

Model 451 925 MHz to 18 GHz (300 MHz to 950 MHz, optional)

The 451 Microwave Pulse Counter automatically and directly measures the frequency of pulse modulated microwave signals up to 18 GHz. It replaces narrow band cavity wavemeters and transfer oscillators. Both of these techniques require auxiliary equipment, skilled operators, and are difficult and time consuming to make, particularly for narrow pulses and low repetition rates. The 451 requires no manual adjustments or other equipment to measure the frequencies of pulsed signals. Consequently, unskilled operators can make measurements formerly requiring experienced personnel. The frequency of the pulsed signal is read directly on a 7 digit LED display to 10 KHz resolution. Pulse widths can be as narrow as 100 nsec, and measurements can be made at virtually any repetition frequency.

Frequency Profile Measurement

Automatic pulse measurements can determine the average frequency of a pulse. In some cases however, additional information may be necessary. For example, a pulsed magnetron may exhibit substantial frequency shift near the leading and trailing edges of the pulse, or a pulsed Gunn diode oscillator may exhibit frequency shift during a pulse due to peak power thermal effects. Measurements of these characteristics are easily made with just the 451 and a delaying pulse generator.

Measures CW, and CW with FM Signals

The 451 also measures the frequency of CW microwave signals and carrier signals with FM modulation up to 40 MHz peak-to-peak deviation at 10 MHz modulation rates. Automatic switching between pulsed and CW signals is provided.

Systems Operation with GPIB

With the GPIB option, the 451 can become an integral part of a system. BCD output and programming are also available.

Options Available (see page 8)

- P1 Temperature Compensated Crystal Oscillator
- P2 Band A: 300-950 MHz
- P3 Rear Panel Inputs (Band A & B)
- P4 BCD Output/Remote Programming
- P5 GPIB (per IEEE Std. 488-1975)
- P6 Chassis Slides

Accessories Available

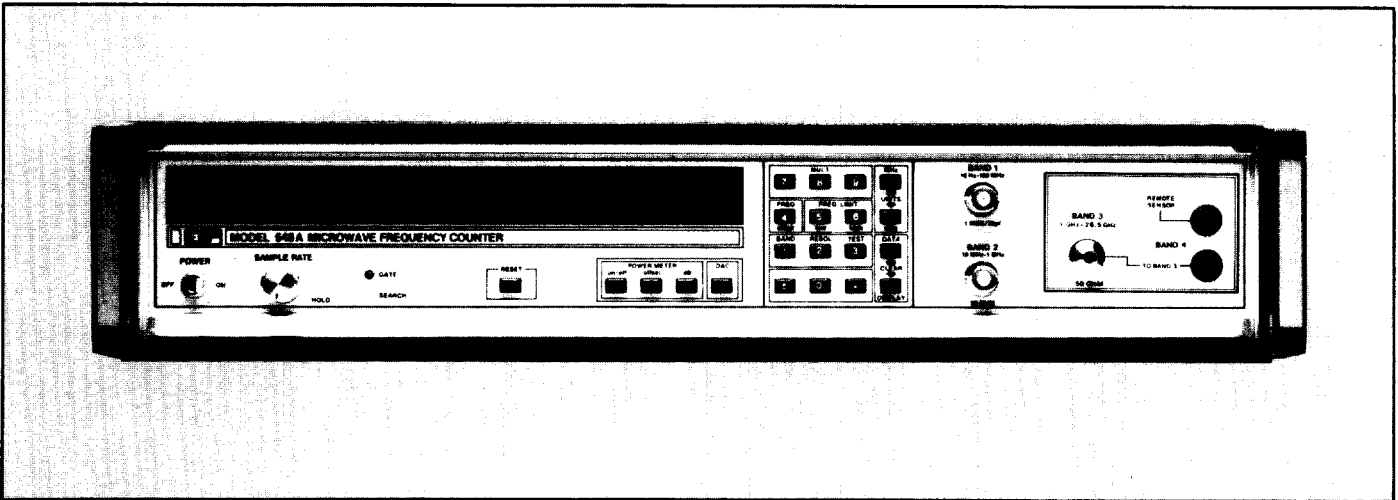
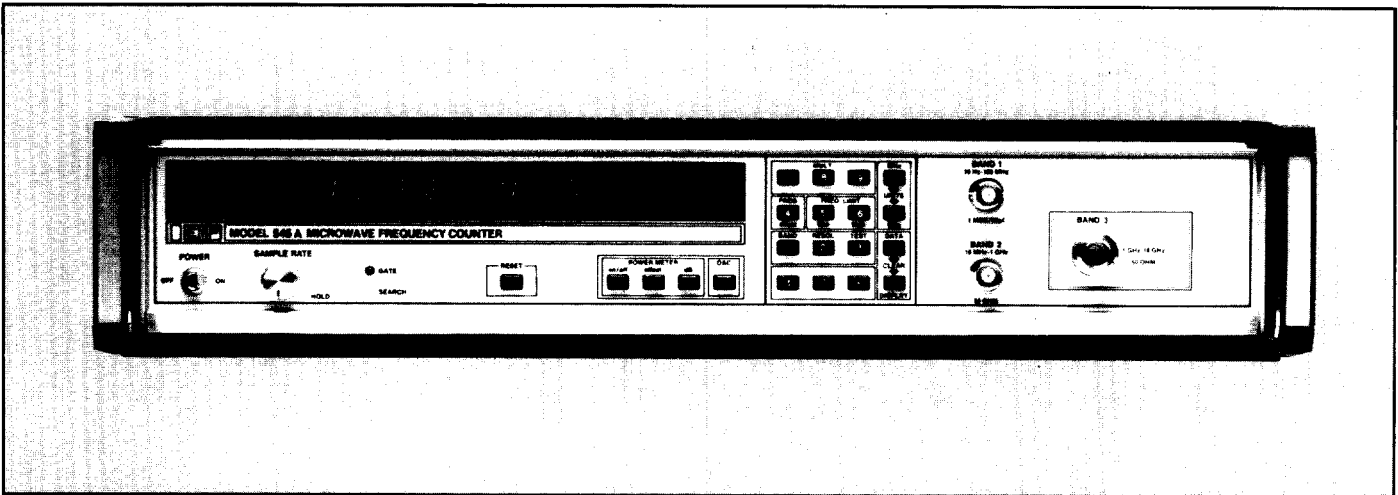
- Carrying Case
- Rack Mount Kit
- 400 Delay Pulse Generator

KEY SPECIFICATIONS

Frequency Range:		
Band A	300 MHz to 950 MHz (Option P2)	
Band B	925 MHz to 18 GHz	
Pulse Characteristics:		
Pulse width	100 nsec min. (measured at 3 dB points)	
Pulse repetition freq.	Minimum-50 Hz normal, 0 Hz rear panel selected; min. off time ≥300 nsec.	
Accuracy:		
CW or pulses	Time base accuracy ±1 count	
>100 μsec	Time base accuracy ±averaging error ± gate error	
Pulse <100 μsec		
Averaging error (kHz rms)		
	Band A	Band B
100 μs Gate	$\frac{200}{\sqrt{PW \cdot 0.03}}$	$\frac{100}{\sqrt{PW \cdot 0.03}}$
1 ms Gate	$\frac{60}{\sqrt{PW \cdot 0.03}}$	$\frac{30}{\sqrt{PW \cdot 0.03}}$
Gate error (max.)	$\frac{\pm 100 \text{ kHz}}{PW \cdot 0.03}$	$\frac{\pm 40 \text{ kHz}}{PW \cdot 0.03}$
PW = pulse width in μs.		
Crystal frequency	10 MHz	
Stability:		
Aging rate	< $ 3 \times 10^{-7} /\text{mon.}$	
Sensitivity:		
Band A (Opt. P2)	300 to 950 MHz	-10 dBm peak
Band B	925 MHz to 10 GHz	-10 dBm peak
	10 GHz to 18 GHz	- 5 dBm peak

FM Tolerance		
Band B (minimum)	CW: 40 MHz p-p deviation for mod. rates DC-10 MHz. PULSE (w/o Input Inhibit): 20 MHz max. freq. shift across pulse. FREQUENCY PROFILE (using Input Inhibit): 20 MHz max. freq. shift during input inhibit pulse.	
Maximum Input Level (peak):		
Band A: 300 to 950 MHz (Opt. P2)	Operating	Burnout Level
	+10 dBm	+27 dBm
Band B: 925 MHz to 18 GHz	+10 dBm	+30 dBm
Measurement Speed (Band B Only)		
Acquisition Time:		
PRF > 100 Hz	100 msec + 50 msec/GHz	
PRF < 100 Hz	100 msec + $\frac{5 \text{ sec}}{\text{PRF}}$	
Reading Time		
Band B (sec):	Band A	Band B
100 μs Gate	$\frac{400}{(PW)(PRF)}$	$\frac{100}{(PW)(PRF)}$
1 ms Gate	$\frac{4000}{(PW)(PRF)}$	$\frac{1000}{(PW)(PRF)}$
PW = pulse width (μsec) PRF = pulse repetition frequency (Hz)		
Resolution	10 kHz, 100 kHz, 1 MHz	

EIP Automatic Microwave Frequency Counters



Model 545A 10 Hz to 18 GHz

Model 545A-W29 10 Hz to 18 GHz (Communications)

Model 548A 10 Hz to 26.5 GHz (Optional to 110 GHz)

Models 545A and 548A are microprocessor-based counters which use EIP's frequency-selective heterodyne technique for counting microwave frequencies. Performance and specifications for the 545A and 548A are identical, except for the upper frequency limit. The 545A-W29 is equipped with a special software package and built-in power meter that adapts the unit to the unique requirements of the high density common carriers and earth stations.

Features and Serviceability

YIG-tuned RF input filters, which provide excellent FM tolerance, frequency selective power measurement and 5 watt burn-out protection, characterize these three high performance counters. Full diagnostic routines check counter operation, and built-in signature analysis allows to-the-component level fault isolation.

Frequency Limits

In the normal mode of operation, automatic amplitude discrimination enables the counter to measure the largest signal in the microwave spectrum, provided there is a 10 dB separation of signals. However, front-panel programming makes it easy to key in upper and lower frequency limits, permitting the counter to "look" for signals only within the selected frequency range. This lets you count and measure the power of a low-level signal (such as a harmonic) even when a signal of much higher level is present.

Optional Power Measurement

With the counter's ability to simultaneously measure frequency and power, you can often eliminate the need for a separate instrument. The power of an incoming signal can be measured in dBm (to a resolution of 0.1 dB) over the entire microwave frequency range. With a bandwidth of ~25 MHz, EIP's unique YIG-tuned pre-selector measures the power of the specific displayed frequency. Thus the user can simultaneously measure both the frequency and the power of individual signals in a multi-signal environment. In the power measurement mode, the counter will measure frequency and power of the selected signal to a resolution of 100 kHz and 0.1 dBm, respectively. The convenient keyboard-entered power offsets can be used to measure power deviation from a reference signal or to compensate for losses in external hook-ups.

Microprocessor Control

The operator uses the front panel keyboard to give general instructions to the microprocessor. These instructions can include frequency band selection, front panel measurement functions/parameters, and initiation of new measurement cycles. The 12-digit LED display is presented in GHz, MHz, kHz & Hz sections which eliminates shifting decimal points and digit overflow. The display is clear and easy to read, even for relatively unskilled operators.

Multiply Function

This feature is used in conjunction with frequency offsets and is particularly useful in applications involving low-level receivers and other microwave-radio equipment. The measured frequency (i.e., a local oscillator) can be multiplied by an integer from 1 to 99 and then a frequency offset (e.g., IF) can be added or subtracted. The resultant $y = mx \pm b$ is read directly from the display to 1 kHz resolution.

GPIB

With the GPIB Option, these counters can become an integral part of any automatic test system. Data output format, high and low frequency limits, and display bypass are all under bus control. All front panel controls except power on/off and sample rate are programmable.

Options Available (see page 8)

- 01 D to A Converter
- 02 Power Measurement
- 03, 04, 05 High Stability Time Base
- 06 Extended Frequency (548A only)
- 07 Remote Programming/BCD Output
- 08 GPIB
- 09 Rear Panel Input
- 10 Chassis Slides

Accessories Available

- Carrying Case
- Rack Mount Kit
- Calibration Kit
- 590 Frequency Extension cable Kit with options 91 – 95 (octave band mixers)
- Soft-Pac Carrying Case

590 Frequency Extension Cable Kit



KEY SPECIFICATIONS

- Resolution** Front panel keyboard select 1 Hz to 1 GHz
- Measurement Time** 1 msec for 1 kHz resolution
1 sec for 1 Hz resolution
- Display** 12 digit LED sectionalized to read GHz, MHz, kHz, Hz
- Accuracy** ±1 count ±time base error
- Test** Front panel selected diagnostics
- Sample Rate** Controls time between measurements, variable from 100 msec typical to 10 sec. Switchable HOLD position holds display indefinitely.
- Reset** Resets display to zero and initiates new reading.
- Offsets** Keyboard control of frequency and power offsets (with power meter Option 02). Displayed frequency (power) is offset by the entered value to 1 Hz resolution (0.1 dB power).

	BAND 1	BAND 2	BAND 3
Range	10Hz-100 MHz	10 MHz-1 GHz	1 GHz-18 GHz (Model 545A) 1 GHz-26.5 GHz (Model 548A)
Sensitivity	25mV rms	-20 dBm	-30 dBm: 1.2 GHz – 12.4 GHz** -25 dBm: 12.4 GHz-18 GHz -20 dBm: 18 GHz-22 GHz -15 dBm: 22 GHz-26.5GHz
Maximum Operating Level	120V rms*	+10 dBm	+7 dBm
Damage Level	150V rms*	+27 dBm	+37 dBm (5 watts)
Acquisition Time	—	<50 msec	<250 msec
Impedance	1M Ohms/20 pF	50 Ohms	50 Ohms

* (Above 1 kHz maximum input decreases @ 6 dB/octave down to 3.0V rms.) **(-25 dBm: 1.0 – 1.2 GHz)

BAND 4	Option 91	Option 92	Option 93	Option 94	Option 95
548A Band Select Waveguide Band	41 Ka	42 U	43 E	44 W	42,43 V
Range	26.5-40 GHz	40-60 GHz	60-90 GHz	90-110 GHz	50-75 GHz
Sensitivity (typical)	-25 dBm	-25 dBm	-25 dBm	-25 dBm	-25 dBm
Waveguide Size	WR-28	WR-19	WR-12	WR-10	WR-15
Waveguide Flange	UG-599/U	UG-383/U	UG-387/U	UG-387/U	UG-387/U
Max. Input (typical)	+5 dBm	+5 dBm	+5 dBm	+5 dBm	+5 dBm
Damage Level	+10 dBm	+10 dBm	+10 dBm	+10 dBm	+10 dBm

NOTE: Options 91 to 95 used with Model 548A/Option 06 & 590 cable kit.