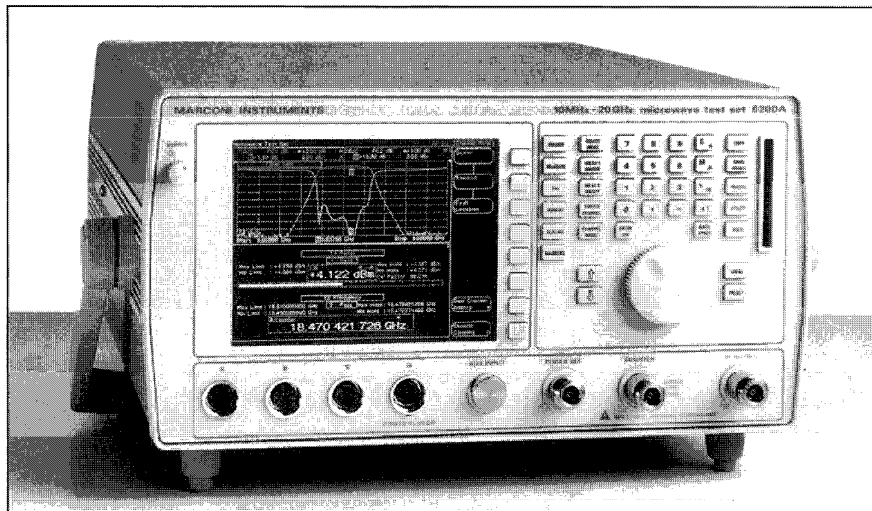


# Microwave Test Set

## Microwave Test Set



- Many instrument functions in one unit
- Economical, Compact and Portable
- 8 GHz, 20 GHz, 26.5 GHz and 46 GHz versions
- Synthesized Sweep Generator
- Four input Scalar Analyzer
- Color Liquid Crystal Display
- Accurate power measurement
- Integral frequency counter
- Real time Fault Location with high resolution
- Programmable V/I source for component evaluation
- 70 dB Sweep Generator step attenuator options
- Ideal for development, production and maintenance
- Memory card for increased storage capacity
- 6210 Reflection Analyzer for precision reflection coefficient and time domain measurements

6200A series Microwave Test Set (MTS) is an innovative instrument combining many measurement functions in a compact and portable package. The high specification and its portability makes it equally suitable for both bench and field applications.

The introduction of the 6200A series MTS enhances the product range with a new color liquid crystal display and additional measurement features.

6200A is more flexible than an assembly of discrete instruments, it is a total test system. In a single unit the facilities of a precision synthesized sweep generator, four-input scalar analyzer with color display, power meter, frequency counter and programmable voltage/current source are combined.

Integration provides a new breadth of measurement functions at a lower cost than an assembly of discrete instruments, with the added benefit of enhanced ease of use. An example is transmission line fault location for locating faults in antenna feeders and sub-systems.

Four versions of the MTS are available; 6200A covers 10 MHz to 20 GHz, 6201A

covers 10 MHz to 8 GHz, 6203A covers 10 MHz to 26.5 GHz and 6204A has full coverage from 10 MHz to 46 GHz. A 70 dB step attenuator option available on most versions provides synthesized outputs over a wide amplitude range.

### System Integration

System integration of many functions improves ease of use. A keyboard is used for rapid selection of mode and parameters and soft keys and menus are used for function selection. The user is prompted to make the required selection. Help messages are used to guide and assist.

A sophisticated Man-Machine Interface using innovative soft key labels and intuitive menu structures ensure rapid assimilation and fast operation. Macros can be written to simplify complex procedures and speed up operation.

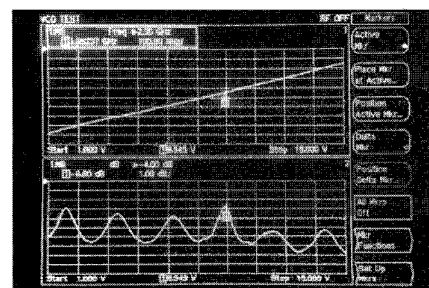
### Multi Facility

A major advantage of an integrated test set is the ability to characterize devices in many different and novel ways. In addition to swept frequency response and return

## 6200A series

loss a power sweep capability is available. Using the step attenuator a sweep over 80 dB may be made to fully characterize amplifiers.

The programmable voltage/current source may be used to stimulate devices such as PIN diode attenuators and voltage controlled oscillators (VCOs). The vertical and horizontal axes can display different parameters. The stimulus frequency, power or voltage can be displayed on the horizontal axis and the response is displayed on the vertical axis. Attenuation values against frequency can therefore be viewed for a PIN attenuator under different bias conditions, or the frequency characteristic of a VCO can be measured, as a function of applied voltage.



Voltage/current output port used to characterize a VCO automatically. The upper trace shows frequency against voltage, the lower trace plots the power variation.

### SYNTHESIZED SWEEP GENERATOR

- Rapid sweeps with synthesizer precision
- Up to +11 dBm levelled power
- Low harmonics and spurious
- Levelled accuracy typically  $\pm 0.5$  dB
- Step attenuator options
- Excellent source match
- Power sweeps up to 80 dB

The MTS incorporates a fast fully synthesized sweep generator which combines the speed and convenience of an analog sweep generator with the precision of a synthesized sweep.

Fast step times coupled with high frequency stability ensures that even narrow filters can be measured with accuracy and confidence. A 400 point sweep can be made in less than 200 ms allowing interactive tuning without compromising accuracy.

Both start/stop and center/span sweep modes may be used as well as CW mode for spot frequency measurements. Power level is settable over a 40 dB range with a maximum typical power of +11 dBm. With the step attenuator (option 001), amplitudes down to -90 dBm may be set for the characterization of amplifiers and other active devices.

## 6200A series

Fundamental frequency generation to 26.5 GHz gives low level spurious signals. Low harmonics of typically less than -40 dBc between 2 and 26.5 GHz are achieved. Spurious signal generation is kept to a low level.

Self-calibration of the output power of the sweep generator is possible because the MTS also incorporates a power meter. Two 'user calibration' stores can be used to give power calibration points over a selected frequency range.

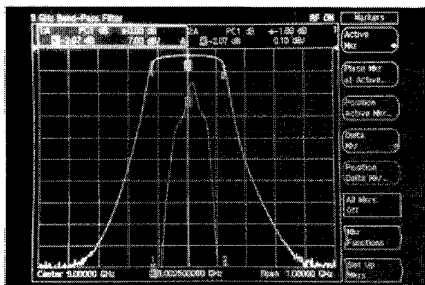
The levelled accuracy of typically  $\pm 0.5$  dB to 26.5 GHz and a superior source match means that a second live detector may be omitted for many swept frequency applications.

### SCALAR ANALYZER

- Four inputs
- High accuracy
- High resolution color display
- Up to 90 dB dynamic range
- Excellent overall linearity
- AC and DC detection
- Eight markers

The four-input scalar analyzer with a clear high resolution color display has a dynamic range of up to 90 dB. Eight markers provide detailed trace examination. Both AC and DC detection modes are provided. Two auto-scaling display channels, each capable of displaying up to two swept measurements, are available.

The channels may be coupled together for the simultaneous update of up to four traces. Each trace can have a different amplitude scale. The channels can be uncoupled so that one displays a different frequency range, allowing simultaneous display of pass-band and stop-band characteristics along with dual amplitude and frequency scales.



One channel frequency response display. Overall response is displayed at 7 dB/division, pass-band ripple is displayed with a scale of 0.10 dB/division.

Intelligent markers and automatic pass/fail analysis against user-entered limit lines assist screen interpretation. The markers may be set to a specific frequency or they can automatically make an 'N-dB'

bandwidth search. Delta, search left, search right functions are also available as well as maximum and minimum find, 'peak-to-peak' and limit checking.

To aid in analysis both averaging and smoothing are provided. Frequency scaling is also available to assist when measuring multipliers and dividers. Frequency offset mode gives the true frequency readout when evaluating mixers.

### VOLTAGE/CURRENT SOURCE

- Programmable source to characterize components and devices
- Voltage range -15 V to +15 V
- Current range -150 mA to +150 mA

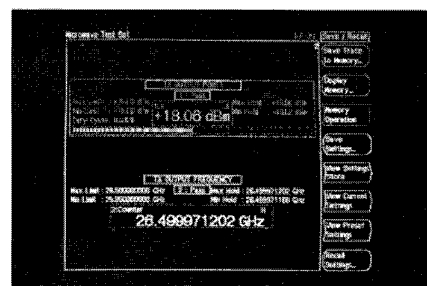
The programmable voltage/current source increases the range of applications so that devices such as VCOs, PIN modulators and amplifiers can be characterized at fixed or swept voltages and currents.

### POWER METER

- Wide dynamic range, -70 dBm to +35 dBm
- Wide frequency coverage, 30 kHz to 40 GHz
- Analog peaking indicator
- Maximum/minimum hold
- Range of 12 power sensors available
- Linearity correction improves accuracy
- Four digit resolution

The fourth input of the scalar analyzer can alternatively be used as a power sensor input. Any of the Marconi Instruments 6900 series power sensors can be connected to permit power measurements over a wide range of powers and frequencies. Power range is -70 dBm (100 pW) to +35 dBm (3 W), frequency range is 30 kHz to 40 GHz. The sensors have an excellent match to minimise mismatch errors.

A 50 MHz internal calibrator port is provided on the front panel to ensure precise power measurements. Full calibration factor and linearity correction is incorporated to further ensure very high accuracy.



Simultaneous measurement of power and frequency.

An analog peaking meter is provided in addition to the four digit display to assist when tuning and peaking. The user can select from 2 to 4 digits of resolution to optimise the response time. The maximum/minimum hold function has many applications including long-term drift monitoring. Upper and lower limits may be entered for automatic pass/fail indication to assist with set-up and adjustment.

### FREQUENCY COUNTER

- 6200A: 10 MHz to 20 GHz
- 6201A: 10 MHz to 20 GHz
- 6203A/6204A: 10 MHz to 26.5 GHz
- Provides both swept and readout response
- Frequency offset facility
- Maximum/minimum hold for drift analysis
- Automatic limit checking

The frequency counter has two principal functions within the MTS. When 'Readout' mode is selected a digital readout of frequency is given. Resolution can be set from 1 Hz to 100 MHz in decade steps to give the optimum compromise between counter gate time (speed) and resolution. In swept mode the counter is used to read and then display the frequency graphically. The vertical axis of the display can be set to record the frequency of a device under test; a typical application is automatic VCO characterization whereby frequency against voltage is automatically plotted.

Maximum/minimum hold for long term drift monitoring is provided for power measurements as well as automatic pass/fail indication against limits.

### FAULT LOCATION

- Real time processing gives rapid fault analysis
- Fault Location measurements from 10 mm to 25 km
- Accuracy 0.1% of range
- High resolution
- Integrated Test Head for convenient connections
- Optional Transmission Line Database for fast measurement setup

The real-time Fault Location capability makes field repair of coaxial and waveguide antenna feeders quick and economical. A display of return loss or VSWR against distance is given to locate the position and magnitude of discontinuities.

Fault Location operates by analyzing the interference patterns generated when signals reflected from impedance discontinuities are combined with a reference signal. A rapid and clear display of return loss against distance is given. Accuracy is 0.1% of range up to 1 km.

Waveguides are analyzed using a non-

# Microwave Test Set

## 6200A series

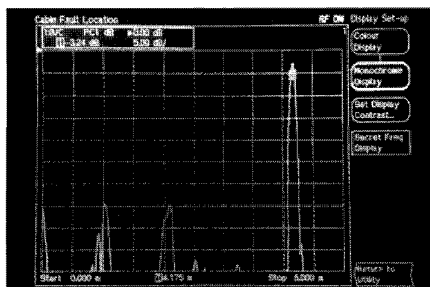
linear sweep to totally eliminate the effects of dispersion so that waveguide results are as fast and clear as for coaxial cable.

Closely spaced faults can be determined so that even loose contacts within a bulkhead connection can be pin-pointed.

The MTS Fault Location has a simple user-interface to allow measurements to be made with little training. It is ideal for microwave and cellular radio operators for antenna feeder measurements. Military applications include fault location on aircraft Electronic Warfare systems and on board ship.

The optional Transmission Line Database contains the necessary parameters for the majority of current waveguide and coaxial medium. This enables rapid instrument setup without the need to refer to manufacturer's datasheets.

The accuracy and resolution makes Fault Location also applicable to laboratory applications since short range discontinuities spaced just a few millimetres apart can also be analyzed using this powerful technique.



*Fault location software clearly and precisely locates faults in cable and waveguides.*

A range of Transmission Line Test Heads and Fault Location Test Heads (6581/6583 series) are available covering to either 20 GHz or 26.5 GHz with coverage extending to 40 GHz to simplify connection to the device under test. A divider and a detector are incorporated in the heads as well as an optional return loss bridge for evaluation after the fault has been repaired. The heads are supplied in a carrying case for ease of transportation.

### SCALAR ANALYZER DETECTORS

Scalar analyzer detectors are required for swept frequency measurements. Three detectors are available for use with the MTS. 6230 has an N type connector and is specified for measurements to 20 GHz, 6233 has a 3.5 mm connector and is specified to 26.5 GHz whilst 6234 incorporates a 2.92 mm connector and operates to 46 GHz.

The detectors are self-identifying when connected to the MTS allowing the

appropriate linearity correction data to be applied automatically. The detectors can also be temperature corrected.

### RETURN LOSS BRIDGES

Return loss bridges or 'Autotesters' are available for the swept measurement of return loss. Versions are available covering to 40 GHz with a choice of connectors.

### POWER METER SENSORS

A power sensor is required if the power meter function is to be used. A range of twelve sensors are listed in the Accessories section, they cover from 30 kHz to 40 GHz with a choice of power range and connector type.

### Operational Ease

Integrating many instruments into one assembly has many advantages. Connecting leads between discrete instruments are eliminated. A further major advantage is that only one common control and display is required.

Many techniques are used to speed up both initial assimilation of the MTS and subsequent routine operation. The soft keys are labelled to guide the operator, the shape of the boxes around the soft key labels indicates the class of operation.

Whenever data needs to be entered a 'Dialogue Box' appears to prompt the user. Should data be entered incorrectly an error message is generated which can give useful hints or advice.

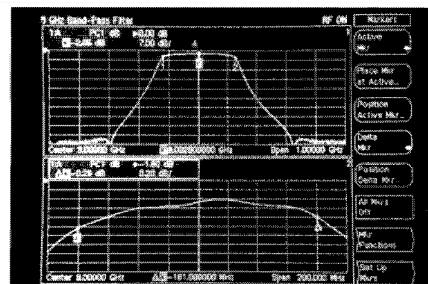
Programming the MTS over the GPIB has also been simplified. Mnemonics are easy to learn since natural language abbreviations are used. GPIB complies with IEEE 488.2.

The six primary function keys provide a logical approach to making measurements. The SOURCE key defines the stimulus to be applied, MEASURE allows the measurement to be defined, CAL provides a means for calibrating out systematic errors, FORMAT selects an appropriate format, SCALING allows choice of reference level and scaling and MARKERS permits detailed examination of measurement.

One or two channel operation is available, in addition 1 or 2 measurements can be selected per channel.

In two channel mode two separate gratitudes, each capable of displaying up to two traces, can be selected. Alternatively up to four digital readouts are available. Power and frequency can be simultaneously displayed for example, or the power sensor can be used at the same time as the scalar analyzer to give high accuracy gain compression measurements.

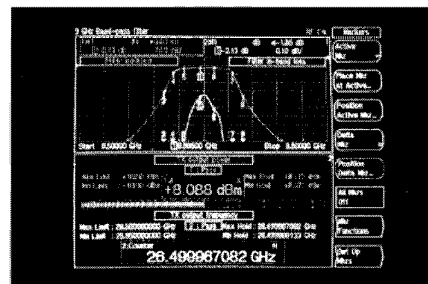
Hard copies of all measurements can be easily obtained either on any compatible HPGL GPIB plotter or any Epson FX series



*Uncoupled mode provides two swept measurement channels with different frequency scales and two vertical scales for comprehensive filter evaluation.*

parallel printer using the COPY key. Control settings, limit lines and measured traces can be saved using the SAVE/RECALL key. The memory card provides additional storage to assist in de-skilling operator actions or to archive results.

Ten complete front panel settings and four traces can be saved using the internal non-volatile memory. The UTILITY key provides access to service, diagnostics and various ancillary functions not required for routine operation.



*In dual channel mode two scalar measurements and two readout measurements can be displayed.*

### Macros

The Macro facility allows the operator to write procedures to simplify and automate measurement tasks. A sequence of key presses and on-screen operator prompts can be stored either in the internal memory or on a memory card. Instructions and messages are generated using the integral TEXT function.

The enhanced Macro capability of the 6200A allows for branching and looping within a macro plus the ability to edit and amend existing macros.

A typical Macro would initially set up the instrument by recalling instrument settings from memory and then display text to guide the user to make the appropriate connections. On completion of each task the operator is asked to press a 'continue' key. Limit lines can be recalled from

# Microwave Test Set

## 6200A series

memory to give simple automatic pass/fail results. Pauses can be included so that activities such as averaging can be concluded before the next stage of the Macro is executed. This innovative technique speeds up measurement procedures, reduces operator training and minimises error.

### Wide Ranging Applications

6200A Series Microwave Test Set has applications throughout the microwave measurement field. For measurements in development it is ideal since so little bench space is taken up. Measurement accuracy is not compromised and the performance is superior to larger and more expensive sweeper systems. A power meter and counter are always conveniently available.

In production the MTS is ideal for assembly, test and quality control measurements. The memory card and macro facilities assist in speeding up and de-skilling measurement tasks and the sophisticated GPIB implementation allows for full integration into an ATE.

For installation and commissioning engineers the MTS is an ideal measurement tool combining a wide range of facilities in a compact and portable unit. Sub-systems, filters and feeders can be readily characterized by measuring frequency response and return loss. Field maintenance and repair is also an ideal application for the MTS. Fault Location measurements permit the rapid and precise location of feeder and connector problems.

## SPECIFICATION

### SYNTHESIZED SWEEP GENERATOR

#### FREQUENCY

##### Range

6200A: 10 MHz to 20 GHz.  
6201A: 10 MHz to 8 GHz.  
6203A: 10 MHz to 26.5 GHz.  
6204A: 10 MHz to 46 GHz.

##### Resolution

0.01 to 26.5 GHz: 1 Hz.  
26.5 GHz to 46 GHz: 2 Hz.

##### CW Accuracy

<±50 Hz ± Frequency standard accuracy to 26.5 GHz  
<±100 Hz ± Frequency standard accuracy to 46 GHz.

##### Typical Swept Accuracy

Step Time	Frequency Up to 2 GHz	>2 GHz
250 µs	<5 kHz	<100 kHz
1 ms	<500 Hz	<1.5 kHz
10 ms	<50 Hz	<50 Hz

### POWER

#### 6200A/6201A/6203A standard

Frequency range (GHz)	Power-levelled (dBm)	
	Guaranteed	Maximum typical
0.01 to 2	-10 to +7	+11
2 to 8	-10 to +6	+8
8 to 18	-10 to +5	+10
18 to 20	-10 to +5	+8
20 to 26.5	-10 to +4	+8

#### 6204A

Frequency range (GHz)	Power-levelled (dBm)	
	Guaranteed	Maximum typical
0.01 to 2	-10 to +6	+10
2 to 8	-10 to +5	+8
8 to 18	-10 to +5	+8
18 to 20	-10 to +5	+6
20 to 26.5	-10 to +3	+6
26.5 to 40	-10 to 0	+2
40 to 46	-10 to -3 typical	-1

#### 6200A/6201A/6203A + option 001 (step attenuator)

Frequency range (GHz)	Power-levelled (dBm)	
	Guaranteed	Maximum typical
0.01 to 2	-80 to +5	+9
2 to 8	-80 to +4	+6
8 to 18	-80 to +3	+7
18 to 20	-80 to +2	+5
20 to 26.5	-80 to +1	+4

For option 002 (Field replaceable RF connector) guaranteed output is reduced by 0.5 dB.

#### Settable power range

Standard: -20 dBm to +20 dBm.

With option 001: -90 dBm to +20 dBm.

#### Resolution

0.01 dB.

#### Power Sweep range

##### (From maximum levelled power)

Option 001 not fitted:

0.01 to 26.5 GHz: >25 dB.  
26.5 to 40 GHz: >10 dB.  
40 to 46 GHz: >7 dB typical.  
With option 001: >80 dB.

### INTERNAL LEVELLING

#### Accuracy (including flatness at 0 dBm)

##### 6200A/6201A/6203A/6204A standard and option 002 if fitted

0.01 to 26.5 GHz: <±1 dB, ±0.5 dB typical.  
26.5 to 40 GHz: <±1.5 dB, ±0.7 dB typical.  
40 to 46 GHz: <±3.0 dB typical.

Linearity: <±0.5 dB over guaranteed levelled power range.

##### 6200A/6201A/6203A with option 001 (including option 002 if fitted)

10 MHz to 8 GHz: <±1 dB ±0.3 dB ±2% of attenuator setting in dB.  
8 GHz to 26.5 GHz: <±1 dB (±1 dB or ±4% of attenuator setting in dB, whichever is greater).

### EXTERNAL LEVELLING

Via rear panel BNC input socket.

Accepts signals from a detector (positive or negative) or from the analog output of a power meter (0 to ±1 V). Accuracy depends on levelling technique.

### POWER STABILITY WITH TEMPERATURE

Typical values following power calibration at operating temperature. Self-calibration with a Power Sensor removes temperature effects.

#### 6200A/6201A

0°C to 20°C	<0.02 dB/°C.
20°C to 40°C	<0.04 dB/°C.
40°C to 50°C	<0.08 dB/°C.

#### 6203A

0°C to 20°C	<0.1 dB/°C.
20°C to 30°C	<0.08 dB/°C.
30°C to 50°C	<0.06 dB/°C.

#### 6204A

	Frequency	
	Up to 2 GHz	>2 GHz
0°C to 20°C	<0.12 dB/°C	<0.05 dB/°C
20°C to 30°C	<0.15 dB/°C	<0.05 dB/°C
30°C to 50°C	<0.08 dB/°C	<0.06 dB/°C

### SIGNAL PURITY

#### Harmonics

0.01 to 2 GHz	<-27 dBc, -35 dBc typical
2 to 8 GHz	<-35 dBc, -40 dBc typical
8 to 26.5 GHz	<-40 dBc, -50 dBc typical
26.5 to 40 GHz	<-20 dBc typical.

#### Sub-harmonics

2 to 26.5 GHz: None.  
26.5 to 40 GHz: <-40 dBc typical.

#### Spurious signals, typical

	25 kHz to 150 kHz	150 kHz to 1 MHz	1 MHz to >1 MHz
0.01 to 2 GHz	<-50 dBc	<-60 dBc	<-60 dBc
2 to 8 GHz	<-50 dBc	<-50 dBc	<-60 dBc
8 to 26.5 GHz	<-50 dBc	<-60 dBc	<-60 dBc
26.5 to 40 GHz	<-40 dBc	<-50 dBc	<-50 dBc

#### Phase noise

Typical values measured in 1 Hz bandwidth at 20 kHz offset from the carrier in CW mode.

0.01 to 2 GHz	<-90 dBc/Hz.
2 to 8 GHz	<-78 dBc/Hz.
8 to 12 GHz	<-74 dBc/Hz.
12 to 20 GHz	<-70 dBc/Hz.
20 to 26.5 GHz	<-67 dBc/Hz.
26.5 to 40 GHz	<-57 dBc/Hz.

#### Residual FM

In 100 kHz bandwidth in CW mode:  
0.01 to 2 GHz: <1 kHz peak.  
2 to 26.5 GHz: <(500F) Hz peak.  
26.5 to 46 GHz: <(1000F) Hz peak.  
F is the frequency in GHz.

### OUTPUT CONNECTOR

#### Type

6200A/6201A: Precision N (female), 50 Ω.  
6203A: MPC (Marconi Precision Connector) 3.5 mm (female), 50 Ω.  
6204A: Precision 2.92 mm (female) 50 Ω.  
Option 002: Field replaceable, 50 Ω precision 3.5 mm (female) and N-type (female) - not for 6204A.

#### Reverse input power

100 mW maximum.

#### Source Match (internally levelled) 6200A/6201A/6203A

Frequency Range (GHz)	VSWR	Return Loss (dB)	
		Minimum	Typical
0.01 to 0.05	<1.45:1	>15	>17
0.05 to 2	<1.11:1	>26	>33
2 to 8	<1.2:1	>21	>30
8 to 12	<1.35:1	>16.5	>25
12 to 26.5	<1.45:1	>15	>20

#### 6204A

0.01 to 40	<1.93:1	>10	>12
40 to 46			>10

With option 001 minimum return loss specification degrades by up to 5 dB.

With option 002 minimum return loss specification degrades by up to 3 dB.

### VOLTS/GHz

Voltage proportional to frequency available from rear panel BNC Voltage/Current output.

Range: 1 V/GHz or 0.5 V/GHz selectable (20 V maximum in 1 V/GHz mode).

Linearity: ±15 mV.

### PROGRAMMABLE VOLTAGE/ CURRENT SOURCE

#### VOLTAGE OUTPUT

Range: -15 V to +15 V.  
Resolution: 1 mV.  
Accuracy: <±15 mV.  
Total power supplied not to exceed 2.5 W.

#### CURRENT OUTPUT

Range: -150 mA to +150 mA.  
Resolution: 10 µA.  
Accuracy: <±300 µA.

#### Stability with temperature

10 µA/°C.  
Total power supplied not to exceed 1.25 W.

### OUTPUT CONNECTOR

Rear panel BNC.

### SCALAR ANALYZER

#### NUMBER OF INPUTS

Four (A, B, C and D).

#### DETECTION MODES

AC and DC.

# Microwave Test Set

## 6200A series

### DYNAMIC RANGE

AC detection: 85 dB (–65 to +20 dBm),  
90 dB typical (–70 to +20 dBm).  
DC detection: 80 dB (–60 to +20 dBm).

### MEASUREMENT POINTS

User selectable from 2 to 1601.

### NUMBER OF CHANNELS

Two channels, two measurements may be made per channel allowing a total of four simultaneous measurements.

### SWEEP TIME

**Settable range**  
40 ms to 500 s.

**Measurement times**  
401 points: <200 ms.  
1601 points: <800 ms.

### DIRECT VOLTAGE INPUT RANGE

Input A, B and C 0 V to –4.5 V.  
Input D 0 V to –9 V.

### NOISE REDUCTION

**Averaging**  
1 to 1000 (applied per measurement).

### Smoothing

Aperture settable from 0.01 to 20% of span, resolution 0.01%.

### CALIBRATION

**Path calibration (Normalization) types**  
Through, short/open, short.

### INSTRUMENTATION ACCURACY

±0.05%.

### SYSTEM ACCURACY

Refer to individual specifications for Detectors and Return Loss Bridges.

### FAULT LOCATION

#### DISTANCE

**Units**  
Metres or feet.

**Accuracy**  
<0.1% of range or 3 mm, whichever is the larger (for a single fault up to 1 km range).

**Full scale**  
Up to 25 km depending on cable or waveguide loss.

**Minimum resolution**  
For two equal amplitude discontinuities using maximum sweep width.

6200A: 1.82 x V<sub>r</sub> cm.  
6201A: 4.54 x V<sub>r</sub> cm.  
6203A: 1.37 x V<sub>r</sub> cm.  
6204A: 0.91 x V<sub>r</sub> cm.  
Where V<sub>r</sub> is the relative velocity.

### DYNAMIC RANGE

Detection	Frequency	
	To 26.5 GHz	26.5 to 40 GHz
AC	80 dB	>40 dB typical.
DC	70 dB	>40 dB typical.

### MEASUREMENT TIME (401 POINTS)

Normal mode: <250 ms.  
Enhanced mode: <500 ms.

### NUMBER OF MEASUREMENT POINTS

User selectable from 51 to 512.

### POWER METER

#### FREQUENCY RANGE

30 kHz to 40 GHz, dependent upon sensor used.

#### POWER RANGE

–70 dBm (100 pW) to +35 dBm (3 W), dependent upon sensor used.

### INSTRUMENTATION ACCURACY

<±0.05%.

### CORRECTION

**Calibration Factor**  
Range: 0.01 to 200%.  
Resolution: 0.01.

### Linearity Factor

Range: 0.1 to 15.  
Resolution: 0.1.

### POWER REFERENCE

Used for Power Sensor correction.

### Output Connector

N (female), 50 Ω. Adapters are supplied with 75 Ω MPC (Marconi Precision Connector) 3.5 mm and 2.92 mm Power Sensors.

### Frequency

50 MHz ±0.01 MHz.

### Level

1 mW.

### Uncertainty

±0.7% traceable to National Standards.

### Accuracy

±1.2% worst case for one year.

### AUTO-ZERO

#### Set

Removes DC offset from signal input.

6910 Series: ±200 nW.  
6920 Series: ±100 pW.  
6930 Series: ±6 μW.

#### Drift over one hour at constant temperature

6910 Series: ±10 nW.  
6920 Series: ±100 pW.  
6930 Series: ±300 nW.

### NOISE

6910 Series: ±100 nW.  
6920 Series: ±100 pW.  
6930 Series: ±3 μW.

### RESPONSE TIME

<100 ms.

### AVERAGING

1 to 1000 selected automatically or manually entered.

### RESOLUTION

2 to 4 digits, user selectable.

### CHART RECORDER

Rear panel voltage/current BNC output gives a voltage proportional to measured power.

### Sensitivity

0 V to 5 V: 0 V level dependent upon detector or sensor.

### Log mode

1 V per decade.

### Linear mode

Scaling dependent on detector or sensor.

### FREQUENCY COUNTER

#### FREQUENCY RANGE

6200A/6201A: 10 MHz to 20 GHz.  
6203A/6204A: 10 MHz to 26.5 GHz.

### RESOLUTION

#### Readout mode

1 Hz to 100 MHz, user selectable.

#### Swept mode

6 digits.

### ACCURACY

#### Readout mode

< ±25 Hz ± frequency standard error.

#### Swept mode

< (6 significant figures or ±100 Hz, whichever is greater) ± frequency standard error.

### TYPICAL SENSITIVITY

	6200A/6201A/6203A	6204A
25 MHz to 10 GHz	< –20 dBm	< –19 dBm.
10 GHz to 20 GHz	< –15 dBm	< –14 dBm.
20 GHz to 26.5 GHz	< –10 dBm	< –8 dBm.

### MAXIMUM INPUT LEVEL

+5 dBm.

### DAMAGE LEVEL

+27 dBm peak.

### INPUT CONNECTOR

#### Type

6200A/6201A: Precision N Type (female).  
6203A/6204A: MPC (Marconi Precision Connector) 3.5 mm (female).  
Option 002: Field replaceable, 50 Ω precision 3.5 mm (female) and N-type (female).

#### Input impedance

50 Ω nominal.

### FM TOLERANCE

#### Readout mode

20 MHz peak to peak at 45 Hz to 10 MHz rate.

#### Swept mode

1.5 MHz peak to peak at 75 Hz to 10 MHz rate.

### AM TOLERANCE

Up to 40% modulation depth for signals within the range of sensitivity and maximum input level.

### ACQUISITION TIME

#### Readout mode

Typically 2 s for frequencies greater than 300 MHz, for 1 Hz resolution.

#### Swept mode

Typically 50 ms per point.

### SELECTIVITY

Typically 25 dB.

### DISPLAY

#### TYPE

Color active matrix TFT Liquid Crystal Display with 16.5 cm (6.5 inch) visible diagonal.  
External color monitor (VGA) output on rear panel.

### NUMBER OF CHANNELS

Two. A channel may be configured either as a swept channel for displaying traces or a readout channel for displaying read-outs of values such as power and frequency.

### NUMBER OF TRACES/READOUTS

Four. Maximum of two per channel.

### TITLES

Screen title plus individual measurement titles.  
Individual title coded to each trace/readout.

### SWEPT CHANNEL CHARACTERISTICS

The horizontal and vertical axes can be configured to display a variety of different measurements. The horizontal axes, referred to as 'Domain', may be defined to display the stimulus such as frequency, power, voltage and current. The vertical axis, referred to as 'Response', may display frequency, power and voltage.

#### Domain (Horizontal axis)

#### Frequency Modes

CW, start/stop, center/span, alternate sweep.

#### Frequency Resolution

Settable to 1 Hz, displayed as six digits.

#### Frequency Offset

Frequency offset between source and display can be entered to characterize frequency changing devices such as mixers.

#### Frequency Scaling

Multiplication factor between source and display can be entered to characterize frequency multipliers and dividers.

#### Power Sweep Range

Range depends on option – refer to Synthesized Sweep Generator section.

#### Power Offset

Power offset between source and display can be entered for use when measuring amplifiers and attenuators.



# Microwave Test Set

## 6200A series

### Response (Vertical axis)

#### Units

dBm, dB, pW to kW, nV to V, VSWR, Hz to GHz.

#### Scaling

Manual auto-scale (single shot), continuous auto-scale (every sweep) or user selectable.

#### Reference level position

Reference level may be set to any graticule line.

#### Reference level value

-199.99 to +199.99 all units except VSWR.  
1 to 100 VSWR.

### MEASUREMENT MANIPULATION

#### Scalar detector and counter inputs

Display live measurement.

Display trace memory.

Display live measurement relative to trace memory.

Measurement hold may be applied for each trace.

#### Scalar detector inputs only

Any input or ratio of inputs may be assigned to any one or more than one of the traces. A trace may display absolute power, power relative to a path calibration or power minus a trace memory.

#### Complex limit lines

Four stores of 12 segments each. Each segment defines an upper and a lower limit line or point. Any store can be applied to any trace.

#### Input Offsets

An offset in the range -99.99 to +99.99 dB in 0.01 dB steps may be applied per detector input.

### MARKERS

Eight per trace plus a separate delta marker.

#### Marker functions

Marker, delta marker, minimum, maximum, search left, search right, N-dB bandwidth (with center frequency) marker tracking. Peak to peak response value and optional test against limit.

#### Marker resolution

##### Domain (Horizontal)

#### Frequency

Six digits with override to give 1 Hz resolution.

#### Power

0.01 dB.

#### Voltage

1 mV.

#### Current

10  $\mu$ A.

### Response (Vertical)

#### Power

0.01 dB.

#### Frequency

Six digits.

#### Voltage

1 nV.

### READOUT CHANNEL CHARACTERISTICS

#### RESOLUTION

##### Power

2 to 4 digits, user selectable.

##### Frequency

1 Hz to 100 MHz, user selectable.

##### Voltage

Four digits.

### UNITS

#### Power

dBm, dB, pW to kW.

#### Frequency

Hz to GHz.

#### Voltage

nV,  $\mu$ V, mV, V, kV.

### MEASUREMENT MANIPULATION

#### Marker readout

Spot readings may be made at the domain value specified by the active marker.

### Limit checking

Upper and lower test limits may be entered.

### Relative measurement

To display the measured offset from a previously entered or measured reading.

### Max/Min hold

To display maximum and minimum values over a period of time for drift measurements.

### Duty Cycle

To display peak power given by average power measured/duty cycle. Range: 0.001 to 100%.

### Peaking Meter Display

Analog display to assist when adjusting power levels.

### Input Offsets

An offset in the range -99.99 to +99.99 dB in 0.01 dB steps may be applied per detector or sensor input.

### AUXILIARY INPUTS AND OUTPUTS

#### GPIB INTERFACE

GPIB is IEEE 488.1 and 488.2 compatible. The interface has three applications:-  
- Instrument control with full talk and listen.  
- Control of a plotter using HPGL. Plotter output is buffered to permit measurements to proceed whilst plotting.  
- Control of a second MTS for mixer measurements. The instruments may be set to sweep with a fixed frequency offset between them.

#### MEMORY CARD INTERFACE

For external storage of data.

#### PARALLEL PRINTER OUTPUT

Compatible with any Epson FX series printer. Output is buffered to allow further measurements whilst printing.

### FREQUENCY STANDARD

#### IN/OUT BNC

1 or 10 MHz input or 10 MHz output (nominally 2 V pk-pk into 50  $\Omega$ ) selectable from front panel.

#### EXTERNAL LEVELLING

##### INPUT BNC

For connection of remote detector or power meter for source levelling.

#### VOLTAGE/CURRENT

##### OUTPUT BNC

User definable to be:

##### Volts/GHz

Voltage proportional to frequency output from source.

##### Fixed

Fixed voltage or current output for bias measurements.

##### Swept V/I

Swept voltage or current for voltage/current domain measurements.

##### Chart recorder

Voltage proportional to power level of scalar detector or power meter sensor input.

#### EXTERNAL MONITOR

Output to a VGA 640x480 standard, color monitor. Rear panel 15 way 'high density' D type female connector.

### GENERAL

#### FREQUENCY STANDARD

For synthesized sweep generator and frequency counter.

#### Internal

30 MHz VCXO.

#### Temperature stability

Better than  $\pm 0.15$  ppm/ $^{\circ}$ C.

#### Ageing

Better than  $\pm 2$  in  $10^6$  per year.

#### External

1 or 10 MHz standard rear panel BNC input socket.

### MEMORIES

#### Standard Trace memories

Four.

#### Settings stores

Ten.

### Power sensor cal stores

Stores for 10 sets of Power Sensor calibration and linearity factor data.

### Memory card

Extra stores available on memory card.

### REAL TIME CLOCK

#### Date and time

Used to date-stamp hard copies and to determine instrument operating hours.

### ELECTRO-MAGNETIC COMPATIBILITY

Conforms with the protection requirements of EEC Council Directive 89/336/EEC.

Complies with the limits specified in the following standards:

EN55011-1:1991	(Emissions)	CISPR11
EN50082-1:1992	(Immunity)	IEC801-2:1991
		IEC801-3:1984
		IEC801-4:1988
EN60555-2:1987	(Main Harmonics)	IEC555-2

### SAFETY

Complies with IEC 348.

### RATED RANGE OF USE

(over which full specification is met)

#### Temperature

0 to 50 $^{\circ}$ C.

### CONDITIONS OF STORAGE AND TRANSPORT

#### Temperature

-40 to +70 $^{\circ}$ C.

#### Humidity

93% RH at 40 $^{\circ}$ C.

### POWER REQUIREMENTS

#### Switchable voltage ranges

115 V set: 90 to 132 V

230 V set: 188 to 265 V.

#### AC Supply

45 to 440 Hz. 500 VA maximum.

### DIMENSIONS AND WEIGHT

Height	Width	Depth
197 mm	389 mm	546 mm
7.75 in	15.3 in	21.5 in

#### Weight

6200A	16 kg 35 lb
6201A	15 kg 33 lb
6203A	16.25 kg 36 lb
6204A	17 kg 37.4 lb

#### Notes:

Guaranteed Power Range, Power Accuracy and VSWR are calibrated for the temperature range 0 to 50 $^{\circ}$ C and are subject to the availability of National Standards.

Typical performance figures are non-warranted.

# Microwave Test Set

## 6200A series

### 6230 series scalar detectors

	6230	6233	6234
Frequency range	10 MHz to 20 GHz	10 MHz to 26.5 GHz	10 MHz to 40 GHz, usable to 46 GHz
Dynamic range	-70 dBm to +20 dBm	-70 dBm to +20 dBm	-70 dBm to +20 dBm
Maximum RF input	+26 dBm CW +30 dBm peak for 2 $\mu$ s	+26 dBm CW +30 dBm peak for 2 $\mu$ s	+26 dBm CW +30 dBm peak for 2 $\mu$ s
VSWR			
10 MHz to 40 MHz	1.40	1.40	1.58
40 MHz to 100 MHz	1.15	1.15	1.15
100 MHz to 2 GHz	1.12	1.12	1.12
2 GHz to 5 GHz	1.17	1.17	1.33
5 GHz to 18 GHz	1.29	1.29	1.33
18 GHz to 20 GHz	1.50	1.50	1.50
20 GHz to 26.5 GHz	—	1.50	1.50
26.5 GHz to 33 GHz	—	—	1.50
33 GHz to 40 GHz	—	—	1.95
Frequency Response			
10 MHz to 50 MHz	$\pm 0.5$ dB	$\pm 0.5$ dB	$\pm 0.5$ dB
50 MHz to 8 GHz	$\pm 0.5$ dB	$\pm 0.5$ dB	$\pm 1.0$ dB
8 GHz to 18 GHz	$\pm 0.65$ dB	$\pm 0.65$ dB	$\pm 1.0$ dB
18 GHz to 20 GHz	$\pm 1.25$ dB	$\pm 1.25$ dB	$\pm 1.5$ dB
20 GHz to 26.5 GHz	—	$\pm 1.25$ dB	$\pm 1.5$ dB
26.5 GHz to 40 GHz	—	—	$\pm 2.0$ dB
POWER ACCURACY*	Detection method (applies to 6230, 6233 and 6234)		
Power level	AC		DC
-60 dBm	$\pm 1.20$ dB		—
-50 dBm	$\pm 0.70$ dB		$\pm 0.90$ dB
-40 dBm	$\pm 0.40$ dB		$\pm 0.45$ dB
-30 dBm	$\pm 0.40$ dB		$\pm 0.40$ dB
-20 dBm	$\pm 0.35$ dB		$\pm 0.35$ dB
-10 dBm	$\pm 0.30$ dB		$\pm 0.30$ dB
0 dBm	$\pm 0.20$ dB		$\pm 0.20$ dB
+10 dBm	$\pm 0.30$ dB		$\pm 0.30$ dB
+13 dBm	$\pm 0.35$ dB		$\pm 0.35$ dB
+16 dBm	$\pm 0.40$ dB		$\pm 0.40$ dB
+16 to +20 dBm	$\pm 1.0$ dB (typical)		$\pm 1.0$ dB (typical)
Dynamic Accuracy		0.07 dB/10 dB typical	
Connector	Precision Type N male	Precision MPC 3.5 mm male	2.92 mm male
Length	90 mm	79 mm	84.1 mm
Width	27 mm	27 mm	27 mm
Weight	260 g	250 g	250 g

\* Specification applies at 50 MHz at a temperature of 23°C  $\pm$  5°C and does not include errors due to mismatch, harmonics and temperature. Performance above +16 dBm is typical non-warranted. Different specifications are given for detectors when using AC or DC detection.

## Return loss bridges – Autotesters

A range of Return Loss Bridges are available for the precise determination of Return Loss over a wide frequency range.

Model/Test Port Connector Characteristic	59999-151W GPC-7	59999-158R N (m) and 59999-159B N (f)	59999-152D WSMA (m) and 59999-166H WSMA (f)	59999-168U 2.92 mm (m) and 59999-169Y 2.92 mm (f)
Frequency range	10 MHz to 18 GHz	10 MHz to 18 GHz	10 MHz to 26.5 GHz	10 MHz to 40 GHz
Directivity				
0.01 to 18 GHz	40 dB	38 dB	40 dB	35 dB
18 to 26.5 GHz	N/A	N/A	38 dB	32 dB
26.5 to 40 GHz	N/A	N/A	N/A	30 dB
Frequency sensitivity	$\pm 1.2$ dB	$\pm 1.5$ dB	$\pm 2.0$ dB	$\pm 3.0$ dB
Accuracy <sup>1</sup>				
0.01 to 8 GHz	$0.010 \pm 0.06p^2$	$0.013 \pm 0.08p^2$	$0.010 \pm 0.10p^2$	$0.018 \pm 0.15p^2$
8 to 18 GHz	$0.010 \pm 0.10p^2$	$0.013 \pm 0.12p^2$	$0.010 \pm 0.10p^2$	$0.018 \pm 0.15p^2$
18 to 26.5 GHz	N/A	N/A	$0.013 \pm 0.12p^2$	$0.025 \pm 0.15p^2$
26.5 to 40 GHz	N/A	N/A	N/A	$0.032 \pm 0.18p^2$
Insertion loss <sup>2</sup>	6.5 dB	6.5 dB	6.5 dB	6.5 dB
Maximum input power	+27 dBm	+27 dBm	+27 dBm	+27 dBm
Input connector	N (f)	N (f)	2.92 mm (f)	2.92 mm (f)
Length <sup>3</sup>	76 mm	76 mm	54 mm	54 mm
Width <sup>3</sup>	50 mm	50 mm	38 mm	38 mm
Depth <sup>3</sup>	28 mm	28 mm	19 mm	19 mm
Weight	340 g	340 g	198 g	198 g

1 where p = measured reflection coefficient – includes directivity and test port reflection effects over the specified frequency range.

2 Nominal value from input port to test port.

3 Excluding connection and cable.

# Microwave Test Set

## 6200A series

### VERSIONS

Ordering numbers	Versions
6200A	10 MHz to 20 GHz Microwave Test Set.
6201A	10 MHz to 8 GHz Microwave Test Set.
6203A	10 MHz to 26.5 GHz Microwave Test Set.
6204A	10 MHz to 46 GHz Microwave Test Set.
Option 001 Option 002	Options (not available for 6204A) 70 dB step attenuator. Field replaceable RF output connector (3.5 mm and N-type).
	Supplied with AC Supply Lead 43123-076Y. 2 m Power Sensor Cable 06950-081W. Operating Manual. Input socket cap 6950-069.

### DETECTORS

	6230 SERIES SCALAR DETECTORS
6230	10 MHz to 20 GHz, N type (m).
6233	10 MHz to 26.5 GHz, MPC (Marconi Precision Connector) 3.5 mm (m).
6234	10 MHz to 46 GHz, 2.92 mm (m).

### PULSE MODULATOR

6145 54441-019A	70 MHz to 20 GHz Pulse Modulator. AC Power Supply.
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### ACCESSORIES

Ordering numbers	POWER SENSORS
56910-900L 56911-900X 56912-900U 56913-900D	6910 Series (-30 dBm to +20 dBm) 10 MHz to 20 GHz, N type (m). 10 MHz to 20 GHz, APC 7. 30 kHz to 4.2 GHz, N type (m). 10 MHz to 26.5 GHz, MPC 3.5 mm (m). 10 MHz to 40 GHz, 2.92 mm (m). 10 MHz to 40 GHz, 2.92 mm (m) plus waveguide 22 transformer. 30 kHz to 3 GHz, N type 75 Ω.
56914-001R 56914-002B	6920 Series (-70 dBm to -20 dBm) 10 MHz to 20 GHz, N type (m). 10 MHz to 26.5 GHz, MPC 3.5 mm (m). 10 MHz to 40 GHz, 2.92 mm (m). 10 MHz to 40 GHz, 2.92 mm (m) plus waveguide 22 transformer.
56919-900Y 56920-900J 56923-900T	6930 Series (-15 dBm to +35 dBm) 10 MHz to 18 GHz, N type (m). 30 kHz to 4.2 GHz, N type (m). 10 MHz to 40 GHz, 2.92 mm (m). 10 MHz to 40 GHz, 2.92 mm (m) plus waveguide 22 transformer.*
56930-900F 56932-900N 56934-001K 56934-002A	TRANSMISSION LINE TEST HEADS 20 GHz Transmission Line Test Head, 6581. 26.5 GHz Transmission Line Test Head, 6583.†
56581-001T 56583-001S	FAULT LOCATION TEST HEADS 20 GHz Fault Location Test Head, 6581E. 26.5 GHz Fault Location Test Head, 6583E.†
56581-002P 56583-002W	SENSOR/DETECTOR CABLES 5 m Power Sensor Cable. 15 m Power Sensor Cable. 50 m Power Sensor Cable. 5 m Detector Extension Cable. 15 m Detector Extension Cable. 25 m Detector Extension Cable. Negative Voltage Measurement Cable. Positive Voltage Measurement Cable. 1.5 m Extension Cable for Transmission Line Test Head. 1.5 m Extension Cable for Fault Location Test Head.

\* -15 dBm to +30 dBm.

† Usable to 40 GHz.

Ordering numbers	MISCELLANEOUS ELECTRICAL CABLES
43129-189U 43126-012S 46884-560M	GPB Cable. 50 Ω BNC (m) to BNC (m) 1.5 m. Parallel Printer Interface Cable
54311-109U 54311-110H 54311-116J 54311-117F 54351-022X 54351-025R 54351-027K	MICROWAVE CABLES Ruggedized Cable N(m) to N(m) 3 m (for Fault Location). Ruggedized Cable 3.5 mm (m) to 3.5 mm (m) 3 m (for Fault Location). Ruggedized Cable N(m) to N(m) 1.5 m (for Fault Location). Ruggedized Cable 3.5 mm (m) to 3.5 mm (m) 1.5 m (for Fault Location). Ruggedized Cable N(m) to N(m) 0.5 m. Ruggedized Cable 3.5 mm (m) to 3.5 mm (m) 0.5 m. Ruggedized Cable 2.92 mm (m) to 2.92 mm (m) 0.5 m.
59999-151W 59999-158R 59999-159B 59999-152D 59999-166H 59999-168V 59999-169Y	RETURN LOSS BRIDGES (AUTOTESTERS) 10 MHz to 18 GHz 7 mm. 10 MHz to 18 GHz N(m). 10 MHz to 18 GHz N(f). 10 MHz to 26.5 GHz 3.5 mm WSMA (m). 10 MHz to 26.5 GHz 3.5 mm WSMA (f). 10 MHz to 40 GHz 2.92 mm (m). 10 MHz to 40 GHz 2.92 mm (f).
54311-123S 54311-124W 54311-161T	POWER SPLITTERS Power splitter DC to 18 GHz Type N. Power splitter DC to 26.5 GHz 3.5 mm. Power splitter DC to 40 GHz 2.92 mm.
59000-181G 59000-182V 59000-186T 59000-264R 54127-309Z 54124-027S 54417-002R 54121-034F 46882-112C 54112-156F 54112-157G	MISCELLANEOUS 32k Blank Memory Card. 128k Blank Memory Card. 512k Blank Memory Card. Transmission Line Database. Rack Mount Kit. Front Stowage Cover. Waveguide 22 to 2.92 mm Transformer. Detector Input Socket Cap. Service Manual. Aluminium Flight Case. Soft Carrying Case.