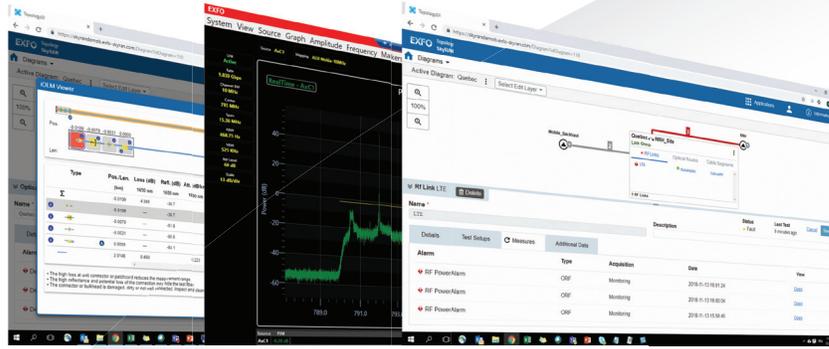
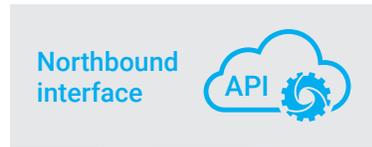


# SkyRAN

## FRONTHAUL REMOTE ACCESS AND MONITORING SOLUTION



SkyRAN fiber management system (FMS)

SkyRAN

Powered by



iOLM  
READY



Scalable solution for real-time, on-demand testing and 24/7 monitoring of the radio frequency (RF) spectrum and optical fiber networks

### KEY FEATURES AND BENEFITS

Quickly and easily identifies any type of RF interference and PIM issues with OpticalRF—industry's most powerful real-time, highest resolution RF spectrum analysis over CPRI.

Modular, flexible and scalable solution that includes centralized fiber characterization through patented OTDR/iOLM technology, dual port RF monitoring, macro and C-RAN optical switch expansion, automatic PIM detection and CPRI rates up to option 7 (9.8 Gbit/s).

Future-proof to support higher CPRI rates and next-generation fronthaul interface (NGFI) protocols.

Best-in-class fiber monitoring solution with patented OTDR/iOLM and Link-Aware technology.

Ideal for today's macro cell sites with compact 1U rackmount chassis and easily scalable to address tomorrow's large C-RAN hubs.

Server-based solution that delivers network-wide visibility of the mobile spectrum. Through SkyRAN, RF interference patterns and sources are identified for proactive detection and quick resolution of RF interference and PIM issues.

## OVERCOMING FRONTHAUL NETWORK CHALLENGES

To address today's network challenges, mobile network operators (MNOs) need a fronthaul test solution that will provide significant savings in cost and time. This can be achieved through:

- › Complete and accurate visibility into the RF spectrum, 24/7
- › Eliminating unnecessary travel time to remote or hard-to-reach cell sites
- › Minimizing troubleshooting time
- › Clear indication of any RF interference and PIM issues
- › Pinpointing exact location of fiber network issues along the fiber span

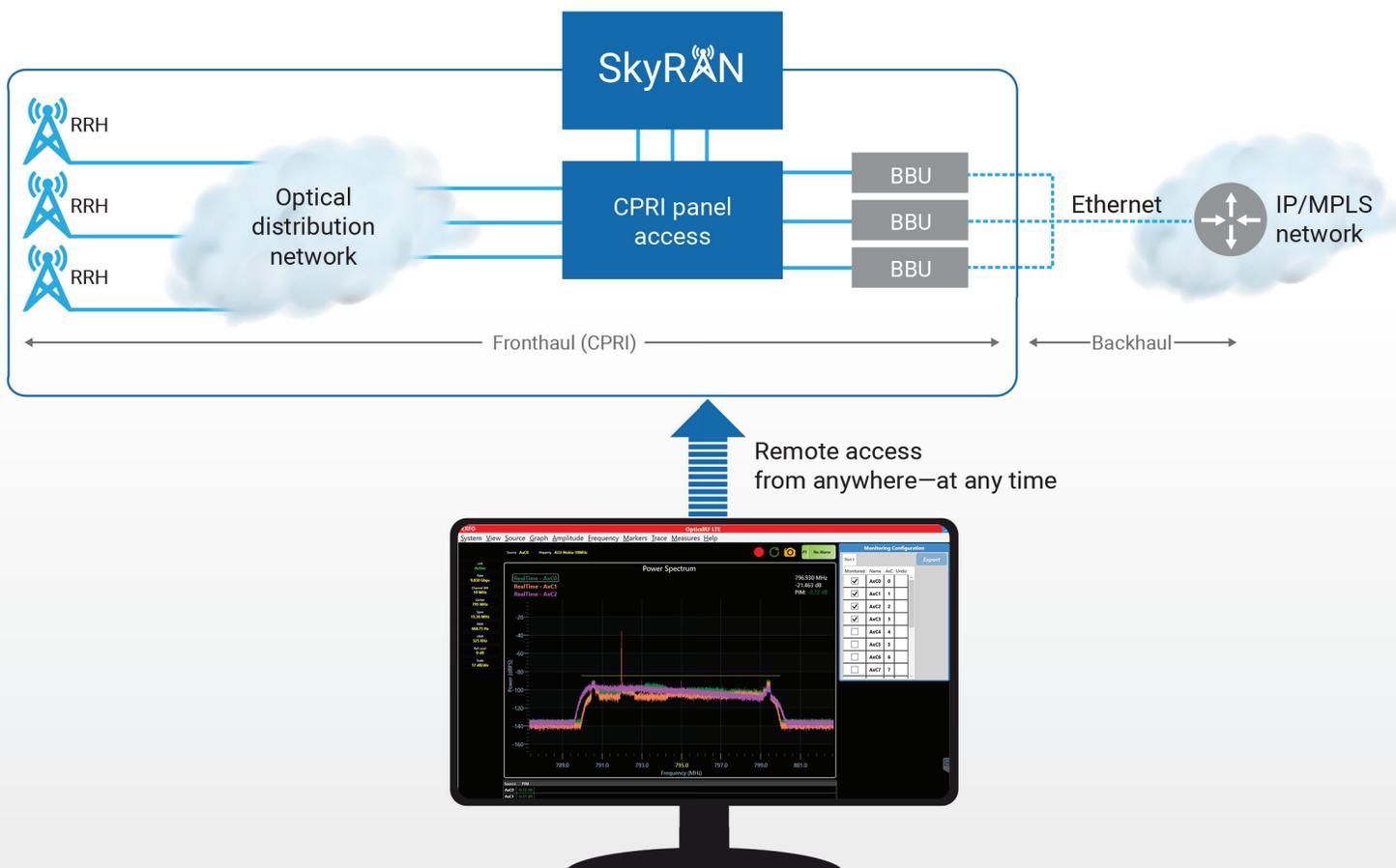
## A POWERFUL, FLEXIBLE AND SCALABLE REAL-TIME SOLUTION FOR MNOs

SkyRAN is a remote access and monitoring solution for next-gen fronthaul networks. It provides real-time, on-demand testing and 24/7 monitoring of the RF spectrum and optical fiber networks. Benefits of SkyRAN include powerful real-time testing and industry-leading performance, flexibility and scalability.

**Powerful real-time testing:** SkyRAN provides the industry's most powerful real-time RF spectrum analysis over CPRI. It delivers the highest resolution in the industry. If there are any RF interference or PIM issues, SkyRAN will detect it.

**Flexibility:** Thanks to its modular design, SkyRAN can include 24/7 fiber network monitoring to pinpoint the exact location of fiber-related issues based on its patented OTDR/iOLM technology. SkyRAN can also be easily upgraded using next-gen modules supporting higher CPRI rates (24.3 Gbit/s) and eCPRI, or even next-gen fronthaul interfaces (NGFI) running at 25 Gbit/s or higher.

**Scalability:** SkyRAN's compact and cost-optimized 1U design is perfect for macro cell sites, while its modular nature makes it easily scalable to test and monitor large C-RAN hub sites with hundreds of fiber links.



## SkyRAN FEATURES

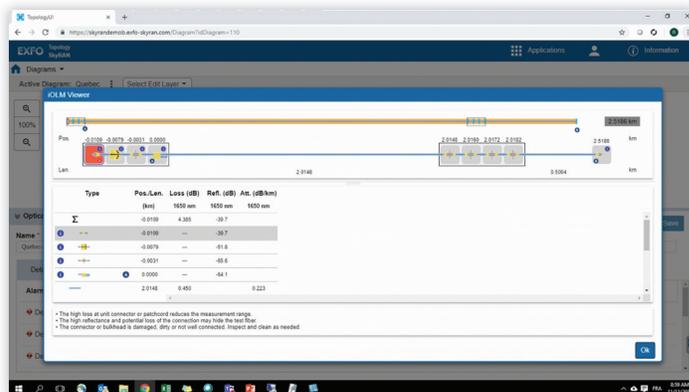
### RF spectrum analysis over CPRI

- › SkyRAN provides the industry's highest resolution RF spectrum analysis over CPRI in real time. This capability is powered by EXFO's OpticalRF
- › In monitoring or test on-demand mode, SkyRAN automatically detects and identifies any type of RF interference and PIM issues
- › Simultaneously displays up to four antenna carriers (AxCs) for quick identification of antenna diversity imbalance or implied PIM issues



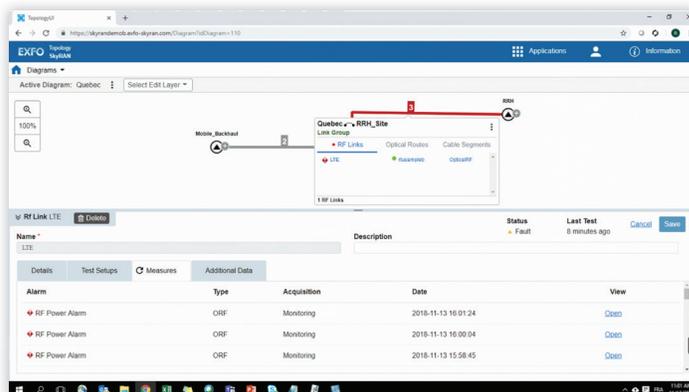
### Fiber characterization

- › SkyRAN delivers best-in-class fiber monitoring thanks to its patented OTDR/iOLM technology
- › SkyRAN uses pass/fail tests for each event, including connectors, splices, etc. to help technicians certify fronthaul fiber quality without being experts
- › Two modes of operation: on-demand testing and monitoring of the fiber links
- › SkyRAN monitors fronthaul fiber 24/7 to detect degradations and fiber cuts that impact the communication between the BBU and RRH, locating faults faster AND reducing mean time to repair (MTTR)
- › SkyRAN can also monitor backhaul fiber links to reduce network downtime if there is any issue related to the fiber. SkyRAN helps you reduce the time required to find and fix failure points.



### Network visibility

- › SkyRAN FMS provides a server-based solution delivering visibility across fronthaul networks
- › Fronthaul network health status at the RF and fiber levels
- › Real-time high-resolution spectrum and on-demand fiber status updates reduce unnecessary travel time to remote sites and allow you to monitor issues from your desk
- › Real-time email notifications



### Actionable analytics

- › Actionable analytics to make sense of interference patterns and identify RF interference sources
- › Analyzing RF interference information in a nation-wide view to identify geographical trends for smarter network insights
- › PIM heat maps and trending levels
- › RSSI/Noise density trending levels
- › Remote radio head (RRH) optical TX power trending level



## SkyRAN SOLUTION

### Macro cell site configurations

SkyRAN's modularity, flexibility and scalability are designed for today's macro cell sites where rackmount space is often limited. Given the high number of distributed macro sites, MNOs require a cost-optimized solution.

#### Cost-optimized form factor

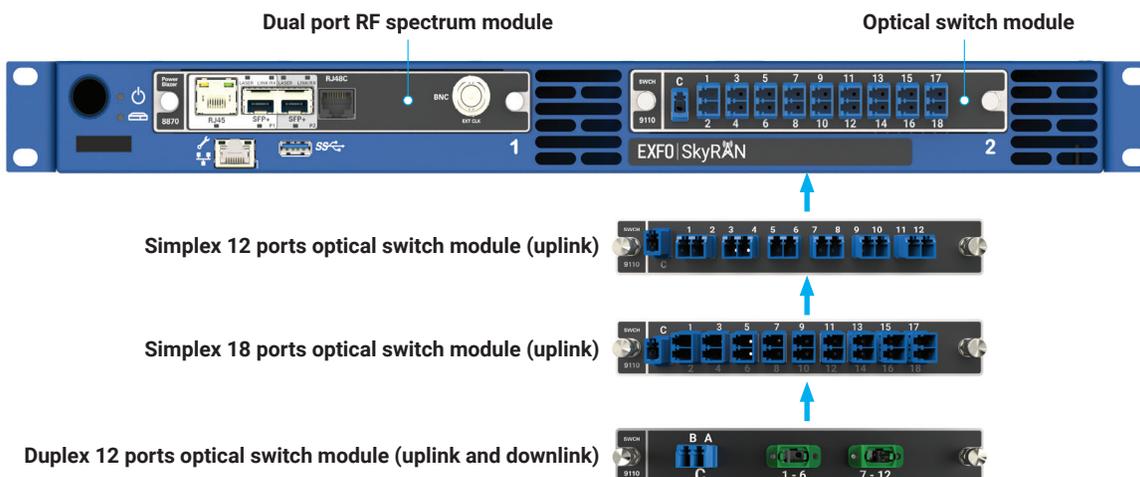
With a 1U rackmount, various RF monitoring port counts are available. The basic SkyRAN system starts at 12 ports using a simplex 12 ports optical switch module which is ideal for today's macro cell sites where typically 9 to 12 RRH are present, supporting 3 to 4 different RF bands.

#### Grow as your RAN grows

As new RF bands are added to macro cell sites, SkyRAN can easily adapt and be upgraded to 18 ports by swapping or replacing the optical switch module for a larger simplex 18 ports optical switch module.

#### Duplex monitoring

If monitoring uplink and downlink RF spectrum is required, a duplex optical switch module can be installed along with the activation of the second port on the RF spectrum module of the SkyRAN platform.



### C-RAN configurations

There are two types of C-RAN topologies: small and large C-RAN hub sites. In some cases, a macro cell site may be converted to a small C-RAN site where two or more macro cell sites are combined into one. Typically, for a small C-RAN site, the total count of fiber links are fairly low (below 50), the fiber spans are short (below 2 km) and point-to-point (using grey optics) is used as the transport mechanism between the baseband unit (BBU) and the RRH.

In the case of large C-RAN hub sites, the total number of links may be in the hundreds with fiber spans between the central BBU location and the remote antenna sites reaching up to 15 km (10 miles). For C-RAN hub sites, the transport mechanism between the BBU and the RRH may use grey optics for point-to-point communication but may also use colored optics (CWDM or DWDM) technology where cost savings are achieved with fiber count reduction.

## SkyRAN's INDUSTRY-LEADING FLEXIBILITY AND SCALABILITY: EASILY ADAPTS TO ANY TYPE OF C-RAN ARCHITECTURE

### Small C-RAN hub sites

Port count can be easily increased (beyond 18 ports) with external 1/2U optical switches to address testing and monitoring requirements of small C-RAN architectures. The external optical switch is available in various port densities such as 26 or 52 ports for simplex monitoring (uplink) or even duplex 26 ports monitoring (uplink and downlink).



Small C-RAN configuration, simplex, uplink, 26 ports, 1.5U



Small C-RAN configuration, simplex, uplink, 52 ports, 1.5U



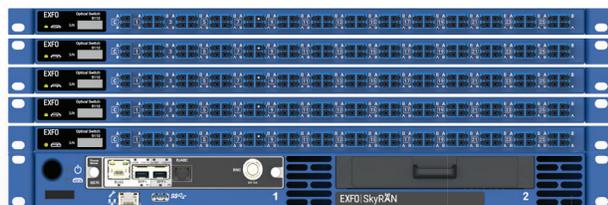
Small C-RAN configuration, duplex, uplink/downlink, 26 ports, 1.5U

### Large C-RAN hub sites

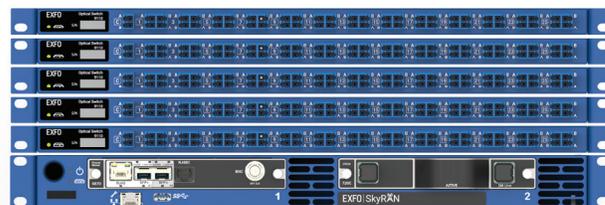
SkyRAN is designed to address large C-RAN hub site topologies with its on-demand and monitoring test features for the RF spectrum and the fiber network. SkyRAN is capable of monitoring hundreds of links at the RF and fiber level for grey or colored fronthaul transport systems.

SkyRAN can grow as the C-RAN hub site grows allowing for port count monitoring expansion by stacking external optical switches to increase the number of links to be monitored. SkyRAN external optical switches can easily be stacked to allow for monitoring of thousands of RF and fiber links. The decision factor of how many ports should be monitored using a single SkyRAN system comes down to desired testing availability (i.e., total amount of time required to test each port in a system).

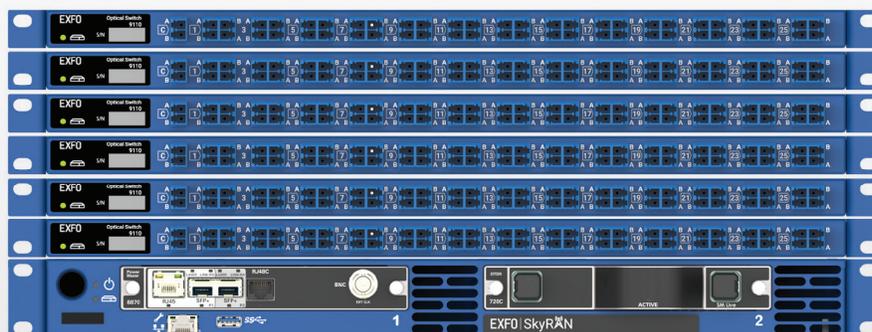
The dual port testing capabilities of SkyRAN's RF spectrum module doubles testing efficiency. For example, a C-RAN hub site containing 256 links can be separated into two sub-systems of 128 links each where each RF spectrum port can be used to simultaneously test a link from each subsystem. Now 256 links can be tested in the time it would normally take to test 128 links. If twice as fast still isn't fast enough, other options are still available such as deploying two SkyRAN systems.



Large C-RAN hub site configuration,  
256 RF uplink ports, 3.5U



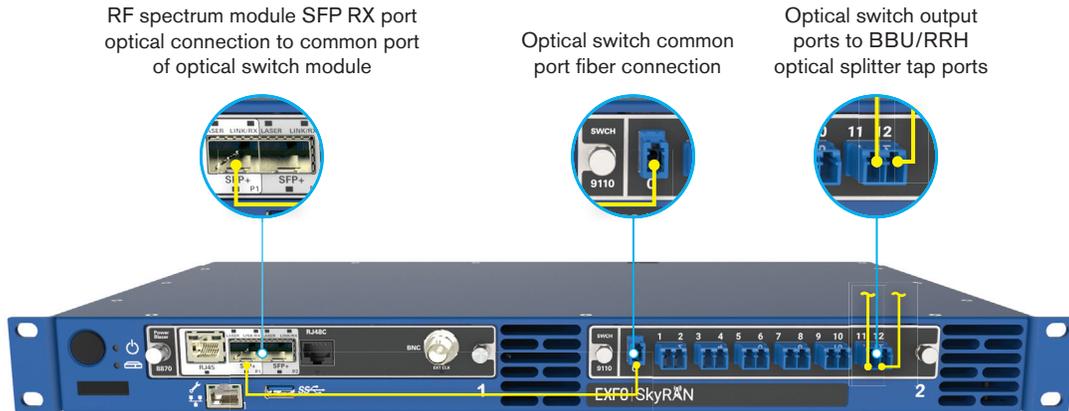
Large C-RAN hub site configuration,  
256 RF uplink, fiber monitoring, 3.5U (grey optics)



Large C-RAN hub site configuration, 256 uplink RF ports,  
plus 26 CWDM/DWDM fiber links, 4U  
(front USB port will be used in this configuration)

## RTU-2 PLATFORM / OPTICAL SWITCH CONNECTIONS

### Macro—optical connections



### Optical and electrical connections

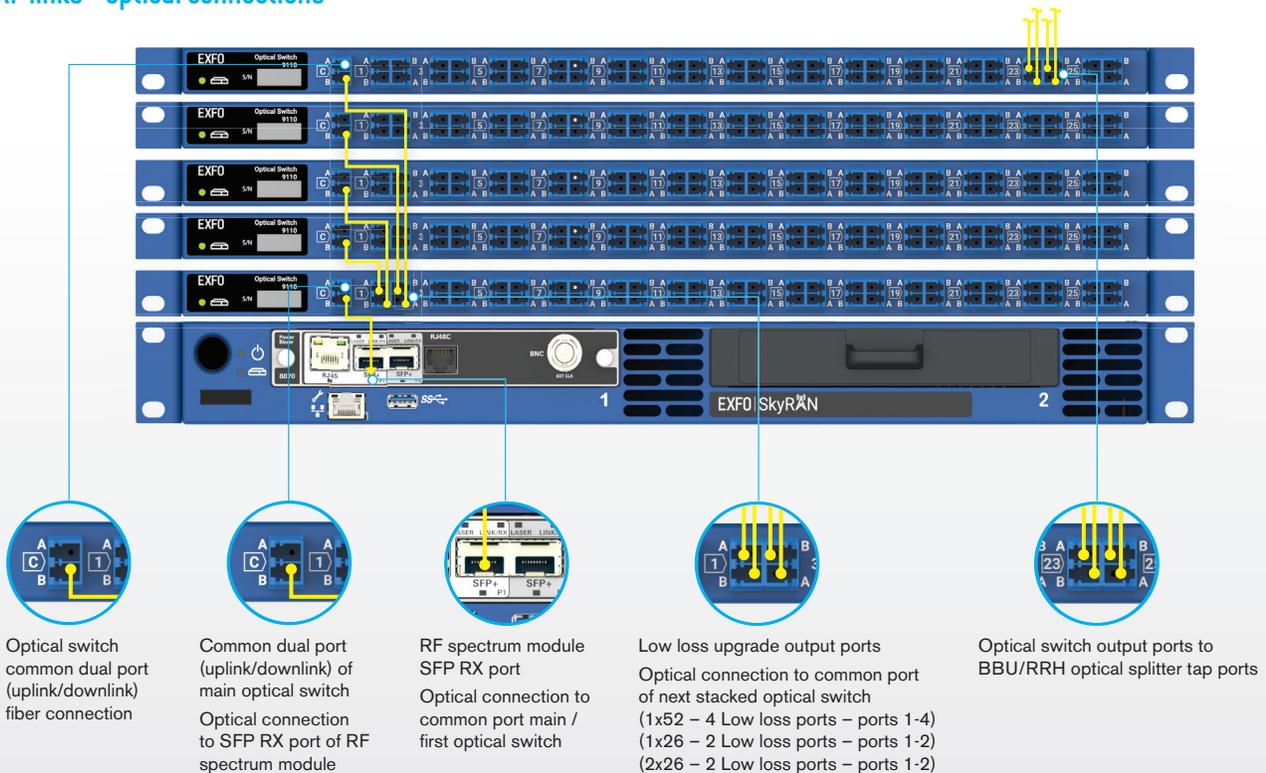
SkyRAN external optical switches can easily be stacked to allow for monitoring of hundreds of RF and fiber links.

The external 1/2U optical switches provide low loss upgrade ports for port count expansion. These upgrade ports are used to connect additional external optical switches to the main external optical switch. The simplex 1x26 and duplex 1x26 external optical switches have 2 upgrade ports (ports 1-2) and the 1x52 external optical switch has 4 upgrade ports (ports 1-4).

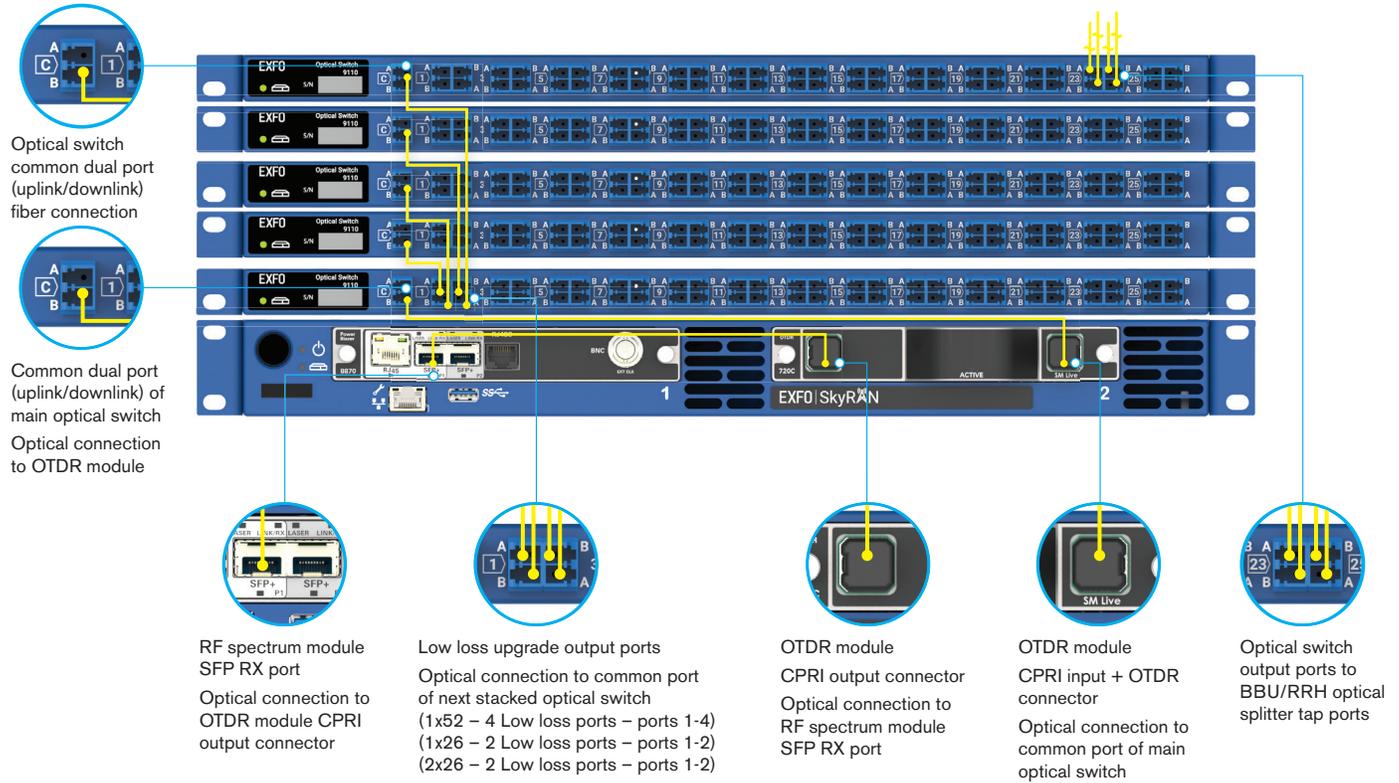
The external 1/2U optical switches are powered and controlled over its USB 3.0 interface. SkyRAN's processing platform, the RTU-2 provides five USB 3.0 interface on the rear panel and one USB 3.0 interface on the front panel in order to power and control up to 6 external optical switches which will provide 307 monitoring ports in a 4U height.

### Large hub site configuration

#### 256 RF links—optical connections

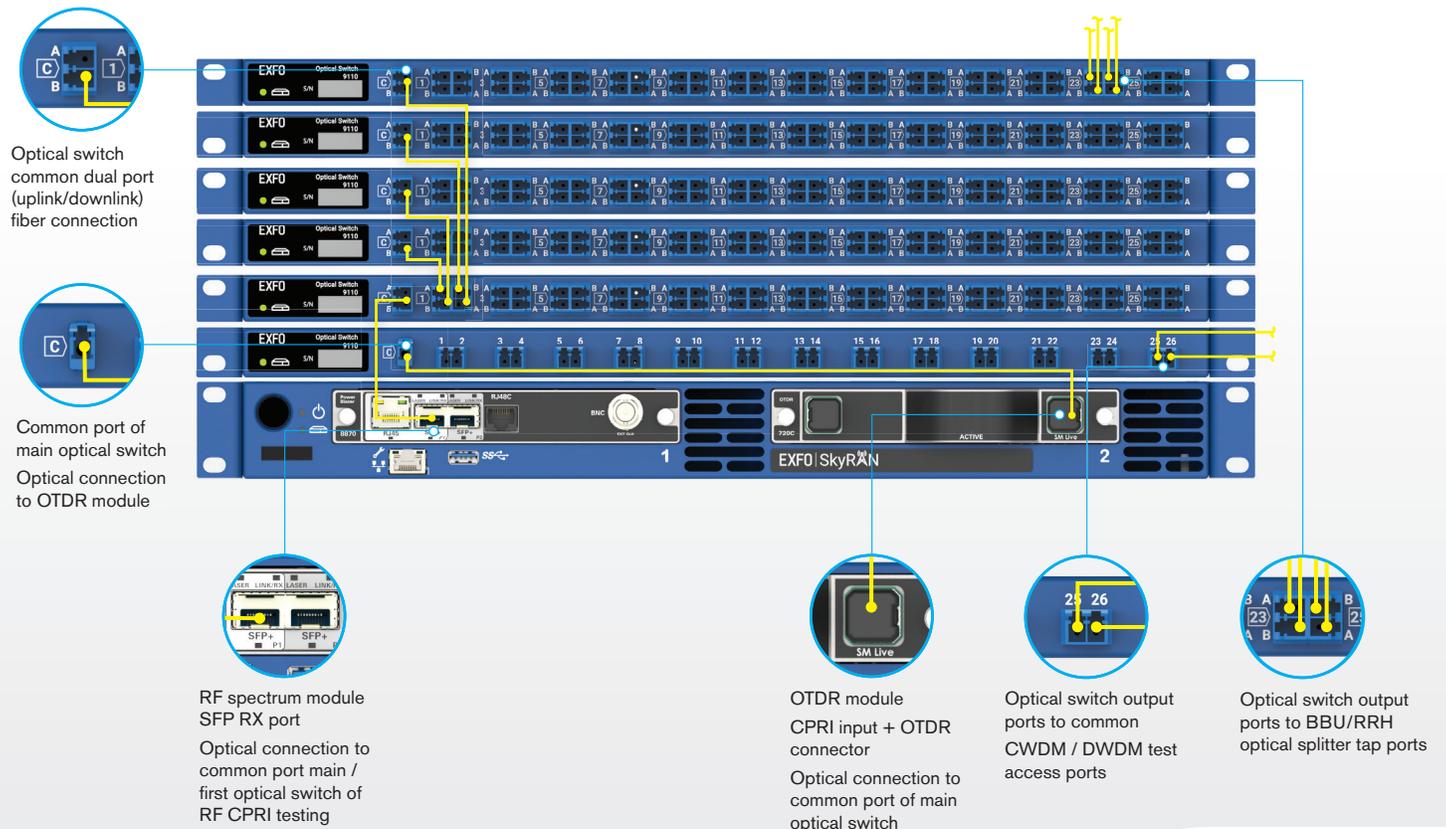


### 256 RF + OTDR (grey optics) links—optical connections



### 256 RF links / 26 OTDR (CWDM/DWDM colored optics) links—optical connections

Front USB port will be used in this configuration



## Modular, flexible and scalable solution



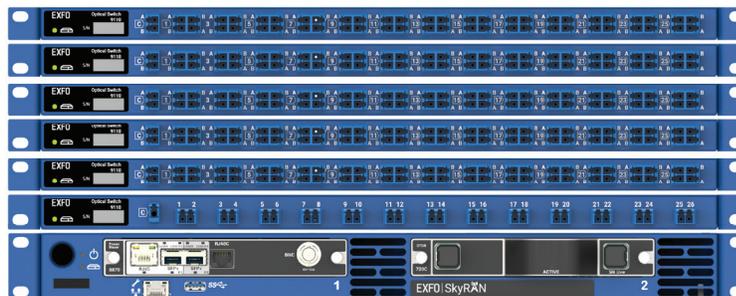
### Seamlessly add fiber monitoring for RAN or DAS topology

- › Best-in-class fiber monitoring solution with patented OTDR/iOLM technology



### Easily upgrade to higher rates

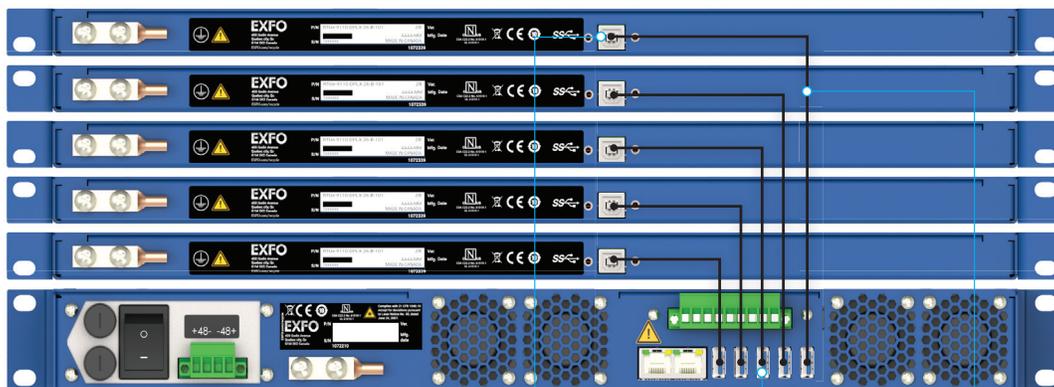
- › Future-proof solution allowing RF spectrum module upgrades to support higher CPRI and NGFI rates (+ 25 Gbit/s)



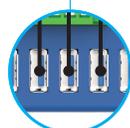
### Seamlessly expand port count capacity

- › Optical switches can be upgraded or stacked for higher port count

Rear view connections for power and communication to external optical switches



USB 3.0 Type A



USB 3.0 Type A (5 ports)



USB 3.0 Type A/B cable included with OSW

FIBER AND LOSS SPECIFICATIONS

500 m	Minimal length between RRH to the TAP
10 dB	Total loss between the OTDR and TAP going to the RRH
-35 dB	Maximum reflection between optical switch and the TAP

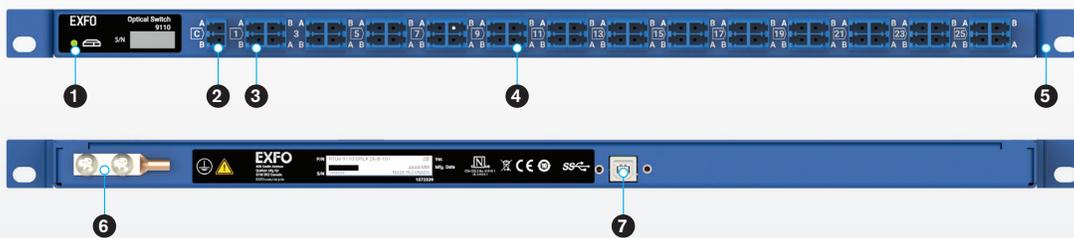
## SkyRAN PLATFORM SPECIFICATIONS



- |                              |                            |                                 |                           |
|------------------------------|----------------------------|---------------------------------|---------------------------|
| 1 Power button               | 5 Ethernet management port | 9 Removable rack mount brackets | 13 Ground lug             |
| 2 Power LED                  | 6 USB 3.0 port             | 10 -48V input circuit fuses     | 14 Dry contact relays (3) |
| 3 System information display | 7 Module - Slot 1          | 11 Main power switch            | 15 Ethernet ports         |
| 4 System LED                 | 8 Module - Slot 2          | 12 -48V dual feed input         | 16 USB 3.0 (5)            |

### SkyRAN PLATFORM SPECIFICATIONS

Mainframe	Quad-core Intel i7 processor / 8 GB / Windows 10
Front interfaces	1 x RJ45 10/100/1000 Mbit/s (management port) 1 x USB 3.0
Rear interfaces	2 x RJ45 10/100/1000 Mbit/s (management + Ethernet ports) 5 x USB 3.0 Relay contact: 3 (power, system and user configurable)
Storage	128 GB SSD internal memory (ordering option: 1 TB SSD)
Power supply	Dual -48 V input, 10 A
Power consumption	Idle state 25 W Full state 113W
Dimensions (H x W x D) (includes brackets)	44 mm (1 U) x 482 mm x 262 mm (1 3/4 in x 19 in x 10 3/8 in)
Weight (includes brackets)	5.1 kg (11.2 lb)
Temperature	Operating -5 °C to 50 °C (23 °F to 122 °F) Storage -40 °C to 70 °C (-40 °F to 158 °F)



- |  |   |                       |
|--|---|-----------------------|
| 1 System LED                                 | 4 Optical switch output ports to BBU/RRH optical splitter tap ports | 6 Ground lug          |
| 2 Common port                                | 5 Removable rackmount brackets                                      | 7 USB 3.0 Type B port |
| 3 Low loss upgrade output ports <sup>a</sup> |   |                       |

**Note**

a. Optical connection to common port of next stacked optical switch  
 (Simplex 1x52 – 4 low loss ports – ports 1-4)  
 (Simplex 1x26 – 2 low loss ports – ports 1-2)  
 (Duplex 1x26 – 2 low loss ports – ports 1-2)

## RF SPECTRUM AND OTDR MODULE SPECIFICATIONS

### RF spectrum analysis over CPRI module

#### SPECIFICATIONS



<b>Module</b>	<a href="#">FTBx-8870</a>
<b>Optical input power range</b>	Flexible—dependent on optical SFP module used
<b>CPRI ports</b>	Dual port capabilities
<b>CPRI link rate</b>	1.2 Gbit/s to 9.8 Gbit/s (CPRI option 2 to 7) Hardware ready for 10.1 Gbit/s to 12.1 Gbit/s (CPRI option 8-9)
<b>Power consumption</b>	25 W

### OTDR module

#### SPECIFICATIONS



<b>Module</b>	<a href="#">FTBx-730C-SM7</a> FTBx-730C-SM7-TAM <sup>a</sup>
<b>Operating wavelength</b>	1650 nm
<b>Power consumption</b>	2.5 W

**Note**

a. This model features an integrated filter to inject iOLM tests and bypass CPRI signals to an output port, towards the ORF analyser.

## CONFIGURATIONS—OPTICAL SWITCH MODULES

12 ports, simplex 1x12 optical switch module (uplink)  
single fiber, LC/UPC port interface, singlemode

**FTBx-9110-SPLX-12**



18 ports, simplex 1x18 optical switch module (uplink)  
single fiber, LC/UPC port interface, singlemode

**FTBx-9110-SPLX-18**



12 ports, duplex 1x12 optical switch module (uplink and downlink)  
dual fiber, LC/UPC common port interface, singlemode, MPO output interface

**FTBx-9110-DPLX-12**



## CONFIGURATIONS—EXTERNAL OPTICAL SWITCH

External 1/2U optical simplex 1x26 switch,  
single fiber, LC/UPC port interface, singlemode

**RTUe-9110-SPLX-26**



External 1/2U optical simplex 1x52 switch,  
single fiber, LC/UPC port interface, singlemode

**RTUe-9110-SPLX-52**



External 1/2U optical simplex 1x26 switch,  
dual fiber, LC/UPC common port interface, singlemode

**RTUe-9110-DPLX-26**



**ORDERING INFORMATION**

SkyRAN-XX-XX-XX-XX-XX-XX-XX<sup>a</sup>

**Memory**

128G = 128 GB internal SSD storage disk  
1TB = 1 TB internal SSD storage disk

**RF spectrum**

00 = without OpticalRF  
FTBx-8870 = OpticalRF–RF spectrum over CPRI

**Optical transceiver**

00 = Without optical transceiver  
SFP-8600 = SFP+ multirate optical transceiver module (1310 nm)  
SFP-8603 = SFP+ multirate optical transceiver module (1310 nm)

**OTDR**

00 = Without OTDR  
730C-SM7 = Singlemode iOLM module  
730C-SM7-TAM = Singlemode iOLM module with pass-through port<sup>c</sup>

**Client software options**

00 = Without client software option<sup>d</sup>  
SSL = SSL certificate  
STD = Connect to SkyRAN application server

**Power input**

DC = Internal DC 48V power supply  
AC = External 48V DC dual input feed with power cord

**Internal optical switch**

00 = Without internal optical switch  
U12 = Simplex 1x12  
U18 = Simplex 1x18  
UD12 = Duplex 1x12

Example 1: SkyRAN-128GB-8870-SFP-8600-730C-SM7-TAM-00-DC-STD  
Example 2: SkyRAN-1TB-00-00-730C-SM7-U12-DC-SSL

**Notes**

- a. You can select up to two different modules among: RF spectrum, and OTDR and internal optical switch
- b. Requires purchase of optical transceivers (SFP/SFP+)
- c. OTAM mandatory when selecting RF spectrum and OTDR modules
- d. Call factory before ordering without client software option

**EXFO Headquarters** > Tel.: +1 418 683-0211 | Toll-free: +1 800 663-3936 (USA and Canada) | Fax: +1 418 683-2170 | info@EXFO.com | [www.EXFO.com](http://www.EXFO.com)

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