

Programmable phase matched 6.0GHz RF over Fiber system



Key Features:

- Next generation RFoF system with significant performances improvement.
- Supports up to 6.0GHz.
- Phased matched CWDM system of $\pm 6^\circ$ up to 5.7GHz
- Gain matched 6.0GHz full band of ± 2.5 dB
- Better linearity, excellent gain flatness, and Tx, Rx and Link gain control.
- Noise Figure down to 6 dB with LNA with MDS ~ 168 dB/Hz for very low incoming signals.
- Internal Microcontroller allows RF and Optical control, enabled by software.
- End-to-end diagnostics reduces installation and maintenance time, enabled by software.
- Gain variation $S_{21}(f_o)$ of ± 1 dB for 90° C variation, utilizing special algorithm.
- Remote management by GUI installed on PC.
- Impedances of 50 Ohms and 75 Ohm.

Configurations:

- 1U Generic enclosure (4 RFoF units)
- Outdoor enclosure (4 RFoF units)

Applications:

- Phased Array Radar
- EW
- Interferometry

RFOptic presents its new innovative controllable Phased Matched RFoF product line.

RFOptic's palm size analog RFoF modules are used to convert RF signals to optical signals to carry over long distances. The Tx unit using an optical transmitter, converts RF to Optical signal and the Rx unit converts back to RF signal. The two units are connected through customer's single mode fiber.

RFOptic's RF over Fiber modules (RFoF) are suitable for Phased Array Radar, EW and interferometry applications.

RFOptic CWDM 6.0GHz RFoF 4 link system is phase matched up to $\pm 6^\circ$ up to 5.7 GHz. Each of the four links is comprised of a Tx unit with LNA and an Rx unit, both with variable attenuators that enable adjustment of the Noise Figure, Input P1dB, and IP3 over wide range of values. The LNA can be activated through an RFoF software tool allowing RF input power in the range of -100 dBm/1MHz for wideband applications, with low Noise Figure of 6 dB. The RFoF link has excellent gain flatness with 0.5dB gain tracking between different links. For special applications requiring temperature stability operation, a unique algorithm supporting 0.5 dB over 100°C has been developed. The DC power of the RFoF modules is flexible from 5 to 12 Volts.

A user-friendly RFoF software enables adjustment of the RF and Optical parameters, such as link gain, Noise Figure, P1dB, Optical power, LED indication and module information, either locally or remotely.

Furthermore, the RFoF link has full diagnostic capability including Tx, Rx and complete link test (Optical and RF). These features save cost of test equipment and provide real time diagnostic of any deployed link.

The [link gain calculator](#) helps to calculate the link gain and the optical predicted parameters for RFOptic's programmable RFoF family.

Programmable Phase matched 6.0GHz RF over Fiber system typical specifications:

Electrical	Unit	Specification LNA "OFF"	Specification LNA "ON"
Frequency Range	MHz	0.5 - 6000	0.5 - 6000
Adjustable Link Gain (nominal value) ^[1]	dB	7	37
Attenuator 31 dB (Tx, Rx) ^[2]	dB	0.5	0.5
Gain Flatness	dB	±2.0	±2.0
Input P1 dB ^[3]	dBm	0	-33
Noise Figure ^[3]	dB	27	6.5
Phased matched - 4 links between 0.5 – 5700 MHz	deg	±6	±6
Gain matched full band - 4 links	dB	±2.5	±2.5
Gain matched at 3.0GHz center frequency - 4 links	dB	±1	±1
Corrected gain tracking between RFoF links ^[4]	dB	±0.5	±0.5
SFDR ^[3]	dB/Hz ^{2/3}	105	100
Maximum Input No damage	dBm	20	20
Spurious	dBm	-100	-100
VSWR Input / Output	dBm	1.8:1	2:1
Input / Output impedance	Ohm	50	50
Optical and Electrical			
Current consumption of Tx Module with 4 units (at 5VDC)	A	1.05	1.55
Current consumption of Rx Module with 4 units (at 5VDC)	A	0.9	0.9
Laser diode wavelengths - 4 links ^[5]	°C	CWDM	CWDM
Optical Power in the fiber (per link)	°C	2.3 ±0.5	2.3 ±0.5
Monitor & Control - RF and Optical parameters	-	USB/SNMP/HTML	USB/SNMP/HTML
Mechanical and Environmental Parameters			
Operating temperature	°C	-20 to +70	-20 to +70
Storage temperature	°C	-40 to +85	-40 to +85
EMC and Safety ^[6]	-	CE & FCC	CE & FCC

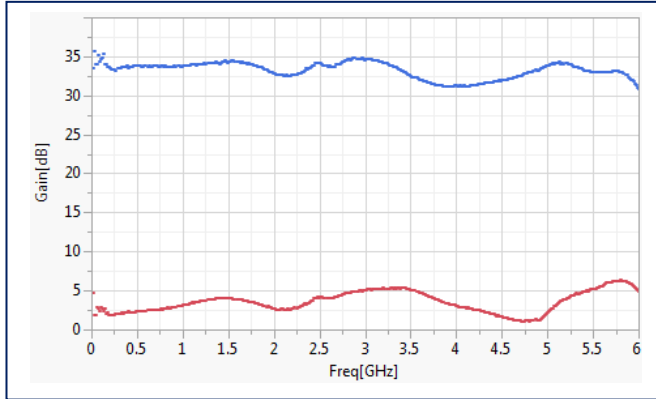
RFoF 6.0GHz Phase matched module/system options:

Parameter	RFoF 6.0GHz 1U Generic	RFoF 6.0GHz Outdoor
Dimensions (mm)	445(W)* 476(L)*44(H)	280(W)*220(L)*85(H)
RF Input / Output Connector	SMA	N Type
Optical Connector	FC/APC	MPO
Power Connector	HP Socket	Circular male 5 pins
Power	110/220 VAC	5-12 VDC
Data Connector	USB2/RJ-45	Circular male 7 pins

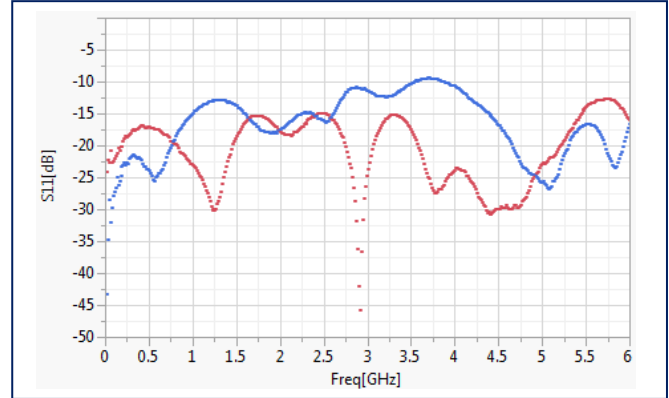
- [1] LNA 'ON' or 'OFF' is selected by RFOptic manufacturing, or by using the RFoF user software.
- [2] 'No Attenuation' is the default for Tx and Rx units. Attenuation values can be selected by the user software.
- [3] Noise Figure, Input P1 dB, Input IP3 and SFDR measured at 3.0GHz, can be selected by 'LNA Off/ON' and Tx Attenuator.
- [4] Using the Tx and/or Rx Attenuators.
- [5] Option: CWDM at 1.55µm band or at 1.31µm band, with 20nm separation between channels
- [6] Safety EN60950-1:2006(2nd); EMC: ETSI EN 300 386 v1.6.1 (2012-04) and FCC CFR-47 part 15 Sub part B.

Programmable 6.0 GHz RFoF phased matched system - Test Results

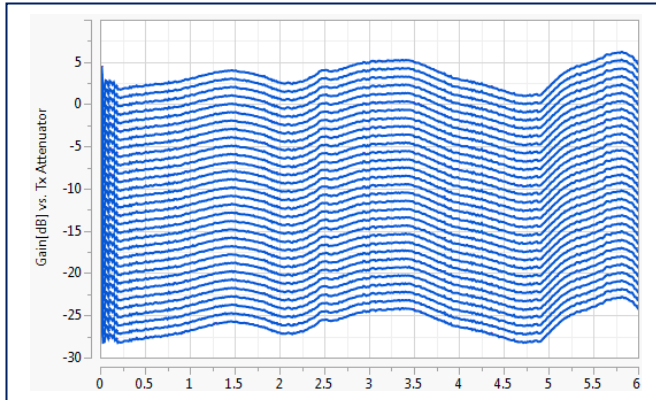
Gain vs. Freq. (S21), 6.0 GHz RFoF - 'LNA On' (top),
'LNA Off' (bottom),



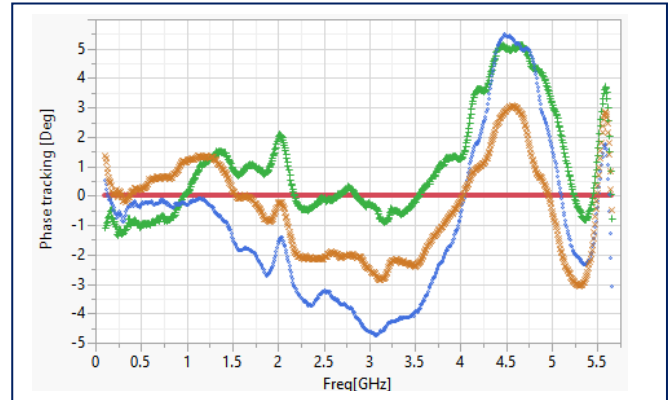
Input Return Loss vs. Freq. (S11), 6.0 GHz RFoF - 'LNA Off' (red) and
with 'LNA On' (blue)



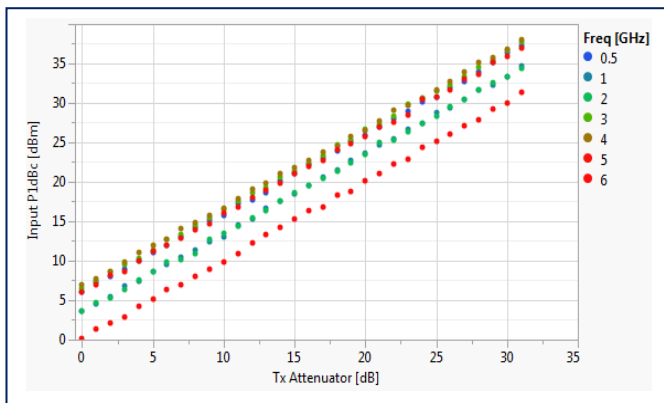
Gain vs. Tx Attenuation value: 0 to 31 dB in 1 dB step, 6.0 GHz RFoF
for 'LNA Off' (similar behavior for 'LNA On')



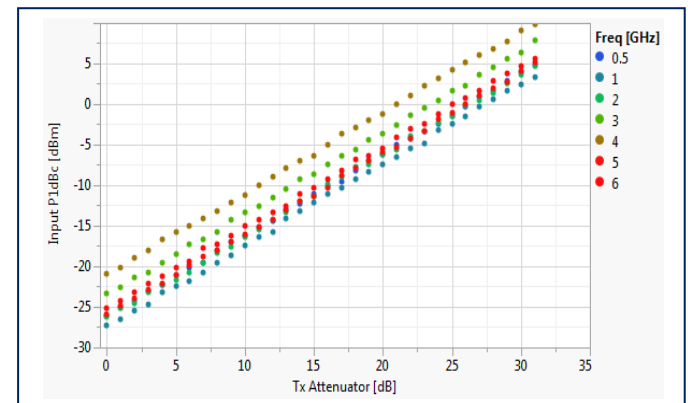
Relative phase error over 4 Link CWDM RFoF system



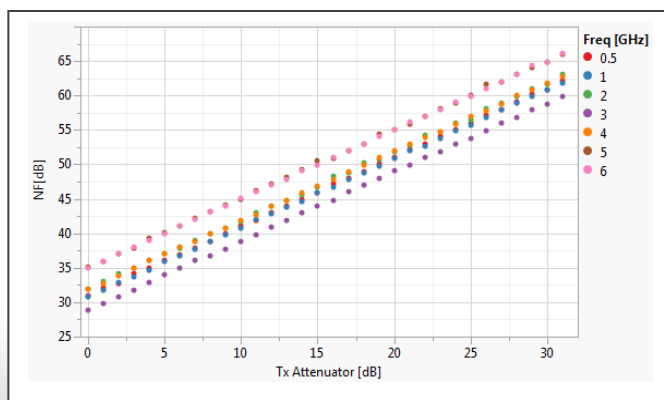
Input P1dBc at 7 frequencies, 6.0 GHz RFoF - 'LNA Off'



Input P1dBc at 7 frequencies, 6.0 GHz RFoF - 'LNA On'



Noise Figure for 7 Freq. vs. Attenuator value, 6.0 GHz RFoF - 'LNA Off'



Noise Figure for 7 Freq. vs. Attenuator value, 6.0 GHz RFoF - 'LNA ON'

