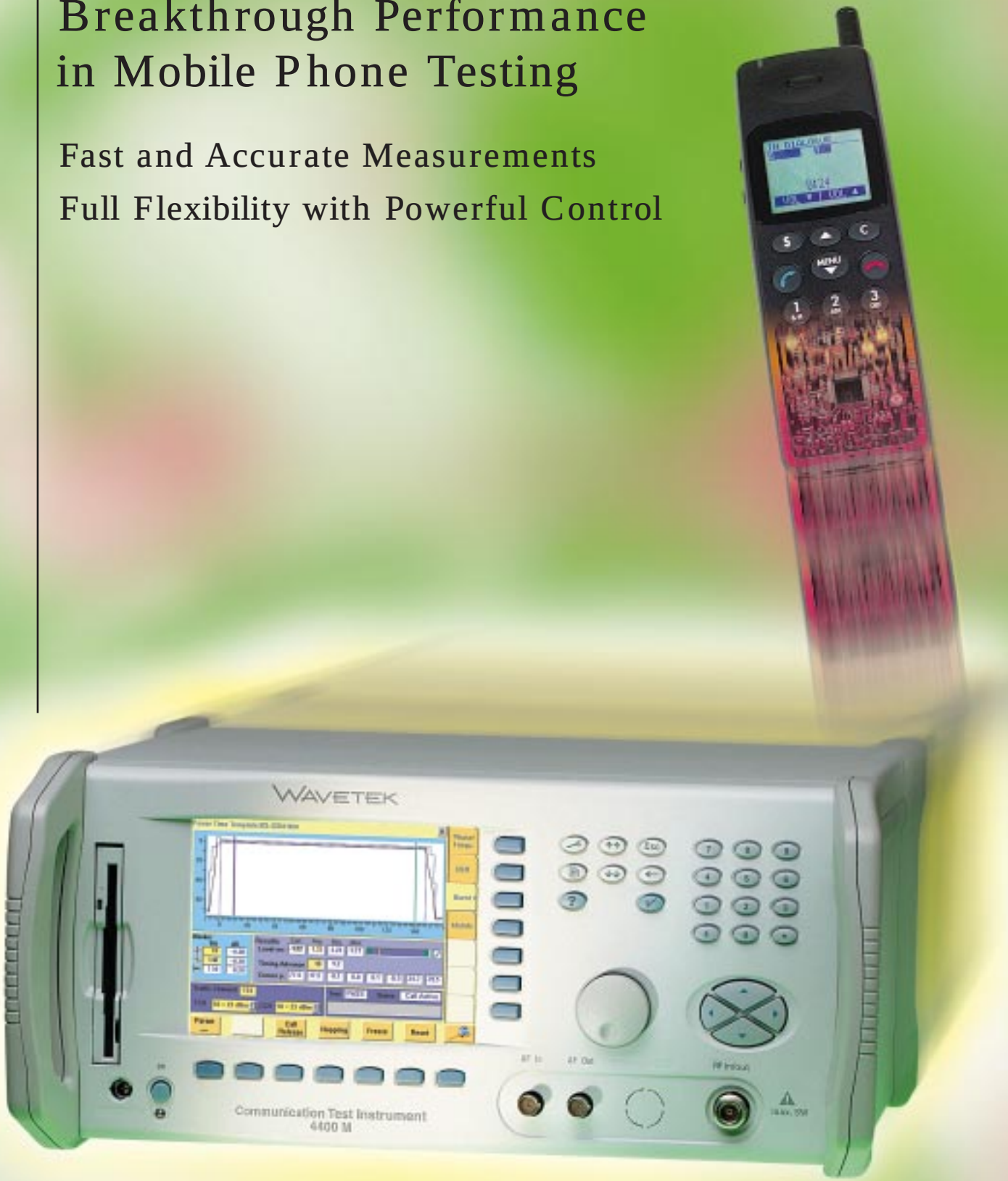
# Breakthrough Performance in Mobile Phone Testing

## Fast and Accurate Measurements

## Full Flexibility with Powerful Control



# The New Platform for Testing Digital Communications

***Breakthroughs in speed of test:***
*Transmitter quality and receiver BER simultaneously measured drastically reduces test time by up to 50%.*
*Using Frequency Hopping saves test time. Uniquely avoids normal channel assignment, reducing test time by eliminating extra signaling.*

***Fast Board Level Test:***
*The Fast Peak Power meter detects, measures and stores bursts 20 times per second.*
*The results can then be transferred together in one block, speeding the power alignment.*

***Breakthroughs in Accuracy:***
*Highest performance in power measurements with precision of ±0.6 dB absolute, ±0.03 dB repeatability, sets new standards.*
*Full 70 dB dynamic range with single RF connector ensures overall specification compliance.*

***Breakthroughs in Control:***
*Internal BASIC commands provide fully automatic test from scripts.*
*Internal editor allows easy program generation and debugging.*
*Controller function can drive GPIB power supplies or other equipment.*
*Industry standard SCPI commands simplify integration into existing production test systems*
*The internal hard disc provides program and results storage, and the PCMCIA ports are industry standard interfaces.*

Wavetek's new 4400 series of mobile phone testers provide multi-band and multi-format testing.

Performance barriers have been broken with the highest speed measurement techniques and accurate RF modules, built upon the latest high technology modular platform. For manufacturing applications the flexibility and unique controllability make it the ideal test instrument for:

- Board level alignment
- Functional/operational test
- Final check
- Quality control checks

**Investment Secured with Modular Design**

The first format supported is GSM at 900, 1800 and 1900 MHz.

The modular system makes the 4400 a secure long-term investment. New formats planned including cdmaOne, and as radio technologies mature for IMT 2000/ UMTS, new protocols and interfaces can easily be included.

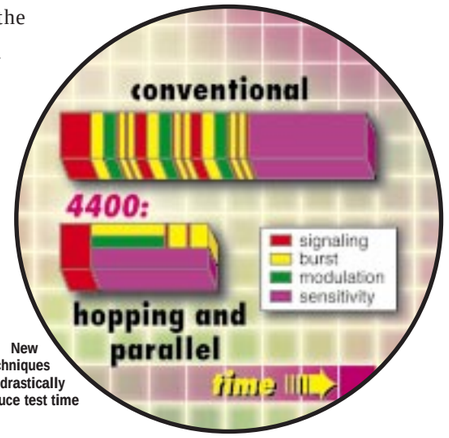
No strap-on units or complicated connection procedures are required, – new modules simply slide in and software upgrades are easily loaded via the floppy disc drive.

**The Best in High-Speed Measurement**

The 4400M employs innovative techniques to reduce test bottlenecks in manufacturing.

**Parallel Testing TX and RX Halve Test Time**

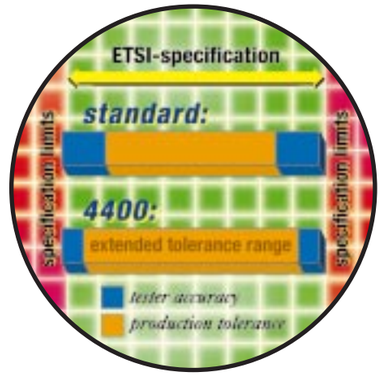
Simultaneous measurements of the receiver sensitivity (BER) and the transmitter signal quality (Power/ Time Template, phase/frequency error and ACPM), reduces test time dramatically, without reducing quality.



New techniques drastically reduce test time

**Hopping Increases Test Efficiency**

Using the frequency hopping capability inherent in GSM phones additionally reduces the mobile test time. Instead of separate tests for RX and TX being carried out sequentially on several channels across the bands, the 4400M checks the mobile phone in hopping mode and assigns the test results up to 5 individual frequencies. No signaling time is lost switching between channels.



High accuracy provides an extended tolerance range


Easy operation due to simple MMI-Interface and clearly layed out screen

**Fast Peak Power Measurements for Board Level Testing**

This unique Fast Peak Power Meter provides precise alignment values for the power staircase, saving time at board level test.

With the 4400M every burst is recognized, the level measured at 20 times per second and the results are stored together with the frame number. The collected data can be transferred back to the system controller in one block, reducing the alignment time.

**Precise RF measurement**

The 4400M sets new standards in mobile phone testing by providing an outstanding level accuracy of ±0.6 dB absolute accuracy and ±0.03 dB repeatability.

The power output and therefore the consumption of the mobile is optimized, so the battery talk time increases.

**Full Versatility**

The full 70 dB dynamic range is available from the low VSWR precision connector without the need for uncalibrated auxiliary ports for lower power levels.

All analyzer settings are decoupled from the generator settings so that signal analysis without the normally fixed 45 MHz offset is possible. Spurious signals, noise floor levels, 900 MHz band harmonics and other out of band signals can be measured.

**Easy Calibration**

Individually calibrated modules, traceable to national standards, can be easily exchanged providing a continuously calibrated system when installed in a test rack.

## Flexible Use with Universal Operation

Using industry standard SCPI commands, the 4400 can be operated by remote control. In master mode an internal GPIB controller function allows IEEE-driven power supplies or other equipment to be integrated into the test program.

**Automatic Test Routines Easily Generated**

To simplify control, automated test procedures RAPID!* programs can be created with the built-in editor and stored on the Wavetek 4400M hard disc. These scripts can be initiated via the GPIB. Results are collected in one block and transferred in the same format. This reduces traffic on the GPIB and allows the test system controller to independently carry out other tasks such as keyboard and display checks.

**Direct Control Using Colorful Screen**

Manual control is still critical for many applications such as:

– controlling and modifying test routines
– verifying test results to locate errors
– integrating new test cases
– integrating new mobiles.

The ergonomic design provides a comfortable environment for manual operation, allowing full concentration for faster results.

**PC Performance Inside**

Connection directly to a standard VGA monitor, PC keyboard or mouse, improves the comfort of working. The industry standard PCMCIA ports allow connection to LANs or other applications.

The 1.4 GB hard disc stores setups, results and RAPID! programs and a 3.5 inch floppy disc drive allows data exchange.

**Use Everywhere in Production**

The 4400M can be used everywhere on the production line, from board level test through functional test up to the final check. With its simple, ergonomic operation, it can also be used for quality control and repair.

Versatility and accuracy also make the 4400M a natural choice for Research and Development Teams involved in chip sets or complete phones.

**Family Includes Service Versions**

The 4400 series includes both manufacturing and service versions, with the 4400S targeted at high-level service and after-sales market for component repair and complete realignment applications.

Wavetek's family of precision instruments covers the complete range for GSM test from Go/NoGo through service and manufacturing up to R&D requirements.

**High precision measurements with traceable results.**

* RAPID!
**R**un **A**pplication **P**rograms with **I**ntegrated **D**evelopment!

## Fast, Flexible and Precise Measurements

Easy transfer of RAPID! programs

Average, max, min. and current values simplify alignment against specifications

On-line help is context sensitive and tracks with software versions


Hopping test across 5 channels reduces signaling time

Examine detailed measurements against standard or user-defined templates using zoom

Power measurements to ±0.6 dB accuracy allow wider production tolerances

# Key Functions

## RX Sensitivity Measurements

- **Bit Error Rate (BER)**

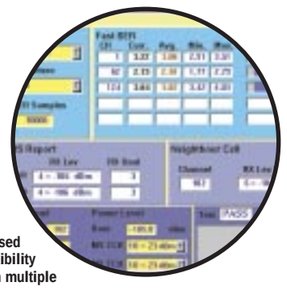
Comprehensive range of measurements are provided on speech bits˜ type Ia, Ib, II, CRC. Additionally the 4400M produces BER on data˜ with coding at different baud rates, 9600, 4800, 2400 bps.

- **Residual Bit Error Rate**

RBERsÄ are provided on type Ib, II bits, and the Frame Erasure Rate (FER).

- **New Fast BER˜,«**

Burst by burst results are also available for mobiles which can enable new (up to 5 times faster) type C loop.



Increased flexibility from multiple BER measurements

˜ The 4400M displays this measurement with actual, average, minimum and maximum values.

« In hopping mode (see above) the results of these measurements are available for each channel as well as an average value of up to 5 channels.

- **Information Screen**

Mobile parameters, are comprehensively shown, including support for A5 cyphering, dual-band, SMS and Power class.

Reported values of FULL and uniquely SUB values, including neighboring cell, are provided to gain a complete picture of mobile measurements.

## TX Quality Measurements

Phase errors˜ are available using two markers, movable by single bit, on a graphical display to give a clear picture of modulator performance over the burst. Uniquely displayed are max, min., average and current values for level, phase and frequency errors.

This aids alignment and the “max” values can help identify intermittent and out of tolerance mobiles.

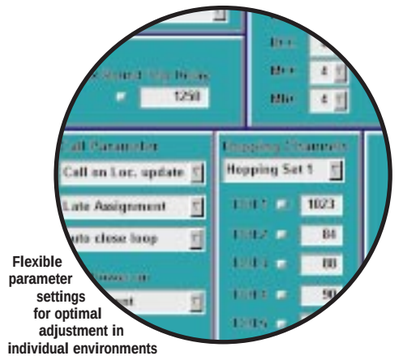
Separating frequency alignment from phase error problems due to modulator misalignment is easier with Phase Error Diagram˜,«, peak and rms phase values shown.

- **Burst Measurement**

The GSM burst is measured against the ETSI standard or user-defined Power/Time Template as an overview or zoom˜,«.

A user-defined mask can be generated with a bit by bit digital read out using markers« to check overshoot or out-of-slot problems.

Up to 8 user defined “corner points”« may also be used on the burst for tolerance tests as a pre-warning during manufacture.




Flexible parameter settings for optimal adjustment in individual environments

The Fast Peak Power« mode allows up to 20 readings per second to be measured and allocated to specific bursts. By ranging down, a complete power staircase can be measured in approximately 15 sec.

Timing advance error can be measured and reaction speed for mobile realignment can be checked.

- **Spectrum Due to Modulation and Switching Transients**

This critical set of tests are displayed« as a table or graphically, for all channels in the required area ±1.8 MHz from carrier against the ETSI or user definable templates.

## High Signaling Flexibility

Both Late or Early Assignment with the time slot, selected from 2 to 6 allowing mobiles which may have problems with a specific time slot to be evaluated. Channel selection is according to GSM 900, GSM 1800 and GSM 1900.

Signaling is provided for MS level, and the new BSP multi-frame to check the sleep mode and hence battery saving capability.

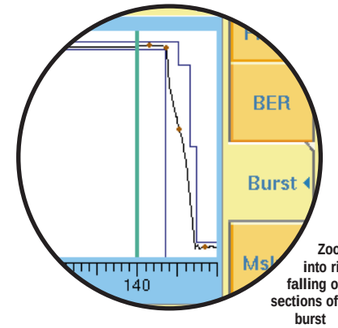
## Hopping over 5 Channels

The mobile can be checked at different power levels across the frequency band chosen without using channel change signaling. Two independent hop sets save time in multi-band phone tests. (this capability is available for all the measurements shown with« ).

## Versatile Signal Generator

The mobile is kept on TCH and the independent analyzer provides full measurement to avoid special test modes in the mobile.

Full range –120 to –10 dBm available avoiding uncalibrated auxiliary connectors.



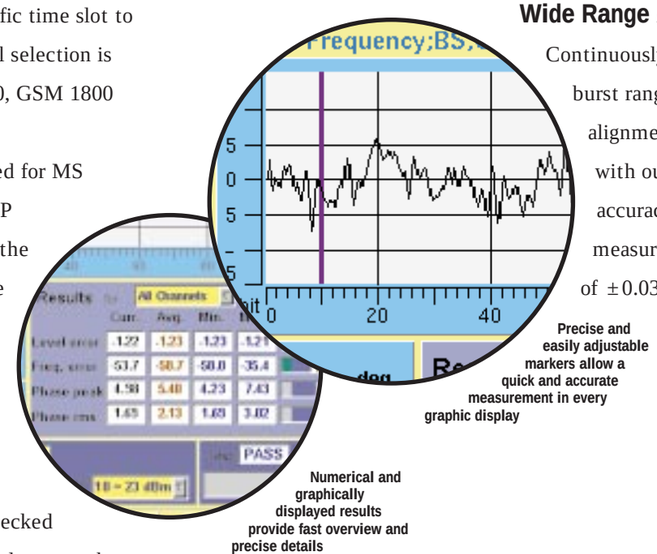

Zoom into rising, falling or flat sections of burst

- **Comprehensive Burst Mode**

Generates signals on BCCH, FCCH modulated with defined or random data; with or without modulation; with or without training sequences for debug, board test and I/Q modulator alignment.

## Wide Range Analyzer

Continuously available > 70 dB burst range provides complete alignment at high speed with outstanding power accuracy ±0.6 dB and measurement repeatability of ±0.03 dB.




Precise and easily adjustable markers allow a quick and accurate measurement in every graphic display

Numerical and graphically displayed results provide fast overview and precise details

## Summary Technical Data

For details please refer to Technical Data Sheets.

### u Basic RF Performance

| | |
|---|---|
| Frequency range | 800 to 1000 MHz,<br>1700 to 2000 MHz |
| Frequency resolution | 1 Hz |
| Frequency error | 0.05 ppm<br>0.5 ppm / year |
| Protocol | GSM 900, 1800, 1900<br>corresponding to ETSI<br>GSM 04.08 |
| VSWR | 1.1 : 1 *, 1.2 : 1 |

### u RX Measurements (RF Generator)

| | |
|---|---|
| Level range | –120 to –10 dBm |
| Level accuracy | ±1.0 dB<br>(–110 to –10 dBm) |
| Level resolution | 0.01 dB |
| BER range | 1000 to $10^6$ Bits |
| BER, RBER | 10 to $10^5$ Frames |
| FBER | 100 to $10^6$ Bursts |
| Phase error | < 2.5° rms, < 7.5° peak |

### u TX Measurements (RF Analyzer)

| | |
|---|---|
| Level range | –10 to +36 dBm |
| Level accuracy | ±0.6 dB * |
| Repetition accuracy | ±0.03 dB |
| Relative to peak level | ±0.2 dB at ±3 dBc<br>±0.5 dB at –10 dBc<br>±2 dB at –40 dBc<br>±5 dB at –70 dBc |
| Level resolution | 0.01 dB |
| Burst dynamic | > 70 dB |
| Phase error accuracy | < 0.8° rms, < 2.4° peak<br>from 1° to 15° rms |

## General Data

| | |
|---|---|
| H x W x T | 180 x 360 x 330 mm |
| Weight | 10.5 kg |
| Power supply | 94 to 132 VAC<br>187 to 264 VAC |
| Power consumption | 160 W |
| Operating temperature | +5 °C up to +45 °C |

* on RX Measurements < –32 dBm
and TX Measurements > 10 dBm

All technical data is still preliminary.

**Your nearest representative:**



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