# Request for Bids
# Goods
**(Two-Envelope Bidding Process)**

## Procurement of:

Supply and installation for upgradation/modernization of NLDC's SCADA/EMS system (Telecommunication system and RTU/Gateways) Package-3, Lot-4

**Memo No:** 27.21.0000.101.07.422.23.5755

**RFB Reference No.:** PGCB/WB/BPSREIP/P-3/LOT-4

**Project:** Bangladesh Power System Reliability and Efficiency Improvement Project

**Purchaser:** Power Grid Company of Bangladesh Limited

**Country:** Bangladesh

**Issued on:** November 23, 2023

## Volume 2 of 2

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# Volume II

# 1. Scope of Works

## 1.1 Description of Overall Project

The scope of the project is to transmit all data that is received from 37 nominated substations/stations of the PGCB transmission network (through gateways that are connected to their DCS systems) to main and backup control centers (NLDC and BNLDC). This MPLS project is initial phase of operation telecom network for Power Grid Company of Bangladesh Limited. The duration of this project is **10 months** from the contract effective date.

The **contract effective date** shall be counted from the date of contract signing.

For this reason, it is needed to establish a communication infrastructure in five regions of Dhaka1, Dhaka2, Chattogram, Khulna and Bogura, as depicted in Appendix 5 and 6 of Volume II, in this figure and table you can find thirty-seven stations/substations in the consultant's proposed ring.

All the bidders should consider this topology and other respective data that is found in this document for preparing their proposal. The winning bidder of this tender should survey all stations/substations of the network and prepare and propose its detailed design and after getting confirmation from PGCB, should implement that design. After site survey in place without sufficient dark fiber and/or other preparation required in substations/stations (Nodes), the contractor should inform PGCB officially.

In order to provide IP/MPLS with MPLS-TP capability transport network for monitoring and control facilities of 37 substations/stations at the National Load Dispatch Center (NLDC) and Back up NLDC (BNLDC) the following provisions shall be made under the contract.

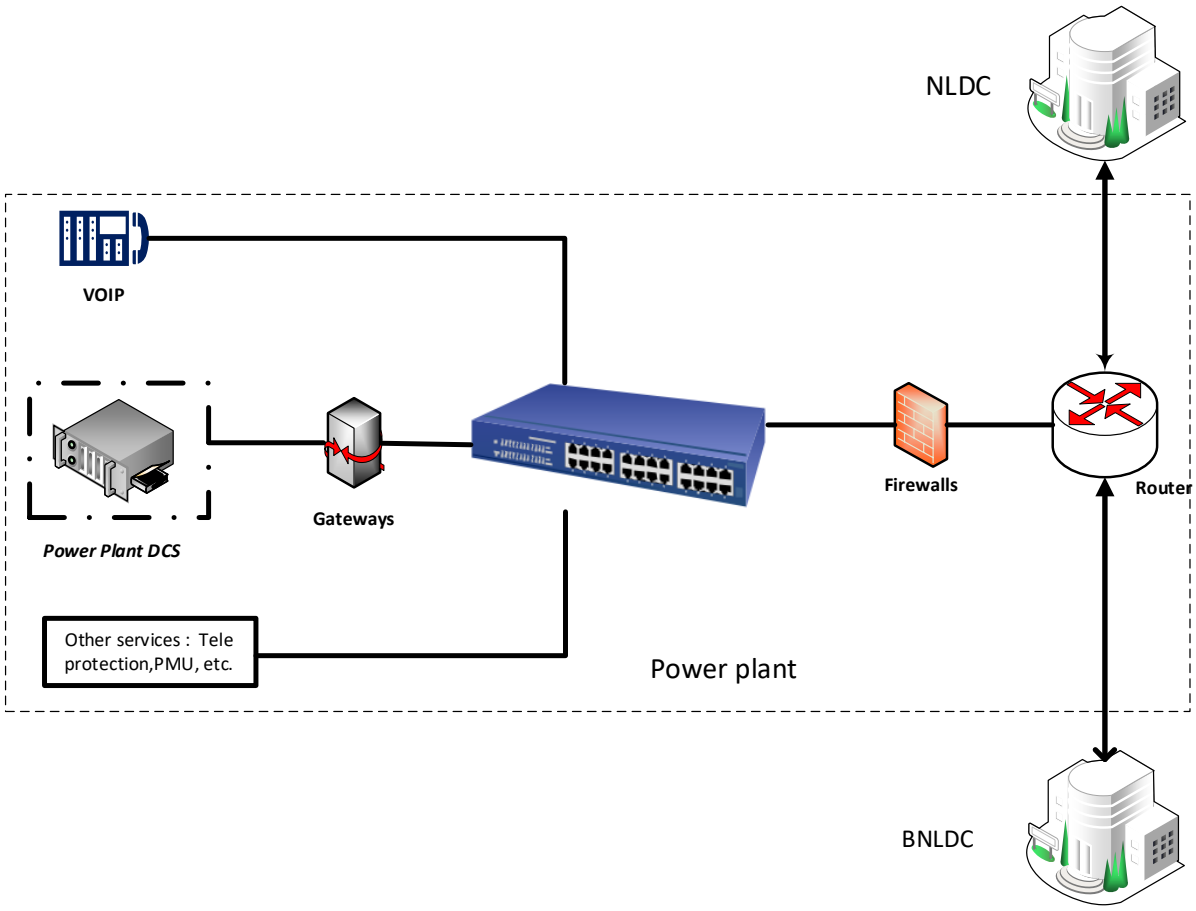
Also, Power Grid Company of Bangladesh (PGCB) plans to purchase some gateways for completing their respective substations to upgrade its NLDC/BNLDC operation.

All required traffic of SCADA shall be transmitted to the NLDC and BNLDC through the MPLS routers in Power plants. The services including SCADA, VoIP Telephony and Tele-protection (both Distance & Differential) shall be considered for every station.

The scope of work shall include but not limited to the following issues:

a. Site Survey
b. Network Design
c. Supply of required equipment in accordance with the specification and meeting point requirements regarding respective substation Automation System (Routers, Gateways, Switches, Firewalls, VOIP phones, NMS, passive equipment and spare parts)
d. To Perform any needed tests such as Factory Acceptance Test (FAT), Site Acceptance Test (SAT), Point to point test, integration test and etc.
e. Full technical document related to installation, commissioning, maintenance and operation
f. Providing Guarantee of all equipment, material, firmware and software subject of the contract.
g. Supply of diagnostic software tools and test equipment specifically designed and sufficient for programming and maintenance of the works
h. Installation of Equipment
i. On-the-Job-Training
j. Commissioning
k. Training of the employer's personnel.

Power Grid Network of Bangladesh is shown in Appendix 4 of Volume II. MPLS network shall be designed according to existing optical fiber (OPGW, ADSS, Under Ground Fiber Optic Cable). Network Topologies diagram is shown in drawing Appendix 5 of Volume II.
This document specifies the essential features and characteristics and requirements to provide Telecom MPLS network and associated equipment.




**Telecom Diagram of power plants' substations**

Based on centralized data flow architecture of SCADA/EMS centers in Bangladesh (NLDC and BNLDC), all data should be transmitted to the centers. Due to nature of DCS stations, all required data is collected and stored in DCS servers. To connect this type of stations to the redundant national centers, gateway will be installed and connected to the PGCB WAN through Firewall. Gateway act as an interpreter/isolator between DCS level and SCADA level. This gateway not only provide a security protection but also translate communication protocol between two levels.
These connections shall be achieved via the PGCB's telecommunication network. The gateway shall communicate with NLDC and BNLDC by using IEC 60870-5-104 and shall act as a server for NLDC/ BNLDC.

# 2. General Requirements

## 2.1 General

Acceptance by the Engineer of the design of the equipment and their components shall not relieve the Vendor of his obligation to supply equipment fully capable of meeting the service requirements. Each and every part of the equipment shall be of such design and construction as to give long and continuous service and low maintenance cost.

### 2.1.1 Environmental Conditions

Environmental requirements are as follows:

1. Equipment shall be capable of operating continuously with no degradation of performance when the ambient temperature ranging from -5 degrees C° to +45 degrees C° with relative humidity 95 percent non-condensing;

2. Dust storms are common and therefore equipment must be fully protected against the effects of air-borne dust and sand. The dust can be expected to contain a high salt content, which presents serious electrical insulation problems for equipment;

## 2.2 Design, Manufacturing and Installation Requirements

### 2.2.1 Quality Control and Quality Assurance

The products and systems to be supplied under this contract shall conform to the requirements of the specification, to the best accepted international standards and to the severe requirements imposed by the service conditions. As a means of ensuring these objectives the vendor shall maintain a documented quality control and quality assurance which shall be generally in accordance with ISO standard ISO 9001 or approved equivalent.
The vendor shall ensure that the same requirements are applied to products, systems, and service supplied by sub-vendors and suppliers.
The vendor shall submit with his tender and outline statement of his quality control and quality assurance policies and procedures. As required by the engineer, the vendor shall submit a more detailed statement of his quality system as applied to materials, manufacture, and testing, supported with samples of documentation used for quality assurance certification. The vendor shall file all quality certification documents relating to the products and systems supplied under the contract. The Engineer shall have full access to such files.

### 2.2.2 Suitability of the Proposed Design

The design shall make adequate provision for:

- Safety of operation and maintenance personnel
- Reliability and continuity in service
- Ease of inspection and maintenance
- Ease and clarity of operation
- Avoidance of spurious alarms

- Ability to withstand the severe service conditions specified
- Freedom from undue vibration and noise
- Exclusion of vermin, birds, and animals
- Precautions to minimize fire risk

## 2.2.3 Interchangeability

To limit the required stock of spare parts all equipment and parts thereof performing similar duties shall be interchangeable.

## 2.2.4 Mechanical Construction

1. The workmanship, material and finish of all equipment supplied shall be free of all defects;
2. Module extenders shall be provided to facilitate maintenance, adjustment and test on operating units;
3. Maximum utilization shall be made of plug-in printed circuit boards (PCBs) of standardized design using long-life, high-reliability components. All plug-in modules shall be either mechanically keyed to prevent improper placement or otherwise protected against damage or improper operation, which might result from a module being plugged into a socket for which it was not intended. PCBs shall be fabricated from glass-epoxy or better material and shall be at least 1.58 mm thick;
4. Routine adjustment control shall be readily accessible from the front of the equipment without removal of the units;
5. All thread sizes for screws, nuts, and bolts shall conform to a standard system, preferably the metric system;
6. Equipment shall be substantially fire-resistant in construction and care shall be taken to keep the acoustical noise generated by the equipment to a minimum;
7. Equipment shall be designed, constructed and arranged for optimum ease and speed of operation and maintenance;
8. The lowest mounted rack shall be at least 0.3 m above floor level, and the highest shall not be higher than 1.8 m from the floor. The overall cubicle height shall not exceed 2.2 m. Cable entry to all racks and cubicles shall be preferably from the bottom;
9. The cubicle door shall be arranged to lie flat back so as to give unrestricted access to the apparatus. The door shall be sealed with suitable gaskets so as to exclude the ingress of dust with minimum IP42 indoor. Any vents considered necessary should include measures to exclude the entry of dust, insects, etc.;
10. The cubicle shall be of fabricated steel construction. Layout of equipment within the cubicle shall be such as to provide convenient access to all modules, cable terminations, test points etc. In this respect both front and rear access should normally be provided with swing frame;
11. All the components shall be clearly marked or otherwise identifiable so that no ambiguity exists;
12. All metallic cabinets and rack parts shall be electrically bonded together;

13. All equipment racks shall conform to a uniform standard rack width.

## 2.2.5 Electrical Construction

1. The electrical construction of all units shall be such as to ensure the highest standards of reliability, long life, and ease of maintenance. Cubicle doors shall be bonded to the main frame so as to ensure electrical continuity.

2. The layout of components on cards and modules shall be neat and orderly with no overcrowding. All components should be so mounted that they can be readily inspected without disturbing other components. It should be possible to replace any component without disturbing other parts or wiring.

3. Components which generate a significant amount of heat shall be adequately spaced away from other components, and also from the mounting cards or panels. The mounting of components across tags on wiring terminal blocks is not favored, and shall normally be avoided.

4. Equipment wiring shall conform to a recognized international standard. The applicable codes and standard shall be so stated in the detail design documentation. Copies of the applicable codes in English shall be provided with the detail design documentation;

5. Equipment and relative accessories shall be suitably protected against over-voltage, overcurrent, and ground leakage. In addition, Direct Current devices shall be suitably protected against voltage polarity reversal;

6. Under this contract reliability, low power consumption and noise immunity shall be a major consideration in selection of equipment;

7. All metering and test circuits shall not affect the operation of the Equipment;

8. Signal cables shall be of a type and installed in a manner so to reduce common-mode and induced noise to a minimum. Metallic shields shall be employed on all cables. All grounding of shields and signal circuits shall be at one point only to prevent ground loops, except where double shielded cable is used, in which case the outer shield may be grounded at both ends.

## 2.2.6 Electromagnetic Compatibility

Many of the locations where equipment will be installed will be in harsh electromagnetic environments such as electrical substations, radio transmitter sites, etc. Much of the equipment will also be required to operate in close proximity to other telecommunications and SCADA equipment.

Therefore, equipment being proposed shall be designed to high standards of electromagnetic compatibility both in terms of immunity and emission.

Equipment being proposed shall have been designed and tested in accordance with relevant, internationally recognized standards.

Equipment shall conform to the following standards, or equivalent standard which is acceptable to the Purchaser, where appropriate:

| | |
|---|---|
| EN 55022 | Limits and methods of measurement of radio interference characteristics of information technology equipment |
| IEC 801 (Pars 1-4): | Electromagnetic Compatibility for Industrial Process, Measurement, and Control Equipment. |

In addition, remote terminal units and interposing equipment shall be designed and tested in accordance with the following standards:

| | |
|---|---|
| IEC 255.4: | Single Input Energizing Quantity Measuring Relays with Dependent Specified Time (Appendix E: Impulse Voltage Withstand Tests and High-Frequency Disturbance Tests) |
| ANSI C37.90a: | IEEE Standard Guide for Surge Withstand Capability (SWC) Tests. |

The Vendor shall state the level or class of compliance with the above standards for all equipment. The minimum requirements for the various types of equipment are as indicated in the following sub-sections.

## - Specific requirement for Telecom Routers

The equipment should support following features and requirements:

- MPLS network must fulfill all requirements of operational services which are as follows:
    1. WAN network for RTU/SAS Gateway data
    2. WAN network for Tele-protection (both Distance & Differential)
    3. WAN network for IP phone
- All units should be hot-swappable
- 1Gbps capacity optical and electrical port in Aggregation and Access Routers
- Minimum capacity of 64 Gbps for Aggregation Routers and 32 Gbps for Access Routers
- Aggregation Routers should be Modular and Carrier class type
- Blank slots should have proper metal card cover
- should have interface for tele-protection (distance & differential) services in all links (Tele-protection should be implemented according to transmission lines in appendix.7)
- Power units should supply both, current Demand and additional 50 percent for future expansion

## - Specific Requirements for gateway

Gateway and interposing equipment shall in general meet the following classes of EMC immunity/emission for the stated standard:

| | | |
|---|---|---|
| EN 55022 | Class B: | Limits on generated interference |
| IEC 801-2 | Level 4: | Immunity to static discharges |
| IEC 801-3 | Level 3: | Susceptibility to radiated energy |

Input/output circuits and power supply inputs for all gateways and associated interposing equipment shall be provided with dielectric withstand capability as per IEC 255.4 and surges

withstand capability (SWC) as per IEC 255.4 or ANSI C37.90a. The levels for both dielectrics withstand and SWC for the various inputs, output and power supply circuit shall be as specified elsewhere in this specification.

## 2.2.7 Components

All components shall be of good quality selected for high reliability and conforming to the appropriate standard. The material of all components shall be resistant to flame propagation to a standard approved by the Engineer.

Components rating should have ample margins over normal operating levels, in the interest of reliability and long life. They should all be operated in accordance with manufacturer's instructions and recommendations, and circuit design should be such that special selection of components for particular applications is avoided.

All keys, push buttons, and other controls shall be approved by the Engineer.

They should be to the highest standard with good operating feel and positive action.

## 2.2.8 Condensation

Any enclosure within which condensation could occur and affect the performance of equipment shall be provided with anti-condensation space heaters. They shall be automatically controlled by a humidistat the operating range of which shall be adjustable. It shall be possible to switch the heater on and off manually. A space heater test circuit shall be installed in each enclosure with a rest push button and associated lamp. A switch for the purpose of isolating the power supply to the heater circuit shall be provided at each enclosure. All enclosures shall be designed to minimize condensation, with provision for ventilation and drainage as appropriate.

## 2.2.9 Expandability

The design shall take full account of the need to ensure that the system can be readily expanded to meet development as called for in the Technical Specifications. To this end the hardware design of equipment shall be expandable in form, so that subsequent extension can be implemented without affecting the operation, performance, or efficiency of the system. Similarly, the software design shall be sufficiently comprehensive, flexible, and adaptable to cope with any future expansion, with the minimum of interruption of the system.

- The telecom systems shall provide an expansion capability of 100 percent aggregation router and of 50 percent access router equipment (for the future).
- The telecom system shall be configured in order to facilitate changes and additions. An expansion shall be possible without changing the system structure and without losing any functionality.
- Should be seen minimum 2 blank slots in the design for future developments

## 2.2.10 Wiring

All small wiring shall comply with the provisions of the section on low Voltage Cabling and Terminations and where appropriate with the Purchaser's regulators.

## 2.2.11 Packing

All equipment shall be packed and securely clamped against movements in robust wooden

packing cases to ensure safe transit from the manufacturer's works to the sites and physical protection shall be provided during handling and storage under the climatic conditions prevailing on site.

Equipment liable to moisture or ingress of foreign matter shall be totally sealed in strong polythene bags. Equipment and surfaces liable to deterioration due to condensation shall be protected by packs of silica-gel or another approved desiccant. Wood wool shall be avoided as far as possible.

Each case shall be indelibly marked with its own individual serial number, the Purchaser's name, the contract number, the Contractor's name, Contractors Agent in the Purchaser's country and his address, its gross and net weights in kilograms, description of contents, case measurements, country of origin, and all necessary slinging and stacking instruction. Each case shall contain a fully detailed packing list in a sealed waterproof envelope.

## 2.2.12 Label Plates and Identification

### 2.2.12.1 General

Each item of equipment shall be provided with a rating plate giving the type and serial number together with its ratings and service conditions and any other information required by IEC Recommendations and by other sections of the Specification.

All withdrawable equipment including detachable doors/panels, units and subunits shall be labeled both on the withdrawable item and on the fixed part with which it mates. All rating plates, nameplates, labels and wiring plates shall be of non-corrodible material. Where etched labels are proposed, clear perplex covers shall be provided to prevent dust accumulation obscuring inscription text.

Inscriptions shall be clearly legible from the operating distance and shall be in English throughout.

Notice indicating danger to personnel shall be in English and in Bengali.

In general, all labels shall be screw fixed in an approved manner; except where otherwise agreed.

By the Engineer, when equipment is installed, additional labeling shall be provided where in the opinion of the Engineer the labeling provided is inadequate.

Equipment labeling should be neat as far as possible uniform in size and type. It will in all cases be subject to approval by the Engineer.

### 2.2.12.2 Control and Indicating Devices

The function of each control and indicating device shall be clearly marked in a manner approved by the Engineer. Where the marking is likely to be subject to appreciable wear, as in the case for example of marking on push button tops, it shall be of a suitably durable form.

### 2.2.12.3 Test Points

Test points shall be clearly marked with the relevant circuit diagram number, and where it is feasible and likely to be assistance, they should also carry a function designation.

### 2.2.12.4 Connectors and Terminations

Connectors shall be marked to relate them to the relevant circuit diagram. The numbering of

individual connectors shall also be clearly indicated.

Terminations shall be similarly marked, and in addition main cable terminations shall have a record of the actual circuits mounted in a convenient position nearby.

## 2.2.13 Equipment and Materials

All equipment and materials shall be new and of the highest quality, and shall be capable of withstanding the stresses imposed on them under the most severe electrical, mechanical and atmospheric conditions which may occur in service.

The recommendations of BS code of practice 1014 shall be observed in the design and in the selection of materials unless otherwise approved by the Engineer.

Repair of damaged equipment or materials shall not be allowed without the approval of the Engineer.

## 2.2.14 Surface Treatment of Metals

All exposed metal surface shall be either painted, galvanized, anodized, plated or otherwise finished to take account of the metal and the climatic conditions to be encountered in service.

## 2.2.15 Contractor's Responsibility for Construction Facilities and Sufficiency of Means Employed

The Contractor shall make his own arrangements with relevant supply authorize for all necessary supplies of electricity, water, gas, telephone etc. required for construction and testing. Where such supplies are not available for any reason, the Contractor shall make provision for adequate site supplies as may be necessary for the installation and testing of the Works.

The Contractor shall also provide at his expense all necessary machinery, lifting equipment, test equipment, tools, etc. required for installation and commissioning. All such equipment shall be maintained throughout the Contract in good working order.

The Contractor shall take upon himself the full entire responsibility for the sufficiency of tools and Contractor's equipment and generally for all means used for the fulfillment of the Contract,

Whether or not such means may have been approved of, recommended by, or commented on by the Engineer.

## 2.2.16 Transport of Materials

The Contractor shall be responsible for transport of all equipment to the various substation sites including importation, off-loading, warehouse storage etc. and all costs and expenses involved in transport from the manufacturer's works to the sites with proper insurance.

The Contractor shall inform himself fully at the tender stage of all available facilities and

restrictions involved in the complete transport operation.

The Contractor shall make all necessary arrangements for the reception of equipment and material at the work sites.

## 2.2.17 Security and Reliability

A primary design objective for the project shall be to ensure that the highest possible standards of reliability and security will be available from the installation. To this end the following requirements shall be met:

- Only well-proven equipment units and modules shall be employed.
- The system design and configuration adopted shall be such as to reduce the risk of common mode failure to minimum.
- Where a unit or subsystem is duplicated, each one shall be separated from the other physically and electrically as far as practicable and each shall be capable of being set up and tested separately.
- It shall not be possible for failure of any outstation, communication link, or peripheral equipment to jeopardize the continued working of the rest of the system.
- Failure of any unit shall lead to a fail-safe condition. In particular, the possibility of a false control operation due to any hardware or software failure shall be negligible.
- Software reliability is equally important and the system hardware shall be supported by fully adequate and well-proven software.
- Special attention shall be given to the design of the power at the master station and outstations, as experience has shown that a significant proportion of faults are due to failure in power supplies.

The basic criteria for reliability shall be the mean time between failures (MTBF) for the various failure modes, and function groups.

Contractor shall supply full information relating to projected MTBF rates for all main items of equipment, subsystems, and function groups, and shall show clearly how these have been derived.

## 2.2.18 Ease of Maintenance

A further important design objective shall be to ensure ease of maintenance both in relation to routine checks an overhaul and in relation to the localization and clearance of faults. To this end the following requirements shall be met:

- There should be ample test points and, where appropriate, built-in test facilities
- There should be ample means to monitor the performance of equipment so that, as far as is practicable, potential faults can be detected before they cause failure
- It should be a simple matter to remove and replace individual modules
- There should be a comprehensive system of fault alarms which will indicate not only the existence of a fault, but also in all cases where it is feasible, the unit or sub-unit in which the fault has occurred

- In the case of power supplies there should be individual fuse alarms for each separate distribution feed, as well as a general "power fail" alarm.

The foregoing represents maintenance requirements which should receive attention at the design stage. Other maintenance requirements are dealt with in the Technical Specification.

# 2.2.19 Language

The English language shall be used for the Contract and for all communications, drawings, instructions, certificates, and all other drawings.

# 2.2.20 Program and Project Management

## 2.2.20.1 Outline Works Program

The Contractor shall submit with his tender an Outline Works Program showing in bar chart form the key dates, commencement dates, durations, and completion dates of the main activities.

The following items shall be shown:

(1) Electrical equipment design and approval

(2) Manufacture of all equipment

(3) Equipment erection

(4) Tests on Completion

(5) Guaranteed dates for completion

The Contractor shall perform the Works in accordance with the Outline Works Program submitted with the Tender until a detailed Works Program is approved by the Engineer.

## 2.2.20.2 Reporting Progress

The Contractor shall at all times notify the Engineer of any delays or proposed variations in his day-to-day schedule of operations which are at variance with the Works Program.

The Contractor shall furnish monthly, in triplicate, a detailed report in the form and content as will provide a precise assessment of actual progress against the Works Program at a date not more than seven days prior to the date of receipt of such report by Engineer.

## 2.2.20.3 Co-Ordination and Site Meetings

Throughout the period of the Contract the Engineer may, from time to time as he considers necessary, call a co-ordination conference on site, at his head-office or at the Contractor's works or elsewhere in order to ensure good communications and to prevent delays in the Works. The Contractor's Project Manager shall attend such conferences together with any other persons who, in the opinion of the Engineer, may be required.

At his discretion, the Engineer may, from time to time agree to the project Manager being represented by another competent person, depending on the subject matters on the agenda.

Throughout the erection period the Purchaser shall convene meetings with the Contractor on site, and otherwise as the Purchaser may decide, to discuss progress, technical and organizational matters and any other matters affecting the execution of the Contract. The Contractor shall be represented at such meetings by his Site Manager and other competent persons as may be required.

### 2.2.20.4 Notification of Accidents/Fires or Similar Incidents

In the event of an accident, fire, or similar incident occurring on, or associated with the site, the Contractor shall immediately notify the Purchaser and the Engineer or their representatives.

Notification to the Purchaser and/or Engineer shall follow the taking of all necessary actions to deal with any of the above situations (e.g., alerting Fire Bridge in the event of a serious fire).

# 3. Active Equipment Specification

## 3.1 IP/MPLS Equipment Specification

### 3.1.1 MPLS Router Specification

- Routers shall be mission-critical WAN designed for power utilities.

- There should be considered two router types, one type for main ring consisting of 33 nodes (Aggregation Routers) and another for last miles (Access Routers for 4 power plants). Access routers should cover all services needed in each substation due to their position in the access layer of the network.

- Aggregation and Access layer routers must be able to support MPLS-based services including Layer 2 VPN (L2VPN) and Layer 3 VPN (L3VPN) and other MPLS-Based services.

- Routers should have capability to support circuit emulation modules such as C37.94 interface module, E1 interface and other TDM interfaces

- Routers should have interface for tele-protection (distance & differential) per circuits and 1+1 redundancy must be available (Tele-protection should be implemented according to transmission lines in appendix.7)
-
- Routers should have electrical interface for distance tele-protection & IEEE C 37.94 interface (optical) for differential protection
- Certification of tele-protection functionality from renowned test lab is advised to be confirmed for proposed Router

- For Tele-protection, Telecom Equipment should have the following facilities:

  Dedicated end to end communication channel for Tele-protection for each line shall be provided. Existing lines with available Tele-protection shall not be interrupted rather multiplying relay can be used to adopt to new Tele-protection scheme. It is not required to supply protective relays but if there is no free contact in protective relay in that case it is required to supply Contact Multiplier Relay (CMR) by contractor.

  For distance protection required number of commands per circuit in different voltage levels:

  - 132 kV system >> 4 commands/circuit
  - 230 kV system >> 8 commands/circuit
  - 400 kV system >> 8 commands/circuit
- Routers should support clock synchronization for PGCB telecom network integration

- Routers should support all MPLS protocols and especially MPLS-TP.

- Line aggregation modules should be redundant and access modules should have redundancy capability

- Considering Minimum throughput 64Gbps for Aggregation routers and Minimum throughput 32Gbps for Access routers are mandatory.

- Aggregation routers should be modular and replaceable on powers, CPUs, Aggregation cards, access cards and cooling system.

- Routers should comply technical specification and condition in Appendix 8.

# 3.2 SCADA Gateway Specification

# 3.2.1 Gateway Technical Specification

### 3.2.1.1 General

This section specifies the scope of supply, essential features and characteristics and design requirements for gateway and associated equipment.

Gateway shall be fully equipped with input/output modules, Sequence of Event recording, interposing relays and other features called for later in this section.

### 3.2.1.2 Equipment Design and Performance

Gateway equipment shall meet the specifications laid down in the general technical requirements. Failure rates for each item of gateway equipment shall be determined and declared in the reply to this specification.

In gateway supplies, 48VDC (±20%), power interruptions in the A.C. supply or D.C. supplies shall not cause equipment damage, and interruptions in the D.C. supply of less than 20 ms shall not cause a break in normal operation of the gateway. Power supply shall be protected from input power polarity reversal and output short circuit.

Protection devices and alarm circuits shall be the approved by the Engineer and shall minimize equipment outages and facilitate rapid fault location.

The equipment shall not cause interference with other equipment and the noise and vibration levels shall be stated. The performance of the equipment shall be such as to meet the requirements specified elsewhere in this specification for information update times and speed of execution of commands.

Gateway design shall be based on microprocessor-controlled equipment and shall include the following mandatory facilities:

**NOTE: Vendor must fulfil all mandatory facilities entirely. When the proposed gateway specifications do not meet one or part of the following items, the whole proposal will be rejected**

1. Gateway shall be designed using the latest available and the most advanced technology, and shall provide a combination of state-of-the-art capability and reliability;
2. The system shall comprise the following in-built features namely failsafe control (i.e. in-built check-before-execute feature), Control system, SOE buffer, interfacing with third party IEDs if required (e.g. Multifunction Meters etc.), interfacing with third party computer system.
3. Communication protocols for communicating (Master/Slave) are IEC60870-5-101(Master and Slave), IEC60870-5-104 (Client and Server), Modbus (Master) and IEC 61850 (Client).
4. Serial Port for gateway RS 232 or RS 485 should be available.
5. Gateway shall have SNMP port for hardware and software management.
6. Gateway shall not have any moving parts for data storage, heat dissipation etc.
7. Gateway shall have multi-processors capability within rack mounted chassis, CPU, Power Supply and Communication shall be provided in the same gateway rack/chassis.
8. Gateway shall have the capability to support simultaneous communications with two or more independent remote master (redundant) stations.
9. Gateway shall use suitable port for storing program/database.
10. Automatic start-up and initialization following power restoration.
11. Gateway shall be able to receive time synchronize packets from the master station over IEC-60870-5-104 protocol or from the slave clock provided in the respective time server on SNTP Protocol.
12. In case of power supply failure, auto start-up and restoration of the Gateway shall be possible without manual intervention.
13. Remote database downloading and uploading of Gateway from master station shall be possible.
14. It shall be possible to increase the number of communication ports in the Gateway by addition of plug-in modules, if required in future. The Gateway shall support the use of a different communication data exchange rate and scanning cycle on each port and different database for each master station.
15. LED indications should be provided on the front to know the status of communication by looking at the front view of the gateway.
16. Vendors shall provide at least 4 serial ports for each gateway for interfacing to other devices with the below specification of the serial interface:
    - Each serial port RS-232, RS-485 selectable;
    - Port connector according to standard gateway specification;
    - Full serial and modem signals;
    - Speed 300 – 56K;
    - Flow control None, RTS/CTS;
    - Protection ESD and short circuit;
    - Cable distance 30 meters;
17. Gateway should acknowledge the polling cycle of less than 1 sec of a master station;
18. Gateway shall be able to report its internal status to the master Centre(s). additionally, self-monitoring for individual modules and components, such as memory and communication

module, to diagnose defective parts and transmit corresponding alarms to control centers (Via communication protocols);

19 . Watch-dog monitoring for modules should be available;

20 . The vendor shall supply any required equipment, software, and toolbox in order to download firmware to gateway processor and communication cards. In addition, vendor shall deliver all security passwords (if it is applicable) without any restriction;

21 . The clock shall have an accuracy of ± 2 PPM i.e. 7.2m sec per hour or better, and minimum gateway clock resolution shall not be more than 1 msec;

### 3.2.1.3 Standardization

As far as economically and technically practicable gateway shall be equipped with identical boards or modules in a standard backplane. The layout of equipment in cabinets shall be standardized, but each gateway may not necessarily be fitted with the same number of plug-in modules or interface modules. Each gateway shall be easily expandable to a common maximum capacity without the necessity of additional wiring. Deviation from the above requirements will be acceptable and preferred where cost or other considerations indicate compliance is not in the purchaser's best interest.

The Vendor must recognize that the gateway will be exposed to relatively severe electrical transients. The Vendor shall therefore, make adequate provision for the protection of all input and output circuits, including power supply and signal circuits, to prevent improper operation or damage of equipment as a result of such transients. Gateway shall comply with the following operating standards: (test, Reference standard, Test level)

a. Electrostatic discharge IEC 61000-4-2, level 4
b. RF immunity, IEC 61000-4-3, Level 3
c. Fast transient Disturbance, IEC 61000-4-4, level 4
d. Surge immunity, IEC 61000-4-5, level 4
e. Conducted RF Immunity, IEC 61000-4-6, level 3
f. Conducted RF Immunity 0-150khz, IEC 61000-4-16 Level 4
g. Radiated & Conducted Emissions, CISPR22 & CISPR32, Class A
h. High frequency disturbance EC 255-22-1 level 3
i. Impulse voltage withstands, EN 60255-27, 5 kV
j. Power frequency interference: CM 500 Vac @ 2 sec
k. Interference CISPR 11 class A.
l. Damped Oscillatory, IEC 61000-4-18 100kHz & 1Mhz 2.5kV CM, 1kV DM
m. Sinusoidal Vibration, IEC 60255-21-1, Class 1
n. Shock & Bump, IEC 60255-21-2, Class 1
o. Seismic, IEC 60255-21-3, Class 2
p. Power magnetic Immunity IEC 61000-4-8 Level 5
q. SAFETY, EN/IEC 60950-1: 2005, Per standard
r. Voltage Dip & interruption, IEC 61000-4-11, 0,40,70,80% dips, 250/300cycle interrupts
s. Change of Temperature, IEC 60068-2-14 Dual Core: -40°C to 70°C, Quad Core: -40°C to 60°C

Vendors are required to state specifically and in detail the differences if the proposed gateway has been

designed and tested according to any other standards than the above.

### 3.2.1.4 Availability

The availability of the gateway shall be 99.9% over the 12-month period of maintenance exclusive of communication channel and other purchaser caused down time

A = MTBF/ (MTBF + MTTR)

Where:

A = Availability

MTBF = Mean Time between Failure

MTTR = Mean Time to Repair

The system hardware architecture shall be fault tolerant to ensure that any single hardware failure does not result in the loss of a critical function.

Vendors shall submit their proposed design for achieving the high availability of critical functions and data requirements specified above.

Vendors are required to describe the failover/back to normal process in detail.

The Vendor is required to provide details covering all possible aspects of maintenance of their equipment and recommended maintenance routines and schedules as well as safety procedures for problem- free gateway operation.

The method and procedures recommended should be effective and suitable for the equipment under actual operational environment conditions.

### 3.2.1.5 Equipment Installation and Construction

Equipment shall be mounted in freestanding and steel cabinet. Cabinets housing electronic equipment shall be so arranged that access to front and rear is provided; this shall be accomplished by providing swing-out unit. Cabinets which exclusively contain terminations of cabling from the process may have front only access. Cable access shall normally be from below. Cabinets shall be to uniform dimensions and finish.

In addition, cabinet shall have degree of protection provided by enclosure according to IEC 529 as Outdoor IP54 (minimum);

Capacity sufficient for the envisaged ultimate development shall be provided for each type of termination employed in each cabinet. In addition, spare terminations shall be provided as specified in datasheet.

All terminations shall be at least 300 mm above floor level. All cabinets, bays, shelves, modules, cards and other components including terminals shall be clearly marked for identification purposes. All cabinets shall be equipped with lighting and a.c. mains convenience sockets. All metalwork which is or can be made accessible and which is not live circuitry shall be earthed in accordance with the "Guide for Safety in Alternating Current Substation Grounding" IEEE No. 80, January 2000.

### 3.2.1.6 Gateway Features and Facilities

- **Capacity**

Gateway shall initially be equipped to cater for the ultimate development as detailed in the station single

line diagrams, documents and the point's list tables. Provision shall be made for expansion above these quantities by the addition, in the future, of extra plug-in modules as specified in datasheet. The Vendor shall indicate the capacity of each gateway, "as delivered", and the absolute expansion possibilities of each gateway, stating the points at which additional racks/cabinets are required.

- **Sequence of Event Recording (SOE)**

SOE shall be provided for gateway forming part of this Contract. The SOE shall time-stamp events on occurrence in the gateway prior to their transmission to the control centres.

The resolution between any two events occurring anywhere in the power network shall be the same as the time specified in datasheet or better. The Resolution between recorded events within each substation shall be the same as the time specified in datasheet or better. The Vendor shall provide details of how the gateway time clocks are synchronised with the control centre time system. This shall preferably be carried out over the communications channel. The Vendor shall state how often synchronisation is carried out and shall indicate how communications transmission delays are allowed for in the synchronisation procedure. Alternatively, the Vendor may provide some means of off-air time synchronisation such as "Global Positioning System (GPS).

Based on the above requirements The Vendor shall provide calculations to indicate the worst possible system-wide time resolution for the control centre i.e. the Vendor shall state the maximum time error which could be recorded between two simultaneous events occurring anywhere in the system under conditions of very high activity.

Gateway shall be capable of storing events in the order in which they occur. The number of time-stamped events which can be stored shall be the amount as specified in datasheet. Overflow events from time tagged memory shall be stored in non-time tagged memory.

As an option the vendor shall quote for an SOE system which provides a resolution as specified in datasheet within any gateway and a system wide resolution as specified in datasheet.

The Vendor shall state whether local time-tagging of events (i.e., at the gateway) can be carried out for non-SOE points. If so, the resolution and accuracy of the non-SOE time-tagging shall be stated.

### 3.2.1.7 Maintenance Port

1. At a gateway, Ethernet port shall be used for maintenance port that allow user to configure the gateway data base and program any gateway function. All necessary software shall be furnished;
2. The maintenance port shall allow downloading and uploading of all programmable gateway parameters from data files generated by the gateway configuration system;
3. The gateway system software shall be adequately protected against any inadvertent modification via the maintenance port during reconfiguration and, maintenance of the gateway. Additionally, data base modification and all control operations via the maintenance port shall be password protected;
4. The maintenance port shall provide the ability to examine the real time state, communication and contents of memory. Simulation of status inputs, local operation of control of outputs, revision of database parameters, set time and other functionality shall be supplied via the port.

- **Gateway Configuration**

Gateway configuration software shall be supplied to configure and program any gateway function locally and remotely.

The system shall include information on operating parameters, physical arrangement of external communication lines, module type and their parameters.

- **Program, Database and configuration update**

The gateway database and configuration shall be editable locally or remotely with a GUI1 application or other secure means, it shall be possible to save/restore and replicate the complete configuration of the gateway on persistent external storage.

To minimize human errors, the gateway database (configuration) shall be programmatically generated (script or equivalent) from the Master database. As such the gateway configuration and database shall be integral part of the SCADA database management system.

During each start-up the gateway shall verify the integrity and the version of its local persistent database and configuration, and if necessary, shall request an update from the current active control centre.

#### 3.2.1.8 Remote Access security

All remote access and configuration transmission to the gateway shall be secured and encrypted regardless of the type connection LAN or WAN.

#### 3.2.1.9 Test Equipment

The gateway test set shall be suitable for testing, exercising and performing fault diagnosis on a gateway. It shall be possible for the gateway test set operator to use the device to fully replicate the dialogue that would take place with the master station. Commands may be issued or interrogations engaged in as seen from the gateway. The dialogue shall be identical with that entered into in normal operations. The operator of the gateway test set shall be able to selectively access and display the contents of gateway memory.

The gateway test set shall be housed in a rugged portable carrying case. It shall have a 3 meter power lead for connection to a local power source. A keyboard for command input and a logging printer for recording the results of tests shall be provided. All inputs shall have a surge withstand capability as defined in ANSI 35.90a or IEC 255.5. It shall be possible to simulate gateway behavior such as normal response, or to simulate frequently encountered error conditions e.g. noisy communications line, vibrating contact indications etc.

All of the above test and maintenance equipment's price shall be included in the total contract price.

### 3.2.2 Ethernet Switch Technical Specification

In order to implement the LAN connection on the services, one Ethernet switch for each power plant is required.

The Ethernet switch shall meet the following requirements:

1. Rack-mountable in a 19" rack;
2. Provide management functions through a Web interface;

[1] Graphic User Interface

3. The switch shall be delivered with an installed port capacity that is 50% above the number of ports required to interconnect the delivered servers, workstations and peripherals;
4. The ports shall be auto-sensing supports speeds of 10, 100 and 1000 Mbps;

### 3.2.3 Firewall Technical Specification

Firewalls shall be deployed for all external network interfaces. For guidelines on Firewalls and Firewall Policy, NIST SP 800-41 standard provides general guidance for selection of firewalls and firewall policies. Firewalls shall include the demilitarized zone, detailed event logging, routing policy, and access levels and lists.
Firewalls are used to stop unauthorized connections between two networks or from a network to a networked device.

a) The Contractor shall provide firewalls and firewall rule sets between network zones or provide firewall rule sets if the firewalls are not provided by the Contractor.
b) The Contractor shall provide firewall rule sets and/or other equivalent documentation. The basis of the rule set shall be "deny all," with exceptions explicitly identified by the Contractor. Note that this information is deemed business sensitive and shall be protected as such.
c) Post-contract award, the Contractor shall provide detailed information on all communications (including protocols) required through a firewall, whether inbound or outbound, and identify each network device initiating a communication.
d) Network Intrusion Detection and Prevention System: A network intrusion detection system (NIDS) is used to identify unauthorized or abnormal network traffic. In addition, network intrusion prevention system (NIPS) is able to block or stop intrusion attempts.
e) Pre-contract award, the Contractor shall provide a recommended placement of the NIDS/NIPS within the control network.
f) The Contractor shall provide traffic profiles with expected communication paths, network traffic, and expected utilization boundaries, for anomaly-based NIDSs.
g) The Contractor shall provide appropriate signatures, for signature-based NIDSs.
h) Post-contract award, the Contractor shall provide configured NIDS/NIPS and provide the information to configure NIDS/NIPS

# 4. Passive Equipment

Passive equipment is included:

- 19-inch Rack
- Optical Patch panel
- Electrical Patch panel
- Required materials such as patch cord and cable management and supply of all control/data/power cables, etc.

The bidder should provide the following passive equipment for each substation.

## 4.1 19-inch Rack

- The rack shall meet the following requirements that are based on Item 1.2.7 of Section IV

Technical Particulars and Guarantees.

- Racks and passive equipment should be according to the chassis of equipment and should have high quality
- Rack air entrance Should be equipped with efficient filter

## 4.2 Optical Patch panel

The optical patch panel shall meet the following requirements:

- Cat6
- Have sufficient slots
- Rack mountable on a 19 rack (1U of space)
- Should have fiber management provision inside
- Have earthing lugs and other accessories.
- Panel cover should be slide out for easy maintenance
- Provide self-adhesive, clear label holders (transparent plastic window type) and white designation labels with the panel, for front panel labelling
- Ports clearly numbered both on front and back
- Labels on front enable each port to be named
- Color coded labels on back should offer both EIA/TIA 568A & 568B wiring
- Metal frame
- EIA/TIA 2/32 spacing

## 4.3 Electrical Patch panel

The electrical patch panel should fulfil following features and requirements:

- Standard 19 inches and height 1U
- Have sufficient ports for installing
- Has a sliding tray for easy access to the equipment
- Have cable ties to keep the cables fixed
- metal body for greater strength and security
- Can be installed in all racks with a depth of 60 cm
- Should have a cable guide channel in front of the patch panel in order to arrange the cables
- Prevent damage to fiber optic patch cords (Support Bar)

# 5. Network Management System

- Bidder shall design proper DCN plan for all active equipment in the scope of work.
- Network Management System (NMS) is used to manage the entire network from NLDC and/or BNLDC as there is a full database synchronization between these two sites. Therefore, by using this system, the user could have integrated monitoring on all equipment and can implement end-to-end services, in addition the user has the overall view of the network.

The network management system should fulfil following features and requirements:

- Complete end-to-end infrastructure management

- Access through web services
- Hot standby database with backup and archive consideration.
- North bound Interface and/or API capability with Licenses included

# 6. Test Equipment

Basic tools and test equipment are necessary to perform general maintenance and troubleshooting tasks on the equipment. Contractor shall supply all test equipment that are required for installation, acceptance testing, commissioning and maintenance.

- The supplier must provide hardware and software testing tools
- All test equipment and material shall be considered by the Contractor

# 7. Redundancy

Network availability goal is five nines so vendor should propose solution and select proper equipment with accommodable MTBF and MTTR to achieve required high availability.

There is no Alternative path and/or additional link between two stations/substations in PGCB station connectivity, so redundancy should be seen in equipment according to following:

- Full Redundancy (Processor, Power, Card Lines, Access Cards) for Aggregation Routers
- Redundancy in Processor, Power for Access Routers

# 8. Documentation

Documentation shall be comprised of below principal elements:

1. Equipment should have a complete set of manuals for installation, operation, maintenance, block diagrams, schematics and implemented software documentation (including operating system, etc.);
2. Manuals shall describe in detail the function, design and construction of each section of equipment (software and hardware) and the recommended procedure for operation, servicing, maintenance and Upgrade equipment to meet the future needs on paper and CD/DVDs;
3. All the equipment internal connections should be given in detail;
4. All the schematic drawings for the printed circuits boards and part locators should be given in detail;
5. Software documents for all the firmware should be given;
6. Configuration and test software manuals and documents should be provided both in electronic format and hard copies;
7. All the documents, configuration and test software tools should be in English.

## 8.1 Documentation Format

All documents including Vendor-generated drawings, original equipment manufacture's

documentation and drawings shall be provided both in electronic format and as hard copies in three (3) copies. The requirement to provide hard and electronic copies applies to all the revisions of the documentation; initial and interim revisions that are delivered for review as well as final documentation.

- Electronic documents shall be supplied in a format that can be edited by the Purchaser. Documents delivered as electronic format shall be in the Purchaser's standard software format.
- All documents shall be searchable.
- All documentation shall be type written in English.
- Purchaser shall have the full property rights on all documentations submitted for the project.
- All documentation shall be provided on standard "A" size sheets and shall be presented in a durable binding which shall be suitable for stacking on shelves. The title of each document shall be clearly marked on the front cover and spine.
- Where available, a copy of all documentation shall be provided in an electronic machine-readable form (CD or DVD), in an industry standard format.
- Each document shall include a table of contents. If a document is divided into several physical volumes, each volume shall contain the complete table of contents of the whole document.

All documentation submitted by the vendor to purchaser shall be accompanied by a letter of transmittal. Furthermore, each document shall be identified by the Contract number, document number, drawing number, revision or issue number, date of release, and revision. The revision record shall include the date of the change, a brief description of the change, an indication that the change has been reviewed and approved in accordance with the vendor's quality assurance procedures, the version or release of the hardware or software to which the document applies.

# 9. Training

It is envisaged that training shall be comprised of two principal elements, namely:

## 9.1 On-the-Job-Training

- Hands-on training given by the vendor during the sample installation, testing phases of the project. This may take the form of either involving the purchaser's staff during these activities or providing advice and assistance where the Purchaser's staffs are carrying out these tasks.
- Contractor must hold On-the-Job-training at one week with PGCB staff at the beginning of physical installation and commissioning and all technical activities within future maintenance agreement with the contractor should be structured and shared with PGCB operation personnel as another on-job-training.

The vendor shall detail his proposals for training for each part under the headings listed above.

The vendor shall prepare and deliver a comprehensive training program on the operation and maintenance of the gateway and associated equipment.

## 9.2 Formal Training

- Formal training course in lecture type presentations and including comprehensive workshop and practical content,

  The provision of training shall be an integral part of the scope of work for this contract.

  The Vendor shall comply with the following general training requirements:

  1. Training courses shall be conducted by qualified and experienced trainers who speak English fluently. Their resume should be sent for Purchaser's approval;
  2. The Purchaser shall be permitted to make video recordings of all training courses upon agreement that the Purchaser shall use such recordings solely for internal staff training purposes and shall not release them to third parties;
  3. All necessary training material shall be provided in class by the Vendor. Each trainee shall receive individual copies of the technical manuals and pertinent documents;
  4. Class materials, including documents sent before the training classes and class handouts shall become property of the Purchaser which reserves his right to copy all material for internal training use only;
  5. Certificate should be issued to trainees at the end of each course;
  6. The Purchaser's staff attending the training courses shall submit confidential evaluation reports regarding the training courses given by the Vendor;
  7. All training shall be classroom courses style using books, printed notes, visual projections, etc.
  8. The Vendor shall submit a training plan prior to initiate any course form the training program and shall obtain the Purchaser's approval;
  9. The training overview shall be presented at the time of the kickoff meeting between the Purchaser and the Vendor;
  10. All training courses shall be completed prior to the beginning of the SAT.

- Training courses syllables include:
  - Introduction theory
  - Subsystems
  - Installation and commission equipment
  - Network management
  - Operation and maintenance
- Contents must be confirmed by the client
- Official certificate must be provided by the equipment product company

## 9.3 Required Training Course

The vendor shall prepare and conduct the courses and trainings as described in the following subsection. The vendor shall provide type written notes, books and visual presentations for all these courses. The numbers of man days (excluding travel time) of training and the desired location for the course are listed in below table.

**Minimum Training Courses for Telecom Network Equipment, NMS, Gateway, Ethernet Switch and Firewall**

| Course | Duration | Number of attending People | Location |
|---|---|---|---|
| Network Equipment | 14 Calendar Days | 8 | Vendor Country |
| NMS | 14 Calendar Days | 8 | Vendor Country |
| Maintenance and Support of Telecom Equipment & NMS | 30 Calendar Days | 10 | Bangladesh |
| Gateway, Ethernet Switch and Firewall | 30 Calendar Days | 10 | Bangladesh |

The cost of the air fare, hotel charges, laundry expenses, travelling expenses, food, health facilities, insurance and all other related cost shall be borne by the Contractor. A per diem (including travel time) allowance of US$ 100 or equivalent shall be additionally given to the Purchaser's Engineers per head for trainings in vendor's country. All costs for the above visits are deemed to be included.

# 10. Guarantee/Warranty

The vendor shall provide complete warranty on all equipment for a period of one year from the issue date of acceptance certificate.

- The manufacturer shall offer an annual test and maintenance agreement, consisting of the following: Regularly and systematically examine, test and adjust all system components.
- Submit test reports, which certify that all components have been tested and that the system is in proper working order and functions in accordance with this specification.
- All technical activities within future maintenance agreement with the contractor should be structured and shared with PGCB operation personal as another on-job-training.

# 11. List of Goods and Delivery Schedule

| Item No. | Description of Goods | Quantity | Physical unit | Final Destination (Project Site) as specified in BDS | Delivery (as per Incoterms) Date | | | Functionality |
|---|---|---|---|---|---|---|---|---|
| | | | | | Earliest Delivery Date | Latest Delivery Date | Bidder's offered Delivery date [*to be provided by the Bidder*] | |
| *[insert item No]* | *[insert description of Goods]* | *[insert quantity of item to be supplied]* | *[insert physical unit for the quantity]* | *[insert place of Delivery]* | *[insert the number of days following the date of effectiveness of the Contract]* | *[insert the number of days following the date of effectiveness of the Contract]* | *[insert the number of days following the date of effectiveness of the Contract]* | |
| 1. | Telecom Aggregation Equipment | 33 | set | Substations according to Appendix 6 | 120 Days | 150 Days | | |
| 2. | Telecom Aggregation Equipment-Spare Part | 4 | set | NLDC | 120 Days | 150 Days | | |
| 3. | Telecom Access Equipment | 4 | set | Power plants according to Appendix 1 | 120 Days | 150 Days | | |
| 4. | Telecom Access Equipment - Spare Part | 1 | set | NLDC | 120 Days | 150 Days | | |
| 5. | Gateway | 4 | set | Power plants according to Appendix 1 | 100 Days | 120 Days | | |
| 6. | Gateway-Spare part | 2 | set | NLDC | 100 Days | 120 Days | | |
| 7. | Ethernet Switch | 4 | set | Power plants according to Appendix 1 | 60 Days | 120 Days | | |
| 8. | Ethernet Switch - Spare part | 2 | set | NLDC | 60 Days | 120 Days | | |
| 9. | Firewall | 4 | set | Power plants according to Appendix 1 | 60 Days | 120 Days | | |

| Item No. | Description of Goods | Quantity | Physical unit | Final Destination (Project Site) as specified in BDS | Delivery (as per Incoterms) Date | | | Functionality |
|---|---|---|---|---|---|---|---|---|
| | | | | | Earliest Delivery Date | Latest Delivery Date | Bidder's offered Delivery date [*to be provided by the Bidder*] | |
| 10. | Firewall - Spare part | 2 | set | NLDC | 60 Days | 120 Days | | |
| 11. | NMS Servers, Hardware and Licenses (High Available Solution) with HA installation in 2 locations | 1 | system | NLDC | 120 Days | 150 Days | | |
| 12. | IP Phone Model Cisco 8841 | 50 | set | | 60 Days | 80 Days | | |
| 13. | Installation Materials | 37 | station | substations | 100 Days | 120 Days | | |
| 14. | Contact Multiplier Relay (CMR) | as required by site survey | set | Substation (name of substations will be clarified in detail design stage) | 120 Days | 150 Days | | |

# 12. List of Related Services and Completion Schedule

| Item No. | Description of Service | Quantity | Physical unit | Place where Services shall be performed | Final Completion Date(s) of Services |
|---|---|---|---|---|---|
| *[insert Service No]* | *[insert description of Related Services]* | *[insert quantity of items to be supplied]* | *[insert physical unit for the items]* | *[insert name of the Place]* | *[insert the number of days following the date of effectiveness of the Contract]* |
| 1. | Site Survey | 37 | PGCB Station | PGCB Stations according to Appendix-6 | 40 |
| 2. | Design and Documentation | 1 | PGCB Network | Onsight and offshore PGCB | 20 |
| 3. | FAT | Required Equipment | Set | At the vendor factory site | 16 |
| 4. | On -the-Job-Training | 5 | day | PGCB | 10 |
| 5. | Transportation and Installation of Equipment | Required Equipment | set | PGCB Stations | 60 |
| 6. | Commissioning | 37 | Site | PGCB Stations | 30 |
| 7. | SAT+PTP Test | 37 | Site | PGCB Stations | 60 |
| 8. | Foreign Training | 16 | Purchaser's representative | Vendor Country | 28 |
| 9. | Local Training | 20 | Purchaser's representative | PGCB | 60 |

The price for site survey and On-the-Job training shall be deemed to have included in the contract price.

# 13. Test

The scope of supply shall include extensive testing of all of the proposed equipment/systems, both as independent equipment/system and as an integrated unit. The Contractor shall be responsible for demonstrating the required reliability, maintainability, functionality and inter-operability of all of the proposed equipment/systems.
For the necessary tests including Pre-FAT, FAT, SAT, Point-to-Point, Availability, performance, etc., test procedures shall be provided by contractor. (Required tests are explained in the 'Technical Specification Section')
The Employer reserves the right to request the additional tests on the system and/or its elements at no extra charge on any work the Employer determinates not to be in accordance with these specifications. Whenever the result of any inspection or test performed or requested by the Employer in accordance with the requirements of this section indicates that the specific hardware, software, firmware or documentation does not meet the specification requirements, the Contractor shall replace, modify or add, at no cost to the Employer,adequate hardware, software, firmware or documentation as necessary to correct the noted deficiencies.

## 13.1 Test Procedures

The Contractor shall submit the substation control and supervision test plans for approval six (6) weeks prior to the start of FAT and SAT. Fully approved FAT and SAT test procedures shall be submitted to the Employer at least two (2) weeks prior to the commencement of the tests. The Employer will only approve test procedures if they are inclusive, thoroughly testingeach section of the equipment. The Contractor shall use IEC standards as a guide in preparingthe substation control and supervision test procedures.

The test procedures shall include the following:

(a) The test schedule, including provision for eight hours of unstructured tests to beperformed by Employer,
(b) The purpose of each test,
(c) The function to be tested,
(d) The plans/ procedures to be followed,
(e) Specific references to project documentation for correlation with the procedures andfor verification of the documentation,
(f) The test set -up, equipment, and conditions for each part of the test,
(g) All test inputs and outputs,
(h) Test software/firmware descriptions and listings,
(i) A copy of any certified test data to be used in lieu of testing,
(j) Expected results,
(k) The acceptance criteria,
(l) Procedures for handling the variances that are identified during testing.

## 13.2 Test Records

The Contractor shall maintain a complete record of all test results. This record shall be keyed to the steps enumerated in the previously approved test procedures.
The record shall include the following items:

(a) Reference to the appropriate section of the test plan,
(b) Description of any special test conditions or special action taken,
(c) Test results (pass/fail).

## 13.3 Routine Tests

The Contractor shall perform routine tests in accordance with the requirements of the Contractor's test specification approved by the Employer. The Contractor shall permit the Employer access to the equipment and software to determine or assess compliance with the provisions of these specifications and to witness the Contractor's routine tests. The Contractorshall submit test reports of routine tests.
The routine tests shall include:

(a) Visual check for completeness
(b) Wiring check
(c) Test of conformity with IEC standards
(d) Functional test of the individual systems at the works and commissioning

## 13.4 Factory Acceptance Tests

Prior to shipping the Telecom equipment from the Contractor's plant, it shall be subjected to the tests and inspections. Two Engineers of the Purchaser shall visit the testing station for witnessing sample tests of Telecom equipment. The cost of the air fare, hotel charges, laundry expenses, travelling expenses, food, health facilities, insurance and all other related cost shall be borne by the Contractor. Each visit must be minimum of 7 days or more (if required) excluding travel time. A per diem (including travel time) allowance of US$ 100 or equivalent shall be additionally given to the Purchaser's Engineers per head. All costs for the above visits are deemed to be included.

## 13.5 Inspection

Representatives of the Employer shall have free entry into the shops of the Manufacturer at any time during design, manufacturing, or testing of the equipment and into any mill, shop, or factory where the hardware or software/firmware described in these specifications is produced.
The Contractor shall provide to the Employer's Representative, free of cost, all reasonable facilities, equipment, and documentation necessary to satisfy the Employer's Representative that the Telecom equipment are manufactured in accordance with the specifications. The inspection rights described above shall apply to facilities of the Contractoror Contractor's subcontractors where the system is manufactured. These inspection rightsshall not apply

to the facilities of subcontractors supplying unit components to the system manufacturer. Such items will be inspected and tested by the Employer's Representative at the manufacturing site. Inspections by the Employer will include visual examination of the physical appearance of the hardware, cable dressings, and equipment and cable labeling. TheContractor's documentation will also be examined to verify that it adequately identifies and describes all system hardware, software, firmware and spare parts. The Employer shall have access to inspect the Contractor's and Manufacturer's quality assurance standards, procedures,and records, which are applicable to this project. Inspection shall not relieve the Contractor ofthe responsibility for furnishing material and equipment conforming to the requirements of the specifications nor shall such inspection invalidate any claim, which the Employer may make because of defective or unsatisfactory substation control and supervision system hardware, software, or firmware.

## 13.6 Testing & Commissioning

Commissioning of the System shall start immediately after the Contractor's pre-commissioning activities are concluded satisfactorily. Commissioning activities shall include but shall not be limited to checking that the on-site operation of the System, including its communications interfaces to all relevant field devices and external systems are ready for commercial operation.

The Contractor shall be responsible for this activity with support from the Purchaser. The project schedule shall allow a minimum of two months for this activity. The Contractor shall allocate a minimum of two people full-time at the Purchaser's site throughout this activity.

The Site Acceptance Test (SAT) shall be started after System Commissioning to formally confirm for the Purchaser is in fact ready for operational use.

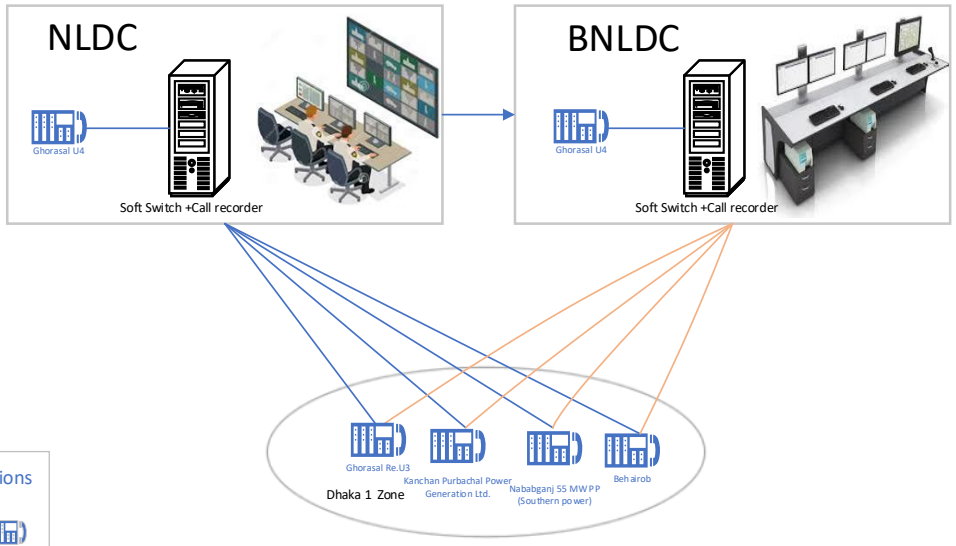
The Availability Test shall be started after SAT is successfully completed and the Availability Test prerequisites. After successful Availability Test, the project manager in consultation with the Purchaser shall issue **Acceptance Certificate**.

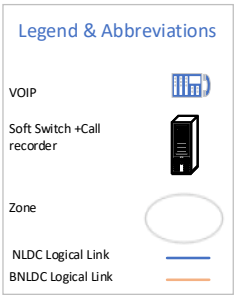
# APPENDIX

## 1. Power Plant list

| Item | Zone | Power Plant | Location |
|---|---|---|---|
| 1 | Dhaka 1 & 2 | Ghorasal Re.U 3 | |
| 2 | | Kanchan Purbachal Power Generation Ltd. | |
| 3 | | Nababganj 55 MW PP (Southern power) | |
| 4 | | Bhairob | |

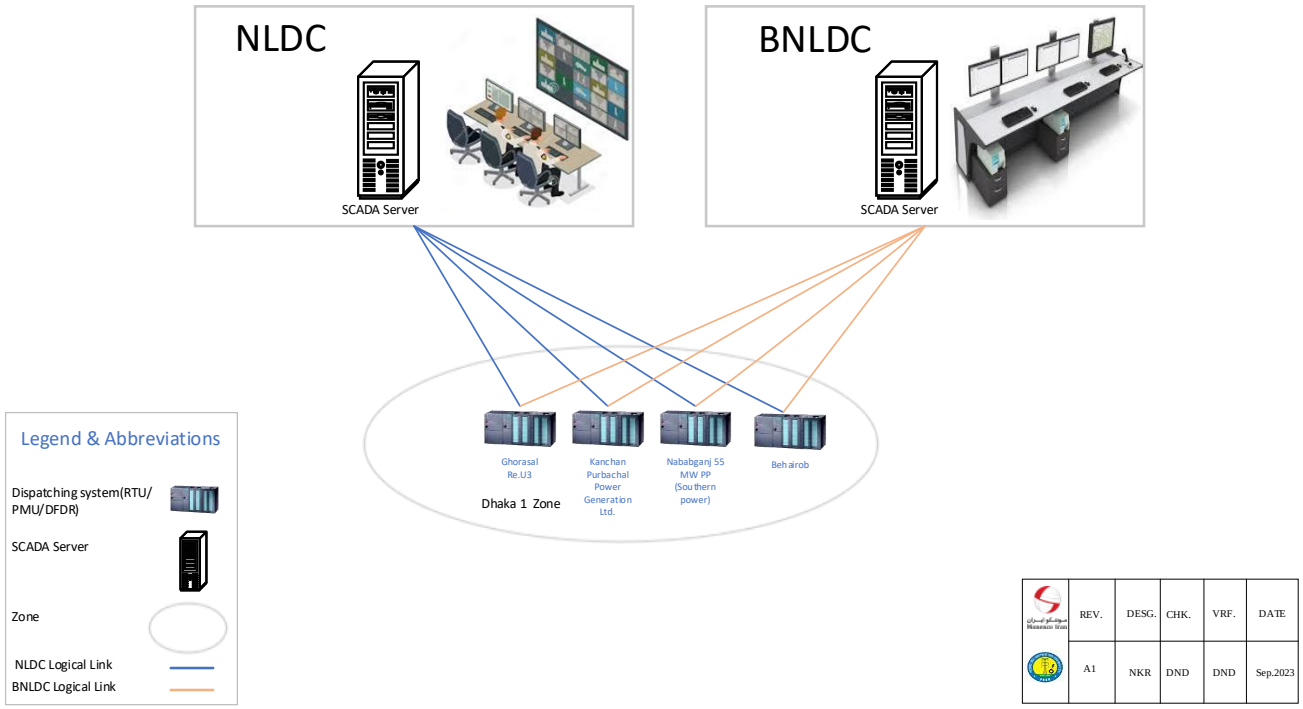
## 2. VOIP Logical Topology



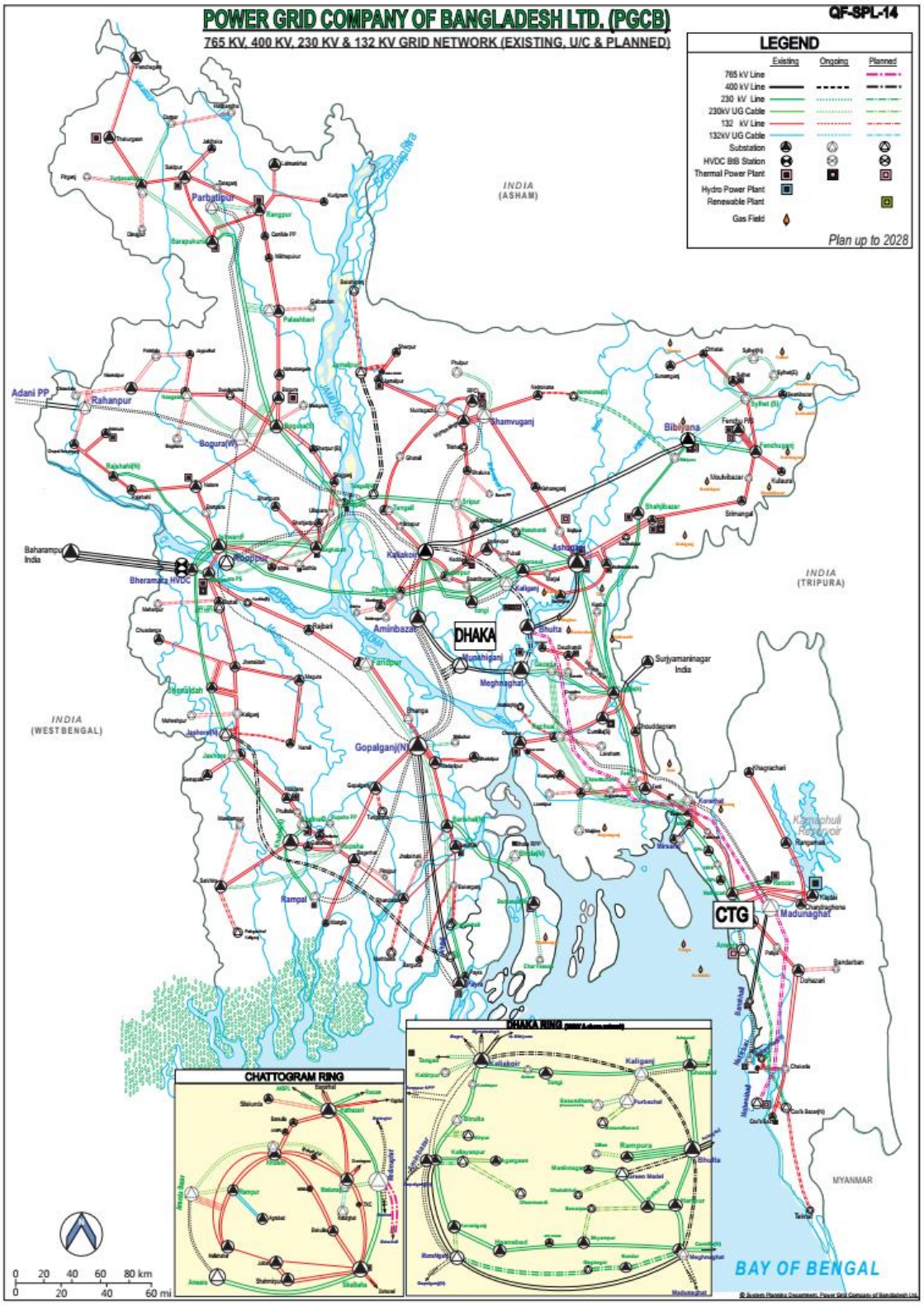

| | REV. | DESG. | CHK. | VRF. | DATE |
|---|---|---|---|---|---|
| | A1 | NKR | DND | DND | Sep.2023 |

## 3. SCADA Logical Topology

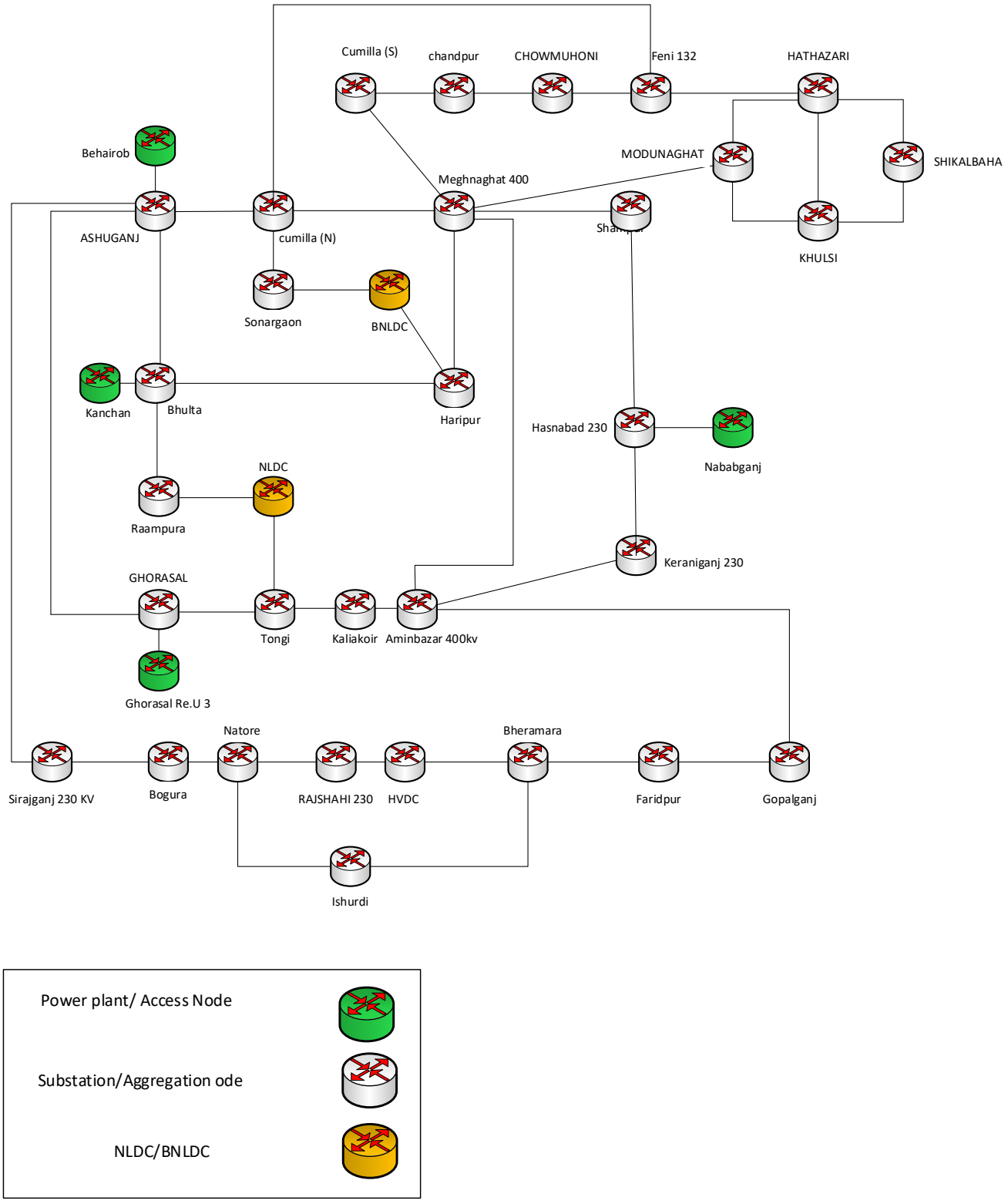



| | REV. | DESG. | CHK. | VRF. | DATE |
|---|---|---|---|---|---|
| | A1 | NKR | DND | DND | Sep.2023 |

## 4. POWER GRID COMPANY OF BANGLADESH LTD. (PGCB)



## 5. Proposed Physical Topology MPLS



## 6. Proposed Telecom Network Links

| N0. Of Nodes | Zone | Level | Source substation | Destination Substation | Distance | Location |
|---|---|---|---|---|---|---|
| 1 | Dhaka 1 & 2 | Aggregation Core | Sonargaon | BNLDC | 18.39 | |
| 2 | | | BNLDC | Haripur | 2.55 | |
| 3 | | | Haripur | Bhulta | 11.8 | |
| 4 | | | Bhulta | Rampura | 17.33 | |
| 5 | | | Raampura | NLDC | 1 | |
| 6 | | | NLDC | Tongi | 17.02 | |
| 7 | | | Tongi | Ghorashal | 27.46 | |
| 8 | | | Ghorashal | Ashuganj | 45.17 | |
| 9 | | | Ashuganj | Cumilla (N) | 82.16 | |
| 10 | | | Meghnaghat 400 | Shyampur | 17.9 | |
| 11 | | | Shyampur | Hasnabad 230 | 12.85 | |
| 12 | | | Hasnabad 230 | Keraniganj 230 | 11.46 | |
| 13 | | | Keraniganj 230 | Aminbazar 400kV | 12.5 | |
| 14 | | | Aminbazar 400kV | Kaliakoir | 50.59 | |
| 15 | | | Kaliakoir | Tongi | 43.9 | |
| - | | | Meghnaghat 400kV | Aminbazar 400kV | 56.13 | |
| - | | | Meghnaghat 400kV | Haripur | 12.16 | |
| 16 | | Access | Ghorashal Re.U 3 | Ghorashal | | |
| 17 | | | Kanchan Purbachal Power Generation Ltd. | Bhulta | | |
| 18 | | | Nababganj 55 MW PP (Southern power) | Hasnabad 230 | | |
| 19 | | | Bhairob | Ashuganj | | |
| 20 | Chattogram | Aggregation Core | Cumilla (N) | Meghnaghat 400kV | 59.6 | |
| 21 | | | Cumilla (S) | Chandpur 132kV | 65.1 | |
| 22 | | | Chandpur 132 | Chowmuhoni | 70.29 | |
| 23 | | | Chowmuhoni | Feni 133 | 33.46 | |
| 24 | | | Feni 132 | Hathazari | 87.32 | |
| 25 | | | Hathazari | Shikalbaha | 28.59 | |
| 26 | | | Shikalbaha | Khulsi | 22 | |
| 27 | | | Khulsi | Modunaghat | 12.5 | |
| 28 | | | Modunaghat | Meghnaghat 400kV | | |
| - | | | Cumilla (N) | Feni 133 | 67.89 | |
| - | | | Hathazari | Modunaghat | 10.91 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| - | | | Hathazari | Khulsi | 27.56 | |
| - | | | Meghnaghat 400kV | Cumilla (S) | 72.58 | |
| 29 | **khulna** | **Aggregation Core** | Gopalganj 400kV | Faridpur | 47.6 | |
| 30 | | | Faridpur | Bheramara | 107.8 | |
| 31 | | | Bheramara | HVDC | 5.7 | |
| 32 | | | HVDC | RAJSHAHI 230 | 92 | |
| - | | | Aminbazar 400kV | Gopalganj 400kV | 85.6 | |
| 33 | **Bogura** | **Aggregation Core** | Sirajganj 230kV | Bogura 230kV | 75 | |
| 34 | | | Bogura 230kV | Natore | 64 | |
| 35 | | | Natore | Rajshahi 230kV | 53.17 | |
| 36 | | | Rajshahi 230kV | HVDC | 92 | |
| 37 | | | Ishurdi | Natore | 42.68 | |
| - | | | Ishurdi | Bheramara | 10.7 | |
| | | | Ashuganj | Sirajganj 230 KV | 149.1 | |

## 7. Tele-protection

Tele-protection (Distance & Differentia) should be implemented in the following transmission lines:

- Hathazari-Shikalbaha 230 KV Transmission Line
- Hathazari-Madunaghat 132 KV Transmission Line
- Khulshi-Madunaghat 132 KV Transmission Line
- Hathazari-Feni 132 KV Transmission Line
- Feni-Chowmuhuni 132 KV Transmission Line
- Meghnaghat-Madunaghat 400 KV Transmission Line
- Meghnaghat-Cumilla (North) 230 KV Transmission Line
- Meghnaghat-Shyampur 230 KV Transmission Line
- Hasnabad-Keraniganj 230 KV Transmission Line
- Ashuganj- Cumilla (North) 230 KV Transmission Line
- Rampura-Bhulta 230 KV Transmission Line
- Tongi-Kaliakoir 230 KV Transmission Line
- Aminbazar-Kaliakoir 400 KV Transmission Line
- Aminbazar-Keraniganj 230 KV Transmission Line
- Aminbazar-Gopalganj 400 KV Transmission Line
- Faridpur-Gopalganj 230 KV Transmission Line
- Ishwardi-Bheramara 230 KV Transmission Line
- Ishwardi-Natore 132 KV Transmission Line
- HVDC-Bheramara 230 KV Transmission Line
- HVDC-Rajshahi 230 KV Transmission Line
- Bogura-Sirajganj 230 KV Transmission Line

## 8. Technical Data Schedules

# Router Datasheet

| NO. | Description | Minimum Requirements | | Guaranteed |
|---|---|---|---|---|
| | | Unit | Data | |
| 1. | Country of origin= USA or European Countries | | | |
| 2. | Redundant processor module | | | |
| 3. | ACL - Access Control List Source and Destination Address Matching | | | |
| 4. | ATM/IMA/PPP/MLPPP Support on OC3 Interface Module | | | |
| 5. | 802.1ad | | | |
| 6. | Any Transport over MPLS (AToM): Ethernet over MPLS (EoMPLS) | | | |
| 7. | Auto-IP | | | |
| 8. | Auto Install Using DHCP for LAN Interfaces | | | |
| 9. | Autoroute announce and forwarding adjacencies for OSPFv3 over IPv4 TE tunnels | | | |
| 10. | BFD - BFD Hardware Offload Support | | | |
| 11. | BFD Support for Multicast (PIM) | | | |
| 12. | BGP - Accumulated IGP | | | |
| 13. | BGP - iBGP NSR | | | |
| 14. | BGP GSHUT enhancement | | | |
| 15. | BGP Monitoring Protocol | | | |
| 16. | BGP PIC (edge & core) - for RFC-3107 labeled iBGP | | | |
| 17. | BGP PIC Edge for IP/MPLS | | | |
| 18. | BX optics | | | |
| 19. | EVC Local Connect | | | |
| 20. | EVPN VPWS | | | |
| 21. | Egress QoS Support on MLPPP Bundle (Strict Priority Queuing) | | | |
| 22. | Egress Shaping on MLPPP Bundle | | | |
| 23. | Ethernet Data Plane Loopback | | | |
| 24. | Ethernet Fault Detection | | | |
| 25. | H-VPLS N-PE Redundancy for MPLS Access | | | |
| 26. | IGMP State Limit | | | |
| 27. | IOS VRF Multicast Multi-Topology Support | | | |
| 28. | IP FRR over BDI | | | |
| 29. | IP FRR/Remote LFA FRR with L2VPN | | | |
| 30. | IPV6 MVPN with MLDP | | | |
| 31. | IPv4 unicast routing support | | | |
| 32. | IPv6 Multicast: PIM Source-Specific Multicast (PIM-SSM) | | | |
| 33. | IPv6 Routing: IS-IS Support for IPv6 | | | |
| 34. | IPv6 Routing: OSPF for IPv6 (OSPFv3) | | | |
| 35. | IPv6 Routing: Static Routing | | | |
| 36. | IPv6 Services: Extended Access Control Lists | | | |
| 37. | IPv6 Switching: CEF/dCEF Support | | | |
| 38. | IPv6 VPN over MPLS (6VPE) | | | |
| 39. | IS-IS - MPLS LDP Autoconfiguration | | | |
| 40. | ISIS IPv4 - link TI LFA FRR protection | | | |

| NO. | Description | | Minimum Requirements | | Guaranteed |
|---|---|---|---|---|---|
| | | | Unit | Data | |
| 41. | Interfaces MIB: SNMP context-based access | | | | |
| 42. | L2VPN Protocol Base CLIs | | | | |
| 43. | L2VPN Protocol Based CLI | | | | |
| 44. | L2VPN: PW Status for Static PWs | | | | |
| 45. | L3 ATM support on RSP2 and ASR920 | | | | |
| 46. | L3 Security ACL for EVC support | | | | |
| 47. | Label Switched Multicast (LSM) Multicast Label Distribution Protocol (MLDP) based Multicast VPN (MVPN) support | | | | |
| 48. | MPLS -TP: IP Less trace support (NodeId, LinkId) | | | | |
| 49. | MPLS LDP Auto config TE Tunnels (ISIS only) | | | | |
| 50. | MPLS TE - Bundled Interface Support (EtherChannel and MLP) | | | | |
| 51. | MPLS TP: IP-less configuration of MPLS TP tunnels | | | | |
| 52. | MPLS Traffic Engineering (TE) - Fast Reroute (FRR) Link and Node Protection | | | | |
| 53. | Model Based AAA | | | | |
| 54. | Multi-protocol BGP (MP-BGP) - MPLS VPN | | | | |
| 55. | OSPFv2 link-protection Topology Independent Loop Free Alternate Fast ReRoute | | | | |
| 56. | PPP | | | | |
| 57. | PPP MLP MRRU negotiation configuration | | | | |
| 58. | Policy-Based Routing (PBR) | | | | |
| 59. | QoS Priority Propagation in Multi-level Scheduler | | | | |
| 60. | RSVP - Resource Reservation Protocol | | | | |
| 61. | Remote LFA FRR and labeled BGP FRR integration | | | | |
| 62. | Routed Pseudo-Wire and Routed VPLS | | | | |
| 63. | Smart Licensing Client | | | | |
| 64. | Support for IEEE 1588-2008 Precision Clock Synchronization Protocol | | | | |
| 65. | Synchronous Ethernet (SyncE): ESMC & SSM | | | | |
| 66. | Uni Directional Link Detection Protocol | | | | |
| 67. | Unicast Reverse Path Forwarding (uRPF) | | | | |
| 68. | Unicast Reverse Path Forwarding (uRPF) Loose mode | | | | |
| 69. | VPLS BGP Signaling | | | | |
| 70. | Virtual Private LAN Services (VPLS) | | | | |
| 71. | WAN mode support | | | | |
| | **Physical Specifications** | | | | |
| 72. | Rack mounts | ETSI rack-mount kit | | | |
| | | 19-in. rack-mount kit | | | |
| 73. | Air flow | Modular far tray | | | |
| 74. | Power supplies | 1+1 DC power supplies | | | |
| 75. | Mean time between failures (MTBF) | Min 300,000 Hours | | | |
| | **Power Specifications** | | | | |
| 76. | Power consumption | Max 150W, Typical: 130W (without PoE) | | | |

| NO. | Description | | Minimum Requirements | | Guaranteed |
|---|---|---|---|---|---|
| | | | Unit | Data | |
| 77. | DC input voltage | Voltage range: -24 VDC to -60 VDC nominal -48VDC | | | |
| | **Environmental Specifications** | | | | |
| 78. | environment and altitude | Operation: -5 to 45ºC, up to 1,000 feet (300m)<br>Storage and transport: -40 to +70˚C | | | |
| 79. | Relative humidity | 95 percent, noncondensing | | | |
| 80. | Acoustic noise | Acoustic noise peak operation maximum 59 dBA, sound pressure level, bystander position for rack-mount products at 20ºC operation as measured by ISO 7779 NAIS noise measurement test standard. Acoustic noise peak operation compliant to the Network Equipment Building Standards (NEBS) GR-63-Core Issue 3 sound power level of 78 dB at 27ºC operation as measured by the ANSI S12.10/ ISO 7779 NAIS noise measurement test standard. | | | |
| 81. | Storage environment | Temperature: -40 to 70ºC altitude: 15,000 feet (4570m) | | | |
| | **Safety and Compliance** | | | | |
| 82. | Safety | UL 60950-1, 2005 | | | |
| 83. | | CAN/CSA C22.2 No. 60950-1: 2005 | | | |
| 84. | | IEC 60950-1, 2005 | | | |
| 85. | | EN 60950-1, 2005 | | | |
| 86. | | AS/NZS 60950.1:2005 | | | |
| 87. | Electromagnetic | FCC CFR47 Part 15 Class A | | | |
| 88. | Emissions compliance | EN55022, class A | | | |
| 89. | | CISPR22, class A | | | |
| 90. | | ICES-003, class A | | | |
| 91. | | EN 300 386, class A | | | |
| 92. | | VCCI, class A | | | |
| 93. | | KN22, class A | | | |
| 94. | | EN61000-3-2 to EN61000-3-3 | | | |
| 95. | Immunity compliance | EN 300 386 | | | |
| 96. | | EN 61000-6-1 | | | |
| 97. | | EN 50082-1 | | | |
| 98. | | CISPR24 | | | |
| 99. | | EN 55024 | | | |
| 100. | | KN 24 | | | |
| 101. | | EN 50121-4 | | | |
| 102. | | EN/KN 61000-4-2 to EN/KN 61000-4-6 | | | |
| 103. | | EN/KN 61000-4-8 | | | |
| 104. | | EN/KN 61000-4-11 | | | |

| NO. | Description | | Minimum Requirements | | Guaranteed |
|---|---|---|---|---|---|
| | | | Unit | Data | |
| 105. | Power substation system compliance | IEC-61850-3 (2002) | | | |
| 106. | | IEEE1613 (2009) | | | |
| 107. | NEBS | GR-63-CORE | | | |
| 108. | | GR-1089-CORE | | | |
| 109. | | SR-3580 NEBS Level 4 | | | |
| 110. | ETSI | ETS/EN 300 119 Part 4 | | | |
| 111. | | ETS/EN 300 019 - Storage: Class 1.2, Transportation: Class 2.3, In-Use/Operational: Class 3.2 | | | |
| 112. | | ETS/EN 300 753 | | | |
| 113. | Network synchronization | ANSI T1.101 | | | |
| 114. | | GR-1244-CORE | | | |
| 115. | | GR-253-CORE | | | |
| 116. | | ITU-T G.703 clause 5 | | | |
| 117. | | ITU-T G.703 clause 9 | | | |
| 118. | | ITU-T G.781 | | | |
| 119. | | ITU-T G.813 | | | |
| 120. | | ITU-T G.823 | | | |
| 121. | | ITU-T G.824 | | | |
| 122. | | ITU-T G.8261/Y.1361 | | | |
| 123. | | ITU-T G.8262 | | | |
| 124. | | ITU-T G.8264 | | | |
| 125. | | IEEE1588-2008 | | | |
| | **Module** | | | | |
| 126. | Line card redundancy | supported | | | |
| 127. | Port density | Minimum 8-port 10/100/1000, RJ45 | | | |
| 128. | Environmental specifications | –40 to 65ºC (–40 to 149ºF) operating temperature (using Industrial temperature XFP, SFP, and SFP+ optics) 0 to 40ºC (32 to 104ºF) operating temperature (CPAK and QSFP optics) | | | |
| 129. | Relative humidity | 5 to 95%, noncondensing | | | |
| 130. | Storage environment | Temperature: –40 to 70ºC (–40 to 158ºF) altitude: 4570 m (15,000 ft) | | | |
| 131. | MTBF at 40ºC (104ºF) operating temperature | Minimum 300,000 hours | | | |
| 132. | Reliability and availability | OIR field-replaceable SFP optics modules | | | |
| 133. | | Support for both 1+1 SONET Automatic Protection Switching (APS) and SDH Linear Multiplexer Section Protection (MSP) protocols | | | |
| 134. | | Single interface module software reset | | | |
| 135. | | Rolling software upgrade, interface module by interface module | | | |

# Gateway Datasheet

| No. | Description | | Minimum Requirements | | Guaranteed |
|---|---|---|---|---|---|
| | | | Unit | Data | |
| 1. | Mfg. and Model | Based on the Proposed Solution | | | |
| 2. | Country of origin | European or American | | | |
| 3. | Input power supply Type and Range | 48VDC (±20%) or 220VAC (-15%~+20%) | | | |
| 4. | Communication protocols for communicating (Master/Slave) | • IEC60870-5-101 (Master and Slave),<br>• IEC60870-5-104 (Client and Server),<br>• Modbus (Master)<br>• IEC 61850 (Client) [2] | | | |
| 5. | LAN Interface Hardware Specification | #4 Ethernet port<br>Ethernet 10/100/1000 Base-T (or better), Shielded RJ-45 1.5 kV isolation transformer | | | |
| 6. | Serial Port | #4 serial port | | | |
| 7. | Management Port | SNMP V2, V3 | | | |

[2] Unlimited number of tags should be supported in all of these protocols.

# Cabinet Datasheet

| No. | Description | | Minimum Requirements | | Guaranteed |
|---|---|---|---|---|---|
| | | | Unit | Data | |
| 1. | Mfg. and Model | | | | |
| 2. | Size (Rack Unit) | Based on the Proposed Solution | | | |
| 3. | Mounting Frame Size | Based on the Proposed Solution | | | |
| 4. | Dimension (WxHxD) | Based on the Proposed Solution | | | |
| 5. | Minimum IP (Ingress Protection) | 42 indoor<br>54 outdoor | | | |
| 6. | Installation Type | Freestanding | | | |
| 7. | Access | Front & Rear or sides | | | |
| 8. | Number of Fans | Minimum 2 | | | |
| 9. | Digital Thermostat with Display | 1 | | | |
| 10. | LED Lamp | Yes | | | |
| 11. | Earthing | Yes | | | |
| 12. | Security Lock | Yes | | | |
| 13. | Patch Panels and Blank Panels | Yes | | | |
| 14. | PDU with Earthing | Yes | | | |
| 15. | PDU sockets is compatible with cabinet equipment plug and socket types | Yes | | | |
| 16. | Number of PDUs | 2 (If Dual AC power source)<br>(If power unit of devices is AC) | | | |
| 17. | Number of PDU sockets | ≥ 10 | | | |
| 18. | With Required Accessories (including LED lamp, installation accessories, power-supply accessories, cable-holder, cable, gland, …) | Yes | | | |

# Ethernet Switch Datasheet

| No. | Description | | Minimum Requirements | | Guaranteed |
|---|---|---|---|---|---|
| | | | Unit | Data | |
| 1. | Mfg. and Model | | | | |
| 2. | Country of origin | European or American | | | |
| 3. | Support SNMP V2, V3 | Yes | | | |
| 4. | Number of Ports<br>(Max number of nodes + 20% spare) | ≥ 16 | | | |
| 5. | Port Speed | 10/100/1000<br>Base-T | | | |
| 6. | Port Connection Type | RJ45 | | | |
| 7. | LAN Base Layer | 3 | | | |
| 8. | Switching Bandwidth (Throughput) | Based on the Proposed Solution | | | |
| 9. | Uplinks | 2x1GbE | | | |
| 10. | Dual Redundant Power Supply | Optional | | | |
| 11. | Form Factor | Based on the Proposed Solution | | | |
| 12. | Height (Rack Unit) | Based on the Proposed Solution | | | |
| 13. | Operating Temperature Range | 10 - 35 °C | | | |
| 14. | Operating Humidity Range | 10 - 80% | | | |
| 15. | MTBF | ≥ 200,000 hrs. | | | |

# Firewall Datasheet

| No. | Description | | Minimum Requirements | | Guaranteed |
|---|---|---|---|---|---|
| | | | Unit | Data | |
| 1. | Mfg. and Model | | | | |
| 2. | Support SNMP V2, V3 | Yes | | | |
| 3. | Number of FE/GE Ports<br>(Max number of nodes can be in service simultaneously + 20% spare) | ≥ 8 | | | |
| 4. | Number of FE Ports | Based on the Proposed Solution | | | |
| 5. | Number of GbE Ports | ≥ 8 | | | |
| 6. | Port Connection Type | RJ45 | | | |
| 7. | Throughput | Based on the Proposed Solution | | | |
| 8. | Dual Redundant Power Supply | Optional | | | |
| 9. | Form Factor | 19" Rack Mounted | | | |
| 10. | Height (Rack Unit) | Based on the Proposed Solution | | | |
| 11. | Operating Temperature Range | 10 - 35 °C | | | |
| 12. | Operating Humidity Range | 10 - 80% | | | |
| 13. | Routing | Yes | | | |
| 14. | IPS/IDS | Yes | | | |
| 15. | With Required Licenses | Yes | | | |
| 16. | MTBF | ≥ 200,000 hrs. | | | |

# NMS Datasheet

| No. | Description | | Minimum Requirements | | Guaranteed |
|---|---|---|---|---|---|
| | | | Unit | Data | |
| **1.** | **Operational efficiency** | Flexible virtual machine or appliance-based deployment models, easy to set up for quick time to value in small to global enterprise-class networks<br>Manage up to 2000 routers, switches, firewalls and access points<br>Streamlined workflows facilitate design, deployment, and operational lifecycle tasks that align with user roles<br>Contextual dashboards and 360-degree User and Device views display only the most relevant information for fast and efficient troubleshooting and remediation | | | |
| **2.** | **Improved operations** | Built-in high availability maximizes uptime for services delivery and improves operational efficiency | | | |
| **3.** | **Administration** | Flexible authentication, authorization, and accounting (AAA) allow for local, RADIUS, or single sign-on options | | | |
| **4.** | **Converged management** | Single pane-of-glass solution for complete end-to-end infrastructure management | | | |
| **5.** | **Complete lifecycle management** | Extensive discovery protocol support to improve accuracy and completeness, including ping, Neighbor Discovery Protocol, Link Layer Discovery Protocol (LLDP), Address Resolution Protocol (ARP), Border Gateway Protocol (BGP), Open Shortest Path First (OSPF), and route table lookups.<br><br>Composite templates to allow greater flexibility and packaging of individual templates into larger, reusable, purpose-built configurations for more consistent and quicker network designs.<br><br>Model-based simplified workflow to assess the network.<br><br>Flexible plug and play functionality.<br><br>Feature configuration templates provided to facilitate Application Visibility and Control (AVC), Zone-Based Firewall, Easy VPN (EzVPN), dynamic multipoint VPN (DMVPN), Group Encrypted Transport VPN (GETVPN), access control lists (ACLs), and ScanSafe deployment and management.<br>Device-level support for ACLs, Routing Information Protocol (RIP), OSPF, static routes, Ethernet interfaces, and Network Address Translation (NAT) configuration. | | | |
| **6.** | **Third-party support** | Ability to discover and monitor third-party Networks | | | |
| **7.** | **Minimum client requirements** | Client hardware: A Mac or Windows laptop or desktop compatible with one of the supported browsers and running 1 GB RAM, 2 GHz or better processor. | | | |

| No. | Description | | Minimum Requirements | | Guaranteed |
|---|---|---|---|---|---|
| | | | Unit | Data | |
| | | Browser: Internet Explorer 9.0 and above with Google Chrome plug-in (plugin not needed by Lobby Ambassador users), Mozilla Firefox ESR 10 and ESR 17 (ESR 17 is recommended), Mozilla Firefox 22 or later, Google Chrome 27.0 or later<br>Resolution: Screen display resolution is recommended to be set to 1280 x 800 or higher | | | |
| **8.** | **Management and security** | SNMPv1, v2c, v3, PNG, JPEG, and AutoCAD (DXF and DWG) import file types supported | | | |

# 19’ inch rack Datasheet

| No. | Description | | Minimum Requirements | | Guaranteed |
|---|---|---|---|---|---|
| | | | Unit | Data | |
| 1. | Materials | High quality SPCC cold rolled steel | | | |
| 2. | Surface process | defatting; phosphating; spray color | | | |
| 3. | thickness | Installation specifications 2.0 mm; Other sizes 1.2-1.5 mm | | | |
| 4. | Color | RAL9004 (black); Other items may be required | | | |
| 5. | Compliant standards | ANSI/EIA; RS-310-D; IEC297-2; DIN41491; Part1; DIN41494; PAR7; GB/T3047.2-92; ETSI | | | |
| 6. | width | 600 mm, 800 mm | | | |
| 7. | Height | 42U, 45U, 47U | | | |
| 8. | depth | 800 mm, 900 mm, 1000 mm, 1100 mm, 1200 mm | | | |
| 9. | Loading capacity | 1000 kg (with Nine-fold frame) | | | |
| 10. | Materials | High quality SPCC cold rolled steel | | | |

# PRICE SCHEDULES

# Schedule B1: Goods of IP/MPLS+MPLS-TP Telecommunication Network Equipment and SCADA Gateway

| Item No. | Description of Equipment Requirement | Unit | Quantity | Foreign Currency (in..... ) | | Remark |
|---|---|---|---|---|---|---|
| | | | | Unit Price | Total Price | |
| | | | *(1)* | *(2)* | *(3) = (1) x (2)* | |
| 1. | Telecom Aggregation Equipment | set | 33 | | | |
| 2. | Telecom Aggregation Equipment-Spare Part | set | 4 | | | |
| 3. | Telecom Access Equipment | set | 4 | | | |
| 4. | Telecom Access Equipment - Spare Part | set | 1 | | | |
| 5. | Gateway | set | 4 | | | |
| 6. | Gateway- Spare part | set | 2 | | | |
| 7. | Ethernet Switch | set | 4 | | | |
| 8. | Ethernet Switch - Spare part | set | 2 | | | |
| 9. | Firewall | set | 4 | | | |
| 10. | Firewall - Spare part | set | 2 | | | |
| 11. | NMS Servers, Hardware and Licenses (High Available Solution) with HA installation in 2 locations | system | 1 | | | |
| 12. | IP Phone Model Cisco 8841 | set | 50 | | | |
| 13. | Installation Materials | station | 37 | | | |
| 14. | Contact Multiplier Relay (CMR) | set | as required by site survey | | | |

**Total Price carried to Summary of Price Schedule**

**Total Price in words ……**

**Name of Bidder:** **Signature of Bidder:**

# Schedule B2: Services

| Item No. | Description of Equipment Requirement | Unit | Quantity | Foreign Currency (in .....) | | Remark |
|---|---|---|---|---|---|---|
| | | | | Unit Price | Total Price | |
| | | | *(1)* | *(2)* | *(3) = (1) x (2)* | |
| 1. | Design and Documentation | PGCB Network | 1 | | | |
| 2. | FAT | set | Telecom equipment | | | |
| 3. | Transportation and Installation of Equipment | set | Required Equipment | | | |
| 4. | Testing & Commissioning | site | 37 | | | |
| 5. | Foreign Training on Telecom Equipment & NMS | including: 16-man 28-days | - | | | |
| 6. | Local Training | including: 20-man 60-days | - | | | |

**Total Price carried to Summary of Price Schedule**

**Total Price in words ……**

**Name of Bidder:** **Signature of Bidder:**

# Schedule B3: Grand Summary

| Schedule B3: Grand Summary | | | |
|---|---|---|---|
| | | Total price | |
| | | Foreign Currency(in .....) | Local Currency(in BDT) |
| | | | |
| Schedule No. B1: | | | |
| Schedule No. B2: | | | |
| Grand Total | | | |