Wireless

2967 GSM 900/1800/1900 Radio Test Set

High Performance GSM 900/1800/1900 and analog test solution with digital test incorporating Dual Band functionality. This product can be used in conjunction with PhoneTest software

- Supports GSM 900/1800/1900 (GSM) and Phase 2 GSM measurements
- Available with PhoneTest software suite
- Power and phase profile plots for normal and access bursts to aid diagnostics
- Full range of BER/RBER/FER measurements for receiver testing
- Dual band functionality
- Manual, GO/NO GO and fully programmable testing
- Supports AMPS, TACS, NMT and MPT 1327 trunking
- Full range of analog instrumentation

The 2967 Radio Test Set supports all the protocols required to perform measurements on GSM 900/1800/1900 MHz systems. In addition, it supports analog cellular standards TACS, AMPS, NMT and the world-wide trunking systems based on MPT 1327.

Based on ETSI GSM11.10 recommendations, the 2967 tests all the essential RF, audio and DC parameters quickly and easily in both Service and Production environments.

Unlike GSM only radio test sets, the 2967 includes a host of RF instrumentation and analog/digital facilities which are invaluable for performing diagnostics, radio alignment and parametric tests.

High-speed testing is ensured by use of pre-programmed test sequences, fully user configurable for depth of test, running on a multi-processor test platform. Further speed enhancements are obtained by performing simultaneous TX or RX measurements over a specified number of bursts using remote control commands.

GSM 900 Phase two testing is fully supported in the 2967.

Extensive GSM Functionality

The 2967 emulates a GSM 900/1800/1900 base station allowing mobiles to be tested in the same way that they operate on a real system without user knowledge of manufacturer specific test modes. Network simulation is especially useful when checking for configuration problems on mobiles. Transmitter tests measure power, peak and RMS phase error, frequency error and timing error, all as specified in GSM11.10. Graphical displays, with fast update rates, show power profile and phase profile against the relevant GSM masks, for both shortened and normal bursts, to aid radio alignment. Receiver testing covers all classes of BER, RBER and FER readings, and automatic sensitivity measurement is also provided.

New system features have been added to test additional terminal facilities, IMSI detach, Cell Barring and Minimum RF level for Access.

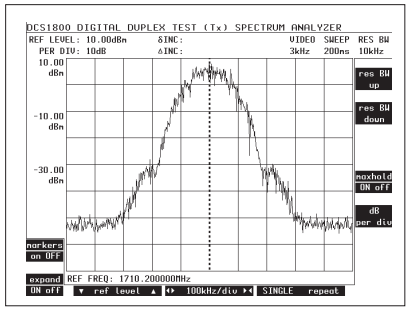
The 2967 covers the Phase 2 frequency plan (E-GSM) and supports the lower power levels (PL16-PL19).

Dual Band Functionality

Multi-band capability has been added to the test functions of the 2967, allowing full testing of multi-band mobiles in manual test, autorun and remote, including PhoneTest applications. Registration and calls to and from the mobile can be tested in the GSM 900 and 1800/1900 bands with handoff carried out from band to band.

Spectrum Analysis

The inbuilt RF spectrum analyzer allows fast, high resolution analysis of signals applied either directly to the RF ports or off-air via an antenna. It carries many features only usually found on stand-alone analyzers, such as full span, selectable resolution bandwidth filters and two steerable markers.



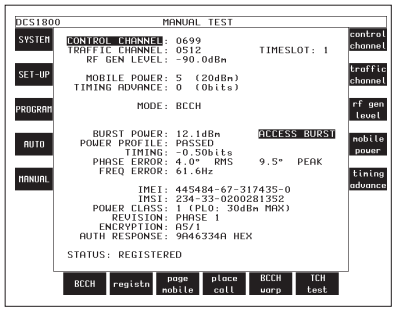
The tracking generator facility (with offset tracking) is provided for RF module characterization. With a useable frequency range of 100 kHz to 1 GHz and 1.3 GHz to 2.2 GHz, the spectrum analyzer supports IQ modulator alignment and the testing of internal local oscillators and IF systems. IQ alignment tests are recommended on most popular GSM terminals.

Advanced GSM Measurements

The 2967 performs advanced GSM measurements for detailed fault diagnosis in production and advanced service centre environments. For radios that refuse to register or go into conversation, the 2967's capability to analyze the access (RACH) bursts is invaluable. All transmitter measurements are automatically triggered on these bursts to help the user isolate problems.

An advanced Mobile Tuning Range Test Capability (Warping) is also available. With this facility (Option 22) the BCCH (Broadcast Control Channel) frequency and data rate can be varied in controlled steps, enabling mobiles with poor reference oscillators to be identified in Manual and Automatic modes of operation.

For complete versatility, the 2967 can be used to transmit or receive at any frequency within the 10 MHz to 1 GHz band, 1.709 to 1.991 GHz Rx and 1.709 to 1.991 GHz Tx frequencies and radios can be tested in test modes, without signaling and synchronization.



Display of Mobile Reports

The 2967 reports equipment and subscriber details during registration and call placement. The IMSI and IMEI are displayed, as are power-class, revision (Phase 1 or Phase 2), and encryption capability (A5/1 or A5/2), frequency and short message service capabilities.

The 2967 produces print outs at the touch of a key, providing the terminal information and test results in a concise form. 'Brief Test', for example, gives a three channel summary in a single page. The pass/fail count is given at the bottom of the page so good radios can be verified quickly and bad ones can be identified.

The 2967 print-outs also include the instrument serial number as well as time/date stamping, and can also be annotated with the Company name and User name for quality control. Printouts can be stored to a standard PCMCIA2 memory card.

Manual and Automatic Operation

The 2967 User Interface offers ready access to many sophisticated functions. The instrument extends the original test set interface established by the 2955 into the world of digital communications.

The large bright, high resolution screen and the 22 associated softkeys on the front panel have significant benefits in terms of user comfort, and hence efficiency in Manual test modes.

For automatic testing, the 2967 includes four built-in test programs ranging from simple call processing to comprehensive performance testing. These test programs are easy to configure – individual tests can be turned on and off, limits changed and averaging periods optimized. For complete flexibility, the 2967 can be programmed through MI-BASIC.

PhoneTest

The 2967 can be enhanced by using PhoneTest, which is a PC based solution running on Windows 95/98 or Windows NT, for GSM 900/1800/1900 testing. PhoneTest brings a new dimension to Radio Test Set applications by introducing more than just the ability to test digital cellular handsets. The PhoneTest suite of programs comprises four component parts, a control driver package, PhoneTest-Repair, PhoneTest-Manager and PhoneTest-Exchange, providing a complete service workshop logistics solution.

Proven Analog Cellular Testing

For analog cellular testing IFR is established as the de facto industry standard. The 2967 provides the fundamental measurements required (e.g. broadband power, FM deviation, SINAD) and a range of advanced diagnostic facilities, such as the unique 40 kHz FFT analyzer and 500 kHz oscilloscope.

TACS, AMPS and NMT come as options which support most country variants.

Test Program Generation Made Easy

The internal MI-BASIC controller allows users to write programs using the internal automatic test routines and the standard instrument functions and measurements. Conventional BASIC functions are supported such as mathematical operations, branching and looping.

Programs can be written using a standard PC text editor and downloaded, via RS-232, to the test set. The program then remains in the instrument even after switch off. A program loaded into the instrument can be copied onto a memory card and then transferred quickly and easily to another unit.

APPLICATIONS

Production

For the production environment the 2967 can be controlled fully over GPIB or RS-232. These interfaces come as standard. Versatility is paramount; all of the internal test sequences can be modified easily by the user – particular tests can be selected/deselected, parameters and limits can be adjusted to suit.

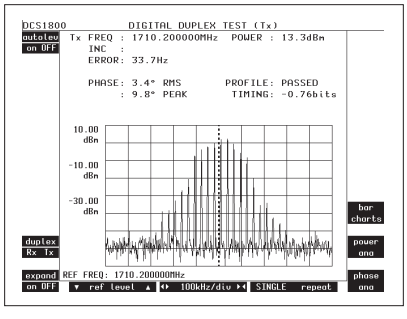
For GSM 900/1800/1900, commands are available to perform and read back the results of either all the TX tests or all the RX tests simultaneously giving a significant time saving.

For more involved testing the unit is fully programmable via the internal MI-BASIC interpreter, allowing the user to write custom test programs. Via this programming language the user has access to all of the internal tests and more: RS-232 read/write can be used to control a radio in test modes and read or write calibration data; four logic controls on the rear of the instrument can be used to drive mechanical actuators. Programs downloaded into the instrument can be copied onto the memory card then quickly and easily transferred to other units.

Alignment

Most modern cellular phones, whether analog or digital, contain few if any mechanical trimmers – most calibration, or 'phasing', is carried out electrically via the keypad or a local PC.

For calibration, the 2967 shows all of the fundamental measurements on the screen at the same time. Rapid update rates simplify alignment. Calibrating the radio for power, frequency and modulation accuracy is straight-forward using the instrument's bar charts and graphical displays.



MI-BASIC provides full access to the RS-232 port and all measurement functions, making the standard instrument suitable for closed-loop alignment applications.

Service

In the field, many faults are simple connector, antenna or battery problems. These can often be identified visually. To locate more complex faults, e.g. unable to register, those that result from component or solder joint failure, sophisticated test tools are required. The 2967 TCH mode allows phones to be tested in test modes. Under Manual mode the instrument behaves as a signal generator and, at the same time, a 'free-running' receiver. No synchronization between the uplink and downlink is required.

Standard features, not available on GSM specific test sets, such as the spectrum analyzer, oscilloscope, multimeter and the unique FFT audio analyzer aid rapid fault diagnosis.

Go/No Go Testing

Go/No Go testing is essential to maintain quality in production, distribution and service. In this application, test speed and ease-of-use are key; the 2967 delivers on both counts.

SPECIFICATION

GENERAL INFORMATION

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

(Applies to version 7.00 and above)

RF SIGNAL GENERATOR

DIGITAL SIGNAL GENERATOR

FREQUENCY

Range

800 MHz to 1 GHz

1709 MHz to 1991 MHz

Resolution

1 Hz to 1 GHz

2 Hz to 1991 MHz

Indication

10 digit display

Setting

Keyboard entry, delta increment/decrement function and rotary variable control

Accuracy

As frequency standard

OUTPUT LEVEL

Range

One-port Dx modes:

N-Type socket:	*–135 dBm to –45 dBm*
TNC socket:	*–135 dBm to –25 dBm*

Two-port Dx modes:

N-Type socket:	*–135 dBm to –35 dBm*
TNC socket:	*–135 dBm to –15 dBm*

Resolution

0.1 dB

Indication

4 digits plus sign (dBm, dB µV, µV, mV PD/EMF)

Accuracy

N-Type socket single port duplex

±1.5 dB

±1.0 dB over the temperature range 15 to 35°C

Sub Harmonics

1709 to 1991 MHz <-40 dBc

GMSK MODULATION – INTERNAL

Frequency Range

800 MHz to 1 GHz, useable to 1.15 GHz

1.805 to 1.88 GHz (GSM 1800)

1.930 to 1.99 GHz (GSM 1900)

Bt

0.3

Phase Error (in useful part of burst)

<1° RMS

<4° peak

BER METER

Types

BER Class I

BER Class II

RBER Class Ib

RBER Class II

FER

Range

0 to 99%

Resolution

0.001%

Indication

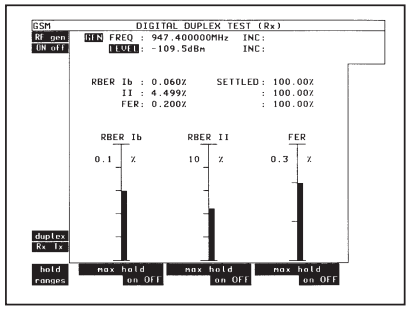
4 digits and bar chart with peak hold

Features

Adjustable Sample Size

Duration Indication

% Settled Indication



RF POWER METER (BURST)

Frequency Range

800 MHz to 1 GHz

1.709 GHz to 1.991 GHz

Dynamic Range

0 dBm to +47 dBm

Power Profile Dynamic Range

44 dB

Power Reading

Average power over useful part of burst

Burst Type

Normal/Access

Indication Units

dBm

Resolution

0.1 dB

Indication

3 digits and bar chart with peak hold

Power profile against GSM11.10 template

Normal/Access bursts

Full burst

Useful Part

Ramps

Accuracy

±0.6 dB for temperatures in the range 15 to 35°C

See also under Environmental/User Calibration

GMSK MODULATION

Frequency Range

800 MHz to 1 GHz

1709 MHz to 1991 MHz

Phase Error Range

10° RMS

±30° peak

Burst Type

Normal/Access

Resolution

0.1°

Indication

3 digits and bar chart with peak hold

Phase profile

Accuracy

Better than 0.3° RMS at 5°

Better than 4° peak

BURST TIMING METER

Burst Type

Normal/Access

Range

–128 to +127 bits

Resolution

0.01 bits

Indication

5 digits

Accuracy

±0.1 bits

GENERAL FEATURES (SYSTEMS)

Test Modes

Manual Test/Auto Test

Auto Test Programs

Call Processing Only
Call and RF Testing
Brief Testing
Comprehensive Testing
User Defined Test
Digital Parametric Auto Test Routines
Tx Timing
Tx Power Level
Tx Power Profile
Tx Frequency Error
Tx RMS Phase Error
Tx Peak Phase Error
Rx BER Class I
Rx BER Class II
Rx RBER Class Ib
Rx RBER Class II
Rx Frame Erasure
Rx Sensitivity
Rx RSSI Report
Dual band handoff

ANALOG SIGNAL GENERATOR

FREQUENCY

Range

100 kHz to 1 GHz, useable 90 kHz to 1.15 GHz

Resolution

1 Hz

Indication

10 digit display

Setting

Keyboard entry, delta increment/decrement function and rotary variable control

Accuracy

As frequency standard

OUTPUT LEVEL

Range

One-port Dx modes:

N-Type socket: –135 dBm to –40 dBm

TNC socket: –115 dBm to –20 dBm

Rx Test and two-port Dx modes:

N-Type socket: –135 dBm to –10 dBm (–20 dBm with AM)

TNC socket: –115 dBm to + 10 dBm (0 dBm with AM)

Resolution

0.1 dB

Indication

4 digits plus sign (dBm, dB μV, μV, mV PD/EMF)

Accuracy

N-Type socket:

±1.2 dB up to 575 MHz for levels above -120 dBm

±1.75 dB up to 1 GHz for levels above –120 dBm

±1.3 dB up to 1 GHz over the temperature range 15 to 35°C

Carrier On/Off

Keyboard operation, reduces signal generator output to less than –120 dBm

Reverse Power Protection

N-Type socket: With instrument switched on 150 W. Overload indicated by visual and audible warning.

TNC socket: Protection up to 10 W. Reset available on removal of RF power. Excess power indicated by visual and audible warnings.

Output Impedance

50 Ω nominal

VSWR

N-Type socket:

better than 1.2 up to 500 MHz;

better than 1.3 up to 1 GHz (typically 1.2),

better than 1.4 up to 1991 MHz (typically 1.3)

TNC socket: typically 1.3 at 900 MHz, typically <1.5 at 1991 MHz

SPECTRAL PURITY

Residual FM (CCITT weighted)

15 to 35°C

Less than 6 Hz RMS up to 575 MHz
Less than 12 Hz RMS up to 1 GHz
Less than 24 Hz RMS up to 1991 MHz

Residual AM (CCITT weighted)

Less than 0.05% RMS

Harmonics

Better than –30 dBc for levels up to +4 dBm (TNC)

Better than –30 dBc for levels up to –16 dBm (N-Type)

Spurious Signals

Better than –45 dBc for carrier frequencies from 100 kHz to 36 MHz;

Better than –50 dBc for carrier frequencies 36 MHz to 1 GHz.

SSB Phase Noise (20 kHz offset)

Better than –114 dBc/Hz up to 575 MHz

Better than –108 dBc/Hz up to 1 GHz.

Better than –102 dBc/Hz up to 1991 MHz

RF Carrier Leakage

Less than 0.5 μV PD generated at the carrier frequency, up to 1 GHz, across a 50 Ω load by a 2-turn 25 mm loop, 25 mm from the surface of the instrument with the output level at <-60 dBm and terminated in a 50 Ω sealed load.

Less than 1.0 μV PD generated at the carrier frequency, from 1 GHz to 2 GHz, across a 50 Ω load by a 2-turn 25 mm loop, 25 mm from the surface of the instrument with the output level at <-60 dBm and terminated in a 50 Ω sealed load.

AMPLITUDE MODULATION – INTERNAL

Frequency Range

100 kHz to 400 MHz, useable to 1.15 GHz

AM Depth Range

0 to 99%

Resolution

0.1%

Indication

3 digits

Setting

Keyboard entry, delta increment/decrement function and rotary variable control

Accuracy[1] (up to 85% AM)

±4% of setting ±1 digit for modulation frequency 1 kHz.

±6% of setting ±1 digit for modulation frequencies from 30 Hz to 10 kHz.

±8% of setting ±1 digit for modulation frequencies from 10 kHz to 20 kHz.

Distortion

Less than 1% at 1 kHz for modulation depths up to 30%, CCITT weighted.

Less than 2% for modulation frequencies from 100 Hz to 20 kHz and depths up to 85%.

Modulation Frequency

Range: 20 Hz to 15 kHz for carrier frequencies up to 36 MHz; 20 Hz to 20 kHz for carrier frequencies up to 400 MHz.

Resolution: 0.1 Hz below 10 kHz; 1 Hz below 20 kHz.

AMPLITUDE MODULATION – EXTERNAL

Input Impedance

Nominally 1 MΩ in parallel with 100 pF

Frequency Range

As internal AM

Modulation Frequency Range

As internal AM with AC or DC coupling

Accuracy

As internal ±2%

Input Sensitivity

1 VRMS for indicated modulation depth

FREQUENCY MODULATION – INTERNAL

Frequency Range

100 kHz to 1 GHz, useable 90 kHz to 1.15 GHz

Indication

4 digits

Setting

Keyboard entry, delta increment/decrement function and rotary variable control

Accuracy [1]

±3% ±1 digit at 1 kHz over the range 15 to 35°C (0.1% per °C outside this range)

Typically ±3% ±1 digit for modulation frequencies from 20 Hz to 5 kHz.

Typically ±7% ±1 digit for modulation frequencies from 5 kHz to 20 kHz.

Typically ±10% ±1 digit for modulation frequencies from 20 kHz to 75 kHz.

Distortion[1]

Less than 0.5% for modulation frequencies from 250 Hz to 5 kHz (for deviation 1 kHz to 800 kHz).

Less than 1% for modulation frequencies from 50 Hz to 20 kHz (for deviation 1 kHz to 800 kHz).

Modulation Frequency Range[6]

20 Hz to 20 kHz Mod generators 1, 2, 3 or

20 Hz to 100 kHz Mod generator 4

Resolution

0.1 Hz

FREQUENCY MODULATION – EXTERNAL

Input Impedance

Nominally 1 MΩ in parallel with 100 pF

Frequency Range

As internal FM

Modulation Frequency Range

DC to 100 kHz (DC coupled)

10 Hz to 100 kHz (AC coupled)

Input Sensitivity

2.828 V pk-pk for indicated deviation

Accuracy

As internal ±2% for frequencies up to 20 kHz

PHASE MODULATION – INTERNAL

Frequency Range

100 kHz to 1 GHz, useable to 1.15 GHz

Indication

4 digits

Setting

Keyboard entry, delta increment/decrement function and rotary variable control

Accuracy

±5% ±1 digit for modulation frequencies from 250 Hz to 3.4 kHz, over the range 15 to 35°C (0.1% per °C outside this range)

Distortion[1]

Less than 1% for modulation frequencies from 250 Hz to 5 kHz (for deviation 1 rad to 160 rads).

Modulation Frequency

Range: 250 Hz to 5 kHz

Resolution

0.1 Hz

PHASE MODULATION – EXTERNAL

Input Impedance

Nominally 1 MΩ in parallel with 100 pF

Frequency Range

As internal phase modulation

Modulation Frequency Range

250 Hz to 5 kHz

Input Sensitivity

2.828 V pk-pk for indicated deviation

Accuracy

As internal ±2%

INTERNAL MODULATION AND AUDIO SOURCES

Up to 6 tone sources can be assigned as 3 modulation generators and 3 audio tone generators.

Modulation Modes

Internal generators may be assigned to AM, FM, ΦM.

AUDIO VOLTMETER

Input Impedance

Nominally 1 MΩ in parallel with 100 pF

Frequency Range

DC and 20 Hz to 500 kHz

AC only 20 Hz to 500 kHz

Polarized DC less than 10 Hz

Level Ranges and Resolution

0-10, 0-30, 0-100 mV,	*resolution 0.1 mV*
0-300 mV,	*resolution 0.3 mV*
0-1 V	*resolution 1 mV*
0-3 V	*resolution 3 mV*
0-10 V	*resolution 10 mV*
0-30 V	*resolution 30 mV*

All RMS reading, autoranging or fixed

Level Indication

4 digits and barchart with peak hold

Level Accuracy (DC Coupled) [3] [5]

+2% of reading +1 mV + resolution, DC and 100 Hz to 20 kHz.

+4% of reading +1 mV + resolution, 40 Hz to 100 kHz.

Level Accuracy (AC Coupled) [3]

±2% of reading ±1 mV, ± resolution 150 Hz to 20 kHz.

±4% of reading ±1 mV, ± resolution 100 Hz to 100 kHz.

Residual Noise

100 μV RMS CCITT weighted

AUDIO FREQUENCY METER

Range

10 Hz to 500 kHz

Resolution

0.1 Hz from 10 Hz to 5 kHz

1 Hz from 5 kHz to 50 kHz

10 Hz from 50 kHz to 500 kHz

Indication

6 digits

Accuracy

As frequency standard ±1 digit ± resolution

Sensitivity

On barchart greater than 25% FSD (DC coupled)

AUDIO SINAD METER

Frequency

1 kHz default. User selectable up to 20 kHz

SINAD Range

5 to 50 dB

Resolution

0.1 dB for readings less than 20 dB
0.2 dB for readings less than 25 dB

Indication

3 digits and barchart with peak hold

Accuracy (Bandpass filter selected)

±0.5 dB ± resolution

Sensitivity

100 mV for 46 dB SINAD

AUDIO DISTORTION METER

Frequency

1 kHz default. User selectable up to 20 kHz

Distortion Range

0 to 30%

Resolution

0.1% distortion for readings greater than 1%
0.2% distortion for readings less than 1%

Indication

3 digits and bar chart with peak hold

Accuracy

±5% of reading ± resolution (bandpass filter selected)

Sensitivity

100 mV for 0.5% distortion

AUDIO S/N METER

S/N Range

0 to 100 dB

Resolution

0.1 dB for readings less than 50 dB
0.2 dB for readings less than 70 dB

Indication

3 digits and bar chart with peak hold

Accuracy

±0.5 dB ± resolution

Sensitivity

2 V for 60 dB, 200 mV for 40 dB

AUDIO OSCILLOSCOPE

Operating Modes

Single or Repetitive sweep

Frequency Range

DC to 500 kHz

10 Hz to 500 kHz (AC coupled)

Glitch Catching

1 µs minimum

Voltage Ranges

2 mV/div to 20 V/div in a 1, 2, 5 sequence

Voltage Accuracy

±5% of full scale

Timebase

5 µs/div to 10 s/div in a 1, 2, 5 sequence

Timebase Accuracy

As frequency standard

Trigger Mode

Auto trigger

Marker Indication

Level: M1, M2, δM

Time: M1, M2, ΔM

Graticule

10 Horizontal by 8 Vertical divisions, can be magnified to full screen

AUDIO FFT ANALYZER

Span Widths

50 Hz to 50 kHz in a 5, 10, 25 sequence

Above 40 kHz signals are attenuated by 80 dB/octave

Graticule

10 Horizontal by 8 Vertical divisions, can be magnified to full screen

Level Reference (top of screen)

10 mV to 20 V, in a 1, 2, 5 sequence

Level Accuracy

±0.3 dB 100 Hz to 15 kHz; typically ±1 dB 40 Hz to 40 kHz

Vertical Scaling

1, 2, 5, 10 dB/div

Dynamic Range

60 dB

Max hold facility

Audio Sweep facility

DC to 20 kHz

Marker Indication

Level: M1, M2, δM

Frequency: M1, M2, ΔM

AUDIO BAR CHARTS

Displays: AF voltage, SINAD, Distortion, S/N.

Vertical Resolution: 1% of full scale.

Ranging: Autoranging, range hold or manual selection (up/down), 1, 3, 10 sequence with hysteresis.

With peak hold facility.

AUDIO AND MODULATION FILTERS

300 Hz Lowpass (±0.1 dB less than 150 Hz, ±0.2 dB, 150-200 Hz relative to 100 Hz).

300 Hz to 3.4 kHz Bandpass (±0.4 dB, 400 to 2100 Hz relative to 1 kHz).

5 kHz Lowpass (±0.3 dB at <3 kHz relative to 1 kHz).

20 kHz Lowpass ±0.3 dB at <12 kHz, typically –0.9 dB at <15 kHz and –3 dB at 20 kHz relative to 1 kHz.

CCITT Psophometric

C-MESSAGE

See also under Environmental/User Calibration

MULTIMETER

Input Terminals

3 x 4 mm, 'Volt/Ohm', 'Current' and 'Common'

Maximum Input Voltage

300 V (CAT II) with respect to instrument chassis

Accuracy specifications apply with a maximum common mode voltage of 25 V

VOLTMETER

Voltage Range

0 to 300 V, 0 to 30 V, 0 to 3 V, 0 to 300 mV, Terminals, 'Volt/Ohm' and 'Common', maximum crest factor 3:1 at range full scale

Frequency Range

Polarized DC or 40 Hz to 1 kHz

Input Impedance

Nominally 6 MΩ in parallel with 100 pF

Resolution

0.1% of FSD

Accuracy [5]

DC: ±3% of reading ±2 mV ±1 digit

AC + DC: ±3% of reading ±3 mV ± 1 digit

See also under Environmental/User Calibration

Indication

3 digits and bar chart with peak hold

AMMETER

Current Range

0 to 1 A and 0 to 10 A

Frequency Range

Polarized DC or 40 Hz to 1 kHz

Resolution

1 mA below 1 A; 10 mA below 10 A

Accuracy

DC: ±5% of reading ±50 mA ±1 digit

AC + DC: ±5% of reading ±150 mA ±1 digit

Indication

3 digits and bar chart with peak hold

RESISTANCE METER

Resistance Ranges

100 Ω, 1 kΩ, 10 kΩ, 100 kΩ, 1 MΩ

Resolution

1 Ω below 1 kΩ or 3 digits

Accuracy[5]

±5% of reading ±1 Ω ±1 digit

Continuity Test

Continuous tone if reading is less than 10 Ω

Indication

4 digits and bar chart with peak hold

RF FREQUENCY ERROR METER

Frequency Range

800 MHz to 1 GHz

1.709 GHz to 1.991 GHz

Frequency Error Range

±5 kHz

Burst Type

Normal/Access

Resolution

0.1 Hz.

Indication

3 digits and bar chart with peak hold

Accuracy

±30 Hz

RF FREQUENCY METER

Range

100 kHz to 1 GHz

Resolution

1 Hz or 10 Hz selectable

Indication

Up to 10 digits

Accuracy

As Frequency Standard ±2 Hz ± resolution

Dynamic Range (Auto tuned)

As RF Power Meter (broadband)

Frequency Range (Auto tuned)

10 MHz to 999.9 MHz

Sensitivity

Manual tuned: –100 dBm (TNC) dependent on receiver bandwidth in off air test mode

Offset Frequency Range

±1 MHz dependent on receiver bandwidth

RF POWER METER (BROADBAND)

Frequency Range

100 kHz to 1 GHz

Dynamic Range (Auto tuned)

10 mW to 150 W (N-Type), 100 μW to 0.5 W (TNC)

Power Reading

True mean power

Indication Units

Watts

Resolution

Better than 1%

Indication

3 digits and barchart with peak hold

Accuracy[5]

100 kHz to 500 MHz:

±7.5% (0.3 dB), 0.1 W to 50 W (N-Type)
±10% (0.4 dB), 20 mW to 150 W (N-Type)
±12% (0.5 dB), 200 μW to 50 mW (TNC)

500 MHz to 1 GHz:

±12% (0.5 dB), 20 mW to 150 W (N-Type)
±15% (0.6 dB), 200 μW to 50 mW (TNC)

100 kHz to 1 GHz:

±7.5% (0.3 dB), 0.1 W to 50 W (N-Type)
±10% (0.4 dB) 1 mW to 50 mW (TNC)

For ambient temperatures in the range 15 to 35°C.

See also under Environmental/User Calibration

Maximum Safe Continuous Rating

N-Type: 50 W

TNC: 0.5 W; overload protected to 10 W

Intermittent Rating

N-Type: 150 W for limited periods, typically 2 minutes at 20°C. Typical off to on ratio is 6:1. Overload indicated by audible and visual warning

RF POWER METER (SELECTIVE)

Frequency Range

100 kHz to 1 GHz

IF Bandwidth

300 Hz to 30 kHz in a 1, 3, 10 sequence and 110 kHz, 280 kHz and 3 MHz

Dynamic Range (Manually tune)

0 dBm to +50 dBm (110 kHz IF bandwidth) (N-Type)

–90 dBm to +20 dBm (110 kHz IF bandwidth) (TNC)

Power Reading

Average

Indication Units

dBm

Resolution

0.1 dB

Indication

3 digits + barchart with peak hold

Accuracy[5]

Typically ±2.5 dB N-Type and TNC

See also under Environmental/User Calibration

RF SPECTRUM ANALYZER

Frequency

Range: 100 kHz to 1 GHz, useable from 30 kHz to 1.05 GHz

1.71 GHz to 1.991 GHz, useable from 1.3 GHz to 2.2 GHz

Spans

500 Hz/div to 100 MHz/div, in a 1, 2, 5 sequence up to 1 GHz

1 MHz/div max, 1.7 GHz to 1.99 GHz

50 kHz/div max 1.3 GHz to 2.2 GHz

Resolution Bandwidth

300 Hz to 300 kHz in a 1, 3, 10 sequence and 3 MHz (automatically selected according to span and manually selectable).

Video bandwidth, auto selection 100 Hz, 1 kHz and 3 kHz.

Filter Shape

Nominally 3 dB/60 dB, 1:11 (300 Hz to 30 kHz bandwidth)

Reference Level (top of screen)

–100 dBm to +70 dBm

On Screen Dynamic Range

80 dB

Vertical Resolution

0.5 dB on 10 dB/div, 0.05 dB on 1 dB/div

Level Accuracy[5]

Typically ±2.5 dB

See also under Environmental/User Calibration

Sweep Speeds

Optimum sweep speed selected according to span and resolution bandwidth

Modes

Single sweep and continuous

Graticule

10 horizontal by 8 vertical divisions

Expanded Mode

Can be made to occupy full screen for high definition

Markers

M1 and M2

Indication

Level: M1, M2, δM

Frequency: M1, M2, ΔM

TRACKING GENERATOR

Available in RF TEST mode

Frequency Range

100 kHz to 1 GHz

Level Range

–135 dBm to +10 dBm

Offset Tracking

Allows testing of mixers, IFs, fundamental and 2nd harmonic analysis (up, down, x2, ÷2)

MODULATION ANALYZER

Dynamic Range (Auto tuned)

As RF Power Meter (Broadband)

Sensitivity (Manual tuned)

N-Type –30 dBm (110 kHz IF bandwidth).

TNC –50 dBm (110 kHz IF bandwidth).

TNC (off-air test mode) –101 dBm (2 μV 10 dB SINAD in 30 kHz IF bandwidth and CCITT weighting).

Demodulation

Accuracy maintained on signals greater than –60 dBm

Receiver Bandwidths

300 Hz to 30 kHz in a 1, 3, 10 sequence and 110 kHz, 280 kHz and 3 MHz.

Demodulation Filters

As audio analyzer plus 5 kHz lowpass (±0.3 dB at less than 3.4 kHz relative to 1 kHz)

Audio Output

Available in to an internal loudspeaker, demodulated output or accessory socket for external loudspeaker or headphones.

Demodulated Output

Nominal output impedance less than 10 Ω. Output voltage is range dependent (2 V peak at top of range)

Switching Speed

Nominally less than 1 ms channel to channel up to 50 MHz apart, settling to within 1 kHz of final frequency

Squelch

A manual squelch control is provided with a variable threshold.

AMPLITUDE MODULATION

Frequency Range

100 kHz to 1 GHz

Modulation Frequency Range

20 Hz to 20 kHz

AM Depth Range

0 to 99.9%

Resolution

0.1% AM

Indication

3 digits and bar chart with peak hold.

Accuracy (up to 85% AM)[1][5]

±3% of reading, ±1% AM, 250 Hz to 5 kHz.

Typically ±5% of reading, ±1% AM, 50 Hz to 15 kHz.

Demodulation Distortion[1]

Less than 1% at 1 kHz, CCITT weighted

Residual AM

Less than 0.1% AM, CCITT weighted

FREQUENCY MODULATION

Frequency Range

1 MHz to 1 GHz

Modulation Frequency Range

20 Hz to 20 kHz

20 Hz to 100 kHz when Option 08 fitted

Deviation Range

0 to 100 kHz

Resolution

10 Hz below 10 kHz deviation; 100 Hz below 100 kHz deviation

Indication

3 digits and bar chart with peak hold.

Accuracy[1] [3] [5]

±3% ± resolution for modulation frequency of 1 kHz.

±5% ± resolution for modulation frequencies from 100 Hz to 15 kHz.

±10% ± resolution for modulation frequency 15 kHz to 100 kHz opt 08 only.

Demodulation Distortion[1]

Less than 0.5% at 1 kHz, CCITT weighted.

Residual FM

Less than 25 Hz RMS CCITT weighted.

PHASE MODULATION

Frequency Range

1 MHz to 1 GHz

Modulation Frequency Range

250 Hz to 5 kHz

Deviation Range

0 to 20 rads

Resolution

0.01 rads

Indication

3 digits and bar chart with peak hold.

Accuracy[1] [3] [5]

±5% ± resolution, 2 to 20 rads

Demodulation Distortion[1]

Less than 0.5% at 1 kHz, CCITT weighted.

AUDIO GENERATORS

See section on modulation generators for interaction of audio and modulation generators

FREQUENCY

Range[6]

1 Hz to 20 kHz AF Gens 1, 2 and 3 or

1 Hz to 100 kHz AF Gen 4

Setting

Keyboard entry, delta increment/decrement function and rotary control.

Indication

6 digits

Resolution

0.1 Hz

Accuracy

As frequency standard

LEVEL

Range

0.1 mV to 5 V RMS (maximum AF output 7 V peak, all generators combined)

Setting

Keyboard entry, delta increment/decrement function and rotary control

Indication

4 digits

Resolution

0.1 mV

Accuracy

±3% ±1 digit, 250 Hz to 5 kHz

±5% ±1 digit, 10 Hz to 20 kHz

±10% ±1 digit, 20 kHz to 75 kHz

Output Impedance

Nominally 5 Ω

Protection

Maximum applied voltage 50 V

SIGNAL PURITY

Distortion[2]

Less than 0.5% at 1 kHz measured in a 30 kHz bandwidth

Less than 1% from 20 Hz to 20 kHz measured in an 80 kHz bandwidth

Typically 0.1% for levels greater than 100 mV

Residual Noise

Less than 50 µV RMS (CCITT weighted)

DC Offset

Less than 10 mV

SIGNALING ENCODER/DECODER

Sequential tones functions

Encodes and decodes up to 40 tones.

CCIR, ZVEI, DZVEI, EEA, EIA or user defined.

Any of the tones may be extended.

Continuous, burst and single step modes available.

User defined tones

Up to three frequency plans may be defined and stored within the 2967 for sequential tones.

Any of the standard tone frequency plans may be copied to user defined and modified.

Tone length 10 ms to 1 s.

Extended tone length 100 ms to 10 s.

CTCSS tones mode

Standard tone frequencies may be selected from a menu

DTMF Encoder/Decode

Generation and decode of DTMF tones, displaying Hi/Lo frequencies, frequency error, timing information and twist

DCS Encode/Decode

Generation and decoding of digitally coded squelch

POCSAG generator

Generation of POCSAG code CCIR No.1

Rec 584. Bit rates from 400 to 9600 bit/s

AUDIO MONITOR

Audio and demodulation signals may be monitored via the internal loudspeaker or via the accessory socket output or BNC socket on the rear panel.

SSB OPTION

SSB Tx

Frequency, range and meter accuracy	*– as RF frequency*
Power, level and accuracy	*– as Broadband power meter*
Detection Range	*– 100 µV to 150 W*
AF Demod range	*– 10 Hz to 5 kHz*
Demod distortion	*– <2% @ 1 kHz CCITT weighted*
Carrier and Alternate s/band suppression	*– Better than –50 dBc*
Sideband/CW Analyzer	*– max 5 kHz full span frequency range*
Spectrum Analyzer	*– as RF spectrum analyzer*
Audio Generator	*– two – as audio generator*
Sideband Selection	*– LSB, USB, CW*

SSB Rx

Sideband Generator	*– as RF Gen (AM mode)*
Offset measurement	*– to 0.1 Hz resolution*
SINAD	*– as SINAD meter*
Distortion	*– as Distortion meter*

Note: No audio is available in SSB option.

GENERAL FEATURES

INTERFACES

Keyboard and Display

Logical color coded keyboard with bright high resolution CRT

GPIB

Full control of all major instrument functions via the GPIB interface.

Flexibility is further enhanced by IFR Ltd's implementation of IEEE-488.2.

Capability

Complies with the following subsets as defined in IEEE-488.1-1978:- SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT1, C1, E1.

Serial

Serial interface is provided for connection of RS-232 for instrument remote control. 9 Way socket.

Parallel

Connector 25 way female D-Type. Provision made for graphics screen dump. A selection of printer drivers are included.

Accessory Socket

Allows the connection of various optional accessories.

With suitable adapters is compatible with most 2955 series accessories.

Memory Card

Meets PCMCIA2/JEIDA – 4 standard. The memory card facility allows the storage of results, set ups and MI-BASIC programs.

Video Output

Color, compatible with most VGA monitors.

15 way Sub Miniature D Type.

FREQUENCY STANDARD

Internal Frequency Standard Output

Frequencies

10 MHz and 13 MHz

Level

Nominally 2 V pk-pk

Output Impedance

Nominally 50 Ω

Temperature Stability

Better than 5 in 10^8, 5 to 50°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 at 20°C

External Frequency Standard Input

Frequencies

1, 2, 5, 10 and 13 MHz

Level

Greater than 2 V pk-pk, less than 5 Vpk-pk

Input Impedance

Nominally 100 Ω

POWER REQUIREMENTS

AC supply

Voltage

100 - 240 V~ (Limit 88 - 264 V~)

Supply frequency

50 - 60 Hz (Limit 45 - 66 Hz)

Power

Nominally 135 W, 260 W maximum, for future options

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 (as amended) and the product safety standard IEC / EN 61010-1 : 2001 + C1 : 2002 + C2 : 2003 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

0 to 50°C and up to 95% relative humidity at 40°C.

User Calibration

User calibrations are provided to maintain high accuracy for any ambient temperature (e.g. in ATE racks or in field measurements). Having allowed the instrument to stabilize, running the user calibrations optimizes the performance at that temperature.

A change in temperature of 5°C from the calibration temperature affects readings as below. These figures are provided as a guide to typical performance. Typical variations are as follows for a 5°C change in temperature.

Power Meter:	*Burst*	*0.5 dB*
	Broadband	*2%*
	Selective	*0.5 dB*
Spectrum Analyzer Level		*0.5 dB*
Audio Analyzer & Modulation Filters		
	Audio Voltage	*0.4%*
	Demod depth & deviation	*0.4%*
Multimeter:	*Voltage*	*0.5%*
	Current	*0.5%*

Storage and Transport

Temperature

–40 to +70°C

Altitude

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

INTERNAL TEST SOFTWARE

OPTION 10 NMT CELLULAR SOFTWARE

NMT450	***NMT900***
Benelux	*NMTF*
Austria	*Spain*
Malaysia	*Indonesia*
Saudi 1	*Saudi 2*
Thailand	*Oman*
Tunisia	*Hungary*
Poland	*Russia*
Czech	*Bulgaria*
Slovenia	*Turkey*

USER DEFINED NMT

OPTION 11 AMPS CELLULAR SOFTWARE

E-AMPS	*N-AMPS*

USER DEFINED AMPS

OPTION 12 TACS CELLULAR SOFTWARE

E-TACS	*TACS-2*
C-TACS I	*C-TACS II*
J-TACS	*N-TACS*
USER DEFINED TACS	

OPTION 13 MPT 1327 TRUNKING SOFTWARE

Band III	*JRC*
UK Water	*Hong Kong*
Autonet	*AMT*
Madeira	*NL-TRAXYS*
NZ MPT1327	*PH-INDO*
USER DEFINED MPT	

OPTION 14 PMRTEST SOFTWARE

USER DEFINED PMR for FM radios

Analog Parametric Auto Test Routines

AF Frequency	*AF Level*
FM Deviation	*Mod Frequency*
Rx Distortion	*Rx Expansion*
Rx Sensitivity	*Rx SINAD*
Rx S/N	*Tx Compression*
Tx Distortion	*Tx Frequency*
Tx Level	*Tx Power Level*
Tx Limiting	*Tx Mod Level*
Tx Noise	*Tx SINAD*
Tx S/N	*SAT Deviation*
SAT Frequency	*ST Duration*
ST Frequency	*ST Deviation*
Data Deviation	*DSAT Deviation*

Signalling Auto Test Routines

Registration / Roaming Update
Place Call
Clear From Mobile
Page Mobile
Handoff
Clear From Land
Speech Quality
Hook Flash
DTMF Decode
Data Performance
PTT On
PTT Off

Auto Test Pause Modes

Pause Manual Only
Pause On Failure
Pause Always

DIMENSIONS AND WEIGHT

Excluding handle, feet and covers.

Height	***Width***	***Depth***
177 mm	370 mm	540 mm
(6.9 in)	(14.5 in)	(21.2 in)

Including handle, feet and covers.

Height	***Width***	***Depth***
203 mm	420 mm	600 mm
(7.9 in)	(16.5 in)	(23.6 in)

Weight

Less than 20.5 kg (45.1 lb)

NOTES

(1) At low modulation levels the residual AM/FM may become significant.

(2) At low audio levels the residual noise may become significant.

(3) Audio and Modulation filter passband errors not included.

(4) Typical performance figures are non-warranted.

(5) Refer to USER CALIBRATION section.

(6) Either 3 modulation plus 3 audio generators up to 20 kHz or 1 modulation or 1 audio generator to 100 kHz.

VERSIONS AND ACCESSORIES

When ordering please quote the full ordering number information.

Ordering Numbers

Versions

2967	Radio Test Set

Options

Option 01	French Language Version
Option 02	Spanish Language Version
Option 03	German Language Version
Option 09	SSB receiver option
Option 10	NMT Cellular Radio option
Option 11	AMPS Cellular Radio option (including N-AMPS)
Option 12	TACS Cellular Radio option (including N-TACS)
Option 13	MPT 1327/MPT 1343 Trunked Radio option
Option 14	PMRTEST for FM radios.
Option 16	GSM 1800
Option 17	GSM 1900
Option 22	Mobile Tuning Range Test

Contact your local Sales Outlet for details of availability of options

Supplied with

	AC Supply lead
	Operating Manual
	Multimeter Lead Kit (Two 4 mm leads to test points)

PhoneTest Options

81506	PhoneTest for 2967
81510	PhoneTest Bundle includes 81506/81507/81508/81509
81507	PhoneTest-Repair
81508	PhoneTest-Manager
81509	PhoneTest-Exchange
81504	PhoneTest and enabled options, site licence software upgrade
81505	PhoneLib

Accessories

54421/001	BNC Telescopic antenna
54431/023	20 dB AF attenuator (BNC)
54112/158	Hard Transit Case
54112/157	Soft Carrying Case
54127/310	Rack Mounting Kit
59000/189	Memory Card (128 K)
54411/052	600 Ω interface and 20dB AF attenuator (requires 46884/645 Accessory socket adapter)
46884/645	Accessory socket adapter (for use with 2955 accessories)
46884/646	Accessory Socket 'Y' adapter
46884/560	Parallel Printer Interface Cable
46884/649	Serial port to PC Cable (25 way)
46884/650	Serial port to PC Cable (9 way)
43129/189	GPIB Cable
43130/596	Coaxial cable N-Type(m) to TNC(m) (double screened)
54311/095	Coaxial cable N-Type(m) to N-Type(m) (1 metre)
54212/001	GSM Phase 2 Plug-In TEST SIM
54212/002	GSM Phase 2 Full Size TEST SIM
54311/071	TNC(m) to BNC(f) adapter
54311/092	N-Type(m) to BNC(f) adapter
52388/900	1 GHz Active Probe
54441/012	Power supply for probe 52388/900
46880/080	Service Manual

Service Support

The 2967 is now supplied with a 2 year warranty as standard

W3	Third year warranty

Contact your local Sales Outlet for availability of these and other service plans

CHINA Beijing
Tel: [+86] (10) 6467 2761 2716
Fax: [+86] (10) 6467 2821

CHINA Shanghai
Tel: [+86] (21) 6282 8001
Fax: [+86] (21) 62828 8002

FINLAND
Tel: [+358] (9) 2709 5541
Fax: [+358] (9) 804 2441

FRANCE
Tel: [+33] 1 60 79 96 00
Fax: [+33] 1 60 77 69 22

GERMANY
Tel: [+49] 8131 2926-0
Fax: [+49] 8131 2926-130

HONG KONG
Tel: [+852] 2832 7988
Fax: [+852] 2834 5364

INDIA
Tel: [+91] 80 5115 4501
Fax: [+91] 80 5115 4502

KOREA
Tel: [+82] (2) 3424 2719
Fax: [+82] (2) 3424 8620

SCANDINAVIA
Tel: [+45] 9614 0045
Fax: [+45] 9614 0047

SPAIN
Tel: [+34] (91) 640 11 34
Fax: [+34] (91) 640 06 40

UK Burnham
Tel: [+44] (0) 1682 604455
Fax: [+44] (0) 1682 662017

UK Stevenage
Tel: [+44] (0) 1438 742200
Fax: [+44] (0) 1438 727601
Freephone: 0800 282388

USA
Tel: [+1] (316) 522 4981
Fax: [+1] (316) 522 1360
Toll Free: 800 835 2352

AEROFLEX
A passion for performance.

www.aeroflex.com

info-test@aeroflex.com

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

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