Multi-Channel Programmable 4GHz RF over Fiber Bi-Dir System (B9)

Generic photo used for illustration purpose only. See RFoF 4GHz Bi-directional sub-system modules drawings in page #3.

RFOptic's multi-channel programmable RFoF Bi-directional system provides RF performance that is superior to coaxial cable interface. The system is composed of 4 RFoF bi-directional terminals that are connected to each other by 4 single mode fibers (SMF). It is tailored to the 5G cellular band and covers the entire 0.5GHz to 4.0GHz bandwidth. This 4-channel system is offered with four RFoF Tx 1310nm units and four RFoF Rx units in each enclosure. The system contains two B9 enclosures. The B9 enclosure contains fully bi-directional RF ports with a wideband high isolation RF combiner which is used to feed the RFoF Tx uplink and combine the RF output of the Rx downlink of each terminal. A diagram on page 2 of this brochure provides details of the RF and Optical configuration. This configuration is supported by RFOptic's sub-system remote management and control functionality through HTML/REST/SNMP interface allow the system to handle very different application requirements.

Key Features:

- Integrated and flexible multi-channel RFoF sub-systems.
- Full support for the 0.5GHz to 4.0GHz bandwidth.
- Excellent linearity, gain flatness, and gain control.
- Programmable RF and Optical performance.
- Built-in end-to-end diagnostics reduces installation and maintenance time.
- Integrated RF power sensors.
- Reduced gain variation over temperature option.
- Remote management and control via HTML/REST/SNMP/USB interface

Both enclosures are Tx and Rx RFoF terminal units. Each of these include LNAs and variable attenuators which can be used to customize the Noise Figure, Input P1dB, and IP3 over wide range of values. For special applications requiring temperature stability operation, a unique optional temperature compensation algorithm supports ±0.5 dB over 100^0C variation of the ambient temperature. The RFoF link has excellent gain flatness with 0.5dB gain adjustment and tracking between different links.

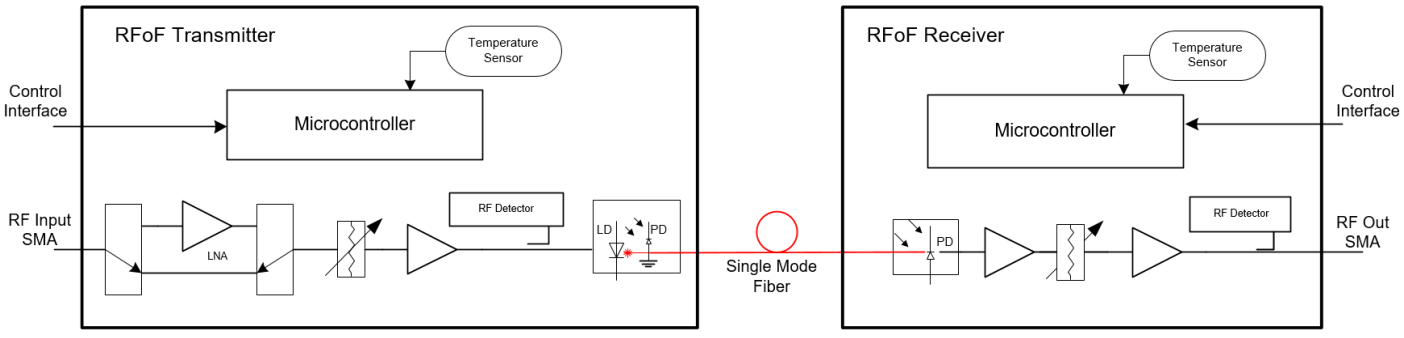
Configuration:

- Two 19" 1U indoor enclosures
- B9 cage with 4 pairs of RFoF Tx 1310nm and 4 Rx units integrated with combiners and filters.
- Outdoor configuration is available.

Applications:

- 5G test sites
- DAS
- Distributed Antenna

Each of the signals is transmitted over an RFoF programmable link. A simplified block diagram of such a link is shown below.



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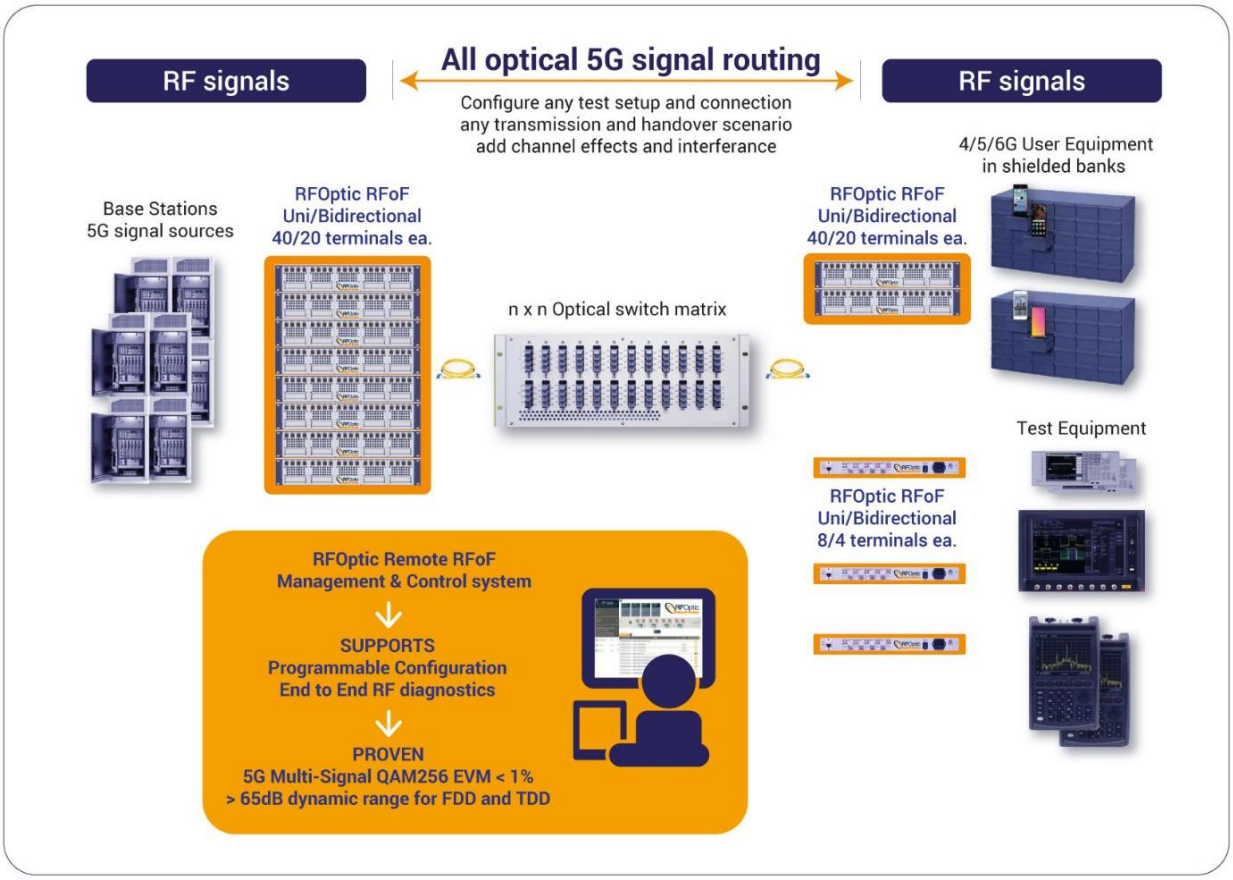
5G Testing Applications overview

Interoperability test of cellular 4G/5G and 6G as well as product testing has been migrating to use RFoF infrastructure as the preferred interface between test equipment and devices under test. The obvious benefits of optical fiber routing include compact and low-cost interconnects, excellent EMC performance and effectively unlimited bandwidth for the RF test environment that ensures that the expensive infrastructure can be migrated to future RF bandwidth needs easily at minimal expense. Unlike coaxial cables the RFoF transport of test signals provides excellent and frequency independent dynamic range performance that can be upgraded as new frequency bands are introduced. RFOptic offers proven RFoF products with exceptional performance that are specifically tailored to the demanding requirements of such applications. All RFOptic RFoF terminals are supported with API driven Management and Control system which makes tight and efficient integration of the testing environment simple and flexible. Having done so the integrated test environment can be configured to handle different test protocols in a matter of minutes with minimal or no setup crew involvement. This flexibility is a huge multiplier in test equipment usage rates and provides access of the test infrastructure to many more applications.

The setup diagram below shows an implementation of such flexible environment with RFoF terminals and an optical switch matrix serving as the main interconnect fabric between Signal sources, devices under test and test equipment. RFOptic's Management and Control system which is API enabled is integrated into the test bed configuration management along with other equipment which allows that test environment to meet any test configuration when and as it may be needed. Furthermore, the flexible programmable environment can support multiple concurrent tests as long as there are sufficient and free resources to handle them all. Immediate diagnostics are available at any critical signal transmission point make calibration and validation simple and quick. No more test equipment sitting idle on work benches and no more setup crews working long shifts to reroute and reconnect equipment and devices. In fact, the environment can be configured to report usage levels and therefore it is simple to apply OPEX criteria to optimize management decisions including Buy/Rent.



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Multi-Channel Programmable 4.0GHz RF over Fiber Bi-Dir 1310nm System Specifications – B9 Configuration

RF Performance [1]	Unit	Specification (typical)	
		LNA Off	LNA ON [3]
Frequency Range	MHz	500 - 6000	500 - 6000
Nominal Link Gain (adjustable) [1]	dB	6	7
Tx/Rx Attenuators 0 to 31dB, 0.5 step	dB	0.5	0.5
Gain Flatness	dB	±2	±2
Input P1dBc [2]	dBm	2	-21
Noise Figure [2]	dB	28	11
Calculated SFDR [2]	$dB/Hz^{2/3}$	103	101
Max Input Return Loss	dB	-11	-11
Max Output Return Loss	dB	-11	-11
Maximum Input No damage	dBm	+20	+20
Input / Output impedance	Ohm	50	50
Optical and Electrical			
Laser diode wavelength	µm	1.310	
System Monitor & Control	-	HTML/REST/SNMP/USB	
Optical Power	mw	3	
Power	-	110/220 VAC	
Mechanical and Environmental Parameters			
19" 1U Enclosure dimensions	mm	445(W)* 476(L)*44(H)	
Number of bi-directional links (terminals)	-	4	
RF Input/Output Connectors	-	SMA	
Optical Connectors (Optional: FC/APC and SC/APC)	-	LC/UPC	
Power Connectors	-	HP Socket	
Data Connector		RJ-45	
Operating temperature	°C	-20 to +70	
Storage temperature	°C	-40 to +85	

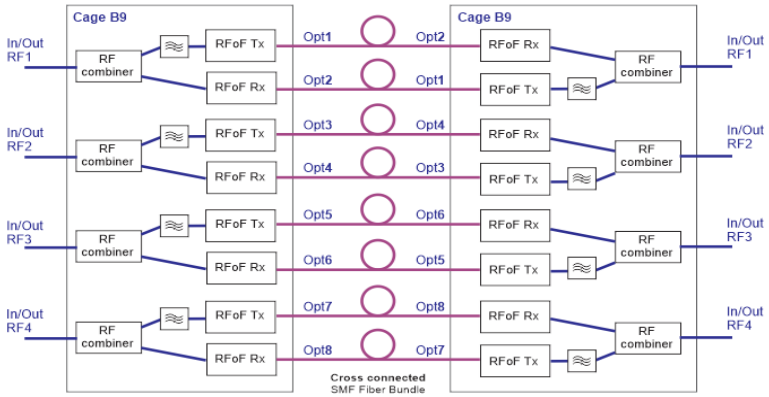
[1] The link Gain is measured using a short fiber patch cord, and can be adjusted by the Tx Attenuator using the user software.

[2] Noise Figure and Input P1 dB are measured at 2GHz, and can be adjusted by using the Tx Attenuator at 'LNA Off/On'.

[3] Bidirectional specifications at LNA ON state are measured with the two Bidir Rx attenuators set to 29dB & 1dB at LNA OFF due to loop gain considerations.

[4] Safety EN60950-1:2006(2nd); EMC: ETSI EN 300 386 v1.6.1 (2012-04) and FCC CFR-47 part 15 Sub part B.

Bidirectional Multi-Channel 4GHz 1310nm RFoF sub-system block diagrams



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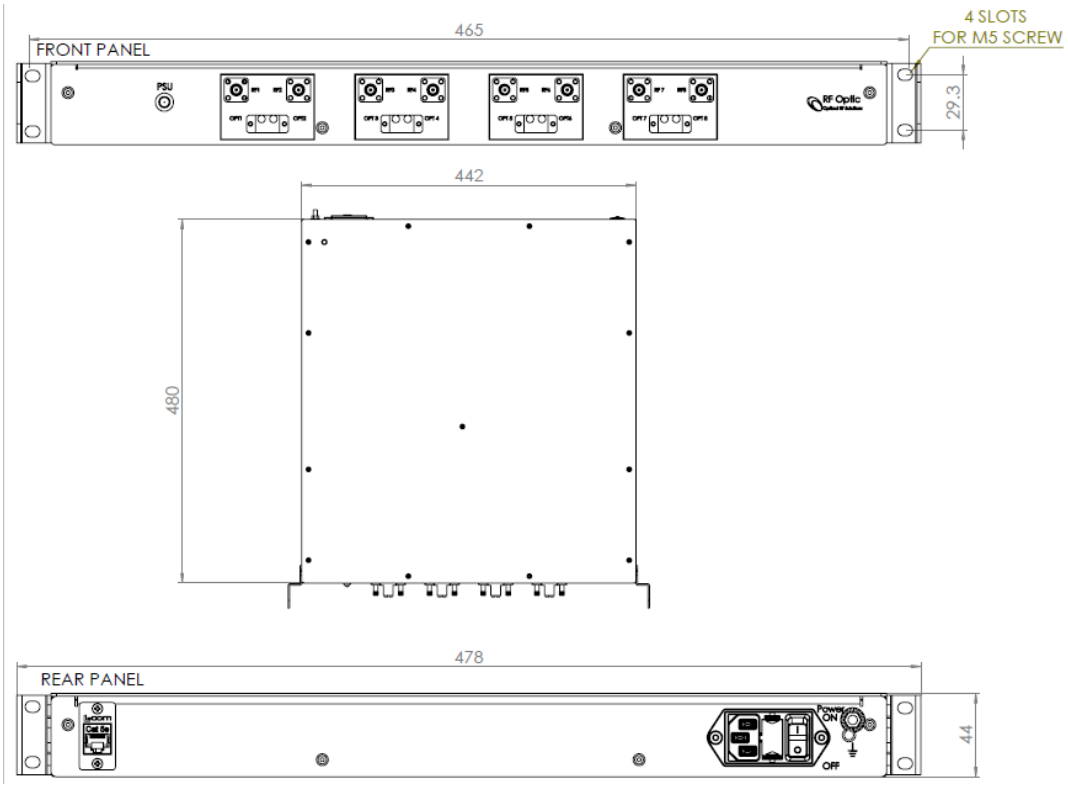
19” 1U enclosure drawings



Ordering Information:

For specific configuration, define the following:

1. Enclosure type - 19” 1U Generic
2. Upper Frequency - 4.0GHz
3. Four of bi-directional terminals including RF combiners and filters
4. Communication type - HTML/REST/SNMP/USB
5. Power - 220 VAC
6. Optical connectors - LC/UPC
7. RF connectors - SMA

ERP P/N	Marketing P/N	Description
SYSA00177	RFoFc-I1SL4T4RIHNA04B9	19" 1U Enclosure with 4*RFoF 6GHz bidirectional 1310nm terminals, combiners, filters, SMA, LC/UPC, HTML

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