

# Specifications (538, 548A and 578)

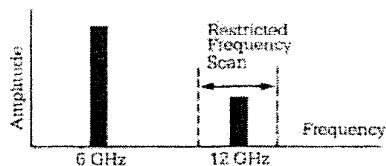
		BAND 1	BAND 2	BAND 3
Range	(538) (548A) (578)	10 Hz-100 MHz 10 Hz-100 MHz 10 Hz-100 MHz	10 MHz-1 GHz 10 MHz-1 GHz 10 MHz-1 GHz	1 GHz-26.5 GHz 1 GHz-26.5 GHz 1 GHz-26.5 GHz
Sensitivity	(538)  (548A & 578)	25mV rms 15 mV typ	- 15 dBm - 20 dBm typ	- 25 dBm: 1 GHz-12.4 GHz - 30 dBm typ - 20 dBm: 12.4 GHz-18 GHz - 25 dBm typ - 15 dBm: 18 GHz-22 GHz - 20 dBm typ - 10 dBm: 22 GHz-26.5 GHz - 15 dBm typ  - 30 dBm: 1 GHz-12.4 GHz - 25 dBm: 12.4 GHz-18 GHz - 20 dBm: 18 GHz-22 GHz - 25 dBm typ - 15 dBm: 22 GHz-26.5 GHz - 20 dBm typ
Impedance		1 M ohm /20 pF	50 ohm	50 ohm
Connector		BNC (female)	BNC (female)	APC 3.5 (female)
Coupling		DC	AC	AC
Max. Operating Level		120V rms*	+ 10 dBm	+ 7 dBm
Damage Level		150V rms*	+ 27 dBm	+ 40 dBm (10 watts)
Acquisition Time		—	<50 msec	<250 msec
Automatic Amplitude Discrimination	(538) (548A & 578)	— —	— —	10 dB, if < 10 dB, will count one signal accurately if separated by > 200 MHz.  10 dB, if < 10 dB will count one signal accurately if separated by >200 MHz; can count desired frequency accurately using frequency limits.
FM Tolerance		—	—	20 MHz PP up to 10 MHz rate
Max. Tracking Speed		—	—	400 MHz/sec (Typical)
VSWR		—	—	2.5:1 Typical
Frequency Limit	(548A & 578)	—	—	Keyboard controlled. Counter will measure largest signal within programmed limits. Signal outside desired range must be separated by 200 MHz (typical) from either limit.
Overload Indication		—	—	Display indicates "OVERLOAD" when input level exceeds approximately + 16 dBm.

\*(Above 1 kHz, maximum input decreases @ 6 dB/octave down to 3.0V rms.)

**BAND 4:** Options 91 to 96 used with Model 548A/06, Model 578/06, and Model 590 Frequency Extension Cable Kit.

	Option 91	Option 92	Option 93	Option 94	Option 95	Option 96
548A/578 Band Select	41	42	43	44	42 or 43	41 or 42
Waveguide Band	Ka	U	E	W	V	Q
Frequency Range	26.5-40 GHz	40-60 GHz	60-90 GHz	90-110 GHz	50-75 GHz	33-50 GHz
Sensitivity (typical)	- 25 dBm	- 25 dBm	- 25 dBm	- 25 dBm	- 25 dBm	- 25 dBm
Waveguide Size	WR-38	WR-19	WR-12	WR-10	WR-15	WR-22
Waveguide Flange	UG-599/U	UG-383/U	UG-387/U	UG-387/U	UG-383/U	UG-383/U
Max. Input (typical)	+ 5 dBm	+ 5 dBm	+ 5 dBm	+ 5 dBm	+ 5 dBm	+ 5 dBm
Damage Level	+ 10 dBm	+ 10 dBm	+ 10 dBm	+ 10 dBm	+ 10 dBm	+ 10 dBm
Acquisition Time (typical)	<2.5 sec	<2.5 sec	<2.5 sec	<2.5 sec	<2.5 sec	<2.5 sec

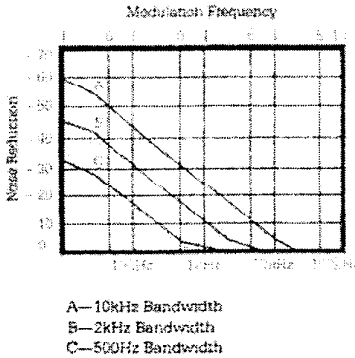
## Time Base (Standard)



EIP's frequency-selective technique permits readings of both frequency and power of the desired signal in the presence of other signals

Crystal Frequency	10 MHz
Stability:	
Aging Rate	< 3 x 10 <sup>-7</sup> /mo., < 1 x 10 <sup>-6</sup> /yr.
Short Term	< 1 x 10 <sup>-9</sup> rms for one second averaging time
Temperature	< 2 x 10 <sup>-6</sup> over the range 0° to 50° C
Line Variation	± 10% change in line voltage produces frequency shift < 1 x 10 <sup>-7</sup>
Warm-up Time	None required
Output Frequency	10 MHz, square wave, 1V peak-to-peak minimum into 50 ohms
External Time Base	Requires 10 MHz, 1V peak-to-peak minimum into 300 ohms

**General**



Phase-locked Spectrum showing Noise Reduction vs. Modulation Frequency

Resolution	Front panel keyboard select 1 Hz to 1 GHz
Measurement Time	1 msec for 1 kHz resolution 1 sec for 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 offset. Displayed frequency is offset by the entered value to 1 Hz resolution. For 548A and 578 with power meter option 02, keyboard control of power offsets. Displayed power is offset by the entered value to 0.1 dB power resolution.
Multiply	Keyboard controlled. Counter will multiply the measured signal by any integer from 1 to 99 and display to 1 kHz resolution. Then OFFSET can be added or subtracted to obtain $y = mx \pm b$ result.
Operating Temperature	0° to 50° C
Power	100/120/220/240/VAC ± 10%, 50 to 60 Hz; 60 VA typical
Net Wt.	~20 lbs. (9.07 kg)
Shipping Wt.	~25 lbs. (11.34 kg)
Dimensions	3.5" x 16.75" x 14.0" (89 mm x 425 mm x 356 mm)

**Source Locking Specifications: 578 only**

Frequency Range	10 MHz-Max. capability of counter
Resolution	10 kHz for phase lock freq. ≥ 50 MHz; 2.5 kHz for < 50 MHz
Accuracy	Equal to counter's time base
Long Term Stability	Equal to counter's time base
Minimum Phase Lock Signal Level	Equal to counter sensitivity
Polarity	Automatically selected
Bandwidth	User select, 10 kHz, 2 kHz or 500 Hz, or automatically selects widest bandwidth capable of locking

**Lock Time (typical)**

Coarse Tune	50 msec + 1 counter acquisition time for source bandwidth greater than 100 Hz, limited by source tuning speed below 100 Hz.
Phase Lock	200 msec
Recall Stored Data	1 counter acquisition + 100 msec limited by source tuning speed.

**Output Drive (maximum)**

Coarse Tune Output	0 to + 10 V into 5 K Ohm min.
Phase Lock Output	± 10 V into 5 K Ohm min. for source gain constant < 64 MHz/V, ± 75 mA into 10 Ohm max. for source gain constant < 3.2 MHz/mA, ± .6 V into 5 K Ohm min. for source gain constant ≥ 64 MHz/V, ± 4.5 mA into 10 Ohm max. for source gain constant ≥ 3.2 MHz/mA.

**Capture Range**

Coarse Tune	Entire range of selected counter band limited by maximum output drive.
Phase Lock	Source gain constant X maximum output drive.

**Output Connector**

Coarse Tune	Rear panel BNC, female
Phase Lock	Rear panel BNC, female

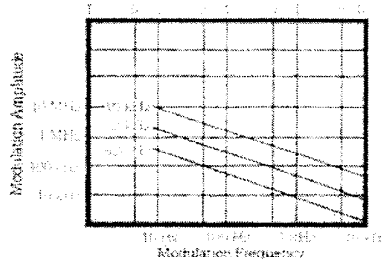
**Phase Locked Spectrum (See figure this page)**

Noise Floor vs. Input Frequency:  
The noise floor extends from the carrier to approximately the loop bandwidth. Beyond this the noise floor decreases 12 dB/bandwidth octave. The noise floor is the greater of:  
1. Noise floor = 70 dBC/Hz  
2. Noise floor = (20 log F) - 65 dBC/Hz where F = Input frequency in GHz

**Required Source Characteristics**

External Sweep (Coarse Tune) Input:	Bandwidth	5 Hz minimum
	Tuning Sensitivity	10 MHz/V minimum; 10 GHz/V maximum
FM (Phase Lock) Input:	Bandwidth	2 kHz minimum
	Tuning Sensitivity:	
	Voltage Driven Input	± 2 MHz/V minimum ± 1000 MHz/V minimum
	Current Driven Input	± 0.1 MHz/mA minimum ± 50 MHz/mA maximum

**Maximum FM**



The counter will still frequency stabilize if maximum FM is exceeded, but accuracy and long term stability will not equal the counter's time base.

## Microwave Counter Options and Accessories for EIP 538, 548A, & 578

**Option 01 (548A & 578)**

**D to A Converter**

Option 01 will convert any three consecutively displayed digits to an analog voltage output. A display of 000 produces 0 V output; 999 produces .999V full scale. Output is updated after every display update.

Accuracy (25° C)	± 0.5% ± 1 mV
Temp. Stability (0-50° C)	± 0.01% /°C
Resolution	1 mV
Load Impedance	1 K ohm minimum
Connector	BNC female (on rear panel)

**Option 02 (548A & 578)**

**Power Measurement**

Option 02 measures power of signals applied to the Band 3 input. Power and frequency are simultaneously displayed to 0.1 dB and 100 kHz resolution, respectively. Option 02 also allows power offsets from -99.9 dB to 99.9 dB (0.1 dB resolution) to be input from the keyboard.

Frequency Range	1-26.5 GHz
Accuracy	± 1.2 dB Typical (0° to 50° C) } Excluding ± 0.5 dB Typical (25° C) } Source Mismatch
Resolution	Power: 0.1 dB
Display	Power: 0.1 dB RES Frequency: 100 kHz to 1 GHz (selectable) RES
Minimum Level	Equal to counter sensitivity
Maximum Operating Level	+ 7 dBm
Damage Level	+ 40 dBm
Measurement Time	1 Gate Time + 50 msec + Frequency Measurement Time
Measurement Window	25 MHz nominal

**Options 03, 04, 05 (538, 548A & 578)**

High Stability Time Bases	Option 03	Option 04	Option 05
Aging Rate Per 24 Hours (After 72 hours warm-up)	< 5 × 10 <sup>-9</sup>	< 1 × 10 <sup>-9</sup>	< 5 × 10 <sup>-10</sup>
Short Term Stability 1 Sec. Avg. (rms)	< 1 × 10 <sup>-10</sup>	< 1 × 10 <sup>-10</sup>	< 1 × 10 <sup>-10</sup>
0° C to + 50° C Temperature Stability	< 6 × 10 <sup>-8</sup>	< 3 × 10 <sup>-8</sup>	< 3 × 10 <sup>-8</sup>
± 10% Line Voltage Change	< 5 × 10 <sup>-10</sup>	< 2 × 10 <sup>-10</sup>	< 2 × 10 <sup>-10</sup>

All Time Base Options utilize a proportional control oven which is energized whenever line cord is connected to AC sources.

Option 06  
(548A & 578)

Option 07  
(548A)

Option 08 (538 & 548A)

Option 09 (538, 548A & 578)

Option 10 (538, 548A & 578)

Option 12 (538)

Internal option 06 is used in conjunction with Model 590 and Remote Sensor options 91 to 96. It allows extended frequency measurement from 26.5 GHz to 110 GHz, depending on which Remote Sensor Option is used

Remote Programming/BCD Output

BCD Output

Format 11 digits plus sign in parallel

"0" State 0.4 V (max.) at 4 mA

"1" State 2.7 V (min.) at -400µA

Negative Ref. Ground

Positive Ref. +5 V at 2 K ohm Source Impedance

Print Command 20 µs wide TTL Low level logic signal

Inhibit Input 2 to 50 V High level logic signal

Input Loading 1 low power Schottky TTL load plus 10 K pull up to +5 V

Functions All front panel controls except:  
Power ON/OFF, Sample rate, Clear Display, and test functions greater than 01.

Input Level TTL compatible.

GPIB IEEE STD 488-1978 (included as standard equipment on Model 578).

Rear Input

Chassis Slides

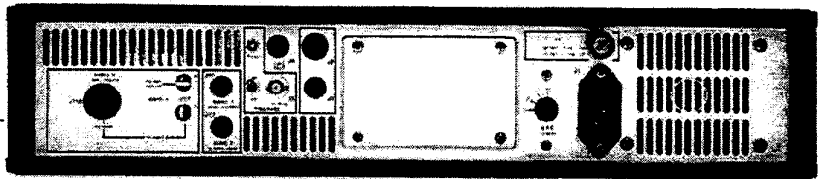
Improved sensitivity by 5 dB guaranteed, 10 MHz to 18 GHz

- 20 dBm 10 MHz-1 GHz
- 30 dBm 1 GHz-12.4 GHz
- 25 dBm 12.4 GHz-18 GHz
- 20 dBm 18 GHz-22 GHz
- 15 dBm 22 GHz-26.5 GHz

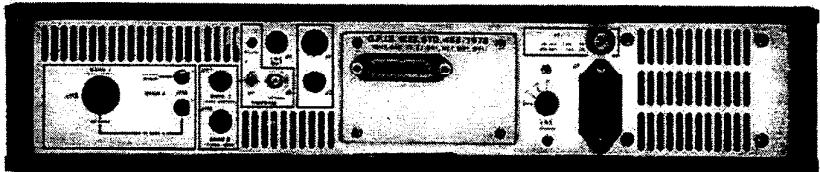
Accessories

- Transit Case
  - Rack Mount Kit
  - Extra Manual (one manual supplied at no charge with each instrument)
  - Model 590 Frequency Extension Cable Kit (548A & 578)
  - Model 91-96 Remote Sensors (548A & 578)
  - Calibration/Service Kit
  - Soft-Pack Carrying Case
- (Power Cord, Manual supplied at no charge with each instrument)

Rear panel:  
EIP 538 Low-cost Counter



Rear Panel:  
EIP 548A Full-function Counter



Rear panel:  
EIP 578 Automatic  
Source-locking Counter

