

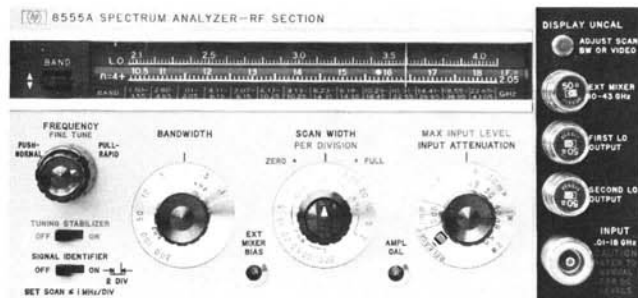
SIGNAL ANALYZERS

141T Spectrum Analyzer System: 10 MHz to 40 GHz

Models 8555A, 8444A & 8445B

- Absolute amplitude calibration
- High sensitivity to -125 dBm (125 nV)
- Resolve signals to 100 Hz

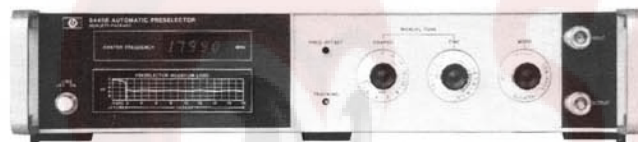
- Scan up to 8 GHz full screen
- 100 dB distortion free dynamic range with preselector
- Companion tracking generator to 1.5 GHz



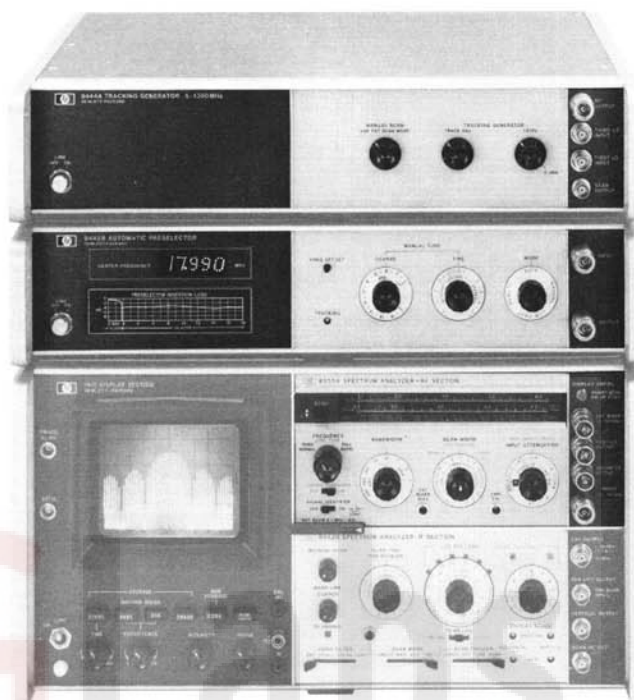
8555A



8444A Opt H59



8445B Opt 002, 003



8555A Spectrum Analyzer

The 8555A Spectrum Analyzer covers 10 MHz to 18 GHz with fundamental and harmonic mixing. A single external waveguide mixer can provide 12.4 GHz to 40 GHz coverage. This broad frequency range coupled with its high sensitivity and resolution bandwidth allow a variety of power measurements, frequency measurements, modulation, and noise analysis on almost every type of design module: the frequency response of amplifiers, mixers, and modulators, response and alignment of filters, isolators, couplers and limiters. With wide scan widths and calibrated amplitude the 8555A is ideal for spectrum surveillance and RFI/EMC field strength analysis with a calibrated antenna.

Absolute Amplitude Calibration

The 8555A offers absolute amplitude calibration from $+10$ dBm to -125 dBm over the 10 MHz to 18 GHz frequency range. This capability makes possible not only absolute signal power measurements, but also the measurement of the power differential between two signals separated by as much as 18 GHz. The parallax-free CRT graticule can read as a log scale (dBm) or a linear scale (volts) with a frequency response accuracy of ± 1.5 dB to 6 GHz and ± 2.0 dB to 18 GHz. The top line of the display is established as the reference level by front panel controls. A light warns of an uncalibrated condition.

High Sensitivity

The high sensitivity from -125 dBm (fundamental mixing) to -100 dBm (4th harmonic) in a 100 Hz bandwidth makes it possible to measure large values of attenuation, out of band filter and amplifier response, weak transmitted signals in surveillance work or micro-volt signals in EMC applications. A post-detection filter with 10 kHz, 100 Hz and 10 Hz positions averages noise and yields an extremely clean observed trace.

High Resolution

Due to low residual FM (<100 Hz peak-to-peak) the 8555A offers outstanding 100 Hz resolution which allows the users to resolve closely spaced signals and low-level sidebands resulting from a 1 kHz modulating signal. The resolution capability makes it possible to analyze spurious low frequency modulation of microwave signals. The high stability of the analyzer results in more accurate measurements of residual FM, long-term drift, phase noise, and spectral purity. Furthermore, the gaussian shape of the IF filters allows fastest sweep for a given resolution bandwidth.

Automatic Tuning Stabilization

When scanning over a relatively narrow frequency range, the frequency stability of the analyzer's internal local oscillators becomes important for high resolution and frequency measurements. For this reason the 8555A is equipped with a tuning stabilizer circuit which automatically phase locks the analyzer to a crystal oscillator. Display jitter and signal recentering are virtually eliminated.

Added Input Mixer Protection

To prevent an inadvertent 0 dB setting of the input attenuator, a pushbutton lockout is provided on the attenuator knob.

8445B Tracking Preselector, 10 MHz to 18 GHz

The 8445B Tracking Preselector is a YIG tuned filter coupled to the 8555A Spectrum Analyzer in order to be tuned exactly to the analyzer's reception frequency. The preselector suppresses harmonic mixing image and multiple responses from 1.8 to 18 GHz. The result is a wide spurious free amplitude measurement range. Clean, full band sweeps are possible in scans of 2, 4, 6 or 8 GHz depending upon the band selected.

Below 1.8 GHz the image and multiple responses are eliminated by a low-pass filter in the preselector.

An optional five digit LED display with 1 MHz resolution allows accurate measurement of either the display frequency at the display marker in full scan mode or the center frequency in per division scan.

8444A Option H59 Tracking Generator

The 8444A Option H59 Tracking Generator provides a level, calibrated RF signal which is exactly the tuned frequency of the spectrum analyzer. This enables swept frequency tests such as frequency response and return loss measurements up to 1500 MHz. With an external counter the frequencies of unknown signals on points along a frequency response curve can be made.

8555A Specifications—with 8552B IF Section

Frequency Specifications

Frequency range: 0.01–40 GHz.

Tuning range

With internal mixer: 0.01–18.0 GHz.

With external mixer: 12.4–40 GHz.

Harmonic mixing mode

Signal identification: not normally required with preselector. Signal identifier provided for positive identification of all responses. Rejection of images and multiple responses with preselector is > 70 dB.

Scan width

Full scan: the width of the scan depends on mixing mode. Scan width = $n \times 2000$ MHz, where n is the mixing mode; e.g. for $n = 2$, scan width is 4 GHz. Maximum scan width full screen is 8 GHz with coaxial mixer. Preselector necessary to make wide scans usable.

Per division: 16 calibrated scan widths from 2 kHz/div to 200 MHz/div in a 2, 5, 10 sequence.

Zero scan: analyzer becomes fixed-tuned receiver.

Frequency accuracy

Dial accuracy: $n \times (\pm 15 \text{ MHz})$ where n is the mixing mode.

Scan accuracy: frequency error between two points on the display is less than $\pm 10\%$ of the indicated separation.

Stability: residual FM stabilized < 100 Hz peak-to-peak (fundamental mixing).

Noise sidebands: for fundamental mixing. More than 70 dB below CW signal 30 kHz or more away from signal, with 1 kHz IF bandwidth and 100 Hz video filter.

Frequency drift

Long term drift: at fixed center frequency after 2-hour warm-up (Typical).

Stabilized: $\pm 3.0 \text{ kHz}/10 \text{ min.}$

Unstabilized: $\pm 25 \text{ kHz}/10 \text{ min.}$

Stabilization range: first LO can be automatically stabilized to internal crystal reference for scan widths of 100 kHz/div or less.

Resolution

Bandwidth range: selectable 3 dB bandwidths from 100 Hz to 300 kHz in a 1, 3, 10 sequence.

Bandwidth shape: approximately gaussian.

Bandwidth selectivity: 11:1 to 20:1 (60 dB/3 dB).

Bandwidth accuracy: individual IF bandwidth 3 dB points calibrated to $\pm 20\%$ (10 kHz bandwidth, $\pm 5\%$).

Amplitude Specifications

Measurement range

Log reference level: from -60 dBm to $+10 \text{ dBm}$.

Linear sensitivity: from $0.1 \mu\text{V}/\text{div}$ to $100 \text{ mV}/\text{div}$.

Sensitivity and frequency response with internal coaxial mixer
noise level: specified for 1 kHz bandwidth.

Frequency response with 10 dB input attenuator setting:

Frequency Range (GHz)	Mixing Mode (n)	Average Noise Level (dBm max.)	Frequency Response* (dB max.)
0.01-2.05	1-	-115	± 1.0
1.50-3.55	1-	-117	± 1.0
2.07-6.15	2-	-108	± 1.3
2.60-4.65	1+	-117	± 1.0
4.11-6.15	1+	-115	± 1.0
4.13-10.25	3-	-103	± 1.5
6.17-10.25	2+	-105	± 1.5
6.19-14.35	4-	-95	± 2.0
8.23-14.35	3+	-100	± 2.0
10.29-18.00	4+	-90	± 2.0

*Includes mixer frequency response, RF attenuator frequency response, mixing mode gain variation, RF input VSWR.

Sensitivity and frequency response with 11517A external waveguide mixer and appropriate waveguide tapers

Average noise level 10 kHz bandwidth (dBm typical):

Frequency Range (GHz)	Mixing Mode (n)	Average Noise Level (dBm)
12.4-18.0	6-	-90
18.0-26.5	6+	-85
26.5-40.0	10+	-75

Frequency response: typically $\pm 3 \text{ dB}$ over 1 GHz frequency scans.

Residual responses: referred to input on fundamental mixing: $< -90 \text{ dBm}$.

Display range

Log: 70 dB, 10 dB/div and 2 dB/div, expanded on a 16 dB display.

Linear: from $0.1 \mu\text{V}/\text{div}$ to $100 \text{ mV}/\text{div}$ in a 1, 2, sequence on an 8-division display.

Spurious responses due to second harmonic distortion with preselector:

Frequency Range	Power Incident on Input Mixer	2nd Harmonic Distortion
0.01-1.85 GHz	-40 dBm	-63 dB
1.85-18.0 GHz	0 dBm	-100 dB

Spurious responses due to third order intermodulation distortion with preselector

Frequency Range	Signal Separation	Power Incident on Input Mixer	Third Order Intermodulation Distortion
0.01-18.0 GHz	> 1 MHz < 20 MHz	-30 dBm	-70 dB
0.01-1.85 GHz	> 70 MHz	-30 dBm	-70 dB
1.85-18.0 GHz	> 70 MHz	0 dBm	-100 dB

Video filter: post detection filter used to average displayed noise. Nominal bandwidths: 10 kHz, 100 Hz, and 10 Hz.

Gain compression: for internal mixer gain compression < 1 dB for -10 dBm peak or average signal level to input mixer. 11517A External Mixer (12.4-40 GHz) gain compression < 1 dB for -15 dBm peak or average signal level to input mixer.

Amplitude accuracy

IF gain variation with different bandwidth settings: (at 20°C.)

Log: $\pm 0.5 \text{ dB}$.

Linear: $\pm 5.8\%$

SIGNAL ANALYZERS

141T Spectrum Analyzer System: 10 MHz to 40 GHz (cont'd)

Models 8555A, 8444A & 8445B

Amplitude display

Log: ± 0.25 dB/dB, but not more than ± 1.5 dB over the full 70 dB display range.

Linear: $\pm 2.8\%$ of full 8-division deflection.

Log reference level: accurate to ± 0.2 dB ($\pm 2.3\%$ linear sensitivity).

Log reference level vernier: accurate to ± 0.1 dB (1.2%) in 0, -6, and -12 dB positions; otherwise, ± 0.25 dB ($\pm 2.8\%$).

Input attenuator range: 0-50 dB in 10 dB steps, manual safety lock-out for 0 dB position.

Frequency response: typically ± 0.6 dB from 10 MHz to 18 GHz.

Calibrator output: amplitude -30 dBm, ± 0.3 dB. Frequency 30 MHz ± 3 kHz.

Absolute calibration accuracy: overall accuracy is a function of measurement technique. With the appropriate technique, absolute accuracy of ± 1.6 dB (fundamental mixing) and ± 2.6 dB (4th harmonic mixing) is achievable.

Input Characteristics

Input impedance: 50 ohms nominal (0.01-18 GHz).

Reflection coefficient: < 0.130 (1.30 SWR) for input RF attenuator settings ≥ 10 dB.

Maximum input level: peak or average power +13 dBm (1.0 V ac rms) incident on mixer (+30 dBm with Opt 002), +33 dBm incident on input attenuator.

RF input connector: type N female.

LO emission: -10 dBm without preselector, -80 dBm with preselector over recommended operating ranges (10 dB input attenuator setting).

General

Scan time: 16 internal scan rates from 0.1 ms/div to 10 sec/div in a 1, 2, 5 sequence.

Power requirements: 100, 120, 220 240 V $\pm 5\%$, -10%, 50-60 Hz, normally less than 225 watts (varies with plug-in units used).

Size: 102 H x 226 W x 344 mm D (4.0" x 8 7/8" x 13.5").

Weight: net, 16.8 kg (14 lb, 15 oz). Shipping, 8.7 kg (19 lb).

Specifications with Option 002;

Internal Limiter Installed

All specifications are the same as for the standard unit except the following:

Frequency range: 0.1-12.4 GHz, usable over 0.01-18 GHz range.

Maximum input level

Continuous: 1 W (+30 dBm).

Pulse: 75 watts peak, pulse width ≤ 1 μ s, 0.001 duty cycle.

Reflection coefficient: < 0.33 (2.0 SWR).

Frequency response (flatness): $< \pm 0.5$ dB degradation in response, 0.1-12.4 GHz.

8445B Tracking Preselector

Frequency Specifications

Frequency range: dc-1.8 GHz low-pass filter. 1.8-18 GHz tracking filter.

Tracking filter 3 dB bandwidth: typically 20-45 MHz.

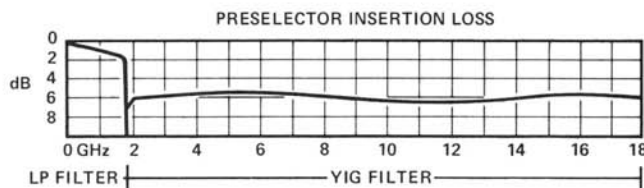
Tracking filter skirt roll-off: characteristics of a three-pole filter. (Nominal: 18 dB/octave.)

Insertion loss

	Frequency	Insertion Loss (Except Opt. 004)	Insertion Loss (Opt. 004)
Low-Pass Filter	DC-1.8 GHz	< 2.5 dB	*
	@2.05 GHz	> 50 dB	*
Tracking Filter	1.8-12 GHz	< 8 dB	< 7 dB
	12-18 GHz	< 10 dB	< 8 dB

*Low-Pass Filter deleted with Opt 004.

Typical preselector minimum insertion loss at 25°C.



Out-of-band rejection: for YIG filter 1 GHz from center of pass-band > 70 dB.

Digital frequency readout (Option 003):

Function:

Full scan mode: displays frequency at inverted marker.

Per division scan: displays center frequency.

Manual or remote operation of preselector: displays tuned frequency of filter.

Resolution: 1 MHz.

Accuracy: 0.01-1.0 GHz: ± 6 MHz.

1.0-4.0 GHz: ± 8 MHz.

4.0-18 GHz: $\pm 0.2\%$

Input Specifications

Input connector: precision Type N female.

Input VSWR: typically < 2.0 (1.8-18 GHz).

Limiting level: (maximum input level for < 1 dB signal compression), $> +5$ dBm.

Damage level: $> +20$ dBm.

General

Remote function: YIG filter frequency can be set by externally supplied voltage.

Power requirements: 100, 120, 220, or 240 V $\pm 5\%$, -10%, 48 to 440 Hz, less than 110 watts.

Size: 88.2 H x 425 W x 467 mm D (3 15/32" x 16 3/4" x 18 3/8").

Weight: net, 8.8 kg (19 lb 8 oz). Shipping, 11.9 kg (26 lb).

8444A Opt H59 Tracking Generator

Frequency range: 10 MHz to 1500 MHz.

Frequency resolution: 1 kHz.

Residual FM (peak-to-peak): 200 Hz (stabilized).

Amplitude range

Spectrum analyzer display: from -130 dBm to +10 dBm, 10 dB/div on a 70 dB display or 2 dB/div on a 16 dB display (8552B only).

Tracking generator (drive level to test device): 0 to -10 dBm continuously variable.

Amplitude accuracy

System frequency response: ± 2.7 dB.

Tracking generator calibration: 0 dBm at 30 MHz to ± 0.5 dB.

Dynamic range: > 90 dB.

Counter output: typically 0.1 V rms.

General

Power: 115 V and 230 V, 48 to 440 Hz, 12 watts max.

Size: 85.2 H x 425 W x 467 mm D (3 15/32" x 16 3/4" x 18 3/8").

Weight: net, 7.1 kg (15 lb, 10 oz). Shipping, 9.5 kg (21 lb).

Ordering Information

	Price
8555A Tuning Section	\$8100
Opt 001: APC-7 connectors	add \$40
Opt 002: Internal limiter	add \$210
Opt 005: Video tape	add \$105
8445B Tracking Preselector, dc -18GHz	\$3180
Opt 001: APC-7 connectors	add \$155
Opt 002: Add manual controls	add \$80
Opt 003: Add digital frequency readout	add \$670
Opt 004: Delete low-pass filter	less \$425
Opt 005: Delete interconnect rigid coax	less \$50
8444A Opt H59 Tracking Generator, 10 MHz-1500 MHz	\$4425
11517A External Mixer (taper section req'd)	\$275
11518A Taper Section, 12.4 to 18 GHz	\$175
11519A Taper Section, 18 to 26.5 GHz	\$175
11520A Taper Section, 26.5 to 40 GHz	\$175