FLUKE®

Calibration

96000 Series

RF Reference Source

Product Specifications

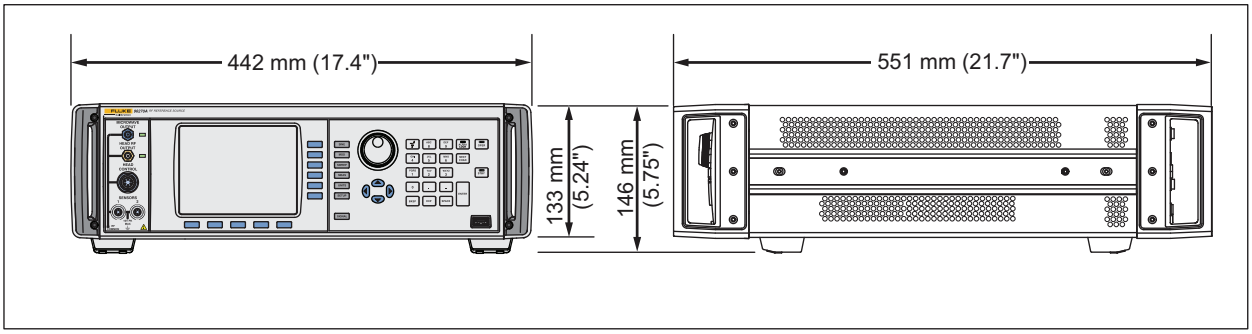
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Product Specifications

General Specifications (96040A and 96270A)

Performance	All specifications apply to a 1-year calibration interval at an ambient temperature of Tcal ±5 °C. Nominal factory Tcal calibration temperature 23 °C. Unless otherwise noted, specifications are stated at a 99 % confidence level
Standard Interfaces	IEEE488.2 (GPIB) 96270A only: Compatible power sensor inputs [1] 96270A only: USB memory device
Warmup Time	60 minutes
Temperature	Operating: 0 °C to 50 °C Specified Operation: 5 °C to 40 °C Storage: -20 °C to +70 °C
Relative Humidity	Operating or Storage: Non-condensing, 5 °C to 30 °C <90 %, <40 °C <75 %, <70 °C <45 %
Altitude	Operating: ≤2,000 m Non-operating: ≤12,000 m
Safety	IEC 61010-1: Overvoltage Category II, Pollution Degree 2
Electromagnetic Compatibility   <



hpn366.eps

96040A and 96270A Dimensions

Frequency Reference Input/Output Specifications (96040A and 96270A)

Frequency Reference Input	Rear-panel Reference Frequency Input BNC connector
Frequency	1 MHz to 20 MHz in 1 MHz steps ±0.3 ppm, typical
Level	1 V pk nominal into 50 Ω, ±5 V pk max

Frequency Reference Output	Rear-panel Reference Frequency Output BNC connector
Frequency	1 MHz or 10 MHz, user selectable
Level	1.5 V pk-pk into 50 Ω, 3 V pk-pk into 1 kΩ, TTL compatible
Accuracy [1] [2]	±0.05 ppm
Ageing Rate and Stability [2]	After 24-hr warmup: $\leq\pm5\times10^{-10}$/day, typical Continuous operation: $\leq\pm2\times10^{-8}$/month typical, $\leq\pm5\times10^{-8}$ over 1 year

[1] Includes all stability effects for the 1-year calibration interval and Tcal ±5 °C temperature range applicable to all specifications.

[2] Specifications apply only if Internal Frequency Reference operation is selected. With External Frequency Reference operation selected, the frequency of the Frequency Reference Output is locked to the signal applied to the Frequency Reference Input.

Leveled Sine Specifications at Leveling Head Output (96040A and 96270A)

Frequency	
Range	1 mHz to 4 GHz
Resolution	Standard: <100 MHz: 0.001 Hz (1 mHz), 100 MHz: 11 digits Enhanced: 0.000 01 Hz (10 µHz)
Accuracy	Internal Frequency Reference: ±(0.05 ppm +5 µHz) External Frequency Reference: ±(Ext Freq Ref Accuracy +5 µHz)

Amplitude	**50 Ω Output**	**75 Ω Output**
Output Connector	Precision 50 Ω N-Series male	Precision 75 Ω N-Series male
Range	-130 dBm to +24 dBm (0.2 µV to 10 V pk-pk) >125 MHz: +20 dBm >1.4 GHz: +14 dBm	-130 dBm to +18 dBm (0.13 µV to 6.3 V pk-pk) >125 MHz: +14 dBm >1.4 GHz: +8 dBm
Resolution	0.001 dB	0.001 dB
VSWR	≤100 MHz: ≤1.05 ≤2 GHz: ≤1.1 2 GHz to 4 GHz: ≤1.0 + 0.05 x f (GHz)	≤100 MHz: ≤1.1 ≤1 GHz: ≤1.2 ≤2 GHz: ≤1.3

Attenuation	50 Ω Output	75 Ω Output
Attenuation 10 Hz [1] to 128 MHz	Relative to +16 dBm output: 0 - 55 dB ±0.025 dB 55 - 64 dB ±0.03 dB 64 - 74 dB [1] ±0.05 dB 74 - 100 dB [1] ±0.07 dB 100 - 116 dB [1] ±0.15 dB Relative to +10 dBm output: 0 - 49 dB ±0.02 dB 49 - 59 dB ±0.03 dB 59 - 69 dB [1] ±0.05 dB 69 - 94 dB [1] ±0.07 dB 94 - 110 dB [1] ±0.15 dB	Relative to +10 dBm output 0 - 33 dB ±0.07 dB 33 - 64 dB ±0.1 dB 64 - 100 dB [2] ±0.2 dB 100 - 110 dB [2] ±0.4 dB
Cumulative and Incremental Attenuation To determine the attenuation specification between any two output levels, apply an RSS [3] summation of the dB values listed for each output level.	Relative to any level between +10 dBm and -100 dBm, 10 Hz [1] to 128 MHz +16 to +10 dBm ±0.025 dB +10 to -39 dBm ±0.02 dB -39 to -48 dBm ±0.03 dB -48 to -58 dBm [1] ±0.05 dB -58 to -84 dBm [1] ±0.07 dB -84 to -100 dBm [1] ±0.15 dB	Relative to any level between +10 dBm and -100 dBm, 10 Hz [2] to 128 MHz +10 to -23 dBm ±0.07 dB -23 to -54 dBm ±0.1 dB -54 to -90 dBm [2 ±0.2 dB -90 to -100 dBm [2] ±0.4 dB

[1] 50 Ω Output attenuation specifications are typical at absolute levels of less than -48 dBm up to 20 kHz, at less than -74 dBm up to 100 kHz, and at less than -84 dBm at all frequencies.

[2] 75 Ω Output attenuation specifications are typical at absolute levels of less than -54 dBm up to 20 kHz, at less than -80 dBm up to 100 kHz, and at less than -90 dBm at all frequencies.

[3] Root Sum Square.

Absolute Amplitude Accuracy	50 Ω Output							
Amplitude								
dBm	10 Hz [1] to <100 kHz	100 kHz	>100 kHz to <10 MHz	10 MHz to 128 MHz	>128 MHz to 300 MHz	>300 MHz to 1.4 GHz	>1.4 GHz to 3 GHz	>3 GHz to 4 GHz
>+20 to +24	±0.03 dB	±0.03 dB	±0.05 dB	±0.05 dB	Output not available			
>+14 to +20	±0.03 dB	±0.03 dB	±0.05 dB	±0.05 dB	±0.07 dB	±0.2 dB		
-17 to +14	±0.03 dB	±0.03 dB	±0.05 dB	±0.05 dB	±0.07 dB	±0.2 dB	±0.3 dB	±0.3 dB
-48 to <-17	±0.03 dB	±0.03 dB	±0.05 dB	±0.05 dB	±0.07 dB	±0.2 dB	±0.3 dB	±0.5 dB
>-74 to <-48	Not Specified	±0.2 dB	±0.2 dB	±0.1 dB	±0.1 dB	±0.4 dB	±0.5 dB	±0.5 dB
>-84 to -74		±0.5 dB	±0.5 dB	±0.1 dB	±0.3 dB	±0.5 dB	±1.0 dB	±1.0 dB
>-94 to -84		±0.5 dB	±0.5 dB	±0.3 dB	±0.5 dB	±1.0 dB	±1.0 dB	Not Specified
-130 to -94				±0.7 dB	±1.5 dB	±1.5 dB	±1.5 dB [2]	

[1] Also applies as typical accuracy at frequencies <10 Hz.

[2] Specifications are typical.

Amplitude Flatness relative to 100 kHz	**50 Ω Output**							
Amplitude								
dBm	10 Hz [1] to <100 kHz	100 kHz	>100 kHz to <10 MHz	10 MHz to 128 MHz	>128 MHz to 300 MHz	>300 MHz to 1.4 GHz	>1.4 GHz to 3 GHz	>3 GHz to 4 GHz
>+20 to +24	±0.03 dB	±0.00 dB	±0.04 dB	±0.04 dB	Output not available			
>+14 to +20	±0.03 dB	±0.00 dB	±0.04 dB	±0.04 dB	±0.06 dB	±0.2 dB		
-17 to +14	±0.03 dB	±0.00 dB	±0.04 dB	±0.04 dB	±0.06 dB	±0.2 dB	±0.3 dB	±0.3 dB
-48 to <-17	±0.03 dB	±0.00 dB	±0.04 dB	±0.04 dB	±0.06 dB	±0.2 dB	±0.3 dB	±0.5 dB
>-74 to <-48		±0.00 dB	±0.2 dB	±0.1 dB	±0.1 dB	±0.4 dB	±0.5 dB	±0.5 dB
>-84 to -74		±0.00 dB	±0.5 dB	±0.1 dB	±0.3 dB	±0.5 dB	±1.0 dB	±1.0 dB
>-94 to -84		±0.00 dB	±0.5 dB	±0.3 dB	±0.5 dB	±1.0 dB	±1.0 dB	
-130 to -94	Not Specified							

[1] Also applies as typical accuracy at frequencies <10 Hz.

Absolute Amplitude Accuracy	**75 Ω Output**							
Amplitude								
dBm	10 Hz [1] to <20 kHz	>20 kHz to <100 kHz	>100 kHz to <10 MHz	10 MHz to 125 MHz	>125 MHz to 300 MHz	>300 MHz to 1.4 GHz	>1.4 GHz [2] to 3 GHz	>3 GHz [2] to 4 GHz
>+14 to +18	±0.12 dB	±0.12 dB	±0.12 dB	±0.12 dB	Output not available			
>+8 to +14	±0.12 dB	±0.12 dB	±0.12 dB	±0.12 dB	±0.15 dB	±0.25 dB		
-23 to +8	±0.12 dB	±0.12 dB	±0.12 dB	±0.12 dB	±0.15 dB	±0.25 dB	±0.3 dB	±0.5 dB
-54 to <-23	±0.15 dB	±0.15 dB	±0.15 dB	±0.15 dB	±0.2 dB	±0.5 dB	±0.5 dB	±0.5 dB
>-80 to <-54	Not Specified		±0.2 dB	±0.2 dB	±0.2 dB	±0.5 dB	±0.5 dB	±0.5 dB
>-90 to -80			±0.7 dB	±0.7 dB	±0.7 dB	±1.0 dB	±1.0 dB	±1.0 dB
>-100 to -90			±0.7 dB	±0.7 dB	±0.7 dB	±1.0 dB	±1.0 dB	Not Specified
-120 to -100				±1.5 dB	±1.5 dB	±1.5 dB	±1.5 dB	

[1] Also applies as typical accuracy at frequencies <10 Hz.
[2] Specifications are typical for frequencies >2 GHz

Leveled Sine Specifications at Microwave Output (96270A)

Frequency	
Range	1 mHz to 27 GHz
Resolution	Standard: <100 MHz: 0.001 Hz (1 mHz), ≥100 MHz: 11 digits, ≥10 GHz 12 digits Enhanced: <4 GHz: 0.000 01 Hz (10 µHz), ≥4 GHz: 0.000 1 Hz (100 µHz)
Accuracy	Internal Frequency Reference: ±(0.05 ppm +5 µHz) External Frequency Reference: ±(Ext Freq Ref Accuracy +5 µHz)

Microwave Output Direct	At the front panel Microwave Output connector. Amplitude set on instrument front panel and delivered at the front panel Microwave Output connector.
Amplitude Range	-4 dBm to +24 dBm [1] >1.4 GHz: +20 dBm [1] With Low-Level Microwave Output option [2]: -100 dBm to +24 dBm [1] >1.4 GHz: +20 dBm [1] >20 GHz: +18 dBm [1]
Amplitude Resolution	0.001 dB
Amplitude Accuracy (Typical, into 50 Ω)	-4 dBm to +24 dBm up to 4 GHz: ±0.5 dB 4 GHz to 26.5 GHz:±1.0 dB
VSWR	≤2.0 typical
Connector	PC2.92 mm female

[1] Amplitude specifications apply into 1.0 VSWR match only.
[2] Internal step attenuator rated to 1.5 million operations.

Microwave Splitter/Sensor Output [1]	At the leveling splitter output port connector. Amplitude set on instrument front panel and delivered at the splitter output port connector.
Leveling Frequency Range	1 kHz minimum, to avoid leveling control tracking instantaneous signal level at lower frequencies
Amplitude Range	-10 dBm to +18 dBm [2] (200 mV to 5 V pk-pk) >1.4 GHz: +14 dBm [2] (3.17 V pk-pk) With Low-Level Microwave Output option [3]: -35 dBm [4] to +18 dBm [2] (11.2 mV to 5 V pk-pk) >1.4 GHz: +14 dBm [2] (3.17 V pk-pk) >20 GHz: +12 dBm [2] (2.52 V pk-pk)
Amplitude Resolution	0.001 dB
VSWR	≤1.22 (HF Leveling Kit splitter device output port VSWR specification)
Connector	PC3.5 mm female (HF Leveling Kit splitter device output port connector)

[1] Requires the HF Leveling Kit or compatible power sensor and splitter with splitter/sensor leveling enabled. Automatic feedback establishes and maintains the level set on the instrument user interface at the splitter output port connector. See Power Meter Readout specifications for compatible power sensor details.
[2] Amplitude range specifications are nominal, apply into 1.0 VSWR match only. Maximum output assumes a typical 6 dB splitter loss and is also influenced by loss in the front panel Microwave output to splitter input interconnection.
[3] Internal step attenuator rated to 1.5 million operations
[4] Leveling operational to -35 dBm minimum with supplied HF Leveling Kit power sensor. As level decreases additional sensor low level reading repeatability/speed considerations and noise floor contributions may be required.

Microwave Splitter/Sensor Output: Cal Factor Uncertainty [1] [2]

Calibration Factor uncertainty, applicable to power sensor calibration

Figures in parenthesis [3] apply with alternative user traceability and correction of mismatch errors.	100 MHz	1 GHz	2.4 GHz	8 GHz	12 GHz	18 GHz	22 GHz	26.5 GHz
	±1.06 % (±0.37 %)	±1.42 % (±0.49 %)	±1.42 % (±0.60 %)	±2.19 % (±0.76 %)	±2.33 % (±0.89 %)	±2.91 % (±1.06 %)	±3.52 % (±1.36 %)	±3.52 % (±2.18 %)

[1] Uncertainties are for 95% confidence level (k = 2), and exclude UUT match contribution.

[2] Unless otherwise stated, applies to performance with supplied HF Leveling Kit and sensors, factory calibration and self-characterization. Self-characterization requires second sensor option. If self-characterization is not performed, additional uncertainty contributions must be considered, for example splitter port tracking error (up to 0.25dB for the supplied HF Leveling Kit device).

[3] Calibration factor uncertainty applicable with reference sensor calibrated with typical state-of-the-art uncertainty, and vector corrections for mismatch errors at splitter output port.

Microwave Splitter/Sensor Output: Power Flatness Uncertainty [1] [2]

Power Flatness uncertainty, applicable to spectrum analyzer and other measurement device flatness calibration

Power Flatness uncertainty into 50 Ω (1.0 VSWR match)	>1 kHz to 100 MHz	>100 MHz to 2.4 GHz	>2.4 GHz to 8 GHz	>8 GHz to 12.4 GHz	>12.4 GHz to 18 GHz	>18 GHz to 26.5 GHz
	±0.05 dB	±0.07 dB	±0.10 dB	±0.10 dB	±0.13 dB	±0.16 dB

[1] Uncertainties are specified for 95 % confidence level (k = 2), and exclude UUT match contribution.

[2] Applies to performance with supplied HF Leveling Kit and sensors, factory calibration and self-characterization. Self-characterization requires second sensor option. If self-characterization is not performed, additional uncertainty contributions must be considered, for example splitter port tracking error (up to 0.25dB for the supplied HF Leveling Kit device).

Microwave Splitter/Sensor Output: Voltage Flatness Uncertainty [1] [2]

Voltage Flatness uncertainty, applicable to oscilloscope bandwidth calibration

Voltage Flatness uncertainty into 50 Ω		>1 kHz to 100 MHz	>100 MHz to 2.4 GHz	>2.4 GHz to 8 GHz	>8 GHz to 12.4 GHz	>12.4 GHz to 18 GHz	>18 GHz to 26.5 GHz
For stated UUT Input VSWR:	1.0	±0.53 %	±0.71 %	±1.10 %	±1.16 %	±1.46 %	±1.76 %
	1.2	±1.4 %	±1.49 %	±1.71 %	±1.75 %	±1.96 %	±2.20 %
	1.6	±3.38 %	±3.41 %	±3.51 %	±3.53 %	±3.64 %	±3.77 %

[1] Uncertainties are specified for 95 % confidence level (k = 2), and include UUT match contribution for the stated UUT input VSWR values.

[2] Applies to performance with supplied HF Leveling Kit and sensors, factory calibration and self-characterization. Self-characterization requires second sensor option. If self-characterization is not performed, additional uncertainty contributions must be considered, for example splitter port tracking error (up to 0.25dB for the supplied HF Leveling Kit device).

Leveled Sine Specifications at Leveling Head Output (96040A and 96270A) and Microwave Output (96270A)

Signal Purity	At maximum output level
Harmonics [1]	≤1 GHz: <-60 dBc, >1 GHz: <-55 dBc
Spurious ≥3 kHz offset	96040A and 96270A: ≤9 MHz: <-75 dBc, ≤500 MHz: <-84 dBc, ≤1 GHz: <-78 dBc, ≤2 GHz: <-72 dBc, ≤4 GHz: <-66 dBc 96270A: ≤8 GHz: <-60 dBc, ≤16 GHz: <-54 dBc, ≤27 GHz: <-48 dBc
Sub-harmonics	≤ 4 GHz, none > 4 GHz, <-60 dBc
SSB AM Noise	10 MHz to 1.4 GHz, <0.015 % RMS, in 50 Hz to 3 kHz Bandwidth, typical

[1] Typical for harmonic content above maximum output frequency for 96270A.

Residual FM	Hz RMS in 50 Hz to 3 kHz Bandwidth Typical	Hz RMS in 50 Hz to 15 kHz Bandwidth Typical
125 MHz	0.004	0.03
250 MHz	0.006	0.035
500 MHz	0.01	0.055
1 GHz	0.02	0.11
2 GHz	0.04	0.22
3 GHz	0.06	0.33

RMS Jitter	Typical, at + 10 dBm output level, Internal Frequency Reference		
Output Frequency	**Integration Bandwidth**	**Phase (m° RMS)**	**Time (fs RMS)**
155 MHz	100 Hz to 1.5 MHz	1.0	18
622 MHz	1 kHz to 5 MHz	4.0	18
2488 MHz	5 kHz to 20 MHz	14.4	16

SSB Phase Noise	dBc/Hz, at +13 dBm, Internal Frequency Reference								
Carrier Frequency	Offset from Carrier								
	1 Hz Spec (Typical)	10 Hz Spec (Typical)	100 Hz Spec (Typical)	1 kHz Spec (Typical)	10 kHz Spec (Typical)	100 kHz Spec (Typical)	1 MHz Spec (Typical)	10 MHz Spec (Typical)	100 MHz Spec (Typical)
10 MHz	-96 (-106)	-116 (-123)	-132 (-139)	-143 (-149)	-150 (-155)	-153 (-157)	-154 (-157)	Not Specified	
>10 MHz to 15.625 MHz	-90 (-100)	-113 (-124)	-130 (-139)	-142 (-148)	-149 (-155)	-152 (-157)	-154 (-158)	-155 (-159)	
>15.625 MHz to 31.25 MHz	-85 (-95)	-110 (-119)	-128 (-135)	-141 (-145)	-148 (-152)	-152 (-157)	-153 (-158)	-155 (-159)	
>31.25 MHz to 62.5 MHz	-80 (-90)	-107 (-114)	-125 (-133)	-141 (-145)	-148 (-152)	-152 (-157)	-153 (-158)	-155 (-159)	
>62.5 MHz to 125 MHz	-78 (-88)	-101 (-107)	-121 (-128)	-141 (-146)	-148 (-153)	-151 (-155)	-153 (-156)	-155 (-158)	
>125 MHz to 250 MHz	-72 (-82)	-96 (-102)	-116 (-122)	-138 (-143)	-148 (-152)	-151 (-155)	-153 (-156)	-155 (-158)	(-162)
>250 MHz to 500 MHz	-66 (-76)	-90 (-96)	-110 (-116)	-134 (-139)	-144 (-148)	-146 (-150)	-152 (-155)	-154 (-157)	(-163)
>500 MHz to 1 GHz	-59 (-69)	-84 (-90)	-104 (-110)	-130 (-135)	-140 (-144)	-141 (-145)	-148 (-152)	-152 (-155)	(-156)
>1 GHz to 2 GHz	-54 (-64)	-78 (-84)	-98 (-104)	-124 (-130)	-134 (-138)	-135 (-139)	-144 (-147)	-148 (-150)	(-150)
>2 GHz to 3 GHz	-48 (-58)	-73 (-79)	-94 (-100)	-120 (-125)	-130 (-134)	-131 (-135)	-141 (-144)	-147 (-149)	(-149)
>3 GHz to 4 GHz	-44 (-54)	-74 (-80)	-94 (-100)	-113 (-117)	-117 (-120)	-118 (-121)	-130 (-133)	-147 (-149)	(-149)
>4 GHz to 8 GHz [1]	(-48)	(-74)	(-94)	(-111)	(-114)	(-115)	(-135)	(-155)	(-155)
>8 GHz to 16 GHz [1]	(-42)	(-68)	(-88)	(-105)	(-108)	(-109)	(-129)	(-149)	(-149)
>16 GHz to 26.5 GHz [1]	(-36)	(-62)	(-82)	(-99)	(-102)	(-103)	(-123)	(-143)	(-143)
SSB Phase Noise at 1 GHz with the 9600FLT [2] wide offset phase noise filter							(-152)	(-170)	(-174)

[1] 96270A Microwave Output only.

[2] The 9600FLT Wide Offset Phase Noise Filter accessory is a narrow bandwidth 1 GHz bandpass filter for use with the 96000 Series models to reduce phase noise levels at high offset frequencies when operating at an output frequency of 1 GHz.

External Leveling Input [1]	Rear panel 50 MHz Counter, Modulation, Leveling and Frequency Pull Input BNC connector
For external power meter leveling [2]	User adjustable full scale voltage, 1 V to 5 V, positive polarity
Input impedance	10 kΩ nominal
Maximum Input	±5 V

[1] For 96270A, External Leveling is not available when using Splitter/Sensor Leveling.

[2] With analog level control feedback from an external power meter readout instrument connected via the rear panel External Leveling Input.

External Frequency Control Input	Rear panel 50 MHz Counter, Modulation, Leveling and Frequency Pull Input BNC connector
Frequency Pull Range	±5 ppm
Frequency Pull Sensitivity	User adjustable between 0.0001 ppm/V to 1.0000 ppm/V, positive or negative polarity
Input impedance	10 kΩ nominal
Maximum Input	±5 V

Modulation Specifications at Leveling Head Output (96040A and 96270A) and Microwave Output (96270A)

Amplitude Modulation	**Microwave Output [1] (96270A only)**	**Leveling Head Output**	
		50 Ω output	**75 Ω output**
Waveform	Sinusoidal, Triangle, or External signal		
Carrier Frequency	50 kHz to 4 GHz		
Carrier Level	-4 dBm to +14 dBm >1.4 GHz: ≤+8 dBm -100 dBm With Low Level Microwave Output option[2]	-130 dBm to +14 dBm >1.4 GHz: ≤+8 dBm	-130 dBm to +8 dBm >1.4 GHz: ≤+2 dBm
Carrier Level Accuracy [3]	As Leveled Sine + 0.5 dB, typical		
Carrier Harmonics	≤ 50 dBc typical		
Rate	≤125.75 MHz, 1 Hz to 220 kHz, ≤ 1 % of Carrier Frequency. >125.75 MHz, 1 Hz to 100 kHz		
Rate Resolution	0.1 Hz, 5 digits		
Rate Accuracy	≥1 kHz: ±1 digit, <1 kHz: ±10 mHz		
Depth	0.1 % to 99 %		
Depth Resolution	0.1 %		
Carrier Frequency and Level Range for Specified Depth Accuracy and Distortion	≤1 GHz, -4 dBm to +14 dBm -56 dBm with Low Level Microwave O/P option [2]	≤1 GHz, -56 dBm to +14 dBm	≤1 GHz, -62 dBm to +8 dBm
AM Sine Depth Accuracy [4]	±(3 % of setting + 0.1 %), for >5 % depth. Typically ± (0.75 % of setting + 0.1 %), for 10 % to 90 % depth, ≤75 MHz carrier frequency.		
AM Sine Distortion [4] [5]	≤40 dBc (1 %), 10 % to 80 % depth, for ≤20 kHz rate, or for > 20 kHz rate at ≤75 MHz carrier frequency. Typically ≤ -50 dBc, 10 % to 80 % depth, ≤75 MHz carrier frequency.		

[1] 96270A: Modulation not available above 4 GHz. Splitter/Sensor leveling not available in Modulation functions. All signal level specifications apply at front panel Microwave Output connector, into 1.0 VSWR match only.
[2] Internal step attenuator rated to 2 million operations.
[3] Signal content at carrier frequency only, excluding sidebands.
[4] Applies to demodulated signal content at rate fundamental frequency. Specifications are typical for modulation rates < 20Hz.
[5] Includes harmonic distortion and noise up to 5 times rate frequency.

AM External	
Input	Rear-panel BNC connector (50 MHz Counter, Modulation, Leveling and Frequency Pull Input). 10 kΩ nominal input impedance.
Bandwidth (-3 dB) [1]	DC coupled [2]: dc to 220 kHz, typical. AC coupled: 10 Hz to 220 kHz, typical.
Depth Sensitivity	User adjustable, 0.5 %/V to 400 %/V
Input Level	±2 V pk maximum operating, ±5 V pk absolute maximum
Carrier Level Accuracy	As AM Internal Sine +20 mV x depth/V setting, typical
Depth Accuracy [3]	±(3 % of setting +0.1 %), for >5 % depth, 1 Vpk input, dc or 200 Hz to 20 kHz
Residual Distortion [4]	As AM Internal Sine, for 1 Vpk input, ≤100 kHz.

[1] Maximum input frequency 100 kHz for carrier frequency >125 MHz.

[2] DC coupled External Modulation permits dc control of carrier level or the offsetting of the modulation waveform. Note that at rates from 0.5 Hz to 10 Hz interaction with carrier leveling may occur, resulting in modulation distortion.

[3] Applies to demodulated signal content at rate frequency fundamental.

[4] Includes harmonic distortion and noise up to 5 times rate frequency.

Frequency and Phase [1] Modulation			
Waveform	FM: Sinusoidal, or External signal. PM: Sinusoidal only.		
Carrier Amplitude Range	Microwave Output [2] (96270A only)	Leveling Head Output	
		50 Ω output	75 Ω output
	-4 dBm to +24 dBm >1.4 GHz: +20 dBm -100 dBm With Low Level Microwave Output option[3]	-130 dBm to +24 dBm >125 MHz: +20 dBm >1.4 GHz: +14 dBm	-130 dBm to +18 dBm >125 MHz: +14 dBm >1.4 GHz: +8 dBm
Carrier Frequency (Fc)	9 MHz to 4 GHz		
Carrier Frequency Accuracy	Internal Frequency Reference: ± (0.05 ppm + 240 mHz) External Frequency Reference: ± (Ext Freq Ref Accuracy + 240 mHz)		
Rate (Fr)	1 Hz to 300 kHz		
Rate Resolution	0.1 Hz, 5 digits		
Rate Accuracy	≥1 kHz: ±1 digit, <1 kHz: ±10 mHz		
Deviation (Fd) [1] [4]	Fc 9 MHz to 31.25 MHz: FM: 10Hz to 300 kHz, PM: ≤1000 rad Fc 31.25 MHz to 125 MHz: FM: 10 Hz to 750 kHz, PM: ≤1000 rad Fc 125 MHz to 4 GHz: FM: 10 Hz to 0.12 % Fc, PM: ≤1000 rad or 0.12 % Fc/Fr		
Deviation Resolution	FM: 0.1 Hz, 5 digits. PM: 0.0001rad, 5 digits		
FM/PM Sine Deviation Accuracy [1] [4]	±(3 % of setting + 240 mHz) Typically ± (0.25 % of setting + 240 mHz), for ≤50 kHz rate.		
FM/PM Sine Distortion [4] [5]	≤ (-40 dBc {1 %} +20 dB/decade) above 10 kHz (See chart). Typically ≤ -65 dBc +20 dB/decade above 1 kHz.		

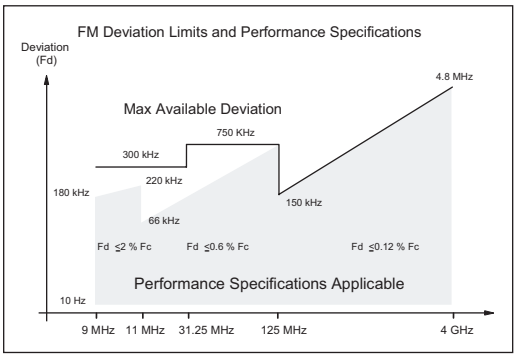
[1] Internal phase modulation is generated by applying sinusoidal frequency modulation with peak deviation derived from the phase deviation and rate settings (Fd = ϕd x Frate).

[2] 96270A: Modulation not available above 4GHz. Splitter/Sensor leveling not available in Modulation functions. All signal level specifications apply at front panel Microwave Output connector, into 1.0 VSWR match only.

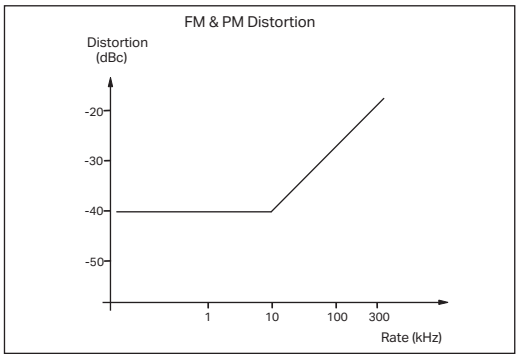
[3] Internal step attenuator rated to 1.5 million operations.

[4] See chart showing maximum available deviation, and maximum deviation for which deviation accuracy and distortion specifications apply. Applies to demodulated signal content at rate fundamental frequency. Specifications are typical for modulation rates < 20Hz.

[5] Includes harmonic distortion and noise up to 5 times rate frequency.



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FM External	
Input	Rear-panel BNC connector (50 MHz Counter, Modulation, Leveling and Frequency Pull Input).10 kΩ nominal input impedance.
Bandwidth (-3 dB)	DC coupled: dc to 1 MHz, typical. AC coupled: 10 Hz to 1 MHz, typical.
Deviation Sensitivity	User adjustable, 500 Hz/V to 19 MHz/V, carrier frequency dependent.
Input Level	±2 V pk maximum operating, ±5 V pk absolute maximum
Carrier Frequency Accuracy	As FM Internal Sine ±20 mV x deviation/V setting, typical.
Deviation Accuracy [1]	±(3 % of setting +240 mHz), for 1 Vpk input, dc or 200 Hz to 20 kHz rate, deviation >0.01 % Fc.
Residual Distortion [1] [2]	As FM Internal Sine, for 1 Vpk input, deviation >0.01 %Fc. Typically ≤-55 dBc +20 dB/decade above 10 kHz, for 1 Vpk input, deviation >0.01 % Fc.

[1] See chart showing maximum available deviation, and maximum deviation for which deviation accuracy and residual distortion specifications apply. Applies to demodulated signal content at rate fundamental frequency.

[2] Includes harmonic distortion and noise up to 5 times rate frequency.

PM External [1]	
Input	Rear-panel BNC connector (50 MHz Counter, Modulation, Leveling and Frequency Pull Input). 10 kΩ nominal input impedance.
Bandwidth (-3 dB)	DC coupled: dc to 1 MHz, typical. AC coupled: 10 Hz to 1 MHz, typical.
Deviation Sensitivity	User adjustable, 0.001 rad/V to 96 rad/V, carrier frequency dependent
Input Level	±2 V pk maximum operating, ±5 V pk absolute maximum
Carrier Frequency Accuracy	As FM Internal Sine, typical
Deviation Accuracy [2]	±(3 % of setting +240 mHz/Frate) rad, for 1 Vpk input, dc or 200 Hz to 20 kHz rate, deviation >0.01 % Fd/Fr rad. typical

[1] External phase modulation deviates the phase of the carrier, applying the set deviation sensitivity to the modulation input signal.

[2] See chart showing maximum available equivalent frequency deviation and equivalent maximum frequency deviation for which phase deviation accuracy specifications apply for sinusoidal inputs (ϕd = Fd / Fr). Applies to demodulated signal content at rate frequency fundamental.

Modulation Trigger Output	Rear panel Trigger I/O BNC connector
Level	TTL compatible logic output, selectable as rising or falling edge
Timing Alignment	±500 ns typical, from modulation waveform zero crossing for sinusoidal or positive peak for Triangle

Frequency Sweep Specifications at Leveling Head Output (96040A and 96270A) and Microwave Output (96270A)

Frequency Sweep Amplitude Range	**Microwave Output [1] (96270A only)**	**Leveling Head Output**	
		50 Ω output	**75 Ω output**
	-4 dBm to +24 dBm >1.4 GHz: +20 dBm -100 dBm With Low Level Micro-wave Output option[2]	-130 dBm to +24 dBm >125 MHz: +20 dBm >1.4 GHz: +14 dBm	-130 dBm to +18 dBm >125 MHz: +14 dBm >1.4 GHz: +8 dBm
Sweep Frequency Range	96040A and 96270A Leveling Head output: 1 mHz to 4 GHz 96270A Microwave Output: 1 mHz to 27 GHz Sweeps are generated as a sequence of discrete synthesized frequencies.		
Sweep Modes	Stop - Start and Center - Span Linear or Logarithmic Sawtooth or Triangular Repetitive, Single Shot, triggered and Manual Sweep Squelch or Non Squelch at frequency transitions Narrow range-locked sweep [3]		
Start, Stop and Step Frequency Setting Resolution [4]	<100 MHz: 0.001 Hz (1 mHz), ≥100 MHz: 11 digits, ≥10 GHz 12 digits		
Frequency Steps	5 million maximum		
Step Size	96040A and 96270A Leveling Head output: 1 mHz to 4 GHz 96270A Microwave Output: 1 mHz to 27 GHz		
Step Dwell Time	20 ms (40 ms for 96270A Microwave Output) to 10 s 2 ms to 10 s for narrow range-locked sweep [3]		
Sweep Duration	100 hrs maximum, calculated from step dwell x number of steps		
Squelch Duration [5]	96040A and 96270A Leveling Head output: <20 ms 96270A Microwave Output: <40 ms		
Trigger Input/Sync Output	Rear panel Trigger I/O BNC connector, selectable as sweep trigger input or sweep sync output.		
Trigger Input	TTL compatible logic input, selectable as rising or falling trigger to start sweep. Typically ≤1 ms delay from trigger to sweep start.		
Sync Output	TTL compatible logic output, selectable as rising or falling sync pulse coincident with sweep start. Typical pulse duration 250 µs. Typical time alignment +15 to +18 ms from sweep start when dwell time ≥20 ms, +1 ms when dwell time <20 ms (delay ensures settled signal at the trigger point).		

[1] 96270A: Splitter/Sensor leveling not available in Sweep function. All signal level specifications apply at front panel Microwave Output connector, into 1.0 VSWR match only.

[2] Internal step attenuator rated to 1.5 million operations.

[3] Narrow range-locked sweep provides phase continuous constant amplitude frequency sweep without hardware boundaries when sweep range setting < 0.03 % of centre frequency and centre frequency > 15.625 MHz.

[4] Sweep progress bar displays output frequency with 0.001 Hz (1 mHz) resolution.

[5] When selected, Squelch is active between all frequency transitions. When deselected, Squelch is active only at hardware range boundaries. Squelch not active in narrow range-locked sweep.

Frequency Counter Specifications

Input	**96270A**	Rear-panel BNC connector (300 MHz Counter). Input impedance selectable 50 Ω (dc coupled) or 10 kΩ [1] (ac coupled), nominal. AC coupled into 0 V threshold.		
	96040A	Rear-panel BNC connector (50 MHz Counter, Modulation, Leveling and Frequency Pull Input). Input impedance 10 kΩ [1] (ac coupled), nominal. AC coupled into 0 V threshold.		
Frequency Range	**96270A**	0.9 MHz to 310 MHz for specified accuracy. Functional to 10 Hz, typical		
	96040A	0.9 MHz to 50.1 MHz for specified accuracy. Functional to 10 Hz, typical		
Frequency Bands	**96270A Only**	0.9 MHz to 50.5 MHz, >50.5 MHz to 310 MHz with 50 Ω selected. 0.9 MHz to 50.5 MHz with 10 kΩ [1] selected.		
Input Level		0.5 V pk-pk minimum operating, ±5 V pk absolute maximum		
Gate Times and Resolutions [2] (in displayed digits)		0.2 s: 7/8 digits, 2 s: 8/9 digits, 20 s: 9/10 digits, 80 s: 10/11 digits		
Accuracy		**Gate Time**	**Internal Frequency Reference**	**External Frequency Reference**
		0.2 s, 2 s, 20 s	±(0.05 ppm +0.5 counts)	±(Ext Freq Ref Accuracy +0.5 counts)
		80 s	±(0.05 ppm +1.25 counts)	±(Ext Freq Ref Accuracy +1.25 counts)

[1] Higher frequencies into 10 kΩ impedance may require an external 50 Ω termination fitted to the 96040A frequency counter BNC, depending on signal matching, or for 96270A, the 50 Ω input impedance setting may be required.

[2] Frequencies are automatically displayed in units of Hz, kHz or MHz. Number of digits depends on gate time selected and display auto-ranging points, arranged in decades at 1 099 999 9(99 9) / 1 100 000 (000).

Power Meter Readout Specifications (96270A only)

Supported Sensors	Rhode & Schwarz NRP-Z series thermal sensor models 51, 52, 55.03, 55.04, 56, 57 and 58
Sensor Channels	Two front panel mounted mini-ODU connectors, compatible with supported sensor models. User selectable as power meter readout or leveling control sensor feedback [1]
Readout/Measurement Functionality	Single or Dual readout, user selectable as power or equivalent voltage into 50 Ω, with linear or logarithmic units. Source/Measure mode allows simultaneous signal output and single/dual power meter readout operation. Relative ratio or difference mode.[2]
Readout Display	Absolute: In W, Vrms, Vpk-pk, dBm, dBuV Relative: ratio in dB or Δ%, difference in W or V Resolution: 0.001 dBm/dB; W/V/%, 5 digits with autoranging unit multiplier
User-selectable Settings/Actions	Reading averaging, single/continuous triggering, sensor zeroing.

[1] When used as the leveling control sensor for the Microwave Output with the HF Leveling kit or compatible splitter and sensor, the measured power is displayed. Settings are automatically configured for optimal performance.

[2] Absolute/Relative mode independently selectable for each readout channel. Relative measurements between channels is not available.

GPIB Command Emulation Mode Specifications

96270A [1] [2]	HP3335A, HP8662A, HP8663A, HP8340A, HP8360 B-Series, Agilent E8257 Series, 9640A.
96040A [1]	HP3335A, HP8662A, HP8663A, 9640A

[1] Only one instrument emulation mode may be selected at any one time.

[2] Emulation includes models with frequency ranges above 27 GHz. These models are emulated within the frequency capabilities of the 96270A.