SIGNAL ANALYZERS

Spectrum Analyzer, 100 Hz to 22 GHz

Model 8566A

- 100 Hz to 22 GHz frequency range
- Synthesizer frequency accuracy
- 10 Hz frequency resolution
- Tunable marker with amplitude and frequency readout
- Integrated preselector with automatic peaking feature
- Store and recall of instrument settings

NEW

8566A

HP-IB

The 8566A Spectrum Analyzer is a high performance spectrum analyzer for bench and remote operation which operates from 100 Hz to 22 GHz. A synthesized local oscillator brings counter-like frequency accuracy to microwave spectrum analysis. 10 Hz resolution bandwidth and superior frequency stability allow difficult measurements such as line related sideband characterization at 22 GHz.

A unique integrated preselector/mixer provides high sensitivity with preselection from 2 GHz to 22 GHz. For example, in a 10 Hz resolution bandwidth, the sensitivity at 18 GHz is <-120 dBm.

8566A Specifications

Frequency

Displayed range

Frequency span: 0 Hz, 100 Hz to 22 GHz over 10 divisions CRT horizontal axis; variable in approximately 1% increments.

Full span: 0–2.5 GHz and 2–22 GHz. 2–22 GHz is selected with INSTR PRESET.

Readout accuracy: Spans 100 Hz to 5 MHz: ±1% of indicated separation; spans >5 MHz: ±3% of indicated frequency separation; zero span: ± frequency reference error x center frequency.

Center frequency: 0 Hz to 22 GHz. Center frequency step size may be set using the numeric keyboard or MKR/Δ→ STP SIZE key.

Readout accuracy: In AUTO resolution bandwidth after adjusting frequency zero at stabilized temperature, and using the error correction function, SHIFT W and SHIFT X. Spans ≤5 MHz: ±(2% of frequency span + (frequency error x center frequency) + 10 Hz). Spans >5 MHz: ±(2% of frequency span + n x 100 kHz + frequency error x center frequency) where n is the harmonic mixing number, depending upon center frequency:

n	Center frequency
1	100 Hz to 5.8 GHz
2	5.8 GHz to 12.5 GHz
3	12.5 GHz to 18.6 GHz
4	>18.6 GHz

Because the analyzer is phase locked at the beginning of each sweep, drift occurs only during the time of one sweep.

Start/Stop frequency: SHIFT O sets the analyzer start and stop frequencies equal to the frequencies of the two Δ markers.

Readout accuracy: Same as center frequency.

Frequency reference error: $<1 \times 10^{-9}$/day and $<2 \times 10^{-7}$/year.

Resolution

Resolution bandwidth: 3 dB bandwidths of 10 Hz to 3 MHz in a 1, 3, 10 sequence. Bandwidth may be selected manually or coupled to frequency span.

Bandwidth accuracy: calibrated to: ±20%, 3 MHz to 10 Hz; ±10%, 1 MHz to 3 kHz.

Bandwidth selectivity: 60 dB/3 dB bandwidth ratio: <15:1, 3 MHz to 100 kHz; <13:1, 30 kHz to 10 kHz; <11:1, 3 kHz to 30 Hz. 60 dB points on 10 Hz bandwidth are separated by <100 Hz.

Stability

Residual FM: for fundamental mixing (n = 1); <50 kHz peak to peak, frequency span ≥5 MHz; <200 Hz peak to peak, frequency span ≤5 MHz; <5 Hz peak to peak, frequency span <100 kHz; <0.2 Hz peak to peak, frequency span <5 kHz.

Drift: typical, after 1 hour warm-up at stabilized temperature. COUPLED FUNCTION not required.

Frequency span	Center frequency drift
<100 kHz	<10 Hz/minute of sweeptime
100 kHz to 5 MHz	<500 Hz/minute of sweeptime
≥5 MHz	<5 kHz/minute of sweeptime

SPECTRUM ANALYZERS

Spectrum Analyzer, 100 Hz to 22 GHz

Model 8566A (cont.)

Spectral Purity

Noise sidebands: >85 dB below the peak of a 5.8 GHz CW signal at 1 kHz offset; >79 dB for 12.5 GHz signal; >75 dB for 18.6 GHz signal; >73 dB for 22 GHz signal; all for resolution bandwidth ≤100 Hz.

Power line related sidebands: >80 dB below the peak of a 5.8 GHz CW signal, <360 Hz offset.

Amplitude

Measurement range: −134 dBm to +30 dBm.

Display range

Scale: over a 10 division CRT vertical axis with the Reference Level at the top graticule line.

Calibration:

Log: 10 dB/div for 90 dB display from Reference Level.
5 dB/div for 50 dB display
2 dB/div for 20 dB display
1 dB/div for 10 dB display
expanded from Reference Level

Linear: 10% of Reference Level/div when calibrated in voltage.

Fidelity

Log:	Incremental	Cumulative
	±0.1 dB/dB over 0 to 80 dB display	<±1.0 dB max over 0 to 80 dB display, 20–30°C. <±1.5 dB max over 0 to 90 dB display.

Linear: ±3% of Reference Level

Reference level

Range

Log: +30.0 to −99.9 dBm or equivalent in dBmV, dBμV, Volts Readout expandable to +60.0[1] volts to −119.9 dBm (−139.9 dBm for <1 kHz resolution bandwidth) using SHIFT I.

Linear: 7.07 volts to 2.2 μvolts full scale. Readout expandable to 223.6[1] volts to 2.2 μvolts (0.22 μvolts for <1 kHz resolution bandwidth) using SHIFT I.

Accuracy: the sum of the following factors determines the accuracy of the reference level readout. Depending upon the measurement technique followed after calibration with the CAL signal, various of these sources of uncertainty may not be applicable. Specifications are with the preselector tracking optimized with MARKER PRESELECTOR PEAK function.

An internal error correction function calibrates and reduces the uncertainty introduced by analyzer control changes from the error calibration state (−7 dBm reference level, and 100 MHz center frequency) when SHIFT W and SHIFT X are executed just prior to the signal measurement (i.e. at the same temperature) within 20–30°C. range.

Calibration uncertainty: ±0.3 dB.

Frequency response (flatness) uncertainty: ±0.6 dB, 100 Hz to 2.5 GHz; ±1.7 dB, 2.0 GHz to 12.5 GHz; ±2.2 dB, 12.5 GHz to 20 GHz; ±3.0 dB, 20 GHz to 22 GHz; for 10 dB attenuator setting. Cumulative flatness ±2.2 dB, 100 Hz to 20 GHz. COUPLED FUNCTION not required as long as display remains calibrated.

Absolute amplitude calibration uncertainty: ±0.6 dB. The certainty of setting the frequency response curve absolutely when using the internal CAL signal or any other calibration signal in the 100 Hz to 2.5 GHz band.

Amplitude temperature drift: at −10 dBm reference level with 10 dB input attenuation and 1 MHz resolution bandwidth. ±0.03 dB/°C (eliminated after recalibration).

Scale fidelity

Log:	Incremental	Cumulative
	±0.1 dB/dB	<±1.0 dB over 0 to 80 dB display <±1.5 dB over 0 to 90 dB display

Linear: ±3% of reference level

Resolution bandwidth switching uncertainty[2]: referenced to 1 MHz bandwidth, corrected (uncorrected). ±0.1 dB (±0.5 dB), 30 Hz to 1 MHz bandwidths. ±0.1 dB (±1.0 dB, 10 Hz and 3 MHz bandwidths.

Log scale switching uncertainty: Corrected (uncorrected). ±0.1 dB (±0.5 dB).

IF gain uncertainty: Corrected (uncorrected). Assuming the internal calibration signal is used to calibrate the reference level at −10 dBm and the input attenuator is fixed at 10 dB, any changes to the reference level function value from −10 dBm will contribute IF gain uncertainty.

Range	Uncertainty
0 dBm to −55.9 dBm	0 dB (±0.6 dB)
−55.0 dBm to −129.9 dBm	±1.0 dB (±1.5 dB)

The range values change with different input attenuator settings. Each 10 dB decrease (or increase, in the amount of input attentuation at the time of calibration and measurement will cause a corresponding 10 dB decrease (increase) in absolute reference level settings described above.

RF gain uncertainty: corrected (uncorrected) 0 dB (±0.2 dB). The gain change between preselected and non-preselected bands.

Error correction: ±0.4 dB

When the error correction function is used (SHIFT W and SHIFT X), amplitude uncertainty is introduced because additional IF gain is used to offset errors in the switching of resolution BW, amplitude scales and RF gain.

Dynamic range

Spurious responses: (signals generated by the analyzer due to input signals). For signals <−40 dBm all harmonic and intermodulation distortion >70 dB below input signal.

Second order harmonic distortion: for mixer levels ≤−40 dBm: <−70 dBc, 100 Hz to 50 MHz; <− 80 dBc, 50 MHz to 700 MHz; <−70 dBc, 700 MHz to 2.5 GHz. For mixer levels ≤−10 dBm: <−100 dBc, 2 to 22 GHz.

Third order intermodulation distortion: third order intercept (TOI): >+7 dBm, 100 Hz to 5.8 GHz; >+5 dBm, 5.8 to 18.6 GHz; >+5 dBm (typical), 18.6 GHz to 22 GHz; >+50 dBm (typical), 2 to 22 GHz for >100 MHz signal separation.

Image responses: (due to input signals 642.8 MHz above or below the tuned frequency) <−70 dBc, 100 Hz to 18.6 GHz; <−60 dBc, 18.6 GHz to 22 GHz.

Multiple responses: (due to the input signal mixing with more than one local oscillator harmonic) <−70 dBc, 100 Hz to 22 GHz.

Out-of-band responses: (due to input signals outside the preselector's frequency span) <−60 dBc, 2 to 22 GHz.

Synthesis related spurious sidebands: <−90 dBc.

Residual responses: (signals displayed by the analyzer independent of input signals) With 0 dB input attenuation and no input signal: <−100 dBm, 100 Hz to 5.8 GHz; <−95 dBm, 5.8 GHz to 12.5 GHz; <−85 dBm, 12.5 GHz to 18.6 GHz; <−80 dBm, 18.6 GHz to 22 GHz.

Gain compression: <1.0 dB, 100 Hz to 22 GHz with ≤−5 dBm at input mixer.

Average noise level: with 0 dB input attentuation and 10 Hz resolution bandwidth. <−95 dBm, 100 Hz to 50 kHz; <−112 dBm, 50 kHz to 1.0 MHz; <−134 dBm, 1.0 MHz to 2.5 GHz; <−132 dBm, 2.0 GHz to 5.8 GHz; <−125 dBm, 5.8 GHz to 12.5 GHz; <−119 dBm, 12.5 GHz to 18.6 GHz; <−114 dBm, 18.6 GHz to 22 GHz.

Video bandwidth: post detection low pass filter used to average displayed noise bandwidth variable from 1 Hz to 3 MHz in a 1,3,10 sequence. Video bandwidth may be selected manually or coupled to resolution bandwidth.

Digital video averaging: displays the sweep-to-sweep average of the trace over a specifiable number of sweeps with SHIFT G, video averaging is turned off with SHIFT H.

Reference Lines

Display line: movable horizontal line with amplitude readout.

Threshold: movable horizontal trace threshold with amplitude read-out.

Accuracy: equals the sum of calibrator uncertainty, and scale fidelity between the reference level and reference line.

[1]Maximum input must not exceed +30 dBm (damage level).
[2]Accounted for under Error Correction Accuracy.
[3]Correction only applies over the 0 dBm to −55.9 dBm range.

Marker

The marker is a bright dot placed upon the display trace which is positioned horizontally by the DATA controls. The marker amplitude and frequency are read out continuously.

Frequency

Normal: displays the frequency at the horizontal position of the tunable marker. PEAK SEARCH positions the marker at the center of the largest signal response present on the display to within ±10% of resolution bandwidth. Following peak search, SHIFT K moves marker to next higher trace maximum. Subsequent SHIFT K entries move marker to sequentially lower maxima. MKR→CF sets the analyzer center frequency equal to the marker frequency; MKR/Δ→STP SIZE sets the center frequency step size equal to the marker frequency.

Accuracy: same as center frequency accuracy.

Signal track: re-tunes the analyzer to place a signal identified by the marker at the center of the CRT and maintain its position (provided the signal remains on-screen during the period of one sweep). Useful when reducing frequency span to zoom-in on a signal; also keeps a drifting input signal centered.

Δ: displays the frequency difference between the stationary and tunable markers. Reference frequency may be outside current frequency span accuracy. MKR/Δ→STP SIZE sets the center frequency difference between the markers. SHIFT O sets the analyzer start and stop frequencies equal to the frequencies of the two markers.

Accuracy: same as frequency span accuracy.

Zoom: makes it possible to reduce the frequency span about the marker (or signal in the track mode) using the step down key.

Amplitude

Normal: displays the amplitude at the vertical position of the tunable marker. PEAK SEARCH positions the marker at the peak of the largest signal present on the display.

MKR→REF LVL sets the analyzer reference level equal to the marker amplitude. RMS noise density in a 1 Hz bandwidth is read out using SHIFT M, by sampling the displayed trace and arithmetically correcting for the analyzer detector response, log shaping, and measurement bandwidth.

Accuracy: same as reference level accuracy plus scale fidelity between the reference level and marker position.

Δ: displays the amplitude difference between the stationary and tunable marker. Reference frequency may be outside current frequency span.

Accuracy: same as frequency response uncertainty and scale fidelity between two markers.

Preselector peak: with the marker at the peak of a displayed input signal, preselector peak automatically adjusts preselector tracking for maximum response. SHIFT = resets the preselector tuning to the nominal factory preset condition. If the marker is not activated when preselector peak is used, a peak search will be exercised prior to preselector peaking.

Sweep

Trigger, continuous and single is the same as the 8568A, pages 497 and 498.

Sweeptime

Zero frequency span

With digital storage: 20 msec full sweep to 1500 sec full sweep n ~ 1% increments.

Without digital storage: 1 μsec full sweep to 10 msec in 1,2,5 sequence.

Marker (sweeps >20 msec only)

Normal: displays time from beginning of sweep to marker position.

Δ: displays time difference between stationary and tunable marker.

Display

The display functions are the same as the 8568A, page 498.

Input

RF Input: 100 Hz to 22 GHz, precision female type N connector, dc coupled.

SWR (typical): 1.2, 100 Hz to 2.5 GHz; 1.5, 2 GHz to 5.8 GHz; 1.9, 5.8 GHz to 22 GHz; with 10 dB input attenuation.

LO emission (typical): <−80 dBm when preselected; <−90 dBm when not preselected.

Maximum input level

AC: continuous power, +30 dBm (1 watt), from 50 ohm source. Mixer protected by diode limiter, 100 Hz to 2.5 GHz. <100 watts, 10 μsec pulse with ≥50 dB RF attenuation (≤0 dBm peak to input mixer).

DC: <100 mA current damage level.

Input attenuator: 70 dB steps. Zero dB attenuation accessible only through numeric/unit keyboard. Attenuation may be selected manually or coupled to reference level to insure a −10 dBm input mixer drive level for full-screen signals; other mixer levels may be specified using SHIFT , and entering the desired amplitude through the keyboard.

Accuracy: ±1.0 dB over 10–70 dB range.

Output

Calibrator: 100 MHz ± (frequency reference error). −10 dBm ±0.3 dB, 50 Ω impedance.

Auxiliary

Auxiliary outputs are the same as the 8568A, page 498.

21.4 MHz IF (rear panel): a 50 Ω, 21.4 MHz output related to the RF input to the analyzer. In log scales, the IF output is logarithmically related to the RF input signal; in linear, the output is linearily related. The output is nominally −20 dBm for a signal at the reference level. Bandwidth is controlled by the analyzer's resolution bandwidth setting; amplitude controlled by the input attenuator, and IF step gain positions.

1st LO (front panel): 2.3 to 6.2 GHz, >5 dBm., 50 Ω output impedance.

Frequency reference (rear panel): >−5 dBm, 50 Ω output impedance

Sweep plus tune output (rear panel): 10.000 MHz, 0 dBm; 50 Ω output impedance.

10 MHz output (rear panel): >− 5 dBm, 50 Ω output impedance.

Sweep plus tune output (rear panel): −1.0 volt per GHz of tune frequency, >10 kΩ load.

Accuracy: −1 V/GHz ±2% ±10 mV.

Instrument State Storage

Up to 6 complete sets of user-defined control settings may be stored and recalled by pressing SAVE or RECALL and the desired register number (1 to 6) from the keyboard. Instrument state information is retained in memory indefinitely in STANDBY and approximately 30 days after line power is terminated.

Remote Operation

The standard 8566A operates on the Hewlett-Packard Interface Bus (HP-IB). All analyzer control settings (with the exception of VIDEO TRIGGER LEVEL, FOCUS, ALIGN, INTENSITY, FREQ ZERO and AMPLD CAL) are remotely programmable. Function values, marker frequency/amplitude, and A/B traces may be output; CRT labels and graphics may be input.

General

Environmental

Temperature: operating 0°C to 55°C, storage −40°C to +75°C.

Humidity: operating <95% R.H., 0°C to 40°C except as noted.

EMI: Conducted and radiated interference is within the requirements of CE03 and RE02 of MIL STD 461A, VDE 0871, and CISPR pub'n 11.

Power requirements: 50 to 60 Hz; 100, 120, 220, or 240 volts (+5%, −10%); approximately 650 VA (40 VA in standby). 400 Hz operation is available as Opt 400.

Weight: total net 50 kg (112 lb): Display/IF Section, 21 kg (47 lb); RF Section, 24 kg (53 lb). Shipping, Display/IF Section 31 kg (69 lb); RF Section 39 kg (87 lb).

8566A Spectrum Analyzer	$47,500
Opt 400: 400 Hz Power Line Frequency Operation	add $400
Opt 907: Front Handle Kit	add $40
Opt 908: Rack Flange Kit	add $30
Opt 909: Rack Flange and Front Handle Kit	add $60
Opt 910: Extra Manual	add $100