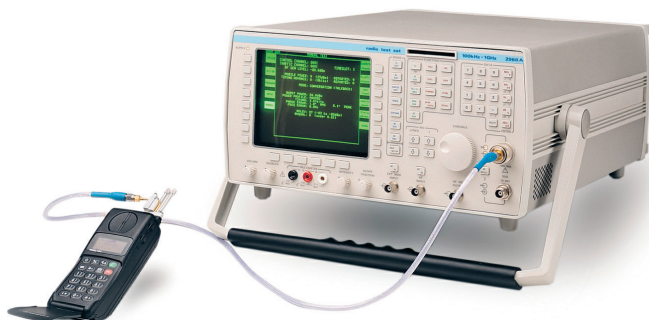


Wireless

2966A 100 kHz to 1 GHz Radio Test Set



A high performance GSM 900 and analog radio tester that provides fast test speeds and very accurate measurements. This product can be used in conjunction with PhoneTest Software.

- Full suite of GSM measurements
- Power profile and phase profile plots for normal and access bursts
- Full range of BER measurements for receiver testing
- Phase 2 frequency plan (E-GSM) and power levels supported
- High performance full span spectrum analyzer
- 500 kHz digital storage oscilloscope
- Accurate frequency counter
- Comprehensive LF generation and analysis

The 2966A Radio Test Set performs all of the measurements and supports protocol functions required in a GSM service or production environment. It also supports all of the international analog cellular standards (TACS, AMPS and NMT) and the main worldwide trunking format (MPT 1327).

Unlike 'GSM Only' testers, the 2966A includes a host of standard RF instruments, such as a spectrum analyzer and CW frequency counter, as well as audio sources, an audio analyzer and a digital multimeter. These are invaluable for radio alignment and detailed fault finding. Performance is uncompromised and test speeds are significantly greater than previous generation equipment.

Based on ETSI's GSM11.10 specifications, the 2966A's functionality has been designed to test all of the essential RF, audio and DC parameters of a GSM radio quickly and easily. The world proven Aeroflex user interface has been extended to allow access to these GSM specific functions.

Standard Features

The 2966A follows the Aeroflex philosophy of offering a complete package with the essential features as standard and not as additional costly options.

Extensive GSM Functionality

The 2966A emulates a GSM base station allowing radios to be tested as if they were on a real system, without user knowledge of manufacturer specific test modes. Network simulation is especially useful when checking for configurational problems.

Transmitter testing provides transmitter power, peak and RMS phase error, frequency error and timing error, all measured 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.

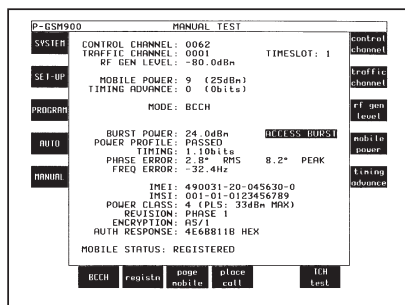
The 2966A covers the phase two frequency plan (E-GSM) and supports the lower power levels (PL16-PL19).

Advanced GSM Measurements

The 2966A performs advanced GSM measurements for detailed fault diagnosis and production environments. For radios that refuse to register or go into conversation, analysis of access (RACH) bursts is essential. All transmitter measurements are automatically triggered on these bursts to help the user to isolate a problem.

An advanced Mobile Tuning Range Test Capability 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 2966A can be used to transmit or receive at any frequency within the 10 MHz to 1 GHz band and radios can be tested in test modes, without signaling and synchronization.



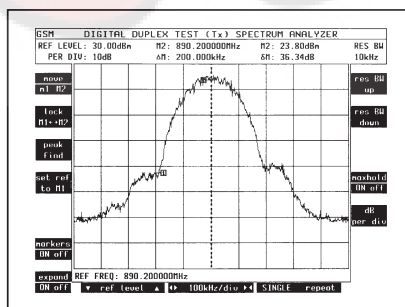
Display of Mobile Reports

The 2966A 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.

During conversation the test set continuously displays the mobile's reported power level, timing advance, RXLEV and RXQUAL.

Spectrum Analysis

The 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 usually only found on standalone 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.



In a GSM environment the spectrum analyzer is invaluable. The max hold facility allows TDMA (GSM) signals to be analyzed. The analyzer also allows IQ modulator alignment (required on some popular GSM phones) and IFs and LOs to be inspected.

Manual and Automatic Operation

The 2966A user interface offers ready access to many sophisticated functions. The instrument extends the original test set interface established by the 2955.

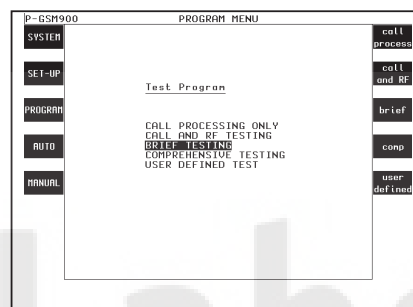
The large bright, high resolution screen and the 22 associated softkeys on the front panel have significant benefits in terms of user com-

fort, and hence efficiency.

For automatic testing, the 2966A 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 2966A can be programmed through MI-BASIC.

PhoneTest

The 2966A can be enhanced by using PhoneTest, which is a PC based solution running on Windows 95 or Windows NT, for GSM 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 Aeroflex is established as the de facto industry standard. The 2966A provides the fundamental measurements required (e.g. broadband power, FM deviation, SINAD) and a range of advanced facilities, such as the unique 40 kHz FFT analyzer.

TACS, AMPS and NMT come as options. Most country variants are standard.

Concise Easy to Read Printouts

The 2966A produces printouts at the touch of a key, providing the information required 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.

2966A printouts also include the instrument serial number, time/date stamping, company name and user name for quality control. Printouts can be stored to a standard PCMCIA2 memory card.

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.

Size and Weight

Not only does the 2966A pack the performance you would normally expect to see on a bench full of instruments, it weighs in at under 19.5 kg (43 lb), so it is portable too.

APPLICATIONS

Production

For the production environment the 2966A option 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 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 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.

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 2966A option shows all 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 instruments 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, more often than not, be identified visually. To locate more complex faults, those that result from component or solder joint failure, sophisticated test tools are required. The 2966A option 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, such as the spectrum analyzer, oscilloscope, multimeter and the unique FFT audio analyzer aid rapid fault diagnosis. Such features are not available on GSM specific test sets.

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 2966A delivers on both counts.

SPECIFICATION

GENERAL DESCRIPTION

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

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 –45 dBm (GMSK)
(–40 dBm with FM/PM/AM).

TNC socket: –135 dBm to –25 dBm (GMSK)
(–115 dBm to –20 dBm with FM/PM/AM).

Rx Test and two-port Dx modes:

N-Type socket: –135 dBm to –35 dBm (GMSK)
(–10 dBm with FM/PM)
(–20 dBm with AM).

TNC socket: –135 dBm to –15 dBm (GMSK)
(–115 dBm to +10 dBm with FM/PM)
(–115 dBm to 0 dBm with AM).

Resolution

0.1 dB

Indication

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

Accuracy

N-Type socket:
 ± 1 dB (GMSK) over the temperature range 15 to 35°C

Otherwise
 ± 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 warnings.
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).

TNC socket: typically 1.3 at 900 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

Residual AM (CCITT weighted)

Less than 0.05% RMS

Harmonics

Better than -30 dBc for levels up to +7 dBm (TNC).

Better than -30 dBc for levels up to -13 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 above 36 MHz

SSB Phase Noise (20 kHz offset)

Better than -114 dBc/Hz up to 575 MHz;

Better than -108 dBc/Hz up to 1 GHz.

RF Carrier Leakage

Less than 0.5 μ V PD generated at the carrier frequency in a 50 Ω load by a 2 turn loop 25 mm or more from the case with output level set to below -60 dBm and terminated in a sealed 50 Ω load.

GMSK MODULATION – INTERNAL

Frequency Range

10 MHz to 1 GHz, useable to 1.15 GHz

Bt

0.3

Phase Error

<1° RMS, <4° peak

AMPLITUDE MODULATION – INTERNAL

Frequency Range

100 kHz to 400 MHz, usable 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)

$\pm 4\%$ of setting ± 1 digit for modulation frequency 1 kHz

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

$\pm 8\%$ 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 M Ω in parallel with 100 pF

Frequency Range

As internal AM

Modulation Frequency Range

As internal AM with AC or DC coupling

Accuracy

As internal $\pm 2\%$

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⁾

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

Typically $\pm 3\%$ ± 1 digit for modulation frequencies from 20 Hz to 5 kHz

Typically $\pm 7\%$ ± 1 digit for modulation frequencies from 5 kHz to 20 kHz

Typically $\pm 10\%$ ± 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 M Ω 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 $\pm 2\%$ 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

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

Distortion ⁽⁴⁾

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 M Ω 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

BER METER

Types

BER Class I
BER Class II
RBER Class Ib
RBER Class II
FER

Range

0 to 99%

Resolution

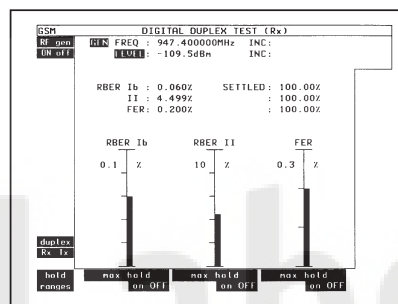
0.001%

Indication

4 digits and bar chart with peak hold

Features

Adjustable Sample Size
Duration Indication
% Settled Indication



AUDIO VOLTMETER

Input Impedance

Nominally 1 M Ω 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

0-10, 0-30, 0-100, 0-300 mV, 0 to 1, 0 to 3, 0 to 10, 0-30 V RMS reading (autoranging or fixed)

Level Indication

4 digits and barchart with peak hold

Level Accuracy (DC Coupled) ^{(3) (5)}

$\pm 2\%$ of reading ± 1 mV \pm resolution, DC and 100 Hz to 20 kHz
 $\pm 4\%$ of reading ± 1 mV \pm resolution, 40 Hz to 100 kHz

Level Accuracy (AC Coupled) ⁽³⁾

$\pm 2\%$ of reading ± 1 mV, \pm resolution 150 Hz to 20 kHz
 $\pm 4\%$ of reading ± 1 mV, \pm resolution 100 Hz to 100 kHz

Residual Noise

100 μ V RMS CCITT weighted

AUDIO FREQUENCY METER

Range

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 \pm 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 \pm 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

$\pm 5\%$ of reading \pm 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 \pm 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 μ s minimum

Voltage Ranges

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

Voltage Accuracy

$\pm 5\%$ of full scale

Timebase

5 μ s/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, M2-M1
Time: M1-M2, M2-M1

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, M1-M2

Frequency: M1, M2, M1-M2

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 M Ω in parallel with 100 pF

Resolution

0.1% of FSD

Accuracy ⁽⁵⁾

DC: $\pm 3\%$ of reading ± 2 mV ± 1 digit

AC + DC: $\pm 3\%$ 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: $\pm 5\%$ of reading ± 50 mA ± 1 digit

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

Indication

3 digits and bar chart with peak hold

RESISTANCE METER

Resistance Ranges

100 Ω , 1 k Ω , 10 k Ω , 100 k Ω , 1 M Ω

Resolution

1 Ω below 1 k Ω or 3 digits

Accuracy ⁽⁵⁾

$\pm 5\%$ 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 (BURST)

Frequency Range

10 MHz to 1 GHz

Frequency Error Range

± 5 kHz

Burst Type

Normal/Access

Resolution

0.1 Hz

Indication

3 digits and bar chart with peak hold

Accuracy

± 15 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 \pm 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 (BURST)

Frequency Range

10 MHz to 1 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
Full burst
Useful Part
Ramps

Accuracy

±0.6 dB for temperatures in the range 15 to 35°C
See also under Environmental - User Calibration.

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 tuned)

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 & 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

Spans

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

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 – fixed at 3 kHz.

Filter Shape

Nominally 3 dB/60 dB, 1:1:1 (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.

Intermodulation Distortion

Less than 80 dB for 2 signals on screen at reference level

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, M1-M2.

Frequency: M1, M2, M1-M2

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, $\div 2$)

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 μ V 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 low pass (± 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

Switching Speed

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

Demodulated Output

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

Squelch

A manual squelch control is provided with a variable threshold

GMSK MODULATION

Frequency Range

10 MHz to 1 GHz

Phase Error Range

10° RMS

$\pm 30^\circ$ 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

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)}

$\pm 3\%$ of reading, $\pm 1\%$ AM, 250 Hz to 5 kHz

Typically $\pm 5\%$ of reading, $\pm 1\%$ 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

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)}

$\pm 3\% \pm$ resolution for modulation frequency of 1 kHz.
 $\pm 5\% \pm$ resolution for modulation frequencies from 100 Hz to 15 kHz

Demodulation Distortion ⁽⁴⁾

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)}

$\pm 5\% \pm$ resolution

Demodulation Distortion ⁽⁴⁾

Less than 0.5% at 1 kHz, CCITT weighted

BURST TIMING METER

Burst Type

Normal/Access

Range

-128 to +127 bits

Resolution

0.01 bits

Indication

5 digits

Accuracy

± 0.1 bits

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 & 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

$\pm 3\% \pm 1$ digit, 250 Hz to 5 kHz
 $\pm 5\% \pm 1$ digit, 10 Hz to 20 kHz
 $\pm 10\% \pm 1$ digit, 20 kHz to 75 kHz

Output Impedance

Nominally 5 Ω

Protection

Maximum applied voltage 50 V

SIGNAL PURITY

Distortion ⁽⁷⁾

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 μ V 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 2966A 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 Encode/Decode

Generation and decoding 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 meter accuracy	– as Broadband power
Detection Range	– 100 μ V 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 Aeroflex's implementation of IEEE-488.2.

Capability

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

Serial

Serial interface is provided for connection of RS-232 for instrument remote control. 9 Way socket. Control language is based on IEEE P1174.

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 and set ups.

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 V pk-pk

Input Impedance

Nominally 1 M Ω in parallel with 40 pF

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°C to +70°C

Altitude

Up to 2500 m (pressurized 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

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

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 Distortion
 Tx Level
 Tx Limiting
 Tx Noise
 Tx S/N
 SAT Frequency
 ST Frequency
 Data Deviation

Tx Compression

Tx Frequency
 Tx Power Level
 Tx Mod Level
 Tx SINAD
 SAT Deviation
 ST Duration
 ST Deviation
 DSAT Deviation

Signaling 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 (6.9 in)	370 mm (14.5 in)	540 mm (21.2 in)

Including handle, feet and covers

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

Weight

Less than 19.5 kg (42.9 lb)

VERSIONS AND ACCESSORIES

When ordering please quote the full ordering number information.

Ordering Numbers

2966A

Versions

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 AM/FM/ΦM radios
- Option 22 Mobile Tuning Range Test

Contact 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 Software for 2966A
- 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 20 dB AF attenuator (Note 1)

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)
54212/001	GSM Phase 2 Plug/In TEST SIM
54212/002	GSM Phase 2 Full Size TEST SIM
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)
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

Note 1 – requires 46884-645 Accessory socket adapter

Service Support

The 2966A is now supplied with a 2 year warranty as standard

W3 Three year warranty

Contact your local sales outlet for availability of these and other service plans

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.