

V3060A Remote Transceiver Module

E-Band 60-90 GHz mixer for automotive radar



Data Sheet Definitions and Conditions

This data sheet provides performance information for Keysight V3060A E-Band 60-90 GHz Mixer for Automotive Radar. Specifications apply when using the cables provided in the box.

Specifications describe the performance of parameters covered by the product warranty and apply to temperature ranges 20 to 30 °C, unless otherwise noted.

95th percentile values indicate the breadth of the population (approx. 2σ) of performance tolerances expected to be met in 95 percent of the cases with a 95 percent confidence, for any ambient temperature in the range of 20 to 30 °C. In addition to the statistical observations of a sample of instruments, these values include the effects of the uncertainties of external calibration references. These values are not warranted. These values are updated occasionally if a significant change in the statistically observed behavior of production instruments is observed.

Typical values (typ) describe additional product performance information that is not covered by the product warranty. It is performance beyond specifications that 80 percent of the units exhibit with a 95 percent confidence level over the temperature range 20 to 30 °C. Typical performance does not include measurement uncertainty.

Nominal values (nom) indicate the expected mean or average performance, or an attribute whose performance is by design, such as the 50-ohm connector. This data is not warranted and is measured at room temperature (approximately 25 °C).

Measured (meas) describes an attribute measured during the design phase for purposes of communicating expected performance, such as amplitude drift vs. time. This data is not warranted and is measured at room temperature (approximately 25 °C).

All the above apply when using the instrument in its default settings unless otherwise stated.

Product Overview

The V3060A E-Band 60-90 GHz Transceiver Module is usable as down- and up-conversion mixer in the frequency range 60-90 GHz. Different IF cable lengths are supported in the standard configuration: 0.5 m, 2 m, and 5 m.

The V3060A is compatible with Keysight X-Series signal analyzers, oscilloscopes, digitizers – for its down conversion applications – and with Keysight X-Series signal generators and selected M8100 Series arbitrary waveform generators – for its up-conversion applications. It does not require an external Local Oscillator (LO) source, as it uses its built-in synthesizer and a 10 MHz or 100 MHz frequency reference input, available from any of the above mentioned Keysight instruments.

The V3060A can be controlled from a Windows-based PC in two ways:

By means of a dedicated Soft Front Panel (SFP), Keysight KS83Mx0A: Soft Front Panel for the Automotive Radar E-Band Mixer

By means of a TAP-based automation software, Keysight KS83200A: Automation Software for Automotive Radar Testing, and its additional features KS83St0A: Automation Software for Automotive Radar – ETSI Standards Testing and KS83Rx0A: Automation Software for Automotive Radar – Receiver and Interference Testing.

The V3060A can be configured as a downconverter in two ways:

Configuration 1: Downconverter + Signal Analyzer (Swept-tuned mode)



Figure 1. Configuration 1: downconverter mode, swept-tuned

Configuration 1 requires an X-series signal analyzer covering the required frequency range and V3060A with option DCL. The IF Out 1 or IF Out 2 output port of V3060A is connected to the X-Series Signal Analyzer RF Input. All signals to be measured are connected to a single port - the V3060A RF input. Frequencies between 60 and 90 GHz are down converted inside V3060A and routed as an Intermediate Frequency (IF) to the X-series signal analyzer.

Configuration 2: Downconverter + digitizer



Figure 2. Configuration 2: block down conversion

Configuration 2 requires a digitizer with a high enough frequency bandwidth: either an MXR-type oscilloscope or an M8131A type digitizer and V3060A with option DCL. All signals to be analyzed are input through V3060A's RF input port. IF Out 1 or IF Out 2 output port of the V3060A is used to route the down converted IF signal to the oscilloscope or digitizer.

The V3060A can be configured as an upconverter in the following way:

Configuration 3: Upconverter + signal source



Figure 3. Configuration 3, block up conversion

Configuration 3 requires an IF signal source: either an M8195A-type AWG or N5183B-type signal generator and V3060A with option UCL. IF In 1 input port of the V3060A is used to route the signal from the AWG or the signal generator. The upconverted RF signal is emitted out of the V3060A RF port.

Frequency

V3060A frequency range

Applies to configurations 1, 2, and 3.

Option	Center frequency range (all measurements, all applications)
DCL	60-90 GHz
UCL	

V3060A frequency bands (upconverter)

Band	Frequency range (approximate)	LO frequency	LO multiplier	Pre-selection filter, 1dB BW (nominal)
1	60-65 GHz	14.25 GHz	4	All Pass Filter
2	65-69 GHz	15.25 GHz		All Pass Filter
3	69-72 GHz	16.25 GHz		69-76 GHz
4	72-76 GHz	17 GHz		69-76 GHz
5	76-77 GHz	18 GHz		76-81 GHz
6	77-81 GHz	18.25 GHz		76-81 GHz
7	76-81 GHz	18 GHz		76-81 GHz
8	81-85 GHz	19.25 GHz		81-89 GHz
9	85-89 GHz	19.75 GHz		81-89 GHz
10	89-91 GHz	21.5 GHz		All Pass Filter

V3060A frequency bands (downconverter)

Band	Frequency range (approximate)	LO frequency	LO multiplier	Pre-selection filter, 1dB BW (nominal)
1	60-64 GHz	14.25 GHz	4	All Pass Filter
2	64-68 GHz	15.25 GHz		All Pass Filter
3	68-72 GHz	16.25 GHz		All Pass Filter
4	72-76 GHz	17.25 GHz		All Pass Filter
5	76-77 GHz	18.25 GHz		76-81 GHz
6	77-81 GHz	18.50 GHz		76-81 GHz
7	76-81 GHz	18.375 GHz		76-81 GHz
8	81-85 GHz	19.5 GHz		All Pass Filter
9	85-89 GHz	20.5 GHz		All Pass Filter
10	89-91 GHz	21.5 GHz		All Pass Filter

Phase Noise

V3060A phase noise (SSB, normalized to 1 Hz) (meas)

In downconverter mode

Frequency	Offset					
	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	10 MHz
62 GHz	-68 dBc/Hz	-75 dBc/Hz	-72 dBc/Hz	-80 dBc/Hz	-108 dBc/Hz	-130 dBc/Hz
76.5 GHz	-63 dBc/Hz	-73 dBc/Hz	-70 dBc/Hz	-79 dBc/Hz	-109 dBc/Hz	-128 dBc/Hz
79 GHz	-70 dBc/Hz	-72 dBc/Hz	-69 dBc/Hz	-79 dBc/Hz	-109 dBc/Hz	-127 dBc/Hz

In upconverter mode

Frequency	Offset					
	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	10 MHz
62 GHz	-65 dBc/Hz	-75 dBc/Hz	-70 dBc/Hz	-77 dBc/Hz	-110 dBc/Hz	-122 dBc/Hz
76.5 GHz	-65 dBc/Hz	-73 dBc/Hz	-68 dBc/Hz	-76 dBc/Hz	-104 dBc/Hz	-119 dBc/Hz
79 GHz	-66 dBc/Hz	-74 dBc/Hz	-69 dBc/Hz	-75 dBc/Hz	-105 dBc/Hz	-117 dBc/Hz

V3060A phase noise using E8257D PSG as external LO source set to 14.25 GHz, 18.25 GHz, and 18.375 GHz respectively (SSB, normalized to 1 Hz) (meas)

In downconverter mode

Frequency	Offset					
	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	10 MHz
62 GHz	-78 dBc/Hz	-88 dBc/Hz	-100 dBc/Hz	-102 dBc/Hz	-124 dBc/Hz	-131 dBc/Hz
76.5 GHz	-77 dBc/Hz	-85 dBc/Hz	-97 dBc/Hz	-100 dBc/Hz	-119 dBc/Hz	-131 dBc/Hz
79 GHz	-81 dBc/Hz	-87 dBc/Hz	-97 dBc/Hz	-99 dBc/Hz	-123 dBc/Hz	-132 dBc/Hz

In upconverter mode

Frequency	Offset					
	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	10 MHz
62 GHz	-62 dBc/Hz	-84 dBc/Hz	-107 dBc/Hz	-107 dBc/Hz	-121 dBc/Hz	-123 dBc/Hz
76.5 GHz	-69 dBc/Hz	-82 dBc/Hz	-104 dBc/Hz	-104 dBc/Hz	-115 dBc/Hz	-119 dBc/Hz
79 GHz	-65 dBc/Hz	-82 dBc/Hz	-103 dBc/Hz	-102 dBc/Hz	-115 dBc/Hz	-115 dBc/Hz

Amplitude

Power/Amplitude	Downconverter mode	Upconverter mode
Input power, max	+6 dBm (4 mW) RF	0 dBm IF (with Internal IF Attenuation set to 10 dB) and -15 dBm IF (with Internal IF Attenuation set to 0 dB)
P1dB	6 dBm (@ RF in port, with Internal IF Attenuation set to 0 dB, meas)	10 dBm RF @ 78.5 GHz (meas)
Attenuator	0 to 26 dB, in 2 dB steps, electronic switching (two attenuators)	0 to 26 dB, in 2 dB steps, electronic switching (one attenuator)
Flatness	4 dB (meas)	4 dB (meas)
Measurement range	Nominally from [DANL + Attenuator + 10logRBW] to [(1 dB Gain Compression) + Attenuator]	

Spurious Responses

Spurious responses	
60-65 GHz	< -45 dBc
65-69 GHz	
69-72 GHz	
72-76 GHz	
76-77 GHz	
77-81 GHz	
76-81 GHz	
81-85 GHz	
85-89 GHz	
89-91 GHz	

DANL (Displayed Average Noise Level)

V3060A DANL

Applies to Config 1 and 2. Input terminated, 0 dB Frequency Extender Atten, filter ON, average detection, normalized to 1 Hz. Includes any contribution from the MXR608B and V3060A

Frequency	DANL (meas)
76 GHz	-159 dBm/Hz
77 GHz	-158 dBm/Hz
78 GHz	-152 dBm/Hz
79 GHz	-152 dBm/Hz
80 GHz	-154 dBm/Hz
81 GHz	-151 dBm/Hz

1 dB Gain Compression

V3060A gain compression

Applies to Config 1 and Config 2, with 0 dB attenuation. Gain compression increases 1:1 with RF input attenuation.

Frequency range	1 dB compression level (nominal)	Additional information
60-65 GHz	6 dBm	
65-69 GHz		
69-72 GHz		
72-76 GHz		
76-77 GHz		
77-81 GHz		
76-81 GHz		
81-85 GHz		
85-89 GHz		
89-91 GHz		

V3060A General and Supplemental Information

Power/Amplitude ranges

LO input level	-20 dBm (nominal) +18 dBm (damage level)
Spurious responses	< -45 dBc (nominal)
RF Input/Output connector	WR12 RF Input
IF Input/Output connector	SMA
Input mismatch (nominal) S11 Log Mag	Rx waveguide flange: 76 .. 81 GHz: < -10 dB 60 .. 76 GHz and 81 .. 90 GHz: < -7 dB Tx waveguide flange: 76 .. 81 GHz: < -10 dB 60 .. 76 GHz and 81 .. 90 GHz: < -7 dB
Rear connectors (listed left to right)	Ref Out/Tx LO In IF In Ref In/Rx-Tx LO In If Out 2 If Out 1
USB connector	USB C PD: USB Type-C with Power Delivery (requires 15 V, 3 A, 45 W minimum)
IF frequency out	DC – 10 GHz
Dimensions	Length: 117 mm (4.6 in) Width: 103 mm (4.06 in) Height: 65 mm (2.56 in)
Weight	1.22 kg (2.69 lbs)
Mounting points	4 each threaded holes for M3 x 0.5
Accessories included	Pair of horn antennas (25 dBi gain) USB hub for data and power supply USB-C to USB-C Cable Adapter, BNC (m) to SMA (f) Torque wrench, 8lb-in 5/16-in Screwdriver, torx Travel case IF cables, SMA (m) to SMA (m) of different lengths: 0.5 m with option C01 2 m with option C02 5 m with option C03
Environmental certifications	
Temperature range	Operating: -10 to + 55 °C Storage: -40 + 70 °C
Cooling	Active forced-air fan cooling; must maintain 5 cm (2 in) of clearance around faces of V3060A with vents

Regulatory Information

This product is designed for use in INSTALLATION CATEGORY II and POLLUTION DEGREE 2 and MEASUREMENT CATEGORY NONE per IEC 61010 3rd ed, and 664 respectively.

This product has been designed and tested in accordance with accepted industry standards and has been supplied in a safe condition. The instruction documentation contains information and warnings which must be followed by the user to ensure safe operation and to maintain the product in a safe condition.

This product is intended for indoor use.

Regulatory information

	The CE mark is a registered trademark of the European Community (if accompanied by a year, it is the year when the design was proven). This product complies with all relevant directives.
cor.keysight@keysight.com	The Keysight email address is required by EU directives applicable to our product.
CAN ICES/NMB-001(A)	"This ISM device complies with Canadian ICES-001." "Cet appareil ISM est conforme a la norme NMB du Canada."
ISM 1-A (GRP.1 CLASS A)	This is a symbol of an Industrial Scientific and Medical Group 1 Class A product. (CISPR 11, Clause 4)
	The RCM mark is a registered trademark of the Australian Communications and Media Authority.
	This symbol indicates separate collection for electrical and electronic equipment mandated under EU law as of August 13, 2005. All electric and electronic equipment are required to be separated from normal waste for disposal (Reference WEEE Directive 2002/96/EC).
	China RoHS regulations include requirements related to packaging, and require compliance to China standard GB18455- 2001.
	This symbol indicates compliance with the China RoHS regulations for paper/fiberboard packaging.
	South Korean Certification (KC) mark; includes the marking's identifier code: R-R-Kst-SP23894

Regulatory, environmental and certifications

EMC	Complies with the essential requirements of the European EMC Directive and the UK Electromagnetic Compatibility Regulations 2016 as well as current editions of the following standards (dates and editions are cited in the Declaration of Conformity): IEC/EN 61326-1 CISPR 11 Group 1, Class A Caution: This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments. AS/NZS CISPR 11 CAN ICES/NMB-001(A) This ISM device complies with Canadian ICES-001 Cet appareil ISM est conforme a la norme NMB-001 du Canada
South Korean Class A EMC declaration	This equipment has been conformity assessed for use in business environments. In a residential environment this equipment may cause radio interference. 사 용 자 안 내 론 이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다. ※ 사용자 안내문은 "업무용 방송통신기자재"에만 적용한다.
Safety	Complies with the essential requirements of the European Low Voltage Directive as well as current editions of the following standards (dates and editions are cited in the Declaration of Conformity): IEC/EN 61010-1
Acoustic statement (European Machinery Directive)	Acoustic noise emission LpA < 50 dBA Operator position Normal operation mode per ISO 7779
Environmental stress	Samples of this product have been type tested in accordance with the Keysight Environmental Test Manual and verified to be robust against the environmental stresses of storage, transportation, and end-use; those stresses include, but are not limited to, temperature, humidity, shock, vibration, altitude, and power line conditions; test methods are aligned with IEC 60068-2 and levels are similar to MILPRF-28800F Class 3.

To find a current **Declaration of Conformity** for a specific Keysight product, go to:

<http://www.keysight.com/go/conformity>

Keysight Support Services

Accelerate your learning curve, enhance your test uptime, and confidently guarantee your instrument accuracy with Keysight Support Services. Keysight Services are here to support your test needs with expert technical support, instrument repair and calibration, training, alternative acquisition program options, and more.

A KeysightCare agreement provides dedicated, proactive support through a single point of contact for an extensive group of instruments, software, and solutions to ensure optimal uptime, with fast response times and resolution. Explore the services that are right for you.

Keysight Services

Offering	Benefits
KeysightCare  KEYSIGHTCARE	KeysightCare provides elevated support for Keysight instruments and software, with access to technical support experts who respond within a specified time and ensure committed repair and calibration turnaround times (TAT). KeysightCare offers multiple service agreement tiers, including KeysightCare Assured, Enhanced, and Application Software Support. See the KeysightCare data sheet for details.
KeysightCare Assured	KeysightCare Assured provides a commitment to respond to your engineer's technical needs quickly. When unexpected repairs are necessary, you can count on a committed repair service turnaround time to get you back up and running.
KeysightCare Enhanced	KeysightCare Enhanced includes all the benefits of KeysightCare Assured plus Keysight's accurate and reliable Calibration Services , accelerated and committed TAT, and technical response.
Keysight Support Portal & Knowledge Center	All KeysightCare tiers include access to the Keysight Support Portal, where you can manage support and service resources related to your assets, such as service requests and status, or browse the Knowledge Center.
Education Services	Build confidence and gain new skills to make accurate measurements, with flexible Education Services developed by Keysight experts. Including Start-up Assistance.
Alternative acquisition options	
KeysightAccess	Reduce budget challenges with a lease-based subscription service that offers low monthly payments, enabling you to get the instruments, software, and technical support you want for your test needs.

Recommended services

Maximize your instrument uptime and confidently make accurate measurements by securing technical support, repair, and calibration services with committed response and turnaround times. High-performance instruments include 1 year of KeysightCare Assured or KeysightCare Warranty Plus. Obtain multi-year KeysightCare upfront to eliminate the need for lengthy and tedious paperwork and yearly requests for maintenance budget. Plus, you benefit from secured service for 2, 3, or 5 years.

Service	Function
KeysightCare Enhanced*	Includes tech support, warranty and calibration
R-55B-001-1	KeysightCare Enhanced – Upgrade 1 year
R-55B-001-2	KeysightCare Enhanced – Extend to 2 years
R-55B-001-3	KeysightCare Enhanced – Extend to 3 years (Recommended)
R-55B-001-5	KeysightCare Enhanced – Extend to 5 years (Recommended)
KeysightCare Assured*	Includes tech support and warranty
R-55A-001-2	KeysightCare Assured – Extend to 2 years
R-55A-001-3	KeysightCare Assured – Extend to 3 years
R-55A-001-5	KeysightCare Assured – Extend to 5 years
Start-Up Assistance	
PS-S40-01	Included – instrument fundamentals and operations starter
PS-S40-04	Recommended – instrument fundamentals and operations starter
PS-S40-02	Optional, technology & measurement science standard learning

* Limited availability might apply. Please review the [service definition tool](#) for model number availability and the [datasheet](#) for country availability. Coverage might be limited to KeysightCare Warranty Plus (R-55F-001). If KeysightCare Enhanced is available, R-55B-001-2/3/5 must be ordered with R-55B-001-1.

Additional Resources

- [N9042B UXA X-Series signal analyzer](#)
- [PathWave X-Series measurement applications](#) and [PathWave Vector Signal Analysis \(VSA\)](#)
- [V3050A frequency extender](#) for an unbanded, preselected frequency range to 110 GHz
- [U9361 RCal](#) receiver calibrator for improved receiver test system accuracy by 10X
- [N9042B UXA Signal Analyzer Configuration Guide \(3121-1036.EN\)](#)

Keysight enables innovators to push the boundaries of engineering by quickly solving design, emulation, and test challenges to create the best product experiences. Start your innovation journey at www.keysight.com.



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