

# 3 GHz and 6 GHz Fiber Optic Links

Wireless Applications



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## Applications

- 4G LTE
- Distributed Antenna System (Indoor/Outdoor)
- Cellular Backhaul
- WiMAX

## Features

- 30 MHz-3 GHz and 30 MHz-6 GHz RF Fiber Optic Links for Wireless Signals
- 3  $\mu\text{m}$  or 1.5  $\mu\text{m}$  Low Noise Isolated DFB Laser
- Optional CWDM Wavelengths
- Internal Tx RF pre-Amplifier
- Automatic Optical Power Control
- 50 Ohm SMA RF Connector
- SC/APC or FC/APC Optical Connector
- LD/PD Monitoring and Alarm
- Optional Wide DC Input: +12 VDC to +24 VDC
- Rugged Dust-Tight Housing
- Laser: Class 1 per CDRH and IEC-825

The 3 GHz and 6 GHz Fiber Optic Links for wireless signals are cost-effective, high-performance broadband transmitter, receiver, and transceiver modules designed for wireless interfacility link applications.

Each module comes with optimal optical power stability with assured performance over full temperature range. Transmit and receive alarm/indicator LEDs simplify installation and provide operational status. Each module is packaged in a rugged cast metal housing.



## EMCORE Advantage

EMCORE's vertically integrated, ISO-9001, RoHS compliant facility and its world-class GaAs InP wafer fab (Ortel heritage) has been successfully designing and manufacturing highly linear, wide-dynamic-range laser/photodiode die, modules, PCBAs, cards, and integrated systems for the CATV, satcom, and telecommunications RF fiber signal transport applications.

This module series is developed with selected laser and photodiode die and modules, then designed and integrated into a PCB module assembly specifically for the wireless and other wideband RF signal transport applications.

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## Performance Highlights - 3 GHz Link

|  | Parameter  | Min                        | Typical   | Max       | Units                |
|--|--|----------------------------|-----------|-----------|----------------------|
| Link   | Frequency Range  | 30                         | -         | 3000      | MHz                  |
|  | Frequency Response   | -                          | +/- 2     | -         | dB                   |
|  | Noise Figure (with RF pre-Amplifier)                                     | -                          | 41 (21)   | -         | dB                   |
|  | Input Third-Order Intercept (with RF pre-Amplifier) <sup>4</sup>         | -                          | 30 (12)   | -         | dBm                  |
|  | Spurs Free Dynamic Range (with RF pre-Amplifier) <sup>2</sup>            | -                          | 104 (107) | -         | dB/Hz <sup>2/3</sup> |
|  | RF Link Gain (with RF pre-Amplifier) <sup>3</sup>                        | -                          | 0 (19)    | 2 (21)    | dB                   |
| Tx   | Output Optical Power   | -                          | 3         | 6         | dBmo                 |
|  | Wavelength   | 1310                       | -         | 1610      | nm                   |
|  | Input Impedance  | -                          | 50 or 75  | -         | Ohm                  |
|  | Input Return Loss  | -                          | 12        | 9         | dB                   |
|  | Input Power Supply Current (with RF pre-Amplifier) <sup>1</sup> @ 12 VDC | -                          | 60 (140)  | 80 (160)  | mA                   |
|  | Rx   | Optical Input <sup>5</sup> | -15       | -         | -                    |
| Output Impedance                                 |  | -                          | 50 or 75  | -         | Ohm                  |
| Output Return Loss                               |  | -                          | 13        | 11        | dB                   |
| Input Power Supply Current <sup>1</sup> @ 12 VDC |  | -                          | 155       | 175       | mA                   |
| TR   | Input Power Supply Current (with RF pre-Amplifier) @ 12 VDC              | -                          | 250 (320) | 400 (460) | mA                   |

1. Does not include custom gain, NF and IIP3 configurations
2. SFDR =  $2/3 * (IIP3 + 174 - NF)$
3. Measured with 1 m of fiber. Link RF Gain dB = TG + RG - 2\* Fiber Loss dBo (assumes Rin = Rout)
4. Equivalent to IMD 60 dB @ 0 dBm total output power (2-tone measurement)
5. dBmo and dBo indicate optical power and loss
6. Minimum optical input is dependent on RF signal type and modulation bandwidth

## Performance Highlights - 6 GHz Link

|  | Parameter  | Min                        | Typical   | Max       | Units                |
|--|--|----------------------------|-----------|-----------|----------------------|
| Link   | Frequency Range  | 30                         | -         | 6000      | MHz                  |
|  | Frequency Response   | -                          | +/- 3     | -         | dB                   |
|  | Noise Figure (with RF pre-Amp)   | -                          | 41 (21)   | -         | dB                   |
|  | Input Third-Order Intercept (with RF pre-Amplifier) <sup>4</sup>         | -                          | 18.5 (2)  | -         | dBm                  |
|  | Spurs Free Dynamic Range (with RF pre-Amp) <sup>2</sup>                  | -                          | 101 (103) | -         | dB/Hz <sup>2/3</sup> |
|  | RF Link Gain (with RF pre-Amp) <sup>3</sup>                              | -                          | 0 (16)    | 1 (18)    | dB                   |
| Tx   | Output Optical Power   | -                          | 3         | 6         | dBmo                 |
|  | Wavelength   | 1310                       | -         | 1610      | nm                   |
|  | Input Impedance  | -                          | 50 or 75  | -         | Ohm                  |
|  | Input Return Loss  | -                          | 11        | 8         | dB                   |
|  | Input Power Supply Current (with RF pre-Amplifier) <sup>1</sup> @ 12 VDC | -                          | 80 (160)  | 95 (175)  | mA                   |
|  | Rx   | Optical Input <sup>5</sup> | -15       | -         | -                    |
| Output Impedance                                 |  | -                          | 50 or 75  | -         | Ohm                  |
| Output Return Loss                               |  | -                          | 11        | 8         | dB                   |
| Input Power Supply Current <sup>1</sup> @ 12 VDC |  | -                          | 160       | 180       | mA                   |
| TR   | Input Power Supply Current (with RF pre-Amplifier) @ 12 VDC              | -                          | 250 (330) | 400 (480) | mA                   |

1. Does not include custom gain, NF and IIP3 configurations
2. SFDR =  $2/3 * (IIP3 + 174 - NF)$
3. Measured with 1 m of fiber. Link RF Gain dB = TG + RG - 2\* Fiber Loss dBo (assumes Rin = Rout)
4. Equivalent to IMD 60 dB @ 0 dBm total output power (2-tone measurement)
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## Absolute Maximum Rating

| Parameter                                 | Min   | Max   | Unit |
|---|-------|-------|------|
| Storage Temperature                       | -40   | 85    | °C   |
| Operating Temperature                     | -20   | 70    | °C   |
| DC Supply Voltage                         | +11.5 | +12.5 | V    |
| Maximum TX RF Input (No RF pre-Amplifier) | -     | +15   | dBm  |
| Maximum RX Optical Input                  | -     | 4     | mW   |

## Monitor Configuration (RS-232, DB-9 Connector)

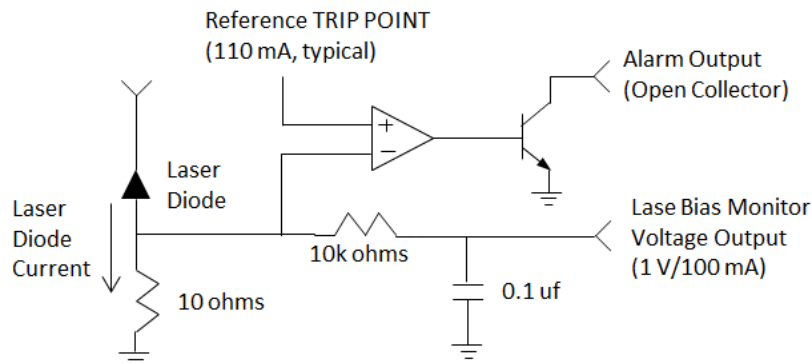
| Pin # | Function                                     |
|-------|--|
| 1     | Laser Enable (+12VDC = laser ON)             |
| 2     | NC   |
| 3     | NC   |
| 4     | 12 V (400 mA max)                            |
| 5     | Ground                                       |
| 6     | Laser Bias Monitor (0.1 V = 10 mA)           |
| 7     | Laser Bias Alarm (open collector, 25 mA)     |
| 8     | Received Power Monitor (1 V = 1 mW)          |
| 9     | Received Power Alarm (open collector, 25 mA) |

## Unit Status LED Indicator

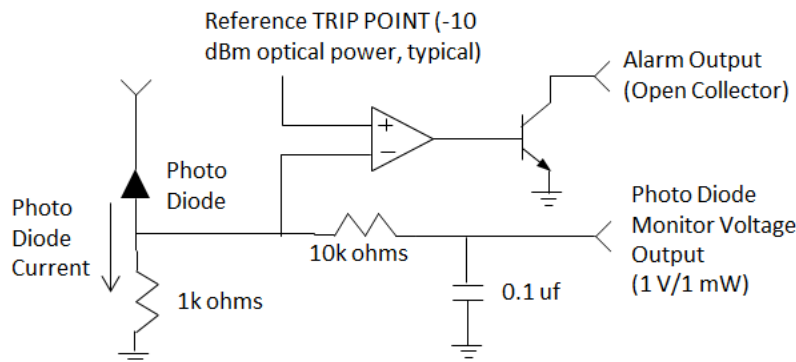
| LED Indicator | Green                                | Red                       |
|---------------|--------------------------------------|---------------------------|
| Transmitter   | Laser Bias Current Normal < 110 mA   | Laser Bias Current Fault  |
| Receiver      | Input Optical Power Normal > -10 dBm | Input Optical Power Fault |

## Alarm and Monitoring Circuit Diagram

### Transmitter (Tx)



### Receiver (Rx)



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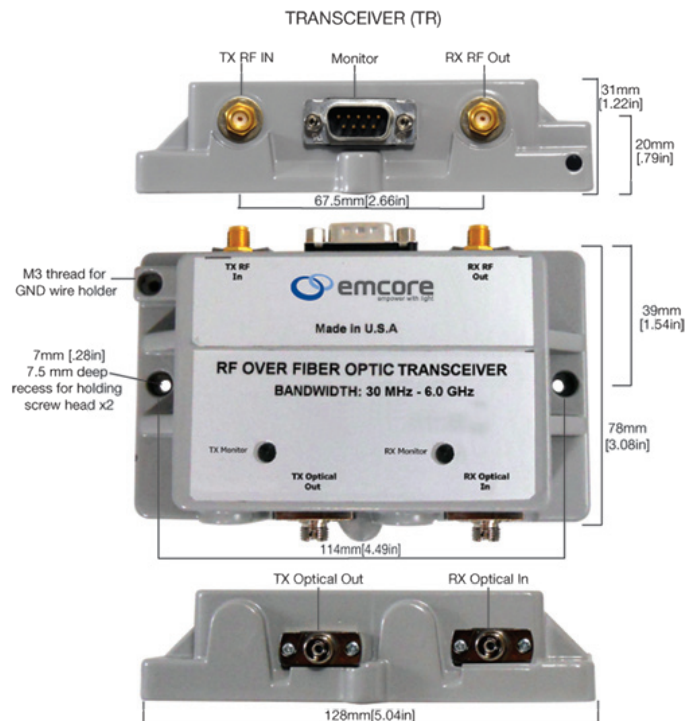
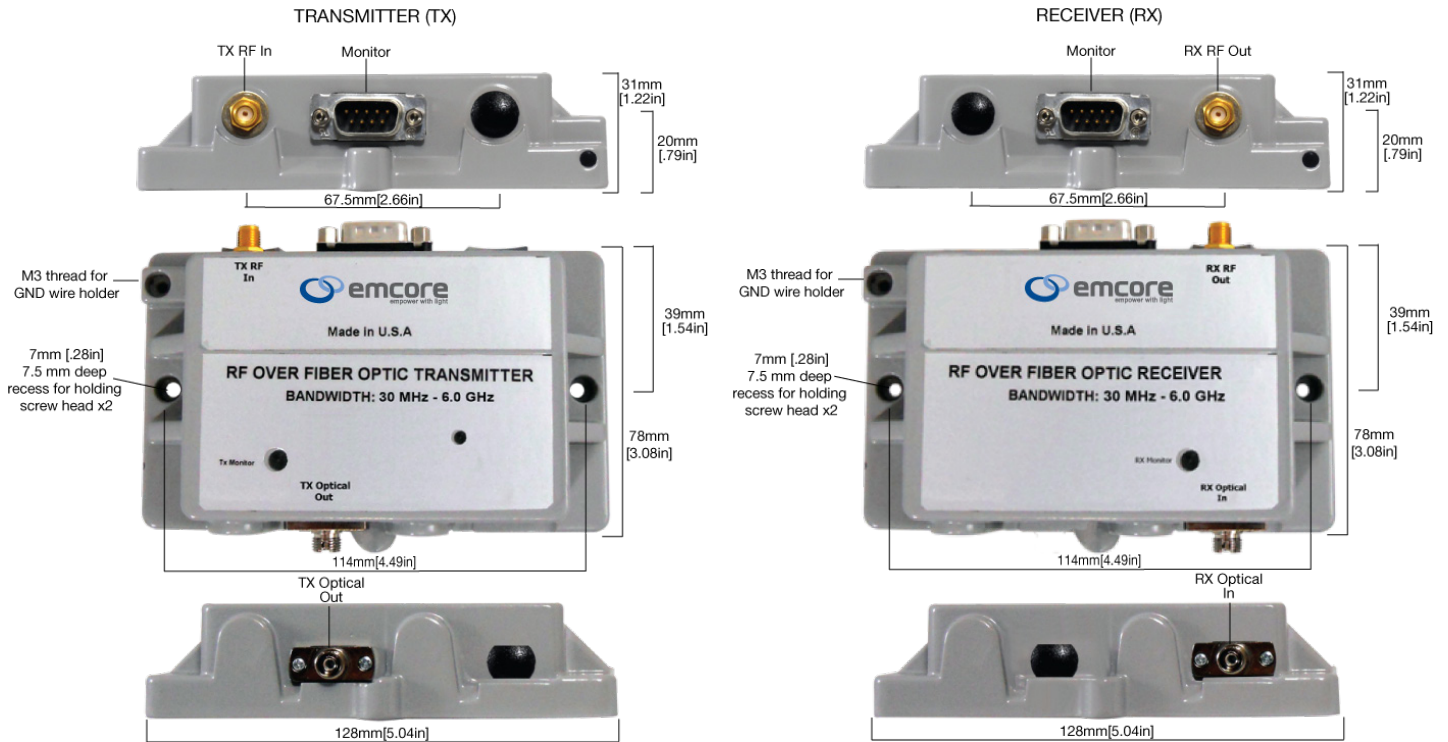
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## Tx/Rx/TR Diagram



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## Ordering Information

| Transmitter (T)     |
|---------------------|
| FOL-WWTX / YY-ZZ-AA |

- When ordering replace "WW" with one of the Frequency Band Option
- When ordering replace "X" with one of the Tx RF pre-Amplifier Options
- When ordering replace "YY" with one of the RF Connector Type Options
- When ordering replace "ZZ" with one of the Optical Wavelength Options
- When ordering replace "AA" with one of the Optical Connector Options

| Model Series           | Frequency Band (GHz)<br>"WW"               | TX Pre-Amplifier Options<br>"X"    | RF Connector Type Options<br>"YY" | Optical Wavelength Options<br>"ZZ"  | Optical Connector Options<br>"AA" |
|------------------------|--|------------------------------------|-----------------------------------|---|-----------------------------------|
| FOL - Fiber Optic Link | 33 = 30 MHz - 3 GHz<br>36 = 30 MHz - 6 GHz | 1 = no pre-Amp<br>2 = with pre-Amp | S5 = SMA (50 Ohm)                 | 13= 1310 nm<br>47= 1470 nm<br>49 = 1490 nm<br>51= 1510 nm<br>53 = 1530 nm<br>55= 1550 nm<br>57 = 1570 nm<br>59= 1590 nm<br>61 = 1610 nm | SA = SC/APC<br>FA = FC/APC        |

| Receiver (R)  |
|---------------|
| FOL-WWR/XX-YY |

- When ordering replace "WW" with one of the Frequency Band Options
- When ordering replace "XX" with one of the RF Connector Type Options
- When ordering replace "YY" with one of the Optical Connector Options

| Model Series           | Frequency Band (GHz)<br>"WW"               | RF Connector Type Option<br>"XX" | Optical Connector Options<br>"YY" |
|------------------------|--|----------------------------------|-----------------------------------|
| FOL - Fiber Optic Link | 33 = 30 MHz - 3 GHz<br>36 = 30 MHz - 6 GHz | S5 = SMA (50 Ohm)                | SA = SC/APC<br>FA = FC/APC        |

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## Ordering Information

| Transceiver (TR)   |
|--------------------|
| FOL-WWTRX/YY-ZZ-AA |

- When ordering replace "WW" with one of the Frequency Band Options
- When ordering replace "X" with one of the Tx RF pre-Amplifier Options
- When ordering replace "YY" with one of the RF Connector Type Options
- When ordering replace "ZZ" with one of the Optical Wavelength Options
- When ordering replace "AA" with one of the Optical Connector Options

| Model Series           | Frequency Band (GHz) "WW"                  | Tx pre-Amplifier Option "X"        | RF Connector Type Option "YY" | Optical Wavelength Option "ZZ"  | Optical Connector Options "AA" |
|------------------------|--|------------------------------------|-------------------------------|---|--------------------------------|
| FOL - Fiber Optic Link | 33 = 30 MHz - 3 GHz<br>36 = 30 MHz - 6 GHz | 1 = no pre-Amp<br>2 = with pre-Amp | S5 = SMA (50 Ohm)             | 13= 1310 nm<br>47= 1470 nm<br>49 = 1490 nm<br>51= 1510 nm<br>53 = 1530 nm<br>55= 1550 nm<br>57 = 1570 nm<br>59= 1590 nm<br>61 = 1610 nm | SA = SC/APC<br>FA = FC/APC     |

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