



SIGNAL ANALYZERS

HP 141T Spectrum Analyzer System: 1 kHz to 110 MHz

Models 8553B & 8443A

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- 10 Hz resolution bandwidth
- High sensitivity (-140 dBm)

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



HP 8553B (141T, 8552B) 8443A

The HP 8553B covers the frequency range 1 kHz to 110 MHz. This frequency range includes audio, video, navigation aids, communications basebands, broadcast AM and FM, and TV. This analyzer features high sensitivity, stability and resolution. The HP 8443A Tracking Generator improves frequency measurement accuracy and provides a tracking source for swept frequency testing of components.

Frequency Range

The frequency range of the HP 8553B extends from audio through the FM broadcast band. In the PER DIVISION mode, scan widths from 200 Hz to 100 MHz can be selected. ZERO SCAN mode allows operation as a fixed tuned receiver with a time domain display. In addition to the full range dial scale, a 0-11 MHz dial scale provides better tuning resolution at low frequencies.

Resolution-Stability

Bandwidths ranging from 10 Hz to 300 kHz may be selected when using an HP 8553B. Wide bandwidths are useful for measurement of FM or other broadband spectra. The 10 Hz bandwidth allows measurement of 60 Hz sidebands which are greater than 60 dB down from the carrier. Low residual FM due to phase-lock stabilization makes this resolution possible. This low residual FM also permits characterization of oscillator stability.

Amplitude Calibration

The HP 8553B is calibrated for either dBm or Volts over the range -142 dBm (18 nV) to $+10$ dBm (0.7 V). An accurate amplitude reference is provided by the internal calibrator. This reference together with low frequency response variations (± 0.5 dB) make possible accurate measurements of absolute amplitude. Calibrated in-circuit made measurements may be made at frequencies from 100 kHz to 110 MHz when using the HP1121A Active Probe with the HP 8553B.

Sensitivity

Low noise figure and 10 Hz bandwidth result in high sensitivity for the HP 8553B. In a 10 Hz bandwidth signal levels of -140 dBm may be measured. With the addition of a low noise preamp, such as the HP 8447, sensitivity can be improved by at least 15 dB.

HP 8443A Tracking Generator-Counter

To complement the HP 8553B, the HP 8443A Tracking Generator provides a tracking source with a frequency range of 100 kHz to 110 MHz. A built-in counter permits precision frequency measurements and RF attenuators allow precise control of output amplitude.

Frequency Accuracy

Frequency measurements with an accuracy of ± 10 Hz are possible when using an HP 8443A. In the TRACK ANALYZER mode, the HP 8443A displays the counted frequency of a tunable marker. The RESTORE mode allows individual signals to be counted in a wide scan without fine tuning.

Swept Frequency Measurements

With the HP 8443A, the HP 8553B can be used to measure both insertion and return loss over the 100 kHz to 110 MHz frequency range. The excellent stability of the HP 8443A permits use of the 10 Hz bandwidth, providing a 130 dB dynamic range for swept frequency response measurements. A system (HP 8553B/8443A) frequency response of ± 1.0 dB insures accurate characterization of DUT frequency response.



Specifications—with HP 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, 10 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: 100 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

± 0.5 dB
 ± 0.25 dB/dB
but not more than ± 1.5
dB over the full
70 dB display range

Linear

$\pm 5.8\%$
 $\pm 2.8\%$ of
full 8 div
deflection

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 Characteristics

Input impedance: 50 Ω nominal, BNC connector. Reflection coefficient < 0.13 (1.3 SWR), input attenuator ≥ 10 dB. A special 75 Ω version of the HP 8553B/8552B is available, as is a 75 Ω matching transformer, the HP 11694A.

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 (HP 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

HP 8553B RF Section

HP 8443A Tracking Generator-Counter