

ARISTA

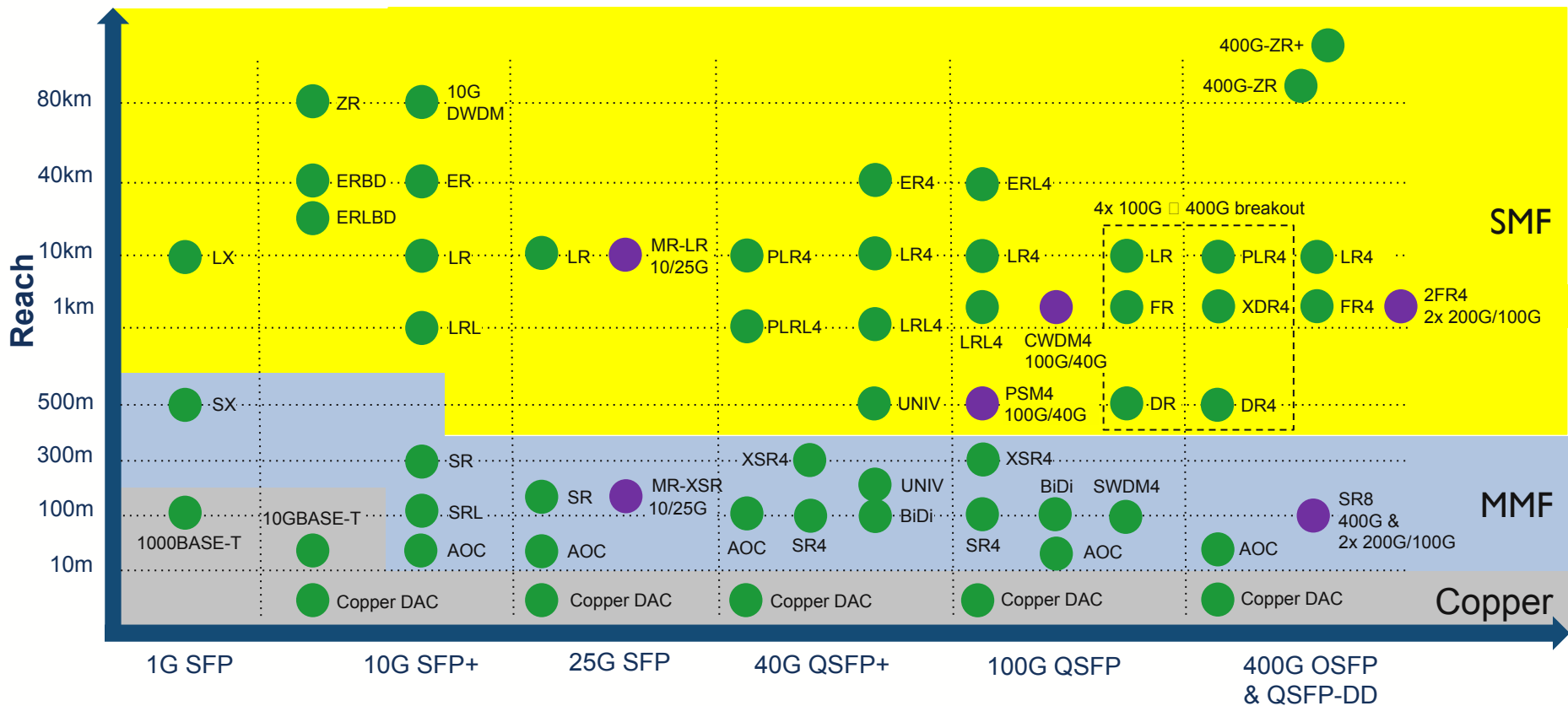
NOG.fi meeting 2022.06

400G-ZR(+) Real World Examples

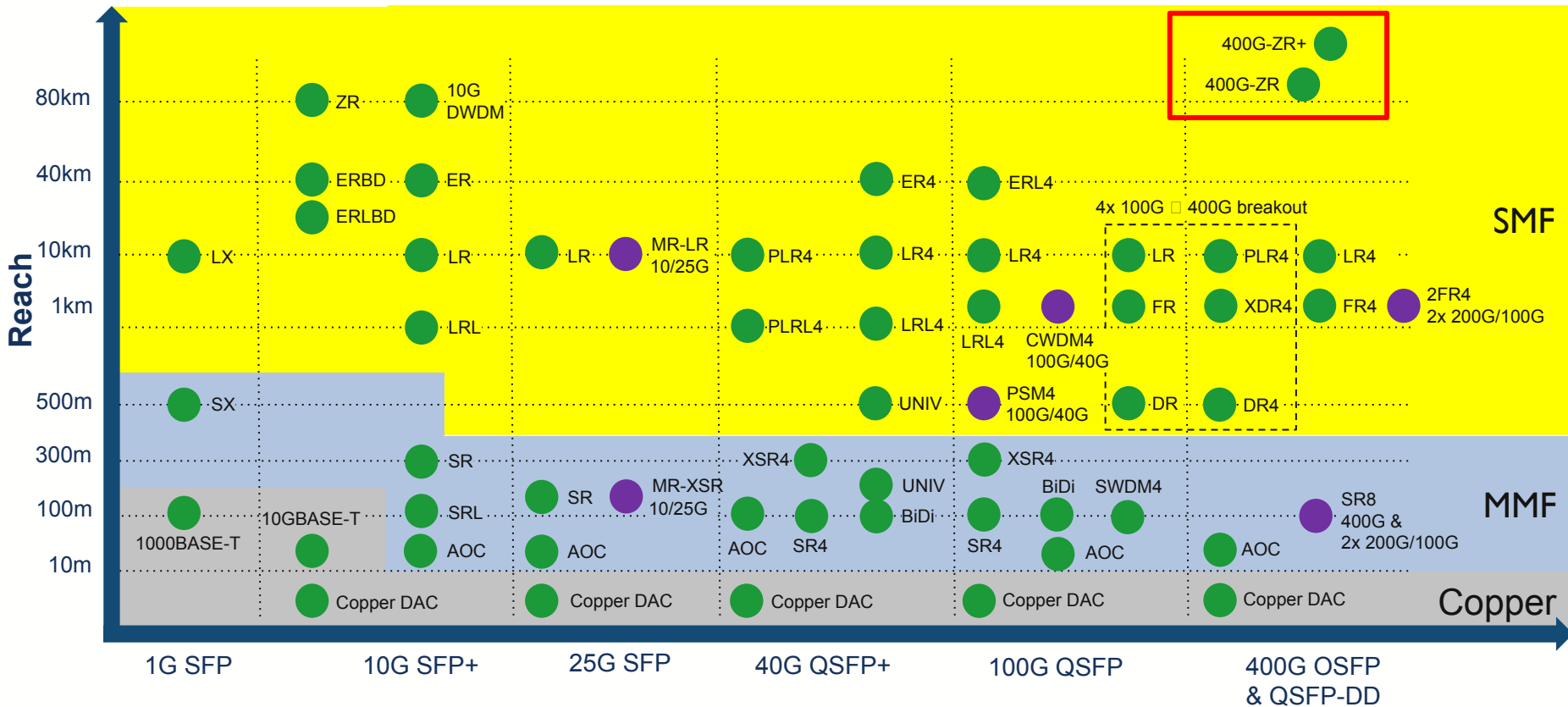
Florian Hibler <florian@arista.com>
Manager, Systems Engineering

Optics Overview

Optics & Cables: Broad Portfolio from 1G to 400G



Optics & Cables: Broad Portfolio from 1G to 400G



400G ZR Metro

400G-ZR Transceiver Specifications

Channel Range (Tunable)	191.375 to 196.100 THz
Channel Grid	100GHz & 75GHz
Optical Connector Type	Duplex LC
Tx output power	> -10 dBm*
Min Tx OSNR	45 dB
Rx input power	-16 dBm to 0 dBm
Min Rx OSNR	> 26 dB
Pre-FEC BER threshold	1.0E-02
Forward Error Correction (FEC)	C-FEC
Max amplified reach **	120km
Max span loss **	25 dB
Min span loss	2 dB
Max chromatic dispersion	2400 ps/nm
Power consumption	16 W Typ, 20 W max
Max case temperature	75C

Frequency and Grid
Spacing

Low Launch Power
Amplification needed

Critical value to ensure
error free signal

Critical value to ensure
link stability

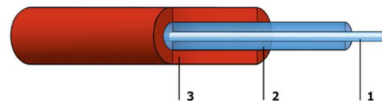
Data based upon [Arista 400G-ZR Datasheet](#)

Typical Fiber Specifications

Single-mode fibre, E9/125/250, OS2 / G.652.D

low attenuation

in accordance with ITU-T G.652.D, IEC 60793-2-50 Type B1.3, equates to EN 50173:2011 OS2



1 Core
2 Cladding
3 Coating

OPTICAL PROPERTIES

Transmission characteristics

Wavelength	[nm]	1310	1383	1550	1625
Maximum attenuation (cabled)	[dB/km]	0.34	0.34*	0.21	0.23
*post hydrogen aging performance					
Maximum Chromatic Dispersion	[ps/(nm x km)]	3,5		18	23
Zero Dispersion Wavelength λ_0	[nm]	$1304 \leq \lambda_0 \leq 1324$			
Maximim Zero Dispersion Slope S_0	[ps/(nm ² x km)]	0.092			
Mode-Filed Diameter	[μ m]	9.2 +/- 0.4		10.4 +/- 0.5	
Maximum Cable Cut-off Wavelength λ_{CC}	[nm]	1260			
Polarisation Mode Dispersion					
PMD Link Design Value	[ps/√km]	≤ 0.04			
Max. individual fibre PMD	[ps/√km]	≤ 0.1			
Max. individual cable PMD	[ps/√km]	≤ 0.2			
Refractive Index		1.4676		1.4682	

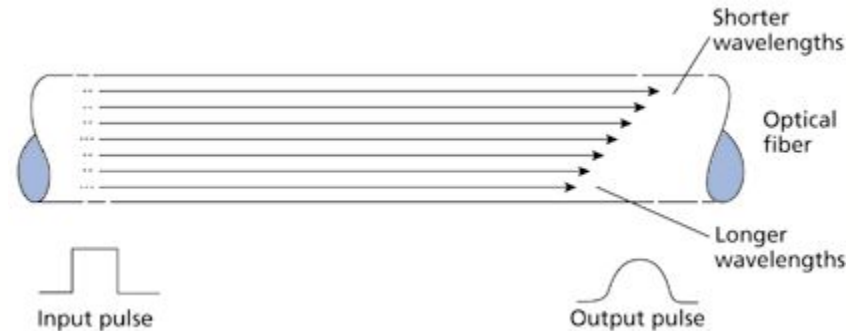
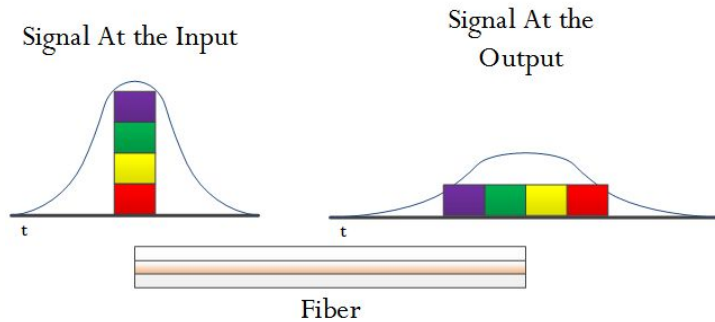
<0.25 dB/km required for ideal range

Typical value is around 17 ps/nm

Data based upon [Datwyler Datasheet Single Mode Fiber OS2/G.652.D](#)

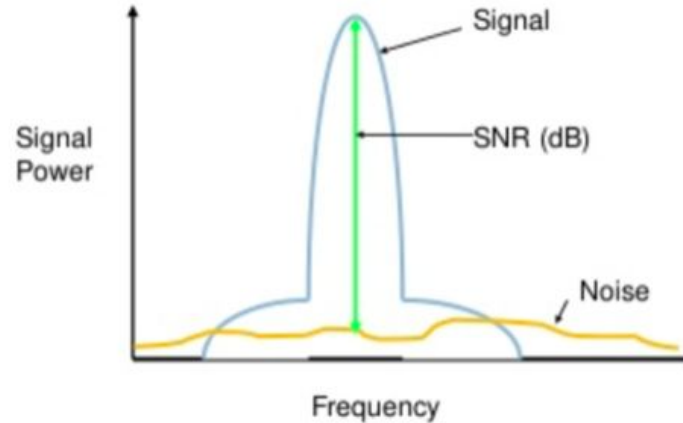
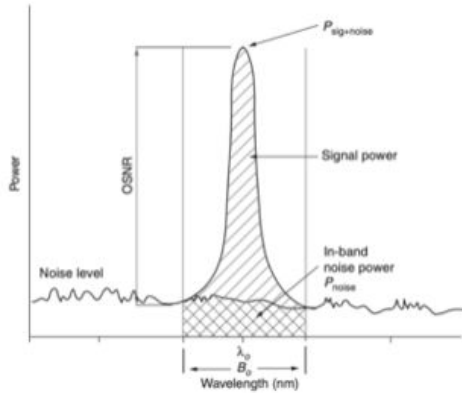
Optical Networking 101: Chromatic Dispersion

- Chromatic Dispersion is the phenomenon in which the phase velocity of a wave depends on its frequency
 - Different wavelength will travel at different speeds and hence broaden the overall signal



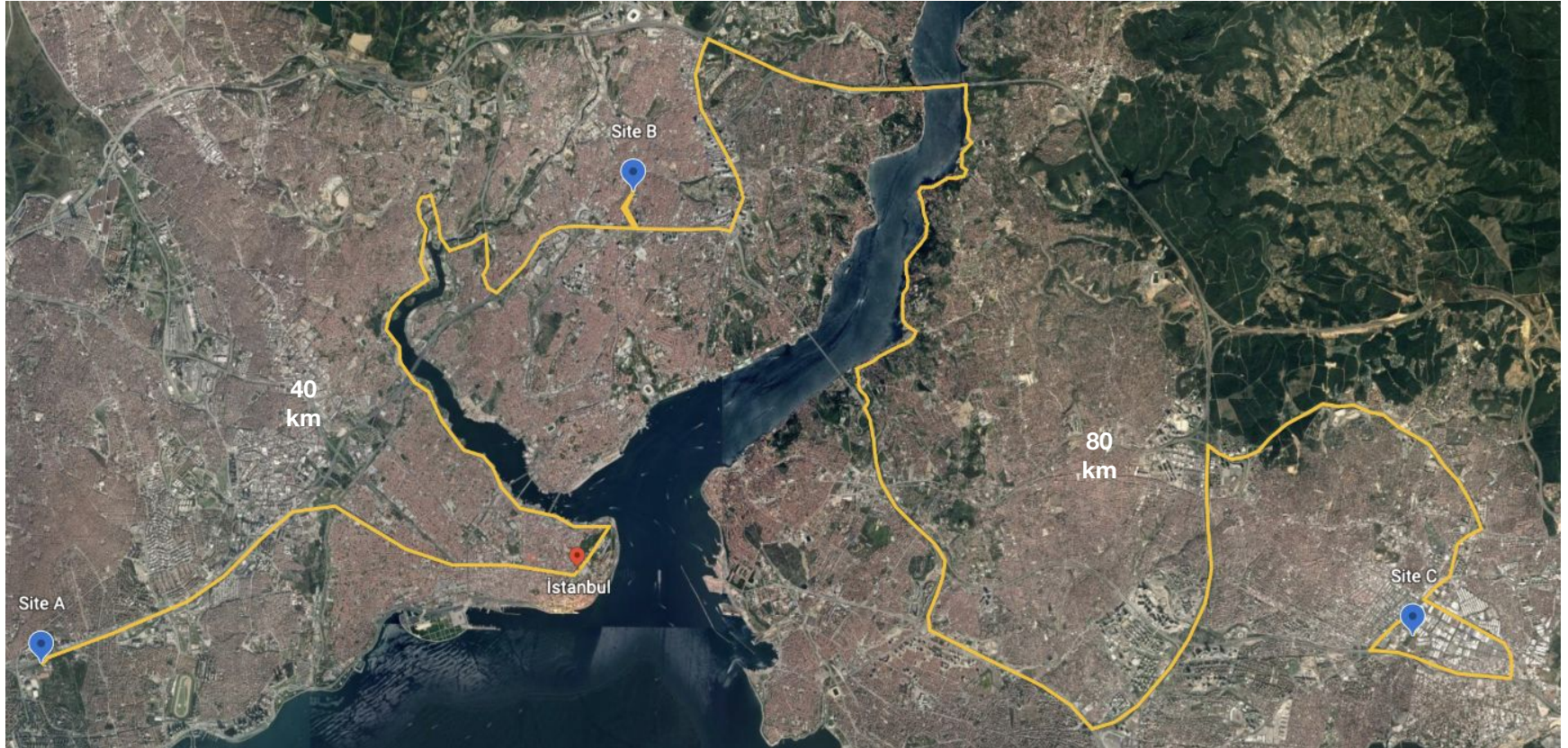
Optical Networking 101: OSNR

- Optical signal-to-noise ratio (OSNR) is used to quantify the degree of optical noise interference on optical signals
 - Direct relationship between OSNR and bit error rate (BER)



$$\text{BER} = \frac{\text{no. of incorrect received bits}}{\text{no. of transmitted bits}}$$

400G-ZR / Point-to-Point for Metro Connections

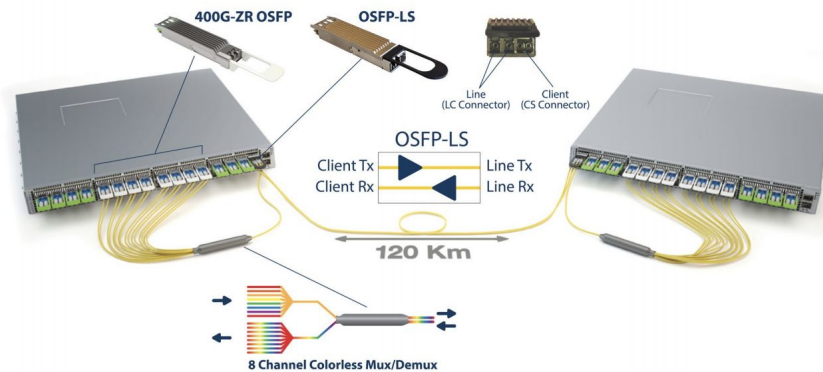


400G-ZR / Configuration

```
SiteA# show interface status | grep ZR
Et34/1      connected    routed    full    400G    400GBASE-ZR
Et35/1      connected    trunk     full    400G    400GBASE-ZR
Et36/1      errdisabled 1         full    400G    AMP-ZR
```

```
interface Ethernet34/1
  description To_SiteB
  no switchport
  ip address 10.1.34.1/24
  transceiver frequency 193100.000
  transceiver transmitter signal-power -10.00
!

interface Ethernet35/1
  description To_SiteB
  switchport mode trunk
  transceiver frequency 193300.000
  transceiver transmitter signal-power -10.00
```



Data Center Interconnect using 400G-ZR optical modules and the OSFP-LS

400G-ZR optics are tunable (coherent)
You define the frequency per optic

400G-ZR / 40 km / Transceiver

```
SiteA# sh int et 34/1 transceiver dom
Ch: Channel, N/A: not applicable, TX: transmit, RX: receive
mA: milliamperes, dBm: decibels (milliwatts), C: Celsius, V: Volts
Port 34
Last update: 0:00:03 ago
```

	Value
Case temperature	66.00 C
Voltage	3.33 V
TX power	-10.03 dBm
RX total power	-4.14 dBm
RX channel power	-8.43 dBm
Pre-FEC BER	2.18e-03
Post-FEC errored frames ratio	0.00e+00
Chromatic dispersion (short link)	-660.00 ps/nm
Differential group delay	3.00 ps
SOPMD	61.00 ps^2
Polarization dependent loss	0.70 dB
Received OSNR estimate	31.60 dB
Received ESNR estimate	16.90 dB
Carrier frequency offset	56.00 MHz
SOP rate of change	0.00 krad/s
Laser temperature	56.07 C
Laser frequency	193100.00 GHz

Post-FEC errored frames ratio is very important

CD on link divided by CD on fiber (average 17 ps/nm)
equals link length

For this link:
 $660/17=38.82$ km

Configured laser frequency

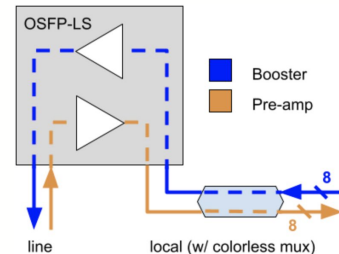
400G-ZR / 40 km / Line System DOM

SiteA# show line system port 36 dom thresholds

	Value	High Alarm Threshold	High Warn Threshold	Low Warn Threshold	Low Alarm Threshold	Unit	Indicator
Temperature	32.16	70.00	65.00	0.00	-5.00	C	
Voltage	3.31	3.47	3.37	3.23	3.14	V	
Booster							
Optical TX power (line)	8.98	16.99	16.53	-0.00	-6.03	dBm	
Optical RX power (local)	-16.99	-7.20	-8.23	-20.97	-23.98	dBm	
Pre-amp							
Optical TX power (local)	9.72	16.99	16.53	-0.00	-6.03	dBm	
Optical RX power (line)	-9.48	14.80	13.80	-19.21	-21.94	dBm	

SiteB# show line system port 36 dom thresholds

	Value	High Alarm Threshold	High Warn Threshold	Low Warn Threshold	Low Alarm Threshold	Unit	Indicator
Temperature	41.47	70.00	65.00	0.00	-5.00	C	
Voltage	3.28	3.47	3.37	3.23	3.14	V	
Booster							
Optical TX power (line)	9.52	16.99	16.53	-0.00	-6.03	dBm	
Optical RX power (local)	-16.35	-7.20	-8.23	-20.97	-23.98	dBm	
Pre-amp							
Optical TX power (local)	9.30	16.99	16.53	-0.00	-6.03	dBm	
Optical RX power (line)	-10.80	14.80	13.80	-19.21	-21.94	dBm	



400G-ZR / 80 km / Transceiver

```
SiteB# sh int et 34/1 transceiver dom
Ch: Channel, N/A: not applicable, TX: transmit, RX: receive
mA: milliamperes, dBm: decibels (milliwatts), C: Celsius, V: Volts
Port 34
Last update: 0:00:05 ago
```

	Value
Case temperature	58.00 C
Voltage	3.30 V
TX power	-9.94 dBm
RX total power	-1.75 dBm
RX channel power	-8.90 dBm
Pre-FEC BER	4.28e-03
Post-FEC errored frames ratio	0.00e+00
Chromatic dispersion (short link)	-1384.00 ps/nm
Differential group delay	4.00 ps
SOPMD	43.00 ps^2
Polarization dependent loss	0.70 dB
Received OSNR estimate	26.70 dB
Received ESNR estimate	15.80 dB
Carrier frequency offset	112.00 MHz
SOP rate of change	0.00 krad/s
Laser temperature	49.21 C
Laser frequency	193100.00 GHz

Post-FEC errored frames ratio is very important

Same calculation as for the previous link

$1384/17=81.41$ km

Configured laser frequency

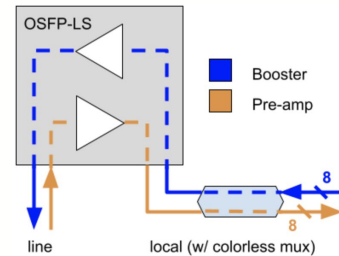
400G-ZR / 80 km / Line System DOM

SiteB# show line system port 36 dom thresholds

	Value	High Alarm Threshold	High Warn Threshold	Low Warn Threshold	Low Alarm Threshold	Unit	Indicator
Temperature	37.59	70.00	65.00	0.00	-5.00	C	
Voltage	3.28	3.47	3.37	3.23	3.14	V	
Booster							
Optical TX power (line)	9.46	16.99	16.53	-0.00	-6.03	dBm	
Optical RX power (local)	-16.50	-7.20	-8.23	-20.97	-23.98	dBm	
Pre-amp							
Optical TX power (local)	8.56	16.99	16.53	-0.00	-6.03	dBm	
Optical RX power (line)	-18.93	14.80	13.80	-19.21	-21.94	dBm	

SiteC# show line system port 36 dom thresholds

	Value	High Alarm Threshold	High Warn Threshold	Low Warn Threshold	Low Alarm Threshold	Unit	Indicator
Temperature	34.00	70.00	65.00	0.00	-5.00	C	
Voltage	3.31	3.47	3.37	3.23	3.14	V	
Booster							
Optical TX power (line)	9.10	16.99	16.53	-0.00	-6.03	dBm	
Optical RX power (local)	-16.99	-7.20	-8.23	-20.97	-23.98	dBm	
Pre-amp							
Optical TX power (local)	7.29	16.99	16.53	-0.00	-6.03	dBm	
Optical RX power (line)	-20.47	14.80	13.80	-19.21	-21.94	dBm	



High attenuation on fiber in one direction

WARN

400G-ZR / 80 km / FEC

- dB Loss Margin
 - C-FEC: 25 dB -> 100 km at 0.25 dB/km
 - O-FEC: 30 dB -> 120 km at 0.25 dB/km
- TX/RX dB loss of our 80 km fiber is 29.93 dB
 - 29.93 dB / 81.41 km -> **0.37 dB/km loss**

```
SiteB# show interfaces ethernet 34/1 error-correction
```

Interface	Configured	Available	Operational
Ethernet34/1	Default	C-FEC, O-FEC	O-FEC

Summary - 400G-ZR

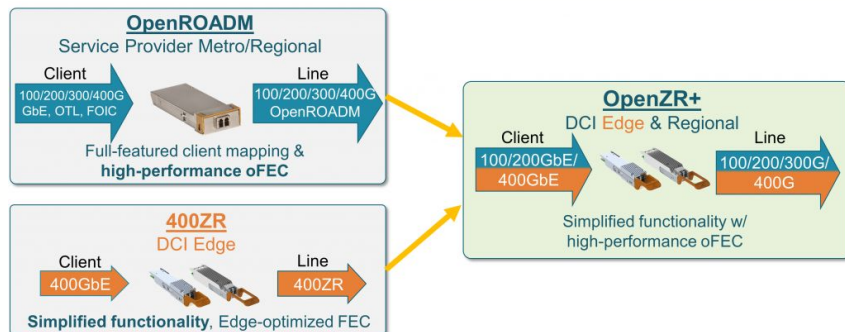
400G-ZR

- 400G-ZR is a point-to-point <120km ONLY solution
 - No ROADMs or in-line amps
- Preamplification/booster available in Transceiver Form Factor
 - Extremely simple & cost effective, but cannot mix with other line systems
- 400G-ZR can work with external line systems, but customer needs to test & validate 3rd party line systems with their optical vendors

400G ZR+ Longhaul / Global

OpenZR+ MSA

- Open Industry standard for Long-haul Connections
- Key benefits of the 400G OpenZR+ MSA specification relative to 400-ZR are
 - 4x100GE multiplexing mode
 - Long-haul performance modes
 - Extended reach for dark fiber application



	400ZR	OpenROADM	OpenZR+
Target Application	Edge DCI	Carrier Metro/LH	Regional DCI
Client Traffic	400GbE only	100-400GbE & OTN	100-400GbE Multirate
Reach	<120km	>120km*	>120km*
Form Factor	QSFP-DD/OSFP	CFP2 or other	QSFP-DD/OSFP
SD-FEC	CFEC	oFEC	oFEC
Max Pwr Consumption	15W	Not Defined	20W*
Standards	OIF	OpenROADM	Leverages other standards work

OpenZR+ specifications are [publicly](#) available

OpenZR+ Application Modes

- ZR+ transceiver supports multiple ‘application modes’ based upon the CMIS specification. Those INCLUDE 400ZR modes!

CMIS Application Code	Host format	Electrical interface	Payload	FEC	Modulation	Operating reach	MSA format
1	400GBASE-R	1x 400GAUI-8 (8x 50G)	400G	CFEC	DP-16QAM	80km	OIF 400ZR app code 0x01
2	400GBASE-R	1x 400GAUI-8 (8x 50G)	400G	CFEC	DP-16QAM	25km	OIF 400ZR app code 0x02
3	4 × 100GBASE-R	4x 100GAUI-2 (2x 50G)	400G	CFEC	DP-16QAM	80km	OIF 400ZR extension
4	400GBASE-R	1x 400GAUI-8 (8x 50G)	400G	oFEC	DP-16QAM	120km	OpenZR+ MSA (small PMD)
5	400GBASE-R	1x 400GAUI-8 (8x 50G)	400G	oFEC	DP-16QAM	450km	OpenZR+ MSA
6	4 × 100GBASE-R	4x 100GAUI-2 (2x 50G)	400G	oFEC	DP-16QAM	450km	OpenZR+ MSA
7	3 × 100GBASE-R	3x 100GAUI-2 (2x 50G)	300G	oFEC	DP-8QAM	600km	OpenZR+ MSA
8	400GBASE-R	1x 400GAUI-8 (8x 50G)	400G	oFEC	DP-16QAM	450km	OpenZR+ MSA
9	4 × 100GBASE-R	4x 100GAUI-2 (2x 50G)	400G	oFEC	DP-16QAM	450km	OpenZR+ MSA
10	3 × 100GBASE-R	3x 100GAUI-2 (2x 50G)	300G	oFEC	DP-8QAM	600km	OpenZR+ MSA
11	2x 100GBASE-R	2x 100GAUI-2 (2x 50G)	200G	oFEC	DP-QPSK	1000km	OpenZR+ MSA
12	2x 100GBASE-R	2 x CAUI4 (4x 25G) w/o FEC	200G	oFEC	DP-QPSK	1000km	OpenZR+ MSA
13	1x 100GBASE-R	1x 100GAUI-2 (2x 50G)	100G	oFEC	DP-QPSK	2000km	OpenZR+ MSA
14	1x 100GBASE-R	1 x CAUI4 (4x 25G) w/o FEC	100G	oFEC	DP-QPSK	2000km	OpenZR+ MSA

400G-ZR modes

OpenZR+ modes

Data based upon [Smartoptics Datasheet SO-TQSPDD4CCZRP](#)

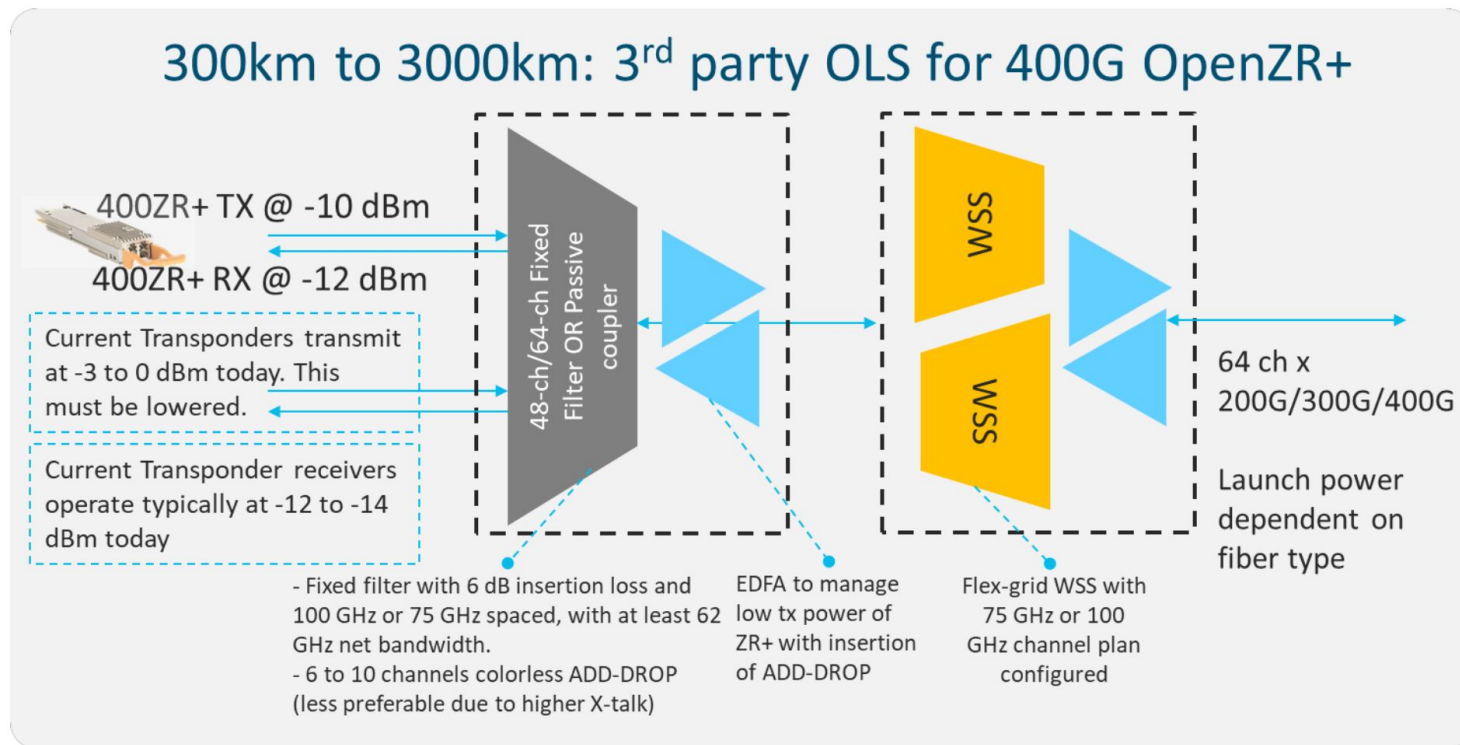
OpenZR+ Link Characteristics

- Each application mode depends on certain link characteristics.

Appl mode	Line rate	Host format	Tx Power ¹⁾	Rx sens @ high OSNR	Rx @ OSNR	Rx OSNR @0.5dB penalty	Rx OSNR @1dB penalty	CDC range
4	400G	1x 400GAUI-8	-10dBm to -6dBm	-20dBm	23.9dB@-12dBm	24.2dB@-14dBm	24.7dB@-16dBm	13 000ps/nm
5	400G	1x 400GAUI-8	-13dBm to -9dBm	-21dBm	23.4dB@-12dBm	23.9dB@-14dBm	24.4dB@-16dBm	13 000ps/nm
6	400G	4x 100GAUI-2	-13dBm to -9dBm	-21dBm	23.4dB@-12dBm	23.9dB@-14dBm	24.4dB@-16dBm	13 000ps/nm
7	300G	3x 100GAUI-2	-12dBm to -8dBm	-22dBm	20.3dB@-15dBm	20.8dB@-17dBm	21.3dB@-19dBm	26 000ps/nm
8	400G	1x 400GAUI-8	-13dBm to -9dBm	-21dBm	23.1dB@-12dBm	23.6dB@-14dBm	24.1dB@-16dBm	13 000ps/nm
9	400G	4x 100GAUI-2	-13dBm to -9dBm	-21dBm	23.1dB@-12dBm	23.6dB@-14dBm	24.1dB@-16dBm	13 000ps/nm
10	300G	3x 100GAUI-2	-12dBm to -8dBm	-23dBm	19.5dB@-15dBm	20.0dB@-17dBm	20.5dB@-19dBm	26 000ps/nm
11	200G	2x 100GAUI-2	-10.5dBm to -6.5dBm	-29dBm	15dB@-18dBm	15.5dB@-20dBm	16dB@-22dBm	50 000ps/nm
12	200G	2x CAUI4 w/o FEC	-10.5dBm to -6.5dBm	-29dBm	15dB@-18dBm	15.5dB@-20dBm	16dB@-22dBm	50 000ps/nm
13	100G	1x 100GAUI-2	-6dBm to -2dBm	-32dBm	11.8dB@-20dBm	12.3dB@-23dBm	12.8dB@-25dBm	50 000ps/nm
14	100G	1x CAUI4 w/o FEC	-6dBm to -2dBm	-32dBm	11.8dB@-20dBm	12.3dB@-23dBm	12.8dB@-25dBm	80 000ps/nm
1) The module transmit power can be provisioned up to the maximum available TX power. If the TX power is not provisioned by the host, the module TX power will default to the maximum available power, which can be any power level in the specified 4dB range.								

Data based upon [Smartoptics Datasheet SO-TQSFDD4CCZRP](#)

OpenZR+ Open Line System Requirements



OpenZR+ Reach

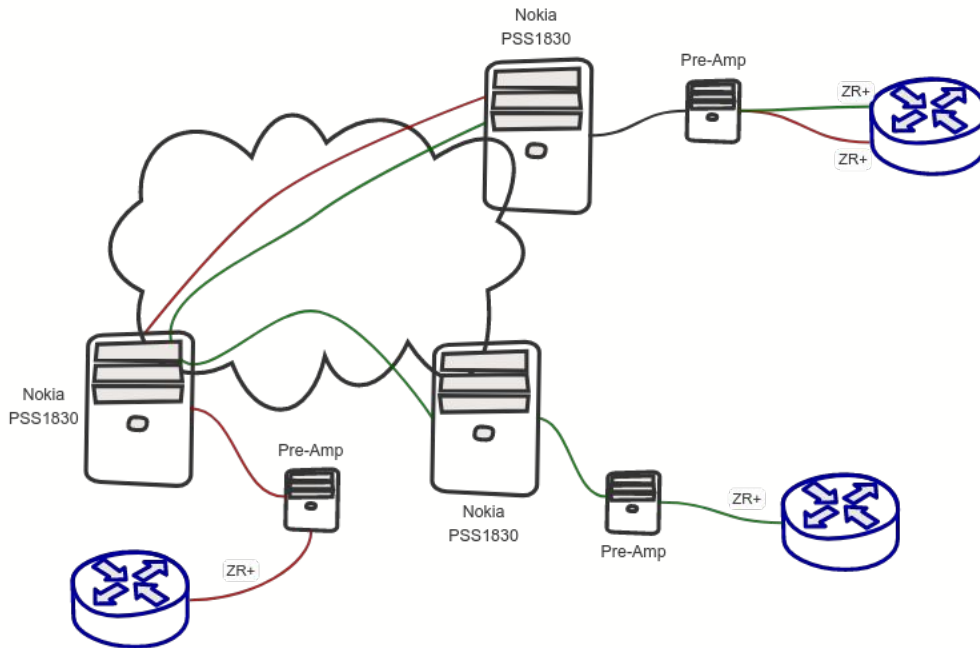
- Reach is achieved by reducing line side speed and modulation
 - The values below are specified by OpenZR+, but might vary between transceiver vendors
- Type of amplification is crucial for 400G and 300G modes

OpenZR+ modes	EDFA-only (km)	EDFA and Raman amplifier (km)
400ZR+ (ZR400-OFEC-16QAM)	480	1040
300ZR+ (ZR300-OFEC-8QAM)	1600	2320
200ZR+ (ZR200-OFEC-QPSK)	2880	2880
100ZR+ (ZR100-OFEC-QPSK)	5840	5840

Remember - the line side mode has impact on how the service is presented to the switch (*CMIS application modes*)

400G-ZR+ / Point-to-Point for Longhaul Connections

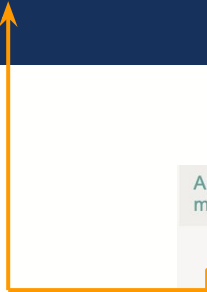
- Brownfield deployment
 - Existing Nokia WDM
 - Arista 7280CR3-32D4
- ZR+ optics
 - SmartOptics ZR+ QSFP-DD (OEM from Acacia)
- 2 different links from the same switch
 - 40 km on red link
 - 750 km on green link



400G-ZR+ / 40 km / Interface configuration

```
SiteA# sh run int et 35/1
interface Ethernet35/1
  no switchport
  ip address 10.0.0.2/24
  transceiver power ignore
  transceiver application override 5
  transceiver frequency 193400.000
  transceiver transmitter signal-power -10.00
```

```
SiteA# sh int et 35/1 transceiver hardware
Name: Et35/1
Media type: 400GBASE-ZR
Maximum module power (W): 23.75 (Power limit check disabled)
Maximum slot power (W): 20.0
Configured frequency (GHz): 193400.0
Computed wavelength (nm): 1550.12
Operational frequency (GHz): 193,400.0
Operational wavelength (nm): 1550.12
Configured TX power (dBm): -10.0
Operational TX power (dBm): -10.0
```



Appl mode	Line rate	Host format	Tx Power ¹⁾	Rx sens @ high OSNR	Rx @ OSNR	Rx OSNR @0.5dB penalty	Rx OSNR @1dB penalty	CDC range
4	400G	1x 400GAUI-8	-10dBm to -6dBm	-20dBm	23.9dB@-12dBm	24.2dB@-14dBm	24.7dB@-16dBm	13 000ps/nm
5	400G	1x 400GAUI-8	-13dBm to -9dBm	-21dBm	23.4dB@-12dBm	23.9dB@-14dBm	24.4dB@-16dBm	13 000ps/nm
6	400G	4x 100GAUI-2	-13dBm to -9dBm	-21dBm	23.4dB@-12dBm	23.9dB@-14dBm	24.4dB@-16dBm	13 000ps/nm
7	300G	3x 100GAUI-2	-12dBm to -8dBm	-22dBm	20.3dB@-15dBm	20.8dB@-17dBm	21.3dB@-19dBm	26 000ps/nm
8	400G	1x 400GAUI-8	-13dBm to -9dBm	-21dBm	23.1dB@-12dBm	23.6dB@-14dBm	24.1dB@-16dBm	13 000ps/nm
9	400G	4x 100GAUI-2	-13dBm to -9dBm	-21dBm	23.1dB@-12dBm	23.6dB@-14dBm	24.1dB@-16dBm	13 000ps/nm
10	300G	3x 100GAUI-2	-12dBm to -8dBm	-23dBm	19.5dB@-15dBm	20.0dB@-17dBm	20.5dB@-19dBm	26 000ps/nm

400G-ZR+ / 40 km / Link status

```
SiteA# sh int et 35/1 transceiver dom
```

	Value

Case temperature	54.00 C
Voltage	3.19 V
TX power	-10.65 dBm
RX total power	-11.84 dBm
RX channel power	-11.27 dBm
Pre-FEC BER	2.12e-03
Post-FEC errored frames ratio	0.00e+00
Chromatic dispersion (short link)	624.00 ps/nm
Chromatic dispersion (long link)	620.00 ps/nm
Differential group delay	1.00 ps
SOPMD	32.00 ps^2
Polarization dependent loss	0.90 dB
Received OSNR estimate	27.90 dB
Received ESNR estimate	16.80 dB
Carrier frequency offset	-8.00 MHz
SOP rate of change	0.00 krad/s
Laser temperature	50.85 C
Laser frequency	193400.00 GHz

```
SiteA# sh transceiver status interface et 35/1 | grep Oper
Operational speed           400Gbps
```

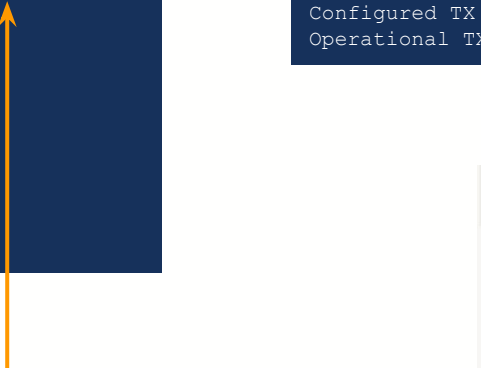
```
SiteA# sh int et 35/1 phy detail
Ethernet35/1
```

	Current State

Interface state	up
Transceiver	400GBASE-ZR
PHY state	linkUp
Oper speed	400Gbps
Lane count	8
PCS RX link status	up
PCS RX fault	ok
PCS TX fault	ok
PCS BER	0
Forward Error Correction	Reed-Solomon
Reed-Solomon codeword size	544
PMA/PMD RX link status	up
PMA/PMD lane RX link status	
Lane 0	up
Lane 1	up
Lane 2	up
Lane 3	up
Lane 4	up
Lane 5	up
Lane 6	up
Lane 7	up

400G-ZR+ / 750 km / Interface configuration

```
SiteC#sh run section 36/
interface Ethernet36/1
    speed 100g-2
    no switchport
    transceiver power ignore
    transceiver application override 7 lanes start 1
    transceiver application override 7 lanes start 3
    transceiver application override 7 lanes start 5
    transceiver frequency 192275.000
    transceiver transmitter signal-power -10.00
interface Ethernet36/3
    speed 100g-2
    no switchport
interface Ethernet36/5
    speed 100g-2
    no switchport
interface Ethernet36/7
    speed 100g-2
    no switchport
```



```
SiteC#sh interfaces et36/1 transceiver hardware
Name: Et36/1
Media type: 400GBASE-ZR
Maximum module power (W): 23.75 (Power limit check disabled)
Maximum slot power (W): 20.0
Configured frequency (GHz): 192275.0
Computed wavelength (nm): 1559.19
Operational frequency (GHz): 192,275.0
Operational wavelength (nm): 1559.19
Configured TX power (dBm): -10.0
Operational TX power (dBm): -10.0
```

Appl mode	Line rate	Host format
4	400G	1x 400GAUI-8
5	400G	1x 400GAUI-8
6	400G	4x 100GAUI-2
7	300G	3x 100GAUI-2
8	400G	1x 400GAUI-8
9	400G	4x 100GAUI-2
10	300G	3x 100GAUI-2

400G-ZR+ / 750 km / Link status

```
SiteA# sh int et 36/1 transceiver dom
```

	Value
Case temperature	50.00 C
Voltage	3.19 V
TX power	-10.22 dBm
RX total power	-7.80 dBm
RX channel power	-11.43 dBm
Pre-FEC BER	5.73e-03
Post-FEC errored frames ratio	0.00e+00
Chromatic dispersion (short link)	12674.00 ps/nm
Chromatic dispersion (long link)	12660.00 ps/nm
Differential group delay	1.00 ps
SOPMD	51.00 ps^2
Polarization dependent loss	1.20 dB
Received OSNR estimate	21.50 dB
Received ESNR estimate	12.40 dB
Carrier frequency offset	131.00 MHz
SOP rate of change	0.00 krad/s
Laser temperature	49.68 C
Laser frequency	193000.00 GHz

```
SiteA# sh transceiver status | i 36/
```

Et36/1	connected	routed	full	100G	400GBASE-ZR
Et36/3	connected	routed	full	100G	400GBASE-ZR
Et36/5	connected	routed	full	100G	400GBASE-ZR
Et36/7	notconnect	routed	full	100G	400GBASE-ZR

Appl mode	Line rate	Host format
4	400G	1x 400GAUI-8
5	400G	1x 400GAUI-8
6	400G	4x 100GAUI-2
7	300G	3x 100GAUI-2
8	400G	1x 400GAUI-8
9	400G	4x 100GAUI-2
10	300G	3x 100GAUI-2

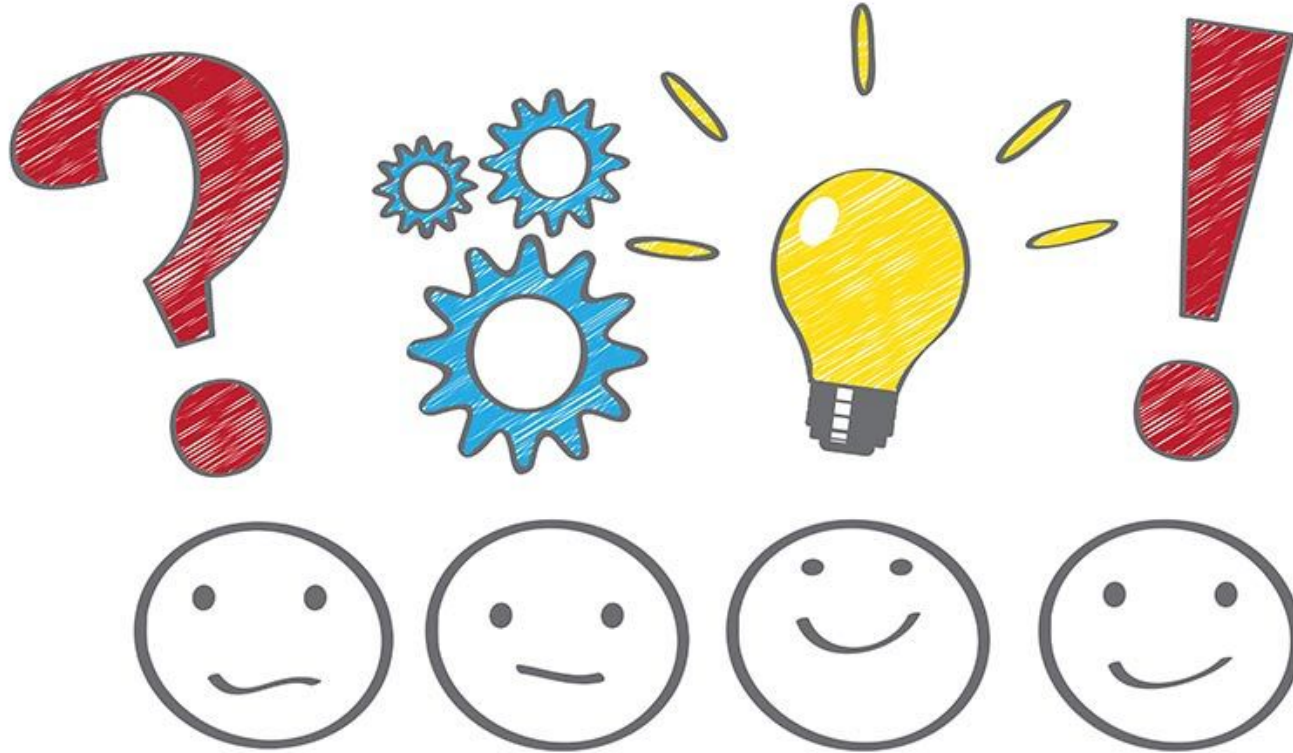
Appl mode	Line rate	Host format	Tx Power ¹⁾	Rx sens @ high OSNR	Rx @ OSNR	Rx OSNR @0.5dB penalty	Rx OSNR @1dB penalty	CDC range
7	300G	3x 100GAUI-2	-12dBm to -8dBm	-22dBm	20.3dB@-15dBm	20.8dB@-17dBm	21.3dB@-19dBm	26 000ps/nm

Summary

400G-ZR+

- 400G-ZR+ is a $> 120\text{km}$ long haul solution
 - Low optical output power $\rightarrow$ not compatible with most brownfield long haul line systems
 - Not compatible with every platform due to power and thermal constraints
 - Transceivers vary between 18W and 25W - it is very inconsistent
 - Using those transceiver in unsupported platforms could irreversibly damage your device!
- 400G-ZR+ with $> 0\text{dBm}$ Tx power is compatible with most long-haul line systems
 - 400G-ZR+ transceivers with $> 0\text{dBm}$ Tx power not available yet
 - Even higher power consumption, so always check platform support as this could irreversibly damage your device!
 - Customer needs to test & validate 3rd party line systems w/ their optical vendors

Questions?



The background of the slide features a large, semi-transparent 'ARISTA' logo at the top. Below it, a network diagram is overlaid on a cityscape at night. The network consists of numerous nodes (represented by small blue squares) connected by a web of thin white lines, creating a complex mesh across the entire slide.

Thank you for your attention!

Florian Hibler
Manager, Systems Engineering
Arista Networks, Inc.

(e) florian@arista.com
(m) +49 171 7576089
(w) <http://www.arista.com>

URL reference

400G-ZR

- Arista 400G-ZR Line System
 - https://www.arista.com/assets/data/pdf/Datasheets/400ZR_DCI_Solution_Datasheet.pdf
- Datwyler Datasheet Single Mode Fiber OS2 / G.652.D
 - https://itinfra.datwyler.com/wp-content/uploads/2020/05/Single-mode-fibre-E9_125_250-OS2-G.652.D_en.pdf

400G-ZR+

- OpenZR+ Specifications
 - <http://openzrplus.org/documents/>
- SmartOptics Datasheet SO-TQSFPDD4CCZRP
 - https://www.smartoptics.com/wp-content/uploads/2021/07/SO-TQSFPDD4CCZRP_R5.3.pdf
- Arista 400G-ZR+ TOI
 - <https://www.arista.com/en/support/toi/eos-4-26-2f/14839-400gbase-zrp-support-toi>