

# Webinar: 400G Technology Review & Test

Thank you for joining us. We will begin shortly

NOTE: This presentation includes Q&A. We will be taking questions during the presentation with answers at the end using the questions section of your control panel.



# Agenda

---

- Welcome and Introductions
  - Lindsay Welch
- TRS-RenTelco: Test & Measurement Solutions
  - James Ranstrom, Regional Sales Director
- VIAVI: 400G Technology Review & Test
  - Guylain Barlow, Senior Product Manager
- TRS-RenTelco: Equipment & Special Promotions
  - James Ranstrom, Regional Sales Director
- Q&A – Joint TRS and VIAVI

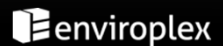
# We provide comprehensive Test & Measurement solutions delivering equipment-as-a-service.

Plan, acquire, and efficiently utilize instruments to maximize return on investment.

- End-to-end fulfillment from our Dallas, TX headquarters
- 5,000+ configurable models available, valued at over \$500MM
- In-House Financing and flexible procurement programs to Rent, Lease, or Buy
- State-of-the-Art 20,000 sq ft Calibration Lab on site
- Same-Day-Shipping with Next Day Delivery Available



A proud member of the  
McGrath Family of Businesses



# Why Do Customers Choose TRS-RenTelco?



## Customer Service Excellence

Talk with a **Live Person** when you call

**24/7/365** Technical Support

**Late-Order** processing



## Comprehensive Solutions

Customized **In-house Financing**

Deep and wide **Inventory**

Equipment ships **Ready To Use**



## Fulfillment Accuracy & Speed

**Same-day Shipping**

**80% of Calibrations** Performed In-house

**99.72%** Customer-Scored Equipment Quality Ranking



## Reliable Expertise

**Strategic singular focus** on the rental market

**Top-tier rental partner** to all major manufacturers

**Financially Secure** publicly traded company



# 400G Technology Review & T

OneAdvisor Transport 400G

Guylain Barlow  
Senior PLM  
April 2023

## Agenda and Objectives

- What's different at 400GE – Tests at 400GE with PAM4/FEC
- Working with pluggable optics. What is ZR/ZR+?
- Key use cases and applications
- Cable testing with AOC and DAC
- Key attributes of Viavi's 400G portable products

# What's different at 400GE?

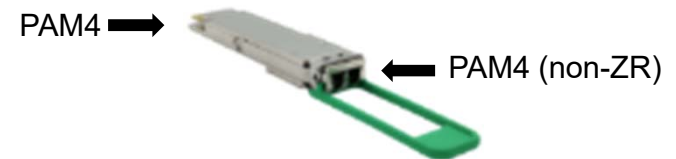
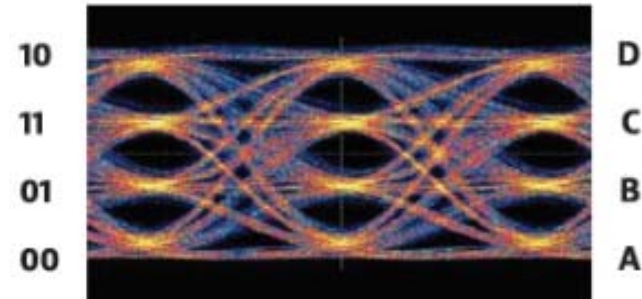
## PAM4 and mandatory FEC

The 400GE physical layer is completely different

Bit Errors on client ports DO occur, guaranteed

Why does this happen

- 1) Noise sensitivity and high bit rate
- 2) PAM4 4 levels -- and not 0's and 1's



How is this fixed?

- 3) Forward Error Correction (FEC)
  - Mandatory at 400GE: detect and correct errors
  - With more than 15 symbol errors out of 544 symbols → uncorrectable errors == bad frames

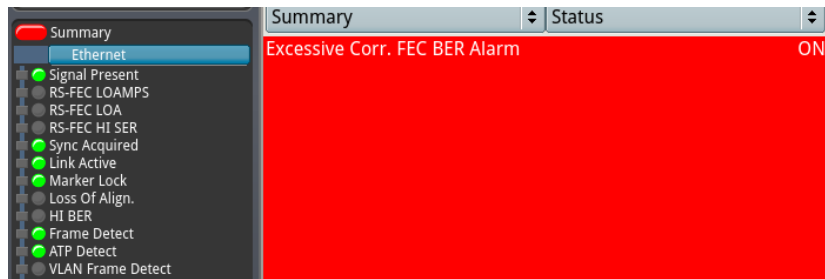
# When is the BER too high?

At 400GE, Bit errors are normal

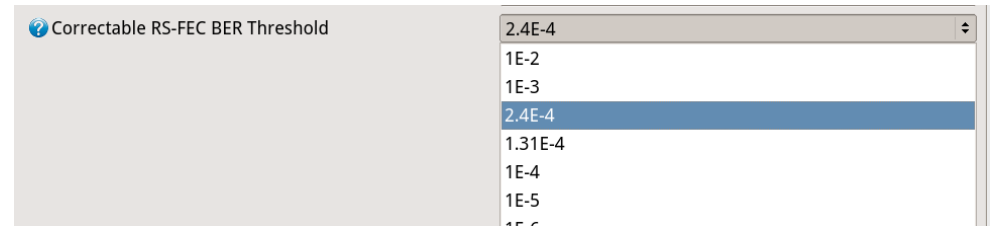
FEC-A+FEC-B	
Corr. A+B CW Errors	82,051
Corr. A+B CW Error Rate	6.56E-05
Uncorr. A+B CW Errors	0
Uncorr. A+B CW Error Rate	0.00E+00
Corr. A+B Sym Errors	82,070
Corr. A+B Sym Error Rate	1.21E-07
Corr. A+B Bit Errors	82,070
Corr. A+B Bit Error Rate	1.21E-08
Corr+Uncorr A+B Bit Error Rate	1.21E-08

This is a normal pre-FEC BER

If BER gets too high: Excessive Correctable FEC BER Alarm (default  $>2.4 \times 10^{-4}$  BER)  
Alarm to provide warning

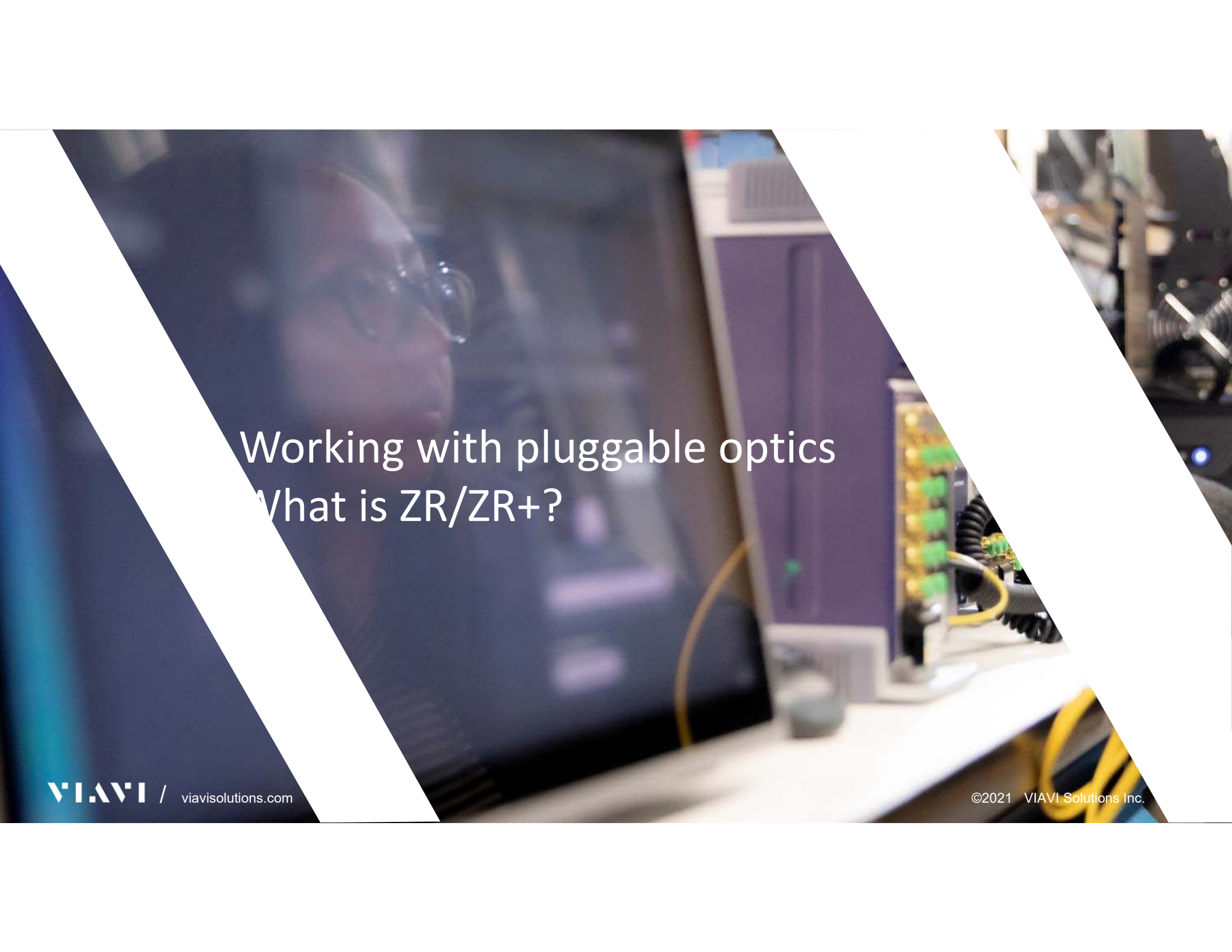


IEEE 802.3 in section 122.1.1 suggests that the bit error ratio be less than  $2.4 \times 10^{-4}$  which is the recommended default



Unique Efficiency Tool with high Error Rate Warning as per IEEE 802.3

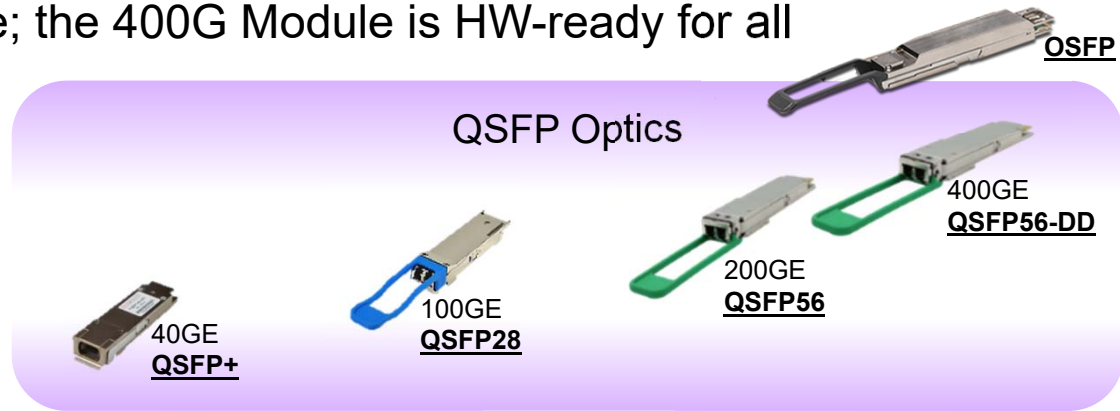


A person wearing safety glasses is looking at a computer monitor. In the background, there is a network switch with several yellow cables plugged into it. The scene is dimly lit, suggesting a server room or data center environment. The image is overlaid with a large white diagonal shape that frames the text.

# Working with pluggable optics What is ZR/ZR+?

# Client pluggable Optics Evolution – QSFP and SFP

OneAdvisor supports all of these; the 400G Module is HW-ready for all



# Optics Self-Test

QSFP / QSFP-DD / OSFP / SFP

## Complex optics often require testing

### Use Cases:

Troubleshooting: Narrow down the issue (example: RFC 2544 or Y.1564 fails)

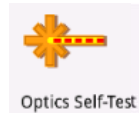
Sample Testing: Sample test optics performance perhaps prior to deploying a new optics type

## Reduce Troubleshooting Time with an easy streamlined function

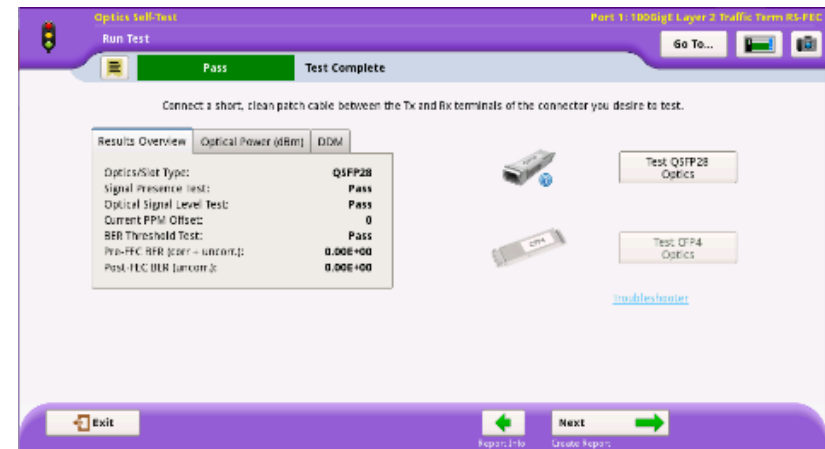
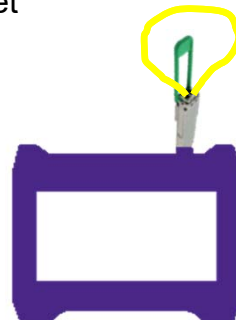
- Field optimized
  - Built-in test time calculator based on BER target
- Built-in report

Recommended test time: BER theory

100GE	95% Confidence Level		
Target BER	Sec	Min	hrs
1E-12	29.09	0.48	
1E-13		4.85	
1E-14		48.48	0.81
1E-15			8.08



Optics Self-Test



Save time: Get both pre-FEC and post-FEC results in one step with Optics Self-Test

# What is ZR and ZR+

## What Is 400G ZR?

For  $\geq 40\text{km}$

A standard for 400GE over an optical wavelength using DWDM and DP-QAM16 modulation

## What Is ZR+?

From OIF OpenZR+ was designed to extend distances beyond 400ZR

Goes beyond 400G ZR to cover 100G, 200G, 300G & 400G line rates utilizing OpenFEC forward error correction

Many optics can cover both ZR and ZR+



# ZR/ZR+ on OneAdvisor

Powered by Superior Cooling – Ready for ZR+ and 0dBm

Comprehensive coverage of ZR/ZR+ optics for deployments

- Fully controllable Tx laser across C-Band
  - Program by frequency, WL, Channel
- Reporting of coherent statistics



Interface	Coherent
Media Pre-FEC	
Current	2.06E-03
CD (ps/nm)	
Current	0
DGD (ps)	
Current	1
SOPMD (ps^2)	
Current	39
PDL (dB)	
Current	0.9
OSNR (dB)	
Current	36.3
Q Factor (dB)	
Current	9.1



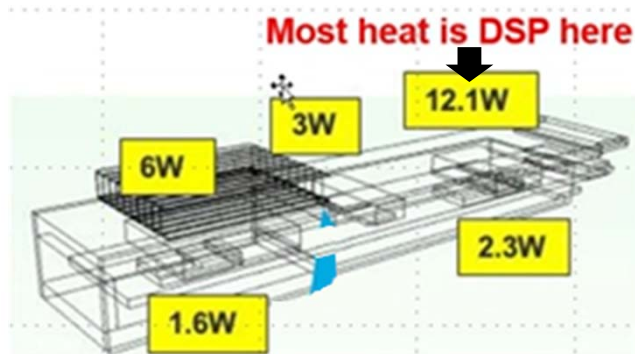
Tunable Device			
	QSFP Expert	I2C	Engineering
73.2	Yes		33GHz supported
100GHz supported	Yes		50GHz supported
25GHz supported	Yes		12.5GHz supported
Fine Tuning supported	Yes		Program Output Power supported
Tunable Setting			
Grid Spacing	100 GHz		
Tuning Mode			
Frequency (THz)	196.100		
Current Frequency (THz)	<b>196.100002</b>		
First Tunable Frequency (THz)	<b>191.3</b>		Last Tunable Frequency (THz) <b>196.1</b>
Tuning In Progress	<b>No</b>		Wavelength Unlock <b>Locked</b>
<input checked="" type="checkbox"/> Fine Tuning			
Fine Tune Offset (GHz)	0.002		
Fine Tuning Resolution (GHz)	<b>0.001</b>		
Fine Tuning Low Offset (GHz)	<b>-6</b>		
Fine Tuning High Offset (GHz)	<b>6</b>		

Investment Protection: Control of ZR optics for field users

## Heat Dissipation

### Heat Dissipation is the key factor for ZR/ZR+ support

- QSFP-DD/OSFP ZR/ZR+ pluggable devices require high power
- **Especially true for ZR+/0-3dBm pluggables – Up to 23 Watts**
- OneAdvisor 800 has strong cooling capabilities
  - Fan speed depends on optics temperatures
  - **4 dedicated fan cooling zones – best in class**



Cooling matters inside the unit



# What are CMIS Application Codes?

CMIS App Codes define the QSFP/OSFP application  
 Examples: using ZR versus ZR+, 400GE vs 4x100GE  
 OneAdvisor provides this advanced feature

Advertisement from optics

Code 1 for 400GE

Code 2 for 4x100GE

	App Code	Host Code (hex)	Host App Name	Media Code (hex)	Media App Name
1	1	11	400GAUI-8 C2M	1C	400GBASE-DR4
2	2	0D	100GAUI-2 C2M	14	100GBASE-DR
3		FF	End of List	00	

Unit auto-selects  
 Code 1 in 400GE

QSFP	QSFP Expert	I2C
Allowable Host App Names		<b>400GAUI-8 C2M</b>
App Code		Default
Current App Code		<b>1</b>
Datapath State		<b>DPInitialized</b>

Code 2 if in 4x100GE

## Optics Vendor Info

QSFP	QSFP Expert	I2C	
Nominal Wavelength (nm)	<b>1311</b>	Rx Power Level Type	<b>Average Power</b>
Vendor	<b>INNOLIGHT</b>	Rx Max Lambda Power (dBm)	<b>7.5000</b>
Vendor PN	<b>T-DP4CNT-N00</b>	Tx Max Lambda Power (dBm)	<b>7.0000</b>
Vendor SN	<b>INNAAI020141</b>	Power Class	<b>Class 6 (&lt;= 12.0 W)</b>
Vendor Rev	<b>1A</b>	Module ID	<b>QSFP-DD</b>
Date Code	<b>230105</b>	Rev Compliance	<b>CMIS 4.0</b>
Lot Code	<b>22</b>	Cable Length	<b>---</b>
Connector Type	<b>MPO 1x12</b>	Transceiver	<b>100GBASE-DR; 400GBASE-DR4</b>
Max Link Length	<b>2km (SMF)</b>		

# Advanced Optics Controls

Advanced features to control alpha/beta Optics

## Challenge: some optics may need tweaking

- Electrical pre-emphasis: Expert Mode to optionally adjust the electrical Interface

The screenshot shows the 'QSFPCMS\_Expert' window with the following settings:

- Allowable Host App Names: 400GAUT-8 C2M
- App Code: Default
- Current App Code: 1
- Datapath State: DPActivated
- Datapath ID: Lane 0-7 all set to 0
- Host Transmit Settings: Pre-Emphasis (Default), Current Pre-Cursor (3), Current Post-Cursor (0), Current Swing (16)
- Module Rx Output Settings: Pre-Emphasis (Vendor Default), Vendor Pre-Cursor (Vendor Default), Vendor Post-Cursor (Advanced), Vendor Swing (n/a)
- Pluggable Optic Reset button

Adjustments on pre-emphasis may be required with some pluggables

## Register control via peek/poke

The screenshot shows the 'QSFPCMS\_I2C' window with the following fields:

- Peek: Peek DevAddr (A0), Peek PageSel (10), Peek RegAddr (82), Peek Value (0x00), Peek Success (0)
- Poke: Poke DevAddr (A0), Poke PageSel (10), Poke RegAddr (82), Poke Value (00), Poke Success (0)

QSFPCMS-DD: Page 0x10, Register 0x82 controls per-lane laser enable/disable. All values are in hexadecimal.

## Register Dump

```
QSFPCMS_RegisterDump
PageNum = 0
00: 1E 40 00 06 00 00 00 00 01 50 00 00 00 00 18 F5 @ P
10: 82 F2 00 00 00 00 00 00 00 00 40 00 00 00 00 00 @
20: 00 00 00 00 00 00 00 DF 84 00 00 00 00 00 00 00
30: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
40: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
50: 00 00 00 00 02 0F 18 44 01 0B 10 44 01 FF 00 D D
60: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
70: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
80: 1E 49 4E 4E 4F 4C 49 47 48 54 20 20 20 20 20 20 INNOLIGHT
90: 20 44 7C 7F 54 2D 46 58 34 46 4E 54 2D 48 30 30 DJ T-FX4FNT-H00
A0: 20 20 20 20 32 41 49 4E 4B 42 58 55 35 33 30 31 2AINKBXU5301
B0: 30 36 20 20 20 20 32 30 31 32 31 31 20 20 20 20 06 201211
C0: 20 20 20 20 20 20 20 E0 1A 00 07 00 00 00 00
D0: 00 00 F0 00 06 00 00 00 00 00 00 00 00 00 0A 00
E0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
F0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
PageNum = 1
80: 00 00 03 0A 43 00 00 00 00 00 65 A4 1B EE 24 F0 C e $
90: 37 20 41 0F 00 00 9D 18 00 FC 77 2E 06 06 06 03 7 A w.
A0: 07 09 3D 40 0F 8C 9E 37 37 00 00 00 00 00 00 00 =@ 77
B0: 01 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00
C0: 00 00 01 0A 03 65 00 00 00 00 00 00 00 00 00 00
D0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
E0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
F0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 31 1
PageNum = 2
80: 4B 00 05 00 46 00 0A 00 8D CC 74 04 87 59 7A 76 K F t Yzv
90: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
A0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
B0: E6 08 04 B2 91 22 09 5F EA 60 13 88 E0 9C 1D 4C ' ' L
C0: F6 08 03 BB 91 22 07 71 00 00 00 00 00 00 00 00 ' ' g
```

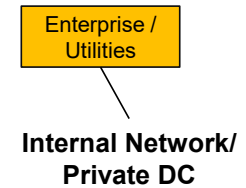
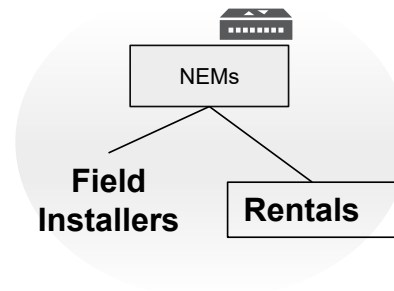
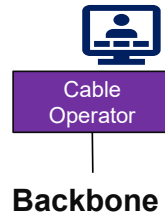
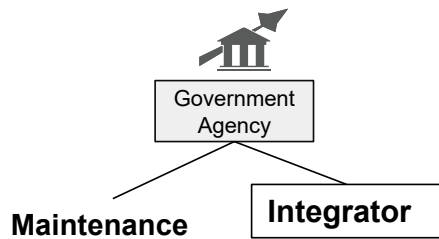
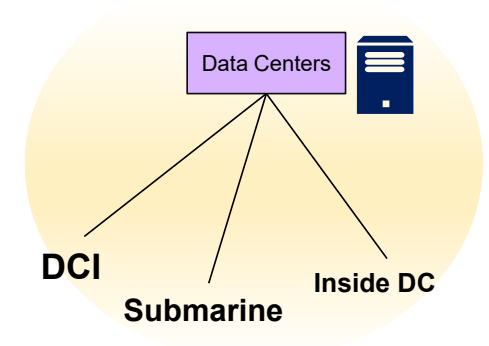
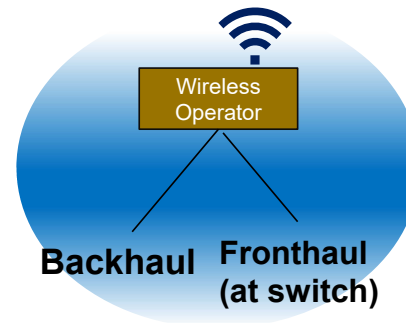
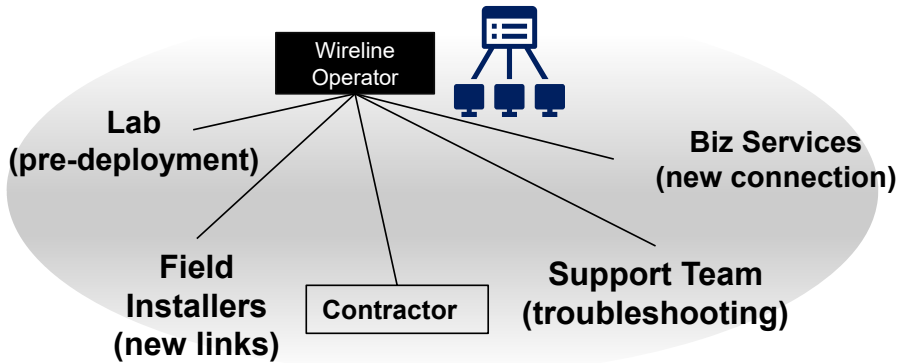




# Use Cases and Applications

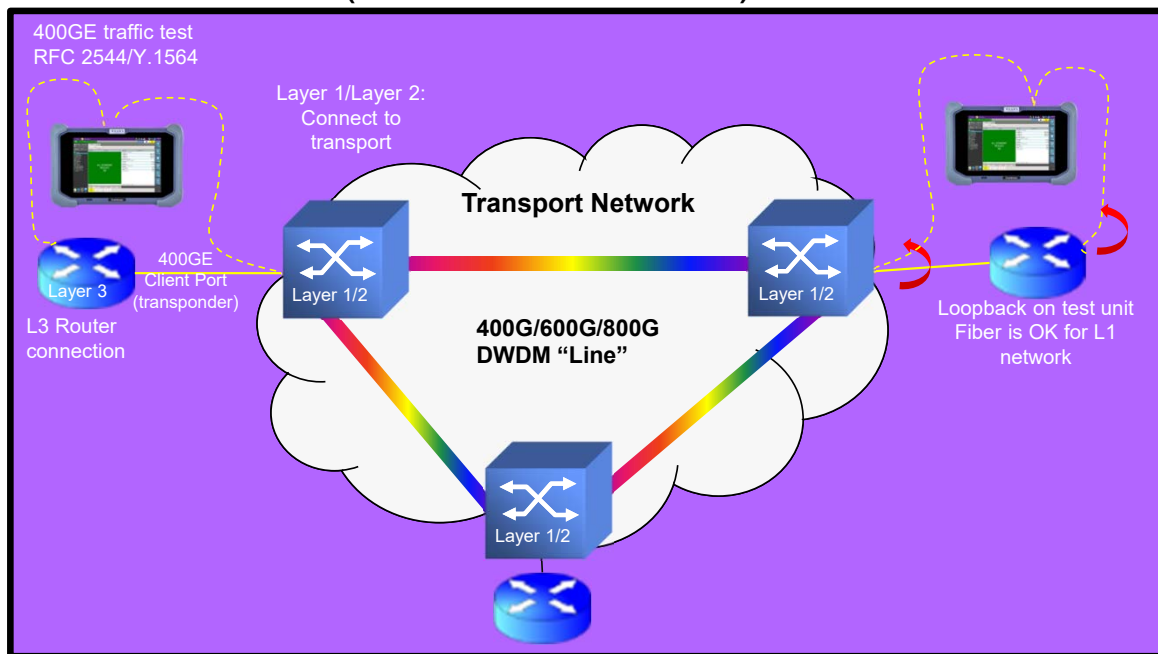
# Typical User Groups for OneAdvisor 800 400G Transport

Primary User Groups for the core metro portfolio: service turn up and troubleshooting

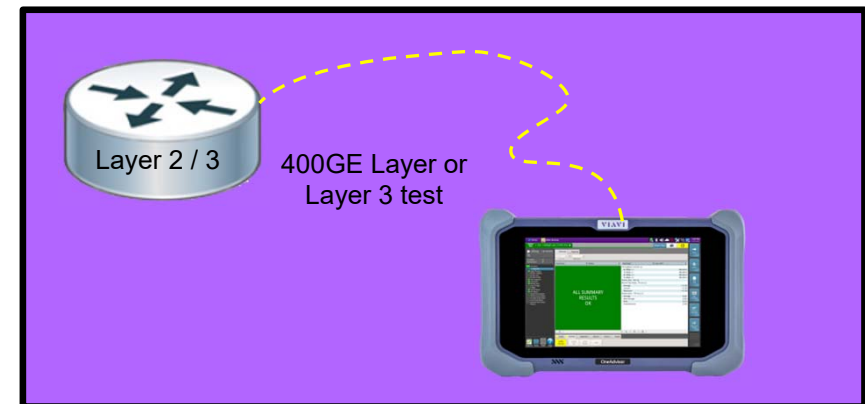


# 400G Test - Use Cases 1

## 400GE Transport Testing Typical connectivity (RFC 2544, Y.1564)

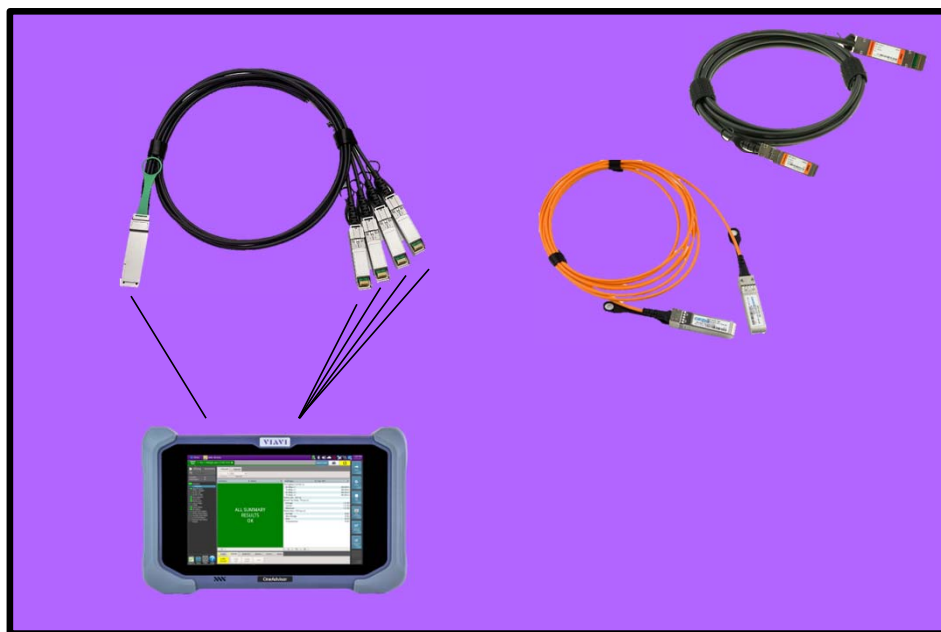


## 400GE Port Testing Data Center



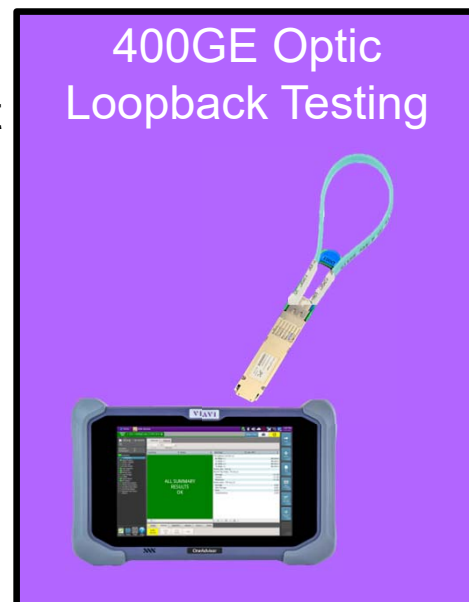
## 400G Test - Use Cases 2

### DAC / AOC Cable Testing Inside Data Center



### Optics Self-Test

- QSFP-DD/OSFP
- QSFP28/56
- SFP



# Dual Rate Applications

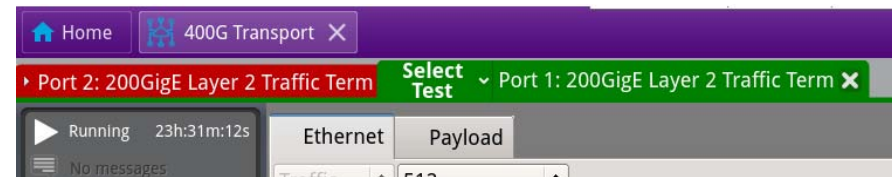
Option CADUALAPPS – ONA 1000 and ONA 800

All Ethernet rates up to 200GE

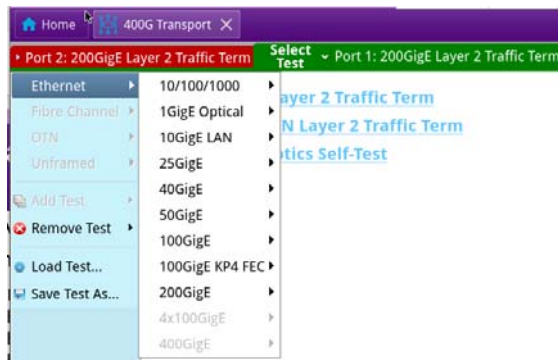
Any port, any rate, any time

10/100/1000Base-T to 200GE

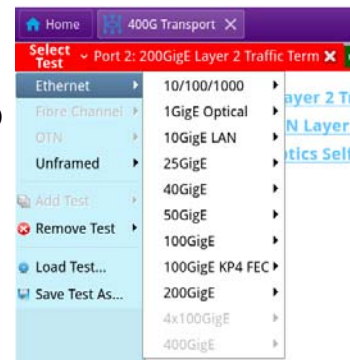
Especially useful in lab applications – 2 test sets in 1!



1 app, all rates



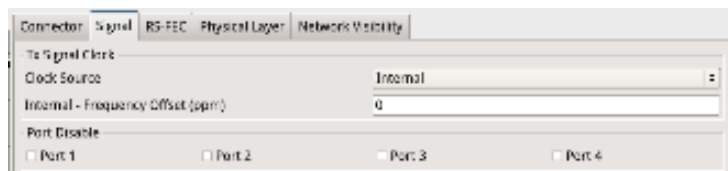
Dual app rates



Dual 400GE is coming in August on OneAdvisor 800

# Special APP 4x100GE with KP4 RS(544,514) CA4X100GE

One QSFP-DD, up to 4 logical ports  
User can disable any logical port



4 traffic engines – can be joined or separate

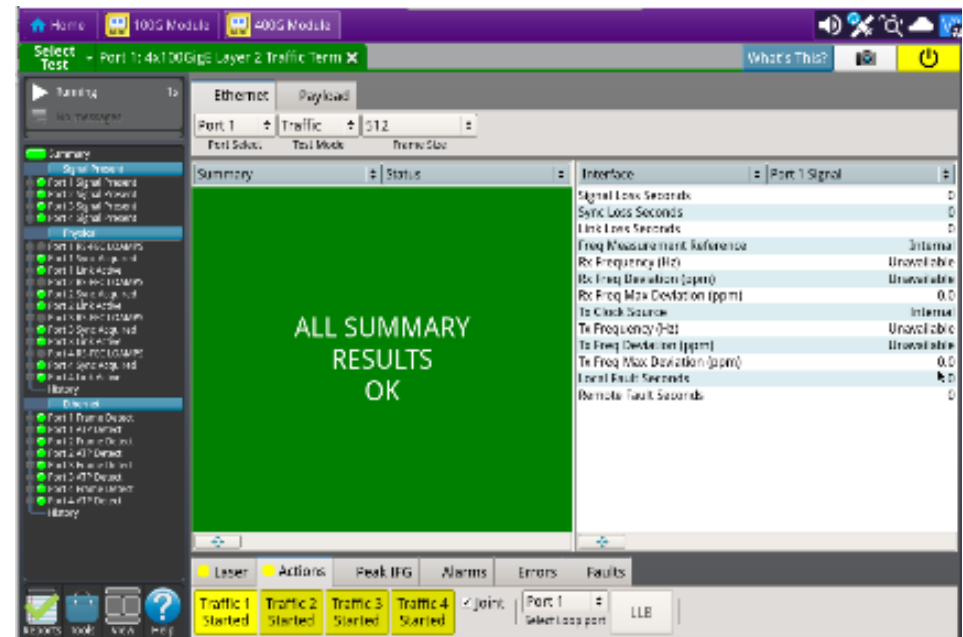
Works with:

- DR4 for breakout (MPO one end, LC breakout other end)
- FR4 point-to-point if optics supports it
- ZR/ZR+ coherent

Port 1 Ethernet - L2 Link Stats		Port 2 Ethernet - L2 Link Stats	
Total Util % E		Total Util % E	
Average	100.000	Average	100.000
Current	100.000	Current	100.000
Minimum	100.000	Minimum	100.000
Peak	100.000	Peak	100.000
Current Util % I		Current Util % I	
Unicast	100.000	Unicast	100.000
Multicast	0.000	Multicast	0.000
Broadcast	0.000	Broadcast	0.000

Port 3 Ethernet - L2 Link Stats		Port 4 Ethernet - L2 Link Stats	
Total Util % E		Total Util % E	
Average	100.000	Average	100.000
Current	100.000	Current	100.000
Minimum	100.000	Minimum	100.000
Peak	100.000	Peak	100.000
Current Util % I		Current Util % I	
Unicast	100.000	Unicast	100.000



# 64GFC – on SFP56

Available on ONA 1000 and ONA 800

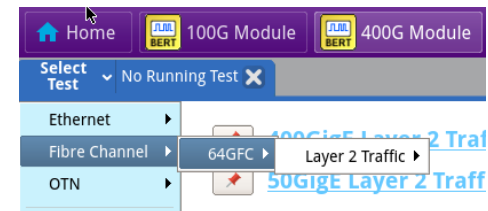
Option CA64GFC

TTS (Transmitter Training Sequence) is a feature to negotiate between NRZ/PAM4 electrically

With TTS enabled use the Viavi recommended optic

Other optics can be tested with TTS disabled

Can connect to transport networks, to fabrics (fabric login), and can test optics



Connector	Signal	RS-FEC	Physical Layer
Flow Control			
Flow Control	On	Login	Explicit (Fabric/N-Port)
Rx Buffer to Buffer Credits(Far-end B-B)	400		
Physical State Machine Control			
TTS	Enable	<input checked="" type="checkbox"/> Advertising of Precoding	
Link Initialization	Enable		
Tx and Rx	Couple		
MAC ID			
Unit Identifier	JDSU-WMTM0064320009-11		
Port Name	008016A0725C		
Fabric/N_Port Login			
Topology	Point-to-Point		
Source N Port Name	1000000102030408	Source Node Name	2000000102030408
Destination ID	A04139	Source ID	A0725C
Auto-start traffic when laser turned on	No		

The screenshot shows a table of test results for 'Port 1: 64Gig Fibre Channel Layer 2 Traffic Term'. The table has columns for test name and status. The 'Fibre Channel' test is selected, and the 'TTS' test is highlighted. The results show that LSN Process Status, TTS Process Status, and Receiver State are all 'Passed'. Other tests like 'Rx LSN TF Control Field', 'Control Field', 'Extended Marker', and 'Request Use of FEC' have specific values or 'Yes' status.

Test Name	Status
Fibre Channel	TTS
LSN Process Status	Passed
TTS Process Status	Passed
Receiver State	AC(LA)
Rx LSN TF Control Field	
Control Field	0x8800
Extended Marker	64GFC
Request Use of FEC	Yes



# Testing AOC and DAC Cables



# Cable Test – The workflow to test AOC and DAC Cables

Workflow is on ONA 1000 and 800

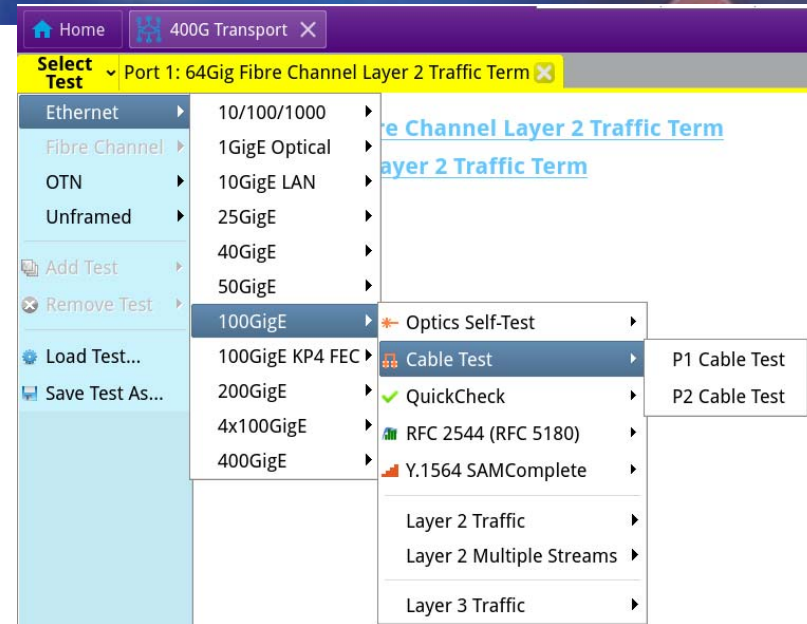
Workflow to test AOC/DAC/AEC (Active Elec Cable)

Works similarly to Cable Test on 5800

Settings for straight cables and breakout cables

Use cases:

- Test cable on single unit (ONA 800)
- Test cable between two units

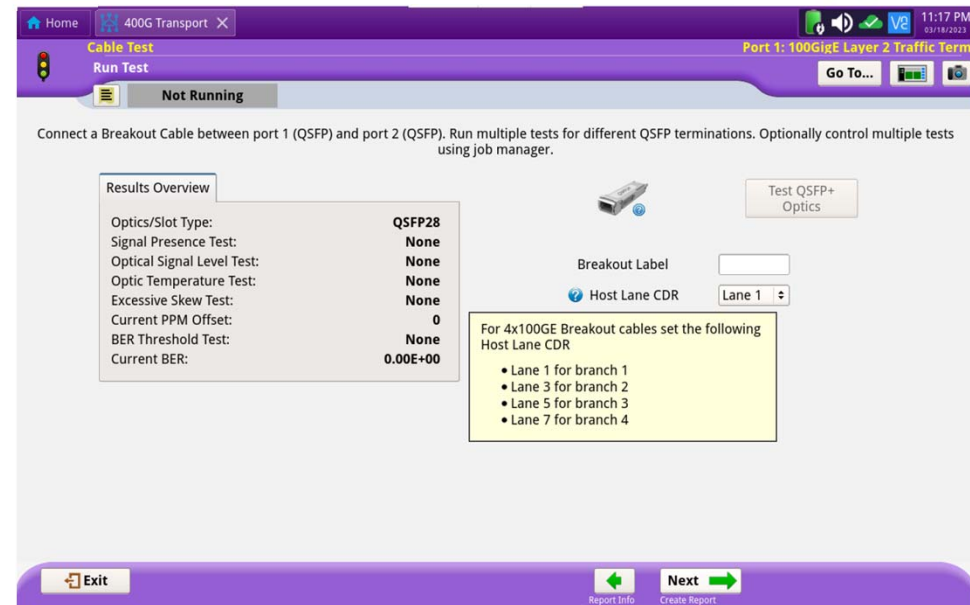
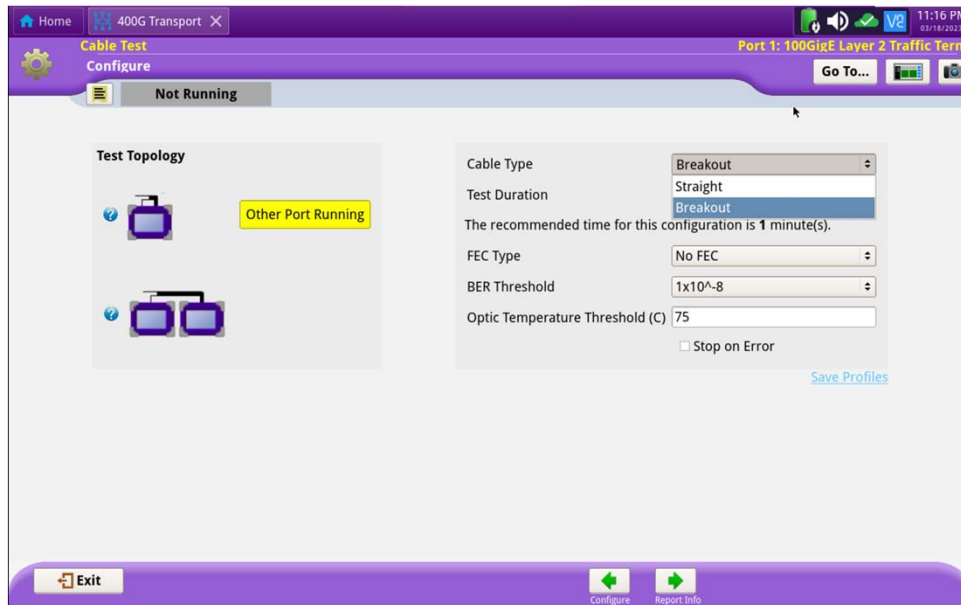


# Cable Test - workflow

Workflow itself is on ONA 1000 and 800  
Loopback on ONA 800

breakout

straight





# 400G Product Portfolio

# Portable Transport Family

## Comprehensive Coverage



**T-BERD /  
MTS-5811P**

Biz Services /  
Transport Test  
Single port



**T-BERD /  
MTS-5822P**

Biz Services /  
Transport Test



**T-BERD /  
MTS-5882**

5G Mobility –  
up to 10G

**10G**



**T-BERD /  
MTS-5800-100G**

CO / High Speed  
Metro Core/  
Long Haul Core  
**100G**



**OneAdvisor 1000**

Central Office



**OneAdvisor 800**

Small portable –  
RF, Transport, Fiber

**400G**



### EXPANSION MODULES



Timing Expansion Module v2 (excl. ONA 1000)



Datacom Expansion Module (5800)



OTDRs



Channel Checker / OSA



PEM (ONA 800)



CAA (ONA 800)



# OneAdvisor 800 and OneAdvisor 1000 400G Field Units

**ONA 800 with  
TM400GB-QO**



**ONA 1000 with  
TM400GA**



- Smallest size
- Low noise
- Run 400GE on QSFP-DD or OSFP
- Scalable battery – can add batteries (PEM)
- Can combine with fiber optics modules

Small size and lightweight for efficiency

- Central office applications
- Can stack two 400G Modules (dual 400GE)
- Combine with 100G Module or fiber
- Always with 2 batteries

Superior Scalability

# OneAdvisor 800 – Transport & Wireless

## OneAdvisor Transport (TM400GB)



### Ethernet Test

- 400G Ethernet incl ZR/ZR+ optics
- 4x100GE
- 200G / 100G / 50G / 40G
- Dual port

### Optical Transport

- OTN
- 64GFC

## Common Capabilities

### Ethernet Test

- 1G/10G/25G Ethernet
- 100G Ethernet
- Timing (PTP/1588) in 10GE/25GE (roadmap on TM400GB)
- Capture

### Cable & Antenna

- Return Loss
- Cable Loss
- Distance to Fault

### Fiber Test

- Fiber Inspection
- OTDR
- Optical Spectrum Analysis

## OneAdvisor Wireless (SPA06MA-O)



### RF Test

- Spectrum Analysis
- Interference Analysis
- Realtime Spectrum
- LTE and 5G Signal Analysis
- Wireless network coverage

### Fronthaul

- RFoCPRI (PIM)
- O-RAN emulation
- CPRI Transport
- 1G/10G/25G Ethernet
- PTP

# OneAdvisor 800 Transport - 400G

Delivers all test capabilities needed to ensure 400G network performance

Delivers all test capabilities needed to ensure 400G network performance

ONA 800 with  
TM400GB-QO



## Key Benefit Summary

### • Superior Scalability

- Add 2 of an OTDR \ OSA \ Power Expansion Module
- Battery scalability (via PEM)

### • **Comprehensive pluggable optics support** – investment protection

- ZR/ZR+ superior cooling & support
- Optics Self-Test for any optics

### • **Very small size** – easy to carry, lightweight

### • **Fast RFC 2544, Y.1564 workflows, job manager** – save time

Investment Protection: Futureproof optics slots, expandability, robust battery support



ONA 800 with 400G      ONA 800 with 400G & 2 expansion modules

## Scalable Battery Support

### **Superior Battery Support**

- Built-in battery provides 45 mins running 400GE
- Use 1 PEM with ZR/ZR+ optics for battery operation
- Expand with 1 or 2 Power Expansion Modules: 2 hours at 400GE!



Convenience and Time Saving via Extended Battery Life





# VI.AVI

VI.AVI Solutions

[viavisolutions.com](http://viavisolutions.com)

# The TRS & Viavi Partnership

[sales@trsrentelco.com](mailto:sales@trsrentelco.com)

800.874.7123

Exclusive Viavi Rental Partner with the most expansive inventory, including:



- Short and Long-term, Full-service Rentals
- New Equipment Sales
- Operating Leases
- Lease with Purchase Option
- As low as 0% Financing for Certified Pre-owned Equipment
- OEM Partner Programs

Questions?

