HP 8662A/HP 8663A Synthesized Signal Generators

Spectral purity is the key contribution of both the HP 8662A and 8663A, making them ideal for many radar, satellite communication, and phase noise measurement applications. Typical absolute phase noise performance of these generators at a 1 kHz offset is as low as –135 dBc/Hz, depending on the band of operation.

The frequency range of the HP 8662A is 10 kHz to 1280 MHz. It offers versatile AM/FM, using either internal 400 Hz and 1 kHz rates or externally applied modulating signals which can be either ac- or dc-coupled. It also has simultaneous modulation capability.

The HP 8663A and 8662A provide the U.S. Air Force MATE (Modular Automatic Test Equipment) capability, via Option 700. This option is an external translator that allows the signal generator to be controlled by the MATE language CIIL (Control Interface Intermediate Language).

HP 8662A Specifications

Frequency
Range: 10 kHz to 1280 MHz (1279.9999998 MHz)
Resolution: 0.1 Hz (0.2 Hz above 640 MHz)

Accuracy and Stability: Same as reference oscillator

Internal Reference Oscillator: 10 MHz quartz oscillator. Aging rate < 5 x 10–10/day after 10-day warmup (typically 24 hrs in normal operating environment).

Spectral Purity

Front-Panel Absolute SSB Phase Noise (dBc/Hz):

<table>
<thead>
<tr>
<th>Frequency range (MHz)</th>
<th>0.01 to 119.9³</th>
<th>120 to 159.9³</th>
<th>160 to 319.9³</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Hz</td>
<td>– 68</td>
<td>– 78</td>
<td>– 66</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frequency range (MHz)</th>
<th>320 to 639.9³</th>
<th>640 to 1279.9³</th>
<th>1.28 to 2559.9³</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Hz</td>
<td>– 54</td>
<td>– 64</td>
<td>– 48</td>
</tr>
<tr>
<td>10 Hz</td>
<td>– 84</td>
<td>– 94</td>
<td>– 78</td>
</tr>
<tr>
<td>1 kHz</td>
<td>– 118</td>
<td>– 125</td>
<td>– 112</td>
</tr>
<tr>
<td>100 kHz</td>
<td>– 131</td>
<td>– 136</td>
<td>– 124</td>
</tr>
</tbody>
</table>

Residual SSB Phase Noise (dBc/Hz):

<table>
<thead>
<tr>
<th>Frequency range (MHz)</th>
<th>0.01 to 119.9³</th>
<th>120 to 159.9³</th>
<th>160 to 319.9³</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 Hz</td>
<td>– 112</td>
<td>– 119</td>
<td>– 105</td>
</tr>
<tr>
<td>100 kHz</td>
<td>– 131</td>
<td>– 136</td>
<td>– 124</td>
</tr>
</tbody>
</table>

SSB Broadband Noise Floor in 1 Hz BW at 3 MHz Offset From Carrier: –146 dBc for fc between 120 and 640 MHz at output levels above +10 dBm.
Signal Sources

High-Performance RF Signal Generators (cont’d)

Spurious Signals:

<table>
<thead>
<tr>
<th>Frequency Range (MHz)</th>
<th>Spurious non-harmonically related</th>
<th>Sub-harmonically related</th>
<th>Power-line (68 Hz) related or microphonically generated (within 300 Hz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.01 to 120</td>
<td>–90 dBc</td>
<td>none dBc</td>
<td>–90 dBc</td>
</tr>
<tr>
<td>120 to 160</td>
<td>–100 dBc</td>
<td>none dBc</td>
<td>–85 dBc</td>
</tr>
<tr>
<td>160 to 320</td>
<td>–96 dBc</td>
<td>none dBc</td>
<td>–80 dBc</td>
</tr>
<tr>
<td>320 to 640</td>
<td>–90 dBc</td>
<td>none dBc</td>
<td>–75 dBc</td>
</tr>
<tr>
<td>640 to 1280</td>
<td>–84 dBc</td>
<td>none dBc</td>
<td>–70 dBc</td>
</tr>
</tbody>
</table>

Output

Level Range: +13 to −139.9 dBm (1V to 0.023 µV into 50 Ω)
Resolution: 0.1 dB
Absolute Level Accuracy: ±15˚ to ±45˚ C; ±1 dB between +13 and –120 dBm; ±3 dB between –120 and –130 dBm
Reverse Power Protection: Typically up to 30 W or ±8 Vdc

Amplitude Modulation

Depth: 0 to 95% at output levels of ±8 dBm and below (±10 dBm in uncorrected mode). AM available above these output levels but not specified.
Resolution: 1%, 10 to 95% AM; 0.1%, 0 to 9.9% AM
Incidental FM: (at 30% AM): ±0.15 to ±640 MHz, <0.12 radian peak; ±640 to 1280 MHz, <0.09 radian peak
Incidental FM: (at 30% AM): ±0.15 to ±640 MHz, <0.12 x fₘₐₓ; ±640 to 1280 MHz, <0.09 x fₘₐₓ
Indicated Accuracy: ±5% of reading ±1% AM. Applies for rates given in table below, internal or external mode, for depths ≤90%.

Rates and Distortion with Internal or External Modulating Signal:

<table>
<thead>
<tr>
<th>AM Distortion</th>
<th>Frequency Range (MHz)</th>
<th>AM Rate</th>
<th>0 to 30% AM</th>
<th>30 to 70% AM</th>
<th>70 to 90% AM</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.15 to 1 MHz</td>
<td>dc to 1.5 kHz</td>
<td>2%</td>
<td>4%</td>
<td>5.7%</td>
<td></td>
</tr>
<tr>
<td>1 to 10 MHz</td>
<td>dc to 5 kHz</td>
<td>2%</td>
<td>4%</td>
<td>5.7%</td>
<td></td>
</tr>
<tr>
<td>10 to 1280 MHz</td>
<td>dc to 10 kHz</td>
<td>2%</td>
<td>4%</td>
<td>5.7%</td>
<td></td>
</tr>
</tbody>
</table>

Frequency Modulation

FM Rates: (1 dB bandwidth): External ac, 20 Hz to 100 kHz; external dc, dc to 100 kHz
FM Deviation: 25 to 200 kHz, depending on carrier frequency
Indicated FM Accuracy: ±8% of reading plus 10 Hz (50 Hz to 20 kHz)
FM Resolution: 100 Hz for deviations <10 kHz, 1 kHz for deviations ≥10 kHz
Incidental AM: (AM sidebands at 1 kHz rate and 20 kHz deviation): <-72 dBc; f ≥640 MHz; <-85 dBc; f = 640 MHz
FM Distortion: <1.7% for rates <20 kHz; <1% for rates <1 kHz
Center Frequency Accuracy and Long-Term Stability in AC Mode: Same as CW mode

Supplemental Characteristic

Frequency-Switching Speed: From 420 µs to 12.5 ms, depending on the programming mode

HP 8663A Specifications

The HP 8663A signal generator is related to the HP 8662A in both concept and structure. Like the HP 8662A, the HP 8663A is an extremely low phase noise signal source, incorporating signal generator modulation capabilities and output characteristics. The HP 8663A also offers increased frequency range to 2560 MHz, increased output level to +16 dBm, and the addition of phase and pulse modulation while maintaining high spectral purity. The result is a highly flexible and powerful signal generator that uses and extends the proven circuitry of the HP 8662A. Thus, the HP 8662A and HP 8663A share many of the same specifications.

Frequency

Range: 100 kHz to 2560 MHz (2559.999996 MHz)
Resolution: 0.1 Hz (f < 640 MHz);
0.2 Hz (640 MHz to 1280 MHz);
0.4 Hz (f > 1280 MHz)

Accuracy, Stability, and Internal Reference Oscillator: Identical to HP 8662A

Spectral Purity

(See HP 8662A specifications)
Spurious Signals: Identical to HP 8662A, except that for f < 1280 MHz and 2560 MHz the spurious non-harmonics are –98 dBc; the sub-harmonically related (f/2, 3f/2, etc.) between 640 and 1280 MHz are –70 dBc; and between 1280 and 2560 MHz the spurious non-harmonics are –78 dBc; the sub-harmonically related (f/2, 3f/2, etc.) between 640 and 1280 MHz are –98 dBc; the power-line (60 Hz) or microphonically generated spurious are –85 dBc.

Harmonics: <–30 dBc, <–13 dBm output; <–25 dBc, <12 dBm output, f ≤1280 MHz, <–25 dBc, f ≥1280 MHz

Output

Level Range: +16 dBm to −129.9 dBm
Resolution: 0.1 dB
Absolute Level Accuracy: ±15˚ to ±45˚ C; ±1 dB ±16 dBm to −119.9 dBm; ±3 dB, −120 dBm and below
SWR: <1.5

Amplitude Modulation

Depth: 0 to 95% at levels of ±10 dBm and below
Resolution: 0.1 dB
Incidental FM: (at 30% AM): Identical to HP 8662A except: <0.3 x fₘₐₓ, for 1280 ≤f < 2560 MHz
Indicated Accuracy: ±6% of reading ±1% AM (400 Hz and 1 kHz, depth 90%)
AM Bandwidth: (1dB): dc to >1.5 kHz, 0.15 MHz ≤f ≤1 MHz; dc to >5 kHz, 1 MHz ≤f ≤10 kHz; dc to >10 kHz, f >10 kHz: external dc coupling, external ac coupling or internal; low-frequency coupling is 20 Hz
Distortion: (400 Hz and 1 kHz): <2% (0 to 30% AM); <3% (30 to 70% AM); <4% (70 to 90% AM)

Frequency Modulation

FM Rates: (1 dB bandwidth): External ac, 20 Hz to 100 kHz, external dc, dc to 100 kHz
Maximum Allowable Peak Deviation: Identical to HP 8662A for f between 100 kHz and 1280 MHz. Up to 400 kHz for f between 1280 and 2560 MHz
Indicated FM Accuracy: (50 Hz to 20 kHz): ±7% of setting ±10 Hz
FM Resolution: 100 Hz to 1 kHz, depending on f and deviation setting
Incidental AM: (AM sidebands at 1 kHz rate and 20 kHz deviation): <–72 dBc (f ≥10 kHz)
FM Distortion: <1% (400 Hz and 1 kHz rates); <1.7% (rates less than 20 kHz)

1 In the remote mode it is possible to have microprocessor clock-related spurious signals spaced 3 MHz apart at an absolute level of typically less than −145 dBm.
2 Spurious signals can be up to 3 dB higher in the dc FM mode.
3 f/2 spurs not specified for carrier frequencies above 850 MHz.
4 At a 50 Hz line frequency, low-frequency coupling is 20 Hz.
5 Due to automatic leveling loop bandwidth changes, brief (30 ms) level inaccuracies may occur when switching through 150 kHz and 1 MHz RF output frequencies.
High-Performance RF Signal Generators

Signal Sources

HP 11721A Frequency Doubler

The HP 11721A doubler is an ideal accessory for extending the usable frequency range of signal generators, frequency synthesizers, or other signal sources. Operating on input frequencies of 50 MHz to 1300 MHz, it provides a doubled output in the range of 100 MHz to 2600 MHz. The HP 11721A will work well with any RF source with an output in the range of 50 to 1300 MHz.

The 50 Ω passive circuit of the HP 11721A offers low conversion loss, low spurious, and excellent flatness over its entire frequency range when operated above +10 dBm.

HP 11721A Specifications

- Input Frequency Range: 50 to 1300 MHz
- Output Frequency Range: 100 to 2600 MHz
- Conversion Loss (+13 dBm input, 50 to 1280 MHz): < 15 dB
- Spurious Referenced to Desired Output Frequency: (+13 dBm input with harmonics < -50 dBc, 50 to 1280 MHz): 1/2, –15 dB; 3/2, –15 dB
- Input SWR: 1.5 typical
- Input/Output Impedance: 50 Ω nominal
- Operating Temperature Range: 0˚ to 50˚ C
- Connectors: Input, type-N male; output, type-N female
- Size: 161 mm L x 30 mm W x 20.5 mm H (6.38 in x 1.19 in x 0.19 in)
- Weight: Net, 0.2 kg (0.5 lb); shipping, 0.4 kg (1 lb)

Ordering Information

HP 11721A Frequency Doubler

Opt W30 Extended Repair Service (see page 70)

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Other HP 8662A and HP 8663A Information

Remote Programming: The HP-IB interface is standard on the HP 8662A and HP 8663A signal generators. All functions controlled from the front panel, with the exception of the line switch, are programmable with the same accuracy and resolution as in manual mode.

Operating Temperature Range: 0˚ to +55˚ C

Leakage: Meets radiated and conducted limits of MIL-STD-461A

Power Requirements: 115 (90 to 126) V or 230 (198 to 252) V; 48 to 66 Hz; 450 VA max

Size: HP 8663A: 425 mm W x 178 mm H x 572 mm D (16.75 in x 7 in x 22.5 in);
HP 8662A: 425 mm W x 178 mm H x 642 mm D (16.75 in x 7 in x 25.3 in)

Note: depth includes front panel depth of 45 mm (1.75 in).

Weight: HP 8662A: net, 30 kg (65.5 lb); shipping, 36 kg (80 lb)
HP 8663A: net, 35.8 (74 lb); shipping, 40 kg (88 lb)

Key Literature

Synthesized Signal Generator 10 kHz to 1280 MHz
Technical Data, p/n 5953-8376

Synthesized Signal Generator 100 kHz to 2.56 GHz
Technical Data, p/n 5953-8376

Ordering Information

HP 8662A 1280 MHz Signal Generator
Opt 001 RF Connectors on Rear Panel Only
Opt 003 Specified SSB Phase Noise for 640 MHz Output
Opt 700 External MATE Translator
Opt 907 Front Handle Kit (5062-3980)
Opt 908 Rack Flange Kit (5062-3978)
Opt 909 Rack Flange Kit w/Front Handles (5062-3984)
Opt 910 Two Sets of Operating and Service Manuals (08662-90069)
Opt W30 Extended Repair Service (see page 70)

HP 8663A 2680 MHz Signal Generator
Opt 001 RF Connectors on Rear Panel Only
Opt 002 Wideband Linear Phase Modulation
Opt 003 Specified SSB Phase Noise for 640 MHz Output
Opt 700 External MATE Translator
Opt 907 Front Handle Kit (5061-9680)
Opt 908 Rack Flange Kit (5061-9678)
Opt 909 Rack Flange Kit w/Front Handles (5061-9684)
Opt 910 Additional Operation and Calibration Manual (08663-90069) and Service Manuals (08663-90071)
Opt 915 Add Service Manual (08663-90071)
Opt W30 Extended Repair Service (see page 70)
Opt W32 Calibration Service (see page 70)

Related Generators

HP 8662A
HP 8663A
HP 11721A

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