

# Wireless

## 2935 & PhoneTest Radio Test Set Solution



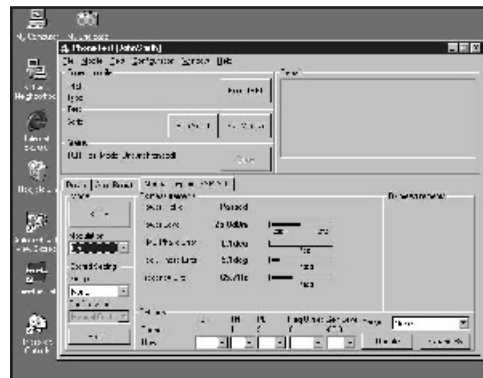
The most flexible GSM service solution for repair, alignment and test

- Economic tester for GSM and GPRS mobiles
- Multi-Band support for GSM 850, 900, 1800 and 1900
- Optional GPRS test mode
- Fast automatic tests for high throughput
- Optional High Speed test mode
- Simple Go/No Go user interface for unskilled pre-screen and final QA testing
- "Wizard" guidance to simplify test script generation
- Flexible store settings to accelerate mobile alignment
- Optional workshop management software to improve process efficiency
- AM suppression alignment using AM Modulator accessory

*IFR's PhoneTest and the 2935 have been developed to meet the ever-increasing demands of the mobile repair environment, where the essentials are speed, flexibility and low cost of ownership. These have been achieved through the innovative use of a PC control interface (PhoneTest) in conjunction with a radio test head (2935).*

The 2935 high speed test head provides all the radio signalling and protocol control required to carry out GSM and GPRS functional testing and radio measurements in accordance with the ETS 300 607-1 specification. It covers the full GSM 850, P-GSM, E-GSM, R-GSM, GSM 1800 and GSM 1900 frequency bands.

PhoneTest provides the user interface, whether it is to be used for simple Go/NoGo testing, or for detailed repair and alignment of mobiles. The software runs on standard PCs, under the familiar Windows 95, 98 and NT operating systems.



In addition to testing mobiles, when used with the Workshop Management option, PhoneTest provides a fully integrated, networked system, greatly improving workshop efficiency. The PhoneTest solution allows the storage and retrieval of test and repair information, generation of warranty claim forms, repair hints, management reporting and repair process tracking. It also provides interchange of data with existing core computer systems.

## PHONETEST AND THE 2935

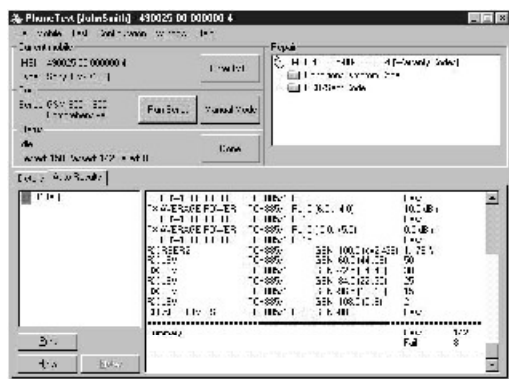
### GSM and GPRS measurements

The 2935 allows parametric measurements of the mobile's transmitter and receiver to be made on any traffic channel in each GSM band using either normal circuit switched or GPRS packet switched connection.

### Dual-band Handoff

The 2935 provides dual-band dynamic hand-off between GSM 900/1800, GSM 850/1900 and GSM 900/1900. In addition, the 2935 provides hand-off between different ARFCN's, timeslots and power levels within a band in both manual test mode or as part of an automated test sequence.

### Automatic testing



Fast automatic testing is achieved through the 2935's extensive use of DSP technology and its ability to perform transmitter and receiver measurements in parallel. Two automatic test modes are provided to match the needs of different user types, an advanced mode for trained repair technicians and a simple Go/No Go mode for use by unskilled operators. In the advanced mode the user has full access and control over all instrument settings and test script selection/generation. The use can also view measurement results as the sequence progresses. A more simplified user interface is provided in the Go/No Go mode, where only essential non-technical information is presented. The user merely has to initiate the test sequence and follow screen prompts making it ideal for deployment in front of store and workshop pre-screening areas. Both modes can be supervisor password protected to ensure testing is always conducted in a controlled manner.



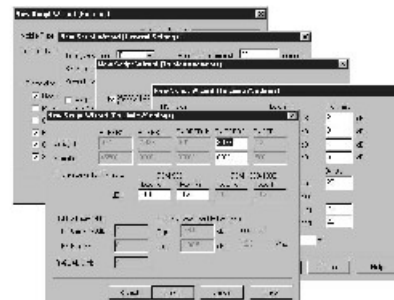
The running of test scripts in both conventional and Go/NoGo modes can be made up to 30 to 40% faster using the high speed test option,02.

### Customized test scripts

PhoneTest's Script Wizard quickly guides the user through the generation of a new test script. It allows selection of the GSM bands, power levels, traffic channels, transmitter and receiver tests required. Further assistance is provided through on-line error checking and on-line help. Test parameters for GSM and optional GPRS modes are independently defined to maximize test flexibility.

Scripts can be stored on the operator's PC, or on a networked drive. The latter ensures that all users access the same programs and most important, the same version.

Stored scripts can be tailored to fit exact needs using a simple text editor.



### Printing test results

When an automated test has been completed, the results can be sent to the user's local or networked printer. Printouts can show simply the pass/fail status of each test, or the full measured value and limits. Printouts can be customized with user information.

### Synchronous manual mode

Manual mode offers the user the ability to fully control all the mobile's parameters. This is an invaluable tool in fault verification, diagnosis and repair. It provides simple and effective protocol control, and a graphical display of transmitter and receiver measurements.

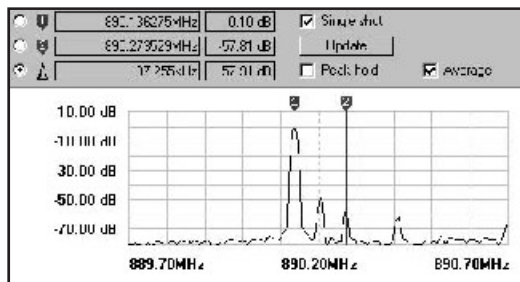
Transmit and receive measurements are displayed as numeric values and bar charts, with out-of-limit conditions clearly highlighted.

When testing automatically, the operator can be warned immediately upon a failure from which manual mode can be entered by a single key click.

### Unsynchronized manual mode

Unsynchronized manual mode is ideal for the alignment of mobiles. Used while under the control of manufacturers' proprietary control software instead of being in a live call, it provides the ability to measure the transmit power, frequency, and peak and RMS phase error, and display the associated traces.

A signal generator is provided, with an output of -40 dBm to -120 dBm. Frequency is specified by channel number, to which any frequency offset can be applied. The signal can be either a simple carrier or GMSK modulated.

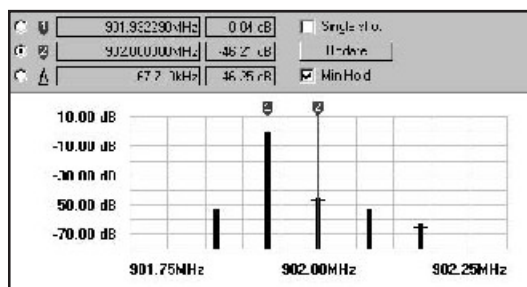


Traditionally, mobile alignment requires the operator to step through a process (defined by the manufacturer) where each step calls for the manual re-setting of the testset's signal generator, receiver and spectrum analyzer. PhoneTest has a unique stores facility that requires the process to be gone through just once for each mobile type, the settings at each step being saved on the system. The operator simply selects the mobile type in question and, on moving from step to step in the alignment process, picks the next setting from the store. The increased efficiency – through speed of use and reduction of errors – typically doubles the throughput in the alignment process.

### Graphical Displays

Within manual mode, the user can view measurements displayed graphically to aid fault diagnosis. Graphical displays are provided for the burst power profile (full burst, useful part or ramps), modulation phase error profile, channel spectrum and I/Q adjustment displays.

All displays are in color, have two independent markers (with delta-marker readout), and can be expanded to full screen. The in-channel spectrum and I/Q alignment display have peak and minimum hold facilities, respectively.



### GPRS Option

The 2935 can be factory fitted or software upgraded with a GPRS test option. This provides additional protocol and measurement capability sufficient to test GPRS terminals in packet data mode. GPRS mode testing includes the addition of receiver BLER (Block Error Rate) measurements for sensitivity. The GPRS option provides support of both GPRS test modes A and B thus enabling BLER and BER measurements to be performed where supported by the mobile. Receiver measurements can be performed using channel coding schemes CS1 or CS4 to permit more thorough examination of the receiver performance. Testing terminals in GPRS mode can lead to more simplified test sequences and so aid higher throughput.

### Language variants



PhoneTest is supplied with five language variants: English, French, German and Chinese - both traditional and simplified.

### Small footprint, more space

The 2935 test head is housed in a compact unit that easily sits between the monitor and body of a standard desktop PC, or can be concealed under (or above) the workbench. By using the PC's display and keyboard, the test head does not need to be regularly accessed, freeing-up valuable space in cluttered workshop environments.

Further improvements in productivity and cost savings can be obtained by controlling two or more 2935s, simultaneously, from a single PC. This is particularly appropriate when PhoneTest is being used in automatic test mode for pre-repair screening and post-repair QA testing where throughput demands are higher.

### AM Modulator accessory

For mobiles requiring AM suppression alignment, there is an add-on AM Modulator kit. This operates in two modes - Direct (or straight-through mode, allowing the unit to remain attached to the 2935 for normal operation) and AM (used when performing the AM suppression alignment).

### PC requirements

PhoneTest has been successfully verified using the following personal computer (PC) configurations -

Operating System: Microsoft Windows 95 (OSR 2), Windows 98, Windows 98 SE, Windows NT 4.0 (Service Pack 5), Windows 2000 Professional (Service Pack 1), Windows XP Professional. CPU: 166 MHz or minimum required by OS. Memory: 64 Mbytes Ram or minimum required by OS. I/O RS232 serial port, mouse, keyboard, VGA display. Storage: 20 Mbytes hard disk space for PhoneTest program storage, CD-ROM drive for PhoneTest software installation.

If the PC is to be networked (for the sharing of test scripts or for some of the workshop management facilities described below) then it will require an interface (such as Ethernet) appropriate to the user's network.

### Phonelib Instrument Driver

The Phonelib instrument driver provides a programming interface for customized Windows 95, 98 and NT applications. Phonelib includes a DLL interface for Visual C / BASIC programming and a

VXI Plug and Play driver for development environments such as National Instruments' LabWindows CVI and LabView.

## WORKSHOP MANAGEMENT OPTION

### Increase throughput and reduce costs

In addition to PhoneTest providing the user interface for automatic and manual control of the 2935, there is an optional software package that provides a host of additional facilities that:

- Streamline the whole repair process
- Reduce time-wasting and errors through repetitive data entry
- Ensure only good mobiles leave the workshop
- Provide traceability for audit purposes
- Provide workshop management reports
- Communicate with existing management systems (core databases) for automatic updating of job status, etc.

With the workshop management option, PhoneTest does not simply act as a user interface for the 2935. It integrates fully into the repair system, thus increasing throughput and reducing costs. The management option also provides the traceability tools being demanded by manufacturers and retailers when awarding repair contracts. Each feature is discussed below in more detail.

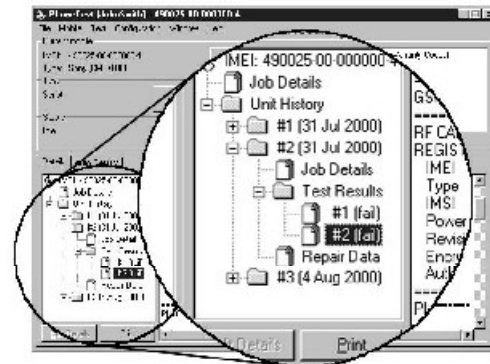
### Warranty claims

Most manufacturers require claims for warranty work to be presented on specific paperwork (or as a formatted text file), with each manufacturer needing different information in a different style. PhoneTest speeds the process by (a) retrieving the necessary customer-related data from the workshop's core database system, and (b) prompting the operator for any additional information (symptom and repair details, parts replaced, missing information relating to the customer, etc). When all the information has been gathered, PhoneTest automatically prints the warranty claim form in a style stipulated by the manufacturer.

Many workshops require their own records for non-warranty claims. Again, PhoneTest can be customized to gather the necessary information and print or store it as required.

### Traceability

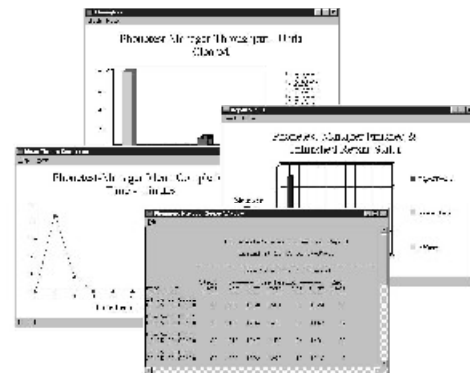
The full job details, test results, symptoms and repair actions taken on all the mobiles that the workshop handles can be logged from all PhoneTest stations to a central PhoneTest database. Then, whenever a mobile is re-identified (i.e. its IMEI is entered or the mobile is registered), the operator has access to its full previous history.



In addition to aiding the repair process, this facility is useful for QC spot checks, and for traceability of mobiles if they should ever return for further work.

### Reporting

Analysis facilities are provided, giving workshop management useful information on throughput, completion time, repair status, parts used and time taken to repair. Each report is available in three forms: color graphics, a text file or a file of comma-separated data. Graphical representation includes a choice of bar graphs, pie charts, line and area graphs. Data filters can be used e.g. date, technician ID, manufacturer, etc. to enhance the flexibility of report generation.



### Hints

Using the accumulated test and repair data stored within the workshop management option an inexperienced repairer can be given hints suggesting the most likely causes of the failure.

### Integration with core system databases

Where an existing core database is used to store customer details, then providing it is ODBC32 compliant, it can be interfaced directly with PhoneTest which can then read data from it, and if authorized, write data to it, e.g. updating job status information.

### Integration

The workshop management option typically involves networking the PhoneTest workstations to central computers (servers) within the user's organization. It can also involve a degree of customization. IFR can advise on ways this can be done to minimize disruption of normal working and, if required, IFR can provide on-site assistance with installation and commissioning, including end-user training.



## SPECIFICATION

### 2935 SPECIFICATION

Certain characteristics are shown as typical. These provide additional information for use in applying the instrument but they are unwarranted.

### DIGITAL SIGNAL GENERATOR

#### FREQUENCY

##### Range

GSM 850 Band 869 MHz to 894 MHz  
GSM 900 Band 921 MHz to 960 MHz  
GSM 1800 Band 1805 MHz to 1880 MHz  
GSM 1900 Band 1930 MHz to 1990 MHz

##### Accuracy

As frequency standard

#### OUTPUT LEVEL

##### Range

-120 dBm to -40 dBm

##### Resolution

0.1 dB

##### Accuracy

Better than  $\pm 1.5$  dB (Typically  $\pm 1$  dB) for generator levels  
< -52 dBm and typically better than  $\pm 1.5$  dB for generator levels  
> -52 dBm

#### OUTPUT IMPEDANCE

Nominally 50  $\Omega$

#### VSWR

Better than 1.3:1

#### REVERSE POWER PROTECTION

10 W max

#### SPECTRAL PURITY

##### Harmonics

Typically better than -20 dBc

##### RF Carrier Leakage

Less than 1.0  $\mu$ V PD generated at the carrier frequency across a 50  $\Omega$  load by a 2-turn 25 mm loop, 25 mm from the surface of the instrument with the output terminated in a 50  $\Omega$  sealed load

#### GMSK MODULATION - INTERNAL

GMSK, Bt 0.3

##### Phase Error

Typically < 1.2° RMS  
Typically < 4° Peak

### RF RECEIVER

#### FREQUENCY RANGE

GSM 850 Band 824 to 849 MHz  
GSM 900 Band 876 to 915 MHz  
GSM 1800 Band 1710 to 1785 MHz  
GSM 1900 Band 1850 to 1910 MHz

### FREQUENCY ERROR METER

##### Burst type

Normal/Access

##### Frequency Error Range

$\pm 5$  kHz

##### Resolution

0.5 Hz

##### Accuracy

As per frequency standard  $\pm 2$  Hz  $\pm$  resolution

### TDMA POWER METER

##### Dynamic Range

-15 dBm to +40 dBm (-40 dBm in TCH Test Mode)

##### VSWR

Better than 1.3:1

##### Power Reading

Average power over useful part of burst

##### Indication Units

dBm

##### Resolution

0.1 dB

##### Accuracy

For  $P_{in}$  -2 dBm: better than  $\pm 0.9$  dB and, between 18°C and 28°C,  
typically better than  $\pm 0.6$  dB

For  $P_{in}$  < -2 dBm: typically better than  $\pm 0.9$  dB

##### Input Power

10 W max

### GMSK MODULATION METER

##### Burst Type

Normal/Access

##### Phase Error Range

10° RMS

$\pm 30^\circ$  peak

##### Resolution

0.1°

##### Indication

2 digits and bargraph

##### Phase Error Accuracy

Better than 1° RMS  
Better than 4° peak

### BURST TIMING METER

##### Burst type

Normal/Access

##### Range

-128 to +127 bits

## Resolution

0.1 bits

## Timing Accuracy

$\pm 0.1$  bits

## BER METER

### Types

BER Class I  
BER Class II  
RBER Class Ib  
RBER Class II  
FER  
BLER (GPRS option)  
Range 0 to 99%  
Resolution 0.001%  
Adjustable sample size  
Duration and % settled indication

## TRACE DISPLAYS

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The following traces are available all with two marker operation

### POWER PROFILE

#### Range

50 dB (40 dB for Access Bursts)

#### Burst Type

Normal/Access

#### Display

Full Burst or Leading and Trailing ramp or  
Useful Part

### PHASE PROFILE

Range  $\pm 25^\circ$

## FREQUENCY STANDARD

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### Internal Frequency Standard

10 MHz

### Temperature Stability

Better than 5 in  $10^8$   $0^\circ\text{C}$  to  $50^\circ\text{C}$

### Ageing Rate

Better than 1 in  $10^7$  per year, after 1 month continuous use

### Warm Up Time

Less than 10 minutes to within 2 in  $10^7$

### External Frequency Standard Input

#### Frequency

1, 2, 5 or 10 MHz

#### Input Level

Greater than 1 V peak to peak

#### Input Impedance

Nominally 1 k $\Omega$

## SUPPORTED FEATURES

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### Controllable Parameters

BOCH ARFCN

TCH ARFCN; TCH TN  
BOC; MCC; MNC (2 & 3 Digit); LAC  
TSC; IMSI-DETACH  
Min Level for Access  
MS Power; MS Timing Advance  
Authentication Challenge  
Authentication Response  
RF Generator Level  
Measurement and Protocol Timeout Periods  
BER/RBER Measurement Samples  
Power, Frequency Error and Phase Error Measurement Samples; use of  
EFR Codec

### GPRS option additional Controllable Parameters

BOCH ARFCN  
PTCH ARFCN; PTCH TN;  
RAC; RA Color;  
BLER Measurement Samples  
Channels Coding Scheme CS1 AND CS4

### TX MEASUREMENTS

Power Level  
Power Profile  
RMS Phase Error  
Peak Phase Error  
Frequency Error  
Timing Advance

### RX MEASUREMENTS

BER I; BER II; BER Ib; RBER II; FER, RX LEV, RX QUAL & GPRS  
BLER/BER

### PROTOCOL FUNCTIONS

MS and BS Originated Call  
MS and BS Originated Clear Down  
MO SMS Messaging  
MT SMS Messaging (US ASCII Character Set)  
Registration  
Authentication  
De-registration  
Handoff  
Dual Band handoff; GPRS Attach; GPRS Test mode A and B activation

## RS-232 INTERFACE

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2 ports (one a test port)

### Baud Rate

2,400 to 38,400 (auto-ranging)

### Connector

9 way male "D" type

### POWER REQUIREMENTS

#### AC supply

#### Voltage

100 V to 240 V

#### Supply frequency

50 Hz to 60 Hz

#### Max AC Power

80 VA

### CALIBRATION INTERVAL

2 years

## ELECTROMAGNETIC COMPATIBILITY

Conforms with the protection requirements of the EEC Council Directive 89/336/EEC. Conforms with the limits specified in the following standards:

IEC/EN61326-1 : 1997, RF Emission Class B, Immunity Table 1, Performance Criteria B

## SAFETY

Conforms with the requirements of EEC Council Directive 73/23/EEC and the product safety standard IEC/EN 61010-1 : 2001 + C1 : 2002 for Class 1 portable equipment, for use in a Pollution Degree 2 environment. The instrument is designed to be operated from an Installation Category 2 supply.

## ENVIRONMENTAL

### Rated Range Of Use

15 to 35°C and up to 95% relative humidity at 35°C

### Storage and Transport

Temperature -40 to +70°C

### Altitude

Up to 2500 m (pressurized freight at 27 kPa differential)

## DIMENSIONS AND WEIGHT

Height	Width	Depth
120 mm	415 mm	400 mm

### Weight

Less than 7.5 kg (< 16.5 lb)

## 82521 AM MODULATOR SPECIFICATION



## DIRECT MODE

### Insertion loss

1.5 dB +/-0.2 dB at 957 MHz, 2.0 dB +/-0.2 dB at 1852 MHz

### Insertion loss (including supplied RF cable)

1.8 dB at 957 MHz, 2.3 dB at 1852 MHz

### Flatness

+/-0.1 dB 925 to 960 MHz, +/-0.25 dB 1805 to 1990 MHz

### VSWR

1.5:1 max

### Reverse power capacity

2 W

## AM MODE

### Max output power

-22 dBm at 957 MHz, -23 dBm at 1852 MHz

### Operational output power

-23 dBm at 957 MHz, -26 dBm at 1852 MHz

### AM depth

83% +/-5%

### AM distortion

15% max

### Typical RF gain

23.1 dB at 957 MHz, 23.8 dB at 1852 MHz

### Modulation frequency

1 kHz and 50 kHz, +/-10%

### Noise floor at 10 MHz offset in 200 kHz bandwidth

-90 dBm

### Reverse power capability

Phone not to transmit in AM mode

### Power requirement

12 V to 18 V DC, 100 mA max, from supplied AC adapter

### Environmental

18 to 35°C operating, RH up to 95% at 35°C

## VERSIONS AND ACCESSORIES

When ordering please quote the full ordering number information.

### Ordering Numbers

#### Versions

2935 GSM 850/900/1800/1900 Radio Test Solution including 2935 Test Head, PhoneTest Software and Getting Started Manual on CD

#### Supplied with:

Serial RS-232 Cable Assembly

Mains Supply Cord

Language variants: English, French, German and Chinese

Evaluation copy of 81500

Phonelib Instrument Driver software

#### Options

01 GPRS Test option factory fitted

02 High Speed test option

RTROPT01A/2935<sub>(1)</sub> GPRS Test option field upgrade

RTROPT01B/2935<sub>(2)</sub> GPRS Test option return to service upgrade (requires MODFTG01/2935 service option)

RTROPT2/2935 High Speed test option field upgrade

81500 PhoneTest Workshop Management Option

### Optional Accessories

82521 AM Modulator kit (Specify US, UK or European AC adapter)

54212/001 GSM Phase 2 Plug-In Test SIM

54212/002 GSM Phase 2 Full Size Test SIM

46884/650 Additional Serial Cable 9 way F to 9 way F

### Warranty

2935 and the 82521 are each supplied with a two year warranty.

### Notes

**Note 1** Requires instrument serial number 293503/xxx or instrument with MODFTG01/2935 RAM upgrade previously installed. Instrument serial number must be supplied with order. A credit may be requested for instruments that already have the MODFTG01/2935 RAM upgrade.

**Note 2** For instruments with serial number 293501/xxx or 293502/xxx and without MODFTG01/2935 previously installed.

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