20GHz RF over Fiber Mini-L Low Noise High SFDR

Key Features

- Frequency Range: 0.1—20GHz
- 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
- Electronic Warfare (EW)

Options

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

RFOptic's compact, analog RFoF modules enable long distance transmission of wideband RF signals. The Tx unit's optical transmitter converts wideband RF signals to an RFoF Optical signal; the Rx unit converts the received RFoF Optical signal back to RF. The two units are connected by a single mode fiber.

In general, a wide, spurious-free dynamic range (SFDR) is desirable when multiple signals of very different power levels are expected. High SFDR transmission of RFoF simplifies signal conditioning needed to avoid signal saturation. For example, during antenna testing, radar, or communications system testing, high SFDR is essential due to the typically large amplitude ratios between the main and sideband lobes or between near and distant targets. The same applies to DF/ELINT systems that 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 111 dB/Hz (minimum). Due to their improved Noise Figure, an additional pre-amplifier may not be necessary. These high-performance products are used in applications such as civil communication, antenna remoting, telemetry, defense systems, satellite communications, and more.

The best low noise performance is offered by our LN (Low Noise) solutions which offer a lower compression level than the Q (standard) solutions.

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RFoF-20GHz-L0-Mini High SFDR Specifications

RF Parameter RF Tx-Rx Link	Unit	Specification (typical)
Frequency Range [1]	GHz	0.1 20
RF Gain [2,3]	dB	(-)18
Gain Flatness for the entire frequency range [5]	dB	±1.6
1dB Input 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]	dBm	≤ (-)95
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
Operating temperature range	°C	0 — 70
Storage temperature	°C	(-)40 — 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

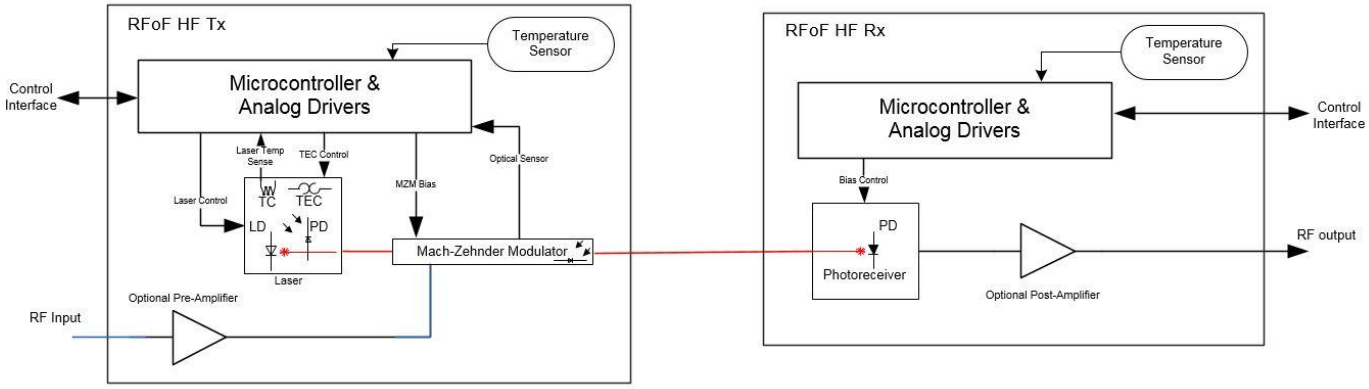
[1] Extended low frequency 0.01 — 20.0 GHz is optional.
[2] Excluding customer fiber loss.
[3] Measured at 10GHz. Gain, P1dB, and typical NF values for RFoF HSFDR with pre/post amplifiers are shown in the table on page 3.
[4] Excluding in-band harmonics. SFDR (calculated) ≈ 2/3x[(IP1dB+10)+174-NF] dB/Hz2/3.
[5] Spur levels of the link without pre/post amplifiers. Spur levels with a 19dB pre-amp are under (-)90dBm. Spur levels with a 17dB post-amp are about (-)78dBm; with a 30dB post-amp they are about (-)65dBm. Each amp adds about ±1.5dB to gain flatness and about 3.5W to module power consumption.
[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.)
[9] For RFoF Tx modules with integrated pre-amplifier, the maximum ambient operating temperature is reduced to 60°C.
[10] Extended operating temperature ranges of (-)20°C—70°C or (-)45°C—70°C are available upon request.

RFoF 20GHz Module Options

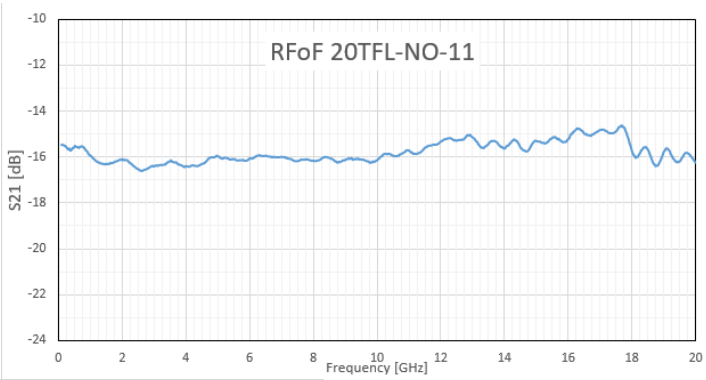
Parameter	Unit	HSFDR 20GHz Transceiver	HSFDR 20GHz Transceiver with Pre-Amp	HSFDR 20GHz Transceiver with Post-Amp	HSFDR 20GHz Transceiver with Pre- and Post-Amp
P/N	—	**RFoF-20GHz-L0-Mini**	**RFoF-20GHz-L1-Mini**	**RFoF-20GHz-L0-Mini-P**	**RFoF-20GHz-L2-Mini**
Gain*	dB	(-)18	0	11	16
Input 1PdB*	dBm	10	(-)8	10	(-)8
Noise Figure*	dB	24	9	25	10
SFDR*	dBc/Hz	113	111	113	111

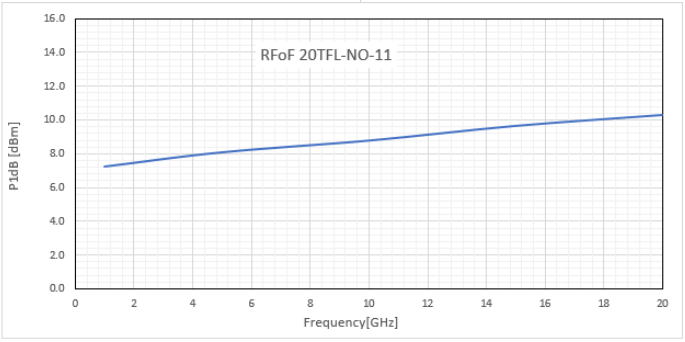
* For HSFDR units integrated in indoor or outdoor enclosures: NF and P1dB values increase by ~2dB; gain decreases by ~2dB.

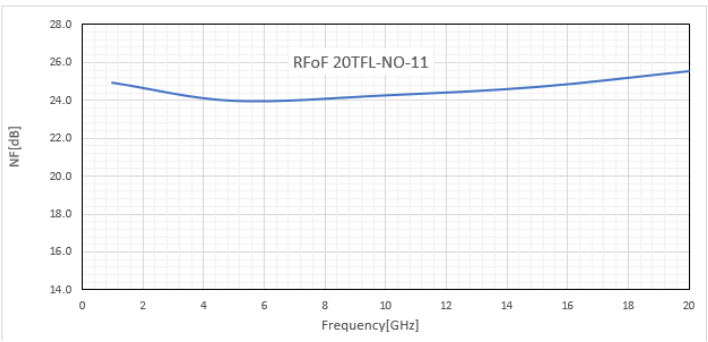
RFoF 20GHz – Simplified Block Diagram



RFoF Low NF 20GHz – Typical Test Results







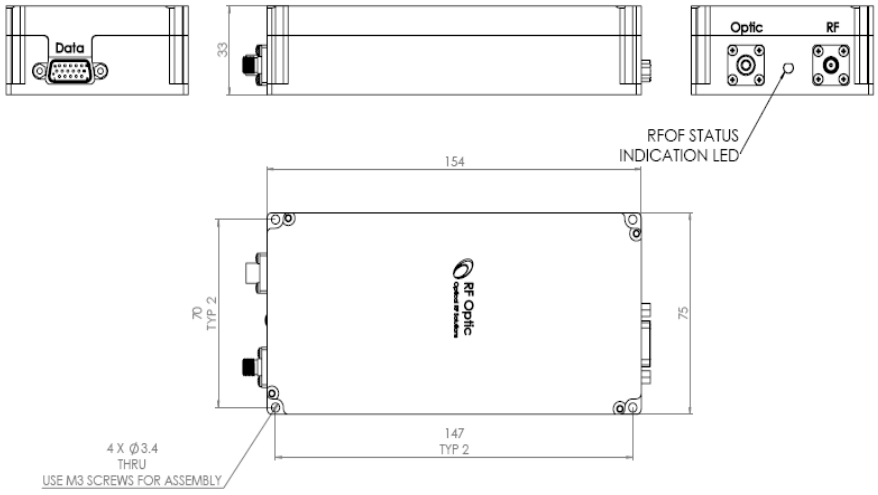
RFoF Enclosure Options

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/RJ45	RJ45 female [2]
Power Connector	HP Socket	DC female/ AC male [2,3]
Power	110 / 220 VAC	9–36VDC / 110/ 220VAC [2,3]

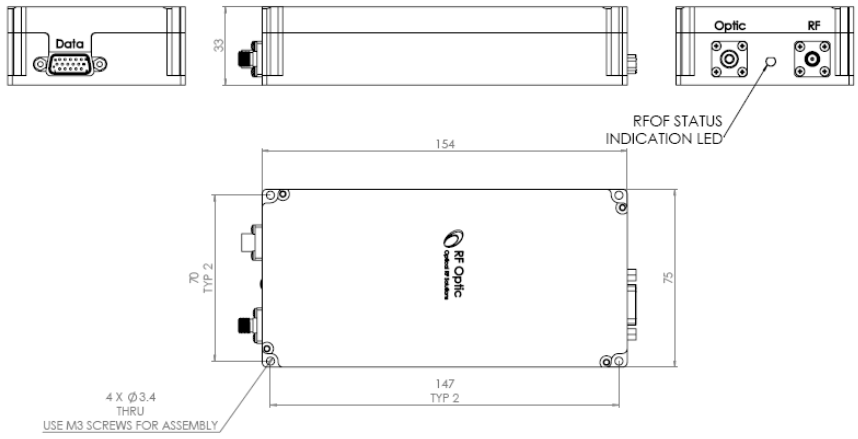
[1] MPO 4/8 optical cable (female) should be ordered by the customer according to the required length and conditions.
Example: GoFoton: P/N BPF3P1SM015FLR020 (4 fibers) / BPF3P1FM015FLR021 (8 fibers). XXX = 15m fiber length.
[2] IP-54 Data, AC and DC opposite connectors are provided as accessories with the module (cables are not included).
[3] DC and AC versions of the outdoor enclosures are available.

Mechanical Outline Drawing - 20GHz RFoF Tx and Rx modules

Tx module



Rx module



Ordering Information

P/N	Description	Tx	Rx
RFoF-20G-L0-Mini	Transceiver 20GHz, HSFDR	RFoF20TFL-N0-11	RFoF20RFL-N0-11
RFoF-20G-L1-Mini	Transceiver 20GHz, HSFDR with pre-amp	RFoF20TFL-A0-11	RFoF20RFL-N0-11
RFoF-20G-L0-Mini-P	Transceiver 20GHz, HSFDR, with post-amp	RFoF20TFL-N0-11	RFoF20RFL-A1-11
RFoF-20G-L2-Mini	Transceiver 20GHz, HSFDR, with pre and post-amp	RFoF20TFL-A0-11	RFoF20RFL-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-20G-L0-Mini.
[2] Accessories / Connectors for outdoor enclosures - supplied with the RFoF-20G-L0-Mini.

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