Table 1-1. HP Model 8569A Specifications (1 of 3)

SPECIFICATIONS

FREQUENCY SPECIFICATIONS

FREQUENCY RANGE

Internal mixer 0.01 to 22 GHz
Covered in six ranges selectable by Frequency Band pushbuttons (in GHz): .01 to 1.8; 1.7 to 4.1; 3.8 to 8.5; 5.8 to 12.9; 8.5 to 18; 10.5 to 22.

External mixer, HP 11517A, Opt. E03, 14.5 to 40 GHz
Covered in two ranges selectable by Frequency Band pushbuttons (in GHz): 14.5 to 26.6 (6+ harmonic mode); 22.9 to 40 (10+ harmonic mode).

FREQUENCY ACCURACY

Tuning Accuracy
The overall tuning accuracy of the digital frequency readout in any span mode:

Internal mixing
±(5 MHz or 0.2% of center frequency, whichever is greater, +20% of frequency span per division)

External mixing
±(0.7% of center frequency +20% of frequency span per division)

CRT digital readout resolution (included in tuning accuracy)
Internal mixing, 100 kHz; external mixing, 1 MHz

FREQUENCY SPANS (on a 10 division CRT horizontal axis)

1.7 to 22 GHz
Multiband span of spectrum from 1.7 to 22 GHz in one sweep. The frequency (position) corresponding to the tuning marker is set by the Tuning control and indicated by the digital frequency displays on the front panel and the CRT.

Full Band
Displays spectrum of entire Frequency Band selected. Tuning marker displayed in Full Band mode (becomes center frequency when Per Divison mode is selected). Marker frequency is given on the digital displays.

Per Division
Eighteen calibrated spans from 1 kHz/Div to 500 MHz/Div in a 1, 2, 5, 10 sequence. In "F" position the entire Frequency Band selected is spanned.

Span width accuracy
The frequency error for any two points on the display for spans from 500 MHz to 20 kHz/Div (unstabilized) is less than ±5% of the indicated separation; for stabilized spans 100 kHz/Div and less, the error is less than ±15%.

Center Frequency
The center frequency represented by the CRT is indicated by the digital frequency displays on the front panel and the CRT.

Zero Span
Analyzer becomes a manually tuned receiver (for the time domain display of signal modulation) set to the frequency indicated by the digital frequency displays.

SPECTRAL RESOLUTION AND STABILITY

Resolution Bandwidths
Resolution (3 dB) bandwidths from .1 kHz to 3 MHz in 1, 3 sequence. Bandwidth may be varied independently or coupled to Frequency Span/Div control. Optimum coupling (convenient ratio of Frequency Span/Div to Resolution Bandwidth) is indicated by alignment of markers (►◄) on both controls.

Uncoupled, the controls for Frequency Span/Div and Resolution Bandwidth may be independently set so any resolution bandwidth (3 MHz to .1 kHz) may be used with any span width (F and 500 MHz to 1 kHz/Div). Analyzer is calibrated if UNCAL is not displayed.

Resolution Bandwidth accuracy
Individual resolution bandwidth 3 dB points:
< ±15%.

Selectivity: (60 dB/3 dB bandwidth ratio) < 15:1 for bandwidths 3 kHz to 3 MHz; < 11:1 for bandwidths .1 kHz to 1 kHz.

Stability

Total residual FM
Stabilized: <100 Hz p-p in 0.1 sec, .01 – 4.1 GHz
Unstabilized: <10 kHz p-p in 0.1 sec, .01 – 4.1 GHz (Fundamental mixing)

Stabilization range: First LO automatically stabilized (unless auto stabilizer is OFF) for frequency spans 100 kHz/Div or less.

Noise sidebands: At least 75 dB down, greater than 30 kHz from center of CW signal when set to a 1 kHz Resolution Bandwidth and a 10 Hz (.01) Video Filter (fundamental mixing).

Video Filter
Post detection low-pass filter used to average displayed noise for a smooth trace. Nominal settings are given as decimal fractions of the Resolution Bandwidth: OFF, .3, .1, .03, .01, and .003. A 1 Hz NOISE AVG (noise averaging) setting is provided for noise level measurement.

AMPLITUDE SPECIFICATIONS

AMPLITUDE RANGE — Internal mixer

(Amplitude specifications for the HP 8569A Spectrum Analyzer with the HP 11517A, Opt. E03, External Mixer are given near the end of Table 1-1.)

Measurement range:
Damage levels:
Total RF power: +30 dBm (1 watt)
dc or ac (<<500 source impedance):
0V with 0 dB input attenuation (1 amp); ±7V with ≥10 dB input attenuation (0.14 amp)

Table 1-1. HP Model 8569A Specifications (2 of 3)

Peak pulse power:
+50 dBm (<10 μsec. pulse width, 0.01% duty cycle), ≥20 dB attentuation

Gain compression:
<1 dB for −7 dBm input level with 0 dB attenuation.

Average noise level:
Sensitivity (minimum discernible signal) is given by the signal level which is equal to the average noise level, causing approximately a 3 dB peak above the noise. Maximum average noise level with 1 kHz Resolution Bandwidth (0 dB attenuation and 0.003 (3 Hz) video filter) is given in the table below:

Frequency Band (GHz)	First IF In MHz	Harmonic Mode	Avg. Noise Level (dBm)
.01-1.8	2050	1−	−113
1.7-4.1	321.4	1−	−110
3.8-8.5	321.4	2−	−107
5.8-12.9	321.4	3−	−100
8.5-18	321.4	4+	−95
10.5-22	321.4	5+	−90

Reference Level

Reference Level range: +60 dBm[1] to −112 dBm in 10 dB steps and continuous 0 to −12 dB calibrated vernier.

Reference Level accuracy:
With Sweep Time/Division control in Auto setting, the optimum sweep rate is selected automatically for any combination of Frequency Span/Div, Resolution Bandwidth and Video Filter settings. Thus, the Auto Sweep setting insures a calibrated amplitude display within the following limits:

Calibrator output
−10 dBm ±0.3 dB
100 MHz ±10 kHz

Reference Level variation (Input Attenuator at 0 dB)
10 dB steps, +20°C to +30°C:
−10 to −70 dBm: <±0.5 dB
−10 to −100 dBm: <±1.0 dB
−10 to −70 dBm: <±1.0 dB, 0°C to +55°C

Vernier (0 to −12 dB) continuous: Maximum error <±0.5 dB, when read from Reference Level Fine control.

Input Attenuator (at preselector input, 70 dB range in 10 dB steps)

Step size variation:
0 to 60 dB, 0.01-18 GHz: <±1.0 dB
0 to 40 dB, 0.01-22 GHz: <±1.5 dB

Maximum cumulative error:
0 to 60 dB, 0.01-18 GHz: <±2.4 dB
0 to 40 dB, 0.01-22 GHz: <±2.5 dB

Frequency Response (with 0 or 10 dB of input Attenuation)
Frequency response includes input attenuator, preselector and mixer frequency response plus mixing mode gain variation (band to band) and assumes preselector peaking.

Frequency Band (GHz)	Frequency Response (± dB MAX.)
.01-1.8	1.2
1.7-4.1	1.5
3.8-8.5	2.5
5.8-12.9	2.5
8.5-18	3.0
10.5-22	4.5

Switching between bandwidths: 3 MHz to 300 kHz, <±0.5 dB; 3 MHz to 0.1 kHz, <±1.0 dB.

Calibrated display range
Log expanded from reference level down:
70 dB with 10 dB/Div scale factor
40 dB with 5 dB/Div scale factor
16 dB with 2 dB/Div scale factor
8 dB with 1 dB/Div scale factor

Linear: Full scale from 0.56 μV (−112 dBm across 50 ohms to 224 volts (+60 dBm)[1] in 10 dB steps and continuous 0 to −12 dB vernier. Full scale signals in linear translate to approximately full scale signals in the log modes.

Display accuracy
Log: < ±0.1 dB/dB but not more than ±1.5 dB over 70 dB display range.
Linear: < ±3% over full 8 division deflection

Residual responses (no signal present at input):
With 0 dB input attenuation and fundamental mixing (0.01 to 4.1 GHz): < −90 dBm.

Signal Identifier:
Provided over entire frequency range and in all Frequency Span/Div. settings. Correct response is a 2 MHz shift to left and approximately a 6 dB lower amplitude. (Reads incorrectly for 100 MHz CAL OUTPUT Signal.)

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 2μsec/Div to 10 sec/Div in 1, 2, 5 sequence. Sweep time accuracy ±10% except for 2, 5, and 10 sec/Div, which are ±20%. Swept frequency modes use sweep times 2 msec/Div through 10 sec/Div. When operated as a fixed tuned receiver (Zero Span) the full range of sweep times (2 μsec to 10 sec/Div) may be used to display modulation waveforms. Sweep times that are too fast or too slow for the Resolution Bandwidth, Frequency Span/Div, and Video Filter settings (producing an uncalibrated display) are indicated by an UNCAL warning on the CRT. Sweep times ≤2 msec/Div (≤msec/Div when In Max Hold, Digital Averaging, or INP-B−A Normalization) produce a mixed mode display with analog traces and CRT control readouts on the CRT.

[1] Input level not to exceed +30 dBm damage level.

Table 1-1. HP Model 8569A Specifications (3 of 3)

GENERAL SPECIFICATIONS

TEMPERATURE RANGE:
Operating 0°C to 55°C
Storage −40° C to +75°C.

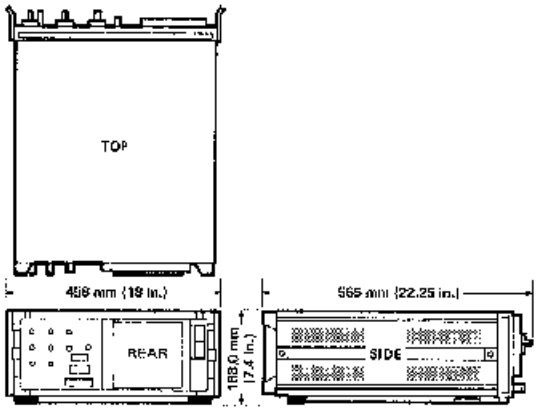
HUMIDITY RANGE (Operating):
< 95% R.H. 0°C to +40°C.

EMI:
Conducted and radiated interference is in compliance with MID-STD 461A Methods CEO3 and REO2, CISPR publication 11 (1975) and Messempfaenger- Postverfuegung 526/527/79 (Kennzeichnung MIL F- Nummer/Funkschutzzeichen).

POWER REQUIREMENTS
48-66 Hz, 100, 120, 200 or 240 volts (−10% to +5%); 220 VA maximum. Fan cooled.

DIMENSIONS

458 mm wide: 188 mm high, 565 mm deep (18 in. x 7 3/8 in. x 22 1/4 in.)



WEIGHT:
Net: 29.1 kg (64 lbs.)
Shipping: 40.9 kg (90 lbs.)

11517A, Opt. E03 EXTERNAL MIXER

When used with the HP 8569A for operation in waveguide 14.5 to 40 GHz:

MEASUREMENT RANGE

Maximum waveguide input: Saturation (gain compression < 1 db), −15 dBm; Damage Level > 0 dBm or 0.1 erg.

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.

STANDARD OPTIONS AVAILABLE

OPTION 001

Comb Generator
Frequency Accuracy: ≤ ±0.005%

OPTION 002

Deletes .3 kHz and .1 kHz resolution BW settings.

All specifications identical to standard HP 8569A except:

Spectral Resolution and Stability
Resolution Bandwidths: Resolution (3 dB) bandwidths from 1 kHz to 3 MHz in a 1, 3 sequence.

Selectivity: (60 dB/3 dB bandwidth ratio) <15:1 for bandwidths 1 kHz to 3 MHz.

Stability
Total Residual FM
Stabilized: < 200 Hz p-p in 0.1 sec. .01—8.5 GHz

OPTION 400, 400 Hz POWER SUPPLY

Permits operation on 50, 60, or 400 Hz mains.

All specifications identical to standard HP 8569A except:

GENERAL SPECIFICATIONS

Temperature range (operating): 50-60 Hz 0°C to 40°C
400 Hz 0°C to 55°C

Power requirements: 50, 60, or 400 Hz; 100, 120, 200, or 240 volts (−10% to +5%); 220 VA, maximum. Fan cooled.

[1]Input level not to exceed +137 dBμV damage level.

Table 1-2. HP Model 8569A Supplemental Characteristics (1 of 4)

SUPPLEMENTAL CHARACTERISTICS

NOTE: Values in this table are not specifications but are typical characteristics included for user information.

FREQUENCY CHARACTERISTICS

FREQUENCY SPANS

1.7 to 22 GHz
When this mode is selected the analyzer displays the entire spectrum from 1.7 to 22 GHz. A 3 MHz Resolution Bandwidth, 9 kHz Video Filter, and 100 msec/div Sweep Time are automatically selected.

Full Band
When selected by panel pushbutton, analyzer displays spectrum of Frequency Band chosen. This automatically selects a 3 MHz Resolution bandwidth and a 9 kHz Video Filter. Sweep Time/Div varies from approximately 10 msec to 100 msec/div depending on which Frequency Band is chosen. Tuning marker frequency (position) indicates where analyzer tuning will be centered if a Per Division span mode is chosen.

Per Division
In "F" position (full band), the entire range of the Frequency Band selected is spanned, thus allowing the use of Resolution Bandwidth and Video Filter settings other than those chosen when the Full Band pushbutton is depressed. Center frequency of the analyzer's display is set by the tuning control and indicated by the LED readouts. The Frequency CAL control to the right of the display window on the front panel is used to set the LED readout to agree with the actual center frequency of the CRT display (normally set using the 100 MHz CAL OUTPUT as a 0.100 GHz frequency reference).

Out-of-range blanking
The out-of-range portion of the CRT trace is automatically blanked whenever the analyzer is swept beyond a band edge.

RESOLUTION

Bandwidth Ranges
See Figure 1 for curves of typical analyzer resolution using different IF bandwidths.

IF Bandwidth shape:
Approximately gaussian (synchronously tuned, 4-pole filter)

Frequency drift (fundamental mixing, .01-4.1 GHz) long term

At fixed center frequency after 2 hours warm-up:
Stabilized $< \pm 3.0$ kHz/10 minutes
Unstabilized $< \pm 25$ kHz/10 minutes

With Temperature Changes:
Stabilized < 10 kHz/°C
Unstabilized < 200 kHz/°C
Auto stabilizer may be disabled in narrow spans (< 100 kHz/Div) by depressing front panel pushbutton switch to "OFF" position.

VIDEO FILTER

Video Filter bandwidths typically ±20% of nominal value.

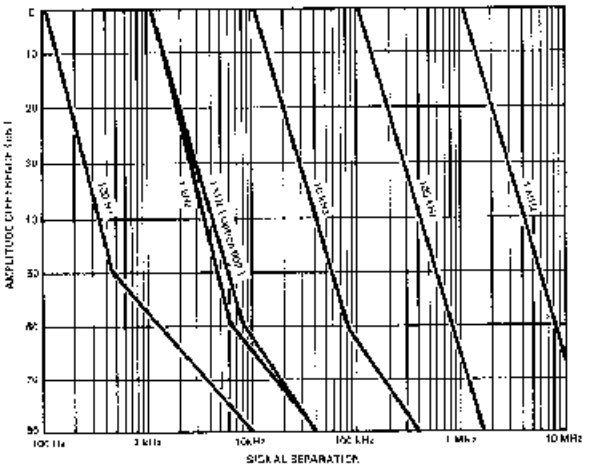


Figure 1. Typical Spectrum Analyzer Resolution

INTERNAL PRESELECTOR

Frequency Range	Description	Rejection
0.01 to 1.8 GHz	Low-pass filter	> 50 dB above 2.05 GHz
1.7 to 22 GHz	Tracking YIG tuned filter	> 70 dB greater than 642.8 MHz from center of pass band 1.7 to 18 GHz. > 60 dB from 18 to 22 GHz

TRACKING PRESELECTOR

Preselector skirt roll-off: Characteristics of a three-pole filter (nominally 18 dB/octave), 3 dB bandwidth typically varies from 25 MHz (at 1.7 GHz) to 70 MHz (at 22 GHz).

Table 1-2. HP Model 8569A Supplemental Characteristics (2 of 4)

SUPPLEMENTAL CHARACTERISTICS

NOTE: Values in this table are not specifications but are typical characteristics included for user information.

AMPLITUDE CHARACTERISTICS

DYNAMIC RANGE

Maximum power ratio of two signals simultaneously present at the input that may be measured within the limits of specified accuracy, sensitivity and distortion (i.e., spurious responses): 0.01 to 22 GHz > 70 dB.

Spurious responses: (Input attenuator set to 0 dB)

Second harmonic distortion

Frequency Range	Input Power	Relative Distortion
0.01 - 1.8 GHz	−35 dBm	< −70 dB
1.7 - 22 GHz	−10 dBm	< −100 dB*

*May be below average noise level

Third order intermodulation

Frequency Range	For Two Input Signals With		Relative Distortion
	Total Power	Signal Sep.	
0.01-22 GHz	−30 dBm	50 kHz	< −70 dB
1.7-12.9 GHz	−10 dBm	70 MHz	< −100 dB*
1.7-22 GHz	−10 dBm	100 MHz	< −100 dB*

*May be below average noise level

For typical harmonic and third order intermodulation distortion, see Figure 2.

Image and Multiple Responses:

Frequency	Image (out of band)	Multiple (in-band)
0.01-1.8 GHz	< −50 dB	non-existent
1.7-18 GHz	< −70 dB	< −70 dB
18-22 GHz	< −60 dB	< −60 dB

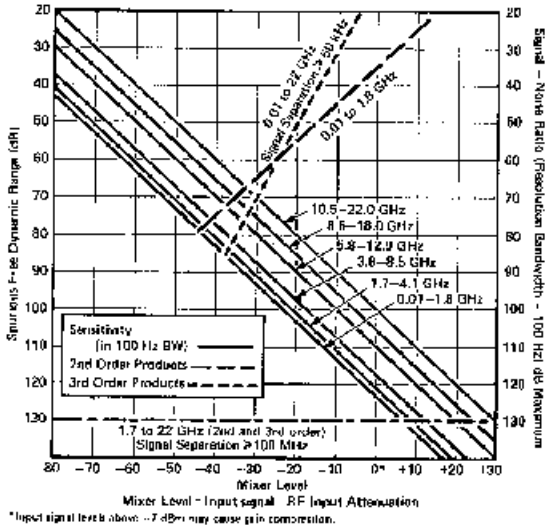


Figure 2. Optimum Dynamic Range Chart

AMPLITUDE ACCURACY

The overall amplitude accuracy of a measurement depends on an analyzer's performance and the measurement technique used. Applying IF substitution eliminates errors caused by the display, bandwidth gain variation, scale factor and input attenuator step size. Only IF gain variation (reference level change with input attenuation constant: < ±0.5 dB), calibrator amplitude (< ±0.3 dB), and frequency response remain. In brief, IF substitution minimizes error by minimizing control changes from the reference measurement (e.g., calibration).

For measurements in the Frequency Bands covering 1.7 to 22 GHz that don't require the best possible accuracy, the front panel preselector peak may be left centered in

Table 1-2. HP Model 8569A Supplemental Characteristics (3 of 4)

SUPPLEMENTAL CHARACTERISTICS

NOTE: Values in this table are not specifications but are typical characteristics included for user information.

its "green" setting. Best amplitude accuracy is obtained by peaking the preselector at the frequency of interest.

Reference Level Variation (For any change of scale factor): < ±1 dB.

FREQUENCY RESPONSE AND AVERAGE NOISE LEVEL

For typical frequency response and average noise level versus input frequency, see Figure 3.

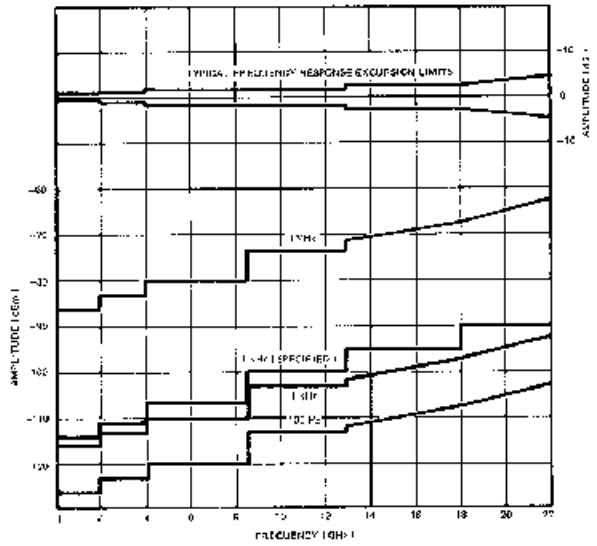


Figure 3. Typical Frequency Response and Average Noise Level Versus Input Frequency

SIGNAL INPUT CHARACTERISTICS

INPUT 50Ω 0.01 TO 22 GHz

Input connector: Precision type N female

Input impedance

Input attenuator at 0 dB: 50 ohms nominal

SWR: < 1.5 0.01 to 1.8 GHz
< 2.0 1.7 to 22 GHz (at analyzer tuned frequency)

Input attenuator at 10 dB or more: 50 ohms nominal

SWR: < 1.3 0.01 to 1.8 GHz
< 2.0 1.7 to 22 GHz

LO Emission (2.00 to 4.45 GHz):
< −80 dBm 0.01 to 1.8 GHz
< −80 dBm 1.7 to 22 GHz

Input Protection (For input signals from .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 (preselector) occurs at total input signal power levels below input mixer damage.

EXTERNAL MIXER INPUT

SMA female connector is a port for LO power transfer, bias current and IF return.

SWEEP CHARACTERISTICS

SWEEP SOURCE

Manual: Sweep determined by front panel control: continuously settable across CRT in either direction.

External: Sweep determined by 0 to +10V external signal applied to External Sweep input on rear panel. Blanking is controlled by signal at Blanking Input. Operation in Digital Storage Display mode with External sweep requires a Retrace signal input to rear panel Retrace Input connector.

Internal: Sweep generated from internal sweep generator.

SWEEP TRIGGER

Free Run: Sweep triggered repetitively by internal source.

Line: Sweep triggered by power line frequency.

Video: Sweep internally triggered by detected waveform of input signal (signal amplitude of 0.5 division peak-to-peak required on CRT display).

Trigger Level: Sets the level of the sweep trigger signal, whether it is the displayed trace (Video mode) or an external trigger input (Ext mode).

External Trigger: Sweep triggering determined by signal input (between +1 and +10 volts) to rear panel BNC connector.

Single: Sweep triggered or reset by front panel Start/Reset pushbutton.

Start/Reset: Triggers sweep in Single sweep mode. Can also reset any internal sweep to left edge of display.

Table 1-2. HP Model 8569A Supplemental Characteristics (4 of 4)

SUPPLEMENTAL CHARACTERISTICS

NOTE: Values in this table are not specifications but are typical characteristics included for user information.

REAR PANEL INPUT AND OUTPUT CHARACTERISTICS

Plotter Interface

Log: <0.1 dB/dB, max error <1 dB
Linear: <0.1 division

X, Y, and Z Axis Outputs: These outputs are compatible with and may be used to drive all current HP XY recorders (using positive pencoils or TTL penlift input) and CRT monitors.

Horizontal Sweep Output (X axis): A voltage proportional to the horizontal sweep of the CRT trace which ranges from −5V for the left graticule edge to +5V for the right graticule edge. Output impedance is 5 kohms.

Vertical Output (Y axis): Detected video output proportional to vertical deflection of the CRT trace. Output increases 100 mV/div from 0 to 800 mV (from a 50 ohm source) for a full 8-division deflection. Output impedance is 50 ohms.

Blank (Penlift or Z axis) Output: A blanking output, 15V from 10 kohms, which occurs during CRT retrace or when sweeping beyond band edges. Otherwise output is low at 0V with a 10 ohm output impedance for a normal or unblanked trace (pen down).

Blanking Input: Permits remote Z axis control of CRT with TTL levels; normal <0.5V or open circuit, blank >2V. Input impedance is 10 kohms. Note that in Digital Storage mode, Blanking input does not directly blank the CRT; instead it sets blank bits in the trace memory so that the appropriate parts of the trace are blanked during the CRT refresh cycle.

Caution: maximum input is ±40V.

External Sweep Input: When the front panel Sweep Source switch is set to the EXT mode, a 0 to 10V ramp will sweep the analyzer through the frequency range determined by front panel Tuning and Frequency Span/Div controls. Input impedance is 10 kohms.

Caution: maximum input ±40V.

Retrace Input: Required for operation in Digital Storage Display mode if External Sweep is used. Normal level <0.5V, blank (retrace) level >2V. Input impedance is 10 kohms.

Caution: maximum input is ±40V.

External Trigger Input: With the Sweep Trigger in EXT mode, a signal will trigger a sweep on the signal's positive slope between +1 and +10 volts according to the setting of the Trigger Level control. 100 kohms input impedance, dc coupled.

Caution: maximum input ±40V.

21.4 MHz IF Output: A 50 ohm, 21.4 MHz output linearly related to the RF input to the analyzer. Bandwidth controlled by the analyzer's Resolution Bandwidth setting; amplitude controlled by the Input Attenuator, IF gain vernier and first 6 IF Reference Level step gain positions (−10 through −60 dBm level with 0 dB input attenuation). Output is approximately −10 dBm from 50 ohms for full scale signals on the CRT.

First LO Output: Connector is SMA Female, 50 ohms. Terminate in a 50 ohm load when not in use.

Frequency: 2.00 to 4.46 GHz
Power Level: typically at +8 dBm
Stability (Typical residual FM):
Stabilized: 30 Hz p-p
Unstabilized: 2 kHz p-p

Aux B: Used during factory calibration.

CATHODE RAY TUBE

Type: Post deflection accelerator, approximately 11.5 kV accelerating potential, aluminized P31 phosphor, electrostatic focus and deflection.

Graticule: Internal 8 × 10 division. 1 division vertically is 1 centimeter, 1 division horizontally is 1.2 centimeters. There are 5 subdivisions per each major division.

Annotation: Major control settings are annotated on CRT.

Viewing Area: Approximately 9.6 centimeters vertically by 11 centimeters horizontally (3.8 inches by 4.7 inches).