RFOptic
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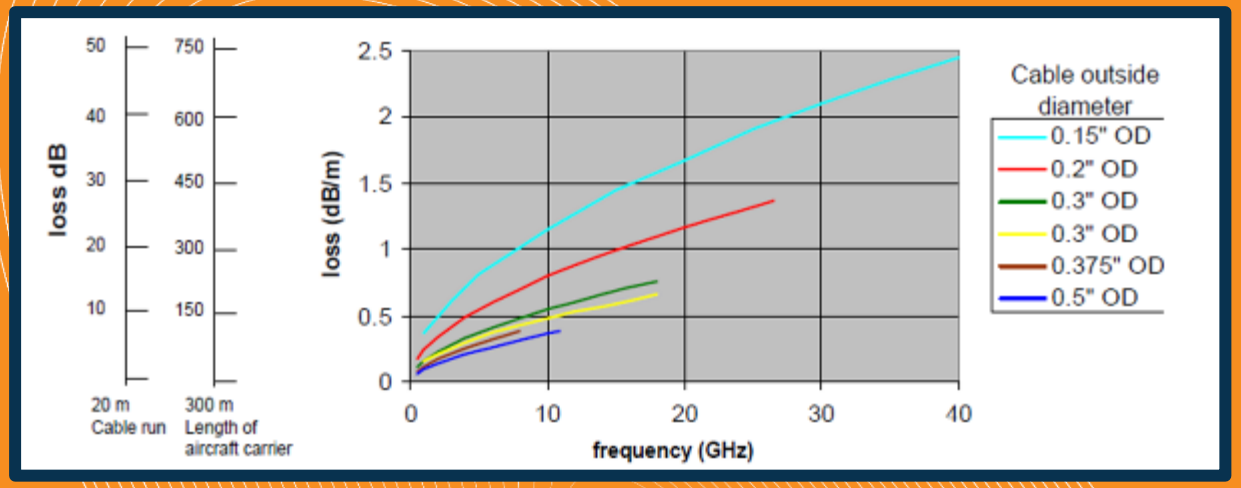
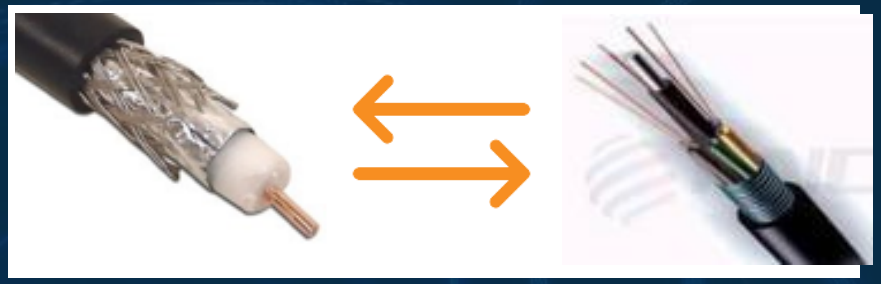
CORPORATE PRESENTATION

MOTIVATION FOR RFOPTIC | Replacing coax with fiber due to coax loss

At 20 GHZ, 1000 meters of single-mode fiber has 7,500 times less loss than 0.15” RF cable





Fiber bundles are very light and compact compared to coax.

Optical fiber transmission loss (single mode) ~0.25 dB/km.
In the RF domain, this optical loss translates to ~0.5dB/km
(Not including conversion loss (~30dB))

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RFOPTIC AT A GLANCE

- RFOptic designs, manufactures, markets and sells its off-the-shelf RF over Fiber (RFoF) products
- We have three RFoF **off-the-shelf** product lines and custom solutions:
  - 1MHz – 6GHz RFoF programmable product line (Soon – programmable up to 9GHz)
  - 0.1 GHz – 18GHz / RFoF Ultra product line
  - 0.1GHz – 67GHz HSFDR RFoF product line

Customized Solutions:

- ODL
- ODL for Altimeter Testing
- Custom and special products; DF/phase matched, optical mixer, phase control, HD systems
- RFOptic specializes in innovative electro-optic RF modules & subsystems
- Large portfolio and sales to 5G cellular, Defense/EW, Satcom, and RF test sectors

- Active in more than 40 countries and regions: USA, EU, UK, APAC and more
- A North-American office in Parlin, N.J. (RFOptic, Inc.)
- ISO 9001-2015,2021 certified. in-house production and local subcontractors
- Privately-owned company

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OUR MISSION STATEMENT

Provide high-value RF-Optical products with superior performance to the 5G / 6G testing applications & EW / RADAR/Satcom defense markets

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OUR VALUE PROPOSITION

- Wide range of RFoF off-the-shelf products from 1MHz — 67GHz
- Marketing Edge: high-end RFoF & ODL solutions
- Monitoring, BIT & control capabilities saves time and resources during installation and maintenance, resulting in substantial OPEX reduction
- R&D-driven manufacturing company targeting large turnkey projects from idea to proof of concept to production
- Highly integrated user-friendly RF-Optical solutions
- Excellent cost/ performance ratio
- Excellent customer service starting with pre-sales and fast response time

OUR MARKET SEGMENTS

5G CELLULAR for testing

RF SATCOM mmWAVE & LEO SOLUTIONS

DRONE/UAV (RFoF remote antenna)

MINES & EMERGENCY SERVICES

BROADCAST

EW & RADAR

GOVERNMENT & DEFENSE

TESTING & MEASURING

BROADCAST RADIO TELESCOPES

SOME OF OUR CUSTOMERS

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WHY CHOOSE US

R&D-driven & innovative manufacturing company with global coverage	High customer satisfaction; high number of repeated orders	Quick response to all customer inquiries & fast order fulfillment	Excellent pre and post support, including troubleshooting	Extensive experience with innovative solutions for the 5G testing and EW & radar markets

Working with us brings added value,

mitigates technical risks, and improves your team

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WHAT OUR CUSTOMERS SAY ABOUT US

"Your response time is light-years beyond the competition. I can't thank you enough for helping to make my job easier!"

A national R&D laboratory

"our devices are solid, and I love having the internal attenuation."

A leading provider of wireless sound systems for live/broadcast events

"We opted for RFOptic's RFoF solution since it was highly recommended to us and everything is working great. We are planning to purchase more soon."

A major systems integrator

"… what we thought would be the largest obstacle, the utilization and acquisition of a RFoF unit, turned out to be a non-issue … in such short order allowed us to complete our endeavor in a timely fashion and professional manner."

An aerospace company

"We opted for RFOptic's Optical Delay Line and I am happy to report that it not only performed well, but even exceeded our expectations. We could not be more pleased."

A major defense contractor

"We will be using your RF over Fiber modules in our new Multi Microwave Radio Telescope, since they perform exceptionally well."

A radio telescope supplier

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PRODUCTION FACILITY

- Automatic line for PCB SMD assembly
- Complete Electronic, electro-optic and mechanical assembly
- Programming, testing & tuning
- Workmanship and QA meets international standards
- ROHS compliant
- High-capacity production; 10,000 units per month per customer
- Product packaging

HERLEY GENERAL MICROWAVE

Elbit Systems

Ai Aitech

UNI

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PRODUCT CATEGORIES AND FEATURES | STANDARD RFOF LINKS

STANDARD RFOF LINKS

Standalone RFoF links supplied with power adaptors, cables and connection fiber, Windows USB Monitoring & Control App.

- **Low frequency coverage from 1.0MHz – 2.5GHz, 2.5GHz GPS/GNSS, 3GHz, 4GHz or 6GHz Programmable series**
  - User configurable RFoF links.
  - Unidirectional or bidirectional (independent RF ports).
  - **High frequency coverage from 100MHz -12GHz, 18GHz DML ULTA**
  - Compact Size -70*70*22 mm
  - Direct Modulation DFB

- **High Frequency coverage from 1GHz (0.1GHz optional) to 12GHz, 18GHz, 20GHz, 30GHz, 40GHz, and 67GHz**
  - Factory configurable RFoF links
  - Exceptional NF and useful P1dBc
  - Optional integrated pre and/or post amplifiers.

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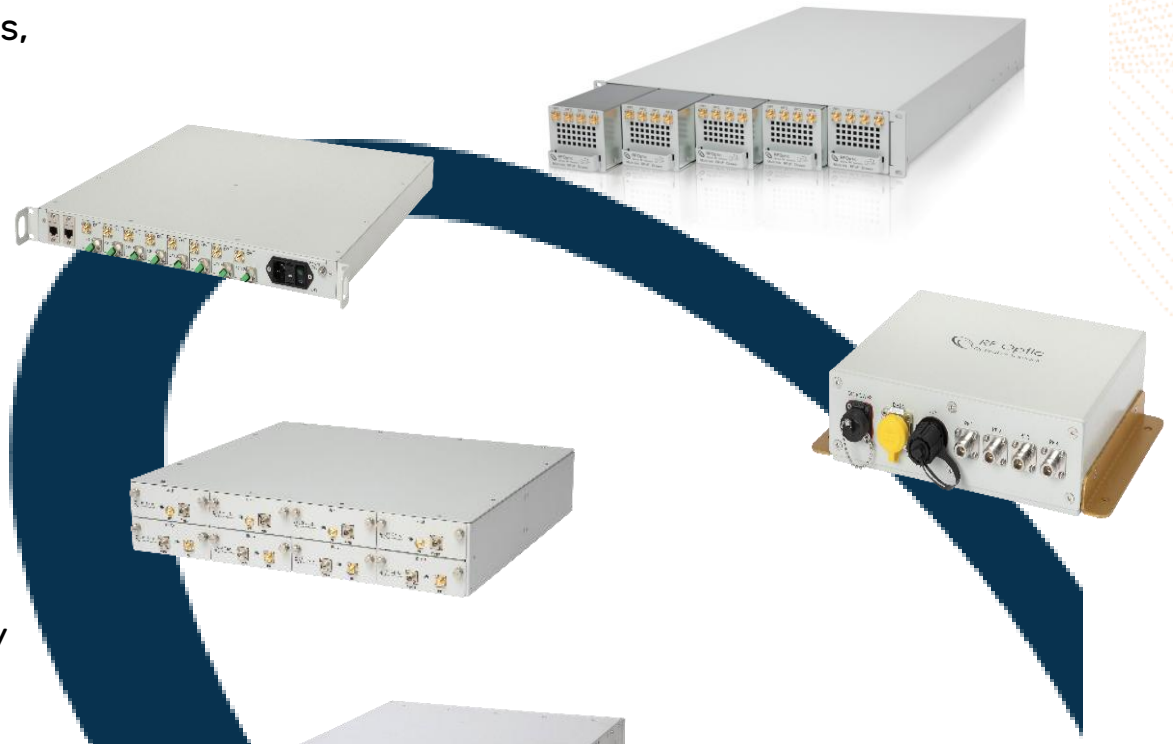
PRODUCT CATEGORIES AND FEATURES (CONT.)

Standard subsystems

- Enclosures with one or more RFoF terminals
- Optional features: USB or Ethernet M&C, IFL, Dual PSU, redundant links, WDM
- 1UR or 2UR, 2UHD enclosures are user configurable with hot-swap terminals
- Indoor & Outdoor Enclosures:- multiple sizes

Custom solutions - Factory configurable custom designs

- **Indoor/Outdoor Enclosures:** Multiple sizes enable implementing special requirements with optical amplifiers, attenuators, and distributed links
- **Optical Delay Lines**: Semi-custom design and implementation, fixed and progressive configurations, Mini (OEM), 3U with or without display and control
- **Custom spool** :segments 24 max and up to 1ms delay, RF/Optical Amplifiers, dispersion compensation, attenuators, amplifiers, and more
- **Mini-ODL:** ODL with a single, fixed delay, and altimeter configurations



FAST DESIGN & QUOTATION TURNAROUND

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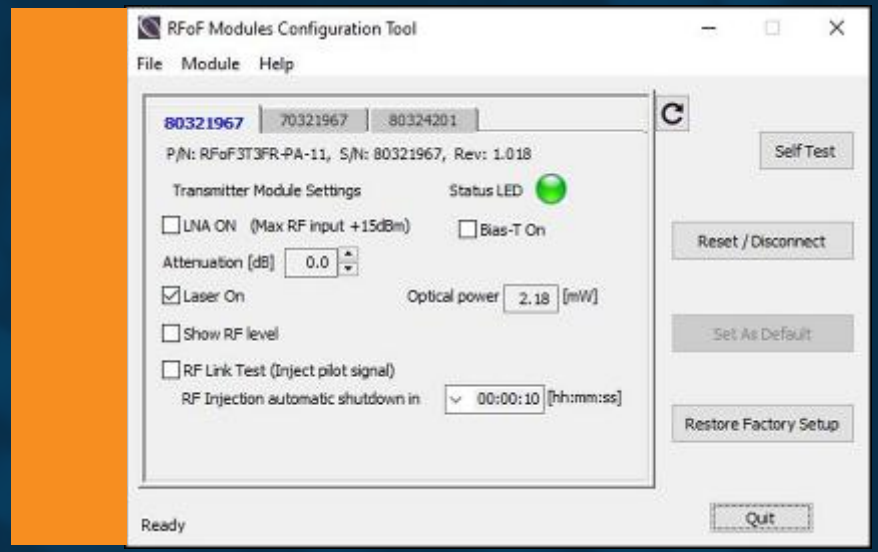
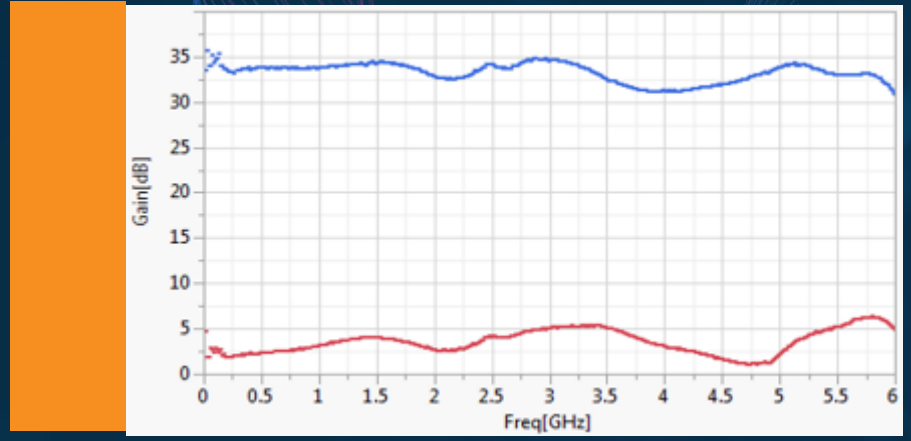
RFOF PROGRAMMABLE PRODUCT LINE | 2.5, 3.0, 4.0, 6.0 GHZ (8GHZ COMING SOON)

RF over Fiber Module
Direct modulation



RFOptic Configuration Tool

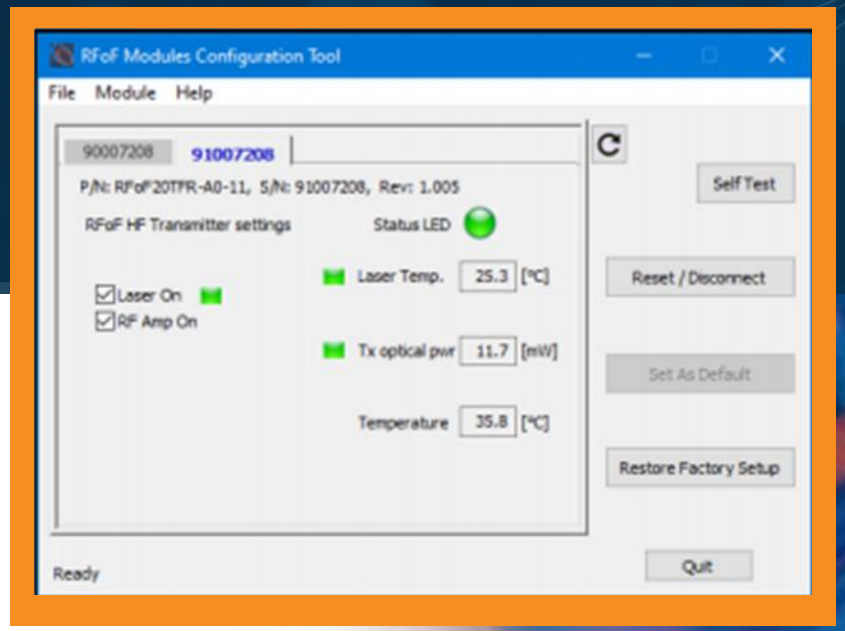


Performance - Example

Bidirectional RF over Fiber
Module Direct modulation

HSFDR PRODUCT LINE | UP TO 67 GHZ

HSFDR RFOF CONFIGURATION TOOL



HSFDR RF OVER FIBER MODULE - HIGH-END PERFORMANCE

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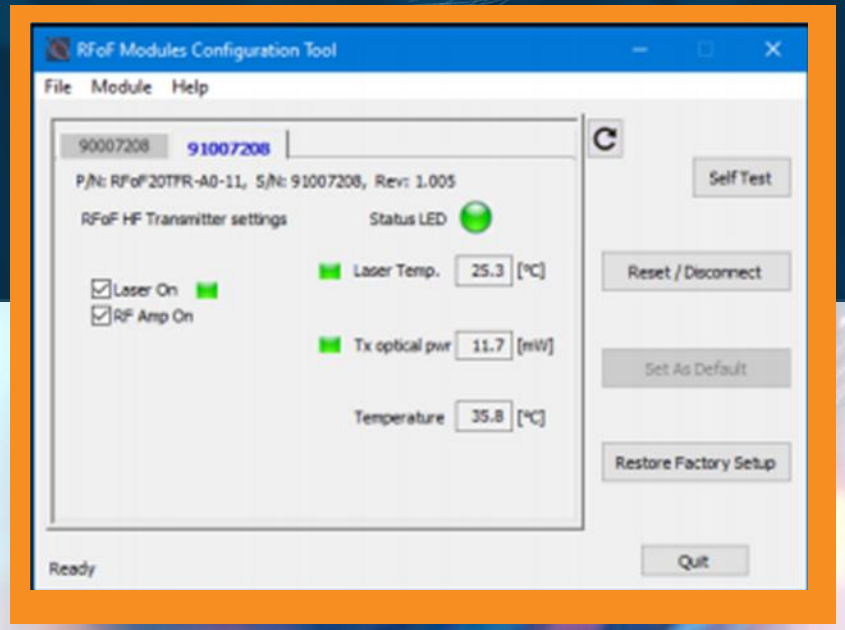
RFOF ULTRA PRODUCT LINE | 12GHZ – 18GHZ

HSFDR RF OVER FIBER MODULE - ULTRA UP TO 18 GHZ

RFOF CONFIGURATION TOOL



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OPTICAL DELAY LINE / OPTICAL DELAY LINE FOR ALTIMETER RADAR TESTING

- From 1MHz – 40GHz (utilizing RFoF and HSFDR modules)
- Delay: 1ns – 1000 μsec (using cascaded enclosures)
- Delay segments: Supports 1 – 24 segments
- Excellent phase noise <130 dBc at 10KHz offset
- Progressive architecture and fixed gain control
- High delay accuracy
- Excellent group delay variation
- Operation and LED warning indicators
- Remote communications interfaces (Ethernet , USB , TTL)
- Switching time: >10 ms
  (*Optional*: ≤100 μs switching time)
- Customized solutions

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ODL FOR TESTING AND CALIBRATING RADAR/ALTIMETER

- Altitude range: 0.5 — 100,000 feet
- Display delay, round-trip distance, range or altitude
- Customizable steps
- Supports frequencies: 1 MHz — 6 GHz
- Handles all altimeter RF signals, encoding and protocols including pulse and CW signals
- Delay accuracy: 0.1%
- Amplitude control: ≤ +40 dB (in steps of 0.5 dB)
- Excellent phase noise
- Fast switching for moving objects

USB GUI Screen

LCD Panel (in m and ft.)

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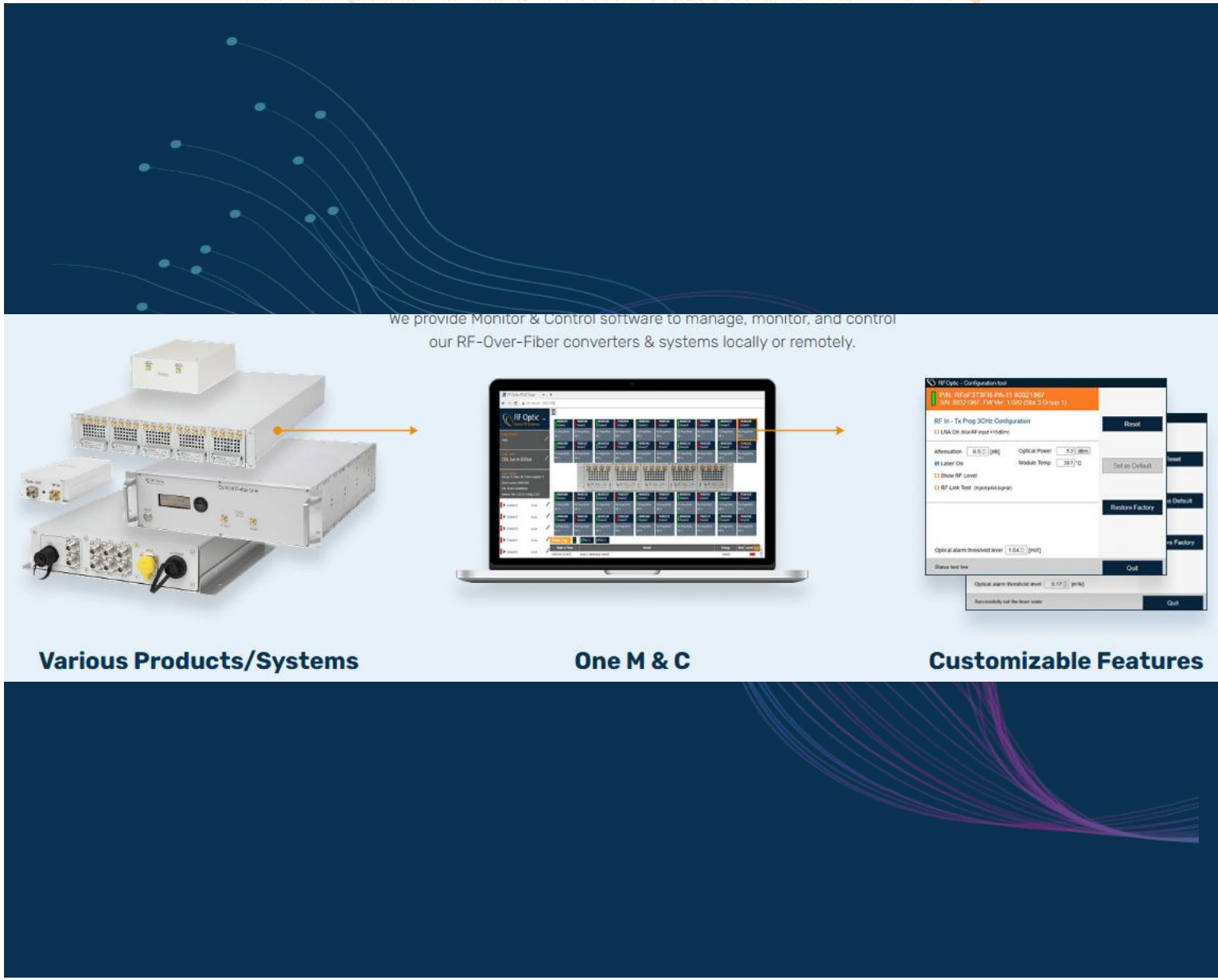
MONITOR & CONTROL SOFTWARE

- SNMP, HTML, & REST protocols
- Supports any combination of RFoF products
- Provides alarms & event log
- Enables management and monitoring
- Remote adjustment of RF and optical parameters
- Supports the entire RFOptic product line set (RFoF, HSFDR RFoF, and ODL)



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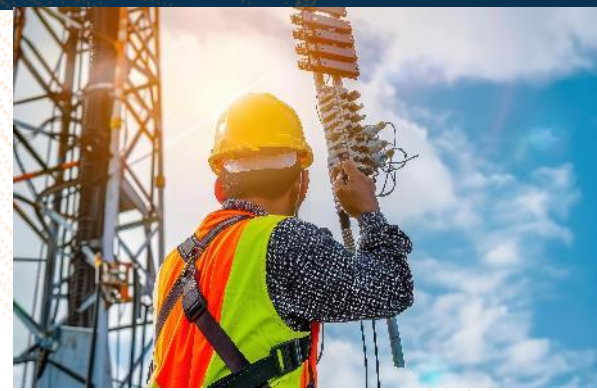
RFOF TECHNOLOGY USE CASES | COMMERCIAL APPLICATIONS

RFoF links:

- Remote antenna, radio telescopes (towers, satcom, Point to Point)
- Secure communication (business campus)
- Distributed access (DAS), WIFI (coverage extenders, airports, Malls)
- Emergency communication (tunnels, buildings)
- Cellular 4G/5G/6G (interoperability testing, integration)
- Remote monitoring, broadcast (event grounds)
- Services GPS/GNSS (tunnels, buildings)
- RF testing (anechoic chambers, Faraday cages, antenna ranges)
- Test equipment extenders, remote sensors (emission scanning)

ODLs:

- Altimeter, range calibration, simulators
- Latency test and simulation
- RF signal storage for delayed processing



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RFOF TECHNOLOGY USE CASES | DEFENSE APPLICATIONS

RFoF links

- RADAR Remote Antenna (lab to tower, point-to-point)
- Direction finding (DF) and interferometry antenna arrays (EW, ELINT, COMINT, ground, air, naval)
- Signal distribution (point to multi-point, phased array RADARS, threat/target simulators)
- Remote monitoring, sensing, secure satcom (ground, air, naval)
- RCS and RF Testing (anechoic chambers, Faraday cages, antenna ranges)
- Test equipment extenders, remote sensors, emission scanning

ODLs

- RADAR, range calibration, target simulators
- Latency test and simulation
- RF signal storage (RFML) for offline processing (ELINT, EW)

Custom:

- Optical mixer, towed repeater, standoff jammer, and more

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RFOF PROGRAMMABLE 4.0/6.0 GHZ | CELLULAR NETWORK TESTS
REPORT SUMMARY

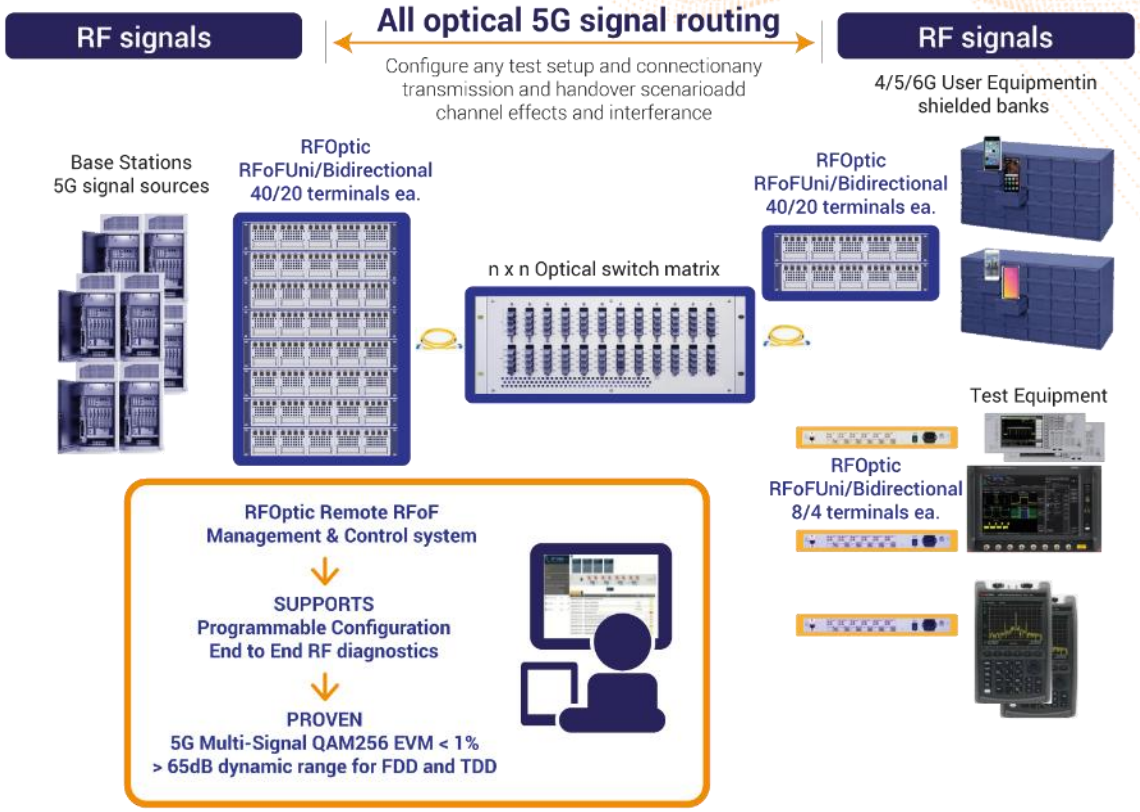
RFOptic offers a **new routing technology**, based on optical switches and RFoF links with M&C system.

It replaces band-limited RF switches, coax cables, and manual re-connection.

Customers include 4/5/6G Cellular equipment vendors and network providers.

Versions:

- 0.5GHz – 4.0GHz
- 0.5GHz – 6.0GHz



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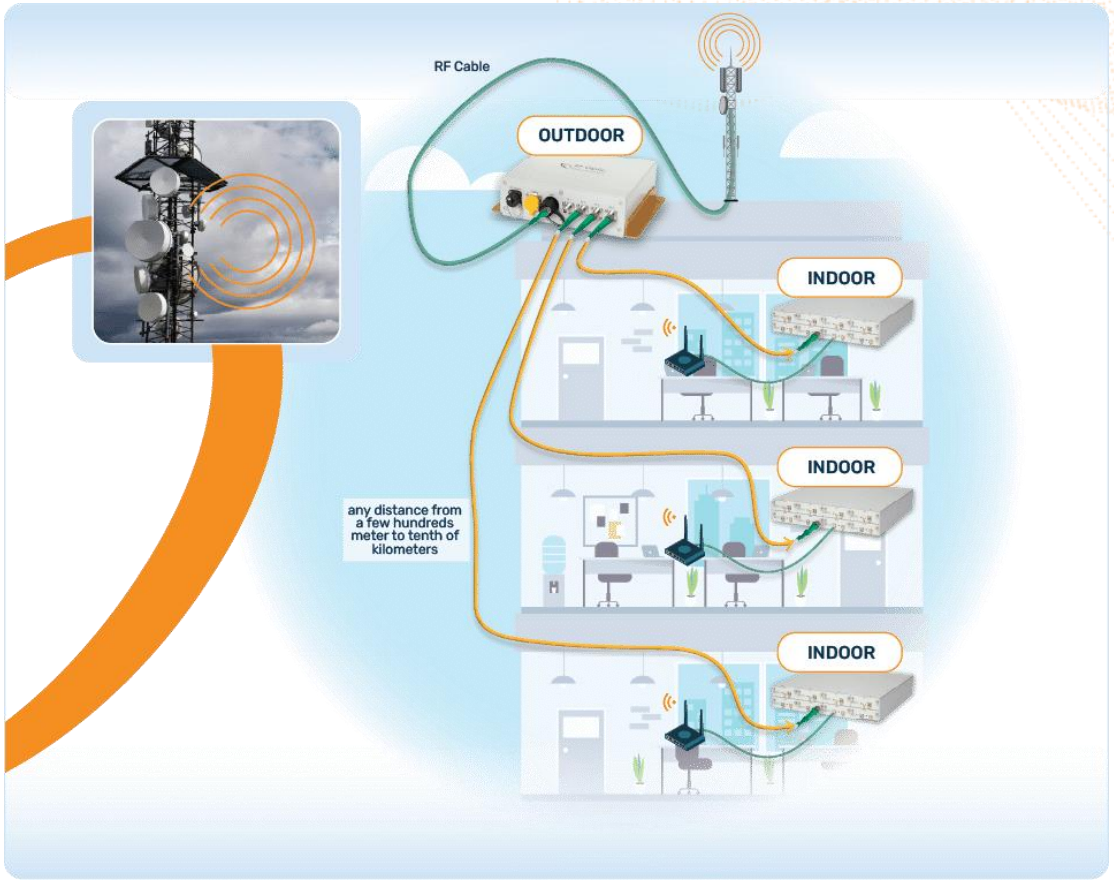
DISTRIBUTED ANTENNA SYSTEM (DAS) APPLICATION

- Solutions include several RFoF Tx terminals in an outdoor enclosure near a rooftop antenna array that is connected to multiple RFoF Rx terminals located on different floors of a building.
- RFOptic provides links up to 6GHz for DAS applications covering 4G/5G/6G cellular bands and the WIFI 2.4GHz and 5.8GHz bands.
- M&C: SNMP/HTML/REST over Ethernet



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GPS OVER FIBER APPLICATION

- GPS/GNSS over fiber is used in tunnels or other places where coax solutions is not suitable.
- The Tx includes bias-T which enables us to feed an active antenna with 5VDC up to 200mA.
- The RFoF GPS link covers 0.15GHz – 2.5GHz
  - GPS (1.176GHz – 1575.42GHz)
  - GNSS (1202.025GHz – 1609.3125GHz)
- In GPS distribution configuration, the optical signal is from a single RFoF Tx.
- The signal is split to feed multiple RFoF Rx modules in different locations.

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ELECTROMAGNETIC COMPATIBILITY (EMC, RFI) APPLICATION

- HSFDR RFoF links support measurement of EM interference and reflection.
- EMC testing in anechoic or Faraday chambers at mm-Wave frequencies.
- Fiber has negligible losses and does not emit radiation.
- To measure radiation and RCS of an airplane or drone:
  - A signal analyzer is connected to a transmitting antenna and a sensing (receiving) antenna through RFoF links enabling both antennas freedom of movement and position.

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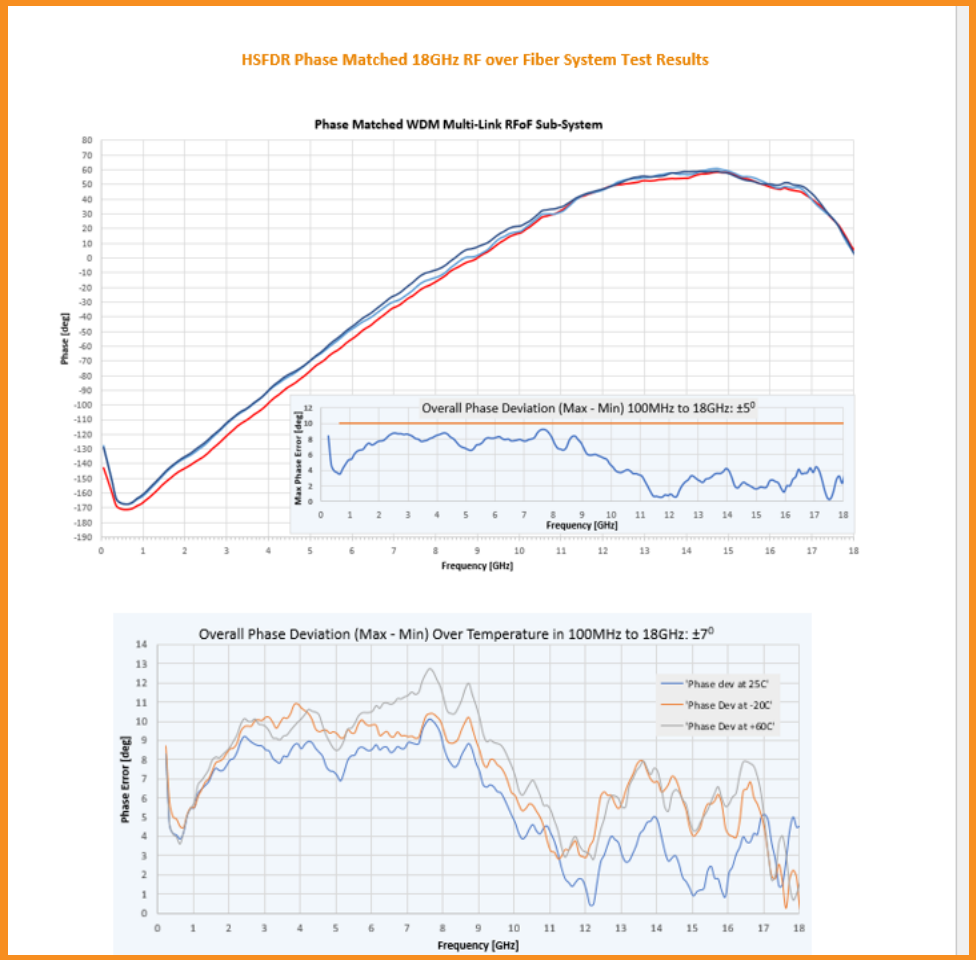
PHASE MATCHED FOR DIRECTION FINDER APPLICATION

Phase-Matched CWDW multi-link RFOF subsystem

- 6 RFoF links with < ± 10 deg. from 0.05 to 18.0GHz, over -20°C to 70°C
- Excellent phase-match stability over temperature range
- Turn-key system provided with optical interconnects
- Tactical optical cable available



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RF OVER FIBER FOR GROUND STATION DRONE APPLICATION

Drones can transmit their downlink signals in real time back to the control center, ensuring a comprehensive datalink.

- Bi-directional support for remote antenna setups
- Designed to operate within the 4 to 6 GHz frequency range
- Supports bidirectional communication for all drone signals
- Low-noise front end with 30dB gain in receive mode
- High-power transmitter for extended range

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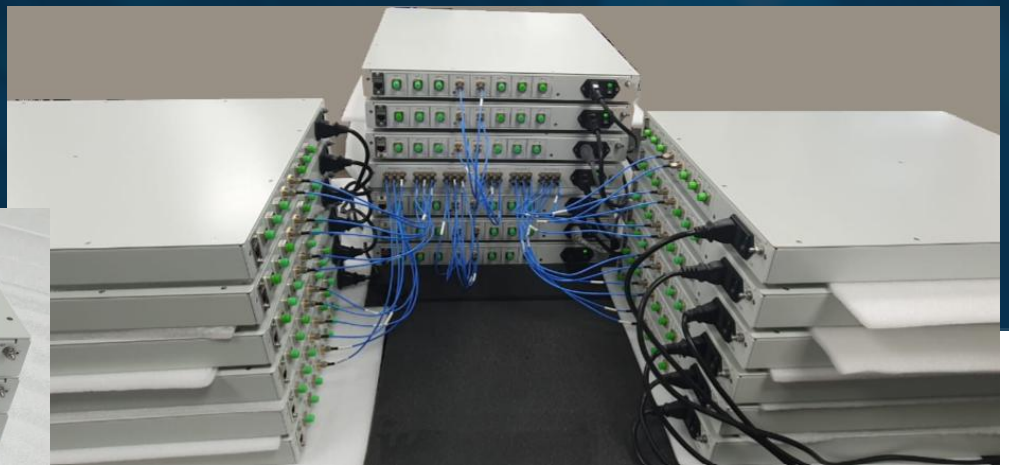
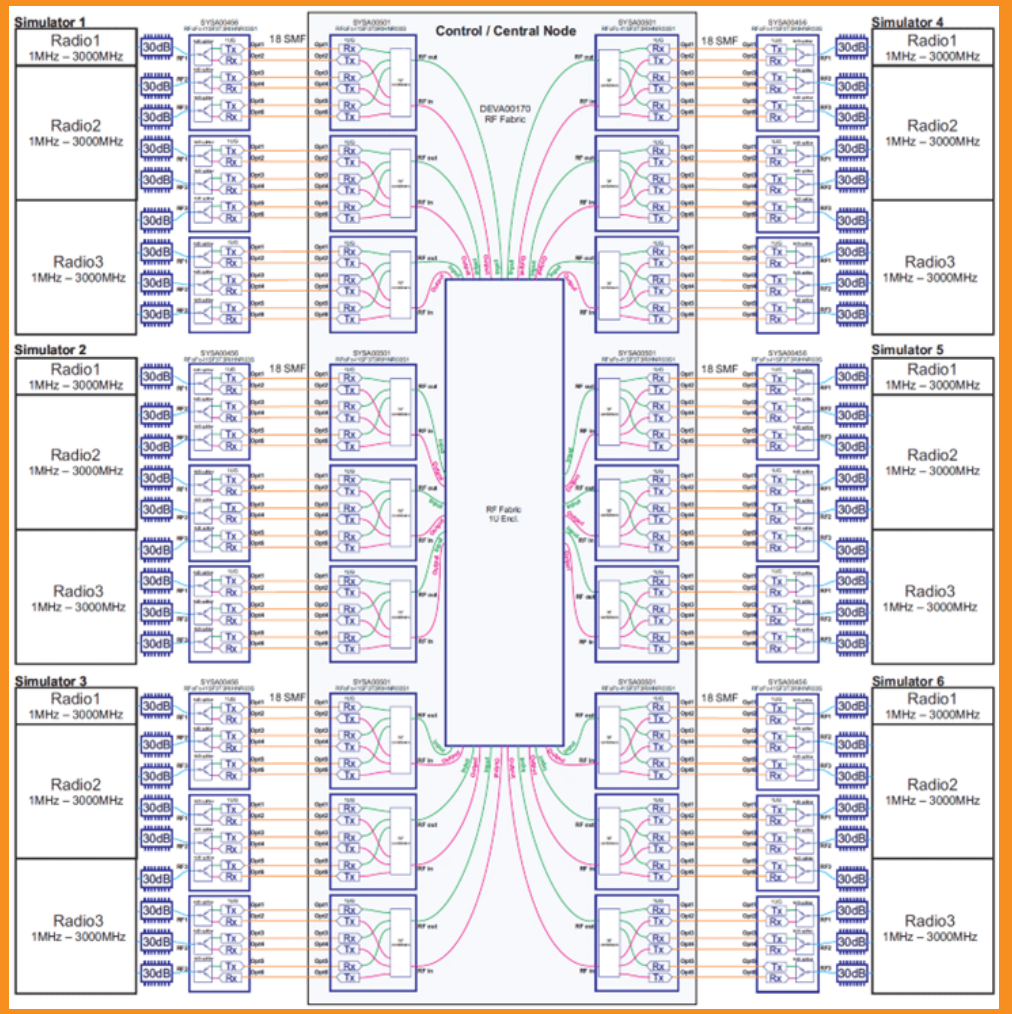
RFOF MULTI-DIMULATOR RADIO INTERCONNECT SYSTEM

Phase-Matched CWDW multi-link RFOF subsystem

- Provides multi-channel private wideband RF connections between multiple radios and datalinks
- Fully bidirectional and allows for the shielded and private equivalent of over-the-air connectivity of numerous radio channels.
- Main applications are: Flight simulator radios cross-communication and Group training radio infrastructure





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