12GHz RF over Fiber Mini-L Low Noise High SFDR

Key Features:

- Frequency Range: 0.1-12GHz
- Low Noise RFoF HSFDR version
- Low spurious level
- High SFDR 112 dB/Hz
- Excellent Phase Noise
- Excellent phase linearity

Configurations:

- Standard (stand-alone)
- 1U Generic enclosure (4 units)
- 1U Removable panel enclosure (2/4 units)
- Outdoor (2/4 units)

Applications:

- Distributed Antenna
- Satcom
- Radio telescopes
- Telecommunication:
  - Antenna Remoting
  - Long RF links via fiber
- EW

Options:

- Customized RF Gain, P1dB, Noise Figure by adding internal Pre & Post amplifier(s)
- Extended low-frequency bandwidth

RFOptic's analog RFoF compact modules enable long-distance transport of wideband RF signals. The Tx unit, using an optical transmitter, converts wideband RF signals to an Optical signal and the Rx unit converts the Optical signal back to the RF signal. The two units are connected by the customer's fiber.

In general, a wide range of spurious-free dynamic range (SFDR) is desirable when multiple signals of very different power levels are expected. This Low Noise RFoF HSFDR link offers improved Noise Figure performance. High SFDR transmission RFoF simplifies signal conditioning requirements intended to avoid signal saturation and subsequent consequences such as power level adjustment. During e.g., antenna testing, radar or communications system testing, high SFDR is essential due to the typical large amplitude ratios between main and side lobes or close and distant targets. The same applies to DF/ELINT systems which have to handle strong jammers concurrent with weak signals of interest.

RFOptic's 12, 18, 20, 30, and 40 GHz RFoF solutions provide high SFDR of minimum 111 dB/Hz. Due to their improved NF, an additional pre-amplifier may not be needed. These high performance products are used in applications such as civil communication, antenna remoting, telemetry, defense systems, satellite communications, and more.

When looking for a high SFDR solution, our L (Low Noise) solutions are the preferred option compared to our Q (standard) solutions.

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RFoF-12GHz-L0-Mini Low Noise High SFDR Specifications

RF Parameter RF Tx-Rx Link	Unit	Specification (typical)
Frequency Range [1]	GHz	0.1-12
RF Gain [2,3]	dB	-16
Gain Flatness for the entire frequency range [5]	dB	±1.2
1dB compression point [3]	dBm	10
Noise Figure [2,3]	dB	24
SFDR (calculated) [3,4]	$dB/Hz^{2/3}$	113
Maximum RF input level (No damage)	dB	16
VSWR Input	-	2:1
VSWR Output	-	2:1
Spurious [5]	dBc	≤-90
Phase Noise at 10KHz offset	dBc/Hz	≤-120
Input / Output impedance	Ohm	50
Optical and Electrical and Environmental (Tx, Rx)		
Laser diode optical wavelength	µm	1.55
Receiver photodiode optical wavelength	µm	1.5-1.58
Monitor – Tx/Rx units	-	
Operating temperature range	°C	0 to +70
Storage temperature	°C	-40 to +85
LED status indicators (Tx/Rx)	-	Blue/Green/Red
Input voltage [6]	VDC	5
Power consumption Tx module [5,7]	Watt	2.5
Power consumption Rx module [5,7]	Watt	0.5
Mechanical (Tx/Rx)		
Dimensions Tx/Rx unit	mm	75*154*33
Weight Tx/Rx unit	grams	450
RF Input / Output connectors	mm	SMA
Optical Connector	-	FC/APC
Power connector and Data/monitor connector [8]	-	DB15

[1] Extended low frequency 0.01-12.0 GHz is optional.
[2] Excluding customer fiber loss.
[3] Measured at 10GHz. Gain, P1dB, and typical NF values for RFoF HSFDR with Pre/Post Amps are indicated in the table on page 3.
[4] Excluding in-band harmonics. SFDR (calculated) ≈ $2/3x[(IP1dB+10)+174-NF]$ $dB/Hz^{2/3}$.
[5] Measured for a link without amplifiers. Spur levels increase with post-amplifier gain.
Each amplifier adds about ±1.5dB to the flatness and up to 3.5 Watts to the power consumption of the module.
[6] See table on page 3 for RFoF enclosure options.
[7] Recommended Power Supplies: Meanwell P/N GSM25U05-P1J (USA); GSM25E05-P1J (Europe); GE40I05-P1J (all purpose).
[8] For USB monitor, download the software here: https://rfoptic.com/software-download-rfof/ (ask your local representative for the password).

RFoF 12GHz Module Options

Parameter	Unit	HSFDR 12GHz Transceiver	HSFDR 12GHz Transceiver with Pre-Amp	HSFDR 12GHz Transceiver with Post-Amp	HSFDR 12GHz Transceiver with Pre- and Post-Amp
P/N	-	**RFoF-12GHz-L0-Mini**	**RFoF-12GHz-L1-Mini**	**RFoF-12GHz-L0-Mini-P**	**RFoF-12GHz-L2-Mini**
Gain*	dB	-16	0	13	16
Input P1dB*	dBm	10	-5	10	-5
Noise Figure*	dB	24	10	24	11
SFDR*	dBc/Hz	113	112	113	112

* For HSFDR units integrated in Indoor or Outdoor enclosures: NF and P1dB values will increase in ~2dB and Gain will decrease in ~2dB.

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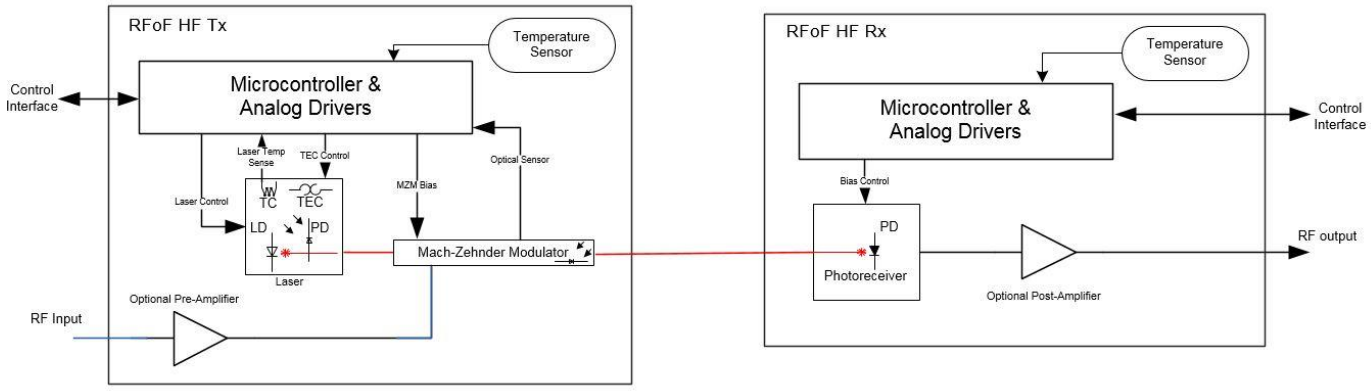
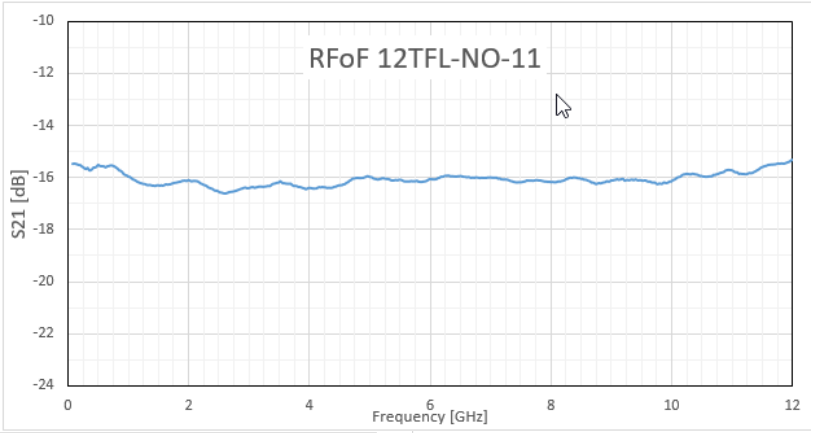
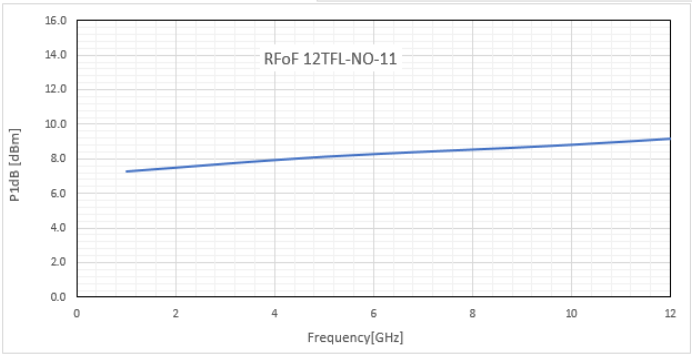
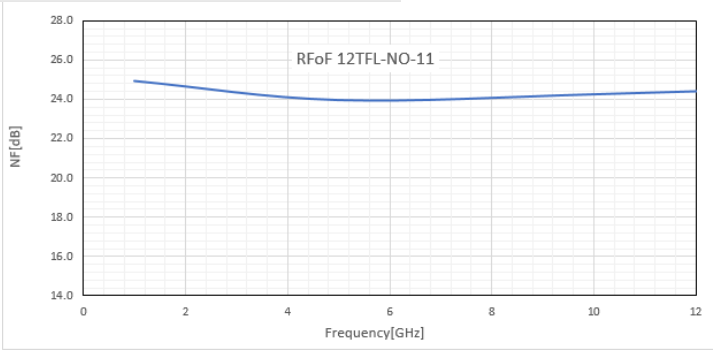
RFoF 12GHz – Simplified Block Diagram



RFoF Low NF 12GHz – Typical Test Results







RFoF Enclosure Options

Parameter	19" 1U Enclosure for RFoF	Outdoor Enclosure for RFoF
Dimensions (mm)	19" 1U Generic: 445(W)* 476(L)*44(H) 19" 1U Removable: 442(W)* 402(L)*44(H)	Small Outdoor: 270(W)*230(L)*85(H) Large Outdoor: 330(W)*350(L)*85(H)
RF Input / Output Connector	SMA female	N Type female
Optical Connector	FC/APC or SC/APC	MPO/APC 4/8 male [1]
Data Connector	USB2/RJ-45	RJ45 female [2]
Power Connector	HP Socket	DC female/ AC male [2,3]
Power	110/220 VAC	9-36DC / 110/220VAC [2,3]

[1] 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.
[2] IP-54 Data, AC and DC opposite connectors are provided as accessories with the module (cables are not included).
[3] DC and AC versions of the outdoor enclosures are available.

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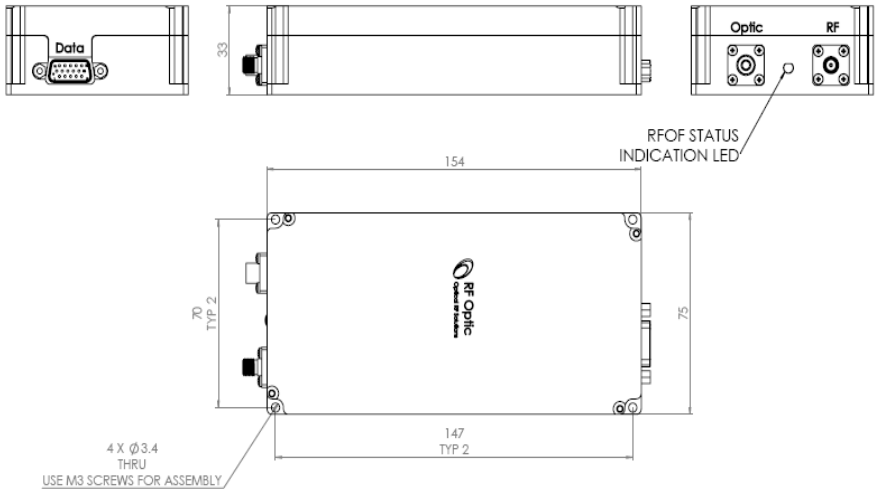
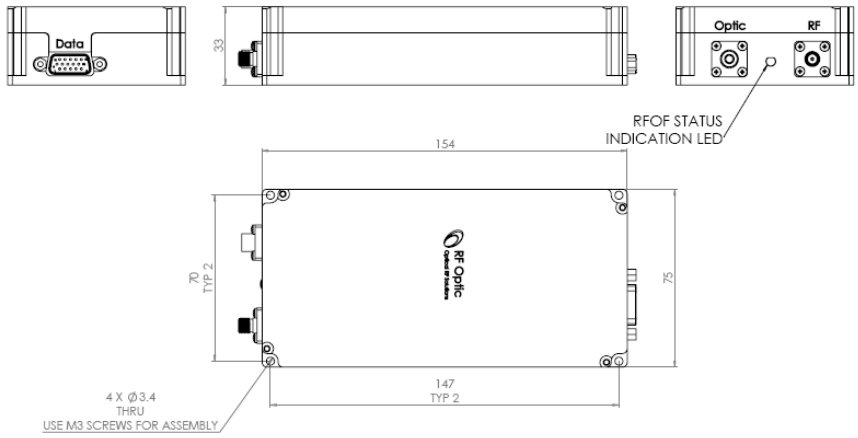
Mechanical Outline Drawing - 12GHz RFoF Tx and Rx modules

Tx module



Rx module



Ordering Information

P/N	Description	Tx	Rx
RFoF-12G-L0-Mini	Transceiver 12GHz, HSFDR	RFoF12TFL-N0-11	RFoF12RFL-N0-11
RFoF-12G-L1-Mini	Transceiver 12GHz, HSFDR with Pre-Amp	RFoF12TFL-A0-11	RFoF12RFL-N0-11
RFoF-12G-L0-Mini-P	Transceiver 12GHz, HSFDR, with Post-Amp	RFoF12TFL-N0-11	RFoF12RFL-A1-11
RFoF-12G-L2-Mini	Transceiver 12GHz, HSFDR, with Pre and Post-Amp	RFoF12TFL-A0-11	RFoF12RFL-A0-11
HSFDR-Cable-Data-DC [1]	2 X D15 to USB 150cm & D15 to DC 25cm special cable	For stand-alone HSFDR link	
Outdoor Data & AC set [2]	Data and 110/220 AC opposite connectors – accessories	For outdoor enclosure with AC supply	
Outdoor Data & DC set [2]	Data and 5VDC opposite connectors – accessories	For outdoor enclosure with DC supply	

[1] Accessory for HSDFR stand-alone link - supplied with the RFoF-12G-L0-Mini.
[2] Accessories / connectors for Outdoor enclosure - supplied with the RFoF-12G-L0-Mini.

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