

Microwave

6840 Series RF & Microwave System Analyzer



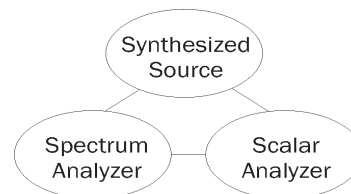
6840 series Microwave System Analyzers provide an integrated solution to component and subsystem testing

- Integrated synthesized source, scalar and spectrum analyzer
- 3 GHz, 8.4 GHz, 20 GHz, 24 GHz, 40 GHz and 46 GHz frequency versions
- Precision scalar network measurements with high dynamic range
- Spectrum analyzer with full range tracking generator
- Offset tracking on network measurements
- Group Delay option
- FM option
- Complete solution to comprehensive component and subsystem characterization
- Real time transmission line Fault Location with 0.1% accuracy
- EEPROM corrected scalar detectors for accurate measurements
- Applications interface allows guided and automatic testing
- Modular design for rapid service
- 3.5 in disk drive for results storage

The 6840 series RF and microwave system analyzers are a powerful new tool for the microwave industry. Integrated into a single instrument are a synthesized source, a three input scalar analyzer and a synthesized spectrum analyzer. The internal source can be used as a simple CW output, as a

swept source for scalar measurements, as a tracking generator with the spectrum analyzer and as an offset tracking source for network measurements on frequency translation devices.

This flexibility simplifies a range of previously complex but commonly made measurements. The receiver in the spectrum analyzer can be used as a tuned input for high dynamic range scalar measurements. The FM option adds frequency modulation to the source. The Group Delay option allows simultaneous measurement and display of group delay and amplitude response, and includes the frequency modulation option.



1 Series - 8 Instruments

The range covers five frequency bands in various convenient combinations of source and spectrum analyzer frequencies, enabling for example the harmonic content of microwave radios to be measured.

6840 series Microwave System Analyzers

6841	1 MHz to 3 GHz Scalar Analyzer with 4.2 GHz Spectrum Analyzer
6842	10 MHz to 8.4 GHz Scalar Analyzer with 20 GHz Spectrum Analyzer
6843	10 MHz to 20 GHz Scalar Analyzer with 20 GHz Spectrum Analyzer
6844	10 MHz to 24 GHz Scalar Analyzer with 24 GHz Spectrum Analyzer
6845	10 MHz to 46 GHz Scalar Analyzer with 46 GHz Spectrum Analyzer
6845R	10 MHz to 40 GHz Scalar Analyzer with 40 GHz Spectrum Analyzer
6846	10 MHz to 8.4 GHz Scalar Analyzer with 24 GHz Spectrum Analyzer
6847	10 MHz to 20 GHz Scalar Analyzer with 26.5 GHz Spectrum Analyzer
6848	1 MHz to 3 GHz Scalar Analyzer with 20 GHz Spectrum Analyzer

Synthesized Source

The synthesized source has low phase noise and 1 Hz frequency resolution. VCOs are used for frequencies above 3 GHz and an integrated RF synthesizer for the 1 MHz to 3 GHz range. Optionally increased output power is available from 3 to 24 GHz. Internal filtering results in excellent harmonic performance of <-55 dBc for improved scalar measurement accuracy. Optional step attenuators are available to set low output powers for amplifier or receiver testing.

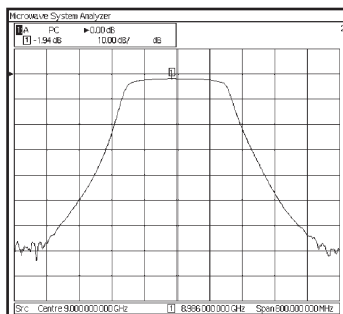
In CW mode the source can be used for local oscillator substitution. A power sweep is provided for amplifier gain compression testing. External FM can be applied by connecting a generator to the rear panel. With the FM option, an internal generator provides frequency modulation of the source.

When used with the scalar analyzer the source provides a swept synthesized output for frequency characterization of components and systems. It can also be used as a spectrum analyzer tracking generator to 46 GHz. The source can be set to any frequency offset or frequency multiple of the receiver tuned input. This powerful feature simplifies measurements of mixers, upconverters and down-converters that have frequency translation.

Scalar Analyzer

The three input scalar analyzer provides network characterization of components and systems. Simultaneous measurement of insertion and return loss are displayed on the 6840 color screen. Excellent measurement accuracy is assured by the use of EEPROM corrected detectors. Each detector is individually characterized for linearity and frequency response to provide a measurement accuracy close to that achieved with a power sensor. A range of autotesters with high directivity is available for return loss measurements.

It is also possible to make scalar measurements with a tuned input. A tuned input gives improved dynamic range. Insertion loss measurements of >80 dB are possible.



Bandpass filter insertion loss measurement

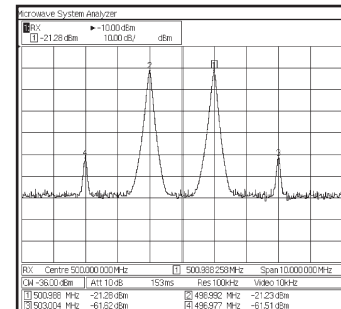
Spectrum Analysis

The 6840 variants contain an integral synthesized spectrum analyzer with 3 MHz to 1 kHz resolution bandwidth filters, >80 dB instantaneous dynamic range and an excellent 3rd order intermodulation intercept point. 6840 series are designed to make routine spectrum measurements on RF and microwave components, subsystems and systems.

Continuous full band sweeps simplify harmonic and spurious meas-

urements. The low distortion front end combined with wide dynamic range ensures that even on full span sweeps, spurious measurements to better than -60 dBc can be performed. High sensitivity at microwave frequencies is ensured by the use of wideband oscillators, this reduces the harmonic number used in the front end mixer.

The spectrum analyzer is fully featured with FM demodulator and built in loudspeaker. This is ideal for locating and identifying the source of interfering transmissions. Individual signals can be precisely identified by use of the internal frequency counter.



Amplifier intermodulation measurement

Optimized operation is provided by the coupling of the fundamental analyzer parameters of resolution bandwidth, sweep speed, video filter and input attenuation. These parameters are automatically set for optimum sweep speed and dynamic range. For specific applications the user can manually override the coupled functions.

Autotune automatically sweeps the full span of the spectrum analyzer and then displays the largest signal at the center and top of the screen. Markers can also be used to select any signal and display it at the center of the screen.

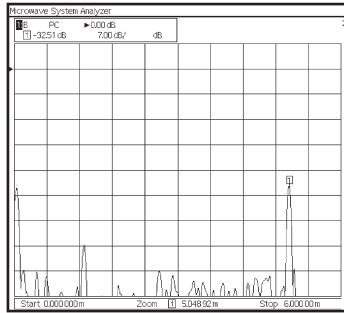
The integral source enables network measurements in normal tracking mode or by applying a frequency offset and/or multiplication factor. Any frequency offset can be supported. This facility makes measurements faster and easier than assembling together separate instruments and a PC controller.

External mixers extend the frequency range to 110 GHz.

Fault Location

Fault location software is standard on all 6840 series instruments. Many modern communication systems rely on a coaxial or waveguide feed between the transmitter and antenna. The fast fault location facility of the 6840 can quickly locate the position of faults causing poor return loss in the feed, which can seriously impact system performance.

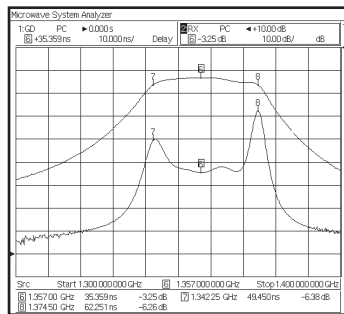
Measurement resolution and accuracy is assured by the use of a synthesized source with up to 1601 measurement points.



Fault location measurement of a coaxial feed and antenna

Group Delay

The Group Delay option allows the simultaneous measurement and display of group delay and amplitude response over the full frequency range of the instrument. Components and assemblies including frequency translation devices can be readily characterized for ripple and variation from linear and parabolic variation using the powerful and easy to use marker functions. Measurement in any operator-specified sub-band within the passband can be displayed as maximum peak to peak ripple in both amplitude and group delay, maximum slope and maximum rate of change of slope.



Amplitude and delay response of a filter

Simplified User Interface

Integration of a source, spectrum analyzer and scalar analyzer into a single instrument has many benefits. The operator uses a single interface to set up any measurement. This saves time and is easier than writing software to perform complex measurement tasks, such as frequency offset network measurements.

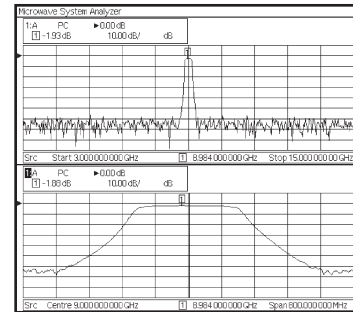
Eight softkeys give rapid access to all commonly used parameters. Softkeys are shaped to inform the user of the action that the key will perform, e.g. enter data, select from list, move to another menu or immediate action. All commonly accessed functions are no more than one level deep, so that the instrument operation is easily learnt.

Applications Interface

An applications interface is built into the 6840 series which allows the user to create their own measurement routines and guide the operator through the test procedure. For example it can display on the 6840 screen how to set up the measurement, lead the operator through a calibration, show where to connect the device under test and then test the device's performance against predefined limits. The applications facility can reduce the incidence of operator error, improve measurement repeatability, provide guidance to infrequent users or simplify complex test procedures.

Color Display

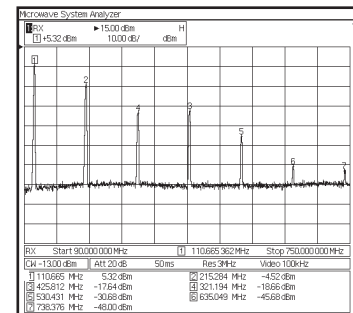
A large TFT color display is fitted to the 6840 as standard displaying up to four measurements on two channels. Scalar and spectrum measurements can be displayed simultaneously on independent channels. Alternatively two spectrum channels can be shown with a wide and narrow frequency sweep. This could be used to scan a frequency spectrum for interfering signals whilst simultaneously displaying the wanted carrier.



Dual channel display, showing wide band and narrow band frequency sweeps

Comprehensive Markers

Up to eight markers are available. The marker menus provide the tools that are most commonly used in each of the measurement modes.



Harmonic measurement with dynamic marker table

In spectrum mode the markers identify the frequency and level of a signal, position signals on the display and measure relative signal values. A peak search feature places markers on the eight highest signals displayed for spurious signal identification. A table displayed below the traces shows the values of all eight markers dynamically.

In scalar mode markers automatically calculate peak to peak ripple, N - dB bandwidth, -1 dB compression point and find the maximum and minimum signal levels. This simplifies device characterization and reduces test time.

For fault location measurements the next peak left/right feature identifies the position and magnitude of each of the discontinuities along the transmission line. The peak find softkey quickly locates the biggest discontinuity on the line.

Fast Field Repair

6840 has a modular architecture with modules slotted onto a common mother board. In the event of a module failure the instrument can be

repaired by module replacement to reduce instrument downtime. Following a repair, software routines realign the replaced module.

Future Proof

The 6840 series microwave system analyzers have been designed to expand and adapt to changing test requirements. A standard instrument has capacity for additional modules. As future options are added, the flexibility and capability of the 6840 platform will expand. This ensures that investment made in the 6840 series today will provide a basis for future test needs.

For Design Engineers

For designers of components and subsystems the 6840 provides a powerful and flexible analysis tool. Devices such as filters, amplifiers, mixers, attenuators and oscillators can be characterized with a single test instrument. This flexibility reduces design cycles as the need to make instrument interconnections is reduced. 6840 has a low noise source for LO substitution and swept frequency measurements. The use of EEPROM detectors ensures accurate scalar measurements. Amplifiers can be precisely characterized for gain compression, output power and frequency response. The use of a tuned input can give >80 dB dynamic range for filter testing and the accessory autotesters, with 40 dB directivity, ensure accurate return loss results. The spurious and harmonic output of oscillators can be measured with the wide span high dynamic range spectrum analyzer.

Manufacturing Test

To the production manager the 6840 offers reduced programming time, reduced test time and simplified archiving of results. 6840 is fully compliant with the IEEE 488.2 GPIB standard. A full 401 data points can be transferred over the GPIB in typically <50 ms. Individual data points can be repetitively read in typically 10 ms. This enables full results archiving with minimal time penalty.

A single instrument replaces 'rack and stack' alternatives which makes program generation simpler. Rack space is also reduced.

Continuity of test is essential in a production environment. A failed test system can result in expensive loss of output. 6840 with its field replaceable modules minimizes any output loss due to test system failure.

Installing and Maintaining Systems

During the installation period of a microwave system it is always necessary to revalidate key parameters. 6840 provides a comprehensive solution for installation teams. It is housed in a ruggedized case, has secure handles and can be supplied with a protective carrying case.

For systems with long waveguide or coaxial feeds the 6840 is used by the installation team to measure return loss and if necessary fault location. The synthesized source with 1601 measurement points ensures precise fault location measurements. The 6840 series provides a tuned input that can be used for return loss and fault location measurements. This measurement technique rejects interfering signals from other transmitters, a common cause of poor measurement performance in the field.

By archiving results onto disk, or the internal instrument memory, the 6840 forms the basis of a preventative maintenance system. Experience shows that degradation in the antenna feed is the major source of system field failures. 6840 has the accuracy to monitor and

identify gradual system degradation with time.

Results Logging and Outputting

Measurement results can either be saved to internal non-volatile memory or to 3.5 in disk. Traces saved onto disk can then be archived or imported into a spreadsheet for viewing.

An alternative method for displaying results in a standard word processor document or in a graphics package is to use the optional MIPlot software. MIPlot captures the measurement data either via the GPIB or from a saved trace on disk. This data can then be embedded into a document and reformatted, colors changed, markers and text added.

SPECIFICATION

SOURCE

Functionality

Synthesized CW
Synthesized sweeper for use with scalar analyzer,
Tracking generator for use with spectrum analyzer.
Offset tracking generator for use with spectrum analyzer (offset by scale or multiplication factor)
CW Power sweep.
External Frequency Modulation
Optional Internal Frequency Modulation in spectrum, scalar and source-only modes.

Frequency Range

6841/6848, 1 MHz to 3 GHz
6842/6846, 10 MHz to 8.4 GHz
6843/6847, 10 MHz to 20 GHz
6844, 10 MHz to 24 GHz
6845, 10 MHz to 46 GHz
6845R, 10 MHz to 40 GHz

Resolution (Settable)

1 Hz to 46 GHz

CW Accuracy

(Frequency Standard error x Frequency) \pm 10 Hz

Swept Accuracy (Typical)

300 ms Step Time
1 MHz to 3 GHz <20 kHz
3 GHz to 46 GHz <200 kHz

1 ms Step Time
1 MHz to 3 GHz <1 kHz
3 GHz to 46 GHz <10 kHz

10 ms Step Time
1 MHz to 3 GHz <100 Hz
3 GHz to 46 GHz <1 kHz

Levelled Power Range

6841/2/3/4/6/7/8 standard
1 MHz to 3 GHz -10 dBm to +10 dBm
3 GHz to 24 GHz -10 dBm to +5 dBm

6842/3/4/6/7/8 + option 030 (higher power)
1 MHz to 24 GHz -10 dBm to +10 dBm

6841/48 + option 010 (110 dB Step Attenuator)
1 MHz to 3 GHz -120 dBm to +8 dBm

6842/3/6/7 + option 011 (70 dB Step Attenuator)
10 MHz to 3 GHz -80 dBm to +8 dBm

3 GHz to 20 GHz -80 dBm to +2 dBm
+ option 030 (higher power)
3 GHz to 20 GHz -80 dBm to +7 dBm

6842/3/4/6/7 + option 012

(90 dB Step Attenuator)

10 MHz to 3 GHz -100 dBm to +8 dBm
3 GHz to 24 GHz -100 dBm to +2 dBm
+ option 030 (higher power)
3 GHz to 24 GHz -100 dBm to +7 dBm

6845 & 6845R

10 MHz to 8 GHz -10 dBm to +8 dBm +10 dBm typ
8 GHz to 20 GHz -10 dBm to +5 dBm +7 dBm typ
20 GHz to 24 GHz -10 dBm to +4 dBm +6 dBm typ
24 GHz to 40 GHz -10 dBm to 0 dBm +3 dBm typ
40 GHz to 46 GHz -10 dBm to 0 dBm typ*

* excluding the effect of connector moding

6845 & 6845R+ option 013 (70 dB step attenuator)

10 MHz to 8 GHz -80 dBm to +6 dBm +8 dBm typ
8 GHz to 20 GHz -80 dBm to +2 dBm +4 dBm typ
20 GHz to 24 GHz -80 dBm to +1 dBm +3 dBm typ
24 GHz to 40 GHz -80 dBm to -3 dBm 0 dBm typ

Note: For option 002 (Field Replaceable connectors) guaranteed levelled output is reduced by 0.5 dB

Settable Power Resolution

0.01 dB

Power Sweep Range (from Maximum Levelled Power) Without Attenuator

>20 dB

External Frequency Modulation

Peak deviation (1 V peak input)

10 MHz - 375 MHz	1 kHz to 5 MHz
375 MHz - 750 MHz	250 Hz to 1.25 MHz
750 MHz - 1.5 GHz	500 Hz to 2.5 MHz
1.5 GHz - 3 GHz	1 kHz to 5 MHz
3 GHz - 46 GHz	20 kHz to 1 MHz

Accuracy (1 kHz modulating frequency) 20 - 400 kHz deviation
 $\pm 3\%$ of indication ± 1 Hz excluding residual FM

-3 dB bandwidth, AC coupled mode

10 MHz - 3 GHz	<100 Hz to >1MHz typical
3 GHz - 46 GHz	<100 Hz to >500 kHz typical

-3 dB bandwidth, DC coupled mode

10 MHz - 3 GHz	DC to >1 MHz typical
3 GHz - 46 GHz	DC to >500 kHz typical

Internal Modulation Generator Option 023 & 022 (Group Delay)

FM Source

Modulation signal sinewave, 0.1 Hz to 500 kHz, resolution 0.1 Hz
Other specifications as for External Frequency Modulation except:

Accuracy (1 kHz modulating frequency) 20 - 400 kHz deviation $\pm 5\%$
of indication ± 1 Hz excluding residual FM

Pulse Generator Source

Modes	Single Pulse
Trigger Modes	External, Internal continuous
Pulse Widths (PW)	120 ns to >1 second
Resolution	120 ns
Pulse Period (PRI)	240ns to 7 seconds (PRF <1 Hz to 4.16 MHz)
Resolution	120 ns
Pulse Delay	Zero to 100 ms where zero is <120 ns referred to trigger or sync pulse falling edge

Resolution 120 ns

Sync Output 120 ns pulse referred to trigger. Available at trigger socket

Inputs/Outputs

Trigger in/out Rear panel BNC connector provides either trigger input or sync output dependant upon trigger mode. TTL level

Internal Levelling Accuracy at 0 dBm (no options fitted)

1 MHz to 3 GHz, ± 0.7 dB
3 GHz to 24 GHz, ± 1.0 dB
24 GHz to 40 GHz, ± 1.5 dB

Levelled Power Accuracy With Options 010, 011, 012, 013

1 MHz to 3 GHz
 $< \pm 1$ dB (± 0.3 dB $\pm 2\%$ of attenuator setting in dB whichever is greater)
3 GHz to 24 GHz
 $< \pm 1$ dB (± 1 dB $\pm 4\%$ of attenuator setting in dB whichever is the greater)
24 GHz to 40 GHz
 $< \pm 1.5$ dB (± 1 dB $\pm 4\%$ of attenuator setting in dB whichever is the greater)

Linearity (No Options Fitted, Option 030) Over Levelled Range Relative to 0 dBm

1 MHz to 40 GHz $< \pm 0.5$ dB

Power Stability With Temperature Typical

1 MHz to 40 GHz < 0.1 dB/°C

Harmonics and Sub-Harmonics Over Levelled Power Range

Harmonics

<70 MHz, <-25 dBc
70 MHz to 24 GHz, <-55 dBc
24 GHz to 40 GHz, <-20 dBc

Sub-Harmonics

1 MHz to 3 GHz, <-60 dBc
3 GHz to 24 GHz, none
24 GHz to 40 GHz, <-40 dBc

Spurious Signals (Typical)

For carrier frequencies <375 MHz
Offset:
30 kHz to 150 kHz, <-50 dBc
150 kHz to 1 MHz, <-55 dBc
> 1 MHz, <-55 dBc

For carrier frequencies >375 MHz
Offset:
30 kHz to 150 kHz, <-50 dBc
150 kHz to 1 MHz, <-60 dBc
> 1 MHz, <-60 dBc

Phase Noise <dBc/Hz in CW mode

CW Freq	Frequency offset		
	1 kHz	10 kHz	100 kHz
0.25 GHz	-86	-95	-108
0.5 GHz	-98	-112	-134
1 GHz	-92	-106	-128
2 GHz	-86	-100	-122
4 GHz	-80	-92	-100
10 GHz	-72	-84	-90
20 GHz	-66	-78	-82
24 GHz	-64	-76	-80
40 GHz	-63	-75	-79

Source Match (Typical)

1 MHz to 3 GHz, 15 dB
 3 GHz to 20 GHz, 10 dB
 20 GHz to 40 GHz, 8 dB

Output Connector

6841/2/3/6/7/8; Precision Type N, female
 6844: Precision 3.5 mm, female
 6845: Precision 2.92 mm, female
 or optional field replaceable connectors

SPECTRUM ANALYZER**FREQUENCY****Frequency Range (Usable from 100 kHz)**

6841, 1 MHz to 3 GHz (usable to 4.2 GHz)
 6842, 6843, 6848, 10 MHz to 20 GHz
 6844, 6846, 10 MHz to 24 GHz (usable to 30 GHz)
 6845, 10 MHz to 46 GHz
 6845R, 10 MHz to 40 GHz
 6847, 10 MHz to 26.5 GHz (usable to 30 GHz)
 Extendible for all units to 110 GHz in waveguide only with external waveguide mixers. The 6840 series unit must be fitted with option 020.

Frequency Span Range

Full span to Zero span, plus any intermediate value

Start Frequency Accuracy

(start frequency x frequency standard error) \pm frequency readout resolution \pm 3% of span \pm 20% resolution bandwidth setting

Span Accuracy

Fully synthesized for spans of 20 MHz or less
 \pm 3% for spans >20 MHz

Number of Measurement Points

Fixed 512

Frequency Readout Resolution

Span/512

Marker Readout Accuracy

As per start frequency accuracy

Sweep Speed

Auto coupled or user set, 10 ms/div to 50 s/div

Phase Noise <dBc/Hz

Analyzer freq	Frequency offset	
	20 kHz	100 kHz
10 MHz	-90	-100
4.2 GHz	-90	-100
(N=1 on the Harmonic Mixer)		
8.6 GHz	-84	-94
(N=2 on the Harmonic Mixer)		
18.5 GHz	-77	-87
(N=3 on the Harmonic Mixer)		
38 GHz	-73 typ	-83 typ
(N=6 on the Harmonic Mixer)		

System Related Sidebands

< -65 dBc at offsets greater than 30 kHz from the carrier

AMPLITUDE**Maximum Input Amplitude**

+20 dBm

Damage Level

+27 dBm @ >10 dB attenuation
 +20 dBm @ 0 dB attenuation

Input Return Loss (typical) with ≥ 10 dB of Input Attenuation

10 MHz to 3 GHz 20 dB
 3 GHz to 12 GHz 12 dB
 12 GHz to 40 GHz 10 dB

Input Connector

6841/2/3/8: Precision Type N, female
 6844/6/7: Precision 3.5 mm, female
 6845: Precision 2.92 mm female
 or optional field replaceable connectors

Input Attenuator

Range 0 to 60 dB in 10 dB steps

Reference Level

Range +30 dBm to -99 dBm

Amplitude Scaling

Range 10 dB/div to 0.1 dB/div

Amplitude Accuracy at 0 dBm Reference Level and 0 dBm Input

(at selected bandwidth)

10 MHz to 3 GHz \pm 1 dB
 to 4.2 GHz* \pm 1.5 dB
 to 20 GHz \pm 4.0 dB
 to 24 GHz** \pm 4.5 dB
 to 40 GHz \pm 5.0 dB
 * does not apply to 6841, ** to 26.5 GHz for 6847

Incremental Reference Level Accuracy from +20 dBm to -40 dBm (Typical)

\pm 0.5 dB

Response Flatness (Typical)

\pm 3.0 dB

Log Incremental Accuracy (Typical)

0.2 dB / 10 dB

Display Linearity

\pm 1.5 dB over 8 divisions (10 dB/div)

Gain Compression (0 dB Attenuation)

<0.5 dB with -10 dBm at the input connector

Resolution Bandwidth Range

1 kHz to 3 MHz in 1, 3, 10 sequences

Resolution Bandwidth Accuracy

± 20 %

Resolution Bandwidth Selectivity

60 dB / 3 dB ratio
1 kHz to 3 MHz 15:1

Resolution Bandwidth Switching Error

<0.25 dB

Video Bandwidth

1, 3, 10, 30, 100, 300, Hz
1, 3, 10, 30, and 100 kHz

Third Order Intermodulation Response (0 dB Attenuation)

<-70 dBc with 2 tones each -30 dBm, with
>50 kHz separation applied at the input connector

Third Order Intercept Point

> +5 dBm

Second Order Single Tone Intercept Point

> +45 dBm

Second Harmonic Distortion >40 MHz and @ -40 dBm

<-70 dBc for -40 dBm at the input connector with 0 dB attenuation

Residual Responses (Input Terminated with 50 Ω)

<-90 dBm

Other Input Related Spurious (0 dB Attenuation)

<-60 dBc with -10 dBm at the input connector

Displayed Average Noise Level in 1 kHz RBW, 30 Hz VBW, 0 dBm Attenuation (Input Terminated with 50 Ω)

@ 1 GHz	<-105 dBm
@ 6 GHz	<-100 dBm
@ 12 GHz	<-100 dBm
@ 18 GHz	<-95 dBm
@ 38 GHz	<-80 dBm typ

EXTERNAL MIXER INTERFACE (option)

LO output, 4.5 - 9.2 GHz @ +17 dBm typical
IF input, 479.3 MHz, maximum level -15 dBm typical
Connectors
SMA (female)

DEMODULATION

Narrow band FM, <20 kHz
Display, kHz vs time
Audio output via speaker

MEASUREMENT FEATURES

Frequency counter
Ability to display channel occupancy masks, user defined
Accurate marker frequency readout
Multiple markers
Two independent channels
Scrollable center frequency, span and resolution bandwidth
Measurement of noise in a 1 Hz bandwidth
Auto-tune display set-up for CW signals
NBFM demodulator with audio output

Demodulated output displayed on screen
Speed 1 ms/div to 1 s/div

Millimeter waveguide, single diode harmonic mixers

Available for all 684X units, option 020 external mixer interface is required.

Model	Frequency	Waveguide	Flange
Number	Range	Designation	Type
M42HW	18-26.5 GHz	WR42, WG20, R220	UG-597/U
M28HW	26.5-40 GHz	WR28, WG22, R320	UG-599/U
M22HW	33-50 GHz	WR22, WG23, R400	UG-383/U
M19HW	40-60 GHz	WR19, WG24, R500	UG-383/U
M15HW	50-75 GHz	WR15, WG25, R620	UG-385/U
M12HW	60-90 GHz	WR12, WG26, R740	UG-387/U
M10HW	75-110 GHz	WR10, WG27, R900	UG-387/U

A Diplexer (DPL.313A) is required for use with the mixers listed above. It is supplied with two SMA (m) barrel adapters for IF and LO interconnection to the spectrum analyzer Option 020 connectors and a 1 meter long, high quality interconnecting cable for connection between mixer and diplexer.

SCALAR ANALYZER

SYSTEM FEATURES

Frequency Range

As per source frequency range

Number of Inputs

3 detector inputs plus tuned input

Number of Measurement Points

User selectable from 2 to 1601

Applications

Return loss vs frequency
Insertion loss vs frequency
Fault Location
Voltage vs frequency
Group Delay vs Frequency (optional)

Detection Modes

AC and DC

Noise Reduction

Averaging, 1 to 1000
Smoothing, 0.01 to 20%

Power Measurements

Using scalar detectors

Detector Correction

Frequency response and linearity read from EEPROM for 6230A/L and fault locators.
Support for 6230 and autotesters.

INSERTION LOSS MEASUREMENTS

Measurement Dynamic Range, AC Scalar Detection, with 623XA Detector

Max source output to -60 dBm
Max source output to -65 dBm (with averaging)

Typical values:
>65 dB (10 MHz to 40 GHz)
>75 dB (1 MHz to 3 GHz) only with 6232A

Measurement Dynamic Range, Tuned Input

Maximum source output to -75 dBm
Typically >80 dB (10 MHz to 17 GHz)

Measurement Update Rate

401 points in 270 ms with DC detection

Calibration

Through path calibration or short and short/open calibrations for single ended insertion loss

Inputs

Single input or ratio

Accuracy (detector inputs and tuned input)

Linearity + mismatch

Linearity (applies after normalization)

Linearity (for Power Levels >-45 dBm) scalar detector inputs

± 0.2 dB / 10 dB but not >0.5 dB in total

Linearity (tuned input)

Log incremental accuracy (typical)

0.2 dB/10 dB

Display Linearity

± 1.5 dB over 8 divisions (10 dB/div)

RETURN LOSS MEASUREMENTS

Measurement Update Rate

401 points in 270 ms with DC detection

Calibration

Short, Open, Short/Open

Inputs

Single input or ratio

Accuracy

Linearity + directivity + test port mismatch

Linearity (for Power Levels >-45 dBm)

± 0.2 dB / 10 dB but not > 0.5 dB in total

FAULT LOCATION MEASUREMENTS

Measurement Range

Up to 25 km depending on cable or waveguide loss

Units

Feet or meters

Number of Measurement Points

User selectable from 50 to 1601

Minimum Resolution

For two equal amplitude discontinuities using maximum sweep width
6841/8: $12.18 \times V_r$ cm
6842/6: $4.32 \times V_r$ cm
6843/7: $1.82 \times V_r$ cm
6844: $1.51 \times V_r$ cm
6845: $0.91 \times V_r$ cm
Where V_r is the relative velocity factor for the transmission line

Measurement Update Rate

512 points in 250 ms, DC detection

Dynamic Range

DC detection 70 dB
AC detection 80 dB

Distance Accuracy

3 mm or 0.1% of range for a single fault

Transmission Line Database

Data supplied as standard

Required Accessory

624X series fault locator
or 658X series transmission line test head
or divider

GROUP DELAY

Measurement Range

± 1 μ s to ± 10 μ s

Resolution* (3 MHz aperture)

0.1 ns to 15 GHz

0.2 ns 15 to 30 GHz

0.3 ns 30 to 40 GHz

Absolute Accuracy* (3 MHz aperture)

± 0.5 ns, 10 MHz to 24 GHz

± 2.5 ns, 24 GHz to 40 GHz

*excluding effects of imperfect match

Relative Accuracy (for peak to peak measurement)

As Resolution (typical)

Scales

0.1 ns/div to 5 μ s/div in a 1, 2, 5 sequence with increment keys
Keypad entry provides user scaling

Reference delay

Defaults to zero, user selectable

Reference position

User selectable, default is centre display

Delay offset

User entry of offset value

Trace displays

Simultaneous amplitude and group delay vs frequency
Absolute delay and "zoom" display vs frequency
Dual channel mode
Comparison over same frequency range at same centre frequency
Comparison over different centre frequencies

FREQUENCY STANDARD

Internal 10 MHz OCXO

Drift

± 5 in 10^8 over 0 to 55°C

Ageing

± 2 in 10^7 per year (OCXO)

External Frequency Standard

1 MHz or 10 MHz

Connector: BNC

REAR PANEL CONNECTORS

RS-232

9 way D-type connector, male
Baud rate 300 to 9600

GPIO Interface

GPIO is IEEE 488.1 and 488.2 compatible. The interface has 2 functions.

-Instrument control with full Talk/Listen capability
-Control of plotter using HPGL. Plotter is buffered to permit measurements to proceed whilst plotting.

10.7 MHz IF Output (from Spectrum Analyzer)

Connector: BNC

Frequency Standard In/Out BNC

10 MHz input or 10 MHz output selectable from front panel

Mod In/Out BNC

Mod in/out

Rear panel BNC connector, TTL level. Impedance approx 100 Ω

Printer Output

25 way D-type connector
Parallel interface.

Drivers supplied for PCL DeskJet and LaserJet printers. Printer is buffered to permit measurements to proceed whilst printing.

External Monitor

Standard VGA, 640 by 480 color output
15 way high density D-type female connector

Voltage Output (Auxiliary 9-pin Connector)

Settable for 0 to 10 V ramp, fixed voltage or chart recorder drive

Video Output (Auxiliary 9-pin Connector)

Output from spectrum analyzer detector
Bandwidth: as per RBW setting

External Levelling Input

Input voltage range: 0 to +1 V
Connector: BNC

GENERAL FEATURES

Number of Display Channels 2

Number of Measurements 4 (2 per display channel)

Number of Measurement Points 2 to 1601 for one trace, scalar
512 fixed, spectrum

Display Color active matrix TFT liquid crystal display with 16.5 cm (6.5 in) visible diagonal

Data Storage 3.5 in floppy disc drive, 1.44 Mb. Trace storage in DOS format.

Limits

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

MARKERS

8 per trace plus separate delta marker

Marker Functions

Marker, delta marker, minimum, maximum, search left, search right, N-dB bandwidth (with center frequency), marker tracking.

Spectrum Analyzer

Find Peak / Next Peak (next highest amplitude or next Left / Right) / Identify Peaks
MKR to CF
MKR to Ref Level
Counter / Set Resolution
Measure Relative to Carrier (dBc)
Search Left / Right
Delta MKR / Set Span / Fixed Delta

Scalar Analyzer

Active marker Max / Min
Max / Min Tracking
Find PK-PK
PK-PK Tracking
Search Right / Left
Bandwidth / Optional CF / DF (Q)
dB / Octave, dB / Decade Readout
Delta Marker On / Off
-1 dB Gain Compression
Peak to peak delay between two markers
Max peak to peak delay in a user defined bandwidth
Deviation from linear between two markers
Deviation from parabolic between two markers

Fault Location

Find Max / Track Max
Next PK Right / Left
Set PK Level
Delta marker On / Off

General

Marker Table
Assign Active MKR / Position Active MKR
Set-up Markers (i.e. On / Off, Position)
Large Readout
All Off

Marker Resolution

Frequency: 6 digits or 1 Hz, user selectable
Power: 0.01 dB
Voltage: 1 nV

Measurement Manipulation

Display live measurement.
Display trace memory.
Display live measurement relative to trace memory.
Measurement hold may be applied for each trace.
Any input or ratio of inputs may be assigned to any one or more than one trace(s). A trace may display absolute power, power relative to a path calibration or power minus a trace memory.

Input Offsets

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

Weight - Variant and Option Dependent

24 kg (53 lb)

Size (Not including front handles)

230 mm H x 430 mm W x 570 mm D
9 in H x 17 in W x 22 in D

Power Supply

100-240 V~ (Limit 90-264 V~)

50-60 Hz (Limit 45-66 Hz)

108-118 V~ (Limit 90-132 V~)

50-400Hz (Limit 45-440 Hz)

300 W Maximum

Rated Range of Use

Temperature 0 to 50°C

6845 and 6845R only +5 to 45°C

Humidity Up to 93% RH at 40°C

Conditions of Storage and Transportation

Temperature -40 to +71°C

Humidity Up to 93% RH at 40°C

Altitude Up to 4570 m (15000 ft)

Electromagnetic Compatibility

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

IEC/EN61326-1 : 1997, RF Emission Class B, Immunity Table 1, Performance Criteria B

Safety

Conforms with the requirements of EEC Council Directive 73/23/EEC (as amended) and the product safety standard IEC/EN 61010-1 : 2001 + C1 : 2002 + C2 : 2003 for class 1 portable equipment, for use in a Pollution Degree 2 environment. The instrument is designed to be operated from an Installation Category 2 supply.

Note : All specifications quoted are for operation at calibration temperature $\pm 3^{\circ}\text{C}$.

Specifications involving Type N connectors above 18 GHz are not traceable to national standards as these do not exist at present.

Specifications involving 2.92 mm connectors above 40 GHz are not traceable to national standards as these do not exist at present

Typical specifications are non-warranted.

VERSIONS AND OPTIONS

When ordering please quote the full ordering number information.

Ordering

Numbers

Version

6840

Microwave System Analyzers

6841	1 MHz to 3 GHz Scalar Analyzer with 4.2 GHz Spectrum Analyzer
6842	10 MHz to 8.4 GHz Scalar Analyzer with 20 GHz Spectrum Analyzer
6843	10 MHz to 20 GHz Scalar Analyzer with 20 GHz Spectrum Analyzer
6844	10 MHz to 24 GHz Scalar Analyzer with 24 GHz Spectrum Analyzer
6845R	10 MHz to 40 GHz Scalar Analyzer with 40 GHz Spectrum Analyzer
6845	10 MHz to 46 GHz Scalar Analyzer with 46 GHz Spectrum Analyzer
6846	10 MHz to 8.4 GHz Scalar Analyzer with 24 GHz Spectrum Analyzer
6847	10 MHz to 20 GHz Scalar Analyzer with 26.5 GHz Spectrum Analyzer
6848	1 MHz to 3 GHz Scalar Analyzer with 20 GHz Spectrum Analyzer

Supplied Accessories

46882/350	Operating Manual
46882/354	Getting Started Guide
46882/360	Remote Operating Manual
43123/076	AC Supply Lead
37591/755	Front Panel Cover

Options

002	Field Replaceable Precision N (f) or 3.5 mm (f) RF Connectors for Source and Spectrum Analyzer for 6842/6843/6844/6846/6847 Field Replaceable Precision N (f) or 2.92 mm (f) RF Connectors for Source and Spectrum Analyzer for 6845 & 6845R
010	3 GHz, 110 dB Step Attenuator (only available for 6841 and 6848)
011	20 GHz, 70 dB Step Attenuator (only available for 6842/6843/6846/6847)
012	26.5 GHz 90 dB Step Attenuator (not available for 6841/6845/6848)/6845R
013	40 GHz 70 dB Step Attenuator (only available for 6845 & 6845R)
020	External Mixer Interface
022	Group Delay
023	Internal Modulation (included in Group Delay option 022)
030	Higher Power Output (not applicable to 6841/6848/6845/6845R)

Complementary Product

6146	500 MHz to 18 GHz Pulse Modulator
54441/109	AC Power Supply for 6146
6147	70 MHz to 40 GHz Pulse Modulator

ACCESSORIES

6230A/L SCALAR DETECTORS

6230A series	Standard Detectors (-65 dBm to +20 dBm) typical
6230A	10 MHz to 20 GHz, N type (m)
6232A	1 MHz to 3 GHz, N Type (m)
6233A	10 MHz to 26.5 GHz, 3.5 mm (m)
6234A	10 MHz to 46 GHz, 2.92 mm (m)
6230L series	Low VSWR detectors (-59 dBm to +26 dBm typical)
6230L	10 MHz to 20 GHz, N type (m)
6233L	10 MHz to 26.5 GHz, 3.5 mm (m)
6234L	10 MHz to 46 GHz, 2.92 mm (m)

AUTOTESTERS AND RF BRIDGE

	Autotesters
59999/151	10 MHz to 18 GHz 7 mm
59999/158	10 MHz to 18 GHz N (m)
59999/159	10 MHz to 18 GHz N (f)
59999/152	10 MHz to 26.5 GHz 3.5 mm WSMA (m)
59999/166	10 MHz to 26.5 GHz 3.5 mm WSMA (f)
59999/168	10 MHz to 40 GHz 2.92 mm (m)
59999/169	10 MHz to 40 GHz 2.92 mm (f)

	RF Bridge
59999/170	5 MHz to 2 GHz N (f)

FAULT LOCATORS

	Fault Locators
6242F	10 MHz to 3 GHz, N (f)
6242M	10 MHz to 3 GHz, N (m)
6240F	10 MHz to 20 GHz, N (f)
6240M	10 MHz to 20 GHz, N (m)
6243F	10 MHz to 26.5 GHz, 3.5 mm (f)
6243M	10 MHz to 26.5 GHz, 3.5 mm (m)
6241	10 MHz to 20 GHz, 7 mm
	Microwave Ruggedized Cables for Fault Locators
54311/197	1.5 m, 18 GHz, N (m) to Right Angle N (m)
54311/198	3.0 m, 18 GHz, N (m) to Right Angle N (m)
54311/201	1.5 m, 26.5 GHz, 3.5 mm (m) to Right Angle 3.5 mm (m)
54311/202	3.0 m, 26.5 GHz, 3.5 mm (m) to Right Angle 3.5 mm (m)
	RF Ruggedized Cables for Fault Locators
54311/199	1.5 m, 3 GHz, N (m) to Right Angle N (m)
54311/200	3.0 m, 3 GHz, N (m) to Right Angle N (m)

TRANSMISSION LINE TEST HEADS

	Transmission Line Test Head
56581/001	10 MHz to 20 GHz Transmission Line Test Head, 6581
56583/001	10 MHz to 26.5 GHz Transmission Line Test Head, 6583

Microwave Ruggedized Cables for Test Heads

54311/116	1.5 m, 20 GHz, N (m) to N (m)
54311/109	3.0 m, 20 GHz, N (m) to N (m)
54311/117	1.5 m, 26.5 GHz, 3.5 mm (m) to 3.5 mm (m)
54311/110	3.0 m, 26.5 GHz, 3.5 mm (m) to 3.5 mm (m)

Scalar Detector and Fault Locator DC Cables (Color coded blue)

43139/099	1.5 m, DC Cable
43139/100	3.0 m, DC Cable
43139/101	10 m, DC Cable
43139/102	25 m, DC Cable
43139/103	50 m, DC Cable

MILLIMETER WAVEGUIDE, SINGLE DIODE HARMONIC MIXERS

Model Number	Frequency Range	Waveguide Designation	Flange Type
M42HW	18-26.5 GHz	WR42, WG20, R220	UG-597/U
M28HW	26.5-40 GHz	WR28, WG22, R320	UG-599/U
M22HW	33-50 GHz	WR22, WG23, R400	UG-383/U
M19HW	40-60 GHz	WR19, WG24, R500	UG-383/U
M15HW	50-75 GHz	WR15, WG25, R620	UG-385/U
M12HW	60-90 GHz	WR12, WG26, R740	UG-387/U
M10HW	75-110 GHz	WR10, WG27, R900	UG-387/U

For other frequencies and sizes please consult factory for details

A Diplexer (DPL 313A) is required for use with the mixers listed above. It is supplied with two SMA (m) barrel adapters for IF and LO interconnection to the spectrum analyzer Option 020 connectors and a 1 meter long, high quality interconnecting cable for connection between mixer and diplexer.

ACCESSORIES

Power Splitters/Dividers

54311/123	Power Splitter DC to 18 GHz, Type N
54311/124	Power Splitter DC to 26.5 GHz, 3.5 mm
54311/161	Power Splitter DC to 40 GHz, 2.92 mm
54311/187	Power Divider DC to 18 GHz
54311/188	Power Divider DC to 26.5 GHz

RF Ruggedized Cables for Bridges and Dividers

54311/195	1.5 m, 3 GHz, N (m) to N (m)
54311/196	3.0 m, 3 GHz, N (m) to N (m)

Fixed Loads

54421/020	7 mm Fixed Load
54421/021	3.5 mm (f) Fixed Load
54421/022	3.5 mm (m) Fixed Load
54421/023	N (m) Fixed Load
54421/024	N (f) Fixed Load

Precision Adapters

54311/175	N (m) to N (m)
54311/167	N (m) to N (f)
54311/174	N (f) to N (f)
54311/176	N (f) to 3.5 mm (f)
54311/177	N (m) to 3.5 mm (f)
54311/178	N (m) to 3.5 mm (m)
54311/185	N (f) to 3.5 mm (m)
54311/137	N (m) to TNC (f)

54311/138 N (m) to TNC (m)

54311/139 N (f) to TNC (f)

54311/186 N (f) to TNC (m)

54311/203 7 mm to N (f)

54311/204 7 mm to TNC (m)

54311/205 7 mm to TNC (f)

54311/136 TNC (m) to TNC (m)

54311/107 3.5 mm (f) to 3.5 mm (f)

54311/165 3.5 mm (m) to 3.5 mm (f)

54311/164 3.5 mm (m) to 3.5 mm (m)

54311/162 2.92 mm (m) to 2.92 mm (m)

54311/206 2.92 mm (m) to 2.92 mm (f)

54311/207 2.92 mm (f) to 2.92 mm (f)

Standard Adapters

54311/133 N (f) to SMA (f)

54311/134 N (m) to SMA (f)

54311/135 TNC (m) to SMA (m)

Miscellaneous Electrical Cables

54311/170 Positive Voltage Measurement Cable

54311/112 Negative Voltage Measurement Cable

43129/189 GPIB Cable

43139/042 BNC (m) to BNC (m) 1.5 m

46884/560 Parallel Printer Interface Cable

43137/604 Autotester Adapter Cable 0.5 m

43139/107 Autotester Adapter Cable 1.5 m

Standard Microwave Cables

54351/022 0.5 m, 18 GHz, N (m) to N (m)

54351/025 0.5 m, 26.5 GHz, 3.5 mm (m) to 3.5 mm (m)

54351/027 0.5 m, 40 GHz, 2.92 mm (m) to 2.92 mm (m)

Attenuators

56534/901 Precision Fixed Coaxial Attenuator 3 dB DC to 18 GHz
5 W, N(m) to N(f)

56534/902 Precision Fixed Coaxial Attenuator 6 dB DC to 18 GHz
5 W, N(m) to N(f)

56534/903 Precision Fixed Coaxial Attenuator 10 dB DC to 18 GHz
5 W, N(m) to N(f)

56534/904 Precision Fixed Coaxial Attenuator 20 dB DC to 18 GHz
5 W, N(m) to N(f)

Software Support

59000/327 MIPlot Software Pack

59000/371 Guided Scalar Measurements

MISCELLANEOUS

46885/038 Rack Mount Kit for 6840

46880/085 Service Manual

84501 Soft Carrying Case

46662/695 Flight Case

54152/001 3.5 mm Torque Wrench

54211/008 Compact Keyboard

2388 1.25 GHz Active Probe

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