The 2945B Communications Service Monitor is the lightest, most rugged service monitor available with a full performance spectrum analyzer as standard. For field work the 2945B 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.

Field Operation
At under 12 kg (25 lb), the 2945B lightens the load to remote sites. The shape of the 2945B is ideal for carrying. The side handle ensures that the instrument is clear of the stairs when ascending buildings and the depth is suitable for the 2945B to be operated comfortably when it is placed on the floor.

A large colour transflective (improved sunlight readable) display aids operation under harsh viewing conditions.

An optional bail arm 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/optional case allowing full operation without removal from the protective case.

Internal Battery
Utilising NiMH technology the internal battery option provides 60 minutes operation in the field.

Compact and light the 2945B is equally at home in the field as on a bench.

Fast Warm Up - Fast Results
The standard TCXO allows results to be made reliably within a minute of switch on. Where even better stability is required, an optional OCXO is available.

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 full span 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 frequency translation. Channel stepping can be performed by defining an increment and then using the FREQ ↑ or ↓ keys. This is particularly useful when testing multi-channel systems.

Live Look and Listen

This feature puts the 2945B above all 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 basestation sites.

From 2 μV to 150 Watts

The 2945B will measure 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 high power 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 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 ±2 dB at all levels above -127 dBm.

Duplex - provided as standard

Full duplex operation is provided by the 2945B. 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 2945 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 2945B.

Printing and Post Analysis

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

A screen capture facility is available so any screen displayed on the 2945B Communications Service Monitor 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 (optional) 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 to allow 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 2945B 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 2945B features high integration with a rugged chassis design to maximize mechanical protection.

Audio Analysis
A comprehensive and expanded range of filter selection is provided as standard, including band pass, lowpass and high pass. Optional filters are available for psophometric weighting of audio signals and demodulation of signals in a simulated radio channel bandwidth.

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.

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 2945B. This complements the fast spectrum analyzer and allows a rapid check that the transmitter is not producing any large 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 signals to be displayed. Signals with bit rates of up to 4800 bits/s can be automatically detected making the 2945B an ideal surveillance tool. The 2945B can be set to detect all messages, a user selectable RIC (just like a Pager), or a fixed message string.
SPECIFICATION

GENERAL INFORMATION

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

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, dBμV, μV, mV PD/EMF)

Accuracy
±2 dB for levels 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 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

(If you require even better spectral purity than that specified here, please consider the 2948B)

Residual FM
Less than 15 Hz RMS (0.3 to 3.4 kHz) up to 500 MHz
Less than 20 Hz RMS (0.3 to 3.4 kHz) up to 1.0 GHz (with OCXO)

Harmonics
Better than -20 dBC

Spurious Signals
Better than -30 dBC (±10 kHz to 1.5 MHz offset from carrier frequency or over range 600 to 700 MHz)
Better than -40 dBC from 400 kHz to 1 GHz

SSB Phase Noise (20 kHz offset)
Better than -95 dBC/Hz up to 1 GHz

RF Carrier Leakage
Less than 0.5 μV PD generated in a 50 Ω load by a 2 turn loop 25 mm from the case. Output level less than -40 dBm into a sealed 50 Ω 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
± 7% ± 1 digit for modulation frequency of 1 kHz
± 10% ± 1 digit for modulation frequencies from 50 Hz to 5 kHz
± 15% ± 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 kΩ in parallel with 40 pF
Frequency Range
As internal AM

Modulation Frequency Range
As internal AM

Sensitivity
1 V RMS for 0 to 100% AM

FREQUENCY MODULATION - INTERNAL

Frequency Range
400 kHz to 1.05 GHz

Maximum Deviation
0 to 75 kHz

Indication
3 digits

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

Accuracy
±5% ± 10 Hz at 1 kHz modulating frequency
±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

FREQUENCY MODULATION - EXTERNAL

Input Impedance
Nominally 10 kΩ in parallel with 40 pF

Frequency Range
As internal FM

Modulation Frequency Range
DC to 100 kHz

Pre-emphasis
750 μs selectable

MICROPHONE INPUT

Input Level
2 mV to 200 mV (AGC levelled)

Input Impedance
Nominally 150 Ω

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 MΩ 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 to 100 mV to 0 to 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
±3% ±3 mV ±1 digit

AUDIO FREQUENCY METER

Frequency Range
20 Hz to 20 kHz

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

Indication
5 digits

Accuracy
As frequency standard ± 1 digit ± resolution

Sensitivity
50 mV

AUDIO SINAD METER

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
±1 dB

Sensitivity
50 mV (100 mV for 40 dB SINAD) reading suppressed if audio voltage is less than 5 mV
AUDI0 DISTORTION METER

**Frequency**
1 kHz (additional frequencies available with option 29)

**Range**
0 to 10%, 0 to 30% and 0 to 100%

**Resolution**
0.1% distortion

**Indication**
3 digits and bar charts

**Accuracy**
±5% of reading ± 0.5% distortion

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

AUDI0 S/N METER

**Range**
0 to 30 dB and 0 to 100 dB

**Resolution**
0.1 dB

**Indication**
3 digits and bar chart

**Accuracy**
±1 dB

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

AUDI0 OSCILLOSCOPE

**Operating Modes**
Single with digital storage on screen 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**
±5% of full scale

**FM Ranges**
±75, 30, 15, 6, 3 and 1.5 kHz deviation full scale, ±10% accuracy

**AM Ranges**
20, 10 and 5% per division, ±10% accuracy

**Timebase**
50 μs/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

BAR CHARTS

**Bar Chart Displays**
AF Voltage, SINAD, Distortion, S/N

**Vertical Resolution**
2% of full scale

**Ranging**
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 μs 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**
100 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 ± resolution

** Acquisition Time**
Less than 1 second (manual tune)
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)**
- ±10% ± resolution up to 1 GHz (FM & CW)

**Maximum Continuous Rating**
- N-Type: 50 W at 20°C
- 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 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 μs/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)

**Audio & Modulation 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 μs de-emphasis

**Highpass filters**
- 50 Hz Highpass, 300 Hz Highpass
- Bandpass filters

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

**AMPLITUDE MODULATION**

**Frequency Range**
100 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**
- ±5% ±1 digit at 1 kHz
- ±8.5% ±1 digit from 50 Hz to 10 kHz

**Demodulation Distortion**
- Less than 2%, at 1 kHz and 30% AM, (CCITT weighted)

**Residual AM**
- Less than 1% (300 Hz to 3.4 kHz)

**FREQUENCY MODULATION**

**Frequency Range**
100 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**
±5% ± 1 digit at 1 kHz modulation frequency
±7.5% ± 1 digit 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 ±10% per 1 kHz deviation

**RF Spectrum Analyzer**

**Frequency Range**
100 kHz to 1.0 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 ±2 dB ±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**
±1 dB ± resolution over 50 MHz span

**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)

<table>
<thead>
<tr>
<th>Span</th>
<th>Resolution Bandwidth</th>
<th>Update (Sweeps/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 kHz</td>
<td>300 Hz</td>
<td>5</td>
</tr>
<tr>
<td>100 kHz</td>
<td>3 kHz</td>
<td>9</td>
</tr>
<tr>
<td>1 MHz</td>
<td>30 kHz</td>
<td>9</td>
</tr>
<tr>
<td>10 MHz</td>
<td>300 kHz</td>
<td>9</td>
</tr>
<tr>
<td>100 MHz</td>
<td>300 kHz</td>
<td>5</td>
</tr>
<tr>
<td>1000 MHz</td>
<td>3 MHz</td>
<td>5</td>
</tr>
</tbody>
</table>

**Marker Indication**
Level and frequency or delta marker from center line of screen.
Single marker for frequency and level display. Marker to center frequency. Δ marker

**Features**
Simultaneous ‘Look and Listen’ spans 100 kHz, 200 kHz, 500 kHz, 1 MHz

**Sensitivity**
2 μV

**Tracking Generator Offset/Frequency Range**
0 to 999 MHz/400 kHz to 1000 MHz

**Audio Generators**

**Frequency**
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 4V RMS

**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**
± 5% ± resolution 50 Hz to 15 kHz
**Output Impedance**

Nominally 5 Ω (minimum load 25 Ω)

**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, D2VEI, 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 2945B 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 POCASAG 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 (dependant upon which system in use)**

Call processing only
Call and RF testing
Brief testing
Comprehensive testing

**Parametric Auto Test Routines**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AF Frequency</td>
<td>AF Level</td>
</tr>
<tr>
<td>FM Deviation</td>
<td>Mod frequency</td>
</tr>
<tr>
<td>Rx Distortion</td>
<td>Rx Expansion</td>
</tr>
<tr>
<td>Rx Sensitivity</td>
<td>Rx SINAD</td>
</tr>
<tr>
<td>Rx S/N</td>
<td>Tx Compression</td>
</tr>
<tr>
<td>Tx Distortion</td>
<td>Tx Frequency</td>
</tr>
<tr>
<td>Tx Level</td>
<td>Tx Power Level</td>
</tr>
<tr>
<td>Tx Limiting</td>
<td>Tx Mod Level</td>
</tr>
<tr>
<td>Tx Noise</td>
<td>Tx SINAD</td>
</tr>
<tr>
<td>Tx S/N</td>
<td></td>
</tr>
</tbody>
</table>

**Signaling Auto Test Routines**

<table>
<thead>
<tr>
<th>Test</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Registration/Roaming Update</td>
<td>PTT On</td>
</tr>
<tr>
<td>Place Call</td>
<td>PTT Off</td>
</tr>
<tr>
<td>Page Mobile</td>
<td>SAT Deviation</td>
</tr>
<tr>
<td>Clear from Land</td>
<td>SAT Frequency Clear from Mobile</td>
</tr>
<tr>
<td>Handoff</td>
<td>ST Duration</td>
</tr>
<tr>
<td>Hook Flash</td>
<td>ST Deviation</td>
</tr>
<tr>
<td>DTMF Decode</td>
<td>DSAT Deviation</td>
</tr>
<tr>
<td>Data Performance</td>
<td></td>
</tr>
</tbody>
</table>

**FREQUENCY STANDARD**

**Internal Frequency Standard (TCXO)**

**Frequency**

10 MHz

**Temperature Stability**

0.5 ppm, 0 to 40°C
0.6 ppm 0 to 50°C

**Ageing Rate**

Better than 1 ppm per year

**Warm Up**

1 minute to specified accuracy

**External Frequency Standard Input**

**Frequency**

1, 2, 5 and 10 MHz

**Input Level**

Greater than 1 V peak to peak

**Impedance**

Nominally 1 kΩ

**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**


**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 the EEC Council Directive 89/336/EEC. Complies with the limits specified in the following standards:

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

Storage and Transport
- Temperature
  -30°C to +70°C
- Altitude
  Up to 2500 m (pressurized freight at 27 kPa differential)

DIMENSIONS AND WEIGHT
Standard Dimensions
- 185 mm (7.3 in) height, 400 mm (15.7 in) width, 460 mm (18.1 in) deep (including handle, feet and covers)

Option 30 Dimensions
- 185 mm (7.3 in) height, 420 mm (16.5 in) width, 565 mm (22.2 in) deep (including handle, feet and covers)

Weight
- Typically less than 11.4 kg, (<25 lb)
- 10.5 kg (No options) Less than 13 kg (fully equipped)

OPTIONS AND ACCESSORIES
600 Ω MATCHING UNIT (OPTION 1)
INPUT CIRCUIT
- Impedance
  600 Ω
- 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
- Accuracy of 1:1 Input:Output Ratio
  ±1% at 1 kHz ± 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 Ω
- 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

HIGH STABILITY INTERNAL FREQUENCY (OCXO) STANDARD (OPTION 3)
- Frequency
  10 MHz
- Temperature Stability
  Better than 0.05 ppm, 5 to 55°C
- Ageing Rate
  Better than 0.1 ppm, per year, after 1 month continuous use
- Warm-up Time
  Less than 10 minutes to within 0.2 ppm at 20°C

PARALLEL INTERFACE (OPTION 4)
- Allows direct connection of a parallel printer
- Additionally provides four 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. +5 V 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
  - IEEE-488:- SH1, AH1, T6, L4, SR1, RL1, DT0, 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 radios.

**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)**
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 MPT 327  PH-INDO
USER DEFINED MPT

**PMRTEST SOFTWARE (OPTION 14)**
USER DEFINED PMR for FM radios

**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.
Capacity

Typically 60 minutes operation

Weight

1.8 kg

Charge Time From Instrument

4 hours

Temperature Range

5-35 °C charge

0-50 °C discharge

Notes

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

When ordering please quote full ordering number information

<table>
<thead>
<tr>
<th>Ordering Numbers</th>
<th>Versions</th>
<th>Options</th>
<th>Optional Accessories</th>
</tr>
</thead>
<tbody>
<tr>
<td>29458</td>
<td>Communications Service Monitor</td>
<td>Option 1</td>
<td>44991/145 Microphone with PTT</td>
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<tr>
<td>29488</td>
<td>Low Phase-Noise Communications Service Monitor</td>
<td>Option 2, Option 21 and Option 32</td>
<td>59000/375 Memory Card (2 M)</td>
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<td>Option 5</td>
<td>46662/779 Soft carrying (suitable for all 294x, except early units being used with external battery)</td>
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<td>Option 6</td>
<td>46662/571 Soft carrying/operational case</td>
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<td>Option 8</td>
<td>46662/616 Soft carrying/operational case for use with option 30</td>
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<td>Option 9</td>
<td>54112/163 Hard Transit Case***</td>
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<td>Option 10</td>
<td>54431/023 20 dB AF Attenuator (BNC)</td>
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<td>Option 11</td>
<td>46884/728 Rack Mounting Kit</td>
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<td>Option 12</td>
<td>54421/001 BNC Telescopic Antenna</td>
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<td>Option 13</td>
<td>46884/650 Serial port to PC control cable (9 way)</td>
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<td>Option 14</td>
<td>46884/649 Serial port to PC control cable (25 way)</td>
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<td>Option 15</td>
<td>46884/648 RS-232 Printer cable (25 way)</td>
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<td>Option 16</td>
<td>59999/170 RF Directional Bridge</td>
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<td>Option 18</td>
<td>54421/002 (1 to 50 MHz) RF Directional Power Head</td>
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<td></td>
<td>Option 19</td>
<td>54421/003 (25 to 1000 MHz) RF Directional Power Head</td>
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<td></td>
<td>Option 20</td>
<td>46880/114 Service Manual</td>
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<td>Note: Option 2 required when ordering any of the following options 10 to 18</td>
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<td>† Options 4 and 5 cannot be fitted together.</td>
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<tr>
<td></td>
<td></td>
<td>†† Options 23 and 24 cannot be fitted together.</td>
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<td>* Option 2, Option 21 and Option 32 - Any two of these options can be fitted together, but not all three.</td>
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<td>** 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.</td>
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<td>‡ External Battery Packs for previous models are still available using the following order codes 2945A Battery pack 43113/021 or 2945 Battery pack 43113/018.</td>
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<td>*** Not suitable for use with units fitted with option 30.</td>
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</table>

**Supplied Accessories**

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