IPTO SPECIFICATION T-2100 A

SYNCHRONIZATION SYSTEM (REFERENCE CLOCK)

Contents

1. Introduction (Background Information)

Many services running on modern digital telecommunications networks require accurate synchronization for correct operation. If switches do not operate with the same clock rates, then slips will occur and degrade performance. Telecommunication networks rely on the use of highly accurate primary reference clocks which are distributed network wide using synchronization links and synchronization supply units.
Proper operation of SDH equipment requires the recovery of a line timed source and the ability to synthesize SDH interface clocks, telecom bus clocks locked to a reference.

Two protocols are available for time transfer over Ethernet, NTP (Network Time Protocol) and PTP (Precision Time Protocol). Both protocols rely upon the exchange of information packets over a network. The packets contain time stamps defining when a packet was transmitted and when it was received, and by analyzing these timestamps it is possible to determine the relative time between the exchanging elements. Both protocols also contain mechanisms for the host to act as either a provider (server) of time or a recipient (client) receiving time.

2. Scope of Work

All the current and the future Network Elements of ADMIE (IPTO) such as Multiservice WDM Switches, SDH, CE switches, servers etc. shall be synchronized with the Primary Reference Clock (PRC) systems by means of a synchronized network.
The synchronization network structure shall comply with the ITU relevant standards and its performance will meet the values specified in those standards.
The hierarchical master-slave method shall be used as the synchronization method. Currently, Synchronous mode (SDH) or the Plesiochronous mode (PDH / MUX) are used as core network.
In the case of the synchronous method the network will be synchronized with the national providers (main telecom providers e.g. OTE, WIND etc.).The PRC systems shall meet the input clock requirements of the synchronization of the frequency and the phase accordingly.
In the case of the Plesiochronous method the highest level of the network synchronization hierarchy, shall meet the requirements of the internal (IPTO) PRC and the national telecom PRC providers e.g. OTE, WIND etc.
Furthermore in the future the synchronization will be expanding at the packet switches, the servers, SCADA etc.

3. Eligibility Criteria

The bidder must possess the requisite experience, strength and capabilities in providing the services necessary to meet the requirements as described in this document. The bidder must also possess the technical know-how and the financial wherewithal that would be required to successfully execution of the project and support services for the entire period of the contract.
The bids must be complete in all respect and should cover the entire scope of work as stipulated in the tender document.
The bidder must provide a customer list with brand names, address, fax, e-mail of telecom and/or utility companies that has installed and successfully operated similar equipment the last 4 years.

4. Technical requirements for the Synchronization System

- Each offer must state the compliance or no compliance at the following sentences.
- Each offer must refer in details all the boards, cards, modules, PSU, Antennas etc. of the offered equipment.

SDH / PDH part

4.1 The PRC and the Synchronization Supply Units must be scalable and modular.
4.2 Must be able to accommodate in 19’ Racks.
4.3 Must be CE certified.
4.4 The requested equipment must comply with the following EMC standards:
- EN 300 386
- EN550022:2010 class B.

4.5 Environmental Specifications:
- Operating temperature -5 to +45 °C.
- Storage temperature -20 to +50 °C.
- Humidity: 5% to 95%

4.6 **The offered equipment must be provided with duplicated power supply.**
4.7 The power supply must be 48V DC +/- 25% and 230V AC +/-10% and could be able to use both of them in any combination as external power redundancy.

4.8 **The offered equipment must be equipped with: one (1) 48V DC** power unit and **one** (**1) x 220VAC** power unit.

4.9 **The offered equipment must be equipped with: duplicated CPU.**

4.10 The requested equipment must have universal input/output slots, accepting a wide range of input or/and output boards/cards.

4.11 Each E1 input board should accept **at least two (signals) ports**, optionally protected by an identical, adjacent card.

4.12 Comply with ITU-T G.811 PRC with dual GPS and/or GLONASS cards.

4.13 Comply with ITU-T G.812 Type I, II, III SSU holdover.

4.14 Ability of 1:1 protection for every card and function.

4.15 **The offered equipment must be equipped with: two (2) Input cards (of 2 E1 ports each): E1** 2.048 Mbps, 2.048 MHz, individually SW/HW selectable (SW preferably), "terminated" at 75Ω or/and 120Ω.

4.16 **The offered equipment must be equipped with: two (2) Separate GPS boards** (1:1) one backup to other.

4.17 **The offered equipment must be equipped with: two (2) GPS Antennas and all the necessary miscellaneous parts** (cables ~100m for each, antennas, connectors, bolts etc.)

4.18 **The offered equipment must be equipped with: two (2) output boards of at least two (2) E1 output ports each,** 2.048 MHz /2.048 Mbps, G703 interface card terminating at 120Ω or 75Ω. (Preferably 120Ω)

4.19 **Tracking and Holdover / Frequency Accuracy:**

- Tracking to GPS: PRC quality and holdover functionality.
- G.8272 PRTC when locked to GNSS.
- G.811 PRC reference with embedded GNSS (or external Cesium) source.
- Input source priority auto-switching.
- **Must be equipped with: G.812 Type II SSU, based on Rubidium holdover better than $5x10^{-11}$ /month (at 25°C).**

Precision Time Protocol (PTP v2) IEEE 1588 Grandmaster Clock

4.20 Supports the latest ITU-T PTP profiles including ITU-T G.8265.1 and future ITU-T G8275.1, G.8275.2 Frequency, Phase and/or Time-of-day auxiliary inputs and outputs.

4.21 PTP Time accuracy: ±100 ns when locked to GPS ITU-T G.8272.

4.22 Supports L3 unicast & multicast or mixed, L2 multicast.

4.23 **PTP (licenses): 500 clients**

4.24 Gigabit Ethernet Electrical and Optical (SFP) ports.

4.25 The offered equipment must be equipped with: two (2) output boards of at least two (2) Gigabit Ethernet Electrical output ports each.

4.26 Network Protocol :

- G.8265.1 Telecom Profile.
- G8275.1/G.8275.2 Telecom Profile (future).
- IPv4 Unicast, IPv6.
- One- or two-step clock (option).
- Simple configuration including automatic and dynamic remote client registration (unicast message negotiation).

Network Time Protocol - NTP

4.27 NTP v1, v2, v3, v4 is not required for this tender but the system should have the capability to expand and use this type of protocol in the near future.

4.28 Data Security 64 bits RSA, Inc. MD5 Message-Digest Algorithm.

Management

4.29 To support and provide Management Software:

- Protocol: SSH and Telnet.
- Communication port USB or RS232/Modem and Ethernet for remote access.

5. Installation

The Bidder shall bear all the costs associated with the preparation and the installation of the systems at the premises, including the spare parts, tools, cables etc.

6. Warranty

The Supplier warrants that the Goods supplied under the Contract are new, unused, of the most **recent models** and incorporate all recent improvements in design and materials. This warranty shall remain valid for a period of two years after installation and commissioning.

The Purchaser shall promptly notify the supplier in writing of any claims arising under this warranty. Upon receipt of such notice, the Supplier shall, with all reasonable speed, replace the defective Goods or parts thereof, without cost to the Purchaser.
If the Supplier, having been notified, fails to remedy the defect(s) within a reasonable period, the Purchaser may proceed to take such remedial action as may be necessary, at the Supplier's risk and expense and without prejudice to any other rights which the Purchaser may have against the Supplier under the contract.

7. Provisional Acceptance Test (PAT) & Final Acceptance Test (FAT)

7.1 Parameters for the PRC testing beyond of the supplier proposal, **shall include** the following tests/parameters:

- Power up / Shutdown process.
- Power up and operation with full load under 48V +/- 25% DC power unit operation.
- Power up and operation with full load under 230V +/- 10% AC power unit operation.
- Hot swap of the CPU.
- Synchronization of the second input GPS board and Antennas and recovery procedure.
- Synchronization on different inputs e.g. Telecom providers and recovery procedure.
- Synchronization on holdover mode and recovery procedure.
- Synchronization on different outputs path E1 or Gigabit Ethernet at PTP.
- E1 boards 1:1 protection failover.
- During FAT must be tested the stability of the synchronization based on rubidium holdover for a period of one month.

7.2 Provisional Acceptance Test (PAT) shall be conducted after ten (10) days of successful operation.

7.3 Final Acceptance Test (FAT) shall be conducted over two months after the PAT of the Transmission network.

8. Training

The objective of the training program shall be to enable the personnel to acquire the expertise concerning system installation, operation, maintenance, troubleshooting, repair and detailed concept of all equipment. The training program shall enable personnel to acquire:

A. Independence in maintenance of the system.
B. System installation capability that allows personnel to undertake future expansion of the network independently.
C. The training program shall adhere to the following instructions:

- Complete proposal of the training courses and their duration under manufacturer training program at IPTO premises covering Operation, Maintenance, Diagnosis, Testing, Measurements, Repairs and Management Information Reporting procedures shall be submitted.
- All the instructors shall possess high technical ability to impart training. They shall have a high command on Greek or English language.
- The efficiency of the training program conducted by the bidder will be under close scrutiny and it will have to be repeated by the bidder without extra cost to IPTO if the training given is found to be ineffective, deficient or un-satisfactory.

8.1 The bidder must add the training charges separately from the contract charges of the PRC Equipment.
8.2 Training shall be conducted to a group of 10 engineers at mutually decided times during the installation period.

9. Technical offer format

Every offer must be accompanied by the following:

9.1 Complete set of Technical documentation.
9.2 Compliance list stating the compliance or no compliance with all the relative requirements of the specification.
9.3 Full break down list of all offered materials (Full list of materials).
9.4 The supplier must provide a customer list with brand names, address, fax, e-mail of telecom or/and utility companies where has installed and successfully operate similar equipment the last 4 years.