



Optical and HFC Platform Update

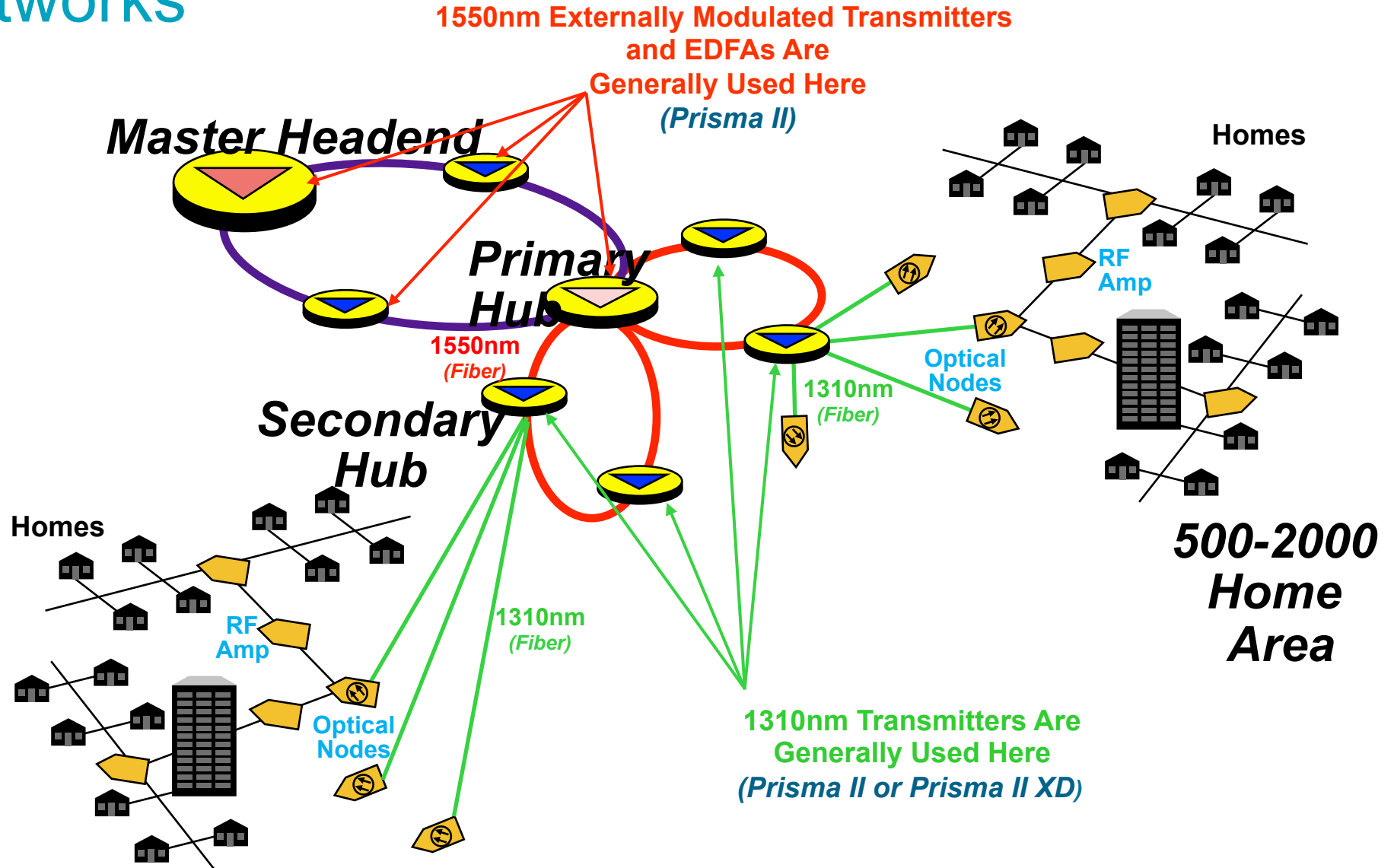
Mike Jensen
Systems Engineer

September 16, 2015

Agenda

- Optical Platform Overview
- Architectural 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

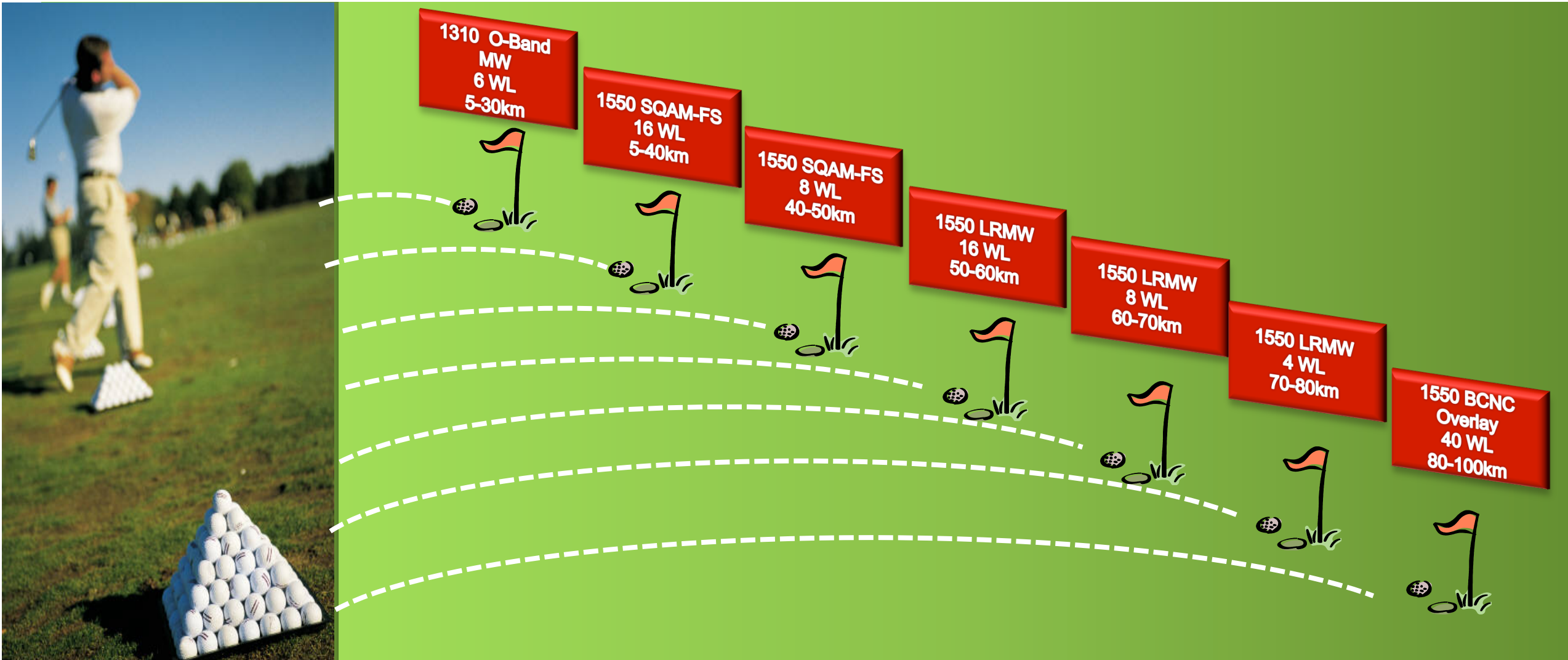


- Low profile - 1 RU
- Highest density platform
- 10 XFP module slots
- AC or DC powering
- Full platform monitoring
- Fixed and Tunable SuperQAM

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

- 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**

New Product!
Avail now



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
- Statue LEDs indicate module condition and simplifies troubleshooting
- Superior Stimulated Brillion 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



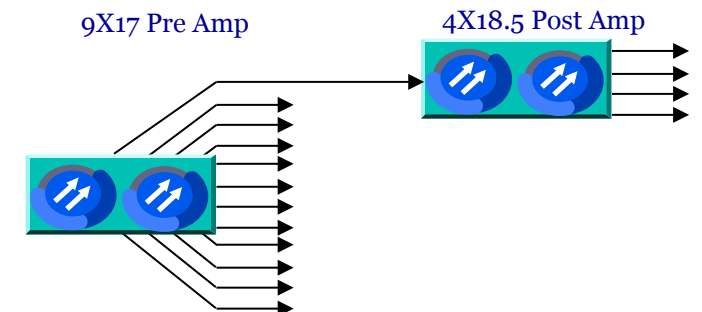
PII 1550nm EDFA – Configurable versions

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

■ 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



SuperQAM XFP

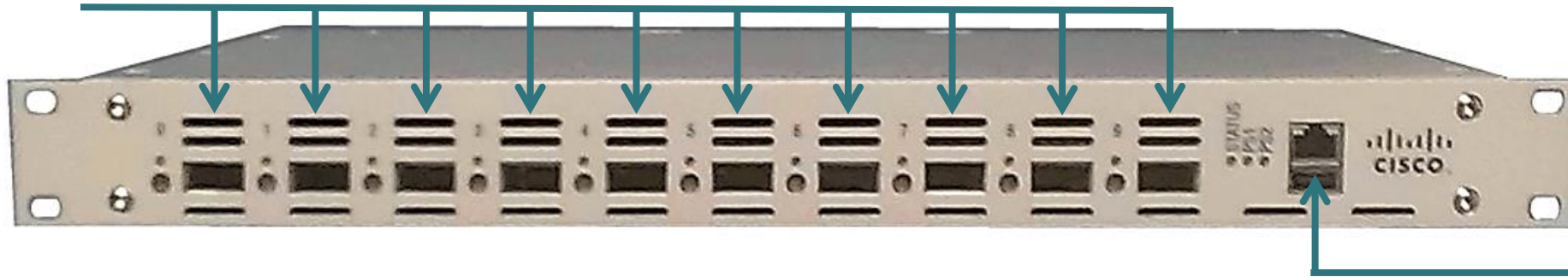


XFP chassis

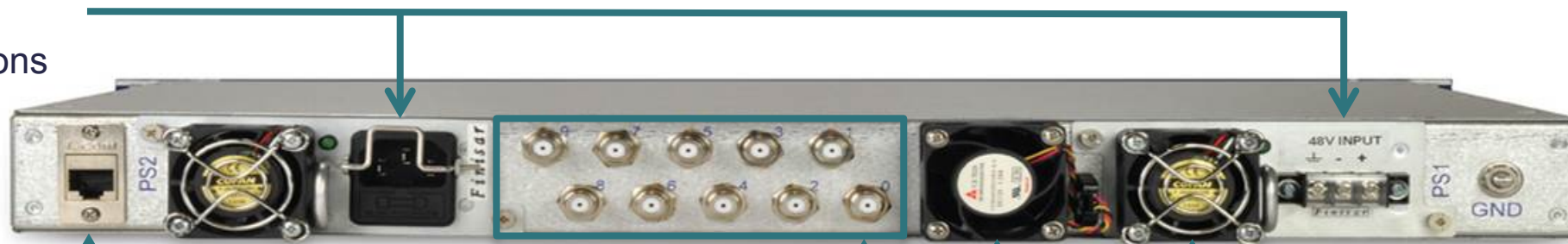
Prisma II XDP Chassis

- 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



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

- Ethernet port for SNMP monitoring

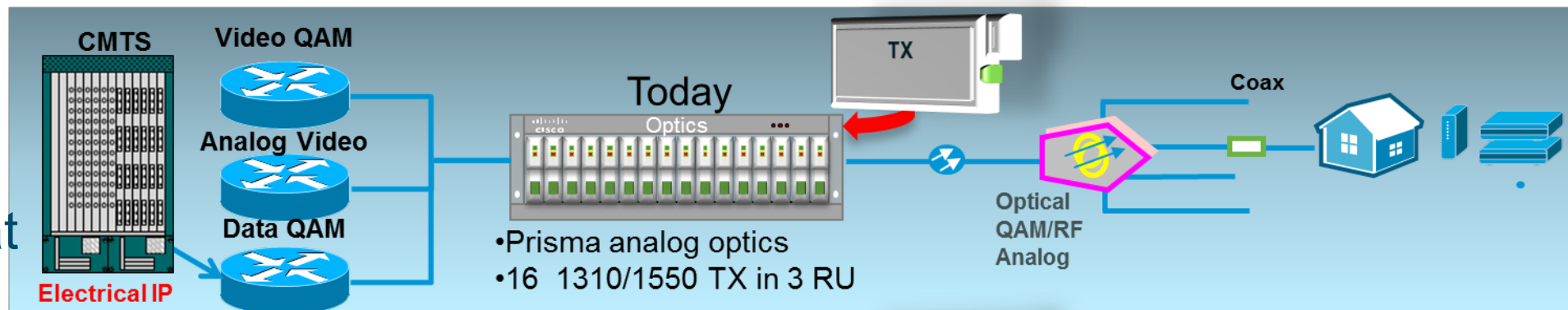
- One NC RF input per XFP
- Shared BC port (not shown)
- 12 dBmV for each (Bc and Nc)

- Field replaceable fans (x3)

Optics Migration into NG-CMTS

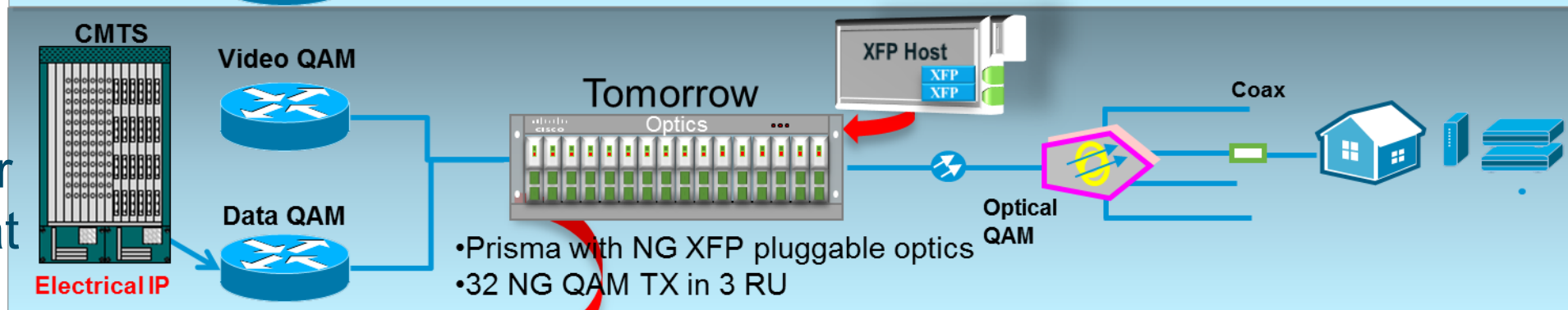
Today

Single Transmitter
in High Density format



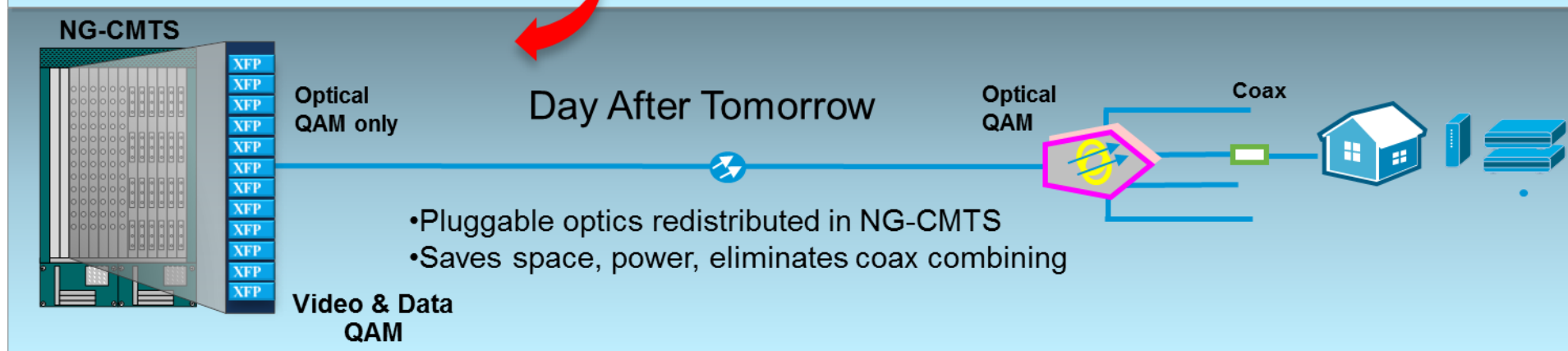
Tomorrow

Dual XFP Transmitter
in High Density format



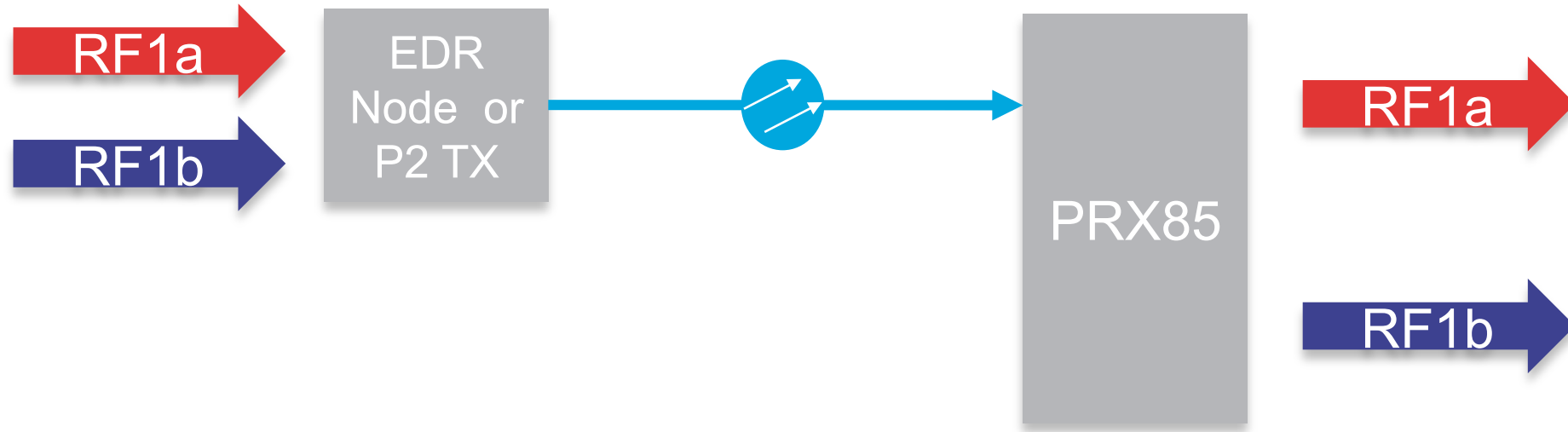
Day After
Tomorrow

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

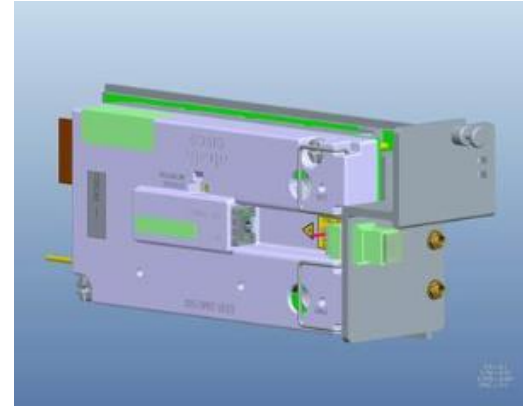


- Prisma II HD Reverse Rx
 - Improved density with Prisma II HD form factor and LC-PC connectors
 - Prisma II XD chassis
 - Prisma II chassis using host module
- Single HD Rx module
 - Six configurable receive modes
 - Simplified inventory management
 - Supports reverse splits of 40, 42, 55, 65 and up 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

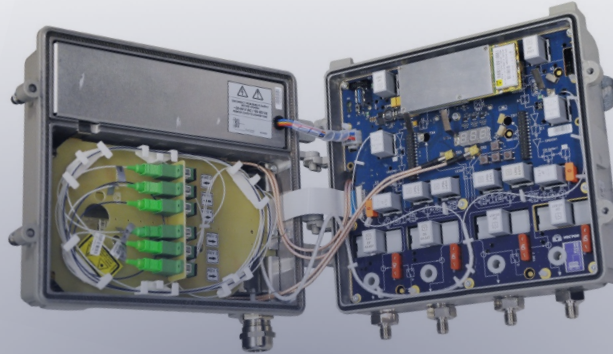
- OEM Partnership in 2015
 - Vector 25 years in the industry in Europe
 - Adapted to the European Market
- TTM on Products and Technologies
 - VECTOR Engineering and Cisco Technology
 - Nodes and Amplifiers Docsis 3.1 /1.2 GHz
- Agility to Market
 - Locally based in Europe
- Orderable soon in CCW
- Information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

Node Portfolio

Cisco Compact



Vector Bootstr



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



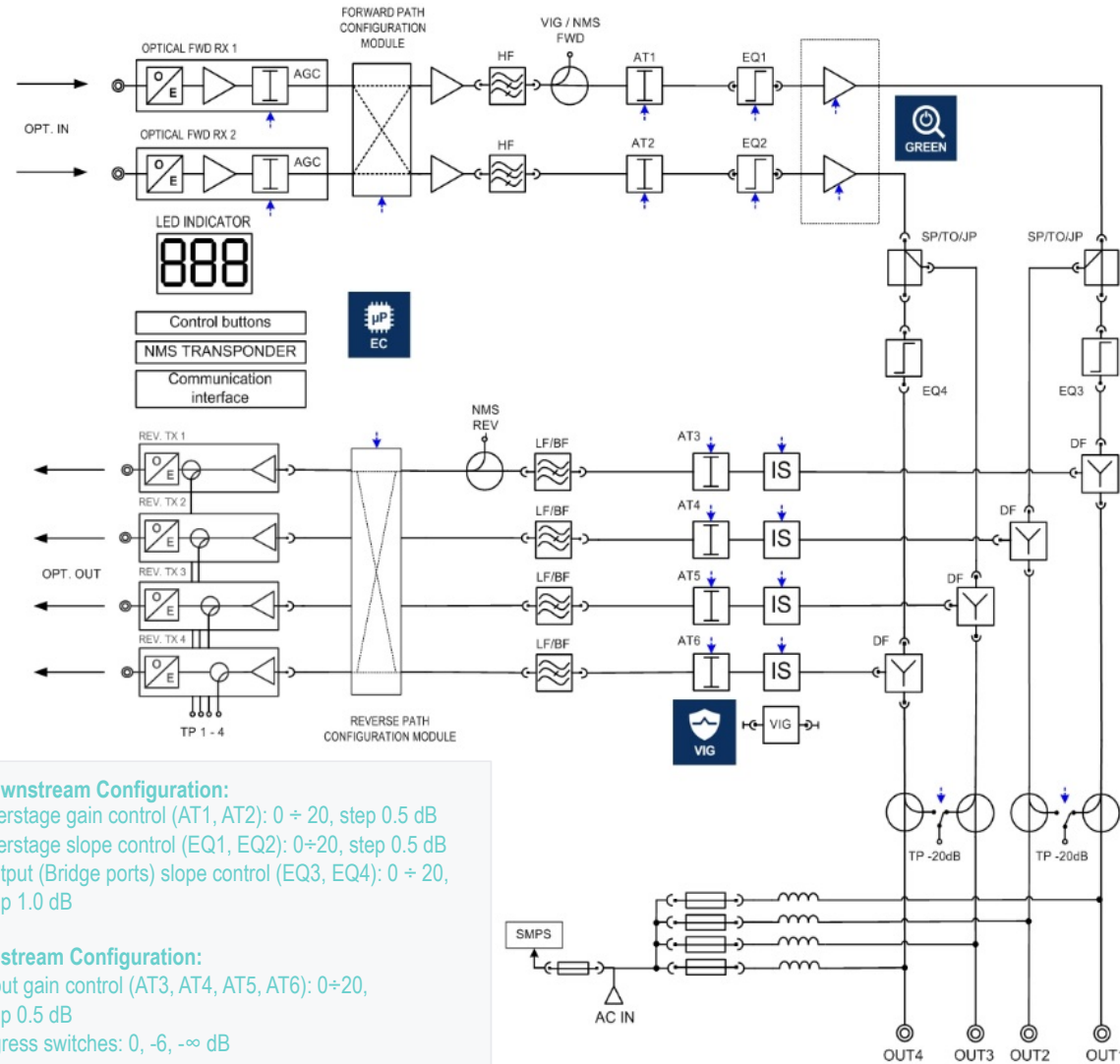
FULL SUPPORT FOR D 3.1 (1.2 GHz / 204 MHz)

LOW POWER CONSUMPTION

COMPACT HOUSING

BOOSTRAL 7910

Block Diagram



Downstream Configuration:

Interstage gain control (AT1, AT2): 0 ÷ 20, step 0.5 dB
 Interstage slope control (EQ1, EQ2): 0 ÷ 20, step 0.5 dB
 Output (Bridge ports) slope control (EQ3, EQ4): 0 ÷ 20, step 1.0 dB

Upstream Configuration:

Input gain control (AT3, AT4, AT5, AT6): 0 ÷ 20, step 0.5 dB
 Ingress switches: 0, -6, -∞ dB

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 ¹	± 0.5 dB
Equivalent Input Noise Current ²	5 pA / √Hz
Output level ³ : CTB ≤ - 60 dBc CSO ≤ - 60 dBc	2 x 116 dBμV 2 x 116 dBμV
Digital Output level ⁴ CINR = 41.5 dB	2 x 109 dBμV
Gain limited output level ⁵	2 x 118 dBμV
Number of outputs ⁶	2 active, up to 4 with passive splitting

Return Parameters

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

Others

Return loss ¹¹	> 18 dB
AC voltage range: remote powering	30 ÷ 65 V AC
Max. current for RF / AC IN ports	10 / 15 A
Power consumption ¹²	< 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 85/85 duplex 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

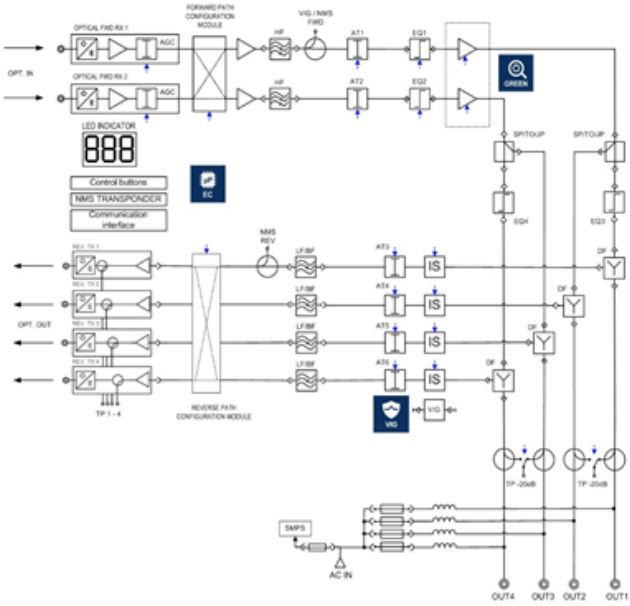


BOOSTRAL 7910

NMS – web interface via WWW / node side



0.0dB



Logout

Node setup

Transponder setup

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

I -5.0 dB I -1.0 dB

Return transmitter 1 OFF

Type

SN: 00067990, C1510 type T

TX current

45 mA

TX power

3 dBm

Return transmitter 2 ON

Type

SN: 00067992, C1610 type T

TX current

45 mA

TX power

3 dBm

Return transmitter 3 ON

Type

SN: 00067885, C1510 type T

TX current

45 mA

TX power

3 dBm

Return transmitter 4 OFF

Type

SN: 00067994, 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



1.2GHz

1.2 GHz technology

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



200MHz

200 MHz technology

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



JXP

JXP configuration

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



VIG

VIG (VECTOR INGRESS GUARD) system compliant

Verification and elimination of the source of ingress in the network

Q SERIES

Exactly what you need



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

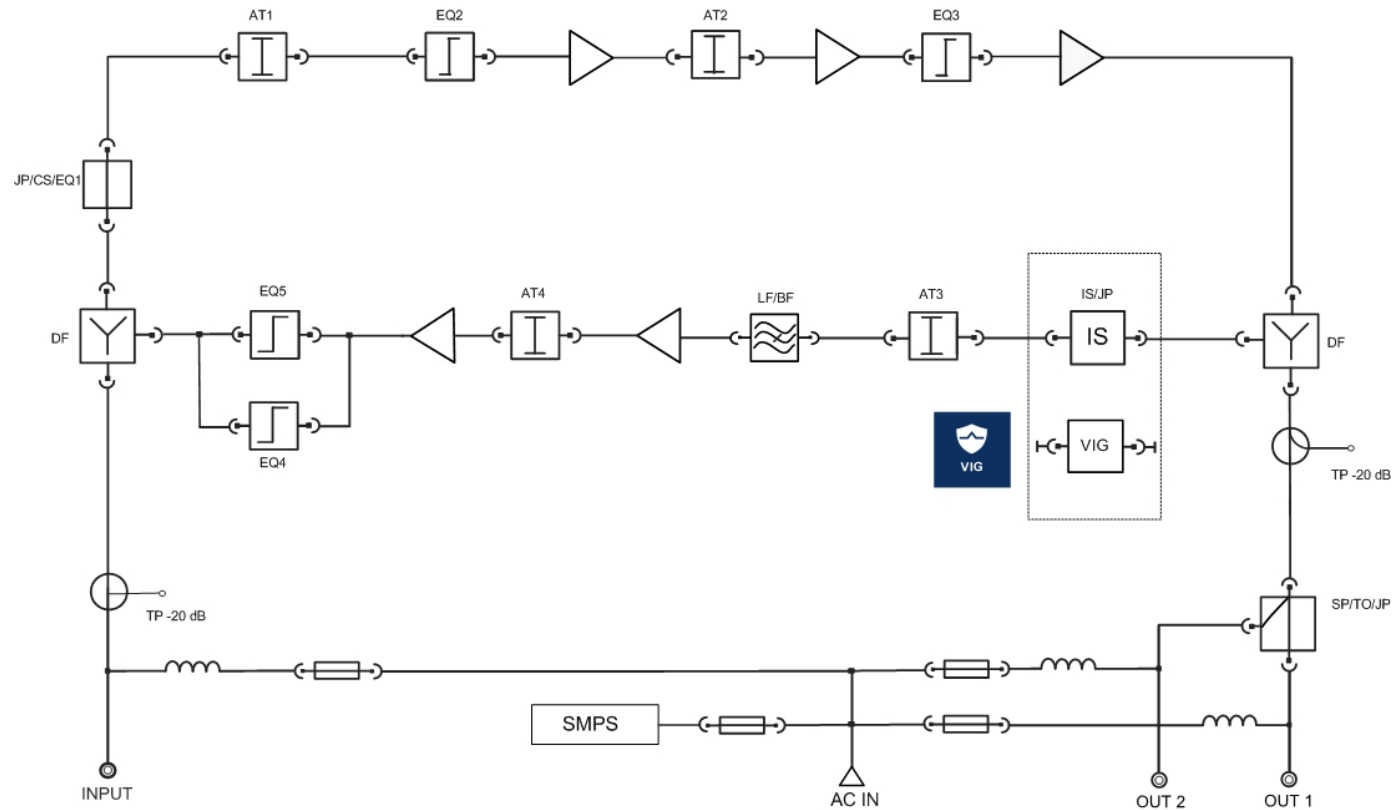
LOW POWER CONSUMPTION

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 ¹	< 4.5 dB
Flatness ²	± 0.75 dB
Output level ³ : CTB ≤ - 60 dBc CSO ≤ - 60 dBc	114 dBμV 114 dBμV
Digital Output level ⁴ 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 ⁵	< 6,5 dB
Flatness ⁶	± 0.75 dB
NPR / Dynamic range ⁷	50 dB / 23 dB

Others

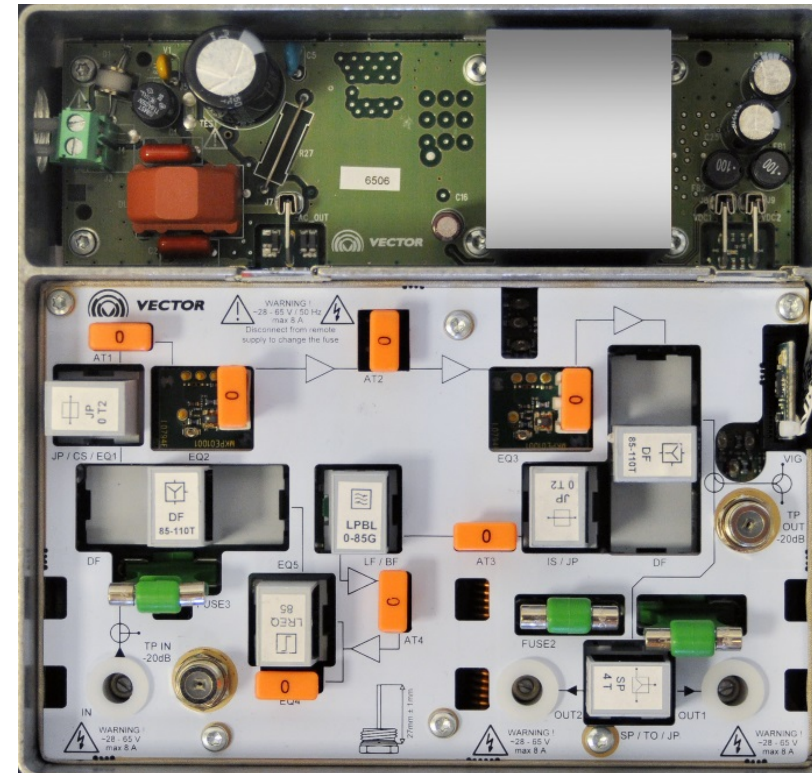
Voltage range: remote powering	30 ÷ 65 V AC
Max. current for RF ports / AC IN	8A / 8A
Return loss ⁸	> 18 dB
Power consumption	< 13,5 W
Operation temperature range	- 40 ÷ 60 °C
Connectors	3 x PG11
Protection class	IP 67
Dimensions (W x L x H)	218 x 204 x 87 mm
Weight	1.5 kg

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 duplex 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.

