

# Test Equipment Solutions Datasheet

Test Equipment Solutions Ltd specialise in the second user sale, rental and distribution of quality test & measurement (T&M) equipment. We stock all major equipment types such as spectrum analyzers, signal generators, oscilloscopes, power meters, logic analysers etc from all the major suppliers such as Agilent, Tektronix, Anritsu and Rohde & Schwarz.

We are focused at the professional end of the marketplace, primarily working with customers for whom high performance, quality and service are key, whilst realising the cost savings that second user equipment offers. As such, we fully test & refurbish equipment in our in-house, traceable Lab. Items are supplied with manuals, accessories and typically a full no-quibble 2 year warranty. Our staff have extensive backgrounds in T&M, totalling over 150 years of combined experience, which enables us to deliver industry-leading service and support. We endeavour to be customer focused in every way right down to the detail, such as offering free delivery on sales, covering the cost of warranty returns BOTH ways (plus supplying a loan unit, if available) and supplying a free business tool with every order.

As well as the headline benefit of cost saving, second user offers shorter lead times, higher reliability and multivendor solutions. Rental, of course, is ideal for shorter term needs and offers fast delivery, flexibility, try-before-you-buy, zero capital expenditure, lower risk and off balance sheet accounting. Both second user and rental improve the key business measure of Return On Capital Employed.

We are based near Heathrow Airport in the UK from where we supply test equipment worldwide. Our facility incorporates Sales, Support, Admin, Logistics and our own in-house Lab.

All products supplied by Test Equipment Solutions include:

- No-quibble parts & labour warranty (we provide transport for UK mainland addresses).
- Free loan equipment during warranty repair, if available.
- Full electrical, mechanical and safety refurbishment in our in-house Lab.
- Certificate of Conformance (calibration available on request).
- Manuals and accessories required for normal operation.
- Free insured delivery to your UK mainland address (sales).
- Support from our team of seasoned Test & Measurement engineers.
- ISO9001 quality assurance.

Test equipment Solutions Ltd  
Unit 8 Elder Way  
Waterside Drive  
Langley  
Berkshire  
SL3 6EP

T: +44 (0)1753 596000  
F: +44 (0)1753 596001

Email: [info@TestEquipmentHQ.com](mailto:info@TestEquipmentHQ.com)  
Web: [www.TestEquipmentHQ.com](http://www.TestEquipmentHQ.com)



# Wireless

## 2948 Low Phase Noise Communications Service Monitor

**AEROFLEX**  
A passion for performance.



All the benefits of the 2945A but with a low phase noise signal generator,  
for the more critical receiver testing

- Low phase noise signal generator
- High stability reference oscillator (OCXO) as standard
- Accurate power measurement to 150 W
- Transient and harmonic analysis
- Fast response high resolution bar charts for peaking and nulling
- Tracking generator with full offset tracking
- Full span spectrum analyzer with 'live' look and listen

*The 2948 Communications Service Monitor is the lightest, most rugged service monitor available with low phase-noise signal generation. For field work, the 2948 provides an excellent combination of instruments for all types of maintenance work. In the workshop it provides all of the performance you would expect for exacting measurements.*

### Low Phase-Noise Signal Generator

The 2948 differs from its 2945A cousin by providing a low phase-noise signal generator as standard. This enhanced capability allows accurate measurement of the noise characteristics of all FM receivers and is especially beneficial when making accurate measurement of narrow band receivers. The performance of the 2948 enables signal-to-noise measurements of better than 46 dB to be made on receivers with 12.5 kHz channel spacing.

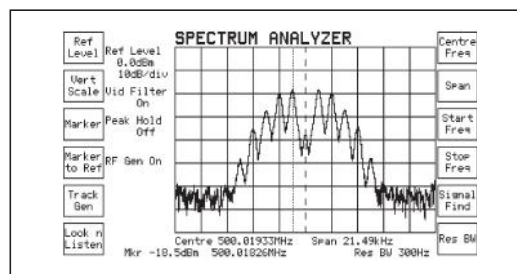
### Field Operation

At under 12 kg the 2948 lightens the load to remote sites. The shape of the 2948 is ideal for carrying; the side handle ensures that the instrument is clear of the stairs when ascending buildings and the 2948's depth is suitable for the instrument to be operated comfortably when it is placed on the floor.

An optional bail arm handle is also available. This option allows a stowage cover to be fitted over the front panel for storage of adapters and further protection to the instrument's front panel. Full operation is possible from the protective 'ever-ready' case so that your investment is protected from transit damage.

Stored settings may be recalled from internal memory or from a memory card allowing fast and straightforward setting up.

### Fast Full Performance Spectrum Analyzer - provided as standard



The spectrum analyzer provides spans from 100 Hz per division to 100 MHz per division and also has a fully adjustable reference level. Speed is comparable with analog analyzers, allowing real time adjustments over the displayed dynamic range. With the tracking generator provided as standard, duplexers and filters can be aligned quickly and easily. An offset facility provides testing of equipment with fre-

quency translation. Channel stepping can be performed by defining an increment and then using the **FREQ**  $\uparrow\downarrow$  keys. This is particularly useful when testing multi-channel systems.

### Live Look and Listen

This feature puts the 2948 above all of its peers with the ability to examine signals on the screen and demodulate them simultaneously. Intermittent interference can be isolated quickly and the signals then easily identified. The trace can be saved to memory card along with the time and date, providing factual evidence that can be recalled later. This feature is particularly useful when looking for rogue transmissions, especially on busy base station sites.

### From 2 $\mu$ V to 150 Watts

The 2948 measures the power of low level signals such as those encountered when monitoring off-air signals or those found when probing a circuit. 150 Watts measurement is provided without the need for external attenuators, so the high power of base stations can be measured directly. Measurement accuracy of better than 10% is guaranteed all the way down to 5 mW on the N-Type connector, allowing cellular radios to be qualified at low power levels.

### Accurate RF Signals

The signal generator provides coverage from 400 kHz to 1.05 GHz with +5 dBm output (+7 dBm overrange) and fast switching speed. Level accuracy is  $\pm 2$  dB at all levels above -127 dBm.

### Duplex - provided as standard

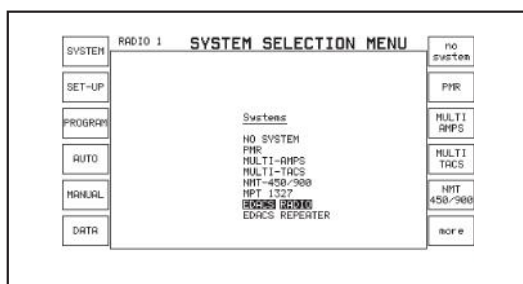
Full duplex operation is provided by the 2948. This allows testing of duplex radios as well as simultaneous testing of repeater transmit and receive paths. There are no restrictions to the duplex offset.

### Cellular and Trunking - built in

AMPS, TACS and NMT analog cellular standards are available internally, with all country variants provided in each package. Trunking for MPT 1327/1343 and variants of them is also available.

A new trunking capability has been added with the introduction of EDACS™ Radio and Repeater test capability.

Remote control of the inbuilt tests is provided, so that measurements can be started and results logged automatically.



### Network Simulation

The 2948 simulates the signalling protocol that the radio would see from the real network. This allows calls to be set up and handled enabling receiver and transmitter parametric measurements to be made.

### Remote Control - RS-232 or GPIB

Remote control is provided, with an RS-232 interface as standard. An IEEE-488.2 interface (option 5) can be fitted where other instruments are required to operate in a system with the 2948.

### Printing Made Easy

With the parallel printer port interface, screen dumps, automatic test results or previously stored results may be sent to most parallel printers. These facilities are available as standard using the serial RS-232 interface.

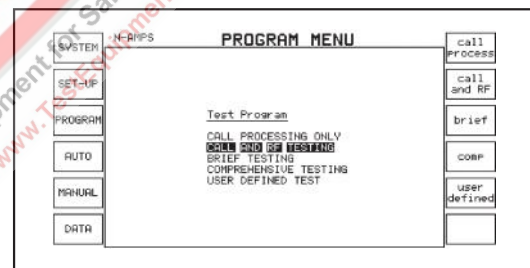
A screen capture facility is available so any screen displayed on the 2948 can be saved direct to a PC via the serial port as a bit map file.

### Autorun - internal control

With the Analog Systems Card fitted, automatic testing without an external controller is possible. Custom tests may be written and run by the operator. Four programmable relay contacts are provided with the optional parallel printer interface. This allows remote control of radios or test fixtures from built-in automatic tests.

### Custom Programs

Users may program the instrument to suit their own specific needs. This is possible either by configuring any of the 4 built-in programs or by using the MI-BASIC interpreter to produce a customised test program that can be executed internally, without an external controller.



### Memory Card - with real time clock

The memory card drive meets the PCMCIA standard format for PC cards. The 2948 provides a DOS based filing system that allows transfer of information to a PC fitted with a memory card slot.

Test setups, test results, screen dumps, spectrum analyzer co-ordinates and test sequences can all be stored on the memory card, allowing information to be easily stored and retrieved when required.

### Reliability

The 2948 features high integration and a chassis designed to maximise mechanical protection.

### Audio Analysis

A comprehensive range of filters are provided as standard, including band pass, low pass and high pass. Optional filters are available for psophometric weighting of audio signals and demodulation of signals in a simulated radio channel bandwidth.

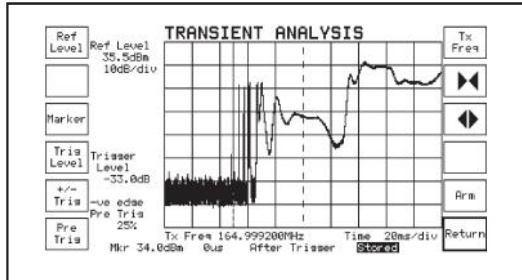
The direct measurement of CTCSS is possible with the 300 Hz LP filter, even with speech present.

Two comprehensive audio generators are provided as standard for internal modulation or audio sources for transmitter stimulus.

External DC coupled FM is provided.

### Comprehensive Oscilloscope

Analysis of audio signals, whether from the demodulated signal or the audio input direct can be viewed for further inspection. The oscilloscope can either be combined with the measurement screen in the Tx, Rx or AF test modes or 'zoomed' to a full screen display. Different levels of persistence can be selected to allow short or long term effects to be captured.



### Transient Analysis

The ability to capture transients on the rising or falling edge of a waveform provides a valuable tool for fault finding radios and radio systems. The user has full control of the trigger level and input attenuation as well as the timebase and five fixed trigger points, making this feature simple and flexible to operate.

### Harmonic Analysis

An automatic harmonic analysis function is included in the 2948. This complements the fast spectrum analyzer and allows a rapid check that the transmitter under test is not producing any excessive harmonics.

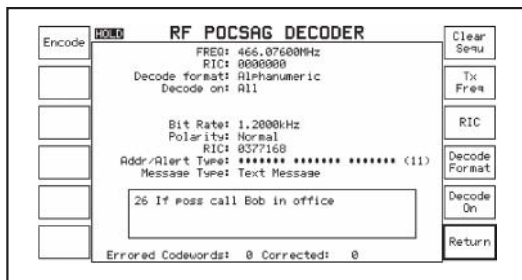
### Tones Generation and Decoding

The tones menus include full remote control so that radio workshops can further automate their tasks and better control the tones from the top level screens.

### POCSAG Decode - built in option

Off-air decoding of POCSAG signals is provided as an option.

This allows tone, numeric and alphanumeric messages to be displayed. Signals with bit rates of up to 4800 bits/s can be automatically decoded making the 2948 an ideal surveillance tool. The 2948 can be set to detect all messages, a user selectable RIC (just like a pager), or a fixed message string.



## SPECIFICATION

### RF SIGNAL GENERATOR

#### FREQUENCY

##### Frequency Range

400 kHz to 1.05 GHz

##### Resolution

10 Hz

##### Indication

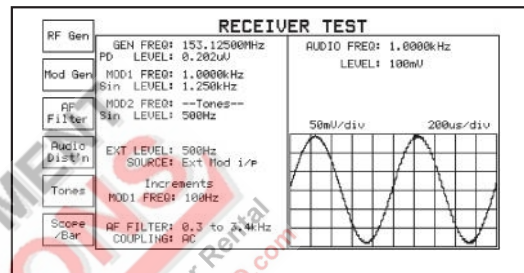
10 digit display

##### Setting

Keyboard entry, delta increment/decrement function and rotary control

##### Accuracy

As frequency standard



#### OUTPUT LEVEL

##### Output Level Range

Rx Test:

N-Type socket: -141 dBm to -21 dBm

BNC socket: -115 dBm to +5 dBm (overrange to +7 dBm)

##### Resolution

0.1 dB

##### Indication

4 digits plus sign (dBm, dBuV, uV, mV PD/EMF).

##### Accuracy

±2 dB for level above -127 dBm on N-Type socket up to 1 GHz

##### Reverse Power Protection

N-Type: 50 W 10 minutes, normal operation. 150 W for 1 minute at 20 °C.

Overload indicated by audible and visual warning.

BNC: 5 W Overload indicated by audible and visual warning.

##### Output Impedance

Nominally 50 Ω

##### VSWR

##### N-Type

Better than 1.2:1 up to 500 MHz

Better than 1.35:1 up to 1.05 GHz

##### BNC

Better than 2.2:1 up to 1.05 GHz



## **SPECTRAL PURITY**

### **Residual FM**

Less than 6 Hz RMS (0.3 to 3.4 kHz) up to 500 MHz

Less than 12 Hz RMS (0.3 to 3.4 kHz) up to 1.05 GHz

### **Harmonics**

-25 dBc

### **Spurious Signals**

Better than -50 dBc

### **SSB Phase Noise (20 kHz offset)**

Better than -112 dBc/Hz up to 500 MHz

Better than -108 dBc/Hz up to 1 GHz

### **RF Carrier Leakage**

Less than 0.5  $\mu$ V PD generated in a 50  $\Omega$  load by a 2 turn loop 25 mm from the case. Output level less than -40 dBm into a sealed 50  $\Omega$  load.

## **AMPLITUDE MODULATION - INTERNAL**

### **Frequency Range**

400 kHz to 1.05 GHz

### **AM Depth Range**

0 to 99%

### **Resolution**

1%

### **Indication**

2 digits

### **Setting**

Keyboard entry, delta increment / decrement function and rotary control

### **Accuracy**

For carrier frequencies from 1.5 MHz to 400 MHz

$\pm 5\%$  at 50% for modulation frequency of 1 kHz.

$\pm 7\% \pm 1$  digit for modulation frequency of 1 kHz.

$\pm 15\% \pm 1$  digit for modulation frequencies from 50 Hz to 15 kHz.

### **Distortion**

Less than 2% at 1 kHz for 30% AM, CCITT weighted

### **Modulation Frequency**

20 Hz to 20 kHz

## **AMPLITUDE MODULATION - EXTERNAL**

### **Input Impedance**

Nominally 10 k $\Omega$  in parallel with 40 pF

### **Frequency Range**

As internal AM

### **Modulation Frequency Range**

As internal AM

### **Sensitivity**

1 V RMS for 100% AM

## **FREQUENCY MODULATION - INTERNAL**

### **Frequency Range**

400 kHz to 1.05 GHz

### **Maximum Deviation**

75 kHz

### **Indication**

3 digits

### **Setting**

Keyboard entry, delta increment/decrement function and rotary control

### **Accuracy (1)**

$\pm 7\%$  at 1 kHz modulating frequency

$\pm 10\%$  at modulating frequencies from 50 Hz to 15 kHz

### **Distortion**

Less than 1% at 1 kHz for deviation of 5 kHz, CCITT weighted

### **Modulation Frequency Range**

20 Hz to 25 kHz

### **Resolution**

25 Hz

### **Pre-emphasis**

750  $\mu$ s selectable

## **FREQUENCY MODULATION - EXTERNAL**

### **Input Impedance**

Nominally 10 k $\Omega$  in parallel with 40 pF

### **Frequency Range**

As internal FM

### **Modulation Frequency Range**

DC to 100 kHz

### **Pre-emphasis**

750  $\mu$ s selectable

### **Sensitivity**

1 VRMS for 0 to 75 kHz deviation

## **MICROPHONE INPUT**

### **Input Level**

2 mV to 200 mV (AGC levelled)

### **Input Impedance**

Nominally 150  $\Omega$

### **Press To Talk (PTT)**

When using the optional microphone in Tx Test mode, the PTT will switch instrument to Rx Test.

## **AUDIO VOLTMETER**

### **Input Impedance**

Nominally 1 M $\Omega$  in parallel with 40 pF

### **Frequency Range**

DC and 50 Hz to 50 kHz

AC only 50 Hz to 50 kHz

Polarized DC (below 1 Hz)

**Maximum input voltage**

30 VRMS, 50 Vdc

**Level Ranges**

0 - 100 mV to 0 - 100 V RMS in a 1, 3, 10 sequence

Digital readout also in mW (user selectable)

**Resolution**

1 mV or 1% of reading

**Indication**

3 digits and bar-chart

**Accuracy AC**

$\pm 3\% \pm 3 \text{ mV} \pm \text{resolution up to } 30 \text{ V RMS}$

**Accuracy DC**

$\pm 1\% + 50 \text{ mV up to } 40 \text{ V}$

**AUDIO FREQUENCY METER**

---

**Frequency Range**

20 Hz to 50 kHz

**Resolution**

0.1 Hz, less than 10 kHz  
1 Hz, at 10 kHz and above

**Indication**

5 digits

**Accuracy**

As frequency standard  $\pm 1 \text{ digit} \pm \text{resolution}$

**Sensitivity**

50 mV

**AUDIO SINAD METER**

---

**Frequency**

1 kHz

**Range**

0 to 18 dB and 0 to 50 dB

**Resolution**

0.1 dB

**Indication**

3 digits and bar-charts

**Accuracy**

$\pm 1 \text{ dB}$

**Sensitivity**

50 mV (100 mV for 40 dB SINAD) reading suppressed if audio voltage is less than 5 mV

**AUDIO DISTORTION METER**

---

**Frequency**

1 kHz

**Range**

0 to 10% and 0 to 30%

**Resolution**

0.1% distortion

**Indication**

3 digits and bar-charts

**Accuracy**

$\pm 1 \text{ dB of reading} \pm 0.5\% \text{ distortion}$

**Sensitivity**

50 mV (100 mV for 1% distortion) reading suppressed if audio voltage is less than 5 mV

**AUDIO S/N METER**

---

**Range**

0 to 30 dB and 0 to 100 dB

**Resolution**

0.1 dB

**Indication**

3 digits and bar-chart

**Accuracy**

$\pm 1 \text{ dB}$

**Sensitivity**

50 mV (100 mV for 40 dB S/N) reading suppressed if audio voltage is less than 5 mV

**AUDIO OSCILLOSCOPE**

---

**Operating Modes**

Single or repetitive sweep

**Frequency Range**

DC to 50 kHz, 3 Hz to 50 kHz AC coupled

**Voltage Range**

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

**Voltage Accuracy**

$\pm 5\% \text{ of full scale}$

**FM Ranges**

$\pm 75, 30, 15, 6, 3 \text{ and } 1.5 \text{ kHz deviation full scale, } \pm 10\% \text{ accuracy}$

**AM Ranges**

20, 10 and 5% per division,  $\pm 10\% \text{ accuracy}$

**Timebase**

50  $\mu\text{s/div}$  to 5 s/div in a 1, 2, 5 sequence

**Graticule**

10 Horizontal by 6 Vertical divisions

**Special features**

Built in antialiasing circuitry and variable decode trigger level

**AUDIO BAR CHARTS**

---

**Bar-chart Displays**

AF Voltage, SINAD, Distortion, S/N

### Vertical Resolution

2% of full scale

### Ranging

Autoranging, range hold or manual selection  
1, 2, 5, sequence with hysteresis

### Audio and Modulation Filters

300 Hz, 3 kHz, 15 kHz Lowpass

300 Hz to 3.4 kHz Bandpass

300 Hz Highpass

750  $\mu$ s de-emphasis

50 kHz Lowpass (No filters applied)

### Audio Analyzer General Features

Tones Mode

## RF FREQUENCY METER

### Frequency Range

400 kHz to 1.05 GHz (manual tune)

10 MHz to 1 GHz (autotune)

### Resolution

1 Hz or 10 Hz, up to 1050 MHz, selectable

0.1 Hz, 1 Hz or 10 Hz up to 999 MHz, selectable

### Indication

Up to 10 digits

### Accuracy

As frequency standard  $\pm$  resolution

### Acquisition Time

Less than 1 second (manual)

Typically 3 seconds (autotune)

### Sensitivity

Autotuned 5 mW (N-Type)

0.05 mW (Antenna port)

Manual Tuned: -34 dBm (N-Type) -60 dBm (Antenna port)

### VSWR

N-Type: Better than 1.2:1 up to 500 MHz

Better than 1.25:1 up to 1.05 GHz

BNC: Better than 3:1 up to 1.05 GHz

## RF POWER METER (BROADBAND)

### Frequency Range

200 kHz to 1.05 GHz

### Dynamic Range

5 mW to 150 W (N-Type)

0.05 mW to 250 mW (Antenna port)

### Indication Units

Watts, dBm or dBW

### Indication

3 digits or bar-chart

### Resolution

0.1 dB max, typically 1%

### Accuracy (N-Type)

$\pm 10\% \pm$  resolution up to 1 GHz

### Maximum Continuous Rating

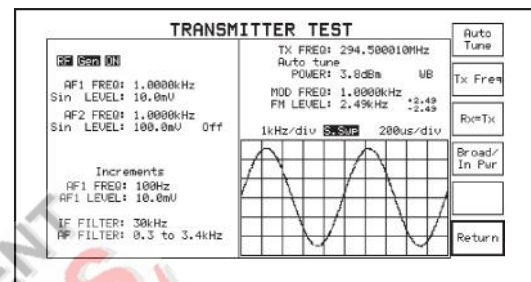
N-Type: 50 W at 20 °C

BNC output: 5 W

Antenna port: 1 W

### Intermittent Rating

N-Type: 150 W for limited periods, typically 1 minute at 20 °C.  
Overload indicated by audible and visual warning.



## HARMONIC AND TRANSIENT ANALYSIS

### Harmonic Measurement

Displays 1st to 5th harmonic of the selected carrier.

### Maximum Harmonic Frequency

1.05 GHz

### Dynamic Range

0 to -60 dBc

## TRANSIENT POWER ANALYSIS

Displays power profile against time

### Frequency Range

1 to 1050 MHz

### Dynamic Range

60 dB below spectrum analyzer reference level

### Scale (power)

10 dB/div

### Scale (time)

50  $\mu$ s/division to 5 s/div

### Trigger Level

Adjustable over full dynamic range +ve or -ve trigger selection

### Pre-trigger

0, 25, 50, 75 or 100% of displayed period

## MODULATION METER

### Sensitivity

Autotuned: 5 mW (N-Type)

0.05 mW (Antenna port)

Manual Tuned:-34 dBm (N-Type)

-60 dBm (Antenna port)

#### Audio and Modulation Filters

300 Hz, 3 kHz, 15 kHz Lowpass

300 Hz to 3.4 kHz Bandpass

300 Hz Highpass

750  $\mu$ s de-emphasis

50 kHz Lowpass (No filters applied)

#### AMPLITUDE MODULATION

##### Frequency Range

400 kHz to 1.05 GHz

##### Modulation Frequency Range

10 Hz to 15 kHz

##### AM Depth Range

0 to 99% (manually tuned)

0 to 90% below 100 MHz

0 to 80% from 100 to 400 MHz

##### Resolution

1% AM

##### Indication

2 digits and bar-chart

##### Accuracy<sup>(1)</sup>

$\pm 5\% \pm 1$  digit at 1 kHz

$\pm 8.5\% \pm 1$  digit from 50 Hz to 10 kHz

##### Demodulation Distortion<sup>(1)</sup>

Less than 2%, at 1 kHz and 30% AM, (CCITT weighted)

##### Residual AM

Less than 1% (300 Hz to 3.4 kHz)

##### Demodulation Output

50 mV peak to peak for 1% AM

#### FREQUENCY MODULATION

##### Frequency Range

400 kHz to 1.05 GHz

##### Modulation Frequency Range

10 Hz to 15 kHz

##### Deviation Range

0 to 75 kHz

##### Resolution

10 Hz below 2 kHz deviation

1% above 2 kHz deviation

##### Indication

3 digits and bar-chart

##### Accuracy<sup>(1)</sup>

$\pm 5\% \pm$  resolution at 1 kHz modulation frequency

$\pm 7.5\% \pm$  resolution for modulation frequencies 50 Hz to 10 kHz

##### Demodulation Distortion

Less than 2% at 1 kHz and 5 kHz FM, (CCITT weighted)

##### Residual FM

Less than 30 Hz (300 Hz to 3.4 kHz)

##### Demodulation Output Socket

200 mV peak to peak  $\pm 10\%$  per 1 kHz deviation

#### RF SPECTRUM ANALYZER

##### Frequency Range

400 kHz to 1.05 GHz

##### Spans

1 kHz/division to 100 MHz/division in a 1, 2, 5 sequence or continuously variable

Start - stop facility allows selection of infinitely variable span width

##### Resolution Bandwidth

300 Hz, 3, 30, 300 kHz, 3 MHz

##### Reference Level (top of screen)

-50 dBm to +52 dBm 0.7 mV to 71 V

##### Displayed Dynamic Range

80 dB

##### Noise floor

Typically 75 dB below top of screen

##### On Screen Linearity

Typically  $\pm 2$  dB  $\pm 1$  resolution (10 dB/div) 10 dB above noise floor

##### Vertical Resolution

0.1 dB on 2 dB/division

0.5 dB on 10 dB/division

##### Level Flatness

$\pm 2$  dB  $\pm$  resolution (10 dB/div)

##### Intermodulation Distortion

Better than 70 dB for two signals at -30 dBm into first mixer

##### Sweep Speeds

10 ms/div to 200 ms/div in a 1, 2, 5 sequence (optimum sweep speed and bandwidth selected according to span or user selectable)

Span	Resolution Bandwidth	Update (Sweeps/sec)
10 kHz	300 Hz	5
100 kHz	3 kHz	9
1 MHz	30 kHz	9
10 MHz	300 kHz	9
100 MHz	300 kHz	5
1000 MHz	3 MHz	5

##### Marker Indication

Level and frequency or delta marker from centre line of screen

Single marker for frequency and level display.

Marker to centre frequency marker

##### Features

Simultaneous 'Look and Listen' spans 100 kHz, 200 kHz, 500 kHz, 1 MHz



### Sensitivity

2  $\mu$ V

### Tracking Generator Offset/Frequency Range

0-999 MHz/400 kHz to 1000 MHz

## AUDIO GENERATORS

### FREQUENCY

#### Frequency Range

10 Hz to 25 kHz (sine or square)

#### Setting

Keyboard entry, delta increment / decrement function and rotary control

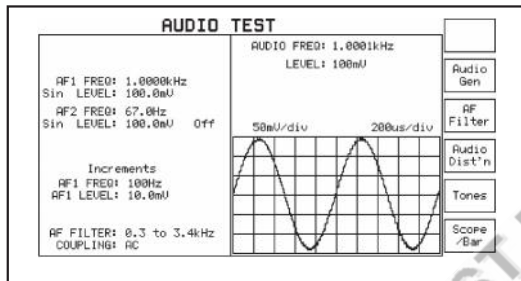
#### Indication

5 digits

#### Resolution

0.1 Hz below 3.25 kHz

1 Hz above 3.25 kHz



#### Accuracy

0.01 Hz below 180 Hz, 0.1 Hz above 180 Hz

#### LEVEL

#### Level Range

0.1 mV to 4 VRMS

#### Setting

Keyboard entry, delta increment / decrement function and rotary control

#### Indication

4 digits

#### Resolution

0.1 mV below 409 mV

1 mV above 409 mV

#### Accuracy

$\pm$  5% + resolution 50 Hz - 15 kHz

#### Output Impedance

Nominally 5  $\Omega$  (minimum load 25 W)

#### Distortion

Less than 0.5% at 1 kHz

Less than 1% from 50 Hz to 15 kHz

### Signaling Encoder/Decoder

Sequential tones functions including revert  
User defined tones

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.

Up to two frequency plans may be defined and stored within the 2948 for sequential tones. Any of the standard tone frequency plans may be copied to user defined and modified.

Tone length 20 ms to 1 s.

Standard tone frequencies may be selected from a menu.

Generation and decoding of DTMF tones.

Generation and decoding of DCS (Digitally Coded Squelch).

Generation of POCSAG code CCIR No.1 Rec 584. Bit rates from 400 to 4800 bit/s. Inversion available.

### AUDIO MONITOR

Demodulated signals and audio signals may be monitored via the internal loudspeaker and the accessory socket output on the front panel.

## CELLULAR AND TRUNKING

### Test Modes

Auto test/manual test

### Auto Test Programs

Call processing only  
Call and RF testing  
Brief testing  
Comprehensive testing

### 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	

### Signaling Auto Test Routines

Registration/Roaming Update  
Place Call  
Page Mobile  
Clear from Land  
Clear from Mobile  
Handoff  
Hook Flash  
DTMF Decode  
Data Performance  
PTT On  
PTT Off  
SAT Deviation  
SAT Frequency  
ST Duration  
ST Frequency  
ST Deviation  
DSAT Deviation

## FREQUENCY STANDARD

---

### Internal Frequency Standard (OCXO)

#### Frequency

10 MHz

#### Temperature Stability

Better than 5 parts in  $10^8$ , 0 to 55°C

#### Ageing Rate

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

#### Warm up

Less than 10 minutes to within 2 parts in  $10^7$  at 20°C

### External Frequency Standard Input

#### Frequency

1, 2, 5 and 10 MHz

#### Input Level

Greater than 1 V peak to peak

#### Input Impedance

Nominally 1 k $\Omega$

## GENERAL

---

### Keyboard and Display

Logical color coded keyboard with bright high resolution fast LCD

### Display Size

160 x 85 mm

### RS-232C

RS-232C interface is provided for printing and remote instrument control

### Connector

9 way female 'D' Type

### POWER REQUIREMENTS

#### AC Supply Voltage

100 - 240 V~ / 108 - 118 V~ (Limit 90 - 264 V~/98 - 132 V~)

#### AC Supply Frequency

50 - 60 Hz / 50 - 400 Hz (Limit 45 - 66 Hz / 45 - 440 Hz)

#### Maximum AC Power

190 VA

#### DC Supply Voltage

11 to 32 V

#### Maximum DC Power

100 W

### CALIBRATION INTERVAL

2 years

### ELECTROMAGNETIC COMPATIBILITY

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

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.

### CALIBRATION INTERVAL

2 years

### ENVIRONMENTAL

#### Rated Range of Use

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

#### Storage and Transport

#### Temperature

-40 to +71°C

#### Altitude

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

### DIMENSIONS AND WEIGHT

#### Height

178 mm (7 in)

#### Width

380 mm (15 in)

#### Depth

457 mm (18 in)

(including handle, feet and covers)

#### Weight

Less than 12 kg (standard version)

### OPTIONS AND ACCESSORIES

---

#### 600 $\Omega$ MATCHING UNIT (OPTION 1)

#### INPUT CIRCUIT

#### Impedance

600  $\Omega$

#### Return Loss

>21 dB at 1 kHz

#### Frequency Response

$\pm 0.5$  dB at 200 Hz to 5 kHz,

$\pm 2$  dB at 100 Hz to 20 kHz

#### Accuracy of 1:1 input:output ratio

$\pm 1\%$  at 1 kHz  $\pm$  accuracy of 2945A, 2946A or 2948

#### Maximum Input

5 V RMS maximum at 200 Hz to 5 kHz

3 V RMS maximum at 100 Hz to 20 kHz

#### OUTPUT CIRCUIT

#### Impedance

600  $\Omega$

#### Return Loss

>21 dB at 1 kHz

**Frequency response**

±0.5 dB at 200 Hz to 5 kHz  
 ±2 dB at 100 Hz to 20 kHz

**Level Accuracy**

±2% at 1 kHz ± accuracy of 2945A, 2946A or 2948

**Output Level**

1 mV to 2.5 V RMS across 600 Ω

**ANALOG SYSTEMS CARD (OPTION 2)**

This option provides automatic testing for cellular, trunked and FM radios and a BASIC Interpreter for customized tests.

**PARALLEL INTERFACE (OPTION 4)**

Allows direct connection of a parallel printer. Additionally provides 4 software programmable output lines.

**Printer Port****Connector**

25 way female D type

**Printers Supported**

75, 100, 150 dots per inch laser printers, FX 80, FX 100 Epson format.

**Accessory Port****Connector**

9 way female D type

**Outputs**

4 independently programmable output lines, each one configurable as a logic line or as a relay contact closure. +5V supply available.

**GPIB (OPTION 5)****Capability**

For printing, remote instrument control or for programming of user defined test sequences.

Complies with the following subsets defined by IEEE488:- SH1, AH1, T6, L4, SR1, RL1, DTO, EI, DC1

**MEMORY CARD DRIVE AND REAL TIME CLOCK (OPTION 6)**

The memory card facility allows the storage of results, set-ups screen dumps and user programs with SRAM cards. Meets PCMCIA 2 standard.

Allows the current date and time to be stored with results to the memory card and/or printed with a screen dump.

**SSB DEMODULATOR (OPTION 8)**

The SSB demodulator allows signals to be demodulated either via the internal loudspeaker or via the accessory socket. Provides demodulation of SSB signals (upper and lower sideband)

**Frequency Range**

400 kHz to 1 GHz

**AF Demodulation Range**

10 Hz to 15 kHz

**Distortion**

Typically less than 3% at 1 kHz (300 to 3.4 kHz)

**Detection Range**

2 μV to 150 W

**Features**

Automatic detection of USB or LSB. BFO can be used for tuning of carrier for AM and FM radio's.

**OCCUPIED BANDWIDTH MEASUREMENT (OPTION 9)**

Calculates the bandwidth of a signal displayed on the spectrum analyzer.

**Frequency Range**

1 MHz to 1 GHz

**Display Resolution**

3 digits

**Accuracy**

20%

**Bandwidth Measurement Range**

3 kHz minimum

Ratio range 90% - 99% selectable in 0.1% steps

**NMT CELLULAR SOFTWARE (OPTION 10)**

NMT 450	NMT 900
Benelux	NMTF
Austria	Spain
Malaysia	Indonesia
Saudi 1	Saudi 2
Thailand	Oman
Tunisia	Hungary
Poland	Russia
Czech	Bulgaria
Slovenia	Turkey
USER DEFINED NMT	

**AMPS CELLULAR SOFTWARE (OPTION 11)**

E-AMPS	N-AMPS
USER DEFINED AMPS	

**TACS CELLULAR SOFTWARE (OPTION 12)**

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

**MPT 1327 TRUNKING SOFTWARE (OPTION 13)**

BAND III	JRC
UK WATER	HONG KONG
AUTONET	AMT
MADEIRA	NL-TRAXIS
NZ MPT1327	PH-INDO
USER DEFINED MPT	

**PMRTEST SOFTWARE (OPTION 14)**

USER DEFINED PMR for FM radio's

**EDACS™ RADIO TEST SOFTWARE (OPTION 15)**

Provides Auto/Manual test capability for EDACS™ radios. Up to 4 User defined variants can be created and stored, each with up to 24 spot channel frequencies.

**EDACS™ REPEATER TEST SOFTWARE (OPTION 16)**

Provides Auto/Manual test capability for EDACS™ repeaters. Up to 4 user defined variants can be created and stored, each with up to 24 spot channel frequencies. A data logging facility is also available to continuously decode and display data messages from the repeater under test.

EDACS is an Ericsson GE registered trademark. IFR is an EDACS trunking licensee.

### POCSAG DECODE (OPTION 22)

Allows off-air decoding of POCSAG messages. Can decode a message as it is received, or decoding can be triggered from a user selectable RIC code or fixed message pattern.

#### Bit Rate

Automatically decodes any standard bit rate up to 4800 bits/s. Numeric or alphanumeric decoding is provided.

Number of received errors is displayed.

### CCITT FILTER (OPTION 23)

Allows a CCITT filter to be inserted into either the demodulated audio path or the audio input path.

### CMESS FILTER (OPTION 24)

Allows a CMESS filter to be inserted into either the demodulated audio path or the audio input path.

### AVIONICS (OPTION 25)

Provides amplitude modulated signals for testing ILS, VOR, Marker Beacons and SELCAL.

(Full details of the Avionics features can be found in the 2946A data sheet, part number: 46891-030)

### BAIL ARM/FRONT COVER (OPTION 30)

Provides a Bail arm carrying handle and front panel cover and storage area. The Bail arm will also provide additional viewing angles when mounted on a bench.

#### Notes

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

## VERSIONS AND ACCESSORIES

When ordering please quote the full ordering number information.

### Ordering Numbers

#### Versions

2948 Low-Noise Communications Service Monitor

#### Options

Option 1 600  $\Omega$  Matching Unit

Option 2 Analog Systems Card

Option 4 Parallel Interface†

Option 5 GPIB Interface†

Option 6 Memory Card Drive with real time clock

Option 8 SSB demodulator

Option 9 Occupied Bandwidth Measurement

Note: Option 2 required when ordering any of the following options 10 to 16

Option 10 NMT Cellular

Option 11 AMPS Cellular

Option 12 TACS Cellular

Option 13 MPT 1327 trunking

Option 14 PMRTEST

Option 15 EDACS™ Radio Test

Option 16 EDACS™ Repeater Test

Option 22 POCSAG Decode

Option 23 CCITT Filter†

Option 24 CMESS Filter†

Option 25 Avionics

Option 30 Bail Arm and Front Panel Stowage

### Supplied Accessories

AC Supply lead

DC Supply lead

Operating Manual

### Optional Accessories

44991/145 Microphone with PTT

59000/189 Memory Card (128k)

59000/375 Memory Cadr (2 M)

46662/571 'Ever-Ready' Case

46662/616 'Ever-Ready' Case for use with Option 30

54112/163 Hard Transit Case

54431/023 20 dB AF attenuator (BNC)

46884/728 Rack Mounting Kit

54421/001 BNC Telescopic Antenna

46884/650 Serial port to PC control cable (9 way)

46884/649 Serial port to PC control cable (25 way)

46884/648 RS-232 Printer cable (25 way)

59999/170 RF Directional Bridge

54421/002 RF Directional Power Head (1 to 50 MHz)

54421/003 RF Directional Power Head (25 to 1000 MHz)

54432/012 Wideband Amplifier (100 Hz to 500 MHz)

46880/082 Service Manual

† Options 4 and 5 can not be fitted together.

† Options 23 and 24 can not be fitted together.





**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

As we are always seeking to improve our products, the information in this document gives only a general indication of the product capacity, performance and suitability, none of which shall form part of any contract. We reserve the right to make design changes without notice. All trademarks are acknowledged. Parent company Aeroflex, Inc. ©Aeroflex 2004.

[www.aeroflex.com](http://www.aeroflex.com)  
[info-test@aeroflex.com](mailto: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.