Programmable 2.5 GHz RFoF units

Key features:

- Next Generation RFoF modules with significant performances improvement.
- Supports up to 2.5 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 S21(f) 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/bidirectional)
- 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 the 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 0.5 dB 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 2.5 GHz RFoF typical specifications

<table>
<thead>
<tr>
<th><strong>Electrical</strong></th>
<th><strong>Unit</strong></th>
<th><strong>Specification LNA “OFF”</strong></th>
<th><strong>Specification LNA “ON”</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Range</td>
<td>MHz</td>
<td>0.5-2500</td>
<td>0.5-2500</td>
</tr>
<tr>
<td>Adjustable Link Gain (nominal value) [1]</td>
<td>dB</td>
<td>12</td>
<td>42</td>
</tr>
<tr>
<td>Attenuator 31 dB (Tx, Rx) [2]</td>
<td>dB</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Gain Flatness</td>
<td>dB</td>
<td>±1.4</td>
<td>±1.4</td>
</tr>
<tr>
<td>Input P1 dB [3]</td>
<td>dBm</td>
<td>-3</td>
<td>-33</td>
</tr>
<tr>
<td>Noise Figure [3]</td>
<td>dB</td>
<td>23</td>
<td>6.5</td>
</tr>
<tr>
<td>SFDR [3]</td>
<td>dB/Hz²/³</td>
<td>104</td>
<td>100</td>
</tr>
<tr>
<td>Gain Flatness any 36 MHz</td>
<td>dB</td>
<td>±0.25</td>
<td>±0.25</td>
</tr>
<tr>
<td>Uncorrected gain variation over Temperature</td>
<td>dB</td>
<td>±3.5</td>
<td>±3.5</td>
</tr>
<tr>
<td>Corrected gain variation over temperature [4]</td>
<td>dB</td>
<td>±1</td>
<td>±1</td>
</tr>
<tr>
<td>Corrected gain tracking between RFoF links [5]</td>
<td>dB</td>
<td>±0.5</td>
<td>±0.5</td>
</tr>
<tr>
<td>Maximum Input No damage</td>
<td>dBm</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Spurious</td>
<td>dBm</td>
<td>-100</td>
<td>-100</td>
</tr>
<tr>
<td>VSWR Input/Output</td>
<td>dB</td>
<td>1.7:1</td>
<td>1.7:1</td>
</tr>
<tr>
<td>Input/Output Impedance [6]</td>
<td>Ohm</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>

### Optical and Electrical

<table>
<thead>
<tr>
<th>Parameter</th>
<th><strong>RFoF2.5GHz</strong></th>
<th><strong>RFoF-2.5GHz-1U</strong></th>
<th><strong>RFoF-2.5GHz-Outdoor</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Input/Output connector</td>
<td>SMA</td>
<td>SMA</td>
<td>N Type</td>
</tr>
<tr>
<td>Optical Connector</td>
<td>FC/APC</td>
<td>FC/APC</td>
<td>Radiall OPUS.117.200.1420</td>
</tr>
<tr>
<td>Power Connector</td>
<td>PIN 3.5<em>1.3</em>9 mm</td>
<td>HP Socket</td>
<td>Circular male 5 pins</td>
</tr>
<tr>
<td>Power</td>
<td>5-12 VDC</td>
<td>110/220 VAC</td>
<td>5-12 VDC</td>
</tr>
<tr>
<td>Data Connector</td>
<td>Micro USB2</td>
<td>USB2</td>
<td>Circular male 7 pins</td>
</tr>
</tbody>
</table>

### Mechanical and Environmental Parameters

- **Operating temperature**: °C, -20 to 70
- **Storage temperature**: °C, -40 to 85

### EMC and Safety [7]

- CE & FCC

[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 1.5 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.

Programmable 2.5 GHz RFoF - typical test data

Gain Variation over Temperature for -20°C (blue) to +70°C (red), ‘LNA Off’ without compensation (top). With Compensation (bottom). Similar behavior for Gain Variation over Temperature for ‘LNA Off’.

Gain vs. Tx Attenuation value: 0 to 31 dB in 1 dB step, 2.5 GHz RFoF for ‘LNA Off’ (similar behavior for ‘LNA On’)

Input Return Loss vs. Freq. (S11), 2.5 GHz RFoF - ‘LNA ‘ON’

Input P1dBc at 5 frequencies, 2.5 GHz RFoF - ‘LNA Off’

Input P1dBc at 5 frequencies, 2.5 GHz RFoF - ‘LNA On’

Noise Figure for 4 Freq. vs. Attenuator value, 2.5 GHz RFoF - ‘LNA Off’

Noise Figure for 4 Freq. vs. Attenuator value, 2.5 GHz RFoF - ‘LNA ON’
**Mechanical Outline Drawing:** Programmable 2.5 GHz RFoF Tx & Rx units

**Ordering Information:**

- **RFoF-2.5GHz-1310-Prog.**
  - 3.0 GHz Transceiver 1310nm, FC/APC, Programmable

- **RFoF-2.5GHz-1550-Prog.**
  - 3.0 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.

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