Agilent 53140 Series

Microwave Counter, Power Meter and DVM in One Portable Package

Product Overview

Everything you need for the installation and maintenance of microwave links:

- A choice of frequency counter ranges up to 46 GHz
- A true power meter to meet your “laboratory-accuracy” requirements in the field
- A dc DVM to assist with antenna alignment and telecom power supply measurements
- Lightweight, rugged and a battery option for complete portability in the field

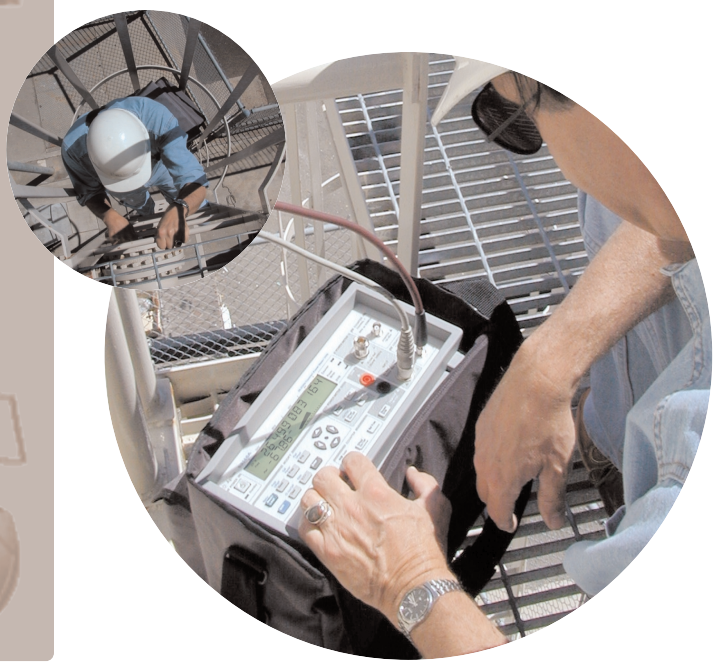
Agilent Technologies

Working together, we can anticipate—and apply—the latest advances in electronic technology, accelerating your progress toward new successes.

Simplify Installation and Maintenance of Point-to-Point Microwave Links

Whether you are installing or maintaining cell-site to base-station links, business-to-business communication links, digital radio links (along railroads, pipelines or power lines) or even satellite ground stations, installing and maintaining microwave links typically requires three pieces of equipment. These are a CW microwave counter, a true power meter and a dc DVM.

The 53140 series reduces the weight, volume and hassle of carrying multiple pieces of equipment in the field by combining these three instruments into one. Its rubber bumpers make it rugged and ready to withstand the elements. A soft carrying case option makes transit to the field easy and has a pouch for accessory storage. You will not have to worry about ac power availability at the site with the 53140 series' battery option. Plus its LCD display with a switchable backlite saves on battery life.



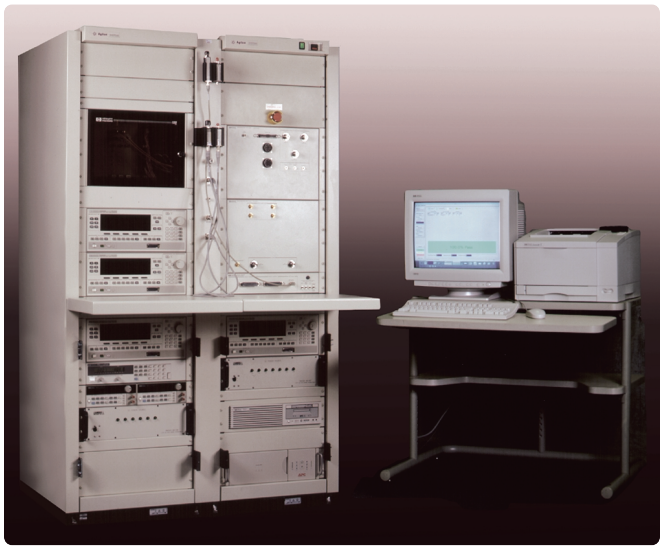
The 53140 Series Measurement Suite

Save ATE Rack Space and Budget Dollars by Combining Three Instruments into One

For measurements used in microwave component and assembly testing, the compact, three-in-one 53140 series reduces the need for expensive ATE rack space. The 53140 series comes ATE-ready with both GPIB and RS-232 SCPI programmable interfaces. A rack mount kit is optional.

CW Microwave Counter up to 46 GHz

Choose the frequency range you need. The 53140 series has three ranges; 20 GHz, 26.5 GHz and 46 GHz. The ultra-wideband microwave input covers from 50 MHz up to the maximum frequency. This reduces the need for channel switching. You don't have to wait for resolution that is not needed as the resolution is selectable from 1 Hz to 1 MHz. For better measurement accuracy over time and temperature, an optional oven timebase is available.



True Power Meter with a Wide Selection of Sensors

The 53140 series true power meter provides laboratory instrument accuracy in a rugged, field-ready package. Obtain 0.01 dB resolution and 0.02 dB basic instrument accuracy where you need it most—on site. The graphical peaking meter allows you to make fast and easy power adjustments. For more flexibility, a wide range of power sensors is available (Agilent 8480 series) with a power range from -70 dBm to +44 dBm.

DC DVM for AGC and Power Supply Measurements

A ±50 Vdc DVM monitors the microwave receiver's AGC circuitry for assistance during antenna alignment. The DVM can also check the -48 Vdc power supplies typically found at telecom sites.

Advanced Instrument Features that Help Make the Job Easier

The Agilent 53140 series has the features you expect in a precision laboratory instrument. Relative readings for both frequency and power measurements show deviations from nominal values. Offset reading allows indirect measurement of either final frequency or power values or both. Averaging smooths out rapidly changing measurement displays for ease of viewing.

Is the convenience of measuring frequency and power with a single input more important to you than power measurement accuracy? Then the 53150 series of CW Microwave Counters may be for you.

For more information,
visit our website at:
www.agilent.com/find/53150

Specifications and Characteristics

All specifications are over full signal and temperature ranges unless otherwise noted. All specifications are warranted. Those items labeled "typical" or "nominal" are characteristics and are not warranted.

Counter Specifications	**53147A**	**53148A**	**53149A**
Frequency range			
Channel 1			
Normal mode	10 Hz to 125 MHz	10 Hz to 125 MHz	10 Hz to 125 MHz
Low pass filter enabled	10 Hz to 50 kHz	10 Hz to 50 kHz	10 Hz to 50 kHz
Channel 2	50 MHz to 20 GHz	50 MHz to 26.5 GHz	50 MHz to 46 GHz
Sensitivity			
Channel 1			
10–30 Hz	40 mV_{rms}	40 mV_{rms}	40 mV_{rms}
30 Hz–125 MHz	25 mV_{rms}	25 mV_{rms}	25 mV_{rms}
Channel 2			
50–300 MHz	-20 dBm	-20 dBm	-20 dBm
0.3–12.4 GHz	-33 dBm	-33 dBm	-33 dBm
12.4–18 GHz	-33 dBm	-33 dBm	-30 dBm
18–20 GHz	-29 dBm	-29 dBm	-27 dBm
20–26.5 GHz	N/A	-25 dBm	-27 dBm
26.5–40 GHz	N/A	N/A	-23 dBm
40–46 GHz	N/A	N/A	-17 dBm
Maximum input			
Channel 1	2 V_{rms}	2 V_{rms}	2 V_{rms}
Channel 2			
50 MHz to 2 GHz	+5 dBm	+5 dBm	+5 dBm
2–46 GHz	+13 dBm	+13 dBm	+13 dBm
Damage level			
Channel 1	120 V (dc + ac pk) linearly derated to 5 V_{rms} at 125 MHz	120 V (dc + ac pk) linearly derated to 5 V_{rms} at 125 MHz	120 V (dc + ac pk) linearly derated to 5 V_{rms} at 125 MHz
Channel 2	+27 dBm	+27 dBm	+27 dBm
Impedance (nominal)			
Channel 1	1 MΩ/60 pF	1 MΩ/60 pF	1 MΩ/60 pF
Channel 2	50 Ω	50 Ω	50 Ω
Connector			
Channel 1	BNC female	BNC female	BNC female
Channel 2	SMA/APC-3.5 compatible female	SMA/APC-3.5 compatible female	2.92 mm removable, SMA/APC-3.5 compatible female
SWR (typical)			
Channel 2			
50–300 MHz	1.5:1	1.5:1	1.5:1
0.3–10 GHz	2.0:1	2.0:1	2.0:1
10–20 GHz	3.0:1	3.0:1	3.0:1
20–26.5 GHz	N/A	3.0:1	2.5:1
26.5–46 GHz	N/A	N/A	2.5:1
Coupling			
Channel 1	ac	ac	ac
Channel 2	ac	ac	ac
Emissions (typical) ("kickback noise")			
Channel 1	N/A	N/A	N/A
Channel 2 (measuring/no input)	-40 dBm/<-70 dBm	-40 dBm/<-70 dBm	-40 dBm/<-70 dBm

Counter Specifications Continued

	53147A	53148A	53149A
Resolution selection (Channel 1 and 2)	1 Hz to 1 MHz	1 Hz to 1 MHz	1 Hz to 1 MHz
Accuracy (Channel 1 and 2, LSD = Resolution selected)	±1 LSD ±residual stability ± (timebase error x frequency)	±1 LSD ±residual stability ± (timebase error x frequency)	±1 LSD ±residual stability ± (timebase error x frequency)
Residual stability (Counter and source tied to same timebase)			
Channel 1	N/A	N/A	N/A
Channel 2	0.6 LSD rms	0.8 LSD rms	1.25 LSD rms
Measurement time (typical)			
Channel 1	1/Resolution + 30 ms	1/Resolution + 30 ms	1/Resolution + 30 ms
Channel 2	1/Resolution + Acquisition time + 30 ms	1/Resolution + Acquisition time + 30 ms	1/Resolution + Acquisition time + 30 ms
Acquisition time (typical) (1 MHz FM rate, power meter off)			
Channel 1	N/A	N/A	N/A
Channel 2 (FM Auto/FM Off)	150 ms/125 ms	150 ms/125 ms	165 ms/140 ms
FM tolerance			
Channel 1	N/A	N/A	N/A
Channel 2 FM Auto	20 MHz p-p max at 10 MHz rate	20 MHz p-p max at 10 MHz rate	20 MHz p-p max to 26.5 GHz,12 MHz p-p max above 26.5 GHz at 10 MHz rate
Channel 2 FM Off	1 MHz p-p at 10 MHz rate	1 MHz p-p at 10 MHz rate	1 MHz p-p at 10 MHz rate
AM tolerance (Channel 1 and 2)	Any index provided minimum signal level is not less than sensitivity	Any index provided minimum signal level is not less than sensitivity	Any index provided minimum signal level is not less than sensitivity
Amplitude discrimination			
Channel 1	N/A	N/A	N/A
Channel 2 <300 MHz	N/A	N/A	N/A
Channel 2 >300 MHz	Automatically measures the largest signal present provided signal is >10 dB (typical) above any signal separated by less than 75 MHz; >20 dB (typical) above any signal separated by more than 75 MHz	Automatically measures the largest signal present provided signal is >10 dB (typical) above any signal separated by less than 75 MHz; >20 dB (typical) above any signal separated by more than 75 MHz	Automatically measures the largest signal present provided signal is >10 dB (typical) above any signal separated by less than 75 MHz; >20 dB (typical) above any signal separated by more than 75 MHz

Counter Specifications Continued

Timebase

Frequency	10 MHz
Output	10 MHz sine wave, 1 Vrms into 50Ω
External timebase input	1, 2, 5, 10 MHz; 1 to 5 Vrms into 50Ω
Connector	BNC female located on rear panel

Internal timebase stability

	TCXO (standard)	**Oven** (Option 001)
Aging rate per day	N/A	$<5 \times 10^{-10}$
Aging rate per month	$<1 \times 10^{-7}$	$<1.5 \times 10^{-8}$
Short term (1 sec. average time)	$<1 \times 10^{-9}$	$<2 \times 10^{-10}$
Line variation (±10%)	$<1 \times 10^{-7}$	$<1 \times 10^{-10}$
Warm-up	N/A	$<1 \times 10^{-8}$ within 5 min. after turn-on at 25° C
Temperature stability (0–55° C)	$<1 \times 10^{-6}$	$<1 \times 10^{-8}$

Power Meter Specifications

Frequency range	100 kHz to 50 GHz, sensor dependent.
Power range	-70 to +44 dBm, sensor dependent.
Power sensors supported	8480 series (see table on page 8)
Resolution	0.01 dB in log mode, 0.1% of full scale in linear mode.
Display units	
Absolute	dBm or Watts
Relative	dB or %
Accuracy	
Instrumentation	±0.02 dB or ± 0.5%. Add power sensor linearity specification for overall system accuracy.
Zero set (digital setting capability of zero)	Sensor dependent (see table on page 8).
Power reference	
Power output	1.00 mW. Factory set to ± 0.7%, traceable to NIST.
Accuracy	±1.2% worst case (± 0.9 RSS) for one year.
Frequency	50 MHz (nominal)
Connector	N (f)

DVM Specifications

Function	DC volts
Range	±50 Vdc
Resolution	2 mV
Accuracy	±0.25% of reading ±10 mV
Damage level	±60 Vdc
Input resistance	0.5 MΩ (nominal)
Connector	4 mm banana sockets
Display	Replaces frequency display when DVM activated

General Information	**Save and recall**	Up to 9 complete instrument setups may be saved and later recalled. These setups are retained when power is removed.
	Sample rate	User-selectable fast (nominally 20 ms between readings), medium (nominally 250 ms between readings), slow (nominally 1 s between readings) and hold.
	Counter gate time	1/Resolution selected.
	Math functions	
	Offset (relative/fixed)	Last reading and/or entered offset to reading for either power or frequency
	Averaging	1 to 99 measurement running average
	Display	Backlit LCD. Backlight can be turned on or off via front panel control.
	Sleep mode (Option 002 only)	Backlight automatically shuts off if no input signal and power sensor present, and no keys pressed, for 5 minutes (nominal).
	Self test	Count and power meter circuitry and internal memory automatically tested at startup, via menu selection, or remotely. Error messages displayed to indicate failed tests.
	Programming	
	Interface	GPIB (IEEE-488.1-1987, IEEE 488.2-1987) and RS-232
	Language	SCPI-1992.0 (Standard Commands for Programmable Instruments)
	RS-232 Rates	User selectable 2400 to 19200 baud
	Power Supply	
	ac	90–132 Vac; 47.5–66 Hz or 360–440 Hz 216–264 Vac; 47.5–66 Hz
	Line selection	automatic
	Power requirements	80 VA max. (32 W typical)
	dc (Option 002 only)	11–18 Vdc; 2A max.
	Battery (Option 002)	
	Type	VHS camcorder, lead acid (2 each)
	Charge Time	8 hours in unit (typical)
	Capacity	2 hours min. at 25° C
	Size	330 mm W x 156 mm H x 376 mm D with bumpers and handles. Rack panel is full EIA width and 3U ISO height.
	Operating temperature	0–55° C
	With battery option	0–40° C
	Weight (nominal)	4.5 kg without battery option, 6.6 kg with battery option
	Warranty	1 year
	Safety	Designed in compliance with IEC-1010, CAN/CSA 1010.1
	EMC	Designed in compliance with IEC-11, EN50082-1, IEC801-2, -3, -4.
Accessories	**Supplied**	Power sensor cable (11730A); DVM test leads (34132B); operating/programming and service manuals; ac power cord.
	Available	
	Power sensors	8480 series (see table on page 8)
	Spare battery	53150-80010
	dc power input cable	53150-60214

Available Sensors

	Frequency Range	Connector	Zero Set
25 Watt sensors 1 mW to 25 W (0 to +44 dBm)			
8481B	10 MHz to 18 GHz	N (m)	±50 µW
8482B	100 kHz to 4.2 GHz	N (m)	±50 µW
3 Watt sensors 100 µW to 3 W (-10 to +35 dBm)			
8481H	10 MHz to 18 GHz	N (m)	±5 µW
8482H	100 kHz to 4.2 GHz	N (m)	±5 µW
100 mW sensors 1 µW to 100 mW (-30 to +20 dBm)			
8485A	50 MHz to 26.5 GHz	APC-3.5 mm (m)	±50 nW
8485A Option 033	50 MHz to 33 GHz	APC-3.5 mm (m)	±50 nW
8481A	10 MHz to 18 GHz	N (m)	±50 nW
8482A	100 kHz to 4.2 GHz	N (m)	±50 nW
8487A	50 MHz to 50 GHz	2.4 mm (m)	±50 nW
High sensitivity sensors 100 pW to 10 µW (-70 to -20 dBm)			
8481D	10 MHz to 18 GHz	N (m)	±20 pW
8485D	50 MHz to 26.5 GHz	APC-3.5 mm (m)	±20 pW
8485D Option 033	50 MHz to 33 GHz	APC-3.5 mm (m)	±20 pW
8487D	50 MHz to 50 GHz	2.4 mm (m)	±20 pW

Ordering Information

Agilent 53147A	20 GHz Counter/Power Meter/DVM
Agilent 53148A	26.5 GHz Counter/Power Meter/DVM
Agilent 53149A	46 GHz Counter/Power Meter/DVM
Option 001	Oven timebase
Option 002	Battery and dc input
Option 007	Soft carrying case
Option 1CM	Rack mounting kit

Visit our website at: www.agilent.com and search for "counters"

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