Data Sheet

will'tek

Willtek 4400 Mobile Phone Tester Series

boosting wireless efficiency

The high end of multi-standard mobile phone testing

The 4400 Mobile Phone Tester Series is a leading-edge product and a good example of Willtek's expertise in RF test and mea-surement. In terms of ease of use and focus on the target ap-plication, the 4400 Series applies the same principles as the 4200 Mobile Service Tester Series, bringing them to higher levels. The instruments of the 4400 Series have been designed to meet the needs of manufacturing, quality assurance, and engineering facilities as well as the requirements in service factories and repair sites. Willtek fulfills these requirements with two different versions of the 4400; the 4403 for service applications and the 4405 for the production environment.

Unless indicated otherwise, all information in this data sheet relates to both the 4403 and the 4405 Mobile Phone Testers.

Improving manufacturing throughput

In manufacturing and production, accuracy is a key factor. Therefore the 4405 Mobile Phone Tester provides exceptional precision, see for example the Voltage Standing Wave Ratio (VSWR). In addition to this outstanding accuracy, the 4405 offers high measurement speed and stability, which makes the 4405 the first choice for production and manufacturing.

With the remote control possibility via the IEEE/IEC bus (GPIB), the 4400 will be easily integrated in every production line. Willtek's experienced support personnel helps manufacturers all over the world to integrate the 4400 into new and existing production lines.

Mobile phone repair from incoming inspection to calibration and alignment

Measurement speed and accuracy of the 4403 Mobile Phone Tester fulfill the needs of the service environment to calibrate and align a mobile phone and then perform a final test. These final tests are different and predefined by major mobile phone manufacturers, and the 4400 Series has been approved for service by all of them.

Today the 4403 Mobile Phone Tester supports and provides solutions for all major mobile communication technologies and is prepared for the future evolution of these standards like HSDPA and HSUPA.

With its user-friendly menu concept and graphical user interface, the 4403 provides quick access to all the measurements and their results. The menus are easy to read and follow the same concept across all standards to keep training time to a minimum.
Measurements cannot only be performed in manual mode but also in a self-contained, automatic test script which is run on the 4403. With RAPID!, a runtime and development environment for applications embedded in the tester, users can perform a complete final test in a very short time. Example test scripts for different communication standards are available on the tester.

Highlights

- All major mobile communication standards
- Prepared for HSPA
- RAPID! – built-in automated test environment
- Options for DC power supply and DC current measurements
- Parallel testing of TX, RX and Audio

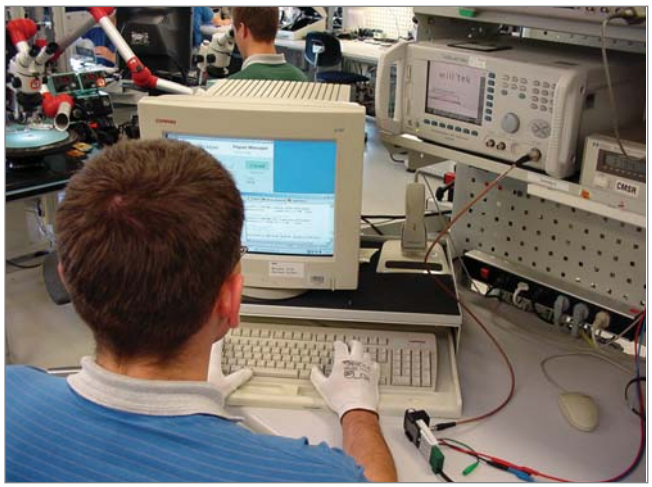

Figure 1: 4403 Mobile Phone Tester – the ideal tool for service centres and the repair loop in production

The 4400 series is approved for service by major mobile phone vendors. These provide special software to align and calibrate the phone. In most cases the vendors adapt their control software to the 4400, making use of the remote control capabilities of Willtek's testers.

Research & development

Engineering and R&D facilities such as design houses require measurement equipment which is easy to use, and which provides high accuracy. With the 4400 Mobile Phone Tester Series, Willtek offers two instruments with the same functionality but different performance, leaving the choice of accuracy and speed to the customer.

Specifications

Specifications valid after 60 minutes warm-up time at ambient temperature, specified environmental conditions and typical measurement range, within a period of one year after calibration.

The published accuracies are determined in accordance with GUM (Guide to the Expression of Uncertainty in Measurement) and EA (European Co-operation for Accreditation) application document EA4/02: "Expressions of the Uncertainty of Measurements in Calibration".

Basic RF data

Two independent synthesisers for RX and TX measurements

Frequency range	430 to 500 MHz[1] 800 to 1000 MHz 1700 to 2300 MHz[2]
Frequency resolution	10 Hz
Frequency and level settling time	350 µs
RF in/out	N-type female connector
Input/output impedance	50 Ω
VSWR	
4403	1.2
4405	1.15[3], 1.2
Attenuation of harmonics up to 4 GHz (f0 = 800 to 1000 and 1700 to 2000 MHz)	> 40 dB
Attenuation of non-harmonics up to 4 GHz at > 5 kHz from carrier	> 43 dB

Frequency base TCXO

Temperature characteristic	1 x 10^{-6} max.
Aging characteristic	1 x 10^{-6} max./year (at +25°C ±2°C)

Frequency base OCXO option

Temperature characteristic	5 x 10^{-8} max.
Aging characteristic	1 x 10^{-7} max./year (after 30 operating days)

[1] Only available with 4464 CDMA2000 System Option
[2] 1700 to 2000 MHz for GSM, GPRS and EDGE
[3] If RX signal > –32 dBm and TX signal > 10 dBm

General data

Control interfaces	IEEE 488.2 (GPIB) LAN (RJ-45, TCP/IP) USB type A (two on the front, two on the back) USB type B Centronics (for printing) PS/2 keyboard) PS/2 mouse VGA RS-232 (access through RAPID!)
Mains power supply	94 to 132 V_{AC} 187 to 264 V_{AC}
Power consumption	max. 140 W
Operating temperature	+5°C up to +45°C
Relative humidity	< 80%
H x W x L	202 x 401 x 431 mm
Weight	10.5 kg (without options)
Delivery includes	mains cable USB memory stick (256 Mb) getting started guide (M 293 013) user's guides (CD) calibration report

RAPID!

Application programming environment
RAPID! = Run Application Programs with Integrated Development environment.

RAPID!	programming language (a modern structured BASIC dialect) programming environment
Input/output control from RAPID! programs	GPIB RS-232 parallel port (printer) floppy and hard disk access screen (text-based) keyboard, incl. bar code reader support
Elements for structured programming	global and local variables functions, subroutines libraries
Elements for event-driven programming	keyboard events SCPI events external interface events
Other programming features	direct access to SCPI command set, to control the 4400 and collect measurement results for postprocessing information hiding (program files can be protected against reading by the user)
Scripting	(to create or change mobile tests easily and efficiently)
Functions of built-in programming environment	file manager editor (multiple files) runtime I/O screen debug screen, display of variables contents

Options for WCDMA (UMTS)

The WCDMA offering on the 4400 consist of two main options, the 4466 WCDMA/UMTS Non-Call Mode Option and the 4467 WCDMA/UMTS Call Mode Option. These software options are based upon the 4479 Baseband Processing Hardware.

4466 WCDMA Non-Call Mode Option

The Non-Call Mode Option, sometimes also known as asynchronous mode or non-signaling mode, offers all the functionality required to tune a WCDMA mobile phone in a production or high level service environment. It offers all the functions necessary to generate and analyze a WCDMA signal. This functionality is dedicated to the alignment and calibration of the Printed Circuit Board (PCB) of a 3G mobile phone; these two steps are necessary to guarantee that the mobile phone's radio frequency parameters are within the limits specified.

Typical tests include:

- Power measurements
- Modulation quality measurements
- Constellation display
- Code domain power measurements
- Spectrum measurements

To tune the receiver of a 3G mobile phone the 4400 offers various signals – a Continuous Wave (CW) signal, a Frequency Modulated (FM) signal and the WCDMA-modulated signal.

There are more features available, like the power staircase measurement or the zero-span analyzer. The power staircase test has been designed for specific measurements of the power changes; the zero-span analyzer can perform the same in a more flexible way and displays power versus time, just as a spectrum analyzer does in zero-span mode. These features can be used to display nearly all signals which are generated within the frequency range of the 4400. Overall the non-call mode functionality is mostly used through remote control and in cooperation with service software controlling both the tester and the device under test.

4467 WCDMA Call Mode Option

The Call Mode Option of the 4400 is prepared for the requirements of a final test. These tests are based on 3GPP/FDD Release '99 and ETSI specification TS 134.121.

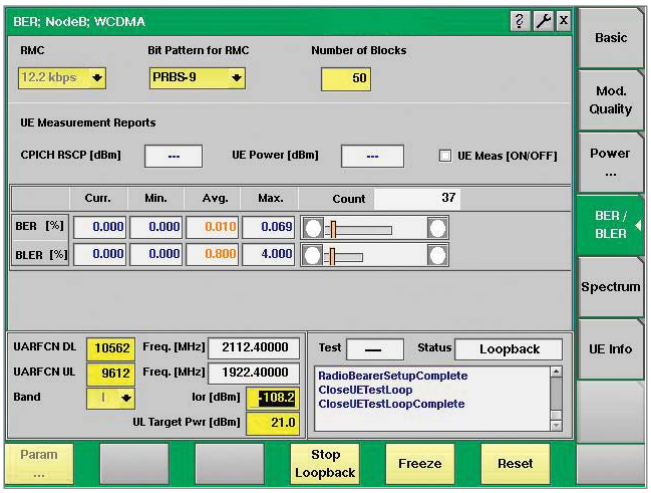

Figure 3: Receiver sensivity level estimation with BER/BLER measurement

Call mode or signalling tests are necessary to test the behaviour of the WCDMA (UMTS) mobile phone in a network, closer to the reality. Therefore the 4400 acts as a Node B (WCDMA base station), supporting the necessary signalling exchange. All the relevant parameters, such as the configured downlink channels, can be configured. The 4400 supports the required call processing algorithm for call set up (mobile-terminated call, mobile-originated call) and also for loopback mode on one of the Reference Measurement Channels (RMC); these channels are specified for transmitter and receiver testing.

The 4400 Mobile Phone Tester Series provides a long list of transmitter measurements, which can be divided into modulation quality, power, code domain and spectrum measurements with additional reports from the phone. Receiver measurements are also included. Fast testing on different frequency channels is supported with the handover procedure to keep test time to a minimum.

4484 WCDMA Tracer Option

In addition to high accuracy and ease of use, R&D and engineering facilities sometimes need tools to analyze the signalling protocol. The 4484 WCDMA Tracer Option offers this functionality by displaying the flow of communication between the 4400 and the mobile phone. The option displays the protocol messages of layer 3 down to the layer 1. This helps the R&D engineer to get a first, quick overview of the communication and potential problems in it, thus saving development time.

General data

Standard	3GPP-FDD
Symbol rate	3.84 Mcps
Bandwidth	5 MHz

RF generator

Modulation type CW, FM, QPSK (WCDMA signal)

WCDMA signal generator

Frequency resolution	1 Hz
Output level range	–120 to –20 dBm
Output level accuracy	0.7 dB, typ. ±0.4 dB
Output level resolution	0.1 dB
Error Vector Magnitude (EVM)	< 5%
Supported channels	DPCH, P-CCPCH, S-CCPCH, P-CPICH, P-SCH, S-SCH, AICH, PICH
Channel level range	Off, –20 to 0 dB to absolute level
Channel level accuracy	±0.2 dB
Channel level resolution	0.1 dB

FM signal generator

Modulation frequency	1 to 100 kHz
Frequency deviation	250 to 1000 kHz
Deviation tolerance	±2%
Distortion tolerance	< 1%

RF analyzer

WCDMA power measurement

Measurement filter	According to standard, 3.84 MHz, RRC, α = 0.22
Power measurement	Peak/mean power, filtered non-filtered
Level range	–60 to +35 dBm
Accuracy	±0.4 dB for –25 to +35 dBm ±0.7 dB for –50 to –25 dBm ±0.9 dB for < –50 dBm
Resolution	0.01 dB

WCDMA analyzer

Modulation quality measurements	
Measurement filter	According to standard, 3.84 MHz, RRC, α = 0.22
Level range	–25 dBm to + 35 dBm

Error vector magnitude

Range	Up to 30%
Accuracy	±2.5%
Resolution	0.1%

Frequency error

Range	±5 kHz
Accuracy	±5 Hz
Resolution	1 Hz

Spectrum

Accuracy	±3 MHz, ±5 MHz
Resolution	15 kHz, 30 kHz

Adjacent channel leakage ratio

Measurement bandwidth	±5 MHz first adjacent channel, ±10 MHz second adjacent channel
Dynamic range	> 48 dB first adjacent channel, > 58 dB second adjacent channel
Display range	80 dB
Level accuracy	±0.7 dB
Resolution	0.1 dB

Occupied bandwidth

Range	1 to 6 MHz
Accuracy	±100 Hz
Resolution	15 kHz

Spectrum emission mask

Measurement filter	
±2.515 to ±3.485 MHz	30 kHz Gaussian
±4 to ±12 MHz	1 MHz Gaussian
Dynamic range	±2.515 to ±3.485 MHz: > 70 dB ±4 to ±12 MHz: > 65 dB
Resolution	0.1 dB

Non-call mode functions

WCDMA analyzer

Power measurements

Peak power, mean power
Min and Max power, target power, inner loop power control (customer specific)

Spectrum measurements

Occupied bandwidth (OBW), Adjacent Channel Power Leakage Ratio (ACLR),
Spectrum Emission Mask (SEM)

Modulation quality

EVM, frequency error, magnitude error, phase error, I/Q Offset, I/Q Imbalance, rho

Code domain measurements

Peak Code Domain Error (PCDE), code domain spectrum
Power staircase (for specific mobiles)

Power vs. time

Zero-span analyzer	(flexible power vs. time measurements)
Sweep time	1 to 85 ms[1)]
Reference level	–23 to 36 dBm
Filter	30 kHz, 100 kHz, 4.6848 MHz

Generator

CW, FM and WCDMA signal

[1)] 51 ms for 4.6848 MHz filter

Call mode functions

WCDMA call processing

Supported bands	
Band I	1920 to 1980 MHz (UL) 2110 to 2170 MHz (DL)
Band II	1850 to 1910 MHz (UL) 1930 to 1990 MHz (DL)
Band III	1710 to 1785 MHz (UL) 1805 to 1880 MHz (DL)
Band IV	1710 to 1770 MHz (UL) 2110 to 2170 MHz (DL)
Band V	824 to 849 MHz (UL) 869 to 894 MHz (DL)
Band VI	830 to 840 MHz (UL) 875 to 885 MHz (DL)
Channels	P-CPICH, P-/S-SCH, P-CCPCH, PICH, DPCH, OCNS (16 channels)

Supported procedures

Universal Routing Update (URA),
mobile originated call,
mobile terminated call,
call clearing by mobile and tester,
inter-frequency handover (channel change),
prepared for inter-RAT handover (WCDMA to GSM)

Reference measurement channels according to 3GPP TS 134121

RMC 12.2, 64, 144, 384 kbps

Transmitter measurements

Peak and mean power,
min and max power,
inner loop power control,
open loop power control

Spectrum measurements

Occupied Bandwidth (OBW),
Adjacent Channel Power Leakage Ratio (ACLR),
Spectrum Emission Mask (SEM)

Modulation quality measurements

Error Vector Magnitude (EVM),
magnitude error,
frequency error,
phase error,
rho,
I/Q offset,
I/Q imbalance,
constellation display

Code domain measurements

Peak Code Domain Error (PCDE), code spectrum

Receiver measurements

BER/BLER measurements
UE Info with UE Measurement Report
(e.g. UE power, CPICH RSCP, CPICH Ec/N0)

Options for TD-SCDMA

TD-SCDMA (Time Division Synchronous CDMA) is a third-generation wireless communications standard for China, combining Time Division Multiplex Access (TDMA) technology with a synchronous CDMA component.

Willtek's TD-SCDMA testing solution is based on the 4400 Series Mobile Phone Tester, the 4450 TD-SCDMA Non-Call Mode Option, the 4451 TD-SCDMA Call Mode Option and the 4479 Baseband Processing Hardware.

4450 TD-SCDMA Non-Call Mode Option

The 4450 TD-SCDMA Non-Call Mode Option can be seen as a combined signal analyzer and generator in one instrument used in R&D, production and high level service environments.

The analyzer functionality provides the following features:

- Power measurements, such as channel, mean, peak, off-power measurements
- Modulation quality measurements with measurements like Error Vector Magnitude (EVM RMS), frequency, magnitude and phase error
- Constellation display
- Code domain power measurements
- Spectrum measurements

Signals such as Continuous Wave (CW), burst and TD-SCDMA together with Q-PSK modulation and various types of payload data allow a flexible tuning of TD-SCDMA handset receivers.

4451 TD-SCDMA Call Mode Option

The Call Mode Option supports the functionality required for typical tests on a TD-SCDMA mobile phone. These tests are based on the 3GPP/TDD Release '99 and ETSI specification TS 134.122 (Low Chip Rate – LCR).

The call processing is required to simulate a TD-SCDMA base station and test the proper behaviour of the TD-SCDMA mobile phone in a network. The 4400 in this way acts as a Node B (TD-SCDMA base station), supporting the necessary signalling. All the relevant parameters, such as the configured downlink channels, can be configured. The 4400 supports the basic registration procedure, as well as the required call processing for the call setup (mobile-terminated and mobile-originated) and for the test loopback mode on one of the Reference Measurement Channels (RMC); these channels are

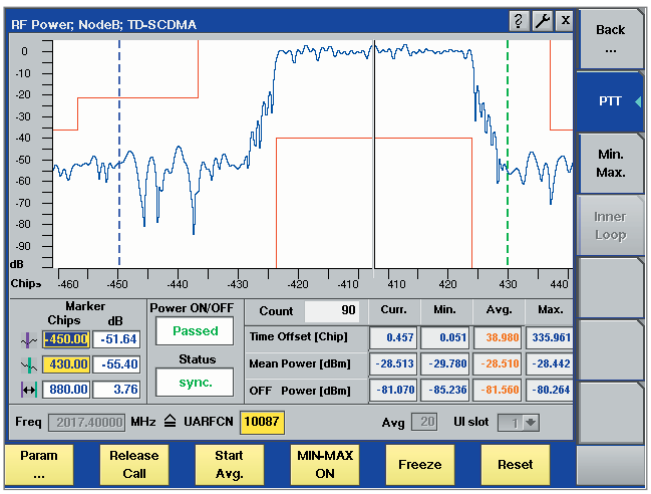

Figure 4: TD-SCDMA power measurements

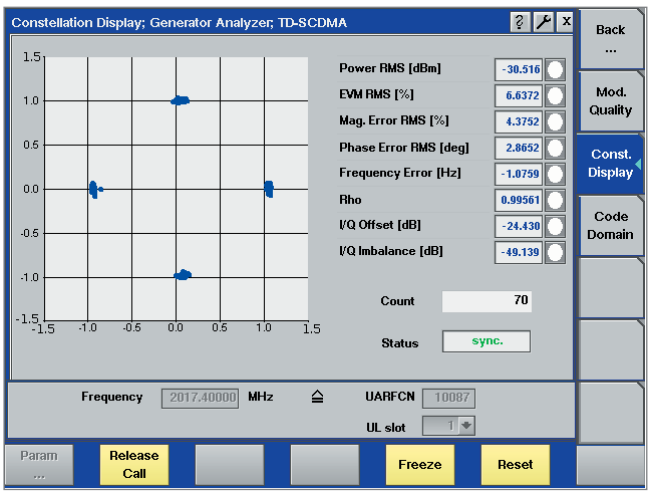

Figure 5: Constellation Display

specified for transmitter and receiver testing.

The 4400 Mobile Phone Tester Series provides a long list of transmitter measurements, which can be divided into modulation quality, power, code domain and spectrum measurements with additional measurement reports from the mobile phone. Receiver measurements are also included and supported. In order to support fast testing on various frequency channels, handover procedures are also included – this will keep measurement time to a minimum.

General data

Standard	3GPP-TDD
Symbol rate	1.28 Mcps
Bandwidth	1.6 MHz

RF generator (preliminary)

Modulation type	CW, Burst, TD-SCDMA downlink

TD-SCDMA signal generator

Frequency range	800 to 1000 MHz 1700 to 2300 MHz
Frequency resolution	1 Hz
Output level range	–120 to –13 dBm
Output level accuracy	0.7 dB, typ. ±0.4 dB
Output level resolution	0.1 dB
Error Vector Magnitude (EVM)	< 5%
Supported physical channels	P-CCPCH, S-CCPCH , PICH, DwPCH, FPACH, DPCH
Code channel level range	off, –30 to 0 dB to absolute level
Code channel level accuracy	±0.2 dB (relative level)
Code channel level resolution	0.1 dB

RF analyzer

TD-SCDMA power measurements (preliminary)

Measurement filter	According to standard, 1.28, RRC, alpha = 0.22
Channel power, Peak/Mean/off power; filtered	power on/off mask
Frequency range	800 to 1000 MHz 1700 to 2300 MHz
Level range	–60 to +35 dBm
Level accuracy	±0.4 dB for high power (–25 to +35 dBm) ±0.7 dB for low power (–60 to –25 dBm) ±0.9 dB for < -60 dBm
Resolution	0.01 dB

Modulation quality measurement

Measurement filter	according to standard 1.6 MHz, RRC, alpha = 0.22
Frequency range	800 to 1000 MHz 1700 to 2300 MHz
Level range	–25 to +35 dBm

Error Vector Magnitude (EVM)

Range	up to 30%
Accuracy	±2.5%
Resolution	0.1%

Frequency error

Range	±10 kHz
Accuracy	±10 Hz
Resolution	1 Hz

Waveform quality

Range	0.9 to 1.0
Accuracy	±0.002
Resolution	0.0001

Spectrum

Span	±1.2 MHz, ±2.4 MHz
Resolution bandwidth	15 kHz, 30 kHz

Adjacent Channel Leakage Power Ratio (ACLR)

Measurement bandwidth	±1.6 MHz, first adjacent channel ±3.2 MHz, second adjacent channel
Dynamic range	> 48 dB, first adjacent channel > 58 dB, second adjacent channel
Display range	80 dB
Level accuracy	±0.7 dB
Resolution	0.1 dB

Occupied bandwidth

Range	1 MHz to 4 MHz
Accuracy	±100 kHz
Resolution	15 kHz

Spectrum emission mask

Measurement filter	
±0.8 MHz to ±2.4 MHz	30 kHz Gaussian
±2.4 MHz to ±4 MHz	1 MHz Gaussian
Dynamic range	
±0.8 MHz to ±2.4 MHz	> 70 dB
±2.4 MHz to ±4 MHz	> 65 dB
Resolution	0.1 dB

Non-call mode functions

TD-SCDMA analyzer

Channel power, peak power, mean power	filtered
Power	on/off mask
Spectrum measurements	Modulation spectrum Occupied Bandwidth (OBW) Adjacent Channel Leakage Power Ratio (ACLR) Spectrum Emission Mask (SEM)
Modulation quality	EVM, frequency error, magnitude error, phase error, I/Q Offset, I/Q Imbalance, Rho
Code domain measurements	Peak Code Domain Error (PCDE), code domain spectrum

Generator

Signal type	CW, burst, TD-SCDMA
Modulation	None, QPSK
Downlink timeslots	1 to 6
Payload data	PN9, PN15, PN23, all 0s, all 1s, 1010..., 1100..., 11110000, 1...10...0

Data rate

(Reference Measurement Channel – RMC)	12.2 kbps

Call mode functions

TD-SCDMA call processing

Supported bands	1900 – 1920 MHz (UL & DL) 2010 – 2025 MHz (UL & DL) 1850 – 1910 MHz: (UL & DL) 1930 – 1990 MHz: (UL & DL) 1910 – 1930 MHz: (UL & DL)
Supported procedures	Registration, mobile originated call, mobile terminated call, call clearing by mobile and tester, inter-frequency handover (channel change)
Reference Measurement Channels according to 3GPP TS 34.122	RMC 12.2 kbps

Transmitter measurements

Peak and mean power, min and max power, inner loop power control, open loop power control, Transmit ON/OFF Time mask

Spectrum measurements

Occupied Bandwidth (OBW), Adjacent Channel Power Leakage Ratio (ACLR), Spectrum Emission Mask (SEM)

Modulation quality measurements

Error Vector Magnitude (EVM), magnitude error, frequency error, phase error, rho, I/Q offset, I/Q imbalance, constellation display

Code domain measurements

Peak Code Domain Error (PCDE), code spectrum

Receiver measurements

BER/BLER measurements
UE Info with UE Measurement Report (e.g. UE power, P-CCPCH RSCP, path loss)

4464 CDMA2000 System Option

The CDMA2000 System Option for the 4400 Series enables users in R&D, manufacturing and service to test subscriber terminals which are based on the cdmaOne and CDMA2000 technologies. The system option supports both asynchronous and synchronous measurements, thus allowing the user to perform alignment as well as functional testing of terminals.

Supported features are:

- cdmaOne and CDMA2000 call processing including registration, MS/BS originated call, MS/BS termination, handovers
- Fast power measurements including Min/Max power, open loop power, gated power, closed loop power and access probe power
- Modulation quality measurements including waveform quality and code domain measurements
- Receiver performance testing including receiver sensitivity and dynamic range using the FER feature
- AM generation for calibration of terminals supporting ZIF (zero intermediate frequency) based chipsets

The CDMA2000 System Option supports the following bands: 0-US Cellular, 1-US PCS, 2-TACS, 3 JTACS, 4-Korean PCS, 5-NMT-450, 6 IMT 2000, 8-1800 MHz, and 9-900 MHz.

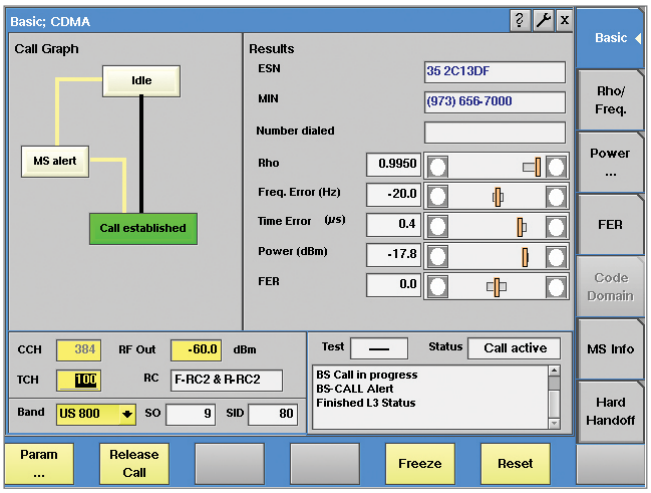

Figure 6: Basic Screen CDMA2000

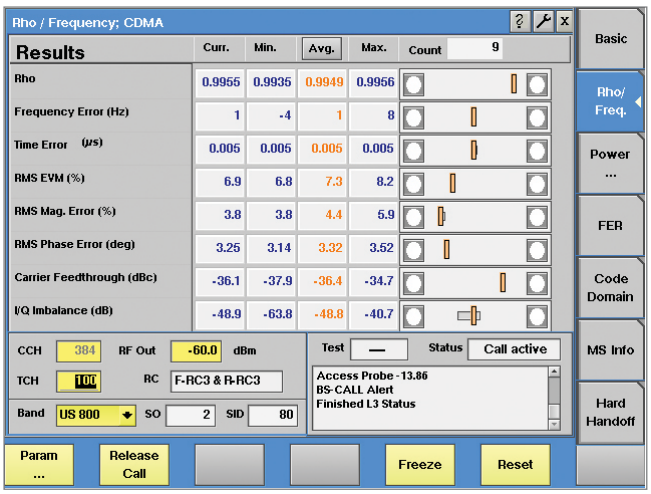

Figure 7: Modulation quality measurement

AMPS call mode functions

AMPS call processing

Supported procedures Handoff CDMA to analog, handoff analog to analog, power level change, call clearing by MS or 4400

AMPS transmitter measurements

power, frequency error, SAT & ST frequency and deviation, Audio deviation, SINAD – requires Audio Option

AMPS receiver measurements

receiver sensitivity with SINAD, (requires Audio Option)

RF generator

CDMA generator

Level range (AWGN Off)	–120 dBm to –15 dBm
Level range (AWGN On)	–120 dBm to –27 dBm
Level accuracy (AWGN Off, –110 dBm to –15 dBm)	
4403	±1.4 dB
4405	±0.9 dB, typ. ±0.6 dB
Level resolution	0.1 dB
Waveform quality (rho)	> 0.97 typ. > 0.99
Carrier feedthrough	< –35 dBc
Code channel level accuracy	±0.25 dB

AWGN generator

AWGN bandwidth	> 1.8 MHz
AWGN, level range relative to CDMA signal	+5 to –10 dB
AWGN level accuracy (relative to signal)	±0.5 dB

Code channels

Sector A	
F-PICH, F-SYNC, F-FCH	–5 dB to –32 dB
F-QPCH	+2 to -5 dB relative to Pilot
F-OCNS	level calculated by 4400
Sector B	
F-PICH,F-FCH	–5 dB to –32 dB
F-OCNS	level calculated by 4400

AMPS generator

Level range	–120 dBm to –15 dBm
Level accuracy 4403	±1.4 dB
Level accuracy 4405	±0.9 dB, typ. ±0.6 dB
Level resolution	0.1 dB
Modulation	FM or none
FM modulation types	
Mod A	5970 Hz, 6000 Hz, 6030 Hz
Mod B	1 kHz or off

RF analyzer

CDMA/AMPS power meter

CDMA level range	–70 dBm to +36 dBm
AMPS level range	–40 dBm to +36 dBm
Level resolution	0.1 dB
Level accuracy 4403	±1.2 dB
Level accuracy 4405	
(–10 dBm to +36 dBm)	±0.5 dB
(–60 dBm to –10 dBm)	±0.6 dB
(–70 dBm to –60 dBm)	±0.7 dB

Modulation analyzer for CDMA2000

Level range	–30 dBm to +36 dBm
Frequency error range	±1 kHz
Resolution	1 Hz
Accuracy (relative to freq. base)	±10 Hz
Waveform quality	
Range	0.9 to 1.0
Accuracy	±0.003
Time offset	
Range	±5 µs
Accuracy	±100 ns
Code domain measurements (1XRTT channels)	
Code channels	W_0^{16} to W_{15}^{16}
Code power range	0 to 40 dBc (relative to total power)
Code power resolution	0.1 dB
Code power accuracy	±0.1 dB
Number of code channels	1 to 6
Timing range	0 to 200 ns
Timing resolution	1 ns
Timing accuracy	±2 ns
Code domain power range	±3.75 dB (relative to reverse pilot)
Code domain power resolution	0.1 dB
Code domain power accuracy	±0.1 dB

Modulation spectrum

Display range	80 dB
Resolution bandwidth	5 kHz, 10 kHz, 30 kHz
Span (select.)	±2.5 MHz, ±1.25 MHz, ±500 kHz

ACPM

Display range	80 dB
Frequencies according to IS-98D up to 2.5 MHz from centre frequency	
Measurements	spectrum due to modulation

Modulation analyzer for AMPS

Level range	–15 dBm to +36 dBm
Frequency error range	±5 kHz
Resolution	1 Hz
Accuracy (relative to freq. base)	±20 Hz
Deviation range	0 to 30 kHz
Deviation resolution	1 Hz
Deviation accuracy	±5%
Audio deviation filter	300 kHz
SAT frequency range	±5 Hz
ST frequency range	±5 Hz
SAT & ST frequency resolution	1 Hz
SAT & ST frequency accuracy	±0.1 Hz

Non-call mode functions

CDMA generator

Signal type	continuous
Modulation	none, BPSK/QPSK
User-definable parameters for CDMA cell simulation	SID, NID, MCC, MNC, PN offset

CDMA analyzer

Supported signal types	OQPSK, HPSK
Supported transmitter measurements	power, gated power, waveform quality, code domain

AMPS generator

Signal types	continuous
Modulation	none, FM

AMPS analyzer

Support signal types	FM
Supported transmitter measurements	power, frequency error, SAT & ST frequency and deviation, Audio deviation, SINAD – requires Audio Option

Call mode functions

CDMA2000 call processing

Supported CDMA2000 bands	band 0 – US cellular (ch 1 to 1023) band 1 – PCS band (Ch 1 to 1199) band 2 – TACS band (ch 1-1000, 1329-2047) band 3 – JTACS band band 4 - Korean PCS (ch 1 to 599) band 5 – NMT-450 band 6 – IMT-2000 (ch 1 to1199) band 8 – 1800 MHz (ch 1 to 1499) band 9 – 900 MHz (ch 1 to 699)
Supported procedures	registrations, mobile-originated call, mobile-terminated call, intracell handover, cross-band handover, call clearing by MS, call clearing by 4400
Special functions	call state diagram
MS information display	Mobile ID Number (MIN), Equipment Serial Number (ESN), IMSI (class 0 and 1), type, slot class, slot index, power class, transmit mode, digits dialed
Common control channel parameters	SID, NID, MCC, MNC, PN Offset
Access channel parameters	nominal power, initial power, power step, number steps, request sequences, response sequences, timeout, preamble length
Paging rate	full
Radio configuration combinations	F-RC1/R-RC1, F-RC2/R-RC2, F-RC3/R-RC3, F-RC4/R-RC3, F-RC5/R-RC4
Service options	1 – 9.6 kbps voice, 2 – 9.6 kbps loopback, 3 – EVRC voice, 9 – 14.4 kbps loopback, 17 – 14.4 kbps voice, 55 – RC1, RC2, RC3, RC4, RC5 loopback, 32768 – 14.4 kbps voice
Reverse link power control modes	alternating, all up, all down, active
Fundamental channel parameters	walsh code, data rate, pattern (PN15, voice loop back or canned), voice loopback delay
Fundamental channel data rates – forward	RC1 - 1.2, 2.4, 4.8, 9.6 kbps RC2, RC5 - 1.8, 3.6, 7.2, 14.4 kbps RC3, RC4 - 1.5, 2.7, 4.8, 9.6 kbps
Fundamental channel data rates – reverse	RC1 - 1.2, 2.4, 4.8, 9.6 kbps RC2,RC4 - 1.8, 3.6, 7.2, 14.4 kbps RC3 - 1.5, 2.7, 4.8, 9.6 kbps

CDMA2000 transmitter measurements

Power measurements	minimum/maximum RF power, open loop power (level and timing), gated output power, access probe power, closed loop power (min./max./range only), stand-by power
Modulation quality measurements	rho, frequency error, rms vector error, time offset, amplitude imbalance, code domain power (graphical and data), code channel time offset, code channel phase

CDMA2000 receiver measurements

Receiver performance	sensitivity, dynamic range (frame error rate)
Demodulator performance	demodulation of forward traffic with AWGN
Mobile reported	FER, pilot strength

Options for 1xEV-DO

The 1xEV-DO offering on the 4400 Mobile Phone Tester Series consist of two main options, the 4452 1xEV-DO Non-Call Mode Option and the 4453 1xEV-DO Call Mode Option.

These software options are based upon the 4479 Baseband Processing Hardware.

4452 1xEV-DO Non-Call Mode Option

The Non-Call Mode Option, sometimes also known as asynchronous mode or non-signaling mode, offers all the functionality required to tune a 1xEV-DO mobile phone in a production or high level service environment. It provides all the functions required to analyze a 1xEV-DO signal. This functionality is dedicated to the alignment and calibration of the Printed Circuit Board (PCB) of a 1xEV-DO mobile terminal; these two steps are necessary to guarantee that the mobile terminal's radio frequency parameters are within the limits specified.

Typical tests include:

- Power measurements
- Modulation quality measurements
- Code domain power measurements
- Spectrum measurements

Overall the non-call mode functionality is typically used through remote control and in cooperation with service software controlling both the tester and the device under test.

4453 1xEV-DO Call Mode Option

The 4453 1xEV-DO Call Mode Option enables users to perform a functional test on a 1xEV-DO Revision 0 mobile terminal. The functional test consists of establishing a connection to the terminal in a similar manner as a connection with a live network. Once a connection is establish, the appropriate RF transmitter and receiver measurements may be performed.

The Call Mode Option allows the user to setup the forward link signaling parameters and traffic channel parameters, thus allowing the user to simulate their specific network. Once the signaling parameters are setup the user may perform one of the following signaling procedures:

- AT Session Open
- AT & AN Connection

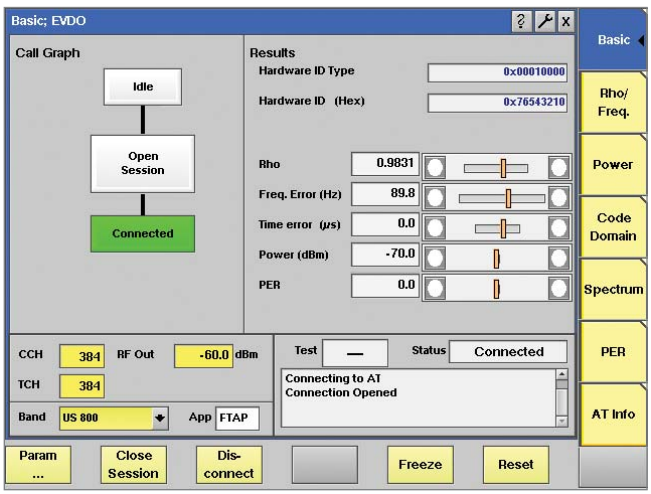

Figure 8: EV-DO basic menu with Call State diagram

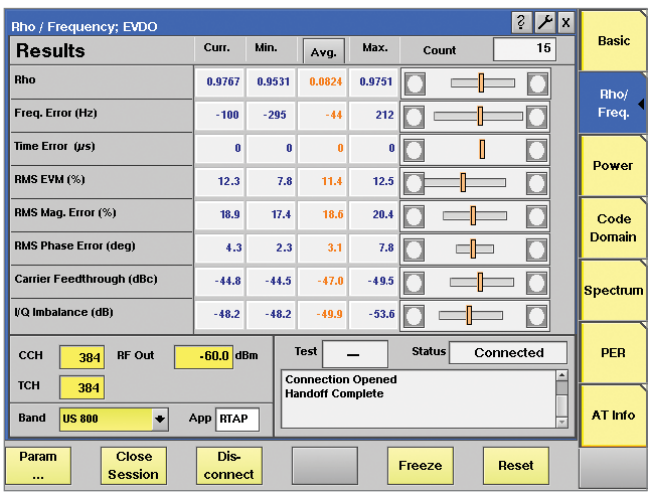

Figure 9: Overview of the transmitter quality parameters

- AT & AN Release
- AT & AN Session Close
- Handover

Once the terminal is in a connection state, an array of transmitter and receiver test may be performed. The transmitter test consist of: minimum/maximum RF power, access probe power, closed loop power (min./max./range only), stand-by power, modulation quality measurements including rho, frequency error, rms vector error, time offset, amplitude imbalance and code domain error. The receiver performance may be verified by utilizing the FTAP/RTAP applications to test sensitivity and dynamic range via a packet error rate measurement.

Preliminary specifications

The published accuracies are determined in accordance with GUM (Guide to the Expression of Uncertainty in Measurement) and EA (European Co-operation for Accreditation) application document EA4/02: "Expressions of the Uncertainty of Measurements in Calibration".

RF generator

Level range	–120 dBm to –15 dBm
Level resolution	0.1 dB
Level accuracy (–110 dBm to –15 dBm)	±0.7 dB
typ.	±0.4 dB
Waveform quality (rho)	> 0.97
typ.	> 0.99
Carrier feedthrough	< –35 dBc
Code channels	F-PICH, F-MAC, F-CCH, F-TCH

RF analyzer

Power meter

CDMA level range	–60 dBm to +35 dBm
Level resolution	0.1 dB
Level accuracy	
–25 dBm to +35 dBm	±0.4 dB
–60 dBm to –25 dBm	±0.7 dB

Analyzer

Level range	–25 dBm to +35 dBm
Frequency error range	±1 kHz
Resolution	1 Hz
Accuracy (relative to freq. base)	±10 Hz

Waveform quality

Range	0.9 to 1.0
Accuracy	±0.003

Time offset

Range	±5 µs
Accuracy	±100 ns

Code domain error measurements

Code power resolution	0.1 dB
Code power accuracy	±0.1 dB

Spectrum analyzer

Display range	80 dB
Resolution bandwidth	15 kHz, 30 kHz
Span (selectable)	±2.5 MHz
	±1.25 MHz
	±500 kHz

ACPM

Display range	80 dB
Frequencies according to IS-98D	up to 2.5 MHz from centre frequency
Measurements	Spectrum due to modulation

Non-call mode functions

Measurements	power measurements
	modulation quality measurements
	rho
	frequency error
	rms vector error
	amplitude imbalance
	code domain power
	modulation spectrum

Call mode functions

Supported revision	Rev. 0

Supported bands

band 0 – US cellular (ch 1 to 1023)
band 1 – PCS band (Ch 1 to 1199)
band 2 – TACS band (ch 1-1000, 1329-2047)
band 3 – JTACS band
(ch 1-799, 801-1039, 1041-1199, 1201-1600)
band 4 – Korean PCS (ch 1 to 599)
band 5 – NMT-450
(ch 1-300, 1039-1473, 1792-2016)
band 6 – IMT-2000 (ch 1 to1199)
band 8 – 1800 MHz (ch 1 to 1499)
band 9 – 900 MHz (ch 1 to 699)

Supported procedures

AT Session Open
AT & AN Connection
AT & AN Release
AT & AN Session Close
Handover

Terminal information

Hardware ID
Hardware ID type
Session seed
UATI 024
UATI color code

Network parameters	Color code (0 to 255)
	Country code (0 to 999)
	Control channel data rate (38.4 or 76.8kbps)
	SectorID (1 to 32 char)
	Subnet mask (0 to 128)
	Preferred control channel cycle (0 to 32767)

Access parameters

Open loop adjust (0 to 255 dB)
Preamble length (0 to 7 frames)
Probe initial adjust (–15 to +16 dB)
Probe num step (1 to 15)
Probe power step (0 to 7.5 dB)
Probe sequence max (1 to 15)

Reverse channel gain parameters

Ack channel (–3 to +6 dB)
DRC channel (–9 to +6 dB)
Data offset nominal (–3.5 to 4.0 dB)
Data offset rate (for various rates)

General parameters	Control channel number
	Total RF power
	PN offset (0 to 511)
Call parameters	Application
	FTAP rate
	RTAP rate
	ACK channel bit fixed mode attrib
	AT directed packets
	Reverse closed loop power control
	AT max power
	MAC index

Transmitter measurements

power measurements
minimum/maximum RF power
modulation quality measurements
rho
frequency error
rms vector error
time offset
amplitude imbalance
code domain power

Receiver measurements

receiver performance sensitivity
dynamic range (packet error rate)

Options for GSM, GPRS and EDGE

The 4400 Mobile Phone Tester Series supports GSM and its enhancements GPRS and EDGE with three different basic options: the 4460 GSM System Option, the 4462 GPRS System Option and the 4468 EDGE System Option.

4460 GSM System Option

Worldwide the GSM standard is being applied in four different frequency bands, all of which are supported by the 4460 GSM System Option.

The 4460 GSM System Option offers two modes in one option: call mode and generator/analyzer functionality. In call mode or signalling mode the 4400 is able to emit a signal similar to that of a GSM base station. Various signalling parameters can be adjusted to test a GSM mobile phone under different conditions.

The parameter menu allows signalling parameters to be easily changed. From the GSM cell parameters, across the definition of SMS message class, to the call set up procedure details, a lot of parameters are accessible in the 4400. A range of measurements are supported to test frequency and phase error, power, spectrum, and various receiver quality parameters.

The generator/analyzer mode provides basic signal generation capabilities as well as frequency and phase, burst (power) and spectrum measurements. This functionality is not limited to GSM channels but available for the whole frequency range supported by the 4400.

The 4400 includes a generic test script to run tests automatically, without user intervention. This test script consists of a final test of a GSM mobile phone operating in one or several of the GSM frequency bands, which are GSM 850 (U.S. cellular band), GSM 900, GSM 1800 and GSM 1900 (U.S. PCS band).

4462 GPRS System Option

GPRS (General Packet Radio Service) adds higher data rate capabilities to GSM by combining a packet data protocol with bundling of multiple time slots. The 4462 GPRS System Option allows testing of the packet data protocol capability as well as the multislot transmit and receive quality.

Users who need to test both GSM and GPRS can also use the 4463 GSM/GPRS System Option, combining the capabilities of the 4460 and 4462 system options.

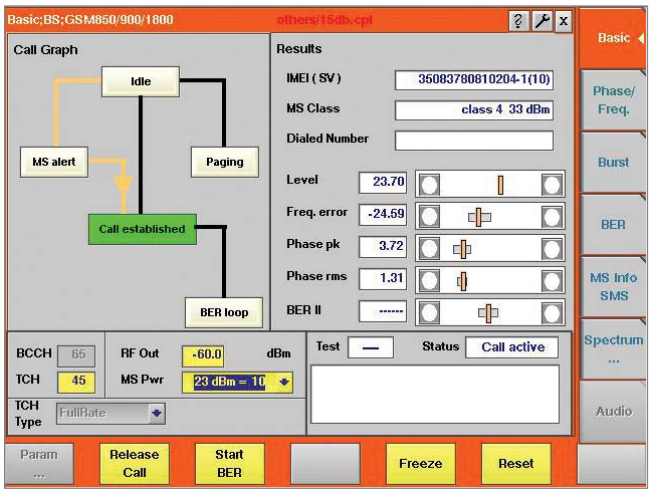

Figure 10: GSM Basic menu

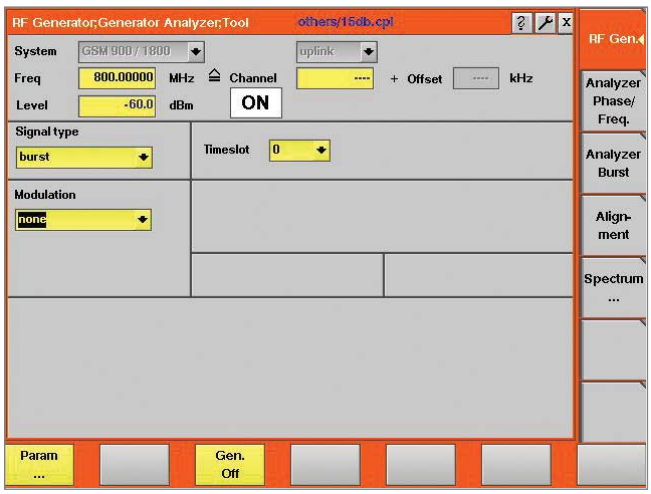

Figure 11: RF generator/analyzer mode

4468 EDGE System Option

A further increase in data throughput is achieved with EDGE (Enhanced Data rates for the Global Evolution), also called Enhanced GPRS. EGPRS introduces a higher modulation format (8-PSK) which requires new tests and measurements.

The modulation quality for EDGE-enabled mobile phones is expressed in Error Vector Magnitude (EVM), origin offset and I/Q imbalance. All these parameters can be tested with the 4468 EDGE System Option, following a data call set up.

RF generator

GSM/GPRS/EDGE system options

RF generator

Level range	–120 dBm to –10 dBm
Level accuracy (–110 dBm to –10 dBm)	
4405	0.7 dB
	typ. 0.3 dB
4403	0.9 dB
	typ. 0.4 dB
Level resolution	0.1 dB
Phase error rms	2.3°
	typ. 1.1°

RF analyzer

Peak power level range	–10 dBm to +36 dBm
Dynamic range	72 dB
Usable down to	–30 dBm

Phase and frequency measurements

Graphical display	phase error vs. time
Marker functions	
	2 markers, difference indication
Vertical display range	
	±2°, ±5°, ±10°, ±20°, ±50°
Horizontal display range	150 bit periods
Frequency error	
Display	current/average/min./max.
Range	±100 kHz
Resolution	1 Hz
Accuracy at 800 MHz to 1000 MHz	
within ±10 kHz error	15 Hz + freq. base
within ±100 kHz error	20 Hz + freq. base
Accuracy at 1700 MHz to 2000 MHz	
within ±10 kHz error	25 Hz + freq. base
within ±100 kHz error	30 Hz + freq. base
Phase error rms	
Display	current/average/min./max.
Range	0° to 15°
Resolution	0.1°
Accuracy	0.5°
	typ. 0.3°
Phase error peak	
Display	current/average/min./max.
Range	0° to 45°
Resolution	0.1°
Accuracy	
1° to 15° error	3.2°
15° to 25° error	4.2°

8-PSK (EDGE) measurements (EDGE system option)

Level range	–25 dBm to +36 dBm
Frequency error	
Range	±10 kHz
Resolution	1 Hz
Accuracy	same as GSM specification
RMS EVM	
Display	current/average/min./max.
Range	0 to 50%
Resolution	0.1%
Accuracy	<1.0%
Peak EVM	
Display	current/average/min./max.
Range	0 to 75%
Resolution	0.1%
Accuracy	<3%
95th percentile	
Display	current/average/min./max.
Range	0 to 50%
Resolution	0.01%
Accuracy	<1.5%
Origin offset	
Display	current/average/min./max.
Range	0 to 50%
Resolution	0.1%
Accuracy	±0.5 dB
I/Q imbalance	
Display	current/average/min./max.
Range	0 to 50%
Resolution	0.1%
Accuracy	±0.5 dB

Burst measurements

Peak level accuracy	
4405	0.37 dB[1]
	typ. 0.15 dB
4403	0.8 dB
Level repetition	
4405	0.01 dB
4403	0.03 dB
Level resolution	0.01 dB
Relative accuracy of 4405	1 dB at –60 dBc
	3 dB at –72 dBc
Graphical display	
Measurement	power vs. time
Marker functions	
	2 markers, difference indication
Range	
Full burst display	–75 dB to +5 dB
	–40 µs to +580 µs
Edge display	–75 dB to +5 dB
	–40 µs to +40 µs
	500 µs to 580 µs
Flat part display	–1.5 dB to +1.5 dB
	0 to 540 µs
Corner points	
	8 measurement points on the burst
Selectable range	–10 bits to +160 bits
Accuracy see relative accuracy	
Resolution	0.1 dB
Timing advance and timing error measurement	
Setting range	0 to 63 bit periods
Timing error measurement unit	µs
Measurement resolution	0.1 µs
Measurement range (relative to 4400 timing)	± half a time slot

Modulation spectrum

Graphical display	power vs. frequency
Display range	80 dB
Resolution bandwidth	10 kHz, 30 kHz
Span (selectable)	±1.8 MHz
	±500 kHz
	±200 kHz
Marker functions	
	2 markers, difference indication
Statistical functions	current, average

ACPM (ORFS) option

Graphical display	bar chart,
	power vs. frequency
Display range	80 dB
Frequencies according to ETSI GSM 11.10	
up to 1.8 MHz from centre frequency	
Measurements	Spectrum due to modulation
	Spectrum due to switching transients

[1] if RX signal > –32 dBm and TX signal > 10 dBm

Non-call mode functions

Asynchronous RF generator

Carrier frequency selection	by frequency
	or channel number
Signal types	continuous, burst
Modulation	none, GMSK, AM (optional)
Training sequence	0 to 7 or none
Burst contents	0...0 (all zeros)
	1...1 (all ones)
	1010 (reversals)
	1100
	11110000
	1...10...0
	PRBS-9
	PRBS-15
	PRBS-23
User-definable parameters for	
GSM microcell simulation	MCC, MNC
	BCC, NCC
	cell access barred/not barred
	cell identity, location area code
	BS-PA-MFRMS (DRX)
	early/late assignment
	call processing on FACCH or SDCCH
Neighbour cells description for up to 6 BCCH carriers	

Asynchronous RF generator (additional specifications for GPRS system option)

Signal type	continuous, burst, multislot
Selectable channel combinations	
	raw GMSK signal
	PDTCH (channel comb. 13)
	BCH + PDTCH (channel comb. 5 on time slot 0, channel comb. 13 on other time slots)
Base channel (channel comb. 5) contents	
	system information message types 1, 2, 3, 4, 5, 6, 13
PDTCH contents	
	RLC/MAC header + data payload
Multislot PDTCH operation	
	1 time slot generated and duplicated
PDTCH data payload	
	PN-9, PN-15, PN-23, 1010...
Multislot power level	
	individually selectable for each time slot
Coding scheme	
	selectable (CS-1, CS-2, CS-3, CS-4)
Training sequence code	
	selectable (0 through 7)
User-definable fields for	
GPRS microcell simulation	RA Colour
	RA Code
	Alpha
User-definable RLC/MAC header fields	
	USF (Uplink State Flag) (fixed or rotating)
	RRBP (Relative Reserved Block Period)
	RRBP Valid
	PR (Power Reduction)
	TFI (Temporary Flow Identifier)
	fixed or incremented BSN

Asynchronous RF analyzer

Carrier frequency selection	by frequency or channel number
Supported signal type	GMSK-modulated burst signal GMSK-modulated continuous signal
Time synchronisation of MS with 4400	not required
RF power conditions	> –20 dBm
Supported transmitter measurements	peak power burst power (full range) corner points frequency/phase error measurements spectrum measurements

Asynchronous RF analyzer (additional specifications for GPRS system option)

In multislot mode, the specified measurement accuracy applies to the time slot with the highest power level.

Maximum number of time slots	up to 4 adjacent time slots
Supported transmitter measurement	same as for GSM, displayed results for selectable time slot, results via SCPI for one selectable slot or for all time slots

Asynchronous RF analyzer (additional specifications for EDGE system option)

In multislot mode, the specified measurement accuracy applies to the time slot with the highest power level.

Maximum number of time slots	up to 4 adjacent time slots
Supported transmitter measurements	frequency error, RMS EVM, peak EVM 95th percentile, origin offset, I/Q imbalance displayed results for selectable time slot, results via SCPI for 1 selectable of for all time slots

Call mode functions

Supported bands	GSM 850 (channels 128 to 251) P-GSM (channels 1 to 124) E-GSM (channels 975 to 1023, 0 to 124) R-GSM (channels 955 to 1023, 0 to 124) GSM 1800 (channels 512 to 885) GSM 1900 (channels 512 to 810)

GSM call processing(additional specifications for GSM system option)

Supported procedures	location update mobile-originated call mobile-terminated call intracell handover cross-band intracell handover call clearing by MS call clearing by 4400 open loop, closed loop procedures early or late assignment SMS to mobile (idle mode) SMS to mobile (on TCH/FS) SMS from mobile (idle mode)
Special functions	call state diagram paging test reduced signalling
TCH slot	selectable, range 2 to 6
MS information display	IMSI IMEI (SV) MS class for GSM 900 MS class for GSM 1800/1900 dual-band capability E-GSM support GSM revision level EFR capability SMS capability A5 ciphering support dialed number RX level full, sub RX quality full, sub reported RX level of neighbouring cells

GPRS call processing (additional specifications for GSM/GPRS system option)

Time slot selection	automatic, according to multislot class
Supported procedures	GPRS attach/detach routing area update downlink TBF establishment uplink TBF establishment (using ETSI-defined GPRS test mode command) reduced signalling
Uplink data modes according to GSM 04.14	test modes (a) (without data loopback in the mobile)
Uplink power control method	closed loop

EDGE call processing (additional specifications for EDGE system option)

Time slot selection	automatic, according to multislot class
Supported procedures	EDGE attach/detach uplink TBF establishment ETSI test mode A only

GPRS transmitter measurements (additional specifications for GPRS system option)

The measurement accuracy specified for the base unit applies to the time slot with the highest power level.

Supported number of time slots	transmitter measurements: 1 through 4
RF power conditions	at least 1 time slot at > –20 dBm max. adjacent slot power difference: 30 dB
Power measurements	peak power for selectable time slot min., max., average, current values 8 corner points for selectable time slot power vs. time for selectable no. of time slots
Frequency/phase error measurements	measurements for selectable time slot min., max., average, current values
Spectrum measurements	modulation spectrum (for selectable slot) spectrum due to modulation (selectable slot) spectrum due to switching transients

EDGE transmitter measurements (additional specifications for EDGE system option)

The measurement accuracy specified for the base unit applies to the time slot with the highest power level.

Supported number of time slots	transmitter measurements: 1 through 4
RF power conditions	at least 1 time slot at > –20 dBm max. adjacent slot power difference: 30 dB
Power measurements	peak power for selectable time slot min., max., average, current values 8 corner points for selectable time slot power vs. time for selectable no. of time slots
Modulation quality measurements	frequency errorr, RMS EVM, peak EVM 95th percentile, origin offset, I/Q imbalance min., max., average, current values
Spectrum measurements	modulation spectrum (for selectable slot) spectrum due to modulation (selectable slot) spectrum due to switching transients

GSM receiver measurements

Supported measurements	Bit Error Rate (BER) Residual Bit Error Rate (RBER) Fast Bit Error Rate (FBER, C loop) Frame Erasure Rate (FER)
Selectable patterns	PRBS-9 PRBS-15 PRBS-23 0000 1111 1010 0101
Displayed results	current, average, min., max.
Number of samples	BER 1000 to 106 bits RBER 10 to 105 bits Fast BER 100 to 106 bit
Supported channels	TCH/FS, TCH/EFS

GPRS receiver measurements (additional specifications for GPRS system option)

Displayed results	minimum, maximum, average BLER/BER
Coding scheme	CS-1
Data	PRBS (PN-9, PN-15, PN-23)
BLER-BCS measurement	
Method	ETSI-defined
Number of time slots	up to 4
Concurrent TX tests	no
Number of blocks	10 to 999
BLER-USF measurement	
Method	ETSI-defined
Number of time slots	up to 4
Concurrent TX tests	yes, up to 4 time slots
Number of blocks	10 to 999

TCH loopback in the 4400

Speech loopback	full rate, enhanced full rate
Data loopback	9.6 kbit/s, transparent data 14.4 kbit/s, transparent data

4473 MS Power Supply Option

In production lines and service centres, mobile phone testing is usually conducted using an external power supply. Now, Willtek helps mobile manufacturers and service factories optimise their workspace, instrument control and budget by integrating the power supply into the Willtek 4400 Series.

Willtek's MS Power Supply Option enhances the functionality of the 4400 Mobile Phone Tester Series by enabling engineers to eliminate the external power supply. With this easy-to-use add-on, the revolutionary 4400 supplies the mobile with DC power and tests RF and audio, all from one instrument.

The option was developed in consultation with mobile phone manufacturers and service centres with the aim of improving mobile phone testing processes and environments.

This innovative testing option provides a number of benefits:

- Easier programming
  The option employs remote control and RAPID! integration based on SCPI and 4400 standards.
- Streamlined troubleshooting
  Quick separation of handset and power supply problems ensures faster problem resolution.
- Return on investment
  Multiple functionality saves buying additional stand-alone equipment.
- Cost reduction
  This easy-to-use option reduces training costs over time.
- Space saving
  No additional external power supply is necessary, saving production and service space.
- Lifelike battery substitution
  The option eliminates the need to use regular mains supplies for testing in mobile phone production lines and repair loops. It replaces the battery while providing similar voltage characteristics.
- Minimise space and cost
  The MS Power Supply Option not only reduces installation and maintenance costs but also saves money over time by reducing the number of devices manufacturers and service centres need to hold.
  The option's simple-to-interpret graphical user interface, which reduces both the need for training and the time taken on each test, further enhances the cost savings.
- Multiple, simultaneous testing capabilities
  The MS Power Supply Option can support both GPRS and HSCSD applications because it is able to feed currents for the transmission of at least two time slots per frame. The number of time slots is limited only by the current level in transmit mode.
- One-box solution
  The MS Power Supply Option is shipped with a one-meter cable, designed to plug simply and easily into the power supply socket on the front panel of your 4400. The open-ended termination on this cable provides free adaptation into an existing test system.
- Built-in protections
  Willtek guards against accidental short-circuits by the addition of a positive temperature coefficient (PTC) resistor in the MS Power Supply Option. It is tripped if too much current flows through.

Specifications

Output voltage

Range	0 to 10 V
Resolution	50 mV
Accuracy (with constant current)	±20 mV
Maximum output current	
Continuous, < 4 V	1 A
Continuous, ≥ 4 V	0.25 A
Peak, < 1 ms, < 4 V	4 A
Peak, < 1 ms, ≥ 4 V	2 A
Ripple noise (peak-to-peak)	100 mV/A
Proof against permanent short-circuit	

Scope of supply

A power supply connection cable of one meter length with open ends for free adaptation according to user needs is delivered with the option.

4474 MS Current Measurement Option

In specific test stations at manufacturing lines and repair stations, measurement of the current from the battery is a "must" in order to identify any failure on the PCB (Printed Circuit Board). Quality assurance measures the current in order to characterise standby and talk times.

For this range of applications the 4400 plug-in option "MS Current Measurement" substitutes an external current meter and measures power and current, which the mobile drains from the battery. The user can choose between a numerical measurement and a unique graphical representation of the current versus time measurements. The current changes dynamically as the mobile's power amplifier generates the RF bursts.

In addition the option provides a statistical evaluation for minimum, maximum, average and peak value regarding the selected duration time.

The duration of the graphical representation is 4.615 ms which enables the user to analyse a complete GSM TDMA frame.

The 4474 MS Current Measurement Option is an extension of the 4473 MS Power Supply Option. To connect the 4400 with the mobile, a power supply cable is delivered with the option. An open-ended termination on this cable provides free adaptation into an existing test system.

Both options extend the test application area of the 4400. The 4400 is now able to supply the mobile under test, measures RF and audio quality and the power consumption with one test instrument.

Benefits in brief:

- Integrated current meter, e.g. to identify short-circuit situations, eases handling for the user
- The 4400 user can test RF, audio and power consumption with one test instrument
- No additional external current meter necessary, this saves space in test systems
- Power, peak current and average current measurements possible
- Easy-to-read numerical measurement display
- Current vs. time measurements for the analysis of burst current characteristics with selectable resolutions
- Statistical evaluation and overload detection
- Battery replacement

Specifications

Measurement

Range	0 to 400 mA or 0 to 4 A
Resolution	
at 400 mA	0.1 mA
at 4 A	1 mA
Accuracy	2%
Offset	±5 mA
Output voltage range	0 to 10 V
Recording	
Duration	4.615 ms (1 TDMA frame)
Resolution	960 points
Sample rate	192 000 samples/s

Connection cable

A 0.5 meter long power supply connection cable with open ends for free adaptation of user needs is delivered with the option.

General Options

Willtek provides additional options for the 4400 Mobile Phone Tester Series, facilitating tests of a mobile phone under various conditions or against special requirements.

RAPID!

RAPID! stands for Run Application Programs with Integrated Development. RAPID! is a combination of the simple-to-use programming language BASIC and the powerful SCPI command language developed for the 4400.

Test scripts are available to test GSM/GPRS/EDGE, CDMA2000 or WCDMA/UMTS. Willtek can help you to setup your own script according to your requirements; you can request this service at support@willtek.com.

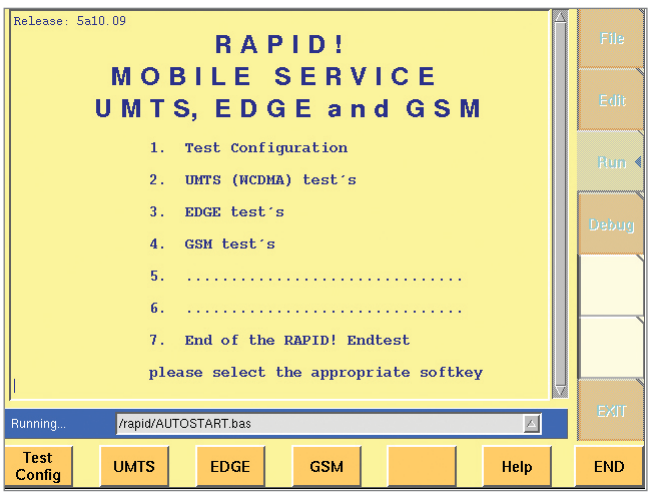

Figure 12: Start menu for evaluation tests provided in RAPID!

4470 Audio Option, 4471 Basic Codec Option and 4472 Codec Extension Option

With Willtek's 4400 Series and the Audio and Codec options, Willtek provides complete testing solutions for mobile phones.

The Audio and Codec Options for the Willtek 4400 Series help to measure and test the audio capabilities of the mobile phone, ensuring its high quality. These options have been designed for the particular needs of R&D, production, repair/service and quality assurance.

The options can be easily integrated in the Willtek 4400 Mobile Phone Tester, resulting in a compact RF and AF test system.

Audio

The Audio Option can test and evaluate the individual audio components or the complete audio path of the mobile. There are different ways to stimulate the mobile phone and to verify the audio quality.

The generated signal can be fed into a loudspeaker to stimulate the microphone; it can also stimulate the mobile at the headset input. Using the codec options, you can transmit voice signals even over the GSM traffic channel.

The audio signal from the mobile can be evaluated using either the basic audio analyzer or the unique audio spectrum analyzer. A high impedance AF input, an auxiliary input for the microphone and the traffic channel (using the additional codec options) can be used as sources for the analysis.

Codecs

There are two different codec options for GSM available: the 4471 Basic Codec Option for Full Rate (FR) speech and the 4472 Codec Extension Option for Enhanced Full Rate (EFR). These codecs supplement the audio measurements, allowing audio signals to be generated and tested via the air interface.

4481 AM Signal Generator Option

The AM Signal Generator allows the tuning of certain phones in asynchronous (or non-call) mode. The modulation index and the modulation signal can be varied to support some vendor-specific AM suppression measurements.

4488 Parallel Multiple Phone Test Package

Today service centres are continuously under pressure to reduce test times. The Willtek 4400 Mobile Phone Tester series already boosts an extremely short test time of between 10 to 12 seconds for a dual-band phone. Setting up the phone for testing is time-consuming, i.e. inserting the phone into the test jig and synchronising it with the Willtek 4400 Mobile Phone Tester .

The parallel multi-phone test is the answer. It allows the technician to set up a phone for testing, whilst the Willtek 4400 Mobile Phone Tester is testing another phone. The test set up offered by the multiple phone test permits up to four phones to be connected (either directly by dedicated cable, or by antenna coupler and shield box). Each phone requires its own antennna coupler and RF Shield.

Available test sequences can be individually configured, i.e. tests can be performed on a single channel per band or on three channels. The call set up to the phone can either be originated by the phone or by the test set.

The Parallel Multiple Phone Test Package consists of a software and a hardware option to connect the RF ports of up to four mobile phones with the 4400 and to control the measurements.

Ordering details

Willtek 4403 Mobile Phone Tester	M 101 105
Willtek 4405 Mobile Phone Tester	M 101 104

System options	
4450 TD-SCDMA Non-Call Mode Option	M 897 255
4451 TD-SCDMA Call Mode Option	M 897 256
4452 1xEV-DO Non-Call Mode Option	M 897 287
4453 1xEV-DO Call Mode Option	M 897 288
4460 GSM System Option	M 897 161
4461 Multislot HSCSD Option	M 897 158
4462 GPRS System Option	M 897 159
4463 GSM/GPRS System Option	M 897 162
4464 CDMA2000 System Option	M 248 663
4466 WCDMA/UMTS Non-Call Mode Option	M 897 248
4467 WCDMA/UMTS Call Mode Option	M 897 249
4468 EDGE System Option	M 897 250
4479 Baseband Processing Hardware	M 248 690
7312 Lector Enhanced	M 897 310
7315 Scriptor	M 897 311

General options

4473 MS Power Supply Option	M 248 355
4474 MS Current Measurement Option	M 248 356
4477 OCXO	M 214 028

GSM options

1103 USIM and GSM Test SIM card	M 860 164
4470 Audio Option	M 248 360
4471 Basic Codec Option	M 248 364
4472 Codec Extension Option	M 897 156
4475 ACPM (ORFS) Option	M 897 163
4480 RAPID! GSM Service Tests	M 897 160
4481 AM Signal Generator Option	M 897 165
4485 RAPID! GSM/EGDE/WCDMA Service Software	M 897 276
4487 RAPID! Mobile/Carrier Test Software	M 897 279

CDMA options

4470 Audio Option for CDMA-only units	M 248 653
4483 RAPID! Mobile/Carrier Test Software	M 897 242

WCDMA option

1103 USIM and GSM Test SIM card	M 860 164

Accessories

Carrying case	M 300 808
Rack mount set	M 378 260
4916 Antenna Coupler	M 248 641
4921 RF Shield	M 248 346
RF Shield and Antenna Coupler package	M 248 348

About Willtek

Who we are

Willtek Communications provides terminal and air interface testing solutions and handheld spectrum analyzers for the mobile telecommunications industry - including network operators, service providers, and equipment manufacturers.

Terminal testing is used for checking and calibrating mobile telephones and equipment during factory production, service centre repairs and for functional tests in sales outlets. Operators of mobile networks use air interface testing equipment to plan their networks. Spectrum analyzers are used for all wireless applications in areas such as repair, EMC (electromagnetic compatibility), engineering, cable TV and fibre optics. Willtek's engineering expertise reflects 45 years of skill and experience in testing radio frequency (RF) environments.

The main R&D and production centre for Willtek's products is in Ismaning near Munich, Germany. Willtek has sales and service centres all over the world.

Foundation and development

The roots of Willtek Communications date back to 1957 when a small group of engineers started a business in southern Munich. In 1958 Schlumberger acquired the company and proceeded to develop its business over the next 36 years, from the world's first synthesizer to the famous STABILOCK series of communication testers.

Wavetek acquired the enterprise in 1994, at the same time integrating the Indianapolis team. In 1998, Wavetek merged with Wandel & Goltermann in Germany. Two years later, US-based Dynatech bought WWG and merged it with its subsidiary TTC. Acterna was born, with 4800 employees worldwide. The Wireless Instruments division, which was a part of Acterna's wireless network segment, acquired Chase Communications (UK) and its air interface operations in 2001.

In 2002, Acterna divested its Wireless Instruments division through an MBO led by the management team.

In March 2003, Investcorp acquired a majority interest to finance Willtek's expansion into new markets and products.

Willtek became a wholly owned subsidiary of Wireless Telecom Group, Inc. in July 2005.

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Note: Specifications, terms and conditions are subject to change without prior notice.

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