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Synchronizace a stabilita

Měření SyncE a 1588v2 PTP s přístroji VeEX – nové vlastnosti

VeEX má velký náskok

- Po 3 letech zaznamenáváme reálný nárůst zájmu o synchronní aplikace
- Jedna z nejžádanějších skupin měření

Novinky a zlepšení v přístrojích VeEX

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- Improved external reference clock synchronization locking mechanism
- Improved Wander and Phase measurement reliability and run-time analysis
- Improved Atomic Clock initialization and disciplining settings
- Added the Phase Graph to track Atomic disciplining status
- Improved GPS-assisted One Way Delay (OWD) measurements
  Accuracy, reliability and ease of use
- Improved PTP PDV measurements accuracy
- Improved Pulse Shape Analysis to work with All-1 (AIS) E1 clock signals
- Improved SSM QL for E1 (Sa) and SDH (S1)
- Added direct PTP protocol capture and Wander files Analysis, directly from a USB memory stick (application auto launch)
- Added open Wander CSV TIE file format and MTIE/TDEV export to CSV

Plán dokonce roku

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320 HW: 1588v2 PTP Pass-through Monitor mode
- Ethernet statistics
- Packet capture with filters

320 HW: Advanced PDV Analysis
- Transparent pass-through with MAC filtering

Evaluating the options for Field and Lab Calibrations (frequency)

GPS-assisted Single-ended One-Way-Delay measurement (under consideration)

Improved GPS module (more stable 1PPS reference)

1588v2 monitoring a analýza

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2 Modes of operation:

- Port 1 to Port 2 Pass-through (RX1→TX2, RX2→TX1)
- Transparent monitoring with optical splitter (RX1, RX2)

Bi-directional analysis of 1588 PTP traffic

- PTP Packet Statistics (received, lost, errors ….)
- Ethernet Statistics
- Bi-directional PTP traffic capture (pcap file)
- PDV graphs
- PDV Measurements and export via USB (with accurate timestamp)
- Packet MTIE and TDEV Analsysis
- PDV FPP, FPC and FPR metrics per ITU-T G.8261.1 standard

1588v2 monitoring a analýza

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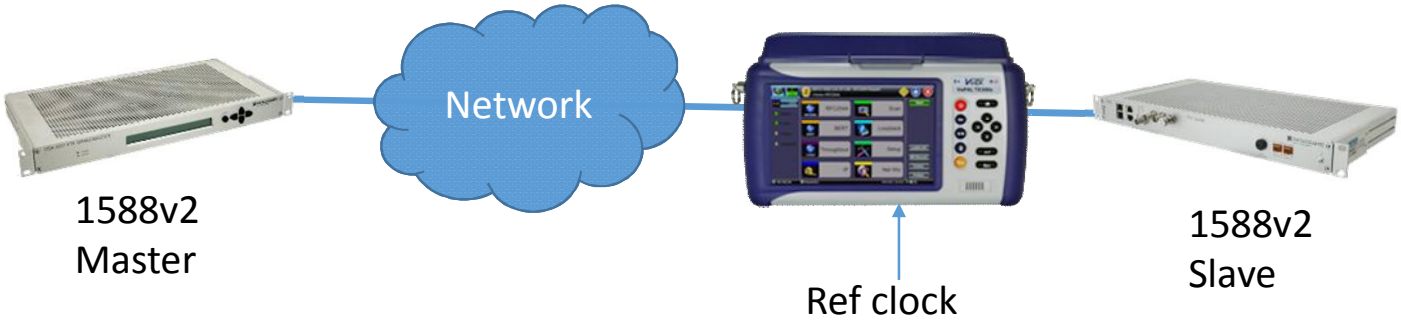
In-line (Pass-Through)



Monitor

Proč je analýza PDV důležitá?

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Packet Network elements between Master and Slave cause non-linear impairments due to congestions, processing delay, queuing mechanisms in network switches and routers. ➔ Network PDV (Packet Delay Variation), packet jitter

PDV is a property of the Network

PDV can lead to Frequency wander and Phase inaccuracy on the Slave because the slave uses the timing packet to recover Frequency and Phase

PDV Metrics:

- Packet MTIE and TDEV
- ITU-T G.8261.1 FPP (Frame Packet Percentage) FPC (Frame Packet Count) FPR (Frame Packet Rate)

Zpoždění paketů a analýza PDV

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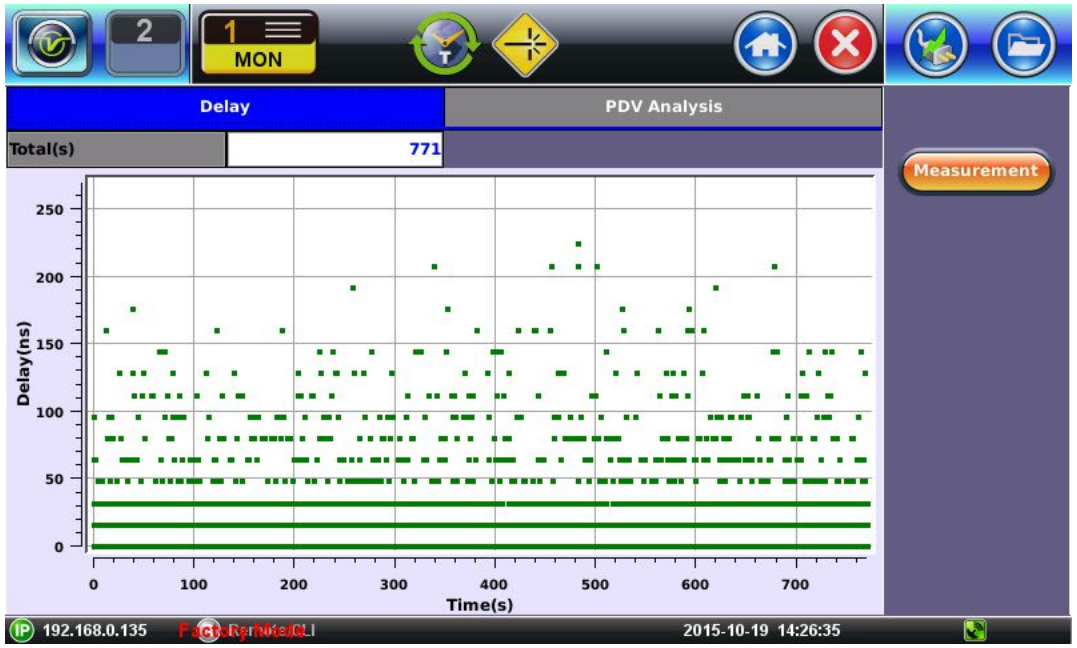

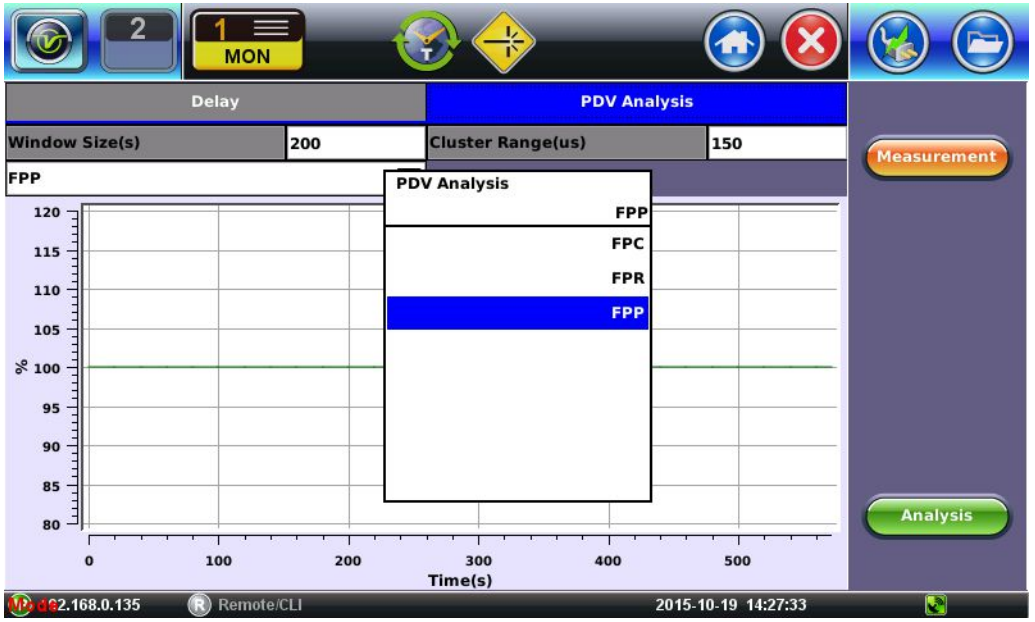

Doporučení ITU-T G.8261.1

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ITU-T G.8261.1 defines the network limits for PDV

- Lucky packets = 1588/PTP Packets that experience minimum network delay (no congestion)
- Lucky packets have low PDV
- Cluster Range Floor window = Range of lucky packets within 150 us of floor delay

Floor Packet Count (FPC)

- Number of 1588/PTP packets that fall in the floor window

Floor Packet Rate (FPR)

- Per second rate of 1588/PTP packets that fall in the floor window

Floor Packet Percentage (FPP)

- Percentage of 1588/PTP packet that fall in the floor window

Per ITU-T G.8261.1 Passing Network Criteria FPP ≥ 1%

- Any Slave must be able to work well with only 1% of the PTP packets being lucky

Referenční zdroje a jejich vlastnosti

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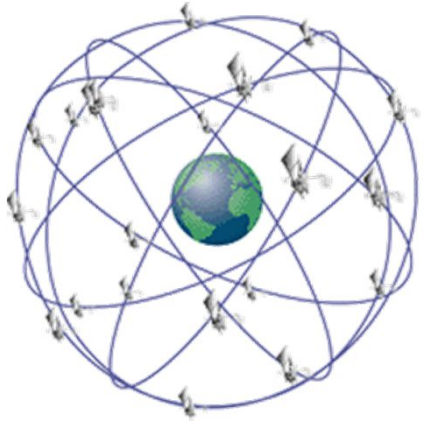
The CSAC uses Cs Gas Cell Coherent technology (not Rb)

- Offers optimum free-running frequency accuracy when operated continuously
- It continues to be the best option currently available for hand-held equipment
- Better accuracy than OCXO (much better than cheap OCXOs)
- Much lower power consumption than OCXO and DOCXO (needed for battery autonomy)



Taking Care of the Precision Atomic Oscillator

- Use the test set long and often to keep the gas cell in its optimum state
- Avoid sudden or extreme temperature changes when the test set is turned OFF
- Store it in stable temperature or use Sleep Mode so it controls its own temperature

Important Precision Oscillator specifications

- Accuracy – How close the free-running frequency is to the ideal (e.g. 0.05 ppb or 5E-11)
- Stability – Amount of variation over certain time windows
- Frequency Retrace – Frequency deviation between uses (after power cycle)

Novinky

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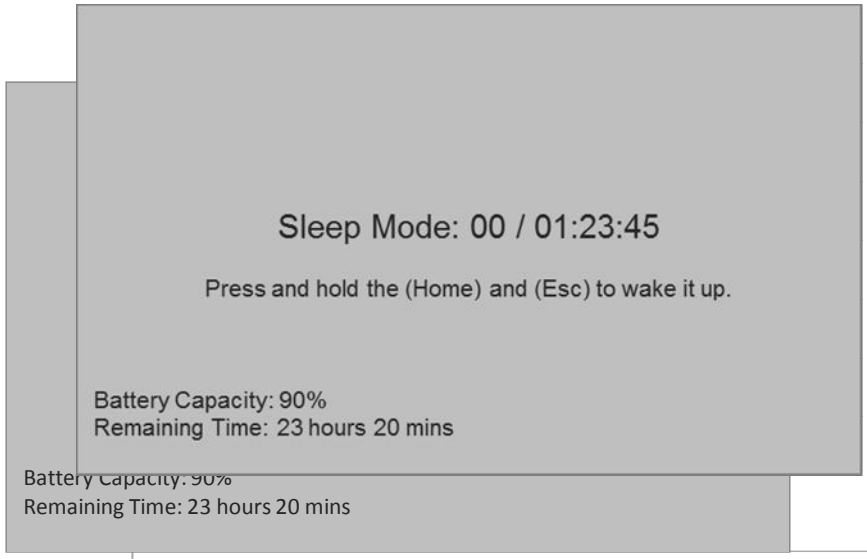
Introduced Sleep Mode with Holdover

- Helps when users need to carry the test set in the bag without risk of overheating
- Helps in keeping the Atomic Clock in optimum performance (calibrated frequency)
- Helps in changing temperature conditions (e.g. storage and transportation)
- Shows total holdover time during sleep
- Saves battery power



Introduced the Atomic Clock Phase Graph

- Helps overcome the lack of other references in the field and brings more visibility
- Helps field users understand the actual disciplining status of their test sets
- Use it to check the quality of the GPS signal
- Determine when to go into holdover