

492PGM Spectrum Analyzer.

## 490 Series Spectrum Analyzers

**100 Hz to 325 GHz frequency coverage**

**Continuous-resolution frequency tuning combines "synthesized" settability and accuracy with analog feel**

**Up to 90 dB viewable dynamic range**

**Built-in frequency counters provide frequency determination to within 0.0000001% ( $1 \times 10^{-9}$ /day ref.)**

**Sensitivities to -134 dBm**

**Built-in intelligence for signal processing/marker functions**

**Push button occupied-bandwidth and noise-normalization functions**

**Macro capability with nonvolatile memory to simplify and speed up commonly-used routines**

**Optional switch-selectable 50/75-ohm impedances**

**Nonvolatile memory for up to nine waveforms and ten front panel settings**

**GPIO programmability with Tek codes and formats for standardized bus operation**

**Ergonomically-designed front panel controls**

**Direct screen data plots without a controller**

**Many application-specific options**

**Ruggedized for harsh field environments**

### Portable Laboratory Performance with Affordable Prices

Tektronix 490 Series Spectrum Analyzers offer a broad selection of features and benefits to meet wide-ranging needs for laboratory-level frequency domain spectrum analysis. All units provide full IEEE-488 (GPIO) programmability, which means you can change front panel settings, read data from the crt display, and send waveforms from internal digital source memory to other GPIO devices. Frequency range of the instruments is as follows:

10 kHz to 325 GHz: 494AP and 492BP

10 kHz to 21 GHz: 492PGM

100 Hz to 7.1 GHz: 497P

100 Hz to 1.8 GHz: 495P

Built to rugged MIL-T-28800C environmental specifications, these units can withstand transportation shock and vibration to a remote site. Or they can simply be moved from the engineering lab to the production floor with complete confidence in measurement accuracy.

A wide array of price/performance alternatives are available. If you need 10 Hz resolution for an exacting close-in spectral purity measurement, consider the 494AP. For more routine uses, such as a microwave transmitter occupied-bandwidth measurement, the 492PGM may be the most cost-effective solution.

### A Wide Array of Intelligent Features

Downloadable programming (macro) capability lets you execute your frequently-used measurement routines from the Spectrum Analyzer's nonvolatile memory. In addition, these Spectrum Analyzers can store up to 10 complete front-panel measurement parameter setups in nonvolatile memory to save you

measurement time. You can also save up to 9 waveform displays, a real benefit when data analysis must be delayed.

Tedious, time-consuming, and often incorrect carrier-to-noise ratio calculations are eliminated; the instrument handles it all with a single keystroke, with automatic noise normalization to 1 Hz and automatic conversion for reference units such as dBm, dBmV, dBV, dBμV, and dB/Hz.

An internal high-stability reference provides marker or center frequency accuracy approaching  $10^{-9}$ /day in the 494AP. For added confidence in measurements, a built-in microwave signal counter in the 494AP with 144 dB dynamic range means you can determine the exact frequency of marked signals only 10 Hz apart — or count the exact delta-frequency between two marked signals — even with greatly differing amplitudes. You also have the flexibility of tying in with a system clock, using the external reference lock capacity.

A permanent record of crt displays can be obtained at the push of a button, without a controller, using the direct plot capability and a GPIO plotter such as the Tektronix HC100.

Menu-selected dynamic markers automatically update frequency and amplitude data with every sweep. Unprecedented signal processing power results when you use these markers in conjunction with the built-in intelligence. With *PULSE* Mode, you can mark the peak of a main lobe and peaks of side lobes at the push of a button. The *CW* Mode locates signals that exhibit CW characteristics and ignores all other signals. The *SPUR* Mode marks all signals that meet user-defined or automatic threshold criteria. User-definable threshold criteria are available for all signal processing modes.

These instruments also offer operator convenience for measuring the bandwidth of filters, amplifiers, and other networks. Just enter the desired bandwidth point and select *BANDWIDTH* Mode, and the markers automatically update to display the new value.

Dedicated direct keypad data entry of major measurement parameters enables fast, accurate instrument setup. Screen messages prompt you for proper keypad inputs — all "valid" keys to push are illuminated to steer you to the proper selections. The unique marker keypad allows Peak Find, Right and Left Next, Next Higher and Lower, Left and Right X dB, and Peak Find and Center operations to be executed directly from the front panel. This makes signal searches much easier.

Optional switch-selectable 50-ohm and 75-ohm impedances add versatility. For applications such as baseband and CATV, 75-ohm/dBmV greatly simplifies spectrum analysis.



The performance leader is the 494AP, which offers frequency coverage from 10 kHz to 21 GHz with its internal mixer, and to 325 GHz with external mixers such as Tek's WM490 Series, or the new WM780 Series (each WM780 Series mixer is individually calibrated). Signal sensitivity is an impressive -134 dBm. The 494AP is optimized for use in baseband through millimeter-wave measurements, where the ability to identify and process signal frequencies and amplitudes over wide dynamic ranges with high accuracy is critical.

The 492BP covers the same frequency range as the 494AP, and provides nearly the same set of outstanding features and state-of-the-art specifications. It is designed as a cost-effective and productive solution to engineering needs.

The 497P provides the same cost-effective performance as the 492BP, but over a frequency range of 100 Hz to 7.1 GHz.

The 492PGM's frequency range of 10 kHz to 21 GHz is ideal for cost-sensitive applications that still require most of the powerful features of the product family, but can get by with slightly-reduced performance specifications.

The 495P features the same functionality and high level of performance as the 494AP, but over a frequency range of 100 Hz to 1.8 GHz. It is optimized for standalone or automated operation in baseband through UHF measurements, where the ability to identify and process weak signals is critical.

### Remote Operation and Complete Spectrum Analysis Packages

Full GPIB-programmability lets you automate your spectrum analysis system needs. Programming is simplified and measurement repeatability ensured. Under program control you can operate the instrument, change front panel settings, read data from the crt display, and send waveforms from internal memory to other GPIB devices. Tek's Standard Codes and Formats keeps commands clear, consistent, and universally understood.

TekSPANS software lets you use the 490 Series Spectrum Analyzers as system components, controlling them with popular instrument controllers such as the Compaq or Epson models, and other PC compatibles. Coupling the computer to the Spectrum Analyzer via the IEEE 488 bus lets you take advantage of the PC's capability, as well as the power and versatility of the Spectrum Analyzer.

Available Tektronix automated spectrum analyzer packages provide ordering convenience. They are configured around a DOS-based PC, one of the 490 Series of programmable Spectrum Analyzers, and Tek's General RF Applications Software Package (GRASP). The GRASP software offers many different applications and utility routines, which are selected through easy menu-driven operation.

In addition to the GRASP software, Tektronix provides an EMI software package for FCC,

VDE, CISPR, and MIL-STD testing. There is also a Remote Site Monitoring (RSM) package that allows remote/unattended monitoring of RF/microwave signals, such as communication channels. Contact your Tektronix Sales Engineer for details.

### TYPICAL MEASUREMENTS

- Baseband Measurements
- Carrier Level Monitoring
- Carrier ON/OFF Ratios
- Carrier/Noise Measurements
- EMI/RFI Compliance
- EW Gathering and Analysis
- Frequency Counting
- Harmonic Distortion
- IF Amplifier Adjustments
- Modulation Adjustments
- Pulse Analysis
- Spectral Monitoring
- Typical Spur Searches

### TYPICAL APPLICATIONS

- Manufacturing ATE
- Avionics
- Broadcasting
- CATV
- Cellular Radio
- Design and Engineering
- Nuclear Physics
- Radio Astronomy
- Satellite Communications
- Terrestrial Microwave
- Two-Way Radio

## 490 SERIES CHARACTERISTICS

### FREQUENCY RELATED

	494AP	492BP	492PGM	497P	495P
Frequency Range with Internal Mixers	10 kHz to 21 GHz	10 kHz to 21 GHz	10 kHz to 21 GHz	100 Hz to 7.1 GHz	100 Hz to 1.8 GHz
Frequency Range with External Mixers	10 kHz to 325 GHz	10 kHz to 325 GHz	N/A	N/A	N/A
Frequency Readout Accuracy (center or marker), $\pm[2\% \text{ span} + (\text{CF} \times \text{Ref}) + (2\text{N} + 25) \text{ Hz}]$	$\pm 20 \text{ kHz @ } 1 \text{ GHz}$ with 100 kHz/div span	$\pm 21 \text{ kHz @ } 1 \text{ GHz}$ with 100 kHz/div span	$\pm 30 \text{ kHz @ } 1 \text{ GHz}$ with 100 kHz/div span	$\pm 21 \text{ kHz @ } 1 \text{ GHz}$ with 100 kHz/div span	$\pm 20 \text{ kHz @ } 1 \text{ GHz}$ with 100 kHz/div span
Frequency Counter Accuracy, $\pm[(\text{CF} \times \text{Ref}) + (5 + \text{N}) \text{ Hz} + 1 \text{ LSD}]$	$\pm 100 \text{ Hz @ } 1 \text{ GHz}$	$\pm 1 \text{ kHz @ } 1 \text{ GHz}$	N/A	$\pm 1 \text{ kHz @ } 1 \text{ GHz}$	$\pm 100 \text{ Hz @ } 1 \text{ GHz}$
Delta Count Accuracy, $\pm[(\text{D-F} \times \text{Ref}) + (10 \times 2\text{N}) + 1 \text{ LSD}]$	$\pm 13 \text{ Hz for } 1 \text{ MHz D-F}$	$\pm 14 \text{ Hz for } 1 \text{ MHz D-F}$	N/A	$\pm 14 \text{ Hz for } 1 \text{ MHz D-F}$	$\pm 13 \text{ Hz for } 1 \text{ MHz D-F}$
Frequency Reference Accuracy	$\leq 1 \times 10^{-7} \text{ /yr (aging)}$	$\leq 1 \times 10^{-6} \text{ /yr (aging)}$	$\leq 1 \times 10^{-5} \text{ /yr (aging)}$	$\leq 1 \times 10^{-6} \text{ /yr (aging)}$	$\leq 1 \times 10^{-7} \text{ /yr (aging)}$
Frequency Stability (residual FM)	$\leq 5 \text{ Hz @ } 1 \text{ GHz}$	$\leq 12 \text{ Hz @ } 1 \text{ GHz}$	$\leq 12 \text{ Hz @ } 1 \text{ GHz}$	$\leq 5 \text{ Hz @ } 1 \text{ GHz}$	$\leq 5 \text{ Hz @ } 1 \text{ GHz}$
Frequency Stability (drift)	$< 50 \text{ Hz/minute}$	$< 50 \text{ Hz/minute}$	$< 50 \text{ Hz/minute}$	$< 50 \text{ Hz/minute}$	$< 50 \text{ Hz/minute}$
Single Sideband Phase Noise (30 kHz offset and N=1)	-105 dBc/Hz @ 1 GHz	-105 dBc/Hz @ 1 GHz	-103 dBc/Hz @ 1 GHz	-105 dBc/Hz @ 1 GHz	-105 dBc/Hz @ 1 GHz
Frequency Span Range (per div)	0 Hz, 10 Hz-10 GHz	0 Hz, 100 Hz-10 GHz	0 Hz, 200 Hz-1 GHz	0 Hz, 100 Hz-500 MHz	0 Hz, 10 Hz-100 MHz
Frequency Span Accuracy	$\pm 5\%$	$\pm 5\%$	$\pm 5\%$	$\pm 5\%$	$\pm 5\%$
Delta Frequency Accuracy Marker Mode	1% of span	1% of span	1% of span	1% of span	1% of span
Resolution Bandwidth (6 dB) Range	10 Hz to 3 MHz	100 Hz to 3 MHz	1 kHz to 3 MHz	10 Hz to 3 MHz	10 Hz to 3 MHz
Resolution Bandwidth Selectivity (-60 dB/-6 dB)	$\leq 7.5:1$ except 15:1 @ 10 Hz	$\leq 7.5:1$	$\leq 7.5:1$	$\leq 7.5:1$ except 15:1 @ 10 Hz	$\leq 7.5:1$ except 15:1 @ 10 Hz
Video Bandwidth Range	0.3 Hz to 30 kHz	0.3 Hz to 30 kHz	3 Hz to 30 kHz	0.3 Hz to 30 kHz	0.3 Hz to 30 kHz



# SPECTRUM ANALYZERS

# TEK

## 490 SERIES CHARACTERISTICS (continued)

### AMPLITUDE RELATED

	494AP	492BP	492PGM	497P	495P
Reference Level Range	-117 to +30 dBm	-117 to +30 dBm	-117 to +30 dBm	-117 to +30 dBm	-117 to +30 dBm
Maximum Safe Input Power, CW	1 Watt (+30 dBm)	1 Watt (+30 dBm)	1 Watt (+30 dBm)	1 Watt (+30 dBm)	1 Watt (+30 dBm)
Maximum Safe Input Power, Pulse 0.1% duty factor	75 W Pk (1 $\mu$ S pulse, 0.1% duty factor)	75 W Pk (1 $\mu$ S pulse, 0.1% duty factor)	75 W Pk (1 $\mu$ S pulse, 0.1% duty factor)	75 W Pk (1 $\mu$ S pulse, 0.1% duty factor)	75 W Pk (1 $\mu$ S pulse)
CRT Display Range, Log	1 to 15 dB/div	1 to 15 dB/div	1 to 15 dB/div	1 to 15 dB/div	1 to 15 dB/div
CRT Display Range, Linear	39.6 nV/div to 2.8 V/div	39.6 nV/div to 2.8 V/div	39.6 nV/div to 2.8 V/div	39.6 nV/div to 2.8 V/div	39.6 nV/div to 2.8 V/div
Input Attenuator Range	0 to 60 dB in 10 dB steps	0 to 60 dB in 10 dB steps	0 to 60 dB in 10 dB steps	0 to 60 dB in 10 dB steps	0 to 60 dB in 10 dB steps
Dynamic Range (maximums): Compression to noise: Signal to distortion harmonic:  Signal to distortion intermod:  Viewable on CRT screen	134 dB 80 dB to 1.7 GHz $\geq 100$ dB 1.7 to 21 GHz 93 dB to 1.7 GHz $\geq 100$ dB 1.7 to 21 GHz 90 dB	120 dB 80 dB to 1.7 GHz $\geq 100$ dB 1.7 to 21 GHz 83 dB to 1.7 GHz $\geq 100$ dB 1.7 to 21 GHz 90 dB	110 dB 80 dB to 1.7 GHz $\geq 100$ dB 1.7 to 21 GHz 76 dB to 1.7 GHz $\geq 100$ dB 1.7 to 21 GHz 90 dB	130 dB 80 dB to 1.7 GHz $\geq 100$ dB 1.7 to 7.1 GHz 80 dB to 1.7 GHz $\geq 100$ dB 1.6 to 7.1 GHz 90 dB	130 dB 80 dB  90 dB 90dB
Residual Response (no signal and zero RF attenuation)	-100 dBm (input terminated)	-100 dBm (input terminated)	-95 dBm (input terminated)	-100 dBm (input terminated)	-100 dBm (input terminated)
Second Harmonic Distortion, RF Frequency Range	-60 dBc (mixer level -40 dBm)	-60 dBc (mixer level -40 dBm)	-60 dBc (mixer level -40 dBm)	-60 dBc (mixer level -40 dBm)	-60 dBc (mixer level -40 dBm)
Second Harmonic Distortion, Microwave Frequency Range	-100 dBc (mixer level -20 dBm)	-100 dBc (mixer level -20 dBm)	-100 dBc (mixer level -20 dBm)	-100 dBc (mixer level -20 dBm)	N/A
Third Order Intermodulation Distortion	-70 dBc (mixer level -27 dBm)	-70 dBc (mixer level -27 dBm)	-70 dBc (mixer level -27 dBm)	-70 dBc (mixer level -27 dBm)	-70 dBc (mixer level -27 dBm)
Calibrator Accuracy	$\pm 0.3$ dB	$\pm 0.3$ dB	$\pm 0.3$ dB	$\pm 0.3$ dB	$\pm 0.3$ dB
Gain Compression (1 dB)	-13 dBm	-13 dBm	-13 dBm	-13 dBm	-13 dBm
Frequency Response (10 dB RF attenuation referred to cal signal)					
Band 1 (10 kHz to 1.8 MHz)	$\pm 2.5$ dB	$\pm 2.5$ dB	$\pm 3.0$ dB	$\pm 2.5$ dB	$\pm 1.5$ dB (100 Hz to 1.8 GHz)
Band 2 (1.7 GHz to 5.5 GHz)	$\pm 3.5$ dB	$\pm 3.5$ dB	$\pm 4.0$ dB	$\pm 3.5$ dB	N/A
Band 3 (3.0 GHz to 7.1 GHz)	$\pm 3.5$ dB	$\pm 3.5$ dB	$\pm 4.0$ dB	$\pm 3.5$ dB	N/A
Band 4 (5.4 GHz to 18 GHz)	$\pm 4.5$ dB	N/A	$\pm 5.0$ dB	N/A	N/A
Band 5 (15 GHz to 21 GHz)	$\pm 6.5$ dB	$\pm 6.5$ dB	$\pm 7.0$ dB	N/A	N/A
In-band Flatness (with 10 dB RF attenuation)					
Band 1 (10 kHz to 1.8 MHz)	$\pm 1.5$ dB	$\pm 1.5$ dB	$\pm 2.0$ dB	$\pm 1.5$ dB (100 Hz to 1.8 GHz)	$\pm 1.0$ dB (100 Hz to 1.8 GHz)
Band 2 (1.7 GHz to 5.5 GHz)	$\pm 2.5$ dB	$\pm 2.5$ dB	$\pm 3.0$ dB	$\pm 2.5$ dB	N/A
Band 3 (3.0 GHz to 7.1 GHz)	$\pm 2.5$ dB	$\pm 2.5$ dB	$\pm 3.0$ dB	$\pm 2.5$ dB (5.4 GHz to 7.1 GHz)	N/A
Band 4 (5.4 GHz to 18 GHz)	$\pm 3.5$ dB	$\pm 3.5$ dB	$\pm 4.0$ dB	N/A	N/A
Band 5 (15 GHz to 21 GHz)	$\pm 5.0$ dB	$\pm 5.0$ dB	$\pm 6.0$ dB	N/A	N/A
Displayed Average Noise Level (input terminated, narrowest resolution bandwidth and video filter)					
Band 1 (100 Hz)	-80 dBm (typical)	-30 dBm (typical)	N/A	-80 dBm (typical)	-100 dBm (typical)
Band 1 (1 kHz to 10 kHz)	-90 dBm (typical)	-85 dBm (typical)	-35 dBm (typical)	-90 dBm	-105 dBm
Band 1 (10 kHz to 100 kHz)	-95 dBm	-85 dBm	-80 dBm	-100 dBm	-110 dBm
Band 1 (100 kHz to 1 MHz)	-115 dBm	-105 dBm	-100 dBm	-120 dBm	-120 dBm
Band 1 (1 MHz to 1.8 GHz)	-134 dBm	-120 dBm	-110 dBm	-130 dBm	-131 dBm
Band 2 (1.7 GHz to 5.5 GHz)	-125 dBm	-120 dBm	-108 dBm	-130 dBm	N/A
Band 3 (3.0 GHz to 7.1 GHz)	-125 dBm	-119 dBm	-108 dBm	-129 dBm	N/A
Band 4 (5.4 to 12 GHz/12 to 18 GHz)	-111 / -107 dBm	-105 / -100 dBm	-94 / -89 dBm	N/A	N/A
Band 5 (15 GHz to 21 GHz)	-105 dBm	-99 dBm	-88 dBm	N/A	N/A
IF Gain Uncertainty	$\pm 2$ dB max over 107 dB range	$\pm 2$ dB max over 107 dB range	$\pm 2$ dB max over 107 dB range	$\pm 2$ dB max over 107 dB range	$\pm 2$ dB max over 107 dB range
Scale Fidelity, Log (80 dB range/90 dB range)	$\pm 2$ dB max/ $\pm 4$ dB max	$\pm 2$ dB max/ $\pm 4$ dB max	$\pm 2$ dB max	$\pm 2$ dB max/ $\pm 4$ dB max	$\pm 2$ dB max/ $\pm 4$ dB max
Scale Fidelity, Linear	$\pm 5\%$ of full scale	$\pm 5\%$ of full scale	$\pm 5\%$ of full scale	$\pm 5\%$ of full scale	$\pm 5\%$ of full scale

490 SERIES CHARACTERISTICS (continued)

AMPLITUDE RELATED (continued)

	494AP	492BP	492PGM	497P	495P
Input Attenuator Switching Accuracy (20 dB to 60 dB settings) 0 to 1.8 GHz	±0.5 dB/10 dB; ±1.0 dB max	±0.5 dB/10 dB; ±1.0 dB max	±0.5 dB/10 dB; ±1.0 dB max	±0.5 dB/10 dB; ±1.0 dB max	±0.5 dB/10 dB; ±1.0 dB max
1.8 to 18 GHz	±1.5 dB/10 dB; ±3.0 dB max	±1.5 dB/10 dB; ±3.0 dB max	±1.5 dB/10 dB; ±3.0 dB max	±1.5 dB/10 dB; ±3.0 dB max (1.8 to 7.1 GHz)	N/A
18 to 21 GHz	±3.0 dB/10 dB; ±6.0 dB max	±3.0 dB/10 dB; ±6.0 dB max	±3.0 dB/10 dB; ±6.0 dB max	N/A	N/A
Resolution Bandwidth Switching Uncertainty (reference BW X 3 MHz)	±0.4 dB	±0.4 dB	±0.4 dB	±0.4 dB	±0.4 dB

TIME RELATED

FREQUENCY RELATED	494AP	492BP	492PGM	497P	495P
Sweep Time Range, Digitized Display	10 msec/div to 10 sec/div	10 msec/div to 10 sec/div	10 msec/div to 10 sec/div	10 msec/div to 10 sec/div	10 msec/div to 10 sec/div
Sweep Time Range, Real-Time Display	20 µsec/div to 10 sec/div	20 µsec/div to 10 sec/div	20 µsec/div to 10 sec/div	20 µsec/div to 10 sec/div	20 µsec/div to 10 sec/div
Sweep Time Accuracy	±5%	±5%	±5%	±5%	±5%
Marker Time Measurement Accuracy	±10%	±10%	±10%	±10%	±10%
Delta Marker Time Measurement Accuracy	±5%	±5%	±5%	±5%	±5%
Sweep Trigger	Free Run, Line, Video, Single, Ext	Free Run, Line, Video, Single, Ext	Free Run, Line, Video, Single, Ext	Free Run, Line, Video, Single, Ext	Free Run, Line, Video, Single, Ext

EXTERNAL INPUT

	494AP	492BP	492PGM	497P	495P
RF Input Impedance	50 ohms nominal	50 ohms nominal	50 ohms nominal	50 ohms nominal	50 ohms nominal
VSWR (10 dB input attenuation)					
<2.5 GHz	1.3:1 max	1.3:1 max	1.3:1 max	1.3:1 max	1.3:1 max
2.5 GHz to 6.0 GHz	1.7:1 max	1.7:1 max	1.7:1 max	1.7:1 max	N/A
6.0 GHz to 18 GHz	2.3:1 max	2.3:1 max	2.3:1 max	N/A	N/A
18 GHz to 21 GHz	3.5:1 max	3.5:1 max	3.5:1 max	N/A	N/A
Local Oscillator Emission Level (10 dB input attenuation)	≤ -80 dBm	≤ -80 dBm	≤ -80 dBm	≤ -80 dBm	≤ -80 dBm
External Mixer Input	Approx 2 GHz IF	Approx 2 GHz IF	N/A	N/A	N/A
External Reference Input	1, 2, 5, or 10 MHz	1, 2, 5, or 10 MHz	N/A	1, 2, 5, or 10 MHz	1, 2, 5, or 10 MHz
Horizontal Input/Trigger Input	0 to +10 V/1 to 50 V	0 to +10 V/1 to 50 V	0 to +10 V/1 to 50 V	0 to +10 V/1 to 50 V	0 to +10 V/1 to 50 V
Video Input/Marker Input	0 to +4 V/0 to -10 V	0 to +4 V/0 to -10 V	0 to +4 V/0 to -10 V	0 to +4 V/0 to -10 V	0 to +4 V/0 to -10 V

EXTERNAL OUTPUT

	494AP	492BP	492PGM	497P	495P
Calibrator	100 MHz ±10 Hz, -20 dBm ±0.3 dB	100 MHz ±100 Hz, -20 dBm ±0.3 dB	100 MHz ±1 kHz, -20 dBm ±0.3 dB	100 MHz ±100 Hz, -20 dBm ±0.3 dB	100 MHz ±10 Hz, -20 dBm ±0.3 dB
1st Local Oscillator	2 to 6 GHz, +7.5 to +20 dBm	2 to 6 GHz, +7.5 to +20 dBm	2 to 6 GHz, +6 to +20 dBm	2 to 6 GHz, +6 to +20 dBm	2 to 4 GHz, +6 to +20 dBm
2nd Local Oscillator	-7 to -17 dBm	-7 to -17 dBm	-7 to -17 dBm	-7 to -17 dBm	-7 to -17 dBm
Video Output (CRT center reference)	0.5 V of signal per div of video	0.5 V of signal per div of video	0.5 V of signal per div of video	0.5 V of signal per div of video	0.5 V of signal per div of video
Sweep Output (CRT center reference)	0.5 V/div; ±2.5 V max	0.5 V/div; ±2.5 V max	0.5 V/div; ±2.5 V max	0.5 V/div; ±2.5 V max	0.5 V/div; ±2.5 V max
Pen Lift	+5 V nominal; TTL-compatible	+5 V nominal; TTL-compatible	+5 V nominal; TTL-compatible	+5 V nominal; TTL-compatible	+5 V nominal; TTL-compatible
2nd IF Output (Opt. 42)	110 MHz, 0 dBm; 3 dB BW is 4.5 MHz	110 MHz, 0 dBm; 3 dB BW is 4.5 MHz	110 MHz, 0 dBm; 3 dB BW is 4.5 MHz	110 MHz, 0 dBm; 3 dB BW is 4.5 MHz	110 MHz, 0 dBm; 3 dB BW is 4.5 MHz
3rd IF Output	10 MHz, -5 dBm	10 MHz, -5 dBm	10 MHz, -5 dBm	10 MHz, -5 dBm	10 MHz, -5 dBm
Probe Power	+5 V, -15 V, +15 V; 100 mA max each	+5 V, -15 V, +15 V; 100 mA max each	+5 V, -15 V, +15 V; 100 mA max each	+5 V, -15 V, +15 V; 100 mA max each	+5 V, -15 V, +15 V; 100 mA max each

GENERAL SPECIFICATIONS

	494AP	492BP	492PGM	497P	495P
Power Requirements					
Voltage	90-132/180-250 Vac	90-132/180-250 Vac	90-132/180-250 Vac	90-132/180-250 Vac	90-132/180-250 Vac
Frequency	48-440 Hz	48-440 Hz	48-440 Hz	48-440 Hz	48-440 Hz
Power	210 W max @ 115 Vac, 60 Hz	210 W max @ 115 Vac, 60 Hz	210 W max @ 115 Vac, 60 Hz	210 W max @ 115 Vac, 60 Hz	210 W max @ 115 Vac, 60 Hz
Weight (carrying), Nominal	22.2 kg (48 lbs)	21.76 kg (47 lbs)	21.3 kg (46 lbs)	20.83 kg (45 lbs)	19.44 kg (42 lbs)



# SPECTRUM ANALYZERS

# TEK

## 490 SERIES CHARACTERISTICS (continued)

### GENERAL SPECIFICATIONS (continued)

	494AP	492BP	492PGM	497P	495P
Dimensions (without handle, feet, or cover), mm/inches	175 x 327 x 499/ 6.9 x 12.87 x 19.65	175 x 327 x 499/ 6.9 x 12.87 x 19.65	175 x 327 x 499/ 6.9 x 12.87 x 19.65	175 x 327 x 499/ 6.9 x 12.87 x 19.65	175 x 327 x 499/ 6.9 x 12.87 x 19.65
Digital Storage	1000 pts horizontal, 250 pts vertical	1000 pts horizontal, 250 pts vertical	1000 pts horizontal, 250 pts vertical	1000 pts horizontal, 250 pts vertical	1000 pts horizontal, 250 pts vertical
Digitizing Rate	9 $\mu$ S	9 $\mu$ S	9 $\mu$ S	9 $\mu$ S	9 $\mu$ S
Macro Programming	8K	8K	N/A	8K	8K
Nonvolatile Memory	9 waveforms, 10 control settings	9 waveforms, 10 control settings	9 waveforms, 10 control settings	9 waveforms, 10 control settings	9 waveforms, 10 control settings
HELP Mode	Yes	Yes	Yes	Yes	Yes

### ENVIRONMENTAL PER MIL-T-28800C, TYPE III, CLASS 3, STYLE C

FREQUENCY RELATED	494AP	492BP	492PGM	497P	495P
Electromagnetic Compatibility (consult data sheet for compliance details)	MIL-STD-461B	MIL-STD-461B	MIL-STD-461B	MIL-STD-461B	MIL-STD-461B
Calibration Interval	1 Year	1 Year	1 Year	1 Year	1 Year

### IEEE 488 GPIB

	494AP	492BP	492PGM	497P	495P
Interface Functions	SH1, AH1, T5, L3, SR1, RL1, PP1, DC1, DT1, and C0	SH1, AH1, T5, L3, SR1, RL1, PP1, DC1, DT1, and C0	SH1, AH1, T5, L3, SR1, RL1, PP1, DC1, DT1, and C0	SH1, AH1, T5, L3, SR1, RL1, PP1, DC1, DT1, and C0	SH1, AH1, T5, L3, SR1, RL1, PP1, DC1, DT1, and C0
Direct Plotter Output	Supports Tek HC100, HP 7470A	Supports Tek HC100, HP 7470A	Supports Tek HC100, HP 7470A	Supports Tek HC100, HP 7470A	Supports Tek HC100, HP 7470A
Waveform Transfer Speed	165 msec/1000 pts	165 msec/1000 pts	165 msec/1000 pts	165 msec/1000 pts	165 msec/1000 pts

### ORDERING INFORMATION

#### 494AP Programmable Spectrum Analyzer

**Includes:** Operator's Manual; Programmer's Manual; 6-ft, 50- $\Omega$  coaxial cable, N-N (012-0114-00); 18-inch, 50- $\Omega$  coaxial cable, BNC-BNC (012-0076-00); N male to BNC female adapter (103-0045-00); rear connector shield (337-3274-00); power cord and spare fuses; CRT filter set consisting of amber and gray light filters plus mesh filter (all except 492PGM); gray crt light filter (492PGM).

#### 492BP Programmable Spectrum Analyzer

**Includes:** same as 494AP

#### 492PGM Programmable Spectrum Analyzer

**Includes:** same as 494AP, except gray CRT filter (no filter set)

#### 497P Programmable Spectrum Analyzer

**Includes:** same as 494AP

#### 495P Programmable Spectrum Analyzer

**Includes:** same as 494AP

### OPTION ORDERING INFORMATION

**Opt. 07** — 75- $\Omega$  dBmV input and calibration in addition to the normal 50- $\Omega$  dBm input and calibration. (Not combinable with Options 21 and 22; no external mixer capability.) Includes 42-inch, 75- $\Omega$  BNC-BNC coax cable (012-0074-00) and BNC male to "F" female adapter (013-0126-00)

**Opt. 21 (494AP, 492BP)** — High-performance 18 to 40 GHz WM490 Series Waveguide Mixer Set

**Includes:** WM490K (18-26.5 GHz) and WM490A (26.5-40 GHz) Waveguide Mixers, Diplexer assembly (015-0385-00), and interconnecting cable (012-0649-00)

**Opt. 22 (494AP, 492BP)** — High-performance 18 to 60 GHz WM490 Series Waveguide Mixer Set

**Includes:** same as option 21 plus WM490U (40-60 GHz) Waveguide Mixer

**Opt. 23 (All)** — GRASP software (S26RF00), PCII/IIA interface, and GPIB cable.

**NOTE:** The PCIIA is a National Instruments GPIB Interface Card.

**NOTE:** Options 27 and 28 are available only in the U.S. For more information on any of these bundled software and computer packages, please contact your local Tek sales representative.

**Opt. 27 (All)** — This Epson LT-386SX laptop computer features an 80386SX processor running at 16 MHz. It has a built-in VGA backlit LCD display, a removable 40 MB hard drive, a 3.5" 1.44 Mb diskette drive, a 2 Mb of RAM. The LT-386SX has serial and parallel interfaces, plus jacks for an external keyboard and color VGA monitor. Tek's GRASP software (S26RF00) and a GPIB cable are included.

**Opt. 28 (All)** — The Compaq Deskpro 386S features an 80386SX processor running at 16 MHz. It includes a 40 Mb hard disk drive, 1.2 Mb floppy disk drive, 2 Mb RAM, a VGA color monitor, and serial and parallel interfaces. Tek's GRASP software and a GPIB cable are included.

**Opt. 39** — Non-lithium (Silver) batteries for battery-backed memory

**Opt. 41 (all except 495P)** — Digital Microwave Radio Measurement Enhancement package

**Opt. 42** — Replaces MARKER/VIDEO input port on the rear panel with a 110 MHz IF output port that provides a 3 dB signal bandwidth  $\geq$  4.5 MHz

**Opt. 45 (all except 492PGM and 497P)** — MATE/CIL language interface

**Opt. B1** — Service manual(s)

**Opt. B2** — Operator's manual, Programmer's manual, and Service manual(s) set

### INTERNATIONAL POWER PLUG OPTIONS

**Opt. A1** — Universal European 220 V/6 A, 50 Hz

**Opt. A2** — UK 240 V/5 A, 50 Hz

**Opt. A3** — Australian 240 V/6 A, 50 Hz

**Opt. A4** — North American 240 V/12 A, 60 Hz

**Opt. A5** — Switzerland 220 V/6 A, 50 Hz

### OPTIONAL ACCESSORIES/ANCILLARIES (for all units unless otherwise noted)

1405 TV Sideband Analyzer Adapter (525/60 markers); TR503 Tracking Generator, 100 Hz to 1800 MHz; Microwave Comb Generator, TM500-Series compatible (067-0885-00, all except 495P); Tek HC100 Color Plotter; CRT Visor (016-0653-00); 75- $\Omega$  to 50- $\Omega$  minimum loss adapter (011-0112-00); DC blocking capacitor, N conn. (015-0509-00); 2-meter GPIB cable (012-0630-00); GPIB cable (012-0991-00); Programmer's Reference Guide (070-5567-00); Service Kit (006-3286-01).

### WARRANTY

Tektronix 490 Series Spectrum Analyzers are warranted to be free from defects in material and workmanship for a period of one year from the date of shipment. Contact your local Tektronix sales representative for additional warranty information.

### WARRANTY-PLUS SERVICE PLANS

Tektronix Warranty-Plus Service Plans for the 490 Series Spectrum Analyzers provide for both routine and remedial service, depending on the plan selected. They offer convenience plus an extra margin of protection for your newly-purchased Tektronix instruments by supplementing the warranties that accompany them. Warranty-Plus is an investment that provides up to five years of coverage, including options for calibration and remedial service. For more information on Warranty-Plus options, contact a Tektronix sales representative.

**Opt. M1** — 2 years service and 2 calibrations

**Opt. M2** — 4 years service

**Opt. M3** — 4 years service and 4 calibrations

**Opt. M7** — 2 calibrations

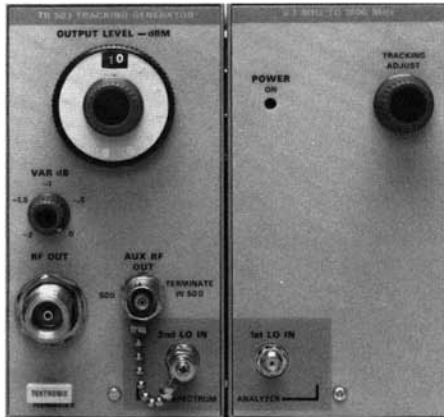
**Opt. M8** — 4 calibrations

**Opt. M9** — 2 years service



TEK

SPECTRUM ANALYZERS



TR 503 Tracking Generator.

## TR 503 Tracking Generator

Swept measurements to 1.8 GHz

Enhances dynamic range to better than 110 dB

Very stable — Useful as a CW signal source

Auxiliary, constant level output provides for frequency counter measurement even of signals at the noise floor

The TR 503 works with all 2750 and 490 Series spectrum analyzers to provide constant level, calibrated RF sources for swept frequency tests to 1.8 GHz. The tracking generator is a two-wide unit compatible with the TM 500 and TM 5000 Modular Instrument Series.

The low residual FM of these systems enhances narrow bandwidth frequency response measurements. When used as a CW signal source with the analyzer in a manual mode, these systems have excellent frequency stability.

The tracking generator sweep rates are controlled with the spectrum analyzer, and the output level is controlled from the tracking generator. The output frequency of the tracking generator is the same as the frequency of the analyzer at any instant of the sweep.

The TR 503 Aux RF Output may be used to drive a frequency counter package, such as the recommended DP 501, DC 509 Option 01. Frequencies up to 1.8 GHz may be measured accurately in the presence of high level adjacent signals to the sensitivity limits of the analyzer.



2712 Spectrum Analyzer and the 1405 TV Sideband Adapter.

## 1405 TV Sideband Adapter

Facilitates in-service testing of transmitter

Measure transmitter frequency response to  $\pm 0.2$  dB

Video circuits can be swept

For in-service testing, use of external blanking allows either full field or single line operation

Check aural FM deviation with built-inessel null technique

Flexible marker system will accept standard crystals

To analyze the sideband response of a television transmitter, the 1405 Sideband Adapter is recommended for use in tandem with the Tektronix 2710, 2750 Series and 490 Series spectrum analyzers. It generates a composite video signal, which is applied as modulation to a television transmitter. The output is displayed on the spectrum analyzer and appears as a response curve, to within  $\pm 0.2$  dB, of the transmitter being tested.

The 1405/Spectrum Analyzer combination will display frequency response characteristics of RF and IF circuits for transmitters with frequencies to 1 GHz. Video circuits can also be analyzed.

### CHARACTERISTICS

#### TR 503/All 490 and 2750 Series

- Frequency Range** — 100 kHz 1.8 GHz
- Output Level** — (Max) 0 dBm  $\pm 0.5$  dB
- Range** — 0 to 59 dB in 10 dB and 1 dB steps
- Flatness** — Within  $\pm 2.25$  dB Max from 100 kHz to 1.8 GHz (Typically  $\pm 1.5$  dB)
- Dynamic Range** —  $\geq 110$  dB
- Residual FM** — 50 Hz P-P
- Output Impedance** — 50  $\Omega$  Nominal, VSWR 2:1 or less to 1.8 GHz
- Auxiliary Output** — 0.1 V RMS into 50  $\Omega$  load 7 dBm minimum
- Spurious Output** — Harmonic 20 dBc; Non-harmonic 40 dBc

### ORDERING INFORMATION

#### TR 503 Tracking Generator

**Includes:** Two 50  $\Omega$  coax cables (012-0649-00); N male to BNC female adapter (103-0045-00); retainer plug-in (343-0604-00); instruction manual (070-3526-00).

#### OPTIONAL ACCESSORIES

**TM 503A** — Power Module

**TM 504** — Power Module

**Blank Panel** — Order 016-0195-03

Correct frequencies at the TV Channel marks on the dial readout for 2750 and 490 Series spectrum analyzers are provided with Option 02, and for the 2710 Spectrum Analyzer with Option 03.

Call your local sales engineer for additional information.

### ORDERING INFORMATION

#### 1405 TV Sideband Adapter 525/60 Markers

**Includes:** Instruction manual (070-2078-00)

#### OPTIONS

**Opt. 01** — TV Sideband Adapter (625/50 Markers)

**Opt. 02** — Dial Readout for 490/2750 Series Spectrum Analyzers

**Opt. 03** — Dial Readout for use with 2710 Spectrum Analyzer

#### INTERNATIONAL POWER PLUG OPTIONS

**Opt. A1-A5** — Available. See 490 Series Options.

#### RACKMOUNT CONVERSION KIT

**Standard 19-inch Rack** — Order 016-0489-00