

High Performance Waveguide Mixer

MA2806A/MA2808A

50 GHz to 75 GHz

60 GHz to 90 GHz

New Design Mixer Solution for Millimeter-Wave Spectrum Analysis

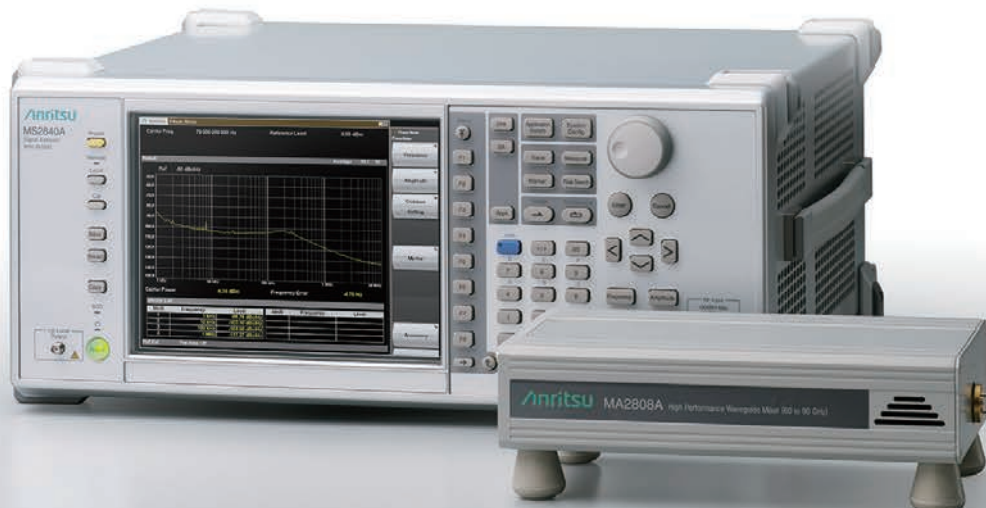


Excellent phase noise performance beyond -100 dBc/Hz suitable for testing new millimeter-wave technologies with MS2840A/MS2830A

More and more services are using wideband millimeter-wave wireless communications, such as wireless backhaul in the 60 GHz to 80 GHz band, WiGig WLAN modules (IEEE 802.11ad) in the 60 GHz band, and automotive radar in the 77 GHz and 79 GHz bands.

Conventional millimeter-wave measurements use a harmonic mixer or down converter but there are various problems when using these setups to measure wideband signals.

The High Performance Waveguide Mixer MA2806A and MA2808A are the new solutions for these problems.



High Performance Waveguide Mixer MA2806A/MA2808A Features

Excellent Minimum Sensitivity and P1dB Performance

By using a dedicated circuit, the MA2806A and MA2808A have an excellent conversion loss of at least 10 dB better than conventional harmonic mixers. When used in combination with the Signal Analyzer MS2840A/MS2830A, the display average noise performance level is excellent at $-150 \text{ dBm/Hz (meas)}^{*1}$ at 75 GHz. Due to this excellent minimum sensitivity performance, it has plenty of margin for evaluating increasingly wider-band millimeter-wave equipment.

For example, at RF Spectrum Mask tests^{*2} of wireless backhaul Out Door Units (ODU), the large connection loss of the harmonic mixer makes it impossible to ensure sufficient measurement margin matching the measurement standards. As future channel bandwidths widen to 1 GHz to 2 GHz, minimum sensitivity will be a key issue affecting inability to secure the necessary measurement margin.

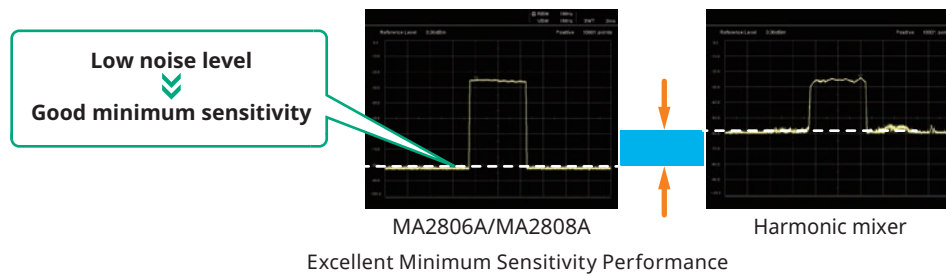
In addition, the P1dB performance of the MA2806A and MA2808A exceed 0 dBm.

P1dB is the input level when the conversion gain is compressed by 1 dB than the normal linear gain. For accurate measurement, something like an external attenuator is inserted to adjust the level so this input level is not exceeded, but this degrades the noise floor of the measurement system in proportion to the attenuation amount.

Since the MA2806A and MA2808A have a superior P1dB performance exceeding 0 dBm, it minimizes the external attenuation value, preventing degraded measurement system Rx sensitivity performance.

*1: Value measured at design but not guaranteed specification.

*2: ETSI EN 302 217-2-2 4.2.4 RF Spectrum Mask



Use High IF Frequency for Wider Measurement Span

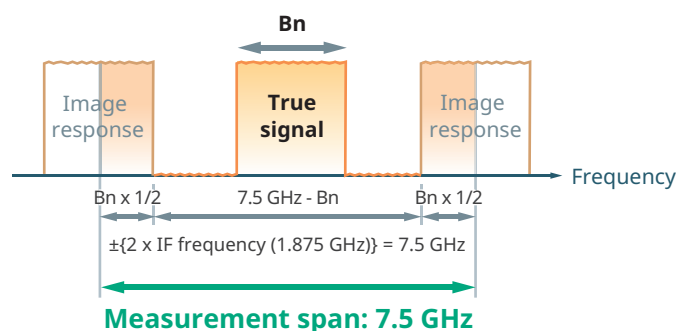
Image response can be eliminated by inserting a preselector in front of the mixer. However, although measurement is possible across the entire frequency range without any effect of image response due to the preselector, the Rx sensitivity performance is degraded badly by the large preselector insertion loss. The MA2806A and MA2808A use a wide-span measurement method that is unaffected by image-response effects, without requiring a preselector.

The measurable span without image-response effects is two times the IF frequency. Since it operates at a high IF frequency of 1.875 GHz, combining the MS2840A/MS2830A with the MA2806A/MA2808A supports an image-response-free range of 3.75 GHz ($2 \times 1.875 \text{ GHz}$). At Spectrum Mask tests, the range is $3.75 \text{ GHz} - B_n/2$, where B_n is the signal bandwidth.

For example, when the value of B_n for a wireless backhaul RF Spectrum Mask test is 1 GHz, the measurement span specified by ETSI is 4 GHz. Using the MA2806A or MA2808A, no image responses are observed up to 6.5 GHz.

Moreover, when B_n is 2 GHz, the specified measurement span is 7 GHz. Although the measurable span based on the above equation is 5.5 GHz and does not satisfy the specifications, using the newly-developed PS function^{*3} supports measurement across a span of 7.5 GHz ($3.75 \text{ GHz} \times 2$) without image-response effects.

*3: Patent pending as of October 2015



Measurement Span Unaffected by Image Responses

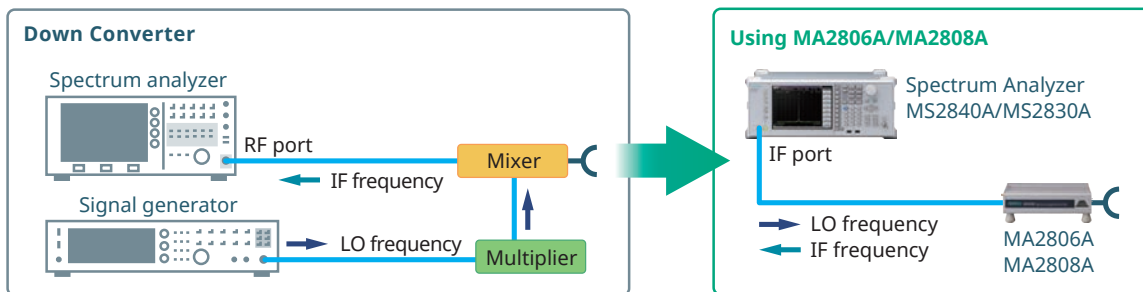
Excellent Millimeter-Wave-Band Phase Noise Performance in Combination with High Performance Waveguide Mixers

In case of 77/79 GHz automotive radar, the phase noise performance is important to detect the objects at short distance and person moving slowly. The High Performance Waveguide Mixer MA2806A/MA2808A support excellent phase noise performance in combination with the Signal Analyzer MS2840A. For example, the phase noise performance is better than -100 dBc/Hz in the 79 GHz frequency band with an offset of either 10 kHz or 100 kHz. Additionally, Phase Noise Measurement Opt-010 simplifies procedures and improves test time.



Simple Equipment Configuration

Using a conventional down converter requires connecting the mixer, LO signal generator and multiplier with coaxial cables, as well as correct operation of each piece of equipment. Since the MA2806A and MA2808A have a built-in multiplier, the system is easily configured using a single coaxial cable connection to the MS2840A/MS2830A. Furthermore, no expensive microwave signal generator is required, because the MS2840A/MS2830A LO signal source is used.



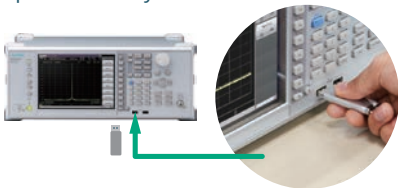
Simple Equipment Configuration using High Performance Waveguide Mixer

Provided Mixer Conversion Loss Data

The MA2806A or MA2808A conversion loss data for the full frequency range is pre-saved at shipping inspection to an accessory USB memory stick.

When using a customer-configured measurement system with conventional down converter, data such as the conversion loss must be collected before measurement to calibrate the measured data. This calibration data collection is time consuming and delays the start of measurement, reducing efficiency. Corrected measurement results can be read directly by reading this data at the MS2840A/MS2830A USB port using simple button operation.

Spectrum Analyzer MS2840A/MS2830A



- Save mixer conversion loss data to USB memory
- Conversion loss automatically reflected in measurement results by using simple button operation to read conversion loss data into MS2840A/MS2830A
- Full mixer frequency range coverage
MA2806A: 50 GHz to 75 GHz
MA2808A: 60 GHz to 90 GHz

Performance Comparison of Measurement Method

Measurement Method	Product Selection Points				
	Min.Sensitivity	Image Response	P 1 dB	System Config	Mixer Conversion Loss Calibration
Anritsu Solution 	Good	Far	High	Simple	No Need
Harmonic Mixer 	Bad ^{*1}	Very Close ^{*2}	High	Simple	No Need ^{*4}
Down Converter 	Good	Very Far	Low ^{*3}	Complex	Need ^{*5}

- *1: High noise floor level and narrow dynamic range due to high mixer conversion order
- *2: Low IF frequency depending on spectrum analyzer causes occurrence of image response generated in measurement range
- *3: Narrow dynamic range due to mixer P1dB performance of only -10 to -5 dBm
- *4: Different calibration procedure depending on spectrum analyzer used
- *5: Requires mixer conversion loss data for measurement range because any IF frequency can be set

Specifications

The specified values are after a 30-minute warm-up at a constant ambient temperature.

The High Performance Waeguide Mixer MA2806A or MA2808A is used by connecting it to the MS2840A-046 or MS2830A-044, MS2830A-045.

Electrical Characteristics

Model No.	MA2806A	MA2808A
Frequency Range	50 GHz to 75 GHz	60 GHz to 90 GHz
LO Amplitude Range	>+10 dBm	
Multiplier	8	12
Conversion Loss*	<15 dB (typ.)	
1 dB Gain Compression (P1dB)*	>0 dBm (typ.)	
LO Leakage	<-30 dBm (nom.)	
RF Input VSWR	≤1.5 (nom.)	
IF/LO Port	1.875 GHz (IF)	≤2.0 (nom.)
VSWR	5 GHz to 10 GHz (LO)	≤2.4 (nom.)
Maximum Input Level (CW)	+10 dBm	

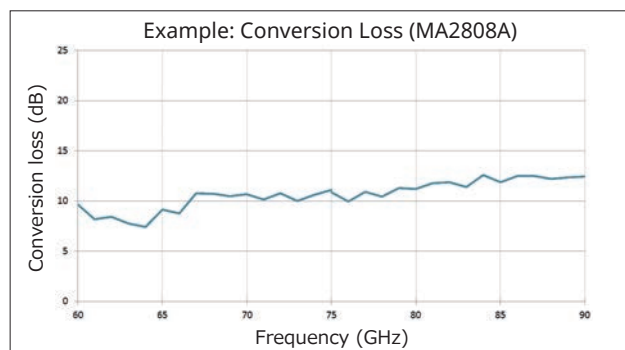
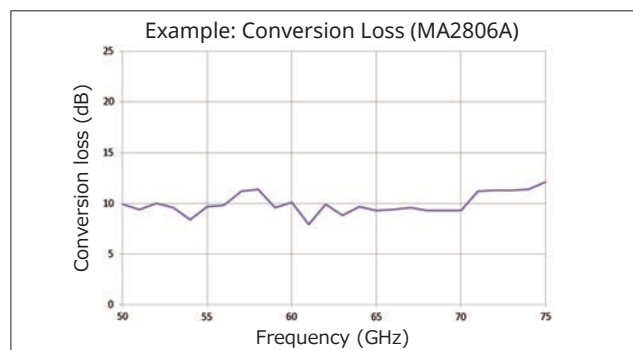
*: At assured performance temperature range

Interfaces

Model No.	MA2806A	MA2808A
RF	Waveguide (WR15, UG-385/U)	Waveguide (WR12, UG-387/U)
IF/LO	SMA-J	

General

Power Supply	100 V(ac) to 120 V(ac)/200 V(ac) to 240 V(ac), 50 Hz/60 Hz, 40 VA
Dimensions and Mass	134 (W) × 51 (H) × 229 (D) mm (excluding projections), <2 kg
Temperature Range	Assured performance range: +18° to +28°C Operating: +5° to +45°C (no condensation) Storage: -20° to +60°C (no condensation)
EMC	EN61326-1, EN61000-3-2



Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model No.	Name	Notes
MA2806A	- Main frame - High Performance Waveguide Mixer (50 to 75 GHz)	Waveguide (WR15, UG-385/U)
MA2808A	High Performance Waveguide Mixer (60 to 90 GHz)	Waveguide (WR12, UG-387/U)
- Standard accessories -		
Z1922A	MA2806A USB Memory: 1 pc	Saved conversion loss data (For MA2806A)
Z1923A	MA2808A USB Memory: 1 pc	Saved conversion loss data (For MA2808A)
Z1625A	AC Adapter: 1 pc	
	Power Cord: 1 pc	
J1692B	Coaxial Cord, 1 m: 1 pc	SMA-P · SUCOFLEX104PE · SMA-P, DC to 18 GHz, 50Ω

Minimum Recommended Configuration

Model No.	Name	Notes
MS2840A	Signal Analyzer	Main unit
MS2840A-046	44.5 GHz Signal Analyzer	
MS2830A	Signal Analyzer	Main unit
MS2830A-044	26.5 GHz Signal Analyzer	Select upper frequency
MS2830A-045	43 GHz Signal Analyzer	Select one of MS2830A-044 or MS2830A-045 options
MA2806A	High Performance Waveguide Mixer (50 to 75 GHz)	Select mixer model
MA2808A	High Performance Waveguide Mixer (60 to 90 GHz)	Select one of MA2806A or MA2808A