

Keysight Technologies
N9029AV01-V15, V1B, V2B
Signal Analyzer
Frequency Extension Module
and Accessories



User's Guide

Notices

© Keysight Technologies, Inc.
2016-2018

No part of this manual may be reproduced in any form or by any means (including electronic storage and retrieval or translation into a foreign language) without prior agreement and written consent from Keysight Technologies, Inc. as governed by United States and international copyright laws.

Trademark Acknowledgments

Manual Part Number

N9030-90061

Edition

Print Date: January 2019

Supersedes: March 2018

Printed in USA

Published by:
Keysight Technologies
1400 Fountaingrove Parkway
Santa Rosa, CA 95403

Warranty

THE MATERIAL CONTAINED IN THIS DOCUMENT IS PROVIDED "AS IS," AND IS SUBJECT TO BEING CHANGED, WITHOUT NOTICE, IN FUTURE EDITIONS. FURTHER, TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, KEYSIGHT DISCLAIMS ALL WARRANTIES, EITHER EXPRESS OR IMPLIED WITH REGARD TO THIS MANUAL AND ANY INFORMATION CONTAINED HEREIN, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. KEYSIGHT SHALL NOT BE LIABLE FOR ERRORS OR FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES IN CONNECTION WITH THE FURNISHING, USE, OR PERFORMANCE OF THIS DOCUMENT OR ANY INFORMATION CONTAINED HEREIN. SHOULD KEYSIGHT AND THE USER HAVE A SEPARATE WRITTEN AGREEMENT WITH WARRANTY TERMS

COVERING THE MATERIAL IN THIS DOCUMENT THAT CONFLICT WITH THESE TERMS, THE WARRANTY TERMS IN THE SEPARATE AGREEMENT WILL CONTROL.

Technology Licenses

The hardware and/or software described in this document are furnished under a license and may be used or copied only in accordance with the terms of such license.

U.S. Government Rights

The Software is "commercial computer software," as defined by Federal Acquisition Regulation ("FAR") 2.101. Pursuant to FAR 12.212 and 27.405-3 and Department of Defense FAR Supplement ("DFARS") 227.7202, the U.S. government acquires commercial computer software under the same terms by which the software is customarily provided to the public.

Accordingly, Keysight provides the Software to U.S. government customers under its standard commercial license, which is embodied in its End User License Agreement (EULA), a copy of which can be found at

<http://www.keysight.com/find/sweula>

The license set forth in the EULA represents the exclusive authority by which the U.S. government may use, modify, distribute, or disclose the Software. The EULA and the license set forth therein, does not require or permit, among other things, that Keysight: (1) Furnish technical information related to commercial computer software or commercial computer software documentation that is not customarily provided to the public; or (2) Relinquish to, or otherwise provide, the government rights in excess of these rights customarily provided to the public to use, modify, reproduce, release, perform, display, or disclose commercial computer software or commercial computer software

documentation. No additional government requirements beyond those set forth in the EULA shall apply, except to the extent that those terms, rights, or licenses are explicitly required from all providers of commercial computer software pursuant to the FAR and the DFARS and are set forth specifically in writing elsewhere in the EULA. Keysight shall be under no obligation to update, revise or otherwise modify the Software. With respect to any technical data as defined by FAR 2.101, pursuant to FAR 12.211 and 27.404.2 and DFARS 227.7102, the U.S. government acquires no greater than Limited Rights as defined in FAR 27.401 or DFAR 227.7103-5 (c), as applicable in any technical data.

Safety Notices

CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING

A **WARNING** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Keysight Technologies

N9029AV01-V15, V1B and V2B

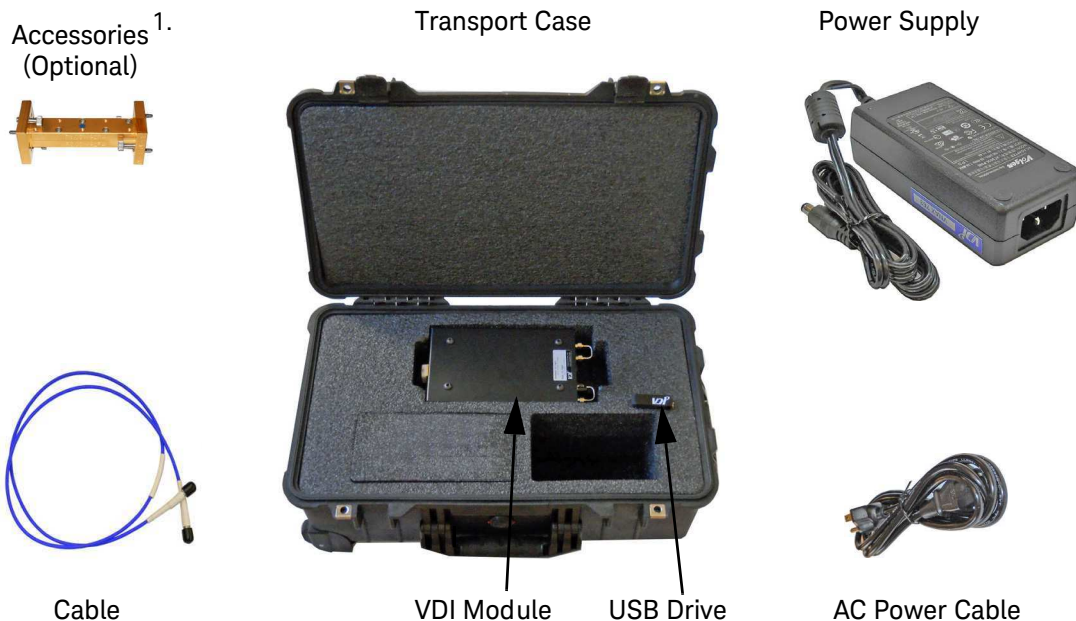
Signal Analyzer Frequency Extension Module and Accessories

The Keysight N9029AV01-V15, V1B and V2B Signal Analyzer Frequency Extension (SAX) Modules are manufactured by Virginia Diodes, Inc. (VDI). The Mixer/Amplifier/Multiplier Chain (MixAMC) modules are for use with the Keysight X-Series Signal Analyzer with the External Mixer Option (EXM), required.

The modules provide high performance broadband frequency down-conversion, and for modules with Option UDC, frequency up-conversion. The modules can be used with microwave signal analyzers to extend the frequency range into the THz range. These modules achieve low conversion loss and excellent noise figure. Refer to the VDI User's Guide included on the USB drive. For more information, see the Product Manual at http://vadiodes.com/images/Products/SAX/VDI-731_SAX_Product_Manual.pdf

The cables and power supply will be included with the module in the transport case. Cutouts have been created for the accessories within the transport case, simply remove the foam insert.

Accessories available for order - Amplifiers*, Attenuators, Filters, and Waveguide Sections.
(* Refer to compliance markings for Options AM1 and AMP. See [page 6](#) for details.)



1. To order accessories, see [Contacting Keysight on page 11](#). For the **Keysight Millimeter Wave Frequency Extenders, Technical Overview** document, visit <http://literature.cdn.keysight.com/litweb/pdf/5991-3161EN.pdf>

CAUTION

Be aware of the power level applied to the waveguide input. Non-warrantied damage to the internal mixer can occur if the power level is at or above the damage level specified in the VDI User's Guide for "RF Input."

NOTE

Before using your SAX module, please read all documentation from VDI (included on the USB drive).

Typical Connection Diagram for External Mixing



Table 1 SAX Modules

Keysight Model	VDI Model	Frequency (GHz)
N9029AV01	WR1.0SAX	750 to 1100
N9029AV1B	WR1.5SAX	500 to 750
N9029AV2B	WR2.8SAX	260 to 400
N9029AV02	WR2.2SAX	325 to 500
N9029AV03	WR3.4SAX	220 to 330
N9029AV04	WR4.3SAX	170 to 260
N9029AV05	WR5.1SAX	140 to 220
N9029AV06	WR6.5SAX	110 to 170
N9029AV08	WR8.0SAX	90 to 140
N9029AV10	WR10SAX	75 to 110
N9029AV12	WR12SAX	60 to 90
N9029AV15	WR15SAX	50 to 75

Table 2 SAX Options

Option	Description
DC9	Standard SAX with 9 VDC supply
UDC	Adds IF input data (on USB) for frequency up-conversion
D48	Adds data on USB down to 48 GHz (for N9029AV15 only)
D73	Adds data on USB down to 73 GHz (for N9029AV10 only)
H50	DC9 SAX with high sensitivity

Table 2 Accessories for Order

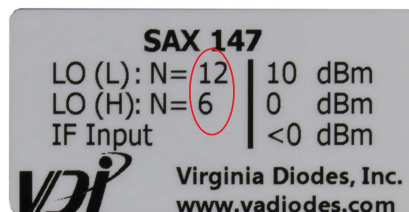
Keysight Model	Description	VDI Part Number
N9029AV01	No Accessories Available	N/A
N9029AV1B-ATN	VDI WR1.5 Fixed 10 dB Waveguide Attenuator	VDI1.5SG2-10
N9029AV02-ATN	VDI WR2.2 Fixed 20 dB Waveguide Attenuator	VDI2.2SG2-20
N9029AV2B-ATN	VDI WR2.8 Fixed 20 dB Waveguide Attenuator	VDI2.8SG2-20
N9029AV03-ATN	VDI WR3.4 Fixed 30 dB Waveguide Attenuator	VDI3.4SG2-30
N9029AV04-ATN	VDI WR4.3 Fixed 20 dB Waveguide Attenuator	VDI4.3SG2-20
N9029AV05-ATN	VDI WR5.1 Fixed 20 dB Waveguide Attenuator	VDI5.1SG2-20
N9029AV06-ATN	VDI WR6.5 Fixed 20 dB Waveguide Attenuator	VDI6.5SG2-20
N9029AV08-ATN	VDI WR8.0 Fixed 30 dB Waveguide Attenuator	VDI8.0SG2-30
N9029AV10-ATN	VDI WR10 Fixed 30 dB Waveguide Attenuator	VDI10.0SG2-30
N9029AV12-ATN	VDI WR12 Fixed 30 dB Waveguide Attenuator	VDI12.0SG2-30
N9029AV15-ATN	VDI WR15 Fixed 40 dB Waveguide Attenuator	VDI15.0SG2-40
N9029AV12-AMI *	Amplifier, 67-87 GHz, 21 dB Gain, WR12	VDI12.0AMP-0067/0087-20-20
N9029AV15-AMP *	Amplifier, 55-67 GHz, 19 dB Gain, WR15	VDI15.0AMP-0055/0067-15-20
N9029AV12-BF1	Bandpass Filter, 59.5-61 GHz, WR12	WR12BPF59.5-61
N9029AV12-BF2	Bandpass Filter, 71-76 GHz, WR12	WR12BPF71-76
N9029AV12-BF3	Bandpass Filter, 81-86 GHz, WR12	WR12BPF81-86
N9029AV12-BF4	Bandpass Filter, 76-81 GHz, WR12	WR12BPF76-81
N9029AV12-SW2	WR12 Waveguide 2-In Straight Section from VDI	WR12SWG-2i
N9029AV15-BF1	Bandpass Filter, 57.2-59.4 GHz, WR15	WR15BPF57.2-59.4
N9029AV15-BF2	Bandpass Filter, 59.4-61.6 GHz, WR15	WR15BPF59.4-61.6
N9029AV15-BF3	Bandpass Filter, 61.5-63.8 GHz, WR15	WR15BPF61.5-63.8
N9029AV15-BF4	Bandpass Filter, 63.7-65.9 GHz, WR15	WR15BPF63.7-65.9
N9029AV15-BF5	Bandpass Filter, 57.2-65.9 GHz, WR15	WR15BPF57.2-65.9
N9029AV15-BF6	Bandpass Filter, 64-71 GHz, WR15	WR15BPF64-71

* Contains the following instrument markings: **CE**, **RCM**, and **ccr.keysight@keysight.com** (see [page 9](#) for details).

NOTE

Always use the information printed on the SAX label of your module.

- When using the **LO/IF (L) Input** (External Mixing), use **LO (L): N= X**, with "X" being the multiplication factor value shown on your SAX label.
- When using the **LO/IF (H) Input**, use **LO (H): N= X**, with "X" being the multiplication factor value shown on your SAX label.



On the SAX label, the multiplication factor values are circled. This is an example only; the actual values will vary.

When using your signal analyzer with the SAX, you must set the analyzer to external mixing, including harmonic and Doubler Switched parameters.

For the N90x0A Models:

[Input/Output] > External Mixer > External Mixer > Ext Mix Setup > Edit Harmonic Table > [Enter] (or select OK).

Table Type > Doubler Switching > Harmonic > [N] > Enter N value (see SAX label on module, or see VDI document, for N value)

For the N90x0B Models:

[Input/Output] > Select Input > External Mixer > External Mixer Setup > Table Type > Doubler Switching > Harmonic (under Harmonic Table) > Enter N value (see SAX label on module, or see VDI document, for N value)

NOTE

For improved spurious response:

- Change the number of sweep points:
[Sweep/Control] > Points > [40001]
Multi-Touch Sweep > Sweep Config > Points > [40001]
- Reduce resolution bandwidth:
[BW] > Res BW > [300 kHz]
- Turn on Signal ID:
[Input/Output] > External Mixer > Signal ID > On > Signal ID Mode > Image Suppress
Multi-Touch Input > Output > Signal ID > On > Signal ID Mode > Image Suppress

There is data on the USB drive that can be used to create a corrections file to improve amplitude accuracy.

Frequency Up-Converter Operation

The option UDC has an IF input and 9 volt connections for external devices. For frequency up-conversion, the left jumper is to be removed.

Voltage Bias Port

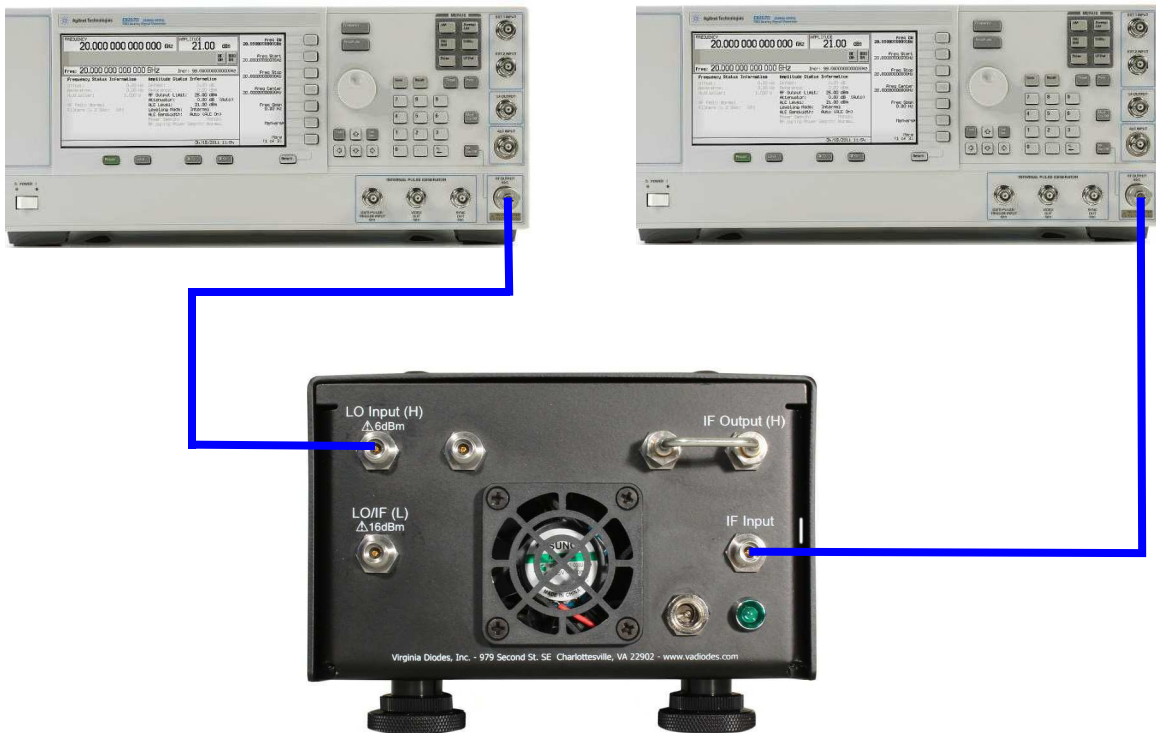


LO input (H)



The IF input frequency will be up-converted to the multiplication factor of the LO input (H) ++ IF input $\{N \times LO\ input\ (H) + IF\ input = waveguide\ output\ frequency\}$. Refer to the VDI User's Guide for frequencies and power levels.

1. Connect RF source to LO input (H), such as an E8257D PSG.
2. Connect RF signal to be up-converted to the IF input, such as an E8257D PSG.














NOTE

Other modes of operation may be found in the VDI documentation.

Instrument Markings

Listed below are definitions for the markings that may be found on the product.

	The instruction documentation symbol. The product is marked with this symbol when it is necessary for the user to refer to the instructions in the documentation.
	The AC symbol indicates the required nature of the line module input power.
	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).
	This symbol indicates that the power line switch is ON.
	This symbol indicates that the power line switch is in the OFF position.
IP 2 0	The instrument has been designed to meet the requirements of IP 2 0 for ingress and operational environment.
	The RCM mark is a registered trademark of the Australian Communications and Media Authority.
	Indicates the time period during which no hazardous or toxic substance elements are expected to leak or deteriorate during normal use. Forty years is the expected useful life of the product.
	The CE mark is a registered trademark of the European Community.
ccr.keysight@keysight.com	The Keysight email address s required by EU directives applicable to our product.
	This is a symbol of an Industrial Scientific and Medical Group 1 Class A product (CISPR 11, Clause 5).
ICES/NMB-001	This is a marking to indicate product compliance with the Canadian Interference-Causing Equipment Standard (ICES-001). Cet appareil ISM est conforme à la norme NMB du Canada.
	This symbol on all primary and secondary packaging indicates compliance to China standard GB 18455-2001.
	South Korean Certification (KC) mark; includes the marking's identifier code which follows this format: MSIP-REM-YYY-XXXXXXXXXXXX.

Safety

Complies with the essential requirements of the European Low Voltage Directive.

EMC

Complies with the essential requirements of the European EMC Directive as well as current editions of the following standards (dates editions are cited in the Declaration of Conformity):

- IEC/EN 61326-1
- CISPR Pub 11 Group 1, Class A
- AS/NZS CISPR 11
- ICES/NMB-001
This ISM device complies with Canadian ICES-001.
Cet appareil ISM est conforme a la norme NMB-001 du Canada.

To find a current Declaration of Conformity for a specific Keysight product, go to:
<http://regulations.about.keysight.com/DoC/search.htm>

South Korean Class A EMC Declaration

If there is a "KC" mark on the product, then the following statement applies:

This equipment has been conformity assessed for use in business environments. In a residential environment, this equipment may cause radio interference.

※ This EMC statement applies to the equipment only for use in a business environment.

사 용 자 안 내 문
이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.

※ 사용자 안내문은 “업무용 방송통신기자재”에만 적용한다.

Acoustic Statement (European Machinery Directive)

- Acoustic noise emission
LpA<70 dB
Operator position
Normal operation mode per ISO 7779

NOTE

This is a sensitive measurement apparatus by design and may have some performance loss (spurs up to 55 dB above a noise floor) when exposed to ambient continuous electromagnetic phenomenon in the range of 80 MHz - 2.7GHz when tested per IEC 61000-4-3.

For information concerning the operation and connections, reference the VDI User Guide (included on the USB Drive), or the Keysight X-Series Signal Analyzer's documentation by searching http://www.keysight.com/find/pxa_manuals. You may also reference the X-Series Signal Analyzer On-line Help System for operational information. Information is also available at <http://vadiodes.com>

Keysight Technologies does not guarantee the performance of the VDI modules, or system performance. However, if warranty or repair is needed Keysight will provide full support to our customer.

Inspect the shipping container. If the container or packing material is damaged, it should be kept until the contents of the shipment have been checked mechanically and electrically. If there is mechanical damage or if the instrument does not pass the performance tests, notify the nearest Keysight Technologies office. Keep the damaged shipping materials (if any) for inspection by the carrier and a Keysight Technologies representative.

Contacting Keysight

Assistance with test and measurement needs, and information on finding a local Keysight office are available on the Internet at:

<http://www.keysight.com/find/assist>

You can also purchase accessories or find documentation items on the Internet at:

<http://www.keysight.com/find>

If you do not have access to the Internet, contact your field engineer.

NOTE

In any correspondence or telephone conversation, refer to the Keysight product by its model number and full serial number. With this information, the Keysight representative can determine the warranty status of your unit.



This information is subject to change without notice.
© Keysight Technologies 2016- 2019
Print Date: January 2019
Supersedes: March 2018



N9030-90061

www.keysight.com