OSCILLOQUARTZ
An ADVA Optical Networking Company

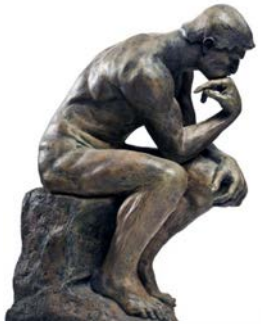
Phase Delivery over PTP Unaware Networks

Nir Laufer , Director Product Line Management

WSTS 2015

Phase Delivery Challenges in Brownfield Deployments

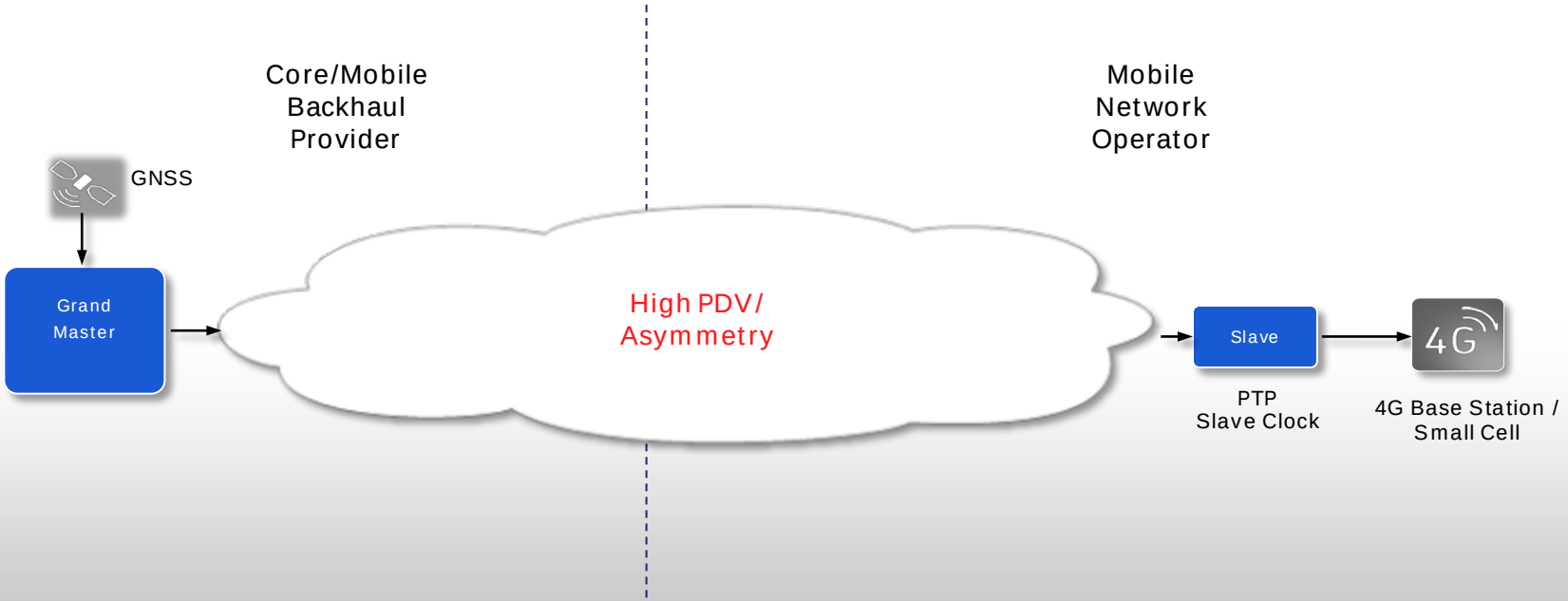
- Existing network introduce high level of asymmetry and PDV
- The asymmetry and PDV varies over time
- Existing networks include different transport technologies
- Upgrading/forklifting the existing NE to Sync-E/BC is very costly



Do we really need frequency and phase in the core network?

The Solution

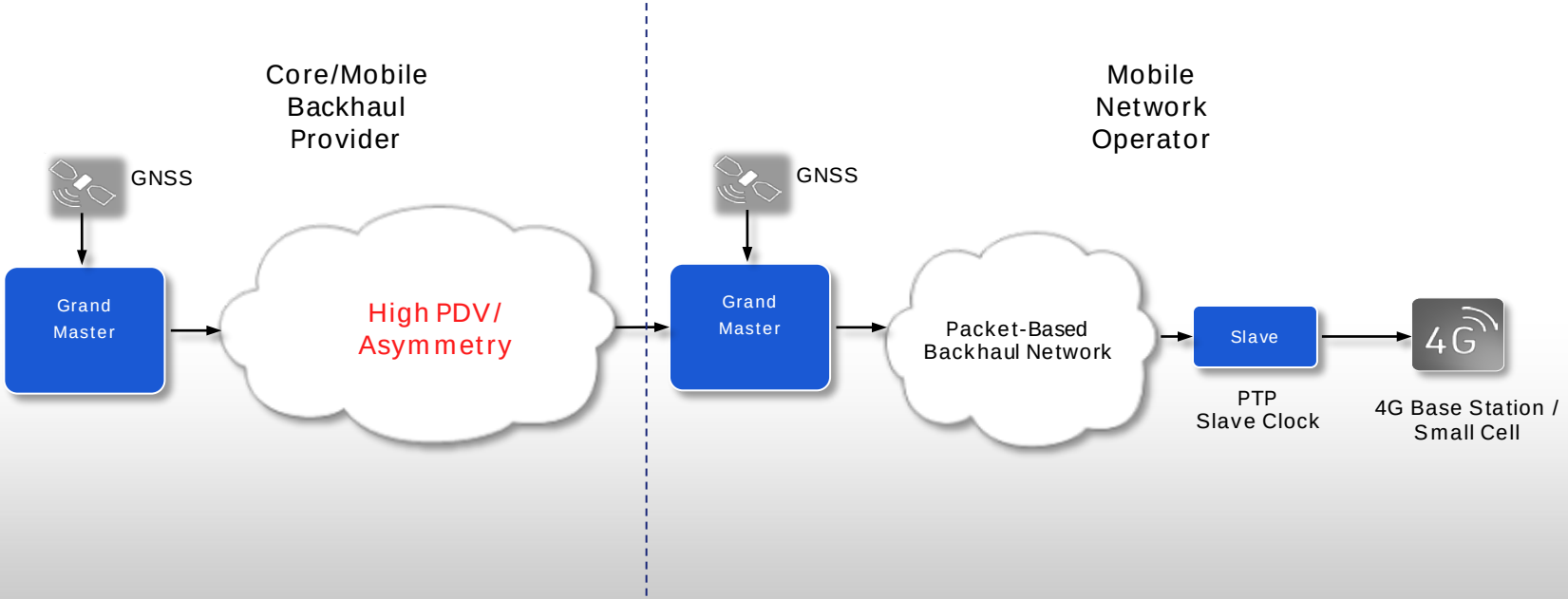
Bypass the problem:
Get the Grand Master closer to the Slave



OSCILLOQUARTZ
An ADVA Optical Networking Company

The Solution

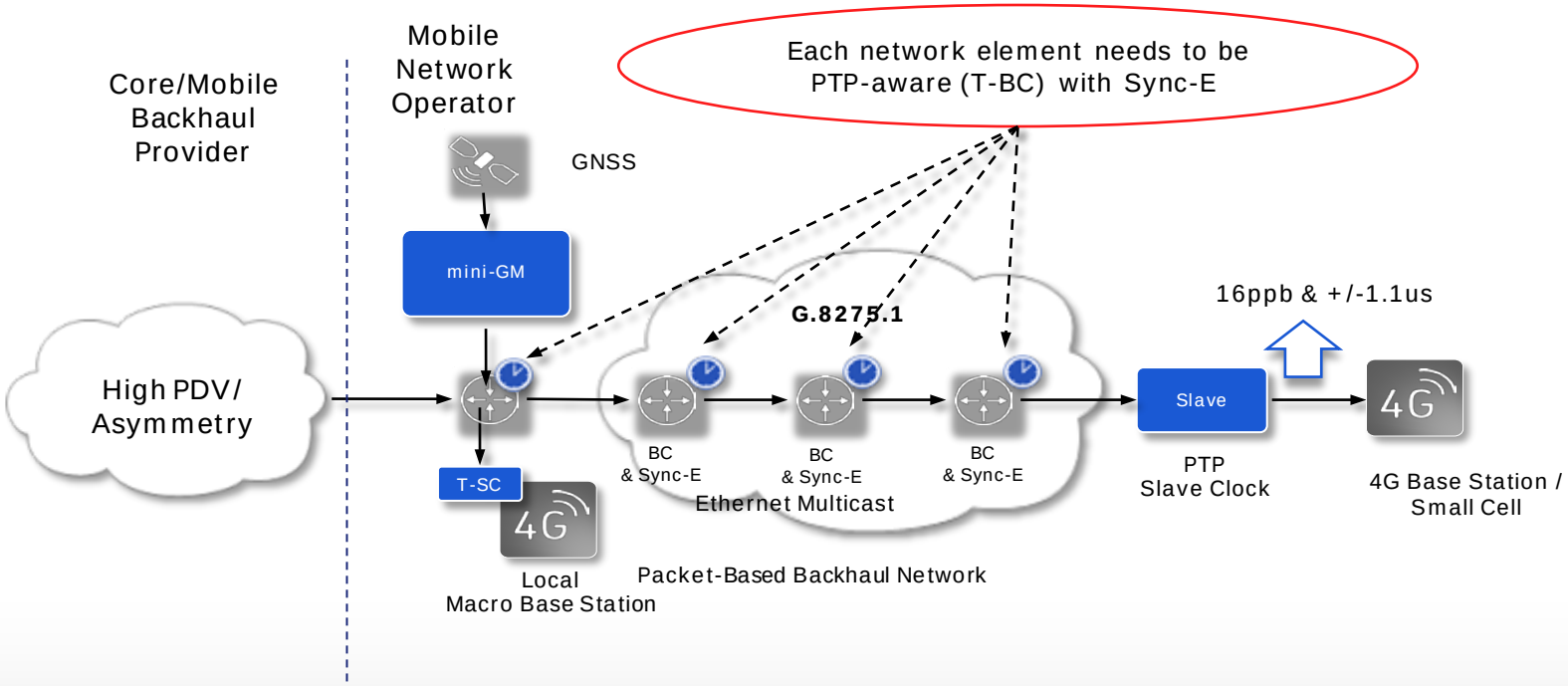
Bypass the problem:
Get the Grand Master closer to the Slave



OSCILLOQUARTZ
An ADVA Optical Networking Company

Phase Delivery:
Small Scale GM & G.8275.1 – Last Mile

- G.8275.1 – Uses hop by hop , Ethernet multicast

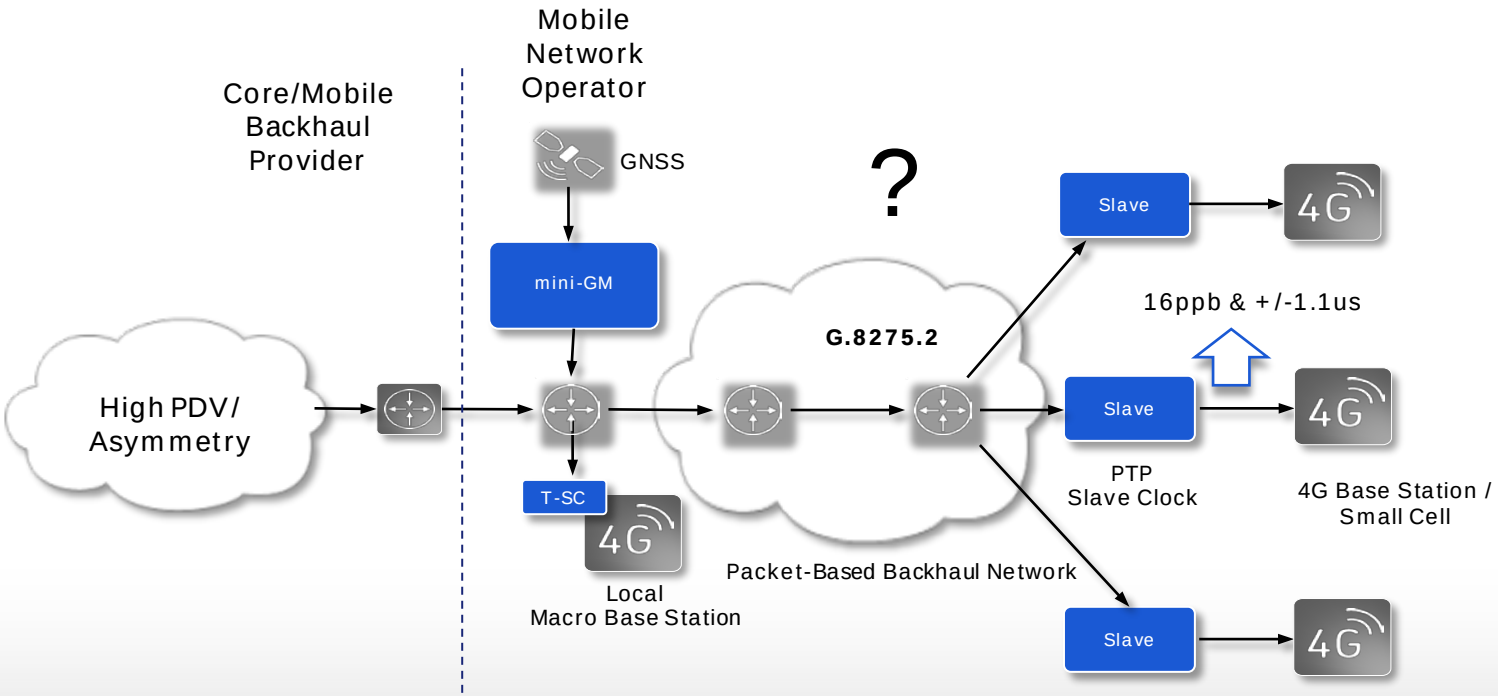


Last mile full on path support
Small Scale GM as a head of G.8275.1 chain

OSCILLOQUARTZ
An ADVA Optical Networking Company

Phase Delivery:
Small Scale GM & G.8275.2 – Last Mile

- G.8275.2 – Uses IP unicast for phase delivery over last mile

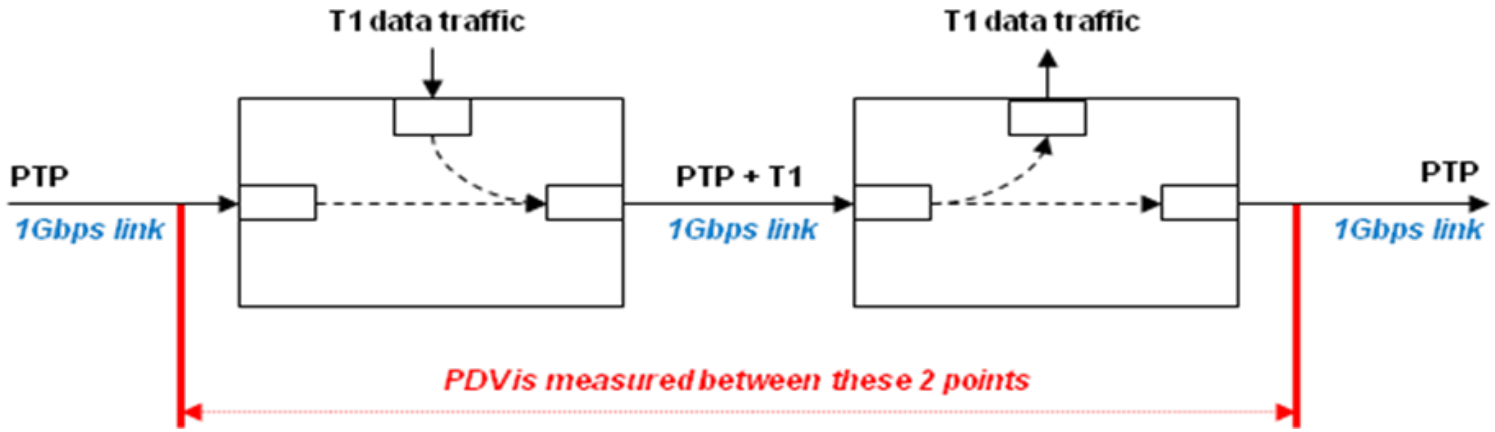


Small Scale GM as a head of G.8275.2 chain

OSCILLOQUARTZ
An ADVA Optical Networking Company

PDV of a single NE

- Single congestion point



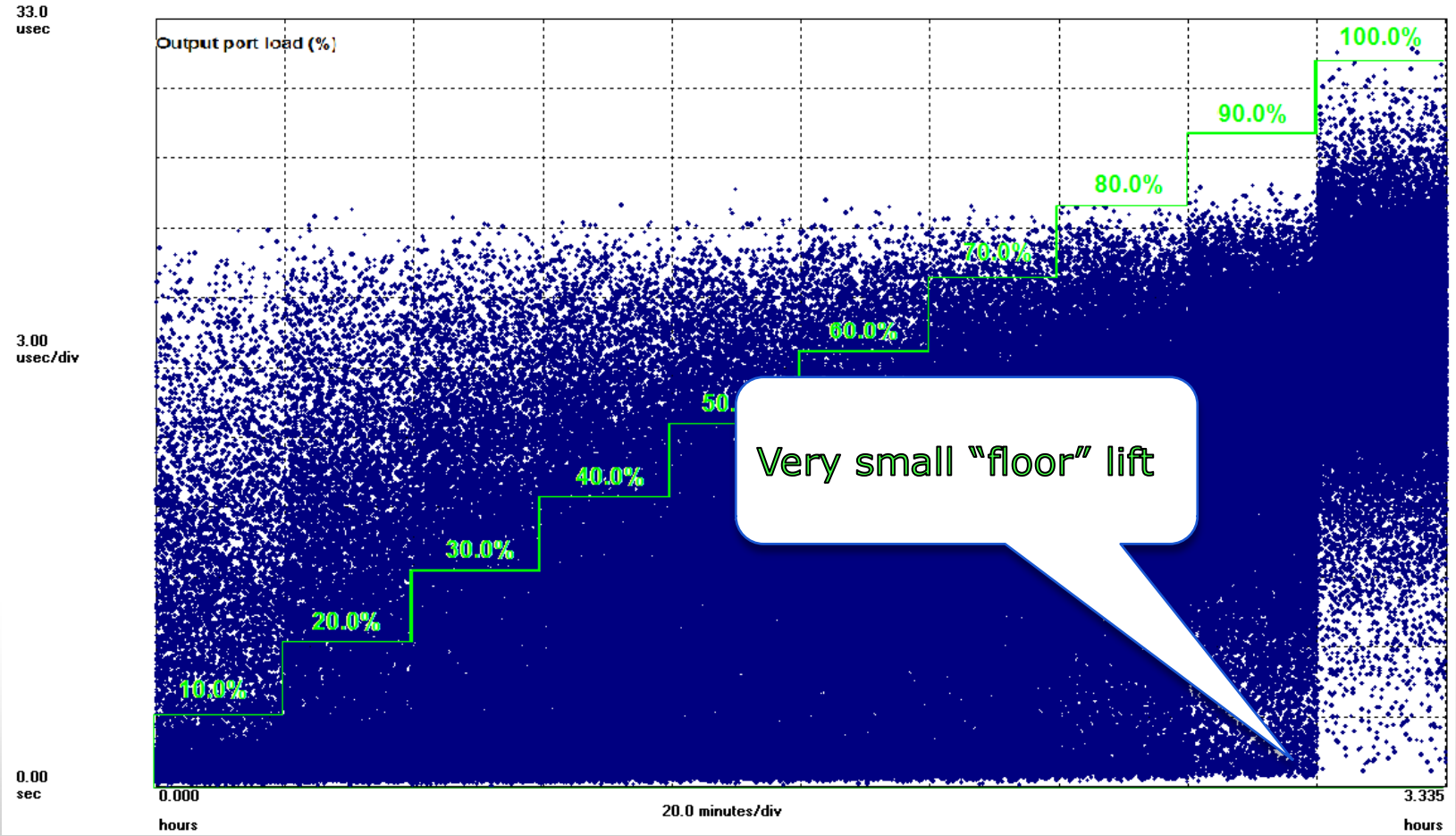
Two types of traffic loads have been considered:

- **Case A**: The size of the data traffic packets was variable, from 64 bytes to 1518 bytes
- **Case B**: All the data traffic packets have a 1518 bytes fixed size

Source - France Télécom Orange

PDV of a single NE – Case A

1Gbps, variable size data traffic:



Source - France Télécom Orange

OSCILLOQUARTZ
An ADVA Optical Networking Company

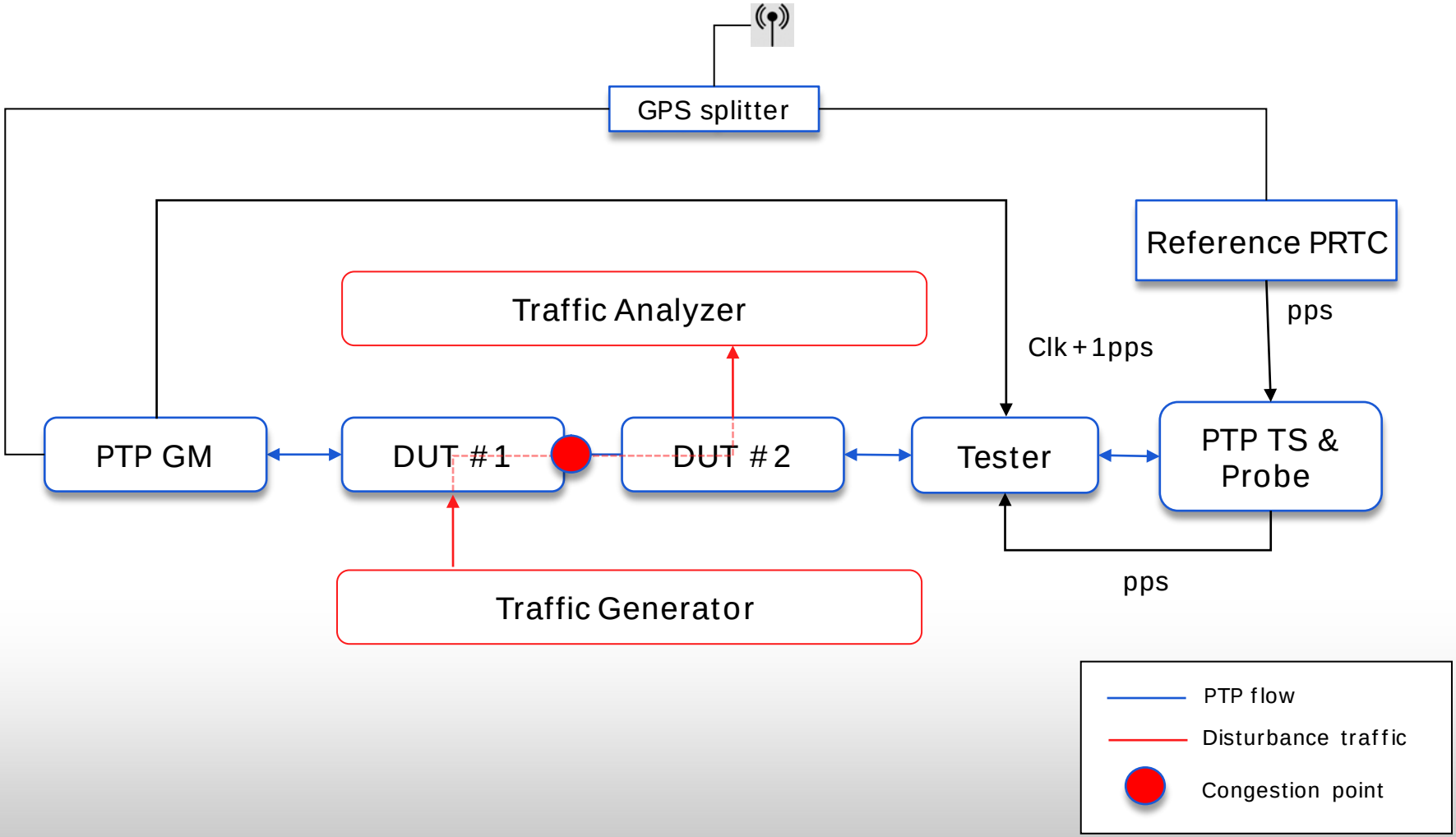
PDV of a single NE – Case B

1Gbps, 1518 bytes data traffic:

Source - France Télécom Orange

OSCILLOQUARTZ
An ADVA Optical Networking Company

Setup #1

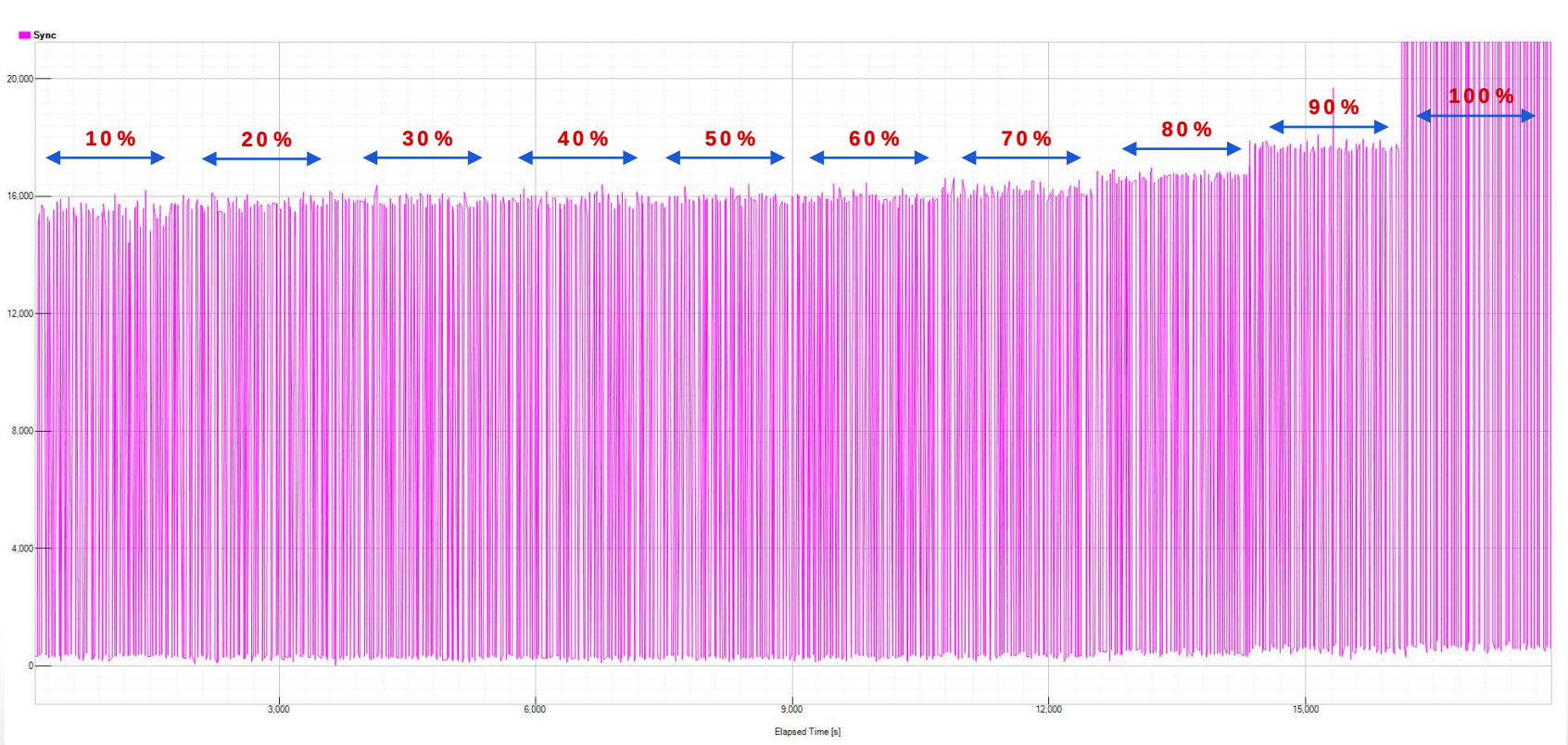


OSCILLOQUARTZ
An ADVA Optical Networking Company

Test 1: G.8261 Traffic model #1

- Single Congestion , VLAN Priority
- PTP - 64 packets per second (on both directions)
- Single congestion point (on forward)
- Forward load traffic (no load on reverse direction)
  - 80% -minimum size packets (64 octets)
  - **15% - maximum size packets (1518 octets)**
  - 5% - medium size packets (576 octets)

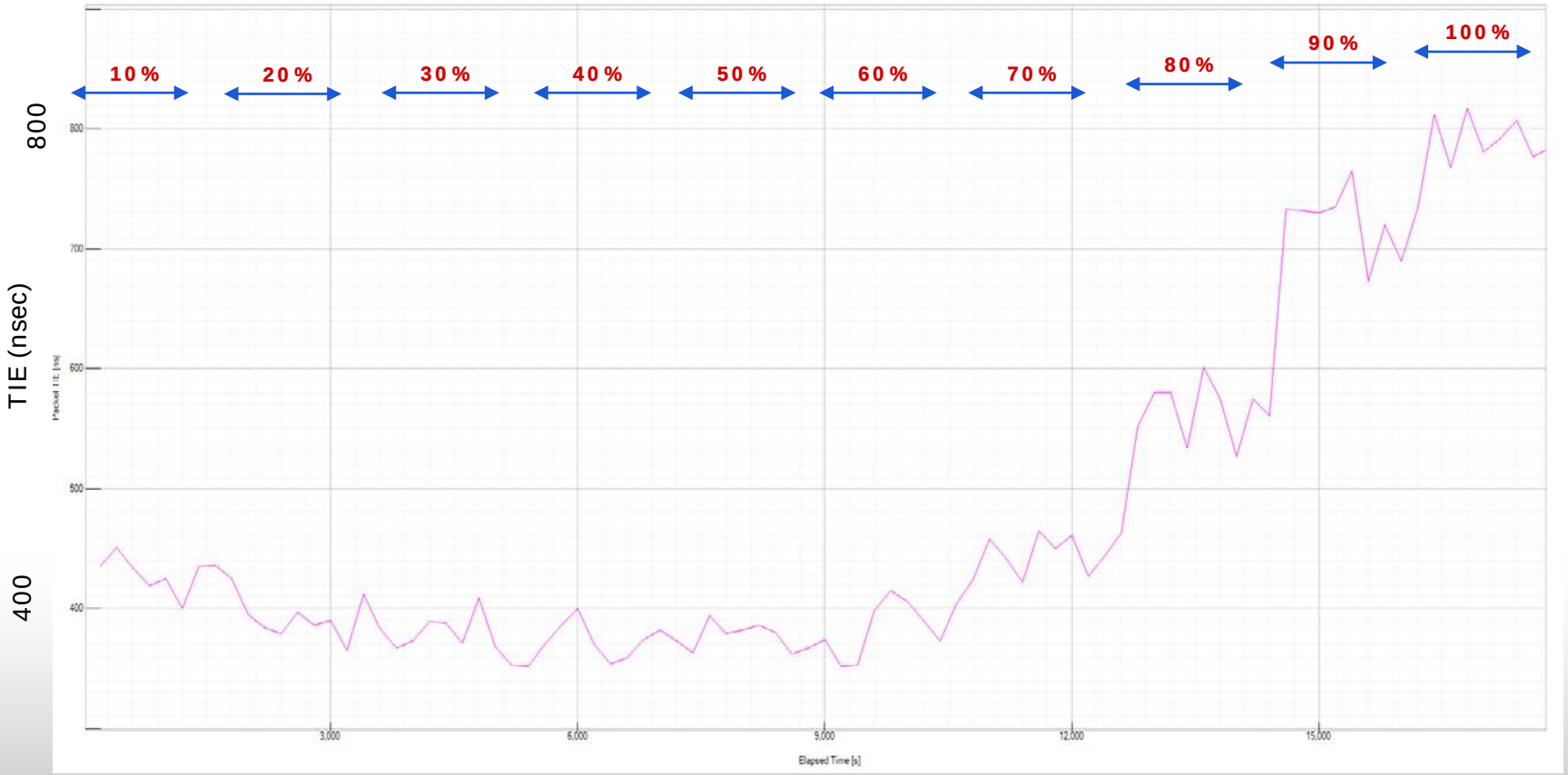
Test #1 - Forward Packet TIE (Tester)



OSCILLOQUARTZ
An ADVA Optical Networking Company

Test #1 - Forward Filtered Packet TIE (Tester)

- Window size – 200 sec , band 0.3%



OSCILLOQUARTZ
An ADVA Optical Networking Company

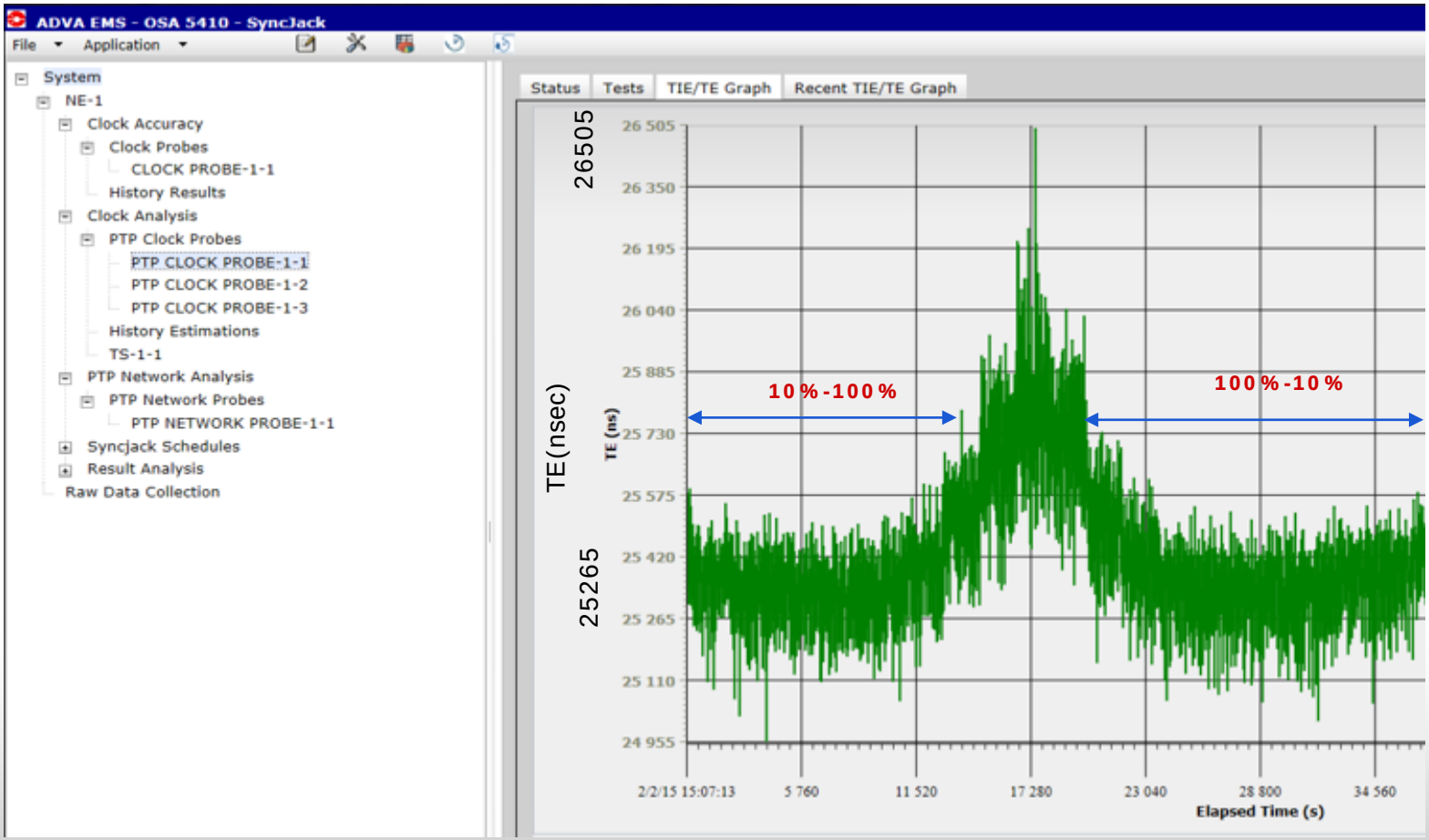
Test #1 - Forward & Reverse Filtered Packet TIE (Tester)

- Window size – 200 sec , 0.3%

OSCILLOQUARTZ
An ADVA Optical Networking Company

Test #1 – Probe Measured Forward Delay

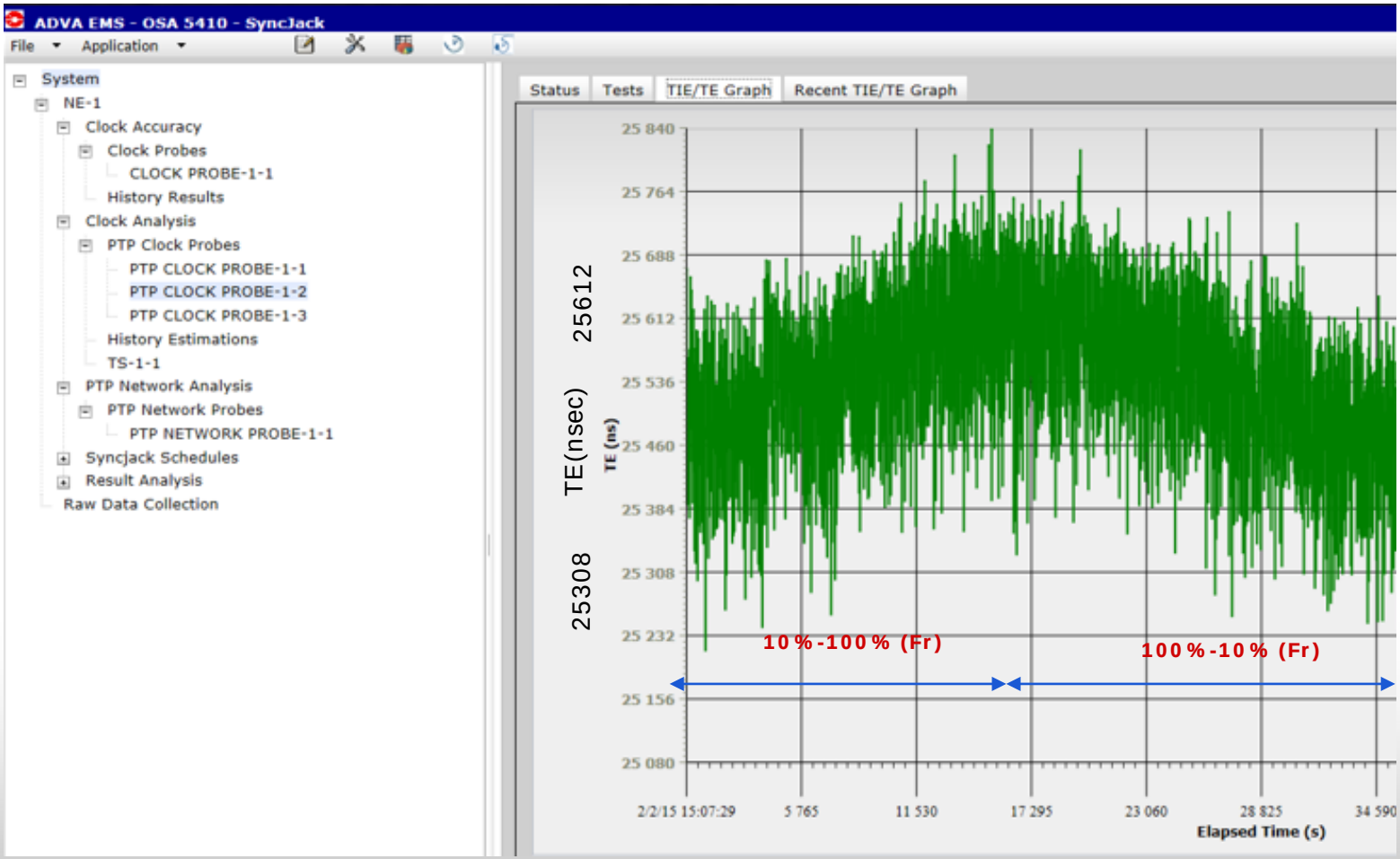
- Window size – 5sec , Lucky packet



OSCILLOQUARTZ
An ADVA Optical Networking Company

Test #1 – Probe Measured Reverse Delay

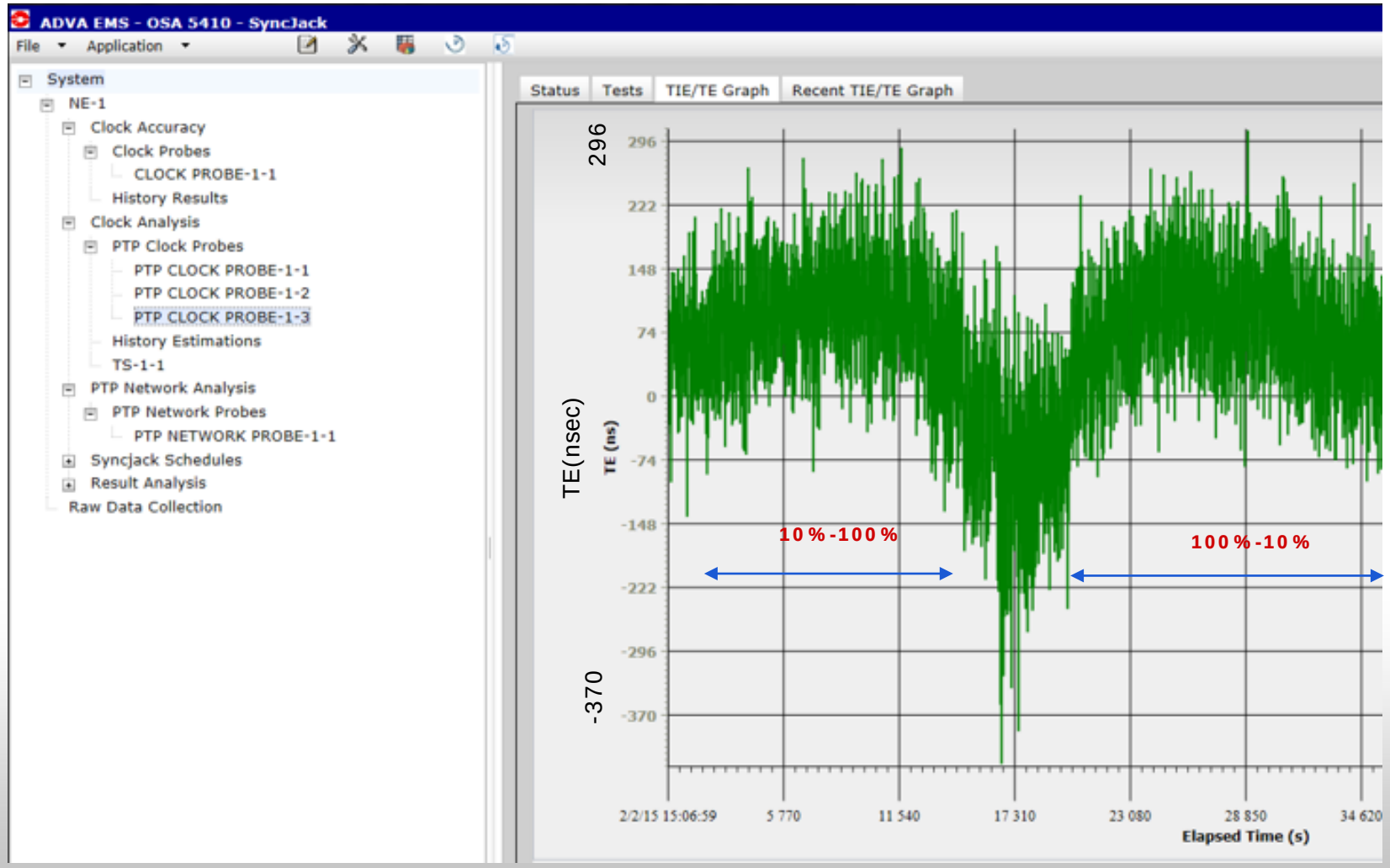
- Window size – 5sec , Lucky packet



OSCILLOQUARTZ
An ADVA Optical Networking Company

Test #1 – Probe Measured Asymmetry

- Window size – 5sec , Lucky packet



OSCILLOQUARTZ
An ADVA Optical Networking Company

Test #1 – 1PPS TE (Tester)

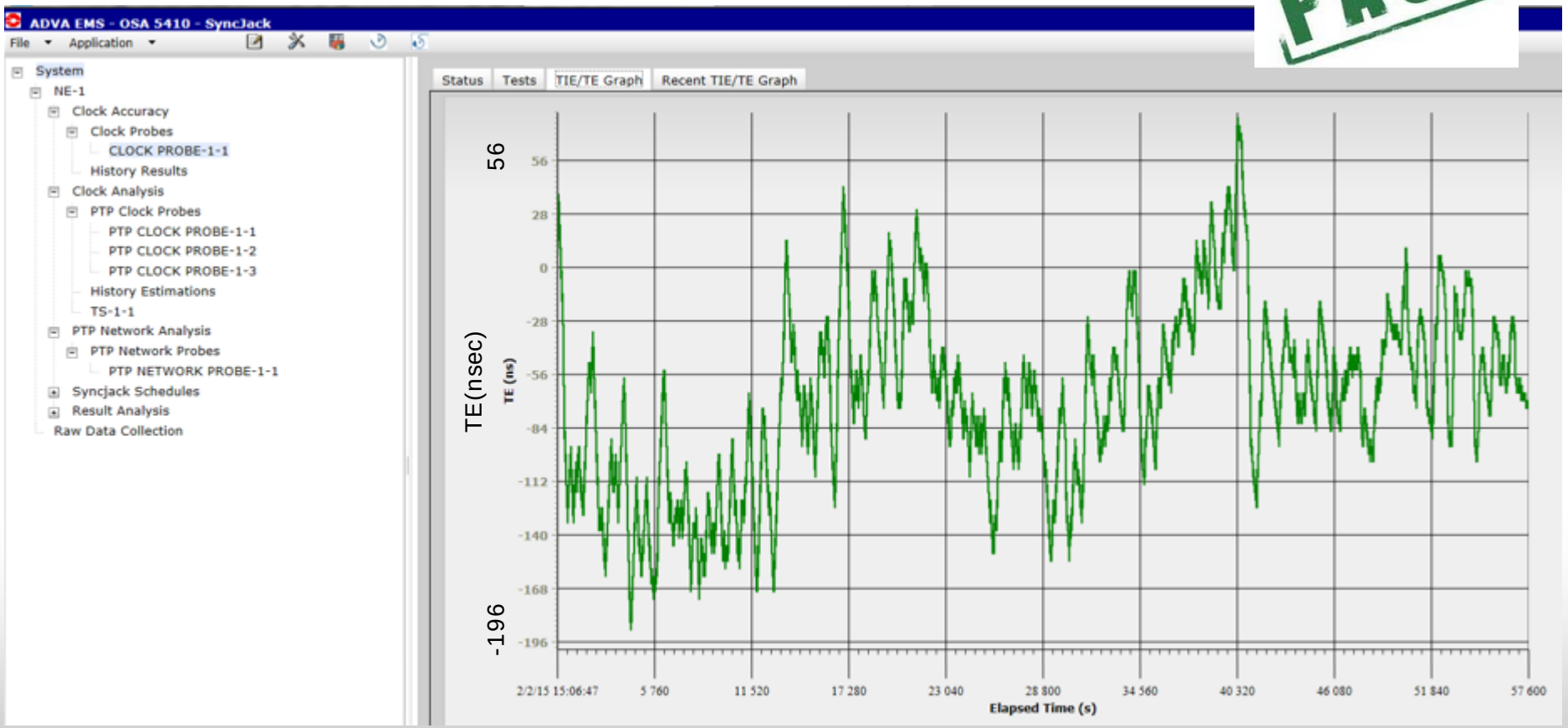
- Time Error within +/- 150nsec – well within +/- 1100nsec

OSCILLOQUARTZ
An ADVA Optical Networking Company

Test #1 – 1PPS TE Probe Vs ref PRTC

- Time Error within +/- 150nsec – well within +/- 1100nsec

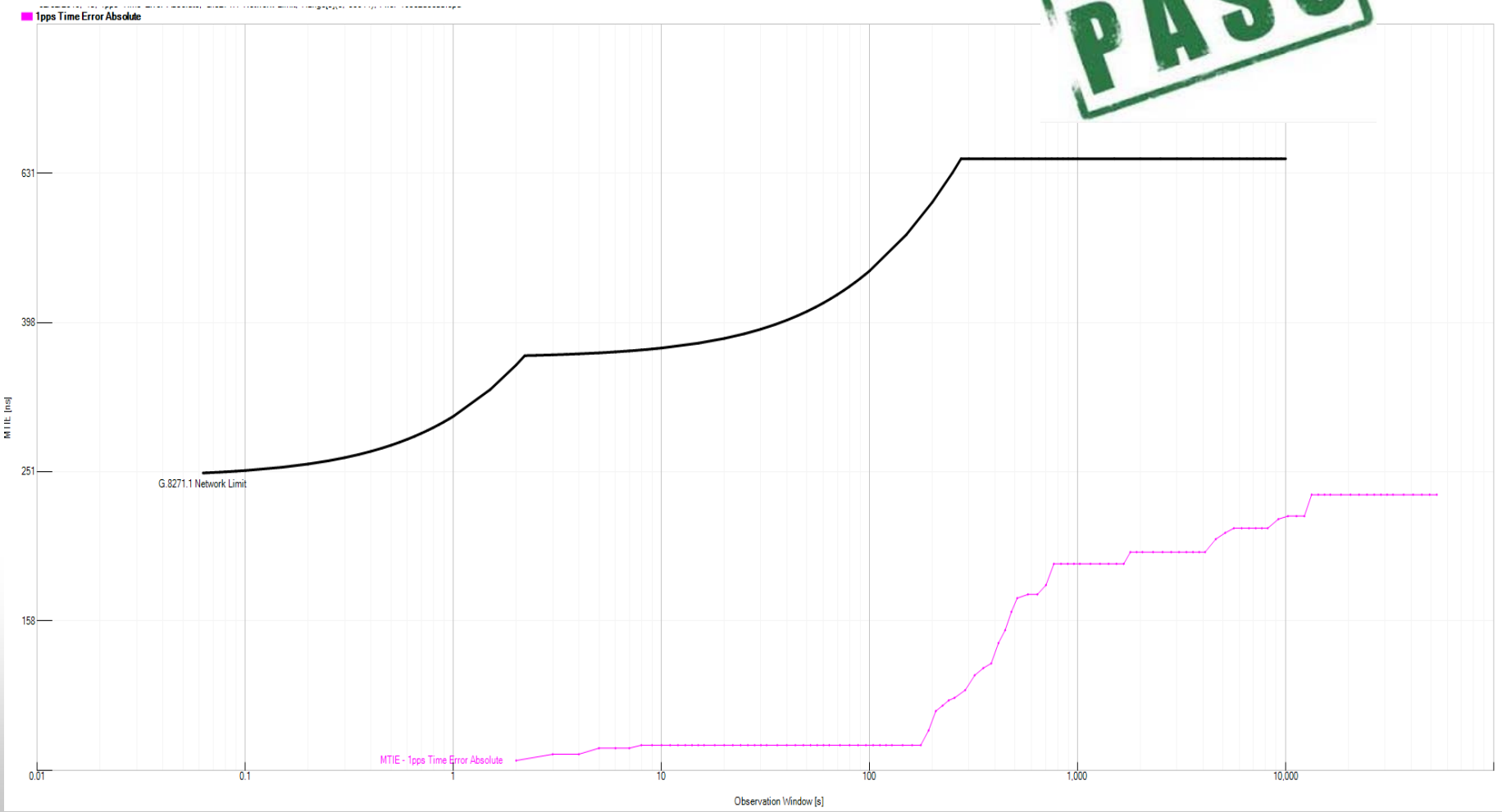
PASS



OSCILLOQUARTZ
An ADVA Optical Networking Company

Test #1 – 1PPS MTIE (Tester)

- MTIE well under G.8271.1 network limits mask

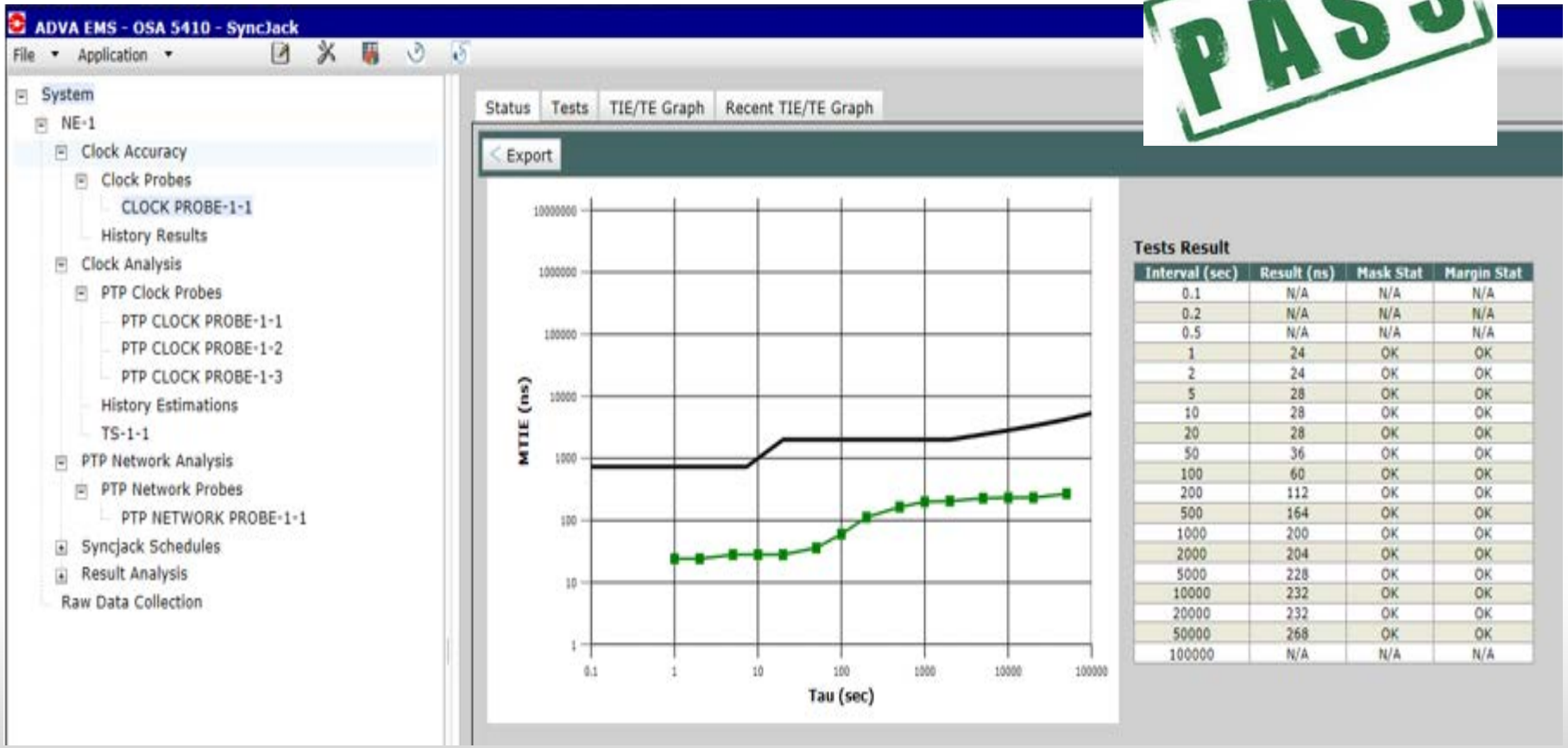


PASS

OSCILLOQUARTZ
An ADVA Optical Networking Company

Test #1 – 1PPS MTIE Probe Vs Ref PRTC

- MTIE well under G.823 pdh mask

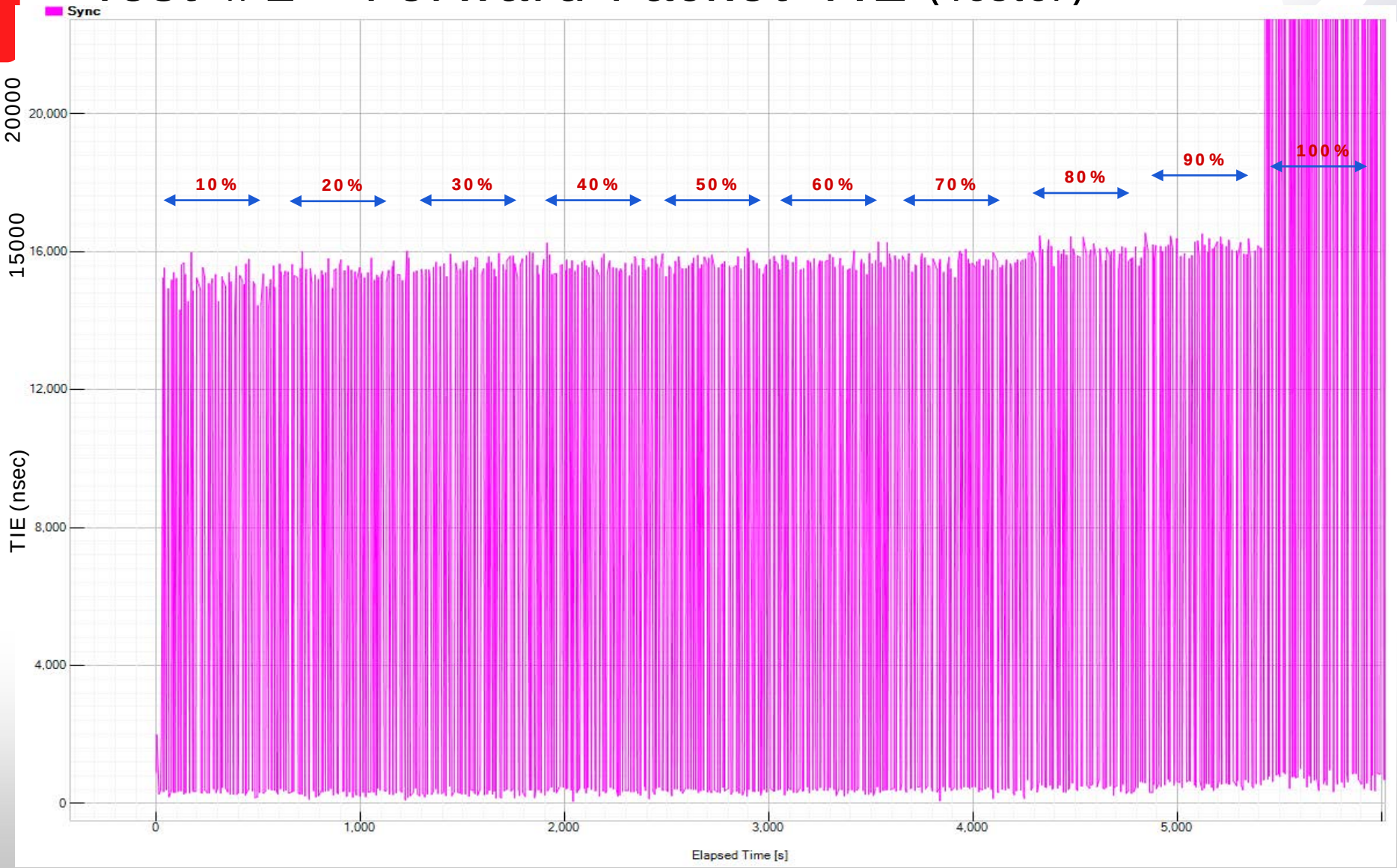


OSCILLOQUARTZ
An ADVA Optical Networking Company

Test 2: G.8261 Traffic model #2

- Single Congestion , VLAN Priority
- PTP - 64 packets per second (on both directions)
- Single congestion point (on forward)
- Forward load traffic (no load on reverse direction)
  - 30% -minimum size packets (64 octets)
  - 60% - maximum size packets (1518 octets)
  - 10% - medium size packets (576 octets)

Test #2 - Forward Packet TIE (Tester)



OSCILLOQUARTZ
An ADVA Optical Networking Company

Test #2 - Forward Filtered Packet TIE (Tester)

- Window size – 200 sec , band 0.3%

OSCILLOQUARTZ
An ADVA Optical Networking Company

Test #2 - Forward & Reverse Filtered Packet TIE (Tester)

- Window size – 200 sec , 0.3%

OSCILLOQUARTZ
An ADVA Optical Networking Company

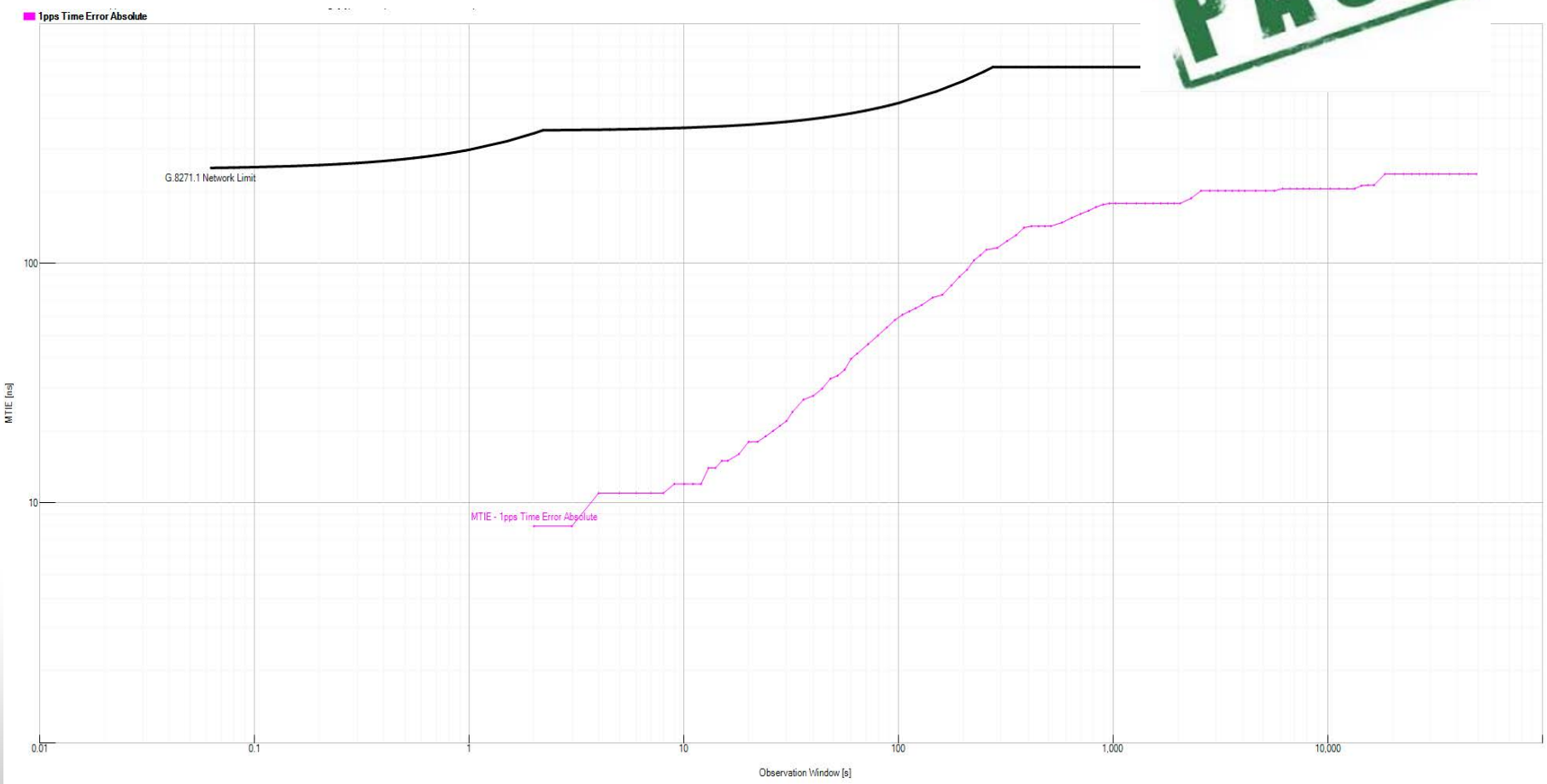
Test #2 – 1PPS TE (Tester)

- Time Error within +/- 200nsec – well within +/- 1100nsec

OSCILLOQUARTZ
An ADVA Optical Networking Company

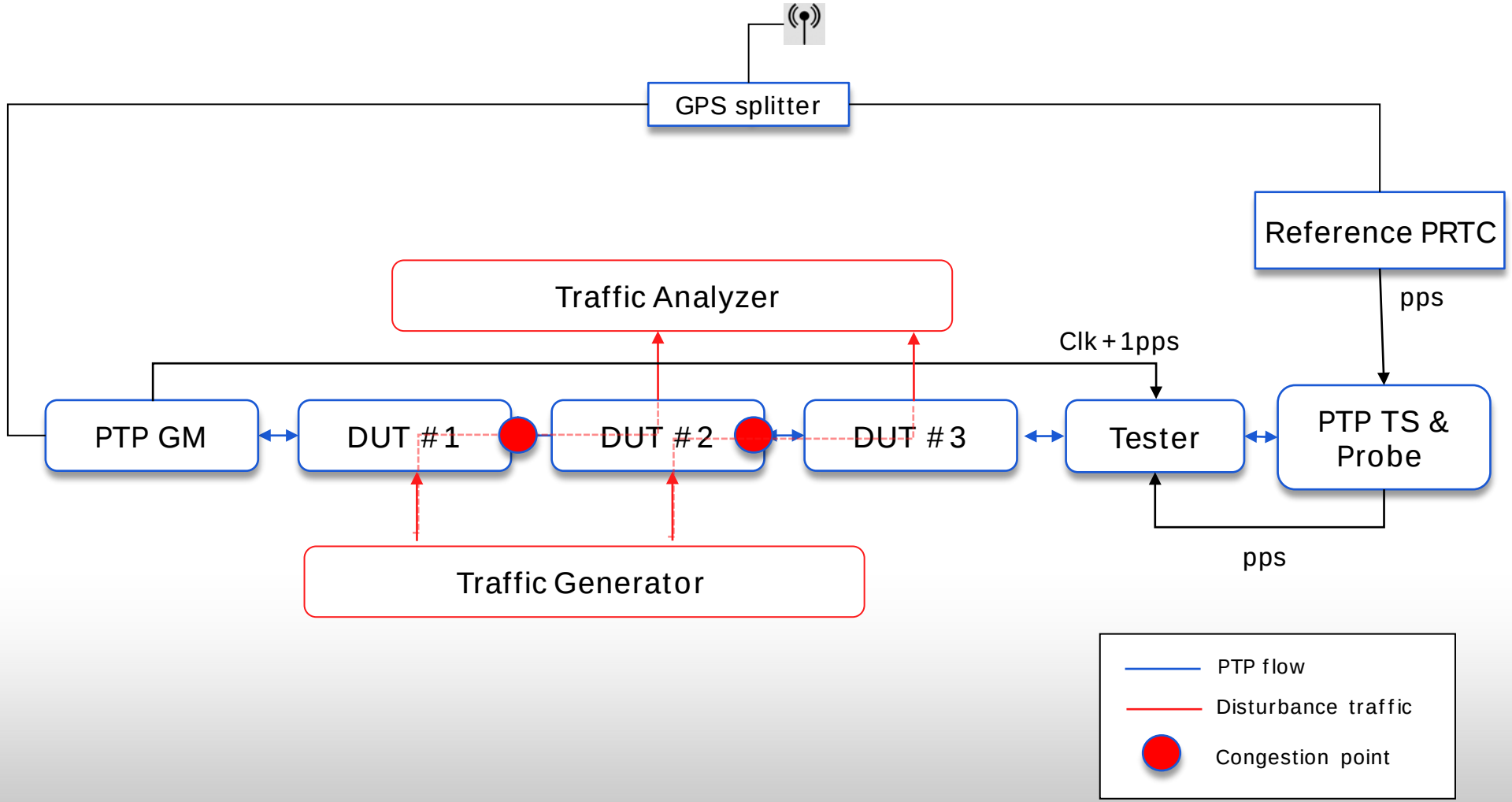
Test #2 – 1PPS MTIE (Tester)

- MTIE well under G.8271.1 network limits mask



OSCILLOQUARTZ
An ADVA Optical Networking Company

Setup #2

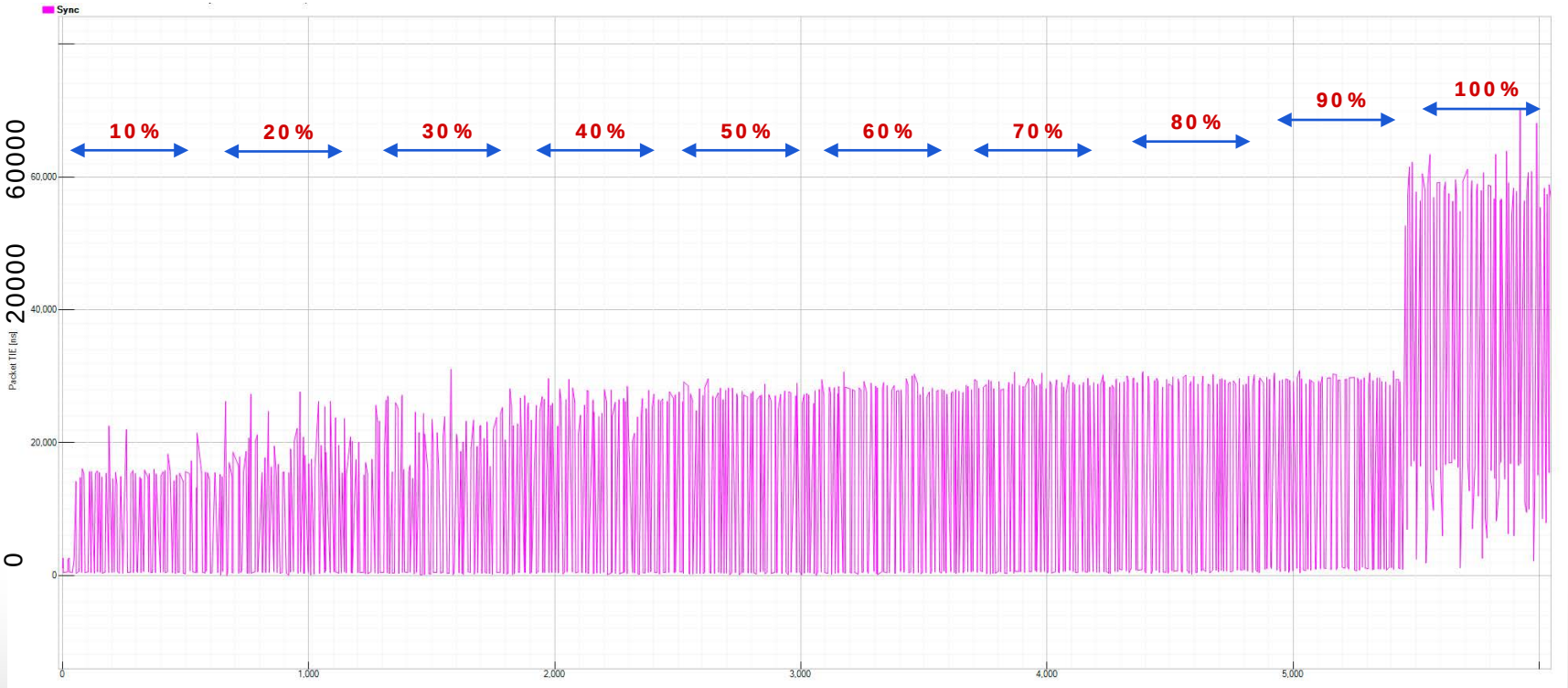


OSCILLOQUARTZ
An ADVA Optical Networking Company

Test 3: G.8261 Traffic model #1

- Two Congestion points , VLAN Priority
- PTP - 64 packets per second (on both directions)
- Single congestion point (on forward)
- Forward load traffic (no load on reverse direction)
  - 60% -minimum size packets (64 octets)
  - **15% - maximum size packets (1518 octets)**
  - 5% - medium size packets (576 octets)

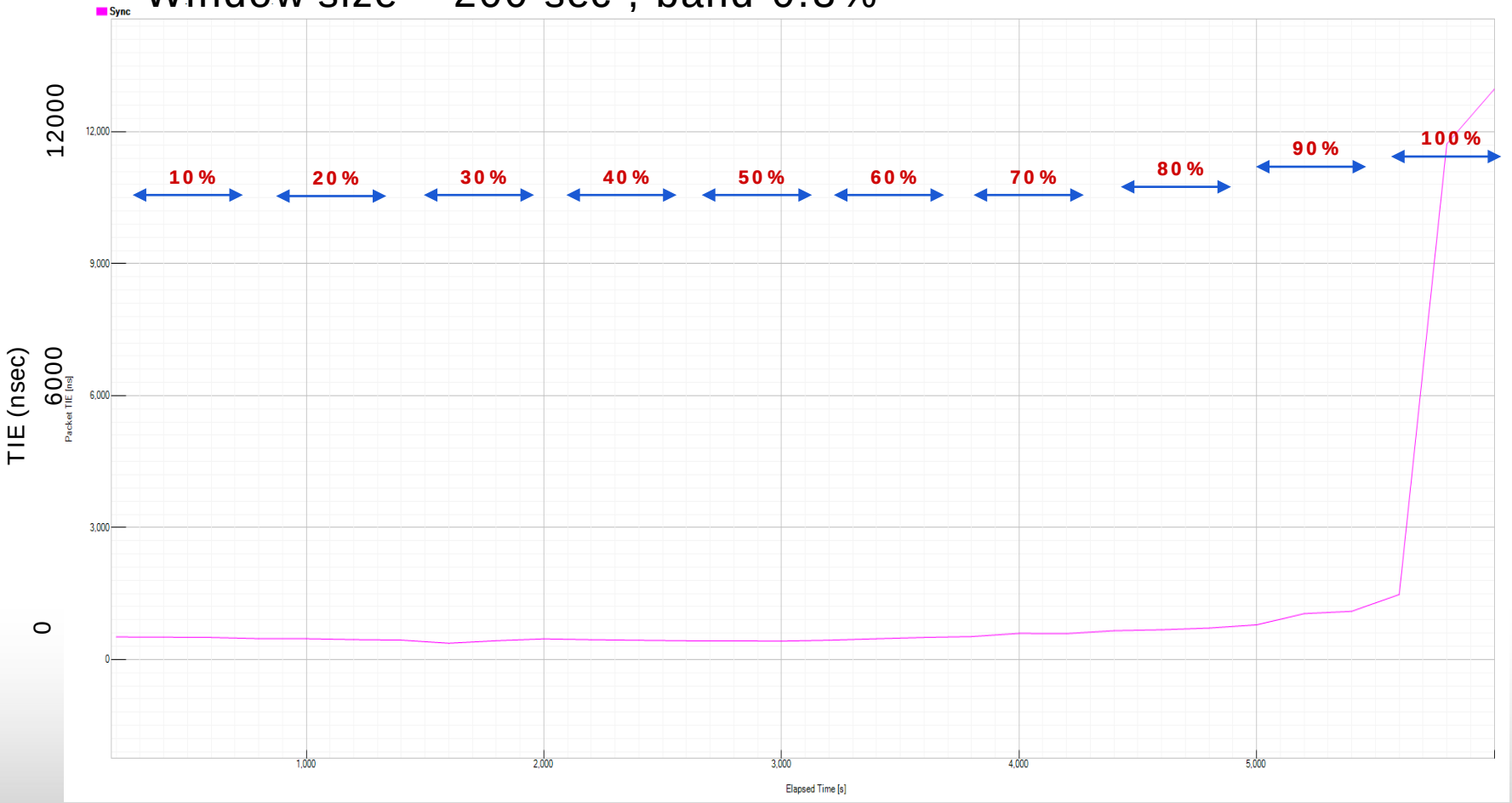
Test #3 - Forward Packet TIE (Tester)



OSCILLOQUARTZ
An ADVA Optical Networking Company

Test #3 - Forward Filtered Packet TIE (Tester)

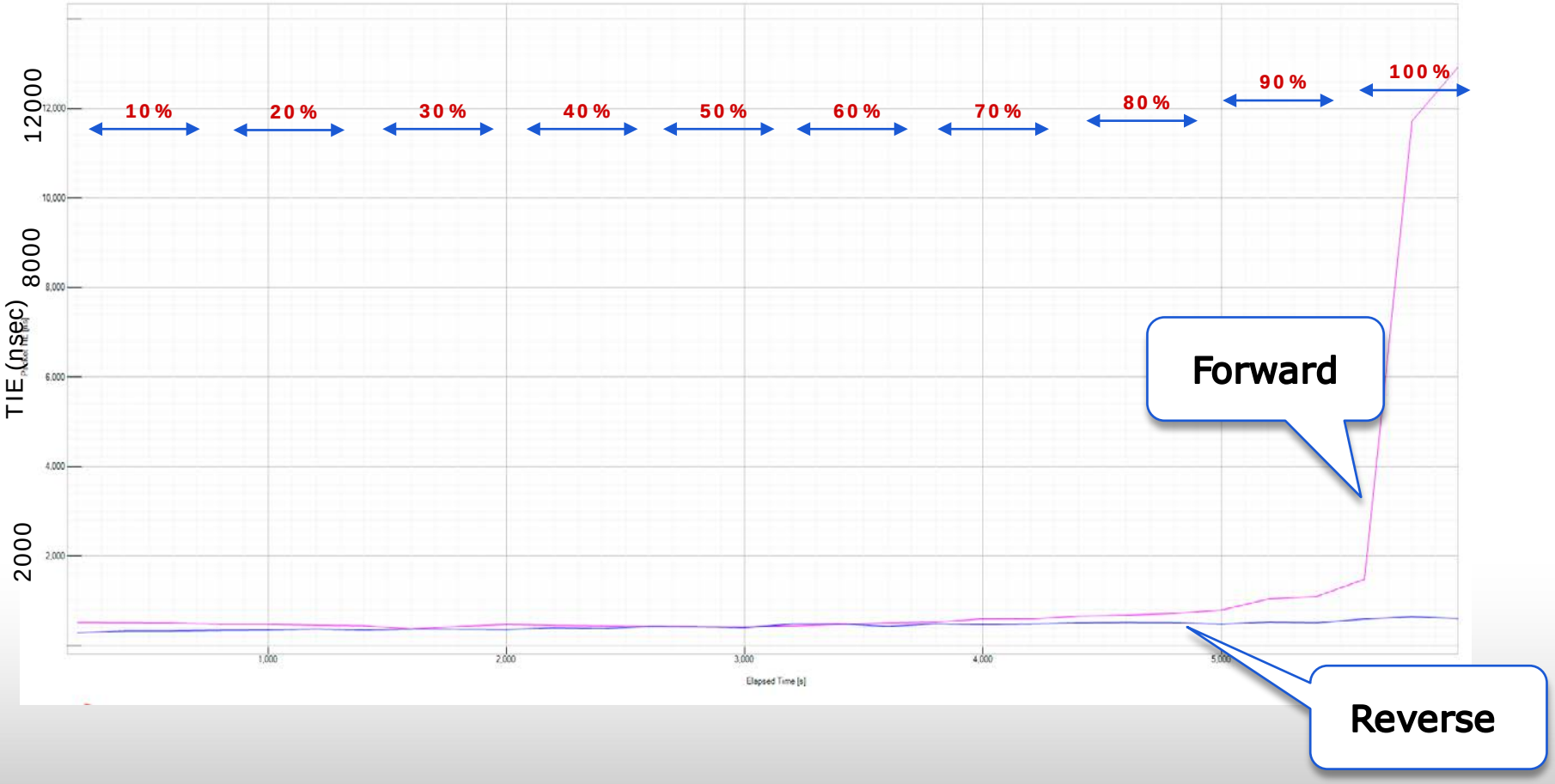
- Window size – 200 sec , band 0.3%



OSCILLOQUARTZ
An ADVA Optical Networking Company

Test #3 - Forward & Reverse Filtered Packet TIE (Tester)

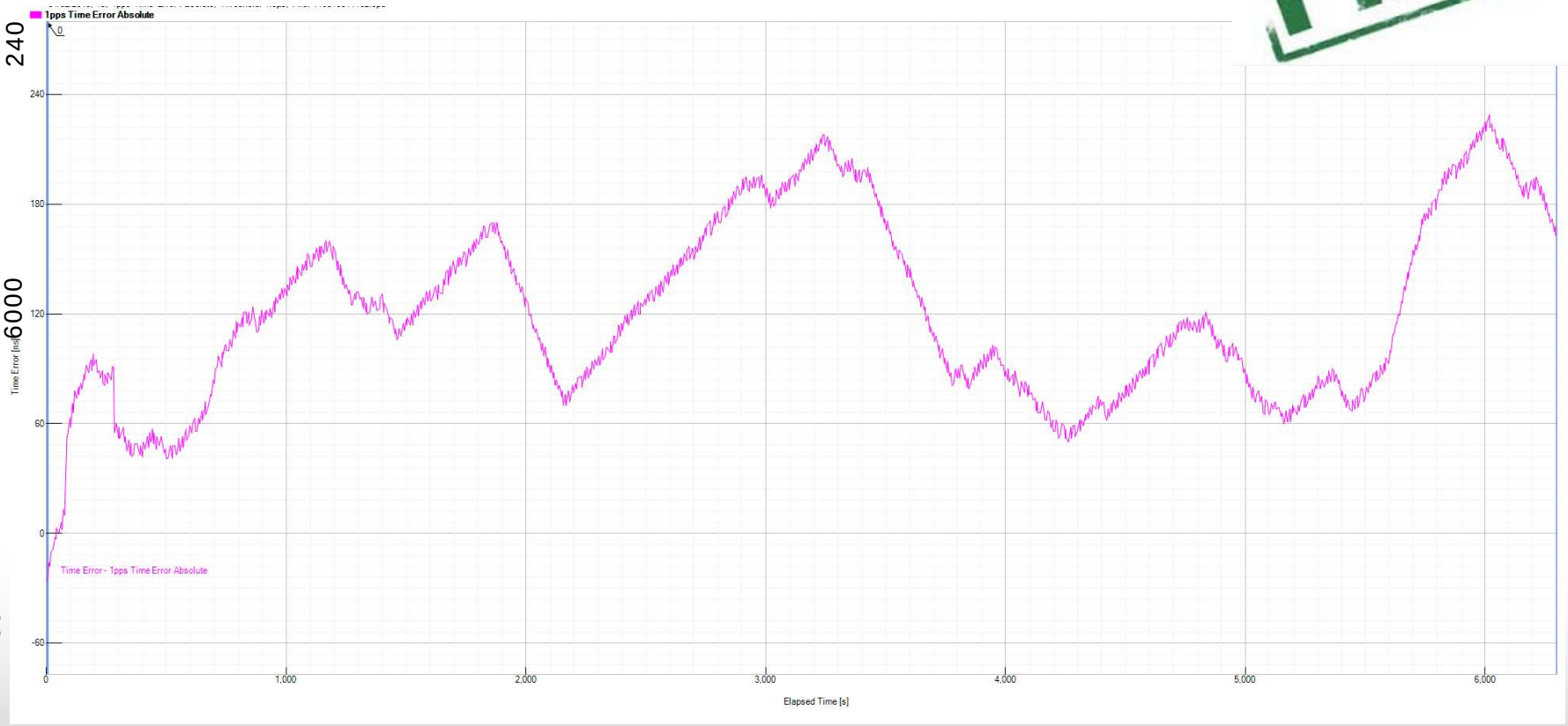
- Window size – 200 sec , 0.3%



OSCILLOQUARTZ
An ADVA Optical Networking Company

Test #3 – 1PPS TE (Tester)

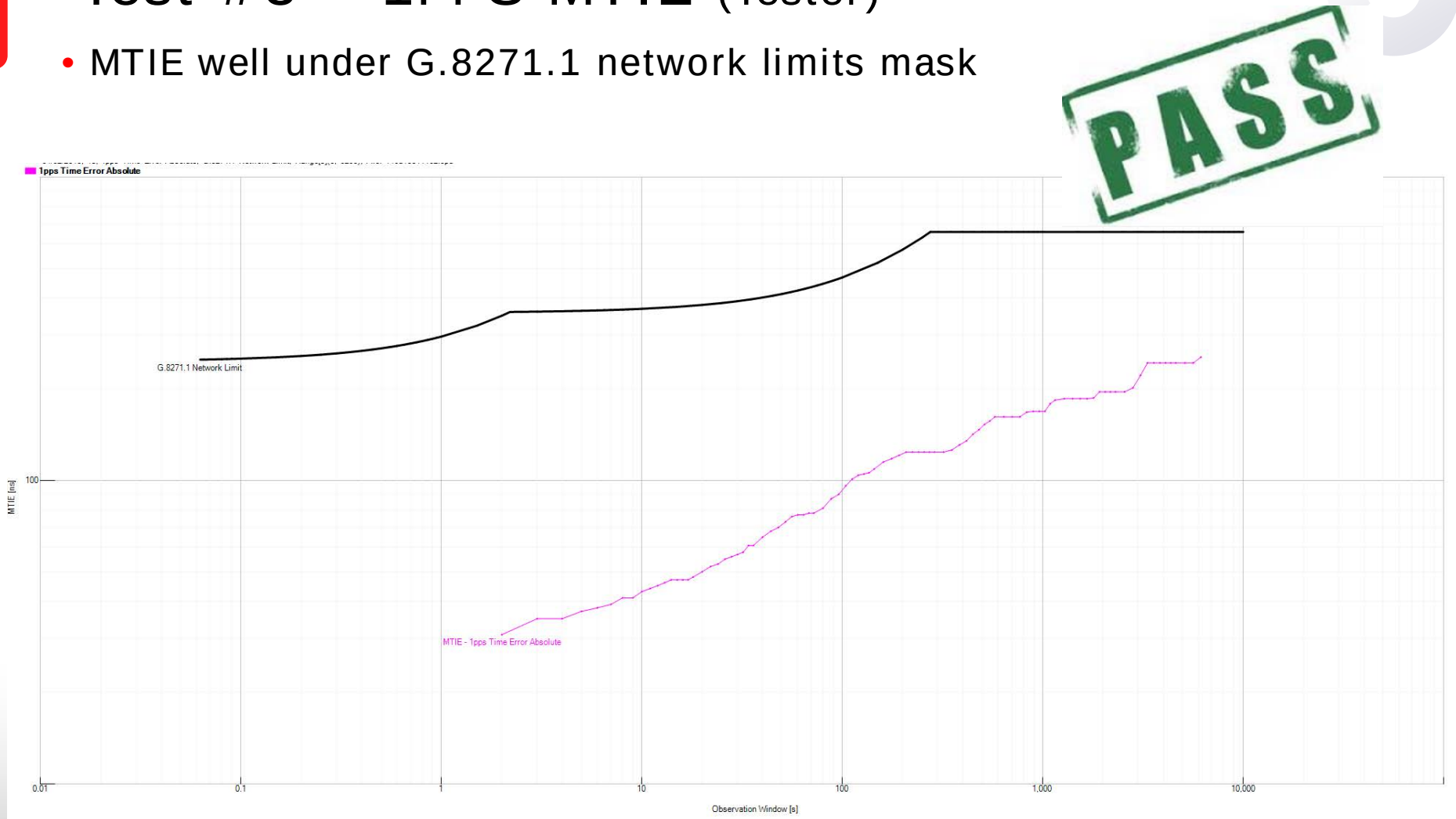
- Time Error within +/- 250nsec – well within +/- 1100nsec



OSCILLOQUARTZ
An ADVA Optical Networking Company

Test #3 – 1PPS MTIE (Tester)

- MTIE well under G.8271.1 network limits mask

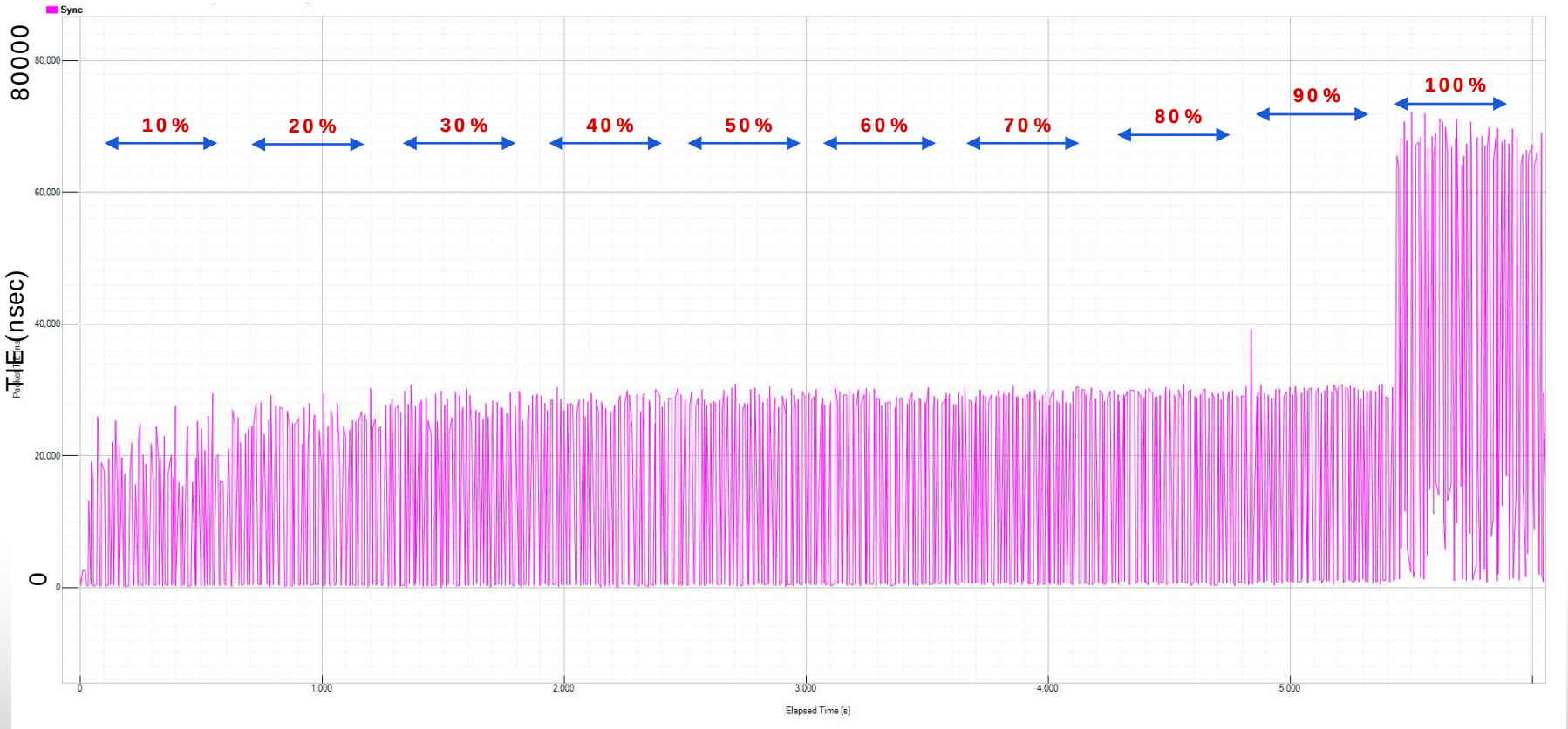


OSCILLOQUARTZ
An ADVA Optical Networking Company

Test 4: G.8261 Traffic model #2

- Two Congestion points , VLAN Priority
- PTP - 64 packets per second (on both directions)
- Single congestion point (on forward)
- Forward load traffic (no load on reverse direction)
  - 30% -minimum size packets (64 octets)
  - **60% - maximum size packets (1518 octets)**
  - 10% - medium size packets (576 octets)

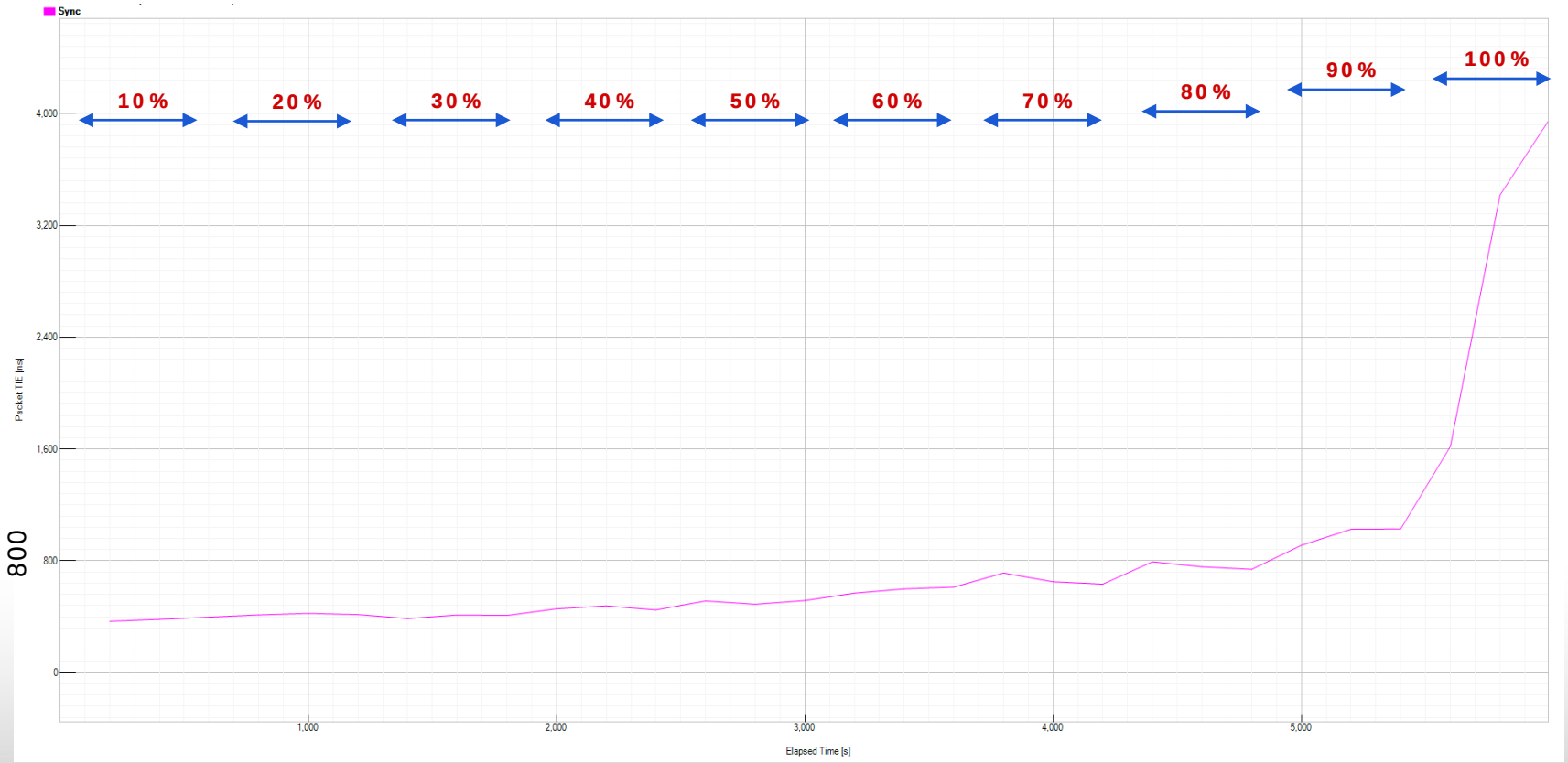
Test #4 - Forward Packet TIE (Tester)



OSCILLOQUARTZ
An ADVA Optical Networking Company

Test #4 - Forward Filtered Packet TIE (Tester)

- Window size – 200 sec , band 0.3%



OSCILLOQUARTZ
An ADVA Optical Networking Company

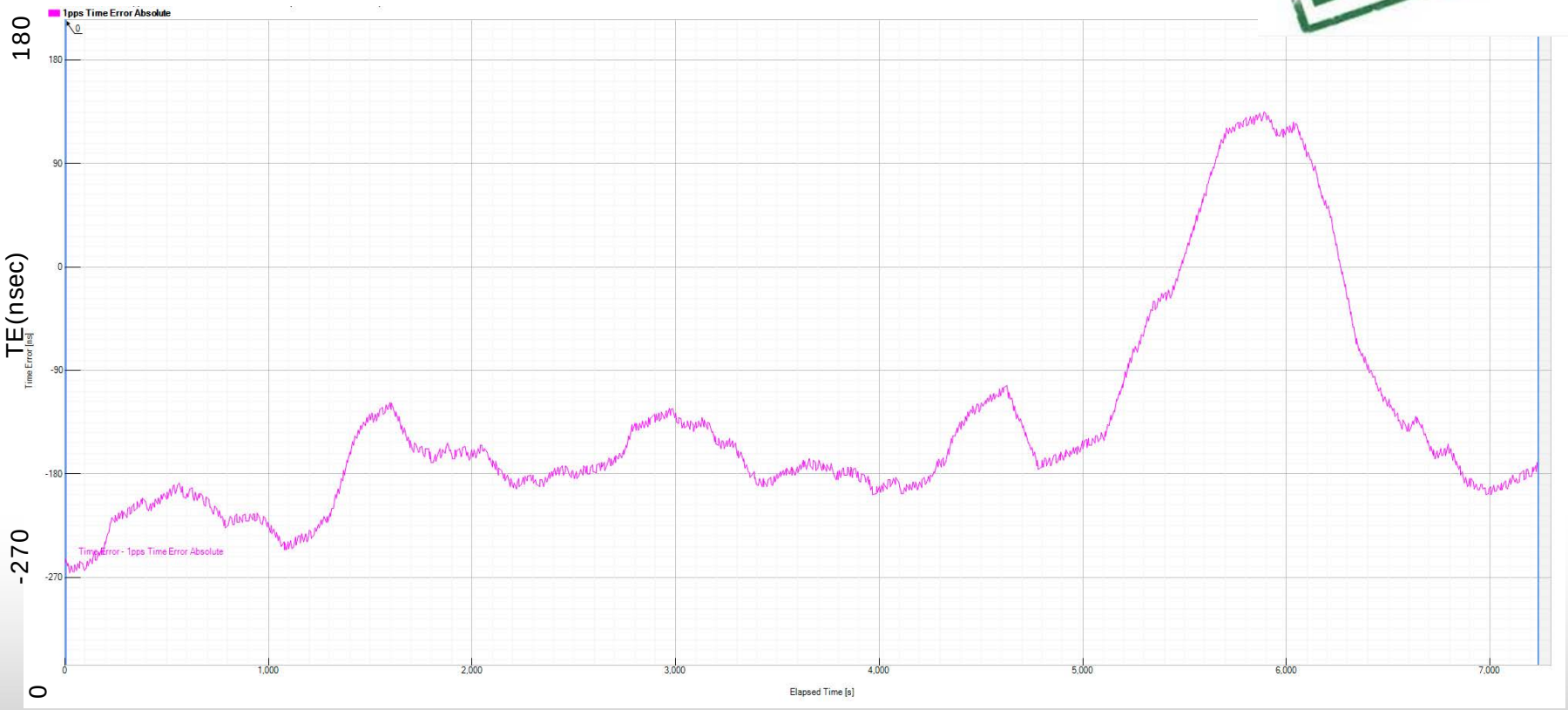
Test #4 - Forward & Reverse Filtered Packet TIE (Tester)

- Window size – 200 sec , 0.3%

OSCILLOQUARTZ
An ADVA Optical Networking Company

Test #4 – 1PPS TE (Tester)

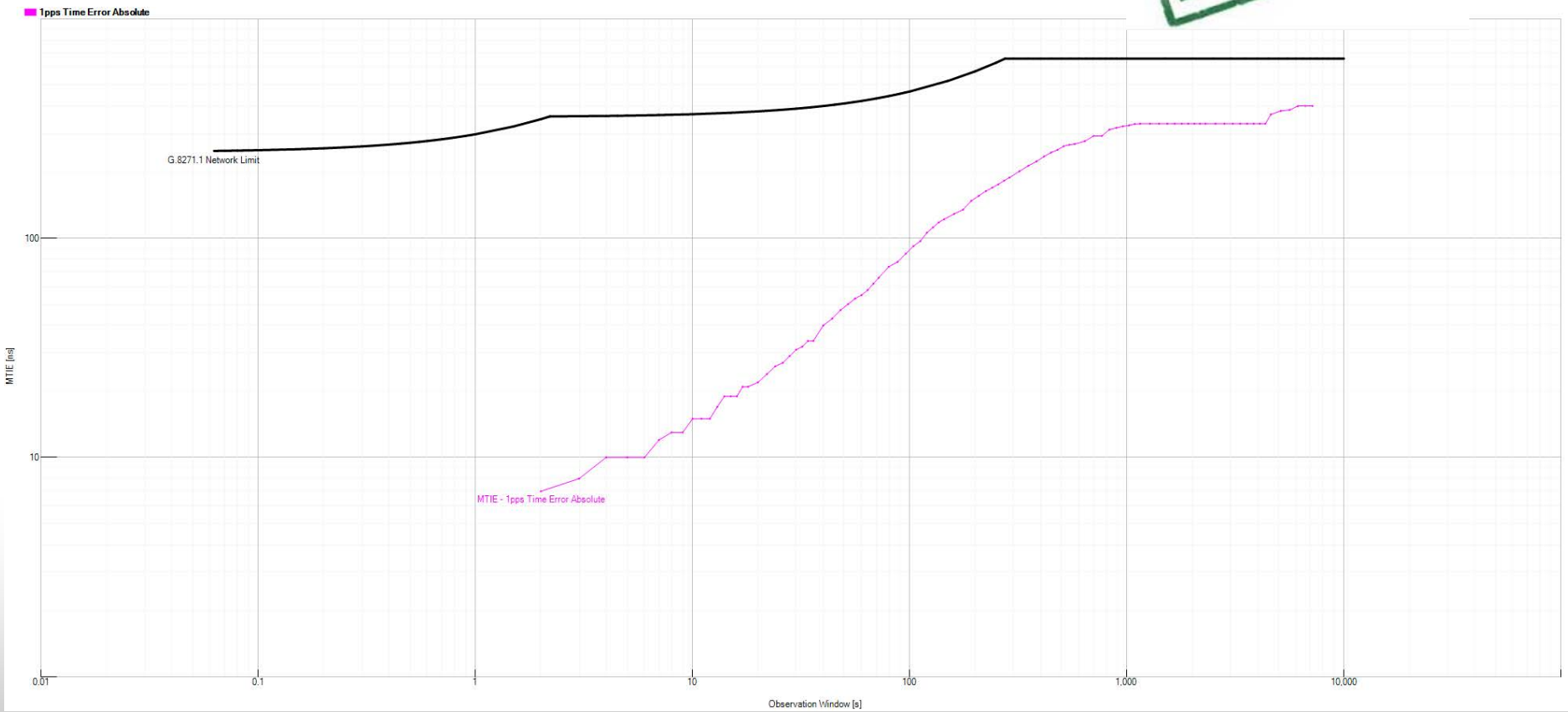
- Time Error within +/- 270nsec – well within +/- 1100nsec



OSCILLOQUARTZ
An ADVA Optical Networking Company

Test #4 – 1PPS MTIE (Tester)

- MTIE well under G.8271.1 network limits mask

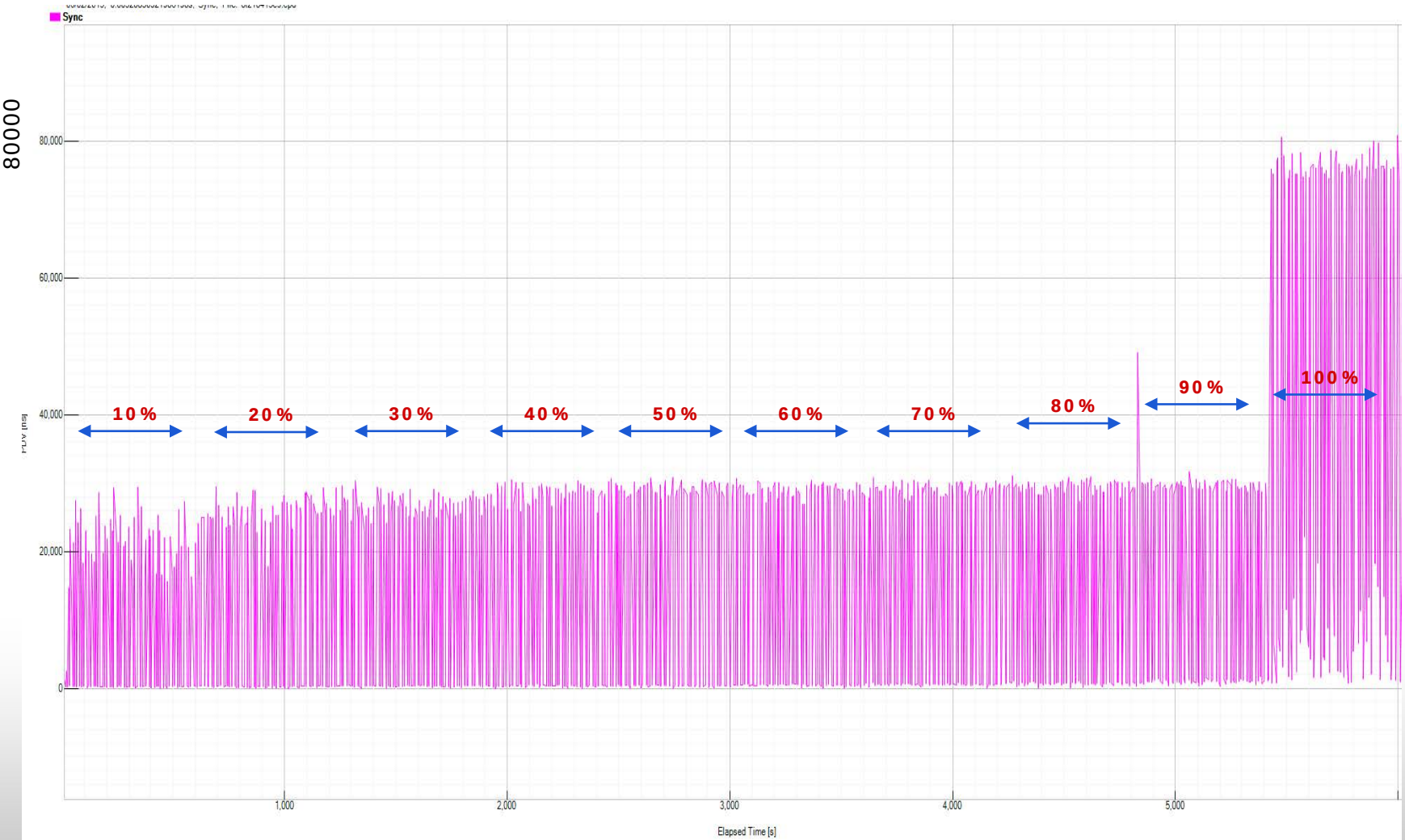


OSCILLOQUARTZ
An ADVA Optical Networking Company

Test 5: Traffic model #3

- Single Congestion , VLAN Priority
- PTP - 64 packets per second (on both directions)
- Single congestion point (on forward)
- Forward load traffic (no load on reverse direction)
  - 10% -minimum size packets (64 octets)
  - **80% - maximum size packets (1518 octets)**
  - 10% - medium size packets (576 octets)

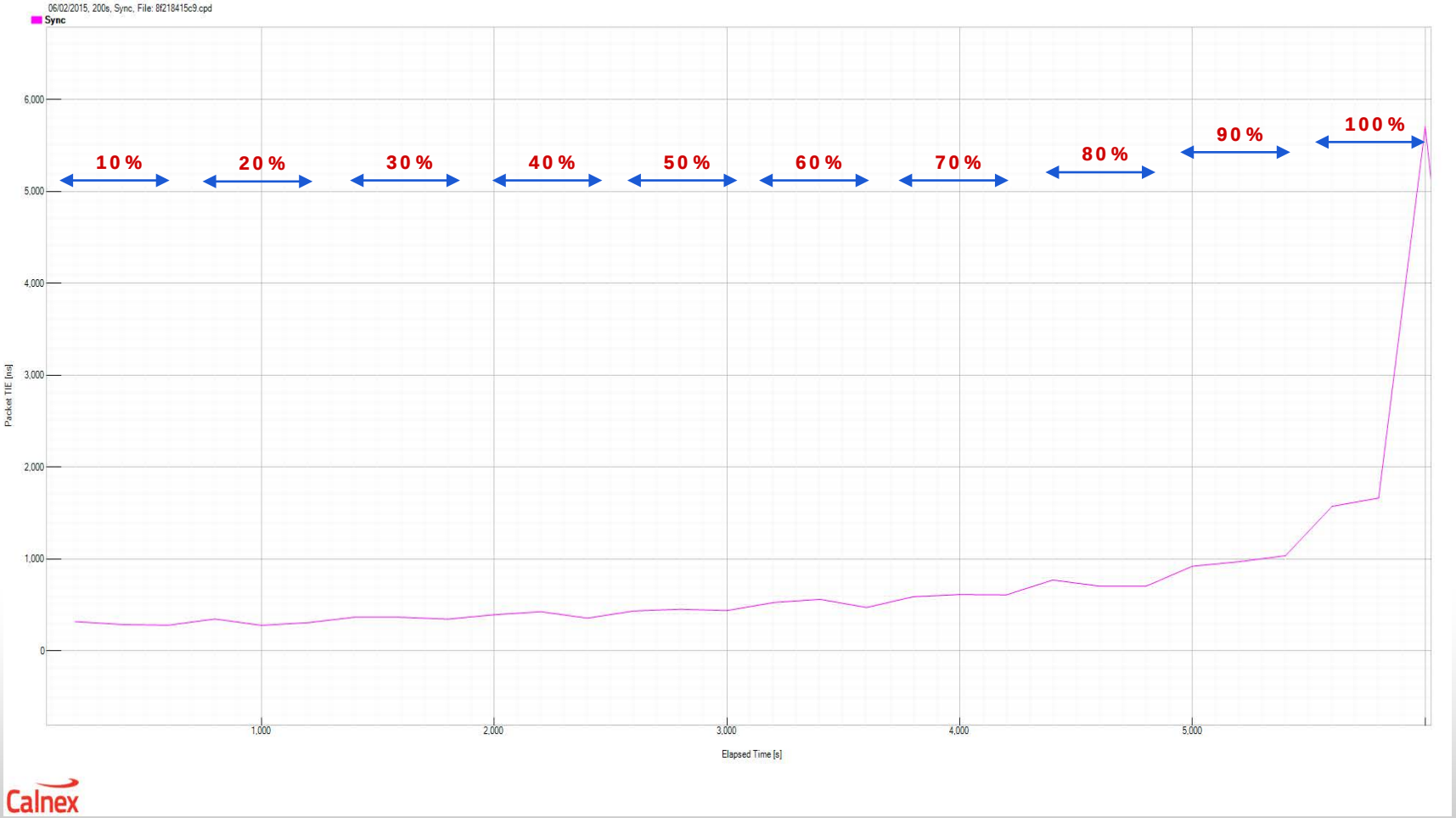
Test #5 - Forward Packet TIE (Tester)



OSCILLOQUARTZ
An ADVA Optical Networking Company

Test #5 - Forward Filtered Packet TIE (Tester)

- Window size – 200 sec , band 0.3%



TIE (nsec)

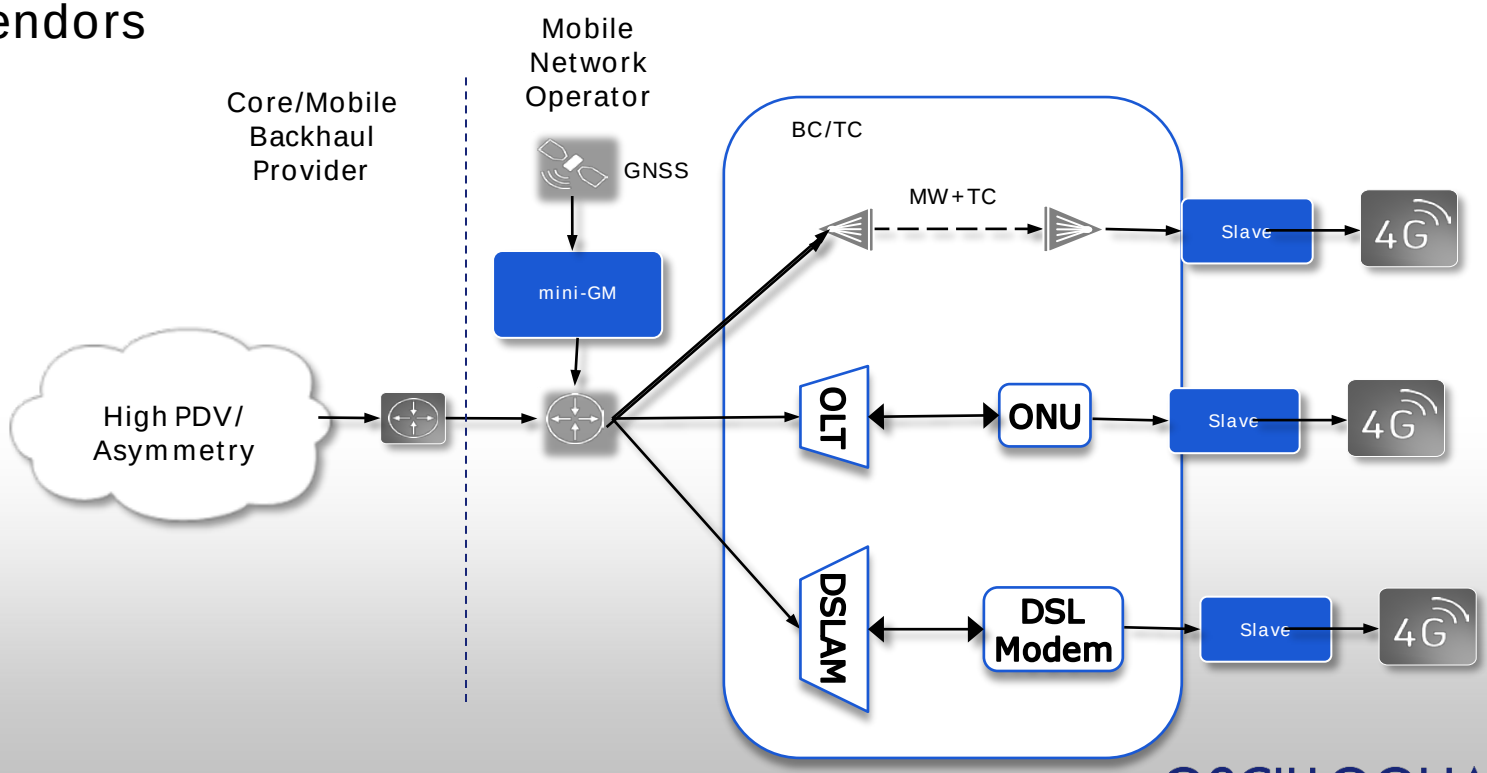
5000

0

OSCILLOQUARTZ
An ADVA Optical Networking Company

Other Access Technologies

- WDM/GPON/DSLAM/MW tend to include high level of PDV & Asymmetry
- In most cases would require on path support (BC/TC) in order to deliver accurate phase
- ITU-T standards not available but proprietary solution are offered by the vendors



OSCILLOQUARTZ
An ADVA Optical Networking Company

Phase Delivery over PTP unaware networks

- Phase delivery over PTP unaware Ethernet (L2) network elements is possible with the following network engineering guidelines:
  - Use QoS to priorities PTP packets
  - Avoid speed mismatch (or compensated for known asymmetry generated by the mismatch)
  - Test your access network elements PDV and asymmetry under realistic load scenario
  - Avoid network traffic unitization above 90%
  - If needed , use PTP aware network element for access technologies (MW/WDM/DSLAM/GPON)

OSCILLOQUARTZ
An ADVA Optical Networking Company

Questions? Thank you!

Nlaufer@advaoptical.com