Differential Timing Methods for Circuit Emulation

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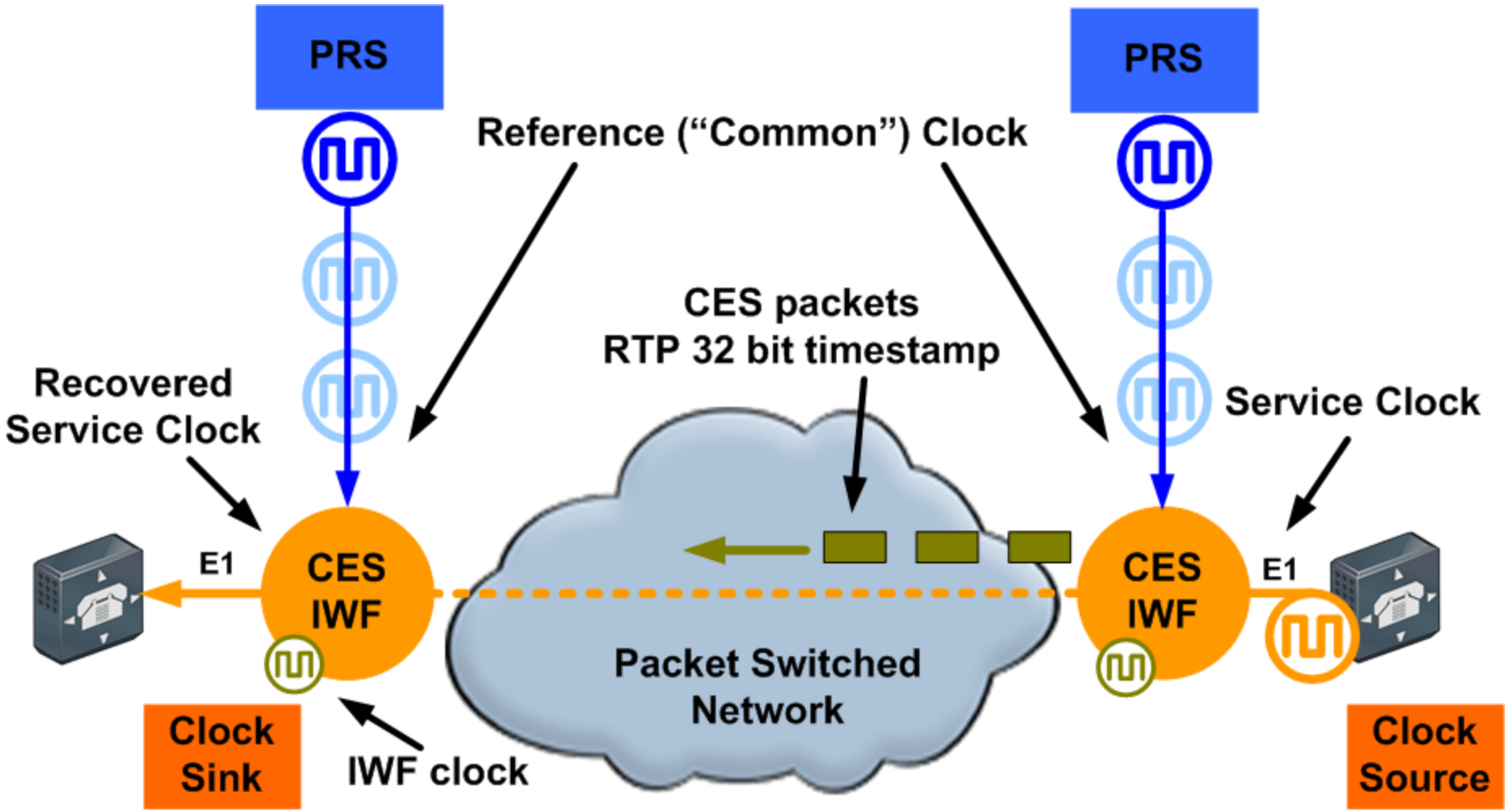
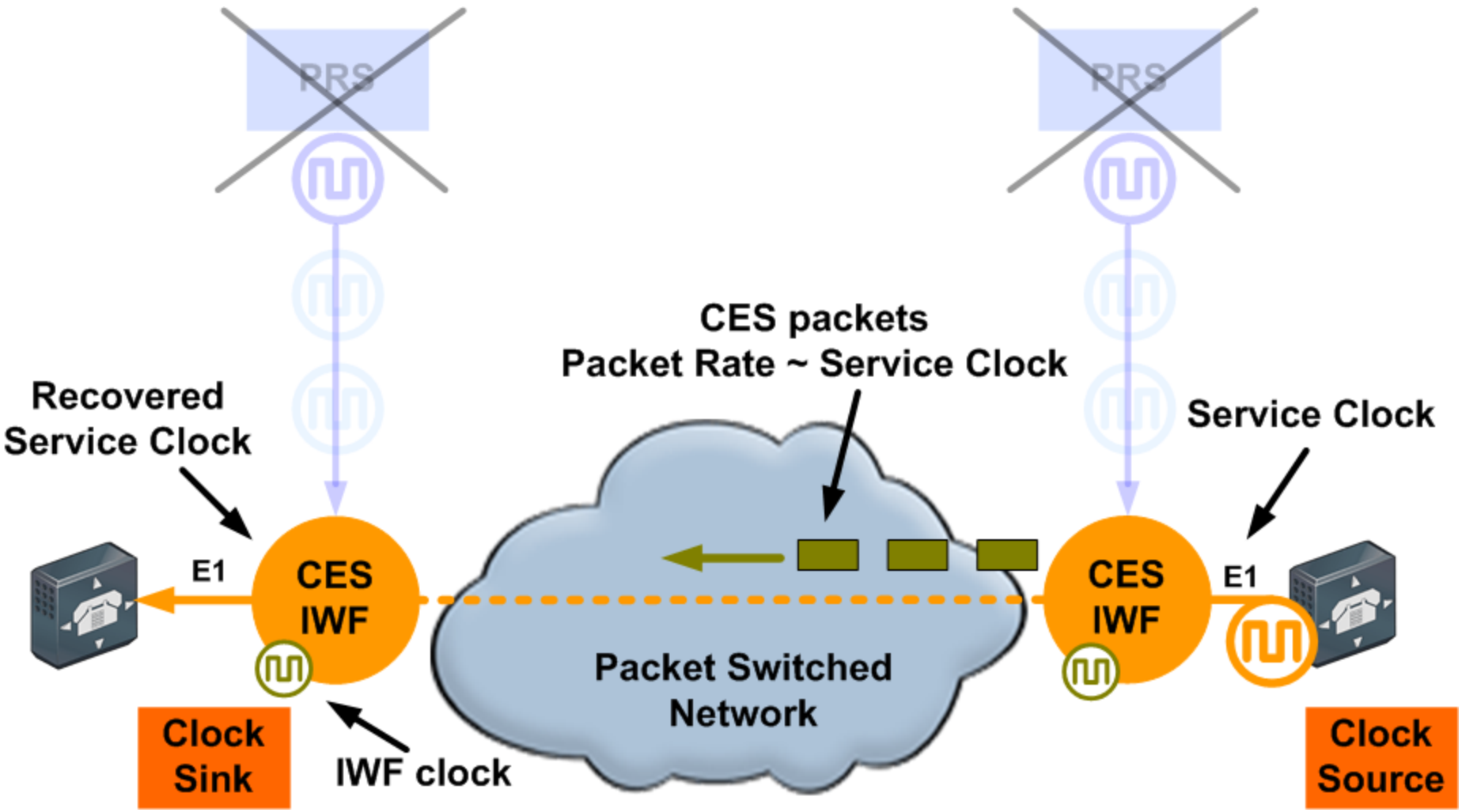
Agenda

- What is Circuit Emulation and what is Differential Timing all about?
- Deployment Scenarios Examples
- Requirements
- Differential Timing Performance Results from our Lab
- Combined Differential Timing and Synchronous Ethernet Lab Results

CES Differential Timing



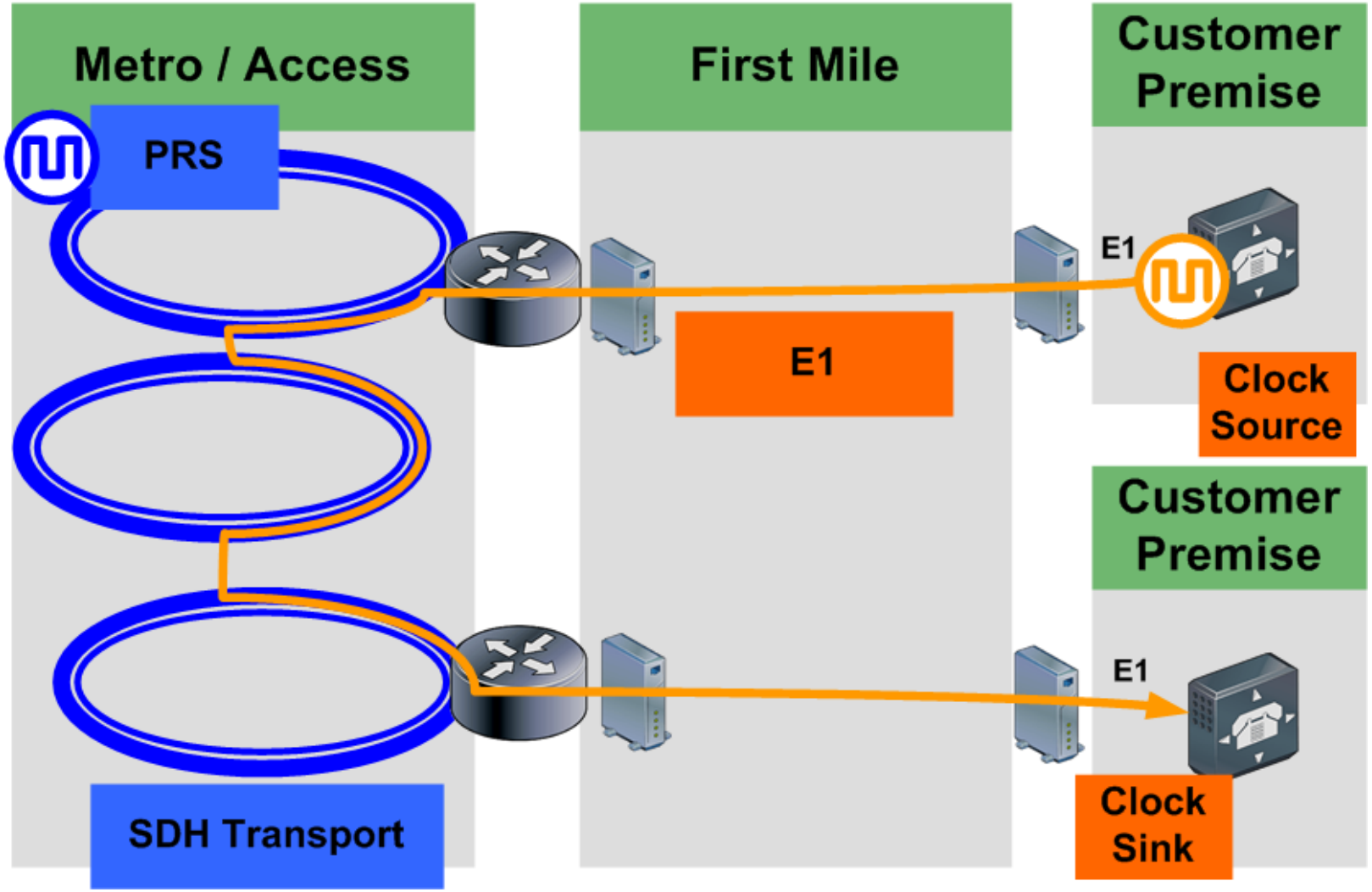
CES Adaptive Timing



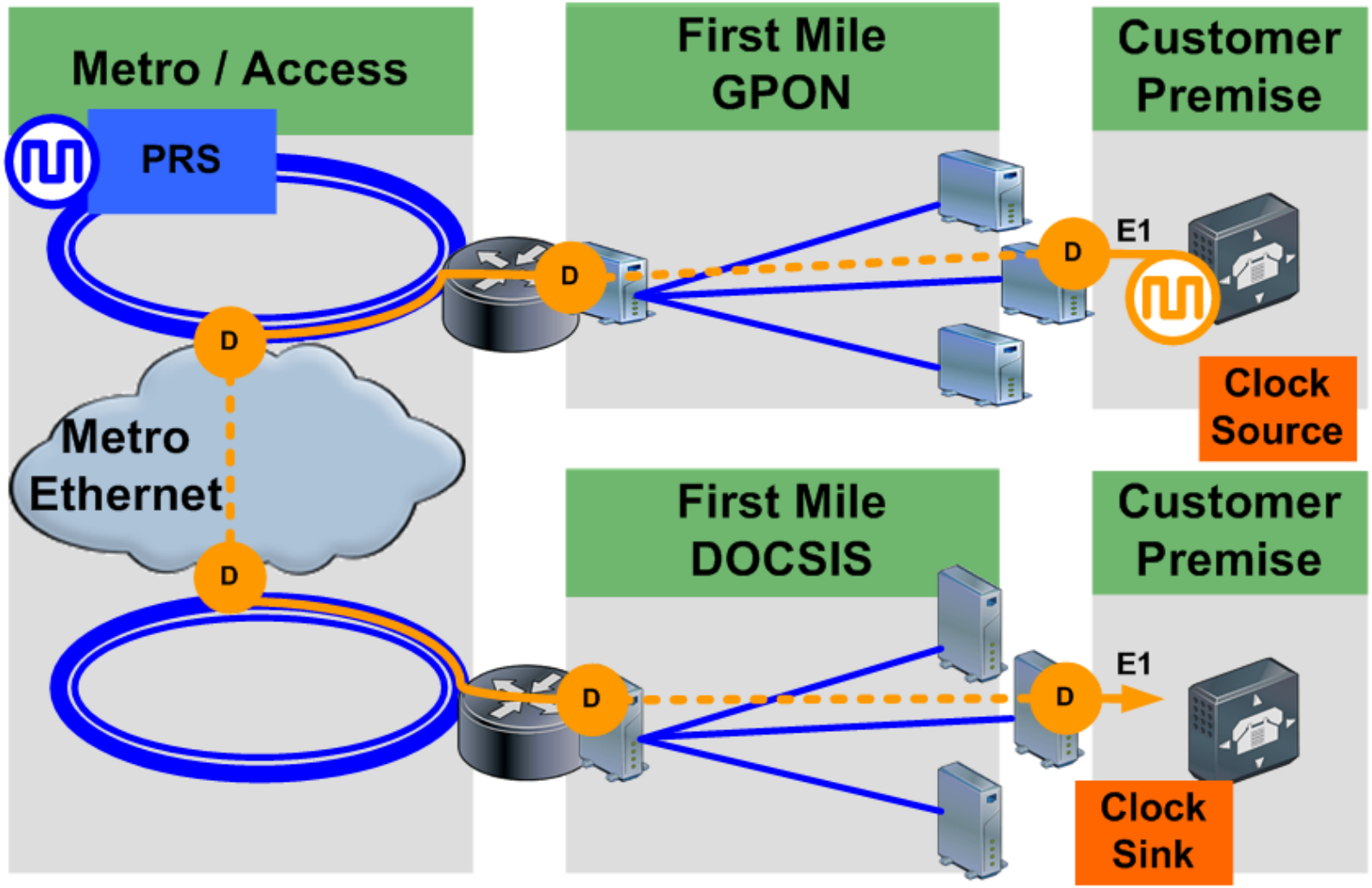
Differential vs. Adaptive

- Differential Timing Pros:
  - Handles well
    - Packet Switched Network (PSN) impairments, and in particular Packet Delay Variation (PDV)
    - Systematic PSN PDV due to beating effects
  - Faster settling time compared to Adaptive
  - Lower requirements for stability of IWF oscillator - leading to potentially cheaper solution with smaller footprint and power requirements
- Differential Timing Cons:
  - Requires Common Reference Clock

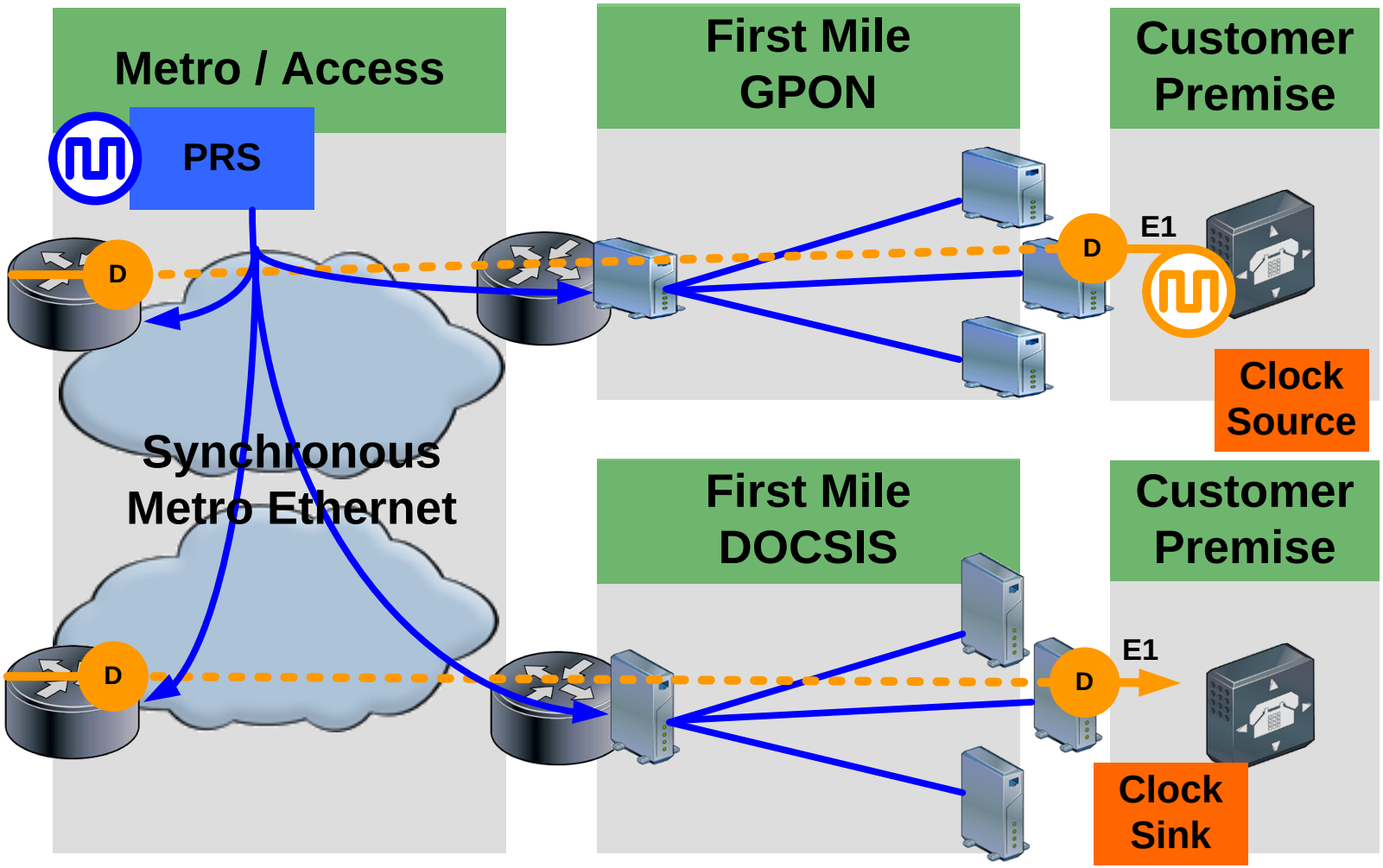
TDM Transport



Synchronous First Mile



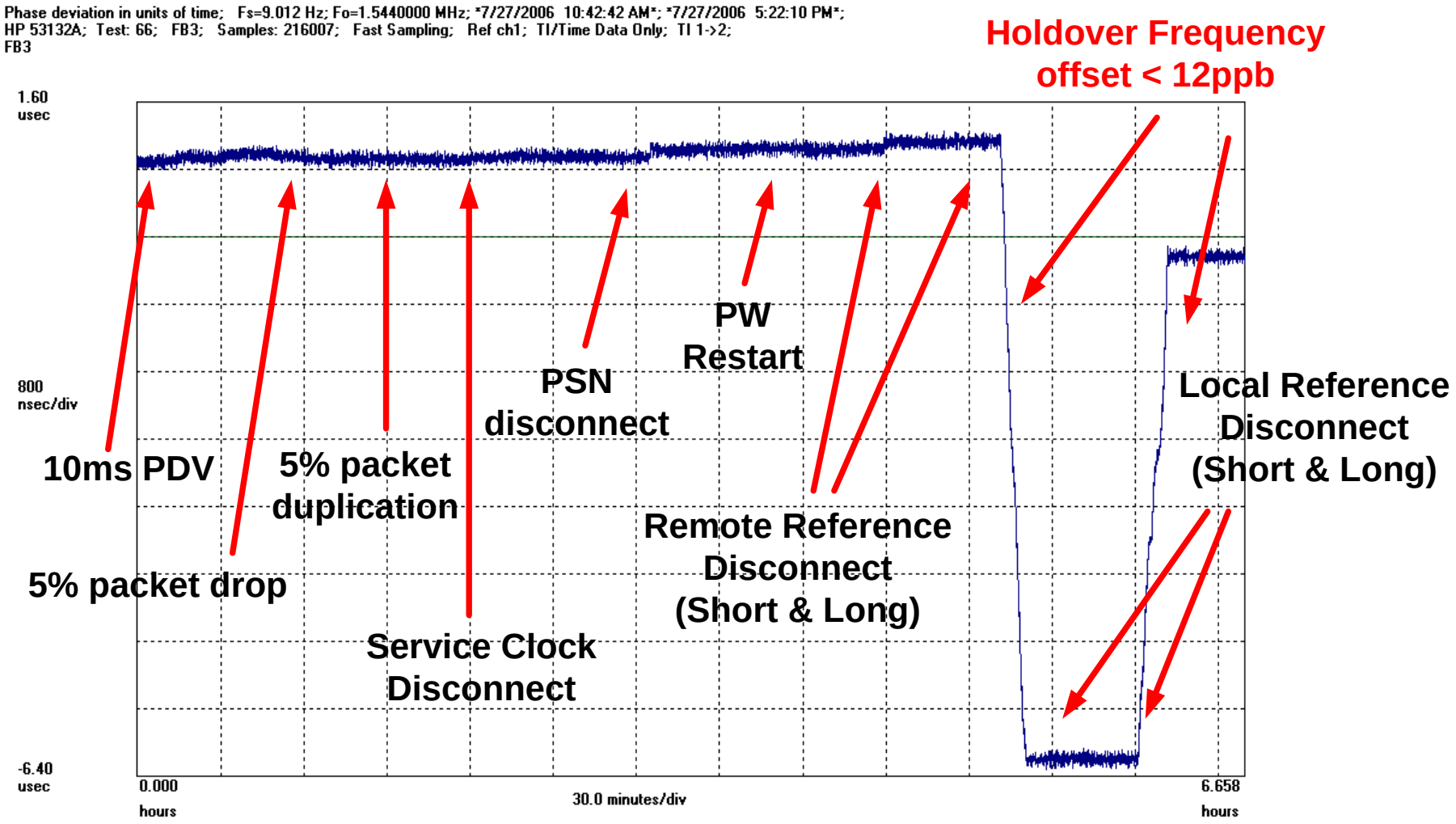
Synchronous Metro Ethernet



Requirements

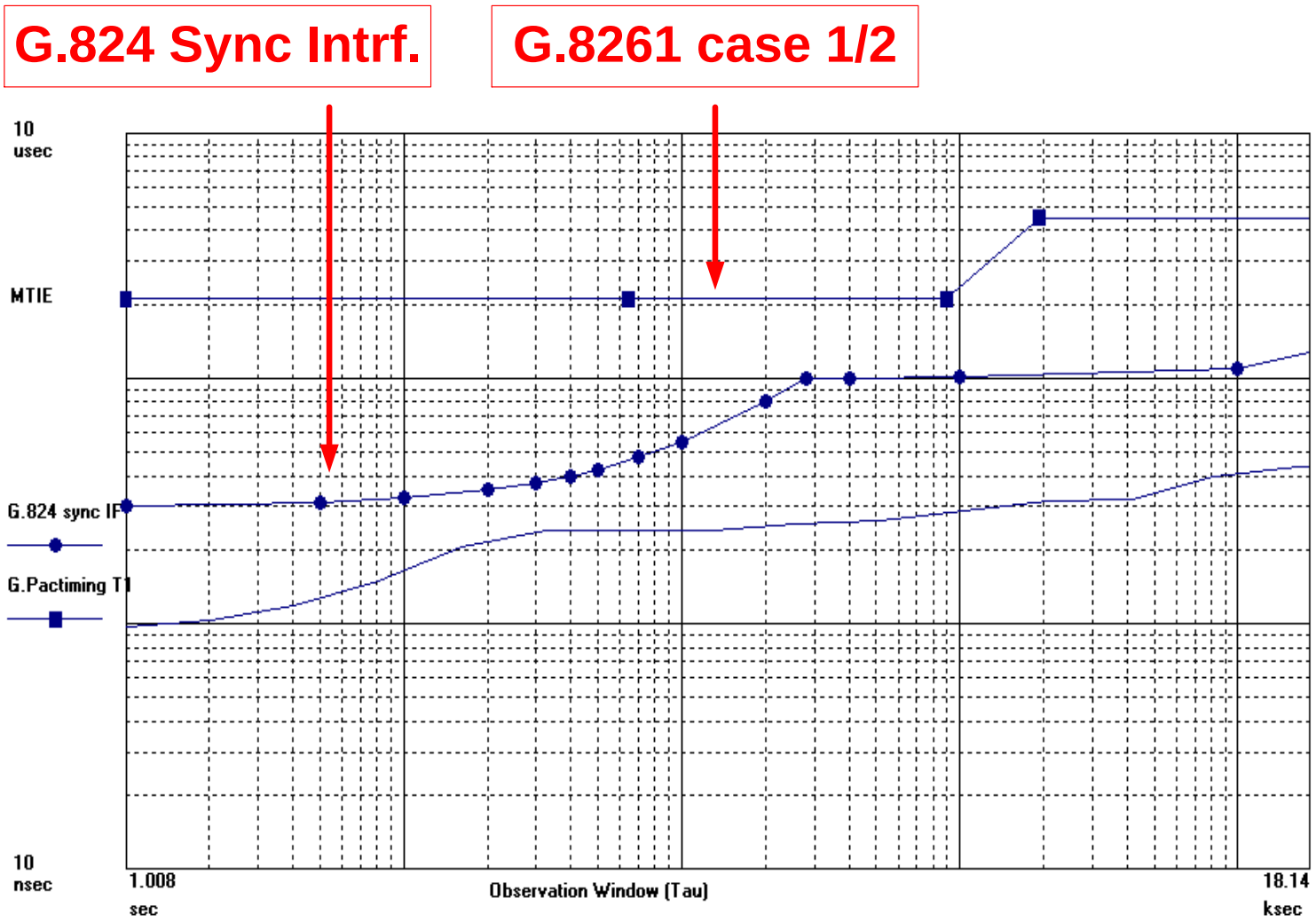
- Wander MTIE compliance as specified in G.8261
  - consistent results across all
    - service clock frequencies
    - relevant common clock frequencies
- Robust to impairments introduced by
  - packet switched network
  - reference clock
  - service clock
- Mid-range performance IWF oscillator and peripherals

TIE: Impairments



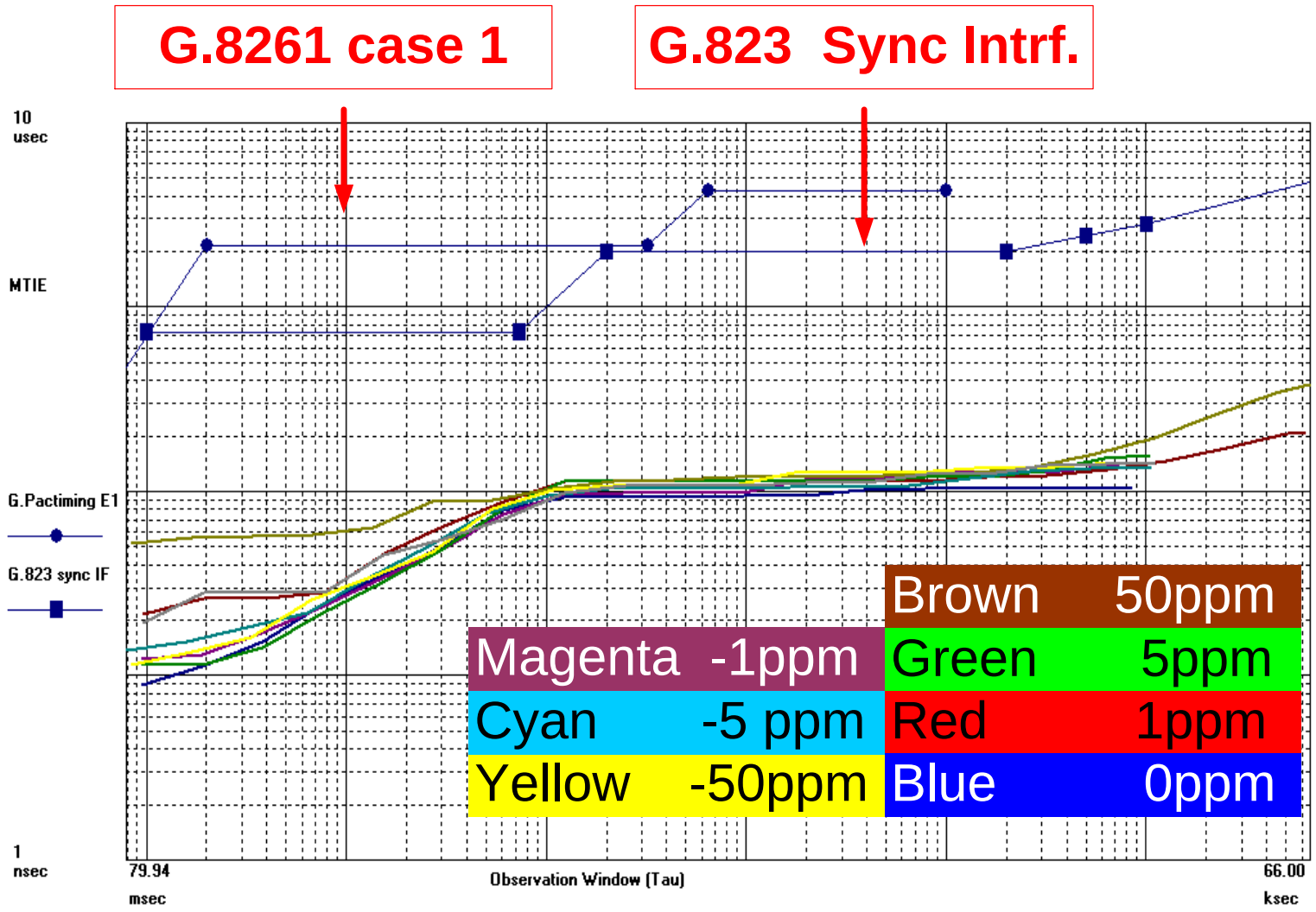
T1, CC=10.24MHz, TCXO

MTIE: Impairments (first 5h)



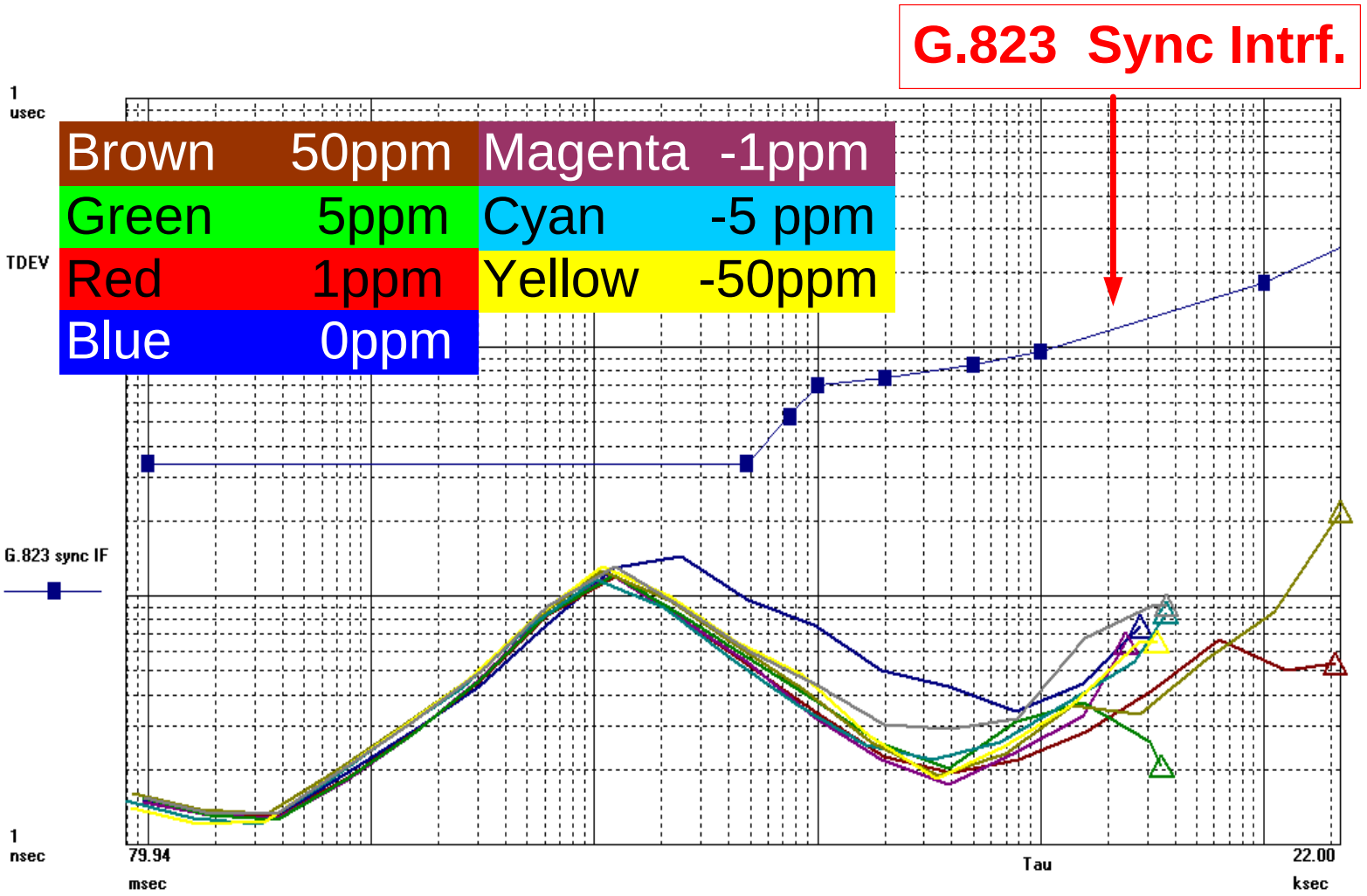
T1, CC=10.24MHz, TCXO

MTIE: Service Clock Dependency



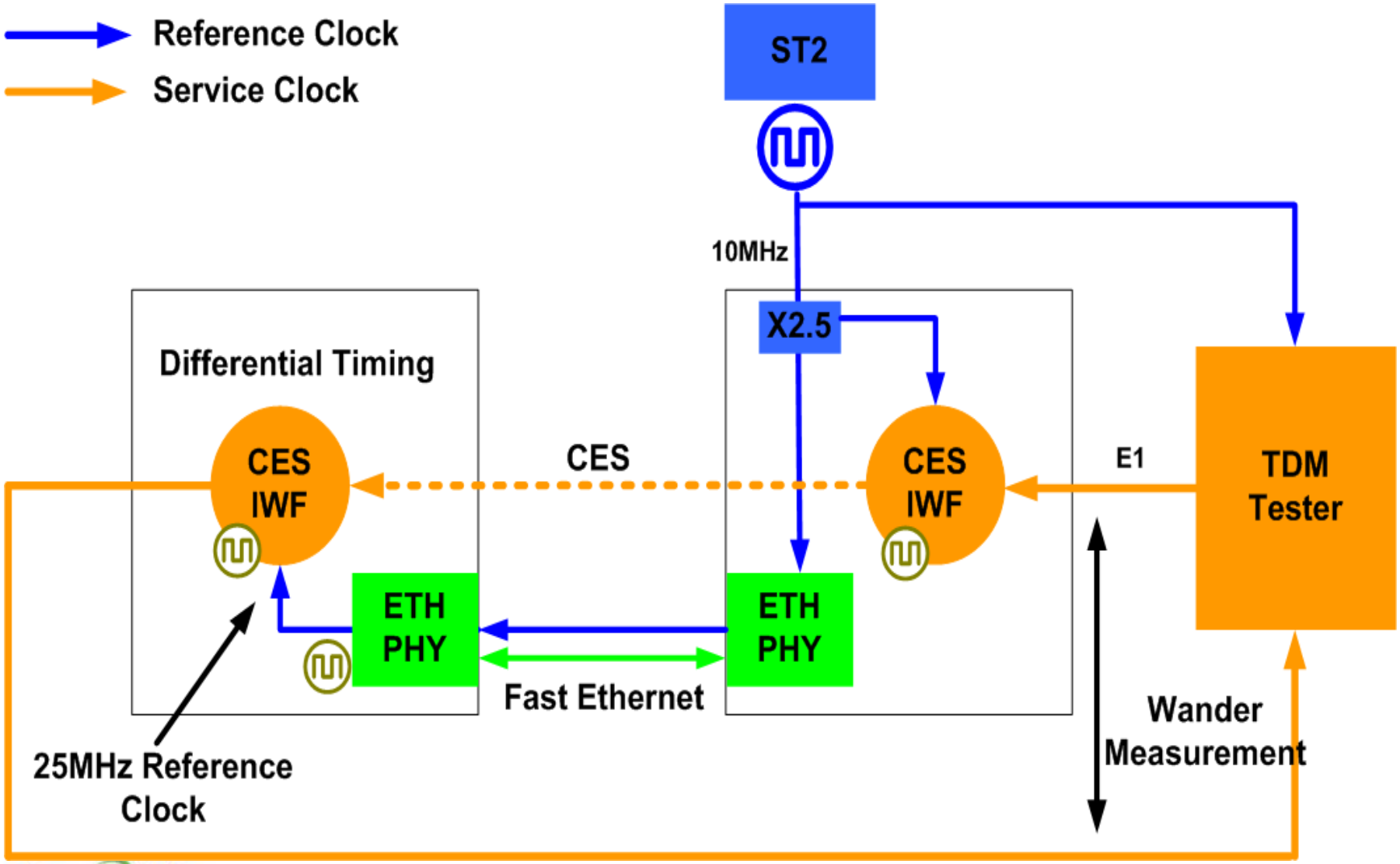
E1, CC=16.384MHz, TCXO

TDEV: Service Clock Dependency

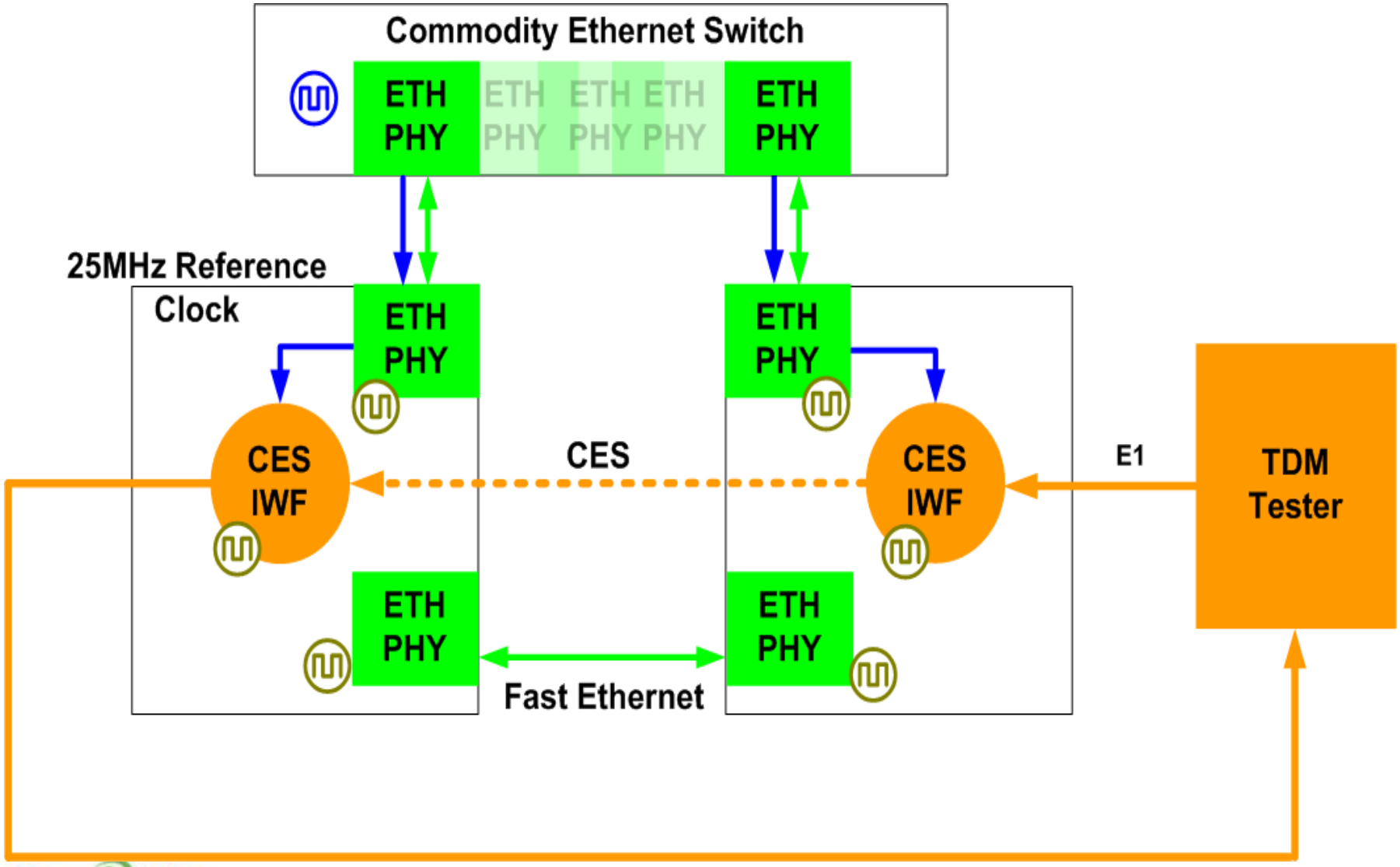


E1, CC=16.384MHz, TCXO

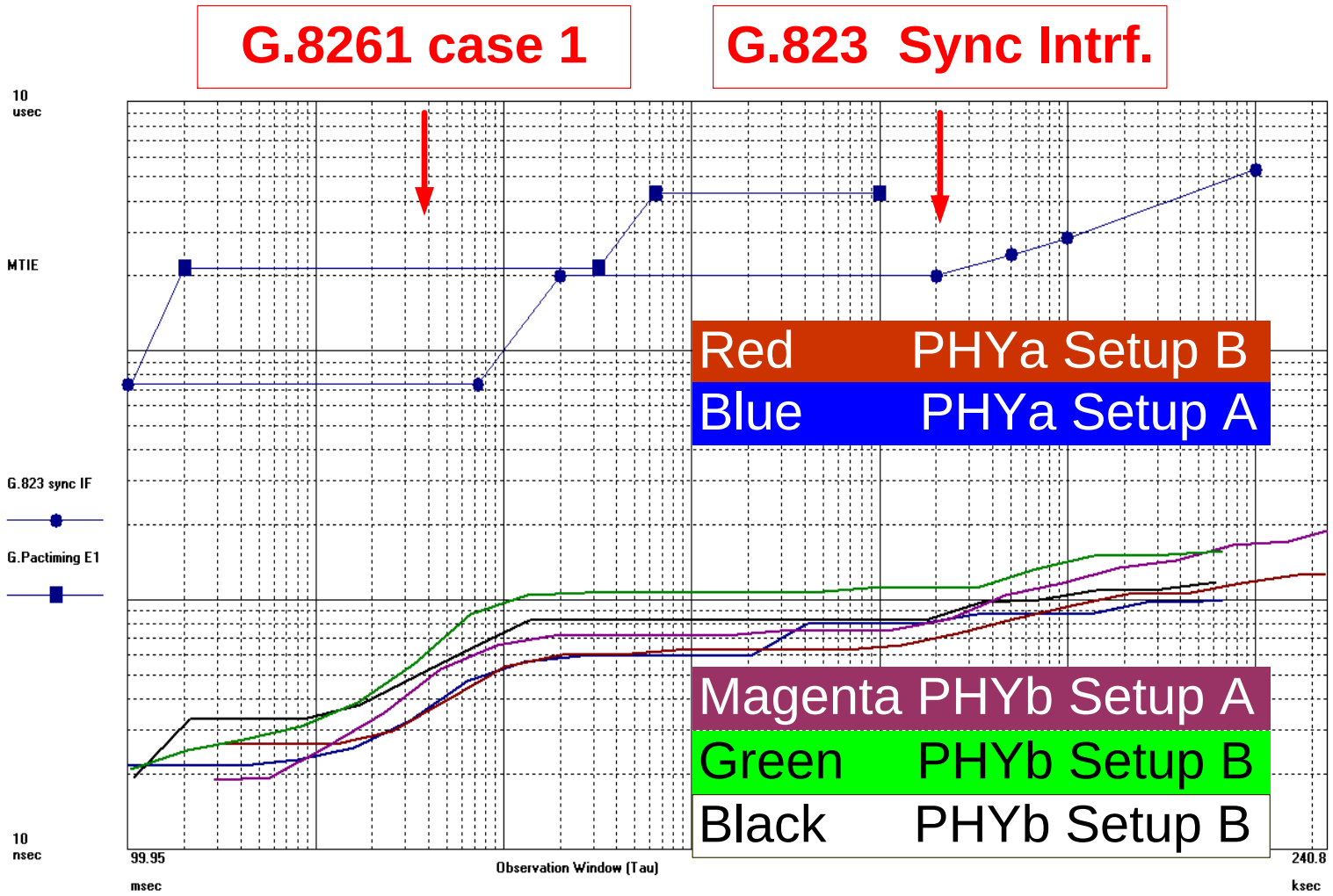
Sync Ethernet Setup A



Sync Ethernet Setup B



MTIE: Sync Ethernet Results

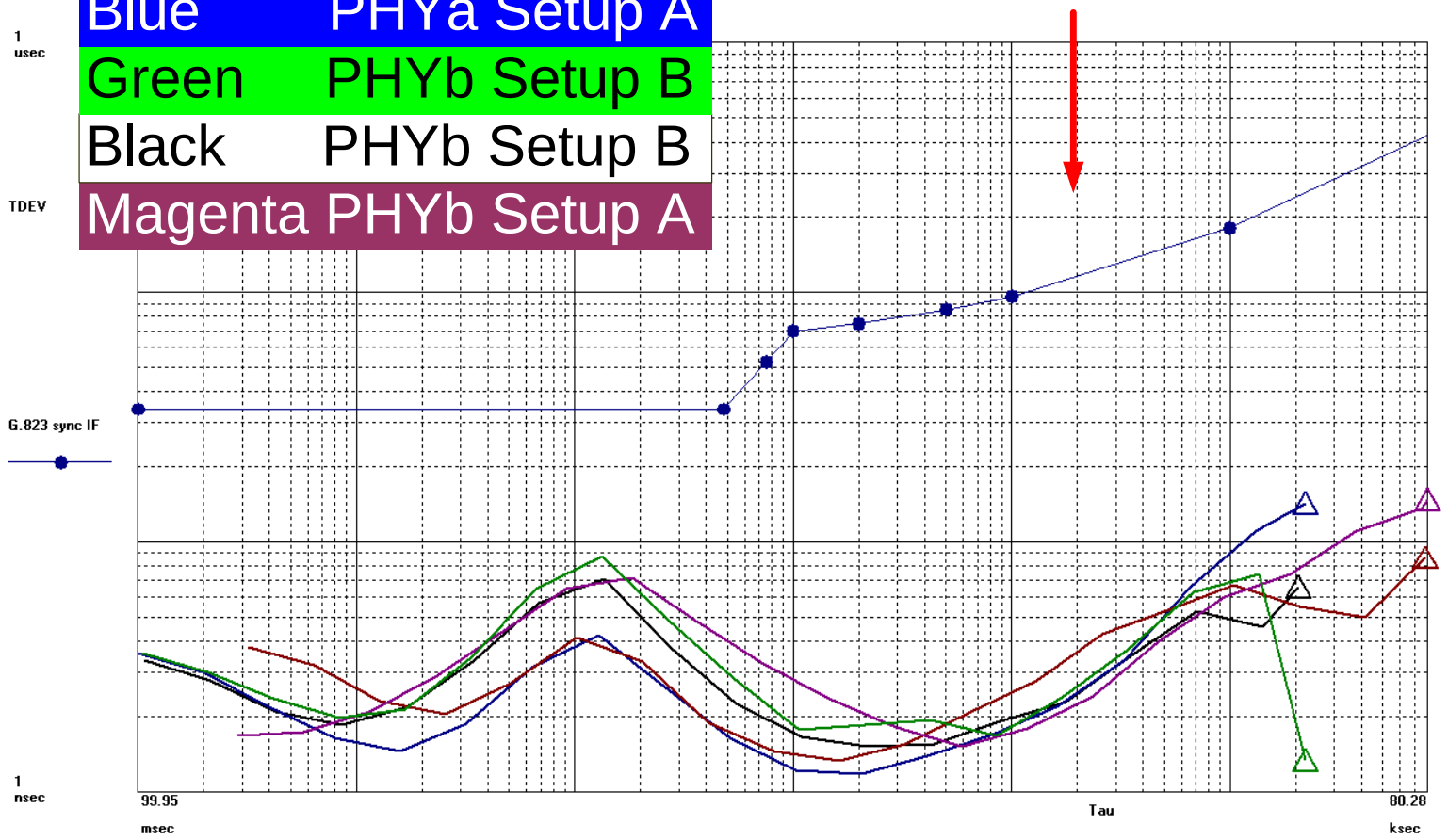


PRELIMINARY RESULTS

TDEV: Sync Ethernet Results

Red	PHYa Setup B
Blue	PHYa Setup A
Green	PHYb Setup B
Black	PHYb Setup B
Magenta	PHYb Setup A

G.823 Sync Intrf.



PRELIMINARY RESULTS

Conclusions

- Packet switched networks which provide common reference clock are happening now
- Differential timing is compliant with strictest performance requirements
- Differential timing is a robust and cost effective solution

Res Olute networks

Thank You

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