OSCILLOQUARTZ
An ADVA Optical Networking Company

PTP Proof of Concept – At Customer Site

Engineering Note

Precision, Stability, Innovation, Support

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1. **Purpose**

The goal of this Proof of Concept (POC) is to be able to show that OSA 5548C *E60 and *E200 equipped with a TCC-PTP GrandMaster (GM) card is able to synchronize a NodeB or EnobeB Slave over a specific customer network in compliance to the ITU-T G8265.1 norm. This POC concerns frequency synchronization (ITU-T G8265.1), not for phase synchronization (ITU-T G8275.1).

1.1 Timescale (ARB or PTP)

The TCC-PTP card by default takes its time reference from any GPS or GLONASS present in the shelf. In this case the PTP timestamps represent the number of seconds and nanoseconds since the PTP epoch (01.01.1970).

Together with the PTP-UTC offset, this data can be used by the slave to generate a TOD according to UTC. In this case, the TCC-PTP uses the PTP timescale.

IEEE1588v2, however, defines two timescales or epoch: PTP and ARB. The first can be used when the clocks share the same origin at 01.01.1970, the second when each system may use a different time origin. When ARB mode is used, that means the OSA 5548C is synchronized by any 2048 kHz signal or 2048 kbits/s signal source.

1.2 Exchange Rate

The rate at which PTP Grandmasters and Slaves exchange PTP packets is configurable. For frequency synchronization most base station manufacturers recommend a rate of 16 exchanges per second. The TCC-PTP is able to provide an exchange rate up to 128 packets/s.

1.3 Unicast Mode

Based on the ITU-T telecom profile (G8265.1), the communication is established between GM and slave in unicast mode, 1 or 2 steps, in OWTT or TWTT, finally a domain number has to be defined too.

The exchange rate for SYNC, DELAY_REQ and ANNOUCE message in this mode are defined by the slave. A grant duration has to be defined by the slave too, the default value is 300 seconds, its range is from 60 to 1000 seconds. The choice of the GM is done by the "ClockClass" quality, a cancel unicast request won't be taken in account.

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1.4   Note

It's strictly recommended by Oscilloquartz to follow a training session on OSA PTP products, and on PTP Principle measurements, which enhances a solid understanding for customers to autonomously continue investigations and analysis of their network, till the whole deployment has been achieved and validated.

*E60   ➔ up to 6 TCC-PTP cards capacity

*E200 ➔ up to 20 TCC-PTP cards capacity

1.5   Interoperability Test (1 Day)

1.5.1 Description

A Customer Field Engineer (CFE) is dispatched on-site to customer.

The CFE, with input from the customer about his Network, installs and runs interop testing of an Oscilloquartz GrandMaster in a test/trial network setup connected to the 3rd party slave.

1.5.2 Schematic Principle

![OSCILLOQUARTZ — An ADVA Optical Networking Company]
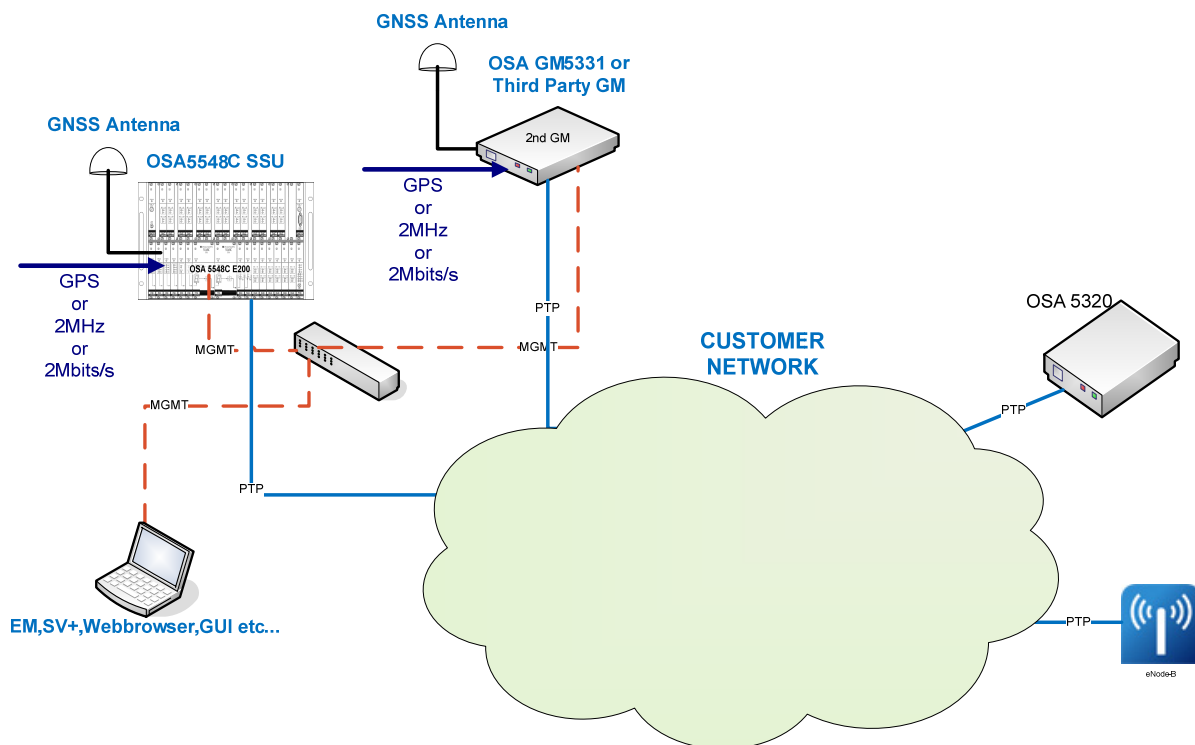
1.5.3 Material List

1x OS A5548C E60 or E200 with at least one TCC-PTP Card

1x OSA GrandMaster 5331 or Third Party Grandmaster for Redundancy

1x OSA 5320 PTP Slave

1x Third Party EnodeB

1x Laptop

2x Optical SFP Single and Multi-mode

1x TAP (Provided by Customer)

1x Calnex Paragon M if customer cannot provides the TAP

Some RJ-45 and Fibers (Provided by Customer)

1.5.4 Software requirements

EM or SV+ version 1.60 or above for OSA 5548C

Third party software for EnodeB

Webserver for OSA5320 slave

Wireshark see www.wireshark.org

1.5.5 Various

The Customer has to provide:

1x48VDC Power Supply

Some 220V Power supply

3xPTP IPs

3xDCN IPs

1.5.6 Deliverable

A report is provided with:

- Method of measurements
- Equipment used
- Measurement results
- Recommendations if necessary
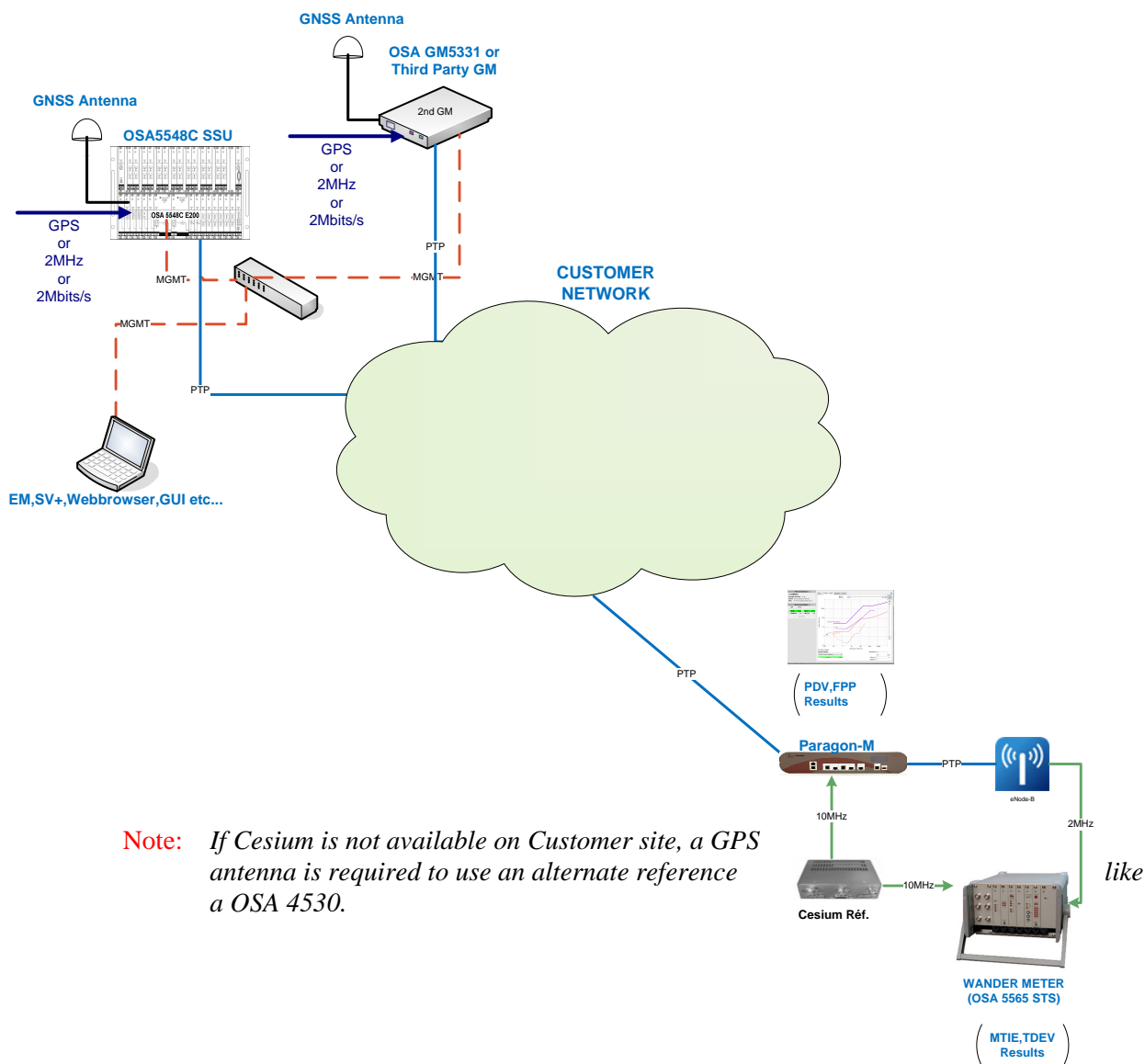- ➔ 1 working day is required to establish the report

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1.6 ITU-T G8261.1 Performance (2 Days)

1.6.1 Description

Following the Interop Test, the CFE performs measurements of the PTP quality and performance at the slave side. Customer will ensure traffic is carried between GrandMaster and Slave as close as the reality.

A 24h test time is required to establish a meaningful performance analysis, as the packets traffic is not constant within the whole cycle.

1.6.2 Schematic Principle

Note: *If Cesium is not available on Customer site, a GPS antenna is required to use an alternate reference* like *a OSA 4530.*
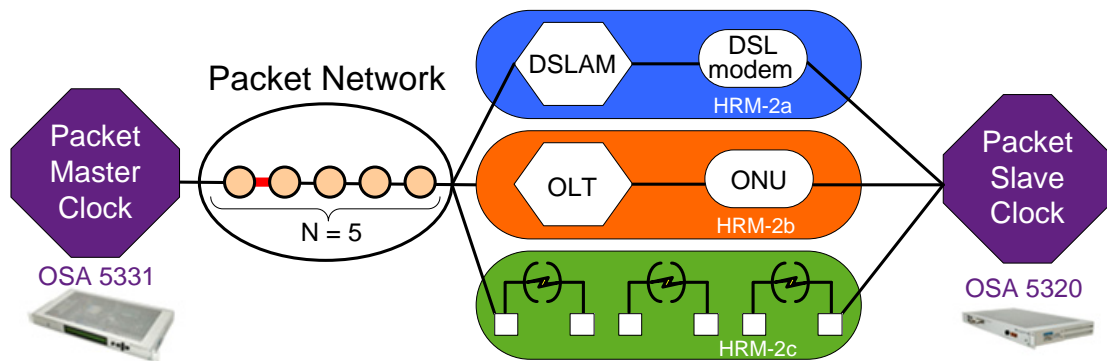
1.6.3 Reference Models

The synchronization architecture proposed herein is based on the so-called Hypothetical Reference Models of ITU-T Rec. G.8261.1. HRM-1 is shown in the figure below:
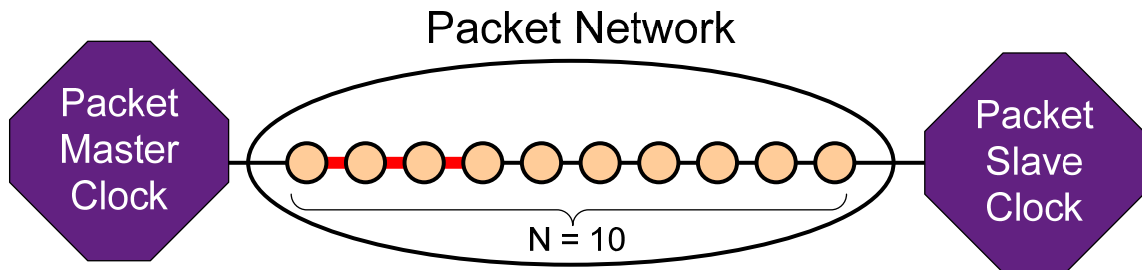
Or through the HRM-2 which is reproduced in the figure below:

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Performances Aspects

For 2G and 3G base stations (BTS, Node B), the synchronization quality at the output of the PTP Slave contained in the base station should be as follows (see ITU-T Rec. G.8261.1):
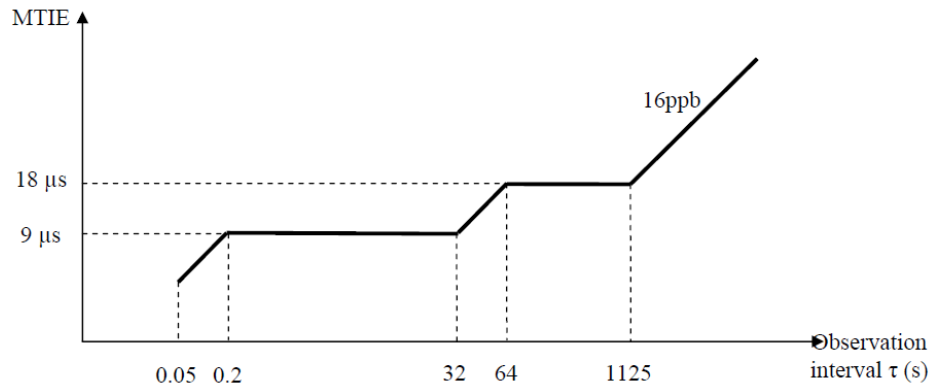
Synchronization performance depends on several factors:

1) Network topology (does the topology comply with the HRMs?)

2) Level of Packet Delay Variation generated by the packet nodes (this depends on the internal design of the packet node and changes from model to model)

3) Traffic load can degrade the performance.

4) PTP slave's capability of mitigating the degradations caused by the network (in particular Packet Delay Variation)

The factors 2), 3) and 4) are not under the control of Oscilloquartz. Although this proposal is based on the extensive experience of Oscilloquartz in this field, Oscilloquartz cannot take responsibility for performance issues related to a lack of control of the factors 2), 3) and 4). In order to achieve targeted performance, Oscilloquartz therefore recommends doing performance measurements during field trials. One Calnex device, should measure Packet Delay Variation on the PTP packet flow at the input of the PTP Slave (interface between network and PTP Slave). Simultaneously the output signal of the PTP Slave should be measured and the performance compared against the MTIE mask shown in the figure above. Note that the output of the PTP Slave is not always accessible. The Packet Delay Variation at the input of the PTP slave should comply with the FPP network limit of G.8261.1 (FPP = Floor Packet Percent):

$$FPP\ (W, \delta) \leq 1\%$$

With:

$$W = 200\ s$$

$$\delta = 150\ \mu$$

If this network limit is met, then a good PTP Slave is being able to meet the MTIE mask shown above at its output.

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1.6.4 Material List

1x OSA STS 5565 SyncTester

1x Calnex Paragon-M (PDV tester)

1x OSA 5548C E60 or E200

1x OSA 5331 GrandMaster or Third Party Grandmaster for Redundancy

1x OSA 5320 Slave

1x OSA Cesium or External reference (OSA4530)

4x Optical SFP Single and Multi-mode

Some RJ-45 and Fibers (Provided by Customer)

1.6.5 Software requirements

EM or SV+ version 1.60 or above for OSA 5548C

Third party software for EnodeB

Webserver for OSA5320 slave

Calnex Software

WinSTS version 3.1 or above

Wireshark see www.wireshark.org

1.6.6 Various

The Customer has to provide:

1x48VDC Power Supply

Some 220V Power supply

3xPTP IPs

3xDCN IPs

1.6.7 Deliverable

A report is provided with:

- Method of measurements

- Equipment used

- Measurement results

- Recommendations if necessary

➔ 2 working days are required to establish the report

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2. **Appendix**

2.1.1 Terms and Abbreviations

POC: Proof of concept

PTP: Precision Time Protocol

ARB: Arbitrary

TCC-PTP: Time Code Card-Precision Time Protocol

EnodeB: Evolve Node B (use in access network for LTE)

BTS: Base Transceiver Station

EM: Element Manager

SV+:   SyncView Plus

GM: GrandMaster

PPS: Pulse Per Second

DCN: Data Communication Network

TAP: Test Access Port

OWTT: One Way Time Transfer

TWTT: Two way Time Transfer

2.1.2 References

ITU-T Rec. G8265.1

ITU-T Rec. G8261.1

OSA 5548C User Guide

OSA 5320 User Guide

OSA 5565 STS User Guide

Calnex Paragon–M User Guide

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3.   Oscilloquartz Contact Information

3.1.1 Technical Assistance

For technical assistance, contact the following:

International

Oscilloquartz SA

Customer Support & Services
16, Rue de Brévards
2002 Neuchâtel 2
SWITZERLAND

Tel: +41-32-722-5555
Fax: +41-32-722-5578

E-mail: css@oscilloquartz.com

3.1.2 Sales

For sales assistance, contact the following:

International

Oscilloquartz SA

Sales & Marketing
16, Rue de Brévards
2002 Neuchâtel 2
SWITZERLAND

Tel: +41-32-722-5555
Fax: +41-32-722-5556

E-mail: osa@oscilloquartz.com

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