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**Agilent Technologies**

Innovating the HP Way

## Full-featured CW Microwave Counters for Field, Factory or Lab



### Product Overview

**HP 53150A 20 GHz Counter**  
**HP 53151A 26.5 GHz Counter**  
**HP 53152A 46 GHz Counter**



**High performance microwave counters: at home in the field, bench or ATE environment**

- Ultrawide range, single input (from 50 MHz up to 46 GHz)
- Simultaneous power and frequency measurement with analog peaking indicator
- HP-IB and RS-232 standard
- Lightweight and rugged
- Battery optional

### **Convenience, Portability and Outstanding Performance**

The innovative designs of the HP 53150 Series microwave counters offer an uncluttered, feature-laden front panel. These designs present no-compromise performance and quality in a surprisingly small, light, battery-operated product.

### **The Convenience of a Single Microwave Input**

The HP 53150 Series has an advanced sampler that integrates a separate zero bias Schottky diode for the accurate measurement of input power. This allows measurement of both frequency and power with a single connection. No compromise in frequency coverage is required for this capability. The ultrawideband microwave input covers the entire RF and microwave spectrum, from intermediate frequencies (IFs) of 50 MHz to millimeter waves.

The power measurement accuracy and repeatability of these counters rivals power meters with diode sensors. Since frequency and power of the input signal are measured simultaneously, adjustment for the diode's frequency response is done automatically. And like the latest in diode sensors, compensation is also made for deviation from square law.

### **Field Tough but Ready for Benchtop or ATE Applications**

The HP 53150 Series is as comfortable in the field as in the laboratory. The rugged case with an integrated tilting handle can tolerate the vibration and shock expected in field use. The backlit LCD display ensures visibility in all environments, from dark to full sunlight, at distances exceeding 15 feet.

If ac power is unavailable, the internal, replaceable camcorder batteries provide at least 2.5 hours of continuous operation. The unit can also be powered from an external 11-18 Vdc source.

For benchtop and ATE applications, the HP 53150 Series delivers full functionality and high measurement speed. The fully programmable RS-232 interface and high speed HP-IB interface are standard features.

### **No Compromise Performance**

The HP 53150 Series offers exceptional sensitivity by utilizing a single board design with low phase noise PLL circuitry. Despite their simple appearance, these counters retain all the powerful functions one expects in precision instrumentation: measurement averaging, arbitrary as well as nulling offsets for both frequency and power, display of power in either dBm or Watts.

Additional capabilities include full control of resolution, sampling rate, and HP-IB address plus extensive self-diagnostics, fast acquisition times and full programmability. Performance surpasses the industry standard HP 5350 Series, in virtually every aspect, in a package less than half the weight and size.

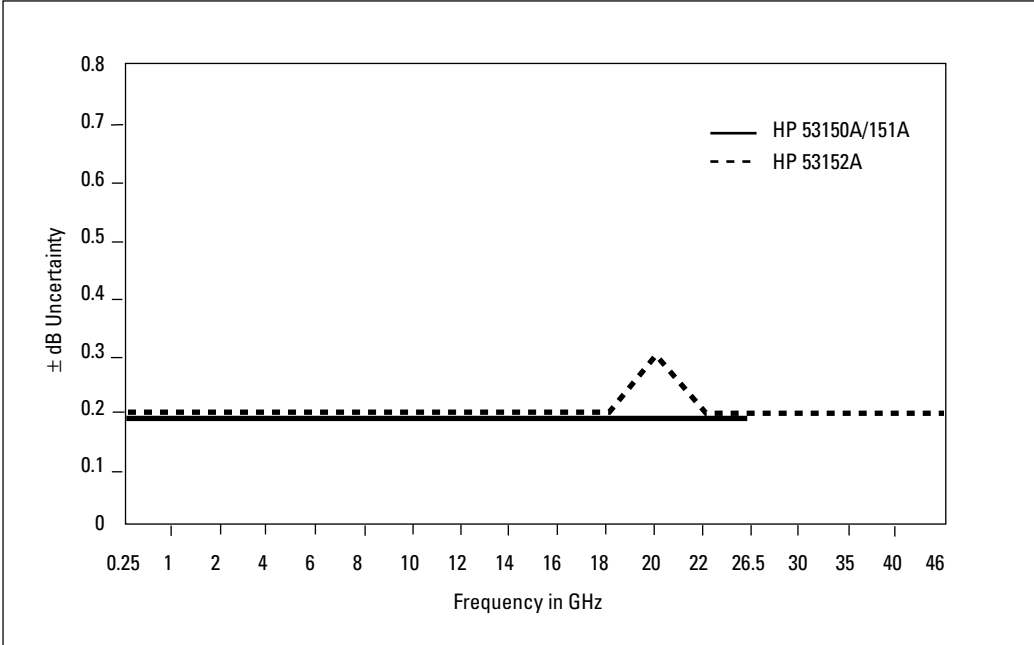
## Measurement Specifications and Characteristics

All measurement specifications are over the full signal and temperature ranges unless otherwise noted.

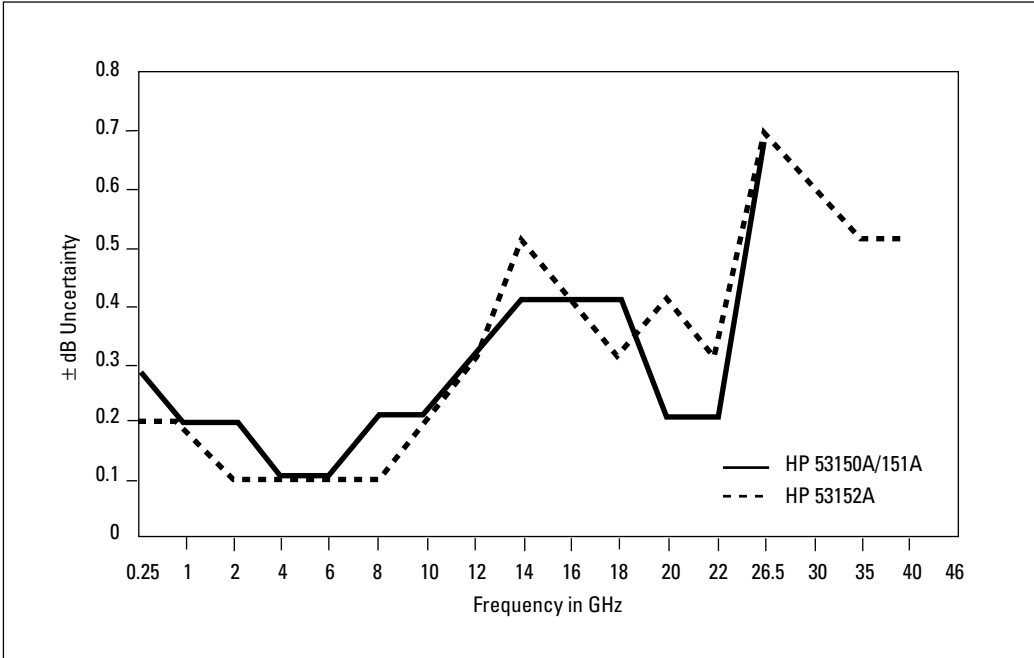
Input Characteristics	HP 53150A	HP 53151A	HP 53152A
<b>Frequency Range</b> Channel 1 (Normal mode) (Low pass filter enabled) Channel 2	10 Hz - 125 MHz 10 Hz - 50 kHz 50 MHz - 20 GHz	10 Hz - 125 MHz 10 Hz - 50 kHz 50 MHz - 26.5 GHz	10 Hz - 125 MHz 10 Hz - 50 kHz 50 MHz - 46 GHz
<b>Sensitivity</b> Channel 1 10-30 Hz 30 Hz-125 MHz Channel 2 50-250 MHz 0.25-12.4 GHz 12.4-18 GHz 18-20 GHz 20-26.5 GHz 26.5-40 GHz 40-46 GHz	40 mV 25 mV -20 dBm -33 dBm -33 dBm -29 dBm N/A N/A N/A	40 mV 25 mV -20 dBm -33 dBm -33 dBm -29 dBm -25 dBm N/A N/A	40 mV 25 mV -20 dBm -33 dBm -30 dBm -27 dBm -27 dBm -23 dBm -17 dBm
<b>Maximum Input</b> Channel 1 Channel 2 50 MHz - 2 GHz 2-46 GHz	2 V <sub>rms</sub> +5 dBm +13 dBm	2 V <sub>rms</sub> +5 dBm +13 dBm	2 V <sub>rms</sub> +5 dBm +13 dBm
<b>Damage Level</b> Channel 1 Channel 2	120 V (dc + ac pk) linearly derated to 5 V <sub>rms</sub> at 125 MHz +27 dBm	120 V (dc + ac pk) linearly derated to 5 V <sub>rms</sub> at 125 MHz +27 dBm	120 V (dc + ac pk) linearly derated to 5 V <sub>rms</sub> at 125 MHz +27 dBm
<b>Impedance (Nominal)</b> Channel 1 Channel 2	1 M $\Omega$ / 60 pF 50 $\Omega$	1 M $\Omega$ / 60 pF 50 $\Omega$	1 M $\Omega$ / 60 pF 50 $\Omega$
<b>Connector</b> Channel 1 Channel 2	BNC female SMA/APC-3.5 compatible female	BNC female SMA/APC-3.5 compatible female	BNC female 2.92 mm removable, SMA/APC-3.5 compatible female
<b>SWR</b> Channel 2 50-250 MHz 0.25-10 GHz 10-20 GHz 20-26.5 GHz 26.5-46 GHz	1.5:1 typical 2.0:1 typical 3.0:1 typical N/A N/A	1.5:1 typical 2.0:1 typical 3.0:1 typical 3.0:1 typical N/A	1.5:1 typical 2.0:1 typical 3.0:1 typical 2.5:1 typical 2:5:1 typical
<b>Coupling</b> Channel 1 Channel 2	ac ac	ac ac	ac ac
<b>Acquisition Time (1 MHz FM rate)</b> Channel 1 Channel 2 (FM Auto/FM Off)	N/A 125 ms/100 ms	N/A 125 ms/100 ms	N/A 140 ms/115 ms
<b>Resolution</b> Channel 1/Channel 2	1 Hz to 1 MHz	1 Hz to 1 MHz	1 Hz to 1 MHz

Input Characteristics	HP 53150A	HP 53151A	HP 53152A
<b>Emissions ("kickback noise")</b> Channel 1 Channel 2 (measuring/no input)	N/A -40 dBm/<-70 dBm	N/A -40 dBm/<-70 dBm	N/A -40 dBm/<-70 dBm
<b>Residual Stability*</b> Channel 1 Channel 2 *Counter and source tied to same timebase	N/A 0.6 LSD rms	N/A 0.8 LSD rms	N/A 1.25 LSD rms
<b>Accuracy</b> Channel 1/Channel 2	$\pm 1 \text{ LSD} \pm \text{timebase error} \times \text{frequency}$	$\pm 1 \text{ LSD} \pm \text{timebase error} \times \text{frequency}$	$\pm 1 \text{ LSD} \pm \text{timebase error} \times \text{frequency}$
<b>Measurement Time</b> Channel 1  Channel 2	1/Resolution + 20 ms  1/Resolution + Acquisition time + 20 ms	1/Resolution + 20 ms  1/Resolution + Acquisition time + 20 ms	1/Resolution + 20 ms  1/Resolution + Acquisition time + 20 ms
<b>FM Tolerance</b> Channel 1 Channel 2 (FM Auto)  (FM Off)	N/A 20 MHz p-p max @ 10 MHz rate  1 MHz p-p @ 10 MHz rate	N/A 20 MHz p-p max @ 10 MHz rate  1 MHz p-p @ 10 MHz rate	N/A 20 MHz p-p max to 26.5 GHz, 12 MHz p-p max above 26.5 GHz @ 10 MHz rate 1 MHz p-p @ 10 MHz rate
<b>AM Tolerance</b> Channel 1 Channel 2	N/A Any index provided minimum signal level is not less than sensitivity	N/A Any index provided minimum signal level is not less than sensitivity	N/A Any index provided minimum signal level is not less than sensitivity
<b>Amplitude Discrimination</b> Channel 1 Channel 2 below 250 MHz above 250 MHz	N/A  N/A 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	N/A  N/A 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	N/A  N/A 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
<b>Power Measurement</b> Channel 1 Channel 2 Range Accuracy at input connector** (0 dBm to -20 dBm) 0.05-12.4 GHz 12.4-20 GHz 20-26.5 GHz 26.5-46 GHz Resolution Display **see graphs for typical data	N/A  Counter sensitivity to +7 dBm  $\pm 1.5 \text{ dB}$ $\pm 1.5 \text{ dB}$ N/A N/A 0.01 dB dBm or millwatts/microwatts	N/A  Counter sensitivity to +7 dBm  $\pm 1.5 \text{ dB}$ $\pm 1.5 \text{ dB}$ $\pm 2.0 \text{ dB}$ N/A 0.01 dB dBm or millwatts/microwatts	N/A  Counter sensitivity to +7 dBm  $\pm 1.0 \text{ dB}$ $\pm 1.5 \text{ dB}$ $\pm 1.5 \text{ dB}$ $\pm 2.0 \text{ dB}$ 0.01 dB dBm or millwatts/microwatts

**Typical\* power measurement uncertainty at 25°C  
for various input levels**



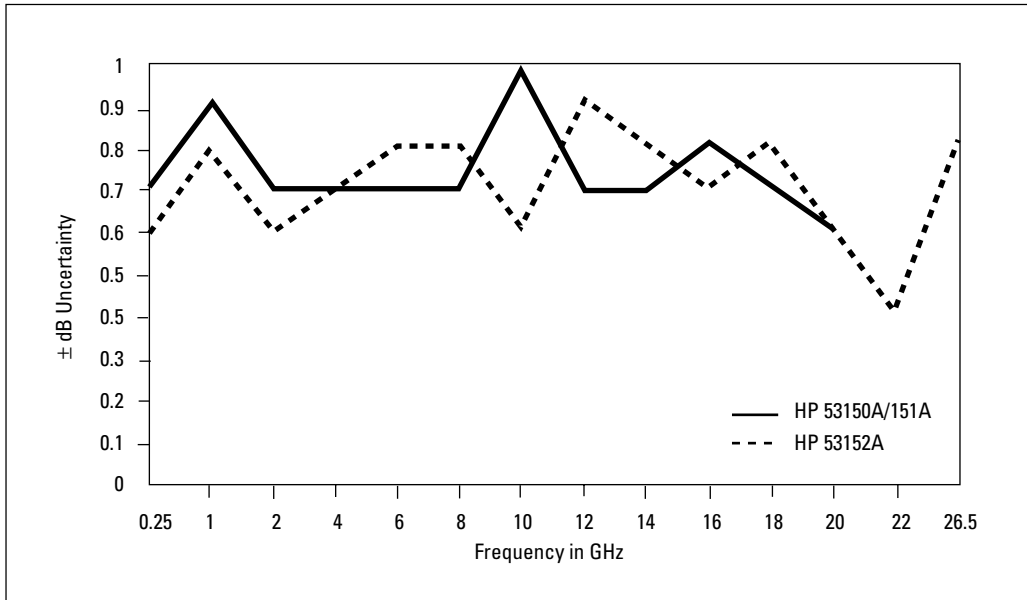
**Graph 1.**  
**-10 dBm input level**  
**at 25°C.**



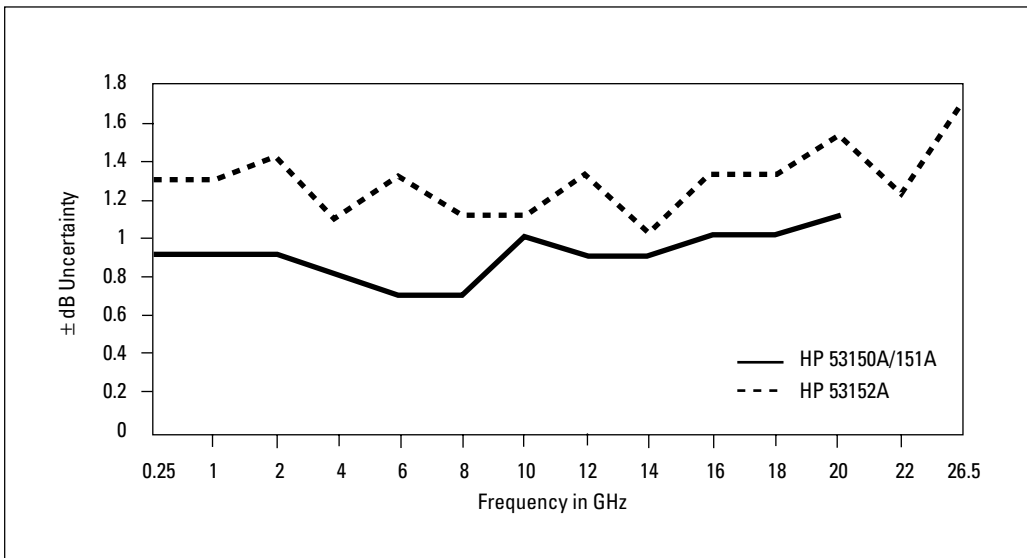
**Graph 2.**  
**0 dBm and -20 dBm**  
**input level at 25°C.**

\*Typical means approximately 2/3 of all units will meet these characteristics.

**Typical\* power measurement uncertainty at -25 dBm input level**



**Graph 3.**  
-25 dBm input level  
at 25°C.



**Graph 4.**  
-25 dBm input level  
from 0 to 55°C.

\*Typical means approximately 2/3 of all units will meet these characteristics.

## Timebase

**Frequency:** 10 MHz

**Output:** 10 MHz sine wave, 1 Vp-p into 50  $\Omega$

**External Timebase Input:** 1, 2, 5, 10 MHz;  
1 to 5 Vp-p into 50  $\Omega$

**Connector:** BNC female located on rear panel

## Internal Timebase Stability

	TCXO (Standard)	Oven (Option 001)
<b>Aging Rate</b> Per Day Per Month	— <1 $\times 10^{-7}$	<5 $\times 10^{-10}$ <1.5 $\times 10^{-8}$
<b>Short Term</b> (1 sec. avg. time)	<1 $\times 10^{-9}$	<2 $\times 10^{-10}$
<b>Line Variation</b> ( $\pm 10\%$ )	<1 $\times 10^{-7}$	<1 $\times 10^{-10}$
<b>Warm-up</b>	—	<1 $\times 10^{-8}$ within 5 min. after turn-on at 25°C
<b>Temperature Stability (0-55°C)</b>	<1 $\times 10^{-6}$	<3 $\times 10^{-9}$

## 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.

**Self Test:** Internal memory and count circuitry automatically tested at startup, via menu selection, or remotely. Error messages displayed to indicate failed tests.

**Size:** 213 mm W  $\times$  88.5 mm H  $\times$  300 mm D

**Operating temperature:** 0-55°C

With battery option: 0-40°C

**Weight:** 4 kg without battery option, 6.4 kg with battery option

**Warranty:** 1 year

**Programming:** HP-IB (IEEE-488.1-1987, IEEE 488.2-1987) or RS-232C

**Language:** SCPI-1992.0 (Standard Commands for Programmable Instruments)

**RS-232C 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: 75 VA max. (25 W typ.)

**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

Capacity: 2.5 hours min. at 25°C

## Math Functions:

**Offset:** Last reading and/or entered offset to reading for either power or frequency

**Averaging:** 1 to 99 measurement running average

**Cable Loss Compensation:** Offsets power reading via linear interpolation of user-entered attenuations with up to 10 independent frequency points.

**Display:** Backlit LCD. Backlight can be turned on or off via front panel control.

**Sleep Mode (Option 002 only):** Automatically activated if no input is present for 5 minutes.

**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

Operating, programming, and service manuals and ac power cord.

## Accessories Available

Battery Charger	53150-60217
Spare Battery	53150-80010
dc Power Input Cable	53150-60214

## Ordering Information

HP 53150A 20 GHz Counter
HP 53151A 26.5 GHz Counter
HP 53152A 46 GHz Counter

## Options

Opt 001 Oven Timebase
Opt 002 Battery and dc input
Opt 1BP Mil-Std-45662A Calibration with data
Opt W30 Three Years of Return Repair Service
Opt W50 Five Years of Return Repair Service

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Hewlett-Packard  
European Marketing Centre  
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1180 AZ Amstelveen  
The Netherlands  
(31 20) 547 9900

**Japan:**

Hewlett-Packard Japan Ltd.  
Measurement Assistance Center  
9-1, Takakura-Cho, Hachioji-Shi,  
Tokyo 192, Japan  
Tel: (81-426) 56-7832  
Fax: (81-426) 56-7840

**Latin America:**

Hewlett-Packard  
Latin American Region Headquarters  
5200 Blue Lagoon Drive  
9th Floor  
Miami, Florida 33126  
U.S.A.  
Tel: (305) 267-4245  
(305) 267-4220  
Fax: (305) 267-4288

**Australia/New Zealand:**

Hewlett-Packard Australia Ltd.  
31-41 Joseph Street  
Blackburn, Victoria 3130  
Australia  
1 800 629 485

**Asia Pacific:**

Hewlett-Packard Asia Pacific Ltd.  
17-21/F Shell Tower, Times Square,  
1 Matheson Street, Causeway Bay,  
Hong Kong  
Tel: (852) 2599 7777  
Fax: (852) 2506 9285

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