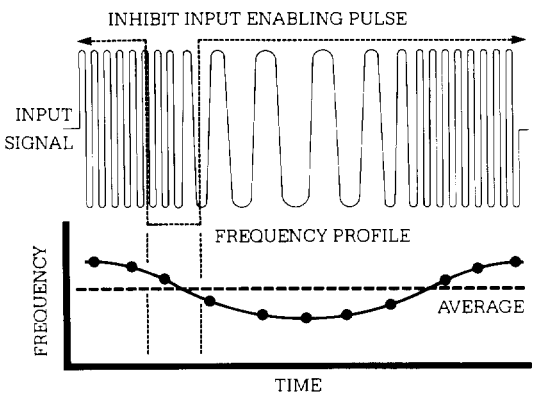
Automatic Pulsed and CW Frequency measurement to 110 GHz

EIP's 585/588 at a Glance

- ☐ 0.3 – 110 GHz Pulse and CW frequency measurement—Automatically
- ☐ 2.2 MHz accuracy with a 50 nanosecond pulsed signal
- ☐ Frequency Profile with samples as small as 15 nanoseconds
- ☐ 10 Watt burn-out protection
- ☐ Electrically erasable read-only memory provides non-volatile memory for up to 10 instrument set-ups
- ☐ Simultaneous display of Carrier Frequency and Pulse Period or Pulse Width
- ☐ Excellent tolerance to high video levels on the incoming RF
- ☐ Special Functions available locally or via GPIB for capability enhancements, diagnostics, and calibration/test aids

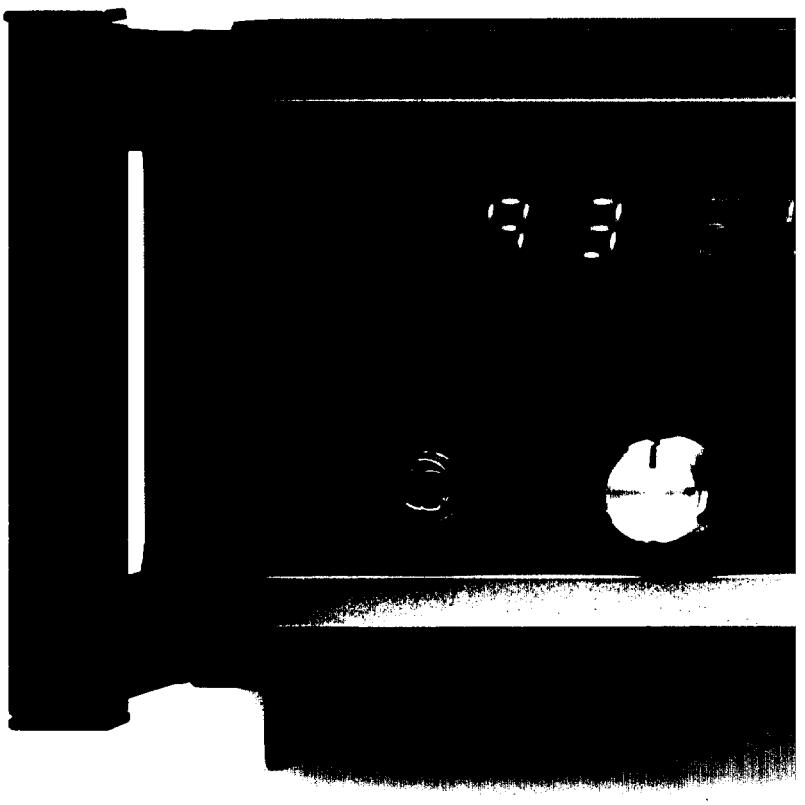


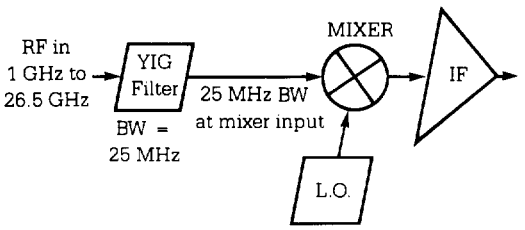
Frequency Profiling with samples as small as 15 nanoseconds can be accomplished with the use of an enabling pulse.

1 **Automatic Pulsed Millimeter Wave Counting** up to 110 GHz with the addition of Model 890 cable kit and harmonic mixers. Large amounts of "chirp" often encountered in millimeter wave signals can be precisely counted using the 588's *Center Frequency Mode.*

2 **The Band 2 Input with EIP's Unique YIG Preselector** provides an excellent combination of burn-out protection, sensitivity, frequency selectivity, and video immunity. In the *Automatic Mode,* the inherent frequency selectivity of the YIG filter allows the 585/588 to count the highest amplitude signal (even with many other signals present), when the frequency difference between all signals is at least 200 MHz. *Frequency Limits,* or the ± 50 MHz *Center Frequency Mode,* allows the counting of a pulse signal which is *not* of the highest amplitude, and rapid acquisition of low PRF signals. The Model 585 (18.6 GHz) is equipped with a standard precision type N connector.

3 **Pulse Width or Pulse Period** can be measured and displayed with a touch of the *Pulse Width* or *Pulse Period* key.





Both the 585 and 588 feature EIP's unique YIG Preselected Heterodyne Down-Converter

A unique input configuration of YIG filter, mixer, and IF amplifier designed especially for pulse counters is used in the 585/588. So, for the first time in counter design, the operator has available all the benefits of YIG filtering for both pulsed and CW signals.

This ***YIG Preselected Heterodyne Down-Converter*** *is the key to high-level burn-out protection, signal selectivity, and high video tolerance on the incoming RF.*

The 585/588's outstanding frequency accuracy provides precise analysis of frequency shift within an RF pulse with pulse samples as narrow as 15 nanoseconds.

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4 **Frequency High/Low Limit** allows the measurement of a lower amplitude signal in the presence of higher amplitude signals.

5 **External Switching Requirements Eliminated** by the use of three independent signal inputs that let the operator apply multiple signals and measure any one by merely switching the 585/588's band selector from the keyboard, or from the *IEEE 488 Bus*.

6 **Over 25 Special Functions** include instrument performance verification, troubleshooting aids, calibration aids, and operational enhancements. These functions are available from the front panel keyboard or via the IEEE 488 Bus.

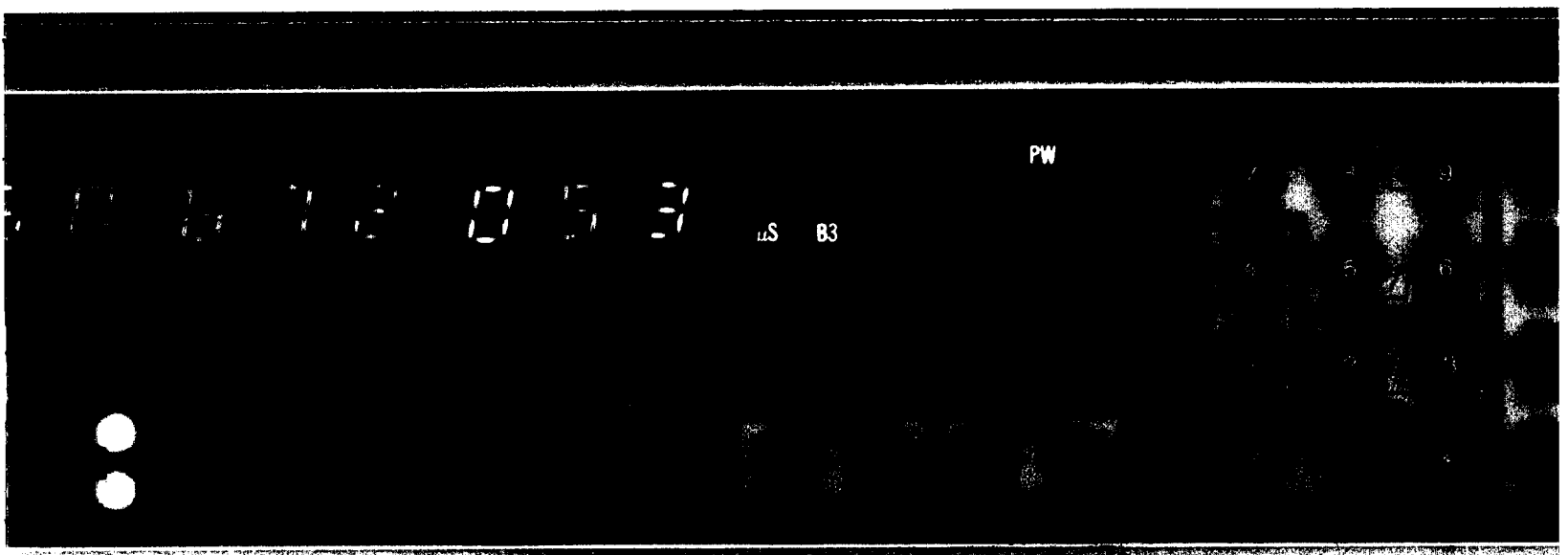
7 **An Averaging Function** automatically computes an operator-specified number of readings, then calculates and displays the average to free controller time and reduce averaging jitter.

8 **Function Indicators** keep the operator informed with LED annunciators that show all active instrument modes, providing continuous status indication.

9 **Dual Display for Fast, Easy Readout** simultaneously provides two important pulsed signal parameters: 1) Frequency to 1 kHz resolution; 2) Pulse width (or pulse period) to 10 nanosecond resolution. The nine-digit *frequency* display is sectionalized into three groups to provide an easy-to-interpret, unambiguous readout for the operator. The three-digit (or six digits with *special function* mode) pulse period/pulse width display utilizes a floating decimal format with annunciators for the one second, millisecond and microsecond ranges.

10 **Automatic Power-up Self-testing and Go-to-local** will allow one keystroke to switch the 585/588 from *remote* to *local*, or to fully initialize the system from *local*. When *initialized*, the instrument automatically executes power-up self-tests and clears all registers. For ATE use, this control may be disabled.

11 **Easy-to-interpret Status Indicators** show signal search mode, and provide gate-open information for the operator, so instrument status is continuously known. Corresponding status bits are incorporated into the status byte on the IEEE 488 Bus.



12 **Precise Pulse Measurements Provided by IF Threshold and Gate Outputs.** These convenient outputs allow the operator to monitor exactly where within the pulse the sample is taken. This feature is especially useful when using the inhibit input for frequency profiling.

13 **All 585/588 Front Panel Functions and Test Sequences can be Placed Under GPIB Control** via the IEEE 488 Bus. The 585/588 can be fully utilized for ATE. IEEE Standard 728-1982 recommended practice for code and format conventions is implemented.

14 **Optional Rear Panel Inputs** simplify signal routing in rack-mounting applications.

15 **The 585/588's External Timebase Reference Capability** allows the use of an external 10 MHz reference for common system measurement.

Photo 1 shows extreme video interference on incoming RF. Photo 2 shows the same RF signal after processing by the 585/588's YIG Preselected Heterodyne Down-Converter input filter, with error causing video component removed.

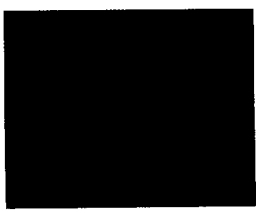


Photo 1

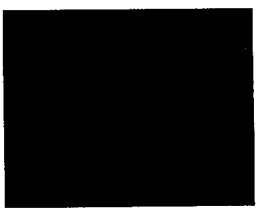
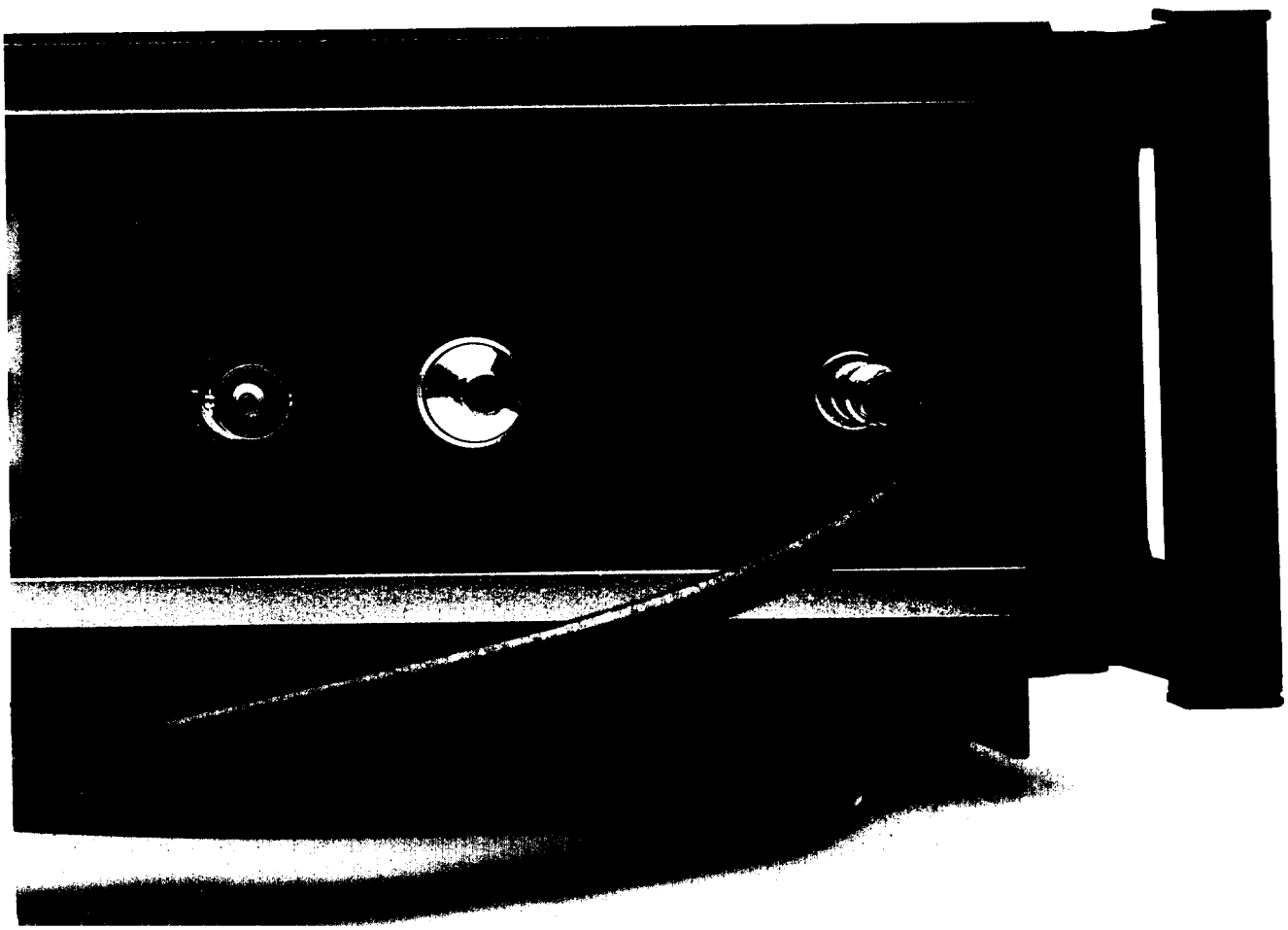


Photo 2



SPECIFICATIONS

	BAND 1 (OPTION)	**BAND 2**	**BAND 3** (OPTION)**
MINIMUM FREQUENCY	300 MHz	950 MHz	26.5 GHz
MAXIMUM FREQUENCY	1 GHz	18 GHz (Model 585) 26.5 GHz (Model 588)	110 GHz
SENSITIVITY	– 15 dBm	– 20 dBm (950 MHz-12.4 GHz) – 15 dBm (12.4-18 GHz) – 10 dBm (18 - 26.5 GHz)	26.5-60 GHz: – 20 dBm, – 25 dBm typ. 60-110 GHz: – 15 dBm, – 20 dBm typ.
CONNECTOR	BNC	Precision N (585) / APC 3.5 (588)	KWIK JACK (accepts 890 cabling kit)
MAXIMUM INPUT	+ 7 dBm peak	+ 7 dBm peak	+ 5 dBm peak
DAMAGE LEVEL	+ 27 dBm peak	+ 40 dBm peak (10 watts)	+ 10 dBm peak
AMPLITUDE DISCRIMINATION	10 dB	15 dB	20 dB
GATE ERROR	GE = (± .07)/(GW)	GE = (± .01)/(GW)	GE = (± .03)/(GW)
	GE is the gate error in Hz. GW in seconds is the logical AND of inhibit and pulse width – 3×10^{-8} seconds		
DISTORTION ERROR	DE = (± .03)/(PW – 3×10^{-8}S)	DE = (± .03)/(PW – 3×10^{-8}S)	DE = (± .02)/(PW – 3×10^{-8}S)
	DE is distortion error in Hz. PW is pulse width in seconds.		
AVERAGING JITTER	AJ = ± 2xsqrrt[RES/((GW)(AVE))]	AJ = ± sqrrt[RES/((GW)(AVE))]	AJ = ± 2xsqrrt[RES/((GW)(AVE))]
	AJ is the RMS averaging jitter in Hz. RES is the specified instrument resolution in Hz (Up to 1 MHz resolution. Above 1 MHz resolution RES is 10^6 Hz.) GW in seconds is the logical AND of inhibit and pulse width – 3×10^{-8} seconds. AVE is the number of specified count averages.		
TOTAL ACCURACY:			
(PULSE)	ACC = ± GE ± DE ± AJ ± Time Base Error e.g. PW = 1 μS RES = 1 kHz AVE = 1 *ACC = 167 kHz *Assume Time Base Error = 0	ACC = ± GE ± DE ± AJ ± Time Base Error e.g. PW = 500 nS RES = 1 kHz AVE = 1 *ACC = 131 kHz *Assume Time Base Error = 0	ACC = ± GE ± DE ± AJ ± Time Base Error e.g. PW = 100 nS RES = 1kHz AVE = 1 *ACC = 953 kHz *Assume Time Base Error = 0
(CW)	ACC = Time Base Accuracy ± 1 Count	ACC = Time Base Accuracy ± 1 Count	ACC = Time Base Accuracy ± N^2 Counts, N = Freq/20 GHz
FREQUENCY LIMITS	*Instrument will ignore signals outside of frequency limits. 10 MHz resolution. ± 50 MHz accuracy. Unwanted signals must be greater than 100 MHz from either limit.*		
CENTER FREQUENCY		Will lock on signals ± 50 MHz from the entered frequency. 10 MHz resolution.	Instrument assumes any signals present to be in the range ± 2 GHz from the specified center frequency and calculates the harmonic number based on this assumption.
ACQUISITION TIME	AQ = 1/PRF + 50×10^{-3}	(Freq. limits): AQ = (FH)[(4×10^{-12}) + (4×10^{-8}/PRF)] + 60/PRF + [(2×10^{-5}) (PP)]/GW + .1 (Center freq.): AQ = 72/PRF + [(2×10^{-5}) (PP)]/GW + .1	(Automatic): AQ = 70/PRF + [(6×10^{-3}) (PP)]/GW + .2 (Center freq.): AQ = 70/PRF + [(8×10^{-4}) (PP)]/GW + .2
(PULSE)	e.g. PRF = 2 kHz AQ = 51 mS	e.g. PRF = 2 kHz PP = 10 μS PW = 500 nS FH = 26.5 – .95 GHz (Freq. Limits): AQ = 744 mS (Center Freq): AQ = 136 mS	e.g. PRF = 10 kHz PP = 50 μS PW = 100 nS Auto: AQ = 4.993 S (Center Freq): AQ = 778 mS
(CW)	AQ = 1/PRF + 50×10^{-3} e.g. PRF = 2kHz AQ = 51 mS	(Freq. Limits): AQ = [FH] [(4×10^{-12}) + (4×10^{-8}/PRF)] + 60/PRF+ .1 (Center Freq.): AQ = 72/PRF + .1 e.g. PRF = 2 kHz FH = 26.5 – .95 GHz Freq. Limit: AQ = 743 mS Center Freq.: AQ = 136 mS	70/PRF + .2 e.g. PRF = 2 kHz AQ = 235 mS
	AQ is the acquisition time in seconds. FH is the difference between Frequency limit high and Frequency limit low in Hz. PRF is the specified instrument PRF in Hz. GW in seconds is the logical AND of inhibit and pulse width – 3×10^{-8} seconds. PP is the period of the input signal in seconds.		
MEASUREMENT TIME	MT = [(4) (PP)]/[(GW) (RES)]	MT = (PP)/[(GW) (RES)]	MT = [(4) (PP)]/[(GW) (RES)]
	MT is the measurement time in seconds. GW in seconds is the logical AND of inhibit and pulse width – 3×10^{-8} seconds. PP is the period of the input signal in seconds. RES is the specified instrument resolution in Hz. (Up to 1 MHz resolution. Above 1 MHz resolution RES is 10^6 Hz.)		
MAXIMUM VIDEO	For Video Frequency < 300 MHz: Signal Level in (dBm) – [10 log(300 MHz/fVideo)^4] – 20 dBm For Video Frequency > 300 MHz Signal Level Frequency > 300 MHz: Signal Level in dBm – 20 dB	Signal Level (in dBm) + 20 dB	15 mV peak-to-peak max
MAXIMUM FM/CHIRP	Carrier Frequency cannot go below 300 MHz or above 1000 MHz	20 MHz peak-to-peak	Auto Mode: 20 MHz peak-to-peak Center Frequency Mode: 150 MHz peak-to-peak*

*Measured Frequency is a function of Average Frequency and Geometric Center Frequency when FM/CHIRP is *greater than* 150 MHz and nonsymmetrical.

**Available for Model 588 only. Unit must have options 5802, 5804, 890 and one or more remote sensors for appropriate bands of interest. See next page, Frequency Extension for 588.

SPECIFICATIONS

GENERAL

HEIGHT	3.5″, 89mm
WIDTH	16.75″, 425mm
DEPTH	14.0″, 356mm
WEIGHT	35 lbs., 15.9 Kg Shipping weight: 41 lbs., 18.6 Kg
OPERATING TEMPERATURE	0-50°C
POWER	110/120, 220/240 VAC ± 10% 50-60 Hz, 60 VA typ.
MINIMUM PULSE WIDTH	50 ns
MAXIMUM PULSE WIDTH	CW
MINIMUM PULSE PROFILE	15 ns
MINIMUM PRF	1 Hz (0 Hz for pulse profile)
MINIMUM OFF TIME	200 ns (will count CW)
MINIMUM ON/OFF RATIO	15 dB
RESOLUTION	1 KHz to 1 GHz
GATE TIME	1 ms to 1 μS (dependent upon resolution)

TIME BASE

CRYSTAL FREQUENCY	10 MHz (TCXO)
STABILITY:	
AGING RATE	$< 3 \times 10^{-7}$/mo.
SHORT TERM	$< 1 \times 10^{-9}$ RMS for one second averaging time
TEMPERATURE	$< 2 \times 10^{-6}$ over the range 0° to 50°C
LINE VARIATION	± 10% change in line voltage produces frequency shift $< 1 \times 10^{-7}$
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 1K ohm

PULSE WIDTH

ACCURACY	± (20 ns + Time base error × PW)
DISPLAY RES.	3 digits, floating point. 10 ns max. (Special function available for 10 ns on all measurements)
RESOLUTION TO G.P.I.B.	10 ns
MIN/MAX PULSE WIDTH	10 ns/9.99 sec
MEASUREMENT POINTS	3 to 6 dB Below Peak

PULSE PERIOD

ACCURACY	± (20 ns + Time Base Error × PP)
DISPLAY RES.	3 digits, floating point. 10 ns max. (Special function available for 10 ns on all measurements)
RESOLUTION TO G.P.I.B.	10 ns
MIN/MAX PULSE PERIOD	10 ns/9.99 sec
MEASUREMENT POINTS	3 to 6 dB Below Peak

OPTIONS

5801	50-400 Hz Operation
5802	Band 1 (0.3 – 1.0 GHz)
5803	Rear Input
5804	Band III (Frequency Extension to 110 GHz – 588 Only; unit must have Option 5802)
890	Frequency Extension Cabling Kit

Specifications subject to change without notice.

ACCESSORIES

CHASSIS SLIDES WITH OR WITHOUT HANDLES (Includes Rack Mount Kit)

RACK MOUNT KIT WITH OR WITHOUT HANDLES

TRANSIT CASE

SOFT-PACK CARRYING CASE

LINE CORD (furnished)

OPERATING MANUAL (furnished)

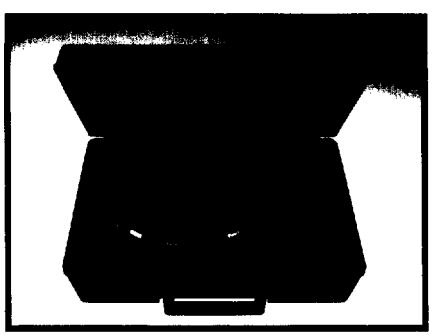
FREQUENCY EXTENSION FOR MODEL 588

For frequencies above 26.5 GHz, model 588 must be equipped with option 5802 and 5804, which provide for extension up to 110 GHz. In addition, a Frequency Extension Cabling Kit (model 890) and one or more of the following Remote Sensor options are required:

891	26.5-40 GHz (Waveguide size: WR-28)
892	40-60 GHz (Waveguide size: WR-19)
893	60-90 GHz (Waveguide size: WR-12)
894	90-110 GHz (Waveguide size: WR-10)
895	50-75 GHz (Waveguide size: WR-15)

Typical sensitivity with these remote sensors is – 25 dBm; typical maximum input is + 5 dBm and damage level is + 10dBm.

Options 5802 and 5804 can be installed at the time of original equipment purchase or factory-retrofitted at a later date. This extended-frequency capability allows the user to build on to the basic 588 as his frequency measurement requirements expand.



Frequency Extension Cabling Kit

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TWX 910-338-0155

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