

## 20GHz RF over Fiber Mini-Q High SFDR



### Key Features:

- Frequency Range: 0.1-20GHz
- 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. 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.

## RFoF-20GHz-Q0-Mini High SFDR Specifications

| RF Parameter RF Tx-Rx Link                                  | Unit                 | Specification (typical) |
|---|----------------------|-------------------------|
| Frequency Range <sup>[1]</sup>                              | GHz                  | 0.1-20                  |
| RF Gain <sup>[2,3]</sup>                                    | dB                   | -23                     |
| Gain Flatness for the entire frequency range <sup>[5]</sup> | dB                   | ±2.5                    |
| 1dB compression point <sup>[3]</sup>                        | dBm                  | 17                      |
| Noise Figure <sup>[2,3]</sup>                               | dB                   | 33                      |
| SFDR (calculated) <sup>[3,4]</sup>                          | dB/Hz <sup>2/3</sup> | 112                     |
| Maximum RF input level                                      | dB                   | 20                      |
| VSWR Input  | -                    | 2:1                     |
| VSWR Output   | -                    | 2:1                     |
| Spurious <sup>[5]</sup>                                     | dBm                  | ≤-95                    |
| Phase Noise at 10KHz offset                                 | dBc/Hz               | ≤-120                   |
| Input / Output impedance                                    | Ohm                  | 50                      |
| <b>Optical and Electrical and Environmental (Tx, Rx)</b>    |                      |                         |
| Laser diode optical wavelength                              | µm                   | 1.55                    |
| Receiver photodiode optical wavelength                      | µm                   | 1.5-1.58                |
| Operating temperature range                                 | °C                   | 0 to +70                |
| Storage temperature   | °C                   | -40 to +85              |
| LED status indicators (Tx/Rx)                               | -                    | Blue/Green/Red          |
| Input voltage <sup>[6]</sup>                                | VDC                  | 5                       |
| Power consumption Tx module <sup>[5,7]</sup>                | Watt                 | 2.5                     |
| Power consumption Rx module <sup>[5,7]</sup>                | Watt                 | 0.5                     |
| <b>Mechanical (Tx/Rx)</b>                                   |                      |                         |
| 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 <sup>[8]</sup>   | -                    | DB15                    |

[1] Extended low frequency 0.01-20.0 GHz is optional.

[2] Excluding customer fiber loss.

[3] Measured at mid-band (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)  $\approx 2/3 \times [(IP1dB+10)+174-NF]$  dB/Hz<sup>2/3</sup>.

[5] Spur levels of the link without Pre/Post amplifiers. Spur levels with a 17dB pre-amplifier is under -90dBm. Spur levels with a 17dB post-amplifier is about -78dBm, and with a 30dB post-amplifier to about -65dBm. Each amplifier adds about ±1.5dB to the gain flatness and about 3.5W to the 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).

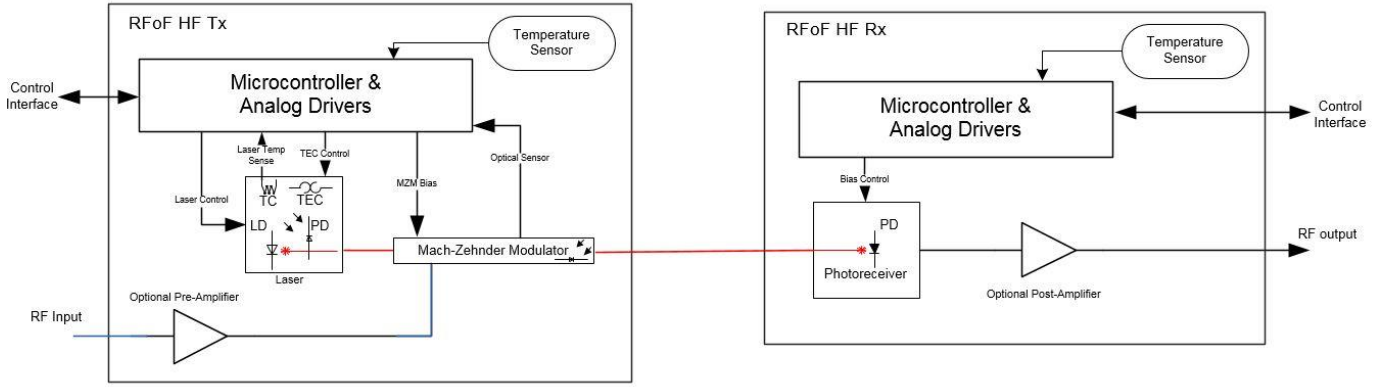
[8] For USB monitor, download the software here: <https://rfoptic.com/software-download-rfof/> (ask your local representative for the password).

## RFoF 20GHz Module Options

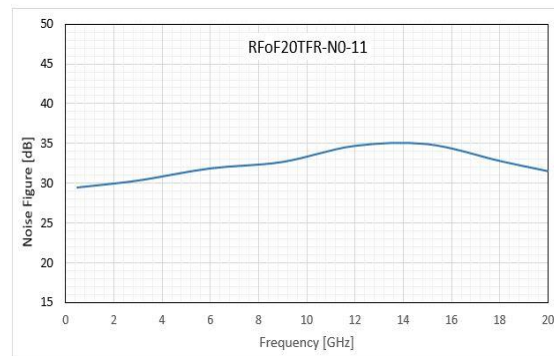
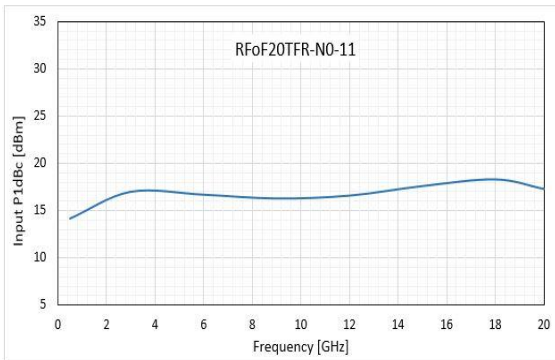
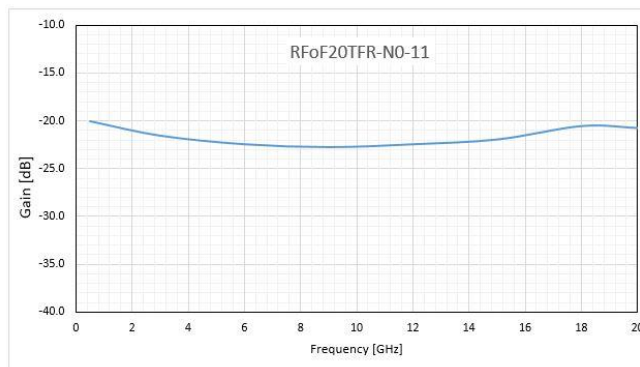
| Parameter     | Unit   | HSFDR 20GHz Transceiver | HSFDR 20GHz Transceiver with Pre-Amp | HSFDR 20GHz Transceiver with Post-Amp | HSFDR 20GHz Transceiver with Pre- and Post-Amp |
|---------------|--------|-------------------------|--------------------------------------|---------------------------------------|--|
| P/N           | -      | RFoF-20GHz-Q0-Mini      | RFoF-20GHz-Q1-Mini                   | RFoF-20GHz-Q0-Mini-P                  | RFoF-20GHz-Q2-Mini                             |
| Gain*         | dB     | -23                     | -6                                   | 8                                     | 10   |
| Input P1dB*   | dBm    | 17                      | 0                                    | 17                                    | 0  |
| Noise Figure* | dB     | 33                      | 18                                   | 33                                    | 18   |
| SFDR*         | dBc/Hz | 112                     | 111                                  | 111                                   | 111  |

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

## RFoF 20GHz – Simplified Block Diagram



## RFoF 20GHz – Typical Test Results



## RFoF Enclosure Options

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

[1] MPO 4/8 optical cable (female) should be ordered by the customer according to the required length and conditions.

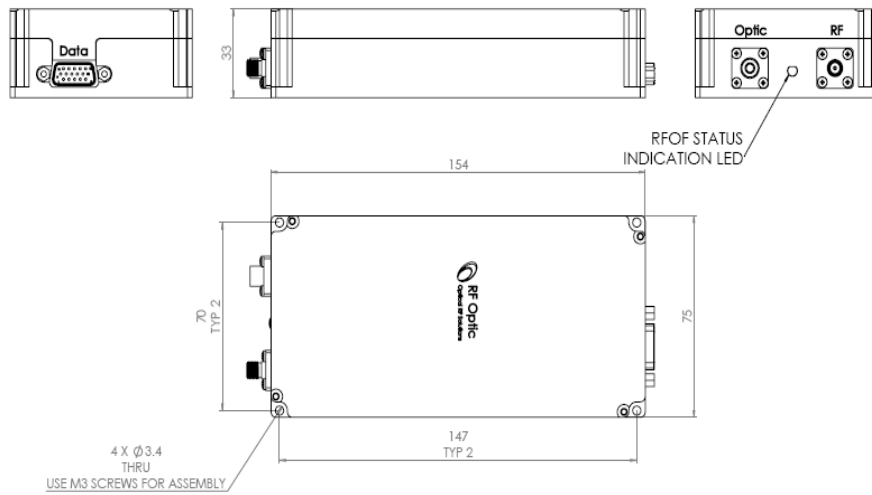
Example: GoFoton: P/N BPF3P1SM015FLR020 (4 fibers) / BPF3P1FM015FLR021 (8 fibers). XXX = 015m fiber length.

[2] IP-54 Data, AC and DC opposite connectors are provided as accessories with the module (cables are not included).

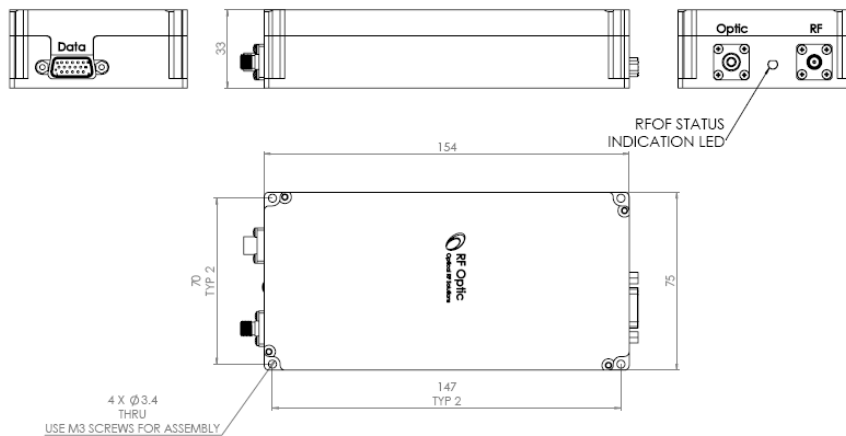
[3] DC and AC versions of the outdoor enclosures are available.

## Mechanical Outline Drawing - 20GHz RFoF Tx and Rx modules

### Tx module



### Rx module



### Ordering Information

| P/N                                  | Description   | Tx                                   | Rx              |
|--------------------------------------|---|--------------------------------------|-----------------|
| RFoF-20G-Q0-Mini                     | Transceiver 20GHz, HSFDR                              | RFoF20TFR-N0-11                      | RFoF20RFR-N0-11 |
| RFoF-20G-Q1-Mini                     | Transceiver 20GHz, HSFDR with Pre-Amp                 | RFoF20TFR-A0-11                      | RFoF20RFR-N0-11 |
| RFoF-20G-Q0-Mini-P                   | Transceiver 20GHz, HSFDR, with Post-Amp               | RFoF20TFR-N0-11                      | RFoF20RFR-A1-11 |
| RFoF-20G-Q2-Mini                     | Transceiver 20GHz, HSFDR, with Pre and Post-Amp       | RFoF20TFR-A0-11                      | RFoF20RFR-A0-11 |
| HSFDR-Cable-Data-DC <sup>[1]</sup>   | 2 X D15 to USB 150cm & D15 to DC 25cm special cable   | For stand-alone HSFDR link           |                 |
| Outdoor Data & AC set <sup>[2]</sup> | Data and 110/220 AC opposite connectors – accessories | For outdoor enclosure with AC supply |                 |
| Outdoor Data & DC set <sup>[2]</sup> | Data and 5VDC opposite connectors – accessories       | For outdoor enclosure with DC supply |                 |

[1] Accessory for HSFDR stand-alone link - supplied with the RFoF-20G-Q0-Mini.

[2] Accessories / connectors for Outdoor enclosure - supplied with the RFoF-20G-Q0-Mini.