Keysight M940xA
PXIe Optical Extenders for Instrumentation

Data Sheet



KEYSIGHT TECHNOLOGIES

Overview

Introduction

The Keysight Technologies, Inc. Optical Extenders for Instruments can transmit your RF or Microwave signal without the power loss of coaxial cables and undesired mixing products of down- conversion techniques—and with the isolation of fiber for extended distances up to and beyond 1000 meters. Choose the combination of modules that best fits your requirements today with the confidence that you can scale the solution to meet the requirements of tomorrow by taking advantage of the modularity, scalability and upgradability of PXI.

Applications

- Antenna ranges, remote antennas, earth stations
- Network analyzer port extenders
- Isolated measurements

Features

- Frequency range of 300 kHz to 26.5 or 50 GHz
- Wideband up to 26.5 GHz or 50 GHz bandwidth
- No software or embedded controller required
- Distances up to and beyond 1000 meters

Keysight Optical Extenders for instrumentation modules

- M9403A PXIe Optical Transmitter: 300 kHz to 26.5 or 50 GHz
- M9404A PXIe Optical Receiver: 300 kHz to 26.5 or 50 GHz
- M9405A PXIe Amplifier: 300 kHz to 26.5 or 50 GHz (+27 dB or +24 dB)
- M9406A PXIe Optical to USB 2.0: Extender
- M9407A PXIe Optical to USB 2.0: 4 port Hub
- M9408A PXIe RF Reflectometer: 300 kHz to 50 GHz

Customer values

- Achieve long RF paths
- Provides the benefit of low-loss optical fiber
- You do not need special software or hardware to operate
- Isolates electrical signals for you
- Eliminates mixing products from downconversion techniques

Optical Extenders for Instrumentation

Product description

The PXIe modular family of optical extenders—M9403A, M9404A, M9405A, M9406A, M9407A and M9408A—can be integrated with other test and automation modules in PXIe and Hybrid chassis offering the benefit of a modular, scalable, and upgradable system. The PXI format offers high performance in a small, rugged package. It is an ideal deployment platform for many automated test systems. A wide array of complementary PXI products are currently available, including: multimeters, waveform generators, local oscillators, digitizers, downconverters, and switch multiplexers.

M9403A and M9404A PXIe Optical Transmitter and Receiver 300 kHz to 26.5 or 50 GHz

The Keysight M9403A and M9404A work together to overcome high loss, long path RF/Microwave applications associated with antenna ranges, distributed RF requirements, earth stations, and applications requiring electrical isolation such as EMI chambers. It is a complete RF/Optical/RF path enabling signals from 300 kHz to 26.5 or 50 GHz to be transmitted across distances up to and beyond 1.5 kilometers. The PXI form factor enables use in any compliant PXI card cage and the modular form factor provides a scalable and upgradeable solution protecting your investment throughout the life of the platform.



The M9403A is a 2-slot, 3U PXIe RF to optical converter, modulating the RF signal onto a 1550 nm single mode optical signal. The M9404A is a one-slot, 3U PXIe Optical to RF converter, demodulating the optical signal and delivering the recovered RF signal to the output connector. The M9403A and M9404A each offer optional, built in +27 dB or +24 dB amplifiers.

M9405A PXIe RF amplifier 300 kHz to 26.5 or 50 GHz

The Keysight Technologies M9405A is an RF/Microwave amplifier providing +27 dB of gain (Option F26) or +24 dB of gain (Option F50). Designed to support the M9403A and M9404A, the M9405A module offers the flexibility of applying the +27 dB or +24 dB of gain as a pre-amplifier to improve the noise figure or after the link to overcome the link conversion loss. The amplifier is also available as an option which can be integrated into either the M9403A, M9404A or both.



The M9405A is a 1-slot, 3U PXIe RF amplifier operating from 300 kHz to 26.5 or 50 GHz (+27 dB or +24 dB) with a noise figure of 7 dB @ 26.5 GHz (Option F26) and 9 dB @ 50 GHz (Option F50). Designed for use with the M9403A and M9404A Optical Links, it can also be used as a standalone RF amplifier.

Optical Extenders for Instrumentation (continued)

M9406A and M9407A PXIe Optical to USB 2.0 Extender and 4 port Hub

The Keysight Technologies M9406A and M9407A is a complete USB 2.0 hub, optically extending the USB ports to enable USB device operation and access to test control at the remote measurement location. The USB extenders enable remote measurement set up and control.

The M9406A and M9407A are both 2-slot, 3U PXIe cards providing fully functional USB 2.0 ports. Designed to complement the optically extended M9403A and M9404A providing USB enabled capability at the remote location, such as a keyboard, mouse, USB video adapter for monitor, power sensor, or E-Cal module. With this capability, remote instruments can be controlled or monitored. Calibrations can be performed from the remote location as well as power measurements useful in verifying RF power levels at the remote device. A two pair optical cable is required to support the transmit and receive path from both the remote and nearby modules.



M9408A PXIe Reflectometer 300 kHz to 50 GHz

The Keysight Technologies M9408A PXIe RF Reflectometer enables the full port extension of a vector network analyzer equipped with a configurable test set. When the two port device requires measurement ports, twenty feet or more, away from the analyzer, the M9408A can fully extend the measurement plane, delivering more power to the test device enabling full two port characterization of devices that could not be characterized using coaxial cables.

The M9408A is a 2-slot, 3U PXIe RF Reflectometer designed to extend the RF ports of a vector network analyzer enabling two port device measurements to span hundreds of feet or more.



Specifications and Characteristics (Typical)[1]

M9403A and M9404A PXIe Optical Transmitter and Receiver



Link performance[1]			
Frequency range	**300 kHz to 26.5 or 50 GHz**		
Input power at compression (Option H02)		@ 0.1 dB	@ 1 dB
	1 GHz	-36 dBm	-28 dBm
	10 GHz	-34 dBm	-26 dBm
	26.5 GHz	-34 dBm	-23 dBm
	50 GHz	-26 dBm	-19 dBm
Maximum input power M9403A	+7 dBM (Option H01) -25 dBm (Option H02)		
Damage input power level M9403A	+20 dBm (Option H01) -10 dBm (Option H02)		
Impedance	50 ohms		
	@ 26.5 GHz	@ 50 GHz	
Return loss **Source** **Receiver**	≥ 6 dB ≥ 8 dB	≥ 4 dB ≥ 6 dB	
Frequency response **Option H01** **Option H02**	 -31 dB -1 dB	 -37 dB -12 dB	
NF[2]	42 dB	43 dB	
RF connector **Option F26** **Option F50**	 3.5 mm 2.4 mm		

1. *Notes: Specifications for the family of OXI modules are nominal. Performance listed is only characteristic and intended as non-warranted information. Only a functional certificate is provided for the optical extenders product family.*
2. *The conversion loss of the link is the primary contributer to the NF results. Amplification is recommended to reduce NF*

Specifications and Characteristics (Typical)

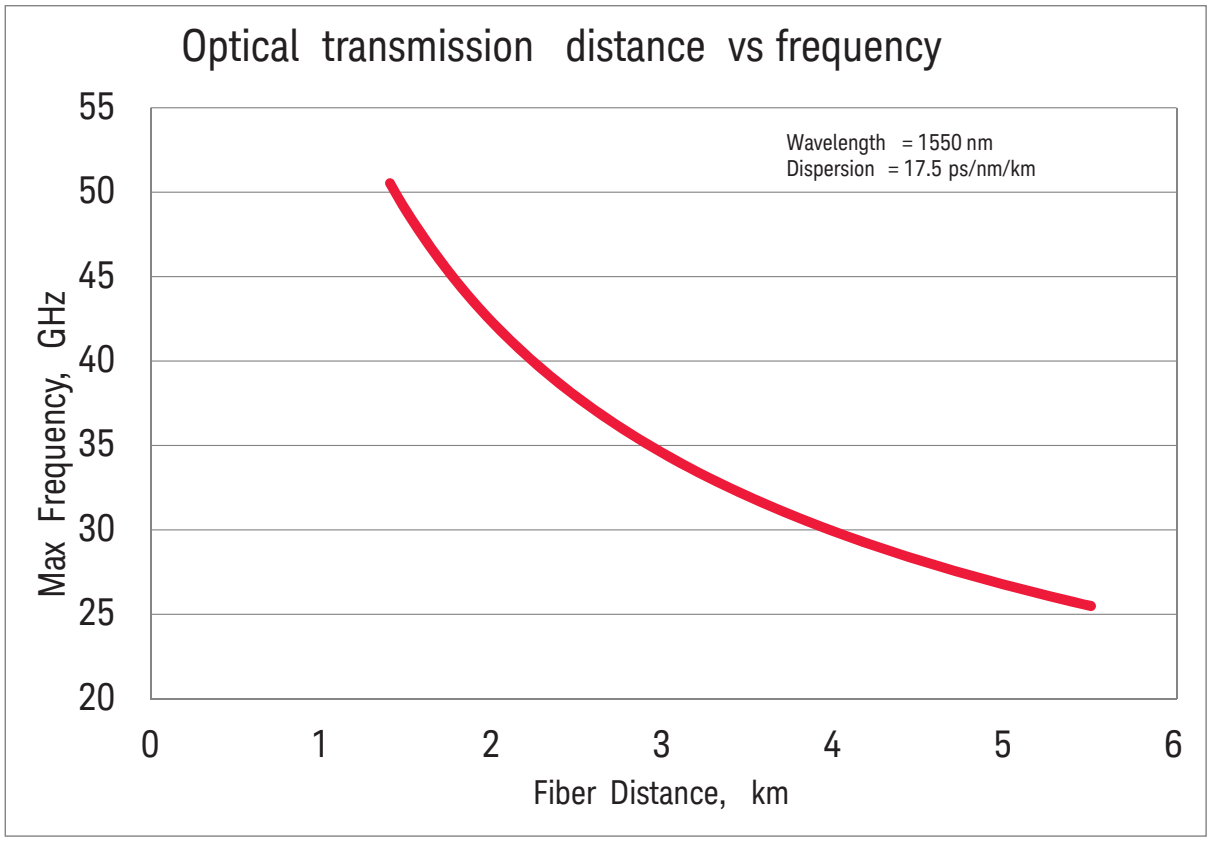


Figure 1. Optical loss graph with fiber length from 26.5 to 50 GHz.

Link performance	
Fiber type	SMF 28 e optical
Connector	E2000 APC
Temperature/drift	Fiber dependent
Bandwidth	300 kHz to 26.5 or 50 GHz full range available
Optical wavelength	1550 nm
Optical power out	+5 dBm
Maximum distance	1500 meters @ 26.5 GHz 1400 meters @ 50 GHz
Number of PXI slots occupied **M9403A** **M9404A**	 2-slot 1-slot
Software	None required
Slot compatibility	PXIe, PXI Hybrid

Specifications and Characteristics (Typical) (continued)

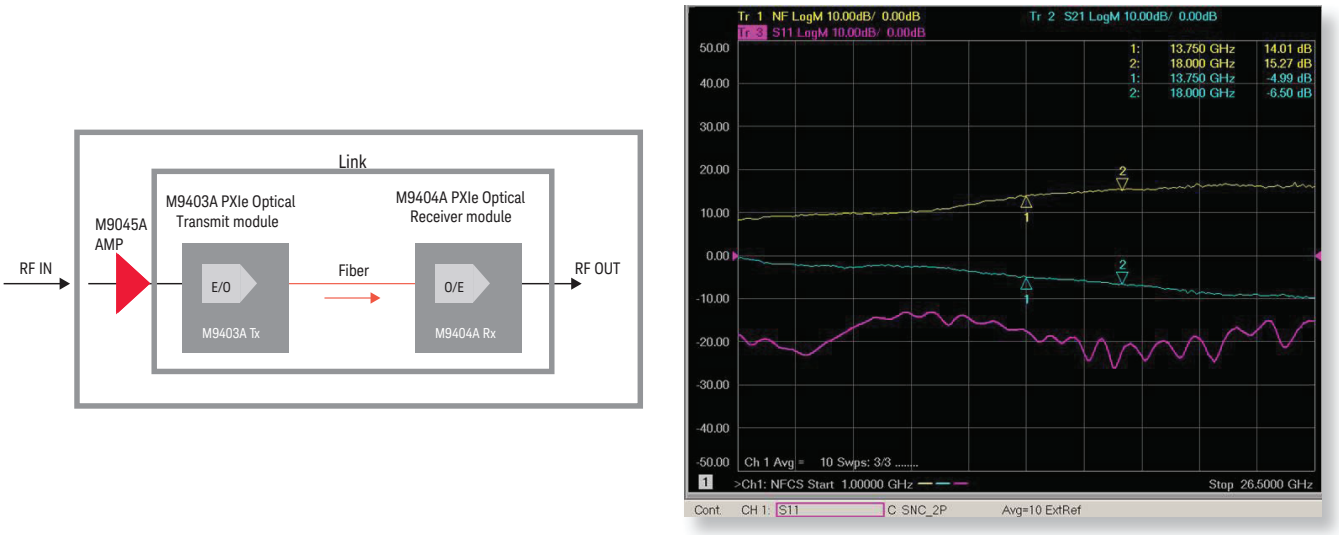


Figure 2. Typical link performance using the Keysight M9403A optical transmitter and M940A4 optical receiver with the M9405A amplifier.

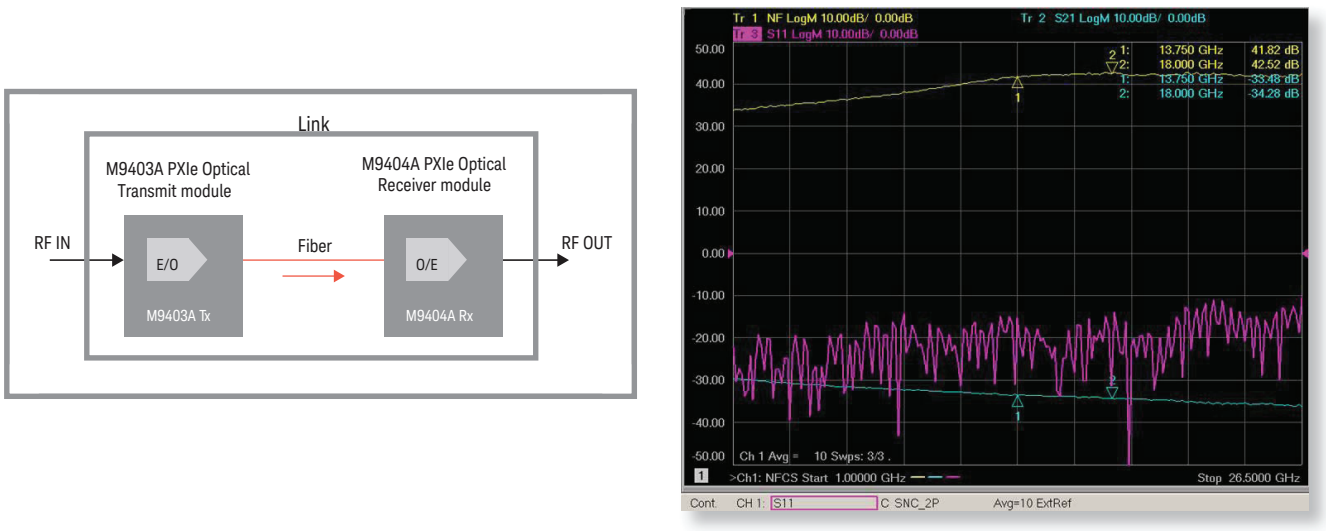


Figure 3. Typical link conversion loss using the Keysight M9403A optical transmitter and M9404A optical receiver without an amplifier.

Specifications and Characteristics (Typical) (continued)

M9405A PXIe RF Amplifier



Link performance						
	Option F26			**Option F50**		
Frequency range	300 kHz to 26.5 GHz			300 kHz to 50 GHz		
Input power at compression		@ 0.1 dB	@ 1 dB		@ 0.1 dB	@ 1 dB
	1 GHz 10 GHz 26.5 GHz	-22 dBm -22 dBm -22 dBm	-18 dBm -13 dBm -14 dBm	50 GHz	-20 GHz	-13 GHz
NF[3]	7 dB			9 dB		
Gain	≥ +27 dB			≥ +24 dB		
Connector type	3.5 mm			2.4 mm		
Return loss	≥ 10 dB			≥ 5 dB		
	Options F26 and F50					
Power consumption	3 W					
Number of PXI slots occupied	1-slot					
PXI slot compatibility	PXIe, PXI Hybrid					
Maximum input power	- 10 dBm					
Impedance	50 Ohms					

3. The conversion loss of the link is the primary contributor to the Noise Figure results. Amplification is recommended to reduce Noise Figure.

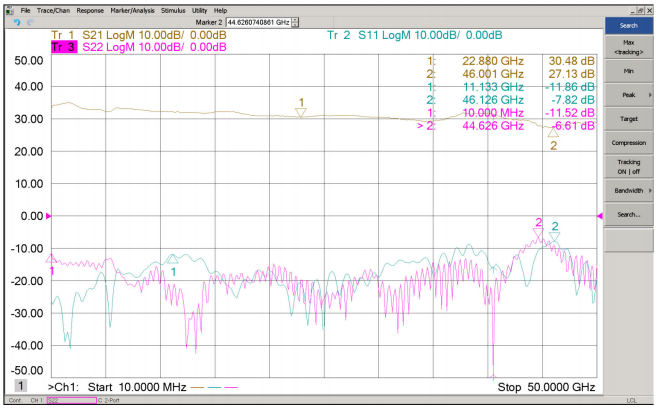


Figure 4. Typical Keysight M9405A amplifier characteristics

Specifications and Characteristics (Typical) (continued)

M9406A and M9407A PXIe Optical to USB 2.0 Extender and 4-port Hub



Data			
USB	**2.0 hub**		
Data rate	1.5 Mbps USB 1.0	12 Mbps USB 1.1	480 Mbps USB 2.0
Optical data			
Wavelength	1310 nm		
Connector type	SC		
Fiber type	Single mode		
Number of PXI slots occupied	2-slow		
PXI slot compatibility	PXIe, PXI Hybrid		

Specifications and Characteristics (Typical) (continued)

M9408A PXIe RF Reflectometer



Data		
Frequency range	10 MHz to 50 GHz 300 kHz to 45 MHz	 (coupling values will degrade performance)
Impedance	50 ohms	
Connector type	2.8 mm	
Number of PXI slots occupied	2-slot	
PXI slot compatibility	PXIe, PXI Hypbrid	

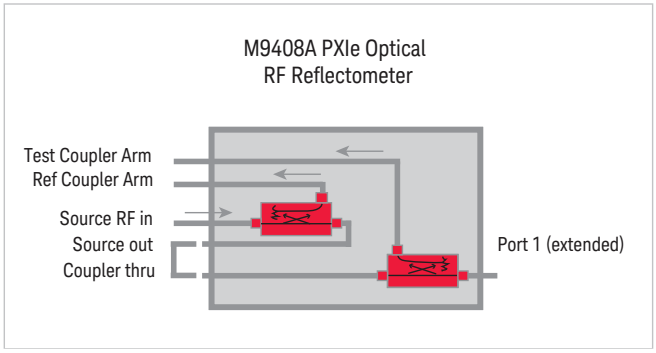


Figure 5. M9408A RF reflectometer.

Configuration and Ordering Information

Software Platform

The family of OXI modules—M9403A, M9404A, M9405A, M9406A, M9407A, and M9408—require no software for operation. The PXIe chassis provides module power. Once installed, they simply work. They can be used with and alongside other PXI modules such as an input attenuator for signal conditioning or paired with a signal source for transmission or signal analyzer for analysis.

Additional Information

Chassis slot compatibility: PXI system slot

Accessories

Model	Description
M9018A	PXI 18-slot chassis



Figure 6. M9018A 18-slot chassis.

Ordering Information

Model	Description
M9403A[1]	PXIe Optical Transmitter: 300 kHz to 26.5 or 50 GHz
M9403A-H01	O/E Converter
M9403A-H02	O/E Converter with Amplifier
M9403A-F26	Frequency 300 kHz to 26.5 GHz
M9403A-F50	Frequency 300 kHz to 50 GHz
M9403A-CA3	Optical Cable 3 Meter E2000pc to E2000PC
M9404A[1]	PXIe Optical Receiver: 300 kHz to 26.5 or 50 GHz
M9404A-H01	O/E Converter
M9404A-H02	O/E Converter with Amplifier
M9404A-F26	Frequency 300 kHz to 26.5 GHz
M9404A-F50	Frequency 300 kHz to 50 GHz
M9404A-CA3	Optical Cable 3 Meter E2000pc to E2000PC
M9405A	PXIe Amplifier: 300 kHz to 26.5 or 50 GHz
M9405A-H01	PXIe Amplifier: 300 kHz to 26.5 or 50 GHz
M9404A-F26	Frequency 300 kHz to 26.5 GHz
M9404A-F50	Frequency 300 kHz to 50 GHz
M9406A[1]	PXIe Optical to USB 2.0
M9404A-H01	PXIe Optical to USB 2.0
M9404A-CA3	Optical cable 3 meter
M9407A[1]	PXIe Optical to 4 port USB 2.0 Hub
M9404A-H01	PXIe Optical to 4 port USB 2.0 Hub
M9404A-CA3	Optical cable 3 meter LC to LC
M9408A	RF Reflectometer: 10 MHz to 50 GHz

1. *Need customer furnished single-mode optical fiber.*

Definitions for specifications

Specifications *describe the warranted performance of calibrated instruments that have been stored for a minimum of 2 hours within the operating temperature range of 0 to 55 °C, unless otherwise stated, and after a 45 minute warm-up period. Data represented in this document are specifications unless otherwise noted.*

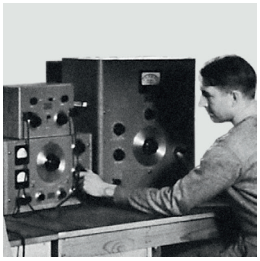
Characteristics *describe product performance that is useful in the application of the product. Characteristics are often referred to as Typical or Nominal values.*

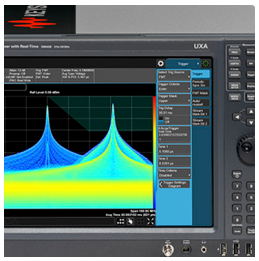
- Typical describes characteristic performance, which 80% of instruments will meet when operated over a 20 to 30 °C temperature range. Typical performance is not warranted.
- Nominal describes representative performance that is useful in the application of the product when operated over a 20 to 30°C temperature range. Nominal performance is not warranted.

Note: All graphs contain measured data from several units at room temperature unless otherwise noted.

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