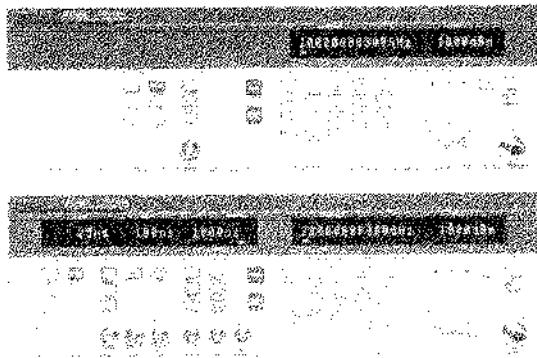


HP 83711A and HP 83712A Synthesized CW Generators

HP 83731A and HP 83732A Synthesized Signal Generators

Technical Data

**10 MHz to 20 GHz
1 to 20 GHz**



Specifications

Specifications describe the instrument's warranted performance over the 0° to 55°C temperature range unless otherwise noted. **Supplemental Characteristics** (indicated by italics) are intended to provide information useful in estimating instrument capability in your application by describing typical, but not warranted, performance.

Frequency

Range:

Synthesized CW Generators

HP 83711A, 1.0 to 20 GHz

HP 83712A, 10 MHz to 20 GHz

Synthesized Signal Generators

HP 83731A, 1.0 to 20 GHz

HP 83732A, 10 MHz to 20 GHz

Resolution: 1 kHz (1 Hz with Option 1E8)

Stability (with high stability timebase, Option 1E5):

Aging rate:

$<1.5 \times 10^{-9}$ /day after 24-hour warm up.

Temperature effects:

$<1 \times 10^{-7}$ over 0 to 55°C, nominally $<1.4 \times 10^{-6}/^{\circ}\text{C}$

Line voltage effects:

$<5 \times 10^{-10}$ for 10% change in line voltage

Stability (without high stability timebase):

Aging rate:

$<1.0 \times 10^{-8}$ /day after 72-hours at 25°C $\pm 10^{\circ}\text{C}$

Temperature effects:

$<5 \times 10^{-6}$ over 0 to 55°C referenced to 25°C

Stability (with external 10 MHz reference):

Same as external reference.

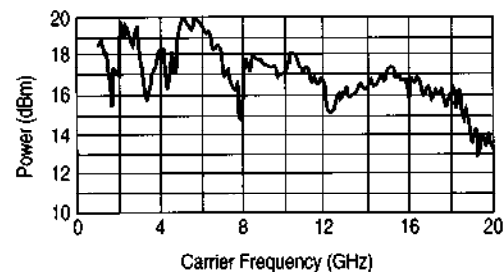
Frequency switching time:

<50 ms to within 1 kHz

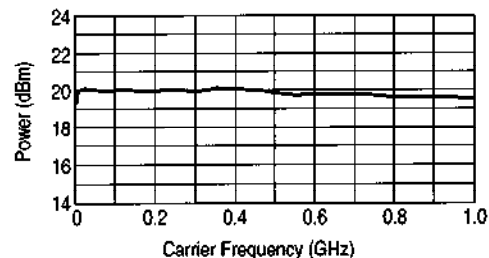
RF Output

Maximum leveled output power:

Frequency	Standard	with Option 1E1
0.01 - 1 GHz	+13 dBm	+13 dBm
1 - 18 GHz	+11 dBm	+10 dBm
18 - 20 GHz	+10 dBm	+8 dBm



Typical maximum available output power from 1 to 20 GHz, at 25°C with output step attenuator (Option 1E1) installed.



Typical maximum available output power from 0.01 to 1 GHz at 25°C.

Minimum leveled output power: -4 dBm
with Option 1E1, -90 dBm

Display resolution: 0.01 dB

Accuracy (-4 dBm to maximum specified leveled output power¹):

10 MHz - 50 MHz, ± 1.3 dB

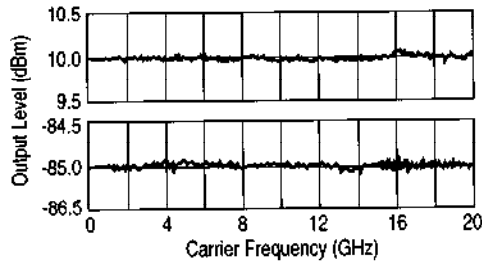
50 MHz - 20 GHz, ± 1.0 dB

Accuracy (over all specified temperatures, and power levels¹):

10 MHz - 50 MHz, ± 2.3 dB

50 MHz - 20 GHz, ± 2.0 dB

¹The use of Type-N RF connectors above 18.0 GHz degrades specification typically by 0.2 dB.



Typical output level accuracy and flatness at +10 and -85 dBm.

Flatness: ± 0.5 dB¹

Level switching time: < 15 ms
(without step attenuator range change)

Attenuator range changes occur at:

HP 83711A, HP 83712A
0 dBm, -10 dBm, -20 dBm, etc.

HP 83731A, HP 83732A
-4 dBm, -14 dBm, -24 dBm, etc.

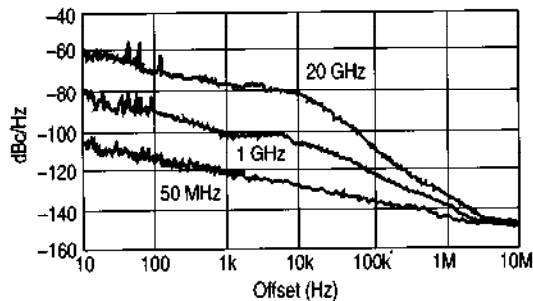
Output SWR: < 2.0 : 1 nominal

Spectral Purity

SSB phase noise (dBc/Hz):

Carrier Freq.	Offsets			
	100 Hz	1 kHz	10 kHz	100 kHz
500 MHz	-70	-86	-103	-119
2 GHz	-66	-74	-91	-107
10 GHz	-69	-75	-79	-101
18 GHz	-63	-70	-73	-99

Phase noise decreases 6 dB/octave below 500 MHz and reaches a floor of < -140 dBc/Hz.



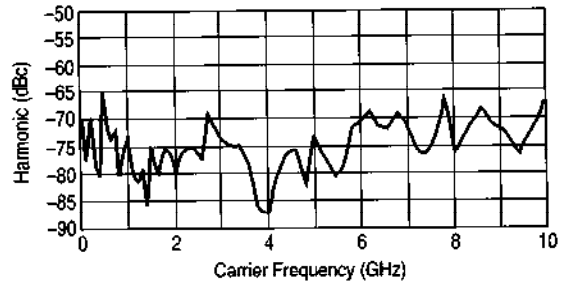
Typical single-sideband phase noise at 50 MHz, 1 GHz and 20 GHz, 25°C, CW mode. Offsets less than 100 Hz require the high stability timebase, Option 1E5.

¹The use of Type-N RF connectors above 18.0 GHz degrades specification typically by 0.2 dB.

Harmonics:

HP 83711A/83712A, < -50 dBc (at levels < +10 dBm)

HP 83731A/83732A, < -55 dBc (at levels < +6 dBm)



Typical 2nd harmonic levels measured at output power of +6 dBm.

Non-harmonic spurious (≥ 3 kHz): < -60 dBc
(includes power supply and frequency synthesis spurious).

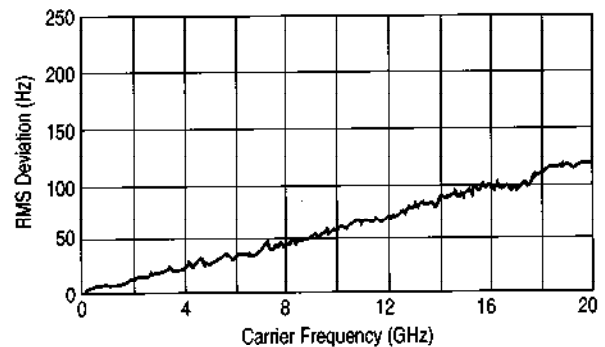
Non-harmonic spurious (< 3 kHz): < -50 dBc

Sub-harmonics: None

Residual FM:

At 1 GHz, in 50 Hz - 15 kHz bandwidth: < 15 Hz

Residual FM decreases 6 dB per octave below 1 GHz.



Typical residual FM measured in 50 Hz - 15 kHz bandwidth, CW mode, with high stability timebase, Option 1E5.

AM noise floor (at 0 dBm and offsets greater than 5 MHz from carrier):

0.01 - 1 GHz, < -140 dBm/Hz

1 - 20 GHz, < -150 dBm/Hz

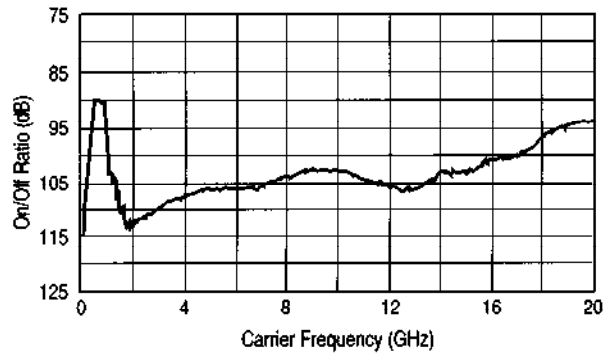
HP 83731A, 83732A Modulation Specifications

Modulation specifications are differentiated by shading, and are not available on the HP 83711A or 83712A.

Pulse Modulation

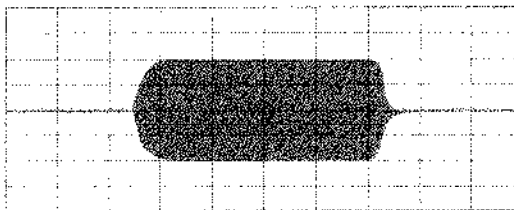
Carrier Frequency	MHz					GHz
	<25	25 to <64	64 to <128	128 to <500	500 to <1000	1 to 20
Minimum Pulse Width	<1 μ s		<100 ns		<25 ns <i>Typically <10 ns</i>	
Rise/Fall Time	<500 ns	<350 ns	<50 ns	<35 ns	<15 ns	<10 ns
Video Feedthrough	<2 mV peak-to-peak at 0 dBm					<20 mV peak-to-peak at 0 dBm
Pulse Width Compression	± 150 ns		± 15 ns		± 5 ns	
Pulse Delay (Video out to RF out)	<1 μ sec		<200 ns		<125 ns	<100 ns

On/Off ratio: >80 dB



Typical pulse modulation on/off ratio at +8 dBm .

- Maximum pulse repetition frequency:** >3 MHz
- Minimum pulse duty cycle:** No restrictions on duty cycle.
- Pulse level accuracy:** ± 1.0 dB (relative to CW)
- Pulse overshoot:** <10 %
- Input impedance:** 50 Ω nominal; TTL drive levels
- Maximum leveled output power in pulse mode:** -0.5 dB (relative to CW)



Timebase = 10.0 ns/div
Carrier Frequency = 10.0 GHz
Risettime = 4.9 ns
Falltime = 2.05 ns

Typical pulse modulation envelope illustrates the fast rise and fall times, excellent flatness and pulse fidelity of the HP 83731A/83732A.

Internal Pulse Source

Pulse source modes: Free-run, triggered with delay, doublet and gated. Triggered with delay, doublet and gated require external trigger source.

Pulse repetition frequency: 3 Hz to >3 MHz
Pulse repetition interval (PRI): 300 ns to 419 ms
Pulse width (T_w): 25 ns to 419 ms

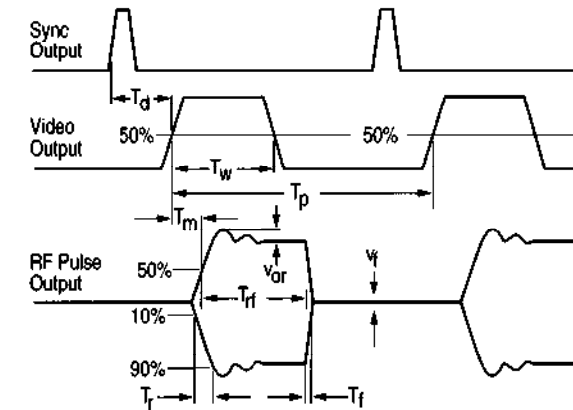
Variable pulse delay

Free-run mode (T_d): ± 419 ms
Triggered with delay & doublet modes (T_d): 225 ns to 419 ms with ± 25 ns jitter

Pulse width/delay/PRI resolution: 25 ns

Pulse delay (video to RF, T_m): 1 to 20 GHz, <20 ns nominal

All pulse modulation specifications and supplemental characteristics apply during use of internal pulse source.



T_d video delay (variable) T_m RF delay T_r RF pulse rise time
 T_w video pulse width (variable) T_{fr} RF pulse width V_{Or} overshoot and ringing
 T_p pulse period (variable) T_{ff} RF pulse fall time V_f video feedthrough

Frequency Modulation

Rates: 1 kHz to 1 MHz

Flatness: ± 2 dB

Frequency	Maximum deviation	Modulation index
256-500 MHz	1.25 MHz peak	> 37
500 MHz-1GHz	2.5 MHz peak	> 75
1-2 GHz	5 MHz peak	> 150
2-20 GHz	10 MHz peak	> 300

The modulation index and maximum deviation decrease by a factor of 2 for each octave below 256 MHz.

FM sensitivity

10-16 MHz	40 kHz/V
16-64 MHz	80 kHz/V
64-256 MHz	320 kHz/V
2.56 MHz-1 GHz	1.25 MHz/V
1-20 GHz	5 MHz/V

FM sensitivity accuracy: $\pm 25\%$ (typ. $\pm 15\%$) at 100 kHz

Incidental AM: <5%

FM input impedance: 600 Ω nominal

Harmonic distortion: <1% (1 MHz peak deviation at 100 kHz rate)

Logarithmic Amplitude Modulation (Scan Modulation)

Maximum depth: > 60 dB

Sensitivity: -10 dB/V; (0 to +6V for 0 to -60 dBc)

Step response (50 dB change in level):

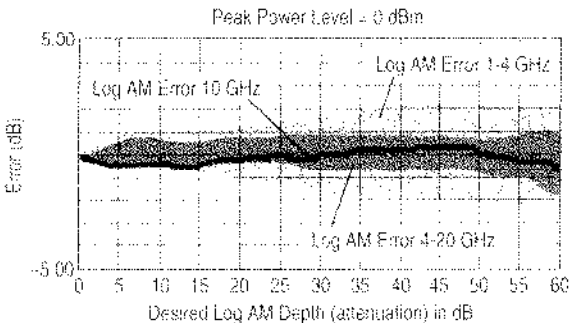
< 1 GHz, < 10 μ s rise time, < 20 μ s fall time

1-20 GHz, < 5 μ s rise and fall times

Input impedance: 5000 Ω nominal

Maximum leveled output power in log AM mode
(relative to CW):

<1 GHz	1 - 4 GHz	>4 GHz
0 dB	-4.5 dB	-1.0 dB



Typical log AM error (deviation from desired depth) at 25°C for carrier frequencies between 1.0 and 20 GHz.

Simultaneous Modulations

Full AM bandwidth and depth is available at any pulse rate or width. FM is completely independent of AM and pulse modulation.

Digital Sweep

Sweep mode: Continuous

Step size: Minimum = frequency resolution

Maximum = 401 points per sweep

Sweep width: Minimum = frequency resolution

Maximum = full frequency span

General

Noise Figure Meter Compatibility

HP 8370 sources are fully compatible with and can be controlled by the HP 8970B noise figure meter through Special Function 41.5.

Programming

The HP 83711A, 83712A, 83731A and 83732A are fully compatible with the Standard Commands for Programmable Instruments (SCPI). SCPI programming complies with IEEE 488.2-1987. Optional CIIL programming compatibility is available. Please consult your HP sales representative for details.

For more information, call your local HP sales office listed in your telephone directory.

Environmental

Operating temperature range: 0° to 55°C

EMC: Meets or exceeds EN55011/CISPR 11/1990, Class A and Mil-Std-461C Part 2 RE02, CE03, CS02, RS03.

Power requirements

Power: 98-132V, 48-440 Hz; 198-264V, 48-66 Hz; 400 VA maximum.

Physical dimensions

Net weight: <16 kg (35 lb) **Shipping:** <23 kg (49 lb)

Size: 498 mm D x 426 mm W x 133 mm H
(19.6" x 16.8" x 5.2")

Transit case available by ordering HP Part No. 9211-2655.

Rear Panel Connectors

10 MHz input

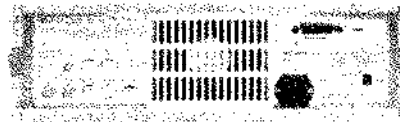
Accepts a 10 MHz \pm 100 Hz, 0 to 10 dBm, external reference signal for operation from an external high stability timebase. Nominal input impedance is 50 Ω .

10 MHz output

Outputs the 10 MHz reference signal, nominally +3 dBm, for use as an external reference signal. Nominal source impedance is 50 Ω .

0.5V/GHz output

Supplies a voltage proportional to output frequency for use with mm-wave frequency multipliers, including the HP 83550 Series Millimeter Wave Source Modules.



HP 83731A/32A
rear panel

Ordering Information

HP 83711A	1-20 GHz Synthesized CW Generator
HP 83712A	0.01-20 GHz Synthesized CW Generator
HP 83731A	1-20 GHz Synthesized Signal Generator
HP 83732A	0.01-20 GHz Synthesized Signal Generator
Option 1E1	Add 90 dB output step attenuator
Option 1E5	Add high stability timebase
Option 1E8	1 Hz frequency resolution
Option 1E9	3.5 mm RF output connector
Option 0B2	Extra operating manual
Option 0BV	Service documentation, component level
Option 0BW	Service documentation, assembly level
Option 1CM	Rack mount kit (HP part number 5062-3977)
Option 1CP	Rack mount and handle kit (HP part number 5062-3983)
Option 1CR	Rack slide kit (HP part number 1494-0059)
Option W30	Two additional years return-to-HP service
Option W32	Three year return to HP calibration service
Option W34	Three year Mil-Std calibration service

Longer term warranty and calibration services are available. Please consult your HP sales representative for details.

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