

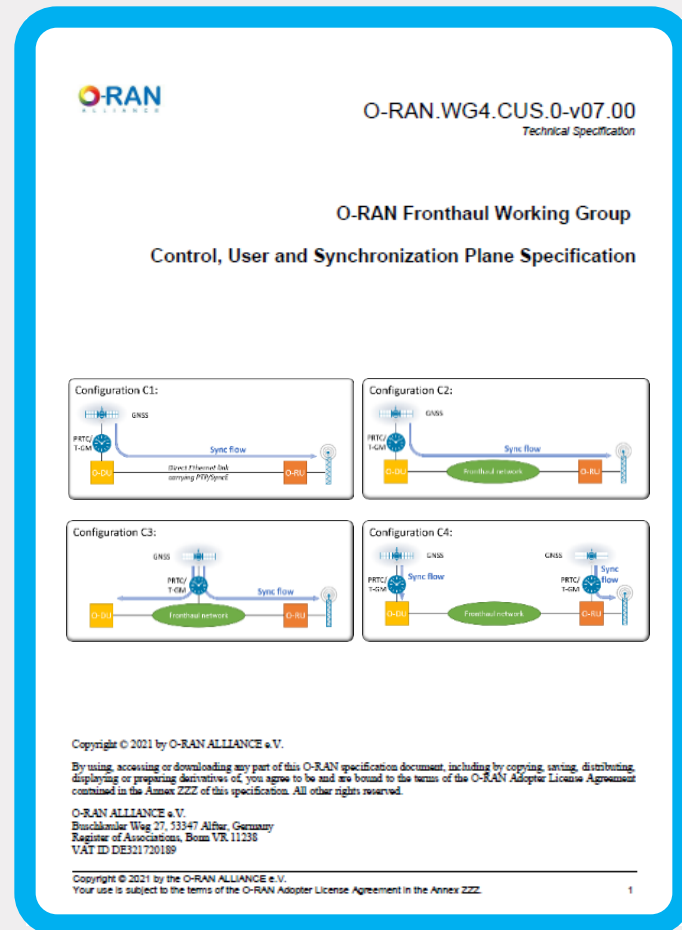
Tim Frost

A close-up, dark, and moody photograph of an owl's face, focusing on its large, yellowish-green eye and textured feathers. The owl is looking slightly to the right.

Challenges in Synchronization Testing for ORAN Fronthaul

WSTS, May 2022

O-RAN Technical Specifications for Synchronization



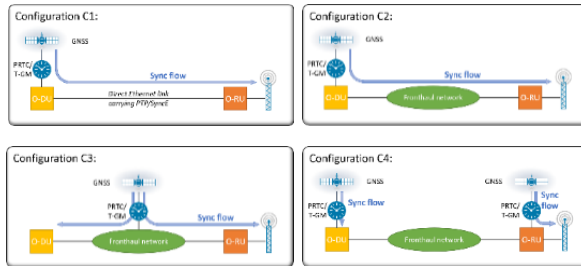
O-RAN Fronthaul Working Group – Control,
User and Synchronization Plane Specification

O-RAN Technical Specifications for Synchronization



O-RAN.WG4.CUS.0-v07.00
Technical Specification

O-RAN Fronthaul Working Group Control, User and Synchronization Plane Specification



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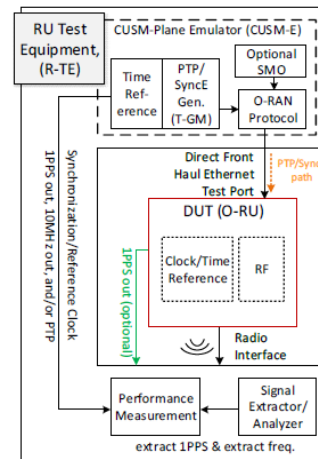
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O-RAN Fronthaul Working Group – Control,
User and Synchronization Plane Specification



O-RAN.WG4.CONF.0-v04.00
Technical Specification

O-RAN Fronthaul Working Group Conformance Test Specification



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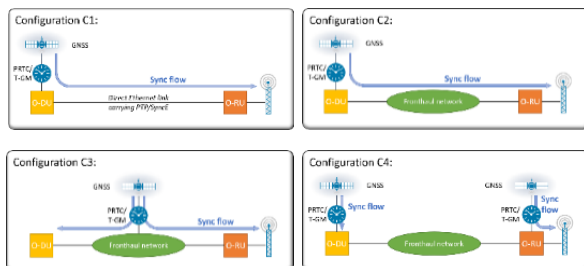
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O-RAN Fronthaul Working Group –
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O-RAN.WG4.CUS.0-v07.00
Technical Specification

O-RAN Fronthaul Working Group
Control, User and Synchronization Plane Specification



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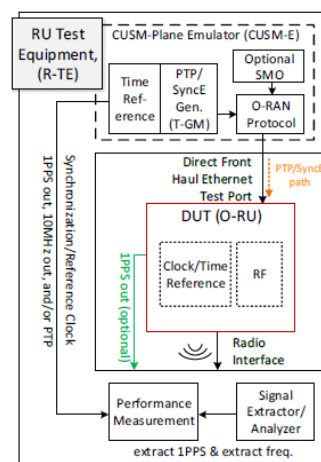
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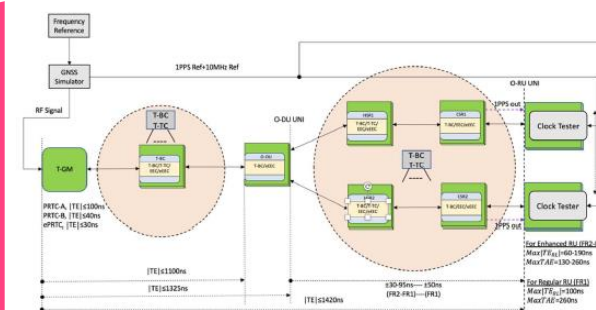
O-RAN.WG4.CONF.0-v04.00
Technical Specification

O-RAN Fronthaul Working Group
Conformance Test Specification



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O-RAN.WG9.XTRP-TST-v01.01
Technical SpecificationO-RAN Open Xhaul Transport Working Group 9
Xhaul Transport Testing

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O-RAN Fronthaul Working Group – Control, User and Synchronization Plane Specification

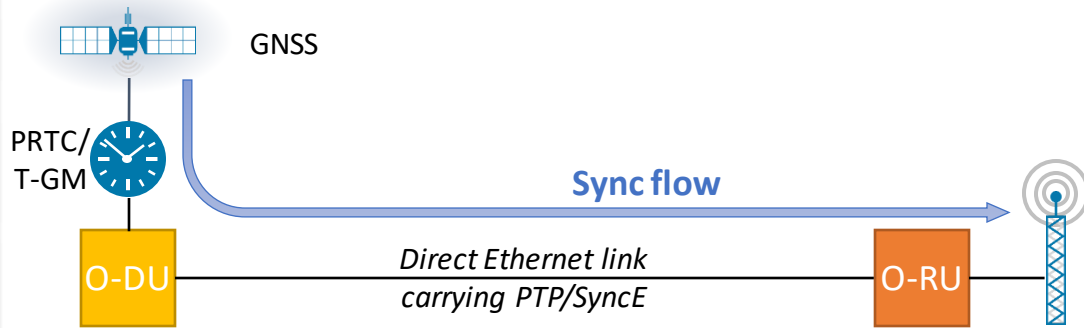
O-RAN Fronthaul Working Group – Conformance Test Specification

O-RAN Open Xhaul Transport Working Group 9 – Xhaul Transport Testing

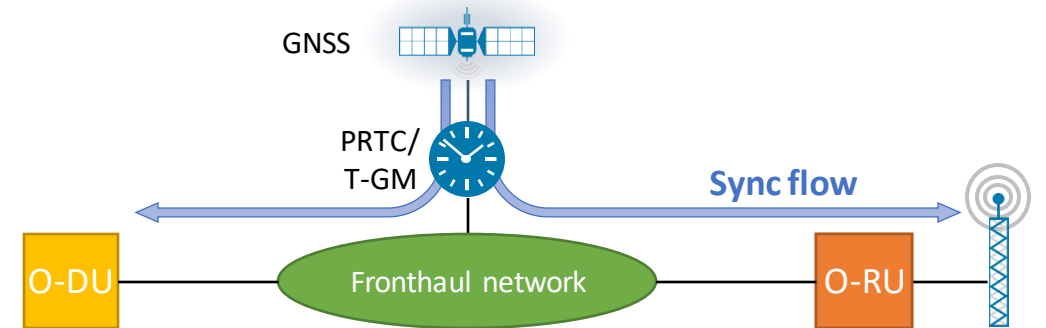
Control, User and Sync Plane Specification

ORAN LLS* Sync Architectures

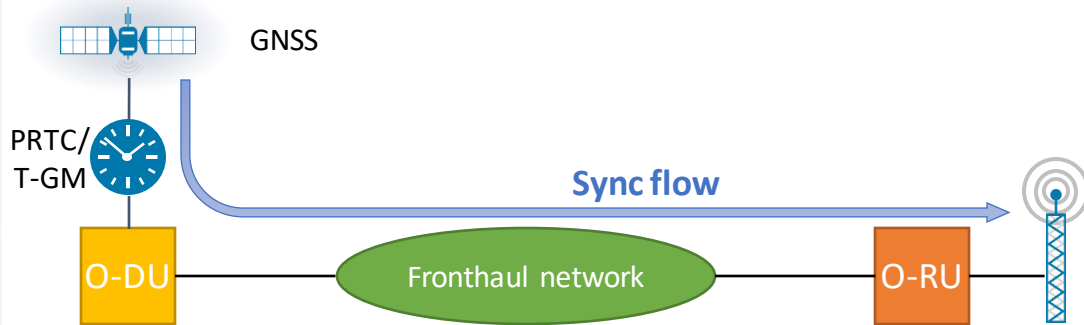
Configuration C1:



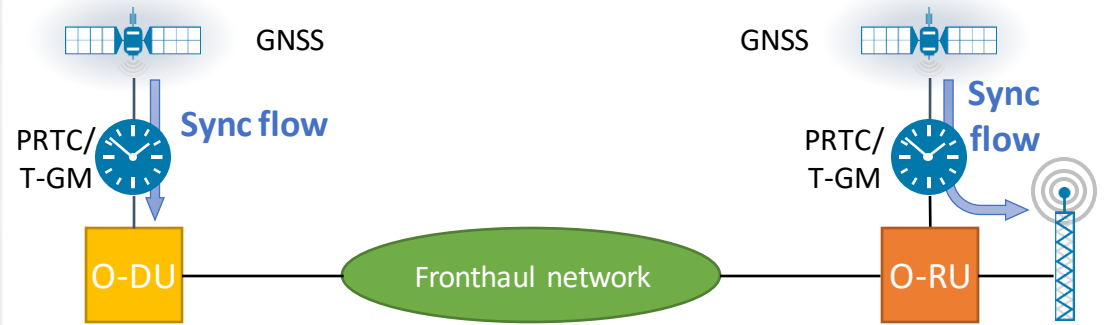
Configuration C3:



Configuration C2:

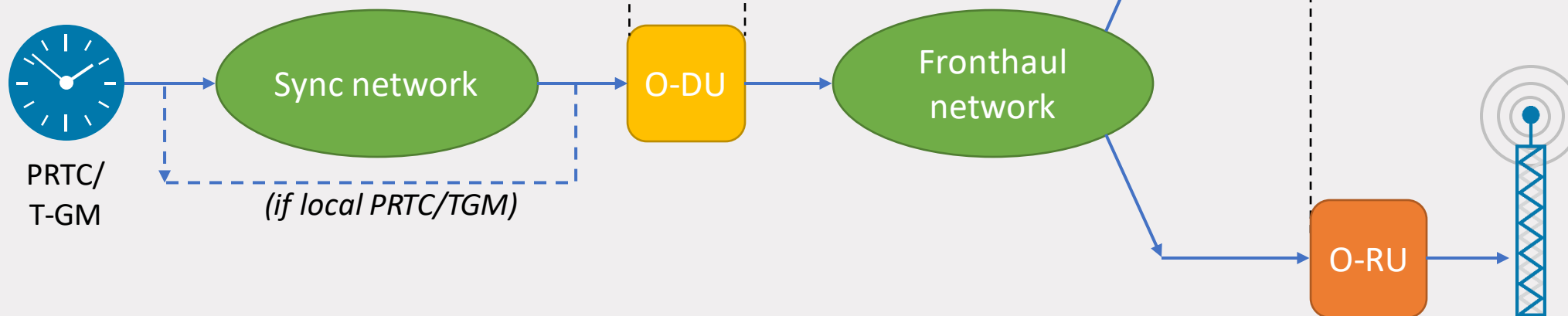
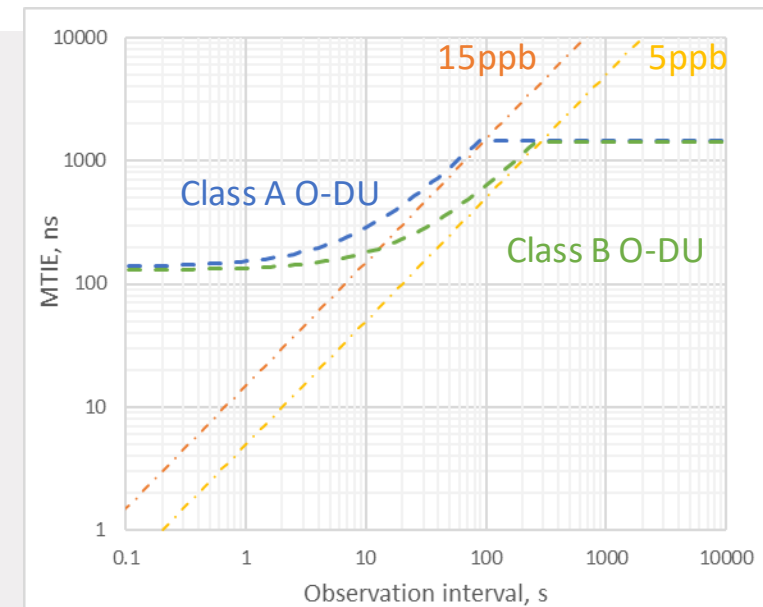
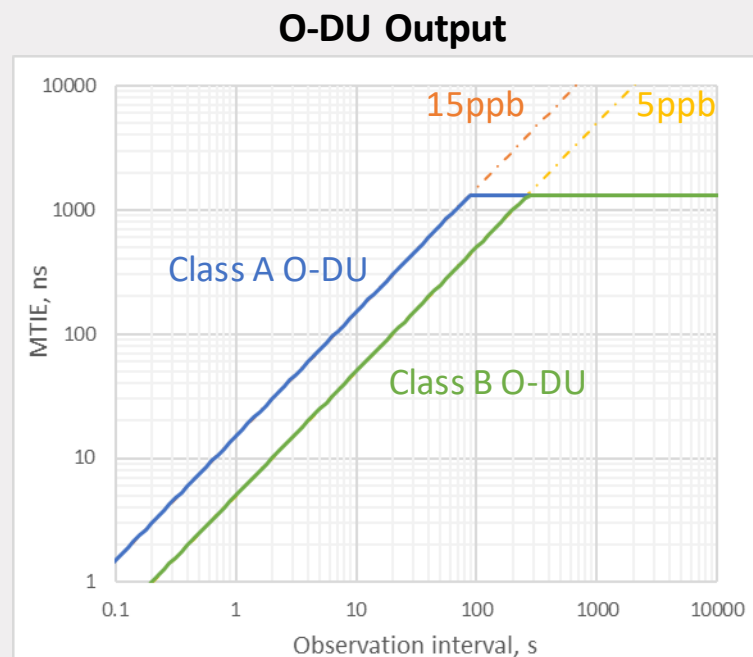
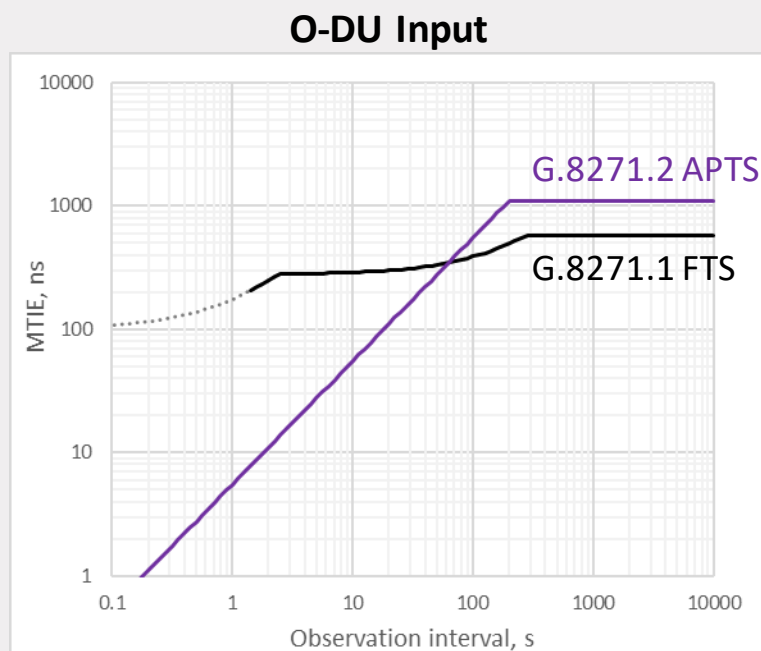


Configuration C4:



*LLS: "Lower Layer Split" – in effect, fronthaul

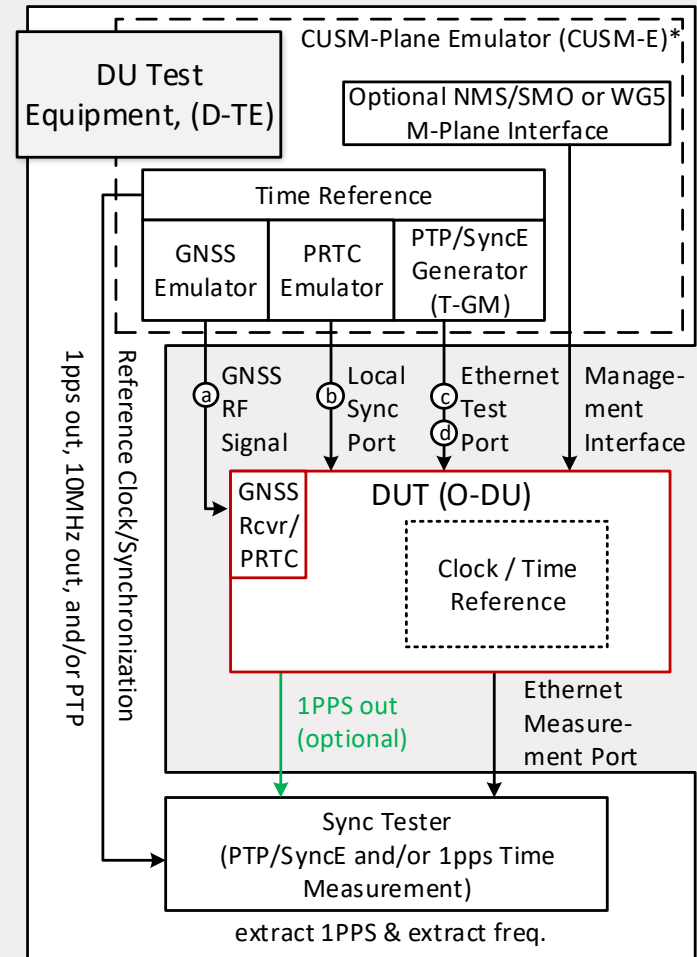
LLS-C2 Fronthaul Input/Output Limits



Conformance Test Specification: O-DU Performance

O-DU Test Configuration (from ORAN-WG4.CONF)

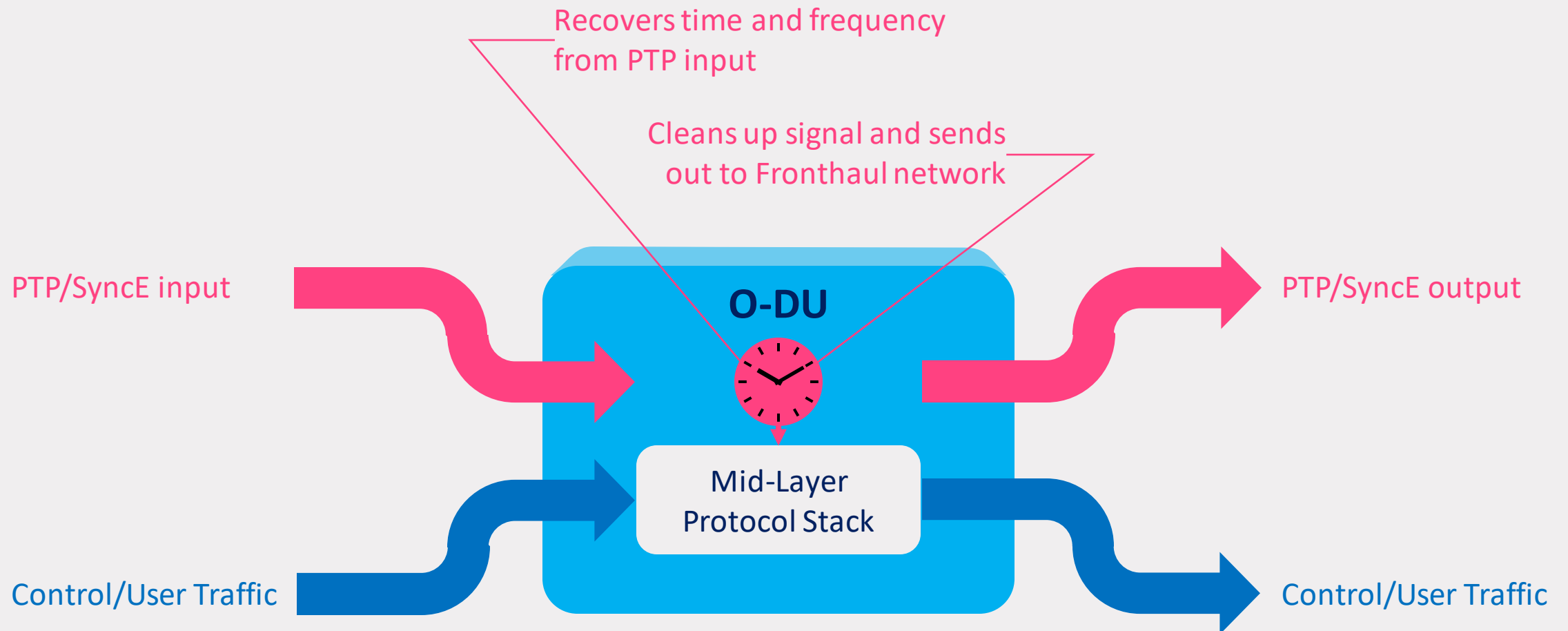
- Requires a CUSM-plane emulator, but
 - M-plane is optional
 - Remainder is the timing reference and measurement
- Sync-plane emulation:
 - Capable of testing S-Plane performance under stress with various noise profiles
 - S-Plane signals traceable to master time reference



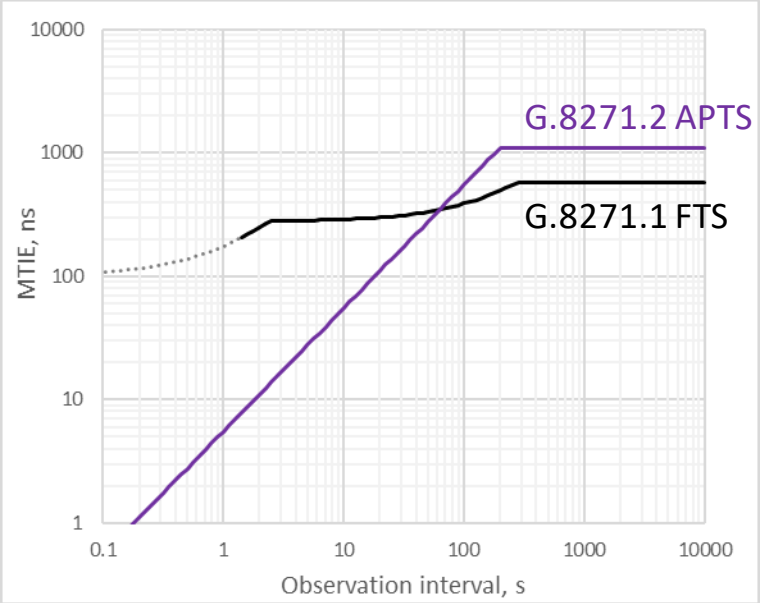
* For O-DU S-Plane testing the CUSM emulator need not implement WG4 C-Plane or U-Plane Protocols.

- (a) Embedded PRTC GNSS radio interface.
- (b) Local PRTC using Local Sync Port (for example ITU-T G.8271 Annex A)
- (c) Local PRTC using PTP and PLFS
- (d) Remote PRTC using PTP and PLFS

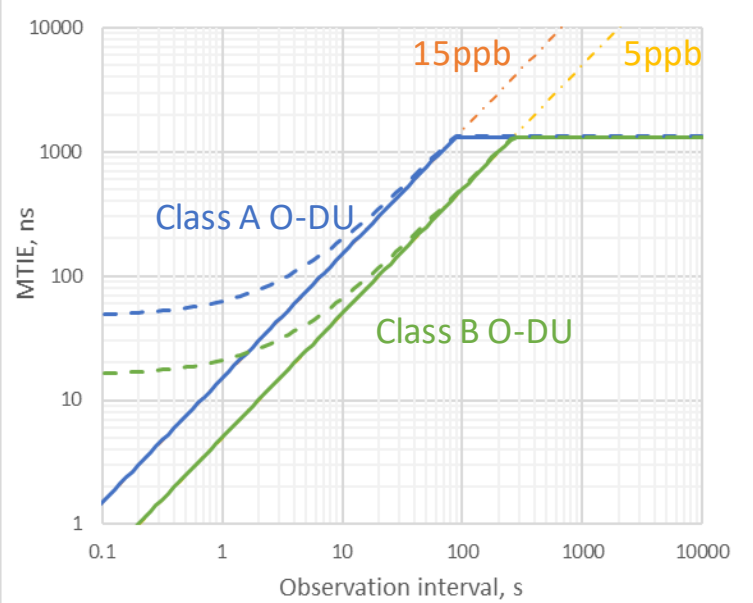
O-DU Synchronization Function



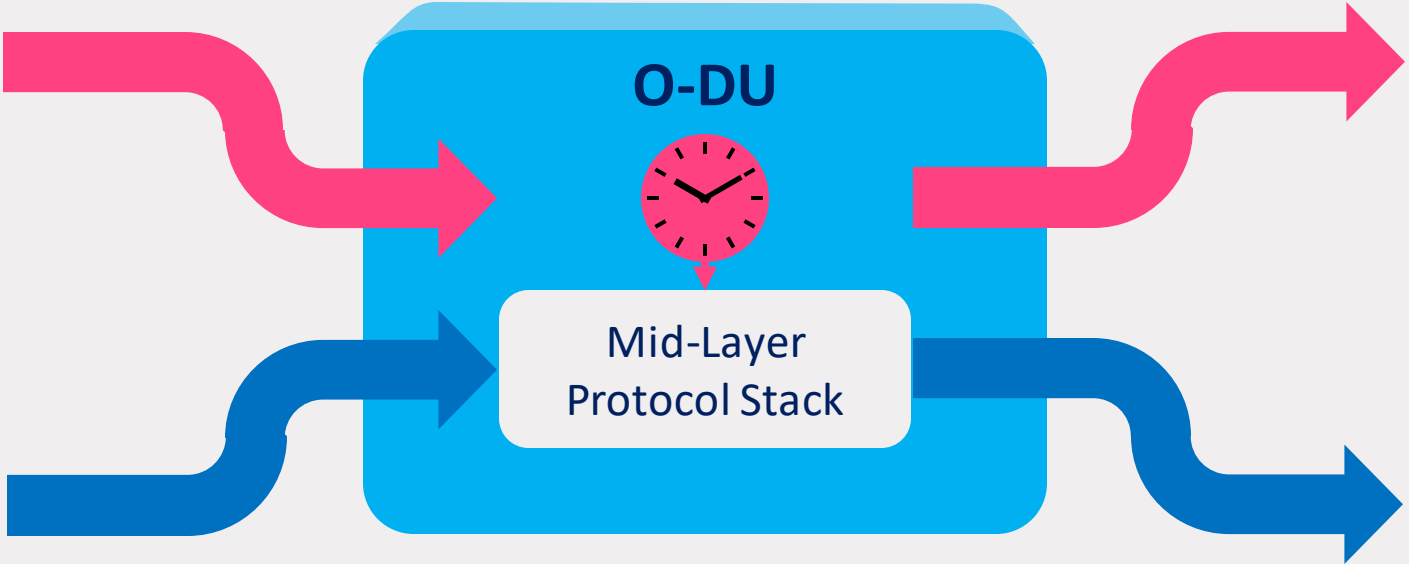
O-DU Synchronization Testing



CUS Annex H,
Figures H.2.3 and H.2.4



PTP/SyncE input

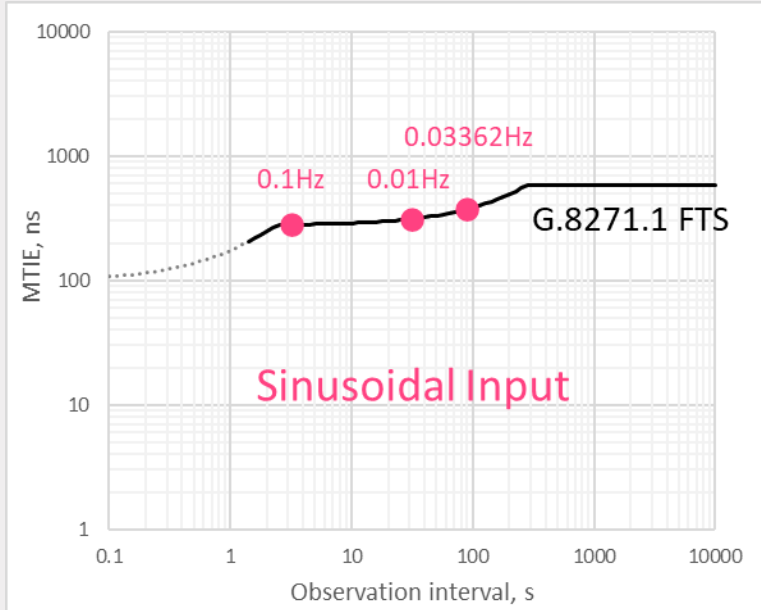


PTP/SyncE output

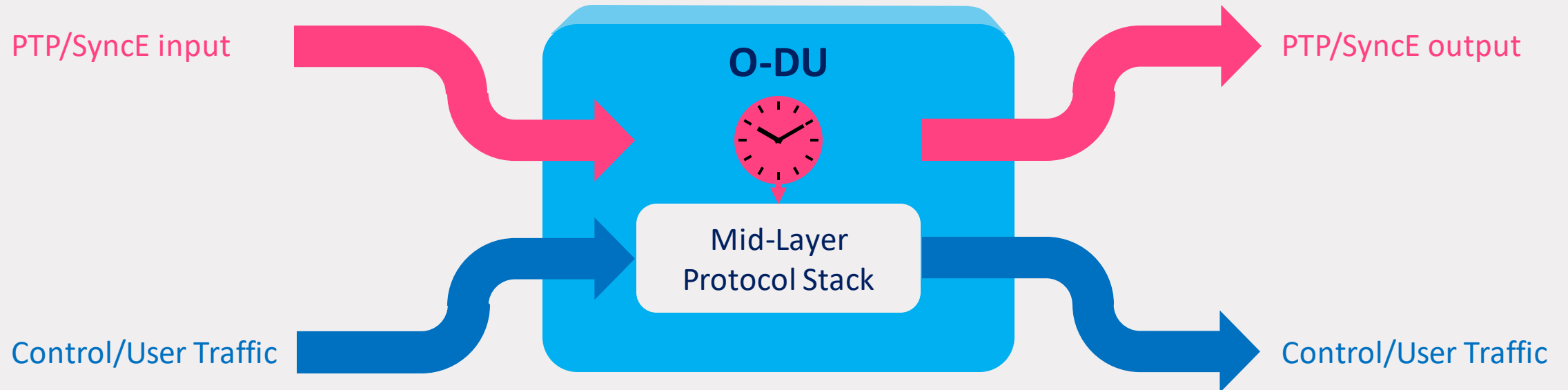
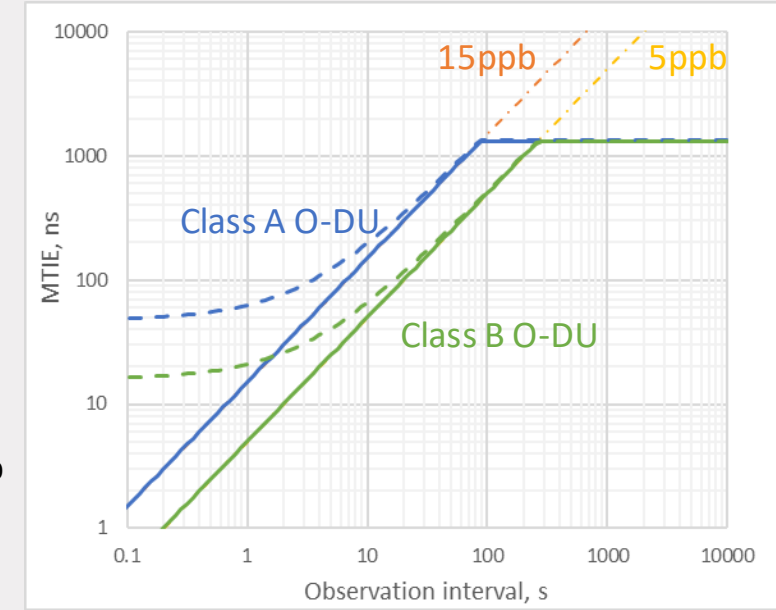
Control/User Traffic

Control/User Traffic

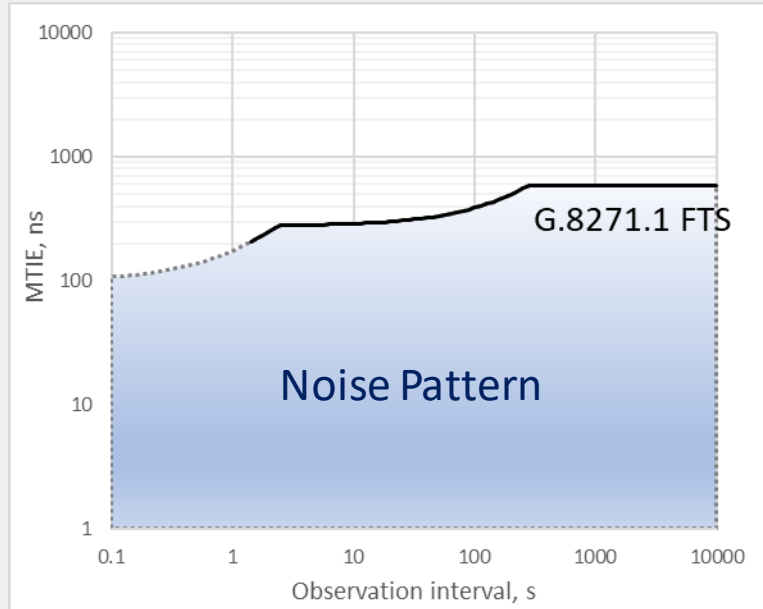
O-DU Sync Testing: CONF clause 3.3.8



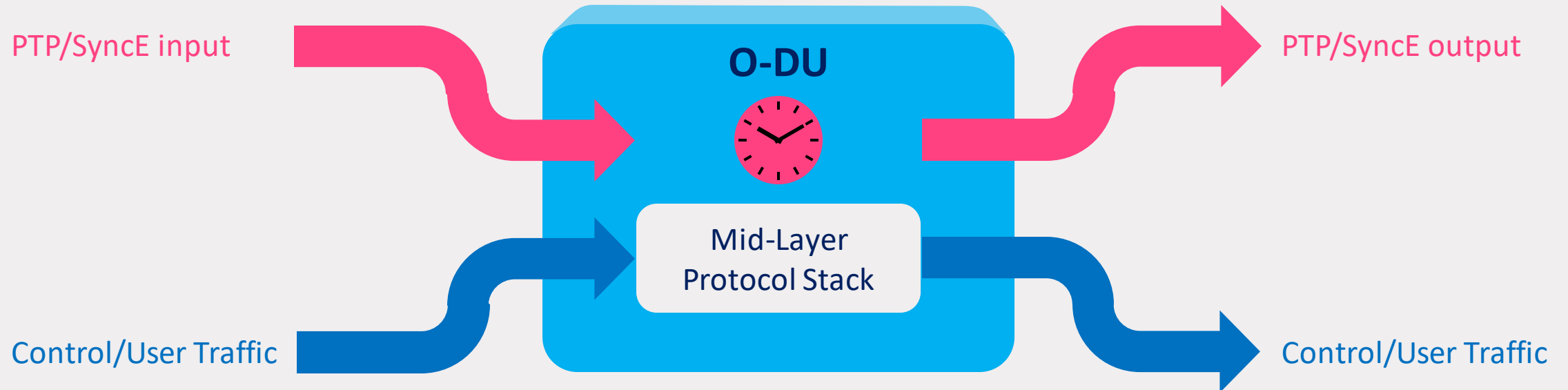
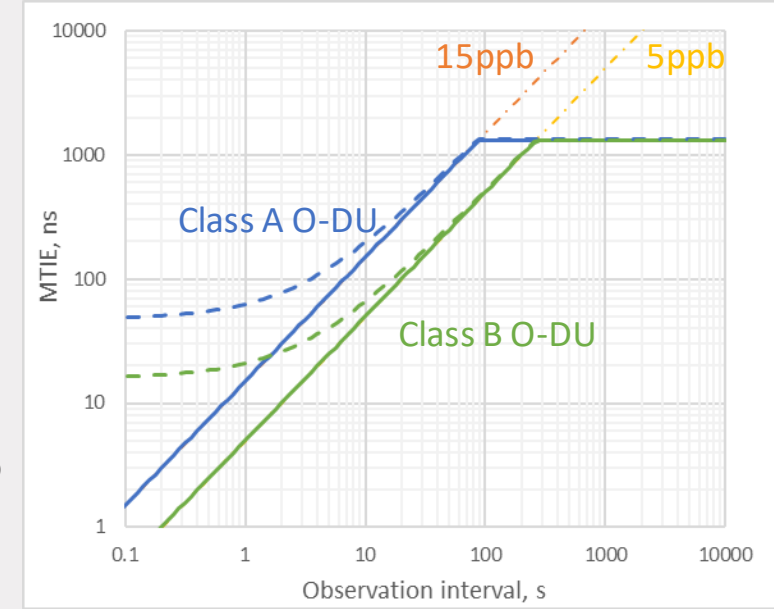
CUS Annex H,
Figures H.2.3 and H.2.4



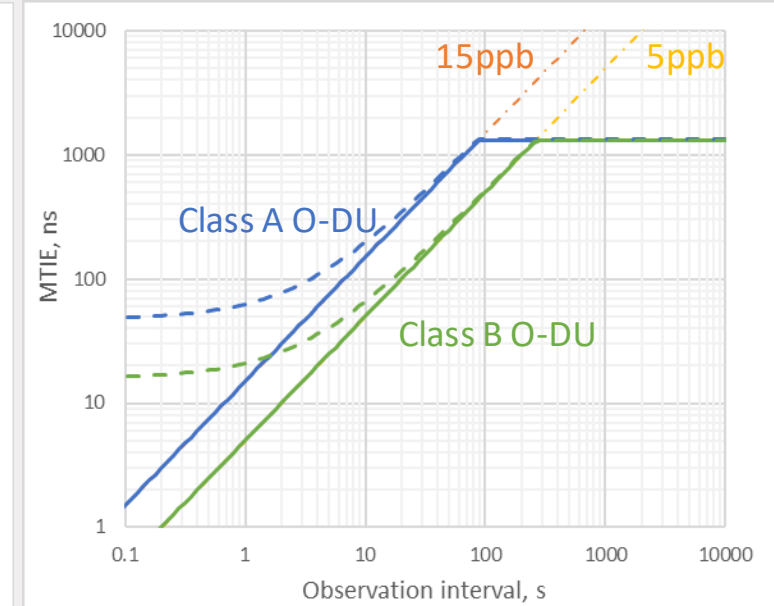
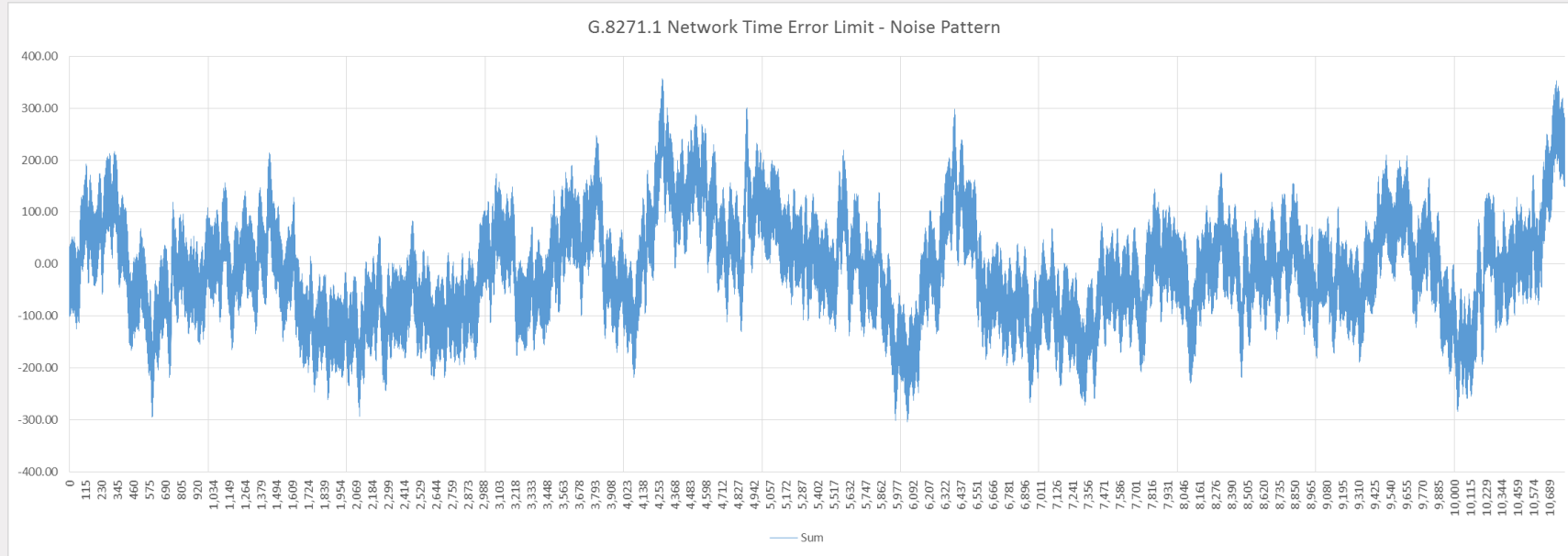
O-DU Sync Testing: ITU-T Method (G.8273.2 App. IX)



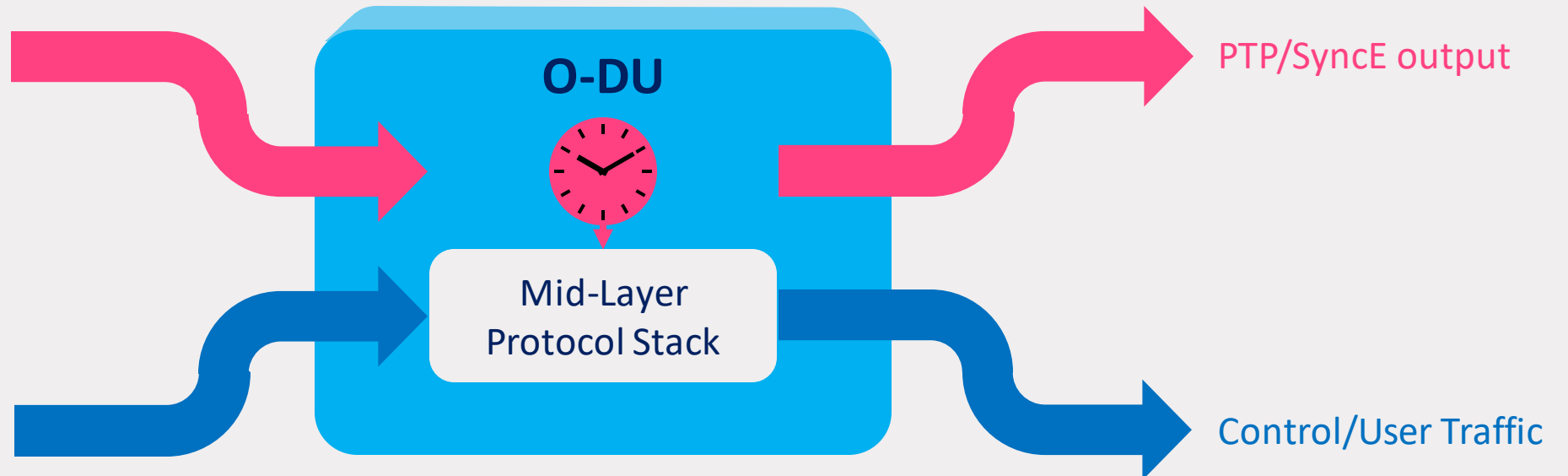
CUS Annex H,
Figures H.2.3 and H.2.4



O-DU Sync Testing: ITU-T Method (G.8273.2 App. IX)



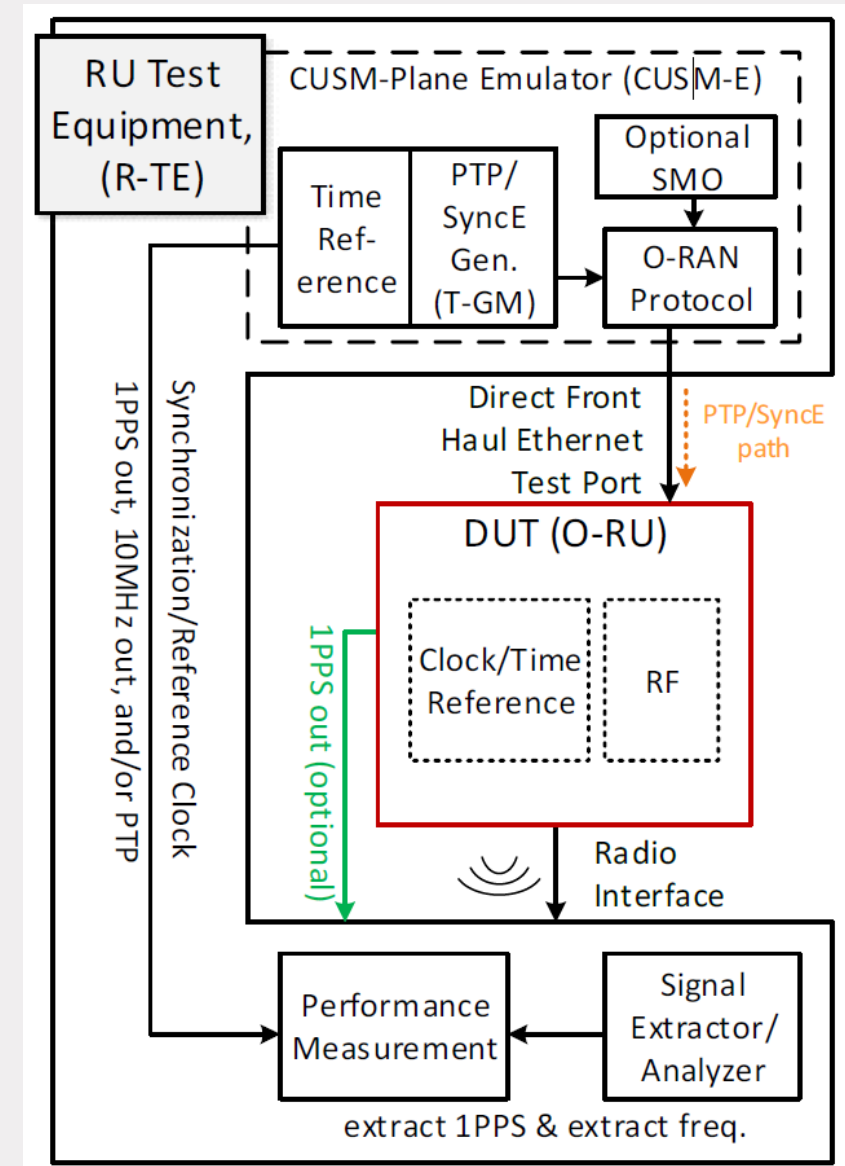
PTP/SyncE input



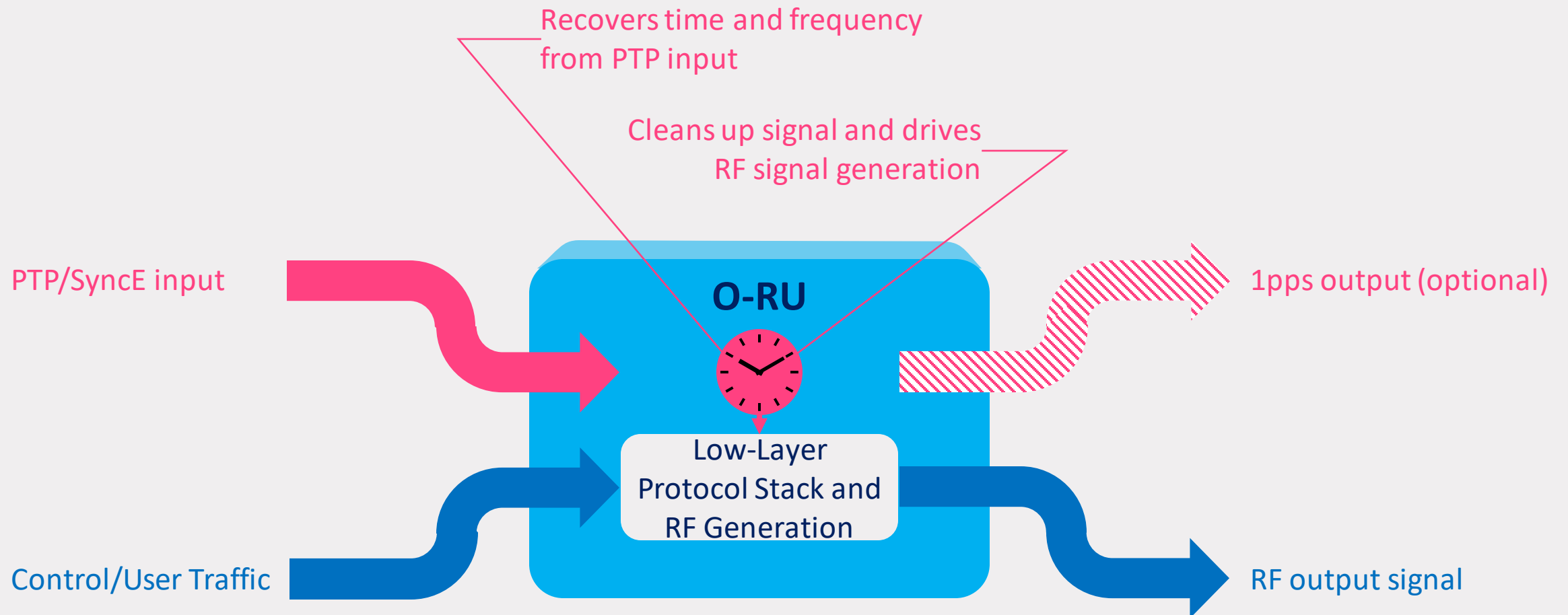
Conformance Test Specification: O-RU Performance

O-RU Test Configuration (from ORAN-WG4.CONF)

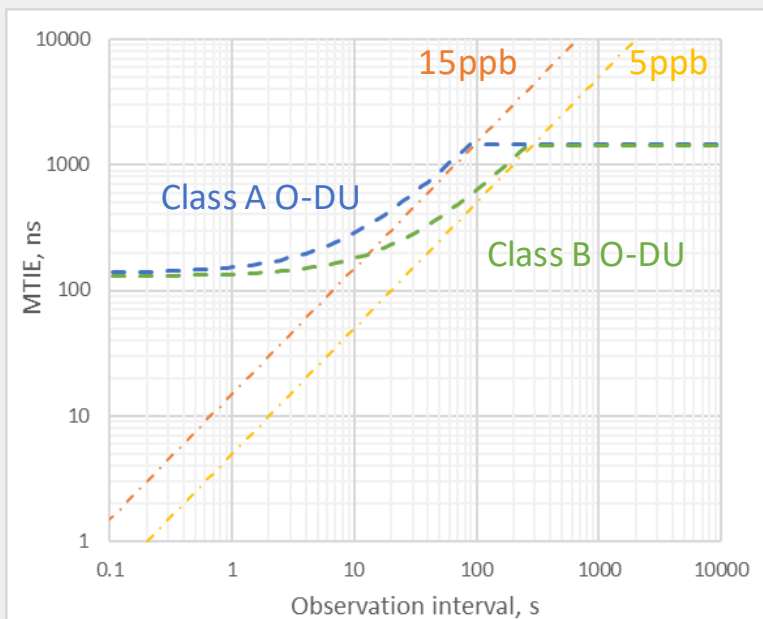
- Requires a CUSM-plane emulator, but
 - M-plane is optional
 - Limited C/U emulation required
 - Remainder is the timing reference and measurement
- Sync-plane emulation:
 - Capable of testing S-Plane performance under stress with various noise profiles
 - S-Plane signals traceable to master time reference
- Measurement either on RF output, or optional 1pps output



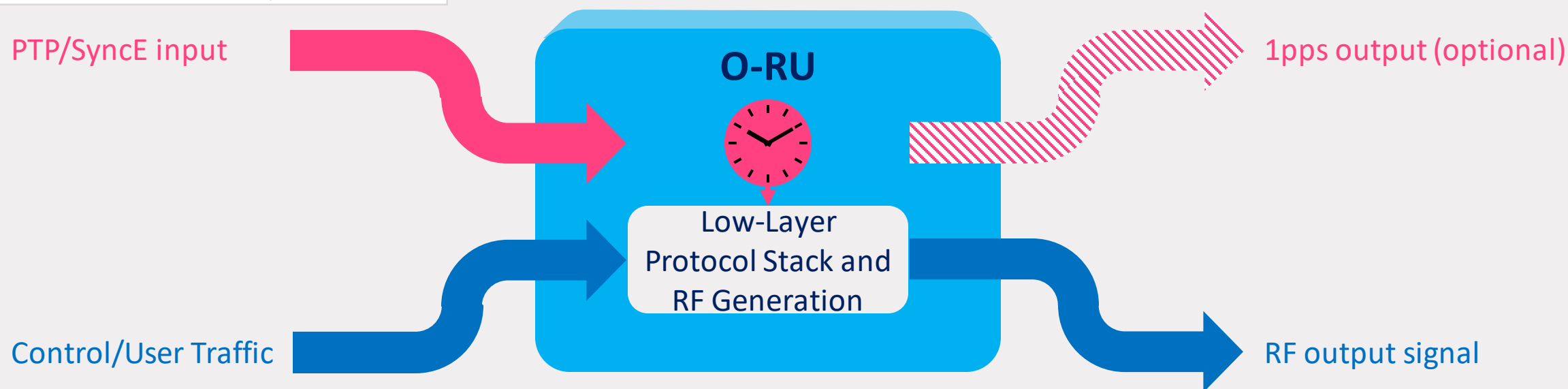
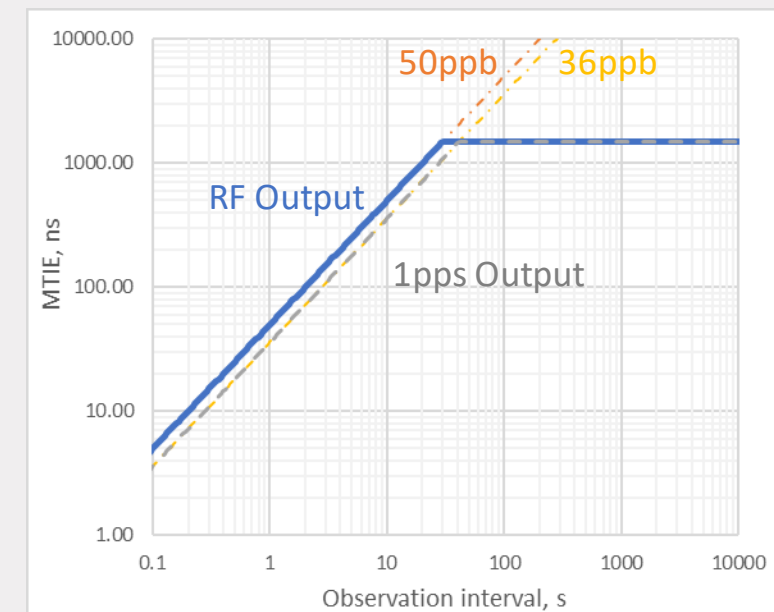
O-RU Synchronization Function



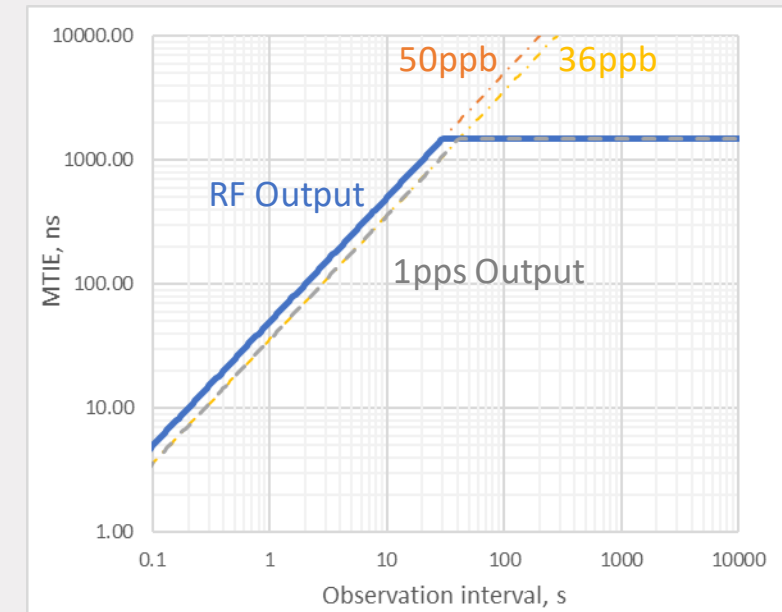
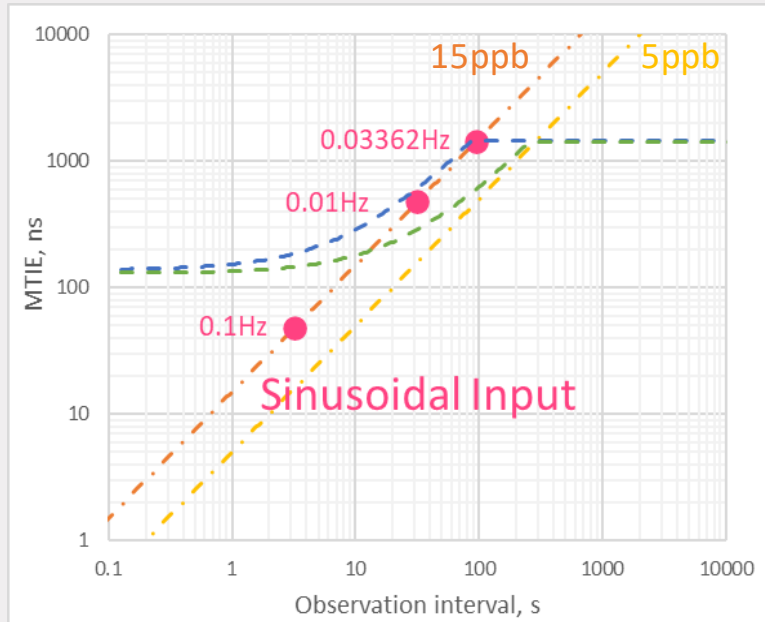
O-RU Synchronization Testing (LLS-C2)



CUS Annex H, Figure H.2.5



O-RU Sync Testing: CONF clause 3.3.3 (LLS-C1 only)



PTP/SyncE input

Control/User Traffic

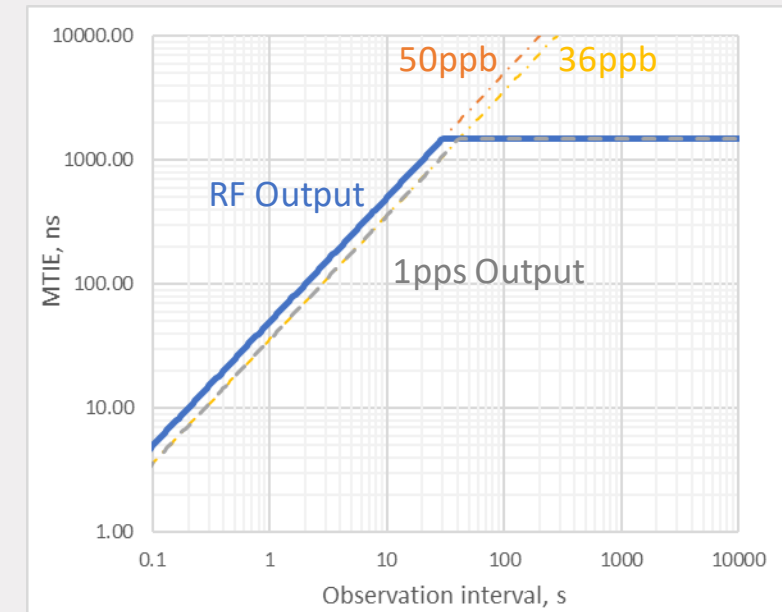
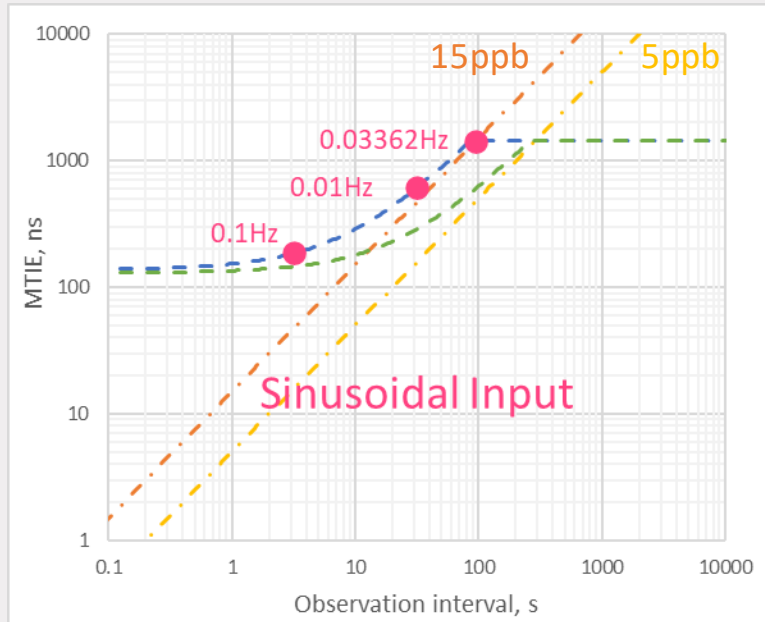
O-RU

Low-Layer
Protocol Stack and
RF Generation

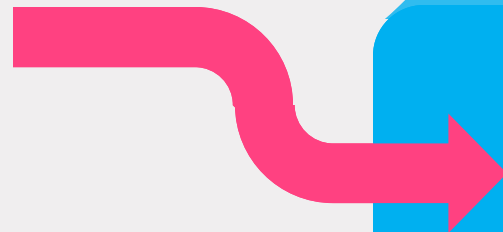
1pps output (optional)

RF output signal

O-RU Sync Testing: CONF clause 3.3.3 modified for LLS-C2



PTP/SyncE input



O-RU

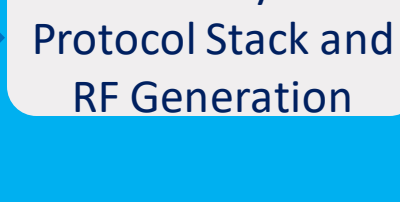


Low-Layer
Protocol Stack and
RF Generation



1pps output (optional)

Control/User Traffic



RF output signal

Tim Frost — Strategic Technology Manager
tim.frost@calnexsol.com

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