ISO 9001:2008

GENERIC REQUIREMENT

Precision Time Protocol (PTP) GM Clock

No. TEC/GR/IT/PTP-002/02/JUN-20

Release 2

TELECOMMUNICATION ENGINEERING CENTRE
KHURSHID LAL BHAVAN, JANPATH, NEW DELHI-110 001, INDIA

वर्गीय आवश्यकताएँ

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No. TEC/GR/IT/PTP-002/02/JUN-20

(Supersedes No. TEC/GR/TX/PTP-002/01/MAR 2012)

Precision Time Protocol (PTP) GM Clock

पीटीपी जीएम क्लॉक

दूरसंचार अभियांत्रिकी केंद्र

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FOREWORD

Telecommunication Engineering Centre(TEC) functions under Department of Telecommunications (DOT), Government of India. Its activities include:

- Issue of Generic Requirements (GR), Interface Requirements (IR), Service Requirements (SR), Essential Requirements (ER) and Standards for Telecom Products and Services
- Field evaluation of products and Systems
- National Fundamental Plans
- Support to DOT on technology issues
- Testing & Certification of Telecom products

For the purpose of testing, four Regional Telecom Engineering Centers (RTECs) have been established which are located at New Delhi, Bangalore, Mumbai, and Kolkata.

ABSTRACT

This GR pertains to the Generic Requirements for a Precision Time Protocol (PTP) Grand Master(GM) Clock, a Standalone Synchronization Equipment, used as clock source in Packet Switched network.

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2.	GR No. TEC/GR /IT/PTP- 002/02/ JUN-20	Generic Requirements for Precision Time Protocol (PTP) Grand Master Clock	2nd issue

REFERENCES

Sl. No.	Document No.	Title/Document Name
1.	ITU-T Rec. G.8260	Definitions and terminology for synchronization in packet networks
2.	ITU-T Rec. G.8261	Timing and synchronization aspects in packet Networks.
3.	ITU-T Rec. G.8271	Time and phase synchronization aspects of packet networks
4.	ITU-T Rec. G.8265.1	Precision time protocol telecom profile for frequency synchronization
5.	ITU-T Rec. G.8275.1	Precision time protocol telecom profile for phase/time synchronization with full timing support from the network
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7.	ITU-T Rec G.8272	Timing characteristics of primary reference time Clocks
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9.	ITU-T Rec G.8272.1	Timing characteristics of enhanced primary reference time clocks
10.	ITU-T Rec G.811.1	Timing characteristics of enhanced primary reference clocks
11.	ITU-T Rec. G.812	Timing requirements of slave clocks suitable for use as node clocks in synchronization networks

12.	IEEE-1588-2008 v2	Time distribution via Precision Time Protocol – 2008.
13.	CISPR 22 {2008}	Limits and methods of measurement of radio disturbance characteristics of Information Technology Equipment
14.	IEC 61000-4-2	Testing and measurement techniques of Electrostatic discharge immunity test
15.	IEC 61000-4-3	Radiated RF electromagnetic field immunity test
16.	IEC 61000-4-4	Testing and measurement techniques of electrical fast transients/burst immunity test
17.	IEC 61000-4-5(2014)	Testing & Measurement techniques for surge immunity test.
18.	IEC 61000-4-6	Immunity to conducted disturbances
19.	IEC 61000-4-11	Testing & measurement technique- voltage dips, short interruptions and voltage variations immunity tests.
20.	IEC 61000-4-29	Testing and measurement techniques- Voltage dips, short interruptions and voltage variations on D.C input power port immunity test.
21.	IS 13252 (2010)/ IEC 60950-1(2005)	Safety of information technology equipment.
22.	IS 10437(1986) / IEC 60215	Safety requirements for radio transmitting equipment's.
23.	QM-333	Specification for environmental testing of electronic equipment for transmission and switching use

24.	TEC/SD/DD/EMC-221/05/OCT-16	Electromagnetic Compatibility Standard for Telecommunication Equipment
25.	ITU T G.703	Physical/electrical characteristics of hierarchical digital interfaces(Ethernet interfaces)

CHAPTER 1

1. Introduction

1.1 This document gives the generic requirements for a Precision Time Protocol (PTP) Grand Master Clock, a Standalone Synchronization Equipment, used as a clock source in Packet Switched network. The function of PTP is to distribute synchronization over packet switched networks. Telecommunications networks are evolving from TDM networks based on circuit switched technology to so called Next Generation Networks (NGN) based on packet switching. Due to this move in telecommunications network from Time Division Multiplexing (TDM) to Packet Switched networks, the PTP assumes a very important role to play in synchronizing the networks. In TDM networks the transfer of synchronization was a natural function of the physical layer of traffic signal. Despite the asynchronous nature of packet switching, synchronization is still very much needed in converged Next Generation Networks. It turns out that many access network technologies require some form of synchronization. This is the case for all cellular mobile networks. They require their base stations to be synchronized for frequency and phase. There are other cases like some of the PON technologies used in Fiber-To-The-Home applications. Some of these technologies require synchronization of their equipment clocks in frequency, some in phase, some even require some form of time- of-day. The applications and use cases of synchronization needs have been explained in Appendix-IV, ITU-T Recommendation G.8261. With the introduction of packet switched networks, new protocol based synchronization techniques were introduced essentially because of asynchronous nature of packet switching. Apart from telecom profile, the synchronization equipment may support different profiles such as power, broadcast, enterprises/default etc.

1.2 PTP GM (PRTC or e-PRTC based) clock synchronizes time, phase and frequency of the other clocks within a network (core/edge/access network) or section of a network.

1.3 PTP GM can be classified based on timing accuracy in locked operating condition, frequency stability in holdover conditions, No. PTP client support

and redundancy of clock & power supply. Based on timing accuracy, PTP GM can be classified into PRTC (defined in ITU-T G.8272) and enhanced PRTC (define in ITU-T G.8272.1) based PTP GM. e-PRTC based PTP GM provides timing accuracy of 30ns as compared to 100ns by PRTC based PTP GM under normal, locked operating conditions. PRTC based PTP GM can be further classified as Core & Edge PTP(PRTC) GM based on factors such as No. PTP clients support, frequency stability in holdover condition, redundant clock & power support.

1.4 The architectural implementation of the frequency and phase synchronization of the telecom network is shown in figure1 below:

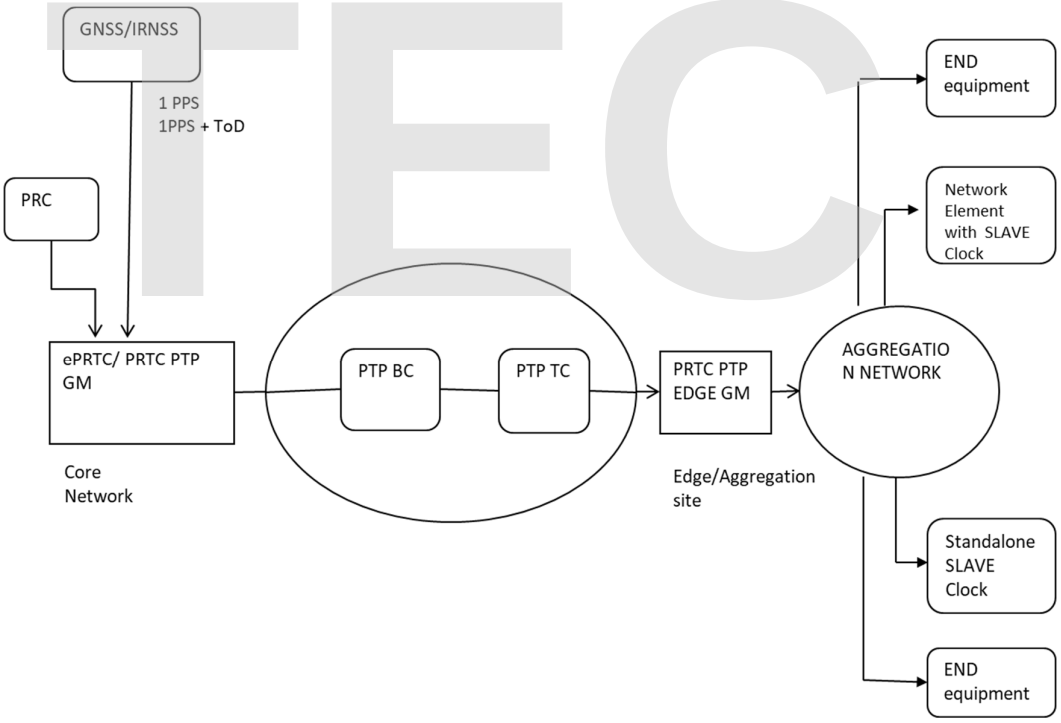

Figure 1: frequency and phase/time synchronization in telecom network

PRC: Primary Reference Clock;

PRTC PTP GM: Primary Reference Timing Clock(PRTC) Precision Time Protocol(PTP) Grand Master;

PTP BC: PTP Boundary Clock;

PTP TC: PTP Transparent Clock

2. Functional Requirement

2.1 The PTP Grand Master clock shall find its applications in synchronizing packet switched networks. Specific applications of PTP are in the wireless and cellular mobile networks where the network elements are connected to the other packet switched networks.

2.2 Considering the growing need for accurate synchronization delivery in next generation networks, the PTP grandmaster classification can be as follows:

a) Type 1: PRTC Clock (defined in G.8272)
b) Type 2: ePRTC Clock (defined in G.8272.1)

2.3 Unlike traditional synchronization technologies which distribute just a common frequency, PRTC PTP GM shall be capable of distributing common frequency and common phase-alignment to remote PTP slave over a packet network. It shall also be possible to extend the functionality of the PRTC PTP GM to deliver the following outputs/capabilities wherever required:

i. PTP
ii. SyncE protocol support
iii. Network Timing Protocol (NTP) support
iv. TDM synchronization and timing ports (E1 or/and 2MHz, 10 MHz)
v. 1PPS (Pulse per Second)
vi. 1PPS + ToD (delivery of time to set clocks)

2.4 The PTP GM (PRTC) clock can be further divided into two categories –

a) Category-1: Core PTP Grand Master
b) Category-2: Edge PTP Grand Master

2.5 The requirement for ePRTC PTP Clock (Type 2 as referred in this document) is more stringent than the PRTC Clock requirements. The PTP GM (ePRTC Clock) shall have the capabilities as per the clause 2.3

2.6 The two end systems shall be PTP Grandmaster clock and PTP Slave clock in the basic architecture in Packet synchronization network. The protocol stacks are available inside the end systems and the network elements.

2.7 The PTP telecom profiles are defined and published mainly by the ITU-T and the IETF. The first of a series of upcoming profiles is contained in ITU-T Recommendation G.8265.1: “Precision time protocol telecom profile for frequency synchronization”. This profile is targeted towards frequency synchronization. This is required for operation of systems which require frequency synchronization like GSM base stations, UMTS Node Bs, WiMax-FDD, LTE-FDD base stations, etc.

2.8 The Phase requirements described under ITU-T G.8275.1 & G.8275.2 profiles is to achieve higher level of timing accuracy. This is required for operation of systems which require frequency and phase synchronization like WiMax-TDD, LTE-TDD, LTE Advanced Services and 5G Networks etc.

2.9 The PTP Grandmaster clock shall be able to interoperate with PTP slave clock – stand alone as well as slave clock embedded in the NE irrespective of the make of the slave clock as long as the stand alone as well as the embedded slave clock is as per IEEE 1588- 2008 and applicable PTP profile as defined by ITU-T.

2.10 The PTP GM shall support a fully managed Synchronization architecture providing full FCAPS for all the levels of manageability viz. Configuration, Performance, Fault/Alarm and Security managements, through a centralized location.

2.11 The management of the PTP Grandmaster shall be managed through SNMPv2c/v3 (or above) or HTTPS or TL1 or CLI.

2.12 The software of the system shall reside in the work station/network server. Hitless local & remote software download facility shall be provided in the equipment.

2.13 **Redundancy**

2.14 Power supply redundancy – The power supply of the PTP-GM equipment shall be dual feed to provide power redundancy.

2.15 **Clock Module Redundancy**: This type of redundancy shall comprise of Rubidium Atomic Clock Oscillator module (Main) and Oven Controlled Crystal Oscillator(OCXO) module (Backup). It shall be applicable to Type 1: Core PRTC Clock and Type 2 ePRTC Clock.

2.16 **Link or geographical redundancy** – This type of redundancy is required to support Best Master Clock(BMC) algorithm when GM is installed at two or more locations, in the event of the failure of one link, the slave shall receive the timing messages through the other link ensuring full availability.

3. Technical Requirement

3.1 Equipment Categories

The functional requirement of PTP Grandmaster is to generate and distribute precisely synchronized IEEE 1588-2008 time across IP-based networks. The support of the no. of PTP slave clocks shall be independent of the client rates such as 16, 32,64 and 128 packets/ second. Broadly, there shall be two Types of PTP Grandmasters based on the functionalities it shall support

I. Type 1: PRTC Clock (defined in G.8272)

a) Category -1 PTP Grandmaster(Core): This category of PTP GM clock shall provide

i. Built in GNSS/IRNSS receiver with external antenna and accessories.

ii. Locked Mode accuracy compliant to G.8272 (PRTC) and G.811 (PRC)

iii. Holdover compliant to G.812 Type II or Stratum 2,

iv. Minimum 4 x GbE PTP/ SyncE/NTP ports that shall be used simultaneously (Electrical RJ45 and/or Optical SFP)

v. Min support of 1000 PTP Slaves at any rate up to 128 pkts/sec.

vi. 4 x2MHz orE1 output port

vii. 1x 2MHz/E1 Input port

viii. 1x 1PPS Interface OUT

ix. 1x 1PPS + ToD IN

x. 1x 1PPS + ToD OUT

xi. 1x 10 MHz IN

xii. 1x 10 MHz OUT

xiii. 10 G (Optional to purchaser)

xiv. Separate management interface port

b) Category -2 PTP Grandmaster(Edge): This type of PTP GM shall provide –

i. Built in multi constellation GNSS/IRNSS receiver with external antenna and accessories. (IRNSS-NavIC receiver is preferable whenever available)

ii. Locked Mode accuracy compliant to G.8272 (PRTC) and G.811 (PRC)Holdover compliant to G.812 Type I, IV, V and VI or Stratum 3/3E

iii. Minimum 2x GbE PTP/SyncE/NTP port (Electrical RJ45 and/or Optical SFP)

iv. Min support of 250 PTP Slaves at any rate up to 128 pkts/sec.

v. 1 x2MHz/E1 output port

vi. 1 x2MHz/E1 input port

vii. 1x 1PPS Interface OUT

viii. 1x 1PPS + ToD IN

ix. 1x 1PPS + ToD OUT

II. Type 2: ePRTC Clock for Core Network (defined in G.8272.1). This category of PTP GM clock shall provide:

a) Built in multi constellation GNSS/IRNSS receiver with external antenna and accessories.

b) Locked Mode accuracy compliant to G.8272.1 (ePRTC) and G.811.1 (ePRC)

c) Holdover compliant to G.8272.1 clause 8.2.

d) Minimum 4 x GbE PTP/SyncE port (Electrical RJ45 and/or Optical SFP)

e) Min support of 750 PTP Slaves at any rate up to 128 pkts/sec.

f) 4 x2MHz/E1 output port

g) 1x 2MHz/E1 Input port

h) 1x 1PPS Interface OUT

i) 1x 1PPS + ToD IN

j) 1x 1PPS + ToD OUT

k) 10 MHz IN

l) 10 MHz OUT

Note-1 The synchronization ports in each category shall be indicated by the user during procurement of the equipment.

3.2 **PTP Grandmaster (PRTC) Clock: (Type 1)**

3.2.1 The PTP GM(PRTC) shall consist of GNSS/IRNSS receiver.

3.2.2 Apart from GNSS/IRNSS, PTP GM shall also synchronize using frequency inputs of 2MHz/E1/10MHz/1PPS.

3.2.3 A PTP GM shall have an absolute timing accuracy better than +/-100 nanoseconds compliant to G.8272 when locked to GNSS/IRNSS.

3.2.4 It shall provide highly stable internal oscillator to maintain accurate synchronization in holdover condition. The frequency stability in holdover condition shall be as per the table below:

a) Category -1 PRTC based PTP Grandmaster(Core), it generally deployed in controlled environmental conditions where precise clock stability is required:

Clock hold-over stability	2.5×10^{-11} /day or better
Output frequency accuracy	1.6×10^{-8} over the entire temperature range
Pull-in/Hold-in range	1.6×10^{-8} or better
Warm-up time for internal Oscillator	< or = 1 hour

Table 1: Clock holdover and frequency stability

b) Category -2 PRTC based PTP Grandmaster(edge)

Clock hold-over stability	1×10^{-10} /day or better
Output frequency accuracy	1.6×10^{-8} over the entire temperature range
Pull-in/Hold-in range	1.6×10^{-8} or better
Warm-up time for internal Oscillator	< or = 1 hour

Table 2: Clock hold over and frequency stability

3.2.5 The main configuration and monitoring shall be accessible via the dedicated network port providing Web access/CLI /SNMP v2c/v3 or TL1 etc.

3.2.6 The PTP GM(PRTC) shall have the following reference inputs:

i. GNSS/IRNSS

ii. E1/2.048 MHz, G.703 – Connector: 75 Ω BNC or 120 Ohms RJ-48

iii. PTP /SyncE /NTP Connector 100/1000 Mbps Electrical and 1 G Optical

iv. 10MHz Input using BNC connector.

v. Standard one pulse per second (1PPS) timing pulse, the positive pulse is rising edge on time, amplitude > 2.4 V into 50 ohms (TTL compatible), pulse width (20+-1) micro second; rise time: <10ns, BNC female connector.

Note :-The GNSS/IRNSS Antenna shall also include along with it the antenna lightning protection kit and cable as per the requirement on a case to case basis.

3.2.7 The PTP Grandmaster shall provide the following outputs:

i. E1/2 MHz, G.703 provided using Connector: 75 Ω BNC for unbalanced output or 120 Ohms for balanced output using RJ48.

ii. PTP/SyncE/NTP Connector using 100/1000 Mbps Electrical and Optical

iii. 1PPS + ToD Connector using RJ45/RS422

iv. 1 PPS Connector SMA or SMB or BNC

v. 10MHz Output using BNC connector.

vi. Standard one pulse per second (1PPS) timing pulse, the positive pulse is rising edge on time, amplitude > 2.4 V into 50 ohms (TTL compatible), pulse width (20+-1) micro second; rise time: <10ns, BNC female connector.

3.2.8 The PTP GM shall be able to work on dual feed DC Power Supply ranging from 40V to 60V DC.

3.2.9 The PTP GM shall provide local and remote management port. The management platform shall be either SNMP v2c/v3 or HTTPS or TL1 or CLI or Telnet or NMS.

3.2.10 Both Category Grand Master's shall support for G.8265.1, G.8275.1, G.8275.2 and default profile IEEE 1588-2008 v2.

3.2.11 Both Category Grand Master's shall be configurable as OC (ordinary clock), TC (transparent clock) and BC (boundary clock)

3.3 PTP Grandmaster(ePRTC) Clock: (Type 2)

3.3.1 The PTP GM shall consist of GNSS/IRNSS receiver.

3.3.2 Apart from GNSS/IRNSS, PTP GM shall also synchronize using frequency inputs of 2MHz/E1/10MHz/1PPS.

3.3.3 A PTP GM shall have an absolute timing accuracy better than +/-30 nanoseconds compliant to G.8272.1 when locked to GNSS/IRNSS.

3.3.4 The holdover requirements shall be as per G.8272.1 Clause 8.2.

3.3.5 The main configuration and monitoring shall be accessible via dedicated management port providing Web access /CLI /SNMP v2c/v3 or TL1 etc.

3.3.6 The PTP GM shall have the following reference inputs:

i. GNSS/IRNSS L1 band -

ii. E1/2.048 MHz, G.703 – Connector: 75 Ω BNC or 120 Ohms RJ-48

iii. PTP/SyncE/NTP Connector 10/100/1000 Mbps Electrical and Optical

Note:-The GNSS/IRNSS Antenna shall also include along with it the antenna lightning protection kit and cable as per the requirement on a case to case basis.

3.3.7 The PTP Grandmaster shall provide the following outputs:

i. E1/2 MHz, G.703 - Connector: 75 Ω BNC or 120 Ohms RJ48

ii. PTP/SyncE Connector 10/100/1000 Mbps Electrical and Optical

iii. 1PPS + ToD Connector RJ45/RS422

iv. 1PPS Connector SMA or SMB or BNC.

3.3.8 The PTP GM shall be able to work on dual feed DC Power Supply ranging from - 40V to 60V DC.

3.3.9 The PTP GM shall provide local and remote management port. The management platform shall be either SNMP v2c/v3 or HTTPS or TL1 or CLI etc.

3.3.10 Both Category Grand Master's shall support for G.8265.1, G.8275.1, G.8275.2 and default profile IEEE 1588-2008v2.

3.3.11 Both Category Grand Master's shall be configurable as OC (ordinary clock), TC (transparent clock) and BC (boundary clock)

4. EMI/EMC Requirement

The equipment shall conform to the EMC requirements as per the following standards and limits indicated therein. A test certificate and test report shall be furnished from an accredited test agency.

a) Conducted and radiated emission (applicable to instruments such as power meter, frequency counter etc.):

Name of EMC Standard: " CISPR 22 {2008}- Limits and methods of measurement of radio disturbance characteristics of Information Technology Equipment.

Limits :-

i. To comply with the category of Group 1 of Class A of CISPR 22 {2008}

ii. The values of limits shall be as per clause No. 8.5.2 of TEC Standard No. TEC/SD/DD/EMC-221/05.OCT 2016.

b) Immunity to Electrostatic discharge:

Name of EMC Standard: IEC 61000-4-2 {2008) "Testing and measurement techniques of Electrostatic discharge immunity test".

Limits: -

i. Contact discharge level 2 {± 4 kV} or higher voltage;

ii. Air discharge level 3 {± 8 kV} or higher voltage;

c) Immunity to radiated RF:

Name of EMC Standard: IEC 61000-4-3 (2010) "Testing and measurement Techniques-

Radiated RF Electromagnetic Field Immunity test"

Limits: -

For Telecom Equipment and Telecom Terminal Equipment with Voice interface (s)

i. Under Test level 2 {Test field strength of 3 V/m} for general purposes in frequency range 80 MHz to 1000 MHz

ii. Under test level 3 (10 V/m) for protection against digital radio telephones and other RF devices in frequency ranges 800 MHz to 960 MHz and 1.4 GHz to 6.0 GHz.

d) For Telecom Terminal Equipment without Voice interface (s)

Under Test level 2 {Test field strength of 3 V/m} for general purposes in frequency range 80 MHz to 1000 MHz and for protection against digital radio telephones and other RF devices in frequency ranges 800 MHz to 960 MHz and 1.4 GHz to 6.0 GHz.

e) Immunity to fast transients (burst):

Name of EMC Standard: IEC 61000- 4- 4 {2012) "Testing and measurement techniques of electrical fast transient/burst immunity test"

Limits: -

Test Level 2 i.e.

i. 1 kV for AC/DC power lines;

ii. 0. 5 kV for signal / control / data / telecom lines;

f) Immunity to surges:

Name of EMC Standard: IEC 61000-4-5 (2014) “Testing & Measurement techniques for Surge immunity test"

Limits: -

i. For mains power input ports:

a) 2 kV peak open circuit voltage for line to ground coupling

b) 1 kV peak open circuit voltage for line to line coupling

ii. For telecom ports:

a) 2 kV peak open circuit voltage for line to ground

b) 2 kV peak open circuit voltage for line to line coupling.

g) Immunity to conducted disturbance induced by Radio frequency fields:

Name of EMC Standard: IEC 61000-4-6 (2013) "Testing & measurement Techniques-Immunity to conducted disturbances induced by radio- frequency fields”

Limits: -

Under the test level 2 {3 V r.m.s.}in the frequency range 150 kHz-80 MHz for AC / DC lines and Signal /Control/telecom lines.

h) Immunity to voltage dips & short interruptions (applicable to only ac mains power input ports, if any):

Name of EMC Standard: IEC 61000-4-11 (2004) "Testing & measurement techniques- voltage dips, short interruptions and voltage variations immunity tests"

Limits:-

i. a voltage dip corresponding to a reduction of the supply voltage of 30% for 500ms(i.e. 70 % supply voltage for 500ms)

ii. a voltage dip corresponding to a reduction of the supply voltage of 60% for

200ms; (i.e. 40% supply voltage for 200ms)

iii. a voltage interruption corresponding to a reduction of supply voltage of >95% for 5s.

iv. a voltage interruption corresponding to a reduction of supply voltage of >95% for v 10ms.

i) Immunity to voltage dips & short interruptions (applicable to only DC power input ports, if any):

Name of EMC Standard: IEC 61000-4-29:2000: Electromagnetic compatibility (EMC) - Part 4-29: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests

Limits:

i. Voltage Interruption with 0% of supply for 10ms. Applicable Performance Criteria shall be B.

ii. Voltage Interruption with 0% of supply for 30ms, 100ms, 300ms and 1000ms. Applicable Performance Criteria shall be C.

iii. Voltage dip corresponding to 40% & 70% of supply for 10ms, 30 ms. Applicable Performance Criteria shall be B.

iv. Voltage dip corresponding to 40% & 70% of supply for 100ms, 300 ms and 1000 ms. Applicable Performance Criteria shall be C.

v. Voltage variations corresponding to 80% and 120%of supply for 100 ms to 10s as per Table 1c of IEC 61000-4-29. Applicable Performance Criteria shall be B.

Note 1: Classification of the equipment:

Class B: Class B is a category of apparatus which satisfies the class B disturbance limits. Class B is intended primarily for use in the domestic environment and may include:

- Equipment with no fixed place of use; for example, portable equipment powered by built in batteries;
- Telecommunication terminal equipment powered by the telecommunication networks
- Personal computers and auxiliary connected equipment.

Please note that the domestic environment is an environment where the use of broadcast radio and television receivers may be expected within a distance of 10 m of the apparatus connected.

Class A: Class A is a category of all other equipment, which satisfies the class A limits but not the class B limits.

Note 2: The test agency for EMC tests shall be an accredited agency and details of accreditation shall be submitted.

Note 3: For checking compliance with the above EMC requirements, the method of measurements shall be in accordance with TEC Standard No. TEC/SD/DD/EMC-221/05.OCT 2016 and the references mentioned therein unless otherwise specified specifically. Alternatively, corresponding relevant Euro Norms of the above IEC/CISPR standards are also acceptable subject to the condition that frequency range and test level are met as per above mentioned sub clauses (a) to (h) and TEC Standard No. TEC/SD/DD/EMC-221/05.OCT 2016. The details of IEC/CISPR and their corresponding Euro Norms are as follows:

IEC/CISPR	Euro Norm
CISPR 22	EN 55022
IEC 61000-4-2	EN 61000-4-2
IEC 61000-4-3	EN 61000-4-3
IEC 61000-4-4	EN 61000-4-4
IEC 61000-4-5	EN 61000-4-5
IEC 61000-4-6	EN 61000-4-6
IEC 61000-4-11	EN 61000-4-11

Table 3: IEC/CISPR standard and their corresponding Euro Norms

5. eMS REQUIREMENTS

The eMS shall meet the requirements as per TEC eMS standard no TEC/SD/IT/EMT-001/01/MAR 2016.

6. Minimum Equipment for Type approval:

a) Type 1 PRTC Clock:

i. Category-1 PTP-GM

Fully loaded equipment for specific "category" with input and output ports along with GNSS/IRNSS receiver as specified in this GR. EMS and LCT shall also be offered. All test jigs, test instruments etc., shall be arranged by the manufacturer.

PTP GM : 2 nos.

PTP Slave : 1 no.

EMS : 1 no.

LCT : 1 no.

Sync Tester : 1 no.

ii. Category – 2 PTP-GM

Fully loaded equipment for specific "category" with input and output ports along with GNSS/IRNSS receiver as specified in this GR. EMS and LCT shall also be offered. All test jigs, test instruments etc., shall be arranged by the manufacturer.

PTP GM	: 2 nos.
PTP Slave	: 1 nos.
EMS	: 1 nos.
LCT	: 1 nos.
Sync Tester	: 1 nos.

b) Type 2 ePRTC Clock:

Fully loaded equipment for specific "category" with input and output ports along with GNSS/IRNSS receiver as specified in this GR. EMS and LCT shall also be offered. All test jigs, test instruments etc., shall be arranged by the manufacturer.

PTP GM	: 2 nos.
PTP Slave	: 1 nos.
EMS	: 1 nos.
LCT	: 1 nos.
Sync Tester	: 1 nos.

Note: Manufacturer can offer any "Type/category" of PTP Grandmaster Clock for testing.

c) Field trial

The equipment shall be subjected to field trial for a minimum period of 4 weeks with working traffic to assess the performance of the

equipment in actual field conditions. Ensure to load the equipment with as much traffic as possible. During the field trial testing, it shall be ensured that the equipment meets the GR requirements. Also, obtain a certificate from the maintenance personnel about the satisfactory performance of the equipment.

CHAPTER -2 - GENERAL REQUIREMENTS

7. Reference documents

7.1 Whatever that has not been specifically stated in this document, shall deem to be as per relevant latest ITU-T recommendations.

7.2 All references to TEC GRs imply for the latest issues.

8. Engineering requirements

8.1 The equipment shall be fully solid-state and shall adopt state-of-the-art technology.

8.2 The equipment shall be compact and composite in construction and light-weight. The manufacturers shall furnish the actual dimensions and weight of the equipment.

8.3 All connectors shall be reliable and of standard type to ensure failure-free operation over long periods and under specified environmental conditions.

8.4 The mechanical design and construction of each card/unit shall be inherently robust and rigid under all conditions of operation, adjustment, replacement, storage and transport.

8.5 Each sub-assembly shall be clearly marked with schematic reference to show its function, so that it is identifiable from the layout diagram in the handbook.

8.6 All controls, switches, indicators etc., shall be clearly marked to show their circuit diagrams and functions.

9. Operational Requirements

9.1 The equipment shall be designed for continuous operation

9.2 The equipment shall be able to perform satisfactorily without any degradation at an altitude up to 3000 meters above mean sea level.

9.3 Wherever the visual indications are provided, green colour for healthy and red colour unhealthy conditions shall be provided. Some other colour may be used for non-urgent alarms.

9.4 If special tools required for wiring, it shall be provided along with the equipment.

9.5 In the event of a bug found in the software, the manufacturer shall provide patches and firmware replacement if involved, free of cost. Compatibility of the existing hardware shall be maintained with future software/firmware.

9.6 In the event of a full system failure, a trace area shall be maintained in non-volatile memory for analysis and problem resolution.

9.7 Necessary alarms (indicators) for indication of faults at various levels of hardware shall be provided on the individual modules

9.8 Live insertion and hot swap of modules shall be possible to ensure sync supply in the network.

9.9 The hardware and software components shall not pose any problems in the normal functioning and also wherever interfacing other network for voice, data and transmission systems.

9.10 Visual indication to show power ON/OFF status shall be provided.

10. Quality Requirements:

10.1 The manufacturer shall furnish the Mean Time between failure (MTBF) predicted and observed values.

10.2 The equipment shall be manufactured in accordance with international quality management system ISO-9001:2015 or latest for which the manufacturer shall be duly accredited. A quality plan describing the quality assurance system followed by the manufacturer, shall be required to be submitted.

10.3 The instrument shall conform to the requirements for environment as specified in the DoT- QA document No.: QM-333 (Latest issue: March 2010) - “Specification for environmental testing of electronic equipment for transmission and switching use”. The applicable tests shall be taken for environmental category B2 including vibration test.

11. Maintenance requirements

11.1 The equipment shall have easy access for servicing and maintenance. Maintenance philosophy shall be to replace faulty units/subsystems after quick on-line analysis through SW. The actual repair will be undertaken at centralized repair centers. The corrective measures at site shall involve replacement of faulty units/sub-systems

11.2 The equipment shall have easy access for servicing and maintenance.

11.3 Suitable alarms shall be provided for identification of faults in the system and faulty units.

11.4 As and when bugs are found/determined in the software the manufacturer shall provide patches/firmware replacement, if involved, free of cost as per the tendering clause. Modified documentation, wherever applicable, shall also be supplied free of cost.

11.5 Ratings and types of fuses used are to be indicated by the supplier wherever applicable.

11.6 The purchaser shall specify the requirements of the maintenance spares in the RFP.

11.7 The supplier shall have maintenance/repair facility in India.

11.8 Supplier should guarantee the spares so long as the equipment is in service, at least for 10 years from the date of supply. The purchaser would like to stock spares as and when the supplier decides to close down the production of the offered equipment. In such an event, supplier shall give a one year's notice to the purchaser so as to stock the spares.

12. Power Supply:

12.1 The equipment shall be powered by the -48V DC power supply from the station power plant and shall meet the following requirements.

12.2 Nominal power supply is –48V DC with a variation over the range –40V to –60V. The equipment shall operate over this range without any degradation in performance.

12.3 The equipment shall be adequately protected in case of voltage variation beyond the range specified in sub clause (a) and also against reverse input polarity.

12.4 The power consumption should be minimal. The actual power consumption to be furnished by the manufacturer.

12.5 The derived DC voltages in the equipment shall have adequate protection against over- voltage, short-circuit and overload.

13. Accessories:

13.1 The supplier shall provide one complete set of:

13.2 All necessary interfaces, connectors, connecting cables and accessories required for satisfactory and convenient operation of the equipment. Types of connectors, adopters to be used and the accessories of the approved quality shall be clearly indicated in the operating manuals which should be in conformity with the detailed list in the GR; Software and the arrangement to load the software at site.

Note: Additional sets may be ordered optionally.

13.3 Special tools, extender boards, extender cables and accessories as essential for installation, operation, maintenance as well as for repair of the equipment shall be clearly indicated and supplied along with the equipment.

14. Documentation:

Technical literature in English language detailing installation, operation and maintenance of the equipment only shall be accepted.

14.1 Installation, Operation and Maintenance manual

It should cover the following:

a) Safety measures to be observed in handling the equipment;
b) Precautions for installation, operation and maintenance;
c) Test jigs and fixtures required and procedures for routine maintenance, preventive maintenance and sub-assembly replacement.

15. Protection Requirements:

15.1 The equipment shall have a terminal for grounding the rack.

15.2 Protection against short circuit/ open circuit in the accessible points shall be provided.

15.3 All switches/controls on front panel shall have suitable safeguards against accidental operation.

15.4 The equipment shall be adequately covered to safe-guarded against entry of even dust, insects etc.

16. Safety Requirements:

The equipment shall conform to IS 13252 part 1: 2010 “Information Technology Equipment - Safety- Part 1 General Requirements" [equivalent to IEC 60950-1 {2005} “Information Technology Equipment -Safety- Part 1 General Requirements" and IS 10437 {1986} “Safety requirements for radio transmitting equipment’s” [equivalent to IEC 60215]. (applicable only if radio interface present and offered)

The equipment shall follow proper construction practice to minimize unintended radiation due to leakage from any gap or monitoring points. All unused ports and monitoring points shall be terminated. The power flux density shall not exceed 1 mW/m2

17. Guidelines for Tendering Authority

The tendering authority shall specify the following parameters:

1.	Type and Category of PTP GM
2.	No and Type of the clock input/output ports
3.	Clock redundancy
4.	No of PTP client support
5.	NTP support
6.	10 G port

Table 4: Parameters for Tendering Authority

Abbreviation

BSNL	:	Bharat Sanchar Nigam Limited
BNC	:	Bayonet Neill–Concelman
CACT	:	Component Approval Centre for Telecommunications
CISPR	:	Special International Committee on Radio Interference
DC	:	Direct Current
DOT	:	Department of Telecommunications
EMC	:	Electro Magnetic Compatibility
EMS	:	Element Management System
ETSI	:	European Telecommunications Standards Institute
FCAPS	:	Fault, Configuration, Administration, Performance & Security Management
GLONASS	:	Global Navigation Satellite System
GM	:	Grand Master
GNSS	:	Global Navigation Satellite Systems
GPS	:	Global Positioning System
GSM	:	Global System for Mobile Communications
HTTPS	:	Hypertext Transfer Protocol Secure
IEC	:	International Electro-Technical Commission
IEEE	:	Institute of Electrical and Electronics Engineers
IETF	:	Internet Engineering Task Force
ISO	:	International Standard Organization
ITU	:	International Telecommunication Union
LCT	:	Local Craft Terminal
MPLS-TP	:	Multi-protocol Label Switching – Transport Profile
MTBF	:	Mean Time Before Failure
MTTR	:	Mean Time To Repair
NGN	:	Next Generation Network
PON	:	Passive Optical Network
PPS	:	Pulse per second
PTP	:	Precision Timing Protocol
QA	:	Quality Assurance
QM	:	Quality Manual
RF	:	Radio Frequency
SNMP	:	Small Network Management Protocol

SSM	:	Synchronization Status Message
STM	:	Synchronous Transport Module
SW	:	Soft Ware
TDM	:	Time Division Multiplexing
TEC	:	Telecommunication Engineering Centre
TL1	:	Transaction Language 1
UMTS	:	Universal Mobile Telecommunications System
WiMax-FDD	:	Worldwide Interoperability for Microwave Access -Frequency Division Duplex