

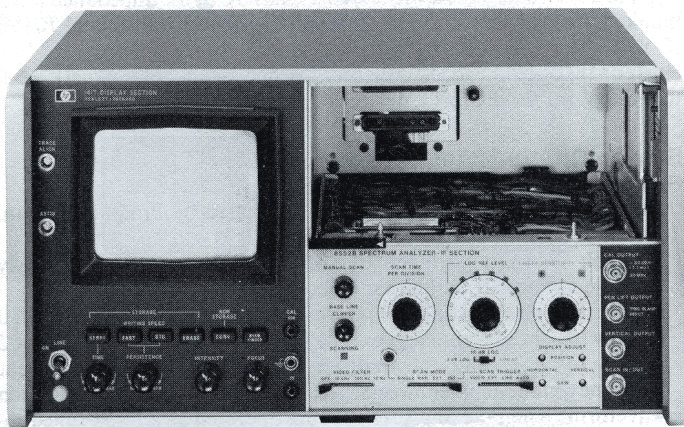
SIGNAL ANALYZERS

Plug-in spectrum analyzer system, 20 Hz to 40 GHz

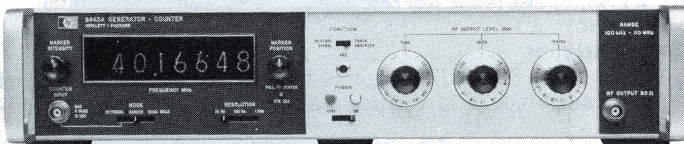
Model 141T system

- 20 Hz to 40 GHz with just a tuning section change
- Advantages of fully calibrated solid state system
- Add measurement capability to your system as needed

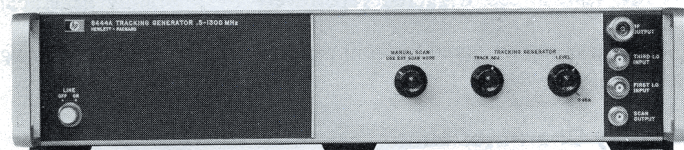
- Tracking generator expands measurement capability
- Increase dynamic range with tracking preselector
- Storage-normalizer adds digital storage



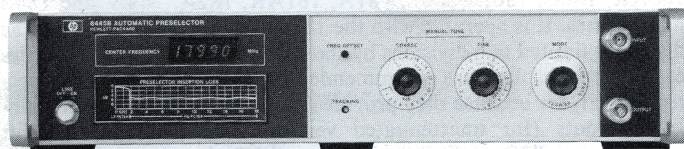
141T, 8552B



8443A



8444A

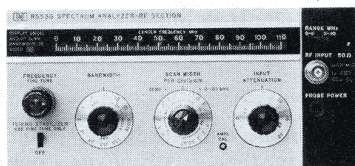


8445B Opt 002, 003

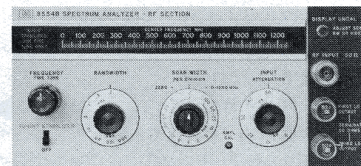
Hewlett-Packard's high performance plug-in spectrum analyzer family makes frequency domain measurements from 20 Hz to 40 GHz. Because of the system's modularity, the user need purchase only analyzer components necessary to meet immediate production or laboratory measurement requirements. Then, as broader frequency capability is required, additional tuning sections or companion instruments can be added.

The models 8553B, 8554B, 8555A, and 8556A are tuning sections which plug into a 141T display mainframe along with an 8552B IF section to form a member of the Hewlett-Packard high performance spectrum analyzer family. Each tuning section covers a frequency range convenient for equipment design or spectrum surveillance: 8556A, 20 Hz to 300 kHz; 8553B, 1 kHz to 110 MHz; 8554B, 100 kHz to 1250 MHz; and 8555A, 10 MHz to 40 GHz. The IF section plug-in which is used with each tuning section, serves to condition the measurement signal for proper display on the CRT. Two IF sections are available, the 8552B high performance model and the 8552A model for economy. The spectrum analyzer specifications included in this catalog assume the use of the 8552B.

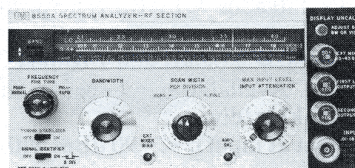
The 8443A and 8444A are tracking generators complementing the basic spectrum analyzer function with an RF source locked to the tuning frequency. The 8445B is an automatic preselector which enhances the dynamic range of the 10 MHz to 40 GHz 8555A tuning section analyzer.



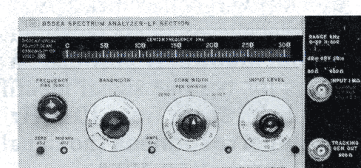
8553B



8554B



8555A



8556A

The 141T based spectrum analyzer features absolute calibration of frequency and amplitude, high resolution and sensitivity, wide dynamic range, and simple to interpret display output.

The following pages cover spectrum analyzer performance with each of the tuning sections and companion tracking generator/preselector.

Absolute Amplitude Calibration

For ease and speed of measurement, full frequency band amplitude calibration allows direct interpretation of signal power or voltage from the CRT display. A choice of logarithmic or linear scaling calibrates the CRT in dBm or μV respectively. Front panel settings set the top horizontal graticule on the CRT as the reference power in the logarithmic mode; all other CRT measurements can be made relative to this reference. In linear scaling the CRT is calibrated in voltage per division using front panel settings. The bottom graticule is zero voltage.

When a combination of frequency scan, bandwidth, or video filter settings are chosen such that the display becomes uncalibrated, a warning light indicates the condition.

High Resolution Frequency Calibration

The frequency measurement capability of the spectrum analyzer is responsive to user need, making spectrum measurements simply and accurately with three frequency scan modes.

First is the FULL scan mode, which displays the entire tuning section frequency band on the 10 cm horizontal CRT graticule. This mode is effective in viewing broadband effects of circuit adjustments and refinements as they are made. In FULL scan a marker on the CRT corresponds in frequency to the position of the pointer on the tuning section frequency scale, so signals can be readily identified.

The second mode, PER DIVISION scan, centers the display about the frequency indicated by the tuning section pointer. In this mode, narrow, calibrated scan per division and automatic frequency stabilization make high resolution measurements for analysis of signal purity, sidebands, and low deviation FM.

In the third mode, ZERO scan, the analyzer becomes a receiver tuned to the frequency indicated on the scale. Modulation in an input signal at the tuned frequency is displayed on the CRT in the time domain. The scan time control provides a calibrated time base.

High Resolution

The ability to resolve close-in signal sidebands, such as line related modulation, is important in frequency domain analysis. The Hewlett-Packard 141T plug-in spectrum analyzers each have narrow bandwidths for such resolution. Up to 110 MHz, the analyzers offer 10 Hz bandwidths and 18 GHz, 100 Hz bandwidths. The frequency stabilization feature already mentioned ensures high resolution by maintaining a jitter-free display.



Wide Dynamic Range, Sensitive

Confidence in signal identification is given by the analyzer's ability to measure wide amplitude differentials without distortion products and to measure very low-level signals. The plug-in spectrum analyzers have typically 70 dB of distortion free dynamic range; that is, the capability of measuring 0.03% signal distortion from the CRT display. With the 8445B Preselector the 8555A has a spurious-free range of 100 dB. The CRT displays full dynamic range on a linear, easy to read scale.

Signals at as low a level as -142 dBm (18 nanovolts, 50 ohms) can be detected by the spectrum analyzer with 10 Hz bandwidth. At high frequencies and with 100 Hz bandwidth, -125 dBm signals can be measured.

A Parallax-free, Storable Display

The 141T spectrum analyzer mainframe and display features a variable persistence CRT which enables response storage for any measurement. With very narrow bandwidth measurements, extremely slow sweeps are necessary to maintain amplitude calibration (allowing band-pass filters time to respond). A recording CRT is necessary to save this response for viewing. Of course, any response can be stored for a display ready to be photographed. Another display mainframe, the 140T, is available with standard persistence.

Interpretation of response levels on the CRT is free from parallax since the graticule is etched on the inside of the display screen adjacent to the phosphor.

IF Section Adds Convenience Features

The high resolution 8552B or the economic 8552A IF section features video filtering, recorder outputs and an internal calibration signal to make the spectrum analyzer easier to use. Video filtering is a low-pass filter which averages noise amplitude response for easier small signal readings. It also makes wide band noise measurements easier.

Recorder outputs, including pen lift, allow hard copy duplication of the CRT display. Manual scan allows setting up of accessories, such as X-Y recorders, adjusting signals on screen during slow scans and measuring frequencies with a counter.

The internal calibration standard is a very stable -30 dBm, 30 MHz signal for quick front panel calibration.

Tracking Generators for Each Frequency Band

Either available internally, or as a companion instrument, are leveled signal sources designed to track the swept tuning frequency of the spectrum analyzer. Amplifiers, filters or any circuit which requires an input signal can be characterized to 1300 MHz, with typically wider dynamic range and more precise frequency accuracy than with the spectrum analyzer alone.

The 8556A low frequency tuning section has an internal tracking generator, standard with the instrument. The 8553B and 8554B/8555A use separate generators namely 8443A and 8444A respectively.

8750A Storage-Normalizer

You can add digital storage to the 140-series spectrum analyzer with the 8750A (Opt. 001) and an external oscilloscope. Digital storage provides a flicker-free display regardless of the analyzer sweep speed and facilitates trace comparisons of two traces. If a tracking generator is employed, the normalization feature significantly reduces frequency response variations. The 8750A Storage-Normalizer is a versatile accessory which may be used directly with other HP spectrum and network analyzers. (See Page 491).

General Specifications

141T Spectrum Analyzer System

Input impedance: 50 Ω nominal. Reflection coefficient <0.30 (1.85 SWR), input attenuator ≥ 10 dB.

Maximum input level: peak or average power $+13$ dBm (1.4 V ac peak), ± 50 V dc.

Attenuator: 0 to 50 dB in 10 dB steps.

Scan time: 16 internal scan rates from 0.1 ms/div to 10 sec/div in a 1, 2, 5 sequence, and manual scan (8552B only).

Scan time accuracy

0.1 ms/div to 20 ms/div: $\pm 10\%$.

50 ms/div to 10 s/div: $\pm 20\%$.

Scan mode

Int: analyzer repetitively scanned by internally generated ramp; synchronization selected by scan trigger

Single: single scan with front panel reset.

Ext: scan determined by 0 to $+8$ volt external signal.

Manual: scan determined by front panel control.

Scan trigger: for internal scan mode, select between

Auto: scan free-runs.

Line: scan synchronized with power line frequency.

Ext: scan synchronized with >2 volt (20 volt max.) signal.

Video: scan internally synchronized to envelope of RF input.

Auxiliary outputs:

Vertical output: 0 to -0.8 V for full deflection.

Scan output: -5 V to $+5$ V for 10 div CRT deflection.

Pen lift output: 0 to 14 V (0 V, pen down).

Display Characteristics

141T, 140T

Plug-ins: accepts Models 8552A/B, 8553B, 8554B, 8555A and 8556A and Model 140 series Oscilloscope plug-ins.

Cathode-ray tube type

Model 141T: post-accelerator storage tube, 9000 volt accelerating potential; aluminumized P31 phosphor.

Model 140T: post-accelerator, 7300 volt potential medium-short persistence (P39) phosphor.

Cathode-ray tube graticule

Model 141T: 8 x 10 division (approx, 7.1 cm x 8.9 cm parallax-free internal graticule).

Persistence, model 141T only

Normal: natural persistence of P31 phosphor (0.1 second).

Variable

Normal writing rate mode: continuously variable from less than 0.2 second to more than one minute.

Maximum writing rate mode: from 0.2 second to 15 seconds.

Erase: manual; erasure takes approximately 350 ms.

Storage time model 141T only: normal writing rate; more than 2 hours at reduced brightness (typically 4 hours).

Fast writing speed, model 141T only: more than 15 minutes.

Functions used with oscilloscope plug-ins only. Intensity modulation, calibrator; beam finder.

EMI: conducted and radiated interference is within requirements of MIL-I-16910C and MIL-1-6181D and methods CEO3, and REO2 of MIL-STD-461 (except 35 to 40 kHz) when appropriate RF tuning section and 8552A or 8552B are combined in a 140T or 141T Display Section.

Temperature range: operating, 0°C to $+55^{\circ}\text{C}$; storage, -40°C to $+75^{\circ}\text{C}$.

Power requirements: 100, 120, 220, or 240V $\pm 5\%$. -10% . 50 to 60 Hz, normally less than 225 watts (includes plug-ins used).

Weight

Model 8552A or 8552B IF section: net, 4.1 kg (9 lb). Shipping 6.4 kg (14 lb).

Model 140T display section: net, 18 kg (40 lb). Shipping, 25 kg (54 lb).

Model 141T display section: net, 19.2 kg (43 lb). Shipping, 26 kg (57 lb).

Tuning section: see following pages.

Size: model 140T or 141T with plug-ins: 221 H x 425 W x 416 mm D (8.8" x 16.8" x 16.4").

Special order: chassis slides and adapter kit.

Ordering Information

140T Normal Persistence Display

Opt 908: Rack Flange Kit

141T Variable Persistence Display

Opt 908: Rack Flange Kit

8552A Economy IF Section

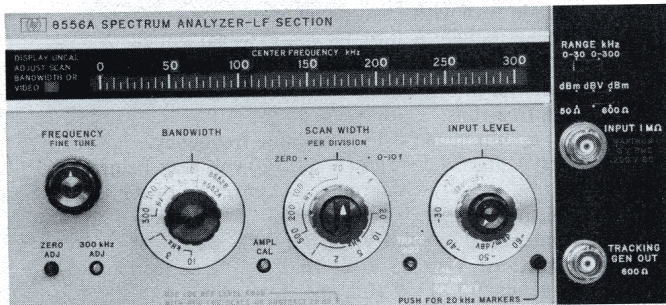
8552B High Resolution IF Section

SIGNAL ANALYZERS

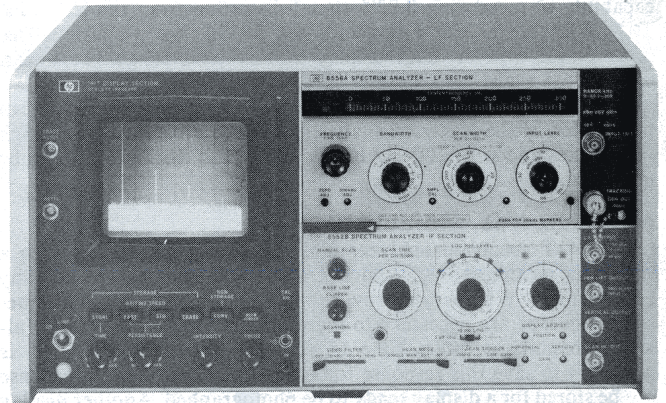
141T Spectrum Analyzer System: 20 Hz to 300 kHz

Model 8556A

- Accurate signal level measurements (± 0.95 dB)
- Accurate frequency measurements (± 3 Hz)
- High sensitivity (-152 dBV)
- Built-in tracking generator



8556A



General Purpose Measurement Flexibility

The 8556A Spectrum Analyzer covers the frequency range from 20 Hz to 300 kHz. It was designed to accommodate the variety of characteristic impedances and amplitude units used in making audio measurements. Balanced or unbalanced inputs are available, and open circuit voltages (dBV or linear) or power (dBm) in several characteristic impedances may be measured. The analyzer is capable of high resolution; frequencies can be measured very accurately. A built-in tracking generator further increases the instrument's utility.

Frequency Range

The 8556A has two frequency scales, 0-300 kHz for full coverage and 0-30 kHz for better resolution at low frequencies. The analyzer may be swept symmetrically about a tunable center frequency, swept from 0 Hz to a selectable end point, or operated as a fixed tuned receiver. 20 kHz crystal markers (accurate to 0.01%) can be generated on the CRT to make very accurate frequency measurements.

Absolute Amplitude Calibration

The 8556A is calibrated for dBm in 600Ω, dBm in 50Ω, dBV, and volts. The very accurate reference level control (± 0.2 dB) and vernier (± 0.25 dB) allow the IF substitution technique to be used to improve amplitude measurement accuracy.

Low Distortion

Careful design has decreased analyzer distortion to the extent that a full 70 dB dynamic range is achieved. This allows small signals, such as harmonic or intermodulation distortion, to be measured in the presence of large ones.

Resolution—Sensitivity

Resolution bandwidths from 10 Hz to 10 kHz are provided on the 8556A. Using the narrow bandwidth, 50 or 60 Hz line related sidebands can be measured. The analyzer's extremely low noise figure together with its narrow bandwidths makes the 8556A very sensitive. Signals as low as -152 dBV (25 nV) can be measured in a 10 Hz bandwidth. The 8556A may be used to measure EMI, such as interference conducted along an ac power line.

Isolated Input

The isolated input eliminates the possibility of spurious signal pickup which could be caused by line related ground currents flowing in the ground connections between the analyzer and signal source. The input impedance (1 MΩ) is high enough so that a scope probe may be used with a minimum of loading. An optional balanced input is available which is transformer coupled for isolation and high common mode rejection. The input impedance is 15 kΩ, and the analyzer is calibrated for either dBm-135Ω or dBm-150Ω as well as dBm-600Ω and dBm-900Ω. Balance (symmetry) is 80 dB at 50 Hz and typically 50 dB at 300 kHz.

Tracking Generator

A tracking generator is built into the 8556A. If an external counter is connected to the tracking generator, frequencies can be measured to an accuracy of ± 3 Hz. Swept insertion loss or return loss measurements can be made on a device such as an amplifier or filter. A 140 dB measurement range is possible using the narrowest resolution bandwidth. The tracking generator also provides a convenient signal for compensating an oscilloscope probe used with the 8556A.

Other Applications

The combination of a tracking generator and spectrum analyzer in this frequency range is valuable in applications such as receiver testing and fault location.

Specifications—with 8552B IF Section

Frequency Specifications

Frequency range: 20 Hz to 300 kHz. Tuning dial ranges of 0-30 kHz and 0-300 kHz.

Scan width: (on a 10-division CRT horizontal axis)

Per division: 10 calibrated scan widths from 20 Hz/div to 20 kHz/div in a 1, 2, 5 sequence.

0-10 f: 10 calibrated preset scans, from 200 Hz to 200 kHz in a 1, 2, 5 sequence. Analyzer scans from zero frequency to ten times the scan width per division setting.

Zero: analyzer is a fixed tuned receiver.

Frequency accuracy

Center frequency accuracy: 0-30 kHz Range: ± 500 Hz; 0-300 kHz Range: ± 3 kHz.

Marker accuracy: RF markers every 20 kHz accurate to within $\pm 0.01\%$. Markers controlled by front panel on/off switch.

Scan width accuracy: frequency error between any two points on the display is less than $\pm 3\%$ of the indicated frequency separation.

Stability

Residual FM: sidebands >60 dB down 50 Hz or more from CW signal, scan time ≥ 1 sec/div, 10 Hz bandwidth.

Noise sidebands: more than 90 dB below CW signal, 3 kHz away from signal, with a 100 Hz IF bandwidth.

Frequency drift: less than 200 Hz/10 min.

Resolution

Bandwidth ranges: IF bandwidths of 10 Hz to 10 kHz are provided in a 1, 3, 10 sequence.

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

Bandwidth selectivity: 60 dB/3 dB IF bandwidth ratios, with IF section: $<11:1$ for IF bandwidths from 10 Hz to 3 kHz; $<20:1$ for 10 kHz bandwidth. For 10 Hz bandwidth, 60 dB points are separated by less than 100 Hz.

Amplitude Specifications
Absolute amplitude calibration

Log calibration modes	
dBV	0 dBV = 1 V rms
dBm-600Ω	0 dBm = 1 mW-600Ω
dBm-50Ω	0 dBm = 1 mW-50Ω

Input impedance is 1 MΩ. dBm ranges are referenced with input properly terminated externally.

Log calibration range: from -150 dBm/dBV to +10 dBm/dBV.
Log display range: 10 dB/div on a 70 dB display, or 2 dB/div on a 16 dB display.

Linear sensitivity: from 0.1 μV/div to 1 V/div in a 1, 2, 10 sequence. Linear sensitivity vernier X1 to X0.25 continuously.

Dynamic range

INPUT LEVEL control: -10 to -60 dBm/dBV in 10 dB steps. Accuracy ±0.2dB. Marking indicates maximum input levels for 70 dB spurious-free dynamic range.

Average noise level: (specified with a 600Ω or less source impedance and INPUT LEVEL at -60 dBm/dBV)

Mode	1 kHz IF Bandwidth	10 Hz IF Bandwidth
dBm-50Ω	<-122 dBm (180 nV)	<-142 dBm (18 nV)
dBm-600Ω	<-130 dBm (250 nV)	<-150 dBm (25 nV)
dBV	<-132 dBV (250 nV)	<-152 dBV (25 nV)
Linear	<400 nV	<40 nV

Video filter: averages displayed noise; bandwidth of 10 kHz, 100 Hz, and 10 Hz. Bandwidth accuracy ±20%.

Spurious responses: input signal level ≤ INPUT LEVEL setting; out of band mixing responses, harmonic and intermodulation distortion products are all more than 70 dB below the input signal level 5 kHz to 300 kHz; 60 dB, 20 Hz to 5 kHz. Third order intermodulation products are more than 70 dB below the input signal level, 5 kHz to 300 kHz with signal separation >300 Hz.

Residual responses (no signal present at input): With the INPUT LEVEL at -60 dBm/dBV and the input terminated with 600Ω or less, all line related residual responses from 0 to 500 Hz are below -120 dBm/dBV. All other residual responses are below -130 dBm/dBV.

Amplitude accuracy:	Log	Linear
Frequency response	±0.2 dB	±2.3%
Amplitude display	±0.25 dB/dB but not more than ±1.5 dB over 70 dB display range	±2.8% of full 8 div display

Log reference level control: provides 90 dB IF gain control in 10 dB steps. Accurate to ±0.2 dB (±2.3%).

Log reference level vernier: provides continuous 12dB range. Accurate to ±0.1 dB (±1.2%) in 0, -6, -12 dB positions; otherwise ±0.25 dB (±2.8%).

Amplitude measurement accuracy: ±0.95 dB with proper technique.

General

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

Scan mode

- Int:** analyzer repetitively scanned internally.
- Ext:** scan determined by 0 to +8 volt external signal.
- Single:** single scan actuated by front panel button.
- Manual:** scan determined by front panel control.

Input level: provides 50 dB control of input preamplification and attenuation to prevent input overload. INPUT LEVEL markings of -60 dBm/dBV to -10 dBm/dBV indicate maximum input level for a minimum of 70 dB spurious-free dynamic range. Accuracy ±0.2 dB (2.3%).

Input impedance: 1 MΩ shunted by ≈32 pF.

Maximum input level: 10 V rms, ±200 V dc. Ground terminals of BNC input connectors are isolated from the analyzer chassis ground to minimize ground loop pickup at low frequencies.

Maximum voltage, isolated ground to chassis ground: ±100 V dc.

Isolated ground to chassis ground impedance: 100 kΩ shunted by approximately 0.3 μF.

Gain compression: for input signal level 20 dB above INPUT LEVEL setting, gain compression is less than 1 dB.

Tracking Generator Specifications

Frequency range: tracks the analyzer tuning, 20 Hz to 300 kHz.
Amplitude range: continuously variable from 100 mV rms to greater than 3 V rms into an open circuit.

Amplitude accuracy: with TRACKING GEN LEVEL in CAL position and 20 kHz markers off, output level at 100 kHz is 100 mV ±0.3 dB into an open circuit.

Frequency response: ±0.25 dB 50 Hz to 300 kHz.

Output impedance: 600Ω.

Residual FM: <1 Hz peak-to-peak.

Power requirements: 100, 120, 200, or 240 V +5%, -10%, 50 to 60 Hz, normally less than 225 watts.

Weight: Model 8556A LF section: net, 3.7 kg (8 lb). Shipping, 5.3 kg (12 lb).

Size: 102 x H x 226 x W 344 mm D (4" x 8.9" x 13.5").

Specifications with 8556A Options 001, 002-balanced Input

Amplitude

Log calibration modes-balanced (bridged) Input

dBm-135Ω (Option 001)	0 dBm = 1mW-135Ω
dBm-150Ω (Option 002)	0 dBm = 1mW-150Ω
dBm-600Ω	0 dBm = 1mW-600Ω
dBm-900Ω	0 dBm = 1mW-900Ω

Input impedance is typically 15 kΩ. dBm ranges are referenced with input properly terminated externally.

Input

Maximum input levels: normal Mode, ±20 V rms or ±150 V dc for normal mode (symmetrical) signals between input signal connectors; Common Mode, 200 V rms at 60 Hz or ±500 V dc for common mode (asymmetrical) voltages between input signal connectors and GUARD or instrument chassis; Guard, ±100 V dc from GUARD to instrument chassis. (GUARD to chassis impedance is approximately 100 kΩ shunted by 0.3μF.)

Balance (Symmetry): 0 -30kHz Range, greater than 80 dB, 50 Hz to 1 kHz; 1 -300 kHz range, greater than 60 dB, 1 kHz to 20 kHz.

Ordering Information

8556A RF Section

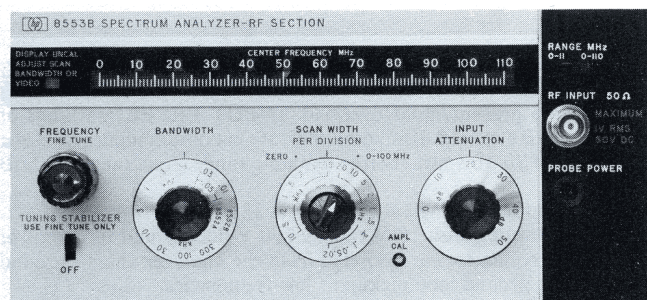
- Opt 001:** Balanced input
- Opt 002:** Balanced input

SIGNAL ANALYZERS

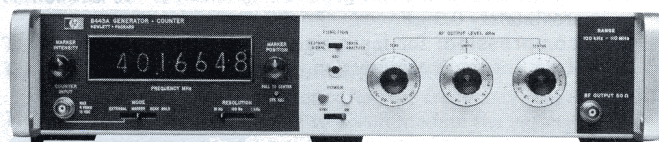
141T Spectrum Analyzer System: 1 kHz to 110 MHz
Models 8553B & 8443A

- Wide frequency range
- 10 Hz resolution bandwidth
- High sensitivity (-140 dBm)

- Accurate amplitude measurements (± 1.25 dB)
- 10 Hz frequency accuracy with tracking generator
- 130 dB swept measurement range



8553B



8443A



General Purpose

The 8553B Spectrum Analyzer makes absolute amplitude and frequency measurements over the 1 kHz to 110 MHz range. This frequency span includes audio, video, navigation aids, telemetry, multiplex communication systems basebands, commercial AM, FM, TV, and land mobile communication. The analyzer features high resolution and stability, low distortion, high sensitivity, and a wide dynamic range. A tracking generator is available which improves the frequency measurement accuracy of the analyzer and can be used to make swept measurements.

Wide Frequency Range

The broad frequency range of 1 kHz to 110 MHz extends from audio through the FM broadcast band. Scan widths from 200 Hz to 100 MHz allow a user to view all or selected parts of the frequency spectrum while the zero scan mode turns the analyzer into a fixed tuned receiver and displays amplitude variations in the time domain. The analyzer has two dial scales, 0–110 MHz for full coverage and 0–11 MHz for better resolution at low frequencies.

Resolution—Stability

The 8553B has resolution bandwidths that range from 300 kHz to 10 Hz. Wide bandwidths are necessary for making measurements on a wideband spectrum such as FM. The extremely high resolution 10 Hz bandwidth allows measurement of 50 Hz sidebands 60 dB down. Such high resolution is made possible by automatic stabilization through phase lock, which reduces residual FM to a negligible level. Good stability is required to measure oscillator residual FM and drift.

Absolute Amplitude Calibration

The 8553B Spectrum Analyzer is absolutely calibrated in both dBm and volts from -142 dBm (18 nV) to $+10$ dBm (0.7 V). This absolute calibration is derived from a built-in calibrator (-30 dBm at 30 MHz) and extremely flat analyzer frequency response (± 0.5 dB). A display uncal. light warns if the display becomes uncalibrated. The probe power output supplies power to a high impedance probe which can be used to make bridging measurements on circuits terminated at both ends.

High Sensitivity

A low analyzer noise figure and narrow bandwidths give the 8553B very high sensitivity. Signal levels as low as -140 dBm can be measured in 10 Hz bandwidth, and a preamplifier is available to further increase sensitivity by 16 dB. Video filtering in 10 kHz, 100 Hz and 10 Hz bandwidths will average the displayed noise. High analyzer sensitivity is required if distortion in an amplifier or oscillator is to be measured as a function of output level. In EMI studies, field strength can be measured with a calibrated antenna.

70 dB Dynamic Range

The 8553B has a 70 dB dynamic range when the signal level is properly conditioned at the input mixer. A wide dynamic range is necessary to measure small signals in the presence of large ones, such as harmonic or intermodulation distortion or to monitor signals of widely varying amplitudes, such as in EMC, RFI, and surveillance work.

8443A Tracking Generator-Counter

A tracking generator, 8443A, is available which covers the 100 kHz to 110 MHz frequency range of the 8553B. It has a built-in counter, and precision RF attenuators which are useful in making substitution measurements.

Frequency Accuracy

In conjunction with an 8443A Tracking Generator, the 8553B Spectrum Analyzer can measure frequencies to an accuracy of ± 10 Hz. When the 8443A is operated in the "track analyzer" mode, the counter will read the frequency at a tunable marker which is generated on the analyzer CRT. The "restore signal" mode is a more convenient way to measure signal frequencies in wide scans because the counter reads the signal frequency automatically without fine tuning. The 8443A Tracking Generator may also be used externally as a 120 MHz direct reading counter.

Swept Measurements

The 8443A Tracking Generator can be used with the 8553B to make swept insertion loss and return loss measurements over the 100 kHz to 110 MHz frequency range. Because the signal source tracks the analyzer's tuning, up to 130 dB dynamic measurement range is possible (at 10 Hz bandwidth). Excellent system flatness (± 1.0 dB) insures the accurate determination of swept response characteristics.

Specifications—with 8552B IF Section

Frequency Specifications

Frequency range: 1 kHz–110 MHz (0–11 MHz and 0–110 MHz tuning ranges).

Scan width (on 10-division CRT horizontal axis)

Per division: 18 calibrated scan widths from 20 Hz/div to 10 MHz/div in a 1, 2, 5 sequence.

Preset: 0–100 MHz, automatically selects 300 kHz bandwidth IF Filter.

Zero: analyzer is fixed tuned receiver with selectable bandwidth.

Frequency accuracy

Center frequency accuracy: the dial indicates the display center frequency within ± 1 MHz on the 0–110 MHz tuning range; ± 200 kHz on the 0–11 MHz tuning range with FINE TUNE centered, and temperature range of 20°C to 30°C.

Scan width accuracy: scan widths 10 MHz/div to 2 MHz/div and 20 kHz/div to 20 Hz/div: Frequency error between two points on the display is less than $\pm 3\%$ of the indicated frequency separation between the two points. Scan widths 1 MHz/div to 50 kHz/div: Frequency error between two points on the display is less than $\pm 10\%$ of the indicated frequency separation.

Resolution

Bandwidth: IF Bandwidths of 10 Hz to 300 kHz are provided in a 1, 3 sequence.

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

Bandwidth selectivity: 60 dB/3 dB IF bandwidth ratios: 10 Hz to 3 kHz bandwidths, $<11:1$; 10 kHz to 300 kHz bandwidths, $<20:1$; 60 dB points on 10 Hz bandwidth separated by <100 Hz.

Stability

Residual FM stabilized: sidebands >60 dB down 50 Hz or more from CW signal, scan time ≥ 1 sec/div, 10 Hz bandwidth (typically less than 1 Hz peak-to-peak).

Residual FM unstabilized: <1 kHz peak-to-peak.

Noise sidebands: more than 70 dB below CW signal, 50 kHz or more away from signal, with 1 kHz IF bandwidth.

Long term drift (after 1-hour warm-up), stabilized: 500 Hz/10 min; unstabilized: 5 kHz/min, 20 kHz/10 min.

Amplitude Specifications

Absolute amplitude calibration range

Log: from -130 to $+10$ dBm, 10 dB/div on a 70 dB display or 2 dB/div on a 16 dB display.

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

Dynamic range

Average noise level: <-110 dBm with 10 kHz IF bandwidth.

Video filter: averages displayed noise; 10 kHz, 100 Hz, and 10 Hz bandwidths.

Spurious responses: are below a -40 dBm signal at the input mixer as follows: All image and out-of-band mixing responses, harmonic and intermodulation distortion more than 70 dB down, 2 MHz to 110 MHz; more than 60 dB down, 1 kHz to 2 MHz. Third order intermodulation products more than 70 dB down, 1 kHz to 110 MHz (Signal separation >300 Hz).

Residual responses (no signal present at input): with input attenuation at 0 dB: <-110 dBm (200 kHz to 110 MHz); <-95 dBm (20 kHz to 200 kHz).

Amplitude accuracy:

Frequency response
(Flatness: attenuator
settings >10 dB):

1 kHz to 110 MHz

Amplitude Display

	Log	Linear
	± 0.5 dB	$\pm 5.8\%$
	± 0.25 dB/dB	$\pm 2.8\%$ of
	but not more than ± 1.5	full 8 div
	dB over the full	deflection
	70 dB display range	

Calibrator amplitude: -30 dBm, ± 0.3 dB

Calibrator frequency: 30 MHz, ± 3 kHz.

Log reference level control: provides 70 dB range (60 dB below 200 kHz), in 10 dB steps. Accurate to ± 0.2 dB ($\pm 2.3\%$, Linear Sensitivity).

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

Amplitude measurement accuracy: ± 1.25 dB with proper technique.

General

Input impedance: 50 Ω nominal, BNC connector. Reflection coefficient <0.13 (1.3 SWR), input attenuator ≥ 10 dB. A special 75 Ω 8553B/8552B is available.

Maximum input level: peak or average power $+13$ dBm (1.4 V ac peak), ± 50 V dc, 1 dB compression point, -10 dBm.

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

Scan mode

Int: analyzer repetitively scanned internally.

Ext: scan determined by 0 to $+8$ -volt external signal.

Manual: scan determined by front panel control.

Attenuator: 0 to 50 dB, in 10 dB increments, coupled to Log Reference Level indicator; automatically maintains absolute calibration. Attenuator accuracy ± 0.2 dB.

Power requirements: 100, 120, 220, or 240 V $+5\%$, -10% , 50 to 60 Hz, normally less than 225 watts.

Weight: Model 8553B RF Section: net, 5.5 kg (12 lb). Shipping, 7.8 kg (17 lb).

Size: 102 H x 226 W x 334 mm D (4" x 8.9" x 13.5").

Tracking Generator-Counter (8443A)

Frequency range: 100 kHz to 110 MHz.

Amplitude range: <-120 dBm to $+10$ dBm in 10 and 1 dB steps with a continuous 1.2 dB vernier.

Amplitude accuracy

Frequency response (flatness): ± 0.5 dB.

Absolute: 0 dBm at 30 MHz: ± 0.3 dB.

Output impedance: 50 Ω , BNC connector, ac coupled, reflection coefficient ≤ 0.09 (1.2 SWR) with output <0 dBm.

Counter

Display: 7 digits with 1 digit over-range. Reads to ± 10 Hz increments.

Resolution (gate time): 1 kHz (1 ms), 100 Hz (10 ms), 10 Hz (100 ms).

Accuracy: ± 1 count \pm time base accuracy.

Time base aging rate: $<3 \times 10^{-9}$ /day (0.3 Hz/day) after warm-up.

External counter inputs: 10 kHz to 120 MHz, 50 Ω , -10 dBm min.

Power: 100, 120, 220, or 240 V $+5\%$, -10% , 48 to 440 Hz 75 watts.

Weight: Model 8443A: net, 11.04 kg (24.3 lb). Shipping, 14.47 kg (31.9 lb).

Size: 88.2 H x 425 W x 467 mm D (3.5" x 16.8" x 18.4").

Ordering Information

8553B RF Section

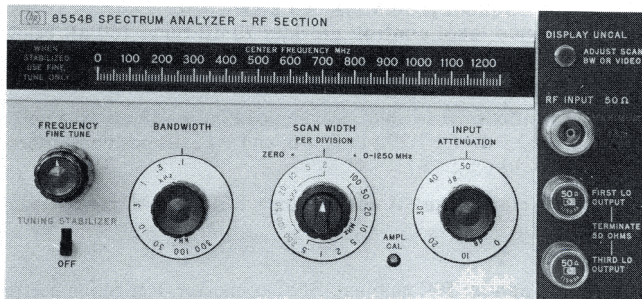
8443A Tracking Generator-Counter

SIGNAL ANALYZERS

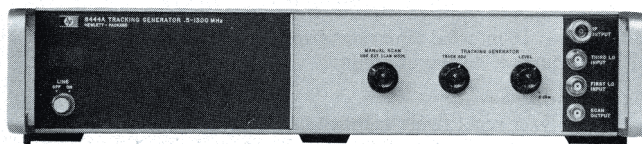
141T Spectrum Analyzer System: 100 kHz to 1250 MHz
Models 8554B & 8444A

- High resolution to 100 Hz
- Flat frequency response ± 1 dB
- High sensitivity to -122 dBm (180 nV)

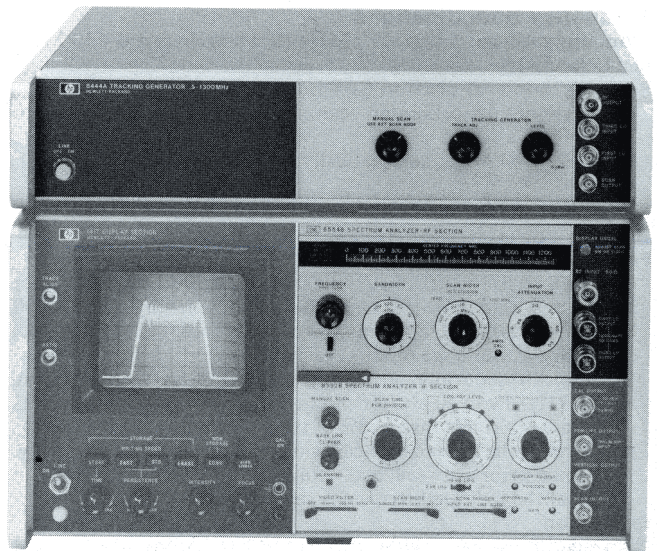
- Variable persistence display
- Companion tracking generator
- Optional internal limiter



8554B



8444A



8554B Spectrum Analyzer

The 8554B Spectrum Analyzer RF Section covers the frequency range from 100 kHz to 1250 MHz. This broad frequency coverage allows analysis from baseband through UHF navigation bands. Absolute amplitude calibration is maintained over the entire range. Some typical applications include power and frequency measurements on modulation, distortion and spurious outputs, frequency response measurements of filters, amplifiers, modulators and mixers. The analyzer can also be used to make noise measurements such as noise power density over a specified frequency band, carrier-to-noise ratio or swept noise figure measurement of amplifiers. With a calibrated antenna or current probe the analyzer can characterize broadband and narrowband signals encountered in EMI applications.

Absolute Amplitude Calibration

Absolute amplitude measurements can be made from $+10$ to -122 dBm with ± 2.8 dB accuracy. This accuracy can be improved to ± 1.75 dB using IF substitution. The display is calibrated in log (dBm) to obtain a wide display range and linear (voltage) for measurements requiring maximum resolution. The top graticule line on the CRT is a calibrated reference level which can be changed by the front panel controls from $+10$ to -72 dBm for IF substitution measurements. Amplitude calibration is dependent upon the proper relationship between sweep width, sweep time, resolution bandwidth and video filtering. An uncal warning light is present to indicate an uncalibrated situation.

Flat Frequency Response

In broadband use, the wide bandwidths allow fast sweeping of the entire spectrum. The analyzer is extremely flat (± 1 dB) over its entire range, allowing direct comparisons of signal amplitudes displayed on the CRT. A 0 to 50 dB input attenuator is provided to prevent overdriving the input mixer.

Resolution

The low residual FM (< 100 Hz peak-to-peak) of the 8554B makes possible resolution bandwidths as narrow as 100 Hz. This enables resolving closely spaced signals such as 1 kHz and 400 Hz sidebands. Bandwidths range from 100 Hz to 300 kHz in a 1, 3, 10 sequence making it easy to select an optimum bandwidth to scan width ratio.

The resolution bandwidths consist of synchronously tuned "gaussian" shaped filters to enable faster sweeping for any given bandwidth. In addition, these filters have narrow shape factors making it possible to measure closely spaced signals differing greatly in amplitude.

Sensitivity

The high sensitivity (-122 dBm in 100 Hz bandwidth) and wide spurious-free measurement range (> 65 dB) of the 8554B means accurate measurements can be made on low level signals and signals varying widely in amplitude. For example, modulation as low as 0.2% can be measured. Low level harmonic and intermodulation distortion, spectrum surveillance and EMI are just a few of the measurements possible. A video filter is provided in the IF section to average displayed noise and simplify the measurement of low level signals.

Automatic Tuning Stabilization

The 8554B Spectrum Analyzer is automatically stabilized in narrow scans. This gives the stability (< 100 Hz peak-to-peak residual FM) needed for high resolution analysis. Stabilization is accomplished by phase locking the LOs (local oscillators) to a crystal reference in scan widths 200 kHz/div and below. No signal recentering or checking for stabilization is required because the signal remains on screen when phase locked.

8444A Tracking Generator

The 8444A Tracking Generator is a signal source, which, when connected to the 8554B Spectrum Analyzer, has an output whose frequency is the same as the swept frequency of the analyzer. The tracking generator is used as a signal source to measure the frequency response of a device. It can also be used for precision frequency measurements. An external counter output is provided on the 8444A and the frequency of unknown signals as well as the frequency of any point on a frequency response curve can be measured. The use of the 5300/5305B Counter is suggested for frequency measurements to 1300 MHz.

The tracking generator-spectrum analyzer system can be used as a sweeper to provide test signals for other devices. The sweep widths and sweep rates are controlled from the spectrum analyzer and the output level from the tracking generator.



8554B Specifications—with 8552B IF Section

Frequency Specifications

Frequency range: 100 kHz to 1250 MHz.

Scan width (on 10-division CRT horizontal axis)

Per division: 15 calibrated scan widths from 100 MHz/div to 2 kHz/div in a 1, 2, 5 sequence.

Preset: 0-1250 MHz, automatically selects 300 kHz bandwidth IF filter.

Zero: analyzer is fixed-tuned receiver.

Frequency accuracy

Center frequency accuracy: The dial indicates the display center frequency within 10 MHz.

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

Resolution

Bandwidth: IF bandwidths of 0.1 to 300 kHz provided in a 1, 3, 10 sequence.

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

Bandwidth selectivity: 60 dB/3 dB IF bandwidth ratio $< 20:1$ for IF bandwidths from 10 kHz to 200 kHz. 60 dB/3 dB bandwidth ratio $< 11:1$ for IF bandwidths 100 Hz to 3 kHz.

Stability (residual FM)

Stabilized: < 100 Hz peak-to-peak.

Unstabilized: < 10 kHz peak-to-peak.

Noise sidebands: more than 70 dB below CW signal, 30 kHz or more away from signal, with 1 kHz IF bandwidth.

Amplitude Specifications

Absolute amplitude calibration range

Log: from -122 to $+10$ dBm. 10 dB/div on a 70 dB display, or 2 dB/div 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.

Dynamic range

Average noise level: < -102 dBm with 10 kHz IF bandwidth.

Spurious responses: All image and out-of-band mixing responses, harmonic and intermodulation distortion products are more than 65 dB below a -40 dBm signal at the input mixer.

Residual responses (no signal present at input): with input attenuation at 0 dB: < -100 dBm.

Amplitude accuracy

	Log	Linear
Frequency response (flatness)		
100 kHz to 1250 MHz	± 1 dB	$\pm 12\%$
Switching between bandwidths (at 20°C)	± 0.5 dB	$\pm 5.8\%$
Amplitude display	± 0.25 dB/dB but not more than ± 1.5 dB over the full 70 dB display range.	2.8% of full 8 div deflection

Calibrator output

Amplitude: -30 dBm, ± 0.3 dB.

Frequency: 30 MHz, ± 3 kHz.

Log reference level control: provides 70 dB range (60 dB below 200 kHz), in 10 dB steps. Accurate to ± 0.2 dB ($\pm 2.3\%$, Linear Sensitivity).

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

Amplitude measurement accuracy: ± 1.75 dB with proper technique.

RF Input Specifications

Input impedance: 50 Ω nominal. Typical reflection coefficient < 0.30 (1.85 SWR), input attenuator ≥ 10 dB.

Maximum input level: peak or average power $+13$ dBm (1.4 V ac peak), ± 50 V dc.

General

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

Scan time accuracy

0.1 ms/div to 20 ms/div: $\pm 10\%$.

50 ms/div to 10 s/div: $\pm 20\%$.

Weight

Model 8554B RF section: net, 4.7 kg (10.3 lb). Shipping 7.8 kg (17 lb).

Size: 102 H, 226 W, 344 mm D (4" x 8.9" x 13.5").

8444A Specifications

Specifications for Swept Frequency Response

Measurements

Dynamic range: > 90 dB from spectrum analyzer 1 dB gain compression point to average noise level (approximately -10 dBm to -100 dBm). Spurious responses not displayed.

Gain compression: for -10 dBm signal level at the input mixer, gain compression < 1 dB.

Absolute amplitude calibration range:

Tracking generator (drive level to test device: 0 to -10 dBm continuously variable. 0 dBm absolutely calibrated to ± 0.5 dB at 30 MHz).

Frequency range: 500 kHz to 1250 MHz.

Frequency resolution: 1 kHz.

Stability

Residual FM (peak-to-peak): stabilized, < 200 Hz; unstabilized, < 10 kHz.

Amplitude accuracy

System frequency response: ± 1.50 dB.

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

Specifications for Precision Frequency Measurements

Frequency accuracy: for unknown signals ± 10 kHz. (Tracking drift typically 50 kHz/10 min after 2-hour warm-up). For points on frequency response curve, counter accuracy \pm Residual FM (200 Hz).

Counter mode of operation

Manual scan: scan determined either by front panel control of 8552B IF Section or by external scan signal provided by the 8444A.

Zero scan: analyzer is fixed-tuned receiver. Counter reads center frequency to accuracy of tracking drift.

Counter output level: typically 0.1 V rms.

Specifications for Sweep/CW Generator

Frequency: controlled by spectrum analyzer. Range 500 kHz to 1250 MHz with 8554B. Scan widths are as enumerated on this page.

Frequency accuracy: ± 10 MHz using spectrum analyzer tuning dial. Can be substantially improved using external counter output.

Flatness: ± 0.5 dB.

Spectral purity

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

Harmonic distortion: 25 dB below output level (typical).

Nonharmonic (spurious) signals: > 35 dB below output level.

Long term stability: drift typically less than 30 kHz/hour when stabilized after 2-hour warm-up.

Sweep width: 20 kHz to 1000 MHz.

Sweep rates: selected by Scan Time per Division on spectrum analyzer.

General

Temperature range: operation, 0°C to 55°C , storage -40°C to 75°C .

EMI: conducted and radiated energy is within the requirements of MIL-1-6181D.

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

Weight: net, 7.1 kg (15.6 lb). Shipping, 9.5 kg (21 lb).

Size: 88.2 H, 425 W, 467 mm D (3.5" x 16.8" x 18.4").

Ordering Information

8554B RF Section

Opt 003: Internal Limiter

8444A Tracking Generator

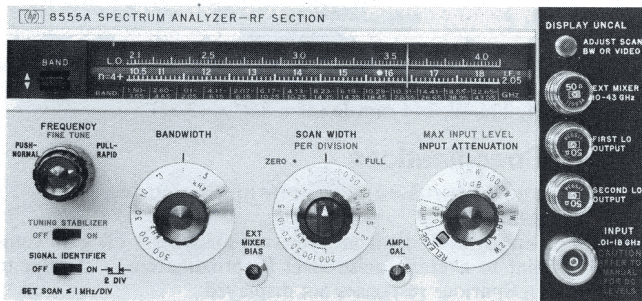
SIGNAL ANALYZERS

141T Spectrum Analyzer System: 10 MHz to 40 GHz

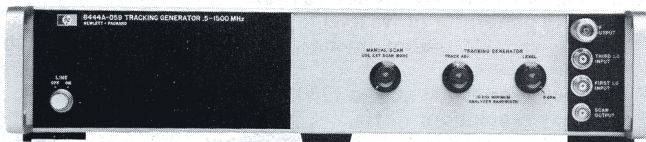
Models 8555A, 8444A Option 059 & 8445B

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

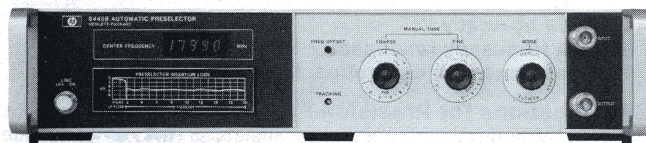
- Scan up to 8 GHz full screen
- 100 dB distortion free dynamic range with preselector
- Companion tracking generator to 1.5 GHz



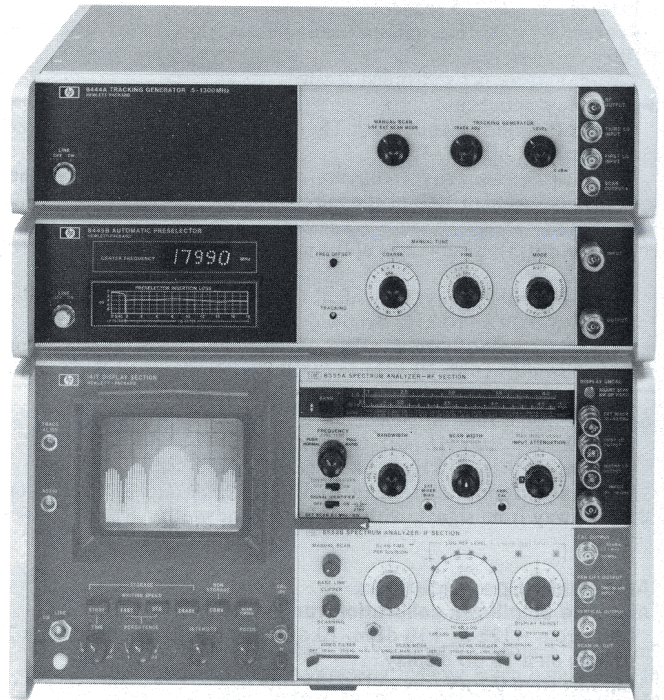
8555A



8444A Opt 059



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 059 Tracking Generator

The 8444A Option 059 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: ± 3.0 kHz/10 min.

Unstabilized: ± 25 kHz/10 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 dBm.

Linear sensitivity: from 0.1 $\mu\text{V}/\text{div}$ to 100 mV/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 ± 3 dB over 1 GHz frequency scans.

Residual responses: referred to input on fundamental mixing: <-90 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 mV/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: ± 0.5 dB.

Linear: $\pm 5.8\%$

SIGNAL ANALYZERS

141T Spectrum Analyzer System: 10 MHz to 40 GHz

Models 8555A, 8444A & 8445B (cont'd)

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 +5%, -10%, 50-60 Hz, normally less than 225 watts (varies with plug-in units used).

Weight: net, 16.8 kg (14.9 lb). Shipping, 8.7 kg (19 lb).

Size: 102 H x 226 W x 344 mm D (4" x 8.9" x 13.5").

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.

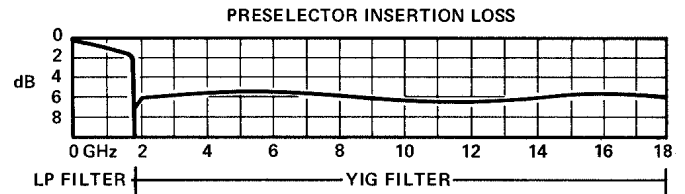
Tracking filter skirt roll-off: characteristics of a three-pole filter. (Nominal: 18 dB/octave.)

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 +5%, -10%, 48 to 440 Hz, less than 110 watts.

Weight: net, 8.8 kg (19.5 lb). Shipping, 11.9 kg (26 lb).

Size: 88.2 H x 425 W x 467 mm D (3.5" x 16.8" x 18.4").

8444A Opt 059 Tracking Generator

Frequency range: 0.5 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.

Weight: net, 7.1 kg (15.6 lb). Shipping, 9.5 kg (21 lb).

Size: 85.2 H x 425 W x 467 mm D (3.5" x 16.8" x 18.4").

Ordering Information

8555A Tuning Section

Opt 001: APC-7 connectors

Opt 002: Internal limiter

Opt 005: Video tape

8445B Tracking Preselector, dc -18GHz

Opt 001: APC-7 connectors

Opt 002: Add manual controls

Opt 003: Add digital frequency readout

Opt 004: Delete low-pass filter

Opt 005: Delete interconnect rigid coax

8444A Opt 059 Tracking Generator

11517A External Mixer (taper section req'd)

11518A Taper Section, 12.4 to 18 GHz

11519A Taper Section, 18 to 26.5 GHz

11520A Taper Section, 26.5 to 40 GHz

SIGNAL ANALYZERS

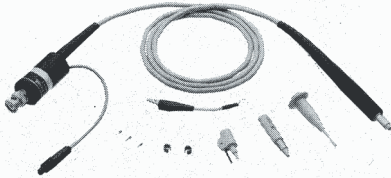
Spectrum analyzer accessories

Models 8750A, 8447 Series, 11694A, 1121A

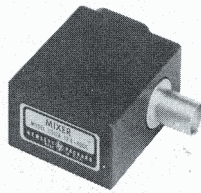
535



11694A



1121A



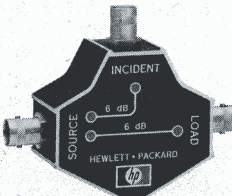
11517A



11693A



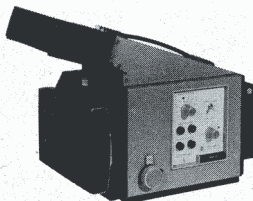
11867A



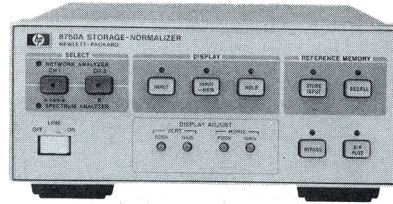
8721A



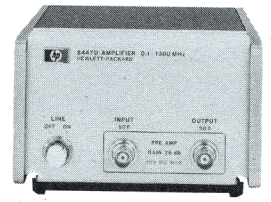
8406A



197B



8750A



8447 Series

8750A Storage-Normalizer

The 8750A is directly compatible with the HP 8557A, 8558B, 8559A, and 8565A Spectrum Analyzers, as well as most HP network analyzers, and requires a conventional low-frequency oscilloscope to be used with the 140 series analyzers. (See page 491).

8447 Series Amplifiers (0.1-1300 MHz)

The 8447 Series Amplifiers feature low noise and wide bandwidth. This makes them ideal for improving spectrum analyzer sensitivity and noise figure while providing input isolation. Accurate measurements over a wide frequency range are assured due to the broad frequency coverage, flat frequency response and low distortion of these amplifiers. (See page 37).

11694A 75Ω Matching Transformer (3-500 MHz)

Allows measurement in 75-ohm systems while retaining amplitude calibration. VSWR is less than 1.2, and insertion loss is less than 0.75 dB. Note: Also see Options 001 and 002 for 75Ω versions of 8557A and 8558B.

1121A Active Probe (0.1-500 MHz)

Provides high impedance (>100 kΩ shunted by <3 pF) input to spectrum analyzer for measurements on sensitive circuits. Probe power is supplied by most HP Spectrum Analyzers and flat response with unity gain assures accurate, convenient measurements. (See page 481).

11517A External Mixer

To extend the frequency range of the 8555A, 8565A and 8566A analyzers to 40 GHz (for use with 8566A, order 11517A, Opt E02). Taper sections for 12.4-18 GHz (11518A), 18-26.5 GHz (11519A) or 26.5-40 GHz (11520A) bands are required.

11693A Limiter (0.1-12.4 GHz)

The Model 11693A Limiter provides input protection for a variety of instruments in general applications (usable from 0.01 to 18 GHz). For example, the input circuits of spectrum analyzers, samplers, or amplifiers may be protected for inputs up to 75 watts peak or 1 watt average power. Also, signal generators can be protected from application of reverse power.

11867A RF Limiter (DC-1800 MHz)

The 11867A is a general purpose diode limiter designed to provide input protection from inadvertent strong signal overloads. Absolute amplitude calibration is maintained with flatness degraded < ±0.25 dB and insertion loss < 0.75 dB. 10 watts average or 100 watts peak power can be tolerated.

8721A Directional Bridge

For making return loss measurements from 100 kHz to 110 MHz. (See page 481 under "11652A: Directional bridge").

8406A Frequency Comb Generator

Produces frequency markers at 1, 10, and 100 MHz increments accurate to ±0.01%. External oscillator can be used to generate precision interpolation sidebands. Comb is usable to beyond 5 GHz.

197B Oscilloscope Camera

For a permanent record of your measurements. (See page 219 for necessary adapters).

Ordering Information

11694A 75Ω Matching Transformer

11517A External Mixer (Mixer only)

11518A/11519A/11520A Waveguide Taper Sections

11693A Limiter

11867A RF Limiter

8406A Frequency Comb Generator

8750A Storage-Normalizer