

# **Datasheets & Specifications of Telecom System**



ENERGISING QUALITY

**PROJECT NUMBER : C221052**



**Datasheets & Specification of Telecom  
System, CCTV Systems**

Total Sheets

18

**Document No.**

**C221052**

**00**



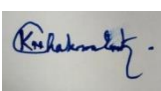
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**Indradhanush Gas Grid Limited**

**NORTH EAST GAS GRID PHASE-III OF IGGL**

					
D1	11.10.2022	Issued For Bid	VK	DGM	KNC
<b>REV</b>	<b>DATE</b>	<b>DESCRIPTION</b>	<b>PREPD</b>	<b>CHKD</b>	<b>APPR</b>

## ABBREVIATION

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
BS	British Standards
I/O	Input / Output
IP	Ingress Protection
PIDS	Pipeline Intrusion Detection System
LCP	Local Control Panel
PLDS	Pipeline Leak Detection System
OFC	Optical Fiber Cable
PAS	Pipeline Application Software
PIDS	Pipeline Intrusion Detection System
PLC	Programmable Logic Controller
RTU	Remote Terminal Unit
SCADA	Supervisory Control and Data Acquisition
SCS	Safety Control System
SIL	Safety Integrity Level
SV	Sectionalizing Valve
UCSPL	Uran Chakan Shikrapur Pipeline
UPS	Uninterruptible Power Supply
XLPE	Cross Linked Polyethylene

## 1. DEFINITION

Where used in this document, the following terms shall have the meanings indicated below, unless clearly indicated by the context to this order

PROJECT	North East Gas Grid Phase-III of IGGL
CLIENT/OWNER	Indradhanush Gas Grid Limited
EPMC	VCS Quality Services Private Limited (VCS) the party to act for and on behalf of OWNER for the Detailed Engineering Services and Project Management.
VENDOR/ MANUFACTURER	Party, which manufactures and supplies equipment and services to the OWNER or to CONTRACTOR

## 2. INTRODUCTION

VCS Quality Services Pvt. Ltd. (VCS) has been appointed as a PMC (Project Management Consultant) by IGGL for **"PMC Services for North East Gas Grid Phase-III of IGGL."**

Indradhanush Gas Grid Limited (IGGL), a joint venture (JV) of IOCL, ONGC, GAIL, OIL and NRL has been entrusted with the responsibility to execute cross country natural gas pipeline connecting all states of the North East and Sikkim. The natural gas pipeline grid in North East would connect Guwahati to capital cities / major cities of North East states like Itanagar, Dimapur, Kohima, Imphal, Aizawl, Agartala, Shillong, Silchar, Gangtok and Numaligarh. The grid would be connected with upcoming Barauni-Guwahati natural gas pipeline as a part of Urja-Ganga scheme. The grid would also connect to sustainable and viable indigenous gas sources in North-East.

The pipeline grid has been designed with flexibility for gas injection in either direction.

### 2.1 Project Brief

Salient details of tentative pipeline details under VCS scope of work in the route segment are as under:

A) **Siliguri – Gangtok Pipeline (Dia 12") – Tentative length is 186 Kms.**

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The pipeline in this section originates from a tap off point on Barauni-Guwahati pipeline at Siliguri and traverses through plain agricultural land and forest land for initial 50 odd kilometers which includes the crossing of Teesta River. Thereafter, the pipeline traverses through hilly terrain along the new highway under construction up to Lava, which is approximately at Ch.108.000 km of this pipeline section and thereafter follows the route of NH-717A up to near Ranipool area. The total area traversed by this pipeline section thus comes out to be approximately 186 km.

**B) Dimapur – Kohima- Imphal Pipeline (Dia 12") – Tentative length is 199.007 Kms**

The proposed pipeline route traverses through plain agricultural land and forest land for initial 5 odd kilometers and then enters the ghats/hilly terrain and traverses through it till Senapati town which is approximately at Ch.155.000 km of this pipeline section (en route taking the under-construction Kohima Bypass Road) and then runs through more or less plain area till Sekmai. The total area traversed by this pipeline section thus comes out to be approximately 199 km.

Summary of various stations envisaged in the proposed Phase-III of Gas Grid Development of Natural Gas Pipeline in North-East are as under:

**A) SILIGURI – GANGTOK PIPELINE (SGPL)**

Sr. No	Type of Station	Nos.	Location
1	Dispatch Terminal-1 ( DT-1)	1	Siliguri
2	Intermediate Pigging Station (IP/SGPL/01)	1	Tentatively at Lava
3	Receipt Terminal-1 (RT-1) with/ without Tap off	1	Gangtok
4	Sectionalizing Valves (SV) with/without Tap off in Line-1	8	Along the Siliguri-Gangtok route

**B) DIMAPUR – KOHIMA- IMPHAL PIPELINE (DIPL)**

Sr. No	Type of Station	Nos.	Location
1	Dispatch Terminal-2 ( DT-2)	1	Dimapur

2	Intermediate Pigging Station-2 (IP-1)	1	Tentatively at Tadubi
3	Receipt Terminal (RT-2) with/without Tap off	1	Imphal
4	Sectionalizing Valves (SV) with/without Tap off in Line-2	10	Along the Dimapur-Kohima-Imphal route

## 2.2 Purpose

The purpose of this document is to define the minimum technical requirements and Seller's scope of work / supply of Telecom and Pipeline Intrusion Detection System Interfacing Cabinet to be purchased for this project.

## 3. SPECIFICATIONS OF TELECOM PANEL & ACCESSORIES

### Site of Installation

1. Plant and Location : As per MR
2. Client : IGGL
3. Consultant : VCS Quality Services Private Limited
4. Location of panel : Control Room and accessories.
5. Floor : Concrete (By client)
6. Air Conditioning : Yes (By client)

## 4.0 Scope of Work

- a) Supply of TELECOM Panel (free standing, cubicle type) along with all accessories like Lamps, MCBs, Relays, Barriers / Isolators, Selector Switch, Signal Multipliers (SDC), etc. as per this Technical specification.
- b) Quantities of control panel accessories (Lamps etc.) shall be as per the Technical Requirements during drawing approval/detail engineering.
- c) Panel Dimensions : Height – 2115mm (including 100mm base channel and 15 mm

anti-vibration pad), Width – 800 mm , Depth – 800 mm

d) Mounting heights (tentative, final shall be decided during detail eng.) :

i) Miniature and subminiature items (3 rows )	Bottom row	1100mm
	Middle row	1350mm
	Top row	1600mm

PANEL CONSTRUCTION		
1.	Type :	Self-supported, Free Standing, enclosed cubicle and Non-graphic.
2.	Panel Manufacturing Standard	IEC 62208 Mechanical protection impact – IEC 62262, IK-08
A	Corrosion Protection	Salt spray test, should comply 720 hours as per ISO 9227
B	Panel Certification	TUV/BV/UL/other third party
C	Load Bearing Capacity	Minimum 1000 Kg
D	Life of panel	20 Years
3.	Lighting :	Required for inside panel with door switch on each side of door.
4.	Ventilation :	Required with louvers backed by wire fly screen & fan. Fan Failure alarm required.
5.	Doors :	CRCA door in the front and Rear of the Panel with locking arrangement. Both Doors shall be provided with minimum 3-Point Ergofoam type Lock or similar with key and handle
6.	Door width :	Each max. of 800mm and shall suit width of the panel. Panel width is indicative only. The sizes shall be sufficient to accommodate the required hardware specified in MR.
7.	Cable Entry :	Bottom, Cable Glands shall be double compression type for external armoured cables. All unused entries shall be plugged.
8.	Receptacles :	Required for incomer supply.

9.	Painting	:	<p>The finish shall include sand blasting, grinding, chemical cleaning, surface finishing by suitable filter and two coats of high grade lacquer with wet sanding between coats.. Two coats of paint in panel colour shall be given for Non-glossy high stain finish.</p> <p>ROHS shall be complied</p> <p>Panel face final colour shall be of the following:</p> <p>a) Siemens Grey (RAL 7035)</p> <p>b) Panel internal shall have a finish color of Siemens Grey (RAL 7035)</p> <p>c) Channel Base shall have a finish color of black</p>
	Channel Base	:	100X50X6 MM, MS material
10.	Tag Plates	:	Front of Panel Instrument Tag plates shall be black laminated plastic with white core. Tag plate shall be provided on the rear of the panel also.
11.	Name Plates	:	Name plates shall be black laminated plastic with white core. It shall include project details. It shall be provided on Front Side of Panel.
12.	Laptop Tray	:	Not Required

## 5.0 Dimensions & Material of Construction

- |    |                                      |   |   |
|----|--------------------------------------|---|---|
| a) | Panel dimension<br>mm anti-vibration | : | 2115 (mm) H (including 100 mm base + 15<br>pad) x 800 (mm) W x 800<br>(mm) D with modular<br>construction |
| b) | Control Panel                        | : | 1.5 mm thick CRCA steel   |
| c) | Side & Top plates                    | : | 1.5 mm thick CRCA steel   |
| d) | Door panel<br>and rear               | : | 2 mm thick CRCA steel, Single door in the front   |
| e) | Cable gland plate                    | : | 3 mm thick CRCA steel   |



- f) Mounting Plate : 3 mm thick or as decided during detail eng.
- g) Anchor Bolt Size : By vendor
- h) Lifting Eye Bolt : Required
- i) Anti Vibration Pad : Required (15mm thick rubber pad).
- j) Laptop Tray : 3 mm thick CRCA steel. Paint of Laptop tray shall be same as panel.
- k) Cable Routing : All cables inside the panel shall be router through proper covered PVC duct of suitable sizes. The same shall be provided asdecided during detail engineering.
- l) Equipment : The MCBs for incomer power supply and distribution supply shall be provided at the top of the Panel shall be mounted approx. in the middle at the approachable height MCBs and Power TBs shall be provided with acrylic sheet cover for safety.
- m) Gasket : PU Foam

**Note :**

**\*Panel shall be electrically isolated from base frame.**

## 12 WIRING

- a) Type : General purpose, Intrinsically safe
- b) Wiring details

DC Wiring (Incomer) : 3C x 10.0 mm<sup>2</sup> copper conductor

230 VAC Wiring (Non UPS) : 3C x 4.0 mm<sup>2</sup> copper conductor

DC Wiring (Inside) : 2C x 2.5 mm<sup>2</sup> (min) copper conductor

- d) **Terminal type** : Screw less push-in type terminal blocks (TB) Suitable for  
Terminal size for signal : min. 2.5 mm<sup>2</sup> size conductor  
Terminal size for power dist. : Suitable for min. 10.0 mm<sup>2</sup> size conductor and higher as per actual cable sizes.
- f) **Power Indication Lamps** : 230VAC NUPS – Red Color  
DC – Green Color

### Specifications of Accessories

1. **MCB**  
Make : As per Vendor List  
Qty. : As required + 20% spare
2. **Lamps**  
Type : LED Clustered Type  
Voltage : 24 VDC  
Make / Model No. : As per Vendor list  
Quantity : As required

Different colour codification shall be followed for various types of wiring. The suggested wiring colourcode is:

SN	Description	Wire Colour	Wire Size	TB Colour
<b>INCOMER</b>				
1	230V AC PHASE	RED	2.5 mm <sup>2</sup>	RED
2	230V AC NEUTRAL	BLACK	2.5 mm <sup>2</sup>	BLACK
3	ELECTRICAL EARTH	GREEN	6 mm <sup>2</sup>	GREEN
4	DC POSITIVE	RED	10 mm <sup>2</sup>	RED
5	DC NEGATIVE	BLACK	10 mm <sup>2</sup>	BLACK
<b>INTERNAL DISTRIBUTION</b>				

4	DC POSITIVE	YELLOW	2.5 mm <sup>2</sup>	YELLOW
5	DC NEGATIVE	WHITE	2.5 mm <sup>2</sup>	GREY
6	EARTH	GREEN WITH YELLOW STRIPS	6 mm <sup>2</sup>	GREEN

Minimum & Mandatory Specification for Terminal Block		
Sr.No.	Discription	Requirement
1	Connection method	Screw less push-in type terminal blocks (TB)
2	Insulating material	Vendor to provide
3	Flammability rating according to UL 94	V0
4	Visual indication for wire Connection making & breaking	Required
5	Double shorting facility	Required
6	Marking Facility	Marking should be on Center & both side of TB .
7	TB Wire size	Wire size required + Lug Zize
8	Special tool requirement	Should not required

#### SPD Specs

Make: MTL/Phoenix Contact

Main Incomer

Minimum Specification For Power supply	Technical Parameter 48 V DC	Technical Parameter 230V
Nominal voltage Un	48 V AC (TN-S)	230 V AC (TN-S)
Maximum continuous operating voltage Uc	70 V AC 70 V DC	264 V AC 230 V DC
Nominal discharge current In (8/20) $\mu$ s (L-N)	1 kA	3 kA
Rated load current IL	26 A (30 °C)	--
Combination wave UOC	2 kV	6 kV
Voltage protection level Up (L-N)	$\leq 0.25$ kV	$\leq 1.35$ kV
Voltage protection level Up (N-PE)	$\leq 0.65$ kV	$\leq 1.5$ kV
Response time tA (L-N)	$\leq 25$ ns	$\leq 25$ ns
TOV behavior at UT (L-N)	100 V AC (5 s / withstand mode) 100 V AC (120 min / withstand mode)	440 V AC (5 s / withstand mode) 440 V AC (120 min / withstand mode)

Surge protection fault message	Optical, remote indicator contact	Optical, remote indicator contact
Ambient temperature (operation)	-40 °C ... 80 °C	-40 °C ... 80 °C
Degree of protection	IP20	IP20
IEC test classification	III T3	III T4
Standards/regulations	IEC 61643-11 2011 EN 61643-11 2012	IEC 61643-11 2011 EN 61643-11 2012
Approvals	KEMA, UL Recognized	KEMA, UL Recognized

## Ethernet SPD

SPD Specification for Ethernet switches	Technical Parameter 24V
Maximum continuous operating voltage UC	$\leq 3.3 \text{ V DC}$
Maximum continuous voltage UC (wire-wire)	$\leq 3.3 \text{ V DC } (\pm 60 \text{ V DC/PoE+})$
Maximum continuous voltage UC (wire-ground)	$\leq 180 \text{ V DC}$
Nominal current IN	$\leq 1.5 \text{ A } (25^{\circ}\text{C})$
Operating effective current IC at UC	$\leq 1 \mu\text{A}$
Nominal discharge surge current In (8/20) $\mu\text{s}$ (Core-Core)	100 A
Nominal discharge surge current In (8/20) $\mu\text{s}$ (Core-Earth)	2 kA (per signal pair)
Total surge current (8/20) $\mu\text{s}$	10 kA
Nominal pulse current Ian (10/700) $\mu\text{s}$ (Core-Core)	$\leq 40 \text{ A}$
Output voltage limitation at 1 kV/ $\mu\text{s}$ (Core-Core) spike	$\leq 85 \text{ V (PoE)}$
Residual voltage at In, (conductor-conductor)	$\leq 15 \text{ V}$ $\leq 100 \text{ V (PoE)}$
Protection level UP (Core-Core)	$\leq 9 \text{ V (B2 (1 kV/25 A) )}$ $\leq 100 \text{ V (B2 (1 kV/25 A) - PoE)}$ $\leq 15 \text{ V (500 V/100 A)}$
Protection level UP (Core-Earth)	$\leq 600 \text{ V}$ $\leq 700 \text{ V (C2 (4 kV/2 kA))}$
Response time tA (Core-Core)	$\leq 1 \text{ ns}$
Standards/regulations	IEC 61643-21 EN 50173-1 ISO/IEC 11801-Am.1

Approvals	UL Listed, GOST
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### Serial (RS485)

SPD Specification for RS-485	Technical Parameter
IEC category	C1 C2 C3 D1
Nominal voltage UN	12 V DC
Max. operating voltage Umax	14 V DC
Nominal current IN	450 mA (45°C)
Response time :	≤ 500 ns
Operating Temperature range	-40 °C ... 85 °C
Degree of protection	IP20
Total surge current (8/20) μs	20 KA
Nominal discharge surge current In (8/20) μs (Core-Core)	10 kA (Core to core) 10 kA (Core to Earth)
Lightning Impulse current	2.5 kA per path
output voltage limitation at 1 kV/μs (Core-Core) spike	≤ 55 V
Output voltage limitation at 1 kV/μs (Core-Earth) spike	≤ 55 V
Voltage protection level Up (core-core)	≤ 80 V (C1 - 1 kV/500 A)
Voltage protection level Up (core-ground)	≤ 85 V (C1 - 1 kV/500 A)
Certificates / Approvals	UL Listed / GL / EAC / EAC

## 6.0 Datasheets For Telecom System Components

Consoles			
	1.	Tag No.	During detailed engg
	2.	Quantity	1 each for All Workstations (SDH NMS Client, EPABX NMS Client, CCTV Client)
	3.	Location	During Detail Engineering
	4.	Make	As per Preferred vendor list
	5.	Model No.	*
	6.	Ordering Code	*

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	7.	Type	Open desk type consoles with bottom entry and wooden top, Sliding Tray for Keyboard
	8.	Construction	CRCA
	9.	Front & Rear doors	1.5 mm
	10.	Finishing & colour	Powder coating Enclosure and doors – RAL 7035 Base – RAL 7022
	11.	Dimensions	≈ 800 (D) X 750 (H) X 800 (W)
	12.	Handles	Turn to lock type with keys 1no. for front door and 1 no. for rear door
	13.	Fan	2 nos. of fans
	14.	Illumination	2 nos. of CFL with door switch, 1no. for front door and 1 no. for rear door
	15.	Ventilation	Required, Louvers with wire fly screens
	16.	Anti vibration pad	Min 25 mm
	17.	Earthing bolts	Min 2 nos. of bolts required on the exterior
	18.	Busbars for Earthing	2 nos. of min, 25 mm wide and 6 mm thick of copper of suitable length.
	19.	Protection class	IP 31
	20.	Base frame	*
	21.	Profile	
	<b>Printer Table</b>		
SPECIFICATION	22.	Tag No.	During detailed engg
	23.	Quantity	1 each for all the printers supplied
	24.	Location	Control room
	25.	Make	As per Preferred vendor list
	26.	Model No.	*
	27.	Ordering Code	*
	28.	Type	Open table top suitable for LaserJet printers
	29.	Construction	CRCA
	30.	Finishing & colour	Powder coating colour – RAL 7035
	31.	Paper mounting rack	Required
	32.	Paper collection tray	Required
	33.	Dimensions	~ 450 (D) X 800 (H) X 600 (W)

Chairs		
SPECIFICATION	34.	Tag No.
	35.	Quantity
	36.	Location
	37.	Make
	38.	Model No.
	39.	Ordering Code
	40.	Type
	41.	Colour
	42.	Dimensions
	1.	'*' = Vendor to specify
	2.	SS tag plate with panel / console name and terminal location shall be fixed on the location
	3.	<u>Documents</u> : Specification with catalogue, GA drawing, Installation / Mounting drawing, test certificates, Installation & maintenance manual.

### SPECIFICATION FOR LASERJET PRINTER:

Make	: HP/ Cannon/ Brothersoft
Quantity	: As per PJS and TS
Model No.	: Vendor to specify
Type	: LaserJet A3 (Colour)
Paper size	: A3
Print Speed	: 20 ppm (Draft Mode) Document delivery
speed	: Vendor to specify
Duty Cycle	: 40,000
Resolution	: 600 X 600 dpi (min)
Processor	: Latest
Memory	: 128MB expandable
Two Side printing	: Required, Automatic
Networking	: Ethernet - 2nos. Languages & fonts

: Vendor to specify

Client Operating Station : Windows  
 Network Operating Station : Windows  
 Network Protocols : Vendor to Specify  
 Security Features : Required  
 Power Supply : 230V AC, 50 Hz

POWER CABLE (THREE CORE)			
GENERAL	1	Description	Power Cable
	2	Type	Armoured
	3	Size	3C
	4	Make	As per suggested vendor list
CONDUCTOR	1	Material	Annealed Bare Electrolytic Copper IS: 8130 '84
	2	Size	As per tender
	3	No. of Strands / Strand size mm	<input checked="" type="checkbox"/> 7/as per size <input type="checkbox"/> 7/0.53 <input type="checkbox"/> 7/0.43 <input type="checkbox"/> 7/0.37
	4	Shape of conductor	Stranded Circular
PRIMARY INSULATION	1	Material	<input type="checkbox"/> PVC (PVC Type.A - IS:5831'84) <input checked="" type="checkbox"/> HRPVC (PVC Type.C -IS:5831'84) <input type="checkbox"/> FRLS PVC
	2	Type	<input checked="" type="checkbox"/> Extruded <input type="checkbox"/> Wrapped
	3	Thickness (nom.) in mm	(Suitable for 1100V as per IS 1554 Part 1)



	4	Colour Scheme	Black ( <i>Note:2</i> )
	5	No. of twists (pair)	~ NA ~
	6	Insulation Voltage Grade	110 V
	7	Binder tape	Provided
INDIVIDUAL PAIR SHIELD	1	Material	~ NA ~
	2	Type	~ NA ~
	3	Thickness (nom.) in mm	~ NA ~
	4	Overlap	~ NA ~
	5	Coverage	~ NA ~
	6	Drain wire type / Size / No. of strands / Formation	~ NA ~
OVERALL SHIELD	1	Material	~ NA ~
	2	Type	~ NA ~
	3	Thickness (nom.) in mm	~ NA ~
	4	Overlap	~ NA ~
	5	Coverage	~ NA ~
	6	Drain wire type / Size / No. of strands / Formation	~ NA ~

INNER SHEATH	1	Material	<input type="checkbox"/> PVC (PVC Type.ST1 - IS:5831'84) <input type="checkbox"/> HRPVC (PVC Type. ST2 -IS:5831'84) <input checked="" type="checkbox"/> FRLS PVC
	2	Type	<input checked="" type="checkbox"/> Extruded <input type="checkbox"/> Wrapped
	3	Thickness (nom.) in mm	(Suitable for 1100V as per IS 1554 Part 1)
	4	Colour Scheme	Black ( <i>Note:2</i> )
	5	Dia over sheath	*
ARMOUR	1	Material	(Suitable for 1100V as per IS 1554 Part 1)confirming to IS:3975'79
	2	Size in mm	(Suitable for 1100V as per IS 1554 Part 1)
	3	Dia over armour	*
OUT ER	1	Material	<input type="checkbox"/> PVC (PVC Type.ST1 - IS:5831'84) <input type="checkbox"/> HRPVC (PVC Type.ST2 - IS:5831'84) <input checked="" type="checkbox"/> FRLS PVC
	2	Type	<input checked="" type="checkbox"/> Extruded

	3	Thickness (nom.) in mm	(Suitable for 1100V as per IS 1554 Part 1)
	4	Overall diameter	*
	5	Tolerance on overall diameter	± 2%
	6	Colour Scheme	Black (Note:2)
	7	Rip cord	Non-metallic under inner sheath
ELECTRICAL PARAMETERS	1	Conductor Resistance (max)	* at 20 Deg.C
	2	Drain wire resistance with shield	* at 20 Deg.C
	3	Insulation Resistance of cable	* at 20 Deg.C
	4	Mutual capacitance: core-core	* at 1 khz
	5	Mutual capacitance: core-screen	* at 1 khz
	6	Mutual inductance	*
	7	L/R ratio	*
	6	High Voltage Test	*
TEST & INSPECTION	1	General	According to IS:1554 (Part I) '88
	2	Insulation	IS:5831'84 except insulation resistance. Voltage/spark test BS:5308(Part-II)'86
	3	Armour	IS: 3975 '79
	4	Armour galvanisation	IS: 2633
FRLS PROPERTY	1	Oxygen index	According to ASTM D 2863
	2	Temp. index	According to ASTM D 2863
	3	HCL emission	According to IEC-754-1
	4	Smoke density	According to ASTM D 2843
	5	Flame retardent test	According to IEC-332-Part III cat. A
OTHERS	1	Drum length / No. of drums	*
	2	Total length	*
	3	Meter marking	*
	4	Possible variation in length	±5% for length < 5 km ±2% for length > 5 km

**Notes:**

1. '\*' = Vendor to specify
2. Core identification shall be as per IS:1554 (Part I)
3. A durable marking to be provided on the surface of the cable at regular intervals not exceeding 625mm. The marking shall include manufacturer's name, conductor material, size, pairs, insulation material etc. as per IS:1554 (Part 1)

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## 1.0 INTRODUCTION

OFC based MPLS-TP telecom equipment, IP EPABX system and Telephones with FXO/FXS Gateways, CCTV systems & Cameras (PTZ & Fixed); leased lines from external service provider have been envisaged for NEGG Telecommunication requirements. Detailed scope will be as define in Material Requisitions (MR) & Particular Job Specification (PJS) of the bid.

The purpose of this specification is to define the outline requirement of dedicated Telecommunication Equipments.


In case of any conflict between the specifications, enclosed data sheets, enclosed attachments, related codes and standards, the same shall be informed at the bid stage, after award of contract change will not be permitted.

Vendor shall be responsible for selection of the correct system to meet the purchaser's specifications at the time of bid. In case of any modification / change in selected equipment model at a later date to meet the Purchaser's Specifications, the same shall be done by the vendor without any price and delivery implications.

## 2.0 SYSTEM / NETWORK DESIGN & ENGINEERING AND SITE-SURVEY:

The vendor shall be fully responsible and shall carryout detailed system/network design and engineering for implementation of new telecom systems for NEGG pipeline to provide Voice, SCADA & CCTV communication facilities required for pipeline operation, which shall include but not limited to the following:


- i. Design & engineering of system/network would include/consider the following as a minimum:
  - Study of proposed system (in PJS & TS), network topology & facilities.
  - Gathering information through site-survey for complete system/network design & detailed engineering to meet the overall system availability objectives.
  - Detailed design & engineering of MPLS-TP network involving MPLS-TP equipments, its NMS, DCN systems, FXO-FXS gateways, PRC etc taking in to consideration of the followings as a minimum:
    - Optical link loss of network hops, guaranteed "End of Life (EOL)" parameters of optical Transmitter / Receiver of the offered MPLS-TP equipment and additional future optical link margin of 6 dB.
    - Site-wise availability of space & power.
    - Provision of station-wise equipped configuration of equipment.

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- Provision of reliable connectivity for Pipeline Voice (for Watchman & Maintenance), SCADA & CCTV System facilities.
- New MPLS-TP network topology/architecture of NEGG pipelines.
- Seamless Integration of the vendor supplied MPLS-TP system/equipment & PRC with regard to Network management & Network Synchronization.
- Setting up of MPLS-TP (10G)(O) [1+1] link in layer-1 connecting to MPLS-TP (10G) (O) [1+0] link in layer-2 under NEGG MPLS-TP network in line with Telecommunication Network

MPLS-TP (10G) (O) [1+1] link in layer-1 will be formed connecting designated MPLS-TP (10G) Equipment with traffic interfaces as indicated in PJS. For the same, necessary provisioning of optical amplifiers, DCM module (amplifiers, pre-amplifiers, DCM module as required), dispersion compensation etc as required to provide future optical link margin of 6 dB (plus 2dB noise margin) as a minimum. All these optical amplifiers, boosters and any other active opto-electronic units, which will be installed along with new MPLS-TP equipment (at those designated locations, preferably in the same chassis) for setting up MPLS-TP (10G) (O) [1+1] layer/tier, shall be from same OEM (or OEM accepted & recommended) of MPLS-TP equipment and shall also be manageable from the new MPLS-TP NMS systems. To meet the link- engineering requirement, MPLS-TP (10G) equipment(s), with traffic interfaces can also be installed at intermediate MPLS-TP (10G) location(s) between designated MPLS-TP (10G) locations. At all other remaining intermediate MPLS-TP (10G) locations, MPLS-TP (10G) equipment with traffic interfaces will be installed to form the MPLS-TP (10G) (O) [1+0] layer, which will be interconnected to the MPLS-TP (10G) (O) [1+1] layer.

- Detailed design & engineering of IP based EPABX systems, CCTV system of NEGG pipeline locations and its associated systems.
  - Detailed design / engineering of all other supplies to meet the tender requirement.
- ii. The vendor shall carryout site survey / inspection as required for design, engineering, installation, integration & commissioning of equipment at site by deploying its competent technical manpower and test/measuring equipment / instruments, tools & tackles. The mentioned site survey & inspection, measurements need to be undertaken following standard test / measurement procedures using calibrated test/measuring equipment / instrument by the vendor.
  - iii. The vendor shall prepare and submit the Network Design Basis document meeting IGGL's telecom facilities requirement immediately after the award of contract for approval of IGGL. As part of network design basis document, the engineering & design details like: Hop-wise Optical link engineering /budget calculations, MPLS-TP equipment setup for providing Voice, SCADA & CCTV system, space & power requirements for all supplied items, network synchronization, local & remote network management provisions, integration / interfacing to existing telecom

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system/network, station-wise equipment/cabling lay-out plan, system/network availability calculations, IP based EPABX system, CCTV system provisioning details etc are to be provided as a minimum.

The vendor shall be fully responsible for detailed engineering and design of the proposed system. The vendor shall design the network in a scalable fashion so as to support the future bandwidth and service needs. The vendor shall provide full details of the network design & engineering (all parameters) in the proposal with regard to following in line with Specifications, requirements & Design guidelines, given elsewhere in this document.


- Optical Link Engineering Hop-wise
- Network Management of MPLS-TP elements
- SCADA polling over IP based channel
- Network Synchronization
- Lease Line Network link engineering for all specified locations

The network shall be configured, equipped & integrated to ensure smooth & efficient operation of SCADA system including facilities like Voice, Data and CCTV Surveillance system.


## 2.1 DESIGN GUIDELINES FOR TELECOMMUNICATION EQUIPMENTS:

1. The system design shall be flexible enough to meet future expansion program up to the maximum capacity of each system and sub-system without deteriorating the performance of the system.
2. In general, specifications provided throughout this document shall apply. In case of conflict more stringent specifications shall override specifications given elsewhere and decision of the Owner/Engineer in all such cases shall be final.
3. Equipments shall conform to the similar housing standards and shall preferably be integrated in one 19" or slim rack or ETSI rack for at stations.
4. The optical and multiplexing equipment should be able to work continuously in non air- conditioned environment (guaranteed performance) under prevailing environmental conditions of the sites.
5. All venting, cooling shall be natural. However, in case of equipment internal forced cooling with suitable dust filters may be used, if required.


All equipments shall have sufficient number of alarms and supervisory indications and shall be provided with self-diagnostic facilities. All alarms and monitoring & diagnostic facilities shall be built-in & shall be displayed on the front panel of the equipments for ease of maintenance. It shall be displayed on the front panel of the equipments for ease of maintenance. It shall be possible to transmit these indicators, parameters to the control stations/NMS.

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- a. The point shall be available on the front panel for system monitoring and easy fault- location.
  - b. The healthy condition of the units shall be displayed by green LED's, unhealthy condition by red LEDs.
  - c. All-important switches shall be provided with controls on the front panel with suitable safeguard to avoid accidental operation. Manual changeover should be performed by more than one Sequential operating procedure to avoid accidental operation.
6. The equipments shall be fully based on solid-state technology. The system hardware shall be modular to have flexibility to meet any demand for expansion or modification with minimum changes.
  7. All equipments shall be immune to EMI, RFI interferences generated by any nearby source & shall meet the latest international standards in this regard.
  8. The equipments shall be capable of functioning with minimum maintenance and shall be preferred to have no requirement of any preventive maintenance.
  9. All PCBs used shall be glass epoxy type and shall not chip owing to repeated soldering/de- soldering. The PCBs shall not warp on any account.
  10. All wiring-including field interconnection wiring shall be cabled and clamped to the chassis. The wiring shall follow standard color-code. All patch cords shall be provided with connectors matching to the cable used and shall have identification markings.
  11. All sub-assemblies or modules, switches and controls and the circuit components shall be so mounted as to permit their replacement without appreciable disturbance to other components.
  12. Vendor to specify the power requirement of the offered Telecom system at each telecom station.
  13. If the vendor is not using distributed power supply system on individual module basis then the Power Supply cards shall be duplicated (1+1). However, one standalone power supply card shall be able to run the system for its entire lifetime & there shall be sharing of load between the two power supply cards under normal conditions.
  14. Racks for all the equipment of individual system, sub-system shall be provided from the reputed manufacturers only and they shall adhere to all the quality norms.
  15. The equipment construction should be such that it does not allow ingress or entry of rodents, insects, and dust. For this, equipment should be suitably sealed from all sides, top and bottom.
  16. All the special tools and tackles, etc. shall be procured and supplied as a

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- package with its carrying cases, accessories (interconnecting cables, connectors, lamps, batteries, fuses etc.) for their respective manufacturer.
17. Termination for all used interfaces shall be provided with 100% spares capacity.
  18. All equipment racks, housings shall be provided with antistatic wristbands.
  19. The nodes (stations) should be hitless i.e. removing or inserting plug-in-units must not affect the existing traffic on the other unit.
  20. The configuration of the nodes should be easily expanded by adding plug-in-units and modifying software settings
  21. It is required that the laser transmitter is automatically shut down when the incoming signal is missing.
  22. Upon completion of OFC laying and termination activities by the OFC laying Contractor, the vendor shall take over the OFC link after testing jointly with the laying contractor or Client's nominated agency, witnessed by CLIENT/ Consultant in line with the approved OFC Hop Test procedure. Vendor shall restore OFC after taking over till completion of trial run. Telecom Vendor shall guide OFC contractor during splicing and termination of OFC at FTC as per the proposed approved channelling plan.
  23. Vendor shall be totally responsible for the completion of the project. Owner/Engineer reserves the right to modify, revise and alter the specifications of equipments and systems prior to acceptance of any offer. System requirements may be modified after selection of successful vendor to meet operational requirements not envisaged at the time of selection of Vendor.
  24. Owner/Engineer reserves the right to modify the system requirements till such time the system is ready for final acceptance. Vendor shall undertake to meet the revised requirements without any financial implication to the Owner provided to additional equipments of selection as required.
  25. In case at the time of implementation there is any change in the network design & configuration to meet the owner's operational requirements, the vendor shall undertake all the activities such as design, manufacturer, supply, Installation, etc. of additional equipment hardware and software for which additional financial implication, if any, shall be approved by the owner on the basis of sufficient details and justifications being provided by the vendor.
  26. If during the course of execution of the work any discrepancy or inconsistency, error or omission in any of the provisions of the contract is discovered, the same shall be referred to the Owner/Engineer who shall give his decision in the matter and issue instruction directing the manner in which the work is to be carried out. The decision of the Owner/Engineer

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shall be final and conclusive and the Vendor shall carry out the work in accordance thereof.

27. The Vendor to give full documentary proof of satisfactory worked of the system.
28. The supplier shall provide link engineering for the configuration offered, taking fibre distance to be 5% higher than the physical distances indicated in the network drawing. Following are the guidelines for the link engineering calculations for pipeline.

A	Attenuation in fibre	0.22 dB/Km for 1550 nm or 0.37 dB/Km for 1310 nm
B	Splice loss	0.1dB per splice and splices at every 2km in building the OFC link in each span/Hop
C	Connector Loss	0.5 dB per connector for 4 connectors per link
D	Required Future Margin	6 dB per link for each MPLS-TP link
E	Cable plant Repair margin	2 dB per link

Vendor to provide details of link budget calculations as part of his bid, for each hop with end of life worst-case figures as per ITU-T. Operating wavelength (optical) shall be 1550 nm.

29. Equipment Panels shall be free standing and conform to minimum IP 42 requirement. The panels shall have lockable front and rear doors and bottom cable entry and provided with gasket and fitting to keep out moisture, salt, dust, greases and corrosives. The panel shall be naturally cooled also fans shall be provided for ventilation. Panel shall be provided with anti vibration pad. Necessary positive electrical isolation for earthing shall be considered as per the requirement of Telecom equipments.

All doors, drawers, trays and other weight supporting parts shall be fabricated of metal and adequately reinforced to limit vibrations. All components and devices inside the panel shall be well highly and the panel shall have a tidy look.

The equipment cabinet (Rittal Make) to be supplied shall be constructed to allow free airflow to dissipate heat generated. Construction shall be such that ventilation grills will not be obstructed when equipment is mounted in its installed position. In order to effectively remove dissipated heat from the cabinets, Min 2 Nos. fans along with vent louvers backed by wire fly screen shall be provided. Vendor shall calculate the heat dissipation and where the calculations prove the necessity, then air flow ventilation shall be assisted by integral low power silent running air extraction fans and same shall be included in vendor's scope. Inlet ventilation grills shall be filled with dust filters.

The Vendor shall guarantee satisfactory functioning of the system hardware mounted in the panels even in the event of failure of air-conditioning unit.

Hardware mounted and wired panels of all systems included in the scope of the Vendor shall be subjected to burn-in operation for minimum 15 days before dispatch to site.

The cabinet shall be made of CRCA sheet enclosures frame minimum thickness shall be 1.5 mm and the cabinet size 2000 mm height x 800 mm width and 800 mm depth and 100 mm base frame. Anti vibration pad & positive isolation for earthing shall be considered. Gland plate thickness shall be 3.0 mm. 20 % minimum two spare hole with locking plug shall be considered.

Power supply separate feeder for Cooling fans, panel door switches, space heater, maintenance socket and Tube lights front & rear end shall be provided.

### Finish

- i. All frame and steel work of the cabinets shall be degreased, then phosphate treated or coated with primer, followed by at least two undercoats
- ii. All the cabinets shall have 'Nameplates' and 'Tag Plates' correlating with the type and location of the cabinet at both side front & back. Name Plate shall incorporate the Project Details (Client, PMC, Contractor, Project name etc.) and Tag plate shall incorporate type of panel and station type.
- iii. The color shall be RAL 7035 Gray for external and internal ; inside the cabinet. (It will be finalized in detailed engineering)

## 2.4 ENGINEERING REQUIREMENTS


The equipment shall be fully solid state and adopt state of the art technology. The equipment shall be compact and in composite construction and light weight. The manufacturer shall furnish the actual dimensions and weight of the equipment.

All connectors shall be reliable and of standard type of ensure failure free operation over long periods and under specified environmental conditions. All connectors and the cable used shall be of low lost type and suitably shielded.

The equipment shall be housed in standard 19" rack, or ETSI rack and with front access. The equipment shall have natural cooling arrangement; use of forced cooling is allowed provided:

- The Fan failure is reported to LCT as well as NMS.
- Multiple fans are there in one tray with hot standby redundancy.
- Fans are DC operated.
- MTBF for fan is better than 60,000 hours.

The plug-in units shall be suitable type to allow their removal/insertion while the equipment is in energized condition. The mechanical design and construction of each card/unit shall be inherently robust and rigid under all conditions of operation, adjustment, replacement and storage.

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Each sub-assembly shall be clearly marked with schematic reference to show its function, so that it is identifiable from the layout diagram in the handbook. Each terminal block and individual tags shall be numbered suitably with clear identification code and shall correspond to the associated wiring drawings.

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

## 2.5 MAINTENANCE REQUIREMENTS

Maintenance philosophy is to replace faulty units/subsystems after quick online analysis through monitoring sockets and alarm indications. The actual repair will be undertaken at centralized repair centres. The corrective measures at site shall involve replacement of fault units/subsystems.

The equipment shall have easy access for servicing and maintenance. Extension of degraded paths to test access point for diagnostic work after traffic is switched over to the healthy path should be provided.

Suitable alarms shall be provided for identification of faults in the system and faulty units. Suitable potential free contacts should be provided for extension of summary alarms.

As and when bugs found/determined in the software, the manufacturer will provide patches/firmware replacement if involved free of cost for three years. Modified documentation (hard copies and soft copies) wherever applicable shall also be supplied free of cost. Ratings and types of fuses used are to be indicated by the supplier.


## 2.6 POWER SUPPLY

The power supply provided for telecommunication system at respective station as define load refer the respective clause of Particular Job specification. Vendor shall select the equipments accordingly. Any AC to DC or DC to DC or DC to AC converter for other voltage if required will be in Vendor's scope.

Nominal power supply is with a variation over the range of 20 %, the equipment shall operate over this range without any degradation in performance. Power shall be provided at one point, further cabling and distribution is in the Vendor's scope.

The power consumption shall be minimal. However, station-wise maximum allowable power consumption is indicate in above respective Clause. The actual power consumption has to be furnished by the manufacturer during detailed engineering.

The derived DC voltages in the equipment shall have protection against over

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voltage, short circuit and overload.

## 2.7 EQUIPMENT SAFETY AND PROTECTION REQUIREMENTS

The equipment shall have a terminal for grounding the rack. Protection against short circuit/open circuit in the accessible points shall be provided.

All switched/controls on front panel shall have suitable safeguards against accidental operations. The equipment shall be adequately safeguarded to prevent entry of dust, insects and lizards.

### ▪ OPTICAL SAFETY REQUIREMENTS

All optical interfaces should comply to optical safety standards as mentioned elsewhere in the technical specification.

### ▪ OPERATING PERSONNEL SAFETY REQUIREMENTS

The operating personnel should be protected against shock hazards as per IS-8437 (1993) "Guide on the effects of current passing through the human body" (equivalent to IEC publication 479-1- 1984).

## 2.8 ELECTROMAGNETIC COMPATIBILITY (EMC)

The equipment shall conform to the EMC requirements as per the following standards and limits indicated therein:

Conducted and Radiated Emissions – To comply with class A [for low capacity (below 34 Mbps data rate)] of C ISPR 22 (1993). "Limits and methods of measurement of radio disturbance characteristics of information Technology Equipment".

### Electrostatic Discharge

To comply with IEC 1000-4-2 "Testing and measurement techniques of Electrostatic discharge immunity test" under following test levels


- Contact discharge level 2 (+ 4 KV)
- Air Discharge level 3 (+ 8 KV)

### Fast transient common mode burst

To comply with IEC 100-4-4 "Testing and measurement techniques of electrical fast transient/burst immunity test" under level 2 (1 KV for DC power lines: 1 KV for signal control lines)

### Immunity

IEC 1000-4-3 "Radiated RF electromagnetic field immunity test" Under Test level 2 (Test field strength of 3 V/m)

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## Surges Common and differential mode

To comply with IEC-4-6 "Immunity to conducted disturbances" indicated by radio frequency field."

## 2.9 EARTHING SYSTEM

- Standard: IS 3043-1966 or equivalent BIS & IEC standard
- The earthing material to be used shall be Electrolytic Copper having the material specifications confirming to the IS standards.
- The dimension of the Earthing strip, which shall be connected between Earth pit & the equipment or the earthing distributor, shall not be less than 25 mm X 5 mm
- The earthing pit should have water-pouring facility.
- Earthing resistance should be less than 2 ohms or should be suitable for the equipment to which the earthing is extended.
- For approval shall be taken for all drawings and the distributions up to equipment from Engineers In charge.

## 3 TECHNICAL SPECIFICATION OF TELECOMMUNICATIONS


### EQUIPMENTS MPLS-TP Equipment

The system shall support the following ITU-T recommendations for MPLS-TP

- G.8110.1/Y.1370.1 Architecture of MPLS-TP Layer Network
- G.8113.1/Y.1372.1 Alternative mechanisms for Operations, Administration and Maintenance in MPLS-TP networks using the tools defined in G.8013/Y.1371
- G.8113.2/Y.1372.1 Operations, Administration and Maintenance mechanisms for MPLS-TP networks using the tools defined for MPLS
- G.8121/Y.1371 Characteristics of MPLS-TP Network Equipment Functional Blocks
- G.8121.1/Y.1371.1 Characteristics of MPLS-TP equipment functional blocks Supporting G.8113.1/Y.1372.1
- G.8121.2/Y.1371.2 Characteristics of MPLS-TP equipment functional blocks Supporting G.8113.2/Y.1372.2
- G.8151/Y.1374 Management aspects of the MPLS-TP network element
- G.8261 G.8161 Timing and Synchronization aspects in Packet Networks
- G.8262 Timing characteristics of synchronous Ethernet equipment slave clock (EEC)
- G.8264 The Recommendation specifies the Synchronization Status Message protocol and formats for use with Synchronous Ethernet

The system shall support the following IETF standards for MPLS-TP:

- RFC 3031 Multiprotocol Label Switching Architecture
- RFC 3032 MPLS Label Stack Encoding
- RFC 3270 Multi-Protocol Label Switching(MPLS) Support of Differentiated Services
- RFC 3916 Requirements for Pseudo-Wire Emulation Edge-to-Edge (PWE3)
- RFC 3985 Pseudo Wire Emulation Edge-to-Edge(PWE3) Architecture
- RFC 4197 Requirements for Edge-to-Edge Emulation of Time Division Multiplexed

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- (TDM) Circuits over Packet Switching Networks
- RFC4377 Operations and management (OAM) requirements for multi-protocol label switched (MPLS) networks
- RFC 4378 A framework for multi-protocol label switching(MPLS) operations and management (OAM)
- RFC 4446 IANA Allocations for Pseudo wire Edge to Edge Emulation (PWE3)
- RFC 4553 Structure-Agnostic Time Division Multiplexing(TDM) over Packet (SAToP)

The MPLS-TP System should be a carrier grade multi-service platform and should be able to support whole new breed of functionalities for efficiently aggregating, switching and managing a mix of global services ranging from applicable optical MPLS-TP services and Layer-2 AND Layer -3 Ethernet services.

The MPLS-TP System should be equipped with a fully non-blocking Switch Matrix. The Equipment shall be connection-oriented packet switching model with traffic engineering capabilities that allow deterministic control of the use of network resources. It shall support traffic engineered point to point

(P2P), point to multipoint (P2MP) and Multipoint to Multipoint (MP2MP) transport path.


MPLS-TP equipment is expected to operate at Layer-1 through Layer-2 of the seven layer OSI model. The basic function of the equipment is to add/drop various traffic from multiples ports (TDM (E- 1/STM-1) / Ethernet / GigE), aggregate and transport across the network. The WAN side would allow support for carrier class protection, OAM and scalability similar to the existing SDH/SONET network as well as support for point-to-point, point-to-multipoint and multipoint-to-multipoint traffic.

In the MPLS-TP network, the services should be conveyed end-to-end through service tunnels over the underlying transport network. In the service tunnel the services (e.g., TDM, and Ethernet) are to be encapsulated and isolated from the transport layer (e.g., MPLS labels). In MPLS-TP, legacy TDM traffic should be emulated and encapsulated into Pseudo-Wire (PW) service tunnels to be transported over the carrier Ethernet network. The service tunnel should be configurable in a flexible way based on requirement

The underlying transport technology shall be able to establish transport paths within the MPLS-TP network and enable the transport paths to carry the service tunnels. The transport path shall be defined as end-to-end path as connectionless transport in principle can't fulfill carrier-grade requirements.

The MPLS-TP equipment shall collect various traffic with or without VLAN tag as per IEEE 802.1Q, aggregate and switch the same and shall hand over the 802.1ad traffic to other MPLS-TP equipment in the network for aggregation and transport through multiples of GigE or 10 GE interfaces.

For the smooth migration of the traditional TDM based network (SDH) to MPLS-TP network, the MPLS-TP equipment shall support Circuit Emulation Services-Over-MPLS.

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The MPLS-TP network shall complement the existing SDH network for better utilization of resources.


The MPLS-TP equipment may be deployed in different topologies to complement the existing network and also for the green field deployment. New pipeline network having many consumers' / compressor stations with route length more than 100 Km shall have two inter-linked optical transmission tiers with 10G MPLS-TP in Tier-1 and 10G MPLS-TP in Tier 2. MPLS-TP will be installed in phase manner in existing/old pipelines. Installed SDH will be replaced with 10 G MPLS-TP Telecom Equipment after obsolescence of existing SDH as per policy. MPLS-TP equipment/network shall be compatible for integration with existing SDH optical layer in multiple numbers of minimum STM 4 capacity

The Equipment shall support packet transport network solution by using PW service tunnel and MPLS-TP transport technology. , TDM and Ethernet traffic are emulated into Pseudo-wires and PW label is added for service identification. End-to-end transport path LSP is created based on MPLS-TP standard (ongoing) and multiple PWs are transported over the same LSP end-to-end in both directions. In order to support traffic engineered point-to-point MPLS-TP circuits it shall support all the MPLS-TP specific requirements specified in the following RFCs. No explicit support for control plane protocols is required. NMS Support shall be mandatory.

RFC 3031  
RFC 3032:  
RFC 3443  
RFC 5462  
RFC 5586  
RFC 5860  
RFC 5960  
RFC 6370  
RFC 6378  
RFC 6423  
RFC 6426  
RFC 6428

In order to support traffic-engineered Pseudo Wire Emulations (PWE) over MPLS-TP, the system shall support the following RFCs. The compliance for these RFCs is required to the extent of supporting MPLS-TP and PWE. No explicit support for control plane protocols is required. NMS support shall be mandatory.

RFC 4446  
RFC 4385  
RFC 4448  
RFC 5659  
RFC 5994  
RFC 6073

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The MPLS-TP network shall have advanced functionality like ability to create Ethernet Layer 2 VPN (channels) such as point-to-point, point-to-multipoint as well as multipoint-to-multipoint to isolate various kind of traffic into their own logical virtual network.

The switching fabric plane of the MPLS-TP equipment shall be bidirectional and non-blocking. The MPLS-TP equipment shall support a wire speed L2 switching capabilities under full load condition.

The equipment shall support Fast Ethernet electrical interface, Gigabit Ethernet (electrical & optical) & 10 Gigabit Ethernet interfaces meeting IEEE and ITU-T Standards.

All port should be Auto and Manual configurable to set parameters like: Rate/Bandwidth, Half/Full Duplex, etc.

It shall be possible to monitor transmit and receive power on all optical interface ports on the Equipment. The MPLS-TP equipment shall support built in power diagnostics to monitor optical SFP/XFP ports, system diagnostics to detect hardware failures.

All the SFP/SFP+/XFP should be with two port i.e one is TX port to transmit the signal, and the other one is RX port to receive signals.

The equipment shall support legacy E1 (TDM) interface in compliance to ITU G.704 to carry Transparent E1/PDH traffic over Packet using Pseudo wire emulation.

The equipment shall support legacy STM1 (channelized) & STM1/4 (virtual container over Packet) SDH optical interface & shall carry over Circuit emulation services (TDM to Packet).


The equipment shall support all Ethernet interface to be configurable as client interface (UNI) and network interface (NNI).

It shall be possible to manually configure end-to-end MPLS-TP tunnels through EMS. It shall be possible to create co-routed bidirectional path from EMS as specified.

It shall support the creation of L2 VPN solutions using statically configured PWs and tunnels as per RFC 4664

It shall be possible to provide 1:1 Linear Protection as per RFC 6378.

Customer ELAN traffic shall be transported over a co-routed bidirectional P2MP MPLS-TP tunnel to allow Traffic Engineered multicast traffic

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It shall support GAL/G-ACH as defined in RFC 5586 5462 The offered Equipment shall use SFP modules for all Optical Interfaces.

The Equipment should support statically configured minimum 200 LSP and 1000 PWs.

It shall be possible to rate limit the traffic in MPLS-TP tunnels at minimum 64 kbps granularity.

It shall be possible to configure end-to-end MPLS-TP tunnels & PWs EMS/NMS

Provision for suitable potential free contacts should be provided for extension of external alarms to NMS.


It shall support LAG as per IEEE 802.3ad, allowing configurations of static LAG on client ports.(Link Aggregation feature)

In order to support traffic engineered MPLS-TP circuits it shall support all the MPLS-TP specific requirements specified in the following RFCs.

- RFC 2205, 3031, 3985 MPLS Pseudo wire Emulation Edge-to-Edge(PWE3)
- RFC 3916, 4446, 4448 Pseudo wires
- RFC 5654 MPLS-Transport Profile(TP)
- LSP Static provisioning
- 1:1 Tunnel protection
- LSP BFD via GAL/G-ACH
- VPLS (Virtual Private LAN Service) and
- Hierarchical VPLS(H-VPLS)
- MPLS Performance Monitoring
- LSP Ping
- LSP Trace route
- PW Ping
- PW Trace route
- RFC 5085 LSP Ping and Trace route extensions to work over Pseudo wires
- (PWVCCV)
- Queuing for MPLS-TP tunnel

## EQUIPMENT PROTECTION

- All the traffic affecting common and control units shall be 1+1 protected, which essentially includes Switch Matrix, Synchronization/Timing Unit and Power Supply modules. Any other Controller hardware should also be protected in case its failure disrupts/affects traffic. For replacement of any faulty Controller hardware in the equipment with good one, removal/insertion of plug-in units shall be possible in energized/ powered on condition of the equipment and shall not affect the operational traffic.
- For a particular type of MPLS-TP equipment, each type of protected common & control hardware units/modules shall be of same type/model.

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- The Controller Module/Card (say "Management Controller") responsible for local & remote management from NMS and for storing NE management data/information (like: ID, Address, DCN information etc) of MPLS-TP equipment shall preferably be 1+1 protected.
- In case, the said Management Controller is not 1+1 protected and its fault resolution by the replacement of faulty controller with spare one (having default/no configuration) in the energized / live / in-service condition of the equipment is traffic affecting, the vendor shall facilitate Maintenance base locations with suitable facilities, systems, sub- systems etc for configuration/programming of spare Management Controller module, so that the configured spare module can be put into operation in place of faulty one in the affected equipment without affecting/disrupting its traffic.
- The 1 + 1 configuration shall be achieved by providing dual redundant aggregate, switch matrix, and power supply cards configured in hot standby configuration, without any single point of failure
- All the cards, modules of the MPLS-TP equipment shall be Hot-swappable including the switching matrix, power supply card, Fans etc.
- The Equipment shall support sub 50ms 1:1 bi-directional linear protection in line with applicable ITU-T/IEEE standards as mentioned below. For all the modes of protection, automatic switching shall take place within 50 ms of expiration of any manually selected hold-off time. The switching time shall be measured from the time a network failure is detected by the single Carrier Ethernet equipment until completion of all switching actions.

## NETWORK TOPOLOGY

The MPLS-TP equipment should support various network topologies as listed below:

- Multiple Rings
- Star
- Meshed-rings
- Rings
- Point-to-Point
- Linear Chains.
- dual homing


The equipment should support all possible topology requirements and should be capable of being configured as a Terminal, ADM, Regen or DXC. The Regen and ADM should be expandable to equip multiple tributary / line interfaces.

## TRAFFIC INTERFACE SUPPORT

The equipment shall support Fast Ethernet electrical interface, Gigabit Ethernet (electrical & optical) & 10 Gigabit Ethernet interfaces meeting IEEE and ITU-T Standards.

All port should be Auto and Manual configurable to set parameters like:

- Rate/Bandwidth, Half/Full Duplex, etc.

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- It shall be possible to monitor transmit and receive power on all optical interface ports on the Equipment.
- Equipment shall have standard pluggable SFPs/SFP+s minimum for all optical interfaces.
- All the SFP/SFP+/XFP should be with two port i.e one is TX port to transmit the signal, and the other one is RX port to receive signals.
- Support legacy E1 (TDM) interface in compliance to ITU G.704 to carry Transparent E1/PDH traffic over Packet using Pseudo wire emulation.
- Support legacy STM1 (channelized) & STM1/4/16 (virtual container over Packet) SDH optical interface & shall carry over Circuit emulation services (TDM to Packet).
- All Ethernet interface shall be configurable as client interface (UNI) and network interface (NNI).
- The Equipment shall support jumbo frame of 9600 Bytes (minimum).
- Devices shall support full throughput for the entire mentioned interface

#### Services:


The Equipment shall support the following services within metro domain as well as the intercity traffic links:

- MEF defined E-LINE services, including the Ethernet Transparent services
- MEF defined E-LAN services
- Support legacy E1 TDM services over pseudo wire for connectivity and traditional voice services.

#### QoS Support

The Equipment shall support traffic classification based on the following:

- Source Interface
- VLAN ID
- 802.1p priority bits
- DSCP/TOS (RFC 5462)
- The Equipment shall support marking of 802.1P, DSCP, EXP/TOS, bits.
- It shall be possible to classify the micro-flow at the ingress.
- The Equipment shall support rate-limiting per class (or flow) in steps of 64kbps for less than 1 Mbps and at 1 Mbps for 1-100Mbps and at 100 Mbps granularity for 100-1000 Mbps. It shall be possible to define Committed Information Rate (CIR) and an Excess Information Rate (EIR) for each flow in steps of 64kbps.
- The Equipment shall support following burst sizes: 16K, 32K, 64K, 128K and 256k Bytes.
- The Equipment shall support Single rate policer, two rate three colour metering (trTCM) as per RFC 2698 and RFC 4115 and colour blind single rate policer and trTCM based metering. There shall be an option to trust the colour of the incoming packet.
- Traffic shaping at egress shall be done on per MPLS-TP Tunnel basis.
- The Equipment shall support 8 class of service per flow.

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- The Equipment shall support following scheduling scheme:
- Strict priority (SP)
- SP + Weighted Round Robin (SP + WRR) Interface type
- The Equipment shall support congestion avoidance mechanism like WRED and
- Tail Drop.

### Operation Administration and Maintenance


- The Equipment shall support Performance monitoring as per ITU-T EthOAM (Y.1731)..

The Equipment shall support OAM feature as per IEEE 802.1ag or based on Proactive continuity and connectivity verification. It shall also support Proactive continuity Verification, Continuity Check and Remote Defect Indication as per RFC 6428.

- It shall be possible to enable/disable IEEE 802.1ag on a per port basis for non MPLS-TP tunnels for the purpose of monitoring the traffic. It shall support Client failure indication as specified in RFC 5860.
- RMON performance management shall be supported based on port.
- The system shall support IEEE 802.1ag for detection, verification and isolation of connectivity failures.
- The equipment shall support MPLS-TP OAM as per ITU-T G.8113.1 standards based on ITU-T Y.1731 or ITU-T G.8113.2 based on BFD including CC (continuity check), RDI (Remote Defect Indication), AIS (Alarm Indication signal), LM (Packet Loss measurement), DM (Delay measurement), LB(OAM loopback), LT(Link trace)
- The system shall provide the capability to diagnose and determine the location of any fault within the network.
- Vendor shall supply service traffic statistic function to be easy to user bandwidth calculation.
- Vendor shall supply service traffic statistic function to be easy to user bandwidth calculation.
- LSP End-to-End Monitoring shall be supported.
- PW Monitoring shall be supported.
- Per-node MEP shall be supported.
- Per-node MIP shall be supported.

### Security

- Port Mirroring: It shall also be possible to mirror a particular service from a particular port or on per SVLAN/PW basis to a probe port.
- Broadcast Storm control: It shall be possible to control multicast, broadcast traffic on per tunnel basis. Frames shall be dropped once the per-second counter goes beyond the configured limit.
- Access Control List (ACL): It shall support ACLs to prevent unauthorized access. It shall be possible to deny traffic based on the following:
- Source Interface type

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- Source/ destination MAC
- VLAN ID.

### Circuit Emulation


- The equipment shall support E1/STM-1 circuit emulation mechanism.
- It shall support minimum 2\* STM-16 channelized ports Circuit Emulation Services Over MPLS as per PWE3 standard to aggregate the TDM PW from the edge and accessCEN. The hardware should support STM-16 interface for future use.
- It shall support minimum 16\* E1 Interface.
- It shall support minimum STM1 or STM4 interface as well
- It shall support Structure-Agnostic Time Division Multiplexing (TDM) over Packet (SAToP) which is defined by IETF RFC 4553

### INTERFACE SUPPORT

Interface support for the Equipment:

- The equipment shall support the following IEEE standards and ITU-T Standards interfaces.
  - 10/100/1000BaseT, 1000BaseSX, 1000BaseL.
  - 10GBASE-SR, 10GBASE-LR and 10GBASE-ER
  - The MPLS-TP Equipment shall support full duplex capabilities on all Ethernet ports
  - E1 Interface
  - Equipment shall have capability to carry STM1, STM4 and STM16 TDM traffic as well.
  - It shall be possible to use all optical interfaces as either client interface and/or network interface
  - Each port shall be configurable for any direction of transmission.
  - The Equipment shall support jumbo frame of 9kBytes. The MTU shall be configurable from 64 Bytes to 9kBytes.
  - The Equipment shall support MDI-X based auto-uplink feature.
  - It shall be possible to monitor transmit and receive power on all optical interface ports on the Equipment.
  - The Equipment shall be based on commercially available pluggable (SFP/XFP) optics for all optical interfaces.
- Network should support below interface
- Tier 1 Network  
Equipment should support STM1/STM4/STM16 capacity worth 5G TDM traffic over MPLS TP.
  - Tier 2 Network  
Equipment should support STM1/STM4 capacity worth STM4 TDM traffic over MPLS TP.

### Packet Switching Fabric

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- The equipment shall support fully centralized redundant switching matrix.
- Equipment shall have minimum 160G packet fabric bi-directional (full duplex) fully non-blocking centralized switch matrix at tier1.
- Equipment shall have minimum 160G packet fabric bi-directional (full duplex) fully non-blocking centralized switch matrix at tier2.
- Physical Layer Features Equipment shall have full duplex capabilities on all Ethernet ports.
- Equipment shall not have any single point of failure.

### Forwarding and learning Support

- The Equipment shall support IEEE-802.3-2002 standard.
- The Equipment shall have unique MAC address.
- It shall be possible to override Equipment MAC address via user configuration
- The Equipment shall support minimum 128K MAC address  
The Equipment shall support the minimum 1K number of statically configured bidirectional LSPs.
- The Equipment shall support Ethernet PW as specified by RFC 3985 and RFC 4385. It shall support Ethernet PW as specified by RFC 4448. The equipment shall support minimum 2K number of bi directional Ethernet PW entries.
- All static entries shall NOT be aged.
- The Equipment shall support Hardware based aging of MAC Address
- It shall be possible to maintain static multicast entries in a separate multicast table.
- Equipment shall support minimum 512 Multicast groups with minimum 2K Members per group.
- The Equipment shall support update of Multicast table using IGMPv1, v2, v3 snooping.
- The Equipment shall support minimum 256 number of VPLS/H-VPLS entries to provide MP2MP services in case of VPLS mode of operation.

### VLAN Switching Requirements

- The Equipment shall have UNI (User Network Interface) and NNI (Network Node Interface). Typically, UNI would be configured in 802.1Q mode or Q-in-Q mode and NNI shall be in MPLS-TP (P2P) or VPLS/H-VPLS (MP2MP) mode. In order to simplify the operation of the product it is intended that no restriction be placed on UNI and NNI ports and all the ports shall be capable to support any mode of operation.
- Single tagged or 802.1Q Mode
- It shall be possible to configure all 4K VID on all ports and at the same time

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support all 4K VLANs simultaneously. The operator must be able to reuse the same VLAN-ID on a different port on the same switch and terminate it into a different PW.

- It shall be possible to accept untagged, prioritytagged and C-tagged frame through an 802.1Q port.
- MPLS-TP RFC for Traffic Engineering or 802.1ad mode Requirements
- It shall support VLAN stacking as per IEEE 802.1ad.
- The Equipment shall have minimum of 4K S-VIDs. VID's "0" and "FFFF" shall be reserved.
- It shall allow only S-tagged frame in 802.1ad ingress ports. It shall be possible to map the traffic to any PW (towards the WAN interface) based on SVLAN
- It shall be possible to set the priority bits in the S-VLAN priority based on the priority bits of C-tag of the incoming packet in 802.1ad mode. It shall be possible to map the priority to EXP/TC bit of the MPLS-TP tunnel towards the WAN interface.


#### NETWORK PROTECTION

- The equipment should be configurable for both protected as well as unprotected services. Offered MPLS-TP equipment shall also meet the requirement of traffic protection wherein the continuity of traffic between traffic end points with availability of any single continued path between those end points via new equipment over multiple segments.
- The equipment shall also support sub 50ms switching mechanisms for Layer-2 Ethernet traffic through implementation of schemes like RPR/ERPS etc.

#### INTERFACE FEATURES AND CAPABILITY:

##### a) Optical interfaces:

- The MPLS-TP equipment shall support applicable 10G and 1G optical interfaces in the same platform compliant with latest ITU-T MPLS-TP specifications.
- The MPLS-TP equipment shall support applicable STM 1/ 4/ 16 optical interfaces in the same platform compliant with latest ITU-T specifications
- The optical ports of offered MPLS-TP equipment shall have broadband / white-band receiver, which will accept and operate with corresponding MPLS-TP equipment over optical signal of both 1310 nm and 1550 nm wavelengths.
- For Optical MPLS-TP interface, which will be used for a link as indicated for which optical link loss has been provided mention below, the interface type (long-haul / short haul operating @ 1310 nm/1550 nm) will be determined considering the associated optical link loss, its guaranteed "End of Life (EOL)" parameters of optical Transmitter / Receiver and additional future optical link margin of 6 dB. Other

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equipped optical MPLS-TP interfaces shall be of minimum Long-Haul (LH) type (@ 1550 nm).

**b) Electrical Interfaces:**

The MPLS-TP equipment shall support E1, E-3, DS-3 & STM-1E interfaces in the same platform having the following features:

a. E1 interfaces:

- Shall be as per ITU-T G.703, G.704 specifications.
- Shall support 120 ohm balanced interfaces.

b. E3 (34 Mbps) & DS-3 (45 Mbps) interfaces

- Shall be as per ITU-T G.703, G.704 specifications.
- E3 and DS-3 interfaces shall be supported


c. STM-1E interface as ITU-T specifications

**c) Ethernet Interfaces & Services:**

- The MPLS-TP equipment shall provide Fast Ethernet electrical interface and Gigabit Ethernet optical interface. The FE & GE ports shall be provided using Electrical (10/100/1000 Base-T, RJ-45 connector) & Optical interfaces (1000 Base LX @GbE SFP) respectively.
- 10Base-T, 100Base-Tx & 1000Base-LX shall be complied with IEEE 802.3, 802.3u & 802.3z respectively.
- All Ethernet interfaces shall support QoS functionality in compliance to IEEE 802.1p.
- The equipment shall provide Layer-2 Ethernet services for provisioning of Point to Point, Point to Multipoint and Multipoint to Multipoint LAN configuration (EPL, EVPL, EPLAN, EVPLAN), Layer 2 aggregation, VLAN tagging complying to IEEE & MEF standards.
- The equipment shall have IGMP Snooping features to effectively handle the multicast Layer-2 Ethernet traffic, so that the spread of the multicast data on layer 2 network can be prevented efficiently without choking the backbone capacity.

**Packet Switching Fabric**

- Bi-directional (full duplex) fully non-blocking switch matrix capacity shall support full throughput for all the interfaces as per 8.11. Complete Switching Fabric should be 1+1 protected. . If one switch matrix module fails, the complete switch matrix should switch to protection module. The equipment

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should be multi-service ready from day one

### SYNCHRONIZATION:

- It shall support adaptive timing where the clock is recovered from data in the PWE3 frame and the arrival time of the frame. Frequency accuracy of  $\pm 15$ ppb should be provided.
- The method of synchronization used shall meet traffic interface requirements as specified in G.813 Section 5 and G.823 Section 1.2.4 for Synchronization interface.
- It shall support SyncE as per ITU-T G.8261
- MPLS-TP equipment shall be able to synchronize from the respective new Synchronization sources to be supplied under this project. Vendor shall synchronize the new network by deriving the network clock. Other clocks as required shall be provided as per ITU – T recommendation.
- The MPLS-TP equipment should have a minimum one Input & minimum one output Synch Interfaces.
- The equipment should be capable to synchronize from:
  - a) External clock   b) Other MPLS-TP Internal clock   c) Internal Stratum clock.

The synchronization shall be as per the following specifications:

- a) Compliance with ITU-T G.813 standard for clock accuracy.
- b) Compliance with ITU-T G.811, G.812 and G.813 standards for minimum free-run accuracy, MPLS-TP jitter and wander and holdover stability

### MPLS-TP EQUIPMENT CONFIGURATION:

**Equipment Capacity:** Category-wise Equipment Capacity in respect of providing maximum numbers of various type of traffic interfaces without addition / upgradation of common & control modules (like: Switch Matrix, Synchronization/Timing unit, and Power Supply modules etc) and sub-rack/motherboard of MPLS-TP equipment are as given below:

Equipment Type	Full Duplex Packet Switching Fabric (Gbps)	10 G (Optical) Line Interface (Minimum)	1 G (Optical) Line Interface (Minimum)	10/100/1000 Base-T (Fixed Electrical Interface) (Min)	10/100/1000 Base-T -GbE (Min)
MPLS-TP Tier-1	160	6	2	16	2

Equipment Type	Full Duplex Packet Switching Fabric (Gbps)	10 G (Optical) Line Interface (Minimum)	1 G (Optical) Line Interface (Minimum)	10/100/1000 Base-T (Fixed Electrical Interface) (Min)	10/100/1000 Base-T -GbE (Min)
<b>MPLS-TP Tier-2</b>	160	6	2	16	2

It shall be possible to equip the above-mentioned equipments with traffic interfaces up to the capacity mentioned in above table for carrying traffic up to the maximum interface rate/speed of individual traffic interfaces/ports in non-blocking manner. For 10G and 1G optical line interfaces, SFPs shall be provided only for the interfaces which shall be used for traffic interface as per the network requirement. The equipment shall be configured from day 1 such that it shall be possible to installed and operate the required SFP of maximum possible distance in the spare ports in the future without any need for hardware or software modification. However, for other interfaces (10/100/100 base-T (fixed)), SFPs shall be provided from day 1 for each port including the SFPs for spare ports. For other interfaces (10/100/100 base-T (GbE) ), SFPs shall not be provided and only spare ports shall be provided.

**Note 1:**

All the MPLS-TP equipment in terms of supporting various interfaces shall be as per above as minimum in a single self as per the present requirement suggested in proposed Telecommunication network; at any interface node present requirements with spare (25 % or minimum 2 nos port - optical) as required has to be considered while designing/ selecting the equipments.

- For a particular type of MPLS-TP equipment, each type of protected common & control hardware units/modules shall be of same type/model.
- Each type of optical & Ethernet interface shall be equipped using minimum two nos. of same type/model hardware modules/units in the offered equipments for all sites. However, Base-T 10/100/1000 GbE ports may be provided in a single card also.
- In case, it is not possible to equip the entire equipment in a single main-chassis; the use of only a single expansion-chassis, provided through extended system backplane, shall be permitted. There shall be neither cross-connections performed in the expansion-chassis nor any control-card housed therein.
  - Ethernet Cable:

Ethernet patch cable [Length = 20 meter (min.)] for all equipped Electrical &

Optical Ethernet interfaces shall be provided.

- **Equipped Configuration:** The equipments at various locations shall be equipped and configured as per telecom network with respect to traffic interfaces and Cross- connect switch-matrix.
- **Software / Firmware Version:** The software / firmware version of the MPLS-TP equipment shall be latest & proven one and shall be same for each type of offered models.

### EMS related requirements

- The EMS shall provide support for a comprehensive Element Management System (EMS) as detailed in this document.
- The EMS shall be provided with an open northbound interface towards Network Management Layer (NML) as per TMF-814 compliant CORBA or TMF 816 based MTOSI for future NMS/OSS integration objectives.
- The EMS shall ensure functional compliance as well as protocol compliance for the management system.
- The modeling of the EMS shall be as per ITU-T Recs. M.3100 & M.3010 and software of the system shall reside in the Work Station/Server.
- Soft copy of EMS on a CD / DVD / Pen Drive shall be provided. The setup/procedure to download the software shall be very clearly mentioned in the system manual of the equipment.
- The EMS shall have mechanisms to be updated with latest security fixes to ensure malware protection.
- EMS shall support E2E service provisioning management as per user-defined topology


### ELEMENT MANAGEMENT FUNCTIONALITY

The MPLS-TP system / Network Element (NE) shall be managed locally & remotely by Local Craft Terminal (LCT) and remotely by central Network Management System (NMS) through standard interface in line with ITU-T standards.

Any single NMS shall be able to manage all the MPLS-TP systems/NEs, which will be supplied under this project, irrespective of their management areas/subnets.

#### GENERAL OPERATIONAL & FUNCTIONAL FEATURES


- a) The EMS shall be multi-user system and based on Graphical User Interface.
- b) It shall be possible to generate reports for various types of faults, performance history, security management etc. It shall also be possible to view and export current and historical PM data at PW, LSP and port level.
- c) The proposed EMS shall support 24x7 hours real-time monitoring.
- d) It shall provide graphical user-friendly interfaces to realize device configuration, end-to-end service management, and topology management, alarm monitoring, performance supervision, security management.

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- e) It shall support network maintenance by providing information about alarms, Performance, Network logs, statistics.

It shall be possible to have a view of selected sub-networks/rings controlled by the Element Management System as per requirement. It shall be possible to drill down up to module-level in each Network Element (NE) for configuration and fault management. A cut-through to NE craft page may also be provided to perform the above operations.

- f) The EMS shall be able to diagnose its own faults and generate report on demand by running diagnostic software.
- g) The Element Manager shall provide the complete view of the NEs and the interconnecting links. The EMS shall have the ability to include the NEs and the links in the visual/graphical map of the domain. The visual maps shall display the elements and the links in different colour depending upon the status of the links.
- h) It shall provide the ability to drill down to the individual element, then to subsystem, then to card and then to port level configuration template from the domain-map by clicking on the icon of the network element.
- i) The Element Manager shall have suitable system level backup mechanism for taking backup of EMS data of at least one month.
- j) The EMS shall provide the visual presentation of the Network Element's status and the alarms. The operator can also customize the background map supporting different background image types like JPG, JPEG, GIF, and PNG.
- k) It shall be possible to take any Network Element out-of-service & in-service from the EMS. It shall be possible to restart the Network Element from EMS.
- l) The configuration of the various network elements like creating, viewing, and editing shall be possible from the EMS.
- m) Manufacturer shall provide soft copy of his EMS on a CD, CD/DVD or Pen Drive. The setup/procedure to download the software shall be clearly mentioned in the system manual of the equipment.
- n) Service management:
- i) It shall be possible to create/manage e-access, e-line, e-lan and e-tree services.
  - ii) It shall be possible to insert a node in a ring or between a pair of nodes.
  - iii) It shall be possible to remove a service
  - iv) User shall be able to see alarms and PM at Service level.
  - v) It shall be possible to see affected services by selecting an alarm.
  - vi) LOS alarm shall be shown visually on links in topology view.
- o) Adding one NE shall automatically update the management control plane of other network elements which are part of same sub network
- p) EMS shall be able to synchronize to NE automatically for configuration and alarms on connection re-establishment.


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- q) Calendar Management: It shall be possible to execute any schedulable administrative task/command i.e.- NE backup and performance at any time by attaching a time tag to the command and it shall be executed when the Network real time matches the time tag. It shall be possible to define both time and date. If no date is mentioned, the task/command shall be executed daily at the time indicated.
- r) The supplier shall provide all necessary interface details (with the documents) for integration of its EMS with existing or proposed NMS / OSS (irrespective of its brand/make) and also provide time bound support for its integration, under obligation of a Non-Disclosure Agreement (NDA).
- s) The supplier shall provide infrastructure requirements to the purchasers for setting up the EMS. The items of infrastructure include A/C power, Air conditioning load, space etc.
- t) A Disaster Recovery EMS shall also be planned with main EMS, with manual/automatic switchover between them.
- i) It shall be ensured that EMS connectivity to sub-network is not disrupted and there is no loss of EMS performance and fault data from the sub-network. To ensure EMS connectivity to the sub-network under control-card failure, there shall be provision to connect two Gateway NEs (GNEs) in a sub-network from EMS. The performance and fault data for the sub-network shall be available even if the master control-card at one GNE fails. In case of total loss of EMS connectivity, the sub-network shall continue to provide the services without any deterioration.
- ii) In case of total loss of EMS connectivity, it is recommended that the performance data of the NE shall be stored in the controller card, and shall be sent to central EMS server upon restoration of EMS connectivity. It is recommended that minimum of 16 fifteen Min intervals and 1twenty four Hr intervals of performance and fault data messages containing a minimum of 100 alarms shall be stored by the system. The response time shall however, be reviewed depending upon total NE load and topology by purchaser during testing of EMS.
- iii) In case of loss of EMS connectivity, the LCT privilege shall remain for monitoring and for local configurations, as privileged by EMS administrator.
- iv) The centralized EMS may consist of standalone application server, database server or it can be a standalone EMS server subject to scaling requirements.
- v) Login to EMS for any network related operation shall be through a user name / password.

## 5.2 NETWORK MANAGEMENT FUNCTION

- a) The equipment EMS shall provide general management functions as given below. The filters for performance and fault management shall also be provided.
- i) Configuration Management: The equipment EMS shall support configuration and provisioning capabilities. The system shall support 'Point & Click' provisioning in a sub-network, subject to clearance by Inventory Management, shall be supported as per the following configuration provisioning:
  - To create the network as per the required topology.

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- Network Element creation in the NE Management domain.
- Configuring the interface cards for service provisioning.
- To create, update, delete and retrieve the managed network topology data.
- Configure ring protection and linear protection as per the topology.
- Network Element configuration.
- Software download (local & remote).

ii) Fault Management: The EMS shall support 'Fault Management Functions'. The 'Equipment Management Function' within the Network Element shall perform a persistency check on the fault-cause, before it declares a fault causing failure. Each failure and clearance shall be time-stamped. The equipment shall do surveillance of alarms & their detection, reporting of relevant events and conditions that lead to the generation of alarm after filtering. The system shall support the alarm history. Further, the element management system shall support the following:

The EMS shall have total alarm visibility of all NEs under its management not limited to the following.

- Real time alarm monitoring and collection
- Alarm display with audible and visual alert signal
- Alarm graphical representation on network map
- Alarm storage
- Alarm reports
- Alarm attributes and colour coded.
- Archiving and exporting
- Alarm acknowledgement and alarm clear
- Alarm filtering.
  - ☐ The fault management system shall be able to perform the following, but not limited to, functions
- Network and service fault alarms with severity level indicators.
- Archive log for historical alarms and events.
- Threshold alarms
- End-to-end logical connection view of service components.
  - ☐ Alarm notification to be generated and recorded, the alarm notification shall include: type, occurrence, severity, probable cause and clearing.
  - ☐ Storing and processing of current alarm information, up to module/unit level.
  - ☐ Storing and processing of historical alarm information for approximately 30 days with a minimum of 10000 historical alarms supported.
  - ☐ Assigning alarm severity i.e., Critical, Major, and Minor

iii) Performance Management: The equipment shall support the 'Performance Management' functions, which shall consist of set of functions that evaluate and report on the behaviour of network element and their effectiveness relating to the communication taking place on the network. The performance management shall deal with definitions, evaluation and reporting of equipment performance. The EMS shall be able to retrieve, generate and print reports and graphs on Performance Management data based on real time, time intervals, daily, weekly, monthly, or specific period, for all NEs and its resources by using the built-in report capabilities. The System shall be able to support provision of performance measurements (e.g. QoS/CoS) for the following but not limited to:

- ☐ Interface/ Port level
- ☐ Logical interface level
- ☐ Service type

The near-end performance monitoring, far-end performance monitoring, performance data collection and performance history shall be provided as per Y.1731. Performance history for minimum 30 days shall be supported with configurable launch-time and performance evaluation/integration period. The main performance functionality to be provided shall be as under:

- ☐ Performance reporting and monitoring.

- ☐ Performance history (data logging)

The EMS shall store the performance data of the sub-network in terms of configured services. In addition to, the following shall also be some of the different parameters that shall be stored-

- ☐ The collection of the performance counters shall be performed at 15 minutes and 24 hours intervals
- ☐ The EMS shall provide extensive network performance reports for end to end service latency, jitter, packet loss etc.
- ☐ The EMS shall provide network utilization reports based on links, tunnels, services.

The EMS shall also provide the power levels of Optical interfaces. The EMS shall also support the following:

- ☐ LSP Ping
- ☐ LSP Traceroute
- ☐ PW Ping
- ☐ PW Traceroute
- ☐ RFC 5085 LSP Ping and Trace route extensions to work over Pseudo wires (PWVCCV)

iv) Security Management: Security management shall control the system access and prevents the network from illegal login and ensure the security of the database. The account can be added, modified, and locked/unlocked. Different authorities and passwords can be assigned to different users. Security management includes role management, account management, and log management. The management system shall provide adequate security to the data and for the access to the management system as per the following details:

- ☐ The EMS shall have the capability of supporting the management of Network through local

and remote Operators. The authorizations and the privileges of the operators (Remote and Local) shall depend upon the Login and Password.

- Low level protection for read only access to faults and performance information.
- Medium level protection for access to configuration status and features.
- High level protection for control of access to change in the configuration and control parameters.
  - ☐ Network management security features shall include operator authentication, command, menu-restriction and operator privileges.
- The system administrator shall be able to monitor and log all operator activities in the EMS and NE.
- The dynamic password facility shall be provided in which the operator may change his password at any time.
  - ☐ All log-in and log-out attempts shall be logged in the security log file of the EMS system.
  - ☐ It shall be mandatory for the system to have a record of all log-ins for a period of at least six months.
  - ☐ The EMS shall be able to back up and restore the data base to and from external storage media;

☐ EXTERNAL SECURITY MEASURES: Network security may require deployment of external devices/machines/ firmware at the network operation centre [NOC], like:


- Firewalls
- access control servers
- data encryption devices/use of PKI keys
- anti-virus packages.
- In the data communication network (DCN) for management system, VLAN tags/MPLS labels may be used for security to information flows from Gateway NEs (GNEs) to DCN Gateways with IPSec, PKI security options.

v) Inventory management:

- ☐ It shall indicate the absence or presence of any physical module in hardware elements.
- ☐ The EMS shall be able to discover and keep the device information
- ☐ The EMS shall provide the complete view of the network elements and the interconnecting links.

vi) Software Management: It shall be possible to carry out the following tasks under the software management function:

- ☐ Loading of new system software.
- ☐ At the time of downloading the software, the message shall be displayed that the software has been downloaded successfully or failed and at what stage.
- ☐ The EMS shall support FTP/TFTP for downloading of Software, configuration, etc., to the Network Element.
- ☐ The operator terminals (local & remote) shall not allow loading of any software without the terminal administrator's authorization.

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☐ Local & remote software download via management system to NEs and LCT shall be possible, including the means of identification of software module versions. No loss of data/traffic & connection-map shall take place during the software down-loading process.

Local & remote software download via management system to NEs and LCT shall be possible, including the means of identification of software module versions. No loss of data/traffic & connection-map shall take place during the software down-loading process.

b) Management Interface: The complete details of the management interface and the protocols, as pertaining to each layer of the protocol-stack implemented in the management system, shall be made available, for the purpose of integrating the local management capabilities with the centralized NMS at a later date. The requirements, in brief, shall be:

☐ Protocol details at all layers of TCP/IP stack.

☐ PHY I/F at each layer.

☐ Database structures.

☐ Number formats.

☐ Node addressing system.


☐ Complete application software details etc.

c) SOUTH BOUND INTERFACE: The system shall provide at least one Local Management Interface and one remote management interface at each Network Element. The system shall provide an SNMP version 2c [or later interface] with standard MIBs Browser. It shall be implemented on UDP/IP stack at all Gateway NEs (GNEs) to interact with a centralized Element Management System (EMS). Or else ITU-T specified Qx or Bellcore specified TL1 interface implemented on TCP/IP, or HTTP interface API based remote management interface shall also be acceptable.

d) NORTH BOUND INTERFACE: For remote management purposes, the equipment shall provide remote and local management interfaces at NEs as outlined in the GR. The northbound interface of the EMS towards NMS layer shall be TMF 814 CORBA [version 2 or higher] or TMF 816 based MTOSI. The purchaser may verify SNMP MIBs and CORBA or MTOSI IDLs during the product testing.

e) Local Management Interface: The manufacturer shall provide a Work Station/Network Server, which shall act as a manager of management activities, i.e. monitoring and controlling NEs or an NE within the management domain. The Local Craft Terminal i.e., a Personal Computer shall support the local management of NEs. The Local Craft Terminal and Network Server shall be operating simultaneously. The inter-office communication shall be facilitated through DCN channels or dedicated data-link. The equipment shall provide /USB//RS232/RJ-45 for connecting a PC-server as a Local Craft Terminal.

f) User Interface: The management system shall be provided with user-friendly interfaces based on Windows/UNIX/LINUX icons & menus and mouse to accomplish management function that needs user interventions. The EMS start-up and shut-down shall be user friendly, and shall provide installation documents and user guides. The EMS shall be able to provide a geographical view of the managed network. It shall be possible to access any manage node with in the whole network in the managed domain. The EMS shall be able to depict the failure state of each link and node in the displayed network. Further, it shall also be possible from the EMS system to get the details of status of an

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individual managed NE, such as equipment presence, settings, alarm status etc.

#### **POWER SUPPLY REQUIREMENT:**

MPLS-TP equipment shall work on (–) 48V DC supply (Nominal) with the provision of dual supply inputs and shall meet the following requirements:

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

Types of fuses used in the equipment are to be indicated along with their ratings and 100% spares for the same shall be supplied by the vendor along with the equipment.

The equipment shall be adequately protected in case of voltage variation beyond the range specified above and also against input reverse polarity. The derived DC voltages in the equipment shall also have protection against over voltage, short circuit and overload.

The power consumption shall be minimal. However, station-wise maximum allowable power consumption is indicated in PJS. The actual power consumption is to be furnished by the Vendor.

#### **G) PERFORMANCE REQUIREMENTS**

The MPLS-TP equipment shall provide no errors for 48 hours on any channel at reference receive level (nominal level).

#### **H) SYSTEM RELIABILITY / AVAILABILITY:**

The system availability should be greater than 99.99% [excluding logistics, fibre and power supply provided by others]. BER shall not exceed  $1 \times 10^{-12}$  for any traffic interface of the MPLS-TP equipment.


#### **REMOTE & CENTRALIZED MANAGEMENT OF MPLS-TP EQUIPMENT /NETWORK:**

New MPLS-TP equipment supplied & installed by the vendors shall be remotely managed from NMS systems in line with following:

##### **1. For MPLS-TP network of pipelines:**

The NMS system shall be installed tentatively at Numaligarh, Guwahati, Schar locations. The NMS system shall have capabilities and configurations with regard to network management functions.

The NMS system shall have the capability to function in both active or master or primary and stand-by or slave or secondary modes. Under normal circumstance, one NMS system will be in active or master or primary mode and other in stand-by or slave or secondary mode. The active or master or primary NMS system shall have the active network management control over complete network and shall periodically update stand-by or slave or secondary NMS to

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maintain identical databases. The active or master or primary and stand-by or slave or secondary modes of NMS systems can be manually controlled or set by issuing command from the workstation of respective NMS systems.

Vendor shall plan and supply all necessary hardware and software so as to have the manageability of all the supplied MPLS-TP elements independently from active or master NMS as per the server locations even during OFC link cut in pipeline network or in event of total collapse of any of the NMS system.

Under multiple OFC cut conditions in a section, some of the MPLS-TP network elements (NE) may get isolated from NMS systems. However, after restoration of link, all the active alarms of the isolated NEs shall be unloaded automatically in the active NMS.

For extending management of MPLS-TP network, the vendor shall hire & provide necessary connectivity (with 99.5% quarterly availability) between server locations for 2 year from external service provider as per the rates quoted in bid.

Accordingly, vendor shall plan and supply all necessary hardware and software.

#### A) **SYSTEM DESCRIPTION:**

The Network Management Systems shall be for the ultimate capacity of the offered MPLS-TP equipment.

The Network management system shall be of open architecture and the NMS shall have built-in supervisory facilities for monitoring the health of various stations automatically. Data from various stations shall be available at both the Network Management systems and shall monitor and control all stations.


The each Network Management System (NMS) setup/infrastructure shall include but not limited to the following:

- NMS Server (Hardware, Firmware & Software) with fully wired server rack, Monitor, Key-board, Mouse etc with configuration as a minimum.
- NMS Client Workstation (Hardware, Firmware & Software) along with 32-inch LCD Monitor, Key-board, Mouse, etc. with configuration as a minimum shall be installed in Network Monitoring area (away from NMS server area).
- Any other hardware or software required to meet the complete functionality.

All the databases in NMS Server should have disk mirroring/ standby configuration. External backup of Network Management databases through Hard Disks should also be provided (this should have both options of manual & scheduled backup). The restoration of the backed-up data to NMS server should be done from external backup media (Hard Disk) directly without any further conversion or transfer to other media.

All the hardware of NMS systems should be provided from proven and reputed sources.

All MPLS-TP equipment shall be manageable through a single application Platform. Collection

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and data base storage in the NMS should be fully automatic. Operation for NMS should be pre-emptive (i.e. in case of any wrong operation the system software should not crash) and Should provide control and robustness for database backup and download by supporting database target verification to prevent the use of a wrong database.

This management platform will provide network topology view (graphical and textural) of all the MPLS-TP elements and alarm log.

The management platform should have graphical user interface and the graphical view of the network elements should offer a quasi-photographic picture at the highest level, going down to block diagram views of the functional blocks i.e. the network management system shall graphically depict the entire network in a single global view.

From this view the following should be accessible.

- a) The topology level- shall display in the main window and shall be the background for all other management views.
- b) The NE shelf view –shall show the internal physical layout of the NE's i.e. the various cards installed in their slots.

Throughout all presentation layers, continuous alarm information should propagate. For all views and tasks, a context sensitive on line help should be provided. In addition, complete product documentation should be accessible via the online help system.

The routing protocol shall be dynamic and in accordance to ITU-T standard protocols, required for Network management. Updates of routing tables should be automatic.

Vendor to provide details of the NMS provided including details of hardware and software utilized and also how the network management can be expanded if the network grows (state addressing rules, action required limits of network (size, etc.).

## B) **CONFIGURATION**

It should be possible to read the configuration from the network elements into a file, make the desired changes in to the file and restore the configuration into the network element, thus providing a way of saving the configuration of a network in the NMS for backup purposes.

## C) **USER ACCESS**

It should be possible to connect two NMS or one NMS and one local craft terminal (hand held serviceterminal /lap top computer ) to the network at the same time.

The user name should define the access right for the system as per defined user privilege class. The different user privileges available shall be as follow:

Allowed Action	Operator	Experienced user	Network Administrator	System Administrator
Display network file	Yes	Yes	Yes	Yes



Enable profile monitoring	No	Yes	Yes	Yes
Create new profile	No	Yes	Yes	Yes
Create new network maps	No	No	Yes	Yes
Create new network files	No	No	Yes	Yes
Purge historical alarms	Yes	Yes	Yes	Yes
Install communication drivers	No	No	No	Yes
Configure drivers	No	No	No	Yes

#### D) **INTERFACE TO HIGHER LEVEL MANAGEMENT SYSTEM**

Vendor is required to provide details of such interfaces.

#### E) **FEATURES / FACILITIES:**

- End-to-end Trail creation by pointing the start of the trail to the end point of the trail automatically.
- Multiple views of layered topology.
- Unified management of different transport layers.
- Multilayer service provisioning.
- functionalities including fault management, performance monitoring, equipment configuration and administration, transmission and connectivity management and system and authorization control features.
- The network management system should be capable of managing both the optical platform and transport network simultaneously through the versatile network manager. The comprehensive management system should provide maximum integration and full modularity.
- The network management system should have free flow of management information between the MPLS-TP and other complimentary access without regard to their source of manufacture. It should support data communication channel (DCC) hardware transparency and allow the creation of DCC path for the transfer of third party management information through the network element and sub networks.
- The network management system should deliver end-to-end management.
- The NMS Operating System (OS) should be based on either licensed UNIX or LINUX or MS-




Windows with all Anti-Virus provisioning. The NMS software should be user friendly. During warranty period, the anti-virus software shall be upgraded/updated on regular basis in systems by the vendor without any cost implication to client.

10. The NMS should have the capability of managing minimum double the numbers of MPLS-TP elements which would be implemented under this project without any software & hardware upgradation of supplied NMS system. Here, all network elements are to be considered to have been upgraded to its maximum capacity.
11. It should be in compliance to IEEE, ITU-T recommendations.
12. The hardware should be provided from proven sources.
13. Printer interface support in the NMS shall be provided for printing the following as a minimum:
  - i) Time, date and alarm
  - ii) Type of alarm
  - iii) Name of station
  - iv) Time, date of alarm reset
  - v) Severity, Status of alarm
14. Alarm reporting interfaces: Real time screen display, both graphical & textual for alarm occurring at any station without need for logging into the particular station.
15. The management system shall also provide audible alarms (with a provision to disable the same, as and when required by Owner), whenever a new alarm enters the management log. Reminder function sound visible blinking shall be available whenever unacknowledged alarms are present in the system. Alarm export to a remote location should be possible in future (without any additional software). Suitable port for the same shall be provided.
16. Alarm categories:
  - Critical
  - Major
  - Minor
  - Warning
  - Cleared or Acknowledged
17. All details of the alarms shall be coming automatically and directly without any human intervention. All alarms (time, date of alarm, Type of alarm. Name of Station, Time, date of alarm reset etc.) shall come discretely at the NMSs, with all details, for each of the above categories ( no summed alarms).

**Fault message storage :** To be stored in a database.

**Maximum number of records to be stored:** Vendor to provide the upper limit of storage of records.

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### **House keeping of the database:**

When the database gets near to the maximum number of records set at the installation, an alarm should be produced for the user. In case database gets filled up, following should be available. A tool for selectively deleting records is to be provided with the NMS. For backups, tools should be provided. In case the user does not delete/clear records, first In first out (FIFO) principle shall apply.

The user interface should have separate alarm lists for new, acknowledged and cleared alarms. A separate dialogue should be available for analyzing the historical alarms.

### **F) PERFORMANCE DATA**

The performance data should be available for each network element. Performance monitoring should be available according to ITU-T

Two separate records for last 15 minutes and 24 hour records shall be available. Performance monitoring shall be possible to set on all above functional blocks, including history records.

### **G) BACKUP**

Back-up provision shall include but not limited to the following:

- Fault data
- Performance data
- Configuration data
- Cross-connection data
- NMS System data

### **H) LOCAL CRAFT TERMINAL (LCT)**

LCT (Local Craft Terminal) [Hardware & Software] along with associated items like: cable, connectors, licensed software shall be provided for local & remote management of supplied MPLS-TP equipment.

The LCT hardware shall be provided form proven sources (hand held service terminal equipment of manufacture/ Laptop computer from reputed along with licensed operating system (OS).


The minimum configuration is mentioned as:

#### **LCT Hardware Configuration**

The hardware of the proposed LCT shall be high reliability personal computer (PC) supplied by a proven Laptop Computer manufacturer.

The minimum requirement of each remote terminal shall be as follows:

Make : HP/ LENOVO/DELL/ASUS or any other reputed  
higher


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manufacture Processor	:	Intel core i7 9 <sup>th</sup> Gen or higher, Min 2.3 Ghz
integrated cache or		
Cache	:	4MB Cache or better
RAM	:	8 GB, DDR4 SD RAM, 2400 MHz or better or higher expandable upto 16GB
Keyboard	:	Full size backlit keyboard with numeric keypad
Display	:	14" Anti-Glare LED-Backlit Display active screen or higher
Mouse	:	Touch point/Touch pad
Port	:	3 USB with min 2 Nos USB 3.0, 1 parallel, 1 No. HDMI, Integrated wireless Blue Tooth, External speaker, External mic, Line in, 1 Nos. RJ-45
Ethernet	:	1 no. of Integrated Gigabit Ethernet with RJ-45 interface (10/100/1000 Mbps)
Webcam	:	HD (720p) webcam with dual array digital
microphones HDD	:	Minimum 1 TB
Integrated Wireless LAN	:	Dual Band Wireless LAN 802.11 a/g/n or b/g/n External/ Inbuilt 8 x min with auto disc cleaner and lens
DVD – CD RW Drive	:	cleaning Cartridge
Weight	:	less than 3 KG
Operating System	:	Latest Window OS with Documentation & recovery mechanism, Latest Microsoft Office Suite CD with license and media, Latest Adobe Acrobat Pro CD with license and media
Manageability	:	DMI /PC 2001 WI - FI certified state of art Management features
Anti-virus	:	Latest Antivirus with license for virus definition free update till 4 years
Accessories	:	OEM executive carrying case,
Power Adapter	:	AC adaptor 240VAC 50Hz with cable (Indian Style).
Battery	:	Battery backup for 3 Hours (Min) with additional battery pack
Ruggedness	:	MIL-STD 810G (Vibration, Altitude, Drop, Shock, Thermal, Humidity).

### **NMS Server Hardware Configuration**

The proposed MPLS-TP management system hardware shall provide high performance and high reliability Server supplied by a well-known proven Server Manufacturer (OEM).

Sr. No	Parameter	Minimum Requirement	Compliance /details	Remarks/ Comments
1		Make		

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2	Model			
3	<b>Processor</b>	Intel latest xeon process silver standard , cores >=8, 64 bit, clock>=2.3 GHz, Turbo-boost, memory controller supporting DDR-4 2666 MHz or higher, 16M cache, minimum 2 memory channels, built-in graphics capable of supporting minimum resolution of 1920x1080p, 32bit colour resolution		
4	<b>Motherboard</b>	OEM Motherboard		
5	<b>Memory</b>	2*8 GB DDR4-2666 Mhz RAM, expandable upto 64 GB		
6	<b>Hard Disk Drive &amp; controller</b>	2*1 TB SATA (redundant, swappable). Support for RAID 0 & 1		
7	<b>Optical Drive</b>	Super Multi DVD writer, Min 16x		
8	<b>Graphics</b>	Integrated Intel Graphics		
9	<b>Audio</b>	Integrated Realtek HD ALC221		
10	<b>Ethernet</b>	Intel X540-T2 1 GbE Dual Port Adapter		
11	<b>Slots</b>	Total : 4 (1) low profile PCI slot, (1) low profile PCI Express x1 slot, (2) low profile PCI Express x16 slots		
12	<b>Ports and Connectors</b>	(2) USB 3.0 (2) USB 2.0, (2) RJ-45, (1) VGA port,(1) DVI Port, (1) Display Port, (1) audio in, (1) audio out, (1) HDMI (optional)		
13	<b>Form Factor</b>	1U or 2U, Rack Mounted		
14	<b>Monitor</b>	19" or higher Foldable KVM Monitor with integrated mouse, Keyboard		
15	Keyboard	Integrated with KVM Monitor		
16	Mouse	Integrated with KVM Monitor		
17	Software	Operating System , Latest Microsoft office Suite or equivalent , Anti Virus		
18	Operating System	Latest operating system compatible with NMS software		



## North East Gas Grid Phase-III of IGGL

19	Recovery Tool	Restore CD		
20	Drivers for different Operating systems	Drivers should be freely available on OEM's web site		
21	Power Supply	Redundant Hot Swappable Power Supply		

### NMS Client Workstation Hardware Configuration

The hardware of the proposed NMS Client Workstation shall be high reliability personalcomputer (PC) supplied by a proven PC manufacturer.

The minimum requirement of each remote terminal shall be as follows:

Sr. No	Parameter	Minimum Requirement	Compliance /details	Remarks/ Comments
1		<b>Make</b>		
2		<b>Model</b>		
3	<b>Processor</b>	Intel latest Core-i9 processor , cores >=8, 64 bit, clock>=2.3 GHz, Turbo-boost, memory controller supporting DDR-4 2666 MHz or higher, 12M cache, minimum 2 memory channels, built-in graphics capable of supporting minimum resolution of 1920x1080p, 32bit colour resolution		
4	<b>Motherboard</b>	OEM Motherboard		
5	<b>Memory</b>	2*8 GB DDR4-2666 MHz RAM expandable upto 32 GB		
6	<b>Hard Disk Drive &amp; controller</b>	1 TB SATA. Support for RAID 0 & 1		
7	<b>Optical Drive</b>	Super Multi DVD writer, Min 16x		
8	<b>Graphics</b>	2 GB NVidia/ AMD graphics card in addition to Integrated Intel Graphics		
9	<b>Audio</b>	Integrated Realtek HD ALC221		
10	<b>Ethernet</b>	Intel Gigabit Ethernet (10/100/1000 Mbps) Dual Port Adapter		
11	<b>Slots</b>	Total : 4 (1) low profile PCI slot, (1) low profile PCI Express x1 slot, (2) low profile PCI Express x16 slots		

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12	Ports and Connectors	Front I/O: (4) USB 3.0, headphone and microphone Rear I/O: (4) USB 3.0 (2) USB 2.0, (2) PS/2, (2) RJ-45, (1) VGA port, (1) DVI Port, (1) Display Port, (1) audio in, (1) audio out, (1) HDMI		
13	Form Factor	Tower		
14	Monitor	32 " Color with minimum FHD (1920 x 1080 @ 60 Hz) resolution. Input connector (1 VGA & 1 DVI)		
15	Keyboard	Wireless keyboard		
16	Mouse	Wireless 2 Button Scroll Mouse		
17	Software	Operating System , Latest Microsoft office Suite , Adobe Acrobat Pro, Anti Virus		
18	Operating System	Latest Windows operating system compatible with NMS software		
19	Recovery Tool	Restore CD		
20	Drivers for different Operating systems	Drivers should be freely available on OEM's web site		

### **DC-DC CONVERTER :**

- A) TYPE :** SMPS
- B) Redundancy :** Not required
- C) Input:**

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1. Voltage : DC Voltage as per the tender requirement
2. Current : To be provided by the Bidder
3. Efficiency: > 95%
4. Protection: Current limiting circuit breaker; Over & Under voltage protection; Automatic shutdown at lower input voltage.

**D) Output:**


1. Voltage : DC Voltage as per the tender requirement
2. Power : As per tender requirement
3. Load Current: As per tender requirement
4. Regulation :  $\pm 2\%$
5. Conversion frequency : > 90 KHz
6. Load sharing : Active current sharing & Democratic load sharing in parallel operation.
7. Protection : Circuit breaker/fuse
  - a) Over voltage: Only faulty unit shuts down
  - b) Over Current: Can sustain short circuit at o/p indefinitely
  - c) Over Temperature : Required

**E) Other:**

- a. Lightening & Surge protection : As per latest national & International Standards
- b. EMI protection : As per latest national & International Standards
- c. Insulation Resistance :
  - a) Input & Earth : > 2 mega ohms
  - b) DC Output & Earth : > 1 mega ohms
  - c) DC input & DC O/p : > 5 mega ohms
- d. Mechanical Noise : < 60 dBA

**F) Monitoring:**

1. Shall provide Display for display / monitoring of the following with accuracy of 1%:
  - a. Input DC Voltage & Current.
  - b. Output DC Voltage & Current
2. Shall provide facility for visual indication / display / monitoring of following Alarms locally:
  - a. Input Failure
  - b. Output Failure
  - c. Module failure
  - d. o/p Over Voltage
  - e. o/p Under Voltage
  - f. Overload

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The above-mentioned alarms shall be categorized under Urgent & Non-urgent alarms depending upon the intensity of the abnormalities. Every Alarm condition shall be accompanied with Audio alarm with the audio cut-off facility. Potential Free contacts shall be provided for the extension of alarms to central location.


- G)** Temperature Range :- -100 C to +600C.
- H)** Mains Buffer : >10ms
- I)** Integrated Gas Field Surge protection :- 4KV
- J)** Static Boost:- upto 125% (PN) for sustained period, Dynamic Boost :- upto 200% (PN) for 5 Sec. & Selective Fuse Breaking :- upto 6 times the nominal current for 15ms
- K)** Residual ripple :- < 50 mVpp
- L)** Voltage converter shall have push button on its face plate for manual voltage setting

### 3.2 **PRIMARY REFERENCE CLOCK (PRC):**

Primary Reference Clock with Dual/redundant GPS Receiver Clock (with redundant Rubidium clock module) with antenna & necessary cables, accessories shall be considered. For PRC as Dual/redundant GPS Receiver Clock (with redundant Rubidium clock module) is considered, all the primary features of Cesium clock required for the system run shall be available.

The PRC system shall consist of following as a minimum:

- i) GPS Receiver Clock (with redundant Rubidium clock module) with antenna & necessary cables, other accessories shall be provided. The clock shall provide minimum 4 x redundant outputs of 2 MHz driving directly from the unit. An external distributor shall not be accepted.
- ii) The GPS module shall be provided with complete GPS Antenna Kit including Lightning Protection Kit and GPS Cable.
- iii) ETSI/19" Rack of reputed make for housing all above PRC components.
- iv) Software for local management of above mentioned components of PRC system, which can be installed and made operational in supplied Local Craft Terminals (LCT) of MPLS-TP equipment under this project.
- v) The alarms from GPS clock will be extended on MPLS-TP NMS

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### Primary Reference Source

- The Primary Reference Source should have Frequency Accuracy better than  $\pm 5.0 \times 10^{-12}$ .
- All modules of PRS should be modular and replaceable in a hot condition, ie. when the equipment is powered up and in use. However, non-modular type GPS based Clocks which are having fixed configuration are also acceptable.
- It should provide a standard management interface for equipment management. The Remote control and monitoring should be via RS-232 or 10/100 Base-T Ethernet Interface.
- The PRS should provide comprehensive alarm reporting and remote monitoring capabilities.
- The PRS should remain fully operative even if the management module is absent.
- It should be supplied in ETSI type Sub-rack. All connectors must be on the front panel.
- Input Power Supply: The PRS must be equipped with two DC power supply inputs. The power supply voltage range should be 40VDC to 60VDC.
- Power Supply Units (PSU) of PRS should operate in 1+1 hot standby protection mode. The failure or removal of one PSU should not affect the function of the Primary

Reference Source.

1	The objective of a GNSS based clock system is to synchronise the MPLS-TP network, Packet based Network, SCADA etc throughout the infrastructure of the IGGL Pipeline project. The GNSS based Clock shall be synchronised by radio communication from orbiting GNSS satellites. The Contractor shall provide the GNSS based Clock which can act as PRC, NTP server ( for Date & Time Information) for the all Nodes through out the network and PTP server (IEEE 1588v2)	
2	Several synchronization sources should be available. Primary reference clock (PRC based on GNSS) suitable for this project shall be provided. PRC should be designed for a long-term frequency departure of not greater than $1 \times 10^{-11}$ . PRC shall be as per ITU-T Rec. G-811. The same shall be GNSS based [Redundant configuration, (1+1) solution] and shall be installed at Site.	
3	GNSS based PRC ( Redundant Configuration) to be provided and shall consist of following major components so that GNSS based Clock service survives during any one failure of hardware, cabling and software:	
	(a) Redundant GNSS based Clock System	

	(b) Redundant GNSS Antenna and Antenna cables	
	(c) Redundant Clock Module (Rubidium & Rubidium)	
	(d) Redundant powering provision, both DC	
	(e) Minimum 4 output (2*MHz) clock.	
	(f) Physically 3 different Ethernet ports supporting 100/1000 Mbit network, RJ45 for NTP	
	(g) 1x Serial RS 232 / RS 422 outputs	
	(h) Sync-E for Frequency synchronisation for Packet transport network.	
	(i) Shall serve more than 8000 requests per second.	
	(j) PTP Grandmaster (E2E, P2P, 1-step, 2-step, Unicast, Multicast, Layer 2)	
	(K) Network Management / MMI for administration, supervision and maintenance respectively.	
4	Synchronization Status Messaging (SSM) for synchronization quality must be available. SSM should be transferred in the S1 byte of STM-N section overhead and it must ensure that the best available timing source is used for synchronizing the network.	
5	The following should be usable as synchronization source: a) GNSS b) E1/2MHz frequency. c) 1PPS d) Internal clock (Oscillator) e) PTP	
6	The management system should include a user definable synchronization priority list of the available timing references in the network. Bidder shall provide details of the priority list and it's functioning.	
7	PERFORMANCE REQUIREMENTS	
7.1	Reliability	
a	MTBF shall be the average operating time accumulated by the total population of identical items between failures. The equipment shall comply with the reliability figures herein:	
	1. GNSS Based Clock: 150,000 Hours, 2. GNSS Antenna: 150,000 Hours,	
7.2	Maintainability Requirements	
	The service life of the GNSS based clock system shall not be less than 12 years.	

### 3.3 SECONDARY REFERENCE CLOCK (SRC):

Secondary Reference Clock with non-redundant GPS Receiver Clock (with non-redundant Rubidium clock module ) with antenna & necessary cables, accessories shall be considered.



The SRC system shall consist of following as a minimum:

- i) Non-redundant GPS Receiver Clock (with non-redundant Rubidium clock module) with antenna & necessary cables, other accessories shall be provided. The clock shall provide minimum 4 x redundant outputs of 2 MHz driving directly from the unit. An external distributor shall not be accepted.
- ii) The GPS module shall be provided with complete GPS Antenna Kit including Lightning Protection Kit and GPS Cable.
- iii) ETSI/19" Rack of reputed make for housing all above PRC components.
- iv) The alarms from GPS clock will be extended on MPLS-TP NMS by using external alarm inputs of MPLS-TP Equipment.

Software for local management of above mentioned components of PRC system, which can be installed and made operational in supplied Local Craft Terminals (LCT) of MPLS-TP equipment under this project.

1	The objective of a GNSS based clock system is to synchronise the MPLS-TP network, Packet based Network, SCADA etc throughout the infrastructure of the IGGL Pipeline project. The GNSS based Clock shall be synchronised by radio communication from orbiting GNSS satellites. The Contractor shall provide the GNSS based Clock which can act as SRC, NTP server ( for Date & Time Information)for the all Nodes through out the network and PTP server (IEEE 1588v2)		
2	Several synchronization sources should be available. Secondary reference clock(SRC based on GNSS) suitable for this project shall be provided. SRC should be designed for a long-term frequency departure of not greater than $1 \times 10^{-11}$ . SRC shall be as per ITU-T Rec. G-811. The same shall be GPS based (Non-redundant configuration) and shall be installed at Site.		
3	GNSS based SRC/Backup Clock system to be provided and shall consist of following major components so that GNSS based Clock service survives during anyone failure of hardware, cabling and software:		
	(a) GNSS based Clock System		
	(b) GNSS Antenna and Antenna cables		
	(c) Non-Redundant Clock Module (Rubidium).		
	(d) Redundant powering provision i.e. 240V AC UPS and DC.		



	(e) Minimum 4 output (2*MHz) clock.		
	(f) Physically 3 different Ethernet ports supporting 100/1000 Mbit network, RJ45 for NTP		
	(g) 1x Serial RS 232 / RS 422 outputs		
	(h) Sync-E for Frequency synchronisation for Packet transport network.		
	(i) Shall serve more than 8000 requests per second.		
	(j) PTP Grandmaster (E2E, P2P, 1-step, 2-step, Unicast, Multicast, Layer 2)		
	(K) Network Management / MMI for administration, supervision and maintenance respectively.		
4	Synchronization Status Messaging (SSM) for synchronization quality must be available.		
5	The following should be usable as synchronization source: a) GNSS b) E1/2MHz frequency. c) 1PPS d) Internal clock e) PTP		
6	The management system should include a user definable synchronization priority list of the available timing references in the network. Bidder shall provide details of the priority list and its functioning.		
7	PERFORMANCE REQUIREMENTS		
7.1	Reliability		
a	MTBF shall be the average operating time accumulated by the total population of identical items between failures. The equipment shall comply with the reliability figures herein:		



	1. GNSS Based Clock: 150,000 Hours, 2. GNSS Antenna: 150,000 Hours,		
7.2	Maintainability Requirements		
	The service life of the GNSS based clock system shall not be less than 12 years.		

### 3.4 **TECHNICAL SPECIFICATION FOR IP BASED EPABX SYSTEM**

IP based EPABX systems shall conform to the latest editions of standards like CCITT, CCIR, BS, IEC, IEEE, EIA, IS etc. and also shall meet the following as a minimum:

#### **System Architecture:**

The system shall be designed with IP based Hybrid for IP & Analogue. The system should also support IPV6 to be future ready.

The Control Unit (hardware & software) of the system shall be built around external Server platform/ In-built Gateway Platform with CPU controller having microprocessor or equivalent type.

The Control Unit/Server of the system should have redundant configuration for its control processor, memory & power-supply module without any single point of failure. It should also conform to the model of complete "mirroring" of the information (both static and dynamic data.) as used in most computer systems.

Both of these active and standby Control Units/ Servers should not be in the same unit/cabinet sharing the same active backplane/motherboard, survivability of the total system in the LAN/WAN network.

The IP based EPABX system should manage CAC (Call Admission Control) mechanisms to optimize the usage of the bandwidth in the WAN for multi-site configurations.

System should support internal and external LDAP compatible directory with web interface to directory.

The system shall support the access of system directory through Digital & IP phones.

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The IP based EPABX system should be stored software / program controlled having multitasking operating system. The EPABX system software shall have required Anti-Virus software for the protection of IGGL's IT infrastructure as well as for the EPABX system itself.

The IP based EPABX system should boot from Flash RAM/Flash Disk/Hard disk. It should be possible to take system backups in Flash RAM / Flash Disk / Hard disks/CD/DVD. Memory storage shall be sufficient to meet the present requirement & future system upgradeability.

The IP based EPABX system should have non blocking architecture at all levels like System processing, Switching fabric & other resources like DTMF receivers, R2 Receivers.

The IP based EPABX system should support following traditional TDM or mixed IP-TDM or full 100% IP configurations on the same platform using same loaded software:


- (i) IP Communication Devices e.g. IP Phones, Mobile IP Phones, multimedia PCs, SIP phones, Soft Phone or H.323 terminal devices etc.
- (ii) Legacy TDM communication devices (Digital and analog 2 Wire telephone instruments with or without caller-id (Both FSK and DTMF), Fax, modems etc.). Analog Phones of EPABX system shall have smooth & trouble-free operation using standard 2-wire telephone cable with minimum length of 1.5 Km and 5 Km respectively from EPABX system.
- (iii) Wireless/ Mobility/ Limited mobility in local loop like VoWLAN, WiFi.
- (iv) Dual mode Fixed Mobile Convenience (WiFi/ Cellular)

The IP based EPABX system should be based on universal port architecture and be modular in design to enable seamless growth of subscriber & trunk interfaces, by adding the desired necessary cards as and when required. System should not impose any restriction in terms of slots usage for a particular functional benefit.

The IP based EPABX system should support for voice encoding the following standards as a minimum:

- (i) G.711, (ii) G.729A/B

The IP based EPABX call switching for internal calls (i.e., limited to a single location)

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should be based on the G.711 uncompressed PCM standard, but WAN calls outside the location may use the G.711, G.729A/B compression algorithm.

The IP based EPABX system must support Network Time Protocol to synchronize the system data/time of network devices.

The IP based EPABX system should be suitable to accommodate both Decadic Pulse (DP) and DTMF telephones. The system should support outgoing DTMF transmission even from IP phones.

The voice and signalling frames in the IP based EPABX system should be marked (tagged) in order to be recognized. The standards of marking supported will be: Layer 2: IEEE 802.1p/Q and Layer 3:


TOS / DiffServ

VoIP Support:

- (v) The IP based EPABX system should support VOIP solutions as an integral part of the system.
- (vi) The IP based EPABX system should be fully compliant to VOIP standards like H.323, SIP (Session Initiation Protocol).
- (vii) The IP based EPABX system should support the QOS features for the VOIP implementation.
- (viii) The system must support Echo Cancellation mechanism in IP Telephony to improve voice quality.
- (ix) When a Desktop PC is connected behind an IP phone (on the same LAN switch port), the VLAN policy of VoIP interfaces should be configured by MAC address. In this way, the default VLAN (called native VLAN) of the Switch is applied to the PC. Explicit VLAN tagging from IP Phone is not necessary.  
If the Switch is not able to use VLAN by MAC address, the IP phone must explicitly tag and use IEEE 802.1q (DHCP, TFTP, signaling and voice are tagged) and the default VLAN value for the frames sent by the PC is dynamically assigned by the Switch. The explicit tag is managed from the IP Phone.

The standby control unit/server should always be in sync (database) with the active control unit/server without any need of manual configuration & administration.


The IP based EPABX system should be able to work on any industry standard based

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IP network infrastructure.

The system should work in Central-Remote architecture with Control Units/Servers at a Central location and Remote Unit(s) at different/distant location(s). The Remote Unit shall meet the following as a minimum:

- ❖ The Remote Unit shall be an integral part/unit of Type-I IP based EPABX system. The integrating link between the Central & Remote units shall be an IP link (over WAN) having maximum bandwidth of 128 kbps to accommodate concurrent three Voice Trunk (of toll quality) & Signalling traffic as a minimum.
- ❖ All management functions like: System Configuration, Programming, Fault/Alarm management, System database backup, Accounting/Logging of traffic/calls etc. for the connected Remote units shall be provided remotely from the central EPABX system.
- ❖ The Remote unit shall provide all features & facilities as those of central unit of Type-I system without the mandatory provision of redundancy of its common & control unit(s).
- ❖ The Remote Unit shall function like an independent IP based EPABX system having its own exchange access code & flexible numbering scheme. It shall also provide following types of inter-office/unit both-way communications in addition to normal intra-office/unit communication:
  - Between central EPABX system and Remote unit over TDM/IP trunk
  - Inter Remote units (say between location-A & location-B) over TDM/IP trunk
  - Inter Remote units (say between location-A & location-B) via central EPABX system
  - Between Remote unit and EPABX (other than central EPABX) over TDM/IP trunk
- ❖ Remote unit shall support survival mechanisms that allow them to maintain 100% of the telephony services for their users, without any disruption & degradation in the intra & inter unit calls/traffic over available media / trunk, in case of failure in IP connectivity with central EPABX system for a minimum duration of 30 days. Once the IP connectivity between remote unit & central EPABX system is restored back, the remote unit shall work with central EPABX system.
- ❖ The Remote unit should be able to restart automatically & shall provide

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100% of telephony service as mentioned above without human intervention when the input power supply to the remote unit is resumed after complete power failure, even under the failure of IP connectivity with central EPABX system.

### **System Survivability:**

The IP based EPABX system should offer maximum availability along with redundancy provision for its critical common & control resource elements. A single incident of fault/failure in any of the critical resource elements of EPABX system shall not disrupt/affect all its extension & trunk services.

The critical common & control resource elements of IP based EPABX system shall minimum include Control Unit/Server (having Processor, Hard disks, RAM, Databases, OS etc), Call Server, IP interfaces, DSP resources, Tone generators, all the IO ports - Serial and Ethernet TCP/IP port, Power supplies, Ring generators, DTMF receivers, Tone detectors. It will be preferred that all hardware- units/modules of the system have their own separate power supplies mounted on the PCB itself, for better reliability and avoiding any dependence on a single card of the system. To achieve the required redundancy / reliability for the system, in case external LAN Switches are required, CISCO make Switches of latest model shall be provided as part of EPABX system.

The bidder must specify list of redundant items / modules included in the hardware & software configuration of the system to be supplied.


These active-standby Control Units / Servers of the IP based EPABX system should provide automatic failover of call processing of IP based EPABX system in such a manner that if one active control unit / server fails the standby control unit / server should be able to take the complete load of the calls automatically (without any manual intervention) & without dropping any active calls.

The Management Platform of IP based EPABX system must provide a backup mechanism for all critical system information in both a manual and an automatic/scheduled archival and a Disaster Recovery mechanism.

Addition / replacement of cards in IP based EPABX system shall be hot swappable (i.e. on power on condition).

The IP based EPABX system should be able to restart automatically & resume its normal operation without human intervention when power supply to the EPABX system is resumed after complete power failure.

### **Security Provisions:**

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System, while communicating with its associated components or / and IP based system over IP link (LAN/WAN), shall support the encryption of all IP packets with advanced encryption mechanism like: AES.

For the purpose of access over IP network, system should only allow secured access mechanism like SSH, HTTPS, SNMP.

Provision shall be available to bar unauthorized user to connect to the system.

Provision shall be available to protect the system against various network-based attacks & broadcast storms.

### **System Features:**

The IP based EPABX system should function as Local as well as Transit switch capable of switching voice, data, video and images without any degradation and blocking.


The IP based EPABX system shall provide field programmable, flexible & user definable numbering scheme. The IP based EPABX should be suitable for up to 8 digit extension numbering scheme. This numbering scheme should be flexible. System should also allow mixed numbering scheme.

The IP based EPABX system should support automatic route selection to route the calls based on user definable priorities. This service will be transparent for users and irrespective of the physical carrier connection.

The IP based EPABX shall be equipped with integrate in-built Automatic Attendant application, which shall automate the handling of incoming calls. The system shall answer the incoming call & guide the caller through a high quality voice guidance menu of various options – to choose extension, operator, or directory service. The call shall be automatically routed to the destination. In case of non-response from the caller's end, the call will automatically flow over to the operator, after a pre-set delay.

Auto-attended system should be able to answer minimum 8 incoming calls simultaneously and place callers on hold, inform them of their position in the holding queue. The switchover from night message to daytime message must be automatic

The IP based EPABX system shall have provision of automatic line testing. The system shall also have provision of automatically identifying and isolating the faulty trunks and the trunks connected to faulty media. For equipped E-1/ PRI trunk, the EPABX system shall also automatically detect line fault conditions like: LOS, AIS etc of connecting E-1 (G.703) link/media and accordingly, isolate the connected E-1/PRI

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trunk port from call routing. Once the faulty media / line problem gets resolved, isolated analog & IP trunks / junction shall automatically become operational.

- 3.4.2 The IP based EPABX system shall be provided with Call Billing system for complete recording of Internal, External and Network calls to generate various types of traffic reports such as STD / ISD / Local calls made from an Extension. Call Billing shall also be provided for Trunk Calls.

**System Management:**

- 3.4.3 The IP based EPABX system shall be field programmable using PC/Server based Programming & Maintenance system for setting / modifying all the system, user, trunk, operator parameters & features. The access control for system management operation shall be through password protection and must provide Role Based Account Management to define different levels of administrator access depending on specific function responsibility as mentioned below:

User : For viewing purpose only  
Operator : For view and modify station/ trunk/ network  
features Owner : For view and Modify all system level  
setting configuration


IP based EPABX shall be provided with Desktop PC of reputed make like: Dell, HP, Lenovo having latest hardware configuration & operating system for PC based Programming & Maintenance system and Call Billing operations. Both Programming & Maintenance and Call Billing operations shall be possible simultaneously from one desktop PC platform using single Ethernet interface.

Incase, the proposed IP-EPABX is server based, then Separate PCs shall be provided as server and NMS Client Work station. If proposed IP-EPABX is integrated microprocessor based, then only NMS client Work Station shall be provided which shall also be used to manage the IP-EPABX.

If Appliance server is provided by the bidder then redundant appliance server shall be provided and specifications of the Appliance sever shall be as per the OEM recommendation.

Bidder shall supply the EPABX system such that the operation and maintenance of EPABX system is not dependent only on the OEM. The EPABX system supplied by bidder shall comply the following –

- For any operation or maintenance related works(including any configuration, changes required in EPABX system), the client at their discretion carry out the works through competent agency without the requirement of OEM.
- In case of any fault in EPABX, it shall be possible to attend the fault and rectify the fault through a separate agency without requiring the services of

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the OEM. Accordingly, bidder shall provide EPABX system.

Bidder shall submit un undertaking for the above.

Single PC shall be provided for EPABX server cum client. All the software of EPABX server and client shall be installed in single PC. The Minimum specification of the EPABX NMS server cum Client Work station shall be as follows:-

Sr. No	Parameter	Minimum Requirement	Compliance /details	Remarks/Comments
1		<b>Make</b>		
2		<b>Model</b>		
3	<b>Processor</b>	Intel latest Core-i9 processor , cores >=8, 64 bit, clock>=2.3 GHz, Turbo-boost, memory controller supporting DDR-4 2666 MHz or higher, 12M cache, minimum 2 memory channels, built-in graphics capable of supporting minimum resolution of 1920x1080p, 32bit colour resolution		
4	<b>Motherboard</b>	OEM Motherboard		
5	<b>Memory</b>	2*8 GB DDR4-2666Mhz RAM expandable upto 32GB		
6	<b>Hard Disk Drive &amp;controller</b>	1 TB SATA. Support for RAID 0 & 1		
7	<b>Optical Drive</b>	Super Multi DVD writer, Min 16x		
8	<b>Graphics</b>	Integrated Intel Graphics		
9	<b>Audio</b>	Integrated Realtek HD ALC221		
10	<b>Ethernet</b>	Intel Gigabit Ethernet (10/100/1000 Mbps) Dual PortAdapter		
11	<b>Slots</b>	Total : 4 (1) low profile PCI slot, (1) low profile PCI Express x1slot, (2) low profile PCI Express x16 slots		
12	<b>Ports and Connectors</b>	<b>Front I/O:</b> (4) USB 3.0, headphone and microphone <b>Rear I/O:</b> (4) USB 3.0 (2) USB 2.0, (2) PS/2, (2) RJ-45, (1) VGA port,(1) DVI Port, (1) Display Port, (1)audio in, (1) audio out, (1) HDMI		
13	<b>Form Factor</b>	Tower		

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14	<b>Monitor</b>	32 " Color with minimum FHD (1920 x 1080 @ 60 Hz) resolution. Input connector (1 VGA & 1 DVI)		
15	<b>Keyboard</b>	Wireless keyboard		
16	<b>Mouse</b>	Wireless 2 Button Scroll Mouse		
17	<b>Software</b>	Operating System , Latest Microsoft office Suite , AntiVirus, Latest Adobe Acrobat Pro		
18	<b>Operating System</b>	Latest Windows operating system compatible with NMS software		
19	<b>Recovery Tool</b>	Restore CD		
20	<b>Drivers for different Operating systems</b>	Drivers should be freely available on OEM's web site		

Programming & Management system console should also support programming and maintenance through following applications:

- 1) Windows based GUI application software over LAN/WAN/VPN.
- 2) Http over LAN/WAN/VPN
- 3) Telnet over LAN/WAN/VPN.
- 4) HyperTerminal over LAN/WAN/VPN & RS-232 port
- 5) SNMP over LAN/WAN/VPN.

**3.4.4** The management platform must provide a user friendly GUI (Graphical User Interface) for the following tasks/operations:

- (i) Configuration and Programming of services, users, categories and all system parameters and features. This module must provide centralized management in local or remote environments of a single system or a network. The network manager will be able to quickly and easily edit, create or delete any network object by the use of import/export functions and multiple operations.
- (ii) Faults and Alarms Management: It shall have the provision for instant fault information, provision of automatically identifying and isolating faulty extensions & trunks and capability for malicious call tracing. It should also manage all the incidents and generate event/alarms reports informing date, hour & severity level with colour indication according to the severity level of the

alarm. This module must be able to centralize the alarms and events of the total system (including remote units if any).

- (iii) Accounting of all calls generated by the users including cost, date, hour. Must provide different options to group the monitoring of the calls (cost center, extension number, trunk, user, city/area associated to dialed numbers). EPABX system should have buffer of last 30 days call details in case of Call billing system/ management system failed.
- (iv) Network Topology Layout: The management system should provide a topological view of the telecommunications system in graphical form such as central EPABX, remote unit(s) and connectivity.

3.4.5 All management traffic between the remote console/session and the control & management system/ unit must be encrypted for necessary system data security.

3.4.6 The IP based EPABX system shall have the provision of remote monitoring, programming & maintenance of EPABX system. This remote monitoring, programming & maintenance of IP based EPABX system from outside by the vendor shall be possible by accessing the system through a dial- up modem connection.

**Inter-Operability with other EPABX systems:**

3.4.7 The IP based EPABX system should be able to inter-connect with IGGL's existing Alcatel, Coral, Tadiran, Ericsson, Siemens, Avaya EPABX systems through different types of Subscriber lines, Junctions, Analog & Digital Trunk lines existing in IGGL.

3.4.8 **Input Power:** The Central unit IP based EPABX system shall be able to operate in the input DC voltage range from -44 to -54 VDC supply (<10 Amp @ 48 VDC) / AC voltage range from 180 to 240 VAC (50 Hz). The Remote unit of IP based EPABX system shall be able to operate in the input DC voltage range from -44 to -54 VDC supply (<5 Amp @ 48 VDC).

3.4.9 **Interfacing Facilities:** The IP based EPABX system shall be able to provide following interfacing facilities:


- a. All Analog & Digital extensions operating on two wires only.
- b. IP Extensions operating over standard CAT-5 cabling
- c. The exchange must support following trunk interfaces/protocols:
  - i) Analog, DC Loop signaling, Decadic, DTMF Signaling, Analog lines in Ring down mode.



- ii) ISDN-PRI, R2MFC, CEPT (programmable for either E1 or PRI) Trunk.
- iii) QSIG compliant.
- iv) ISDN-PRI trunks & BRI (Subscriber/Trunk)
- v) All the common Signaling Standards for PSTN connections
- vi) LAN/Ethernet, TCP-IP
- vii) E1 (G.703, Balance)

**3.4.10 Telephony Facilities:** The IP based EPABX shall provide following telephony facilities as a minimum:

- i) Operator Console connectivity
- ii) Auto-attendant facility for DID through integrated auto-attended system
- iii) Caller Line Identification for all Digital, Analog Subscribers & Trunks
- iv) User programmable Station groups like: Call Pickup, Hunt on Rotation, Emergency etc
- v) Connected Line identification.
- vi) 3-Party Conference
- vii) Direct inward dialing (DID) through C.O lines
- viii) In-built Voice Guides/Announcement facility with good voice quality for (i) incoming trunks / PSTN calls. (ii) extension/code fault conditions, (iii) no answer conditions (iv) Feature activation/deactivation conditions.
- ix) Emergency transfer to predefined extensions of C.O. lines on power failure.
- x) In-built Music on Hold with melodious music having high audio quality, audio level selection, recording / changing of MOH using PC interface. Music on hold should support most popular digital audio format like \*.wav, \*.mp3 etc
- xi) User Programmable Classes of Service for Extensions & Trunks.


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- xii) Area Code Restriction
- xiii) Abbreviated Dialing.
- xiv) Mixed Mode dialing (DTMF / Pulse interchangeability).
- xv) Discriminative ringing for internal calls, junction/trunk calls, auto call back, wake up service and emergency reporting service
- xvi) Call Parking.
- xvii) Call waiting.
- xviii) Line lockout
- xix) Automatic Trunk Route selection on trunk overflow & fault
- xx) Night service mode
- xxi) Paging interface.
- xxii) Boss-Secretary grouping
- xxiii) Malicious call trace.

**3.4.11 Extension Service Features:** The IP based EPABX system should provide following Extension service features:

- i) Direct Outward Dialing
- ii) Extension to extension calling
- iii) Auto Call Back on busy
- iv) Call Forwarding (on Busy, No Answer, all with user/ system defined time)
- v) Call Forwarding Cancel
- vi) Call Transfer
- vii) Call Pick up
- viii) Group call pickup

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- ix) Do not Disturb
- x) Pad lock facility or STD/ISD locking & shall not restrict local outgoing & intercom calls.
- xi) Operator call
- xii) Operator assisted calling
- xiii) Add on Conference
- xiv) Station camp on
- xv) Trunk camp on
- xvi) Executive override with tone indication
- xvii) Last Caller Re-Dial (different than Last Called Number Re-Dialled)
- xviii) One Number Service – Parallel ringing

**3.4.12 Call Logging & Billing System:** The IP based EPABX system shall support user friendly Call Logging & Billing system, which shall facilitate the following:

- a. It shall allow dedicated billing systems for organization with different rates in line with DoT standard. System shall allow dedicated i.e. by number wise reports, department, section wise, authorization code, account code, top money utilizes, called number wise reports, date-wise reports etc. System shall allow out-dialed number privacy in call billing by suppressing partial or full digits for printing in the billing report. It shall provide graphical user interface for analysis of all such reports. Call billing software shall work in back ground mode.
- b. The system shall give detailed information for outgoing calls on all the CO lines, Analog and Digital trunk lines separately.
- c. The billing software shall have feature, which shall help in evaluation of communication cost, ways to improve in answering and handling the incoming calls etc. Thus billing software shall be able to generate complete MIS (Management Information reports) giving information on the:
  - Trend in cost of communication-usage of CO lines.
  - Graphical reports for easy interpretation.
- d. The Call billing software shall have the provision for adding/modifying/deleting the STD/ISD/Local codes, call tariff & call time zones at site as & when required

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- to accommodate the changes carried out by DoT / Service provider time to time.
- e. The billing software shall also preferably have traffic observation & performance observation features.


- 3.4.13** For each site/location, the bidder shall supply (i) the same model of rack/sub-rack for any given type of operation and (ii) the same model of cards for any given type of extension/trunk interface such as Analog line, Digital extension line, BRI, PRI etc. Multiple models of rack/sub-rack for same requirement or multiple models of cards for same type of interface at a single site/location are not acceptable.

The extension (Analog, Digital & IP) & trunk interface (E-1/PRI) modules/cards should be of same model in Central location of IP based EPABX system, so that they can be interchangeable without any degradation in performance/operation.

**3.4.14 Technical Specifications of Desktop Operator Console (OPCON):**

The IP based EPABX system should support desktop Operator Console, which shall have connectivity with EPABX system using one pair of telephone cable and it shall provide the following minimum facilities:

- i) Operator Extension should be configurable for Working Hours and Non-working Hours
- ii) Minimum 29 functional and programmable keys
- iii) Control access to specified trunks
- iv) Minimum 40 character alphanumeric display
- v) DTMF Dial Pad with call processing buttons.
- vi) Lamp indications for console status and system alarms.
- vii) Multiple tenant groups with designated group queue and night service extensions.
- viii) Trunk verification
- ix) Name dialing
- x) Status indication of Station.
- xi) Serial Calling.
- xii) Priority Queuing
- xiii) Force trunk release.

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- xiv) Override/Barge- in
- xv) Monitoring of ongoing conversation: Programmable enable and disable.
- xvi) Trunk group status
- xvii) Visual indication for major, minor and warning alarms.
- xviii) Last Number redial
- xix) Hands free dialing
- xx) Date and Time Display

### 3.4.15 **TECHNICAL SPECIFICATION FOR DESKTOP IP PHONE (with / without monitor)**

The connection for IP phone will be provided by existing CAT-5 cable that is being used for data access. The IP hard phone should have inbuilt dual ports Ethernet Switch of 10/100/1000 Mbps to connect desktop PC through RJ-45. Other features should be as follow.

- i) 10/100/1000BT connection: half/full duplex with auto negotiation and configuration. The maximum cable length is up to 100m (330ft) for 100BT (for cable of category 5).
- ii) IP phone should have inbuilt / integrated Ethernet switch with QoS support with the facilities for TOS diffserv & 802.1p/q.
- iii) Ethernet (10/100/1000 Mbps) line interface with secondary (10/100/1000 Mbps) port for collocated PC or Laptop with IEEE 802.3af power over Ethernet compliant ports.
- iv) IP hard phone should support protocol H.323/SIP.
- v) Protocol support for voice quality G.711, G.723.1, G.729a/b and for echo cancellation.
- vi) IP addressing Static or dynamic IP parameter configuration. A DHCP client should be integrated in the set
- vii) IP Configuration through an internal man machine interface during its activation allowing configuration of the main IP parameters such as:- MAC address access, Program a static IP address (if no DHCP server) and IP Subnet mask, Router IP address, Frame tagging activation/deactivation & default VLAN 802.1pq etc.
- viii) Tilt-able Graphical Display of high resolution, minimum 4-line text message on screen.
- ix) Messages wait Indicator.
- x) Incoming call indication (display) while one line is in use.
- xi) Minimum 10 programmable keys
- xii) 4 way keys for menu navigation.
- xiii) Incoming Speech Gain Control.

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- xiv) Ringer Volume Control.
- xv) Full Speakerphone with high audio quality in Hands-free operation (full Duplex) & Mute facility.
- xvi) Hot dialling from key pad for call transfer, conference (while a conversation is already in progress).
- xvii) Adjustable Handset and Monitor speaker volume.
- xviii) On-Hook dialling
- xix) Optical call alert (LED/LCD) for incoming call
  
- xx) Echo cancelling for local echo (AEC full duplex)
- xxi) Alphabetic keyboard for dial-by-name
- xxii) Make: OEM of IP EPABX system / For SIP Phone: Cisco or Polycom

### 3.4.16 **TECHNICAL SPECIFICATION FOR ANALOG PHONE**


- i) Caller Line Identification (CLI) [supporting both FSK and DTMF]
- ii) Pulse/Tone switch-able.
- iii) Modular connection plugs for line and handsets.
- iv) Electronic ringer with adjustable volume
  
- v) Flash, pause, redial, mute functions
- vi) Desktop model
- vii) Line Cord –detachable - 2 Meter long.
- viii) Hand set cord –detachable.
- ix) Termination Box - To be provided.
- x) Hook Switch endurance - 1 Million Operation
- xi) No additional power requirement using Battery cell or AC adaptor
- xii) Available colours - To be specified
- xiii) Make/Model: Beetel P66 or equivalent

### 3.4.17 **Main Distribution Frame (MDF) for exchange side of supplied EPABX system shall meet the following as minimum :**

- i) Connectors : Krone LSA module
- ii) Capacity : As per EPABX configuration.
- iii) Type of enclosure : Metallic Fully covered  
Floor Mounted (Rack) Or Wall mounted (DB)
- iv) Cable insertion & extraction tools : Two nos
- v) To be equipped with line protection units (IPM) fuse for all Trunk & CO lines.
- vi) Five numbers of Jack for line isolation and monitoring per site

### 3.4.18 **REQUIRED EPABX CONFIGURATION:**

New IP based EPABX system shall have configuration & setup envisaged as under, wherein the Equipped & Additional Wired capacities of various interfaces are indicated. Accordingly:

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- For Equipped Capacity: The vendor shall supply, configure / provision & commission the complete facilities including the required hardware, software, firmware, cabling, and terminations in the supplied system.
- For Additional Wired Capacity: The vendor shall keep the system ready with all cabling terminated at both equipment (for vacant / free slot) & MDF ends excepting the provision of hardware module in the supplied system. With the installation of interface module in the wired slot, the facility will be available at MDF.

In addition to the above mentioned Equipped & additional Wired capacity, the IP based EPABX system should also be expandable up to certain defined capacity, as mentioned below. This expansion should be in building block architecture by adding on additional cards / stacks / cabinets at central EPABX system and/or existing Remote units and also by addition of new Remote unit(s) under existing central EPABX system. However, such expansion up to the defined Expandable Capacity should not involve any addition / upgradation of Processor, Software or any of the other common control hardware of existing central EPABX system and existing Remote units.

***For each of the sites, licenses has to be supplied for all hardware module / software / firmware of the IP based EPABX systems up to the aggregated capacity of their individual 'Equipped Capacity' & 'Additional Wired Capacity', as mentioned below.***

This IP based EPABX system of Pipeline locations shall have following configuration/setup with Expandable Capacity up to 200 lines (inclusive of all types of Subscriber & Trunk Lines):

The EPABX system at shall be equipped with minimum following, meeting the tenderrequirement:

S. No	Description of Items (inclusive of Hardware, Software & Firmware)	Equipped Capacity with license	Expandable Wired Capacity
1	Common & Critical Control unit	Duplicated in Hot Stand-by configuration	
2	Analog Subscriber / Extension port (nos.)	20	60
3	CO line (for PSTN connection) port (nos.)	10	05
4	IP Phone Subscriber (nos.)	80	140
5	PRI (2 Mbps) [G.703, 120 ohms balanced] Trunk port (nos.) (Maximum two ports on each PRI module)	04	02
6	IP Trunk provision (nos.)	10	10
7	Desktop Operator Console & associated items	One Set	

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8	PC Based Programming & Maintenance, Billing and Accounting Facilities inclusive of Hardware, Software and associated items.	One Set
9	Exchange MDF to cater all equipped Subscriber lines, Trunks lines & CO lines.	1 set equipped for 200 Terminations (minimum)
10	IP Telephone Set (nos.)	As per MR
11	Analog Telephone Set (nos.)	As per MR
12	Voice Mail	200 nos.

#### **TEC COMPLIANCE:**

The offered model of IP based EPABX system should have approval from TEC for interfacing with PSTN. In this regard, duly notarized copy of TEC certificate is required be submitted with the un-priced bid document. This TEC certificate should be valid for minimum period of six months from bid due date.

#### **3.4.19 FXO-FXS VOICE GATEWAY SETUP FOR PIPELINE VOICE COMMUNICATION:**

FXO type VoIP gateway shall be provided with EPABX for integration of analog telephones at remote locations in the future. FXS shall be provided at remote stations where analog phones are provided for extension of analog telephones to the remote locations via Ethernet / IP network. However, the provision shall be provided at each station such that it shall be possible to add FXO and FXS to EPABX in future without any modification or license requirement in future for addition of FXO type VoIP gateways at EPABX side and FXS type VoIP gateway at remote location to which analog phone shall be connected.

#### **3.4.20 EXPLOSION-PROOF PHONE**

S. N.	Parameter	Technical Specification
1	Description	Intrinsically safe Explosion-proof IP Based phone with all accessories i.e., Handsets, Cords, Glands, Inbuilt ringer etc. (entire filling must be in a single enclosure)
2	Housing material	Glass-fibre-reinforced polyester/Aluminium (LM6) alloy
3	Hardware	As per OEM standard
4	Finish	Anti-corrosive Epoxy Power
5	Approval	ATEX/CCOE/CMRI
6	Display	Built-in LED display
7	Keypad	Minimum No. of keys: 0 to 9, *, #, Flash, Redial
8	Dialling	DTMF and Pulse Mode switchable
9	Degree of protection	IP65

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10	Impact Protection	IK09
11	Operating Temperature	0°C to +60°C
12	Ringling Sound Pressure Level	app 90 db(A) at 1 m distance
13	Line Voltage	From EPABX
14	Temperature Classification	T3
15	Certified for use in Gas	Grp IIA and IIB
16	Zone Classification	Zone-1
17	Intrinsically safe	Ex "ib" /IIC /II 2 D protected
18	Mounting	Wall / column / structural
19	Handset cord	As per IP phone provided
20	Compatibility	Fully compatible with all EPABXs' IP Telephone line
21	Cabling	Cat 6 / OFC

### 3.4.1 **EXPLOSION PROOF TELEPHONES ACQUSTIC BOOTHS**

#### **General**

The explosion proof telephones shall be housed in a full enclosure with Howler & flashing beacon acoustic booth installed outside the acoustic booth. The acoustic booth shall be full enclosure with Howler & flashing beacon type with doors. The acoustic booth shall house the explosion proof telephone set, including all accessories for fixing to the telephones set. These telephones shall be connected through EPABX at manned stations.

The acoustic booth will reduce noise level ( $\square$  15 dB) and protect the telephone. Location of these telephones shall be finalized during detailed engineering. Vendor's scope include supply of all materials, interface, cabling, power supply, trenching, back filling etc., all complete.

One galvanized cable tray shall be fixed on the steel pole to guide and protect cables. One hole shall be provided in the floor-mounted plate to facilitate entry of cables.

#### **Specification:**

Wiring, Cable glands, shall be included with the equipment. All cables outside the building shall be armoured type. All hardware such as nuts, bolts, washers etc. shall be cadmium plated or zinc passivated. All equipment shall be coated to ensure proper corrosion protection.

Acoustic booths shall have polyester powder coating of 60 um minimum in case of metal or should be made of FRP. Galvanization thickness for steel pillar and flash support shall be 80 um minimum.

All metallic parts which are not permanently protected against corrosion shall be protected with anti-corrosion painting. Vendor shall indicated the extent of noise reduction for the offered acoustic booths

### 3.5 OPTICAL FIBER PIGTAIL, CONNECTORS & OPTICAL PATCH CORDS TO BE USED IN THE FTC

The single mode fiber pigtails and connectors should meet the ITU-T recommendations G-652 D as required.

Both connectors and cable should be robust and should withstand wear and tear due to frequent use, Connection and disconnection. Normal expected life should be 15 year or more. The patch cords provided shall be 20 mtr in length.

Optical Fiber Cable, Patch Cord connections & pigtails shall be fully compatible and matching to each other.


#### PARAMETERS OF CONNECTORS WITH PIGTAILS

Insertion Loss	:	Maximum 0.3db per connector plus fibre loss
Return Loss	:	Better than 40db
Temperature Dependency	:	< 0.3 db from -20 to +60
Change in connection Loss with passage of time at 60 °C for 100hrs	:	It should be < 0.3db
Change in connection loss due to vibration	:	< 0.05 db
Reproducibility of connection loss by repeated connection and disconnection for 500 times.	:	< 0.05 db
Change in connection loss in relation to tensile Strength	:	Loaded : - 50db, Unloaded : -30db

**The specification of Jointing Closure, Jointing Pit, Marker, and make of electronic marker shall be provided to Vendor for rectification / restoration of damaged OFC if required.**

### 3.6 LAN Switch

- a) Number of ports Minimum 24

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b)	Data rates	10/100/1000 Mbps
c)	Connectors	RJ45
d)	Standard supported	IEEE 802.1d, 802.1p, 802.1q, 802.1w, 802.1x, 802.3ad, 802.3af, IEEE 802.1s



Energising Quality

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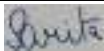



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## VCS Quality Services Pvt. Ltd.

### STANDARD SPECIFICATION FOR CLOSED CIRCUIT TELEVISION (CCTV) NETWORK SYSTEM

VCS-SS-IN-5907\_02

					
02	11.05.2022	SV	KNC	HK	GVW
01	18.01.2020	RB	VB	KNC	AD
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Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By

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**STANDARD SPECIFICATION  
FOR  
CCTV NETWORK SYSTEMS**

**DOCNO: VCS-SS-IN-5907  
Rev No : 02**

<b>REVISION RECORD</b>						
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02	11.05.2022					VCS QMS Integration
		Sarita Verma	Kedar Nath Chakraborty	Hashim khan	GV Walimbe	



## **ABBREVIATION**

CCD	Charge Coupled Device
CCTV	Close Circuit Tele Vision
CCITT	International Telegraph and Telephone Consultative Committee
CENELEC	European Committee for Electro technical Standardization
DCS	Distributed Control System
ECR	Emergency Control Room
EMI	Electro Magnetic Interference
EPC	Engineering, Procurement & Commissioning
FEED	Front End Engineering & Design
IEC	International Electro technical Commission
IEEE	Institute of Electrical and Electronics Engineers
IES	Instrument Equipment Shelter
IP	Ingress Protection
ITU	International Telecommunication Union
LCD	Liquid Crystal Display
LTG	L&T-GULF Pvt. Ltd.
MCR	Main Control Room
OFC	Optical Fiber Cable
RFI	Radio Frequency Interference
SC	Subscriber / Standard Connector
TRR	Telecom Rack Room
UPS	Uninterrupted Power Supply
VCR	Video Cassette Record



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## **1 SCOPE**

This Specification covers the minimum requirements for the design, materials, construction, fabrication inspection, testing and commissioning of the Closed Circuit Television Camera (CCTV) system. The Vendor shall be responsible for integrating all CCTV hardware, software, system testing, documentation, delivery, training, installation supervision and field support for the CCTV systems as defined within this specification.

The Vendor shall also be responsible for installation supervision and field support as required for pre-commissioning and commissioning of the CCTV system during the plant startup

## **2 DEFINITIONS**

For the purpose of this document, the words and expressions listed below shall have the meanings assigned to them as follows:

Owner/ Purchaser/ Company	Owner of the particular Project (Project Specific).
Consultant	The party which comes out all or part of the engineering, procurement, construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.
Bidder/ Manufacturer / Supplier / Vendor	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.
Works/ Shop	The place where the ITEM / UNIT is fabricated and tested and transported to Purchaser.
Datasheet	Technical data provided by the Purchaser / Owner / Company.
Standard Specification	Specifications Developed as Standard by the Company.
Job Specification	Specifications Developed pertaining to particular project / Job in regard.
Material Requisition	Requisition as raised to Supplier for Quotation of the item
Purchase Requisition	Requisition as raised to Supplier for Procurement of the item
Purchase Order	Legal Order supplied to Supplier for procurement of the Engineered Item

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Site	The work place where the equipment is installed and commissioned.
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### 3 REFERENCE DOCUMENTS

#### 3.1 Codes & Standards

The related standards referred to herein and mentioned below shall be of the latest editions prior to the date of the Purchaser's enquiry.

##### **American Society of Mechanical Engineers**

IEC 60028	International Standard of Resistance for Copper
IEC 60228	Conductors of insulated cables
IEC 60255	Electrical relays all or nothing
IEC 60331	Fire resistance characteristics of electric cables
IEC 60326	Printed circuit boards
IEC 60529	Degrees for protection provided by enclosures (IP Code)
IEC 60801	Electromagnetic Compatibility for Industrial Process Measurement and Control Equipment
IEC 60885	Electrical test methods for electric cables
ITU-T	Standards and Recommendation including those previously published under the CCITT regulations
IEEE-472	Surge Withstand Capability

#### 3.2 Order of Precedence

In the event of conflict between Specifications, Data sheets, related standards, codes etc., the order of precedence shall be as follows:

- Data sheets
- Job Specifications
- Standard Specifications
- Codes and Standards

Vendor shall refer the matter to the Purchaser for clarification and only after obtaining the approval in writing, the same should proceed with the manufacture of the items in question.



## 4 DESIGN

The following design requirement covers the general requirements of CCTV Network System and its accessories etc., but for the exact requirements and applications, the relevant, project specifications and design basis shall be referred and complied.

### 4.1 GENERAL

The system shall include, but not limited to, the following equipment's:

- a. A Central Control Rack providing the interface between the control and monitoring facilities and field installed camera equipment.
- b. Field installed colour cameras, equipped with auto focus, and zoom lens. A number of cameras shall be mounted on motorized pan and tilt units which enables orientation of both Azimuth and Elevation. Also, necessary Mast and Support should be provided.
- c. Control facilities and video display monitors providing a display of camera images manually selected from the control keyboard or sequentially selected pictures arranged in a pre-determined sequence.
- d. The system shall have telemetry bi.

#### 4.1.1 EQUIPMENT LOCATION

- a. A Central Equipment Rack - 19" type equipment racks, located in the Telecoms Rack Room (TRR).
- b. Operator Monitoring and Control:
  - i. The Main Control Room (MCR) shall include a 29" colour video display monitor with flat square screen LCD and associated control keyboard units.
  - ii. The Emergency Control Room (ECR) shall include 3 x 29" colour video display monitors with flat square LCD screen and associated control and keyboard Units
  - iii. Each IES shall contain an optical fibre patch panel for CCTV system
- c. External located coloured cameras shall provide coverage of:
  - i. External Process Plant
  - ii. The required number of cameras, monitors, etc. shall studied and proposed for COMPANY approval during the EPC phase to ensure adequate plant coverage.
  - iii. Cameras locations inside the plant to be defined by the FEED Engineer

#### 4.1.2 TRANSMISSION EQUIPMENT

Transmission equipment shall be of modular construction and shall utilize optical fiber cables as defined in the LTG-SPC-5501 LTG Standard Specification for OFC and Conduit. Multimode optical fibre cables shall be provided between the Central Equipment Rack and the field located optical fiber patch panels located in each IES. These optical

Fiber cables shall carry both video and telemetry data control information. Each camera shall be connected via multimode fiber cable that has minimum capacity of four fibers.

#### 4.1.3 CCTV CAMERA MULTIMODE O.F.: TRANSMITTER UNIT

The multimode optical fiber cable from each camera will be terminated via a SC connector to an optical fiber transmitter unit. The bi-phase telemetry data control information shall terminate on a RS-485 data module. One transmitter and data



module is required for each camera unit. The O.F. transmitter and the bi-phase telemetry data unit shall be contained within the camera housing. The optical fiber transmitter shall modulate the analogue video signal and convert it to light, suitable for optical fibre cable transmission. The video signal will then be routed via the optical fibre cable and patch panels to the video matrix within the CCTV Central equipment rack. The telemetry bi-phase data control information will be used to control the pan and tilt unit, auto iris, zooming, focus and other camera parameters.

## **4.2 CENTRAL RACK EQUIPMENT**

The Central Rack Equipment shall house the main electrical, electronic, optical fiber and processing equipment necessary for system distribution and control.

The rack shall be provided with powered fans to enable adequate air flow. The system should be capable to be interfaced with other desired system

### **4.2.1 CENTRAL RACK UNIT**

The CCTV Central Rack Unit with its associated switching and fibre optic equipment, complete with rack mounted 9" monitor shall be provided. This shall enable the CCTV to operate as an independent stand-alone CCTV sub-system should the need arise, i.e. the event of a fault or a break in the optical fibre cable, and or a fault within the main CCTV control and switching system. Hence operation and control of the cameras can still be available directly from a control keyboard / display unit or portable PC.

### **4.2.2 SWITCHING MATRIX UNIT**

Video switching shall be carried out by a microprocessor-based cross point matrix switching units capable of automatically routing video signals from a requested camera position to a specified monitor.

The switching unit shall present a number of output ports for interfacing to monitors and accommodate other integrated VCRs.

An interface port shall be reserved for maintenance/administration purposes. A Laptop PC terminal shall be provided; it shall be loaded with the latest version of diagnostic software according to standard specs.

An interface port shall be reserved for a Real Time Clock GUI port required for the connectivity of central rack unit with LAN of control room is required, to enable authorized workstations to monitor the whole plant from their locations.

### **4.2.3 VIDEO QUAD PROCESSOR**

Selectable quad/full screen coloured processors units shall be provided. The system shall be capable of presenting the selected video images to video monitors and recorders in quad, split or full screen viewing modes, and shall be independent of both record and real time viewing functions.

### **4.2.4 VIDEO CASSETTE RECORDERS**

A number Video Cassette Recorders shall be required. The Vendor shall state within his tender documents the number of video recorders to be provided.

- a. The TV video to be recorded shall be pal colour 625.
- b. Only S-VHS high grade professional tapes shall be provided.
- c. The recorders shall be capable of being fed from and played back through multi plexes.
- d. The equipment shall be suitable for 19" rack mounting and shall be located within the central equipment rack.
- e. All video recorders shall have the facility to be switched on and off remotely.



- f. Time, date and title of cameras shall be recorded on all tapes.
- g. It shall be possible to replay both real time and lapse recordings through the same system, whether in quad, split or full screen mode.
- h. Recorders shall operate in the standard 3 hour mode for real time recording.
- i. A facility for external time synchronization shall be provided.

### **4.3 OPERATOR CONTROL KEYBOARD UNITS**

Control functions of the CCTV cameras from the MCR and ECR keyboards i.e. camera selection, sequence programming, sequence hold commands shall be provided. Alpha numeric/display keyboards shall be provided, suitable for desk mounting. A busy indicator device shall be provided on each monitor to indicate, if a chosen camera is already under control by another operator.

One keyboard / display unit shall be installed in each of the DCS workstations in the MCR, and one keyboard / display unit shall be installed in the ECR and shall have the following functions:

- a. Power on/off control of each camera
- b. Focus and zoom control of each camera
- c. Pan and tilt control of each camera
- d. Sequence control, to program required automatic camera selection
- e. Iris control, to open / close camera iris
- f. Wash/wipe Control - enable the wash / wipe facility to clean camera glass face
- g. Camera selection enabling up to four camera outputs to be displayed on the monitors simultaneously
- h. Access security programmed codes shall be provided, for use of keyboards by authorized operators
- i. Control keyboard/displays shall have a programmable priority hierarchy access level for priority selection of each camera. Company will establish and advise the Vendor at a later date, the priority access level for individual users

### **4.4 MONITORS**

At least 21" diagonal size CCTV monitors shall be supplied. They shall be of the indoor type with a minimum protection of IP-20, c/w with overhead brackets suitable for ceiling mounting and the model has to be the latest at time and to be reviewed and approved by the Company.

CCTV monitor control adjustments shall be via an infra-red or wireless remote control unit, and shall include the following control functions as a minimum:

- a. Brightness control
- b. Contrast control
- c. Colour control
- d. On / Off and standby control

#### **4.4.1 PICTURE QUALITY**

- a. To be compatible with pal 625 colour standard or better
- b. The monitors shall be responsive to widely varying lighting conditions from 5 lux reflected light to 100,000 lux as may be associated with bright sunlight and welding arc lights.

- c. Under the worst case lighting conditions specified above the overall signal-to-noise ratio shall be 45 dB
- d. Horizontal resolution as per project requirement
- e. Accept a supply voltage of 240 Volts, 50 Hz

#### 4.4.2 OTHER FACILITIES

- a. Time, date and title 10 information of cameras shall be displayed on all monitors
- b. The monitors shall be capable of supporting 2 or 4 way split screen displays

### 4.5 CAMERAS

Colour Charge Coupled Device (CCD) cameras shall be provided and installed at strategic locations within the plant / process area to enable efficient monitoring of the plant equipment for safe operation. The main features of the cameras shall meet the following:

- a. The standard shall be pal 625 line colour with 2:1 interlace
- b. The cameras shall generate standard pal 625 line colour video and provide a 1V Peak-to-Peak video signal at the video output
- c. Cameras shall be designed to provide high picture quality under varying light conditions and fitted with automatic light correction facilities
- d. Fitted with automatic iris control, zoom and gain control
- e. Able to operate with a fixed focus lens and motorized zoom lens
- f. All cameras shall be powered from a 240 Volts 50Hz local power source

#### 4.5.1 CAMERA HOUSING

Depending on the location, the cameras shall be housed in an explosion-proof and/or weather-proof case. The explosion proof requirements shall be in accordance with the area classification in which the equipment will be installed.

The camera housing shall be:

- a. Suitable for housing all equipment necessary for camera operation
- b. Cameras shall be housed in a sealed unit, with a heavy duty pan and tilt Unit
- c. Equipped with sun hood, and window wipe facilities
- d. Able to operate with a motorized zoom lens

#### 4.5.2 CAMERA PAN / TILT UNIT

The pan and tilt unit shall meet the following requirements:

Pan rotation	0° to 350°
Tilt rotation	-90° to +90°
Pan speed	4.5° to 6°/Sec
Tilt speed	4.5°/Sec

The pan/tilt unit shall be provided with a motor overload protection facility.

Contractor shall consider that suitable supporting structures shall be required to obtain proper positions for each camera and ensure that the cameras are accessible by a ladder built in the support structure.

## 4.6 EQUIPMENT ALARMS

The Vendor shall state the alarm indications supplied as standard with the equipment.

These alarms shall include but not limited to the following:

- a. Equipment failure
- b. Mains fuse failure
- c. Common group or individual equipment failure. This shall take the form of an earth-free and volt-free contact rated nominally for 5 amps at 24V DC. This alarm condition shall be interfaced to the DCS for annunciation
- d. Provision in the DCS to be considered by the Contractor and DCS Vendor for CCTV alarm

## 4.7 CABLES

All required cables including the multimode optical fibre cables between field cameras and optical fiber patch panels shall be provided by Contractor.

## 4.8 ELECTRICAL PROTECTION

All field mounted electrical equipment shall be of the explosion-proof type EEx(d) or EEx(i) certified to CENELEC / IEC or equivalent for hazardous area classified zone 1,

IIC, T3 or Zone 2, IIC, T3 as required.

## 4.9 POWER SUPPLIES AND EARTHING

The control system, monitors and all critical components of the CCTV system shall be powered by a 240 Volt, 50 Hertz Uninterruptible Power Supply (UPS). Power to all cameras and associated equipment will be supplied from the plant's 240 volt 50 Hertz vital power distribution panels.

All system components shall be capable of operating at a minimum of  $\pm 10\%$  available voltage,  $\pm 5\%$  frequency, and interruption time of 10m Seconds and 5% harmonic content.

Vendor shall state the total load requirements for each system, at an agreed date, to permit sizing of the UPS system. This shall include the power requirements for each cabinet and total power for each system. Vendor will include inrush currents and crest factors in supplied information.

## 4.10 MEAN TIME TO REPAIR (MTTR)

The design and construction of the CCTV system shall ensure high reliability and availability.

The CCTV system shall employ modular constructional techniques in its design, allowing a first line maintenance philosophy of module replacement to be implemented.

The average module replacement time for the system will be less than 1 hour as long as the correct spares holdings are maintained as recommended by the Supplier.

## 4.11 SYSTEM SOFTWARE

All software shall be supplied fully installed on the equipment and a master copy provided on suitable media, CD-ROM preferred. All manuals shall be included and

Vendor shall ensure that all applicable software licenses are transferred to Company.



## **5 FABRICATION AND PAINTING**

Vendor shall obtain approval in writing from the Purchaser before start of fabrication and manufacturing of the system. Vendor shall submit the required specification, drawings & documents for approval. Also Vendor shall refer the relevant codes and standards for manufacturing mentioned herein.

Painting shall be in accordance with Company Painting Specifications.

## **6 INSPECTION AND TESTING**

Vendor shall perform all inspection and testing as per job Specification requirements, and as per relevant codes, prior to shipment. The inspection and testing for CCTV

Network System shall be carried out as per approved Inspection and Test Plan. Vendor shall submit the Inspection and Testing Plan for Proprietary items / Special items for approval. Vendor shall submit the test certificates to the Company for the tests conducted during the manufacturing process like Continuity test, enclosure test, hazardous area certification test, and any other before Factory Acceptance Testing (FAT).

### **6.1 FACTORY ACCEPTANCE TESTING (FAT)**

Prior to FAT, Vendor shall submit to the Company a detailed FAT procedure, for review and approval, listing all the systems and subsystems for CCTV Network system, complete with the project approved tags, and highlighting the inspection and testing requirements of all such devices. FAT shall be carried out as per approved Inspection and Test Plan. FAT shall be carried out prior to shipment of the system.

FAT procedures shall be submitted at least 4 weeks prior to FAT testing taking place.

FAT shall be carried out at the manufacturing facilities. The tests shall be witnessed by the Company or their approved representative. FAT procedure will be signed off by the Vendor and Company or their approved representative at the successful completion and conclusion of testing.

The FAT shall be consisting of the following as a minimum:

- a. Visual inspection
- b. Earthing isolation and continuity measurements at sample locations
- c. Power up, power distribution verification plus voltage and current measurements
- d. Diagnostics
- e. Power supply test (momentary power loss, voltage fluctuations, etc.)
- f. RFI and EMI testing
- g. Functional test( if possible)
- h. Any other tests defined in FAT Procedures

A certificate to detail the results and records obtained during the FAT shall be made available for ratification by the Vendor on the date of test.

### **6.2 SITE ACCEPTANCE TESTING (SAT)**

A SAT shall be carried out on completion of the installation of the equipment at site which shall be witnessed by the Company / Owner's representative. SAT shall be performed on the complete CCTV Network System and Subsystem as per the approved test procedure. A comprehensive test procedure in compliance with the Company specification shall be developed and issued to Company / Owner for review and approval.



The Site Acceptance Test (SAT), in general, shall demonstrate that the entire CCTV Network System functions correctly and properly in accordance with the specified requirements.

## **7 MARKING, PACKING AND SHIPMENT**

Following FAT completion, Vendor shall ensure that all equipment and associated materials and accessories for the CCTV Network System are designed properly, marked and packed, and secured for transit to site without damage.

Vendor shall provide and submit his standard 'Marking, Packing and Shipping Procedures' for review by Company / Owner.

Vendor shall specify any conditions, normal or special, to be verified in intermediate storage and during transport.

Equipment shall be suitably packed including any dismantling, transit fastening and bracing necessary to prevent distortion or damage during transit.

Adequate protection shall be provided to prevent mechanical damage and atmospheric corrosion in transit and at the jobsite. Preparation for shipment and packing will be subject to inspection and rejection by Company's / Contractor's inspectors. All costs occasioned by such rejection shall be to account of the Vendor.

## **8 SPARES AND ACCESSORIES**

The following spare philosophy shall be followed in case it is not covered in Job Specification.

The Vendor shall include recommended Spare Parts List for start-up, precommissioning and two years operation as per the following;

- a. Itemized recommended spare parts list for start-up and pre-commissioning.
- b. Itemized recommended spare parts list for two years operation.

Vendor shall recommend accessories and special tools required for operation and maintenance of CCTV Network System, for Company review.

All the spare parts furnished by Vendor shall be wrapped and packaged to preserve an original as-new condition under normal conditions of storage. The same parts shall be properly tagged with stainless steel tags and coded so that later identification as to their intended equipment usage shall be clear.

All items supplied shall be packaged separately and clearly marked as "Spare Parts" and shipped with the equipment.

## **9 DOCUMENTATION**

The following documentation shall be fulfilled by the Vendor, if it is not covered in Job Specification.

### **9.1 DOCUMENTATION REQUIRED WITH TECHNICAL BID**

During bidding stage Vendor shall submit in his offer the following documents as a minimum:

- a. CCTV system FAT Specification
- b. CCTV system hardware configuration
- c. Bill of Materials including Vendor list, details for third party items



- d. Catalogues and Manuals
- e. Quality Assurance Plan
- f. Any other documents (Job specific)

## **9.2 DOCUMENTATION REQUIRED FOR APPROVAL**

Upon placement of Purchase Order, Vendor shall submit as a minimum the following drawings, documents and specifications for the Company's approval:

- a. CCTV System hardware configuration and termination details
- b. System software design specification
- c. Procedures for FAT & SAT
- d. Recommended spare parts list with part numbers
- e. Connection drawings and wiring details
- f. Installation, operation, maintenance and fault finding manuals
- g. Functional design specification (FDS) for CCTV
- h. Quality Assurance Plan
- i. Any other documents (Job specific)

## **9.3 GUARANTEE / WARRANTY**

Vendor shall guarantee that the complete scope of supply shall be safely and reliably meet all of the requirements of this Company specification.

Generally Vendor shall provide warranty support for a period of 12 months from the date of supply or 18 months from the date of manufacturing. Warranty shall apply to defective material workmanship and facility design. Warranty work shall be done at Owner's local facilities. The cost of correction / replacement of any warranty items shall be borne by the Vendor.

The Job specifications / Data sheets shall be referred for any specific warranty / guarantee.