

# Wireless

## 2948B Low Noise Communications Service Monitor

**AEROFLEX**  
A passion for performance.



All the benefits of the 2945B but with a low phase noise signal generator, for 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
- Color transfective superfast LCD with rapid refresh rate for easy monitoring and real time adjustment
- Tracking generator with full offset tracking
- Full span spectrum analyzer with 'live' look and listen

*The 2948B Communications Service Monitor is the lightest, most rugged service monitor available with low phase-noise signal generation. For field work, the 2948B 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 2948B differs from its 2945B '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 2948B enables signal-to-noise measurements of better than 46 dB to be made on receivers with 12.5 kHz channel spacing.

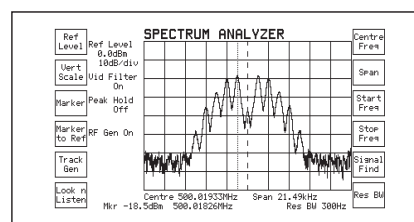
### Field Operation

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

A large color transfective (improved sunlight readable) display aids operation under harsh viewing conditions. 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. A selection of cases are available including a hard transit case, standard soft carrying case or an integrated soft carrying/operational case allowing full operation without removal from the protective case.

Stored settings may be recalled from internal memory or from a memory card allowing fast and straightforward set 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 genera-

tor provided as standard, duplexers and filters can be aligned quickly and easily. An offset facility provides testing of equipment with frequency 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 2948B 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 the 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

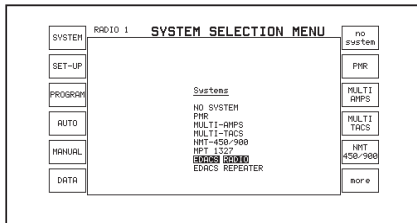
The 2948B measures the power of low level signals such as those encountered when monitoring off-air signals or those found when probing a circuit. 150 Watts measurement is provided without the need for external attenuators so the high power of base stations can be measured directly. Measurement accuracy 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 2948B. 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.



### PMR, Trunking and Cellular

The 2948B provides extensive support for the various tone signaling systems used in Professional Mobile Communications such as DTMF, TONE REMOTE (Option), DCS and CTCSS. Also a highly flexible user defined system enables the instrument to be configured to accommodate a wide variety of other tone formats that are in use.

Additionally trunked networks are supported with network signaling protocol simulations for MPT-1327/1343, LTR (available Oct 05) and EDACS radio / repeater measurements. Legacy analog cellular standards are also available internally and include AMPS, TACS and NMT with all country variants provided.

### 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 2948B.

### Printing and Post Analysis

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 2948B can be saved direct to a PC via the serial port as a bit map file.

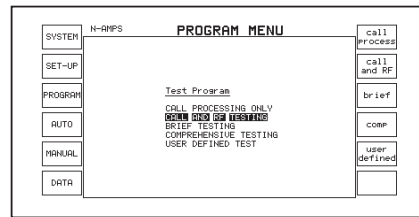
A single trace dump command allows fast transfer of the spectrum analyzer, OBW or transient analysis trace to be transferred as 249 ordinate values for detailed post-processing and analysis.

### 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 range of built-in programs or by using the MI-BASIC interpreter to produce a customized 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 2948B 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 coordinates, and test sequences can all be stored on the memory card, allowing information to be easily stored and retrieved when required.

### Reliability

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

### Audio Analysis

A comprehensive and expanded range of filter selection is 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.

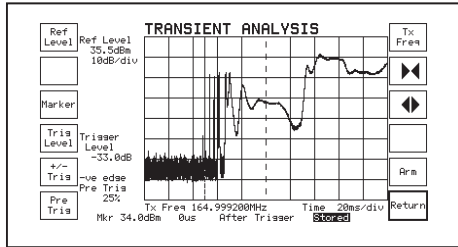
The standard 1 kHz notch filter provides for normal distortion/SINAD measurements. Additional notch filters can be added to enable distortion/SINAD measurements for signals in the range 50 Hz to 20 kHz where required.

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 2948B. This complements the fast spectrum analyzer and allows a rapid check that the transmitter under test is not producing any excessive harmonics.

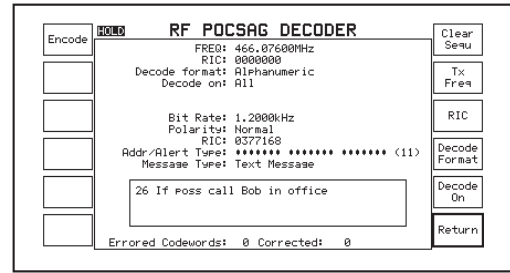
### Tones Generation and Decoding

The tones menus include full remote control so that radio workshops can further automate their tasks. It is possible to enter tones durations of up to 20 seconds directly, simplifying operation with some of the more extreme tones systems in use. These and other improvements are in response to user feedback and allow better control of 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 2948B an ideal surveillance tool. The 2948B 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

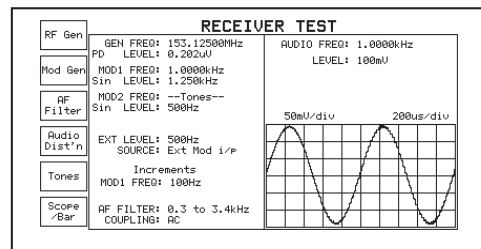
### OUTPUT LEVEL

#### 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

#### Atten Hold Facility (CW and FM modes only)

Allows user to define start point for seamless generator operation across a range of up to 20 dB (guaranteed 10 dB minimum)

#### 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  $\Omega$

#### **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**

5 Hz to 33 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 <sup>(a)</sup>**

$\pm 7\%$  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**

5 Hz to 33 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, dBm, dBV, dBr (user selectable)

External load R selectable compensation for 4, 8, 16, 75, 100, 150, 300, 600 Ohms

Peak hold facility

### 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 SINADMETER

---

### Frequency

1 kHz (additional frequencies available with option 29)

### 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 (additional frequencies available with option 29)

### 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  $\mu$ s/div to 5 s/div in a 1, 2, 5 sequence

## Graticule

10 Horizontal by 6 Vertical divisions

## Special Features

Built in anti-aliasing circuitry and variable decode trigger level

## AUDIO BAR CHARTS

### Bar chart Displays

AF Voltage, SINAD, Distortion, S/N

### Vertical Resolution

2% of full scale

### Rangig

Auto-ranging, range hold or manual selection

1, 2, 5, sequence with hysteresis

### Audio and Modulation Filters

Lowpass filters

Four independently configurable Lowpass filters LP1, LP2, LP3, LP4 that can be set to any frequency cut off point from 250 Hz to 20000 Hz (excluding the band 1001 Hz to 2999 Hz)

50 kHz Lowpass (No filters applied)

750  $\mu$ s de-emphasis

Highpass filters

50 Hz Highpass, 300 Hz Highpass

Bandpass filters

Any combination of LP1, LP2, LP3, LP4 and the Highpass filters

### Audio Analyzer General Features

Tones Mode

## RF FREQUENCY METER

### Frequency Range

400 kHz to 1.05 GHz (manual tune)

10 MHz to 1 GHz (auto-tune)

### 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 (auto-tune)

### Sensitivity

Auto-tuned 5 mW (N-Type) 0.05 mW (Antenna port)

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

Auto or manual control of input attenuator

## 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 (FM & CW)

### Maximum Continuous Rating

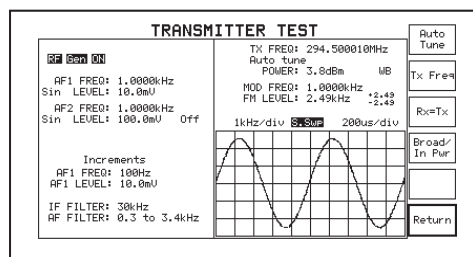
N-Type: 50 W at 20 °C

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**

Auto-tuned: 5 mW (N-Type)

0.05 mW (Antenna port)

Manual Tuned: -34 dBm (N-Type)

-60 dBm (Antenna port)

Auto or manual control of input attenuator

### **Audio and Modulation Filters**

Lowpass filters

Four independently configurable Lowpass filters LP1, LP2, LP3, LP4 that can be set to any frequency cut off point from 250 Hz to 20000 Hz (excluding the band 1001 Hz to 2999 Hz)

A 50 kHz Lowpass (No filters applied)

750  $\mu$ s de-emphasis

Highpass filters

50 Hz Highpass, 300 Hz Highpass

Bandpass filters

Any combination of LP1, LP2, LP3, LP4 and the Highpass filters

## **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

Peak hold facility

### **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>(2)</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

Peak hold facility

### **Resolution**

10 Hz below 2 kHz deviation

1% above 2 kHz deviation

### **Indication**

3 digits and bar chart

### **Accuracy<sup>(2)</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 center line of screen
- Single marker for frequency and level display
- Marker to center 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

- 5 Hz to 33 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 2948B for sequential tones. Any of the standard tone frequency plans may be copied to user defined and modified.

Tone length 20 ms to 20 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 (dependent upon which system in use)

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	PTT On
Place Call	PTT Off
Page Mobile	SAT Deviation
Clear from Land	SAT Frequency
Clear from Mobile	ST Duration
Handoff	ST Frequency
Hook Flash	ST Frequency



DTMF Decode  
Data Performance

ST Deviation  
DSAT Deviation

IEC/EN61326-1 : 2006, RF Emission Class B, Immunity table 3

## 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 color high resolution fast LCD

### Display Size

144 x 80 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:

### 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

-30 to +70°C

#### Altitude

Up to 2500 m (pressurized 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 2945B or 2948B

##### 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 2945B or 2948B

### 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.

### LTR TRUNKING TEST SOFTWARE (OPTION 18)

Provides Auto/Manual test capability for LTR Trunked radios. (Planned

availability Q3 2006)

#### 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 Option 25 data sheet, Part number: 46891/213)

#### TONE REMOTE (OPTION 26)

Provides configuration screens and generation of Tone Remote control signals

#### PLUS 2 DISTORTION NOTCH FILTERS BOARD (OPTION 29)

The standard instrument is supplied with a 1 kHz notch for Distortion and Sinad measurements. This option allows the user to carry out Distortion/Sinad measurements at two additional frequencies. The two additional notch frequencies can be anywhere in the band 50 Hz to 20 kHz and must be stipulated at the time of ordering.

#### 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.

#### IF OUTPUT (OPTION 31)

Allows access to the IF signal from the rear of the instrument (Note: Incorporation of this option replaces the standard demod out capability)

Notes

<sup>(1)</sup> 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

2948B

#### Versions

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 18

- 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 18 LTR Trunking
- Option 22 POCSAG Decode
- Option 23 CCITT Filter†
- Option 24 CMESS Filter†
- Option 25 Avionics
- Option 26 Tone Remote
- Option 29 Plus 2 Distortion Notch Filters board\*\*
- Option 30 Bail Arm and Front Panel Stowage
- Option 31 IF Output Capability

#### Supplied Accessories

- AC Supply lead
- DC Supply lead
- CD-Rom containing Operating Manual

#### Optional Accessories

- 44991/145 Microphone with PTT
- 59000/189 Memory Card (128k)

59000/375	Memory Card (2 M)
46662/779	Soft carrying case (suitable for all 2948/2948B)
46662/571	Soft carrying/optional case
46662/616	Soft carrying/optional 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)
46880/115	Service Manual

† Options 4 and 5 can not be fitted together.

† Options 23 and 24 can not be fitted together.

\*\* Option 29, The standard instrument is supplied with a 1 kHz notch for Distortion and Sinad measurements. This option allows the user to carry out Distortion/Sinad measurements at two additional frequencies. The two additional notch frequencies can be anywhere in the band 50 Hz to 20 kHz and must be stipulated at the time of ordering.

**CHINA Beijing**

Tel: [+86] (10) 6539 1166  
Fax: [+86] (10) 6539 1778

**CHINA Shanghai**

Tel: [+86] (21) 5109 5128  
Fax: [+86] (21) 6457 7668

**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] (0) 80 4115 4501  
Fax: [+91] (0) 80 4115 4502

**JAPAN**

Tel: [+81] 3 3500 5591  
Fax: [+81] 3 3500 5592

**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 Cambridge**

Tel: [+44] (0) 1763 262277  
Fax: [+44] (0) 1763 285353

**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 2010.

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



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