4400

Mobile Phone Tester Series

Highlights

- All major mobile communication standards

- Remote control through GPIB, LAN, USB

- Options for DC power supply and DC current measurements

- Parallel testing of TX, RX and Audio
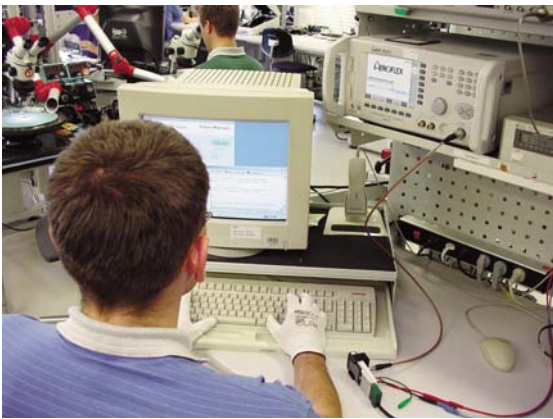
Figure 1: 4403 Mobile Phone Tester – the ideal tool for service centres and the repair loop in production

The 4400 Mobile Phone Tester Series is a leading-edge product and a good example of Aeroflex's expertise in RF test and measurement. 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. Aeroflex 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. Aeroflex'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.

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 under remote control. The 7310 Lector and Scriptor family of test automation programs facilitates easy-to-use tests; these are started with very few mouse clicks and return a simple Pass or Fail verdict along with more technical details. See the Lector and Scriptor info sheet for more details.

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 Aeroflex's testers.

Research and 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, Aeroflex offers two instruments with the same functionality but different performance, leaving the choice of accuracy to the customer.

SPECIFICATION

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 synthesizers for RX and TX measurements.

Frequency Range

430 to 500 MHz[1]

800 to 1000 MHz

1700 to 2300 MHz

Additional frequency range with the 1209 Downconverter[2]

529.6 to 729.6 MHz

600.0 to 800.0 MHz

1564.8 to 1764.8 MHz

2329.6 to 2529.6 MHz

2400.0 to 2600.0 MHz

Frequency Resolution

10 Hz

Frequency and Level Settling Time

350 ms

RF In/Out

N-type female connector

Input/output Impedance

50 Ω

[1] Not available with WCDMA and TD-SCDMA

[2] With 1209 Downconverter. Different input and output level ranges apply, see separate data sheet for the 1209 Downconverter.

[3] If RX signal >−32 dBm and TX signal >10 dBm

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

TCXO FREQUENCY BASE

Temperature Characteristic

1×10^{-6} max.

Aging Characteristic

1×10^{-6} max./year (at +25°C ±2°C)

OCXO FREQUENCY BASE (OPTION)

Temperature Characteristic

5×10^{-8} max.

Aging Characteristic

1×10^{-7} max./year

EXTERNAL SYNCHRONIZATION INPUT

Input level

0 to +15 dBm

Impedance

50 Ω

Frequency

5, 10, 13 MHz (autodetection)

GENERAL DATA

Control Interfaces

IEEE 488.2 (GPIB)

LAN (RJ-45, TCP/IP)

USB type A (two on the front, two on the back, for USB flash drive, keyboard and mouse connection)

USB type B, for remote control

VGA

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 (8 x 15.8 x 17")

Weight

10.5 kg (without options) (23 lbs.)

Delivery Includes

Mains cable

USB memory stick

Getting started guide

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

Figure 2: The 1209 Downconverter is an optional frequency extension for Bluetooth, WLAN, GPS tests and Mobile TV standards.

GENERAL OPTIONS

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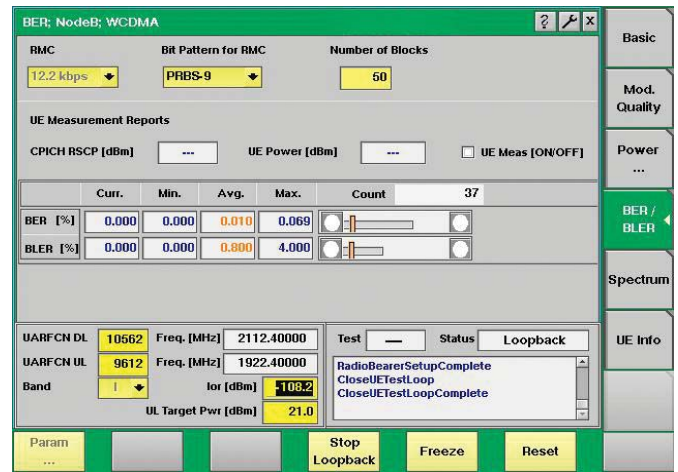

Figure 3. Start menu for evaluation tests provided in RAPID!

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

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

The Audio and Codec Options for the Aeroflex 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 Aeroflex 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.

GSM 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.

4473 MS Power Supply Option

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

Aeroflex'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.

- Minimize 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 centers 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 GPRS 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.

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 characterize 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 analyze 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.

The 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

Resolution (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/sec

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.

OPTIONS FOR WCDMA (UMTS) AND HSDPA

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
- TX-RX sweep calibration

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.

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.
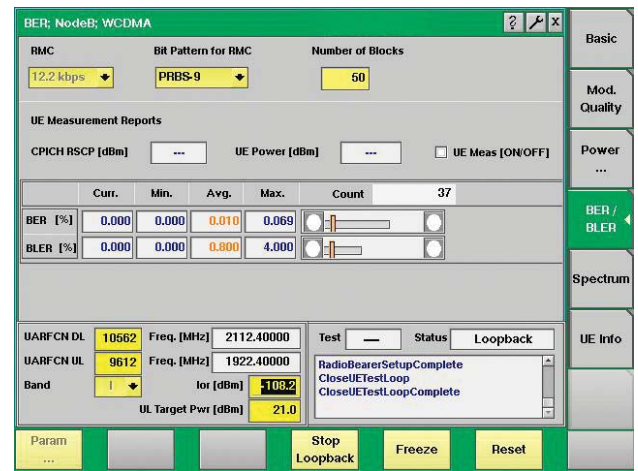

Figure 3: Receiver Sensivity Level Estimation with BER/BLER Measurement

HSDPA

High Speed Downlink Packet Access is an optimization for UMTS/WCDMA in the Downlink.

The HSDPA testing solution for the 4400 Mobile Phone Tester Series consists of two options: the 4456 HSDPA Non-Call Mode Option and the 4455 HSDPA Call Mode Option. Each of these options requires the related WCDMA option– and the 4479 Baseband Processing Hardware to be installed.

4456 HSDPA Non-Call Mode Option

The HSDPA Non-Call Mode Option provides all the necessary functionality to calibrate and align an HSDPA-capable device in production or high level service environment. For this purpose, it offers generator and analyzer functions with measurements as follows:

Power measurements, modulation quality, code domain power and spectrum measurements

4455 HSDPA Call Mode Option

4455 HSDPA Call Mode Option offers the functionality to fully test an HSDPA-capable device according to 3GPP Release 5 specification TS 134 121. The 4400 simulates a radio cell with HSDPA capabilities, where the device can log onto (PS attach). Once successfully registered, an RMC-based connection can be established and HSDPA data is transmitted. Based on the connection settings, different tests can be performed such as:

- Power measurements (e.g. maximum power)
- Modulation quality (e.g. peak and RMS error vector magnitude (EVM))
- Code domain power measurements (e.g. peak code domain error (PCDE))
- Receiver characteristics (e.g. maximum input level)
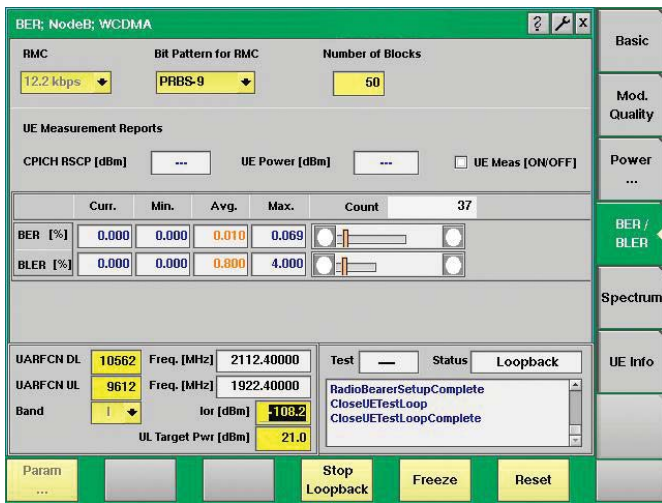- Receiver performance (e.g. CQI reporting, data rate through-put/BLER)

Figure 4: HSDPA Basic Connection Menu

GENERAL DATA

Standard
3GPP-FDD Release 5

Symbol Rate
3.84 Mcps

Bandwidth
5 MHz

RF GENERATOR

Modulation Type
CW, FM, WCDMA, WCDMA/HSDPA

WCDMA/HSDPA SIGNAL GENERATOR

Frequency Resolution
10 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%

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/HSDPA POWER MEASUREMENT

Measurement Filter
According to standard, 3.84 MHz, RRC, $a = 0.22$

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/HSDPA ANALYZER

Modulation Quality Measurements

Measurement Filter
According to standard, 3.84 MHz, RRC, $a = 0.22$

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 ANALYZER

Frequency Span
±3 MHz, ±5 MHz

Resolution Bandwidth
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

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/HSDPA ANALYZER

Power Measurements

Peak power, mean power

Spectrum Measurements

Occupied bandwidth (OBW), adjacent channel power leakage ratio (ACLR), spectrum emission mask (SEM)

Modulation Quality

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 domain power

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 1755 MHz (UL)

2110 to 2155 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)

Band VIII-880 to 915 MHz (UL)

925 to 960 MHz (DL)

Band IX-1749.9 to 1784.9 MHz (UL)

1844.9 to 1879.9 MHz (DL)

Band X- 1710 to 1770 MHz (UL)

2110 to 2170 MHz (DL)

Supported Procedures

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

Reference Measurement Channels According to 3GPP TS 134121

RMC 12.2, 64, 144, 384 kbps

HSDPA Specific Reference Channels

H-Set 1 – 6 QPSK, 16QAM with AWGN and fading (PA3)

Transmitter Measurements

Peak and mean power

Min and max output power

Inner loop power control

Open loop power control

HS-DPCCH power

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

Phase discontinuity

HSDPA: Error vector magnitude

Phase discontinuity

Relative code domain power

Relative code domain error

Code Domain Measurements

Peak code domain error (PCDE), code domain power

Receiver Measurements

BER/BLER measurements

UE Info with UE Measurement Report

HSDPA: Maximum throughput test

BLER

Demodulation of HS-DSCH

Reporting of channel quality indicator (CQI)

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.

Aeroflex'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 QPSK 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 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.
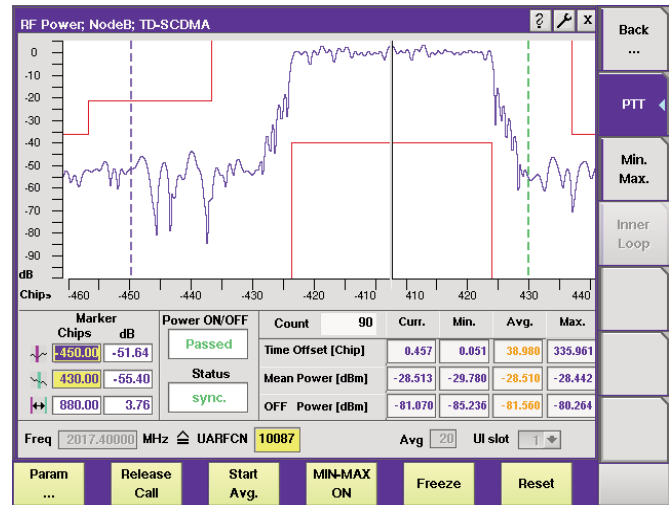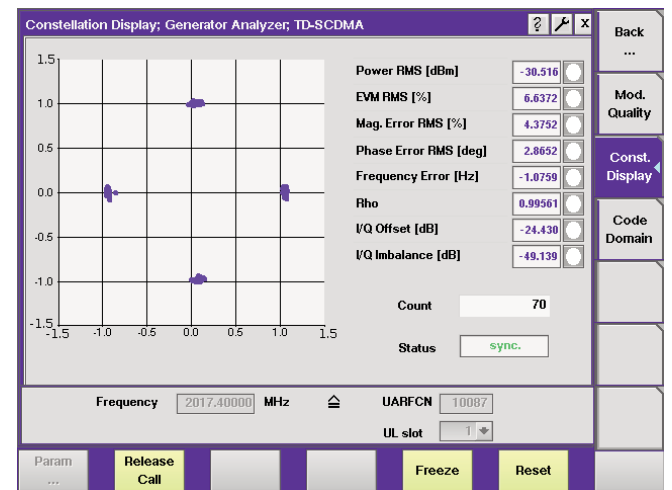

Figure 5: TD-SCDMA power measurements

Figure 6: Constellation Display

GENERAL DATA

Standard

3GPP-TDD

Symbol Rate

1.28 Mcp

Bandwidth

1.6 MHz

RF GENERATOR

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

Measurement Filter

According to standard, 1.28, RRC, alpha = 0.22

Measurements

Channel power, peak/mean/off power, 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

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

Power Measurements

Channel power, peak/mean/off power, 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 to 1920 MHz (UL & DL)

2010 to 2025 MHz (UL & DL)

1850 to 1910 MHz: (UL & DL)

1930 to 1990 MHz: (UL & DL)

1910 to 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 (single code and multicode)

RMC 64 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)

OPTIONS FOR CDMA2000

The CDMA2000 system options for the 4400 Series enable users in R&D, manufacturing and service to test subscriber terminals which are based on the cdmaOne and CDMA2000 technologies. The 4447 CDMA2000 1xRTT Non-Call Mode Option supports asynchronous measurements and the 4448 CDMA2000 1xRTT Call Mode Option supports synchronous measurements, so the combination of the both allow 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.
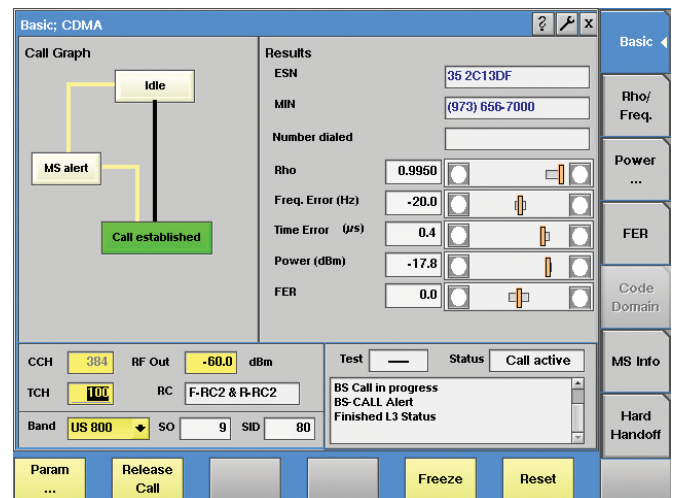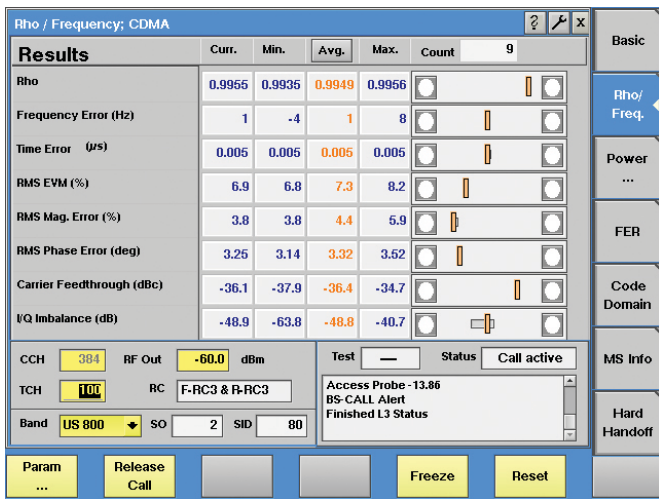

Figure 7: Basic Screen CDMA2000

Figure 8: Modulation Quality Measurement

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 Bm)

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

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

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 QUALITY 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 (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

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 to 1199)

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 timeoffset, 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

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)

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 Rev.0 or Rev. A 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 or Revision A 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

• 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.
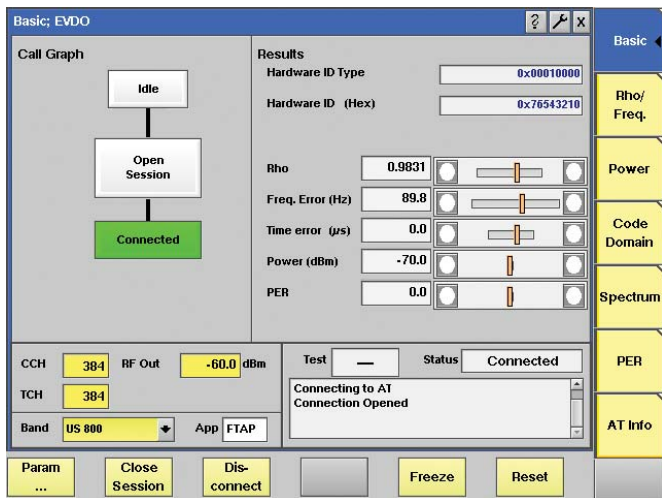
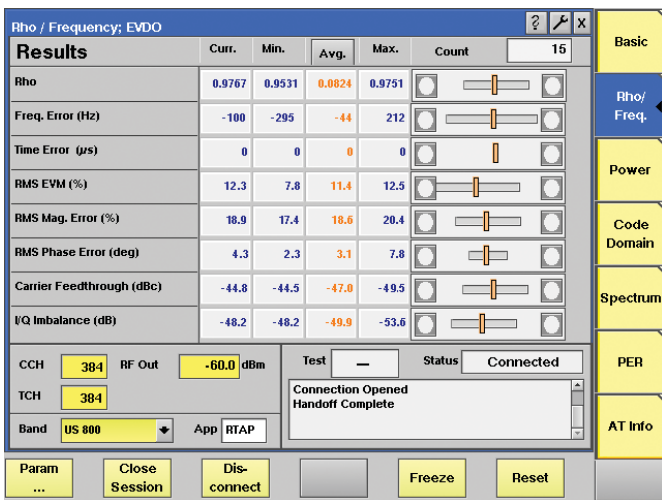*Figure 9: EVDO Basic Menu with Call State Diagram*

Figure 10: Overview of the transmitter quality parameters

SPECIFICATIONS

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

EVDO 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 ±0.6 dB

MODULATION QUALITY 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

Resolution

 0.001

ERROR VECTOR MAGNITUDE

Range

 Up to 30%

Accuracy

 ±2.5%

Resolution

 0.1%

TIME OFFSET

Range

 ±5 µs

Accuracy

 ±100 ns

Resolution

 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

  ±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 Revisions

  Rev. 0, Rev. A

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 to 1199)

  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

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

  Physical Layer Subtype

  Application

  FTAP/FETAP rate

  RTAP/RETAP 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 different basic options:the GSM non-call mode and call mode options, the GPRS non-call mode and call mode options, and the EDGE non-call mode option and call mode options.

GSM System Options

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

The 4457 GSM Call Mode Option offers a signaling mode in which the 4400 is able to emit a signal similar to that of a GSM base station. Various signaling parameters can be adjusted to test a GSM mobile phone under different conditions.

The parameter menu allows signaling 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 call mode option 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).

The generator/analyzer mode of the 4458 GSM Non-Call Mode Option 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.

GPRS System Options

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 Call Mode Option allows testing of the packet data protocol capability as well as the multislot transmit and receive quality during a connection. Tests without the connection setup can be done with the 4454 GPRS Non-Call Mode Option.

Users who need to test both GSM and GPRS in call mode and non-call mode, can also use the 4463 GSM/GPRS System Option combining the capabilities of all the four system options.

EDGE System Options

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.
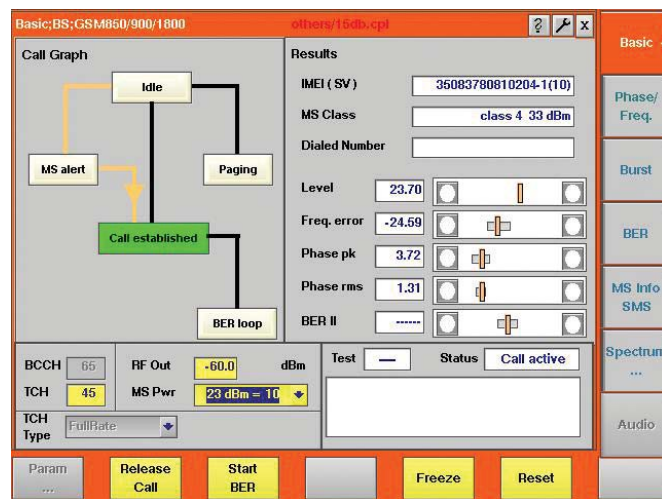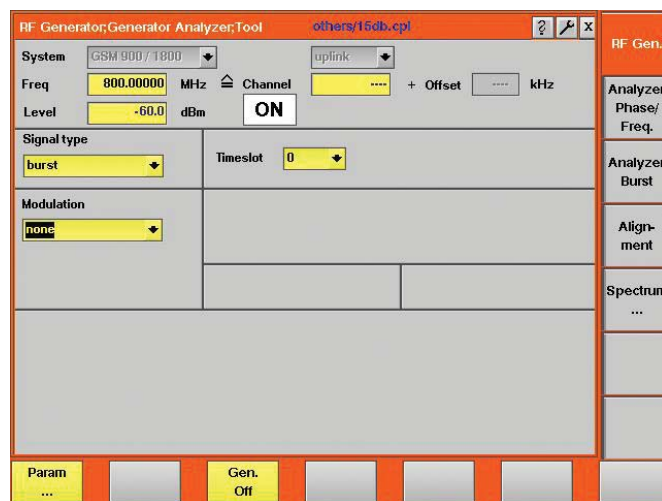

Figure 11: GSM Basic Screen

Figure 12: RF Generator/Analyzer Mode

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 Options)

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

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

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

Power vs. Time Display Modes

Full burst, edges, flat part

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

Measurement Resolution

0.1 µs

Measurement Range

± half a time slot (relative to 4400 timing)

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

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

Fixed bit patterns, PRBS (PN-9, PN-15, PN-23)

ASYNCHRONOUS RF GENERATOR

(Additional specifications for GPRS Non-Call Mode 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)

PDTCH Content

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

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 Non-Call Mode Option)

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

Maximum Number of Tme Slots

Up to 4 adjacent time slots

Supported Transmitter Measurements

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 Non-Call Mode 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

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

GPRS CALL PROCESSING

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 Mode According to GSM 04.14 test mode a)

(Without data loopback in the mobile)

Uplink Power Control Method

Closed loop

EDGE CALL PROCESSING

Time Slot Selection

Automatic, according to multislot class

Supported Procedures

EDGE attach/detach

Uplink TBF establishment

ETSI test mode A only

GPRS Transmitter Measurements

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

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 error, 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

Fixed bit patterns, PRBS (PN-9, PN-15, PN-23)

Displayed Results

Current, average, min., max.

Number of Samples

BER 1000 to 106 bits

RBER 10 to 106 bits

Fast BER 100 to 106 bits

Supported Channels

TCH/FS, TCH/EFS

GPRS RECEIVER MEASUREMENTS

Displayed Results

Minimum, maximum, average BLER/BER

Coding Scheme

CS-1

Data

PRBS (PN-9, PN-15, PN-23)

BLER-BCS Measurement

Number of time slots	Up to 4
Concurrent TX tests	No
Number of blocks	10 to 999

BLER-USF Measurement

Number of time slots	Up to 4
Concurrent TX tests	Yes, up to 4 time slots
Number of blocks	10 to 999

EDGE RECEIVER MEASUREMENTS

Displayed Results

Minimum, maximum, average BLER

Coding Scheme

CS-1

BLER-USF MEASUREMENT

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

ORDERING DETAILS

Aeroflex 4403 Mobile Phone Tester	AG 101 105
Aeroflex 4405 Mobile Phone Tester	AG 101 104

System Options

4445 GSM/GPRS Call Mode Option	AG 897 297
4446 GSM/GPRS Non-Call Mode Option	AG 897 298
4447 CDMA2000 1xRTT Non-Call Mode Option	AG 897 299
4448 CDMA2000 1xRTT Call Mode Option	AG 897 300
4449 EDGE Non-Call Mode Option	AG 897 301
4450 TD-SCDMA Non-Call Mode Option	AG 897 255
4451 TD-SCDMA Call Mode Option	AG 897 256
4452 1xEV-DO Non-Call Mode Option	AG 897 287
4453 1xEV-DO Call Mode Option	AG 897 288
4454 GPRS Non-Call Mode Option	AG 897 302
4455 HSDPA Call Mode Option	AG 897 304
4456 HSDPA Non-Call Mode Option	AG 897 303
4457 GSM Call Mode Option	AG 897 305
4458 GSM Non-Call Mode Option	AG 897 306
4460 GSM/GPRS/EDGE Hardware Option	AG 248 710
4462 GPRS Call Mode Option	AG 897 307
4463 GSM/GPRS System Option	AG 248 712
4464 CDMA2000 1xRTT Hardware Option	AG 248 711
4466 WCDMA/UMTS Non-Call Mode Option	AG 897 248
4467 WCDMA/UMTS Call Mode Option	AG 897 249
4468 EDGE Call Mode Option	AG 897 308
4479 Baseband Processing Hardware	AG 248 690
7312 Lector Enhanced	AG 897 310
7315 Scriptor	AG 897 311

General Options

4473 MS Power Supply Option	AG 248 355
4474 MS Current Measurement Option	AG 248 356

4477 OCXO	AG 214 028

GSM Options

1103 USIM and GSM Test SIM card	AG 860 164
1104 Test Micro USIM Card (3FF)	AG 860 147
4470 Audio Option	AG 248 360
4471 Basic Codec Option	AG 248 364
4472 Codec Extension Option	AG 897 156
4475 ACPM (ORFS) Option	AG 897 163
4481 AM Signal Generator Option	AG 897 165

CDMA Options

4470 Audio Option for CDMA-only units	AG 248 653

WCDMA Option

1103 USIM and GSM Test SIM card	AG 860 164
1104 Test Micro USIM Card (3FF)	AG 860 147

Accessories

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

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Our passion for performance is defined by three attributes represented by the icons pictured above: solution-minded, performance-driven and customer-focused.

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