value in Pixel
XLen	Length of graphical data
Xn	Graphical data

Comment: Query only

Top region

Command: **MEAS**ure[**:SCAL**ar]**:RFTR**ansmit[**:ONLY**]**:BLOC**kdata **:BURS**tshape**:FLAT**ness?

Parameters: None

Response: RefOffset, DeltaOffset, SampleTime, MaxYdB, MinYdB, MaxYPixel, MinYPixel, XLen, X_1...X_n

RefOffset:	Time units, leading edge
DeltaOffset:	Time units to start of trailing edge
SampleTime:	Sampling time in ns (nanoseconds)
MaxYdB	Maximum value in dB
MinYdB	Minimum value in dB
MaxYPixel	Maximum value in Pixel
MinYPixel	Minimum value in Pixel
XLen	Length of graphical data
Xn	Graphical data

Comment: Query only

GPRS

BLER-BCS measurement

Command: **MEAS**ure**:GPRS:BLER:BCS**?

Parameters: None

Response: Block error rate in %

Comment: Query only.
Requires the BLER-BCS signaling: page 5-52
Setting the measurement parameters: page 5-44

BLER-USF measurement

Command: **MEAS**ure**:GPRS:BLER:USF**?

Parameters: None

Response: Block error rate in %

Comment: Query only.
Requires the BLER-USF signaling: page 5-53
Setting the measurement parameters: page 5-44

RFGenerator command set

■ Set RF output level

Command: **RFG**enerator:<system>:**LEV**el

Parameters: <Value>

Willtek 4208 only

GSM 850/900	–24.0 dBm through –103.0 dBm
GSM 1800/1900	–30.0 dBm through –103.0 dBm

All other Willtek 4200 models

GSM 850/900	–38.0 dBm through –117.0 dBm
GSM 1800/1900	–44.0 dBm through –117.0 dBm

Comment: With query

■ Activate/deactivate modulation

Command: **RFG**enerator:<system>:**MOD**ulation:**STAT**e

Parameters: ON | GMSK | AM | OFF

ON	Activate modulation (the tester constantly transmits the bit sequence 11111 ...).
GMSK	Identical to ON.
AM	AM modulation on (see below).
OFF	Modulation off.

Comment: With query. Parameter AM only takes effect if the AM modulation option is installed (see also page 4-64).

■ Set AM modulation frequency

Command: **RFG**enerator:<system>:**MOD**ulation:**AM**:**MFR**equency

Parameters: <Value>

Value	Modulation frequency 1 kHz through 10 kHz in 1 kHz increments

Comment: With query

■ Set AM modulation depth

Command: **RFG**enerator:<system>:**MOD**ulation:**AM**:**MDEP**th

Parameters: <Value>

Value	Modulation depth 1 % through 100 %

Comment: With query

CONFigure command set

Sets all test parameters. All these settings directly affect the CALL command set.

■ Configure system

Command: **CONF**igure:**CSYS**tem

Parameters: GSM | PCN | PCS | GSM,PCN | GSM,PCS

Comment: With query. The query returns one of the following boldfaced terms:

GSM = GSM 900 **PCN** = GSM 1800
PCS = GSM 1900 **GSMPCN** = GSM 900/1800
GSMPCS = GSM 900/1900

If you prefer to use the modern system names for the parameters, then the following command applies:

Command: **CONF**igure:**SYST**em

Parameters: GSM900 | GSM1800 | GSM1900 | GSM900,GSM1800 | GSM900,GSM1900

Comment: With query. The query returns one of the following values:

1 = GSM 900 3 = GSM 900+1800 5 = GSM 900+1900
2 = GSM 1800 4 = GSM 1900

☞ An example of the use of the SCPI commands for testing dual-band telephones can be found on page 5-67.

■ Configure BCCH

Command: **CONF**igure:<system>:**BS**:**CCH**:**ARFC**n

Parameters: <Channel number>
GSM 900: 1...124
E-GSM: 0...124 and 975...1023
GSM-R: 0...124 and 955...1023
GSM 1800: 512...885
GSM 1900: 512...810

Comment: With query

Set periodic location update interval timer

Command: **CONF**igure:<System>**:BS:PUIT**

Parameters: <Value>
Value: 0…255,
Setting in decimal hours (6 minutes)
0 = Off

Comment: With query.

Configure TCH

Command: **CONF**igure:<system>**:BS:TCH:ARFC**n

Parameters: <Channel number>
GSM 900: 1...124
E-GSM: 0...124 and 975...1023
GSM-R: 0...124 and 955...1023
GSM 1800: 512...885
GSM 1900: 512...810

Comment: With query

Query currently active BCCH

Command: **CONF**igure**:BS:CCH:ARFC**n?

Response: <BCCH number>

Comment: Query only

Query currently active TCH

Command: **CONF**igure**:BS:TCH:ARFC**n?

Response: <TCH number>

Comment: Query only

■ Activate/deactivate Asynchronous Mode

Command: **CONF**igure:<system>:**BS:ABUR**st:**STAT**e

Parameters: ON | FPOWER | OFF

ON — The tester switches to Asynchronous Mode. All the measurements from the MEASure command set permitted in this operating mode can then be called.

FPOWER — The tester switches to Asynchronous Mode. Only the RF power measurement is then permitted. The advantage of this mode is that the measurement duration is approximately halved compared with ON.

OFF — The tester switches from Asynchronous Mode back to normal operating mode.

Comment: With query

■ Asynchronous Mode (auto-synchronization)

Command: **CONF**igure:<system>:**BS:ABUR**st:**ASE**arch:**STAT**e

Parameters: ON | OFF

ON — In Asynchronous Mode, the tester regularly carries out synchronization on the basis of recognized bursts (see <Time> parameter). Depending on the stability of the mobile phone, this allows drift problems to be eliminated at an early stage.

OFF — In Asynchronous Mode, the tester carries out synchronization only once on the basis of the first recognized burst.

Comment: With query

■ Asynchronous Mode (time)

Command: **CONF**igure:<system>:**BS:ABUR**st:**ASE**arch:**TIME**

Parameters: <Time>

Time: Interval (1 s through 300 s) at which automatic synchronization is carried out in Asynchronous Mode.

Comment: With query

Configure power level (BCCH)

Command: **CONF**igure:<system>**:MS:CCH:PLEV**el

Parameters: <Power level>
GSM 900: 0...19
GSM 1800: 0...15, 29...31
GSM 1900: 0...15, 30 and 31

Comment: With query

Configure power level (TCH)

Command: **CONF**igure:<system>**:MS:TCH:PLEV**el

Parameters: <Power level>
GSM 900: 0...19
GSM 1800: 0...15, 29...31
GSM 1900: 0...15, 30 and 31

Comment: With query

Set Timing Advance

Command: **CONF**igure:<system>**:MS:TADV**ance

Parameters: <TA value> 0...63

Comment: With query

Configure audio loopback

Command: Speech mode = FR (Full Rate)
CONFigure:<system>**:AUD**io**:LOOP**back

Speech mode = EFR (Enhanced Full Rate)
CONFigure:<system>**:AUD**io**:EFR**ate**:LOOP**back

Parameters: ON | OFF

Comment: With query. Only available in speech mode, not for VGCS calls.

Set number of samples for BER measurement

Command: **CONF**igure:<system>**:BER:ERR**or**:COUN**t

Parameters: <Value> Number of samples (500...100000).

Comment: With query

■ Set number of samples for FER measurement

Command: **CONF**igure:<system>:**BER:FER**asure:**COUN**t

Parameters: <Value> Number of samples (500...100000).

Comment: With query

■ Set pre-attenuation (depending on system)

Command: **CONF**igure:<system>:**PATT**enuation:**LEV**el

Parameters: <RX>, <TX>
RX: RX pre-attenuation (–50.0 dB...+50.0 dB)
TX: TX pre-attenuation (–50.0 dB...+50.0 dB)

Comment: With query. Any system-independent preattenuation set with the **SYSTem** command will overwrite system-dependent pre-attenuation values.

■ Set external synchronization

Command: **CONF**igure:**FREQ**uency:**EREF**erence:**STAT**e

Parameters: ON | OFF
ON: External synchronization is operative
OFF: External synchronization is inoperative

Comment: With query

Response: 0 = Internal synchronization
5 = 5 MHz external synchronization
10 = 10 MHz external synchronization
13 = 13 MHz external synchronization

■ De-tuning BCCH

Command: **CONF**igure:<system>:**BS:FREQ**uency:**OFFSET**

Parameters:: <Value> Frequency offset (max. –75 kHz ... +75 kHz)

Comment: With query. Command only takes effect if the de-tuning option is installed (see also page 4-65).

■ GSM-R group call: Set Group ID

Command: **CONF**igure:**VGCS:GID**

Parameters: <Value> Group ID (up to 9 digits)

Comment: With query. Command only permitted for the Willtek 4202R tester. For details on group calls, see also page 4-47.

GSM-R group call: Set Call Priority

Command: **CONF**igure:**VGCS**:**CPRI**ority

Parameters: <Value> 0 through 7

Parameter	Priority level	Parameter	Priority level
0	reserved	4	1
1	4	5	0
2	3	6	B
3	2	7	A

Comment: With query. Only permitted for Willtek 4202R. For details on group calls, see also page 4-47.

GSM-R: Automatically process IDs

Command: **CONF**igure:**USSD**:**FNUM**ber:**AUT**omatic:**STAT**e

Parameters: ON | OFF

Response: 0 = OFF
1 = ON

Comment: With query. Only permitted for Willtek 4202R. Activates automatic registration and deregistration of functional IDs.
10 IDs are saved. If the memory is full, registrations continue to be processed, but are no longer saved.To start saving these again, the memory has to be cleared with CONF:USSD:FNUM:CLE

GSM-R: Clear stored IDs

Command: **CONF**igure:**USSD**:**FNUM**ber:**CLE**ar

Parameters: None

Comment: No query. Only permitted for Willtek 4202R.
This command clears the memory containing the functional IDs.

■ GSM-R: Query ID values

Command: **CONF**igure:**USSD**:**FNUM**ber?

Parameters: <number> (optional, only relevant if CONF:USSD:FNUM:AUT:STAT=OFF)
Specifies the expected number of functional IDs to be received.
Default: 1
Value range: 1 through 10

Response: <USSDString>
Registration: **214*SI***#
Deregistration: ##214*SI***#
SI = supplementary information, contains the international functional ID.
Example of <USSDString>:
214*04921234501*#,##214*04926666601***#,##214*04921234501***#,,,,,,,

Comment: Query only. Only permitted for Willtek 4202R.

If CONF:USSD:FNUM:AUT:STAT=ON:
The 10 IDs most recently stored are output. 10 values are always returned, even if some IDs are empty.

If CONF:USSD:FNUM:AUT:STAT=OFF:
The command only returns the IDs when the number of IDs specified by <number> has been reached. If the parameter is not specified: number = 1.

■ GSM-R: 1 kHz tone during call

Command: **CONF**igure:<System>:**AUDI**o:**GEN**erator

Parameters: ON | OFF

Response: 0 = OFF
1 = ON

Comment: With query.

■ GPRS: Set channel number (PDTCH)

Command: **CONF**igure:<System>:**BS:GPRS:PDT**ch:**ARFC**n

Parameters: <Channel number>
GSM 900: 1...124
E-GSM: 0...124 and 975...1023
GSM-R: 0...124 and 955...1023
GSM 1800: 512...885
GSM 1900: 512...810

Comment: With query. Command is only permitted for the Willtek 4202S tester with an installed GPRS option.

■ GPRS: Set power level (PDTCH)

Command: **CONF**igure:<System>:**MS:GPRS:PDT**ch:**PLE**vel

Parameters: <Power level>
GSM 900: 0...19
GSM 1800: 0...15 and 29...31
GSM 1900: 0...15, 30, 31

Comment: With query. Command is only permitted for the Willtek 4202S tester with an installed GPRS option.

■ GPRS: Setting the number of BLER-BCS blocks

Command: **CONF**igure:<System>:**GPRS:BLER:BCS:COUN**t

Parameters: <Value> the number of blocks (100 to 5000)

Comment: With query. The command is only permitted for Willtek 4202S testers using the GPRS option.

■ GPRS: Setting the number of BLER-USF blocks

Command: **CONF**igure:<System>:**GPRS:BLER:USF:COUN**t

Parameters: <Value> the number of blocks (100 to 5000)

Comment: With query. The command is only permitted for Willtek 4202S testers using the GPRS option.

■ GPRS: Setting the number of UL slots

Command: **CONF**igure:<System>:**GPRS:ULSL**ot

Parameters: <Value> the number of UL time slots (1 or 2)

Comment: With query. The command is only permitted for Willtek 4202S testers using the GPRS option. The number of UL time slots is used for the BLER-USF measurement and for the TX measurement (see also page 5-35).

■ GPRS: Setting the number of DL slots

Command: **CONF**igure:<System>:**GPRS:DLSL**ot

Parameters: <Value> the number of DL time slots (1 to 4)

Comment: With query. The command is only permitted for Willtek 4202S testers using the GPRS option. The number of DL time slots is used for the BLER-BCS measurement (see also page 5-35).

CALL command set

This command set allows you to establish a connection and to query information on the mobile phone (MS).

■ Establish speech connection by MS

Command: **CALL:MSOR**iginate
Parameters: None
Comment: No query

■ Clear speech connection by MS

Command: **CALL:MSR**elease
Parameters: None
Comment: No query

■ Establish speech connection by tester

Command: **CALL:BSOR**iginate
Parameters: None
Comment: No query

■ Automatic call acceptance

Command: **CALL:BSOR**iginate:**AUT**omatic:**ACC**ept
Parameters: <"imsi">
imsi IMSI (quotation marks have to be observed!)
Optional parameter
Comment: No query. Command only valid for Willtek 4208.
If there is no parameter specified, the default IMSI (001010123456789) and the last IMSI registered are called. The default IMSI is always called. The call is released via CALL:BSRelease

■ Clear speech connection by tester

Command: **CALL:BSR**elease
Parameters: None
Comment: No query

Establish data connection by MS

Command: **CALL:DATA:MSOR**iginate
Parameters: None
Comment: No query. Command not valid on Willtek 4201S

Clear data connection by MS

Command: **CALL:DATA:MSR**elease
Parameters: None
Comment: No query. Command not valid on Willtek 4201S

Establish data connection by tester

Command: **CALL:DATA:BSOR**iginate
Parameters: None
Comment: No query. Command not valid on Willtek 4201S

Clear data connection by tester

Command: **CALL:DATA:BSR**elease
Parameters: None
Comment: No query. Command not valid on Willtek 4201S

Force Location Update

Command: **CALL:LUPD**ate
Parameters: None (see page 4-16)
Comment: No query

Set Mobile Country Code

Command: **CALL:CELL:LAI:MCC**
Parameters: <Value> 0...999 (see page 4-12)
Comment: With query

Set Mobile Network Code

Command: **CALL:CELL:LAI:MNC**
Parameters: <Value> 0...99 (see page 4-12)
Comment: With query

Set BS-PA-MFRMS

Command: **CALL:CELL:BSP**amfrms
Parameters: <Value> 0...7
Comment:: With query (see page 4-12)

Read RX level

Command: **CALL:MSIN**fo:**RXL**evel?
Response: <Value> 0...63
Comment: Query only

Read RX quality

Command: **CALL:MSIN**fo:**RXQ**ual?
Response: <Value> 0...7
Comment: Query only

Read number

Command: **CALL:MSIN**fo:**NUMB**er?
Response: <Number>
Comment: Query only

Read IMSI

Command: **CALL:MSIN**fo:**IMSI**?
Response: 15-digit decimal integer
Comment: Query only

Read IMEI or IMEISV

Command: **CALL:MSIN**fo:**IMEI**?
CALL:MSINfo:**SVIM**ei?
Response: IMEI: 15-digit decimal integer
SVIMEI: 17-digit decimal integer
Comment: Query only

Read MS power class

Command: **CALL:MSIN**fo:**MSCL**ass?
Response: <Value> 1...5 (see page 4-37)
Comment: Query only

Read revision level

Command: **CALL:MSIN**fo:**RLEV**el?

Response: <Value>
0 = Phase 1, 1 = Phase 2

Comment: Query only

Query SMS support

Command: **CALL:MSIN**fo:**SMS**?

Response: <Value> 1 = Yes 0 = No

Comment: Query only

Query E-GSM support

Command: **CALL:MSIN**fo:**EFR**equency?

Response: <Value> 1 = Yes 0 = No

Comment: Query only

Query A5 algorithm

Command: **CALL:MSIN**fo:**A5**?

Response: <Value> 0...7
1 = A5/1, 2 = A5/2, 4 = A5/3

Comment: Query only

Classmark 3: Query status

Command: **CALL:MSIN**fo:**CM3**?

Response: <Value>
0 = Classmark 3 information is not available
1 = Classmark 3 information is available

Comment: Query only

Multiband: Query status

Command: **CALL:MSIN**fo:**MBAN**d?

Response: <Value>
0 = Not a multiband unit
5 = GSM900 + GSM1800
6 = E-GSM900 + GSM1800

Comment: Query only

Extension bit: Query status

Command: **CALL:MSIN**fo**:EBIT**?

Response: <Value>
0 = No
1 = Yes

Comment: Query only

Query MS Power Class (E)-GSM 900

Command: **CALL:MSIN**fo**:ARC1**?

Response: <Value> 1...5 (see page 4-37)

Comment: Query only

Query MS Power Class GSM 1800/1900

Command: **CALL:MSIN**fo**:ARC2**?

Response: <Value> 1...5 (see page 4-37)

Comment: Query only

SMS (MS ➔ Tester)

Command: **CALL:SMS:MSOR**iginate?

Response: <Message Class>,<Message Type>,<Number>,
<SC number>,<Validity Period>,<Text>

Message Class:	0 through 3
Message Type:	0 through 63
Number:	ASCII
SC number:	ASCII
Validity Period (VP):	0 through 255 (see table)
Text:	ASCII

Comment: Query only. Command only permitted for Willtek 4202 tester (see also page 4-50).

Conversion table for Validity Period	
VP = 0 through 143	t = (VP+1) x 5 minutes
VP = 144 through 167	t = 12 h + ((VP–143) x 30 minutes)
VP = 168 through 196	t = (VP–166) x 1 days
VP = 197 through 255	t = (VP–192) x 1 weeks

■ SMS (Tester ➔ MS)

Command: **CALL:SMS:BSOR**iginate

Parameters: <Message Class>,<"Number">,<Text>

Message Class:	0 through 3
Number:	Phone number (Quotes must be used!)
Text:	ASCII

Comment: No query. Command only permitted for Willtek 4202 tester (see also page 4-50).

■ GSM-R: Establish call with MS CALL

Command: **CALL:VGCS:MSOR**iginate

Parameters: None

Comment: With query (Group ID and Priority level). Command only permitted for the Willtek 4202R tester. For details on group calls, see also page 4-47.

■ GSM-R: Establish call with BS CALL

Command: **CALL:VGCS:BSOR**iginate

Parameters: None

Comment: No query. Command only permitted for the Willtek 4202R tester. For details, see also page 4-47.

■ GSM-R: Clear connection

Command: **CALL:VGCS:BSR**elease

Parameters: None

Comment: No query. Only permitted for Willtek 4202R. For details, see also page 4-47.

GSM-R: User-to-User-Message

Command: **CALL:VGCS:UUM**essage

Parameters: None

Comment: No query. Only permitted for Willtek 4202R.
Command for intercepting the user-to-user message after a test emergency call.
The questionable status register can be queried to establish whether a user-to-user message was processed or whether the command was cancelled after 30 s by a remote timeout.

GPRS: Attach

Command: **CALL:GPRS:ATT**ach

Parameters: None

Comment: No query. Command only permitted for the Willtek 4202S tester with an installed GPRS option. For details about GPRS tests, see also page 4-67.

GPRS: Detach

Command: **CALL:GPRS:DET**ach

Parameters: None

Comment: No query. Command only permitted for the Willtek 4202S tester with an installed GPRS option. For details about GPRS tests, see also page 4-67.

GPRS: BLER-BCS signaling

Command: **CALL:GPRS:BLER:BCS**

Parameters: ON | OFF
ON: Start BLER-BCS signaling
OFF: Stop BLER-BCS signaling

Comment:: With query. Requires a previous GPRS Attach signaling. Do not start BLER-BCS and BLER-USF signaling at the same time. The command is only permitted for Willtek 4202S testers using the GPRS option.
Setting the measurement parameters: page 5-44.
Querying the measurement results: page 5-35.

■ GPRS: BLER-USF signaling

Command: **CALL:GPRS:BLER:USF**

Parameters: ON | OFF
ON: Start BLER-USF signaling
OFF: Stop BLER-USF signaling

Comment:: With query. Requires a previous GPRS Attach signaling. Do not start BLER-BCS and BLER-USF signaling at the same time. The command is only permitted for Willtek 4202S testers using the GPRS option.
Setting the measurement parameters: page 5-44.
Querying the measurement results: page 5-35.

■ GPRS: Query multislot class

Command: **CALL:MSINfo:GPRS:MSCLass?**

Parameters: <Value> 1 through 29 (see page 4-70)

Comment: Query only. Command only permitted for the Willtek 4202S tester with an installed GPRS option.

■ GPRS: Setting the slot for TX measurements

Command: **CALL:GPRS:TXSLot**

Parameters: <Value> the number of UL time slots (1 or 2) to be used for the TX measurements.

Comment: With query. The command is only permitted for Willtek 4202S testers using the GPRS option. See page 4-75 for more information on TX measurements.

Configuring IMSI list

Command: **CALL:LUPD**ate**:IMSI**

Parameters: <Value>, <"imsi">
Value = 1 to 20
You can enter up to 20 IMSIs to be accepted by the tester.
imsi = IMSI (quotation marks have to be observed!).
Partial IMSI entry:
* = wildcard for all following characters or for a group of characters.
? = wildcard for one character.
Default: "00101*"
Delete entry: ""
Accept all mobile phones: "*"

Response: Query: **CALL:LUPD**ate**:IMSI**? <Value>
imsi = IMSI string

Comment: Command only valid for Willtek 4208.

Initializing IMSI list

Command: **CALL:LUPD**ate**:IMSI:INIT**ial

Parameters: None

Comment: No query. This command deletes all entries created by the command for configuring the IMSI list (page 5-54) and enters the string "00101*" as an IMSI default value. Command only valid for Willtek 4208.

Query RX level during loc update

Command: **CALL:LUPD**ate**:PME**asurement

Parameters: None

Response: <Value> in dBm

Comment: Query only. Command only permitted for Willtek 4208 tester. Queries the measured value of the last location update. Any pre-attenuation values which have been set are taken into account.

STATus command set

This command set provides information on the current status of the tester.

The quick reference section at the end of this chapter provides information on the status registers (in the STATus section).

■ Query register operation

Command: **STAT**us:**OPER**ation[:**EVEN**t]?

Response: <Value> 0...32768

Comment: Query only

■ Query register signaling

Command: **STAT**us:**OPER**ation:**SIGN**alling[:**EVEN**t]?

Response: <Value> 0...255

Comment: Query only

■ Query QUEStionable register

Command: **STAT**us:**QUES**tionable[:**EVEN**t]?

Response: <Value> 0...32768

Comment: Query only

SYSTem command set

The SYSTem command set allows you to make device settings and query the current error status.

Switch tester to local mode

Command: **SYST**em:**COMM**unicate:**LOC**al

Parameters: None

Comment: No query

Set system date

Command: **SYST**em:**DATE**

Parameters: <Year>,<Month>,<Day>
Year: 4-digit year specification (1997...2049)
Month: 1...12
Day: 1...31

Comment: With query

Set system time

Command: **SYST**em:**TIME**

Parameters: <Hour>,<Minute>,<Second>
Hour: 0...23
Minute: 0...59
Second: 0...59

Comment: With query

Define pre-attenuation

Command: **SYST**em:**SETT**ings:**PATT**enuation:**LEV**el

Parameters: <RX>,<TX>
RX: RX pre-attenuation (–50.0 dB...+50.0 dB)
TX: TX pre-attenuation (–50.0 dB...+50.0 dB)

Comment: With query

■ Activate/deactivate timeout

Command: **SYST**em:**COMM**unicate:**SER**ial:**TIM**eout:**STAT**e

Parameters: ON | OFF

Comment: With query
An active timeout prevents the tester from being permanently blocked if a mobile phone does not react as expected (because of a fault). The effect of a timeout can be compared to pressing the Esc button: the current test (command) is aborted and the subsequent SCPI command is executed. It is useful if the subsequent command provides information on the progress of the previous test (test executed completely or aborted due to a timeout; see the example).

A timeout affects the following tests/commands:
- Activate/deactivate Asynchronous Mode
- MS connection setup
- BS connection setup (tester)
- BER measurement

Example:

SYST:COMM:SER:TIM 30	Set timeout to 30 s
SYST:COMM:SER:TIM:STAT ON	Activate timeout
CALL:BS	BS connection setup. If this test causes the tester to be blocked, it is aborted after 30 seconds and the next command is executed.
STAT:OPER:SIGN?	Query signaling register (bit 6 = Call Active): 1 = Connection established successfully; 0 = No connection

The status of bit 9 in the questionable status register shows whether a timeout has occurred (see page 5-73). This bit is set as soon as an operation is cancelled by a timeout (remote control) or using Esc (manually).

Set timeout duration

Command: **SYST**em:**COMM**unicate:**SER**ial:**TIM**eout

Parameters: <Value>
<Value> Duration of timeout in seconds (1 s through 100000 s).

Comment: With query

Read error queue - code and text

Command: **SYST**em:**ERR**or[**:NEXT**]?

Response: <Value>,<String>
Value: Error code (see table)
String: Error message in plain text e.g. -350,"Queue overflow"

Comment: Query only

Read error queue - code only

Command: **SYST**em:**ERR**or:**CODE**[**:NEXT**]?

Response: <Value> Error code (see table)

Comment: Query only

Read error queue - all codes

Command: **SYST**em:**ERR**or:**CODE:ALL**?

Response: <Value 1>;<Value 2>...<Value n>
Error code (see table)

Comment: Query only

Query number of errors in error queue

Command: **SYST**em:**ERR**or:**COUN**t?

Response: <Value> Number of error messages, currently stored in error queue.

Comment: Query only

Error queue messages

Code	Message	Meaning
0	No error	No error codes in queue
Command errors		
-100	Command error	General command error
-101	Invalid character	Invalid character
-102	Syntax error	Invalid command or data type
-103	Invalid separator	Invalid separator
-104	Data type error	Invalid data type
-108	Parameter not allowed	Too many parameters received
-109	Missing parameter	Too few parameters received
-112	Program mnemonic too long	Command name is longer than 12 characters
-113	Undefined header	Command name not defined
Program execution errors		
-200	Execution error	General execution error
-225	Out of memory	Insufficient memory to carry out command
-233	Invalid version	Command not supported in this version
-240	Hardware error	Command cannot be executed due to hardware problem
Device errors		
-300	Device-specific error	General device-specific error
-311	Memory error	Error in system memory (e.g. incorrect checksum)
-315	Configuration memory lost	Tables in EEPROM of RF stage are errored
-330	Self-test failed	Self-test failed
-340	Calibration failed	Calibration failed
-350	Queue overflow	Dummy code if no more space is available in the queue for the actual error code
-360	Communication error	Error during communication over the serial port
Query error		
-400	Query error	General query error

■ ESC command

Command: **SYST**em:**UBR**eak

Parameters: None

Response: None

Comment: The effect of the ESC command (Escape) is analogous to the effect of the (Esc) key. Thus, for instance, a location update can be cancelled by issuing an ESC command.
The software handshake protocol must be deactivated on the controller for this command to work.

■ Delay for ESC command

Command: **SYST**em:**UBR**eak:**DEL**ay

Parameters: <Time> Delay time 0 through 60 s, default value: 0

Response: Time

Comment: With query. This command delays execution of the ESC command, i.e. an operation is not cancelled immediately the command is sent.
Example: A location update should not be cancelled immediately, delay time is 2 s. The Willtek 4208 waits 2 seconds for incoming information in the context of the location update.

■ Switch sound on/off

Command: **SYST**em:**SOUN**d

Parameters: ON | OFF

Response: 0 = ON
1 = OFF

Comment: With query.

■ Set baud rate

Command: **SYST**em:**COMM**unicate:**SER**ial:**BAUD**rate

Parameters: <Baud rate>
Baud rate = 4800 | 9600 | 19200 | 38400
Default value = 9600

Response: Baud rate

Comment: With query.

Set handshake protocol

Command: **SYST**em:**COMM**unicate:**SER**ial:**PROT**ocol

Parameters: <Protocol>
Protocol = XONXOFF | RTSCTS
Default value = XONXOFF

Response: 1 = XONXOFF
2 = RTSCTS

Comment: With query.

RXTX-line normal or crossed

Command: **SYST**em:**COMM**unicate:**SER**ial:**RXTX**

Parameters: <RXTX>
RXTX = NORMAL | CROSSED

Response: 1 = NORMAL
2 = CROSSED

Comment: With query.

CALibration command set

This command set contains only the one command: CALibration. If this command is issued before TX measurements are carried out, it calibrates a tester in such a way that the highest possible accuracy is achieved during measurement. Calibration should be carried out more regularly while the tester is warming up than after it has reached operating temperature. Calibration takes approximately 6 seconds for single-band systems and 10 seconds for multiband systems.

■ Start calibration prior to TX measurements

Command: **CAL**ibration[**:ALL**]

Parameters: None

Comment: No query. During the calibration process no measuring signal should be supplied to the tester.

General commands

Clear status register

The *CLS command resets the status report system. The following actions are carried out:

- Status byte is reset.
- Event status register is reset.
- Operation status register is reset.
- Signaling register is reset.
- Questionable status register is reset.
- Event/error queue is flushed.

Command: ***CLS**
Parameters: None
Comment: No query.

Set event status register mask

This command defines the mask for calculating the sum bits in the status byte. The event status register (ESR) is ANDed with the mask before the value of the sum bit is calculated from the result.

Command: ***ESE**
Parameters: <Value> 0...255
Comment: With query

Read event status register

Command: ***ESR**?
Parameters: None
Response: <Value> 0...255
Comment: Query only

Read device ID

Command: ***IDN**?

Parameters: None

Response: <Manufacturer>,<Model>,<Serial number>,<Version number>
e.g. Willtek,4201S,00123456,1.40

Comment: Query only

Execute reset

The tester is restarted. The status report system is cleared and signaling is switched off.

Command: ***RST**

Parameters: None

Comment: No query
During a reset operation, the tester does not react to received commands for a brief period. Since the duration of this pause depends on the firmware, fixed wait times before the next command is executed are not recommended. It is better to couple the *RST command with a quick query (e.g. *RST;*IDN?). The query is then always executed immediately after the reset. Any subsequent command thus reliably reaches the tester.

Read status byte

Command: ***STB**?

Parameters: None

Response: <Value> 0...255

Comment: Query only

■ Perform self-test

Command: ***TST**?

Parameters: <loop/no_loop>
loop/no_loop 1 = Internal Loop 1 and 2 will be tested.
0 = Internal Loop 1 and 2 will not be tested
Default value = 0 (Willtek 4208), 1 (all other models)

Response: <Response 1>,<Response 2>...<Response 13>
0 = PASS 1 = FAIL 2 = Not tested

1	Sum bit	**8**	+15 V
2	GSM loop	**9**	+4.9 V
3	GSM 1800-Loop	**10**	–10 V
4	+3 V	**11**	+5 V loop
5	+5 V	**12**	+5 V IQ
6	V_{CC}	**13**	+Synth. Sync.
7	–18 V		

Comment: Query only. To test the internal Loop 1 and 2 of a Willtek 4208, the RX and TX sockets of the tester must be connected to each other.

Sample program

Single-band mobile phone

Command (abbreviated)	Response from tester	Comment
*CLS		;Clear status report
CONF:CSYS GSM		;Select GSM system
CONF:GSM:BS:CCH:ARFC 63		;Channel 63 is CCH
CONF:GSM:BS:TCH:ARFC 27		;Channel 27 is TCH
CONF:GSM:MS:CCH:PLEV 9		;MS transmits on CCH with power level 9
CONF:GSM:MS:TCH:PLEV 9		;MS transmits on TCH with power level 9
SYST:SETT:PATT:LEV 1.5,1.5		;Pre-attenuation for TX/RX: 1.5 dB
RFG:GSM:LEV -60		;Output level of 4200: –60 dBm
CALL:MSOR		;Establish connection from MS
CALL:MSIN:IMSI?	001011234567890	;Read IMSI
CALL:MSIN:IMEI?	445200516624260	;Read IMEI
CALL:MSIN:NUMB?	1234567890	;Read number dialed
MEAS:ARR:RFTR:GRO:ALL:MAV? 10	...6.79e+00,2.42e+00,-1e+00	;transmit measurements, 10x, average
MEAS:RFTR:TEMP?	0,0,0,0,0	;Power/time template = PASS!
RFG:GSM:LEV -102		;Output level: –102 dBm
CONF:GSM:BER:ERR:COUN 4000		;Number of samples for BER measurement
MEAS:RFR:RBER:C2:LIM:FAIL? 2.44,0	0	;BER = PASS!
RFG:GSM:LEV -80		;Output level: –80dBm
CONF:GSM:BS:TCH:ARFC 120		;TCH = 120
CONF:GSM:MS:TCH:PLEV 5		;MS power level = 5
MEAS:RFTR:POW?	3.27e+01	;Power measurement
MEAS:RFTR:POW:UNIT?	dBm	;Read unit
CALL:BSR		;Hang up from 4200
SYST:ERR:COUN?	0	;Error queue: no errors
SYST:COMM:LOC		;Switch 4200 to local mode
		;END

Dual-band mobile phone

Command (abbreviated)	Response from tester	Comment
*CLS		;Clear status report
CONF:SYST GSM900,GSM1800		;Select GSM 900/1800 system
CONF:GSM900:BS:CCH:ARFC 63		;GSM 900 Channel 63 is CCH
CONF:GSM1800:BS:TCH:ARFC 698		;GSM 1800 Channel 698 is TCH
CONF:GSM900:MS:CCH:PLEV 9		;MS transmits on CCH GSM 900 with power level 9
CONF:GSM1800:MS:TCH:PLEV 5		;MS transmits on GSM 1800 TCH with power level 5
CONF:GSM900:MS:TCH:PLEV 10		;MS transmits on GSM 900 TCH with power level 10
CONF:GSM900:PATT:LEV 1.5,1.5		;GSM 900 pre-attenuation for TX/RX: 1.5 dB
CONF:GSM1800:PATT:LEV 2.0,2.0		;GSM 1800 pre-attenuation for TX/RX: 2.0 dB
RFG:GSM900:LEV -60		;GSM 00 output level of 4200: –60 dBm
RFG:GSM1800:LEV -60		;GSM 1800 output level of 4200: –60 dBm
CALL:MSOR		;Establish connection from MS
CALL:MSIN:IMSI?	001011234567890	;Read IMSI
CALL:MSIN:IMEI?	445200516624260	;Read IMEI
CALL:MSIN:NUMB?	1234567890	;Read number dialed
MEAS:RFTR:POW?	2.10e+01	;Single power measurement
MEAS:RFTR:TEMP?	0,0,0,0,0	;Power/time template = PASS!
RFG:GSM1800:LEV -102		;GSM 1800, TCH output level: –102 dBm
CONF:GSM1800:BER:ERR:COUN 4000		;GSM 1800, number of samples for BER measure.
MEAS:RFR:RBER:C2:LIM:FAIL? 2.44,0	0	;BER = PASS!
RFG:GSM1800:LEV -80		;GSM 1800, TCH output level: –80dBm
CONF:GSM900:BS:TCH:ARFC 120		;GSM 900, TCH = 120
CONF:GSM900:MS:TCH:PLEV 5		;MS power level = 5
MEAS:RFTR:FREQ?	2.3e+01	;Single frequency error measurement
MEAS:RFTR:FREQ:UNIT?	Hz	;Read unit
CALL:BSR		;Hang up from 4200
SYST:ERR:COUN?	0	;Error queue: no errors
SYST:COMM:LOC		;Switch 4200 to local mode
		;END

GPRS mobile phone

Command (abbreviated)	Response from tester	Comment
*CLS		;Clear status report
CONF:CSYS GSM		;Select GSM system
CONF:GSM:BS:GPRS:PDTCH:ARFCN 35		;Channel 35 is packet data frequency channel
CONF:GSM:BS:CCH:ARFCN 35		;Channel 35 is GSM control channel
CONF:GSM:MS:GPRS:PDTCH:PLEV 9		;MS to transmit GPRS at power control step 9
CONF:GSM:MS:CCH:PLEV 9		;MS to transmit GSM at power control step 9
SYST:SETT:PATT:LEV 2.0,2.0		;Set pre-attenuation of 2.0 dB for TX and RX
RFG:GSM:LEV –60		;Output level of 4200: –60 dBm
CALL:GPRS:ATTACH		;Establish GPRS link (attachment) with MS
		Switch on MS only now
CALL:MSIN:GPRS:MSCLASS?	10	;Query GPRS multislot class.10 means MS supports 4 slots in the downlink, 2 slots in the uplink, max. 5 both at the same time
CALL:MSIN:IMSI?	001011234567890	;Read IMSI
CALL:MSIN:IMEI?	445200516624260	;Read IMEI
		TX measurements – MS should support BLER-USF
CONF:GSM:GPRS:ULSL 2		;Configure 2 slots in the uplink (if supported by MS)
CONF:GSM:GPRS:BLER:USF:COUN 100		;Configure 100 blocks per BLER-USF measurement
CALL:GPRS:BLER:USF ON		;Initiate BLER-USF mode
CALL:GPRS:TXSL 2		;Select the second time slot to be measured (applicable if ;two slots are configured in the uplink)
MEAS:RFTR:GRO:ALL?	9.32e+00,2.42e+00,...	;Measure transmit parameters for second slot
CALL:GPRS:TXSL 1		;Select the first time slot to be measured
MEAS:RFTR:GRO:ALL?	...	;Measure transmit parameters for first slot (using this or any ;other TX measurement command)
CALL:GPRS:BLER:USF OFF		;Stop BLER-USF mode
		RX measurements based on BLER-USF test mode
CALL:GPRS:BLER:USF ON		;Initiate BLER-USF mode again (must be released and reinitiated when changing between TX and RX measurements)
MEAS:GPRS:BLER:USF?	.00	;Measure BLER-USF, in %
MEAS:GPRS:BLER:USF?	.00	;Measure BLER-USF again
CALL:GPRS:BLER:USF OFF		;Stop BLER-USF mode
		BLER-BCS receiver measurements
CONF:GSM:GPRS:DLSL 3		;Configure 3 slots in the downlink (if MS supports it)
CONF:GSM:GPRS:BLER:BCS:COUN 100		;Configure 100 blocks per BLER-BCS measurement
CALL:GPRS:BLER:BCS ON		;Initiate BLER-BCS mode
MEAS:GPRS:BLER:BCS?	.00	;Measure BLER, in %
MEAS:GPRS:BLER:BCS?	.00	;Measure BLER again
CALL:GPRS:BLER:BCS OFF		;Stop BLER-BCS mode
RFG:GSM:LEV –104		;Select different 4200 transmit power (–104 dBm)
CALL:GPRS:BLER:BCS ON		;Resume BLER-BCS mode
MEAS:GPRS:BLER:BCS?	.00	;Measure BLER, in %
CALL:GPRS:BLER:BCS OFF		;Stop BLER-BCS mode
CALL:GPRS:DETACH		;Release GPRS connection

Quick reference

Convention **{ }** If a command sequence include braces, these enclose the name of a table. The required entry must be taken from the table indicated.

						MEASure
Query unit	**MEAS**ure	{meas. val.}	{unit}	?		
Single measurement	**MEAS**ure	{meas. val.}	{stats}	?		
Single measurement, graphical data	**MEAS**ure	[:**SCAL**ar]	{graph}	?		
Single measurement with assessment	**MEAS**ure	{meas. val.}	{stats}	{limit}		
Multiple measurement	**MEAS**ure	:**ARR**ay	{meas. val.}	{stats}	?	<number>
Multiple measurement, graphical data	**MEAS**ure	[:**SCAL**ar]	{graph}	?		
Multiple measurement with assessment	**MEAS**ure	:**ARR**ay	{meas. val.}	{stats}	{arraylimit}	
GPRS: BLER-BCS measurement	**MEAS**ure	:**GPRS**	:**BLER**	:**BCS**	?	
GPRS: BLER-USF measurement	**MEAS**ure	:**GPRS**	:**BLER**	:**USF**	?	

Table: **{meas. val.}** for MEASure			
Transmit measurements			
Measurement of all values	:**RFTR**ansmit	:**GRO**up	:**ALL**
Peak phase error	:**RFTR**ansmit	:**PPE**ak	
RMS phase error	:**RFTR**ansmit	:**PRMS**	
Frequency error	:**RFTR**ansmit	:**FREQ**uency	
Burst length	:**RFTR**ansmit	:**LENG**th	
RF power (peak power)	:**RFTR**ansmit	:**POW**er	
Power/time template	:**RFTR**ansmit	:**TEMP**late	
Measure Timing Advance	:**RFTR**ansmit	:**UTIM**e	
Receive measurements			
Class II: RBER II (residual mode)	:**RFR**eceive	:**RBER**	:**C2**
FER (residual mode)	:**RFR**eceive	:**RBER**	:**FER**

Table: **{graph}** for MEASure					
Graph, burst spectrum	:**RFTR**ansmit	[:**ONLY**]	:**BLOC**kdata	:**MSP**ectrum	[:**MCUR**rent]
Graph, burst spectrum (Average)	:**RFTR**ansmit	[:**ONLY**]	:**BLOC**kdata	:**MSP**ectrum	:**MAV**erage
Graph, burst spectrum (Peak Hold)	:**RFTR**ansmit	[:**ONLY**]	:**BLOC**kdata	:**MSP**ectrum	:**PHOL**d
Graph, burst profile	:**RFTR**ansmit	[:**ONLY**]	:**BLOC**kdata	:**BURS**tshape	[:**MCUR**rent]
Graph, burst profile (edges)	:**RFTR**ansmit	[:**ONLY**]	:**BLOC**kdata	:**BURS**tshape	:**RAMP**
Graph, burst profile (top)	:**RFTR**ansmit	[:**ONLY**]	:**BLOC**kdata	:**BURS**tshape	:**FLAT**ness

Table: **{unit}** for MEASure		
Query unit set	:**UNIT**	?

Table: **{stats}** for MEASure	
Return current measurement	done automatically
Return average value	:**MAV**erage

Table: **{limit}** for MEASure				
Pass/fail query with new values for upper <limu> and lower <liml> limits (for this measurement only)	:**LIM**it	:**FAIL**	?	<limu>,<liml>

Table: **{arraylimit}** for MEASure				
Pass/fail query with new values for upper <limu> and lower <liml> limits (for this measurement only)	:**LIM**it	:**FAIL**	?	<number of measurements>,<limu>,<liml>

					RFGenerator
Query output level	**RFG**enerator	{system}	:**LEV**el	?	
Set output level	**RFG**enerator	{system}	:**LEV**el	<Value>	
Modulation on	**RFG**enerator	{system}	:**MOD**ulation	:**STAT**e	ON or GMSK | AM
Modulation off	**RFG**enerator	{system}	:**MOD**ulation	:**STAT**e	OFF
Query modulation status	**RFG**enerator	{system}	:**MOD**ulation	:**STAT**e	?

Table: **{system}** for RFGenerator	
GSM / E-GSM / GSM-R	:**GSM** or :**GSM900**
GSM 1800 (PCN)	:**PCN** or :**GSM1800**
GSM 1900 (PCS)	:**PCS** or :**GSM1900**
GSM 900+1800	:**GSM,PCN** or :**GSM900,GSM1800**
GSM 900+1900	:**GSM,PCS** or :**GSM900,GSM1900**

							CONFigure
Which system is activated?	**CONF**igure	:**CSYS**tem	?				
Activate GSM system	**CONF**igure	:**CSYS**tem	GSM				
Activate PCN system	**CONF**igure	:**CSYS**tem	PCN				
Activate PCS system	**CONF**igure	:**CSYS**tem	PCS				
Activate GSM+PCN system	**CONF**igure	:**CSYS**tem	GSM,PCN				
Activate GSM+PCS system	**CONF**igure	:**CSYS**tem	GSM,PCS				
Which system is activated?	**CONF**igure	:**SYST**em	?				The **SYST** command acts in the same way as the **CSYS** command. The only difference lies in the names of the various radio systems
Activate GSM900 system	**CONF**igure	:**SYST**em	GSM900				
Activate GSM1800 system	**CONF**igure	:**SYST**em	GSM1800				
Activate GSM1900 system	**CONF**igure	:**SYST**em	GSM1900				
Activate GSM900+1800 system	**CONF**igure	:**SYST**em	GSM900,GSM1800				
Activate GSM900+1900 system	**CONF**igure	:**SYST**em	GSM900,GSM1900				
Query BCCH no. (system independent)	**CONF**igure	:**BS**	:**CCH**	:**ARFC**n	?		
Query TCH no. (system independent)	**CONF**igure	:**BS**	:**TCH**	:**ARFC**n	?		
Query CCH number	**CONF**igure	{system}	:**BS**	:**CCH**	:**ARFC**n	?	

Set CCH number	**CONF**igure	{system}	:**BS**	:**CCH**	:**ARFC**n	<Value>	
Set periodic location update interval timer	**CONF**igure	{System}	:**BS**	:**PUIT**	<Value>		
Query TCH number	**CONF**igure	{system}	:**BS**	:**TCH**	:**ARFC**n	?	
Set TCH number	**CONF**igure	{system}	:**BS**	:**TCH**	:**ARFC**n	<Value>	
Query TCH power level	**CONF**igure	{system}	:**MS**	:**TCH**	:**PLEV**el	?	
Set TCH power level	**CONF**igure	{system}	:**MS**	:**TCH**	:**PLEV**el	<Value>	
Query Timing Advance value	**CONF**igure	{system}	:**MS**	:**TADV**ance	?		
Set Timing Advance value	**CONF**igure	{system}	:**MS**	:**TADV**ance	<Value>		
Asynchronous Mode on	**CONF**igure	{system}	:**BS**	:**ABUR**st	:**STAT**e	ON	
Asynchronous Mode on (Fast Power)	**CONF**igure	{system}	:**BS**	:**ABUR**st	:**STAT**e	FPOWER	
Asynchronous Mode off	**CONF**igure	{system}	:**BS**	:**ABUR**st	:**STAT**e	OFF	
Query Asynchronous Mode	**CONF**igure	{system}	:**BS**	:**ABUR**st	:**STAT**e	?	
Async. Mode auto-synchronization on	**CONF**igure	{system}	:**BS**	:**ABUR**st	:**ASE**arch	:**STAT**e	ON
Async. Mode auto-synchronization off	**CONF**igure	{system}	:**BS**	:**ABUR**st	:**ASE**arch	:**STAT**e	OFF
Async. Mode auto-synchronization status	**CONF**igure	{system}	:**BS**	:**ABUR**st	:**ASE**arch	:**STAT**e	?
Set Async. Mode auto-synchronization time	**CONF**igure	{system}	:**BS**	:**ABUR**st	:**ASE**arch	:**TIME**	<Value>
Async. Mode auto-synchronization status	**CONF**igure	{system}	:**BS**	:**ABUR**st	:**ASE**arch	:**TIME**	?
De-Tuning of BCCH frequency	**CONF**igure	{system}	:**BS**	:**FREQ**uency	:**OFFSET**	<Value>	
Query CCH power level	**CONF**igure	{system}	:**MS**	:**CCH**	:**PLEV**el	?	
Set CCH power level	**CONF**igure	{system}	:**MS**	:**CCH**	:**PLEV**el	<Value>	
Set RX/TX pre-attenuation	**CONF**igure	{system}	:**PATT**enuation		:**LEV**el	<RX value>,<TX value>	
Query RX/TX pre-attenuation	**CONF**igure	{system}	:**PATT**enuation		:**LEV**el	?	
1 kHz tone during call = on	**CONF**igure	{System}	:**AUDI**o	:**GEN**erator	ON		
1 kHz tone during call = off	**CONF**igure	{System}	:**AUDI**o	:**GEN**erator	OFF		
Query 1 kHz tone setting	**CONF**igure	{System}	:**AUDI**o	:**GEN**erator	?		
Query audio loopback setting	**CONF**igure	{system}	:**AUD**io	:**LOOP**back	?		
Audio loopback on	**CONF**igure	{system}	:**AUD**io	:**LOOP**back	ON		
Audio loopback off	**CONF**igure	{system}	:**AUD**io	:**LOOP**back	OFF		
Query number of frames for BER	**CONF**igure	{system}	:**BER**	:**ERR**or	:**COUN**t	?	
Set number of frames for BER	**CONF**igure	{system}	:**BER**	:**ERR**or	:**COUN**t	<Value>	
Query number of frames for FER	**CONF**igure	{system}	:**BER**	:**FER**rasure	:**COUN**t	?	
Set number of frames for FER	**CONF**igure	{system}	:**BER**	:**FER**rasure	:**COUN**t	<Value>	
Enable external synchronization	**CONF**igure	:**FREQ**uency		:**EREF**erence		:**STAT**e	ON
Disable external synchronization	**CONF**igure	:**FREQ**uency		:**EREF**erence		:**STAT**e	OFF
Query external synchronization setting	**CONF**igure	:**FREQ**uency		:**EREF**erence		:**STAT**e	?
GSM-R: Automatically process functional IDs	**CONF**igure	:**USSD**		:**FNUM**ber	:**AUT**omatic	:**STAT**e	ON
GSM-R: Manually process functional IDs	**CONF**igure	:**USSD**		:**FNUM**ber	:**AUT**omatic	:**STAT**e	OFF
GSM-R: Query functional ID mode	**CONF**igure	:**USSD**		:**FNUM**ber	:**AUT**omatic	:**STAT**e	?
GSM-R: Clear functional ID memory	**CONF**igure	:**USSD**		:**FNUM**ber	:**CLE**ar		

GSM-R: Set Group ID	**CONF**igure	:**VGCS**		:**GID**		<Value>	
GSM-R: Query Group ID	**CONF**igure	:**VGCS**		:**GID**		?	
GSM-R: Set Priority level	**CONF**igure	:**VGCS**		:**CPRI**ority		<Value>	
GSM-R: Query Priority level	**CONF**igure	:**VGCS**		:**CPRI**ority		?	
GPRS: Set PDTCH channel number	**CONF**igure	:{system}	:**BS**	:**GPRS**	:**PDT**ch	:**ARFC**n	<Value>
GPRS: Query PDTCH channel number	**CONF**igure	:{system}	:**BS**	:**GPRS**	:**PDT**ch	:**ARFC**n	?
GPRS: Set PDTCH power level	**CONF**igure	:{system}	:**MS**	:**GPRS**	:**PDT**ch	:**PLE**vel	<Value>
GPRS: Query PDTCH power level	**CONF**igure	:{system}	:**MS**	:**GPRS**	:**PDT**ch	:**PLE**vel	?
GPRS: Set BLER-BCS blocks	**CONF**igure	:{System}	:**GPRS**	:**BLER**	:**BCS**	:**COUN**t	<Value>
GPRS: Query BLER-BCS blocks	**CONF**igure	:{System}	:**GPRS**	:**BLER**	:**BCS**	:**COUN**t	?
GPRS: Set BLER-USF blocks	**CONF**igure	:{System}	:**GPRS**	:**BLER**	:**USF**	:**COUN**t	<Value>
GPRS: Query BLER-USF blocks	**CONF**igure	:{System}	:**GPRS**	:**BLER**	:**USF**	:**COUN**t	?
GPRS: Set UL-Slot	**CONF**igure	:{System}	:**GPRS**	:**ULSL**ot	<Value> 1 or 2		
GPRS: Query UL-Slot	**CONF**igure	:{System}	:**GPRS**	:**ULSL**ot	?		
GPRS: Set DL-Slot	**CONF**igure	:{System}	:**GPRS**	:**DLSL**ot	<Value> 1 to 4		
GPRS: Query DL-Slot	**CONF**igure	:{System}	:**GPRS**	:**DLSL**ot	?		

Table: **{system}** for CONFigure		
GSM / E-GSM / GSM-R	:**GSM**	or :**GSM900**
GSM 1800 (PCN)	:**PCN**	or :**GSM1800**
GSM 1900 (PCS)	:**PCS**	or :**GSM1900**
GSM 900+1800	:**GSM,PCN**	or :**GSM900,GSM1800**
GSM 900+1900	:**GSM,PCS**	or :**GSM900,GSM1900**

					CALL
Establish speech connection from tester	**CALL**	:**BSOR**iginate			
Automatic call acceptance CALL	**CALL**	:**BSOR**iginate	:**AUT**omatic	:**ACC**ept <"imsi"> (4208 only)	
Clear speech connection from tester	**CALL**	:**BSR**elease			
Establish speech connection from MS	**CALL**	:**MSOR**iginate			
Clear speech connection from MS	**CALL**	:**MSR**elease			
Establish data connection from tester	**CALL**	:**DATA**	:**BSOR**iginate		
Clear data connection from tester	**CALL**	:**DATA**	:**BSR**elease		
Establish data connection from MS	**CALL**	:**DATA**	:**MSOR**iginate		
Clear data connection from MS	**CALL**	:**DATA**	:**MSR**elease		
Force location update	**CALL**	:**LUPD**ate			
Configuring IMSI list	**CALL**	:**LUPD**ate	:**IMSI**	<Value>, <"imsi">	
Querying IMSI list value	**CALL**	:**LUPD**ate	:**IMSI**	? <Value>	
Initializing IMSI list	**CALL**	:**LUPD**ate	:**IMSI**	:**INIT**ial	
Query RX level during loc update	**CALL**	:**LUPD**ate	:**PME**asurement	?	

Set/query MCC	**CALL**	:**CELL**	:**LAI**:**MCC**	? or <Value>
Set/query MNC	**CALL**	:**CELL**	:**LAI**:**MNC**	? or <Value>
RX level, measured by MS	**CALL**	:**MSIN**fo	:**RXL**evel	?
RX qual., measured by MS	**CALL**	:**MSIN**fo	:**RXQ**ual	?
Telephone number (MS CALL only)	**CALL**	:**MSIN**fo	:**NUMB**er	?
Query IMSI	**CALL**	:**MSIN**fo	:**IMSI**	?
Query IMEI	**CALL**	:**MSIN**fo	:**IMEI**	?
Query IMEISV	**CALL**	:**MSIN**fo	:**SVIM**ei	?
Query mobile power class	**CALL**	:**MSIN**fo	:**MSCL**ass	?
Query phase 1 or phase 2 support	**CALL**	:**MSIN**fo	:**RLEV**el	?
Query SMS support	**CALL**	:**MSIN**fo	:**SMS**	?
Query support for extended frequency range	**CALL**	:**MSIN**fo	:**EFR**equency	?
Query A5 algorithms used	**CALL**	:**MSIN**fo	:**A5**	?
Classmark 3: Query status	**CALL**	:**MSIN**fo	:**CM3**	?
Extension bit: Query status	**CALL**	:**MSIN**fo	:**EBIT**	?
Multiband: Query status	**CALL**	:**MSIN**fo	:**MBAN**d	?
Query MS Power Class 1 (multiband)	**CALL**	:**MSIN**fo	:**ARC1**	?
Query MS Power Class 2 (multiband)	**CALL**	:**MSIN**fo	:**ARC2**	?
SMS (MS ➔ Tester)	**CALL**	:**SMS**	:**MSOR**iginate	?
SMS (Tester ➔ MS)	**CALL**	:**SMS**	:**BSOR**iginate	<Message Class>,<Number>,<Text>
GSM-R: Query functional ID values	**CALL**	:**USSD**	:**FNUM**ber	? <Number>
GSM-R: Establish group call with MS CALL	**CALL**	:**VGCS**	:**MSOR**iginate	
GSM-R: Query Group ID/Priority lev. of MS	**CALL**	:**VGCS**	:**MSOR**iginate	?
GSM-R: Establish group call with BS CALL	**CALL**	:**VGCS**	:**BSOR**iginate	
GSM-R: Clear group call connection	**CALL**	:**VGCS**	:**BSR**elease	
GSM-R: User-to-user message	**CALL**	:**VGCS**	:**UUM**essage	
GPRS: Attach	**CALL**	:**GPRS**	:**ATT**ach	
GPRS: Detach	**CALL**	:**GPRS**	:**DET**ach	
GPRS: Query multislot class	**CALL**	:**MSIN**fo	:**GPRS**	:**MSCL**ass?
GPRS: State of BLER-BCS	**CALL**	:**GPRS**	:**BLER**:**BCS**	? or <ON | OFF>
GPRS: State of BLER-USF	**CALL**	:**GPRS**	:**BLER**:**USF**	? or <ON | OFF>
GPRS: Set TX-Slot	**CALL**	:**GPRS**	:**TXSL**ot	<Value> 1 or 2
GPRS: Query TX-Slot	**CALL**	:**GPRS**	:**TXSL**ot	?

					STATus
Read operation status register	**STAT**us	:**OPER**ation	[:**EVEN**t]	?	
Read signaling status register	**STAT**us	:**OPER**ation	:**SIGN**alling	[:**EVEN**t]	?
Read questionable status register	**STAT**us	:**QUES**tionable	[:**EVEN**t]	?	

Meaning of the register bits	
Operation status register	
0	CALibrating: tester has performed calibration
1-3	reserved
4	MEASuring: tester has performed a measurement
5-7	reserved
8	Composite signaling status register
9-12	reserved
13	INSTrument Summary Bit: Indicates that an operational status has been set
14	PROGram running: tester has run an Autorun program
15	This bit is always set to 0
Signalling status register	
0	Idle: tester is in idle mode, signaling is deactivated
1-3	reserved
4	GSM-R: Show talker mode
5	GPRS: attached
6	Call Active: tester is currently in call mode
7	Closed Loop: tester has switched the MS to test mode (BER or AFLOOP)
Questionable status register	
0-4	reserved
5	FREQuency: Synthesizer is not in a steady state
6-7	reserved
8	CALibration: Error occurred during calibration
9	This bit is set in case of a remote timeout or if the operation is aborted manually with Esc
10-12	reserved
13	INSTrument Summary Bit: Indicates that a QUEStionable status has been set
14	Command Warning: Invalid command was not executed
15	This bit is always set to 0

					SYSTem
Read error message from error queue (code + text)	**SYST**em	:**ERR**or	[:**NEXT**]	?	
Query number of error messages in error queue	**SYST**em	:**ERR**or	:**COUN**t	?	
Read error message from error queue (code only)	**SYST**em	:**ERR**or	:**CODE**	[:**NEXT**]	?
Read entire error queue (code only)	**SYST**em	:**ERR**or	:**CODE**	:**ALL**	?
Switch from remote to local	**SYST**em	:**COMM**unicate	:**LOC**al		
Set/query baud rate	**SYST**em	:**COMM**unicate	:**SER**ial	:**BAUD**rate	? or <baud rate>
Set/query serial protocol	**SYST**em	:**COMM**unicate	:**SER**ial	:**PROT**ocol	? or <protocol>
Set/query RXTX line status	**SYST**em	:**COMM**unicate	:**SER**ial	:**RXTX**	? or <RXTX>

Activate timeout	**SYST**em	:**COMM**unicate	:**SER**ial	:**TIM**eout	:**STAT**e	ON
Deactivate timeout	**SYST**em	:**COMM**unicate	:**SER**ial	:**TIM**eout	:**STAT**e	OFF
Query timeout status	**SYST**em	:**COMM**unicate	:**SER**ial	:**TIM**eout	:**STAT**e	?
Set timeout duration (in seconds)	**SYST**em	:**COMM**unicate	:**SER**ial	:**TIM**eout	<second>	
Query timeout duration status	**SYST**em	:**COMM**unicate	:**SER**ial	:**TIM**eout	?	
ESC function	**SYST**em	:**UBR**eak				
Delay for SYST:UBReak	**SYST**em	:**UBR**eak	:**DEL**ay		<time>	
Switch on/off or query sound	**SYST**em	:**SOUN**d	<ON | OFF> or ?			
Set system date	**SYST**em	:**DATE**	<yyyy>,<mm>,<dd>			
Query system date	**SYST**em	:**DATE**	?			
Set system time	**SYST**em	:**TIME**	<hh>,<mm>,<ss>			
Query system time	**SYST**em	:**TIME**	?			
Set RX/TX pre-attenuation	**SYST**em	:**SETT**ings	:**PATT**enuation		:**LEV**el	<RX value>, <TX value>
Query RX/TX pre-attenuation	**SYST**em	:**SETT**ings	:**PATT**enuation		:**LEV**el	?

		CALibration
Start calibration prior to TX measurements	**CAL**ibration	[:**ALL**]

		General commands
Clear status register	***CLS**	
Set event status register mask for deriving sum bit in status byte	***ESE**	<Value>
Query mask	***ESE**?	
Query event status register (see below)	***ESR**?	
Query device ID	***IDN**?	
Execute reset	***RST**	
Query status byte (see below)	***STB**?	
Perform self-test	***TST**?	
Perform self-test without Loops (Willtek 4208 only)	***TST**?	0

Event status register: Meaning of the register bits	
0	Operation Complete: Set when all queued commands have been executed
1	reserved
2	Query Error: Set when a query error has occurred (Error code = –400 through –499)
3	Device Dependent Error: Set when a device-specific error has occurred (Error code = –300 through –399)
4	Execution Error: Set when an execution error has occurred (Error code = –200 through –299)
5	Command Error: Set when a command error has occurred (Error code = –100 through –199)
6	reserved
7	Power On: Set when the tester is powered up

Status byte: Meaning of the bits	
0-1	reserved
2	Error Queue: Errors have been stored in the error queue
3	Composite questionable status register
4	reserved
5	Composite event status register
6	reserved
7	Composite operation status register

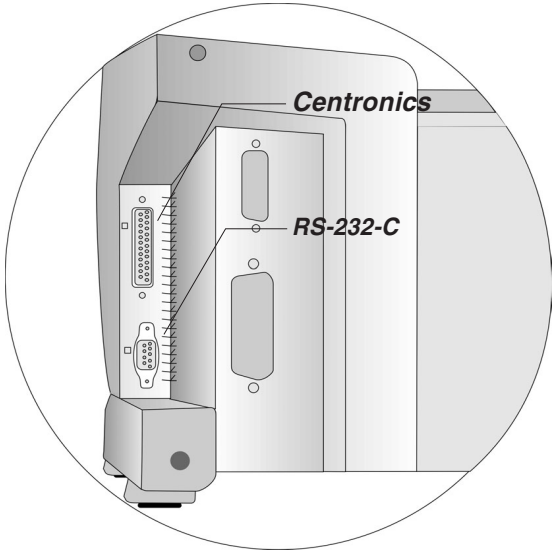
APPENDIX

Technical data

RF generator		
Frequency range (standard)	GSM 850	869 to 894 MHz
	GSM 900	935 to 960 MHz
	E-GSM	925 to 960 MHz
	GSM-R (4202R/4201A)	921 to 960 MHz
	GSM 1800	1805 to 1880 MHz
	GSM 1900	1930 to 1990 MHz
Extended frequency range	GSM 900	921 to 963 MHz
	GSM 1800	1802 to 1885 MHz
	GSM 1900	1926 to 1995 MHz
RF measurements		
Frequency spectrum	GSM 850	824 to 849 MHz
	GSM 900	890 to 915 MHz
	E-GSM	880 to 915 MHz
	GSM-R (4202R/4201A)	876 to 915 MHz
	GSM 1800	1710 to 1785 MHz
	GSM 1900	1850 to 1910 MHz
General data		
Input/Output impedance	50 Ω	
Permitted storage temperature	–30 to +50 °C	
Operating temperature	+15 to +35 °C	
Size	310 mm x 170 mm x 165 mm	
Weight	2.4 kg	

A complete set of all technical data you'll find in the 4200 data sheet which is available on the Willtek website: www.willtek.com

Interfaces

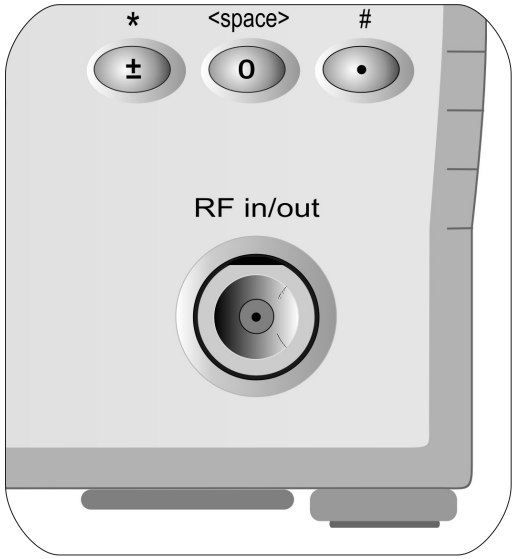


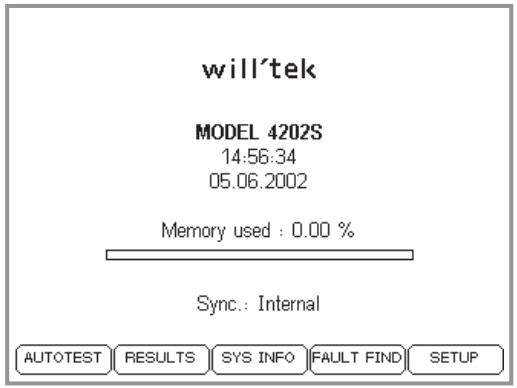
Position of the interface sockets

Interface sockets

The interface sockets acts an RS-232-C port (PC) and a Centronics port (printer).

Pin allocation of the sockets		
Pin (socket)	Allocation	
1	DCD	RS232C
2	RXD	
3	TXD	
4	DTR	
5	GND	
6	DSR	
7	RTS	
8	CTS	
9	–	
1	Strobe	Centronics
2	D0	
3	D1	
4	D2	
5	D3	
6	D4	
7	D5	
8	D6	
9	D7	
10	Ack	
11	Busy	
12	Paper End	
13	Select	
14	–	
15	Fault	
16	Reset	
17	Select Input	
18 to 25	GND	





N socket

The N socket can optionally be used to attach an antenna (extra accessory; needs adapter N/TNC) or the supplied RF adapter cable (standard accessory; N connector).

☞ Always fasten the N connector's coupling ring securely by hand to ensure perfect contact. Otherwise measurements may not be reproducible and reliable.

Make sure that the contact surfaces of the N plug-in connector are kept clean (to ensure secure contact).

External synchronization

The BNC socket on the rear panel is the signal input for an external synchronization (e.g. an in-house reference signal).

$U_{in} \geq 0.2\ V_{rms}$ @ 50 Ω

You can synchronize the Willtek 4200 with one of the following frequencies:

5 MHz – 10 MHz – 13 MHz

The current status of the synchronization is shown on the start menu. Line *Sync.* shows the frequency of the extrenal synchronization signal or in case of no external signal the message *Internal*.

☞ For using the external synchronization you have to feed in at first the external signal, even before you switch on the Willtek 4200. After any changement in external synchronization you should call up the start menu. This hands over the changement to the tester.

Printing

This is what you can print

- AUTOTEST logs (detailed listing of all measurements taken with planned and actual values), see also page 3-8.
- The current configuration of your Willtek 4200 (serial number, firmware version, etc.), see also page 1-18.

Printer requirements

- Any model of printer is usable unless the printer works under DOS but needs no DOS driver. If AUTOTEST logs containing graphics (e.g. company logos) you will require an Epson or HP (Hewlett Packard) printer, or one which understands the graphics command sets of these two makes. Please consult your printer's manual for more details.
- Standard Centronics interface (36-pin socket on printer).
- Option of setting a monospace font (e.g. `Courier`, where all characters have the same width). Please consult your printer's manual for more details here.

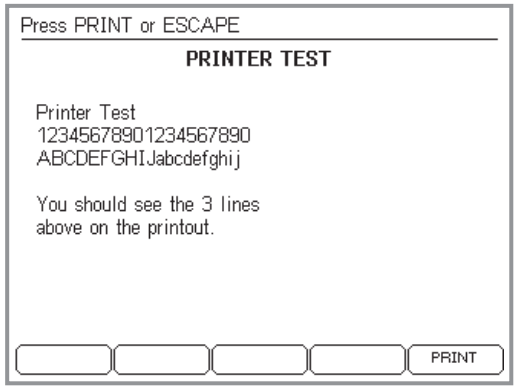
Connecting a printer

1. Switch off both your Willtek 4200 and the printer.
2. Connect the Centronics port of the Willtek 4200 with the Centronics port on your printer. Use for that the Centronics cable (`860 378`). Other extensions available on the market are also acceptable, provided the overall length of a cable does not exceed approx. 5meters (see page 6-3 for pin layout).

☞ ***Printing on the PC***
You can transfer test logs to a PC using the Windows "4X00 Data Exchange" software and automatically output them on the PC printer or on a network printer (see page 6-16).

Testing the printer

This test tells you whether your Willtek 4200 is able to communicate with the printer.



⇦ + SETUP + *Self check* + ✓ + *Printer test* + ✓

1. Switch on your Willtek 4200 and the printer. Make sure that the printer is ready to start printing (enough paper, online/ready message or lamp).
2. Call the *PRINTER TEST* menu on the tester (see on the left). Press PRINT to start testing. The printer test is executing always with the current selected printer driver (see page 2-4).
3. If the three test lines appear on the printout, data communications between the two devices are generally functioning correctly. If you encounter problems when printing AUTOTEST logs later on (missing graphics, formatting errors), the next section provides a few tips on troubleshooting.
4. Back with Esc.

Troubleshooting

Printer does not respond

Complete failure is generally the result of the printer being connected incorrectly or the use of an unsuitable printer. Driver problems – as often experienced with PCs – can be excluded, as the tester outputs pure ASCII data (during the printer test).

- Check proper printer selection (see page 2-4)
- If you are using an extension cable, repeat the printer test, this time without an extension.
- Make sure that all cables are firmly plugged into their respective sockets.
- The printer is a Windows printer which (unlike a DOS printer) is unable to interpret the pure ASCII data. If no DOS printer is available, first export the test logs to a PC (see page 6-16) and then print them to a Windows printer from the PC.

– Check that the printer is functioning correctly by connecting it to a PC and then printing something from an installed word processing program (remember to set the right printer driver on the PC first).

Bad characters — If the printer's output is garbled, select *ASCII* in the tester's *PRINTER* menu.

Bad formatting — AUTOTEST logs are formatted in such a way that e.g. all *PASS/FAIL* readings are listed in clearly arranged lines one beneath the other. For this to happen, however, a monospace font such as `Courier` must be set on your printer. If your printer is set to a proportional font, the above formatting will not work. Please consult your printer's manual for information on how to switch fonts.

Correct formatting with a monospace font

```
Call from Basestation      PASS
  Power Time template      PASS
  TX power                 PASS
```

Incorrect formatting with a proportional font

Call from Basestation PASS
Power Time template PASS
TX power PASS

Data transfer between the tester and the PC

de4x00.exe

The Windows software "4X00 Data Exchange" offers you an easy way of transfering data between your Willtek 4200 and a PC:

- **Firmware update:** Load your tester with the newest firmware which you can download from the Willtek web site for free (see also page 6-26).
- **MS TYPE list:** Copy test specifications for mobile phones from one tester to any number of other testers (including user-defined AUTOTESTs). This saves the time-consuming entry of identical test specifications on muliple test systems.
- **Test logs:** Export the AUTOTEST logs saved in the tester to a PC, for instance to back up the data, for printing or for statistical evaluation of the test logs.
- **AUTOTEST:** Import of all user-defined AUTOTESTs created using the Utility Software (optional) and made available on the Internet, for instance.

www.willtek.com

Where can I get the software?

4X00 Data Exchange (`de4X00.exe`) is provided on the accompanying CD. The current version is also available on the Internet.

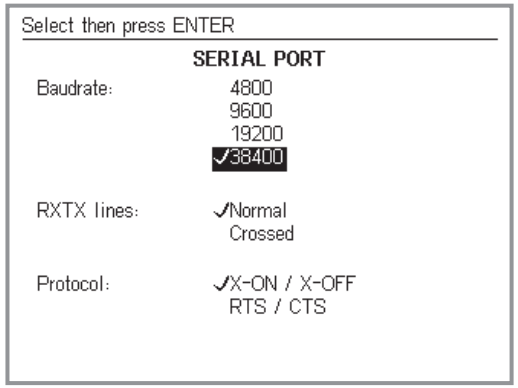
Installing the software

Save the file `de4X00.exe` in any directory on your PC's hard disk. No setup procedure is required. The first time it is started, the program creates an INI file in the installation directory. This file is relevant when exporting test logs in Excel format (see page 6-18).

Preparation

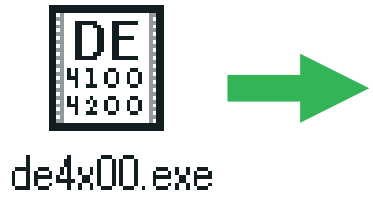
No matter what type of data transfer you are planning, the necessary preparations are always the same.

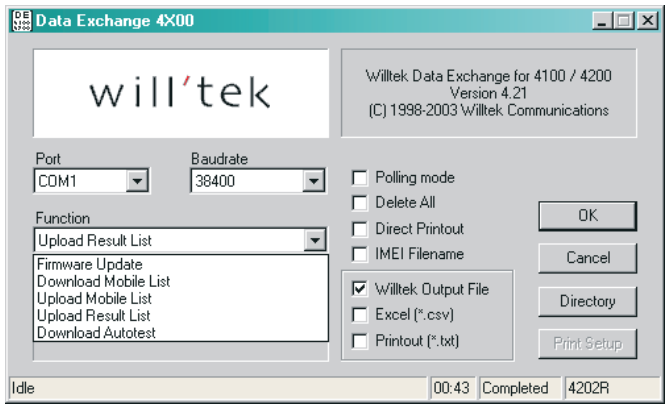
1. Switch off the PC and your tester.
2. Connect the RS-232-C connector on the tester with the RS-232-C cable (860 379) to a free COM port on the PC (COM1...COM255).
3. Switch on the PC and the tester. On the tester, call up the *SERIAL PORT* menu.



⇦ + SETUP + *Serial port* + ✓

4. Choose a baud rate (see also page 2-8).
5. Start the 4X00 Data Exchange on your PC by double clicking on `de4x00.exe`.

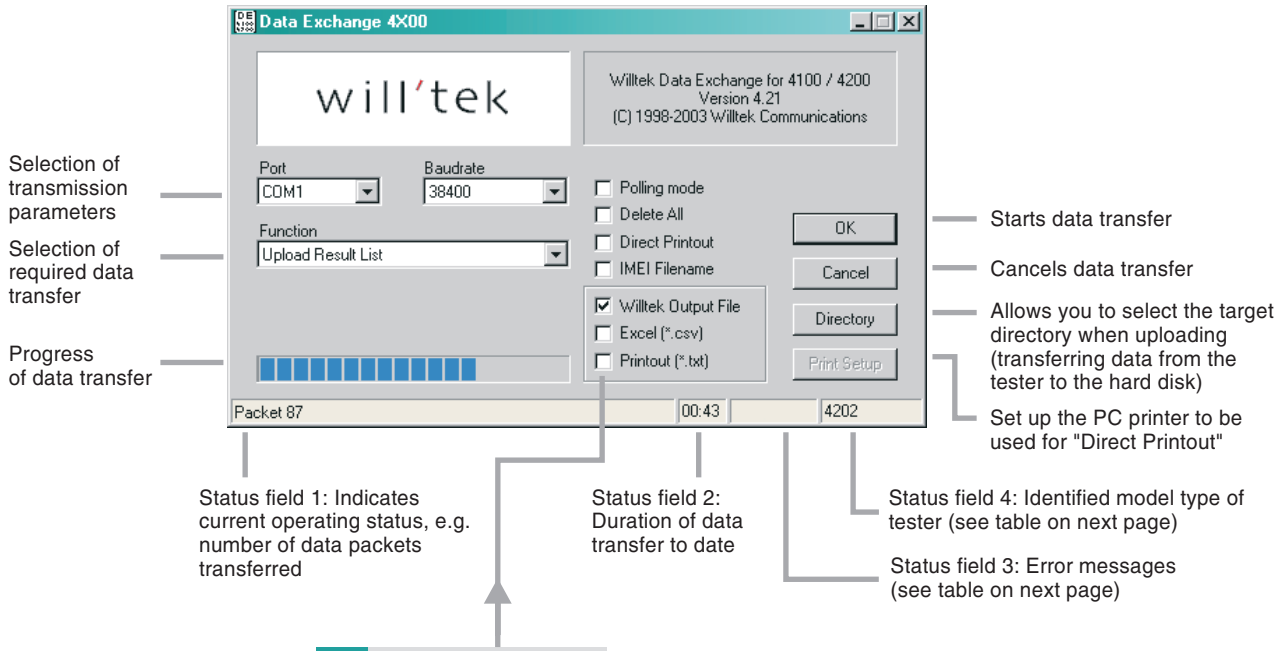




6. Select the COM port used and the baud rate previously set on the tester with the **Port** and **Baudrate** menus.

This completes the preparations. You can now perform one of the types of data transfer between the tester and the PC as described below.

The Program window



Options for Function = Upload Result List

Polling mode	Export individual test logs. Details: see page 6-21.
Delete All	Once test logs have been exported (see page 6-16), all test logs are automatically deleted on the tester.
Direct Printout	Print out test logs on the PC printer (see page 6-16 to find out how to set up the printer with [Print Setup]).
IMEI Filename	All text logs are merged on export into a container file (box not checked) or are exported individually, in which case the IMEI of each log determines the file name used. Details: see page 6-17.
Willtek Output File Excel (*.csv) Printout (*.txt)	Selection of output files which are created when exporting test logs. In most cases the output in Excel and/or Printout format (both are text files) is sufficient. For special evaluations the original raw data can be stored in addition (more from page 6-18 on).

No data transfer?

If no data is transferred between the tester and the PC, the message `Timeout` appears in status field 4 after approximately 2 seconds. In this event, you should check the following:

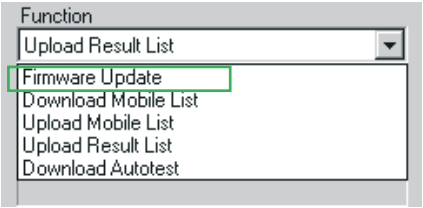
- Is the tester connected to the correct COM port?
- Are the cables seated properly?
- Is the same baud rate set at the tester and in the 4X00 Data Exchange program?
- Are the `RXTX lines` and `Protocol` settings correct on the tester? If you are using original cables, choose the settings `Normal` and `X-ON / X-OFF`.
- Is the baud rate too high for the PC interface (only with older PCs)?

☞ If data transfer fails, switch off your Willtek 4200 briefly before trying again in order to ensure stable operating conditions.

Error messages

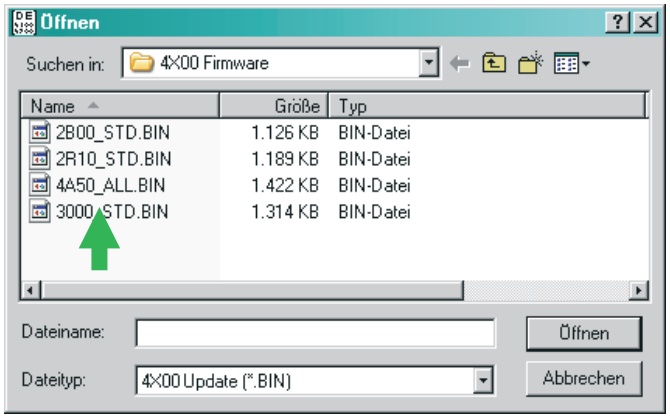
Status field 3	
Aborted	Data transfer canceled by user
Timeout	Tester is not reacting to requests from the program
Completed	Data transfer completed successfully
Out of sync	Aborted because sender and receiver are out of synchronization
Unknown	Aborted for unknown reason
NACK	Sender requests retransmission of an acknowledgement (Non Acknowledge)
CRC Error	Aborted due to invalid checksum
Status field 4	
4XXX	Identified model type of tester
Timeout	No response from the tester
Unknown	Unknown model

Performing a firmware update



*Standard dialog box for opening the firmware file *.BIN under Windows 95/98 (shown here in German). If the file (msw_0211.bin in the example) is not shown immediately, you must first open the right folder as described in your Windows documentation.*

1. Completed the preparations (see page 6-9)? Then choose ***Firmware Update*** from the ***Function*** list box in 4X00 Data Exchange.
2. Confirm the settings by clicking the [OK] button.
3. After you click [OK], Windows displays the standard file open dialog box. Since you want to perform a firmware update, the file type *.BIN has already been entered in the appropriate field.
4. Double clicking on the BIN file starts the load process. If an error occurs, please refer to page 6-11.



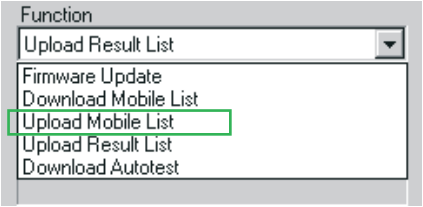
5. As soon as data transfer is complete, the Willtek 4200 restarts automatically.
6. On the tester, call up the menu *SYSTEM INFORMATION*. If the new firmware version is shown there, the update has been successful.

Abortion during an update

If data transfer is aborted when performing a firmware update (e.g. because the tester was switched off), the exact time at which the operation was aborted determines the subsequent reaction.

- If the update is aborted early, the SETUP settings and any stored test logs are lost, but otherwise the tester starts as usual (with the previous version of the firmware).
- If the update is aborted late, the tester will only display a prompt to start a download. In this event, restart the load procedure from the PC by double clicking on the firmware file.

Copying MS TYPE records



If you wish to transfer a long list of MS TYPE records including user-defined AUTOTESTs from one tester to another, you must first export the MS TYPE list. The resulting AUT file can then be transferred by floppy, email or Internet. The recipients then import the file into the target unit.

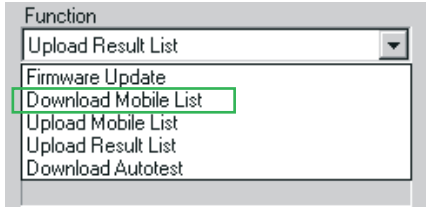
■ Exporting an MS TYPE list to PC

1. Completed the preparations (see page 6-9)? Then choose ***Upload Mobile** List* from the ***Function*** list box in in 4X00 Data Exchange.
2. Click [Directory] and select the hard disk directory you want.
3. Confirm your settings by clicking on [OK] in 4X00 Data Exchange.
4. After you have clicked on [OK], the MS TYPE records start to be uploaded from the tester to the PC. This can be seen by the message *REMOTE* on the display of the Willtek 4200 and by the *Packet* counter in status field 1 of the program. If an error occurs, please refer to page 6-11.

You can, for instance, now send the record to the recipient by email. The recipient in turn uses the 4X00 Data Exchange software to import the record from the PC to their Willtek 4200.

☞ *The file name of the MS TYPE record depends on the device, as it always indicates the MCU serial number of the tester from which the MS TYPE list comes in order to allow unique identification (see also page 1-18). The file name extension is always AUT.*

⚠ When you export an MS TYPE list, any existing MS TYPE list already stored in the target directory will be overwritten without any confirmation. You can avoid this by renaming the existing file or by moving it to a different directory.



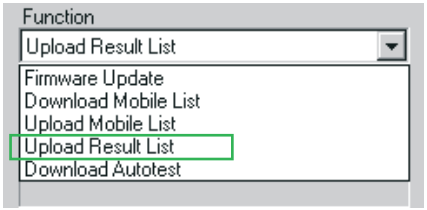
■ Importing an MS TYPE list from the PC

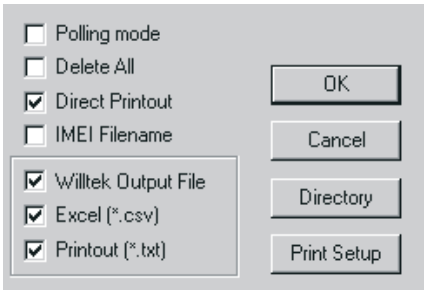
1. Completed the preparations on the target unit (see page 6-9)? Then choose ***Download Mobile List*** from the ***Function*** list box in in 4X00 Data Exchange.
2. Confirm your settings by clicking on [OK] in 4X00 Data Exchange.
3. After you click [OK], Windows displays the standard file open dialog box (see also page 6-12). Since you want to load an MS TYPE list, the file type *.AUT has already been entered in the appropriate field. In this dialog box, open the directory containing the AUT file you wish to import.

   ⚠ When you import an MS TYPE list, all existing MS TYPE lists and user-defined AUTOTESTs are deleted from the target unit. This data can be backed up if you export the MS TYPE list from the target unit beforehand.

4. Double clicking on the AUT file starts the load process. If an error occurs, please refer to page 6-11.
5. As soon as the data transfer is complete, the newly imported MS TYPE records, including the user-defined AUTOTESTs are ready to use immediately.

Exporting test logs





Test logs stored in the memory of a Willtek 4200 during an AUTOTEST can be exported to a PC where they can be archived or statistically evaluated, for instance.

1. Completed the preparations (see page 6-9)? Then choose ***Upload Result List*** from the ***Function*** list box in 4X00 Data Exchange.
2. Select the required export options using the mouse pointer by checking the ☐ box as required. The export options are described below.
3. Click [Directory] and select the hard disk directory you want.
4. Confirm your settings by clicking on [OK] in 4X00 Data Exchange.
5. After you have clicked on [OK], the test logs start to be uploaded from the tester to the PC. This can be seen by the message *REMOTE* on the display of the Willtek 4200 and by the *Packet* counter in status field 1 of the program. If an error occurs, please refer to page 6-11.

■ Export options

`Polling mode` Detailed description as of page 6-21.

`Delete All` **With** ✓: After export to a PC, all test logs on the tester are automatically deleted (to increase the available memory space).
Without ✓: The logs are retained on the tester.

`Direct Printout` **With** ✓: Functions identically to `Printout (*.txt)`, but the TXT file (test results) is also output on the PC or network printer. Set up the printer with [Print Setup].
Without ✓: No printout.

`IMEI Filename` This export option has a dual effect: It extracts all text logs from the Willtek Output File and affects the way in which file names are assigned automatically on export.

Willtek Output File
A Willtek Output File (ALL file, see also page 6-18) contains the raw data of all exported test logs. All other export files are therefore simply derived from the ALL file. If the ALL file is divided into individual test logs (using an export option IMEI Filename), the same number of RES files are created as there are logs in the ALL file.

These RES files, too, still contain raw data that is difficult to interpret. Only once the Data Exchange program has expanded the raw data using INI files (formatting, text), the more comprehensible TXT and CSV files are created from the ALL file or the RES files (see page 6-18).

With ✓: All test logs in the Willtek Output File (ALL file) are extracted automatically and saved as separate files with the suffix RES (Result). The RES files still contain raw data. Thus, it is advisable to select the export option Excel or Printout (or both) in addition. This also produces separate test logs, but they are saved in TXT and/or CSV file format, which is more easily interpreted.

Names are assigned to RES, TXT and CSV files automatically, according to the following pattern:

`IMEI_HHMMSS_DDMMYYYY`

`IMEI`	IMEI number of the tested mobile phone (see page 4-37).
`HHMMSS`	The time the test took place: Hour-Minute-Seconds.
`DDMMYY`	The time the test took place: Day-Month-Year.

Example of name assignment
143_153.ALL: File will contain all logs which were stored in the tester between 23 May (143rd day of the current year) and 2 June.

143_0952.ALL: File will contain all logs which were stored in the tester on 23 May. The most recent (final) log to enter the file is the one stored in the tester at 9.52 in the morning.

Without ✓: No RES files are extracted from the ALL file. Since the export files (ALL, TXT, CSV) are now containers for several test logs, names are assigned according to the following pattern:

`AAA_BBBB`

`AAA`	Day counter (1 through 365): The day on which the oldest AUTOTEST log was stored in the tester.
`BBBB`	Day counter (1 through 0365): The day on which the most recent AUTOTEST log was stored in the tester, **or** (if all logs are stored on the same day) the time of day at which the most recent AUTOTEST log was stored in the tester.

`Willtek Output File`

With ✓: Test logs are exported in the form of an ALL file (see also page 6-17). This is a text file with unprocessed raw data (for an example, see page 6-20). The ALL file is a container which holds all test logs that were saved in the tester at the time of export.
Without ✓: The ALL file is not created.

`Excel (*.csv)`

With ✓: Test logs are exported in the form of a CSV text file formatted for import into a spreadsheet program (separator: semicolon). The identifiers (see page 6-28) are expanded to include plain-text explanations on the basis of the `DE4X00.INI` file (see page 6-8) (identifier A15 is expanded to include MS Power Level, for instance).
Page 6-20 shows the appearance of such a CSV file.

***Tip**: `DE4X00.INI` can be loaded in standard ASCII text editors, where it can be edited and saved. Thus, if terms such as MS Power Level are translated, the explanations will appear in the local language.*

The [Excel column] and [Excel row] sections in the file `DE4X00.INI` determine how the CSV file is prepared for viewing in Excel (definition of the column titles and the way in which the rows are presented for each test result). Only when these specifications have been made will the tabular representation of the data be clear. The following extract from a table of this type illustrates how the column and row definitions in the INI file shown on the left) affect the appearance of the Excel spreadsheet.

[Excel column]
4 Time
5 Date
6 Result
7 MSTYPE name
8 Autotest name
...
38 Question ID
39 Printout

1	2	3	4	5	6	7		39
			Time	**Date**	**Result**	**MSTYPE name**	...	**Printout**
A01	Test name	Demotest	02:36:19	12.05.99	Fail	Mobile XYZ		
A02	Mobile inf...	00101123...						
A03	Tester inf...	4201S						
...								
A42	Question...	Pull antenna...			Pass			O.K.

[Excel row]

```
A01;Test name;4,5,6:PASS:FAIL,7,8,9,10:Cable:Antenna:Coupler,11:Standard:User
A02;Mobile information;12,13,14,15::Phase 1:Phase 2,16:No:Yes,17:No:Yes,18
A03;Tester information;19,20,21,22
A10;Call from mobile;6:PASS:FAIL
...
A42;Question box;38,6:PASS:FAIL,39
```

Without ✓: The CSV file is not created.

`Printout (*.prn)`

With ✓: Text logs are exported in the same form that they would have if they were printed to paper (simulated printout). The resulting export file is a text file (TXT). Any text editors or word processing programs can be used to view the simulated printout.

Without ✓: The TXT file is not created.

Examples of exported test logs

The following examples show two identical records exported once as an ALL file (top) and once as a CSV file (bottom). The file `DE4X00.INI` (see page 6-8) modifies the ALL file in such a way that it can be represented clearly and understandably under Excel. If a record contains several test logs, A01 always indicates the start of the next log.

```
A01;02:36:19,05.10.98,1,AA GSM STANDARD,GSM 900 Standard,1,0,0
A03;Willtek 4201S,212044,USER NAME,USER COMPANY,3a00
A23;A,B,63,15.0,13.0
A23;A,T,3,15.0,13.0
A23;B,T,45,15.0,13.0
A23;C,T,123,15.0,13.0
A21;-80.0
A22;63
A16;1,3
A15;0,9
A10;1
```

```
;;;Time;Date;Result;MSTYPE name;Autotest name;Tested network;
Connection;Test;IMSI;IMEI;MS class;MS Revision;Extended frequency;
Short message capability;A5 ciphering support;Tester model;Serial
number;User name;User company;Level;TCH;TX Pre attenuation (dB);RF
level;Broadcast no;Channel ID;Channel type;Channel no;RX pre att
(dB);TX pre att (dB);Dialed digits;Reference digits;Measured;Low
limit;High limit;Question ID;Printout;
A01;Test name;;02:36:19;05.10.98;FAIL;AA GSM STANDARD;GSM 900
Standard;1;Cable;Standard;
A03;Tester information;;;;;;;;;;;;;;;;;;Willtek 4201S;212044;USER
NAME;USER COMPANY;3a00;
A23;Pre att by MSType;;;;;;;;;;;;;;;;;;;;;;;;;;;A;B;63;15,0;13,0;
A23;Pre att by MSType;;;;;;;;;;;;;;;;;;;;;;;;;;;A;T;3;15,0;13,0;
A23;Pre att by MSType;;;;;;;;;;;;;;;;;;;;;;;;;;;B;T;45;15,0;13,0;
A23;Pre att by MSType;;;;;;;;;;;;;;;;;;;;;;;;;;;C;T;123;15,0;13,0;
A21;RF output level (dBm);;;;;;;;;;;;;;;;;;;;;;;;;;;-80,0;
A22;Broadcast channel;;;;;;;;;;;;;;;;;;;;;;;;;;;63;
A16;Traffic channel;;;;FAIL;;;;;;;;;;;;;;;;;;3;
A15;MS power level;;;;PASS;;;;;;;;;;;;;;;;;9;
A10;Call from mobile;;;;FAIL;
```

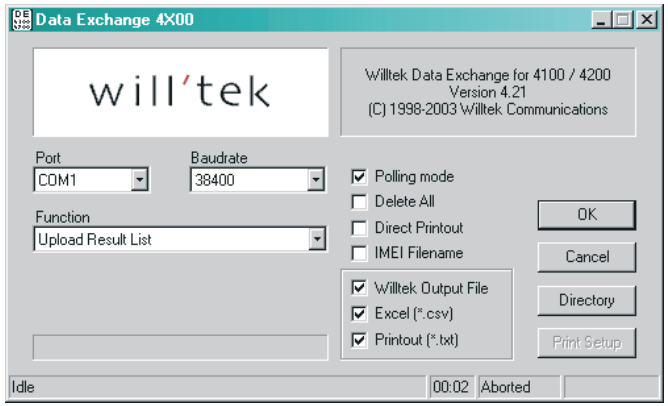
Data polling

☞ *Unlike the normal export of test logs (see page 6-16), data polling allows you to transfer individual test logs to a PC.*

As of Version 3.00, the program 4X00 Data Exchange can also transfer test results using data polling. To do this, the tester must be set to data polling. The output to a printer can then be redirected to a PC using the RS-232-C port. The (PRINT) softkey will be replaced by the (UPLOAD) softkey in the relevant menus of the tester.

■ Requirements for data polling

- The tester must be fitted with the *Upload (Polling mode)* option. The *SYSTEM INFORMATION* menu will indicate whether this is true for your tester (see page 1-18).

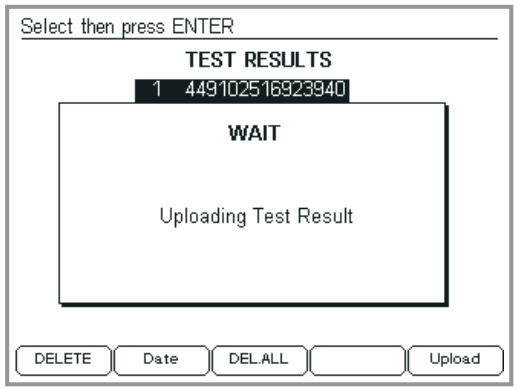


- On your tester the upload test results option in the *PRINTER* menu must be activated (see page 2-5). The *TEST RESULTS* menu will display the (UPLOAD) softkey in place of the (PRINT) softkey if this has been carried out.

Practical tip: *If you include the 4X00 Data Exchange in the Windows Startup folder, it starts up when the PC is switched on and uses the last set of valid settings. If the data polling process was running when the PC was switched off, then as soon as the PC has started up again you will be able to transfer data immediately. An interrupted working session can thus be resumed quickly and easily.*

■ Starting data polling on the PC

1. Are all preparations complete (see page 6-9)? Then select the entry ***Upload Result List*** under ***Function*** in 4X00 Data Exchange.
2. Check the ***Polling mode*** box with a mouse click.
3. Now click on [Directory], and select the target directory on the hard disk, you can also select a network share.



You can start data polling on the PC and then on the tester, or vice versa. If you start on the tester, the message shown here will only disappear when 4X00 Data Exchange on the PC is ready to receive data.

4 Start the data polling by clicking on the [OK] button in 4X00 Data Exchange. The program will now wait for the data (coming from the tester) and indicates this in status field 1 *Waiting for transmitter*. Should you have any problems, refer to page 6-11.

■ Starting data polling on the tester

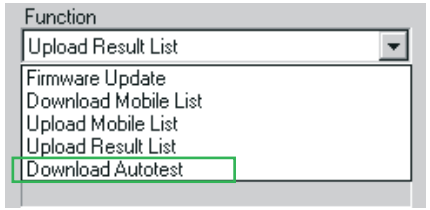
As soon as data polling is started on the PC you can transfer any test logs from the tester to the PC. This applies to stored test log as well as to those that save not been stored (i.e. directly after an AUTOTEST has been completed).

1 Use ⟲+(RESULTS) to call the *TEST RESULTS* menu and select the test log you require from the menu. Or carry out the desired AUOTEST to transfer the results to the PC.

2 (UPLOAD) starts data polling on the tester. The message *Uploading Test Results* will disappear as soon as the test log has been transferred completely. The file name that the exported test log receives depends on the status of the *IMEI Filename* export option (see page 6-17). This allows you to transfer any number of test logs, one after the other, to the PC.

3 Terminate data polling under 4X00 Data Exchange by clicking on [Cancel].

Importing AUTOTESTs

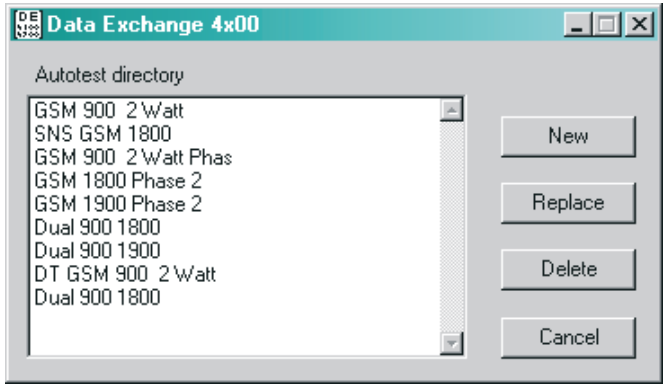


The Utility Software (optional) allows you to simply create user-defined AUTOTESTs and to save them as DLD files (Down Load Data). This means that if, for instance, a telephone vendor makes a file of this type available to you on the Internet, you will be able to import it into your Willtek 4200.

1 Have you made all the preparations (see page 6-9)? Then choose ***Download Autotest*** from the **Function** drop-down list in 4X00 Data Exchange.

2 When you click [OK], the standard Windows file open dialog box appears (see also page 6-12). Since you want to import an AUTOTEST, the file type *.DLD has already been entered in the appropriate field. In the dialog box, open the directory containing the DLD file you want to import.

3 Double-click on the DLD file to open a window with a list of all the user-defined AUTOTESTs stored on your tester.



4 If you want to insert the new test, click on [New]. If you want to overwrite an existing test, click on the name of the test you want to overwrite and then click on [Replace]. Click on [Delete] to cancel the presently marked AUTOTEST, and with [Cancel] you close the window without performing any action.

The fact that the AUTOTEST is being downloaded from the PC to the tester can be seen by the message *REMOTE* on the display of the Willtek 4200 and by the *Packet* counter in status field 1 of the program. In the event of an error, refer to page 6-11.

Command line parameters

-Fn	Function (n = 0 to 4)	
	-F0	Firmware Update
	-F1	Download Mobile List
	-F2	Upload Mobile List
	-F3	Upload Result List
	-F4	Download Autotest
-Cn	Port (n = 1 to 255)	
	-Cn	COMn
-Bn	Baudrate (n = 4800 to 38400)	
	-B4800	4800 Baud
	-B9600	9600 Baud
	-B19200	19200 Baud
	-B38400	38400 Baud
-P"Path or file name"	Entry depends on the selected function	
	Firmware Update	File name of the update
	Download Mobile List	File name of the mobile list
	Upload Mobile List	Target folder of the mobile list
	Upload Result List	Target folder of the result list
	Download Autotest	File name of the AUTOTEST
-Mxn	Upload Result modes (x = P,D,E,T, I or W) (n = 0 or 1)	
	-MP0	Polling mode off
	-MP1	Polling mode on
	-MD0	Delete All off
	-MD1	Delete All on
	-ME0	Excel file off
	-ME1	Excel file on
	-MT0	Printout file off
	-MT1	Printout file on
	-MI0	IMEI filename off
	-MI1	IMEI filename on
	-MW0	Willtek Output File off
	-MW1	Willtek Output File on

The 4x00 Data Exchange program recognizes command line parameters that trigger the required action automatically when the program is started.

Syntax:

```
de4x00.exe -Fn -Cn -Bn -P"path \ file name" -Mxn
```

Example: The program should update the firmware of a Willtek 4200 automatically and should use the COM1 port and a transfer rate of 38400 baud. The corresponding program call is:

```
de4x00.exe -F0 -C1 -B38400
-P"C:\Update\V400.bin"
```

General notes

- Invalid paramters are ignored.
- If a parameter is missing, the program will assume the most recently used value.
- If no function (*-Fn*) is declared, the required function has to be selected manually after starting the program.
- If the *Firmware Update*, *Download Mobile List* or *Download Autotest* functions are called up without the parameter *-P*, the program expects a file name to be selected/entered manually after starting.
- Once the program has been executed, the program is closed automatically.
- The program logs command line actions in the file `de4x00.log`.

Updating the firmware

Updating the firmware will erase all SETUP settings and all the test logs stored in the tester (for details on backing up test logs, see page 6-16). The MS TYPE list and all AUTOTESTs are retained.

To a large extent, it is the firmware which is responsible for determining the performance characteristics of your Willtek 4200. Willtek continually maintains this software, providing new versions at intervals free of charge. Making use of these firmware updates provides you with new or optimized features.

This is how to get your update package

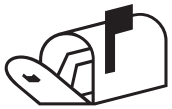
- **Internet:** If you have access to the Internet, you can download the latest firmware from Willtek's Web site (from the download area) to your PC. From there, you can upload it to your tester. The address of our Web site is:

  http://www.willtek.com

  The files of the update package are all stored in a self-extracting file with the name:

  4200_XXX.EXE

  ID of firmware version



- **Direct sales:** Contact the sales office from whom you obtained your Willtek 4200. In order to identify the firmware currently installed in your tester, it is a good idea to have the information which is displayed in the *SYSTEM INFORMATION* menu at the ready (see page 1-18).

To update you will need these

- A PC with Windows 95/98 or later.
- An update package.
- A connecting cable between the PC and your tester. A suitable cables is the RS-232-C cable (860 379).
- A free COM port on the PC (serial interface).

Contents of the update package

You can unpack the update package to any directory on you hard disk. You can also subsequently move the files to other directories.

A firmware update comprises a number of files. The most important are as follows:

- **de4x00.exe** Windows program (4X00 Data Exchange) responsible for uploading the firmware files from the PC to your Willtek 4200. The program is also used for exchanging user data (test logs, MS TYPE list) between the PC and the tester.
- **XXXX.BIN** Firmware file for the tester.
- **README1st.TXT** Text file with accompanying information. This may include the latest installation notes which differ from those listed in the manual.

Performing the update

Refer to the information as of page 6-12 for details on performing a firmware update with the Windows Data Exchange software.

The code used in log listings

Read from top to bottom, a log reflects exactly the chronological sequence of events in an AUTOTEST. Each log begins with the identifier A01. In "ALL" files, this identifier marks the beginning of a new log.

The tables below show the meaning of each identifier, along with its associated data (the data in the same line).

General information = A01

Field type	Example	Information
Identifier	A01;	
Test ID (time)	10:14:42	Time of test start
Test ID (date)	07.03.97	Date of test start
Overall Test Result	0	0=PASS, 1=FAIL
MS TYPE Name	BLUE MOBILE	Name from MS TYPE list
AUTOTEST Name	GSM STANDARD	Name of the performed test
Tested network	1	1=GSM900 2=GSM1800 3=GSM900+1800 4=GSM1900 5=GSM900+1900 7=GSM900+1800+1900
Connection	0	0=Cable, 1=Antenna 2=Coupler
Test type	0	0=Standard 1=User

Mobile information = A02

Identifier	A02;	
IMSI	001011234567890	Subscriber id
IMEI	490402810032110	Mobile id
MS class	4	Power class of mobile
MS revision	1	1=Phase 1, 2=Phase 2
Extended frequency	0	0=No, 1=Yes
Short message capability	0	0=No, 1=Yes
A5 cyphering support	1	0 to 7 1=a5/1, 2=A5/2, 4=A5/3

Identifier	A02;	
Classmark 3 info	1	0=Classmark 3 not avail. 1=Classmark 3 available
Extension Bit status*	0	0=No, 1=Yes
Multiband info*	5	0=single band mobile 5=GSM900+1800 6=E-GSM900+1800
MS Pwr class 1*	4	valid for (E-)GSM900
MS Pwr class 2*	1	valid for GSM1800
MS Pwr class 1900*	3	valid for GSM1900 (Tri-band only)
EFR Speech mode	1	0=Only FR available 1=EFR available
IMEI SV	00	Software version (2 digits)
MS Class	4	GPRS power class MS
RX max. slots	2	GPRS max number RX slots
TX max. slots	4	GPRS max number TX slots
Summary max. slots	5	GPRS max number of RX+TX slots (total slots)
*) Only if Classmark 3 is available		

Tester information = A03

The identifiers are not always numbered sequentially: any gaps you may find are intentional.

Identifier	A03;	
Tester model	4201S	Model
Tester serial number	120025	Serial number
User name	MILLER	
User company	Willtek	
Firmware version	2.10	

Call from mobile = A10

Identifier	A10;	
Result	0	0=PASS, 1=FAIL

Call from base station = A11

Identifier	A11;	
Result	1	0=PASS 1=FAIL

Release from mobile = A12

Identifier	A12;	
Result	0	0=PASS 1=FAIL

Release from base station = A13

Identifier	A13;	
Result	0	0=PASS 1=FAIL

MS power level = A15

Identifier	A15;	
Result	0	Level change 0=PASS, 1=FAIL
Level	5	Power level
Network	4	1=P-GSM900 4=GSM1800 2=E-GSM900 5=GSM1900 3=R-GSM900 6=GSM850

Traffic channel = A16

Identifier	A16;	
Result	0	Handover signaling 0=PASS, 1=FAIL
TCH	27	Traffic channel
Network	1	1=P-GSM900 4=GSM1800 2=E-GSM900 5=GSM1900 3=R-GSM900 6=GSM850

Pre-att. defined by AUTOTEST = A20

Identifier	A20;	
RX value	1.5	Dimension dB
TX value	1.5	Dimension dB

RF output level (tester) = A21

Identifier	A21;	
Value	-60.0	Dimension dBm

Broadcast channel = A22

Identifier	A22;	
Value	63	
Network	4	1=P-GSM900 4=GSM1800 2=E-GSM900 5=GSM1900 3=R-GSM900 6=GSM850

Pre-att. defined by MS TYPE = A23

Identifier	A23;	
Channel ID	1	1=First channel 2=Second channel 3=Third channel
Channel type	2	1=Broadcast channel 2=Traffic channel
Channel	63	
RX value	1.5	Dimension dB
TX value	1.5	Dimension dB
Network	1	1=GSM900 2=GSM1800 3=GSM1900

Dialled number = A30

Identifier	A30;	
Result	0	0=PASS, 1=FAIL
Dialled digits	123456789	Transmitted from mobile
Reference digits	123456789	

Power/Time Template = A31

Identifier	A31;	
Total result	0	0=PASS, 1=FAIL
Rising edge res.	0	0=PASS, 1=FAIL
Middle area res.	0	0=PASS, 1=FAIL
Falling edge res.	0	0=PASS, 1=FAIL
Burst information (answer 1 to 3 in asynchronous mode only)	1	0=No information 1=With training sequ. 2=All other GMSK bursts 3=Contin. GMSK signal
GPRS uplink slot	0	0=none GPRS >0=Measured slot

TX power = A32

Identifier	A32;	
Result	0	0=PASS, 1=FAIL
Measured	34.0	Dimension dBm
Low limit	29.0	Dimension dBm
High limit	37.0	Dimension dBm
GPRS uplink slot	0	0=none GPRS >0=Measured slot

RMS phase = A33

Identifier	A33;	
Result	0	0=PASS, 1=FAIL
Measured	2.77	Dimension degrees
Low limit	0.00	Dimension degrees
High limit	8.50	Dimension degrees
GPRS uplink slot	0	0=none GPRS >0=Measured slot

Peak phase = A34

Identifier	A34;	
Result	0	0=PASS, 1=FAIL
Measured	9.33	Dimension degrees
Low limit	0.00	Dimension degrees
High limit	22.50	Dimension degrees
GPRS uplink slot	0	0=none GPRS >0=Measured slot

Frequency error = A35

Identifier	A35;	
Result	0	0=PASS, 1=FAIL
Measured	37	Dimension Hz
Negative limit	-115	Dimension Hz
Positive limit	115	Dimension Hz
GPRS uplink slot	0	0=none GPRS >0=Measured slot

Burst length = A36

Identifier	A36;	
Result	0	0=PASS, 1=FAIL
Measured	559	Dimension μs
Low limit	543	Dimension μs
High limit	563	Dimension μs
GPRS uplink slot	0	0=none GPRS >0=Measured slot

RX level = A37

Identifier	A37;	
Result	0	0=PASS, 1=FAIL
Measured	52	
Low limit	46	
High limit	54	

RX quality = A38

Identifier	A38;	
Result	0	0=PASS, 1=FAIL
Measured	0	
Low limit	0	
High limit	1	

BER = A39

Identifier	A39;	
Result	0	0=PASS, 1=FAIL
Measured	0.20	Dimension %
Low limit	0.00	Dimension %
High limit	1.50	Dimension %

AF loop = A40

Identifier	A40;	
Result	0	0=PASS 1=FAIL
Speech mode	1	0=FR 1=EFR

FER = A41

Identifier	A41;	
Result	0	0=PASS, 1=FAIL
Measured	0.20	Dimension %
Low limit	0.00	Dimension %
High limit	1.50	Dimension %

Quest. box def. in AUTOTEST = A42

Identifier	A42;	
Question Identifier	1	
Result	0	0=PASS, 1=FAIL
Printout	BATTERY	

Input box defined in AUTOTEST = A43

Identifier	A43;	
Input Identifier	4	
User input	123456789	e.g. UUT serial number

User break = A50

Identifier	A50;	
Fail flag	1	Signals with (BREAK) disrupted connection

Location Update = A51

Identifier	A51;	
Result	1	0=PASS, 1=FAIL

Data call from Mobile = A52

Identifier	A52;	
Result	0	0=PASS, 1=FAIL

Data call from Base Station = A53

Identifier	A53;	
Result	1	0=PASS, 1=FAIL

MS Timing Advance = A54

Identifier	A54;	
Value	0...63	See page 4-43

MS Timing Advance Result = A55

Identifier	A55;	
Result	0	0=PASS, 1=FAIL
Measured	2.77	n × 3,69/4 µs Dimension = µs
Low Limit	-3.69	Dimension = µs
High Limit	3.69	Dimension = µs

GSM-R Voice Group Call: Start Listener = A56

Identifier	A56;	
Result	0	0=PASS, 1=FAIL
Group ID	500	
Priority level	2	0 through 4, A or B

GSM-R Voice Group Call: Stop Listener = A57

Identifier	A57;	
Result	0	0=PASS, 1=FAIL

GSM-R Voice Group Call: Start Talker = A58

Identifier	A58;	
Result	0	0=PASS, 1=FAIL
Group ID	500	
Priority level	2	0 through 4, A or B

GSM-R Voice Group Call: Stop Talker = A59

Identifier	A59;	
Result	0	0=PASS, 1=FAIL

GPRS Attach = A60

Identifier	A60;	
Result	0	0=PASS, 1=FAIL

GPRS Detach = A61

Identifier	A61;	
Result	0	0=PASS, 1=FAIL

GPRS BLER USF = A62

Identifier	A62;	
Result	0	0=PASS, 1=FAIL
Measured	0.90	Dimension = %
Low limit	0.00	Dimension = %
High limit	1.50	Dimension = %
Blocks	1000	Number of blocks
Uplink slot	2	Mesured slot

GPRS BLER BCS = A63

Identifier	A63;	
Result	0	0=PASS, 1=FAIL
Measured	0.90	Dimension = %
Low limit	0.00	Dimension = %
High limit	1.50	Dimension = %
Blocks	1000	Number of blocks
Uplink slot	2	Mesured slot

SMS from mobile = A64

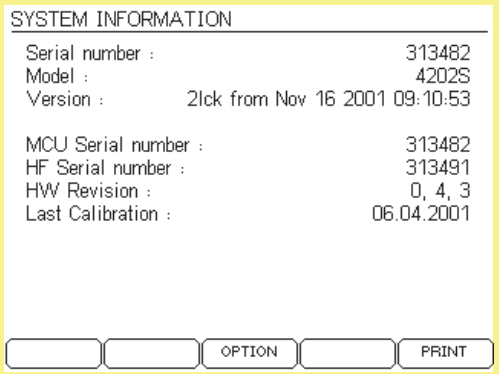
Identifier	A64;	
Result	0	0=PASS, 1=FAIL
Received SMS text	Hello World	
Estimated SMS text	Hello World	

SMS from base station = A65

Identifier	A65;	
Result	0	0=PASS, 1=FAIL
Transmitted SMS text	Hello World	

Troubleshooting

Basic settings lost	▪ To store the basic settings, the tester use a powerful capacitor, not a battery. If a tester is left switched off for more than about 14 days, the energy reserves may drain away. The tester must be switched on in order to load the capacitor. Simply supplying power via the power supply unit whilst the tester is switched off is not sufficient. To reenter lost settings, see chapter 2.
Display is blank	▪ Contrast correctly set? ▪ Supply voltage present?
Mobile phone does not recognize tester	▪ Test SIM correctly mounted? ▪ Battery in mobile phone OK? ▪ Correct radio system (GSM 900/1800/1900)? ▪ Tester's RF output level set to maximum value (*BS Power Level*)? ▪ In the case of a wireless connection: is the distance between the tester and the mobile phone less than approx. 50 cm? ▪ In the case of a cable-based connection: are you using the correct RF adapter and is this installed correctly?



+ SETUP + *Self check* + ✓ + *System info* + ✓

Please have the information on this menu ready when contacting Willtek for product support. Press PRINT to start printing the menu.

Tests not reproducible	▪ Test channels (BCCH and TCH) are being used by nearby base stations? ▪ Battery in mobile phone OK? ▪ In the case of a wireless connection: are there any metallic objects lying between the tester and the mobile phone? ▪ In the case of 4916 Antenna Coupler: are there any nearby base stations on same channels as test frequencies? Is the mobile phone fitting snugly in the cradle/clamp?
Print problems	▪ See page 6-6.

Willtek 4200 Timeline

The chronological timeline tells you what modifications have been made to the firmware (FW) and the User Guide. After a firmware update the timeline helps you to find out quickly about all major changes (see code).

FW	Manual Version	Code C = Correction I = Important Note N = New Feature M = Modified	Comment	See Chapter
1.00	9905-100-A	–	First edition of the manual (unapproved preliminary version)	–
	9907-100-A	M	First edition of the manual (approved version) incl. description of External Synchronization	6
	9908-100-A	C	Technical Data updated and final edition of "Declaration of EU Conformity"	6
	9909-100-A	C	Order numbers corrected	6
1.10	0004-120-A	N	Graphic display of the measured burst signal (power/time template)	4
		N	Graphic display of the measured burst spectrum (modulation spectrum)	4
		N	Graphic display of the measured phase error	4
		N	Bargraph for easy tuning the IQ modulator	4
		M	Description "Asynchronous Mode" moved from chapter 5 to chapter 4	4
		N	SCPI commands in command set MEASure (read graphics data of burst, spectrum etc)	5
1.20	0004-120-A	N	Check function for used/unused RF channels	3
		N	Easy entry of identical pre-attenuation values with (COPY)	4
		I	Usable are printers that need no driver for printing in DOS mode	2
		N	Additional menu for entry of special test parameters: MCC, MNC	4
		N	Audio echo loop now with FR/EFR selection and RF level adjustment	4
		N	Forced Location update	4
		N	SCPI commands in command set CALL (location update, set and read MNC/MCC etc)	5
		N	Speech mode EFR considered in identifiers A02 and A40	6
		N	Bit 9 in questionable status register signals timout in remote mode	5
	0005-120-A	C	Some minor fixes in the manual	–
2.00	0009-210-A	M	User Guide valid for all models of the ACTERNA 4200 series	all
		M	*SYSTEM INFORMATION* menu reachable via the start menu	1
		N	Identification of inclosed options within the *SYSTEM INFORMATION* menu	1
		M	Inverse mode for the display is available again	2
		N	Complete new and improved result presentation of an AUTOTEST	3
		N	Additional sub-modes in FAULT FIND mode: DATA 9600, SMS and DE-TUNING	4
		N	Testing of the burst profile now with setting of the MS power level	4
		N	Input option for Base Station Paging Multiframes in the *PARAMETER* menu	4
		N	Statistical calculation (Min., Max., Avg.) for important measurement values	4
		N	Limit curve in burst spectrum displays for easy rating	4

FW	Manual Version	Code C = Correction I = Important Note N = New Feature M = Modified	Comment	See Chapter
		N	Additional SCPI commands matching the new sub-modes in FAULT FIND mode	5
		N	Additional identifiers (A51 to A53) for data calls and location update	6
2.01	0009-210-A	N	Option AM modulation for RF carrier signal	4/6
		N	Last calibration date reported in menu *SYSTEM INFORMATION*	1
2.10	0103-210-A	N	The test set now supports multiband radio systems (GSM 900+1800+1900)	4
		N	Entry of limits to verify measurement results in FAULT FIND mode (menu LIMIT in Parameter setup)	4
		I	Emergency exit in case of selecting a complete unknown menu language	2
2.11	0106-211-A	C	Bug fixes	–
	0107-211-A	M	Minor changements in the manual only	–
2.12	0108-212-A	C	Bug fixes in IQ tuning and MS power level	–
	0109-212-A	M	SIM adapter from plug-in to full-size format no longer part of the standard items	1/6
2.20	0201-220-A	N	GSM 850 radio system available (option)	3/4
		N	New menu for recognition of available and installed options	1
		N	Direct data upload (test results) to a PC with new polling mode (option)	6
		N	Timestamp sorting of stored test results supplemented by IMEI sorting	3
		N	Timing Advance measurement incl. new SCPI commands and identifiers (4202S only)	4/5/6
		M	Renaming of the brand from Wavetek to Acterna	all
		M	Test 1 now with Location Update instead of BS Call	4
	0202-220-A	N	New RF Shield II available	3/6
2.30	0207-230-A	N	Frequency extension in generator mode (see technical data)	6
		N	Possibility to adjust the internal reference frequency oscillator for special purposes	2
		N	Portuguese user interface	2
		M	Renaming of the brand from Acterna to Willtek	all
3.00	0211-300-A	N	Introduction of the new model Willtek 4202R for GSM-R equipment test	all
		N	Voice Group Call Service: Additional test mode incl. new SCPI commands for Willtek 4202R	4/5
		M	MS Info menu shows IMEISV instead of IMEI	4
		C	Bug fixes	–
4.00	0302-400-A	N	Basic GPRS testing (Go/NoGo test)	4
		M	4x00 Data Exchange software version 4.00 with new user interface and new functionality	6
		N	Command line parameters for 4x00 Data Exchange software	6
		N	Additional Axx identifier for GSM-R (VGCS) and GPRS, new SCPI commands for GPRS	5/6
		M	Voice Group Call Service: Call Priority (value: 0...7) changed to Priority level (0...4, A, B)	4/5
4.50	0308-450-A	N	Enhanced GPRS testing (BLER BCS/USF and TX measurements)	4
			Description of battery operation with DC option	1

FW	Manual Version	Code C = Correction I = Important Note N = New Feature M = Modified	Comment	See Chapter
4.50	0308-450-A	N	New SCPI commands for GPRS measurements	5
		N	4x00 Data Exchange software version 4.20 with full COM-port support and direct printout feature	6
		N	New RF Shield III available	–
4.51		N	EDGE IQ-Tuning implemented (function only, without description)	–
5.00	0401-500-A	N	4x00 Data Exchange (4.21): new export option Willtek output file	6
		M	4x00 Data Exchange (4.21): modified file extensions for Excel/Printout output files	6
		N	4x00 Data Exchange (4.21): new button to delete a selected AUTOTEST	6
		C	Bug fixes	–
		N	GPRS: Multislot capability added	4
5.10	0404-510-A	N	GPRS: Multislot measurement support for AUTOTEST	–
		C	Bug fixes	–
		N	Description of EDGE IQ tuning taken at the manual (see FW 4.51)	4
		C	GPRS: SCPI command TXSLot moved from CONFIG to CALL section	5
		M	Mode ASYNCHRON renamed to ANALYZER	4
		M	RF GENerator now reachable by menu SELECT MODE	4
5.11	0406-511-A	N	Support of new model Willtek 4201A in the Willtek 4200 Mobile Service Tester series	1/5
5.13	0412-513-A	C	Correctly transmitted phone number in SMS mode	–
		N	Recovery time reduced from 30 to 5 seconds when a call is terminated unexpectedly	–
		N	Motorola G20 supported	–
		N	Lenovo mobiles supported	–
		N	New Sony Ericsson mobiles supported	–
		C	A connected printer does not eject an empty page when switching on the 4200	–
		N	USB to RS-232 adapters supported	–
		C	Bug fixes	–
5.20	0505-520-A	N	Introduction of new model Willtek 4208 Off-Air Mobile Tester	all
		N	New SCPI commands	5
		M	New Cell Broadcast Channel Message	4
		M	Online Help updated	–
		C	Bug fixes	–
5.30	0509-530-A	N	Fast Power Measurement for Willtek 4208	4
		N	Automatic Accept Call for Willtek 4208	5
		N	New SCPI commands for extended IMSI lists for Willtek 4208	5
		N	Extended Special characters for SMS available	4
		C	Generation of triband testprotocol corrected	–
		C	Autotest for EFR audioloop corrected	–

FW	Manual Version	Code C = Correction I = Important Note N = New Feature M = Modified	Comment	See Chapter
5.40	0512-540-A	N	Quadband functionality (in SCPI, Autotest and manual modes)	–
		N	SMS test also available in Autotest mode	–
		N	Periodic Location Update timer T3212 adjustable via SCPI (useful for battery standby time evaluation)	5
		C	Requested MS transmit power level in GPRS mode is now always being displayed correctly	–
5.50	0609-550-A	N	Push To Talk functionality in VGCS mode (4202R)	4
		N	Functional IDs can be registered and deregistered (4202R)	5
		N	A User to User message sent after a railway emergency call, is now processed automatically (4202R)	4
		N	In Autotest mode, the necessary options are now checked at the beginning of an Autotest	–
		N	1 kHz tone during established speech connection	5
		C	SCPI commands during the boot process are processed correctly (or blocked) now	–
		C	Autotest configuration for GSM1900 band corrected	–
		C	Handover procedure corrected from GSM850 to GSM1900	–

Accessories and options

Standard accessories

Order number	Description
M 860 164	1103 USIM & GSM test SIM, plug-in format (4201S, 4202S and 4208)
M 860 603	Power cord
M 860 378	Centronics cable, 3 m (4201S and 4202S). *Purpose: attaching a printer with a Centronics interface to a Willtek 4200*
M 860 379	RS-232-C cable (D-Sub 9; 2 m). *Purpose: attaching a PC with an RS-232-C port to a Willtek 4200*
M 382 780	RF adapter cable, N/TNC
M 295 013	Getting Started manual CD with User Guide in PDF format

Extra accessories

M 860 XXX	RF adapters for different mobile phones (see page 6-45)
M 248 641	4916 Antenna Coupler (see page 2-19)
M 248 346	4921 RF Shield (N-TNC))
M 248 348	RF Shield Package (= M 248 641 + M 248 346)
M 860 261	Antenna, 850/900 MHz (needs M 886 098)
M 860 262	Antenna, 1.8/1.9 GHz (needs M 886 098). *Purpose: wireless testing of mobile phones*
M 886 098	RF socket adaptor N(m) to TNC(f). *Purpose: connecting antennas with TNC socket*
M 205 014	External battery kit 4281 (inclusive battery pack 8 Ah). Attached to the underside of a Willtek 4200
M 205 012	Battery pack 8 Ah

Options

M 897 110 **Utility Software** plus **User Guide**: *Purpose: menu-driven creation of user-defined AUTOTESTs with individual selection of the range of testing of the limits for PASS/FAIL assessment*

M 248 505 Software option **De-tuning**. This option can be used directly for all models of the Willtek 4200 series as of serial number 0213000. Older devices can be upgraded with the option at a charge. *Application: Setting a specific frequency offset for the BCCH signaling channel.*

M 248 506 Option **AM Modulation Upgrade Kit**. This option can be used directly for all models of the Willtek 4200 series. *Application: Amplitude modulation of the carrier signal for special calibration purposes.*

M 897 136 Software Option **Upload (Polling mode)**. Simple transfer of test log data from the tester to a PC (data polling); see page 6-21.

M 897 185 Software option **GPRS Go/NoGo**. Only for Willtek 4202S. This option allows elementary GPRS tests such as check-in and check-out procedures (Attach and Detach).

M 897 186 Software option **GPRS Measurement** (requires GPRS Go/NoGo option). Only for Willtek 4202S. More extensive GPRS function tests, such as BLER and multislot measurements. Testers with serial numbers < 613 XXX require an additional GPRS upgrade kit (M 248 657) for the hardware.

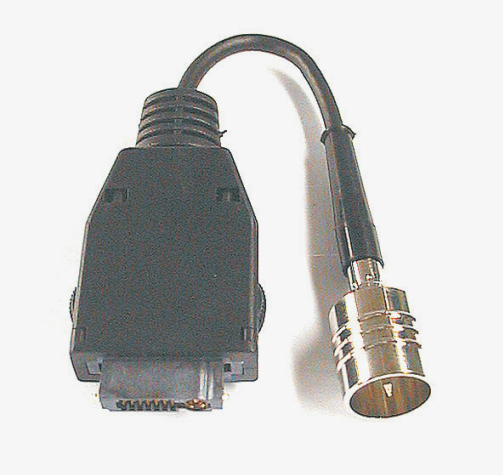
M 248 418 Option **GSM 850**. Testers with serial numbers < 613 XXX require an additional GSM 850 upgrade kit (M 248 404).

M 204 094 **DC-Option**. Replaces a standard internal AC power supply with a DC/DC converter with a permitted input voltage of 7 V...28 V. An external AC/DC power supply is also provided.

M 247 748 **Remote power option**. Within a system, it is no longer necessary to switch each Willtek 4200 on or off manually if the remote power option is used. Instead, the tester can be switched on using the system's main switch.

M 248 500 **Upgrade** from Willtek 4201S to Willtek 4202S.

RF adapters



Owing to the great number of different mobile phones, RF adapters are required to perform cable-based testing. These adapters join the mobile phone's RF connection to the RF adapter cable attached to the tester. For precise measurements Willtek strongly recommend to use an RF adapter.

⚠ Mobile-specific RF adapter cables are available from the mobile's manufacturer or from Willtek. Please contact your local Willtek representative for available adapters.

However, should the RF adapter for your mobile not be at hands, the air connection with the 4916 Antenna Coupler (extra accessory) offers a simple-to-use alternative for quick tests (see chapter 2). In conjunction with the RF Shield III (extra accessory) precise measurements can be achieved without interference. For reproducible test results Willtek strongly recommend to use the RF Shield III.

Entering special characters via SCPI

You can enter special characters via SCPI using escape sequences. The structure of an escape sequence is as follows: `\x` followed by a two-digit hexadecimal number (punctuation).
Example: `\x00` = @

Special character	Escape sequence
@	\x00
£	\x01
$	\x02
¥	\x03
è	\x04
é	\x05
ù	\x06
ì	\x07
ò	\x08
Ç	\x09
LF	\x0A
Ø	\x0B
ø	\x0C
CR	\x0D
Å	\x0E
å	\x0F
Δ	\x10
_	\x11
Φ	\x12
Γ	\x13
Λ	\x14
Ω	\x15
Π	\x16
Ψ	\x17
Σ	\x18
Θ	\x19
Ξ	\x1A

Special character	Escape sequence
Æ	\x1C
æ	\x1D
ß	\x1E
É	\x1F
"	\x22
¤	\x24
,	\x2C
¡	\x40
¿	\x60
Ä	\x5B
Ö	\x5C
Ñ	\x5D
Ü	\x5E
§	\x5F
ä	\x7B
ö	\x7C
ñ	\x7D
ü	\x7E
à	\x7F
€	\x1Be
{	\x1B(
}	\x1B)
[	\x1B<
]	\x1B>
~	\x1B=
\	\x1B/

Overview GSM threshold values

This User Guide contains various references to the permissible threshold values for mobile telephones (according to the GSM standard specification). These values are summarized in tabular form below.

Power classes

RF power classes					
Code digit	**1**	**2**	**3**	**4**	**5**
GSM 850/900/E-GSM	43 dBm	39 dBm	37 dBm	33 dBm	29 dBm
PCN/GSM1800	30 dBm	24 dBm	36 dBm	–	–
PCS/GSM1900	30 dBm	24 dBm	33 dBm	–	–

Power level/RF power

Highlighted values: When the power level corresponds to the power class of the mobile phone, then the tolerance is reduced to ±2.0 dB.

Power level/RF power/permissible tolerances								
GSM 850/900/E-GSM			**GSM 1800 (PCN)**			**GSM 1900 (PCS)**		
0	43 dBm	±2 dB	29	36 dBm	±2 dB	29	res.	–
1	41 dBm	±3 dB	30	34 dBm	±3 dB	30	33 dBm	±2 dB
2	39 dBm	±3 dB	31	32 dBm	±3 dB	31	32 dBm	±3 dB
3	37 dBm	±3 dB	**0**	30 dBm	±3 dB	**0**	30 dBm	±3 dB
4	35 dBm	±3 dB	1	28 dBm	±3 dB	1	28 dBm	±3 dB
5	33 dBm	±3 dB	2	26 dBm	±3 dB	2	26 dBm	±3 dB
6	31 dBm	±3 dB	**3**	24 dBm	±3 dB	**3**	24 dBm	±3 dB
7	29 dBm	±3 dB	4	22 dBm	±3 dB	4	22 dBm	±3 dB
8	27 dBm	±3 dB	5	20 dBm	±3 dB	5	20 dBm	±3 dB
9	25 dBm	±3 dB	6	18 dBm	±3 dB	6	18 dBm	±3 dB
10	23 dBm	±3 dB	7	16 dBm	±3 dB	7	16 dBm	±3 dB
11	21 dBm	±3 dB	8	14 dBm	±3 dB	8	14 dBm	±3 dB
12	19 dBm	±3 dB	9	12 dBm	±4 dB	9	12 dBm	±4 dB
13	17 dBm	±3 dB	10	10 dBm	±4 dB	10	10 dBm	±4 dB
14	15 dBm	±3 dB	11	8 dBm	±4 dB	11	8 dBm	±4 dB
15	13 dBm	±3 dB	12	6 dBm	±4 dB	12	6 dBm	±4 dB
16	11 dBm	±5 dB	13	4 dBm	±4 dB	13	4 dBm	±4 dB
17	9 dBm	±5 dB	14	2 dBm	±5 dB	14	2 dBm	±5 dB
18	7 dBm	±5 dB	15	0 dBm	±5 dB	15	0 dBm	±5 dB
19	5 dBm	±5 dB	–	–	–	–	–	–

Rx Level

Equivalent code numbers/RF receive levels (dBm)					
0	< –110	22	–89 to –88	44	–67 to –66
1	–110 to –109	23	–88 to –87	45	–66 to –65
2	–109 to –108	24	–87 to –86	46	–65 to –64
3	–108 to –107	25	–86 to –85	47	–64 to –63
4	–107 to –106	26	–85 to –84	48	–63 to –62
5	–106 to –105	27	–84 to –83	49	–62 to –61
6	–105 to –104	28	–83 to –82	50	–61 to –60
7	–104 to –103	29	–82 to –81	51	–60 to –59
8	–103 to –102	30	–81 to –80	52	–59 to –58
9	–102 to –101	31	–80 to –79	53	–58 to –57
10	–101 to –100	32	–79 to –78	54	–57 to –56
11	–100 to –99	33	–78 to –77	55	–56 to –55
12	–99 to –98	34	–77 to –76	56	–55 to –54
13	–98 to –97	35	–76 to –75	57	–54 to –53
14	–97 to –96	36	–75 to –74	58	–53 to –52
15	–96 to –95	37	–74 to –73	59	–52 to –51
16	–95 to –94	38	–73 to –72	60	–51 to –50
17	–94 to –93	39	–72 to –71	61	–50 to –49
18	–93 to –92	40	–71 to –70	62	–49 to –48
19	–92 to –91	41	–70 to –69	63	> –48
20	–91 to –90	42	–69 to –68	–	–
21	–90 to –89	43	–68 to –67	–	–

Rx Qual(ity)

Equivalent code digits/BERs*			
0	< 0,2 %	1	0.2 % to 0,4 %
2	0.4 % to 0,8 %	3	0.8 % to 1,6 %
4	1.6 % to 3,2 %	5	3.2 % to 6,4 %
6	6.4 % to 12,8 %	7	> 12.8 %
*) BER, measured by the mobile phone. Not to be confused with the tester's BER measurement.			

BER/FER

Permissible limits for BER/FER			
RF level	**Phone**	**BER**	**FER**
–100 dBm	all	0.00 %	–
–104 dBm	P > 2 W	< 2.44 %	–
–102 dBm	P ≤ 2 W	< 2.44 %	0.10 %

Channel numbers

Permissible channel numbers (BCCH and TCH)	
GSM 850 (option)	0128 through 0251
GSM 900	0001 through 0124
E-GSM	0000 through 0124 and 0975 through 1023
GSM-R (4202R/4201A)	0000 through 0124 and 0955 through 1023
GSM 1800 (PCN)	0512 through 0885
GSM 1900 (PCS)	0512 through 0810

Frequency error

Permissible frequency error		
GSM 850/900/E-GSM	GSM 1800 (PCN)	GSM 1900 (PCS)
≤ ±90 Hz	≤ ±180 Hz	≤ ±180 Hz

Phase error

Permissible phase error	
Phase error (Peak)	≤ ±20°
Phase error (RMS)	≤ ±5°