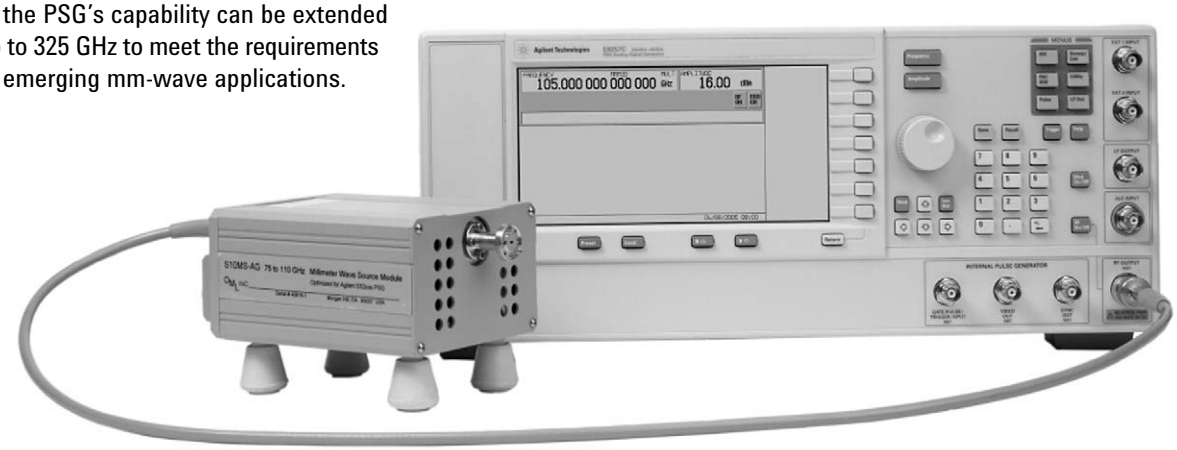
Agilent Technologies mm-wave Source Modules from OML, Inc. for the Agilent PSG Signal Generators

Technical Overview

The Agilent PSG signal generators (PSG) provide excellent signal power, resolution, stability, and analog modulation performance for coaxial applications to 67 GHz. Now, when paired with new, high power mm-wave source modules from OML, Inc., much of the PSG's capability can be extended up to 325 GHz to meet the requirements of emerging mm-wave applications.

High performance mm-wave source modules extend the frequency coverage of the PSG to 325 GHz.



50 to 75 GHz	75 to 110 GHz	110 to 170 GHz

60 to 90 GHz	90 to 140 GHz	140 to 220 GHz	220 to 325 GHz

Agilent Technologies

Characteristics of the Millimeter Wave Spectrum

While it is generally recognized that mm-wave frequencies are between 30 GHz and 300 GHz, factors such as broadband solid state microwave electronics, relatively low atmospheric absorption of signals < 50 GHz, the need for high communication bandwidths, and advances in coax transmission capabilities have allowed the microwave band to virtually encompass the 30 GHz to 50 GHz frequency applications.

The mm-wave spectrum beyond 70 GHz offers many advantages to certain applications. Millimeter-wave wavelengths are small (< 10 mm) which means mm components are smaller than microwave components. This in turn results in smaller, more focused transmit and receive antennas – with apertures that have narrower beam widths and transmissions that suffer less losses in the presence of rain, smoke, fog, and dust.

Atmospheric constituents and gases attenuate millimeter signals at different rates for different frequencies. Overall, there are narrow regions (bands) of high signal absorption and wide regions of low signal absorption that occur over the entire millimeter frequency range. The low absorption bands provide sufficient bandwidth for localized applications such as automotive collision radar or autonomous cruise control (77, 94 GHz), broadband gigabit wireless communications (70 to 86 GHz), non-ionic imaging (110 to 300 GHz), material characterization and chemical sensing (225 to 310 GHz).

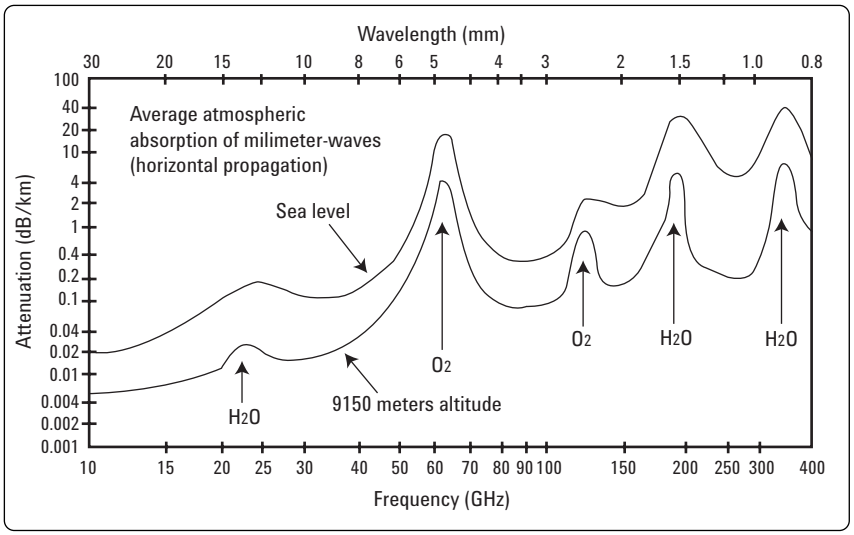


Figure 1. Atmospheric absorption of millimeter waves.

Solving your mm-wave signal source needs

Millimeter wave sources are essential instruments for developing almost all millimeter wave systems and for extending the range of microwave systems. The SxxMS-AG series of high power, frequency banded mm-wave source modules from OML, Inc., when driven by Agilent's high performance PSG, provide synthesized mm-wave test signals for waveguide bands from 50 to 325 GHz. The SxxMS-AG series have RF input power protection allowing all PSG's with high output power (Option 1EA) to drive mm-wave source modules without the need for external RF power amplifiers. In addition, the SxxMS-AG series were designed to derive DC power directly from the PSG (through the source-module-interface connector), and eliminates the need for an external DC power supply.

High accuracy and resolution

Because the SxxMS-AG series modules employ frequency multiplication to generate mm-wave frequencies, the output frequency specifications are directly proportional to the characteristics of the PSG driving the module. The PSG's frequency resolution is typically in the milli-Hz range, which allows a mm-wave carrier frequency of 325 GHz to have a frequency resolution of < 1 Hz.

Spectral Purity

The SxxMS-AG series mm-wave source modules offer harmonic, sub-harmonic, and spurious suppression of > 20 dBc, in any band. The high stability and low phase noise performance of the PSG is raised by a factor of 20 log N, where N is the multiplier factor of the specific module. For the seven SxxMS-AG series modules, N varies from 4 (50 to 75 GHz model) to 18 (220 to 325 GHz model) and 20 log N varies from 12 dB (50 to 75 GHz) to 18 dB (90 to 140 GHz) to 25 dB (220 to 325 GHz).

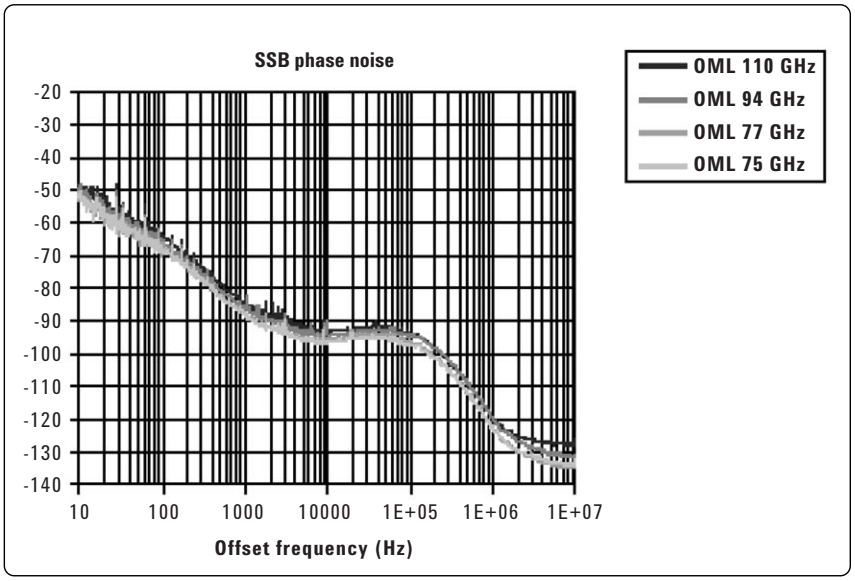


Figure 2. Typical phase noise performance of PSG with OML S10MS-AG module at different carrier frequencies.

Output Power

The SxxMS-AG series offers outstanding fixed output power allowing them to be used as LO's in mixer measurements and provides additional dynamic range for insertion loss/gain measurements (+ 8 dBm @ 75 GHz to + 5 dBm @ 110 GHz).

The output signal power is fixed and can only be varied through the use of an external fixed attenuator, an external mechanical variable attenuator, or an external electronic variable attenuator.

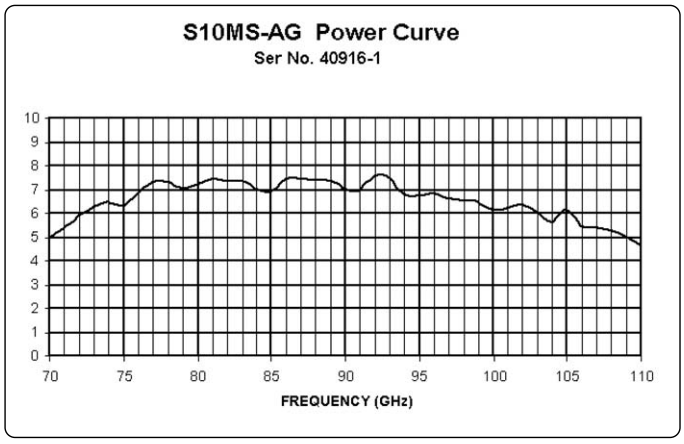


Figure 3. Typical output power vs. mm-wave frequency for OML S10MS-AG.

Excellent FM, PM and Pulse Modulation

FM and/or PM may be applied to the SxxMS-AG series module input signal with the corresponding mm-wave output signal being modulated with an FM/PM deviation that is N times the input deviation (no change in the FM/PM rate) where N is the multiplier factor of the SxxMS-AG module.

The pulse modulation characteristics of the input signal are reproduced faithfully, with the exception of pulse rise and fall times. The non-linear characteristics of the source module will typically produce an output signal pulse with faster rise and fall times. Faster rise and fall times will also yield a small increase in the width of the pulse.

AM and Vector Modulation

The non-linear multiplication characteristics of the SxxMS-AG series do not allow replication of linear AM (sinusoidal amplitude modulation) or vector modulated signals.

Easy connection and operation

The SxxMS-AG has been designed to work directly with the PSG source-module interface (SMI) power supply specifications. Once the SxxMS-AG module is connected to the PSG via the SMI cable and an RF cable (Figure 5), the PSG user interface can be configured to directly display the mm-wave output frequency.

Connect the SxxMS-AG module per Figure 5. Then follow the PSG key steps shown in Figure 6 to select the appropriate mm-wave frequency band for the connected module. Once the OEM source module "ON" selection has been made, the frequency shown on the PSG will be the output frequency of the mm-wave source module. To change the output frequency of the source module, simply enter the desired mm-wave output frequency into the PSG, and the PSG will do the rest. The amplitude value shown on the PSG is the output power of the PSG, and it must be set to +16 dBm for the source module to work properly.

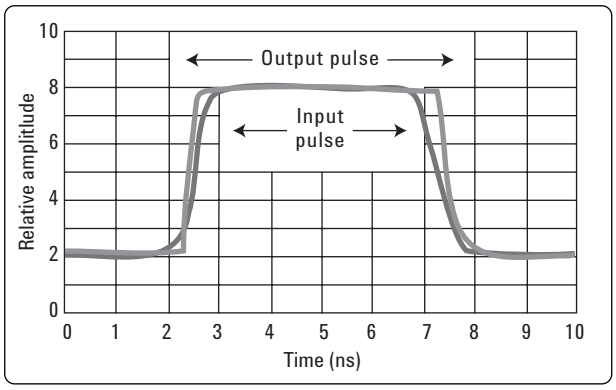


Figure 4. Typical rise and fall time of the module output signal vs. the pulsed, input driving signal.

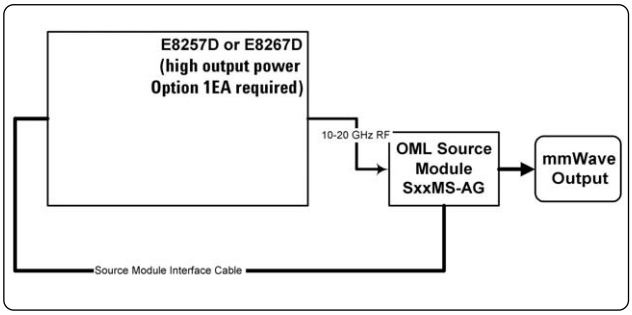


Figure 5. Source module to PSG hardware connections.

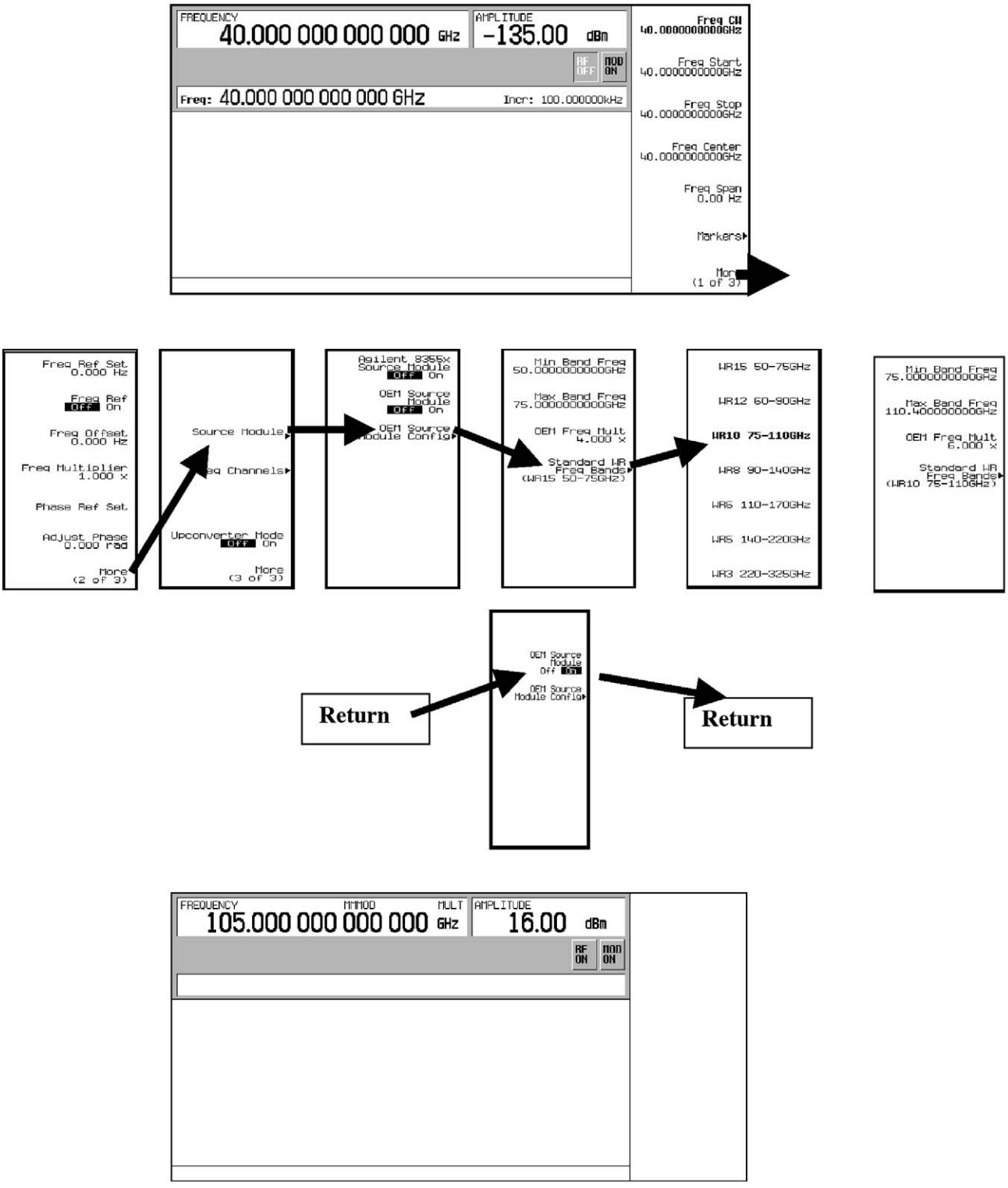


Figure 6. PSG keystroke sequence that enables the PSG source - mm module interface.

Specifications

Oml Inc. source modules for use with Agilent PSG (E82x7C/D) signal generators

Model/ specifications [1]	S15MS-AG	S12MS-AG	S10MS-AG	S08MS-AG	S06MS-AG	S05MS-AG	S03MS-AG
Frequency in (GHz)	12.5 to 18.7	10.0 to 15.0	12.5 to 18.4	11.2 to 17.5	9.1 to 14.1	11.6 to 18.4	12.2 to 18.1
Frequency out (GHz)	50.0 to 75.0	60.0 to 90.0	75.0 to 110.0	90.0 to 140.0	110.0 to 170.0	140.0 to 220.0	220.0 to 325.0
RF in (dBm)	Supplied by E82x7C/D PSG with Option 1EA (high power)						
RF in, damage level (dBm)	+36	+36	+36	+36	+36	+36	+36
RF out (dBm) typical [2]	+8	+6	+5	-2	-6	-12	-25
Harmonics and sub-harmonics (dBc) typical [3]	≤ -20	≤ -20	≤ -20	≤ -20	≤ -20	≤ -20	≤ -20
In-band spurious (dBc) typical [4]	≤ -20	≤ -20	≤ -20	≤ -20	≤ -20	≤ -20	≤ -20
RF in VSWR	≤ 2.0	≤ 2.0	≤ 2.0	≤ 2.0	≤ 2.0	≤ 2.0	≤ 2.0
RF out VSWR	≤ 1.7	≤ 1.7	≤ 1.7	≤ 1.7	≤ 1.7	≤ 1.7	≤ 3.0
RF in port	SMA female						
RF out port [5]	WR-15	WR-12	WR-10	WR-08	WR-06	WR-05	WR-03
Power	Supplied by E82x7C/D PSG (+8 VDC @ 1.2 A max,+15 VDC @ 150 mA max)						
Temperature	+20 to +30 °C						
Weight	2.5 lbs typical						
Size [6]	2.8″ (H) x 4.3″ (W) x 5.7″ (D)						

Order information [7]

Agilent model number	OML model model number	Description	Frequency range
E8257DS15	S15MS-AG	WR-15 Source Module	50 to 75 GHz
E8257DS12	S12MS-AG	WR-12 Source Module	60 to 90 GHz
E8257DS10	S10MS-AG	WR-10 Source Module	75 to 110 GHz
E8257DS08	S08MS-AG	WR-08 Source Module	90 to 140 GHz
E8257DS06	S06MS-AG	WR-06 Source Module	110 to 170 GHz
E8257DS05	S05MS-AG	WR-05 Source Module	140 to 220 GHz
E8257DS03	S03MS-AG	WR-03 Source Module	220 to 325 GHz

OML standard accessories
V00DCDC3 2 m DC power cable
V00LOIF 1 m RF cable SMA(m) to SMA(m)

1. Specifications subject to change without notice.
2. Not traceable to NIST above 110 GHz.
3. As relates to the desired output frequencies.
4. In-band mixing products. Typically ≤ -15 dBc in the lower 10% of the WR-15, WR-12 or WR10 bands.
5. RF output port flange configuration per MIL-F-3922-67B-xx.
6. Height excludes the adjustable rubber feet length and depth dimension excludes the output waveguide length.
7. Each source module ordered includes one each of the Standard Accessories listed below (2 m DC power cable and 1 m RF cable).

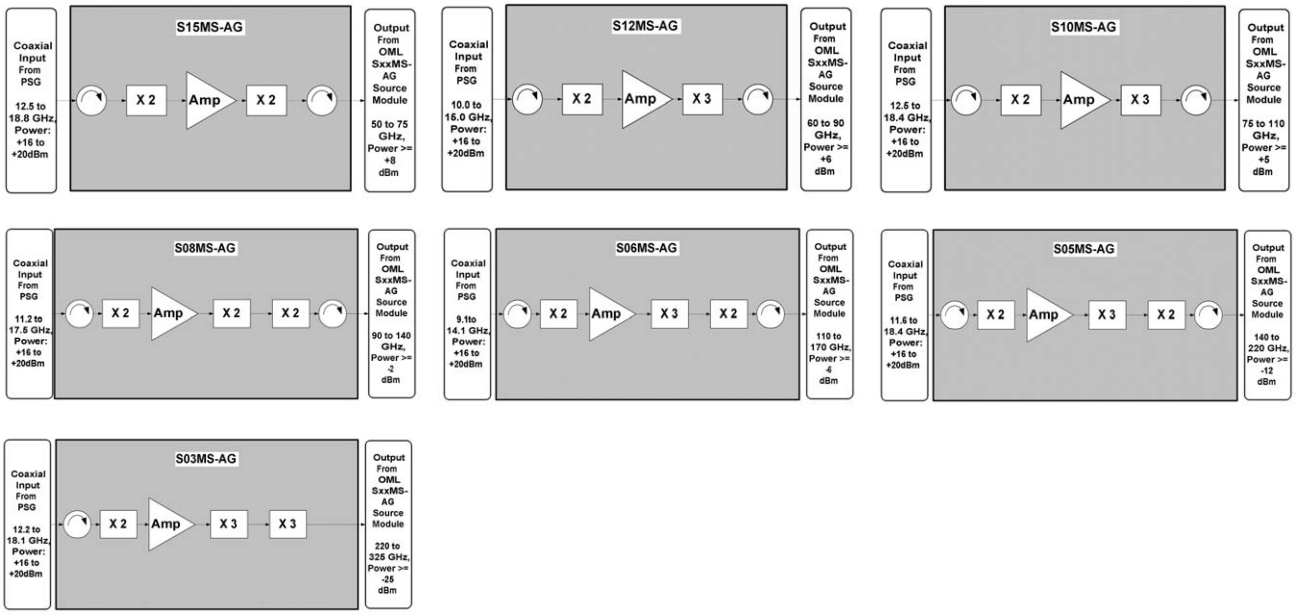


Figure 7. SxxMS-AG internal multiplier configurations.

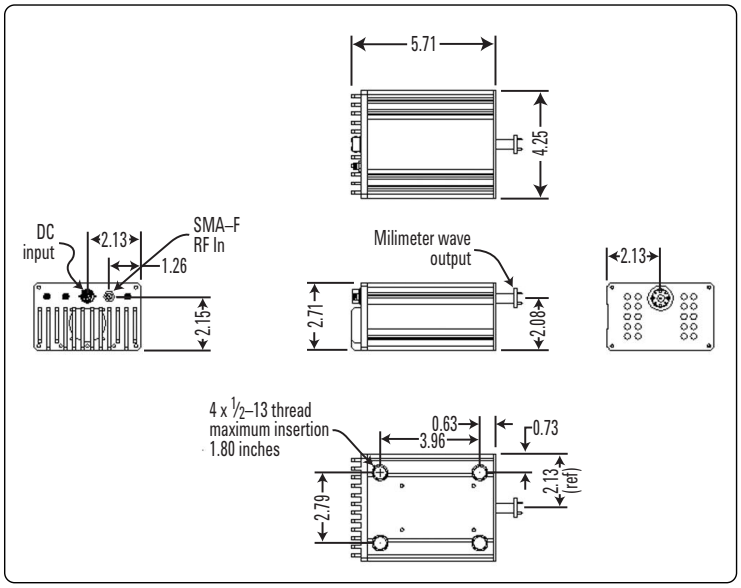


Figure 8. Overall dimensions of the millimeter wave source modules.

Related Literature

Agilent E8267D PSG Vector Signal Generator, Data Sheet,
Literature number 5989-0697EN

Agilent E8267D PSG Vector Signal Generator, Configuration Guide,
Literature number 5989-1326EN

*Agilent PSG Signal Generator*s,
Brochure,
Literature number 5989-1324EN

Agilent E8257D PSG Analog Signal Generator, Data Sheet,
Literature number 5989-0698EN

Agilent E8257D PSG Analog Signal Generator,
Configuration Guide,
Literature number 5989-1325EN

Related Web Resources

For more information on Agilent PSG signal generators, visit:
www.agilent.com/find/PSG

For more information on OML Inc.'s source modules, visit: **www.oml-mmw.com**

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