

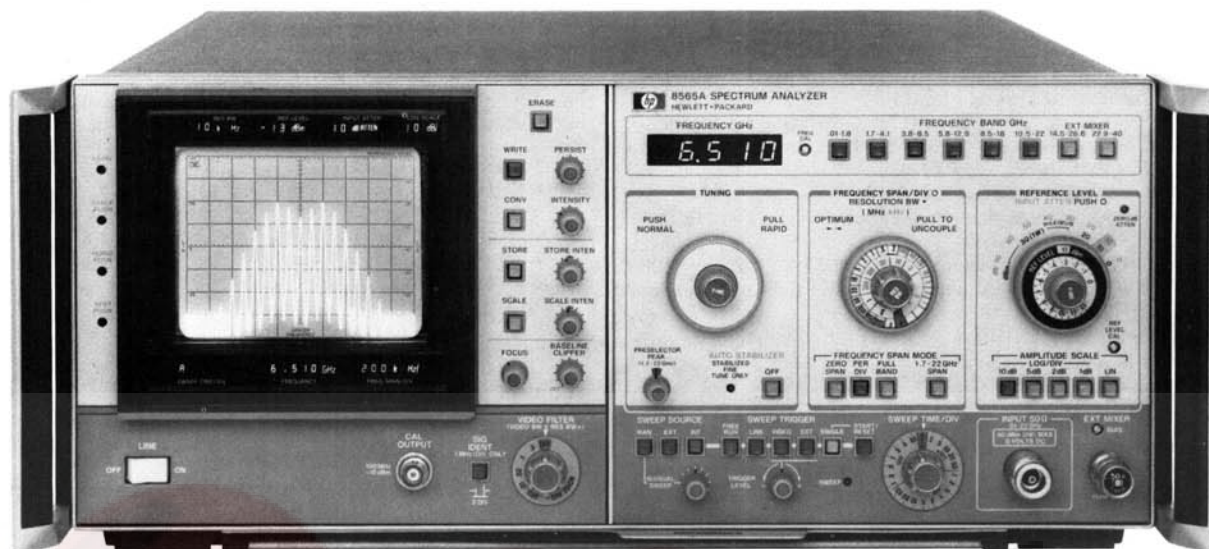


## SIGNAL ANALYZERS

Spectrum Analyzer, 10 MHz to 40 GHz

Model 8565A

- 0.01 to 22 GHz, external mixing to 40 GHz
- Internal preselection 1.7 to 22 GHz
- Wide choice of resolution bandwidths
- Simple three knob operation
- Absolute amplitude calibration
- CRT bezel readout displays control settings



8565A

### 8565A Spectrum Analyzer

Covering from 0.01 to 22 GHz with its internal mixer, the 8565A has built-in preselection and brings accuracy plus convenience to microwave spectrum analysis. The wide range, spurious-free display, compact design and ease of use make it well suited for lab, production, or field applications requiring accurate measurement from IF thru microwave frequencies. The 8565A can cover 0.01 to 22 GHz in just two spans for rapid location of signals prior to close-in analysis in one of six bands. Coverage is easily extended up to 40 GHz with the HP 11517A External Mixer.

#### High Resolution

Fully automatic stabilization in narrow spans reduces residual FM and drift. Standard resolution bandwidths range from 1 kHz to 3 MHz. The 1 and 3 MHz bandwidths allow fast sweeps in wide spans and increased dynamic range for pulsed RF; the narrow bandwidths allow measurement of closely spaced signals. Option 100 provides additional 100 Hz and 300 Hz IF bandwidth filters, and residual FM is <100 Hz when stabilized. This 100 Hz resolution is usable up to 8.5 GHz and the 300 Hz resolution bandwidth to 22 GHz. All resolution filters are gaussian-shaped for repeatable measurements, faster non-distorting sweeps and best pulse response.

#### Absolute Amplitude Calibration

Absolute signal levels from -112 dBm to +30 dBm are easily measured because the HP 8565A always displays the value of the reference line with LED's in the CRT bezel and at the reference level control. Changes in RF, IF gain, and preselector loss are automatically included. In addition, flat frequency response insures accuracy for relative as well as absolute power measurements.

#### Wide Dynamic Range

Internal preselection (1.7 to 22 GHz) enables you to measure distortion products as much as 100 dB down. Even for closely spaced signals or measurements below 1.7 GHz, all distortion products are greater than 70 dB down. In either case, maximum dynamic range is assured even for 1 watt signals with the 70 dB input attenuator. An input limiter (0.01 to 1.8 GHz) and the internal preselector (1.7 to 22 GHz) enable the 8565A to withstand RF signals up to +30 dBm for all input attenuator settings.

#### Designed for Convenience

Coupled controls allow you to make most measurements in 3 simple steps. Green color coded keys preset the 8565A for normal operation so a measurement only requires that you tune to a signal, select a desired span, and raise it to the reference level. Automatically selected sweep times insure a calibrated display for all combinations of fre-

quency span, resolution bandwidth and video filtering.

The CRT bezel LED's display all pertinent control settings to give you all the information needed for signal evaluations in one central location. These data are also captured in CRT photos.

### 8444A Option 059 Tracking Generator

Make swept frequency response measurements to  $\pm 1.7$  dB from 10 to 1300 MHz ( $\pm 2.7$  dB up to 1500 MHz) with greater than 90 dB of dynamic range. The output is absolutely calibrated at 0 dBm and continuously variable to <-10 dBm. The frequency of unknown signals as well as the frequency of any point on the frequency response curve can be measured from the external counter output using the low-cost HP 5300/5305B Counter.

### 8750A Storage-Normalizer

The analyzer is made even easier to use with the digital storage of the 8750A because there is no need to re-adjust intensity or persistence as the sweep time changes. With the push of a button, a signal can be frozen on the CRT and then compared directly to the current input signal. Traces can also be compared arithmetically (i.e., normalized) to automatically remove frequency response variations. This is especially useful when used with the HP 8444A Opt. 059 Tracking Generator.

### 8565A Specifications

#### Frequency Specifications

**Frequency range:** 0.01 to 22 GHz with internal mixer, 14.5 to 40 GHz with HP 11517A External Mixer. Extendable to 220 GHz with other commercially available mixers and using signal ID as in Application Note 150-14.

#### Tuning Accuracy (digital frequency readout in any span mode)

**Internal mixing:** 0.01 to 2.5 GHz  $< \pm (5 \text{ MHz} + 20\% \text{ of Frequency Span/Div.})$ ; 2.5 to 22 GHz  $< \pm (0.2\% \text{ of center frequency} + 20\% \text{ of Frequency Span/Div.})$ .

**External mixing:** 14.5 to 40 GHz  $< \pm (0.7\% \text{ of center frequency} + 20\% \text{ of Frequency Span/Div.})$ .

#### Frequency Spans

**1.7 to 22 GHz:** multiband span from 1.7 to 22 GHz in one sweep.

**Full band:** displays spectrum of entire band selected.

**Per division:** eighteen calibrated spans from 1 kHz per div. to 500 MHz per div. in a 1, 2, 5 sequence, plus a full band span, "F".

**Span width accuracy:** the frequency error for any two points on the display for spans from 500 MHz/div to 20 kHz/div (unstable) is less than  $\pm 5\%$  of the indicated separation; for stabilized spans 100 kHz/div and less, the error is less than  $\pm 15\%$ .

**Zero span:** analyzer becomes a manually tuned receiver.





## Spectral Resolution and Stability

**Resolution bandwidths:** resolution (3 dB) bandwidths from 1 kHz to 3 MHz in 1, 3 sequence. Bandwidth and span width are independently variable or may be coupled for optimum display when control markers are aligned (▶◀).

**Resolution bandwidth accuracy:** 3 dB points:  $< \pm 15\%$ .

**Selectivity (60 dB/3 dB bandwidth ratio):**  $< 15:1$ .

**Stability:** total residual FM (fundamental mixing 0.01 to 4.1 GHz): stabilized,  $< 200$  Hz p-p in 0.1 s; unstabilized  $< 10$  kHz p-p in 0.1 s.

**Stabilization range:** first LO automatically stabilized for frequency spans 100 kHz/div or less. First LO residual FM typically 30 Hz p-p when stabilized.

**Noise sidebands:**  $> 70$  dB down,  $> 30$  kHz from center of CW signal in a 1 kHz Res. Bandwidth and a 10 Hz (0.01) Video Filter.

## Amplitude Specifications

### Amplitude Range - Internal Mixer

#### Measurement Range

**Total power:** +30 dBm (1 watt).

**Damage levels:** (50  $\Omega$  nominal source impedance.)

**dc:** 0 V with 0 dB input atten,  $\pm 7$  V with  $\geq 10$  dB input atten.

**ac:** 0 V with 0 dB input atten, 10 V peak with  $\geq 10$  dB input atten.

**RF:** (signals above 10 MHz) + 30 dBm for any attenuator setting.

**Gain compression:**  $< 1$  dB for 0 dBm input level with 0 dB attenuation.

**Average noise level:** max. avg. noise level with 1 kHz Res. Bandwidth (0 dB atten and 3 Hz video filter) is in the table below:

Frequency Band (GHz)	First IF in MHz	Harmonic Mode	Noise Level (dBm)	Frequency Response* ( $\pm$ dB MAX)
0.01-1.8	2050	1-	-112	1.2
1.7-4.1	321.4	1-	-109	1.7
3.8-8.5	321.4	2-	-103	2.5
5.8-12.9	321.4	3-	-94	2.5
8.5-18	321.4	4+	-87	3.5
10.5-22	321.4	5+	-75	4.5

\*Frequency response includes input attenuator, preselector and mixer frequency response plus mixing mode gain variation (band to band).

### Amplitude Range - HP 11517A External Mixer

**Measurement range:** saturation (gain compression  $< 1$  dB),  $-15$  dBm. Damage level  $> +10$  dBm.

**Sensitivity** (average noise level in a 10 kHz IF bandwidth): 14.5-18 GHz  $< -80$  dBm, 18-26.5 GHz  $< -70$  dBm, 26.5-40 GHz  $< -60$  dBm. Typical sensitivity is 10 dB better for each band.  **$> 40$  GHz:** for signal analysis above 40 GHz with commercially available mixers see Application Note 150-14.

#### Reference Level

**Reference level range** +70 dBm (+30 dBm max. input) to  $-102$  dBm in 10 dB steps and continuous 0 to  $-12$  dB calibrated vernier.

**Reference level accuracy:** the Auto Sweep setting of the sweep time/div control insures a calibrated display within these limits:

**Calibrator output (100 MHz  $\pm$  10 kHz):**  $-10$  dBm  $\pm 0.3$  dB.

**Reference level variation (input attenuator at 0 dB):** 10 dB steps  $\leq \pm 0.5$  dB (0 to  $-70$  dBm);  $\leq \pm 1.0$  dB (0 to  $-90$  dBm).

**Vernier (0 to  $-12$  dB) continuous:** maximum error  $< 0.5$  dB.

**Input attenuator:** (at preselector input, 0-70 dB in 10 dB steps).

**Step size variation:**  $\leq \pm 1.0$  dB, 0.01 to 18 GHz;  $\leq \pm 1.5$  dB, 0.01 to 22 GHz.

**Maximum cumulative error over the 0 to 60 dB range:**  $\leq \pm 2.4$  dB, 0.01 to 18 GHz, 0 to 60 dB;  $\leq \pm 2.5$  dB, 0.01 to 22 GHz, 0 to 40 dB.

**Frequency response:** see table above.

**Switching between bandwidths:** 3 MHz to 1 kHz,  $\pm 1.0$  dB

#### Calibrated Display Range

**Log:** (expanded from reference level down): 70 dB @ 10 dB/div, 40 dB @ 5 dB/div, 16 dB @ 2 dB/div and 8 dB @ 1 dB/div.

**Linear:** full scale from  $1.8 \mu$ V ( $-102$  dBm in 50  $\Omega$  to 707 volts (+70 dBm) in 10 dB steps and continuous 0 to  $-12$  dB vernier.

#### Display Accuracy

**Log:**  $\leq \pm 0.1$  dB/dB, but  $\leq \pm 1.5$  dB over full 70 dB display range.

**Linear:**  $\leq \pm 3\%$  over full 8 division deflection.

**Residual responses (no signal present at input):** with 0 dB input atten, fundamental mixing (0.01 to 4.1 GHz)  $< -90$  dBm.

**Signal identifier:** available from 10 MHz to 40 GHz and in all Freq. Span/Div settings for signal identification.

## Signal Input Characteristics

**Input impedance:** 50 ohm nominal, 0.01 to 22 GHz.

**Input connector:** precision Type N female.

#### Input SWR

**Input attenuator at 0 dB:**  $< 1.5$ , 0.01 to 1.8 GHz;  $< 2.0$ , 1.7 to 22 GHz.

**Input attenuator at  $\geq 10$  dB:**  $< 1.3$ , 0.01 to 1.8 GHz,  $< 2.0$ , 1.7 to 22 GHz.

**LO Emission (2.00 to 4.46 GHz):**  $-50$  dBm, 0.01 to 1.8 GHz;  $-85$  dBm, 1.7 to 22 GHz.

#### Input Protection (for input signals from 0.01 to 22 GHz)

**0.01 to 1.8 GHz frequency band:** internal diode limiter.

**1.7 to 22 GHz frequency bands:** saturation of YIG filter (pre-selector) occurs at total input signal power levels below input mixer damage.

**External mixer input:** BNC female connector is a port for LO power transfer, bias current and IF return.

## Sweep Specifications

#### Sweep Time

**Auto:** sweep time is automatically controlled by Frequency Span/Div, Resolution Bandwidth and Video Filter controls to maintain an absolute amplitude calibrated display.

**Calibrated sweep times:** 21 internal sweep times from  $2 \mu$ s/div to 10 s/div in 1, 2, 5 sequence.

## Display Characteristics

**Cathode Ray Tube (aluminized P31 phosphor,  $8 \times 10$  div internal graticule)**

#### Persistence

**Conventional:** natural persistence of P31 phosphor.

**Write:** continuously adjustable from 0.2 s to full storage.

**Storage time:** continuously adjustable from 1 minute (full brightness) to  $> 30$  minutes (minimum brightness).

**Write speed:** continuously adjustable to vary CRT sensitivity to capture large signal deflections in fast sweeps.

**CRT Bezel readout:** bezel LEDs display the following measurement data (included in CRT photographs taken with the HP 197B Opt 001, 006 Oscilloscope Camera): Ampl. Scale Factor, Ref. Level, Input Atten., Res. Bandwidth, Sweptime/Div., Freq., Freq. Span/Div. **General Specifications**

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

**Humidity range (operating):**  $< 95\%$  R.H.  $0^\circ\text{C}$  to  $40^\circ\text{C}$ .

**EMI:** Conducted and radiated interference is in compliance with MIL-STD 461A Methods CE03 and RE02, CISPR publication 11 (1975), and Messempfänger-Postverfuegung 526/527/79 (Kennzeichnung Mit F-Nummer/Funkschutzzeichen).

**Power requirements:** 48-66 Hz, 100, 120, 200 or 240 volts ( $-10\%$  to  $+5\%$ ) 220 VA max (400 Hz operation available as Opt 400).

**Size:** 188 H x 426 W x 552 mm D ( $7'' \times 16.8'' \times 21.8''$ ).

**Weight:** net 29.5 kg (64 lb). Shipping 39 kg (85 lb).

#### Standard Options Available

**Opt 100, 100 and 300 Hz resolution bandwidths:** adds 100 Hz and 300 Hz resolution bandwidths with 11:1 shape factor, residual FM  $< 100$  Hz when stabilized and improves sensitivity by 10 dB.

**Opt 200—Calibration in  $\text{dB}\mu\text{V}$**

**Opt 400—400 Hz Power Supply**

**Part No. 1540-0654 - Transit Case.** Order Part No. 1490-0913 also for castors.

#### Ordering Information

	Price
8565A Spectrum Analyzer	\$27,075
Opt 100: 100 Hz and 300 Hz Resolution Bandwidths	\$1,500
Opt 200: Calibration in $\text{dB}\mu\text{V}$	\$100
Opt 400: Internal 50 to 400 Hz Power Supply	\$250
Opt 908: Rack Flange Kit	\$35
Opt 910: Extra Operating and Service Manual	\$50
Opt 913: Rack Flange Kit for instruments with handles	\$40
11517A External Mixer (taper section req'd)	\$450
11518A Taper Section, 12.4 to 18 GHz	\$275
11519A Taper Section, 18 to 26.5 GHz	\$275
11520A Taper Section, 26.5 to 40 GHz	\$275
8444A Opt 059 Tracking Generator, 10 to 1500 MHz	\$4,760
8750A Storage-Normalizer	\$2,155