AMCAD Engineering
Advanced Modeling for Computer-Aided Design

Brochure and specifications

- **Compact design**
- **Variable frequency step**
- **Wideband frequency response**
- **Flat amplitude and phase response**

HPR727A Dual Output Comb Generator

AMCAD

COMB GENERATOR – HPR7227A
10MHz – 27GHz

Comb generator main features

- Broadband input (10 MHz to 7 GHz)
- Compatible with an external synthesizer
- Dual differential comb Generator output connectors
- One HPR provides both CAL and REF for time-domain calibrated RF measurements
- Can be used in single mode with output n°2 terminated with 50Ω load
- Flat amplitude response versus frequency
- Calibrated with 10MHz input signal using NIST traceable Comb Generator.
- Output harmonic signals are available from 10MHz to 26.5GHz with a 10MHz input signal
- Stable output signal & repeatable measurements
- Input connector: Super SMA Female (Front panel)
- Output A connector: 2.92mm male (Back panel)
- Output B connector: 2.92mm female (Back panel)
- DC supply : USB Powered 5VDC / 200mA (Front panel)

HPR727A – Front Panel

	Minimum	Maximum
Input signal		
Frequency	10 MHz	7GHz
Peak-to-peak Level	0,2 Vpp	3,4V pp
Absolute level	-3,8V	+3,8V
Output signal @10MHz Input		
Power @ [10MHz ; 7GHz]	-68dBm	
Power @ [7GHz ; 20GHz]	-83dBm	
Power @ [20GHz ; 26.5GHz]	-99dBm	

Application examples

The comb generator provides harmonic signals with a fixed and known phase relationship between each tone.

This wideband signal can be used for different applications :

- Time domain calibrated RF measurements for Power Amplifier Waveform engineering
- RF Transistor EPHD Behavioral Modeling
- EMC & EMI Testing

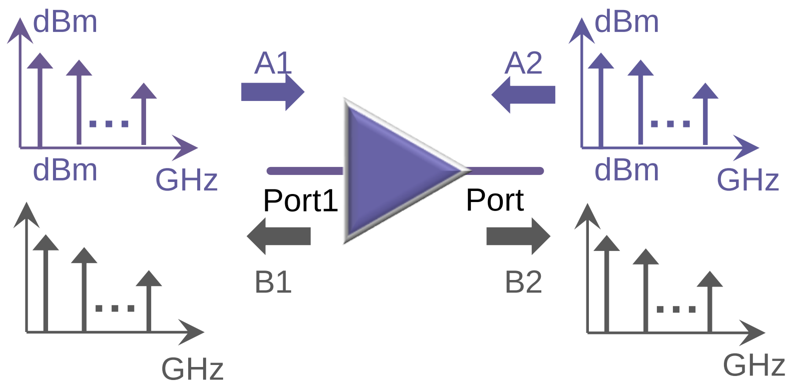
Application example

Large Signal Analysis & Waveform Engineering

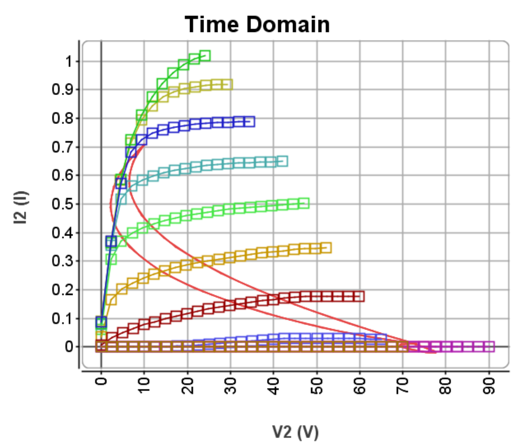
AMCAD wideband comb generator has been developed for the characterization of nonlinear RF devices (transistors, amplifiers), enabling the measurements of absolute phase of the harmonic content of a signal and allowing Waveform engineering capabilities in time-domain Load-Pull.

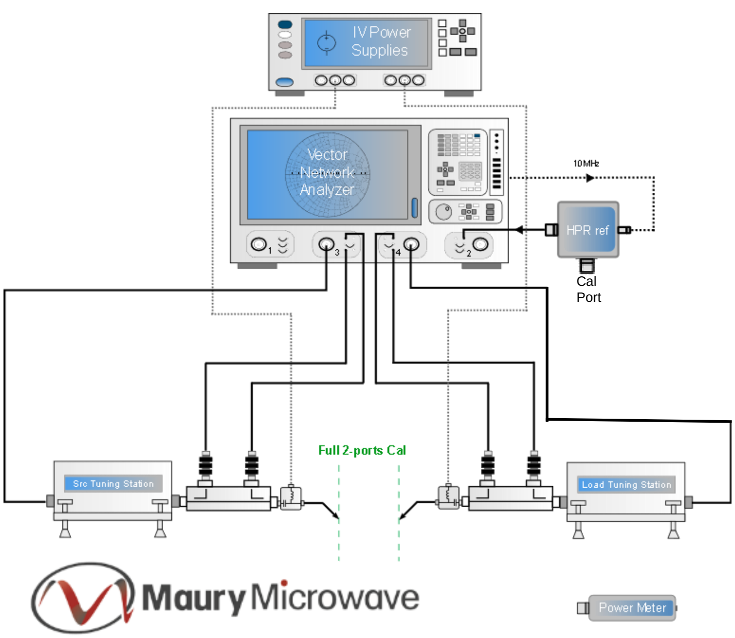
Waveform engineering can be used to minimize the power consumption and to optimize the power added efficiency of amplifiers, operating in a switch mode class of operation like Class F or inverse Class F.

See IVCAD MT930GA Large Signal Analyzer operating manual



Incident and scattered waves contain fundamental and harmonic tones





Large Signal Analysis load pull measurement bench architecture

Used in combination with **IVCAD Software**, this Comb Generator enables an accurate phase-calibrated measurement of harmonic signals when measured with a Vector Network Analyzer, in order to provide a true RF waveform measurements at the DUT reference plane.

This phase calibration standard allows optimizing the operating class of RF transistors using harmonic load tuning with IVCAD MT930C VNA based load pull measurement bench control and IVCAD MT930GA Time-Domain LSA software module.

Application example

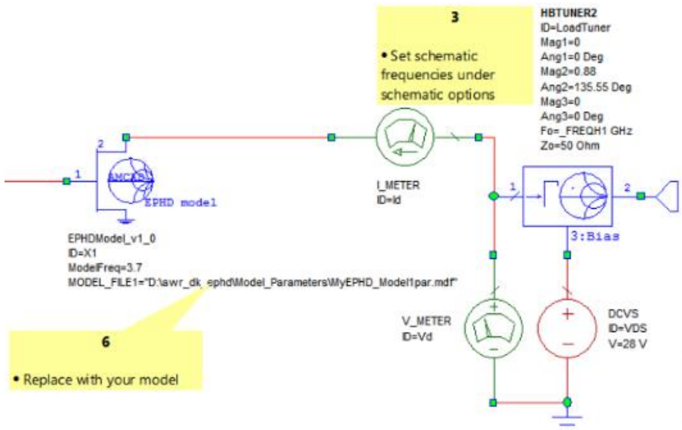
RF Transistor EPHD Behavioral Modeling

RF measurements of magnitude and phase-calibrated harmonic signal can be used to extract transistor's Enhanced Poly-Harmonic Distortion (EPHD) Model using IVCAD MT930R1 IVCAD software module.

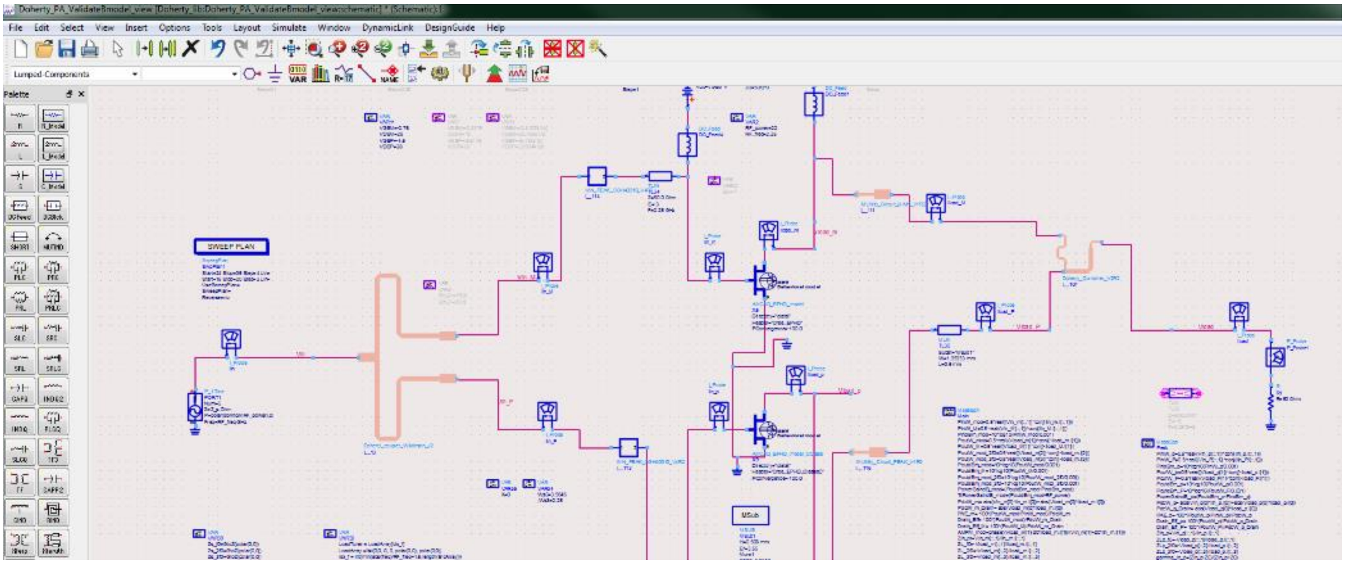
See IVCAD MT930R1 Behavioral Modeling Extraction and Simulation operating manual

With IVCAD **MT930C** VNA Based Load Pull and IVCAD **MT930GA** Large Signal analysis modules, harmonic phase-calibration and harmonic impedance control are used to generate time-domain load pull data which can be used to extract a transistor model directly from large signal measurements.

Using the comb generator, a transistor model can now be extracted within 2 or 3 days at several frequencies. Including, calibration, measurements, extraction and model validation time.



EPHD transistor behavioral model used in Cadence MWO circuit simulator

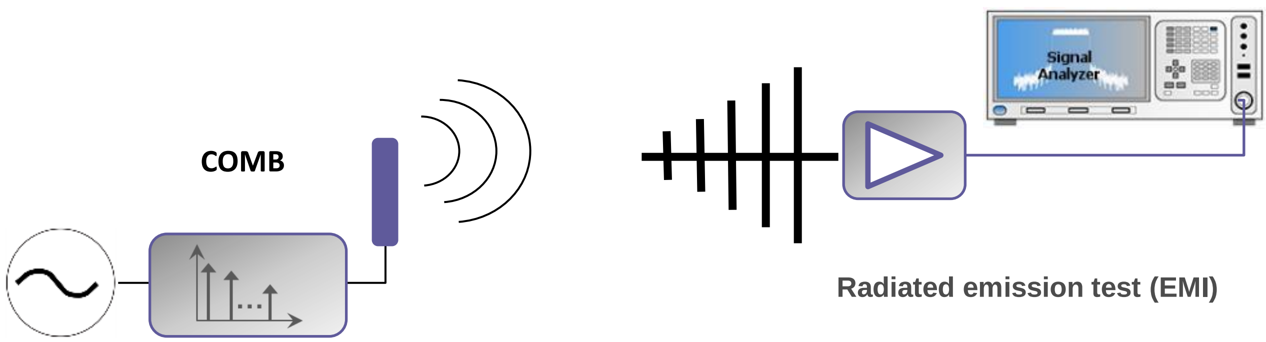


Doherty simulation using an EPHD transistor behavioral model with Keysight Pathwave ADS circuit simulator

Application example

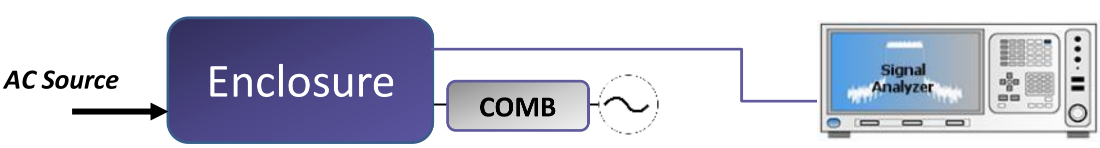
EMC testing

The **HPR7227A** comb generator can be used as a very broadband reliable EMC signal source reference for rapid and efficient testing.
The HPR can generate signals up to 26Ghz at frequency intervals as small as 10MHz.
EMC Laboratories calibrate their test sites, instrumentation and accessories regularly. Calibration procedures can be complex and time consuming. However, in EMI/EMC test site validation, using calibrated instruments does not prevent bad readings. These may be due to multiple causes, such as damaged receivers, broken cables, bad connections, or a defective antenna.



Radiated emission test (EMI)

Monitoring the radiated signal with an antenna using a very wideband signal makes it possible to check the entire configuration of the test site very quickly and efficiently.
Any potential problem with the test setup can be detected before it causes erroneous results.



Conducted emission test (EMC)

Equipped with an external RF source, and a broadband antenna, the compact size of our comb generator allows small enclosures to be evaluated when used as a reference source for shielding effectiveness measurements.

The comb generator is supplied with a super SMA input connector and two 2,92mm output connectors (Male and Female) for direct connection to wired test systems, or to an external antenna in order to generate test fields for evaluating radiated emission test systems.

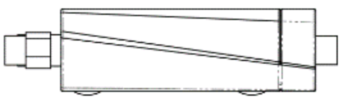
Specifications

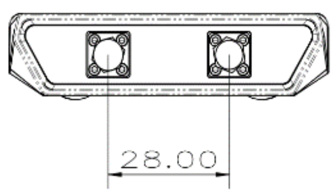
	Minimum	Typical	Maximum	Unit
Bias				
Voltage	**4.3**	**5**	**5.5**	**V**
Current			**200**	**mA**
Input signal				
Frequency	10 MHz		7 GHz	
Peak-to-peak Level	0,2		3,4V	Vpp
Absolute level	-3,8		+3,8	V
Output signal @10MHz Input				
Pout [10 MHz – 4 GHz]	-65			dBm
Pout [4 – 7 GHz]	-68			dBm
Pout [7 – 8,5 GHz]	-71			**dBm**
Pout [8,5 – 11,5 GHz]	-74			**dBm**
Pout [11,5 – 17 GHz]	-79			**dBm**
Pout [17 – 20 GHz]	-83			**dBm**
Pout [20 – 23 GHz]	-87			**dBm**
Pout [23 – 24 GHz]	-90			**dBm**
Pout [24 – 26,5 GHz]	-99			**dBm**
Pulse width		**45**		**ps**
Phase Stability				
10 MHz – 7 Ghz			**+/-2**	**°**
7 – 23 GHz			**+/-5**	**°**
23 – 26.5 GHz			**+/-10**	**°**
Operating T°	**-40**	**25**	**+65**	**°C**

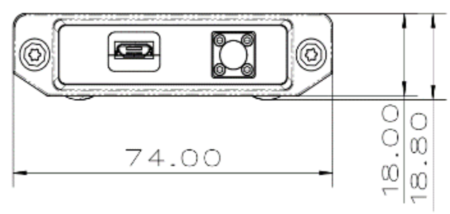
Note : Typical and nominal characteristics are included for information only and they are not specifications.

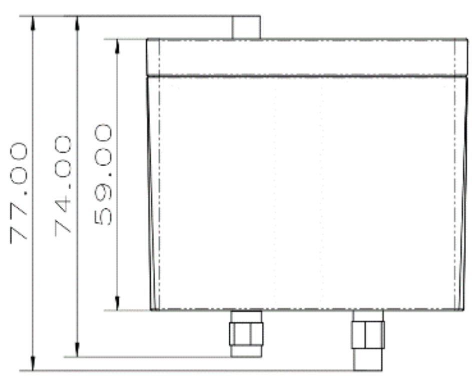
Mechanical Dimensions

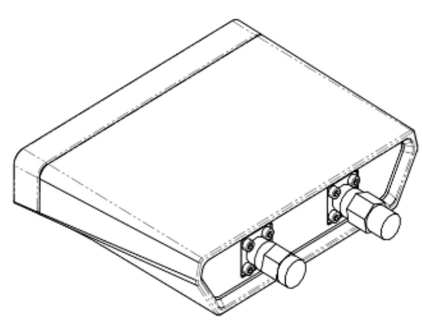
- **Weight : 120** g
- **Input connector :** Super SMA female
- **Output A connector** : 2,92mm male
- **Output B connector** : 2,92mm female
- **Dimension** : mm











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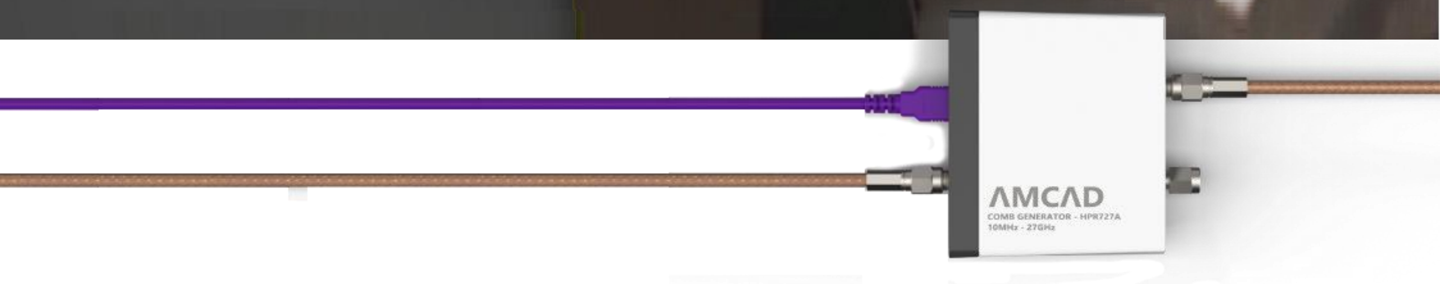
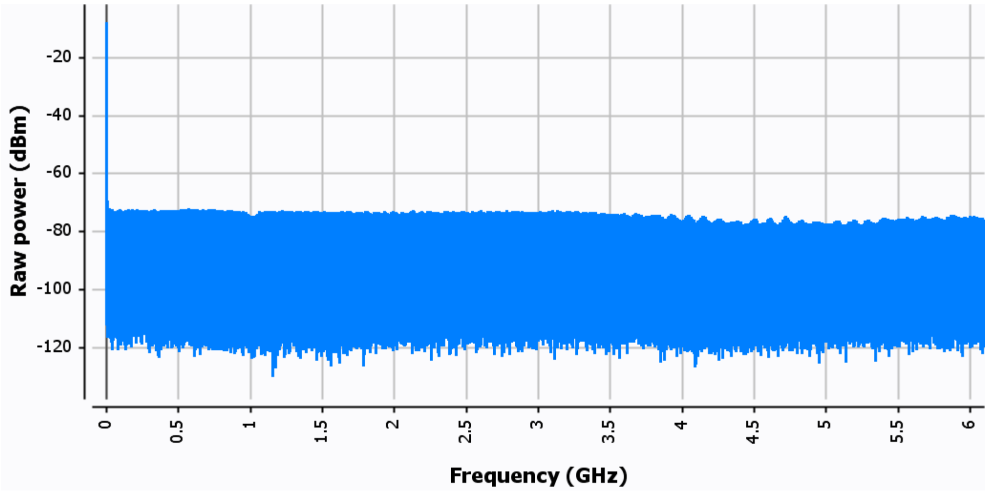
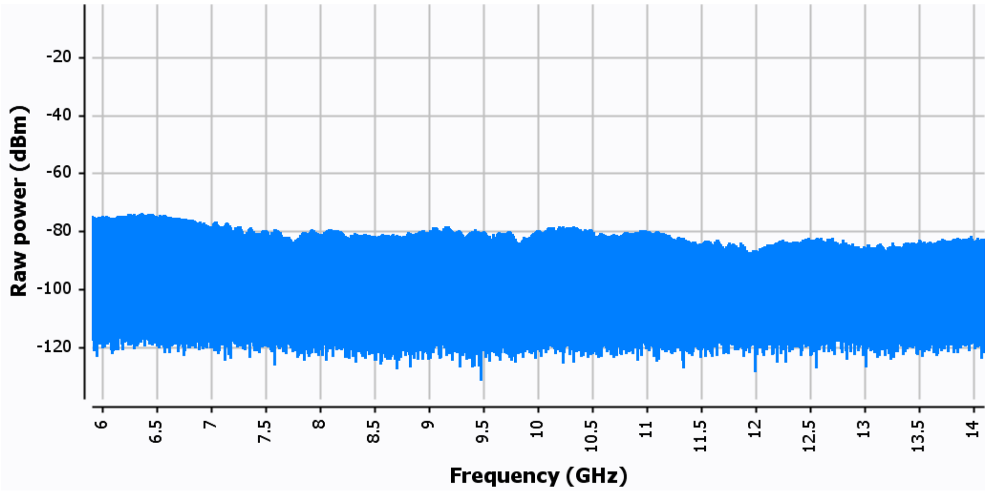
Typical Measurement example



Input 10MHz // Output from 10MHz to 6GHz



Input 10MHz // Output from 6GHz to 14GHz



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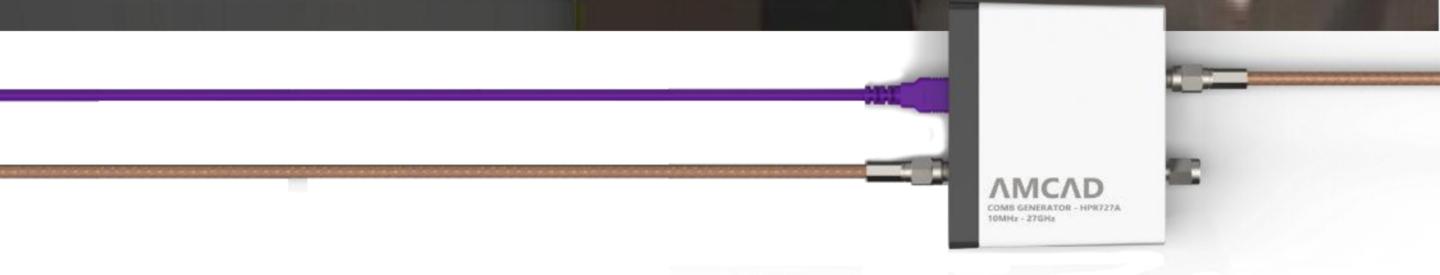
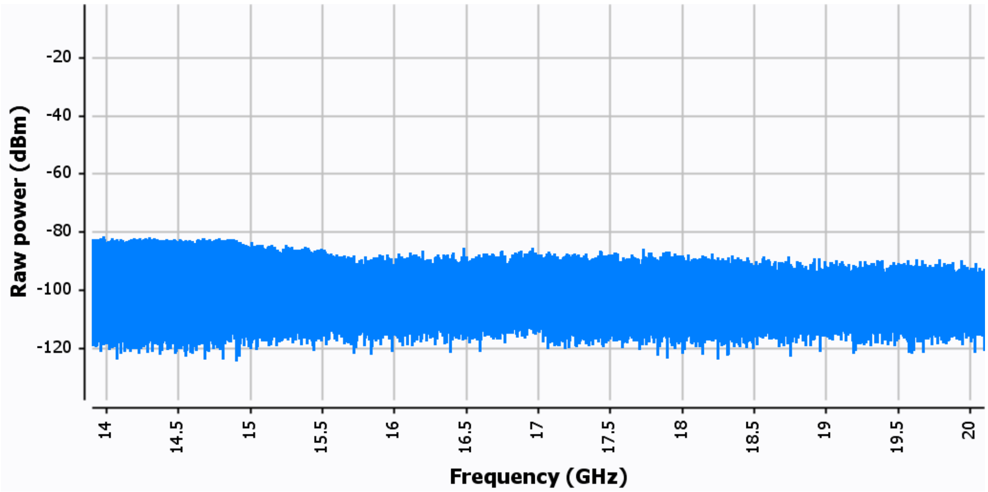
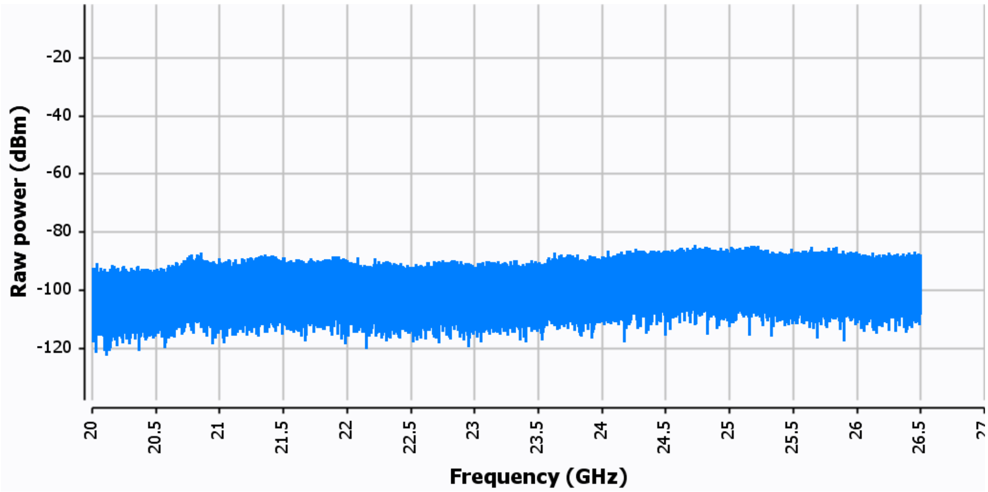
Typical Measurement example



Input 10MHz // Output from 14GHz to 20GHz



Input 10MHz // Output from 20GHz to 26.5GHz



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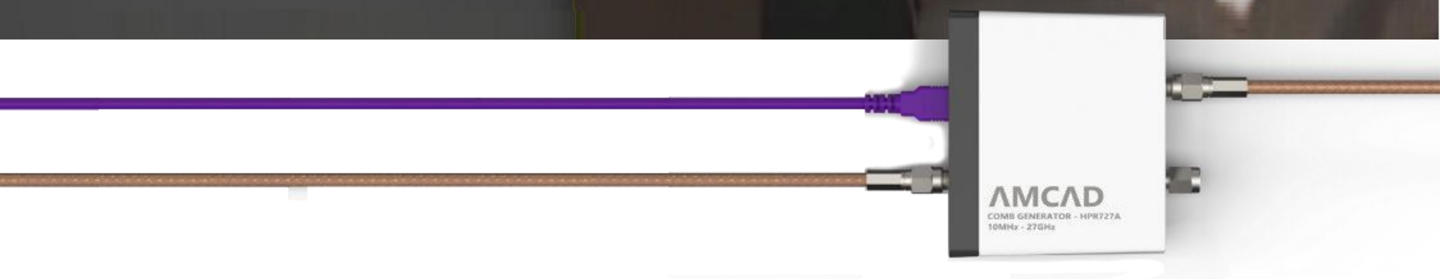
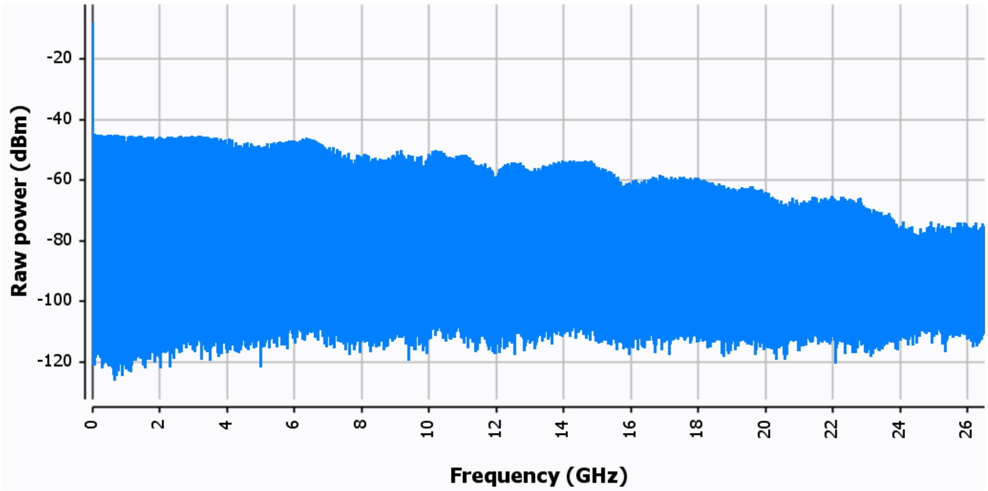
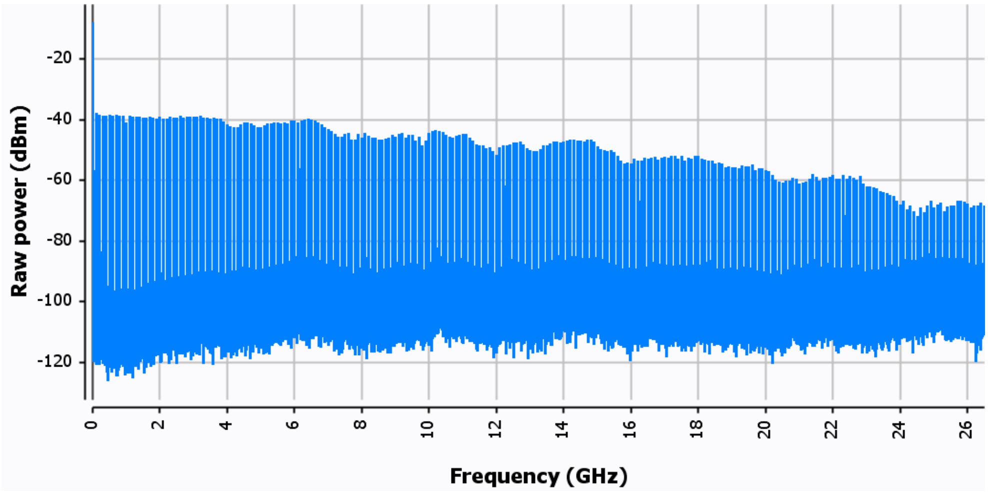
Typical Measurement example



Input 50MHz // Output from 50MHz to 26.5GHz



Input 100MHz // Output from 100MHz to 26.5GHz



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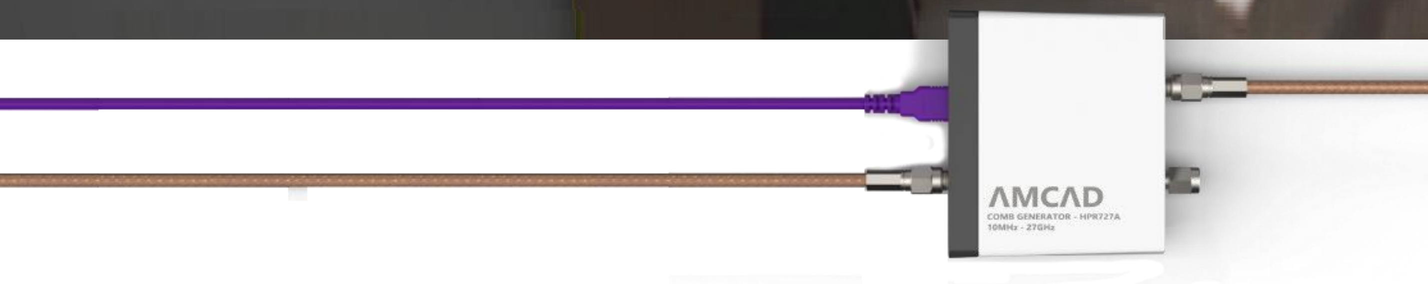
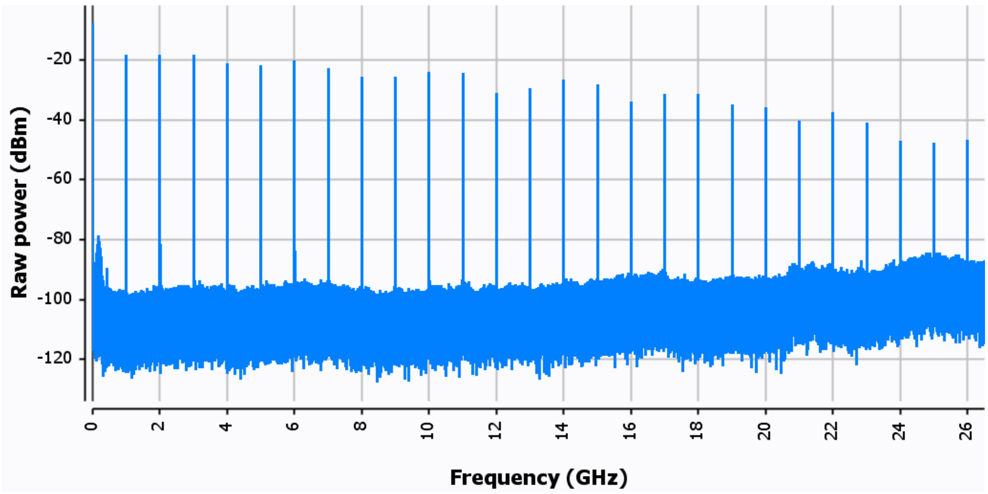
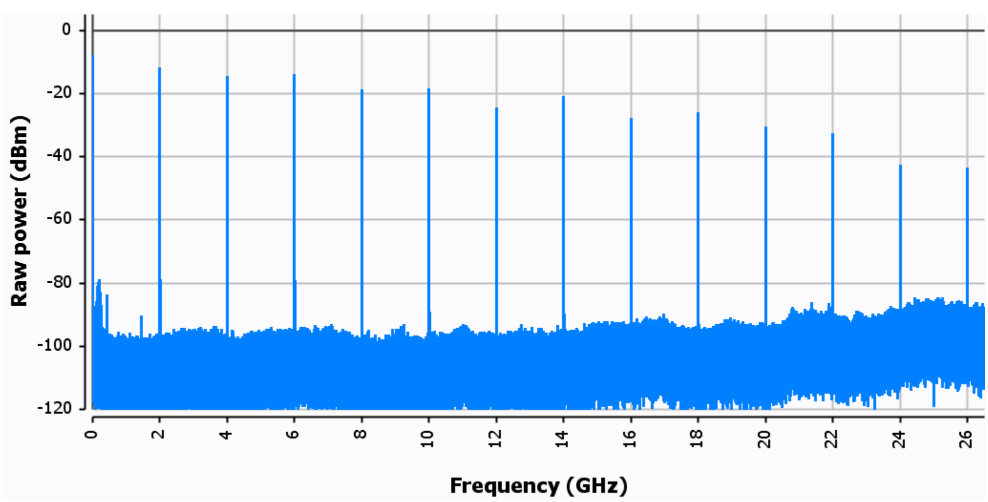
Typical Measurement example



Input 1GHz // Output from 1GHz to 26.5GHz



Input 2GHz // Output from 2GHz to 26.5GHz



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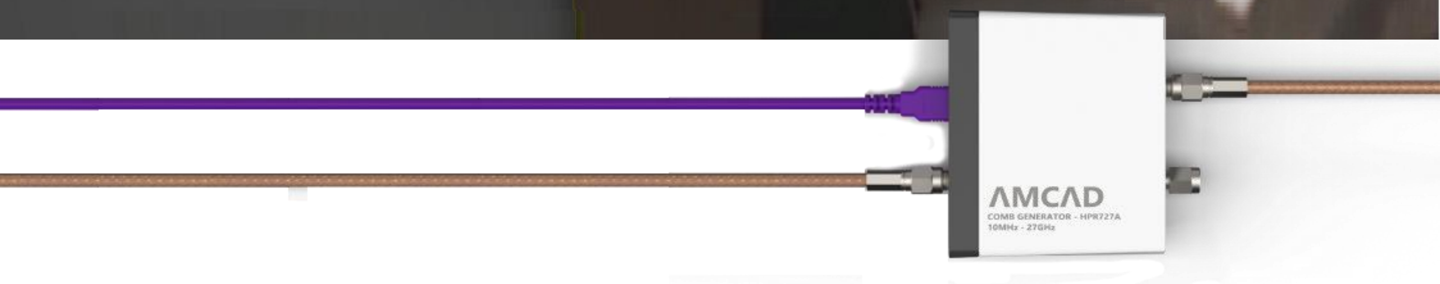
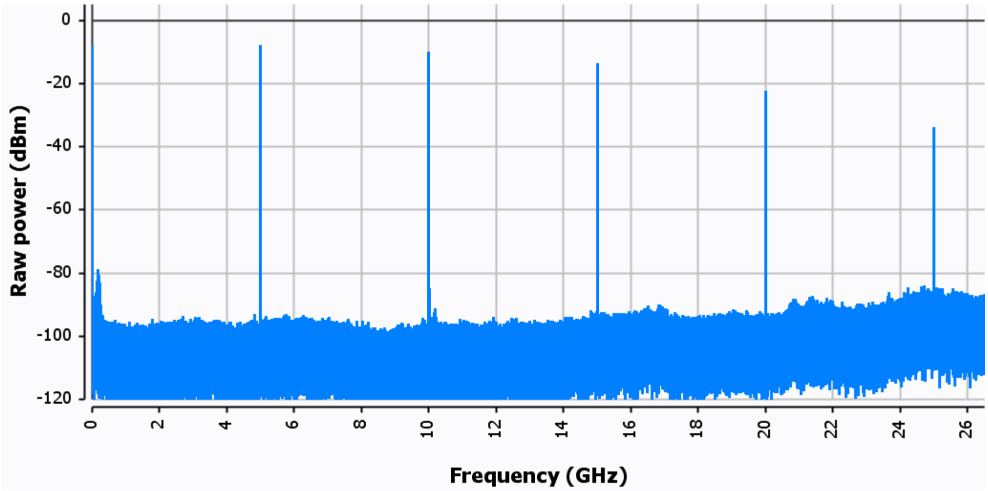
Typical Measurement example



Input 5GHz // Output from 5GHz to 26.5GHz



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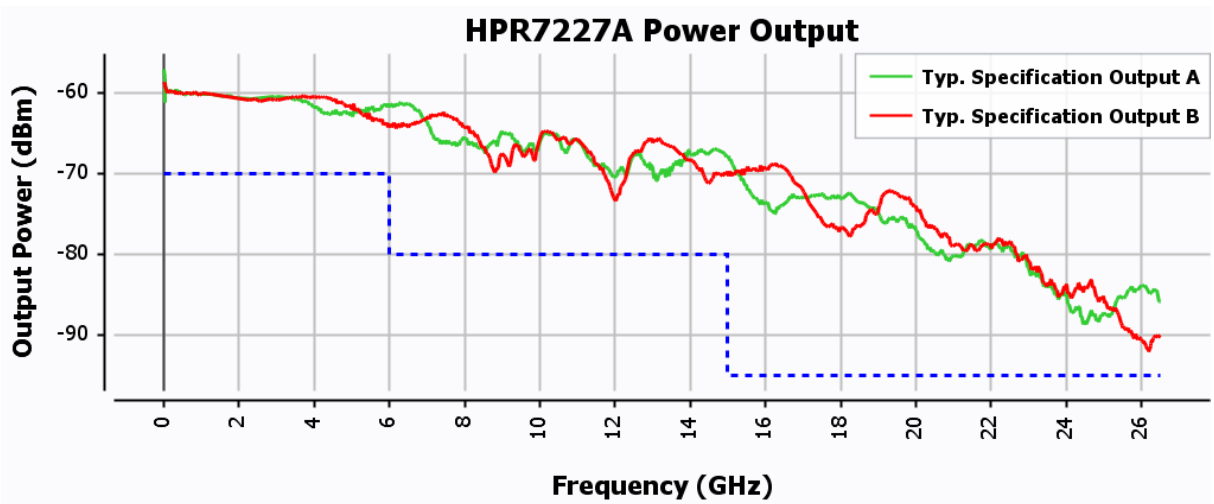
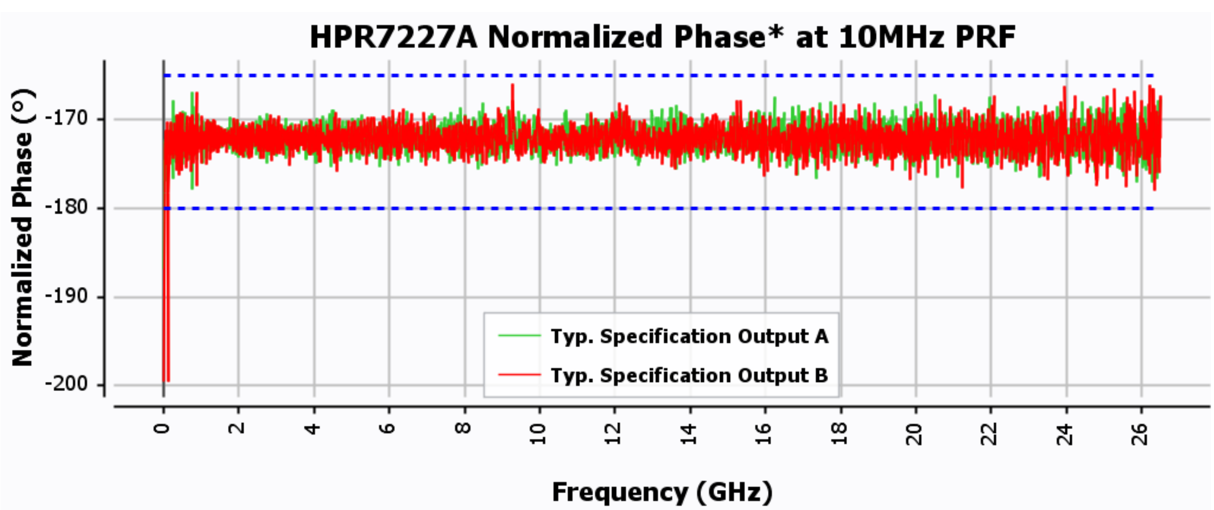
Typical Measurement example

HPR7227A Power



HPR7227A Normalized Phase* at 10MHz PRF



* Normalized Phase : phase difference between 2 successive harmonic tones
Note : Typical and nominal characteristics are included for information only and they are not specifications.

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