



# Optical and HFC Platform Update

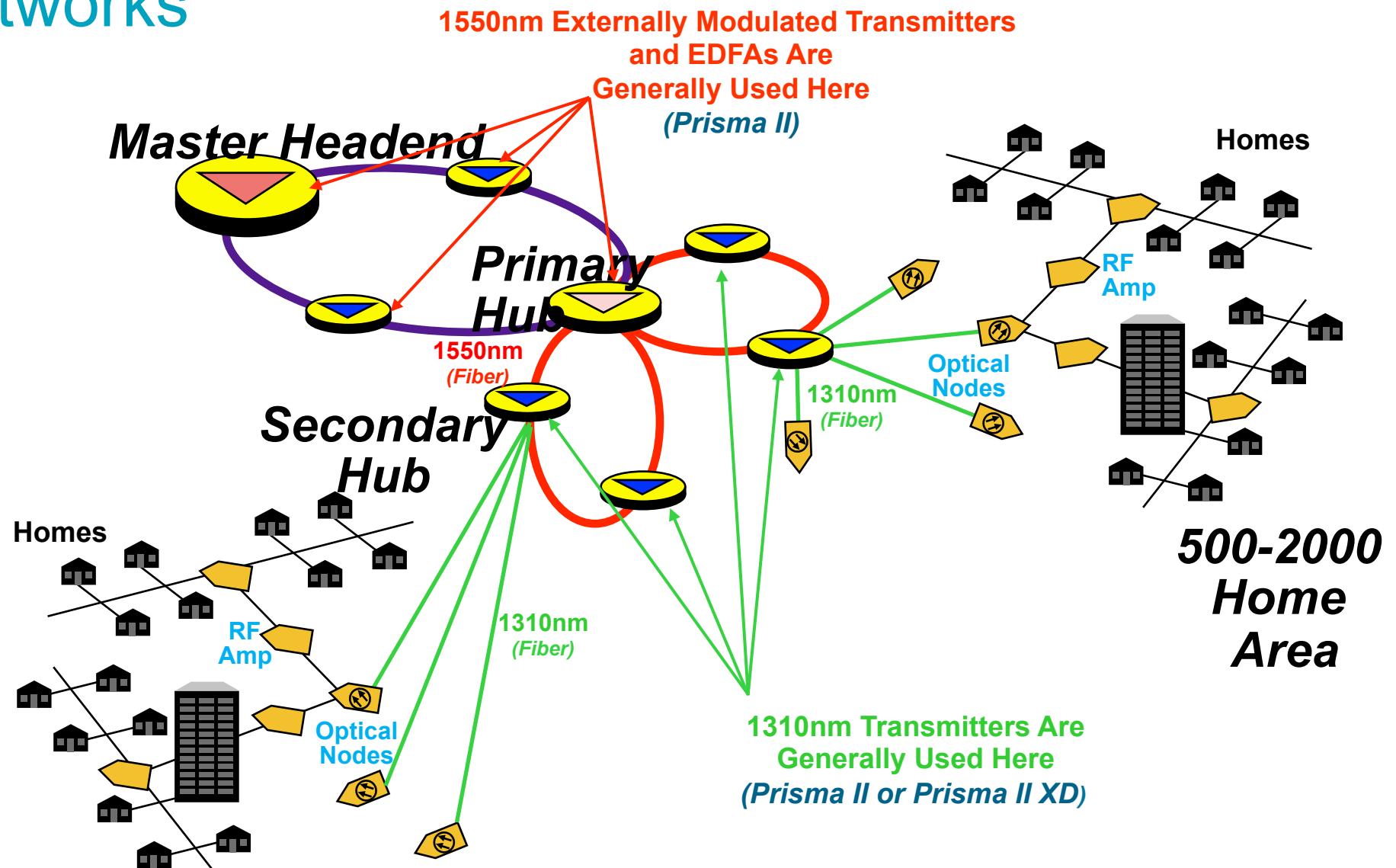
Mike Jensen  
Systems Engineer

September 16, 2015

# Agenda

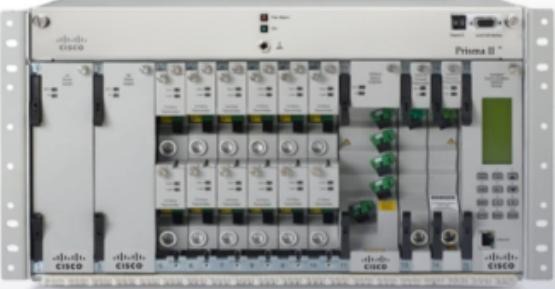
- Optical Platform Overview
- Architectual Drivers
- Prisma II Modules
- SuperQAM XFP
  - XDP Chassis
- EDR – Enhanced Digital Return
- Optical Nodes and Amplifiers
  - OEM Partnership

# Access Networks



# Prisma II Chassis Platforms Overview

Prisma II



- Full height - 6 RU
- Highest flexibility/ performance platform
- 12 module slots, HD host cards double capacity
- AC or DC powering
- Full platform monitoring
- Broadcast Tx, 1310, MW, LRMW, SuperQAM, XFP, RFoG, EDFAs, Rx, bdr, EDR, Optical SW

Prisma II XD



- Medium height - 3 RU
- High density platform
- 16 module slots
- Low power consumption, 7.5W per module
- AC or DC powering
- Full platform monitoring
- Broadcast Tx, 1310, MW, SuperQAM, XFP, EDFAs, Rx, EDR, Optical SW

Prisma II – 1RU

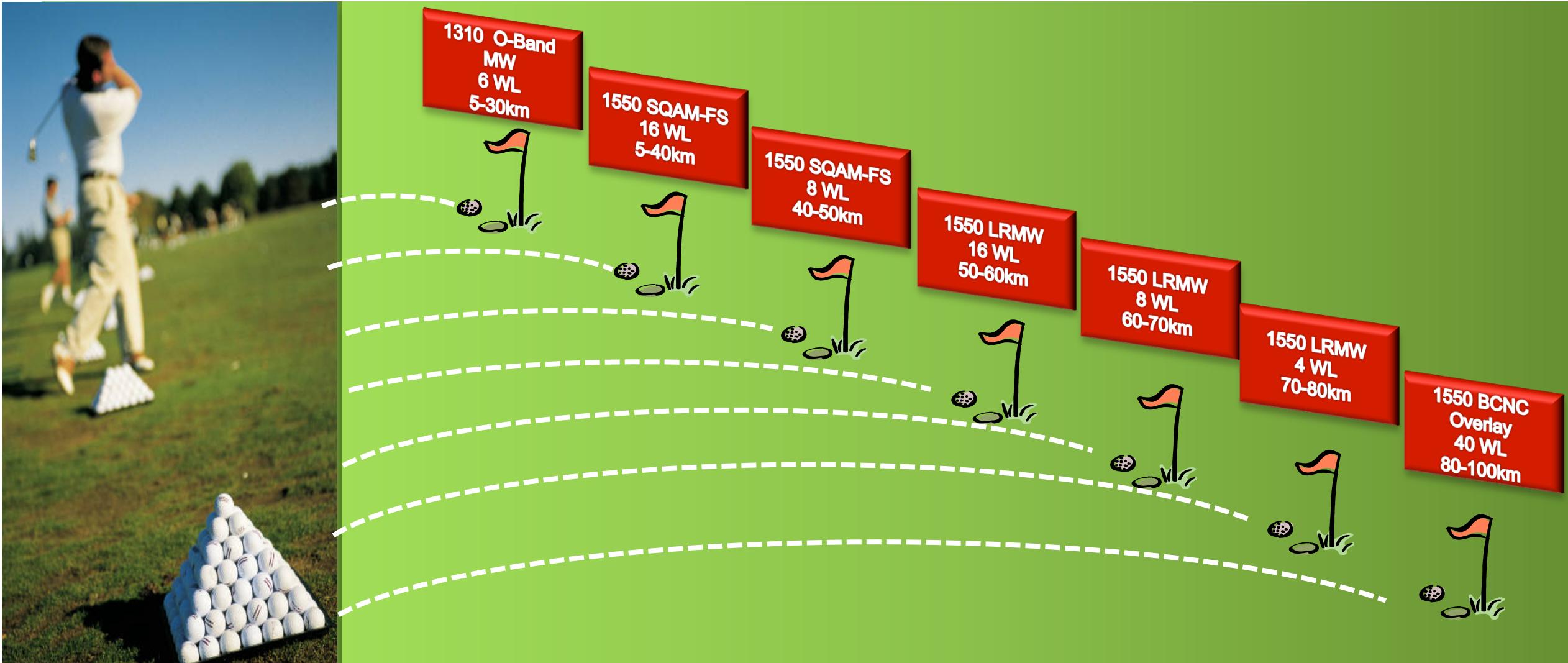


- Low profile - 1 RU
- Highest density platform
- 10 XFP module slots
- AC or DC powering
- Full platform monitoring
- Fixed and Tunable SuperQAM

# Drivers for Cable Optical Architectures

- **Distance** – are these short links, or is it long haul?
- **Analog Loading** – Full, Partial or All Digital?
- **Fiber** Rich vs. Fiber Poor
- **CAPEX** – what problem are you trying to solve, and what is the least expensive architecture?

# Solution Selection ~ Wedge, Iron or Wood?



# 1310 Forward Tx

New Product!  
Avail now

- DOCSIS 3.1 ready – supporting 1.2 GHz
- HD form factor allowing up to 26 transmitters in a Prisma II Chassis, or 16 in the Prisma XD
- Dual RF inputs for broadcast video and narrowcast content
- Optical Output Power
  - Standard: 3, 5, 6, 8, 10, 12, 14, and 15 dBm
- Excellent distortion performance:
  - CTB: -69 dBc, CSO: -64 dBc
- Low power consumption – 7.5W per Tx



# SuperQAM Tx (C-band)

New Product!  
Avail now

- DOCSIS 3.1 ready – supporting 1.2 GHz
- 10 dBm optical output power
- Reach distances of over 100 km with amplification
- ITU 40 and iWDM (16) WL plans supported



- HD form factor allows up to 26 transmitters in a Prisma II Chassis (16 in the Prisma XD)
- Supports both overlay and direct fed architectures – one transmitter!
- Low power consumption – 7.5W per Tx

# Long Reach Multiwave (C-band); LRMW

- Forward 1GHz transmitter, optical output powers of 8dBm and 12.5dBm
- Reach distances of over 100 km with amplification
- iWDM wavelength plan, up to 16 wavelengths
- Supports full 78 ch analog loading
- Single-wide Prisma II application module allowing up to 13 per chassis
  - Not an application module for the Prisma II XD
- Longest reach, highest performance 1GHz transmitter



## Multiwave

|             |    |
|-------------|----|
| Distance    | 30 |
| Wavelengths | 6  |
| Loading     | 78 |

## SuperQAM

|             |      |
|-------------|------|
| Distance    | 100+ |
| Wavelengths | 40   |
| Loading     | 0    |

## SuperQAM FS

|             |      |
|-------------|------|
| Distance    | 100+ |
| Wavelengths | 16   |
| Loading     | 30   |

## LRMW

|             |      |
|-------------|------|
| Distance    | 100+ |
| Wavelengths | 16   |
| Loading     | 30   |

# PII 1550nm EM Broadcast TX

## Overview

The Prisma II 1550 nm Externally-Modulated Transmitters (EMTs) are plug-in modules for the Prisma II platform. These transmitters are ideally suited to transport broadcast signals over large distances

## Features

- 1 GHz RF passband
- Status LEDs indicate module condition and simplifies troubleshooting
- Superior Stimulated Brillouin Scattering (SBS) suppression
- RF predistortion for maximum CNR while maintaining excellent CTB and CSO performance
- User selectable Automatic Gain Control (AGC)
- Nonvolatile storage of preset settings
- -20 dB test point
- Optical Output Power: 10 dBm
- Performance: 78 NTSC + 200 QAM: CNR: 51.5, CSO -65, CTB -65

## Transmitter Options

- Long Reach Tx: Pre-tuned for 60km
- Extended Reach Tx: Pre-tuned for 80km
- High Performance Supertrunk Long Haul Tx
- Available in ITU or Non ITU (ITU available only on select models)



# PII 1550nm EDFA – standard versions

## Overview

The Prisma II Optical Amplifiers offer a broad range of output powers in stand-alone modules. Operating over a wide range of input powers from a Prisma II 1550 nm Transmitter or another 1550 nm Optical Amplifier upstream, the amplifier modules provide reliable, high-performance transmission of voice, video, and data signals for all optical networking needs.

## Features

- Input Wavelength Range: 1530 nm to 1560 nm
- Low Noise Figure: approx 5 dB
- Single amplifier modules with various output power and number of output port options
- Ultra-high output power potential
- Nonvolatile storage of pre-set operating parameters simplifies installation
- Master / Slave Redundancy



# PII 1550nm EDFA – Configurable versions

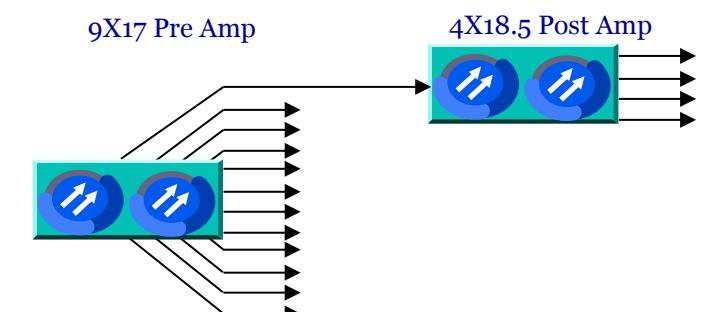
## Overview

The Prisma II Configurable Erbium Doped Fiber system consists of one high-power 9 by +17 dBm pre-amplifier module and one post-amplifier module. The post-amplifier module is available with various number of output port and power output options. For flexibility in network expansion, add-on post-amplifier modules can be added to the configurable system. Up to nine (9) additional post-amplifier modules can be used with the configurable system for outstanding network expansion capabilities. Post-amplifier modules require the high optical input provided by the pre-amplifier modules of the configurable system.



## Features

- Configurable amplifier system with one pre-amplifier and added amplifier modules
- Various number of output port options for both pre-amplifier and modules
- Ultra-high output power potential
- Nonvolatile storage of pre-set operating parameters simplifies installation procedures
- Master / Slave Redundancy



# PII HD 300 MHz Return Path Receiver

**New Product!  
Avail now**

## Features

- DOCSIS 3.1 ready
- 5 to 300 MHz pass band
- Two versions:
  - Standard input: +2 to -18 dBm
  - Low input: -10 to -25 dBm
- Operational with both 1310 or 1550 wavelengths
- Status LEDs indicate module condition and simplifies troubleshooting
- RF output, Typ. 58 dBmV (composite)
- Noise equivalent power (0-50 C):
  - Standard input: < 2.5 pA/sqr root Hz
  - Low input: < 1.2 pA/sqr root Hz
- Two (2) receivers per module



# SuperQAM XFP

- **Concept**
  - SuperQAM transmitter redesigned into an XFP form factor



SuperQAM XFP

- **Highlights**
  - Up to 153 digital QAMs per transmitter (all digital....)
  - 50% less power consumption, less than 3.5 W per module
  - Future migration path to NG-CMTS with pluggable optics – part of the CCAP initiative
  - 10x XFP module in new 1RU chassis

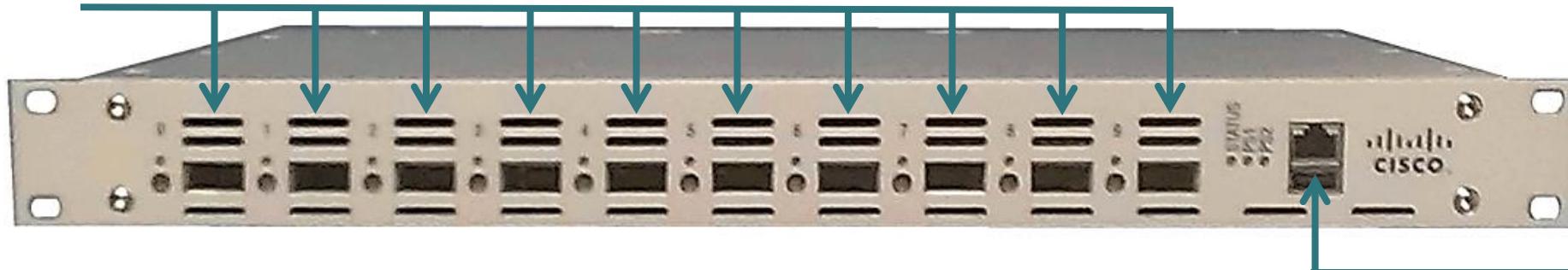


XFP chassis

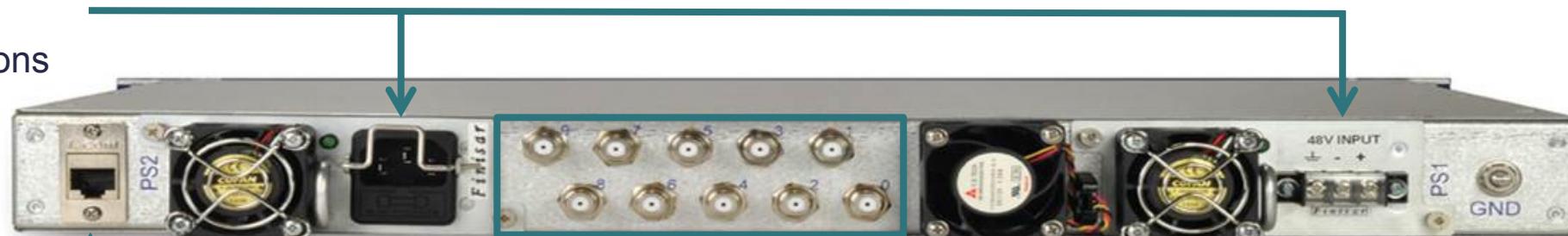
# Prisma II XDP Chassis

- Newest chassis in the Cisco Prisma portfolio
- Industry leading power and density
- DOCSIS 3.1 Ready (1.2 GHz)

- 10 XFP Ports per RU



- Fully Redundant AC and DC Power Options



- Field replaceable fans (x3)

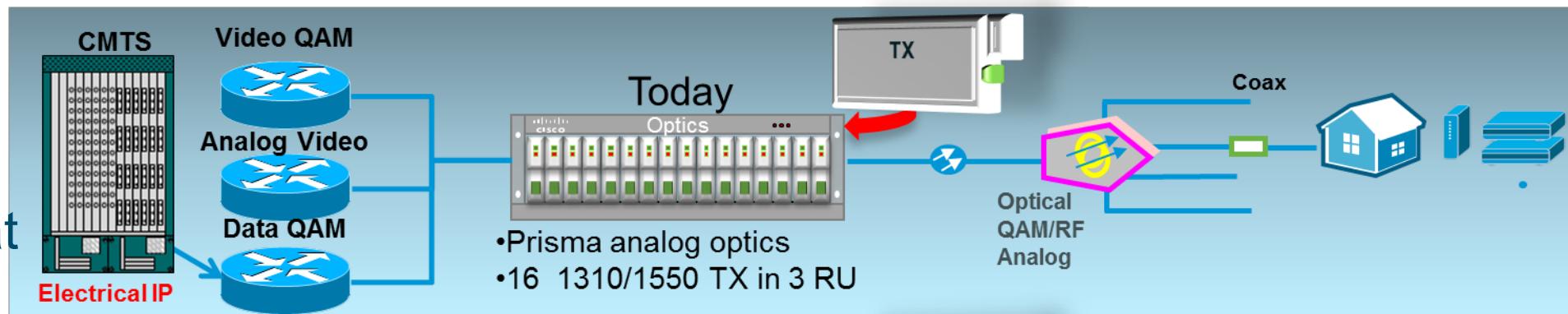
- USB and Ethernet ports for SNMP monitoring
- ICIM/LCI Support (future release)

- 12 dBmV for each (Bc and Nc)

# Optics Migration into NG-CMTS

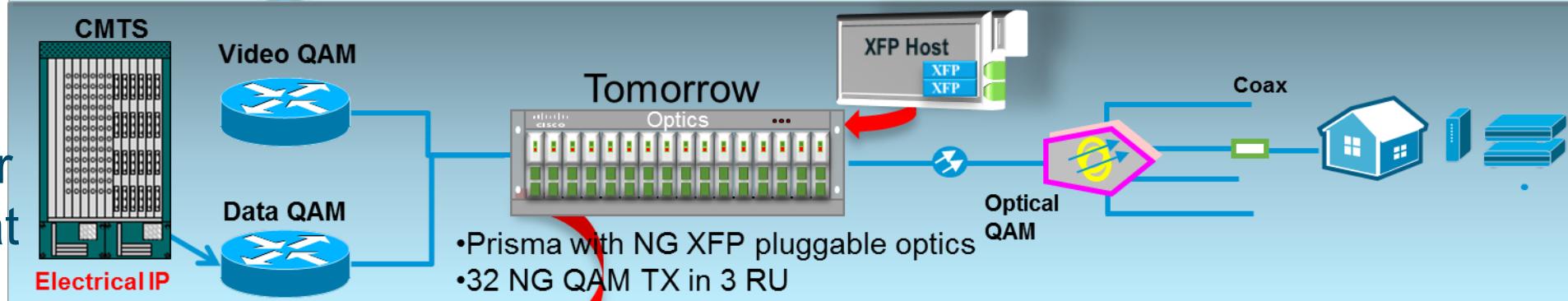
Today

Single Transmitter  
in High Density format



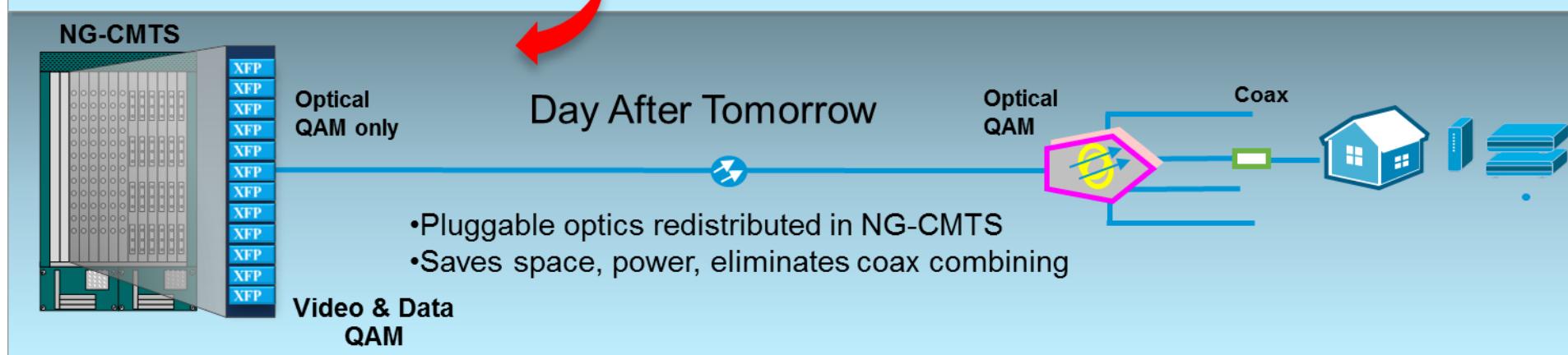
Tomorrow

Dual XFP Transmitter  
in High Density format



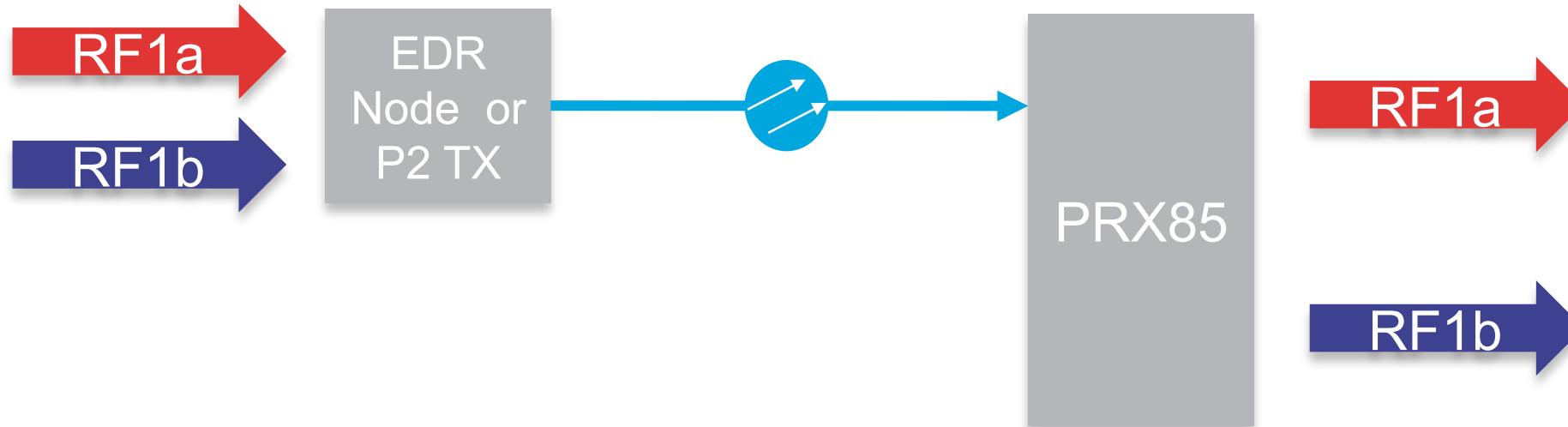
Day After  
Tomorrow

XFP Transmitter  
Plugging directly  
into CMTS



# Cisco EDR HD Reverse Rx Single 2:1

- Receiver mode configuration is set by entering mode ID numbers in the Prisma II Web User Interface System
- Single 2:1 mode supports one optical Rx input producing two independent RF streams



# Cisco EDR HD Reverse Rx



32 Returns in 3 RU XD Chassis  
52 Returns in 6 RU Prisma II Chassis



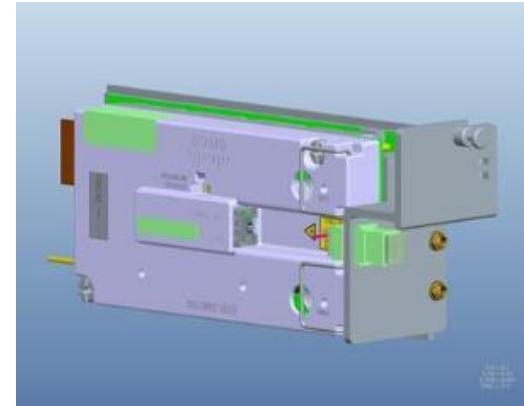
PRX85

- Prisma II HD Reverse Rx
  - Improved density with Prisma II HD form factor and LC-PC connectors
  - Prisma II XD chassis
  - Prisma II chassis using host module
- Single HD Rx module
  - Six configurable receive modes
  - Simplified inventory management
  - Supports reverse splits of 40, 42, 55, 65 and up to 85 MHz
- Small form factor OPM
  - Standard range (21 dB link)
  - Extended range (28 dB link)

# Prisma II 2:1 EDR Tx

New Product!  
Available

- Prisma II Host Module with integrated 2:1 (or 1:1) EDR Tx
- Supports a hub-based BDR/EDR architecture for Regional MSOs in US and international markets
- Supported in P2 std chassis and XD
- 18x CWDM and 45x DWDM available



# Cisco and Vector Partnership

- OEM Partnership in 2015
  - Vector 25 years in the industry in Europe
  - Adapted to the European Market
- TTM on Products and Technologies
  - VECTOR Engineering and Cisco Technology
  - Nodes and Amplifiers Docsis 3.1 /1.2 GHz
- Agility to Market
  - Locally based in Europe
- Orderable soon in CCW
- Information about Vector: [www.vector.net](http://www.vector.net)

# Node Portfolio

Cisco Compact



Vector Bootstral



Vector Hargon





*Your innovation  
Our creation*

## BOOSTRAL 7910

### *Segmentable optical node*

**TECHNICAL PRESENTATION**



# BOOSTRAL 7910

Segmentable optical node 2x4, 2 active outputs, 1.2 GHz / 200 MHz



## 1.2 GHz technology

An extended bandwidth available in downstream up to 1.2 GHz; DOCSIS 3.1 standard compliant



## 200 MHz technology

A possibility of extending bandwidth in upstream up to 200 MHz; DOCSIS 3.1 standard compliant



## GaN Technology

The Output parameters for analog and digital carriers improved for lower power consumption



## Electronic control

A quick and uninterrupted device configuration; the large stocks of the plug-in modules not needed anymore



## VMC (VECTOR Mobile Configuration)

Convenient and user-friendly configuration through mobile devices



## LED Indicator

Easy configuration by using buttons and LED Indicator



## NMS transponder (DOCSIS/EuroDOCSIS)

Reduced operating costs thanks to the remote monitoring and configuration



## VIG (VECTOR INGRESS GUARD) system compliant

Verification and elimination of the source of ingress in the network



## Integration of optical passives

A possibility of installing CWDM/DWDM/WDM filters inside the housing



## GREEN mode – Intelligent Power Consumption

A significant reduction of power use thanks to optimization of its consumption

## V SERIES

Response to your variety of needs



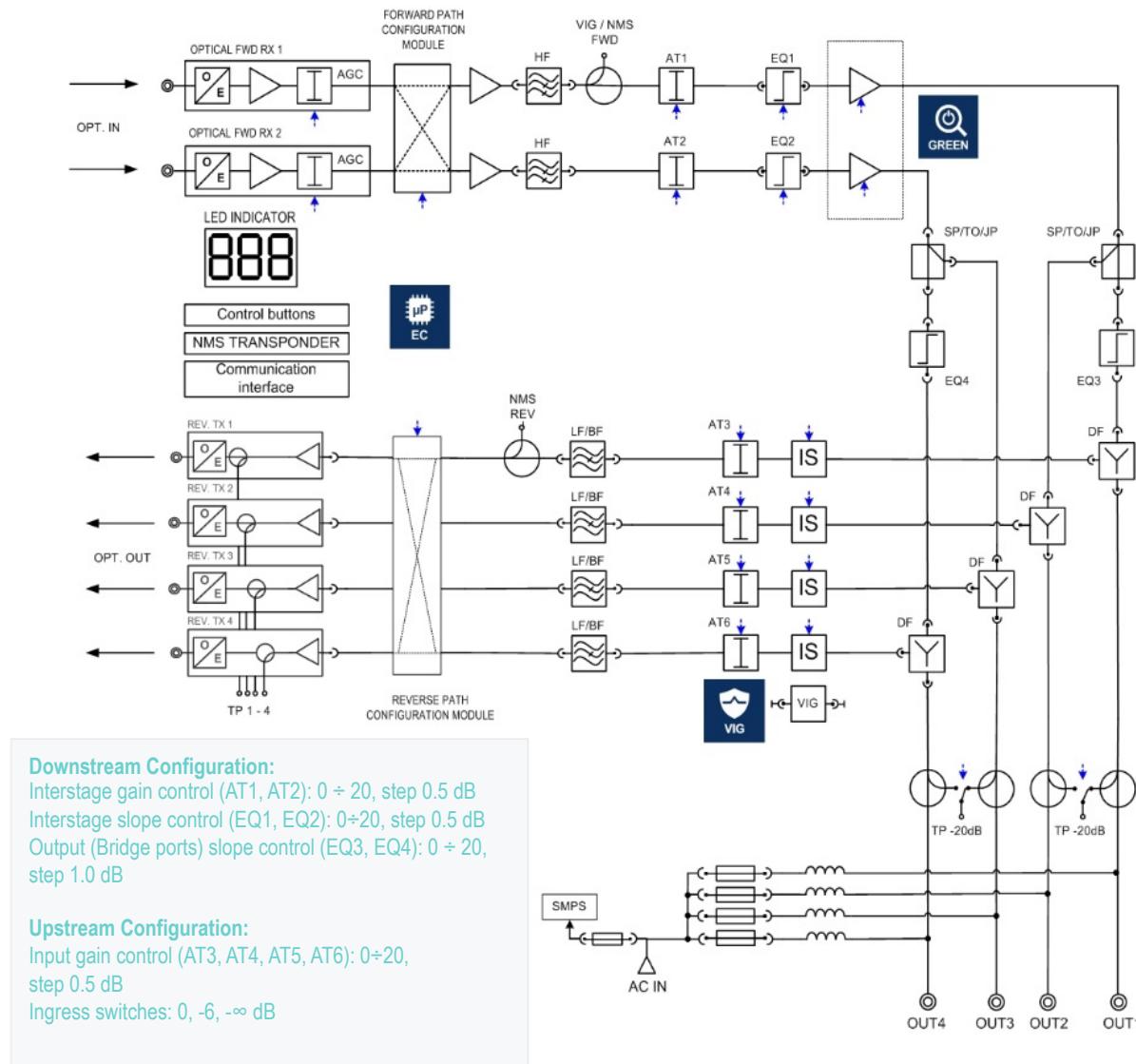
FULL SUPPORT FOR D 3.1 (1.2 GHz / 204 MHz)

LOW POWER CONSUMPTION

COMPACT HOUSING

# BOOSTRAL 7910

## Block Diagram



# BOOSTRAL 7910

## Parameters

### Forward Parameters

|   |  |
|---|--|
| Wavelength                                  | 1260 ÷ 1620 nm                           |
| Bandwidth                                   | 85...258 ÷ 1218 MHz                      |
| Optical input power range                   | - 9.9 ÷ 2 dBm                            |
| Optical AGC range                           | - 7 ÷ 0 dBm                              |
| Flatness <sup>1</sup>                       | ± 0.5 dB                                 |
| Equivalent Input Noise Current <sup>2</sup> | 5 pA / √Hz                               |
| Output level <sup>3</sup> :                 |  |
| CTB ≤ - 60 dBc                              | 2 x 116 dBµV                             |
| CSO ≤ - 60 dBc                              | 2 x 116 dBµV                             |
| Digital Output level <sup>4</sup>           | 2 x 109 dBµV                             |
| CINR = 41.5 dB                              |  |
| Gain limited output level <sup>5</sup>      | 2 x 118 dBµV                             |
| Number of outputs <sup>6</sup>              | 2 active, up to 4 with passive splitting |

### Return Parameters

|  |                    |
|--|--------------------|
| Bandwidth                                      | 5 ÷ 65 ... 204 MHz |
| Flatness <sup>7</sup>                          | ± 0.5 dB           |
| Optical output power <sup>8</sup>              | 3 ± 0.5 dB         |
| Min RF input level to get 10% OMI <sup>9</sup> | 70 dBµV            |
| NPR / Dynamic range <sup>10</sup>              | 40 dB / 5 dB       |

### Others

|                                      |                    |
|--------------------------------------|--------------------|
| Return loss <sup>11</sup>            | > 18 dB            |
| AC voltage range:<br>remote powering | 30 ÷ 65 V AC       |
| Max. current for RF / AC IN ports    | 10 / 15 A          |
| Power consumption <sup>12</sup>      | < 45 W             |
| Operation temperature range          | - 40 ÷ 60 °C       |
| Optical connectors                   | SC / APC           |
| RF connectors                        | 4x PG11            |
| Protection class                     | IP 67              |
| Dimensions (W x L x H)               | 255 x 234 x 128 mm |
| Weight                               | < 4.0 kg           |

1. In range 85 - 600 MHz; ± 0.75 dB in range 600-1006 MHz; ± 1.0 dB in range 1006 ÷ 1218 MHz

2. Typical value; the worst case 6 pA / √Hz

3. According to EN 50083-3, 9 dB slope between 85 to 862 MHz, 42 channels CENELEC, typ. value

4. Full digital load 258 ÷ 1218 MHz, 120 channels QAM 256, 12 dB slope

5. AGC on, 3.25% OMI, - 7 dBm optical input level, 1310 nm

6. Unbalanced split with splitter / tap out

7. Up to 85 MHz; ± 0.75 dB up to 204 MHz

8. For CWDM lasers, up to 16 wavelengths are available

9. With AT3,AT4,AT5,AT6 =0dB regardless of US configuration

10. Measured with 12 dB link (15km fiber + loss), 60 MHz BW noise load, EINC 7pA / √Hz

11. In 5 ÷ 65 MHz; 18 dB for f < 40 MHz; 18 dB -1.5 dB / oct for f > 40 MHz, but > 11 dB

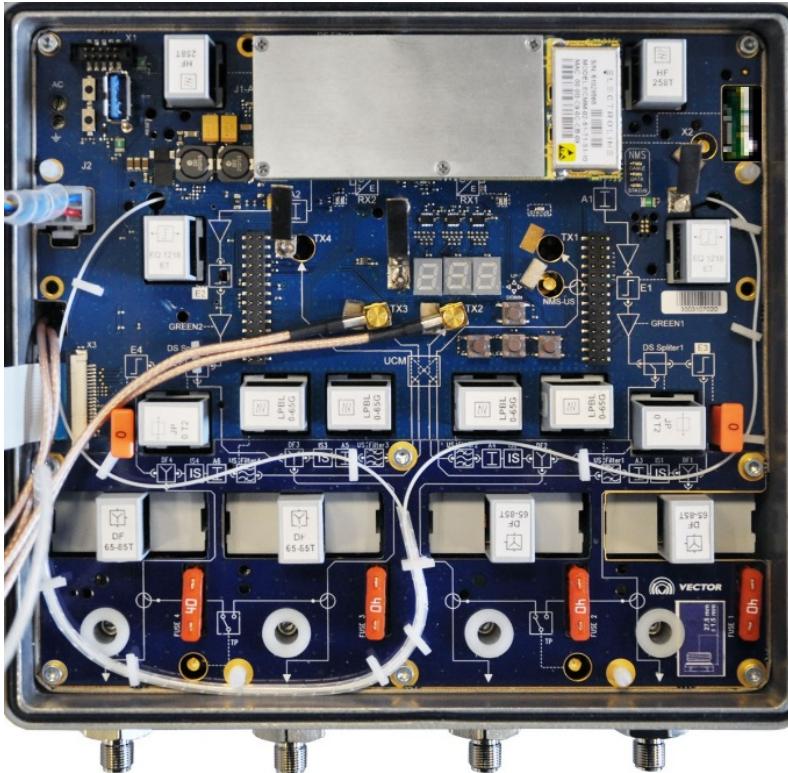
12. 50 VAC; Configuration: 2x FWD Rx, 4x 3 dBm CWDM lasers, EDCM

Unless otherwise specified, the whole specifications are tested with 65/85 diplex filters installed; at room temperature 25°C and present typical values.

11/05/2015 Specifications are subject to change without notice.

# BOOSTRAL 7910

*Front view*



# BOOSTRAL 7910

NMS – web interface via WWW / node side

The diagram illustrates the internal architecture of the BOOSTRAL 7910. It shows the optical input (OPT. IN) and output (OPT. OUT) paths. The forward path (top) includes Optical FWD RX 1 and 2 with AGC, a Forward Path Configuration Module, and a VIG-FWD module. The reverse path (bottom) includes Reverse Path Configuration Module, Return Transmitter 1-4, and a Return Path module. Various attenuators (AT1, AT2, EG1, EG2) and isolators (IS) are used throughout the system. A power supply section at the bottom shows an AC IN connection and a SMPS power supply.

| Node setup                     |                            | Transponder setup |      |    |
|--------------------------------|----------------------------|-------------------|------|----|
| Logout                         |                            |                   |      |    |
| BOOSTRAL 7900, s/n: 0000053420 |                            |                   |      |    |
| Firmware                       | 0.0.0.67                   |                   |      |    |
| Temperature                    | 32 °C                      |                   |      |    |
| Tamper:                        | compromised                |                   |      |    |
| Up time:                       | 00:01:23                   |                   |      |    |
| Supply 3.3V                    | 3.2 V                      |                   |      |    |
| Supply 5.4V                    | 5.1 V                      |                   |      |    |
| Supply 24V                     | 23.1 V                     |                   |      |    |
| Forward receivers              |                            |                   |      |    |
| RX1 power                      | -40.8 dBm                  |                   |      |    |
| RX2 power                      | -40.8 dBm                  |                   |      |    |
| Thresholds                     | 1.50                       | dB                | -1.0 | dB |
| Return transmitter 1 OFF       |                            |                   |      |    |
| Type                           | SN: 00867990, C1510 type T |                   |      |    |
| TX current                     | 45 mA                      |                   |      |    |
| TX power                       | 3 dBm                      |                   |      |    |
| Return transmitter 2 ON        |                            |                   |      |    |
| Type                           | SN: 00867992, C1610 type T |                   |      |    |
| TX current                     | 45 mA                      |                   |      |    |
| TX power                       | 3 dBm                      |                   |      |    |
| Return transmitter 3 ON        |                            |                   |      |    |
| Type                           | SN: 00867885, C1510 type T |                   |      |    |
| TX current                     | 45 mA                      |                   |      |    |
| TX power                       | 3 dBm                      |                   |      |    |
| Return transmitter 4 OFF       |                            |                   |      |    |
| Type                           | SN: 00867994 C1610 type T  |                   |      |    |
| TX current                     | 45 mA                      |                   |      |    |
| TX power                       | 3 dBm                      |                   |      |    |

SET   REFRESH   PRINT

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*Your innovation  
Our creation*

## HARGON 351

### *Line extender amplifier*



## TECHNICAL PRESENTATION

# HARGON 351

## *Line extender amplifier*

## Q SERIES

Exactly what you need



### 1.2 GHz technology

An extended bandwidth in downstream up to 1.2 GHz; DOCSIS 3.1 standard compliant



### 200 MHz technology

A possibility of extending bandwidth in upstream up to 200 MHz; DOCSIS 3.1 standard compliant



### JXP configuration

A simple and cost-effective configuration of devices with the plug-in modules



### VIG (VECTOR INGRESS GUARD) system compliant

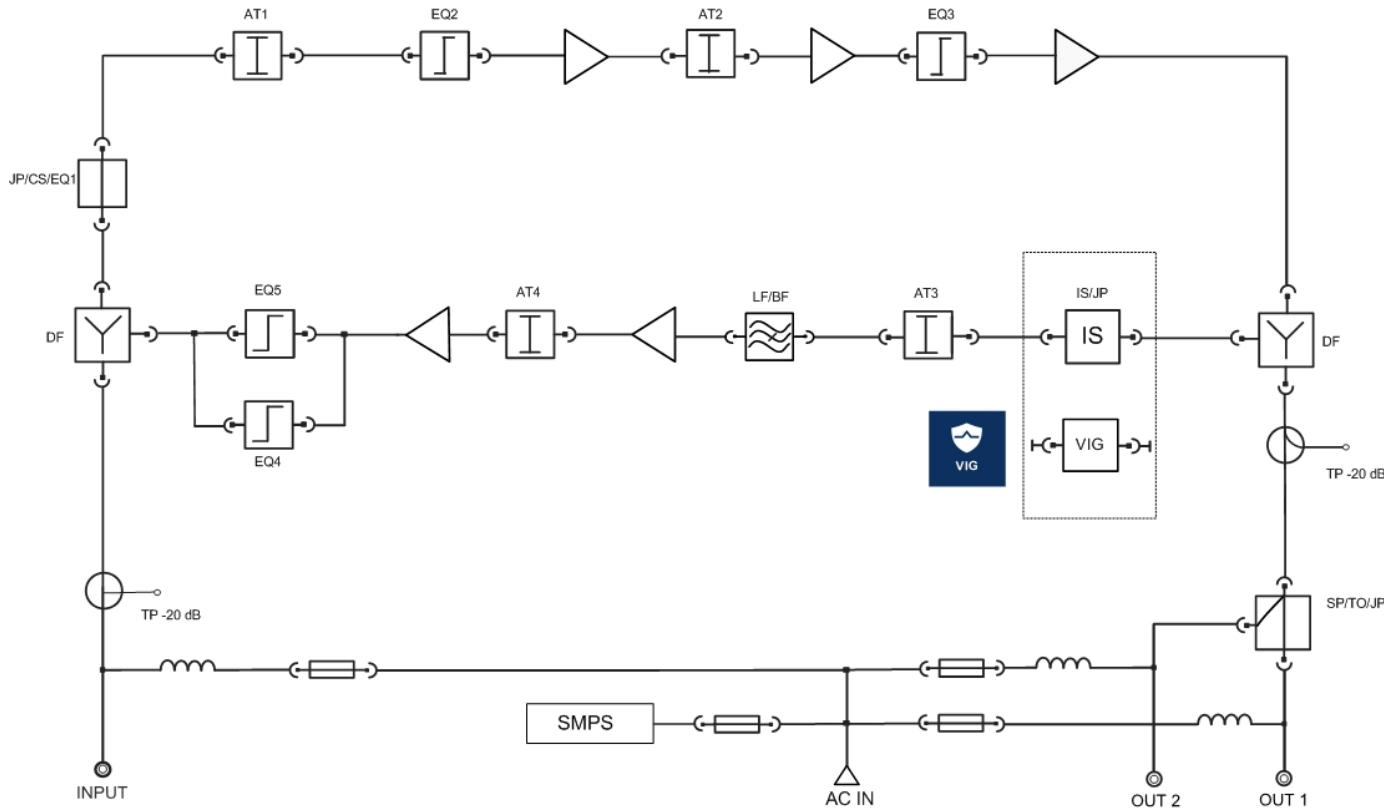
Verification and elimination of the source of ingress in the network



- FULL SUPPORT FOR D 3.1 (1.2 GHz / 204 MHz)
- LOW POWER CONSUMPTION
- COMPACT HOUSING
- TWO RF OUTPUTS

# HARGON 351

## Diagram



### Downstream Configuration:

Forward gain control (AT1, AT2): 0 ÷ 20 step 1 dB  
 Forward slope control (EQ1, EQ2): 0 ÷ 20 step 1 dB  
 AUX: 0 – 20 step 1 dB  
 CS: 3,5; 6,5; 9,5 dB

### Upstream Configuration:

Forward gain control (AT3, AT4, AT5): 0 ÷ 20 step 1 dB  
 Forward slope control (EQ3, EQ4): 65 / 85 / 200 MHz

# HARGON 351

## Parameters

### RF Parameters

#### Forward Channel

|   |                      |
|---|----------------------|
| Bandwidth   | 85...258 ÷ 1218 MHz  |
| Gain @1.2 GHz   | 40 ± 1 dB            |
| Noise figure <sup>1</sup>                                     | < 4.5 dB             |
| Flatness <sup>2</sup>   | ± 0.75 dB            |
| Output level <sup>3</sup><br>CTB ≤ - 60 dBc<br>CSO ≤ - 60 dBc | 114 dBµV<br>114 dBµV |
| Digital Output level <sup>4</sup><br>CINR = 41.5 dB           | 108 dBµV             |
| Input testpoint (bi-directional)                              | - 20 ± 1.0 dB        |
| Output testpoints (directional)                               | - 20 ± 0.5 dB        |

#### Reverse Channel

|                                  |                  |
|----------------------------------|------------------|
| Bandwidth                        | 5 ÷ 65...204 MHz |
| Gain                             | 26 dB ± 1 dB     |
| Noise figure <sup>5</sup>        | < 6.5 dB         |
| Flatness <sup>6</sup>            | ± 0.75 dB        |
| NPR / Dynamic range <sup>7</sup> | 50 dB / 23 dB    |

### Others

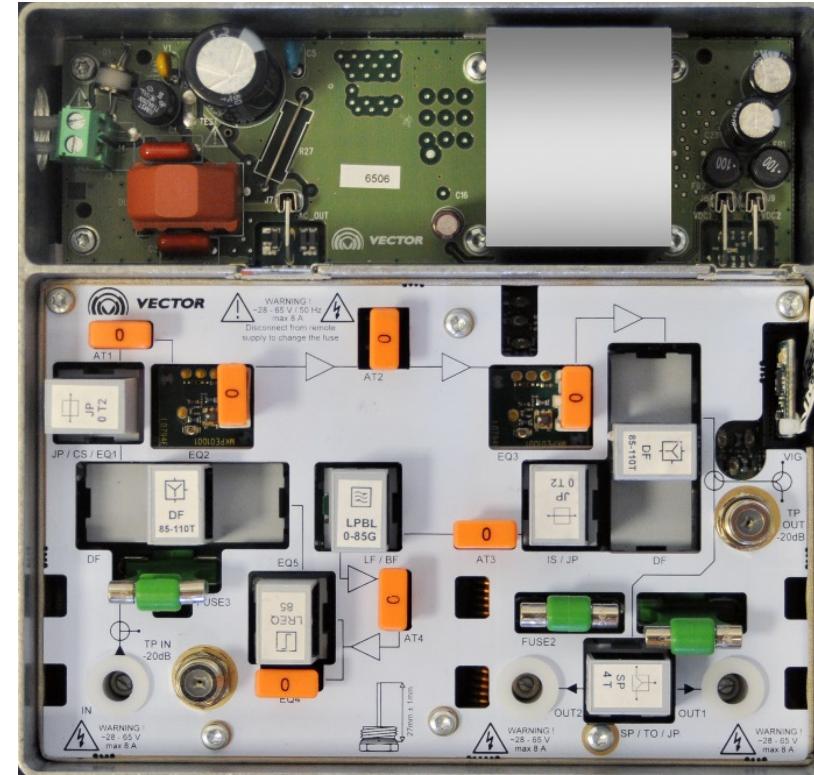
|                                   |                   |
|-----------------------------------|-------------------|
| Voltage range: remote powering    | 30 ÷ 65 V AC      |
| Max. current for RF ports / AC IN | 8A / 8A           |
| Return loss <sup>8</sup>          | > 18 dB           |
| Power consumption                 | < 13,5 W          |
| Operation temperature range       | - 40 ÷ 60 °C      |
| Connectors                        | 3 x PG11          |
| Protection class                  | IP 67             |
| Dimensions (W x L x H)            | 218 x 204 x 87 mm |
| Weight                            | 1.5 kg            |

1. Typical value up to 1 GHz; 6,5 dB up to 1.2 GHz
2. Valid after starting frequency 10% above DF roll off and up to 1218 MHz
3. Typical value, According to EN50083-3, 9 dB interstage slope, 42 channels CENELEC
4. Full digital load 258 ÷ 1218 MHz, 120 channels QAM 256, 12 dB slope
5. Typical value up to f = 204 MHz
6. For 5 – 60 MHz with DF 65-85 T
7. NPR @ -9 dBµV / Hz, measured 5 ÷ 204 MHz with 60 MHz loading
8. In 5 ÷ 65 MHz; 18 dB for f ≤ 40 MHz, 18 dB -1.5 dB / oct for f > 40 MHz, but not worse than 11 dB

Unless otherwise specified, the whole specifications are tested with 65/85 diplex filters installed; at room temperature 25°C and present typical values.

11/05/2015 Specifications are subject to change without notice.

# HARGON 351



## Key HFC Takeaways

- Cisco has the best Access strategy in the industry, with an unmatched end-to-end portfolio vision
- Pluggable Optics will reduce power and rack space, and ultimately provide a path to directly plugging into the cBR platform
- Partnerships to bring Future Proof Network Evolution

Thank you.

