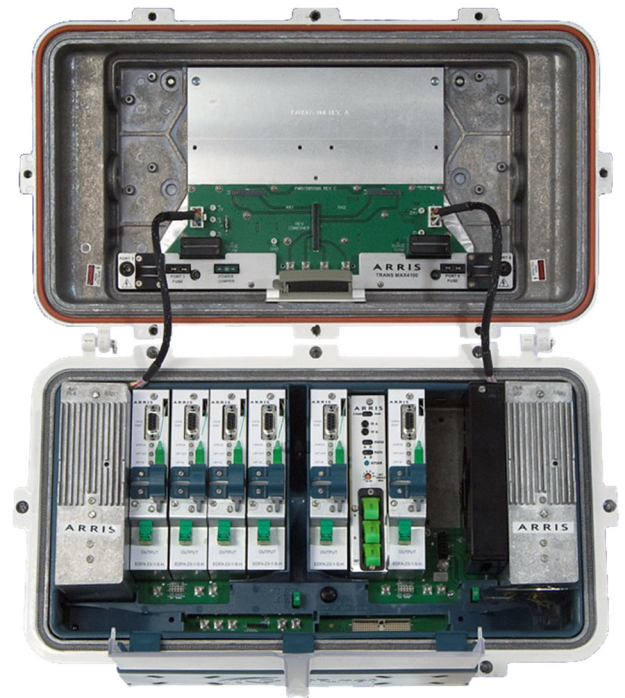


Trans Max[®] Hardened Field Hubs

TM4100-A Field Optical Amplifier

FEATURES

- Supports migration to fiber deep networks by maximizing fiber usage
- Full spectrum multiwavelength solutions simplify complicated designs
- Hub reductions help to lower maintenance OPEX
- High density optical passives simplify fiber management
- Extends network reach utilizing optical amplification



PRODUCT OVERVIEW

The Trans Max[®] TM4100 (TM4100-A) is an essential part of evolving multiwavelength HFC networks. The TM4100 can be strategically located to extend C-Band optical signals up to 100 km, reaching new subscribers. The field hardened TM4100 features an optional optical switch to provide redundancy for improved customer Quality of Experience (QoE). Redundant load-sharing power supplies within the TM4100 further improve network protection. In addition, operators have the option of monitoring TM4100 products with digital return transmitters remotely through CORView[™], which can reduce unplanned outages.

Faster Time to Revenue

Operators can configure a single TM4100-A to accommodate up to 6 transport fibers and support bidirectional optical architectures for forward and return transport. When used with the CHP CORWave® II forward transmitters, operators can support multiple wavelengths on as little as one fiber. Modules include single output with constant gain or constant power at 17 or 21 dBm, single output with constant gain at 20.5 and 23.5 dBm, or a dual output with constant power at 19 dBm per port. No special RF accessories are required to set up the optical amplifier – configuration and monitoring is done via the craft GUI. Customized optical passives platforms support a wide range of optical designs and facilitate ease of installation.

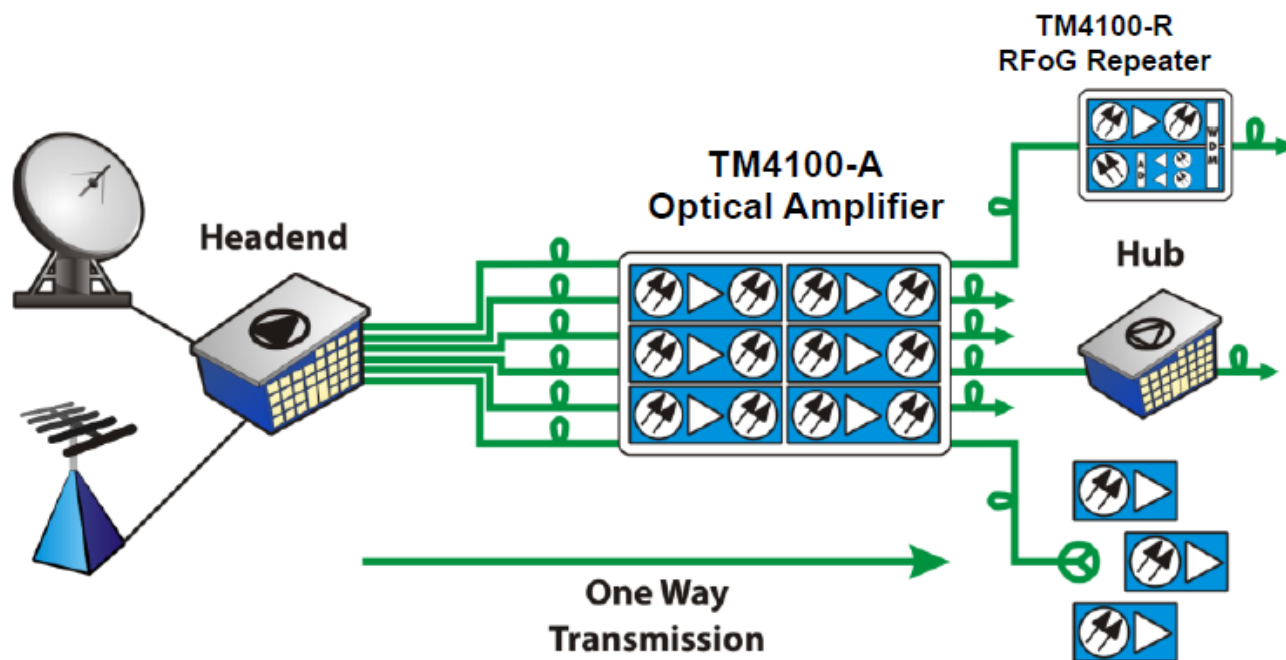
Lower OPEX with Reduced Inventory SKUs

Commonality with OM4100 optical nodes reduces sparing and inventory SKUs of the housing, power supply modules, return transmitters, EDFA modules, and interface board. This commonality also allows operators to convert from an OM4100 node configuration to a TM4100-A if needed.

APPLICATION DIAGRAMS

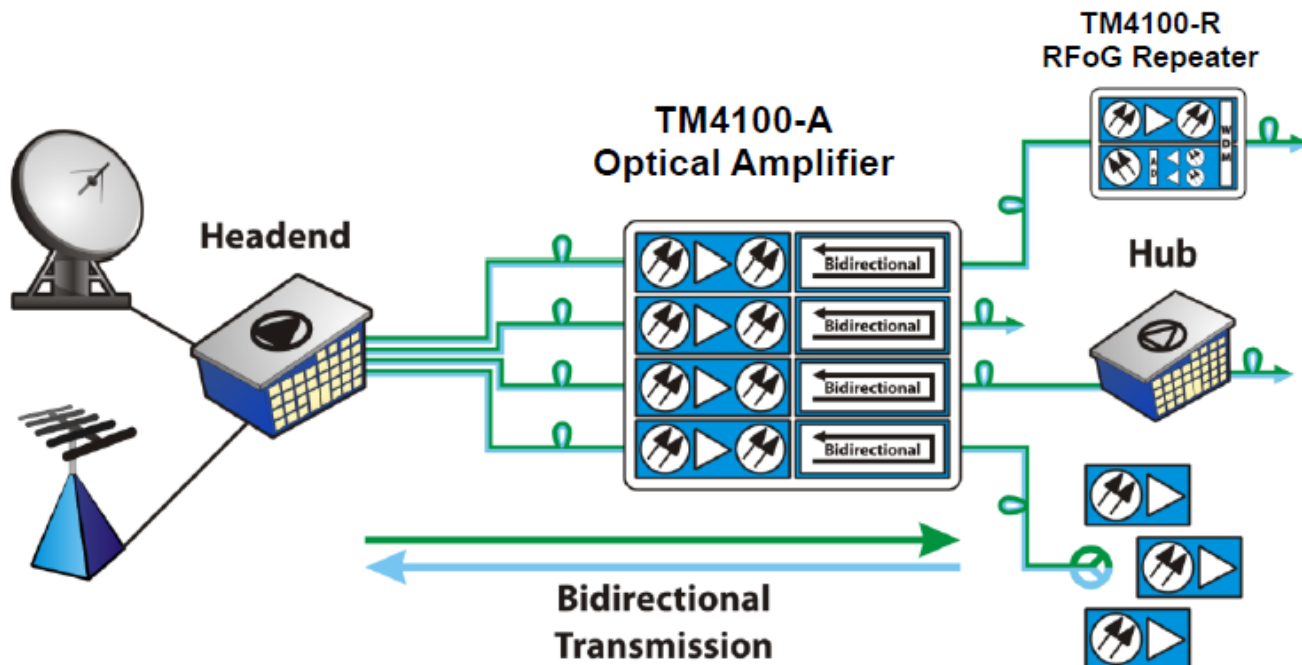
One Way (per fiber) Operation

The following diagram shows a TM4100 configured as a field-hardened optical amplifier. In this configuration, the TM4100 can support up to six EDFAs in a Trans Max housing that is set up for one-way transmission. This allows the field optical amplifier station to manage up to six transport fibers at a single location. The optical amplifier in this illustration is configured to handle six transport fibers that could be used to feed additional hub sites, RFoG repeater service groups, or groups of HFC optical nodes. Each module can have signals flowing from left to right or right to left within the same housing.



Bidirectional (per fiber) Operation

The following diagram shows a TM4100-A configured as an optical amplifier. In this configuration, the TM4100 can support up to four EDFA modules (up to 3 EDFAs with EMS), and associated bidirectional optical passive modules, in a Trans Max housing when it is set up for bidirectional transmission on each fiber. This allows the field optical amplifier station to manage up to four bidirectional transport fibers at a single location. The optical amplifier in this illustration is configured to handle four transport fibers that could be used to feed additional hub sites, RFoG repeater service groups, or groups of HFC optical nodes bidirectionally.



ARRIS Solutions

ARRIS solutions for coax architectures include the Opti Max™ segmentable optical nodes, 1 GHz GMODs, the CHP CORWave® and CHP CORWave® II multiwavelengths transmitters and digital return receivers, the Trans Max® TM4100 RFoG Repeater, and a full range of customizable optical passives. Please contact your ARRIS sales professional for more information on these products.

SPECIFICATIONS

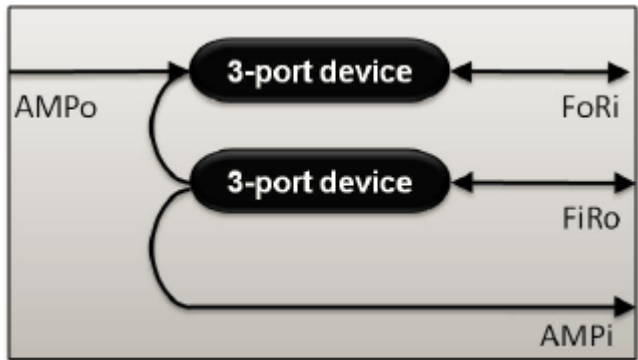
Optical Amplifiers (EDFAs)						
OM4-EDFA-						
Characteristics	17-1-S-N	21-1-S-N	19-2-S-N	20-1-S-H	23-1-S-H	23-1-S-K
Optical Input Power						
Constant Gain Mode, dBm ^{1,2}	-10 to 12	-10 to 12	NA	0 to 14.5	2 to 15	-2 to 15
Constant Power Mode, dBm ^{3,4}	-3 to 12	-3 to 12	-3 to 12	NA	NA	7 to 17
Wavelength Range, nm	1530 – 1562			1527 – 1562		
Optical Input Connector	SC/APC			SC/APC		
Optical Output Power						
Minimum Output Power per Port, dBm	17.0	21.0	19.0	20.5	23.5	23.5
Number of Output Ports	1	1	2	1	1	1
Power per Port Tolerance, dB	NA	NA	+0.5 / -0.0	NA	NA	NA
Maximum Output Power Variation, dB ⁵	± 0.5			± 0.5		
Maximum Gain Variation, dB ⁶	± 0.5			± 0.5		
Residual Pump Power, dBm	-35			-35		
Optical Output Connector(s)	SC/APC			SC/APC		
ASE Noise Figure						
-10 to 0 dBm in 1550 ± 5 nm, dB (Typ/Max)	4.5/4.8	4.5/4.8	4.5/4.8 ⁵	NA	NA	NA
-10 to 0 dBm in 1530-1562 nm, dB (Max)	5.5	5.5	5.5 ⁵	NA	NA	NA
0 to 6 dBm in 1550 ± 5 nm, dB (Typ/Max)	5.5/6	5.5/6	5.5/6	NA	NA	NA
0 to 6 dBm in 1530-1562 nm, dB (Max)	6.5	6.5	6.5	NA	NA	NA
> 6 dBm in 1550 ± 5 nm, dB (Typ/Max)	5.5/6	5.5/6	5.5/6	NA	NA	NA
> 6 dBm in 1530-1562 nm, dB (Max)	8.0	8.0	8.0	NA	NA	NA
2dBm to 13.5 dBm in 1540-1562nm, dB (Typ/Max)	NA	NA	NA	5/6.0	5/5.5	5/5.5
2dBm to 13.5 dBm in 1528-1562nm, dB (Typ/Max)	NA	NA	NA	6/7.0	6/6.5	6/6.5
Gain Flatness						
Optimum Gain, dB	11.0	14.0	NA	8.0	10.0	10.0
Minimum Settable Gain, dB	7.0	10.0	NA	6.0	8.5	8.5
Maximum Settable Gain, dB	15.0	18.0	NA	10.0	11.5	11.5
1535-1560nm, dB	± 1.5	± 1.5	NA	NA	NA	NA
1525-1562nm, dB	± 3.0	± 3.0	NA	1.5 (pk-pk)	3.5 (pk-pk)	3.5 (pk-pk)
1540-1562nm, dB	NA	NA	NA	1.2 (pk-pk)	1.1 (pk-pk)	1.1 (pk-pk)
Dynamic Gain Tilt from 1540-1562 nm, dB	NA	NA	NA	0.5	0.3	0.3
Dynamic Gain Tilt from 1525-1562 nm, dB	NA	NA	NA	0.9	1.0	1.0
EDFA Environmental						
EDFA Operating Temperature Range, ° C ⁷	-30 to 75 (-22 to 167° F)					
EDFA Storage Temperature Range, ° C	-40 to 85 (-40 to 185° F)					

SPECIFICATIONS

General EDFA	
Input/Output Isolation, dB	30
Input/Output Return Loss, dB	-55
Polarization Mode Dispersion, dB	0.5
Polarization Dependant Loss, ps	0.3
Transient Response, ms	10
EDFA Powering Requirement	
DC Current, mA @ 24 VDC	425
DC Current, mA @ 12 VDC	150
DC Current, mA @ 5 VDC	30
General Trans Max Specifications	
Number of AC Powering Ports	2
Number of Optical Ports	4
Operating Temperature Range, ° C	-40 to 60 (-40 to 140° F)
Weight, Crated/Uncrated	42 lbs (19.1 kg)/40 lbs (18.1 kg)
Dimensions, Crated, W x H x D	23.25 x 15.3 x 13.63 inches (59.1 x 38.9 x 34.6 cm)
Dimensions, Uncrated	20.0 x 11.7 x 10.2 inches (50.8 x 29.7 x 25.9 cm)

4 Port Bi-directional Optical Passive Module (P/N OCRD04H0000PB)

Channel Optical Performance	
Central Wavelength, nm	1550
Bandwidth, nm	1550 ± 30
Insertion Loss	
AMPo to FoRi or FiRo to AMPi, dB max.	0.9
FoRi to FiRo, dB max.	1.8
Isolation @ 23° C	
FoRi – AMPo or AMPi – FiRo, dB min.	40
FiRo to FoRi, dB min.	60



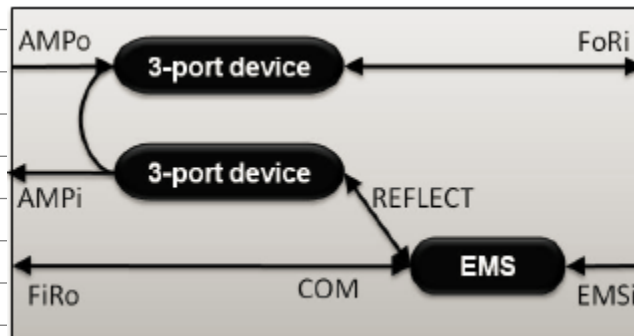
General Optical Performance	
Directivity	
AMPo to FiRo or FoRi to AMPi, dB min.	50
AMPo to AMPi, dB min	70
Return Loss, dB min.	50
Polarization Dependent Loss, dB max.	0.2
Polarization Mode Dispersion, ps max.	0.1
Power Handling, mW max.	500
Operating and Storage Temperature	-40 to 85° C (-40 to 185° F)

SPECIFICATIONS

5 Port Bi-directional Optical Passive Module (P/N OCRD05H0650PB)

Channel Optical Performance

Central Wavelength, nm	1550
Bandwidth, nm	1550 ± 30
Insertion Loss8	
AMPo to FoRi or FiRo to AMPi, dB max.	0.9
FiRo to AMPi, dB max.	1.50
FoRi to FiRo, dB max.	2.4
EMSi to FiRo, dB max.	0.8



Isolation @ 23° C	
FoRi – AMPo or AMPi – FiRo, dB min.	40
FiRo to FoRi, dB min.	60

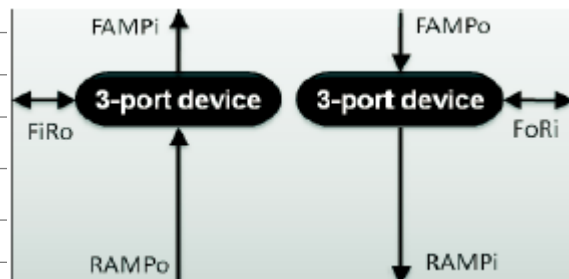
General Optical Performance

Directivity	
AMPo to FiRo or FoRi to AMPi, dB min.	50
AMPo to AMPi, dB min	70
Return Loss, dB min.	50
Polarization Dependent Loss, dB max.	0.2
Polarization Mode Dispersion, ps max.	0.1
Power Handling, mW max.	500
Operating and Storage Temperature	-40 to 85° C (-40 to 185° F)

6 Port Bi-directional Optical Passive Module (P/N OCRD06H0000PB)

Channel Optical Performance

Central Wavelength, nm	1550
Bandwidth, nm	1550 ± 30
Insertion Loss8, RAMPo to FiRo, FiRo to FAMPi, FAMPo to FoRi, or FoRi to RAMPi, dB max.	0.9
Isolation @ 23° C, FiRo to RAMPo, FAMPi to FiRo, FoRi to FAMPo, or RAMPi to FoRi, dB min.	40



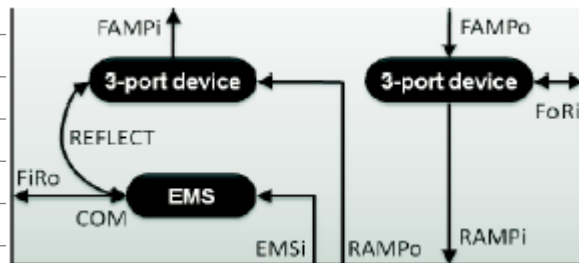
General Optical Performance	
Directivity, FiRi to RoFo, dB min.	50
Return Loss, dB min.	50
Polarization Dependent Loss, dB max.	0.2
Polarization Mode Dispersion, ps max.	0.1
Power Handling, mW max.	500
Operating and Storage Temperature	-40 to 85° C (-40 to 185° F)

SPECIFICATIONS

7 Port Bi-directional Optical Passive Module (P/N OCRD07H0650PB)

Channel Optical Performance

Central Wavelength, nm	1550
Bandwidth, nm	1550 ± 30
Insertion Loss ⁸	
EMSi to FiRo, dB max.	0.8
FAMPo to FoRi or FoRi to RAMPi, dB max.	0.90
FiRo to FAMPi or RAMPo to FiRo, dB max.	1.50
Isolation @ 23° C, FAMPi to FiRo, FoRi to FAMPo, RAMPi to FoRi, or FiRo to RAMPo, dB min.	40



General Optical Performance

Directivity, RAMPo to FAMPi or FAMPo to RAMPi, dB min.	50
Return Loss, dB min.	50
Polarization Dependent Loss, dB max.	0.2
Polarization Mode Dispersion, ps max.	0.1
Power Handling, mW max.	500
Operating and Storage Temperature	-40 to 85° C (-40 to 185° F)

Optical Switch

Optical Characteristics

Operating Wavelength Range, nm	1260 to 1620
Input Optical Power Range, dBm ⁹	-10 to +20
Insertion Loss, dB	< 2
Optical Crosstalk, dB	> 50
Optical Return Loss, dB	> 45
Optical Isolation, dB Typ. ¹⁰	30
Optical Connector Type	SC/APC

Switching Characteristics

Switching Time, ms ¹¹	< 20
Switch Type	Latching
Optical Switching Threshold Ranges, dBm	+15 to -10 (3 dB Steps)
Optical Power Test Point, V/mW ¹²	1.0 (1 mW/V) Low Scale or 0.1 (10 mW/V) High Scale with automatic scaling
Optical Power Test Point Accuracy	10%
Wait Time Before Restoration, Seconds Typ. ¹³	30

SPECIFICATIONS

Operational Switching Table

Operating Mode	Path A Input	Path B Input	Path Selected
Automatic	Above Threshold	Above Threshold	Path A
Automatic	Above Threshold	Below Threshold	Path A
Automatic	Below Threshold	Above Threshold	Path B ¹⁴
Automatic	Below Threshold	Below Threshold	Path A
Force B	Independent of Input Level	Independent of Input Level	Path B
Force A	Independent of Input Level	Independent of Input Level	Path A

Visual Indicators

Status LEDs

Green	Optical input power of associated path above threshold.
Red	Optical input power of associated path below threshold.
Amber ¹⁵	Optical input power of associated path less than 10% above threshold.

Path LEDs

Green	Indicates active path and operating in automatic mode.
Flashing Green	Indicates active path and operating in Forced mode. Must press AUTO/A/B path control switch to change operating mode.
Flashing Red	Optical switch error—path not switching.

Notes:

- When operating in Constant Gain Mode, the sum of the input power and the gain set-point should not exceed the nominal output power or the high output power shutdown may be triggered.
- Laser emissions shall turn off when the input power is < -2 dBm for OM4-EDFA-23-1-S-H, < -4 dBm for OM4-EDFA-20-1-S-H, and < -10 dBm for OM4-EDFA-17-1-S-N and OM4-EDFA-21-1-S-N. Laser emissions shall turn on when the input power is > 1 dBm for OM4-EDFA-23-1-S-H, > -1 dBm for OM4-EDFA-20-1-S-H, and > -7 dBm for OM4-EDFA-17-1-S-N and OM4-EDFA-21-1-S-N.
- EDFAs operating in Constant Power Mode will meet output power specifications with input power levels > -3 dBm. At input power levels between -10 and -3 dBm, the EDFA will attempt to maintain the set point output power but it may be less than specifications.
- Laser emissions shall turn off when the input power is < -10 dBm for OM4-EDFA-17-1-S-N, OM4-EDFA-21-1-S-N, and OM4-EDFA-19-2-S-N. Laser emissions shall turn on when the input power is > -7 dBm for OM4-EDFA-17-1-S-N, OM4-EDFA-21-1-S-N, and OM4-EDFA-19-2-S-N.
- Variation of optical power over specified temperature, wavelength, and all polarization states.
- Gain will not vary more than ± 0.5 dB when adding or subtracting wavelengths in AGC mode.
- Representative of the Trans Max4100 internal temperature range when the node is operating in an external temperature range of -40° C to 60° C.
- Insertion loss excluding connectors. A pair of connectors have a loss of 0.5 dB maximum and 0.3 dB typical.
- EMS monitorable to 18 dBm maximum.
- Isolation specification for the downstream optical power monitored from the upstream transmitter.
- Optical threshold settings lower than 10 dB below the optical input may delay switching by 15 ms typical.
- Test Points use two ranges as listed. The correct range is automatically set and indicated on the device.
- Automatic return to path A, after a switch to path B, has a 30 second delay that will self-reset each time in that 30 second period that path A's input level drops below the threshold.
- If the input to path B remains above threshold and the input to path A goes above threshold and remains there for 30 seconds, the optical switch will switch back to path A.
- Optical threshold is set within the hysteresis window for path B to switch back to path A. To avoid unintended switching, set the threshold lower.

RELATED PRODUCTS

DOCSIS Transponder	Optical Patch Cords
Power Supplies	Optical Passives
Management Module	Installation Services

Note: Specifications are subject to change without notice.

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(rev 11-2014)

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Optical Hub-TM4100

Fiber-Deep

DOCSIS® 3.1

Node Segmentation

HPON™/RFOG

FTTx