Interoperability & Feasibility Showcase 2015 Participation

Meinberg Radio Clocks GmbH & Co. KG

Lange Wand 9
31812 Bad Pyrmont, Germany

Phone: +49 (0) 52 81 / 93 09 - 0
Fax: +49 (0) 52 81 / 93 09 - 30
Email: info@meinberg.de
Web: www.meinberg.de
www.meinbergglobal.com

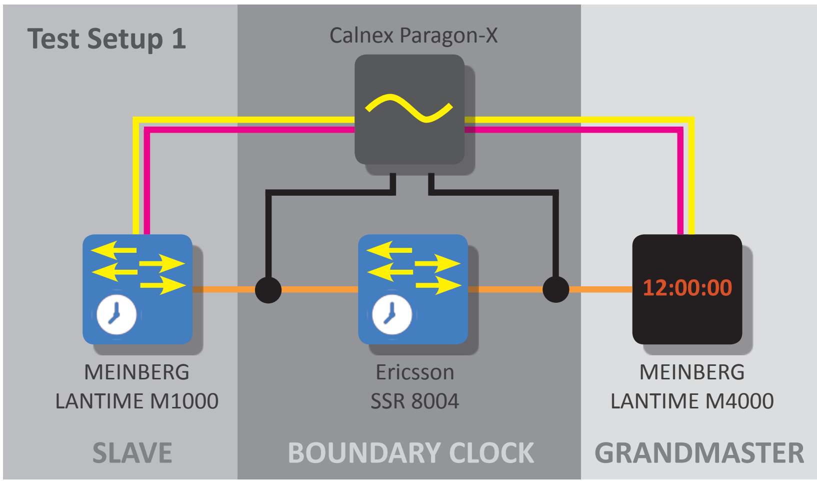


Figure 1: Phase / Time Synchronization with Full Timing Support T-BC noise measurement.

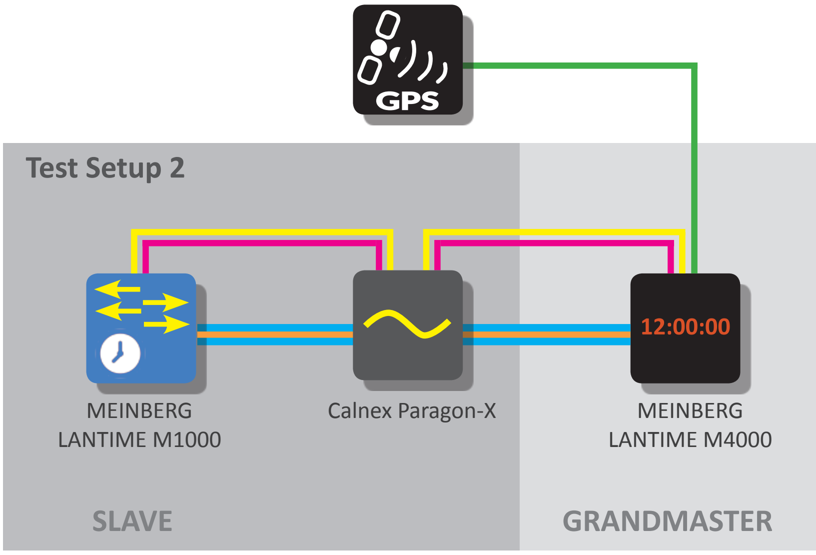


Figure 2: Hold over Performance Setup.

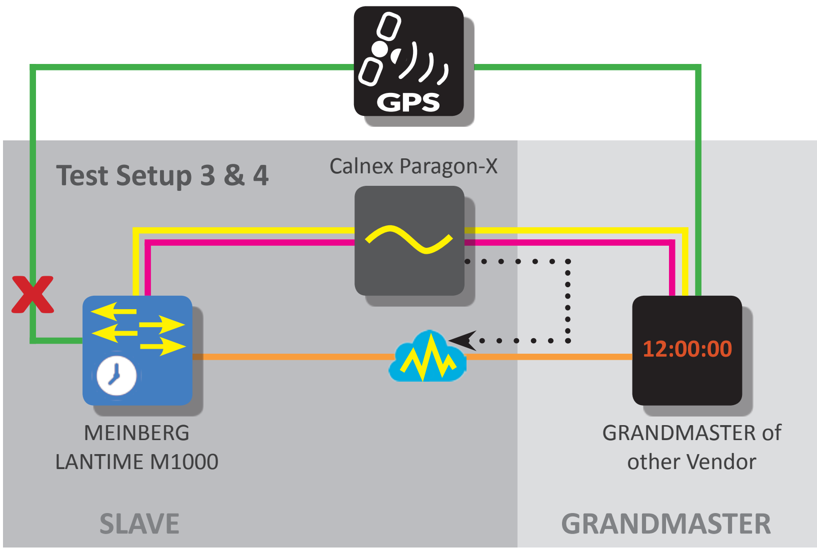


Figure 3: Phase/Time Assisted Partial Timing Support Setup.

Meinberg participated in a handful sets of IEEE1588 / PTP interoperability tests with other vendors with focus on phase/time synchronization including full and partial timing support.

PTP was designed for time and phase synchronization where sub-microsecond or even nanosecond accuracy is required. For such synchronization any asymmetric and unpredictable behavior in the network can degrade desired performance of end application.

In full on-path timing support (ITU G.8275.1) all network nodes in the PTP path help to keep accuracy within designates limits by continuously correcting its own clock with updates coming from the reference clock.

However, not everywhere the full timing support is available; therefore partial timing support profile (ITU G.8275.2) has been proposed as alternative. This is where some of nodes are PTP aware and some are not. During EANTC 2015 testing both full and partial timing support profile have been tested and evaluated for interoperability including numerous vendors with their devices for grandmaster, slave, PTP switches and other necessary equipment to perform the tests.

Test Setup 1:

Phase / Time Synchronization with Full On-Path Timing Support (ITU G.8275.1) – T-BC Noise

In this test Meinberg LANTIME M4000 was acting as grandmaster and LANTIME M1000 as end application / PTP slave. T-BC from different vendors (Albis ACCEED 2014, Ericsson SSR 8004, Ericsson MINI-LINK TN) successfully synchronized with M4000 Grandmaster and M1000 as slave successfully synchronized with T-BCs from all mentioned vendors. The time error of PTP packets was measured at the entrance and at the exit of a T-BC for inbound / outbound constant and dynamic noise, respectively. At the same time, 1PPS from all nodes was measured by Paragon-X by Calnex or Ixia Anue 3500 with a reference coming from the LANTIME M4000 (see Figure 1). The setup with Meinberg installations passed the T-BC requirement of G.8273.2 for constant time error (cTE) and dynamic time error (dTE).

Test Setup 2:

Phase / Time Synchronization with Full On-Path Timing Support (ITU G.8275.1): Hold over Performance

The test started with a slave locked onto the grandmaster. Then PTP packet impairment was introduced in the link to simulate an outage of PTP synchronization. The slave clock changed into phase/time holdover mode, SyncE was used as physical reference to provide assistance during the holdover (see Figure 2). The test was running over night. Meinberg LANTIME M1000 acting as slave successfully passed the short-term and long-term phase transition as specified in ITU-T G.813 mask, phase accuracy requirement of ± 1.1µs and frequency accuracy requirements of G.823 SEC.

Test Setup 3:

Phase / Time Assisted Partial Timing Support (ITU G.8275.2): Delay Asymmetry

First, a packet delay variation (PDV) simulated through 10 nodes without on-path support was introduced in the link between grandmaster and slave both initially locked to GPS. Afterwards, baseline phase and frequency were measured on the slave.

Secondly, GPS antenna was disconnected and an asymmetrical delay of 250µs towards the slave was introduced into the link (see Figure 3). In this test LANTIME M1000 acted as end application, detected the step in the delay asymmetry correctly and successfully passed requirements of ± 1.1µs for phase error and G.823 SEC MTIE mask.

Test Setup 4:

Phase / Time Assisted Partial Timing Support (ITU G.8275.2): Hold over Performance

The test started with both grandmaster (from other vendor) and slave (LANTIME M1000) clock locked to GPS and established PTP connection between them. A packet delay variation (PDV) based on G.8261 to simulate a test case without on-path timing support was introduced into the system. The baseline phase and frequency were measured on the slave clock (see Figure 3).

The test has been restarted with disconnected GPS antenna on the slave system, simulating a GPS outage. After an overnight disconnection the phase and frequency were measured on the slave clock M1000. The setup passed the phase accuracy requirement of ± 1.1µs and frequency accuracy requirements of G.823 SEC.

Test Setup 5:

Phase / Time Synchronization: Master Clock Scalability

The test was designed to verify the maximum amount of slaves a grandmaster can support with no degradation of PTP accuracy for phase. The PTP clients were gradually introduced into the link starting with 2 up to the maximum number where desired PTP performance could still be achieved. The clients were emulated with a rate of 128 packets per second for Sync and Delay Request messages (see Figure 4). Meinberg LANTIME M4000 acting as grandmaster reached the highest scalability with 2048 clients compared with the scores of grandmasters coming from other vendors.

Meinberg M4000 Grandmaster currently holds a World Record of 2048 clients it can support!

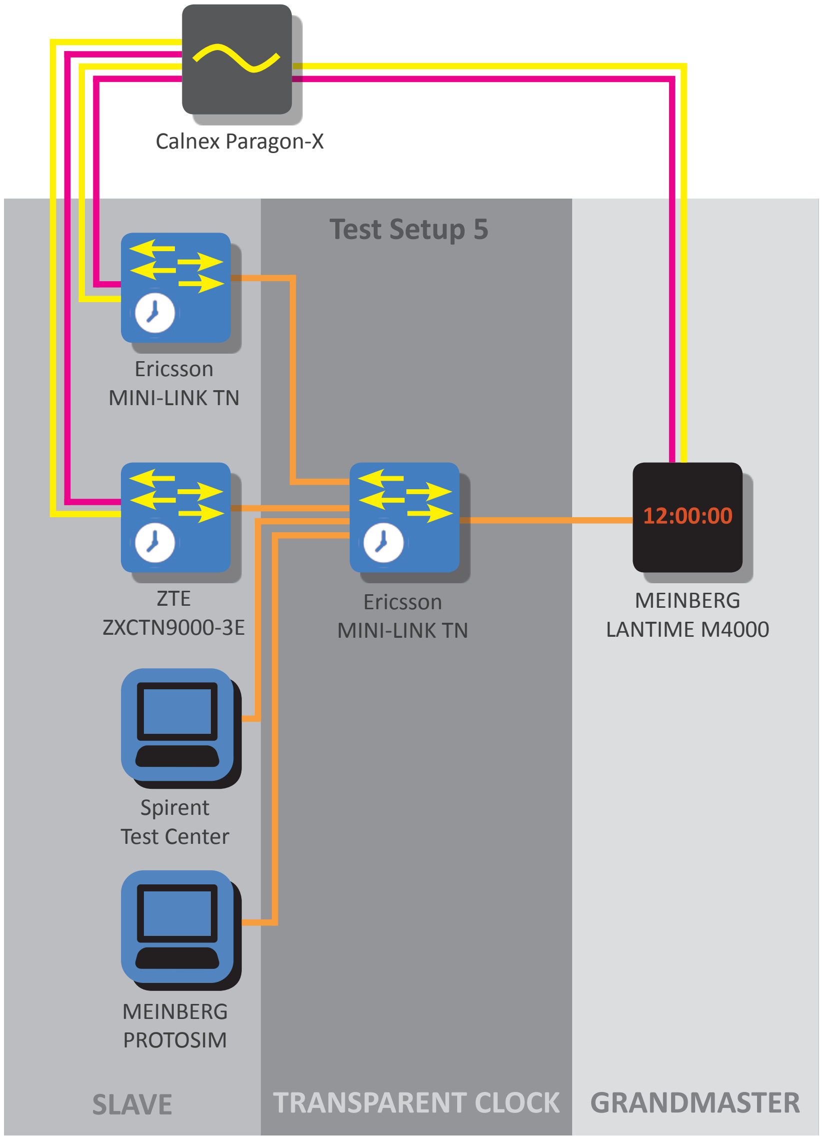
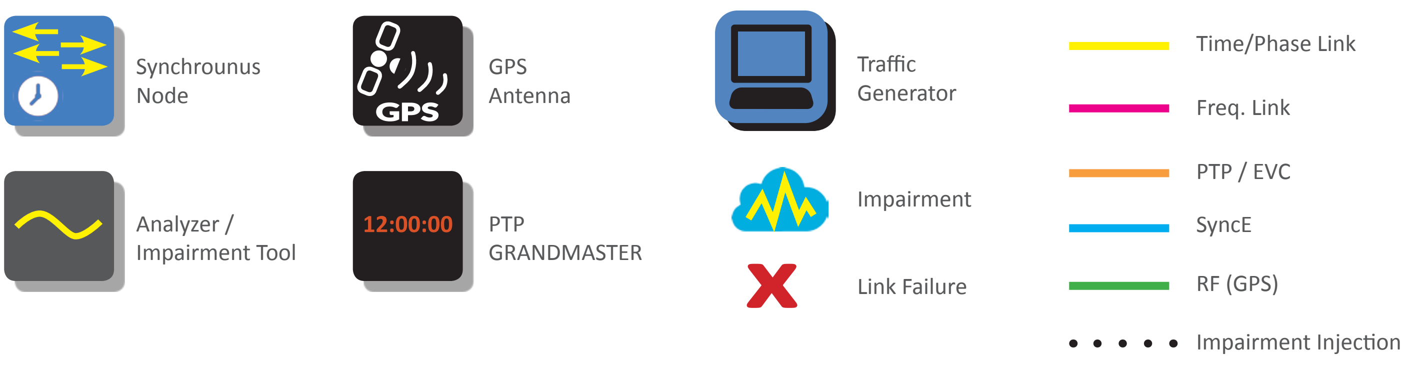


Figure 4: Phase / Time Synchronization: Master Clock Scalability.



*Reference: Interoperability & Feasibility Showcase 2015, White Paper

EANTC Interoperability & Feasibility Showcase 2015 Participation

Two telecom specific Meinberg products have been successfully tested during this year's EANTC Interoperability Test Event and participated in the multi-vendor Interoperability Showcase organized by the European Advanced Networking Test Center (EANTC) at the MPLS SDN World Congress, V6 World Congress and NFV & SDN Summit 2015 in Paris, France.

The EANTC is an international leading and objective test center. It provides vendor-neutral network test facilities for manufacturers, service providers and enterprise customers.

Meinberg's telecom specific network synchronization solutions, the LANTIME M1000 and LANTIME M4000, have been successfully interoperated at the EANTC Event.

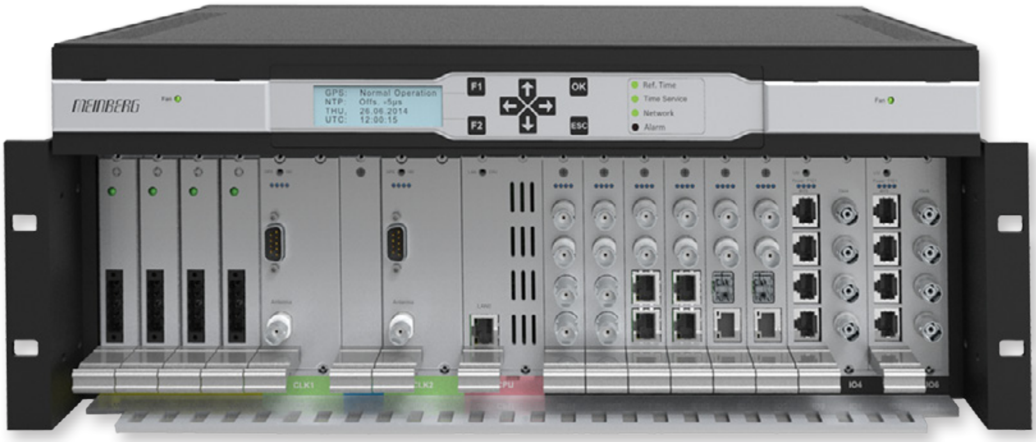
They successfully interoperated in all test cases they took part in and were utilized in many test cases in a supporting role.

The modularity and scalability of both products allow their use for different roles, such as PRC/PRTC or Edge Grandmaster.

The M4000 is the ideal synchronization solution for telecommunication networks, all connectors and control elements of the M4000 are accessible from one side. The 4RU chassis can either be mounted in a 300mm ETSI rack or in a standard 19 inch IT rack.

LANTIME IMS M4000

- *Redundant Power Supplies*
- *Redundant Receivers*
- *IEEE-1588 Time Stamp Unit*
- *Standard Input References PPS, 10MHz, Time Code*
- *Telecom Input References and*
- *Telecom Output Signals (E1/T1)*
- *Optimized for ETSI Rackmount*



LANTIME IMS M1000

- *Redundant Power Supplies*
- *IEEE-1588 Time Stamp Unit*
- *Telecom Input References and*
- *Telecom Output Signals (E1/T1)*

M4000 Chassis - based on a 4U Enclosure

Due to the fact that all connectors and control elements of the M4000 are placed on one side and its chassis can either be built into a 300mm ETSI rack or into a 19inch rack, the M4000 is the ideal synchronization solution for telecommunication networks.

The form factor and the mounting brackets are compatible to ETSI rack (standard ETS 300 119-2). The upper 1U section of the case provides free space for optional fan boards.

The M4000 can act as a Telecom Grandmaster for thousands of clients. For NTP-based synchronization, each of the TSU module network interfaces of the LANTIME M4000 can be configured to act as a carrier grade NTP server with 10 ns time stamp accuracy, serving up to 12000 NTP requests per second on each port.

M1000 - Modular Synchronization in 1U Housing

The M1000 configuration supports up to four I/O modules of your choice, which are interoperable with M4000 or any other device from the Meinberg IMS product line.

Key Features

- GNSS (GPS and/or GLONASS) synchronized PRTC (compliant to ITU-T G.8272)
- IEEE 1588 Grandmaster (multi-profile, incl. ITU-T G.8275.1 and G.8265.1)
- Synchronous Ethernet In/Out
- GBit PTP Interfaces (SFP/RJ45)
- Carrier Grade NTP Time server with HW time stamping
- E1/T1 BITS and Clock In/Out (ITU-T G.703)
- 1PPS In/Out, 10 MHz In/Out
- PTP and NTP Input
- IEEE 802.1Q VLAN Tagging
- DSCP and IEEE 802.3p QoS
- Web GUI, CLI, SNMP, RADIUS, TACACS+
- Redundant DC and AC power supplies