

Programmable 6.0 GHz RFoF units



1U Enclosure for RFoF



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Key features:

- ❖ Next Generation RFoF modules with significant performances improvement.
- ❖ Supports up to 6.0 GHz.
- ❖ 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 $S_{21}(f_0)$ 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:

- ❖ Bias-T for GPS applications
- ❖ Outdoor enclosure (unidirectional/bi-directional)
- ❖ 1U Generic enclosure (4 units)
- ❖ 1U Removable panel enclosure (4/8 units)

Applications:

- ❖ Remote Antennas Communication
- ❖ Satcom
- ❖ 4G LTE
- ❖ GPS
- ❖ Broadcast
- ❖ Distributed Antenna
- ❖ Radio Telescopes

RFOptic presents its new innovative controllable 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.

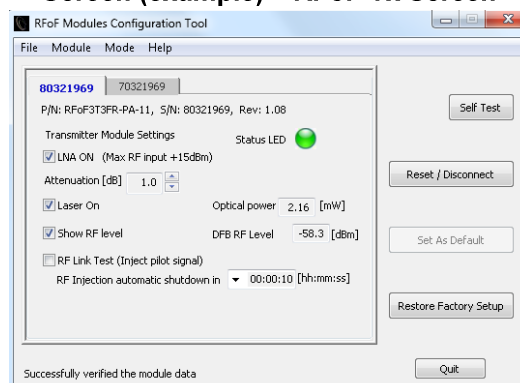
RFOptic's RF over Fiber modules (RFoF) are suitable for telecommunications, satellite, radio telescopes, distribution antennas, broadcasting audio and video, timing synchronization and GPS applications. For example, point-to-point antennas can be connected from several meters to many kilometers away from the control room by fiber cables; Base stations can be connected through fiber to remote sector antennas; Satellite antennas can be connected through fiber cable to remote sites by RF over Fiber solutions.

Both the Tx and Rx units includes LNAs and variable attenuators that enable customer to adjust the Noise Figure, Input P1dB, IP3 with wide dynamic range values. The LNA can be operated through the RFoF Software 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.

Screen (example) – RFoF Tx Screen



Programmable 6.0 GHz RFoF Specifications

Electrical	Unit	typical (without LNA)	typical (with LNA)
Frequency Range	MHz	0.5-6000	0.5-6000
Adjustable Link Gain (nominal value) ^[1]	dB	>0	>29
Attenuator 31 dB (Tx, Rx) ^[2]	dB	0.5	0.5
Gain Flatness	dB	±3	±3
Input P1 dB ^[3]	dBm	6.5	-23
Noise Figure ^[3]	dB	29	7.5
SFDR ^[3]	dB/Hz ^{2/3}	107	102
Gain Flatness any 36 MHz	dB	±0.25	±0.25
Uncorrected gain variation over Temperature	dB	±3.5	±3.5
Corrected gain variation over temperature ^[4]	dB	±1.5	±1.5
Corrected gain tracking between RFoF links ^[5]	dB	±0.5	±0.5
Maximum Input No damage	dBm	20	20
Spurious	dBm	-100	-100
VSWR Input/Output	dB	1.9:1	1.9:1
Input/Output Impedance ^[6]	Ohm	50	50
Optical and Electrical			
Current consumption of Tx unit	mA	390	390
Current consumption of Rx unit	mA	225	225
Laser diode wavelength	um	1.31 or 1.55	1.31 or 1.55
Optical Power in the fiber	mw	2.5 ±0.5	2.5 ±0.5
LED status indicators (Tx/Rx)	-	RGB	RGB
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 ^[7]	-	CE & FCC	CE and FCC

Parameter	RFoF-6.0GHz	RFoF-6.0GHz-1U	RFoF-6.0GHz-Outdoor
Dimensions (mm)	70(W)*70(L)*22(H)	445(W)* 350(L)*44(H)	280(W)*220(L)*85(H)
RF Input/Output connector	SMA	SMA	N Type
Optical Connector	FC/APC	FC/APC	Radiall OPUS.117.200.1420
Power Connector	PIN 3.5*1.3*9 mm	HP Socket	Circular male 5 pins
Power	5-12 VDC	110/220 VAC	5-12 VDC
Data Connector	Micro USB2	USB2	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 GHz, can be selected by 'LNA Off/ON' and Tx Attenuator.

[4] Using internal temperature compensation algorithm selected by the User Software.

[5] Using the Tx and/or Rx Attenuators.

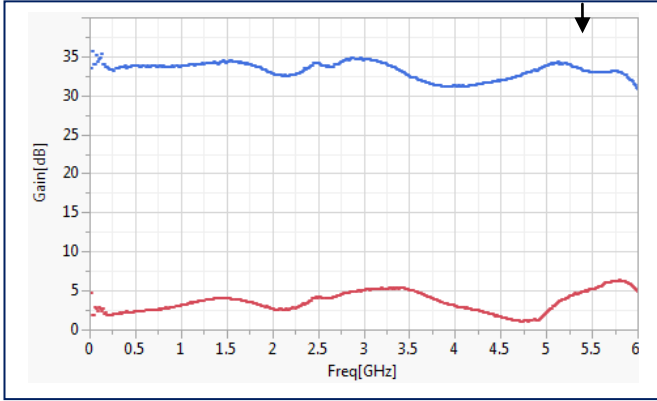
[6] 75 Ohm is optional with similar VSWR, by using SMA/BNC adaptor.

[7] Safety EN60950-1:2006(2nd)+A11:2009+A1:2010+A12:2011+A2:2013; EMC: ETSI EN 300 386 v1.6.1(2012-04)

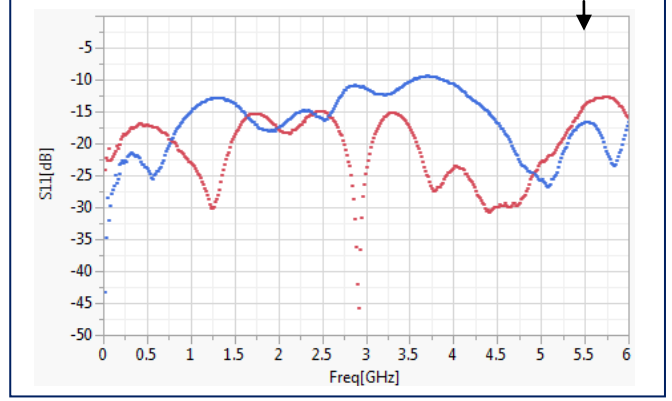
and FCC CFR-47 part 15 Subpart B.

Programmable 6.0 GHz RFoF - Test Results

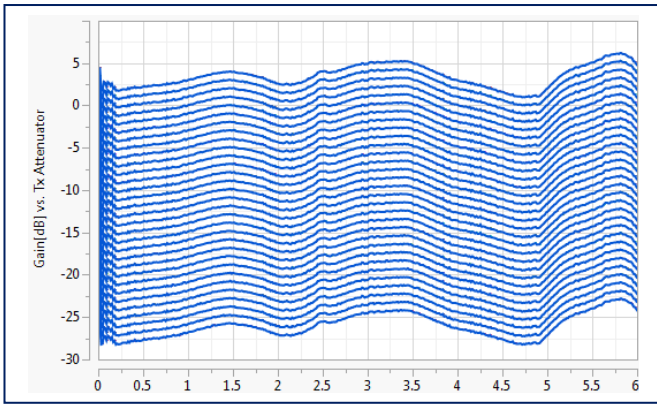
Gain vs. Freq. (S21), 6.0 GHz RFoF - 'LNA On' (top), 'LNA Off' (bottom),



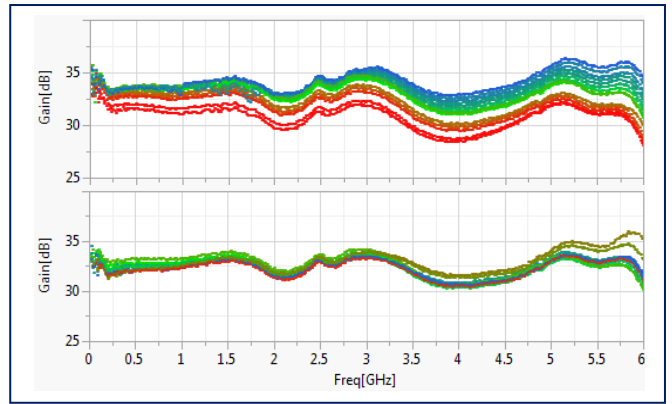
Input Return Loss vs. Freq. (S11), 6.0 GHz RFoF - 'LNA Off' (red) and with 'LNA On' (blue)



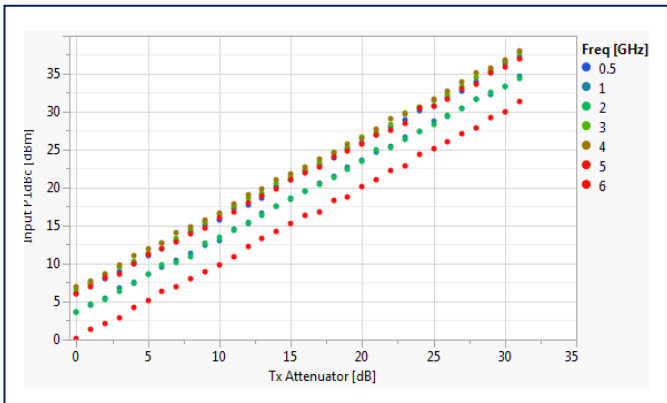
Gain vs. Tx Attenuation value: 0 to 31 dB in 1 dB step, 6.0 GHz RFoF for 'LNA Off' (similar behavior for 'LNA On')



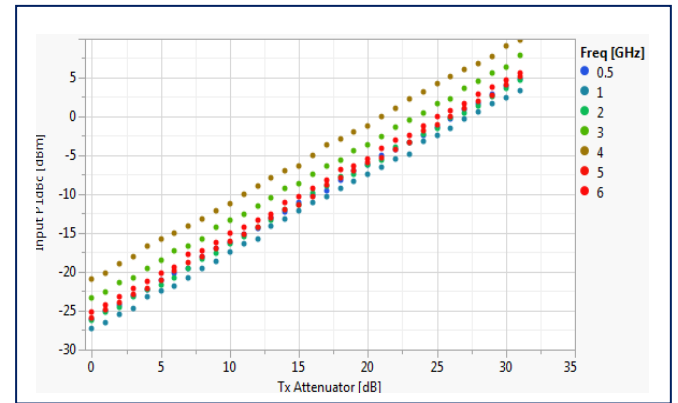
Gain Variation over Temperature for -20 °C (blue) to +70 °C (red), 'LNA On' (i) without Compensation (top); (ii) with Compensation. Similar behavior for Gain Variation over Temperature for 'LNA Off'.



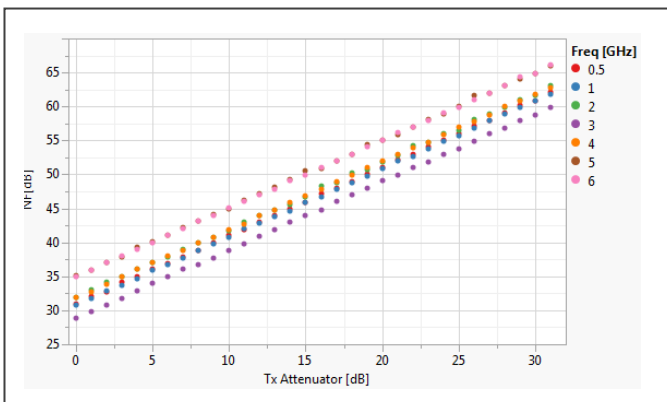
Input P1dBc at 7 frequencies, 6.0 GHz RFoF - 'LNA Off'



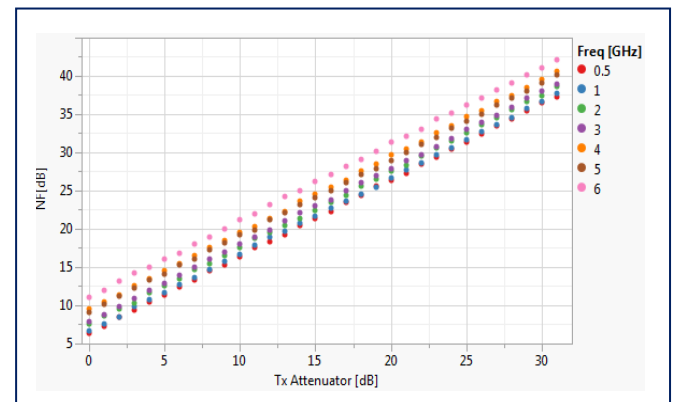
Input P1dBc at 5 frequencies, 6.0 GHz RFoF - 'LNA On'



Noise Figure for 3 Freq. vs. Attenuator value, 6.0 GHz RFoF - 'LNA Off'

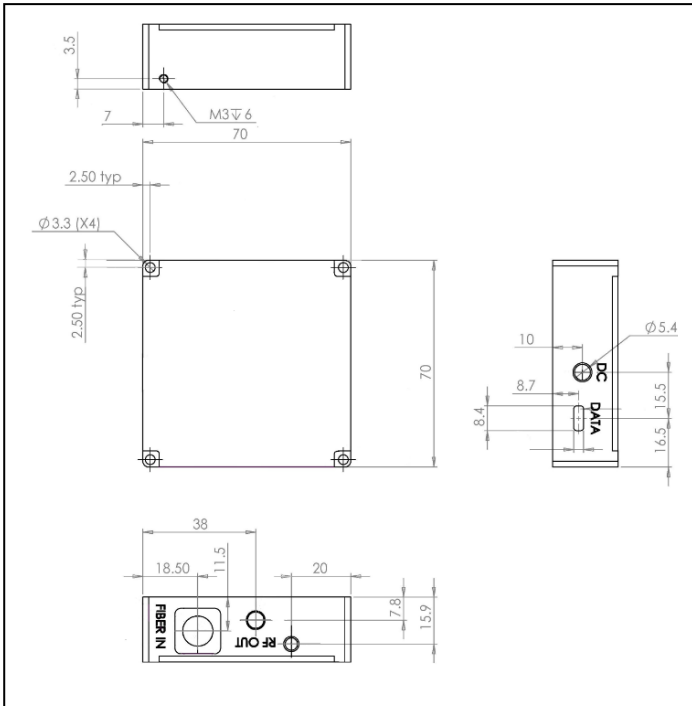


Noise Figure for 3 Freq. vs. Attenuator value, 6.0 GHz RFoF - 'LNA ON'

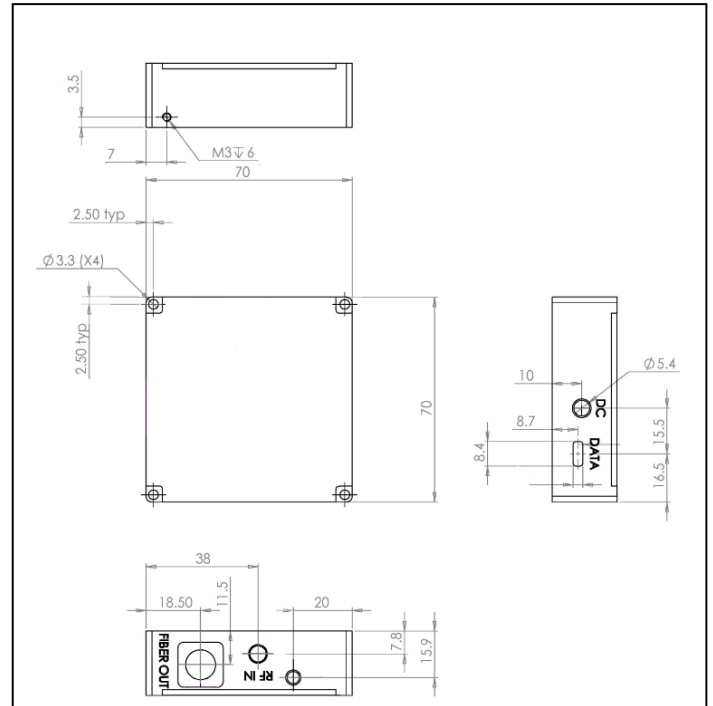


Mechanical Outline Drawing: Programmable 6.0 GHz RFoF Tx & Rx units

Rx unit



Tx unit



DC connector: positive center plug OD: 3.5mm, ID: 1.3mm, L: 9mm

Ordering Information:

RFoF-6.0GHz-1310-Prog.	6.0 GHz Transceiver 1310nm, FC/APC , Programmable
RFoF-6.0GHz-1550-Prog.	6.0 GHz Transceiver 1550nm, FC/APC , Programmable
RFoF- AC-DC-Prog.	Two 220/110 AC/5VDC Converters for Programmable RFoF
RFoF Outdoor LF	Outdoor Enclosure for RFoF, with Mux, capable of holding Low Freq. Tx and Rx units for Uni or Bidirectional applications.
RFoF 1U Generic	Indoor 19" 1U Enclosure for RFoF, with 2 power supplies and HUB, capable of holding Low Freq. Tx or Rx units for Uni or Bidirectional applications.