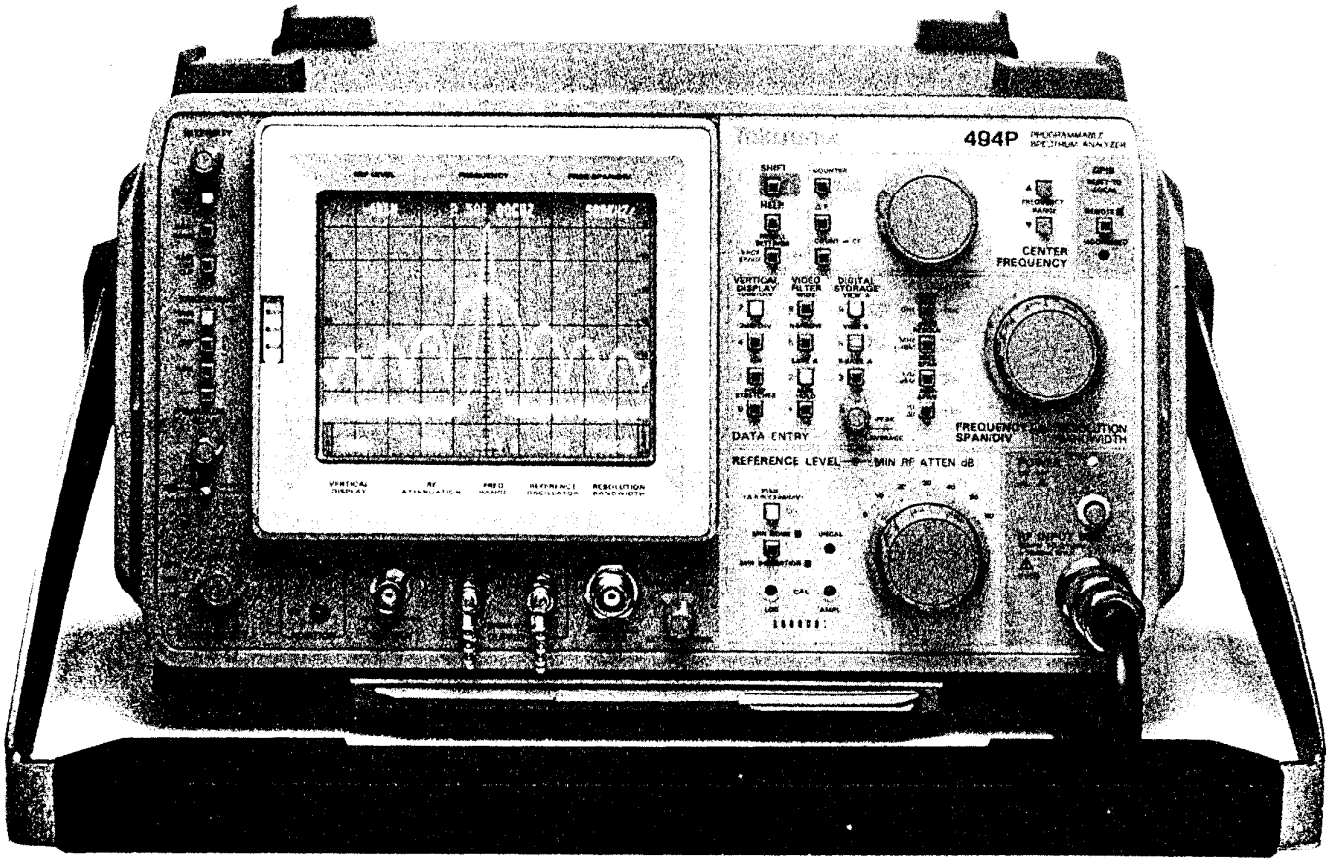
TEK 10 kHz TO 325 GHz PORTABLE SPECTRUM ANALYZER

NEW



GPIB IEEE-488 **494P** **494**

The 494P complies with IEEE Standard 488-1978 and with Tektronix *Standard Codes and Formats*.

- Built-in Frequency Counter to 325 GHz
- HELP Manual in ROM
- Nonvolatile Memory Storage
- Keypad Data Entry
- Direct Plot Capability
- Alternate Language Options
- Full Three Year Warranty

SPECTRUM ANALYZERS

More accuracy, convenience, performance, and value

The new Tek 494 and fully programmable 494P are altogether advanced, innovative spectrum analyzers offering portability, ease of use and unprecedented versatility. They deliver maximum utility and benefits at a surprisingly reasonable cost.

Counter center frequency accuracy, zero long-term drift, superior range and resolution in a compact, portable package

The 494 offers the widest amplitude calibrated frequency range of any spectrum analyzer available: 10 kHz to 21 GHz in coax, and 325 GHz using one or more of ten Tek waveguide mixers.

A 4 GHz signal can be measured to within 41 Hz with 1 Hz readout resolution 30 minutes after turn on. And the 494's zero drift will insure long-term measurement repeatability on that frequency.

You get 30 Hz resolution bandwidth to 60 GHz, 100 Hz resolution bandwidth to 220 GHz and 1 kHz bandwidth to 325 GHz with excellent sensitivity and low phase noise. Popular features common to other 490 Series spectrum analyzers are standard on the 494, including digital storage, manual to programmable convertibility, and environmentalization per MIL-T-28800C, Type III, Class 3, Style C.

An exclusive pushbutton *HELP* mode makes the 494 accessible to operators of widely varying skills and experience. At the touch of a button or twist of a knob the 494 tells you what to expect from nearly every control—in plain English. Plus optional French, German, or Spanish. Pull-out reference cards supply an additional level of detail. Having answers available at your fingertips minimizes training time and reduces complexity.

Center frequency, span/div., amplitude scaling and reference level selected either by μP-aided three-knob operation or direct pushbutton entry

In push-button mode, variables can be set to non-standard values, i.e., 7 dB/div vertical mode or 9.2 kHz/div frequency span.

Nonvolatile memory retains up to ten set-ups and nine displays—for rapid measurements and easy data comparison. One memory location stores on-screen settings to quickly bring the analyzer back if power is turned off.

The fully programmable 494P provides easy-to-implement automated measurements. The 494P is straightforward to interface to our GPIB controllers...or yours. If you want to free your controller but still get graphics output, a convenient front panel *PLOT* button will send display data to a plotter.

In strong testimony of the incomparable reliability of the 494 and 494P, Tek offers the first spectrum analyzer three year warranty. Beyond the first three years of warranty coverage, Tek will extend your service coverage for two years providing all your calibration and maintenance needs for the first five years.

NEW

CHARACTERISTICS

The following characteristics and features apply to the 494/494P Spectrum Analyzer after a 30-minute warmup period unless otherwise noted.

FREQUENCY RELATED

Center Frequency Range — 10 kHz to 21 GHz standard; amplitude specified coverage to 325 GHz with optional Tektronix waveguide WM 490 Series mixers.

Center Frequency Accuracy — Bands 1 and 5-12 with span/div >200 kHz and bands 2-4 with span/div >100 kHz.

±[(20% of span/div or res bw, whichever is greatest) + (CF x Ref Freq Error) + (N x 15 kHz)].

Bands 1 and 5-12 with span/div ≤200 kHz and Bands 2-4 with span/div ≤100 kHz.

±[(20% of span/div or res bw, whichever is greater) + (CF x Ref Freq Error) + (2N + 25 Hz)].

Center Frequency, Readout Resolution — At least 10% of span/div.

Signal Counter Accuracy — ±[(Counter Frequency x Reference Frequency error) + (10 + 2N) Hz + 1 LSD)].

Counter Sensitivity — Center Screen S/N ≥20 dB.

Counter Frequency Readout Resolution — 1 Hz through 1 GHz.

Reference Frequency Error (Aging Rate) — 1×10^{-9}/day, 1×10^{-7}/year.

Frequency Span Per Division — 50 Hz/div to 500 MHz/div in coaxial bands (10 kHz through 21 GHz) and 50 Hz/div to 10 GHz/div in waveguide bands (18 GHz through 325 GHz), plus zero span and maximum span. Any span to two significant digits (within 50 Hz and up to 10 GHz) can also be selected with the Data Entry Keyboard.

Frequency Span/Div Accuracy — Within 5% of the selected span/div over the center 8 div of the 10 div CRT display.

Resolution Bandwidth (6 dB) — 30 Hz then 100 Hz to 1 MHz in decade steps plus auto.

Accuracy — Within 20%.

Shape Factor (60 dB/6 dB) — 7.5:1 or less, 100 Hz through 1 MHz and 15:1 or less for 30 Hz.

Residual FM (After 1 Hour Warmup) — Bands 1 and 5-12 with span/div >200 kHz, and bands 2-4 with span/div >100 kHz: ≤(7 kHz) N total excursion in 20 ms.

Bands 1 and 5-12 with span/div ≤200 kHz, and bands 2-4 with span/div ≤100 kHz: ≤(10 + 2N) Hz total excursion in 20 ms.

Long-Term Drift (at Constant Temperature and Fixed Center Frequency and After 1 Hour Warmup) — Bands 1 and 5-12 with span/div >200 kHz, and bands 2-4 with span/div >100 kHz: ≤(5 kHz) N per minute of sweep time.

Bands 1 and 5-12 with span/div ≤200 kHz, and Bands 2-4 with span/div ≤100 kHz: ≤50 Hz per minute of sweep time.

Noise Sidebands — At least −75 dBc at 30 times the resolution bandwidth offset from the center frequency (−70 dBc for 100 Hz resolution bandwidth or less).

AMPLITUDE RELATED

Reference Level Range — Full screen, top of graticule −117 dBm to + 40 dBm (+40 dBm, includes maximum safe input of +30 dBm and 10 dB gain of IF gain reduction) for 10 dB/div and 2 dB/div log modes. 1 W maximum safe input in the linear mode.

Vertical Display Modes — 10 dB/div, 2 dB/div, and linear. Any integer between 1-15 dB/div can also be selected with the data entry keyboard.

Reference Level Steps — 10 dB, 1 dB and 0.25 dB for relative level (Δ) measurements in Log mode. 1-2-5 sequence and 1 dB equivalent increments in Lin mode. The RF attenuator steps 10 dB for reference level changes above −30 dBm (−20 dBm when minimum noise is active) unless minimum RF attenuation is greater than normal. The IF gain increases 10 dB for each reference level change below −30 dBm (−20 dBm when minimum noise is active).

Display Dynamic Range — 80 dB at 10 dB/div, 16 dB at 2 dB/div and 8 div in linear mode.

Reference Level Accuracy — Accuracy is a function of the characteristics listed below.

Calibrator — (Cal out) See output signal characteristics on next page.

Input Attenuator Accuracy — 0.3 dB/10 dB to a maximum of 0.7 dB over the 60 dB range, up to 4 GHz; 0.5 dB/10 dB to a maximum of 1.4 dB over the 60 dB range from 4 GHz to 18 GHz. 1.5 dB/10 dB to a maximum of 2.6 dB over the 60 dB range from 18 GHz to 21 GHz.

Frequency Response — See Frequency Response Table on this page.

SENSITIVITY AND FREQUENCY RESPONSE

Freq Range	LO Harmonic Number	Ave Noise Level For 1 kHz Res BW	Minimum Frequency Counter Sensitivity 30 Hz Res BW	Freq Response Referenced To 100 MHz With 10 dB Attn	Freq Response About the Mid Point Between Two Extremes
10 kHz-1.8 GHz	1	−110 dBm	−101 dBm	±3.0 dB	±2.0 dB
50 kHz-1.8 GHz	1	−110 dBm	−101 dBm	±2.5 dB	±1.5 dB
1.7 GHz-5.5 GHz	1	−110 dBm	−101 dBm	±3.5 dB	±2.5 dB
3.0 GHz-7.1 GHz	1	−110 dBm	−101 dBm	±3.5 dB	±2.5 dB
5.4 GHz-18.0 GHz	3	−95 dBm (to 12 GHz) −90 dBm (12-18 GHz)	−86 dBm −81 dBm	±4.5 dB	±3.5 dB
15.0 GHz-21.0 GHz	3	−85 dBm	−76 dBm	±6.5 dB	±5.0 dB

WITH TEKTRONIX OPTIONAL HIGH PERFORMANCE WAVEGUIDE MIXERS

18.0 GHz-26.5 GHz	6	−100 dBm	−91 dBm	WM 490K	±6.0 dB	±2.0 dB
26.5 GHz-40 GHz	10	−95 dBm	−86 dBm	WM 490A	±6.0 dB	±2.0 dB
33 GHz-50 GHz	10	−95 dBm	−86 dBm	WM 490Q	±6.0 dB	±2.0 dB
40 GHz-60 GHz	10	−95 dBm	−86 dBm	WM 490U	±6.0 dB	±2.5 dB
*50 GHz-75 GHz	15	−95 dBm @ 50 GHz −90 dBm @ 75 GHz	−86 dBm −81 dBm	WM 490V	±6.0 dB	±3.0 dB
*60 GHz-90 GHz	15	−95 dBm @ 60 GHz −85 dBm @ 90 GHz	−89 dBm −79 dBm	WM 490E	±6.0 dB	±3.0 dB
*75 GHz-110 GHz	23	−90 dBm @ 75 GHz −80 dBm @ 110 GHz	−84 dBm −74 dBm	WM 490W	±6.0 dB	±3.0 dB
*90 GHz-140 GHz	23	−85 dBm @ 90 GHz −75 dBm @ 140 GHz	−79 dBm −69 dBm	WM 490F	±6.0 dB	±3.0 dB
*110 GHz-170 GHz	37	−80 dBm @ 110 GHz −70 dBm @ 170 GHz	−74 dBm −64 dBm	WM 490D	±6.0 dB	±3.0 dB
*140 GHz-220 GHz	37	−75 dBm @ 140 GHz −65 dBm @ 220 GHz	−69 dBm −59 dBm	WM 490G	±6.0 dB	±3.0 dB
*220 GHz-325 GHz	56	−65 dBm @220 GHZ −50 dBm @ 325 GHz	−50 dBm −35 dBm	119-1728-00 J	±6.0 dB	±3.0 dB

**Typical values and with frequency response indicated over any 5 GHz range.*

Display Amplitude Accuracy — ±1.0 dB/10 dB to a maximum cumulative error of ±2.0 dB over the 80 dB window and ±0.4 dB/2 dB to a maximum cumulative error of ±1.0 dB over the 16 dB window. Lin Mode is 5% of full scale.

Resolution Bandwidth Gain Variation — ±0.4 dB, after Cal routine has been executed and with respect to the 1 MHz filter.

IF Gain Variation — Gain steps are monotonic (same direction) with the following limits: Within 0.2 dB/dB to a maximum of 0.5 dB/9 dB, except at the decade transitions of −19 dBm to −20 dBm, −29 dBm to −30 dBm, −39 dBm to −40 dBm, −49 dBm to −50 dBm, and −59 dBm to −60 dBm, where an additional 0.5 dB can occur for a total of 1.0 dB per decade. Maximum deviation over the 97 dB range is within ±2 dB.

SPURIOUS RESPONSES

Residual (No Input Signal Referenced to Mixer Input) — −100 dBm or less. Fundamental mixing Bands 1-3.

Harmonic Distortion (cw Signal Minimum Distortion Mode) — Typically −60 dBc for full screen signal in the minimum distortion mode to 21 GHz. At least −100 dBc for preselected bands 1.7 GHz to 21 GHz.

Third-Order Intermodulation Distortion (Minimum Distortion Mode) — At least 70 dB down from two full screen signals within any frequency span. At least 100 dB down for two signals spaced more than 100 MHz apart from 1.7 GHz to 21 GHz for preselected bands.

LO Emissions (No RF Attenuation) — −70 dBm maximum to 21 GHz.

INPUT SIGNAL CHARACTERISTICS

RF Input — Type N female connector.

Input Impedance — 50 Ω.

Maximum VSWR*1 with ≥10 dB Attenuation

Frequency Range	Typical	Specified Maximum
Dc to 2.5 GHz	1.2:1	1.3:1
2.5 GHz to 6.0 GHz	1.5:1	1.7:1
6.0 GHz to 18 GHz	1.9:1	2.3:1
18 GHz to 21 GHz	2.7:1	3.5:1

**1 At Type N female connector to internal mixer*

Input Level (Optimum Mixer Level for Minimum Distortion Linear Operation) — −30 dBm (minimum distortion control setting); 1 dB gain compression −23 dBm.

Optimum Mixer Level for Minimum Noise Display Dynamic Range Enhanced Operation — −20 dBm (minimum noise control setting); 1 dB gain compression −18 dBm.

External Reference Frequency — 1 MHz, 2 MHz, 5 MHz or 10 MHz ±5 ppm (minimum).

Waveshape: Sinewave, ECL, TTL duty cycle 40%-60%.

Input Impedance: 50 Ω ac, 500 Ω dc.

Power: −15 dBm to +15 dBm.

Maximum Safe Input Level (RF Attenuation at Zero dB) — +30 dBm (1 W) continuous, 75 W peak for 1 μs or less pulse width and 0.001 maximum duty factor (attenuation limit). Dc must never be applied to RF input.

SPECTRUM ANALYZERS

NEW

SPECTRUM ANALYZERS

OUTPUT SIGNAL CHARACTERISTICS

Calibrator (Cal Out) — −20 dBm ±0.3 dB, 100 MHz x reference frequency error.

1st and 2nd LO — Provides access to the output of the respective local oscillators (1st LO +7.5 dBm minimum to a maximum of +15 dBm; 2nd LO −22 dBm minimum to a maximum of +15 dBm). These ports must be terminated in 50 Ω at all times.

Vertical Out — Provides 0.5 V ±5% of signal/div of video above and below the center line.

Horizontal Out — Provides 0.5 V either side of center. Full range −2.5 V to +2.5 V ±10%.

Pen Lift — TTL, +5 V nominal to lift pen.

IF Out — Output of the 10 MHz IF. Level is approximately −5 dBm for a full screen signal at −30 dBm input reference level. Nominal impedance 50 Ω.

Probe Power — Provides operating voltages (+5 V, +15 V, −15 V, and ground) for active probes.

494P Only: IEEE Standard 488-1978 Port (GPIB) — In accordance with IEEE Standard 488.

GENERAL CHARACTERISTICS

Sweep Time — 20 μs/div to 5 s/div in 1-2-5 sequence. (10 s/div in auto).

CRT Readout — Displays reference level, frequency, frequency span/div, vertical display, RF attenuation, resolution bandwidth, and reference oscillator.

CRT — 8 x 10 cm, GH (P31) Phosphor is standard.

Configuration — (Portable) 494/494P total weight including front cover and standard accessories 24 kg (52 lb), 17.5 cm x 32.7 cm x 49.9 cm (6.9 in x 12.9 in x 19.7 in) without handle or cover.

Input Voltage — 90 V ac to 132 V ac or 180 V ac to 250 V ac, 48 Hz to 440 Hz.

Power — 210 W maximum, 3.2 A, at 115 V and 60 Hz.

ENVIRONMENTAL CHARACTERISTICS

Per MIL-T-28800C Type III, Class 3, Style C.

Temperature — Operating: −15°C to +55°C. Nonoperating: −62°C to +85°C.

Humidity — Operating: 95%. Nonoperating: 120 hours per MIL-STD-810.

Rain Resistance — Drip proof at 16 liters/hour/square foot.

Altitude — Operating: 4500 m (15,000 ft). Nonoperating: 12 000 m (40,000 ft).

Vibration — 5 Hz to 55 Hz at 0.020 inch excursion.

Shock — 30 g of half sine 11 ms duration.

Drop — 12 inches.

Electromagnetic Compatibility — 490 Series spectrum analyzers meet the requirements of MIL-STD-461B, operating from 48 Hz to 440 Hz power sources, with the exceptions shown below.

Conducted Emissions — CE01: 1 kHz to 15 kHz only. CE03 (Narrowband): Full limits. CE03 (Broadband): 15 dB relaxation from 15 kHz to 50 kHz.

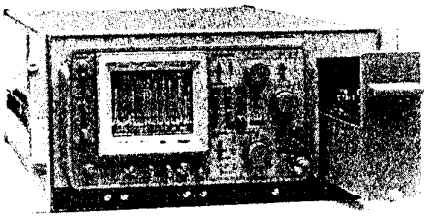
Conducted Susceptibility — CS01: Full limits. CS02: Full limits. CS06: Full limits.

Radiated Emissions — RE01: 10 dB relaxation for first 10 harmonics of power line frequency, and exceptioned from 30 kHz to 36 kHz. RE02: Full limits.

Radiated Susceptibility — RS01: Full limits. RS02-1: Full limits. RS02-2: To 5 A only. RS03: Up to 1 GHz only.

INCLUDED ACCESSORIES

Diplexer assembly (015-0385-00); 6 ft N to N connector 50 Ω coaxial cable, (012-0114-00); N male to BNC female adaptor (103-0045-00); 18 in BNC to BNC connector, 50 Ω coaxial cable (012-0076-00); CRT mesh filter (378-0726-01); two 4 A fast blow fuse (159-0017-00); 115 V power cord (161-0118-00); cord clamp (343-0170-00); CRT visor (016-0653-00); gray CRT light filter (378-0115-02); amber CRT light filter (378-0115-01); blue CRT light filter (378-0115-00); operators manual; operators handbook. 494P also includes 2 m, double shielded GPIB cable (012-0630-03), programmers manual.



490 Series Spectrum Analyzers Rackmount/Benchmount Options

The following options denote mechanical configurations of the 490 Series. Option 30 is a rackmount configuration for the 490 Series with standard front panel input/outputs. Option 31 is a rackmount configuration with rear panel input/output capability. Option 32 adds side covers and trim to an Option 31, making it into a stackable bench top configuration.

The Option 30 and 31 Rackmount is a standard 19 inch rack width and comes with standard rackmount fittings. A spectrum analyzer accessories storage drawer is also included. Dimensions are 22.23 cm x 42.9 cm x 63.5 cm (8.75 in x 16.89 in x 25.0 in). Weight is 32.7 kg (72 lb); including the spectrum analyzer.

The Option 32 Benchmount is approximately the same size as the Rackmount but is dressed with side and top panels and carrying handles and feet. The Benchmount provides a convenient surface for stacking other instruments. Dimensions are 23.5 cm x 45.7 cm x 63.5 cm (9.25 in x 17.9 in x 25.0 in). Weight is 31.8 kg (70 lb); including the spectrum analyzer.

ORDERING INFORMATION

494 Spectrum Analyzer **$41,770**

494P Spectrum Analyzer **$45,950**

494 to 494P Conversion — Conversions are made by your nearest Tektronix Service Center.
Specify 040-1140-00 ..... **$5,300**

Option 08 — Delete External Mixer Capability. Deletes internal switching front panel connector and external diplexer to connect and use external waveguide mixers. ..... **−$1,750**

Option 12 — Help Mode Text, CRT prompts selectable between German and English. Pull-out reference cards in German ..... **+$200**

Option 13 — Help Mode Text, CRT prompts selectable between French and English. Pull-out reference cards in French ..... **+$200**

Option 14 — Help Mode Text, CRT prompts selectable between Spanish and English. Pull-out reference cards in Spanish ..... **+$200**

Option 20 — General Purpose 12.4 GHz to 40 GHz Waveguide Mixer Set includes three mixers (12.4 GHz to 18 GHz, 18 GHz to 26.5 GHz, and 26.5 GHz to 40 GHz) and attaching hardware to extend the upper frequency ..... **+$900**

Option 21 — High Performance 18 GHz to 40 GHz Waveguide Mixer Set includes two mixers (18 GHz to 26.5 GHz and 26.5 GHz to 40 GHz) and attaching hardware to extend the upper frequency ..... **+$2,525**

Option 22 — High Performance 18 GHz to 60 GHz Waveguide Mixer Set includes three mixers (18 GHz to 26.5 GHz, 26.5 GHz to 40 GHz, and 40 GHz to 60 GHz) and attaching hardware to extend the upper frequency ..... **+$4,250**

Option 30 — Rackmount. 19 inch rack width with front panel input/outputs ..... **+$790**

Option 31 — Rackmount. 19 inch rack width with rear panel input/output capability ..... **+$840**

Option 32 — Benchmount. Adds side and top panels, carrying handles and feet for a stackable bench top configuration ..... **+$940**

Option 41 — Digital Radio. Provides wider bandwidth preselector, 30 Hz video filter with 100 kHz resolution bandwidth and 5 MHz span/div optimized for 6 GHz and 11 GHz D/R . **+$450**

Option 42 — 110 MHz IF Output. Provides 5 MHz bandwidth at 6 dB points ..... **+$1,500**

INTERNATIONAL POWER CORD AND PLUG OPTIONS

Option A1 — Universal Euro 220 V/16 A, 50 Hz
Option A2 — UK 240 V/13 A, 50 Hz
Option A3 — Australian 240 V/10 A, 50 Hz
Option A4 — North American 240 V/15 A, 60 Hz
Option A5 — Switzerland 220 V/10 A, 50 Hz

WARRANTY-PLUS SERVICE PLAN—REFER TO PAGE 15

M1 — Provides two calibrations during the warranty period, one in year two (2) and one in year three (3).
494 ..... **+$695**
494P ..... **+$715**

M2 — Remedial service coverage for years four (4) and five (5).
494 ..... **+$1,330**
494P ..... **+$1,350**

M3 — Provides four calibrations, one each in years two (2), three (3), four (4), and five (5), plus remedial service coverage for years four (4) and five (5).
494 ..... **+$2,725**
494P ..... **+$2,785**

M4 — Provides five calibrations during the warranty period, one in year one (1) and two each in years two (2) and year three (3). Certification is provided with each calibration.
494 ..... **+$1,590**
494P ..... **+$1,630**

M5 — Provides nine calibrations, one in year one (1) and two each in years two (2) through year five (5). Certification is provided with each calibration. Remedial coverage is extended to cover years four (4) and five (5).
494 ..... **+$4,145**
494P ..... **+$4,240**

OPTIONAL ACCESSORIES

TR 503 Tracking Generator — For more information on the TR 503 see page 214 ..... **$6,620**

Microwave Comb Generator TM 500 Series Compatible — Order 067-0885-00 ..... **$1,800**

75 Ω to 50 Ω Minimum Loss Pad — Order 011-0112-00 **$60**

Dc Block BNC to BNC — Order 015-0221-00 ..... **$85**

FET Probe P6201 to 900 MHz — Order 010-6201-01 **$1,210**

1405 TV Sideband Adaptor (525/60 Markers) — **$5,780**

C-5C Camera — **$495**

TV Trigger Synchronizer — Order 015-0261-01 ..... **$395**

Hard Case (Transit) — Order 016-0658-00 ..... **$625**

Soft Case — Order 016-0659-00 ..... **$125**

Lab Cart Model 3 ..... **$595**

Note: 490 Series spectrum analyzers are compatible with all Tektronix C-50 Series cameras.

PERIPHERAL PRODUCTS FOR 494P SPECTRUM ANALYZER

4041 System Controller (See page 324) **$3,995**
4105 Color Terminal (See page 55) **$3,995**
4695 Color Graphics Copier (See page 68) **$1,595**
6120 Scientific Desktop Computer (See page 48) **$7,995**