Programmable 2.5GHz RF over Fiber for GPS Applications

Key Features:

- Programmable GPS Over Fiber modules
- Broadband support from 0.5 MHz to 2.5 GHz including L1, L2, L5 frequencies
- +5VDC Bias-T option with up to 250mA provides power to an active GPS antenna on the RF port.
- Internal microcontroller for RF and Optical control through RFOptic App.
- App controlled Embedded LNA and attenuator to provide S21 link gain up to +42 dB
- Better linearity, excellent gain flatness,
- Noise Figure down to 6 dB with LNA with MDS ~-168 dB/Hz for very low incoming signals.
- End-to-end diagnostics to reduce installation and maintenance time, enabled by software.
- Gain variation S21 (fo) of ±1 dB for 90° C variation, utilizing special algorithm.
- Impedances of 50 Ohms and 75 Ohm

Monitoring:

- Local Management and Control through the micro-USB port on module using the RFOptic app
- Ethernet based HTML/SNMP Remote M&C for RFoF modules housed in ODU or 1U chassis
- UI based optical power gauge on Tx and Rx modules

Configurations:

- Point-to-Point
- Point-to-Multi Point (up to 16)
- Outdoor Enclosure, ODU, houses up to 8 modules
- 1U Chassis houses up to 8 modules
- Redundant

Applications:

- Timing Signal transportation for GPS and GNSS
- Distributed Antenna Systems
- 5G/6G Networks
- Data Centers

RFOptic's GPSoF product line is based on our innovative programmable 2.5 GHz RFoF link which consists of palm sized analog RFoF modules that are used to convert RF signals to optical signals to carry over long distances. The Tx module using an optical transmitter, converts RF to Optical signal and the Rx unit converts it back to RF signal. The two units are connected through customer's single mode fiber.

GPSoF link supports all GPS satellites carrier frequencies: L1, at 1575.42 MHz, and L2, at 1227.6 MHz, and L5, at 1176 MHz.

The Tx module has embedded BiasT to power up the GPS antenna through the SMA port, and UI controllable LNA and attenuators to adjust the S21 level gain to the GPS timing receiver's requirements. The LNA is operated through the RFOptic app allowing RF input power in the range of -100 dBm/1MHz for wideband applications, with low Noise Figure of 6 dB. This permits the use of GPS antenna even without externa LNA.

The RFoF link has excellent gain flatness with 0.5 dB gain tracking between different links. For special applications requiring temperature stability operation, a unique algorithm supporting 0.5 dB over 100C has been developed.

GPSoF modules are very power efficient drawing less than 0.4 Amps at +5 VDC for a power consumption of less than 2 Watt

A user-friendly RFOptic app enables adjustment of the RF and Optical parameters, such as link gain, Noise Figure, P1dB, Optical power, and provides LED indication and module information, either locally or remotely. The UI based optical output and input power gauges of the Tx and Rx modules enable the user to determine the health of the fiber path

The RFoF link has full module and link level Optical and RF diagnostic capabilities. These features save cost of test equipment and provide real time diagnostic for deployments.

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

Programmable 2.5GHz RF over Fiber for GPS specifications

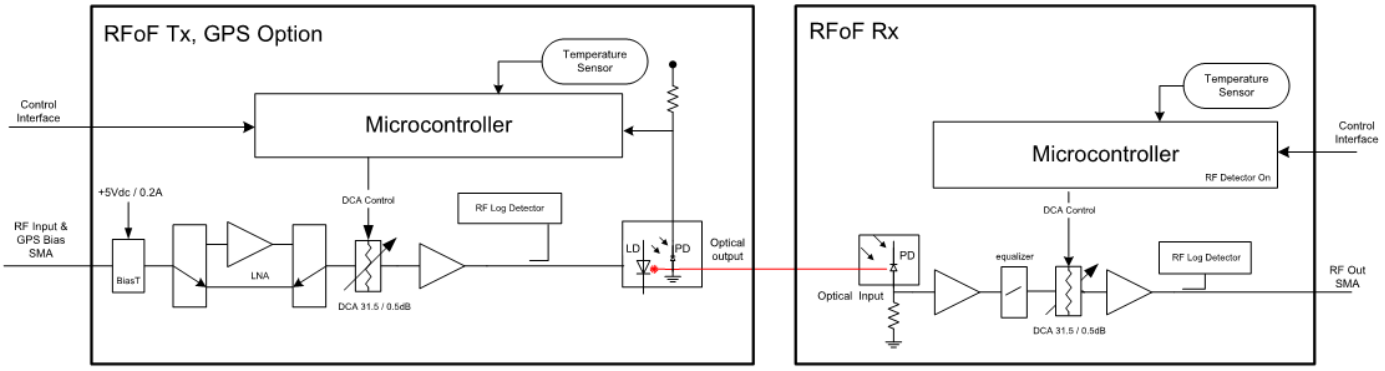
Electrical	Unit	Specification LNA "OFF"	Specification LNA "ON"
Frequency Range	MHz	0.5 - 2500	0.5 - 2500
Adjustable Link Gain (nominal value) [1]	dB	12	42
Attenuator 31 dB (Tx, Rx) [2]	dB	0.5	0.5
Gain Flatness	dB	±1.5	±1.5
Input P1 dB [3]	dBm	-3	-33
Noise Figure [3]	dB	25	5
SFDR [3]	$dB/Hz^{2/3}$	104	100
Gain Flatness any 36 MHz	dB	±0.25	±0.25
Corrected gain variation over temperature [4]	dB	±3.5	±3.5
Corrected gain tracking between RFoF links [5]	dB	±1	±1
Maximum Input No damage	dBm	20	20
Spurious	dBm	-100	-100
VSWR Input / Output	dBm	1.7:1	1.7:1
Optional Bias-T for active GPS antenna	VDC/mA	+5/250mA	+5/250mA
Input / Output impedance [6]	Ohm	50	50
Optical and Electrical			
Current consumption of Tx unit (at 5VDC)	mA	260	385
Current consumption of Rx unit (at 5VDC)	mA	225	225
Laser diode wavelength	µm	1.31 or 1.55	1.31 or 1.55
Optical Power in the fiber	mw	2.3 ±0.5	2.3 ±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 & FCC

RFoF 2.5GHz for GPS module options:

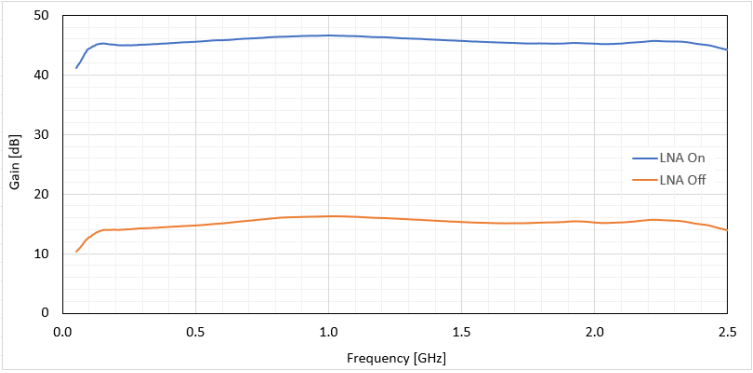
Parameter	RFoF Tx/Rx Units	19" 1U Enclosure for RFoF	RFoF 2.5GHz Outdoor
Dimensions (mm)	70(W)*70(L)*22(H)	19" 1U Generic: 445(W)*476(L)*44(H) 19" 1U Removable: 442(W)*402(L)*44(H)	Large Outdoor: 330(W)*350(L)*85(H) Small Outdoor: 270(W)*230(L)*85(H)
Number of units	-	Up to 8 Up to 4	Up to 6 Up to 4
RF I/O Connector	SMA female	SMA female	N Type female
Optical Connector	FC/APC or SC/APC	FC/APC or SC/APC	MPO/APC 4/8 male [10]
Data Connector	Micro USB[8]	USB2/RJ-45	RJ45 female [11]
Power Connector	PIN 3.5*1.3*9 mm[9]	HP Socket	DC female/ AC male [11,12]
Power	5-12 VDC	110/220 VAC	9-36 DC / 110/220VAC [11,12]

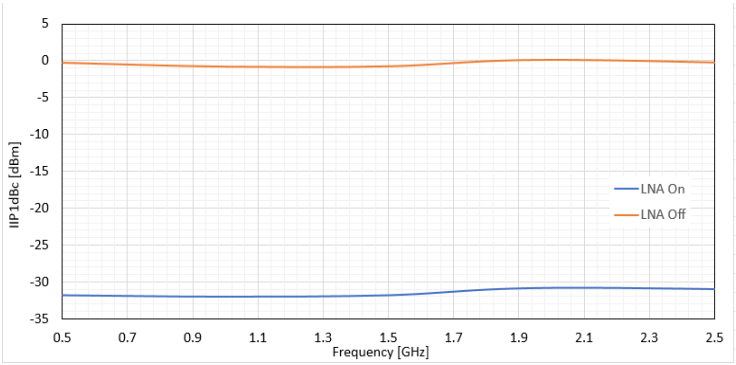
[1] LNA 'ON' or 'OFF' is selected by RFOptic manufacturing, or by using the RFoF user software.
[2] 'No Attenuation' is the default for Tx and Rx units. Attenuation values can be selected by the user software.
[3] Noise Figure, Input P1 dB, Input IP3 and SFDR measured at 1.5GHz, can be selected by 'LNA 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); EMC: ETSI EN 300 386 v1.6.1 (2012-04) and FCC CFR-47 part 15 Sub part B.
[8] For USB control, download software here: rfoptic.com/software-download-rfof/ (ask your local representative for password)
[9] 2 cables clamps to secure the power adapters cables of the Tx and the Rx can also be provided.
[10] MPO 4/8 optical cable (female) should be ordered by the customer according to the required length and conditions.
Example: GoFoton: P/N BPF3P1SM015FLR020 (4 fibers)/BPF3P1FM015FLR021 (8 fibers). XXX = 015m fiber length.
[11] IP67 Data, AC and DC opposite connectors are provided as accessories with the module (cables are not included).
[12] DC and AC versions of the outdoor enclosures are available.

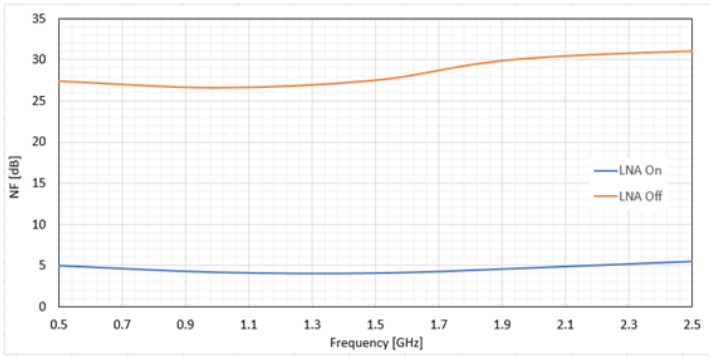
Programmable 2.5GHz RFoF for GPS applications – Simplified Block Diagram



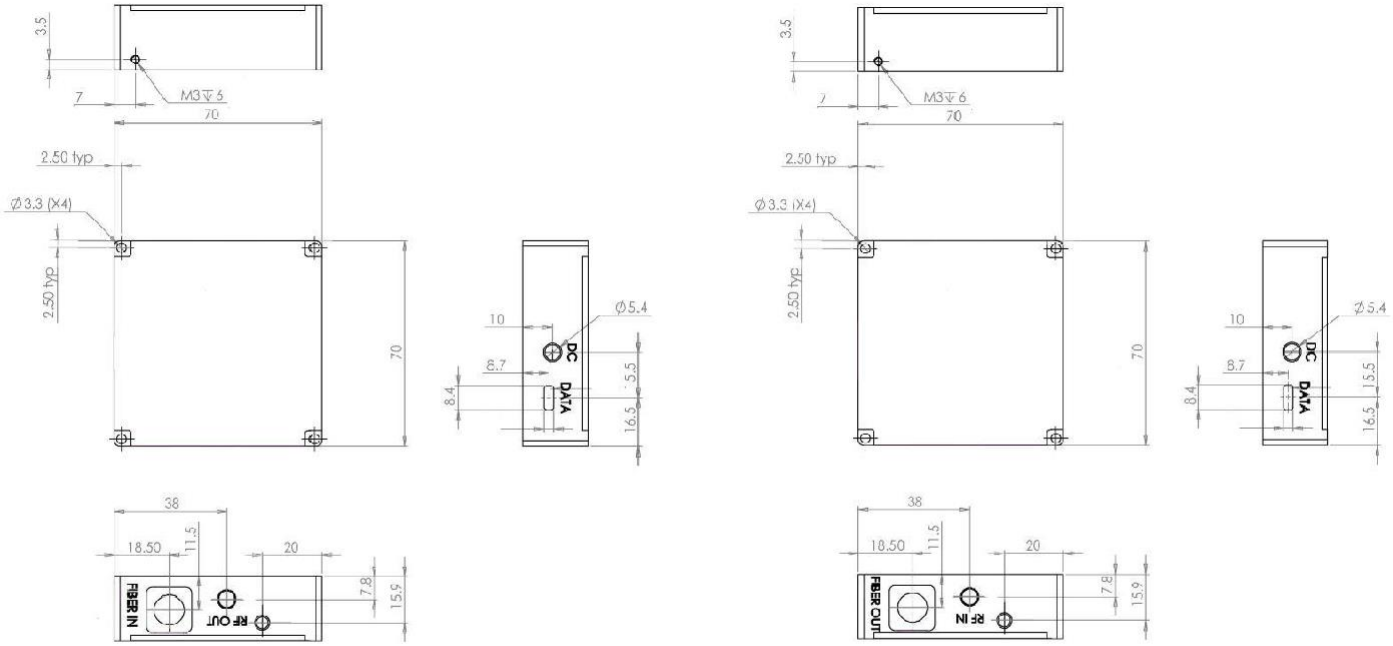
Programmable 2.5GHz RFoF for GPS applications - Test Results (Typical)

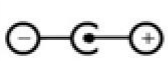






Mechanical Outline Drawing: Programmable 2.5GHz RFoF Rx & Tx units





Connector: Positive center plug OD: 3.5mm, ID: 1.3mm, L: 9mm

Ordering Information

Part Number	Product Description	Tx	Rx
RFoF-2.5GHz-1310-GPS	2.5GHz Transceiver 1310, FC/APC, Programmable, Bias-T	RFoF2T3FT-PA-11	RFoF2R3FT-PA-11
RFoF-2.5GHz-1550-GPS	2.5GHz Transceiver 1550, FC/APC, Programmable, Bias-T	RFoF2T5FT-PA-11	RFoF2R5FT-PA-11
RFoF-AC-DC-Prog.	2*220/110 AC/5VDC adapter for Programmable *	-	-
RFoF-AC-DC-Prog-1	1*220/110 AC/5VDC adapter for Programmable	-	-

* Since each RFoF module requires one AC/DC adapter, 2 adapters will be needed for a link

Options:

- For outdoor or rack mount options, please contact RFOptic at **info@rfoptic.com**
- SC/APC adaptor is an option

Programmable 2.5GHz RFoF for GPS Version March 2023
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