



## Company Profile

Founded in 2003 and located in Glen Burnie, Maryland, adjacent to Baltimore-Washington International Airport, Pharad, LLC is a customer focused company carrying out innovative research and development in the areas of highly efficient, electrically small antenna technologies and RF over fiber technologies.

Pharad has developed and delivered technology solutions for hundreds of customers, ranging from Fortune 500 companies to a variety of government agencies. To meet the needs of our customers we draw on the extensive and diverse experience of our engineering team, including: Electromagnetics, Photonics, Microwave and Millimeter-wave circuits, Software, Electronics, Mechanical and Packaging, and Test and Measurement.

Pharad has invested heavily in engineering resources and state-of-the-art facilities. Our Class A office space is co-located with engineering laboratories that comprise microwave, millimeter-wave, electronics and photonics laboratories, antenna measurement laboratories including an anechoic chamber, antenna Specific Absorption Rate measurement test equipment, rapid prototyping and final assembly laboratories, as well as environmental test facilities. Additionally, we operate an ISO9001:2008 manufacturing facility that delivers high quality production volume products to some of the most demanding customers in the world.

In response to increased customer demand, Pharad formed the **octane**® division in 2007 and we now sell our products through the **octane**® brand.



Octane is the commercial sales division of Pharad, LLC

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Octane is a registered trademark of Pharad, LLC



# RF over Fiber Systems



## Applications

- Wideband RF Signal Transport
- Antenna Remoting
- SATCOM
- Wireless Backhaul
- Terrestrial Communications
- Electronic Warfare
- SIGINT/ISR
- Aircraft/Shipboard RF Distribution

## Features

- Operating Bandwidths covering HF to Ka-band
- High Spurious-Free Dynamic Range
- Low Noise Figure
- Low Loss
- WDM Compliant
- 19" 1RU Rack Mount
- Remote Status/Alarm Monitoring via RS-232 Interface

## Optimized Performance RF Photonic Transceivers

Pharad has developed a comprehensive family of optimized performance RF photonic transceivers for high dynamic range and low loss RF signal over optical fiber transport. The transceivers are packaged in 19" rack mountable enclosures and provide electrical-to-optical (E/O) and O/E conversion of wideband RF signals over operating bandwidths covering 3 MHz to 40 GHz. Fiber-optic remoting of a multitude of RF signals can be supported using a single transceiver with a multi-band operating frequency range.

The transport of RF signals over optical fiber offers a number of benefits over conventional RF coaxial cables and waveguide including reduced cabling size and weight; low loss over a wide RF bandwidth; and improved signal isolation. Pharad's range of RF photonic transceivers employs proprietary techniques to achieve the best gain, noise figure (NF), and spurious-free dynamic range (SFDR) performance available. They are the ideal solution for supporting the high fidelity bi-directional transport of wideband RF signals over an optical fiber link or network.

Applications include RF signal distribution over optical fiber in communications, radar, electronic warfare, and SIGINT/ISR systems, antenna remoting, aircraft and shipboard RF distribution systems, as well as commercial wireless networks and SATCOM platforms.



Model Number	Operating Frequency	RF Gain <sup>†</sup> (Typ)	Noise Figure <sup>†</sup> (Max)	SFDR <sup>††</sup> (Min)
PXR-005-030-S*	0.5 - 3 GHz	-7 dB	14 dB	120 dB-Hz <sup>2/3</sup>
PXR-030-100-S	3 - 10 GHz	-5 dB	19 dB	116 dB-Hz <sup>2/3</sup>
PXR-100-200-N	10 - 20 GHz	0 dB	10 dB	114 dB-Hz <sup>2/3</sup>
PXR-020-200-N	2 - 20 GHz	10 dB	10 dB	105 dB-Hz <sup>2/3</sup>
PXR-004-155-N	0.4 - 15.5 GHz	4 dB	8 dB	108 dB-Hz <sup>2/3</sup>
PXR-001-190-N	0.003 - 19 GHz	15 dB	7 dB	104 dB-Hz <sup>2/3</sup>
PXR-260-400-N	26 - 40 GHz	5 dB	7 dB	108 dB-Hz <sup>2/3</sup>
PXR-030-400-N	3 - 40 GHz	10 dB	10 dB	104 dB-Hz <sup>2/3</sup>

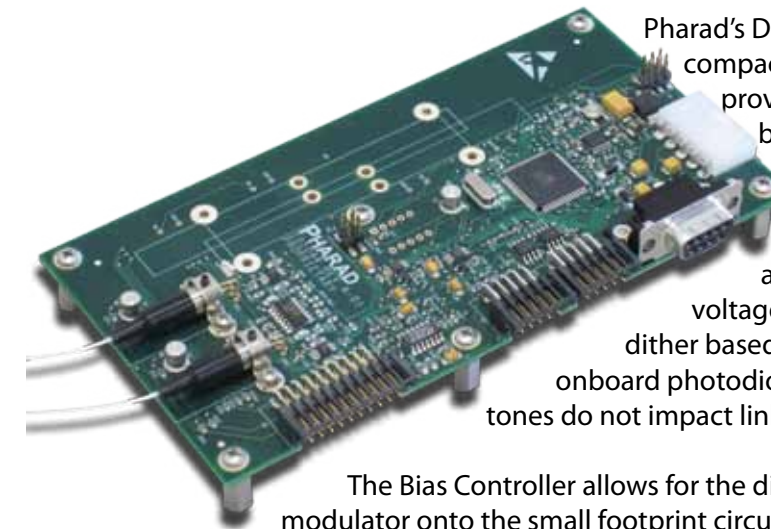
<sup>†</sup> RF Link Gain, Noise Figure, and SFDR specified with optical loss over 1 meter of fiber.

<sup>††</sup> SFDR specified over single octave.

\*Out-of-band rejection filtering recommended.

Custom configurations are available. Call Pharad for details and pricing.

## Compact Dither-Free Modulator Bias Controller



Pharad's Dither-Free Bias Controller is a compact circuit for OEM applications that provides accurate and highly stable bias voltage control of optical modulators. As the bias point of the modulator drifts over time, the Bias Controller automatically adjusts the bias voltage to maintain its set point. Non-dither based control in conjunction with two onboard photodiodes ensures unwanted dither tones do not impact link performance.

The Bias Controller allows for the direct mounting of the optical modulator onto the small footprint circuit board and can be used in with both periodic and non-periodic modulator transfer functions. Users can select a range of modulator bias voltages via an RS-232 interface in addition to the more conventional quadrature bias point of the modulator's transfer function characteristic. Onboard power and RS-232 connections allow simple operation with user supplied external optical couplers.

## Features

- Precision Bias Control of Optical Modulators
- Operates with Periodic and Non-Periodic Modulator Transfer Functions
- User Selectable Bias Voltage via RS-232 Interface
- Dither-free Operation
- Compact Form Factor
- Direct Mounting of Modulator to Board
- Onboard Power and RS-232 Connections

## Photonic Cross-Connect

Pharad has developed a Photonic Cross-Connect that interfaces with our high performance RF Photonic Transceivers and supports the low loss routing, switching and distribution of multiple RF over fiber signals. The Photonic Cross-Connect replaces conventional RF switches for the routing of RF signals to different locations and enables dynamic reconfiguration of the RF photonic links.



The compact unit incorporates a non-blocking, transparent optical switch matrix that can switch any of four input optical signals carrying RF signals to any of four output ports, as required in a particular application. It features low power consumption, millisecond switching time and provides extremely reliable optical performance.

The Photonic Cross-Connect operates independently of the frequencies of the RF signals being transported over fiber and can be interfaced with any of Pharad's RF Photonic Transceivers. In addition to providing real time creation and reconfiguration of the photonic signal paths, the Photonic Cross-Connect includes continuous optical power monitoring to ensure reliable operation of the entire system.

## Features

- Photonic Switching and Routing of RF over Fiber Signals
- Dynamic Reconfiguration of RF Photonic Link Paths
- Non-Blocking Optical Switch Matrix
- Millisecond Switching Time
- Low Insertion Loss
- RF Frequency Independent
- Optical Power Monitoring
- 4 x 4 Fiber Ports
- 19" 1RU Rack Mount
- Optical Path Configuration and Monitoring via RS-232 Interface