



Maharashtra Information Technology Corporation Limited
(A GOVERNMENT OF MAHARASHTRA ENTERPRISE)

**Request for Proposal
For
Selection of Project Implementation Agency (PIA) for
MahaNet-I (BharatNet-II) Project in Maharashtra
(*updated with Corrigendum and Clarification points*)**

Reference No.: Mahait/CNI/001/01/2018

Dated: 31/01/2018

Issued by: -

MAHARASHTRA INFORMATION TECHNOLOGY CORPORATION LIMITED

Room No 514, 5th Floor, Annexe Building,
Hutatma Rajaguru Chowk, Mantralaya,
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Contents of the RFP Template

RFP TEMPLATE SECTION	SECTION DESCRIPTION	Page No.
SECTION I	INVITATION TO BID	5
SECTION II	GENERAL INSTRUCTIONS TO BIDDERS	15
SECTION III	GENERAL CONDITIONS OF THE CONTRACT AND SLA	33
SECTION IV	BID SUBMISSION FORMATS	66
SECTION V	SCOPE OF WORK	147
ANNEXURE A	TECHNICAL SPECIFICATIONS	173
ANNEXURE B	ENGINEERING INSTRUCTIONS	383
ANNEXURE C	INTEGRITY PACT/ PROFORMA	437
ANNEXURE D	SPECIAL INSTRUCTION FOR e-TENDER	443
ANNEXURE E	LIST OF TALUKAS AND GRAM PANCHAYATS	445
ANNEXURE F	GIS SURVEY DATA	447
ANNEXURE G	SOIL STRATA ANALYSIS	449
ANNEXURE H	WORK FRONTS RELATED GUIDANCE	452
ANNEXURE I	MAHANET WI-FI SOLUTION	455
ANNEXURE J	RESPONSIBILITY MATRIX	471
ANNEXURE K	REWARDS AND PENALTIES	495
ANNEXURE L	STRATEGY FOR NOC INTEGRATION	503
ANNEXURE M	SOLVENCY CERTIFICATE	507

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Section I
Invitation to Bid

Section I - Invitation to Bid

**Maharashtra Information Technology Corporation Limited (“MahalT”)
(A Government of Maharashtra Enterprise)**

ROOM NO. 514, 5TH FLOOR, ANNEXE BUILDING,
MANTRALAYA, MUMBAI 400 032
TEL.: +91 (022) 22026534

NIT No: MahalT/CNI/001/01/2018

Dated: 31st January 2018

On behalf of Managing Director, MahalT online digitally signed and sealed open tenders are invited from the Bidders in the e-tendering process through Notice Inviting Tender (NIT) No. - **MahaIT/CNI/001/01/2018** dated 31.01.2018 for “**Selection of Project Implementing Agency (PIA) for MahaNet-I (BharatNet-II)**” for the state of Maharashtra. The Project Implementation Agency (PIA), selected through this tender process, shall be responsible for:

- a) **Summary of scope:** Survey, planning, supply, installation, end-to-end integration, testing and commissioning of OFC (Underground and Aerial) IP-MPLS network and Radio network, as well as electronics (access electronics, central electronics, and Wi-Fi services). Also, the PIA would undertake the responsibility for Operations & Maintenance (O&M) and facilitating service provisioning of the established network for five years on turnkey basis.
- b) **Additional requirement:** Bidders shall submit a business plan for Utilization and Monetization of the network established under MahaNet-I (BharatNet Phase-II) along with the bid response (**Business plan will not be used for evaluation process**).
- c) **Accessibility of tender document:** The Tender Document to participate in e-Tender shall be available for downloading from 31st January, 2018 at 15:00 Hrs. from the Website www.mahatenders.gov.in. Tender document shall not be available for download on or after its submission/ closing date. The tender fee of of **INR 25,000/- (INR Twenty Five Thousand only)** is to be submitted by the bidder by making online payment against the RFP **for each package that they bid for**.
- d) **Sale of hard copy of tender document:** As MahalT has decided to use process of e-tendering for inviting this bid, hence the hard copy of the tender shall not be available for sale.
- e) **Bid submission documents:** Bidder shall submit the ‘Technical Bid’ and ‘Financial Bid’ online.

/Sd-

Managing Director

No. of Packages: The Gram Panchayats to be connected under MahaNet-I (BharatNet-II) have been divided into three packages namely:

- Package - A
- Package - B
- Package – C

Package	Key components	District Count	District Name	Fibre Laying Method*	No. of Talukas	No. of GPS**	Estimated Route-KM**	Estimated Route-KMs per laying method**	Estimated Route-KMs per fibre type**
Package A	1. Optical Fibre Cable (OFC-underground and aerial) site survey, planning, procurement, design, implementation of Taluka and GP network as well as O&M (this also includes radio connectivity for Gram Panchayats that cannot be connected through fibre) 2. OFC (underground and aerial) site survey, planning, procurement, design, implementation of horizontal connectivity to Government premises, schools and PHCs 3. Access electronics implementation(The PIA would be responsible for supply for equipment and services included in the scope of the package) and O&M	9	· KOLHAPUR · NASHIK · PALGHAR · PUNE · RATNAGIRI · SANGLI · SATARA · SINDHUDURG · THANE	U U A U U U A A A U	6 10 5 6 6 2 8 2 6	391 772 237 547 467 172 980 69 456	1,544 3,049 936 2,160 1,844 679 3,870 272 1,801	Aerial Route KMs = 5,079 2,769 48F ADSS = 3,809 Kms 24F ADSS = 1,270 Kms	96F Ribbon Type = 7,754 Kms 48F Ribbon Type = 554 Kms 24F Loose Type = 2,769 48F ADSS = 3,809 Kms 24F ADSS = 1,270 Kms
	4. Central electronics implementation and O&M - NOC/ DR - DC/ Cloud - NMS - BSS 5. Wi-Fi implementation and O&M		26	All districts in MahaNet-I (BharatNet-II) across all packages –A, B and C	N/A	170	12,740	N/A	N/A

Package	Key components	District Count	District Name	Fibre Laying Method*	No. of Talukas	No. of GPS**	Estimated Route-KM**	Estimated Route-KMs per laying method**	Estimated Route-KMs per fibre type**
Package B	<p>1. Optical Fibre Cable (OFC-underground and aerial) site survey, planning, procurement, design, implementation of Taluka and GP network as well as O&M (this also includes radio connectivity for Gram Panchayats that cannot be connected through fibre)</p> <p>2. OFC (underground and aerial) site survey, planning, procurement, design, implementation of horizontal connectivity to Government premises, schools and PHCs</p>	8	· AKOLA	U	5	395	1,560		
			· AMRAVATI	U	7	403	1,592		
			· CHANDRAPUR	U	9	513	2,026		
			· GADCHIROLI	U	6	225	889		96F Ribbon Type = 9,610 Kms
			· NANDED	U	11	964	3,807		48F Ribbon Type = 686 Kms
			· WARDHA	A	6	223	881		24F Loose Type = 24F Kms
			· WASHIM	A	3	346	1,366		24F Loose Type = 686 Kms
			· YAVATMAL	U	13	976	3,854		24F Loose Type = 686 Kms
Package C	<p>1. Optical Fibre Cable (OFC-underground and aerial) site survey, planning, procurement, design, implementation of Taluka and GP network as well as O&M (this also includes radio connectivity for Gram Panchayats that cannot be connected through fibre)</p> <p>2. OFC (underground and aerial) site survey, planning, procurement, design, implementation of horizontal connectivity to Government premises, schools and PHCs</p>	9	· AHMEDNAGAR	U	13	1,085	4,285		
			· AURANGABAD	U	4	492	1,943		
			· BEED	A	3	13	51		
			· BULDHANA	A	10	588	2,322		
			· HINGOLI	A	5	540	2,133		
			· JALGAON	U	9	521	2,058		
			· LATUR	A	3	268	1,058		
			· PARBHANI	A	6	428	1,690		
			· SOLAPUR	U	6	669	2,642		

Total	<p>Underground Route KMs = 35,733</p> <p>Aerial Route KMs = 14,581</p>	<p>96F Ribbon Type = 18,984 Kms</p> <p>48F Ribbon Type = 1,356 Kms</p> <p>24F Loose Type = 6,780</p> <p>48F ADSS = 17,395 Kms</p> <p>24F ADSS = 5,798</p>
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Note:

1. ***U = Primarily Underground** (Mixed laying type comprises of primarily underground OFC. These rings would also have upto 5% hybrid (comprising underground and aerial) as well as aerial fibre in spurs in the districts mentioned)
A = Aerial (Aerial laying type comprises of aerial fibre in rings and spurs of the ring in the districts identified)
2. As per envisaged design in case of districts with:
 - **Underground fibre laying method**, 96F Ribbon Type (~70% of overall route km) and 48F Ribbon Type fibre (~5% would be utilized in the ring architecture whereas 24 ADSS Aerial fibre (upto 25% route km only) would be utilized for spurs
 - **'Aerial' fibre laying method**, 48 ADSS Aerial fibre would be utilized in the ring architecture (~75% of the overall route km) and 24 ADSS Aerial fibre (upto 25% route km only) would be utilized for spurs.
3. **For the No. of GPs, fibre laying method, route-km per fibre laying method and fibre type to be utilized, the SIA reserves the right to modify the scope defined in any of the packages in MahaNet -I scope.
4. As per the Detailed Project Report (DPR) the number of GPs was 13,561 which has been reduced to 12,740. The route KMs (50,313 KMs as per the approved DPR) have been apportioned basis the revised number of GPs. **Route-KMs are an indicative estimate**. Where possible, SIA would provide optimized route information. Selected route information is available in the RFP (refer Annexure - F). Additional information may be provided before the bid submission.
5. **For the Route-KMs bidders would need to rely on Route-KMs identified as part of route survey that they would be performed as part of the implementation scope.**
6. It is essential that the selected PIA meets the project timeline of March 2019 by which connectivity must be provided for all GPs in scope.

Package – A scope comprises of:

1. **Optical Fibre Cable** (OFC-underground and aerial) planning, procurement, design, implementation as well as O&M for GP and Taluka connectivity, including
 - Planning of network and site survey
 - Route survey for finalization of OFC routes (Underground and aerial)
 - Verification and optimization of routes designed based on GIS data
 - Procurement of duct, fibre cable and accessories
 - Digging, trenching and OFC laying
 - Laying of optical fibre from Taluka to Gram Panchayat using “ring topology” to the extent possible
 - Installation, commissioning and testing of OFC and related equipment
 - Creation of Taluka and GP rings with ring connectivity
 - Connectivity to NOC, DR NOC and Virtual Private Cloud (DC)
 - GP connectivity would also include planning, procurement, design, implementation of radio equipment for GPs which cannot be connected through fibre
 - O&M of various components mentioned above, to ensure uptime of the network as per agreed SLAs for a period of five years

2. **Optical Fibre Cable** (OFC-underground and aerial) planning, procurement, design, implementation as well as O&M for five years for Horizontal connectivity to schools, primary healthcare centers, Government buildings/premises, as may be prescribed

3. **Access electronics** (across all packages A, B and C) [electronics at Talukas and GPs]
 - Planning, procurement, design, implementation of active electronics at Talukas and GPs for all packages across the entire state
 - O&M for all central electronics components, to ensure uptime of the network as per agreed SLAs for a period of five years
 - Integration of Active electronics (for all packages A,B and C across the entire state)

4. **Central electronics** (across all packages A, B and C)
 - Planning, procurement, design and implementation of a **MahaNet Network Operations Center (NOC) in Navi Mumbai and Disaster Recovery NOC in Nagpur**
 - Integration of MahaNet NOCs with National (BBNL) NOC. *Strategy for integration is provided by BBNL, in the document titled – “Strategy for integration of “State” NOC/ NMS with BBNL NOC/ NMS” dated 13th February 2018. Please refer Annexure – L - “Strategy for NOC Integration” in RFP.*
 - Provide Tier 1 & Tier 2 support for network problem isolation, determination and resolution using NOC tools.
 - Planning, procurement, design and implementation of cloud based DC architecture
 - Planning, procurement, design and implementation of Network Management System (NMS) for monitoring of electronics and fibre infrastructure
 - Planning, procurement, design and implementation of OSS/ BSS
 - O&M for all central electronics components, to ensure uptime of the network as per agreed SLAs for a period of five years
 - Integration for all packages A,B and C across the entire state

5. **Wi-Fi** (across all packages- A, B and C)
 - Planning, procurement, design and implementation of Wi-Fi Access Points (2 per GP), and other equipment (controllers, etc. for the entire state)
 - O&M for all central electronics components, to ensure uptime of the network as per agreed SLAs for a period of five years

Packages – B and C scope comprises of:

1. **Optical Fibre Cable** (OFC-underground and aerial) planning, procurement, design, implementation as well as O&M for GP and Taluka connectivity, including
 - a. Planning of network and site survey
 - b. Route survey for finalization of OFC routes (Underground and aerial)
 - c. Verification and optimization of routes designed based on GIS data
 - d. Procurement of duct, fibre cable and accessories
 - e. Digging, trenching and OFC laying
 - f. Laying of optical fibre from Taluka to Gram Panchayat using “ring topology” to the extent possible
 - g. Installation, commissioning and testing of OFC and related equipment
 - h. Creation of Taluka and GP rings with ring connectivity
 - i. Connectivity to NOC, DR NOC and Virtual Private Cloud (DC)
 - j. GP connectivity would also include planning, procurement, design, implementation of radio equipment for GPs which cannot be connected through fibre
 - k. O&M of various components mentioned above, to ensure uptime of the network as per agreed SLAs for a period of five years
2. **Optical Fibre Cable** (OFC-underground and aerial) planning, procurement, design, implementation as well as O&M for five years for Horizontal connectivity to schools, primary healthcare centers, Government buildings/premises, as may be prescribed

These packages shall be treated as part of one tender, as the same are envisaged to be implemented in parallel / simultaneous mode. Hence, for deciding the maximum no. of packages which can be awarded to a bidder, the bidder shall meet the aggregate/ cumulated benchmark/ value of eligibility criteria for the packages under consideration.

Bidders to note:

MahaIT believes in reduction of transaction costs. Further, time is of great essence for completion of MahaNet-I (BharatNet-II).

Considering the importance of this project for the state, MahaIT is endeavouring towards single window clearance for trenching and access to premises of all GPs, Taluka/Tehsil offices and NOC. (DIT, GoM has approved holistic RoW approvals and RoW charges for MahaNet Project, however, restoration needs to be completed by the bidder as per scope. Govt Order in this regard is enclosed. For RoW regarding Central Govt. authorities MahaIT will help facilitate early approval).

Document Control Sheet:

NIT No.	Mahait/CNI/001/01/2018
Name of State/SIA	Maharashtra Information Technology Corporation Limited
Tender Type (Open/Limited/EOI/Auction/Single)	OPEN
Tender Category (Services/Goods/works)	Services/Goods
Type/Form of Contract (Work/Supply/ Auction/Service/Buy/Empanelment/Sell)	Supply&Service
Product Category (Civil Works/Electrical Works/Fleet Management/ Computer Systems)	“Selection of Project Implementing Agency for MahaNet-I (BharatNet– II)”
Re-bid submission allowed by the bidder before bid submission date (Yes/No)	Yes
Is Offline Submission Allowed (Yes/No)	No
General Technical Evaluation Allowed (Yes/No)	No
Withdrawal Allowed (Yes/No)	Yes
Is Multi Currency Allowed	No (Only INR)
Payment Mode (Online/Offline)	Online
Date of Issue/Publishing of the RFP	31/01/2018 (1500 Hrs.)
Document Download/Sale Start Date	31/01/2018 (1500 Hrs.)
Document Download/Sale End Date	21/02/2018 (1500 Hrs.)
Clarification Start Date	31/01/2018 (1500 Hrs.)
Clarification End Date	05/02/2018 (1000 Hrs.)
Date for Pre-Bid Conference	05/02/2018 (1500 Hrs.)
Venue of Pre-Bid Conference (Mahait)	Main Conference Hall, 7 th Floor, New Administrative Block Mantralaya, Hutatma Rajaguru Chowk Mumbai 400 032

Last Date and Time for Submission of Bids	12/03/2018 (1100 Hrs.)
Date and Time of Opening of Technical Bids	13/03/2018 (1600 Hrs.)
Date and Time of Opening of Financial Bids	15/03/2018 (1500 Hrs.)
Contract Type (Empanelment/ Tender)	Tender
Bidder to be Selected	1 (One) per package
Tender Fee	INR 25,000/-
Bid Validity days (180/120/90/60/30)	180 days
Location (Work/ Services/ Items/ As per tender document)	As per tender document
Validity of the Contract from the date of issuance of Award of Work	5 years
Address of communication	<p>Managing Director Maharashtra Information Technology Corporation Limited Room No. 514, 5th Floor Mantralaya Annexe, Hutatma Rajaguru Chowk Mumbai 400 032</p> <p>E-mail: mahanet.mahait@maharashtra.gov.in Tel.: +91 22 22026534 Fax: +91 22 2815087</p>

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Section II

General Instructions to Bidders

Section II – General Instructions to Bidders

1.1 Procedure for Submission of Bids

- 1.1.1 Bids (Technical bid and Financial bid) shall be submitted online on website URL platform.
- 1.1.2 The participating Bidders in the tender should register themselves free of cost on e-procurement portal.
- 1.1.3 The Bidders can login to e-procurement –portal in secure mode only by signing through the Digital certificates.
- 1.1.4 The Bidders should scan and upload the respective documentary evidence as mentioned in Eligibility Criteria.
- 1.1.5 The bidders shall sign on all the statements, documents, certificates uploaded by them, owning responsibility for their correctness/ authenticity.
- 1.1.6 The rates should be quoted in the financial bid format attached with the tender and uploaded online only.
- 1.1.7 ***The Sole Bidder or Lead Bidder of a consortium can bid for maximum up to two (2) out of three packages. If more than two bids are submitted by a Bidder, its bid for package A will be summarily rejected without opening of its technical bid.***
- 1.1.8 ***For any Bidder submitting bids for two Packages, the total EMD would be the summation of the EMD values of the two bids submitted***
- 1.1.9 ***Bidder must quote separately for each package under the below mentioned Tender IDs***
 - a. ***Bidder for Package A must submit their bid at the eTender portal under 2018_ITD_276537_1***
 - b. ***Bidder for Package B must submit their bid at the eTender portal under 2018_ITD_276537_2***
 - c. ***Bidder for Package C must submit their bid at the eTender portal under 2018_ITD_276537_3***

1.2 Other Conditions of Bid Submission

- 1.2.1 After uploading the documents online, original Bank Guarantee (BG) in respect of EMD and Demand Draft in respect of Tender Fee is to be submitted by the bidder in sealed envelope to the following before bid submission end date and time mentioned in the bid document:

Managing Director

Maharashtra Information Technology Corporation Limited

Room No. 514, 5th Floor Mantralaya Annexe,

Hutatma Rajaguru Chowk

Mumbai 400 032

The cover thus prepared should also clearly indicate the name, address, telephone number, E-mail ID and fax number of the Bidder to enable the Bid to be returned unopened in case it is declared "Late".

- 1.2.2 Failure to furnish original copy of Bank Guarantee in respect of EMD and Tender Fee shall result in rejection of the bid. MahalIT shall not be liable for postal delay. Similarly, if any of the certificates, documents, etc., uploaded by the Bidder online are found to be false/fabricated/bogus, the Bidder shall be disqualified, blacklisted and action shall be initiated as deemed fit and the Bid Security shall be forfeited.
- 1.2.3 MahalIT shall not hold any risk and responsibility regulating non-visibility of the scanned and uploaded documents.
- 1.2.4 The documents that are uploaded online on the portal shall only be considered for Evaluation of bids.

2. Cost of Bidding

- 2.1 The Bidder shall bear all costs associated with the preparation and submission of its bid including cost of presentation for the purposes of clarification of the bid, if so desired by the

State. In any case State shall not be responsible or liable for those costs, regardless of the conduct or outcome of the tendering process.

3. Content of the RFP

3.1 The RFP includes:

- Section I - Invitation to Bids
- Section II - General Instructions to Bidders
- Section III - General Conditions of the Contract and Service Level Agreement
- Section IV - Bid Submission formats
- Section V - Scope of Work
- Annexure A – Technical Specifications
- Annexure B – Engineering Instructions
- Annexure C – Integrity Pact
- Annexure D – Special Instructions to Bidders for e-Tendering
- Annexure E – List of GPs and Talukas
- Annexure F – GIS Survey data
- Annexure G – Soil Strata Analysis
- Annexure H – Work-front guidance
- Annexure I – MahaNet Wi-Fi Solution
- Annexure J – Responsibility Matrix
- Annexure K – Rewards and Penalties

3.2 The Bidder is expected to examine all instructions, terms and conditions, forms and scope of Work in the RFP and furnish all information as stipulated therein.

4. Clarifications in the Tender

4.1 A prospective Bidder requiring any clarification on the RFP may submit his queries, in writing, at the Purchaser's mailing address viz.;

**Managing Director
Maharashtra Information Technology Corporation Limited
Room No. 514, 5th Floor Mantralaya Annexe,
Hutatma Rajaguru Chowk
Mumbai 400 032**

Or through email mahanet.mahait@maharashtra.gov.in as per schedule indicated in **Section I – Invitation to Bids**

4.2 The queries submitted in the following format (in Excel file, *.xls) only shall be considered for clarification:

S. No.	Section No.	Clause No.	Reference/Subject	Clarification Sought

The soft copy of the clarification on RFP should be in MS Excel only and not in word and PDF or any other format.

4.3 All queries on the RFP should be received on or before the clarification end date and time as mentioned in Section I – Invitation to bids. The responses to the clarifications shall be notified on the website by means of Corrigendum to the RFP. Bidders are responsible for duly checking the website regularly for any clarifications.

Note: Inputs/suggestions/queries submitted by bidders as part of the pre-bid meeting or otherwise shall be given due consideration by the Tender committee. However, State is neither mandated to accept any submission made by the bidder nor the bidder shall be given any written response to their submissions. If an input is considered valid by the committee the same shall be accepted and incorporated as part of the corrigendum.

5. Amendments to the RFP

- 5.1 At any time prior to the last date for receipt of bids, the purchaser, for any reason, whether at its own initiative or in response to a clarification requested by a prospective Bidder, may modify the Tender Document by an amendment. The amendment shall be notified on <https://mahatenders.gov.in> and should be taken into consideration by the prospective bidders while preparing their bids.
- 5.2 In order to provide the prospective Bidders reasonable time to take the amendment into account in preparing their bids, the Purchaser may, at its discretion, extend the last date for the receipt of Bids.

6. Language of the Bid

- 6.1 The Bids prepared by the Bidder and all correspondence and documents relating to the bids exchanged by the Bidder and the Purchaser, shall be written in English language, however, any printed literature furnished by the Bidder may be written in another language provided that the same is accompanied by its English translation in which case, for purposes of interpretation of the bid, the English translation shall govern.

7. Documents Comprising the Bids

The bids prepared by the Bidder shall comprise of the following documents:

- 7.1 **Earnest Money Deposit (EMD) and Tender Fee** in the form of a Bank Guarantee and Demand Draft respectively from a Scheduled Bank
- 7.2 **Technical Bid** - The Technical Bid, besides the other requirements of the Tender, shall comprise of the following:
 - 7.2.1 **Power of Attorney** executed by the Bidder in favour of the Principal Officer or the duly Authorized Representative, certifying him as an authorized signatory for the purpose of this Tender (Refer Clause 14)
 - 7.2.2 **Annexure 4.2 – Bidder’s Profile**
 - 7.2.3 **Annexure 4.3 - Technical Bid Letter**
 - 7.2.4 **Annexure 4.4 – Details of Litigation(s)**
 - 7.2.5 **Annexure 4.12 - MAF (all applicable OEMs)**
- 7.3 **Financial Bid** –The Financial Bid, besides the other requirements of the Tender, shall comprise of the following:
 - 7.3.1 **Annexure 4.6 - Financial Bid Letter**
 - 7.3.2 **Annexure 4.11 - Financial Bid**

8. Cover – I (To be uploaded online)

- 8.1 Scanned copy of **EMD and Tender Fee** (as mentioned in this RFP).
And
- 8.2 **The original Bank Guarantee for EMD, must be submitted in a sealed envelope mentioning “EMD for NIT No. Mahait/CNI/001/01/2018” before last Date and Time for Submission of Bids as mentioned in Section I-Invitation to bids.**

9. Cover – II (To be uploaded online)

- 9.1 **Cover II should be submitted individually for each package for which the bidder is submitting a proposal**
- 9.2 **The document should be uploaded in .RAR format and should be saved as Pre_Qual_Tech_bid_<MENTION TENDER NUMBER>.rar’ and should further contain two files Part 1.rar and Part 2.rar as per details mentioned below.**

9.3 Part 1 must contain - RAR file for Pre-qualification bid which must contain the following information in Pdf format–

- a) Annexure 4.1 – Schedule of Requirements (SoR)
The bidder should populate and submit the appropriate form based on the package.
- b) Annexure 4.2 – Bidder’s Profile
- c) Annexure 4.3 – Technical Bid Letter
- d) Annexure 4.4 – Details of Litigation
- e) Annexure 4.5 – Compliance Document (Eligibility Criteria)
Eligibility Criteria (in pdf format) which should contain all the supporting documents, as asked for eligibility.
- f) Annexure 4.7 – RFP Acknowledgement Letter
- g) Annexure 4.8 – Details of experience of responding firm
- h) Annexure 4.12 - Manufacturer’s Authorization Format (MAF) FROM OEM
- i) Annexure 4.13 – Declaration Proforma
- j) Annexure 4.14 – Self Certification on PMA
- k) Annexure 4.15 – Form of Power of Attorney for consortium
- l) Bidders Profile

10. Cover – III (To be uploaded online)

- 10.1 *Cover III should be submitted individually for each package for which the bidder is submitting a proposal*
- 10.2 *Duly filled Financial Bid should contain the following information in PDF format –*
 - i. Annexure 4.6 – Financial Bid Letter
 - ii. Annexure 4.11 – Financial Bid (The bidder should populate and submit the appropriate form based on the package).
- 10.3 *The format of the financial bid should be strictly in the prescribed format. Non adherence may lead to rejection of the bid.*
- 10.4 *All the bid documents must be signed by the authorized signatory of company. In case the bid is signed by the person other than the authorized signatory of the company, the bidder should enclose authorization letter from HR department of the company for the officer, who signed the bid.*
- 10.5 *Bidders must submit their Financial Bid for each package in the PDF document format provided (please refer filenames 'FinancialBidForm_A-Final' for Package A, 'FinancialBidForm_B-Final' for Package B and 'FinancialBidForm_C-Final' for Package C uploaded on 6 March 2018). Only the bids tendered in these documents would be considered for Financial Evaluation.*
It may be noted that MahalT had earlier provided Excel based BOQ documents (BOQ_471001.xls for Package A, BOQ_483186.xls for Package B and BOQ_483188.xls for Package C) as well. This stands superseded by the Financial Bid PDF documents mentioned above. However, it is mandatory from a system requirement perspective of the e-tender portal that the Excel based BoQ document for specific package be uploaded for Financial Bid submission. Therefore, the bidders are requested to enter the company name and populate a notional price of Rs. '1' for each of the items in the Excel based BoQ file, and upload along with the PDF document Financial Bid submission.
It is reaffirmed that the Excel based BoQ is a dummy sheet and will not be considered for any evaluation purposes. Only the financial bid submitted in the PDF document would be considered for Financial Evaluation.

11. Bid Prices

- 11.1 The Bidder shall indicate in the prescribed proforma, the unit rates and total Bid Prices of the equipment / services, it proposes to provide under the Contract. Prices should be shown separately for each item as detailed in **Annexure 4.11 - Financial Bid** given in **Section IV – Bid Submission Format**.
- 11.2 In the absence of above information as requested in Clause 11.1, bid shall be considered as incomplete and be summarily rejected.

11.3 The Bidder shall prepare the bid based on the details provided in the RFP. It must be clearly understood that the Scope of Work is intended to give the Bidder an idea about the order and magnitude of the work and is not in any way exhaustive and guaranteed by the Purchaser. The Bidder shall carry out all the tasks in accordance with the requirement of the RFP and it shall be the responsibility of the Bidder to fully meet all the requirements of the RFP.

12. Firm Prices

- 12.1 Prices quoted in the bid must be firm and final and shall not be subject to any upward modifications, on any account whatsoever. However, the Purchaser reserves the right to negotiate the prices quoted in the bid to effect downward modification. **The Bid Prices shall be indicated in Indian Rupees (INR) only.**
- 12.2 The Financial bid should clearly indicate the price to be charged and the taxes shall be applicable as per actual. It is mandatory that such charges wherever applicable/payable should be indicated separately in **Annexure 4.11 – Financial Bid given in Section IV – Bid Submission Format**. In case there is a change in the applicable taxes, the same shall apply.

13. Discount

- 13.1 The Bidders are advised not to indicate any separate discount in the Financial Bid. Discount, if any, should be merged with the quoted prices. Discount of any type, indicated separately, shall not be taken into account for evaluation purpose. However, in the event of such an offer is found to be the lowest without taking into account the discount, the Purchaser shall avail such discount at the time of award of contract.

14. Bidder qualification

- 14.1 The "Bidder" as used in the RFP shall mean the one who has signed the Tender Form. The Bidder may be either the Principal Officer or his duly Authorized Representative, in either cases him/she shall submit a certificate of authority. All certificates and documents (including any clarifications sought and any subsequent correspondences) received hereby, shall, be furnished and signed by the authorized representative and the principal officer.
- 14.2 It is further clarified that the individual signing the RFP or other documents in connection with the RFP must certify whether he/she signs as the Constituted attorney of the firm, or a company.
- 14.3 The authorization shall be indicated by written power-of-attorney accompanying the bid.
- 14.3 The power or authorization and any other document consisting of adequate proof of the ability of the authorized signatory to bind the Bidder shall be annexed to the bid.
- 14.4 Any change in the Principal Officer shall be intimated to MahalT in advance.

15. Earnest Money Deposit (EMD)

- 15.1 *The Bidder shall furnish, as part of its bid, an Earnest Money Deposit (EMD) of the amount given in the below:*
 - ii) EMD for Package A – INR. 10,00,00,000/- (INR Ten Crore only)*
 - iii) EMD for Package B – INR. 5,00,00,000/- (INR Five Crore only)*
 - iv) EMD for Package C – INR. 5,00,00,000/- (INR Five Crore only)*

- 15.2 The EMD must be submitted in the form of Bank Guarantee valid for period of 180 days, of any Scheduled Bank drawn in favour of **Maharashtra IT Corporation**, payable at Mumbai.

Bank Details for Bharat Net Project

- 1) Account Name:- Maharashtra Information Technology Corporation Limited - Bharat Net**
- 2) Account No:- 005710110004792.**
- 3) IFSC Code:- BKID0000057**
- 4) Bank & Branch:- Bank of India, Nariman Point Branch.**

- 15.3 The EMD is required to protect the Purchaser against the risk of Bidder's conduct which would warrant the security's forfeiture, pursuant to Clause 15.6.
- 15.4 Unsuccessful Bidder's EMD shall be returned after the award of contract to the Project Implementation Agency (PIA). No interest shall be paid by the Purchaser on the EMD.
- 15.5 The EMD of PIA shall be returned upon the execution of the Contract, pursuant to Clause 37 and furnishing the Bank Guarantee/Security deposit, pursuant to Clause 41. No interest shall be paid by the Purchaser on the EMD.
- 15.6 The EMD may be forfeited:
 - a) If bidder withdraws its bid during the period of bid validity specified by the Bidder in the Bid; or
 - b) If PIA fails to sign the Contract or to furnish the Bank Guarantee for contract performance in accordance with Clause 41.

16. Security Deposit

- 16.1 Validity: **Valid for 5 years. The Bank Guarantee (BG) shall be released after 5 years and 60 days.**
- 16.2 Instrument: **One single deposit** in the form of Bank Guarantee
- 16.3 In the event of termination, Purchaser may invoke the Bank Guarantee/Security Deposits, recover such other direct costs and other amounts towards direct damages from the PIA that may have resulted from such default and pursue such other rights and/or remedies as may be available to the Purchaser under law.

17. Period of Validity of Bids

- 17.1 Bids shall remain valid for 180 days after the date of opening of Technical Bids prescribed by the Purchaser. A bid valid for a shorter period may be rejected by the Purchaser as non-responsive.
- 17.2 In exceptional circumstances, the Purchaser may request the Bidder for an extension of the period of validity up to 180 days or more. The request and the responses thereto shall be made in writing (or through e-mail). The validity of EMD provided under Clause 17.1 may also be extended, if required.

18. Format and Signing of Bids

- 18.1 The original and all copies of the bid shall be typed or written in indelible ink. The original and all copies shall be signed by the Bidder or a person or persons duly authorized to bind the Bidder to the Contract in accordance with Clause 14. All pages of the bid, except for unamended printed literature, shall be initialed and stamped by the person or persons signing the bid.
- 18.2 The response to the bid should be submitted along with legible, appropriately indexed, duly filled Information sheets and sufficient documentary evidence as per Checklist. Responses with illegible, incomplete Information sheets or insufficient documentary evidence shall be rejected.
- 18.3 The bid shall contain no inter-lineations, erasures or overwriting except as necessary to correct errors made by the Bidder, in which case such corrections shall be initialed by the person or persons signing the bid.
- 18.4 The Bidder shall duly sign and seal its bid with the exact name of the firm/company to whom the contract is to be issued.

19. Revelation of Prices

- 19.1 Prices in any form or by any reason before opening the Financial Bid should not be revealed, failing which the offer shall be liable to be rejected.

20. Terms and Conditions of Bidders

- 20.1 Printed terms and conditions of the Bidders shall not be considered as forming part of their Bids.

21. Local Conditions

- 21.1 It shall be incumbent upon each Bidder to fully acquaint himself with the local conditions and other relevant factors at the proposed site which would have any effect on the performance of the contract and / or the cost.
- 21.2 The Bidder is expected to make a site visit to obtain for himself on his own responsibility, all information that may be necessary for preparing the bid and entering into contract. Obtaining such information shall be at Bidder's own cost.
- 21.3 Failure to obtain the information necessary for preparing the bids and/or failure to perform the activities that may be necessary for the providing services before entering into contract shall in no way relieve the PIA from performing any work in accordance with the RFP.
- 21.4 It shall be imperative for each Bidder to fully inform themselves of all legal conditions and factors which may have any effect on the execution of the contract as described in the bidding documents.
- 21.5 It is the responsibility of the Bidder that such factors have properly been investigated and considered while submitting the bid proposals and that no claim whatsoever including those for financial adjustment to the contract awarded under the bidding documents shall be entertained by the Purchaser and that neither any change in the time schedule of the contract nor any financial adjustments arising thereof shall be permitted by the Purchaser on account of failure of the Bidder to appraise themselves of local laws and site conditions.

22. Last Day for Receipt of Bids

- 22.1 Bids (Only hard copy of EMD) shall be received by the Purchaser at the address specified under Section I - Invitation of bids before the last date and time of submission of bids. In the event of the specified date for the receipt of Bids being declared a holiday for the Purchaser, only hard copy of EMD shall be received up to the appointed time on the next working day.
Tender fees is to be deposited online only.
- 22.2 The Purchaser may, at its discretion, extend the last date for the receipt of bids by amending the RFP in accordance with Clause 5, in which case all rights and obligations of the Purchaser and Bidders previously subject to the last date shall thereafter be subject to the last date as extended.

23. Late Bids

- 23.1 Any bid received by the Purchaser after the last date and time for receipt of bids prescribed by the Purchaser, pursuant to Section I - Invitation for Bids, shall be rejected.

24. Modifications and Withdrawal of Bids

- 24.1 No bid shall be altered / modified subsequent to the closing date and time for receipt of bids. Unsolicited correspondences from Bidders shall not be considered.
- 24.2 No bid shall be withdrawn in the interval between the last date for receipt of bids and the expiry of the bid validity period specified by the Bidder in the Bid. Withdrawal of a bid during this interval may result in the Bidder's forfeiture of its EMD.

25. Address for Correspondence

- 25.1 The Bidder shall designate the official mailing address, place and fax number to which all correspondence shall be sent by the Purchaser.

26. Contacting the Purchaser

- 26.1 No Bidder shall contact the Purchaser on any matter relating to its bid, from the time of bid opening to the time the Contract is awarded.
- 26.2 Any effort by a Bidder to influence the Purchaser's bid evaluation, bid comparison or contract award decisions may result in the rejection of the Bidder's bid.

27. Opening of Technical Bids by Purchaser

- 27.1 The Purchaser shall convene a bid opening session as per time schedule where one representative from the Bidder, who has successfully submitted the bid, can participate.

Subsequent to this, Purchaser shall further evaluate the Bid of only those agencies whose EMD is found to be in order.

28. Evaluation of Bids

- 28.1 A committee/s shall be formed for evaluation of the bids. Decision of the committee would be final and binding upon all the Bidders.
- 28.2 The evaluation process of the RFP proposed to be adopted by the Purchaser is indicated under RFP clause number 29. The purpose of this clause is only to provide the Bidder(s) an idea of the evaluation process that the Purchaser may adopt. However, the Purchaser reserves the right to modify the evaluation process at any time during the Tender process, without assigning any reason, whatsoever, and without any requirement of intimating the Bidder(s) of any such change.
- 28.3 Bidder must possess the requisite experience, strength and capabilities in providing the services necessary to meet the Purchaser's requirements, as described in the RFP. Bidder must possess the technical know-how and the financial wherewithal that would be required to successfully execute the services mentioned in **Section I: NIT as well as Section V: Scope of Work**. The Bidder's bid must be complete in all respect and covering the entire scope of work as stipulated in the RFP.

29. Preliminary Examination

The Purchaser shall examine the bids to determine their responsiveness, i.e. whether they are complete, whether the bid format confirms to the RFP requirements, whether any computational errors have been made, whether required EMD and Tender Fee have been furnished, whether the documents have been properly signed, and whether the bids are generally in order.

A bid determined as not substantially responsive shall be rejected by the Purchaser and may not subsequently be made responsive by the Bidder by correction of the nonconformity.

30. Clarification

- 30.1 When deemed necessary, during the tendering process, the Purchaser may seek clarifications on any aspect from any or all the Bidders. However, that would not entitle the Bidder to change or cause any change in the substance of the tender submitted or price quoted.
- 30.2 MahalIT reserves the right to seek clarifications on the already submitted documents.

31. Evaluation of Eligibility Criteria

- 31.1 In this part, the bids shall be reviewed for determining the Compliance of the general conditions of the contract and Eligibility Criteria as mentioned in the RFP. Any deviation for general conditions of the contract and eligibility criteria shall lead to rejection of the bid.
- 31.2 Bidders are expected to meet all the conditions of the RFP and the eligibility criteria as mentioned below. Bidders failing to meet these criteria or not submitting requisite supporting documents / documentary evidence in support of eligibility criteria are liable to be rejected summarily.
- 31.3 The invitation to the bids is open to all the bidders who qualify the eligibility criteria as follows:

S. No.	Eligibility Criteria	Documents Required
1	<p>a. The Sole Bidder or each of the Consortium members should be registered under Indian Companies Act 2013 as per section 2 (20) of the Indian Companies Act 2013 or Companies Act 1956 or as amended and should have at least 3 years of operations in India as on bid submission date.</p> <p>b. Sole bidder or lead bidder of a consortium, in the last three (3) audited</p>	<p>The Sole Bidder or each of Consortium members:</p> <ul style="list-style-type: none"> a) Copy of Certification of Incorporation / Registration Certificate b) PAN card c) GST Registration d) Audited financial statements for the last three financial years (2014-15, 2015-16 and 2016-17) e) Certificate from the Statutory Auditor/Company Secretary on turnover

S. No.	Eligibility Criteria	Documents Required
	<p>financial years (2014-15, 2015-16 and 2016-17), should have an average annual turnover of at least:</p> <ul style="list-style-type: none"> • Rs. 650 crore for Package-A • Rs. 500 crore for Package-B • Rs. 500 crore for Package-C <p>c. The sole bidder or a Consortium can bid for maximum up to 2 packages and the turnover criteria shall be cumulative for the number of packages for which bid is submitted.</p> <p>d. For a bidder that intends to bid for package A, the following additional criteria will also be applicable.</p> <p>i) The sole bidder or lead bidder of a consortium shall have a cumulative turnover of at least Rs. 250 crore over the last three (3) financial years (2014-15, 2015-16 and 2016-17) from activities related to provision of IT Systems Integration services / IT services / Network services / Active Telecom equipment and services / NMS / OSS/ BSS services in India or abroad.</p> <p>Note: Turnover considered would be a consolidated turnover of the company i.e. a parent company can use the turnover of its child company where it has a majority shareholding (>51%) if the child company is a telecom solution provider but a child company cannot use parent company's turnover.</p>	<p>details for the last three (3) financial years (2014-15, 2015-16 and 2016-17).</p> <p>f) For Package A wrt Additional Criteria, Certified copy of the relevant work order(s) and certificate(s) (on the letterhead of the company issuing the certificate) with details from the client(s) stating that the work(s) has been completed or Certificate from Chartered Accountant/ Company Secretary to meet this financial criteria</p>
2	The Bidder / Consortium partner and its Parent Company shall not be a Licensed Telecom Service Provider to provide Basic Services/ Cellular Telephony Services/ Internet Services/ UASL/ NLD/ ILD Services, anywhere in India.	Self-Certificate by the bidder shall be submitted
3	The Sole Bidder or Lead bidder of consortium should have an experience as per the below mentioned scope of work in last 5 years as on bid submission date. “Experience of Laying, Installation, Testing and Commissioning of Optical Fibre Cable (Underground and Aerial), PLB Duct and accessories of at least 5,000 route km.	<p>The Sole Bidder or any of Consortium members: Completion Certificate issued and signed by the competent authority of the client entity along with the supporting documents such as Work order/Purchase order OR Contract clearly highlighting the scope of work Bill of Material and value of the contract/ order.</p> <p>In case of ongoing project/s, then a certificate from the Client must be submitted stating the completion of the requisite eligibility criteria laid down in this Tender</p>

S. No.	Eligibility Criteria	Documents Required
		has been completed by the bidder in its ongoing project.
4	<p>Bidder should provide Solvency Certificate as per the last audited financial year and should be for at least</p> <ul style="list-style-type: none"> i) INR 300 Crores for Package-A ii) INR 200 Crores for Package-B iii) INR 200 Crores for Package-C <p>The sole bidder or a Consortium can bid for maximum up to 2 packages and the solvency criteria shall be cumulative for the number of packages for which bid is submitted</p>	Solvency certificate from Banker
5	<p>Bidder should have minimum net worth equivalent to</p> <ul style="list-style-type: none"> i) INR 300 Crores for Package-A ii) INR 200 Crores for Package-B iii) INR 200 Crores for Package-C <p>as per the last audited (2016-17) financial figures.</p> <p>The sole bidder or a Consortium can bid for maximum up to 2 packages and the networth criteria shall be cumulative for the number of packages for which bid is submitted</p>	Certificate from statutory auditor/ Chartered Accountant
6	The Sole Bidder or Lead Bidder, should have valid ISO 9001:2008/ ISO 9001:2015 for Quality Management System which should be valid as on bid submission date	The Sole Bidder or Lead Bidder: Copy of valid certificate
7	The Sole Bidder or each of the Consortium members should not remain blacklisted/ debarred by any State/ Central Govt. department or any Govt. PSU for Telecom or OFC business in India as on bid submission date.	The Sole Bidder or each of the Consortium members: An undertaking signed by CEO/ Country Head/ Authorized Signatory of the company to be provided on Non – judicial stamp paper of INR 100/- or such equivalent amount and document duly attested by notary public.

S. No.	Eligibility Criteria	Documents Required
8	<p>OEM shall ensure that all equipment / components / sub-components being supplied by them shall be supported for the entire contract period. If the same is de-supported by the OEM for any reason whatsoever, the bidder shall replace it with an equivalent or better substitute that is acceptable to Purchaser without any additional cost to the Purchaser and without impacting the performance of the solution in any manner whatsoever.</p> <p>For Package-A:</p> <ul style="list-style-type: none"> i) Lead Bidder can only bid with a single OEM for all IP/MPLS Routers for GP and Talukas. In case of Lead Bidder offering multiple OEM options for IP/MPLS routers, the bid of such Lead Bidder will be rejected. ii) Lead Bidder can only bid with a single OEM for Wi-Fi Access Points. In case of Lead Bidder offering multiple OEM options for IP/MPLS routers, the bid of such Lead Bidder will be rejected. iii) Lead Bidder can only bid with a single OEM for security. In case of Lead Bidder offering multiple OEM options for Security Solution, The bid of such Lead Bidder will be rejected. For the full scope of security solution, refer Annexure A 10 iv) For other electronics components (e.g.. NOC) multiple OEMs are allowed 	Documentary evidences such as Authorization letters MAF (Manufacturers Authorization Form) from all OEM/Vendors whose products are being quoted by the Bidder need to be attached in the bid.
9	The Sole Bidder or Lead Bidder should have a project office in the respective project area / zone. However, if the local presence is not there in the State, the selected bidder should give an undertaking for establishment of a project office, within one month of award of the contract.	Self-certification duly signed by authorized signatory on company letter head.
10	The Sole Bidder or Lead Bidder shall be the single point of contact and shall be solely responsible for all the Terms and Conditions of the RFP	Self-certification duly signed by authorized signatory on company letter head.
11	Product OEM qualification	
11 (a)	<p>IP-MPLS</p> <p>In case a bidder intends to bid for Package-A, the following incremental criteria will also be applicable.</p> <ul style="list-style-type: none"> i) OEM should have deployed similar solutions in at least five Service Providers in India/Globally 	For Copy of PO/Contract/Agreement with the client along with certificate from client on their letterhead with details of quantity supplied or Self-certification duly signed by authorized signatory on company letter head

S. No.	Eligibility Criteria	Documents Required
	<p>ii) The OEM should have an aggregate installed base of at least 300 IP/MPLS edge/aggregation/core routers which should be working satisfactorily for over one year Of these, a minimum of 150 IP-MPLS edge/ aggregation/ core routers should be deployed in India in one single network.</p> <p>iii) The aggregate installed base of Access routers deployed in India/Globally by the OEM should be at least 7,500, which should be working satisfactorily for over two years</p>	
11 (b)	<p>OFC</p> <p>i) The OFC manufacturer should have Infrastructure Assessment (IA) certificate issued by BSNL QA, Bangalore for manufacturing capacity of minimum 50,000 cable km per annum for minimum 48F type cables</p> <p>ii) The OFC manufacturer should use ITU-T grade G.652.D and G.657.A1 optical fibre, sourced from CACT approved indigenous sources.</p> <p>iii) The OFC Manufacturer should not be blacklisted for Telecom business by any Central/ State Government or Govt. PSU for Telecom or OFC business as on the date of bid submission</p> <p>iv) The OFC manufacturer should have valid ISO 9001 and TL9000 certification in its name with no prior history of withdrawal.</p> <p>v) The OFC manufacturer should have supplied a cumulative of at least 50,000 cable kms of minimum 24F and above OFC, to Telecom Companies (Private Telecom Operators, PSUs and Government Telecom Operators), including <ul style="list-style-type: none"> Cumulative of at least 7,000 km of minimum of 48F and above Ribbon in India during the last three financial years (i.e., FY14-15, FY15-16, FY 16-17) </p> <p>vi) The OFC Manufacturer should have a sum total of revenues of minimum INR 400 crore from the sale of OFC during the last three financial years (i.e., FY14-15, FY15-16, FY 16-17)</p> <p>vii) The OFC Manufacturer should have a minimum networth of Rs 75 crore as on 31st March, 2017. A certificate from</p>	<p>Certificate from Authorized Signatory of the bidder mentioning the turnover in the last three financial years. For listed entities, in case the published audited annual reports contain the detailed breakup of financial as required, a copy of such annual reports certified by the authorized signatory may be provided.</p> <p>CACT certificate to be submitted.</p> <p>Copy of PO/Contract/Agreement with the client along with certificate from client on their letterhead with details of quantity supplied.</p> <p>A certificate from the statutory auditor/ Chartered Accountant of the bidder regarding networth as on 31st March 2017</p>

S. No.	Eligibility Criteria	Documents Required
	the statutory auditor/ Chartered Accountant of the bidder to this effect should be submitted.	

Note 1: Tender items - OFC, Splitters, Radio equipment (If applicable) Solar Panel, Batteries, and Charging Control Unit should have valid Type Approval Certificate (TAC) from Telecom Engineering Centre (TEC), New Delhi or Technical Specification Evaluation Certificate (TSEC) from Quality Assurance Circle, BSNL, Bengaluru, against the respective technical specifications of this RFP (**Type Approval Certificate (TAC) from Telecom Engineering Centre (TEC), New Delhi or Technical Specification Evaluation Certificate (TSEC) from Quality Assurance Circle, BSNL, Bengaluru is required for passive infrastructure**). In case any of the quoted models does not have TAC/ TSEC then it should be applied for TSEC to Quality Assurance Circle, BSNL, and Bengaluru or to TEC, New Delhi for the model against the technical specifications, at least one day before the opening of the tender. The registration number allotted for the TSEC purpose by Quality Assurance Circle, BSNL, and Bengaluru or for TAC purpose by TEC, New Delhi shall be submitted along with the bid. However, only type approved products as per above specifications shall be accepted which shall have to be obtained before issuing Work Order by the purchaser.

The TSEC obtained by the OEMs of bidders for the various tenders floated by BBNL/BSNL in the last two years shall be acceptable for the items which are part of this RFP provided that the technical specifications remains unchanged. In case of OFC, any change in the source of raw material shall be subject to fresh TSEC process of QA.

Note 2: Consortium Criteria:

1. In case of consortium, the Lead Bidder must be specified by the bidder.
2. The Lead bidder cannot be a partner in more than one consortium in other packages in same RFP.
3. In case of a consortium, applicant consortia shall have a valid Memorandum of Understanding (MoU)/ Consortium Agreement among all the members signed by the CEO/ Country Head/Authorized Signatories of the companies dated prior to the submission of the bid. The MoU/ Consortium Agreement shall clearly state the composition of the consortium who shall be the Lead bidder, the complete description of the partner and roles and responsibilities of the partners.
4. The consortium bid submitted without valid MoU / Consortium Agreement shall be treated as non-responsive.
5. In case of a consortium, the maximum members should not be more than 3 including the Lead bidder.
6. By submitting the Bid, the Bidder shall also be deemed to have acknowledged and agreed that in the event of a change in control of a Consortium Member or an Associate whose Technical Capacity and/ or Financial Capacity was taken into consideration for the purposes of short-listing and technically qualified under and in accordance with this RFP, the Bidder shall be deemed to have knowledge of the same and shall be required to inform the competent authority forthwith along with all relevant particulars about the same and the competent authority may, in its sole discretion, disqualify the Bidder or withdraw the work order from the PIA, as the case may be. In the event such change in control occurs after signing of the Agreement but prior to sign off of the project, it would, notwithstanding anything to the contrary contained in the Agreement, be deemed to be a breach of the Agreement, and the same shall be liable to be terminated without the competent authority being liable in any manner whatsoever to the Bidder.

In such an event, notwithstanding anything to the contrary contained in the Agreement, the competent authority shall be entitled to forfeit and appropriate the Bid Security and Performance Security, as the case may be, as damages, without prejudice to any other right

or remedy that may be available to the competent authority under the Bidding Documents and/ or the Agreement or otherwise

7. The bidder (each member of the consortium) shall have company registration certificate, registration under labour laws and contract act, valid GST registration certificate and Permanent Account Number (PAN) issued by Income Tax department, Memorandum of Association and Article of Association (copy of the same should be provided)
8. Attested copies in respect of company's financial statements for the last three audited financial years (2014-15, 2015-16 and 2016-17) shall be attached along with the bid. Bidder should submit an undertaking that Bidder (or each of the consortium members) should not have been blacklisted/debarred by any Govt. department or any PSU in India as on bid submission date
9. The award of contract shall be signed with the Lead Bidder only and the Lead Bidder shall be single Point of Contact for this Project. BG shall be submitted by the Lead Bidder
10. The payments for the said project shall be released only in the name of Lead Bidder.
11. Lead Bidder shall be solely responsible for any failure liable to the Government for the execution of the project in accordance with the terms and conditions of the bid document and a statement of this effect shall be included in the MoU/ Consortium Agreement.

32. Evaluation of Financial bids

- 32.1 Financial bids submitted of only those bidders, who are technically qualified shall be opened and are eligible for further evaluation.

32.2 Evaluation of bids shall be done on Least Cost/Lowest Cost (L1) criteria as detailed.

The bidder have to qualify the eligibility criteria for further evaluation for being eligible for opening of financial bid. The bids quoted as per the financial bid format shall be considered for financial evaluation. Further Financial Evaluation by the purchaser shall be done on Net Present Value (NPV) discounting at the rate of 10% of O&M shall be calculated on a yearly basis as quoted in Annexure 4.11 Financial Bid Section IV – Bid Submission Formats

$$Z=X_1+X_2$$

X1=Total of Table A of Financial Bid

X2=NPV value for O&M in Table-B of Annexure 4.11- Financial Bid

Formula for calculating NPV is as follows:

$$X_2 = NPV = R \times \frac{1 - (1 + i)^{-n}}{i} - \text{Initial Investment}$$

R is the Net cash inflow expected to be received in each period

i is the required rate of return per period

N are the No. of periods during which the project is expected to operate and generate cash inflow

- 32.3 The Bidder who shall have the least/lowest value of "Z"

"Z=X1+X2 (NPV)" after calculating NPV value for O&M in Table A- of Annexure 4.11- Financial Bid given in Section IV – Bid Submission Formats shall be declared as "L1" and shall be awarded the project. States'/SIAs' decision shall be final and binding.

- 32.4 Bidders quoting unrealistic cost of items shall be rejected straightaway by the committee and EMD of such bidder shall be forfeited. Any bid found to have unsatisfactory response in any of the eligibility criteria as mentioned may be rejected and shall not be considered for further evaluation.

33. Final Bid Evaluation

- 33.1 If any bidder withdraws his bid, at any stage after the last date and time of bid submission till the final evaluation or declaration of the final selected bidder, it shall be declared a "defaulting bidder" and EMD of such defaulting bidder shall be forfeited. In such situation the tendering process shall be continued with the remaining bidders as per their ranking.
- 33.2 If the bidder relents after being declared as selected bidder, it shall be declared as defaulting bidder and EMD of such defaulting bidder shall be forfeited and MahalT reserves right to blacklist/debarred such company for next three years from participating in any MahalT tender. In such situation, the tendering process shall be continued with the remaining bidders as per their ranking.

34. Purchaser's Right to Vary Scope of Contract

- 34.1 The Purchaser may at any time, by a written order given to the Bidder, make changes to the scope of the Contract as specified.
- 34.2 If any such change causes an increase or decrease in the cost (+/-20%) or the time required for the bidder's performance of any part of the work under the Contract, whether changed or unchanged by the order, an equitable adjustment shall be made in the Work Order Value or time schedule, or both, as decided by the committee and the Contract shall accordingly be amended. Any claims by the Bidder for adjustment under this Clause must be asserted within thirty (30) days from the date of the Bidder's receipt of the Purchaser's changed order.

35. Purchaser's Right to Accept Any Bid and to Reject Any or All Bids

- 35.1 The Purchaser reserves the right to accept any or all bid, and to annul the tender process or reject all bids at any time prior to award of contract, without thereby incurring any liability to the affected Bidder or Bidders or any obligation to inform the affected Bidder or Bidders of the grounds for the Purchaser's action.

36. Notification of Award

- 36.1 Prior to the expiry of the period of bid validity, pursuant to Clause 17, the Purchaser shall notify the PIA in writing by fax, followed by registered letter to be confirmed in writing by registered letter, that its bid has been accepted.
- 36.2 The notification of award shall constitute the formation of the Contract.
- 36.3 Upon furnishing of Bank Guarantee of 10% of the Work Order Value for contract performance by PIA, the Purchaser may notify each unsuccessful Bidder and shall refund their EMD, pursuant to Clause 15.4.

37. Award of Contract

- 37.1 There shall be only one bidder in each package in same RFP
- 37.2 At the same time as the Purchaser notifies the PIA that his bid has been accepted, the Purchaser shall end the PIA a Proforma for Contract as per **Annexure 4.10 of Section IV – Bid Submission Formats** provided in the RFP
- 37.3 Within 7 days of receipt of the Contract, the PIA shall sign and date the Contract and return it to the Purchaser.
- 37.4 The Bidder whose bids are accepted shall be required to give a Security Deposit as mentioned in the RFP along with acceptance of work order, within 15 days. Security Deposit shall be in the form of Bank Guarantee (BG) from any Scheduled Bank. Security Deposit should be valid for the entire period of 5 years plus 60 days and thereafter the Security Deposit shall be refunded to the PIA without any interest.
- 37.5 MahalT may, at any time, terminate the contract by giving written notice to the PIA without any compensation, if the PIA becomes bankrupt or otherwise insolvent, provided that such termination shall not prejudice or affect any right of action or remedy which has accrued or shall accrue thereafter to MahalT
- 37.6 If at any point during the contract, if the PIA fails to deliver as per the RFP terms and conditions or any other reason amounting to disruption in services, the Termination and Exit Management clause shall be invoked.

38. Confidentiality of the Contract

- 38.1 The Contract is confidential and the PIA shall ensure that anything contained in the Contract shall not be disclosed in any manner, whatsoever.

39. Tender Related Conditions

- 39.1 The PIA shall confirm unconditional acceptance of full responsibility of completion of job and for executing the 'Scope of Work' of this RFP. This confirmation should be submitted as part of the Technical Bid. The Sole Bidder or Lead Bidder shall be the sole point of contact and shall be solely responsible for all purposes of the Contract.
- 39.2 The PIA should not be involved in any litigation that may have an impact of affecting or compromising the execution of work as required under this contract as per Annexure 4.4 given in Section IV – Bid Submission Formats. If at any stage of tendering process any suppression / falsification is brought to the knowledge of the Purchaser, the Purchaser shall have the right to reject the bid or terminate the contract, as the case may be, without any compensation to the PIA.

40. Rejection Criteria

- 40.1 Besides other terms and conditions highlighted in the RFP, bids may be rejected under following circumstances:
- 40.2 General Rejection Criteria
- 40.2.1 Bids submitted without or improper Tender fee and EMD
 - 40.2.2 Bids received through Telegraphic / Fax/E-Mail/ Hard copies except, wherever required.
 - 40.2.3 Bids which do not conform to unconditional validity of the bids as prescribed in the RFP.
 - 40.2.4 If the information provided by the Bidder is found to be incorrect / misleading at any stage / time during the Tendering Process.
 - 40.2.5 Any effort on the part of a Bidder to influence the Purchaser's bid evaluation, bid comparison or contract award decisions.
 - 40.2.6 Bids received by the Purchaser after the last date for receipt of bids prescribed by the
 - 40.2.7 Bids without Power of Attorney and any other document consisting of adequate proof of the ability of the authorized signatory to bind the Bidder.

40.3 Technical Rejection Criteria

- 40.3.1 Technical Bid containing financial details.
- 40.3.2 Revelation of Prices in any form or by any reason before opening of the Financial Bids
- 40.3.3 Failure to furnish all information mentioned in the RFP or submission of a bid not substantially responsive to the RFP in every respect.
- 40.3.4 Bidders not quoting for the complete scope of work as indicated in the RFP, addendum (if any) and any subsequent information given to the Bidder.
- 40.3.5 Bidders not complying with the material, specifications and General Conditions of the Contract as stated in the RFP.
- 40.3.6 The Bidder not conforming to unconditional acceptance of full responsibility of providing services in accordance with the **Section III – General Conditions of Contract and Service Level Agreements and Section V - Scope of work of this RFP**.
- 40.3.7 If the bid does not conform to the timelines indicated in the RFP.

40.4 Financial Rejection Criteria

- 40.4.1 Incomplete Financial Bid
- 40.4.2 Financial Bids that do not conform to the RFPs' financial bid format
- 40.4.3 If there is an arithmetic discrepancy in the financial bid calculations, the Purchaser shall rectify the same. If the Bidder does not accept the correction of the errors, it may be rejected.

41. Bank Guarantee for Contract Performance

- 41.1 Within 15 days of the receipt of notification of award from the Purchaser, the successful bidder shall furnish the security deposit in the form of Bank guarantee valid for a period of 5 years or sign off plus 60 days whichever is later in accordance with the General Conditions of the Contract, in the prescribed contract format as per the **Annexure– 4.9 given in Section IV – Bid Submission Formats.** ***PIA can submit PBG/Security Deposit with validity of 3 years which must be extended for another 3 years and so on before expiry of its validity.***
- 41.2 Failure of the PIA to comply with the requirement of **Clause 41.1** shall constitute sufficient grounds for the annulment of the contract and forfeiture of the EMD.

Bank Guarantee as per following schedule:

S. No.	Item	Value
1	Instrument	<p><i>Two deposit in the form of Bank Guarantee, applicable at:</i></p> <ol style="list-style-type: none"> <i>1. For capital works undertaken – Pertaining to implementation and Warranty phase.</i> <i>2. For Operations and Maintenance (O&M) – Pertaining to O&M cost for the GPs in scope</i>
2	Validity of Bank Guarantee	<p><i>Bank Guarantee to be submitted within 15 working days from date of Work Order and should be valid for</i></p> <ol style="list-style-type: none"> <i>1. For capital works – 60 days after FAT of last GP</i> <i>2. For O&M – 60 days after end of O&M period</i>
3	Amount	<ol style="list-style-type: none"> <i>1. For capital works – 5% of the order value</i> <i>2. For O&M – 5% of the order value</i>

42. Placing of Work Orders

- 42.1 Quantities mentioned “**Annexure 4.11 -Financial Bid**” given in **Section IV – Bid Submission Formats** are indicative and SIA reserves the right at the time of issuance of work order to increase or decrease the quantity of goods and / or services from the original requirements as specified in the terms and conditions of the RFP as mutually agreed.
- 42.2 Objection, if any, to the work order must be reported to the concerned section of MahalT by the PIA within fifteen (15) working days counted from the date of issuance work order for modifications, otherwise it shall be assumed that the PIA has accepted the work order.
- 42.3 If the PIA is not able to do the complete work as mentioned in the scope of work within the specified period, the penalty clause shall be invoked.
- 42.4 The decision of MahalT shall be final and binding on the PIA. MahalT reserves the right to accept or reject an offer without assigning any reason whatsoever.

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Section III

General Conditions of Contract

Section III – General Conditions of Contract

In this RFP, the following terms shall be interpreted as indicated:

1. **“Applicable Laws”** means all applicable statutes, enactments, acts of legislature or laws, ordinances, rules, by-laws, regulations, notifications, guidelines, policies, directions, directives, requirement or other governmental restriction and orders or judgements of any Governmental authority, tribunal, board, court or other quasi-judicial authority or other governmental restriction or any similar form of decision applicable to the relevant Party and as may be in effect on the date of execution of Agreement and during the subsistence thereof, applicable to the Project;
2. **“Confidential Information”** means any information disclosed to or by any Party to this Contract and includes any information in relation to the Parties, a third party or any other person who is covered within the ambit of the Purchaser's legislation including any such information that may come to the knowledge of the Parties hereto / PIA's Team by virtue of this Contract that:
 - a. is by its nature confidential or by the circumstances in which it is disclosed confidential; or
 - b. is designated by the disclosing Party as confidential or identified in terms connoting its confidentiality; but does not include information which is or becomes public knowledge other than by a breach of this Contract;
3. **“Contract”** means the Agreement entered into between the PIA and the Purchaser as recorded in the Contract form signed by the Purchaser and the PIA including all attachments and Annexes thereto, the RFP and all Annexes thereto and the agreed terms as set out in the bid, all documents incorporated by reference therein and amendments and modifications to the above from time to time;
4. **“Deliverables”** means the products, infrastructure, licenses and services agreed to be delivered by the PIA in pursuance of the Contract as elaborated in the RFP and includes all documents related to the user manual, technical manual, designs, process documentations, the artefacts, the training materials, process and operating manuals, service mechanisms, policies and guidelines, inter alia payment and/or process related etc. and all their respective modifications;
5. **“Document”** means any embodiment of any text or image however recorded and includes any data, text, images, sound, voice, codes or and databases or microfilm or computer generated micro fiche;
6. **“Goods”** means all of the equipment, hardware, software, products accessories and/or other material / items which the PIA is required to supply, install and maintain under the contract;
7. **“Go-live”** means the date on which the proposed MahaNet-I (BharatNet-II) Project is successfully implemented as specified in the RFP and all the acceptance work, services, terms and conditions etc. as defined in the RFP are successfully concluded to the satisfaction of USOF;
8. **“Intellectual Property Rights”** means any patent, copyright, trademark, trade name, service marks, brands, propriety information, software whether arising before or after the execution of this Contract and the right to ownership and registration of these rights;
9. **“End-to-End Connectivity”** means Complete Installation, Integration, Commissioning and Testing of the created network (duly approved by TPA) which shall include OTDR link test, Power On and Self Testing, Radio equipment testing (If applicable)As Build Diagram (ABD reports), integration of IP-MPLS router with State and BBNL NOC and Final acceptance certificate;
10. **“OEM”** means the Original Equipment Manufacturer of any equipment / product that is providing such goods to the PIA under the scope of this RFP / Contract;
11. **“Parties”** means the Purchaser and the PIA and “Party” means either of the Parties;
12. **“Project Implementing Agency (PIA)”** means the successful bidder whose bid has been accepted by the Purchaser and with whom the order for “Selection of Project Implementing Agency (PIA) for MahaNet-I (BharatNet – II) has been placed as per requirements and terms and conditions specified in this RFP and shall be deemed to include the Bidder's successors, representatives (approved by the Purchaser), heirs, executors, administrators and permitted assigns, as the case may be, unless excluded by the terms of the contract;
13. **“Project Store”** means list of locations provided by the PIA to store the material as required in District/Block;
14. **“Purchaser”** means State Implementation Agency/SIA, which is Mahait Corporation, a 100% state owned autonomous corporation in Maharashtra

15. “PIAs’ Team” means the Successful Bidder along with all of its partners / OEMs, who have to provide goods and services to the Purchaser under the scope of this RFP / Contract. This definition shall also include any authorized service providers/partners/agents and representatives or other personnel employed or engaged either directly or indirectly by the PIA for the purposes of this PIA / Contract;
16. **PMC** means Project Management Consultants, details about which are mentioned in **Clause 1 Section V- Scope of Work** as well as **Annexure J- Responsibilty Matrix**.
17. **TPA** means Third Party Auditors, details about which are mentioned in **Clause 2.24 Section V- Scope of Work** as well as **Annexure J- Responsibilty Matrix**
18. “Notice” means:
 - a. a notice; or
 - b. a consent, approval or other communication required to be in writing under this Contract;
19. “Work Order Value” means the price come out after the site survey done by the PIA and the value payable to the PIA under this Contract for the full and proper performance of its contractual obligations;

Details of the General Conditions of Contract are asunder:

1. Interpretation

In this RFP unless a contrary intention is evident:

- a. The clause headings are for convenient reference only and may not be part of this RFP;
- b. Unless otherwise specified a reference to a clause number is a reference to all of its sub-clauses;
- c. Unless otherwise specified a reference to a clause, sub-clause or section is a reference to a clause, sub-clause or section of this RFP including any amendments or modifications to the same from time to time;
- d. A word in the singular includes the plural and a word in the plural includes the singular;
- e. A word importing a gender includes any other gender;
- f. A reference to a person includes a partnership and a body corporate;
- g. A reference to legislation includes legislation repealing, replacing or amending that legislation;
- h. Where a word or phrase is given a particular meaning it includes the appropriate grammatical forms of that word or phrase, which have corresponding meanings.
- i. In the event of an inconsistency between the terms of this RFP and the Bid, the terms and conditions hereof shall prevail.

2. Sub-Contract

- 2.1 The PIA shall notify the Purchaser in writing of all subcontracts awarded under this contract if not already specified in its bid. Such notification, in its original bid or later shall not relieve the PIA from any liability or obligation under the Contract.

2.2 There shall be only one level of sub-contracting i.e. the sub-contractor, appointed by the PIA shall directly execute the work without further subcontracting the work **and sole bidder or lead bidder of a consortium should provide self-certification as a part of bis stating that their sub-contractor should not have been blacklisted/ debarred by any state/central Govt. department or any Govt. PSU for Telecom business in India.**

3. Representation and Guarantee

- 3.1 In order to induce the Purchaser to enter into this Contract, the PIA hereby represents and guarantee as of the date hereof, the following:
 - 3.1.1 That the PIA has the power and the authority that would be required to enter into this Contract and the requisite experience, the technical know-how and the financial wherewithal required to successfully implement the terms and conditions of this contract and to provide services sought by the Purchaser under this contract
 - 3.1.2 That the PIA is not involved in any litigation or legal proceedings, pending, existing, potential or threatened, that may have an impact of affecting or compromising the performance or execution of the work under this Contract.

- 3.1.3 That the representations and guarantee made by the PIA in its Bid, the Contract shall continue to remain true and fulfil all the requirements as are necessary for executing the obligations and responsibilities as laid down in the Contract and the RFP and unless the Purchaser specifies to the contrary, the PIA shall be bound by all the terms and conditions of the Bid and the contract throughout the period of the contract.
- 3.1.4 That the PIA has the professional skills, personnel, infrastructure and resources/authorizations that are necessary for providing all such services as are necessary to fulfil the scope of work stipulated in the RFP and in the Contract.
- 3.1.5 That there shall not be any privilege, claim or assertion made by a third party with respect to right or interest in, ownership, mortgage or disposal of any asset, property, movable or immovable as mentioned in any Intellectual Property Rights.
- 3.1.6 That the execution of the scope of work and the Services herein is and shall be in accordance and in compliance with all applicable laws.
- 3.1.7 That all conditions precedent under the Contract have been satisfied.
- 3.1.8 That neither the execution and delivery by the PIA of the Contract nor the PIA's compliance with or performance of the terms and provisions of the Contract (i) will contravene any provision of any Applicable Law or any order, writ, injunction or decree of any court or Governmental Authority binding on the PIA , (ii) will conflict or be inconsistent with or result in any breach of any or the terms, covenants, conditions or provisions of, or constitute a default under any Contract, Contract or instrument to which the PIA is a party or by which it or any of its property or assets is bound or to which it may be subject or (iii) will violate any provision of the Memorandum and Articles of Association of the PIA .
- 3.1.9 That the PIA certifies that all registrations, recordings, filings and notarizations of the Contract and all payments of any tax or duty, including but not limited to stamp duty, registration charges or similar amounts which are required to be effected or made by the PIA which is necessary to ensure the legality, validity, enforceability or admissibility in evidence of the Contract have been made.
- 3.1.10 That the PIA confirms that there has not and shall not occur any execution, amendment or modification of any agreement/contract without the prior written consent of the Purchaser, which may directly or indirectly have a bearing on the Contract or the Project.
- 3.1.11 That the PIA owns or has good, legal or beneficial title, or other interest in, to the property, assets and revenues of the PIA on which it grants or purports to grant or create any interest pursuant to the Contract, in each case free and clear of any encumbrance and further confirms that such interests created or expressed to be created are valid and enforceable.
- 3.1.12 That the PIA owns, has license to use or otherwise has the right to use, which are required or desirable for performance of its services under this contract. All Intellectual Property Rights (owned by the PIA or which the PIA is licensed to use) required by the PIA for the performance of the contract are valid and subsisting. All actions (including registration, payment of all registration and renewal fees) required to maintain the same in full force and effect have been taken thereon and shall keep the Purchaser indemnified in relation thereto.
- 3.1.13 That the PIA shall at all times maintain sufficient manpower, resources, and facilities, to provide the Services in a workmanlike manner on a timely basis.
- 3.1.14 That in providing the Services or deliverables or materials, neither PIA or its agent, nor any of its employees, shall utilize information which may be considered confidential information of, or proprietary to, any prior employer or any other person or entity;
- 3.1.15 That the PIA shall provide adequate and appropriate support and participation, on a continuous basis

4. Scope of Work

- 4.1 Scope of the Work shall be as defined in **Section V - Scope of Work and Annexes** thereto of this tender.
- 4.2 Purchaser has engaged the PIA for the scope as defined in **Section I: NIT as well as Section V: Scope of Work**. The PIA is required to provide such services, support and infrastructure

as the Purchaser or Purchaser's representative may deem proper and necessary, during the term of this Contract, and includes all such processes and activities which are consistent with the proposals set forth in the Bid, the RFP and this Contract and are deemed necessary by the Purchaser, in order to meet its business requirements (herein after 'scope of work').

- 4.3 The Purchaser or Purchaser's representative reserves the right to amend any of the terms and conditions with mutual agreement in relation to the Scope of Work and may issue any such directions which are not necessarily stipulated therein if it deems necessary for the fulfilment of the Scope of Work pursuant to Clause 21

5. Key Performance Measurements

- 5.1 Unless specified by the Purchaser to the contrary, the PIA shall execute the work and carry out the scope of work in accordance with the terms and conditions of this Contract, Scope of Work and the service specifications as laid down in **Section III – General Conditions of Contract** of this RFP.
- 5.2 The Purchaser reserves the right to amend any of the terms and conditions in relation to the Contract and may issue any such directions which are not necessarily stipulated therein if it deems necessary for the fulfilment of the scope of work. These changes shall be carried as per mutual consent.

6. Bank Guarantee for Contract Performance

- 6.1 Within 15 days after the receipt of notification of award of the Contract from the Purchaser, the PIA shall furnish **two Bank Guarantees to the Purchaser**,
- a) **One Bank Guarantee, which shall be equal to 10% of the work order value of capex/ equipment and implementation services**
 - b) **One Bank Guarantee for O&M**

and shall be in the form of a Bank Guarantee Bond from a Nationalized Bank in the Pro forma given at **Annexure 4.1 – Bank Guarantee** for contract performance of **Section IV – Bid Submission Formats**

b. Validity of Bank Guarantee for Contract Performance

- i. In case of Implementation order the Bank Guarantee shall remain valid for a period of sixty (60) days beyond the validity of the order.
- ii. In case of Operations and Maintenance order the Bank Guarantee Shall remain valid for a period of sixty (60) days beyond the validity of the order.

7. Commencement and Progress

- 7.1 The PIA shall proceed to carry out the activities / services with diligently and expeditiously in accordance with the stipulations regarding time, manner, mode, and method of execution contained in this RFP.
- 7.2 The PIA shall be responsible for and shall ensure that all Services are performed in accordance with the Contract, Scope of Work and Specifications. PIA shall comply with all Specifications and other standards, terms and other stipulations/conditions set out hereunder.
- 7.3 The items supplied under this Contract shall conform to the standards mentioned in Annexure A - Technical Specifications (TEC GR Nos). In other cases where no applicable standard is available such standards which are issued by the relevant certified agencies shall be applicable. Delivery of the items shall be made by the PIA in accordance with the terms specified by the Purchaser in its Notification of Award / Work Order.

8. Contract Administration

- 8.1 No variation or modification of the terms and conditions of the contract shall be made except by written amendment signed by the parties.
- 8.2 Either party may appoint any individual / organization as their authorized representative through a written notice to the other party. Each Representative shall have the authority to:
- a. Exercise all of the powers and functions of his/her Party under this Contract other than the power to amend this Contract and ensure the proper administration and performance of the terms hereof; and

- b. Bind his or her Party in relation to any matter arising out of or in connection with this Contract.
- 8.3 The PIA along with other members / third parties / OEMs shall be bound by all undertakings and representations made by the authorized representative of the PIA and any covenants stipulated hereunder, with respect to this Contract, for and on their behalf.
- 8.4 For the purpose of execution or performance of the obligations under this Contract, the Purchaser's representative would act as an interface with the nominated representative of the PIA. The PIA shall comply with all instructions that are given by the Purchaser's representative during the course of this Contract in relation to the performance of its obligations under the terms of this Contract and the RFP.

9. Purchaser's Obligations

- 9.1 The Purchaser's Representative shall interface with the PIA, to provide the required information, clarifications and to resolve any issues as may arise during the execution of the Contract. Purchaser shall provide adequate cooperation in providing details, assisting with coordinating and obtaining of approvals from various governmental agencies, in cases, where the intervention of the Purchaser is proper and necessary.

10. Intellectual property rights

- 10.1 Purchaser shall own and have Intellectual Property Rights of all the deliverables which have been developed by the PIA during the performance of Services and for the purposes of inter-alia use of such Services under this Contract. The PIA undertakes to disclose all Intellectual Property Rights arising out of or in connection with the performance of the Services to the Purchaser and execute all such agreements/documents and file all relevant applications, effect transfers and obtain all permits and approvals that may be necessary in this regard to effectively conserve the Intellectual Property Rights of the Purchaser.
- 10.2 If Purchaser desires, Further, the PIA shall be obliged to ensure that all approvals, registrations which are inter-alia necessary for use of the infrastructure installed by the PIA, the same shall be acquired in the name of the Purchaser, prior to termination of this Contract and which shall be assigned by the Purchaser to the PIA for the purpose of execution of any of its obligations under the terms of the Bid, RFP or this Contract. However, subsequent to the term of this Contract, such approvals etc. Shall endure to the exclusive benefit of the Purchaser.
- 10.3 The PIA shall ensure that while it uses any hardware, processes or material in the course of performing the Services, it does not infringe the Intellectual Property Rights of any person and PIA shall keep the Purchaser indemnified against all costs, expenses and liabilities however, arising out of any illegal or unauthorized use (piracy) or in connection with any claim or proceedings relating to any breach or violation of any permission/license terms or infringement of any Intellectual Property Rights by the PIA during the course of performance of the Services.

11. Record of Contract Documents

- 11.1 The PIA shall at all time make and keep sufficient copies of the specifications and Contract documents for him to fulfil his duties under the contract, in excess of his own requirement and those copies shall be available at all times for use by the Purchaser's Representative and by any other person authorized by the Purchaser's Representative.

12. Ownership of Equipment

- 12.1 The Purchaser shall own the services and items supplied by the PIA arising out of or in connection with this Contract.

13. Indemnity

The PIA shall indemnify and defend State/ MahalT and its representatives and employees and hold Maharashtra/MahalT, its representatives, employees harmless from:

- 13.1 Damages and losses caused by its negligent or intentional act or omission or any damages and losses caused by the negligent act of any third party or sub-contractor or agency engaged by the PIA;
- 13.2 Damages and losses resulting from the non-compliance with the established obligations; Third Party claim against State/ MahalT or its nominated agency that any

Deliverables/Services/Equipment provided by the PIA infringes a copyright, trade secret, patents or other intellectual property rights of any third party in which case the PIA shall defend such claim at its expense and shall pay any costs or damages that may be finally awarded against Mahalt or its nominated agency. The PIA shall not indemnify Mahalt, however, if the claim of infringement is caused by (a) State/ Mahalt misuse or modification of the Deliverables; or (b) State/ Mahalt failure to use corrections or enhancements made available by the PIA; or (c) State/PIA use of the Deliverables in combination with any product or information not owned or developed or supplied by the PIA.

- 13.3 If any Deliverable is or likely to be held to be infringing, the PIA shall at its expense and option either (i) procure the right for Mahalt to continue using it, or (ii) replace it with a non-infringing equivalent, or (iii) modify it to make it non-infringing.
- 13.4 Any environmental damages caused by it and/or its representatives or employees or employees of any third party or sub-contractor or agency engaged by the PIA
- 13.5 Breach (either directly by it or through its representatives and/or employees) of any representation and guarantee declared herein by it;
- 13.6 From any and all claims, actions, suits, proceedings, taxes, duties, levies, costs, expenses, damages and liabilities, including attorneys' fees, arising out of, connected with, or resulting from or arising in connections with the services provided due to neglect, omission or intentional act.

14. Confidentiality

- 14.1 The PIA shall not use Confidential Information, the name or the logo of the Purchaser except for the purposes of providing the Service as specified under this RFP;
- 14.2 The PIA shall not, either during the term or 6 months after expiration of this Contract, disclose any proprietary or confidential information relating to the Services, Contract or the network architecture, Purchaser's business plan or operations without the prior written consent of the Purchaser.
- 14.3 The PIA may only disclose Confidential Information in the following circumstances:
 - i. with the prior written consent of the Purchaser;
 - ii. to a member of the PIA's Team ("Authorized Person") if:
 - a. the Authorized Person needs the Confidential Information for the performance of obligations under this contract;
 - b. the Authorized Person is aware of the confidentiality of the Confidential Information and is obliged to use it only for the performance of obligations under this contract
- 14.4 The PIA shall do everything reasonably possible to preserve the confidentiality of the Confidential Information including execution of a confidential agreement with the members of the, subcontractors and other service provider's team members to the satisfaction of the Purchaser.
- 14.5 The PIA shall sign a **Non-Disclosure Agreement (NDA)** with the Purchaser on mutually agreed terms and conditions. The PIA and its antecedents shall be bound by the NDA. The PIA shall be responsible for any breach of the NDA by its antecedents or delegates.
- 14.6 The PIA shall notify the Purchaser promptly if it is aware of any disclosure of the Confidential Information otherwise than as permitted by this Contract or with the authority of the Purchaser.
- 14.7 The Purchaser reserves the right to adopt legal proceedings, civil or criminal, against the PIA in relation to a dispute arising out of breach of obligation by the PIA under this clause.

15. Taxes

- 15.1 The quoted offer **should be exclusive of Taxes**. Taxes shall be paid extra on actual, as applicable. The taxes prevailing at the time of raising the invoice shall be paid. Mahalt shall deduct appropriate tax as applicable at source from the payment against the delivery and services and corresponding TDS certificate shall be issued at the end of respective quarter.
- 15.2 In case of any variation (upward or downward) in Government levies/ Taxes wherever applicable up to the date of invoice, the benefit or the burden of the same shall be passed on to Mahalt. Entry taxes, whichever is applicable, if any, shall be paid by Mahalt on production of respective payment receipts/ documents. Necessary documentary evidence shall be

produced for having paid the excise duty, GST, if applicable and/ or other applicable levies. Variation would also include the introduction of any new tax/ cess.

16. Warranty

- 16.1 A comprehensive on-site warranty and Operations and Maintenance on all goods supplied under this contract shall be provided by the respective Original Equipment Manufacturer (OEM) through PIA till the end of the Contract.
- 16.2 Technical Support shall be provided by the respective OEM for till the end of the contract period.
- 16.3 The PIA shall warrants that the goods supplied under the Contract are new, non-refurbished, unused and recently manufactured; shall not be nearing End of Sale / End of Support; and shall be supported by the PIA and respective OEM along with service and spares support to ensure its efficient and effective operation for the entire duration of the contract.
- 16.4 The PIA warrants that the goods supplied under this contract shall be of the reasonably acceptable grade and quality and consisted with the established and generally accepted standards for materials of this type. The goods shall be in full conformity with the specifications and shall operate properly and safely. All recent design improvements in goods, unless provided otherwise in the Contract, shall also be made available.
- 16.5 The PIA further warrants that the Goods supplied under this Contract shall be free from all encumbrances and defects/faults arising from design, material, manufacture or workmanship (except insofar as the design or material is required by the Purchaser's Specifications)
- 16.6 The Purchaser shall promptly notify the PIA in writing of any claims arising under this warranty.
- 16.7 Upon receipt of such notice, the PIA shall, with all reasonable speed, repair or replace the defective Goods or parts thereof, without prejudice to any other rights, which the Purchaser may have against the PIA under the Contract.
- 16.8 If the PIA, having been notified, fails to remedy the defect(s) within a reasonable period, the Purchaser may proceed to take such remedial action as may be necessary, at the PIA s' risk and expense and without prejudice to any other rights which the Purchaser may have against the PIA under the Contract.

17. Stipulated Time Schedule

- 17.1 The key milestone dates ("critical dates")* as anticipated by the Purchaser are mentioned in Annexure K. Please refer Annexure K for Rewards and Penalties.
- 17.2 Bidders will be rewarded for optimizing the route kilometers post physical survey of the GPs. Following table will be used determining the incentives.

S. No.	Route Optimization (% of the total in a package)	Incentives	Time of payment
1	0 – 10%	Nil	
2	10-20%	0.5% of the total bid value of fibre, duct, laying cost the respective package	Post completion of Site Survey upon review / approval of the SIA or other designated agencies
3	>20%	1% of the total bid value of fibre, duct, laying cost the respective package	Post completion of Site Survey upon review / approval of the SIA or other designated agencies

Note: Bidders are advised to quote as per their own assessment of the soil strata in Maharashtra and only a single unit rate need to be quotes.

***PIA shall start end-to-end connectivity of GPs in those blocks for which the site survey has been conducted and approved by MahalIT. Meanwhile the PIA shall also continue to do the site survey for the remaining GPs. Hence, the site survey and commissioning of network at GPs shall go simultaneously.**

For example: PIA can submit the survey report of 10 blocks for the approval by MahalIT and can start implementing the required work and can continue the site survey for other GPs and start delivery and implementation of the approved sites. But the survey of whole package should be completed within two months.

18. Liquidated Damages

- 18.1 The PIA shall perform the Services and comply in all respects with the critical dates and the parties hereby agree that failure on part of the PIA to meet the critical dates without prejudice to any other rights that the Purchaser have, may lead to the imposition of such obligations as are laid down in the Delay and Deterrent Mechanism and/or levy of penalty as set and/or termination of the Contract at the discretion of the Purchaser.
- 18.2 **Penalties shall be capped to maximum of 12% of total cost of Project (excluding O&M cost) Value. Beyond 12% the Purchaser has the right to terminate the contract or a portion or part of the work thereof.** The purchaser shall give 30 days' notice to the PIA of its intention to terminate the Contract and shall so terminate the Contract unless the Bidder initiates remedial action acceptable to the Purchaser during the 30 days' notice period.
- 18.3 The Purchaser may without prejudice to its right to effect recovery by any other method, deduct the amount of liquidated damages from any money belonging to the PIA in its hands (which includes the Purchaser's right to claim such amount against PIA s' Bank Guarantee) or which may become due to the PIA. Any such recovery or liquidated damages shall not in any way relieve the PIA from any of its obligations to complete the Works or from any other obligations and liabilities under the Contract.
- 18.4 Delay not attributable to the PIA shall be considered for exclusion for the purpose of computing liquidated damages.

19. Term and extension of Contract

- 19.1 The term of this Contract shall be initially **for a period of 6 years (1 Year for implementation, 1 year for warranty and 4 years for operations & maintenance) from the date of issue of contract and go-live of the entire work, according to the time schedules specified in Section III - Clause17 (Annexure K) .**
- 19.2 The Purchaser shall reserve the sole right to grant any extension to the term above mentioned and shall notify in writing to the PIA , at least 6 months before the expiration of the term hereof, whether it shall grant the PIA an extension of the term. The decision to grant or refuse the extension shall be at the Purchaser's discretion. Accordingly, the Bank Guarantee of the same amount shall be extended up to extended period of the Contract
- 19.3 **Additional period up to 3 years** as deemed appropriate (State / MahalIT reserves the right to extend the Contract with the PIA), terms and conditions for SLA, penalty and Prices for on premise services shall remain same as given for 3 Year.
- 19.4 Where the Purchaser is of the view that no further extension of the term be granted to the PIA, the Purchaser shall notify the PIA of its decision at least 6 (six) months prior to the expiry of the Term. Upon receipt of such notice, the Bidder shall continue to perform all its obligations hereunder, until such reasonable time beyond the Term of the Contract within which, the

Purchaser shall either appoint an alternative PIA or create its own infrastructure to operate such Services as are provided under this Contract. Purchaser shall make payment for work executed for the extended period post contract expiry.

20. Prices

- 20.1 Prices quoted must be firm and shall not be subject to any upward revision on any account whatsoever throughout the period of contract. Purchaser however reserves the right to review the charges payable for the Maintenance and Management of the infrastructure at any time at the request of Purchaser whichever is earlier to incorporate downward revisions as applicable and necessary.
- 20.2 If at any time, during the period of contract, the PIA offers identical services/products to any other Govt. Department/ Organization at prices lower than those chargeable under this contract, he shall notify the same to the purchaser and extend such reduced prices to the purchaser with immediate effect.

21. Change Orders/Alteration/Variation

- 21.1 The PIA shall agree that the requirements / quantities / specifications and Service requirements given in the RFP are minimum requirements and are in no way exhaustive and guaranteed by the Purchaser.
 - 21.1.1 Any upward revision (and/or additions consequent to errors, omissions, ambiguities, discrepancies in the quantities, specifications, architecture etc. of the RFP which the PIA had not brought to the Purchaser's notice till the time of award of work and not accounted for in his Bid shall not constitute a change order and such upward revisions and/or addition shall be carried out by the PIA without any time and cost effect to Purchaser.
 - 21.1.2 It shall be the responsibility of the PIA to meet all the performance and other requirements of the Purchaser as stipulated in the RFP / Contract. Any upward revisions / additions of quantities, specifications, service requirements to those specified by the PIA in his Bid documents, that may be required to be made during installation/ commissioning of the network or at any time during the currency of the contract in order to meet the conceptual design, objective and performance levels or other requirements as defined in the RFP. These changes shall be carried out as per mutual consent
- 21.2 The Purchaser may at any time, by a written change order given to the PIA, make changes within the general Scope of Work. The Purchaser shall have an option to increase or decrease (decrease only if communicated to PIA prior to availing of services / dispatch of goods/ equipment) the Quantities and/or Specifications of the goods/equipment to be supplied and installed by the PIA or service requirements, as mentioned in the Contract, at any time during the contract period.
- 21.3 The written advice to any change shall be issued by the Purchaser to the PIA up to 4 (four) weeks prior to the due date of provisioning/supply of such goods/equipment or commencement of services.
- 21.4 In case of increase in Quantities / Specifications or Service requirements or in case of additional requirement, the rate as provided in the Contract shall be considered as benchmark rates for procurement of the additional requirement from the PIA. However, based on the industry trends, Purchaser retains the right to review these rates. The additional requirement shall also be governed by the same terms and conditions as provided in the Contract except for the appropriate extension of time to be allowed for delivery/installation of such extra goods/equipment or for commencement of such services.
- 21.5 In case applicable rates for the increase/decrease in question are not available in the Contract then the rates as may be mutually agreed shall apply. The PIA shall not be entitled to any

claim by way of change of price, damages, losses, etc. The PIA shall be compensated at actual for any cancellation charges provided the claim is duly supported by documentary evidence of having incurred cancellation charges, which results from Purchaser's action in reducing/cancelling Scope of Work.

21.6 Conditions for Change Order

- 21.6.1 The change order shall be initiated only in case (i) the Purchaser directs in writing the PIA to incorporate changes to the goods or design requirements already covered in the Contract. (ii) the Purchaser directs in writing to the PIA to include any addition to the scope of work or services covered under this Contract or delete any part thereof, (iii) PIA requests to delete any part of the work which shall not adversely affect the work and if the deletions proposed are agreed to by the Purchaser and for which the cost and time benefits shall be passed on to the Purchaser,
- 21.6.2 Any change order comprising an alteration which involves change in the cost of the goods and/or services (which sort of alteration is hereinafter called a "Variation") shall be the Subject of an amendment to the Contract by way of an increase or decrease in the Contract Value and adjustment of the implementation schedule if any.
- 21.6.3 If there is a difference of opinion between the PIA and Purchaser's Representative on whether a particular item, work or part of the work constitutes a change order or not, the matter shall be handled in accordance with the procedures set forth in **Clause 21.7.11**

21.7 Procedures for change Order

- 21.7.1 Upon receiving any revised requirement / advice, in writing, from the Purchaser, the PIA would verbally discuss the matter with Purchaser's Representative.
- 21.7.2 In case such requirement arises from the side of the PIA, he would also verbally discuss the matter with Purchaser's Representative giving reasons thereof.
- 21.7.3 In either of the two cases as explained in Clause 21.7.1 and clause 21.7.2 above, the representatives of both the parties shall discuss on the revised requirement for better understanding and to mutually decide whether such requirement constitutes a change order or not.
- 21.7.4 If it is mutually agreed that such requirement constitutes a "Change Order" then a joint memorandum shall be prepared and signed by the PIA and Purchaser to confirm a "Change Order" and basic ideas of necessary agreed arrangement.
- 21.7.5 PIA shall study the revised requirement in accordance with the joint memorandum under Clause 21.7.4 and assess subsequent schedule and cost effect, if any.
- 21.7.6 Upon completion of the study referred to above under Clause 21.7.5 the results of this study along with all relevant details including the estimated time and cost effect thereof with supporting documents would be submitted to the Purchaser to enable the Purchaser to give a final decision whether PIA should proceed with the change order or not in the best interest of the works.
- 21.7.7 The estimated cost and time impact indicated by PIA shall be considered as a ceiling limit and shall be provisionally considered for taking a decision to implement change order
- 21.7.8 The time impact applicable to the Contract shall be mutually agreed, subsequently, on the basis of the detailed calculations supported with all relevant back up documents.
- 21.7.9 In case PIA fails to submit all necessary substantiation/calculations and back up documents, the decision of the Purchaser regarding time and cost impact shall be final and binding on the PIA.
- 21.7.10 If Purchaser accepts the implementation of the change order under Clause 21.7.6 in writing, which would be considered as change order, then PIA shall commence to

proceed with the enforcement of the change order pending final agreement between the parties with regard to adjustment of the Contract Value and the Schedule.

- 21.7.11 In case, mutual agreement under Clause 21.7.4 above, i.e. whether new requirement constitutes the change order or not, is not reached, then PIA in the interest of the works, shall take up the enforcement of the change order, if advised in writing to do so by Purchaser's Representative pending settlement between the two parties to the effect whether such requirement constitutes a change order or not as per the terms and conditions of Contract. The time and cost effects in such a case shall be mutually verified and recorded. Should it establish that the said work constitutes a change order, the same shall be compensated taking into account the records kept in accordance with the Contract.
- 21.7.12 The PIA shall submit the necessary back up documents for the change order showing the break-up of the various elements constituting the change order for the Purchaser's review. If no agreement is reached between the Purchaser and Bidder within 60 days after Purchaser's instruction in writing to carry out the change concerning the increase or decrease in the Contract Value and all other matters described above, either party may refer the dispute to arbitration.

21.8 Conditions for Revised Work / Change Order

- 21.8.1 The provisions of the Contract shall apply to revised work / change order as if the revised work / Change order has been included in the original Scope of work. However, the Contract Value shall increase / decrease and the schedule shall be adjusted on account of the revised work / Change orders as may be mutually agreed in terms of provisions set forth in Clause 21. The Bidder's obligations with respect to such revised work/ change order shall remain in accordance with the Contract.

22 Suspension of Work

- 22.1 The PIA shall, if ordered in writing by the Purchaser's Representative, temporarily suspend the works or any part thereof for such a period and such a time as ordered, then PIA shall not be entitled to claim compensation for any loss or damage sustained by him by reason of temporary suspension of the Works as aforesaid but shall be eligible for the payment (of products/ services delivered and accepted) during the suspension period as per contract. An extension of time for completion, corresponding with the delay caused by any such suspension of the works as aforesaid shall be granted to the PIA, if request for same is made and that the suspension was not consequent to any default or failure on the part of the PIA. Both PIA and purchaser acknowledges the suspension of work by purchaser, if results in extension of contract, the extra cost shall be on account of Purchaser which shall be mutually agreed. In case the suspension of works, is not consequent to any default or failure on the part of the PIA, and lasts for a period of more than 2 months, the Bidder shall have the option to request the Purchaser to terminate the Contract with mutual consent.
- 22.2 In the event that the Purchaser suspends the progress of work for any reason not attributable to the PIA for a period in excess of 30 days in aggregate, rendering the PIA to extend his Bank Guarantee then Purchaser shall bear only the cost of extension of such bank guarantee for such extended period restricted to the normal bank rates as applicable in the international banking procedures subject to the PIA producing the requisite evidence from the bank concerned.

23 Time is of Essence

- 23.1 Time shall be of the essence in respect of any date or period specified in this RFP or any notice, demand or other communication served under or pursuant to any provision of this RFP and in particular in respect of the completion of the Services by the PIA by the completion date.

24 Completion of the Contract

- 24.1 Unless terminated earlier, pursuant to Clauses 3, 10.3, 12, 14 the Contract shall terminate on the completion of term as specified in the Contract and only after the obligations mentioned in Clause 28 are fulfilled to the satisfaction of the Purchaser.
- 24.2 Special Conditions of Contract Amendments of, and Supplements to, Clauses in the General Conditions of the Contract.

25. Payment Schedule

- 25.1 Mobilization advance to the tune of 10% of the PO value can be given to the vendor, on its request, against submission of Bank Guarantee of equivalent amount.
- 25.2 The bills will be submitted by the vendor on the monthly basis block-wise. This will include bills of material supplied and services rendered (such as survey, GPs commissioned, etc.) during the previous month.
- 25.3 Further Payments shall be released only on satisfactory acceptance of the deliverables for each Task as per the following schedule:

a. First Milestone

- i) Supply of materials: vendor can submit claim relating to supply of materials during previous month (PO wise) of materials required for commissioning of GPs **and central electronic infrastructure** as per schedule in that PO. The timelines for completion of supplies will be as defined in PO.
- ii) The first bill for payment against supplies shall be restricted to 60% of the eligible claim. The remaining claim towards supply of material will be admitted by MahalT along with commissioning of GPs **and central electronic infrastructure** pertaining to that PO.

b. Second Milestone

The vendor can submit his claim for second milestones towards commissioning of the GPs on GP-wise i.e. for each GP **commissioned and commissioning of central electronic infrastructure** the vendor can submit his claim towards remaining 25% of the material supplied and 85% claim towards services.

The only exception to above is in case where different PIAs are selected for package A and other packages (B/C) and in case Package B and/or C second milestone is delayed due to reasons solely attributable to PIAs of package B and/or C, then PIA of package A will be allowed to invoice against the 25% payment for electronics material supply, after 60 days from the due date of RFI, as per payment schedule for package B and C.

c. Third Milestone

Balance 5 % payment of the cost towards supply of material and services will be made after start of O&M and submission of O&M PBG.

Payments shall be released only on satisfactory acceptance of the deliverables for each task as per the following schedule:

i) For Package A

S. No.	Milestone	Payment against material	Payment against services	Documentary evidence
1	Mobilization advance	10% of PO value against supplies	10% of PO value against services	Against submission of BG of 100% of mobilization advance
2	Supply of all the material required to commission the GPs in a particular month	60% payment of supply made during previous month	N.A.	Delivery of material: Copy of duly signed and stamped delivery challan

S. No.	Milestone	Payment against material	Payment against services	Documentary evidence
3 (a)	Commissioning of GPs in a month	25% payment of supplied material consumed in commissioning in previous month	85% payment of service, i.e. GPs commissioned during previous month	<p>Delivery of material: Copy of duly signed and stamped delivery challan</p> <p>Services: <i>Acceptance as per the clause 2.22.4.a in Section V- Scope of Work, OTDR link test reports, As-Built Diagram (ABD report) and Monthly Progress Report.</i></p>
3 (b)	<i>Commissioning of central electronic infrastructure, e.g. NOC, DR-NOC, NMS, OSS/ BSS, etc.</i>	<i>25% payment of supplied material consumed in commissioning</i>	<i>85% payment of service for commissioning of central infrastructure</i>	<p>Delivery of material: Copy of duly signed and stamped delivery challan</p> <p>Services: <i>Acceptance as per the clause 2.22.5 in Section V- Scope of Work and As-Built Diagram (ABD report).</i></p>
4	After start of Operations and Maintenance (O&M) on submission of O&M Performance Bank Guarantee (PBG)	5% payment of supplied material consumed in commissioning of GPs.	5% payment of services, i.e. GPs commissioned in the block	<p>Delivery of material: Copy of duly signed and stamped delivery challan</p> <p>Services: <i>Acceptance as per the clause 2.22.2 in Section V- Scope of Work, OTDR link test reports and As-Built Diagram (ABD report).</i></p>

S. No.	Milestone	Payment against material	Payment against services	Documentary evidence
5	Operation and Maintenance (inclusive of services levels agreement)	Payment shall be made GP wise after completion of every quarter arrears (based on SLA parameters)		SLA report duly certified by state

ii) For Package B and C

S. No.	Milestone	Payment against material	Payment against services	Documentary evidence
1	Mobilization advance	10% of PO value against supplies	10% of PO value against services	Against submission of BG of 100% of mobilization advance
2	Supply of all the material required to commission the GPs in a particular month	60% payment of supply made during previous month	N.A.	Delivery of material: Copy of duly signed and stamped delivery challan
3	Commissioning of GPs in a month	25% payment of supplied material consumed in commissioning in previous month	85% payment of service, i.e. GPs commissioned during previous month	Delivery of material: Copy of duly signed and stamped delivery challan Services: Acceptance as per the clause 2.22.4.a in Section V- Scope of Work, OTDR link test reports, As-Built Diagram (ABD report) and Monthly Progress Report.

S. No.	Milestone	Payment against material	Payment against services	Documentary evidence
4	After start of Operations and Maintenance (O&M) on submission of O&M Performance Bank Guarantee (PBG)	5% payment of supplied material consumed in commissioning of GPs.	5% payment of services, i.e. GPs commissioned in the block	Delivery of material: Copy of duly signed and stamped delivery challan Services: Final acceptance as per the clause 2.22.2 in Section V- Scope of Work, OTDR link test reports and As-Built Diagram (ABD report).
5	Operation and Maintenance (inclusive of services levels agreement)	Payment shall be made GP wise after completion of every quarter arrears (based on SLA parameters)		SLA report duly certified by state

Note:

- Each work front shall be treated as a separate entity for measurement, monitoring and reporting on project status and progress.

In case progress is not commensurate with the progress planned; the SIA/ MahalT reserves the right to transfer the complete ownership of the particular work front to any of the PIAs of the other packages. In such cases, the Bidder of the said package (that is tardy/ underperforming on particularl workfronts) is liable to pay penalties, as outlined in Annexure - K ('Rewards and Penalties').

In such cases, an amount equivalent to the project fee per workfront would be deducted from the project award amount from the PIA and the same amount would be paid to any of the other package bidder/s that have been awarded the said work front.

As example, if the PIA of package B is unable to complete the workfronts per the project plan submitted by it, then MahalT reserves the right to grant the award of that workfront to PIAs of any of the other packages. In such cases PIA of Package B is liable to pay penalty and its project fee would be reduced as well for those route km. PIA of one of the remaining packages would be invited to complete the award

- The workfront awarded to the PIA of the other package shall be duty bound to complete the implementation in the awarded workfront in a timely manner based on the project plan provided by the Bidder
- All payments shall be released after certification of Delivery and Implementation Milestones by MahalT / MahalT appointed TPA (Third Party Auditors)
- All Payments shall be made in **Indian Rupees Only** and shall be subject to provisions of Clauses 31 and shall be made through RTGS only
- Payments should be subject to deductions of any amount for which the PIA is liable under the RFP conditions. Further, all payments shall be made subject to deduction of TDS (Tax deduction at Source) as per the current Income-Tax Act

- Payment shall be released by the purchaser against the invoices raised by PIA within 30 calendar days on providing all the relevant documents timely and are complete in all reference.
- The successful PIA / vendor (s) shall conduct independent site survey for preparing the Bill of Quantity (BOQ) for each site. Once the LoA (Letter of Acceptance) is issued to the PIA / vendor, for successful implementation and completion of the site, the Successful PIA / vendor (s) needs to finalize a site survey report and BOQ within 4 weeks of issuance of LoA. Based on the site survey report and finalized BOQ, the successful PIA / vendor (s) needs to carry out the implementation of the purchase order.

26. Operations and Maintenance Charges

- 26.1 If O&M value quoted is found to be less than 5% as given in Table G of Section IX Part B in each package, in that case Mahalt will load O&M rate to make it 5% for the purpose of evaluation and ordering. The difference between the percentage quoted and 5% per year will be reduced/ adjusted from the ordering price of the main bid of the successful bidder.
- 26.2 The 5% cost of O&M will be based on actual expenditure incurred for commissioning of GPs. The actual commissioning cost of GPs in a block will be added up to arrive at actual execution cost of that particular block. The O&M cost of entire package will be arrived at by adding expenditure incurred in all the blocks and the cost of common control equipment, if any.
- 26.3 The O&M cost includes comprehensive Operation and Maintenance cost of all network elements as indicated in clauses of **Section V Part C**.

27. Event of default by the Bidder

- 27.1 The failure on the part of the PIA to perform any of its obligations or comply with any of the terms of this Contract which results in a material breach of the contract shall constitute an Event of Default on the part of the PIA. The events of default as mentioned above may include inter-alia the following:
 - a. The PIA has failed to adhere to any of the key performance indicators as laid down in the Key Performance Measures/ Contract, or if the PIA has fallen short of matching such standards/targets as the Purchaser may have designated with respect to any task necessary for the execution of the scope of work under this Contract which results in a material breach of the contract. The above mentioned failure on the part of the PIA may be in terms of failure to adhere to timelines, specifications, requirements or any other criteria as defined by the Purchaser;
 - b. the PIA has failed to remedy a failure to perform its obligations in accordance with the specifications issued by the Purchaser, despite being served with a default notice which laid down the specific deviance on the part of the PIA to comply with any stipulations or standards as laid down by the Purchaser; or
 - c. the PIA / PIAs' team has failed to conform with any of the Service/ Facility Specifications/standards as set out in the scope of work of this RFP or has failed to adhere to any amended direction, modification or clarification as issued by the Purchaser during the term of this Contract and which the Purchaser deems proper and necessary for the execution of the scope of work under this Contract
 - d. the PIA has failed to demonstrate or sustain any representation or warranty made by it in this Contract, with respect to any of the terms of its Bid, the RFP and this Contract
 - e. There is an order from a court of competent jurisdiction for bankruptcy, insolvency, winding up or there is an appointment of receiver, liquidator, assignee, or similar official against or in relation to the PIA.

28. Consequences of Event of Default

Where an Event of Default subsists or remains uncured the Purchaser may/ shall be entitled to:

- 28.1 The PIA shall in addition take all available steps to minimize loss resulting from such event of default.
- 28.2 The Purchaser may, by a written notice of suspension to the PIA, suspend all payments to the PIA under the Contract, provided that such notice of suspension:

- 28.3 In all cases of risk purchase, the difference in cost shall be borne by defaulting PIA with capping of maximum 10% of the value of goods/services at contract
- 28.4 Termination of the Contract in Part or Full
 - 28.4.1 Retain such amounts from the payment due and payable by the Purchaser to the PIA as may be required to offset any losses caused to the Purchaser as a result of such event of default and the PIA shall compensate the Purchaser for any such loss, damages or other costs, incurred by the Purchaser in this regard. Nothing herein shall effect the continued obligation of the PIA and PIA's team to perform all their obligations and responsibilities under this Contract in an identical manner as were being performed before the occurrence of the default.
 - 28.4.2 Invoke the Bank Guarantee and other Guarantees furnished hereunder, recover such other costs/losses and other amounts from the PIA as may have resulted from such default and pursue such other rights and/or remedies that may be available to the Purchaser under law.

29. Termination

- 29.1 The Purchaser may, terminate this Contract in full or in part by giving the PIA a prior and written notice indicating its intention to terminate the Contract under the following circumstances:
 - a. The Purchaser is of the opinion that there has been such Event of Default on the part of the PIA which would make it proper and necessary to terminate this Contract and may include failure on the part of the PIA to respect any of its commitments with regard to any part of its obligations under its Bid, the RFP or under this Contract.
 - b. Where it comes to the Purchaser's attention that the PIA (or the PIA's Team) is in a position of actual conflict of interest with the interests of the Purchaser, in relation to any of terms of the PIA's Bid, the RFP or this Contract.
 - c. Where the PIA's ability to survive as an independent corporate entity is threatened or is lost owing to any reason whatsoever, including inter-alia the filing of any bankruptcy proceedings against the PIA, any failure by the PIA to pay any of its dues to its creditors, the institution of any winding up proceedings against the PIA or the happening of any such events that are adverse to the commercial viability of the PIA. In the event of the happening of any events of the above nature, the Purchaser shall reserve the right to take any steps as are necessary, to ensure the effective transition of the project to a successor PIA and to ensure business continuity.
 - d. Termination for Insolvency: The Purchaser may at any time terminate the Contract by giving written notice to the PIA, without compensation to the PIA, if the PIA becomes bankrupt or otherwise insolvent, provided that such termination shall not prejudice or affect any right of action or remedy which has accrued or shall accrue thereafter to the Purchaser.
 - e. Termination for Convenience: The Purchaser, may, by prior written notice sent to the PIA at least 6 months in advance, terminate the Contract, in whole or in part at any time for its convenience. The notice of termination shall specify that termination is for the Purchaser's convenience, the extent to which performance of work under the Contract is terminated, and the date upon which such termination becomes effective.
- 29.2 The PIA may, subject to approval by the Purchaser, terminate this Contract before the expiry of the term by giving the Purchaser a prior and written notice at least 12 months in advance indicating its intention to terminate the Contract.

30. Consequences of Termination

- 30.1 In the event of termination of this contract due to any cause whatsoever, the contract will stand cancelled effective from the date of termination of this contract.
- 30.2 In case of exigency, if the Purchaser gets the work done from elsewhere, the difference in the cost of getting the work done shall be borne by the PIA with capping of maximum 10% of the value of goods/services at contract.
- 30.3 Where the termination of the Contract is prior to its stipulated term on account of a Default on the part of the PIA or due to the fact that the survival of the PIA as an independent corporate entity is threatened/has ceased, or for any other reason, whatsoever, the Purchaser through

redetermination of the consideration payable to the PIA as agreed mutually by the Purchaser and the PIA or through a third party acceptable to both the parties may pay the PIA for that part of the Services which have been authorized by the Purchaser and satisfactorily performed by the PIA up to the date of termination. Without prejudice any other rights, the Purchaser may retain such amounts from the payment due and payable by the Purchaser to the PIA as may be required to offset any losses caused to the Purchaser as a result of any act/omissions of the PIA. In case of any loss or damage due to default on the part of the PIA in performing any of its obligations with regard to the execution of the scope of work under this Contract, the PIA shall compensate the Purchaser for any such loss, damages or other costs, incurred by the Purchaser. Additionally, other members of its team shall perform all its obligations and responsibilities under this Contract in an identical manner as were being performed before the collapse of the PIA as described above in order to execute an effective transition and to maintain business continuity. All third parties shall continue to perform all/any functions as stipulated by the Purchaser and as may be proper and necessary to execute the scope of work under the Contract in terms of the PIA's Bid, the RFP and this Contract.

- 30.4 Nothing herein shall restrict the right of the Purchaser to invoke the Bank Guarantee and other Guarantees furnished hereunder, enforce the Deed of Indemnity and pursue such other rights and/or remedies that may be available to the Purchaser under law.
- 30.5 The termination hereof shall not affect any accrued right or liability of either Party nor affect the operation of the provisions of this Contract that are expressly or by implication intended to come into or continue in force on or after such termination.

31. Penalty

- 31.1 Ongoing performance and service levels shall be as per parameters stipulated by the Purchaser in this RFP, failing which the Purchaser may, at its discretion, impose Penalties on the PIA as defined in **Section III – General Conditions of the Contract and Service Level Agreement**.

32. Arbitration

- 32.1 Except otherwise provided in this RFP in the event of any question or interpretation of any clause, dispute or difference or to any other claim, right, matter or thing whatsoever in any way arising out or relating to this RFP whether arose during the progress of the work or after the cancellation, termination, completion or abandonment thereof, shall be settled by the parties amicably through negotiation within a period of 30 days of the notice by other party, failing which, the dispute shall be referred to the sole arbitrator appointed by the Principal Secretary, Dept. of Information Technology, Govt. of Maharashtra. The arbitration shall be conducted in accordance with the provisions of the Arbitration & Conciliation Act, 1996 or any statutory modification of re-enactment thereof and the rules made there under and for the time being in force shall apply to the arbitration proceedings. The arbitrator shall adjudicate on only such disputes as are referred to him by the appointing authority (**Chairman, MahalT**) and give separate award against each dispute and claim referred to him and shall give reasons for the award. The fee payable to arbitrator shall be paid equally by both the parties.
- 32.2 Notwithstanding any dispute or claim of the pendency of any arbitration or other proceedings, State shall continue to Implement the project and provide the services for the whole duration of the RFP.

33. Insurance

- 33.1 The Goods supplied under this Contract shall be fully insured by the PIA, against any loss or damage up to the time it is delivered to the PIA -designated carrier for shipment to Purchaser or to Purchaser's designated location. The PIA shall submit to the Purchaser, certificate of insurance issued by the insurance company, indicating that such insurance has been taken.
- 33.2 The PIA shall bear all the statutory levies like customs, insurance, freight, etc. applicable on the goods during their shipment from respective manufacturing/shipment site of the OEM to the port of landing.
- 33.3 All charges like transportation charges, taxes, etc. that may be applicable till the goods are delivered at the respective site of installation shall also be borne by the PIA.

33.4 The PIA during the term of this contract undertakes to ensure that it has taken or shall take up all appropriate insurances for the delivery of goods that it is required to undertake under law as well as to adequately cover its obligations under this Contract: shall take out and maintain, at his own cost insurance with IRDA approved insurers against the risks, and for the coverage, as specified below: shall pay all premium in relation thereto and shall ensure that nothing is done to make such insurance policies void or voidable at the Purchaser's request, shall provide certificate of insurance to the Purchaser showing that such insurance has been taken out and maintained. Employer's liability and workers' compensation insurance in respect of the Personnel of the PIA / PIA s' Team, in accordance with the relevant provisions of the Applicable Law, as well as, with respect to such Personnel, any such life, health, accident, travel or other insurance as may be appropriate; and Insurance against loss of or damage to (i) equipment or assets procured in full or in part for fulfilment of obligations under this Contract (ii) the PIA s' assets and property used in the performance of the Services

34. Transfer of Ownership

- 34.1 The PIA must transfer all titles to the assets and goods procured for the purpose of the project to the Purchaser upon end to end connectivity of GPs.
- 34.2 The asset(s) so created shall be a National Asset fully owned by the Government of India and non-discriminatory access, including leasing of dark fibre, shall be provided to PIA.

35. Limitation of the Bidder's Liability towards the Purchaser

- 35.1 Except in case of gross negligence or willful misconduct on the part of the PIA or on the part of any person or company acting on behalf of the PIA in carrying out the Services, the PIA, with respect to damage caused by the PIA to Purchaser's resulting in bodily injury, death or damage to physical property with respect to all claims arising under this Contract, shall in aggregate not be liable to purchaser.
 - i. For any indirect or consequential loss or damage; and
 - ii. For any direct loss or damage that exceeds the total payments payable under this contract to the PIA hereunder.
- 35.2 This limitation of liability shall not affect the PIA s liability, if any, for direct damage to Third Parties resulting in bodily injury, death or damage to physical property caused by the PIA or any person or firm/company acting on behalf of the PIA in carrying out the Services. Notwithstanding anything stated to the contrary in the RFP, Limitation of liability, including for direct damage to Third Parties, shall be to the extent of 100% of the total cost of the project calculated up to and as on the date when such section / clause is required to be invoked.

36. Conflict of Interest

- 36.1 If the PIA found to have a Conflict of Interest shall be disqualified. In the event of disqualification, the Purchaser shall forfeit the EMID as mutually agreed, without prejudice to any other right or remedy that may be available to the Purchaser hereunder or otherwise. The PIA shall disclose to the Purchaser in writing, all actual and potential conflicts of interest that exist, arise or may arise (either for the PIA or the PIA s' team) in the course of performing the Services as soon as practical after it becomes aware of that conflict.
- 36.2 The Purchaser requires that the PIA provides services which at all times hold the Purchaser's interests paramount, avoid conflicts with other assignments or its own interests, and act without any consideration for future work. The PIA shall not accept or engage in any assignment that would be in conflict with its prior or current obligations to other clients, or that may place it in a position of not being able to carry out the assignment in the best interests of the Purchaser.

37. Severance

- 37.1 In the event any provision of this Contract is held to be invalid or unenforceable under the applicable law, the remaining provisions of this Contract shall remain in full force and effect.

38. Governing Language

38.1 The Contract shall be written in English language. Subject to Clause 41.5 such language versions of the Contract shall govern its interpretation. All correspondence and other documents pertaining to the Contract that are exchanged by parties shall be written in English language only.

39. No Claim Certificate

39.1 The PIA shall not be entitled to make any claim, whatsoever against the Purchaser, under or by virtue of or arising out of, this contract, nor shall the Purchaser entertain or consider any such claim, if made by the PIA after he shall have signed a “No claim” certificate in favour of the Purchaser in such forms as shall be required by the Purchaser after the works are finally accepted.

40. Publicity

40.1 The PIA shall not make or permit to be made a public announcement or media release about any aspect of this Contract unless the Purchaser first gives the PIA its written consent.

41. Force Majeure

41.1 If, at any time, during the continuance of this contract, the performance in whole or in part by either party of any obligation under this contract is prevented or delayed by reasons of any war or hostility, acts of the public enemy, civil commotion, sabotage, fires, floods, explosions, epidemics, quarantine restrictions, strikes, lockouts or act of God (hereinafter referred to as events) provided notice of happenings of any such eventuality is given by either party to the other within 21 days from the date of occurrence thereof, neither party shall by reason of such event be entitled to terminate this contract nor shall either party have any claim for damages against other in respect of such non-performance or delay in performance, and deliveries under the contract shall be resumed as soon as practicable after such an event come to an end or cease to exist, and the decision of the Purchaser as to whether the deliveries have been so resumed or not shall be final and conclusive. Further that if the performance in whole or part of any obligation under this contract is prevented or delayed by reasons of any such event for a period exceeding 60 days, either party may, at its option, terminate the contract.

41.2 Provided, also that if the contract is terminated under this clause, the Purchaser shall be at liberty to take over from the PIA at a price to be fixed by the purchaser, which shall be final, all unused, undamaged and acceptable materials, bought out components and stores in course of manufacture which may be in possession of the PIA at the time of such termination or such portion thereof as the purchaser may deem fit, except such materials, bought out components and stores as the PIA may with the concurrence of the purchaser elect to retain.

42. General

42.1 Relationship between the Parties

- a. Nothing in this Contract constitutes any fiduciary relationship between the Purchaser and PIA /PIA s' Team or any relationship of employer employee, principal and agent, or partnership, between the Purchaser and PIA.
- b. No Party has any authority to bind the other Party in any manner whatsoever except as agreed under the terms and conditions of this Contract.
- c. The Purchaser has no obligations to the PIA s' Team except as agreed under the terms and Conditions of this Contract.

42.2 No Assignment

The PIA shall not transfer any interest, right, benefit or obligation under this Contract without the prior written consent of the Purchaser.

42.3 Survival

The provisions of the clauses of this Contract in relation to documents, property, Intellectual Property Rights, indemnity, publicity and confidentiality and ownership survive the expiry or termination of this Contract and in relation to confidentiality, the obligations continue to apply unless the Purchaser notifies the PIA of its release from those obligations.

42.4 Entire Contract

The terms and conditions laid down in the PFP and all the annexures thereto as also the Bid and any attachments/annexes thereto shall be read in consonance with and form an integral part of this Contract. This Contract supersedes any prior Contract, understanding or representation of the Parties on the subject matter.

42.5 Governing Law

This Contract shall be governed in accordance with the laws of India.

42.6 Jurisdiction of Courts

All legal disputes are subject to the jurisdiction of Civil Courts Mumbai only.

42.7 Compliance with Laws

The PIA shall comply with the laws in force in India in the course of performing this Contract.

42.8 Notices

a. a "notice" means:

- i. A notice; or
- ii. A consent, approval or other communication required to be in writing under this Contract

All notices, requests or consents provided for or permitted to be given under this Contract shall be in writing and shall be deemed effectively given when personally delivered or mailed by pre- paid certified / registered mail, return receipt requested, addressed as follows and shall be deemed received two days after mailing or on the date of delivery, if personally delivered:

To Purchaser at:

MahalT

<<Attn: XXXX, XXXX, MahalT>>

[Phone:]

[Fax:]>>

To PIA at:

Attn:

[Phone:]

[Fax:]

Any Party may change the address to which notices are to be directed to it by notice to the other parties in the manner specified above.

A notice served on a Representative is taken to be notice to that Representative's Party.

42.9 Waiver

- a. Any waiver of any provision of this Contract is ineffective unless it is in writing and signed by the Party waiving its rights.
- b. A waiver by either Party in respect of a breach of a provision of this Contract by the other Party is not a waiver in respect of any other breach of that or any other provision.
- c. The failure of either Party to enforce at any time any of the provisions of this Contract shall not be interpreted as a waiver of such provision.

42.10 Modification

Any modification of this Contract shall be in writing and signed by an authorized representative of each Party.

42.11 Application

These General Conditions shall apply to the extent that provisions in other parts of the Contract do not supersede them.

43. Exit Management Plan

43.1 This clause sets out the provisions which shall apply upon completion of the contract period or upon termination of the contract for default of the PIA. An Exit Management plan shall be furnished by PIA in writing to the Purchaser within 60 days on completion of the contract period or termination of the contract for default of the PIA, which shall deal with at least the following aspects of exit management in relation to the contract as a whole and in relation to the Project Implementation and Service Level monitoring.

- i. A detailed program of the transfer process that could be used in conjunction with a Replacement PIA including details of the means to be used to ensure continuing provision of the services throughout the transfer process or until the cessation of the services and of the management structure to be used during the transfer;
- ii. Plans for provision of contingent support to Project and Replacement PIA for a reasonable period after transfer.
- iii. Exit Management plan in case of normal termination of Contract period
- iv. Exit Management plan in case of any eventuality due to which Project is terminated before the contract period.
- v. Exit Management plan in case of termination of the PIA

43.2 Exit Management plan at the minimum adhere to the following:

- i. Three (3) months of the support to Replacement PIA post termination of the Contract
- ii. Complete handover of the Planning documents, bill of materials, technical specifications of all equipment, user manuals, guides, IPR, network architecture, change requests if any reports, documents and other relevant items to the Replacement PIA / Purchaser
- iii. Certificate of Acceptance from authorized representative of Replacement PIA issued to the PIA on successful completion of handover and knowledge transfer
- iv. In the event of termination or expiry of the contract, Project Implementation or Service Level monitoring, both PIA and Purchaser shall comply with the Exit Management Plan.
- v. During the exit management period, the PIA shall use its best efforts to deliver the services.

44. Service Level Agreement and Targets

44.1 The PIA has to maintain the Operations for 5 years (maintenance period) as per the terms and conditions of the RFP and to meet the SLA

44.2 The SLA module shall be capable of delivering a report capturing the following measurements of the Network Elements

- a. Availability
- b. Break-up of the Non-availability period on the basis of power failure/ Shut down and due to fibre cut
- c. Response Time/Round trip delay
- d. Load
- e. Traffic In/Out
- f. Errors

The purpose of this Service Level Agreement (hereinafter referred to as SLA) is to clearly define the levels of service which shall be provided by the bidder to MahalT for the duration of Operation and Maintenance phase. Service Level Agreement (SLA) shall become the part of Agreement between MahalT and the successful bidder.

SLA defines the terms of the successful bidder's responsibility in ensuring the timely delivery of the deliverables and the correctness of the same based on the agreed performance indicators as detailed in this section. The successful bidder has to comply with service levels requirements to ensure adherence to timelines, quality and availability of services.

Penalties shall not be levied in the following cases:

- There is a Force Majeure event effecting the SLA which is beyond the control of the successful bidder.

- The non-compliance to the SLA is due to reasons beyond the control of the bidder.

Note:

- Theft cases by default would not be considered as “beyond the control of Bidder”. However, certain cases, based on circumstances and certain locations, MahalT may agree to qualify as “beyond the control of Bidder”.
- Power shut down would not be considered as “beyond the control of Bidder”.
- Damages due to road accident/mishap will be considered as “beyond the control of Bidder”.
- Deliberate damage to field devices: camera, pole etc. would not be considered as “beyond the control of Bidder”. Bidder is advised to have strong poles and proper housing to protect from such damages.
- Bidder is also required to note that in case of SLAs not being made applicable for cases considered as “beyond the control of bidders”, the bidder would still need to replace the component (if it is not functional as per SLA) within the SLA defined for resolution of any issue. In case the bidder doesn't adhere to the issue resolution SLA timelines, the original SLA shall be made applicable.
- Force Majeure includes damages of items due to vandalism or due to events such as such as earthquake, fire, natural calamities, war, act of God

44.3 Network availability – Uptime SLA for network connectivity of Gram Panchayat at Taluka level (*SLA is calculated on a quarterly basis*)

S.No.	Uptime	Penalty (% of O&M)
1	$\geq 99.5\%$	No Penalty
2	$\geq 85.0\% \text{ to } < 99.5\%$	10
3	$\geq 75.0\% \text{ to } < 85.0\%$	15
4	$\geq 65.0\% \text{ to } < 75.0\%$	20
5	$\geq 55.0\% \text{ to } < 65.0\%$	25
6	Below 55%	50

For Minimum Uptime SLA calculations for GPs having spur connectivity, following criteria will be used.

S.No.	Uptime	Penalty (% of O&M)
1	$\geq 95\%$	No Penalty
2	$\geq 85.0\% \text{ to } < 95\%$	10
3	$\geq 75.0\% \text{ to } < 85.0\%$	15
4	$\geq 65.0\% \text{ to } < 75.0\%$	20
5	$\geq 55.0\% \text{ to } < 65.0\%$	25
6	Below 55%	50

- 44.3.1** PIA shall be entitled to a maximum of **8** hours of Planned Outages per District with maximum four (4) Maintenance Windows per year, thus totaling 32 hours of outages during 1 year period for the network installed and commissioned by the PIA. Such downtime shall not be treated as part of downtime for Service Level calculations. The PIA shall give 1 week prior notice in case of any such planned outages. The time for such outages shall be normally during non-peak unless otherwise decided mutually for some other time window.

44.3.2 Any relaxation in SLA condition in a particular quarter shall be reviewed by TPA and approved by SIA in case of unforeseen /force majeure circumstances

In addition, following are minimum requirements of the SLAs for various components

44.3.3 Network Operation Centre (NOC) Performance

S.No.	Component	Requirement	Falls By	Penalty	Calculation (INR)
1	Average Call Response Time / Average Speed of Answer (Average time taken by callers waiting in queue to be attended by the Operator)	95% of incoming calls within 10 seconds (4 rings)	0.50%	20,000	For every increase of 0.50% in attending incoming calls within 10 seconds (4 rings) calculated over a period of one quarter, a penalty of 20000 shall be imposed.
2	Average Call handling Time	95% of incoming calls shall have average call handling time of less than 180 seconds.	0.50%	15,000	For every increase of 0.50% in average call handling time calculated over a period of one quarter, a penalty of 15000 shall be imposed.
3	Abandoned Call Rate	1%	0.10%	50,000	For every increase of 0.50% in abandoned call rate calculated over a period of one quarter, a penalty of 50,000 shall be imposed
4	NOC – Logging of service ticket number	99.00%	0.50%	20,000	For every decrease of 0.50% in logging of service ticket number calculated over a period of one quarter, a penalty of 20,000 shall be imposed
5	NOC – Resolution of ticket logged	99.00%	0.50%	20,000	For every decrease of 0.50% in resolution of service ticket calculated over a period of one quarter, a penalty of 20000 shall be imposed.

44.3.4 Data Centre Hosting – Performance

S.No.	Component	Requirement	Falls By	Penalty	Calculation (INR)
1	Server / Storage / Tape drive/ Router/Link Load Balancer/ UPS	99.99%	0.10%	1,50,000	For every decrease of 0.10% in availability of each device & its associated component in a quarter, a penalty of 1,50,000 shall be imposed
2	Firewall	99.99%	0.10%	1,00,000	For every decrease of 0.10% in availability of the device & its associated component in a quarter, a penalty of 1,00000 shall be imposed
3	Lawful Interception	99.99%	0.10%	1,00,000	For every decrease of 0.10% in availability of the device & its associated component in a quarter, a penalty of 1,00000 shall be imposed
4	Access Network and ISP Gateway	99.99%	0.10%	1,50,000	For every decrease of 0.10% in availability of each device & its associated component in a quarter, a penalty of 1,50,000 shall be imposed

S.No.	Component	Requirement	Falls By	Penalty	Calculation (INR)
5	Security Reporting	Quarterly security report to be submitted with 100% KPIs defined for security	1 day	2000	For every delay of one day a penalty of 2000/day shall be imposed
6	Vulnerability assessment and closure	Vulnerability assessment for all systems/subsystems shall be performed at least once every quarter and all detected vulnerabilities to be closed within 7 days. Mahait may appoint third party agency to cross-check	1 day	2000	For every delay of one day after 7 days a penalty of 2000/day shall be imposed
7	Penetration testing	Penetration testing shall be conducted once every quarter All vulnerabilities shall be closed within 7 days.	1 day	2000	For every delay of one day after 7 days, a penalty of 2000/day shall be imposed
8	Application Security	Cyber Crime/Hacking /Data Theft/Fraud attributable to the successful bidder	1 day	2000	For every delay of one day a penalty of 2000/day shall be imposed

44.3.5 Wi-Fi Network – Performance

S.No.	Component	Requirement	Falls By	Penalty	Calculation (INR)
1	Availability of Wi-Fi through Access Points (AP)	99%	0.25%	10,000	For every decrease of 0.25% in availability of each device & its associated component in a quarter, a penalty of 10000 shall be imposed
2	Average bandwidth up to 50 concurrent users per GP	2 Mbps	0.25 Mbps	50,000	For every decrease of 0.25 Mbps in average bandwidth in a quarter, a penalty of 10000 shall be imposed
3	Authentication of user (Time taken for user to successfully connect to the Wi-Fi network from the and welcome screen is filled and submitted with required information)	within 3 mins	1 min	100	For every increase of 1 min in authenticating the user by each device in a quarter, a penalty of 100 shall be imposed

For Minimum Uptime SLA calculations for availability of Wi-Fi through APs for GPs connected via spur, following criteria will be used

S.No.	Component	Requirement	Falls By	Penalty	Calculation (INR)
1	Availability of Wi-Fi through Access Points (AP) for GPs connected via spur	95%	0.25%	10,000	For every decrease of 0.25% in availability of each device & its associated component in a quarter, a penalty of 10000 shall be imposed
2	Average bandwidth up to 50 concurrent users per GP	2 Mbps	0.25 Mbps	50,000	For every decrease of 0.25 Mbps in average bandwidth in a quarter, a penalty of 10000 shall be imposed
3	Authentication of user (Time taken for user to successfully connect to the Wi-Fi network from the and welcome screen is filled and submitted with required information)	within 3 mins	1 min	100	For every increase of 1 min in authenticating the user by each device in a quarter, a penalty of 100 shall be imposed

Note: O&M: Quarterly Operations and Maintenance cost

45. Exclusions

- 45.1 For the purpose of calculating SLA, the following faults or outage hours shall be excluded:
- Periods where the State / MahalT office staff is inaccessible to confirm the status of the system after fault clearance by the PIA.
 - Periods where any link is switched off at State / MahalT or Govt. Office due its own reasons. The onus lies on State / MahalT or respective Govt. establishment to ensure that the on-site equipment are powered ON and / or the Network Monitoring tools, if any, that are used by State / MahalT should be able to filter out the time period of link being voluntarily switched off from the down time calculations.
 - Periods where the failure of any components or equipment belonging to State / MahalT / Govt. office.
 - The time lost in attending to a complaint due to delay in entering State / MahalT / Govt. institutions premises shall not be considered as a down time.

46. Fraud and Corrupt Practices

- 46.1 The Bidders and their respective officers, employees, agents and advisers shall observe the highest standards of ethics during the Bidding Process and subsequent to the issue of the Award of Work and during the subsistence of the Contract. Notwithstanding anything to the contrary contained herein, or in the Award of Work or the Contract, the Purchaser shall reject

a Bid, withdraw the Award of Work, or terminate the Contract, as the case may be, without being liable in any manner whatsoever to the Bidder as the case may be, if it determines that the Bidder, as the case may be, has, directly or indirectly or through an agent, engaged in corrupt practice, fraudulent practice, coercive practice, undesirable practice or restrictive practice in the Bidding Process. In such an event, the Purchaser shall forfeit and appropriate the Bid Security or Performance Security, as the case may be, as mutually agreed genuine pre-estimated compensation and damages payable to the Purchaser towards, inter alia, time, cost and effort of the Purchaser, without prejudice to any other right or remedy that may be available to the Authority hereunder or otherwise.

- 46.2 Without prejudice to the rights of the Purchaser under Clause 45.1 hereinabove and the rights and remedies which the Purchaser may have under the Award of Work or the Contract, if a Bidder, as the case may be, is found by the Authority to have directly or indirectly or through an agent, engaged or indulged in any corrupt practice, fraudulent practice, coercive practice, undesirable practice or restrictive practice during the Bidding Process, or after the issue of the Award of Work or the execution of the Contract, such Bidder shall not be eligible to participate in any RFP issued by the Purchaser during a period of 2 (two) years from the date such Bidder, as the case may be, is found by the Purchaser to have directly or indirectly or through an agent, engaged or indulged in any corrupt practice, fraudulent practice, coercive practice, undesirable practice or restrictive practices, as the case may be. For the purposes of this Clause 45, the following terms shall have the meaning hereinafter respectively assigned to them:
- a. "Corrupt Practice" means (i) the offering, giving, receiving, or soliciting, directly or indirectly, of anything of value to influence the actions of any person connected with the Bidding Process (for avoidance of doubt, offering of employment to or employing or engaging in any manner whatsoever, directly or indirectly, any official of the Purchaser who is or has been associated in any manner, directly or indirectly with the Bidding Process or the Award of Work or has dealt with matters concerning the Contract or arising therefrom
 - b. "Fraudulent Practice" means a misrepresentation or omission of facts or suppression of facts or disclosure of incomplete facts, in order to influence the Bidding Process;
 - c. "Coercive Practice" means impairing or harming or threatening to impair or harm, directly or indirectly, any person or property to influence any person's participation or action in the Bidding Process;
 - d. "Undesirable Practice" means (i) establishing contact with any person connected with or employed or engaged by the Purchaser with the objective of canvassing, lobbying or in any manner influencing or attempting to influence the Bidding Process; or (ii) having a Conflict of Interest; and
 - e. "Restrictive Practice" means forming a cartel or arriving at any understanding or arrangement among Bidder with the objective of restricting or manipulating a full and fair competition in the Bidding Process.

Abbreviations:

ABD	As Build Diagram
ADSS	All-dielectric self-supporting
BG	Bank Guarantee
BoQ	Bill of Quantity
CPE	Customer Premise Equipment
DD	Demand Draft
DoT	Department of Telecommunication
EMD	Earnest Money Deposit
ESH	Extended Service Hour
Eth	Ethernet
FAT	Final Acceptance Test
FEC	Finance Evaluation Committee
FTB	Fibre Termination Box
Gol	Government of India
GP	Gram Panchayat
HDPE	High Density Polyethylene
IP-MPLS	Internet Protocol – Multi Protocol Label Switch
INR	Indian National Rupee
LCBS	Least Cost Based Solution
LoI	Letter of Intent
MAF	Manufacturers Authorisation Form
MoU	Memorandum of Understanding
N/w	Network
NDA	Non-Disclosure Agreement
NIT	Notice Inviting Tender
NOC	Network Operation Centre
O&M	Operation and Maintenance
O/H	Overhead
OEM	Original Equipment Manufacturer
OTDR	Optical time-domain reflectometer
PBH	Primary Business Hour
PIA	Project Implementing Agency
PLB	Permanently Lubricated
PMC	Project Management Consultants
PoP	Point of Presence
PQC	Pre-Qualification Criteria
PSU	Public Sector Unit

RCC	Reinforced Cement Concrete
RF	Radio Frequency
RFP	Request for Proposal
RoW	Right of Way
SIA	State Implementation Agency (MahaNet)
SLA	Service Level Agreement
SOR	Schedule of Rate
SPV	Solar Photovoltaic
TAC	Type Approval Certificate
TEC GR	Telecommunication Engineering Centre Generic Requirements
TPA	Third Party Auditor
TSEC	Technical Specification Evaluation Certificate
USOF	Universal Service Obligation Fund
VPN	Virtual Private Network
VRLA	Valve-regulated lead-acid
Wi-Fi	Wireless Connectivity

Section IV

Bid Submission Format

Section IV – Bid Submission Format

The PIA is required to submit a Schedule of Requirements in response to this RFP. This section provides the outline, content and the format that the PIA is required to follow in the preparation of their Bids.

ANNEXURE 4.1.A – SCHEDULE OF REQUIREMENTS (SOR) FOR PACKAGE A

Sr. No.	Item Description as per technical specifications	Package A Complied (Yes/ No)
Supply of equipment, installation and commissioning		
Supply (Material)		
A Passive infrastructure (Underground Cable)		
1	96F Metal free Optical Fibre Cable Ribbon type with double HDPE Sheath (G.652DFibre): Specification as per “BSNL Tender No. : CA/MMT/NOFN/Selection of PIA/T-610/2017 Dated 29.12.2017	
2	48F Metal free Optical Fibre Cable Ribbon type with double HDPE Sheath (G.652DFibre): Specification as per “BSNL Tender No. : CA/MMT/NOFN/Selection of PIA/T-610/2017 Dated 29.12.2017	
3	24F Metal free Optical Fibre Cable Loose type with double HDPE Sheath (G.652DFibre): Specification shall comply as per TEC draft GR “TEC/GR/OFC-23/01/XXX-2011 (under finalisation in TEC)	
4	Supply of PLB HDPE Duct (40/33) and accessories as per specifications	
5	Supply of Cable locator as per specifications (per 150 km)	
6	Supply of Route Markers/ Joint Indicator as per specifications (6 nos./ km)	
7	Manhole/ Joint Chamber along with straight/ branching splice closure as per specifications (1 nos./ 2 kms)	
B Passive infrastructure (Aerial cable and Miscellaneous)		
1	Self-supporting Metal Free Aerial Optical Fibre Cable (24F ADSS): Specification shall comply as per TEC GR TEC/GR/TX/OFC-022/02/MAR-17, Type II A (for Kohlapur, Nashik, Pune, Ratnagiri, Sangli, and Thane) ” with latest amendments if any.	
2	Self-supporting Metal Free Aerial Optical Fibre Cable (24F ADSS): Specification shall comply as per TEC GR TEC/GR/TX/OFC-022/02/MAR-17, Type III A (for Palghar, Satara, and Sindhudurg districts) , with latest amendments if any.	
3	Self-supporting Metal Free Aerial Optical Fibre Cable (48F ADSS): Specification shall comply as per TEC GR: TEC/GR/TX/OFC-022/02/MAR-17, Type III A (for Palghar, Satara, and Sindhudurg districts) , with latest amendments if any.	
4	Galvanized steel poles of tubular in design and swaged of the length 7 meters, with top cap welded and lightning spike and including muff (where pole erection is required estimated as 21 nos./ km)	
5	Galvanized steel poles of tubular in design and swaged of the length 8 meters, with top cap welded and lightning spike and including muff (where pole erection is required estimated as 4 nos./ km)	
6	Stay arrangement for 7 mtr / 8 mtr steel poles (where strengthening is required)	
C FDM and Other Passive Infrastructure		
1	FDMs Taluka including fibre patch cords, Pig-Tails with appropriate connectors	
2	FDMs GP including fibre patch cords, Pig-Tails with appropriate connectors	
3	Rack 42 U-floor mount with all accessories for NOC	

Sr. No.	Item Description as per technical specifications	Package A Complied (Yes/ No)
4	Rack 42 U-floor mount with all accessories for Taluka	
5	Rack 6 U-floor mount with all accessories for GP	
6	Spare Cable Box	
D	Power infrastructure	
1	Online UPS (6 KVA) at Taluka level as per specifications	
2	Offline UPS (600 VA) at GP as per specifications	
3	Solar Photo-Voltaic power supply system at the GP shall consist of following subsystems as per TE No. CA/MMT/NOFN/Selection of PIA/T-610/2017: 1. VRLA Maintenance Free battery (for 12Hrs Back-up) 2. Solar Panel: 12V/ 60W 3. SMPS: 12V/ 7A 4. Charge Controller: 120W	
E	Active infrastructure	
I)	IPMPLS	
1	Aggregation Routers at THQ-3/4	
2	Aggregation Routers at THQ-1/2	
3	Access Routers at GP1	
4	Access Routers at GP2	
5	Access Routers at GP3	
6	Access Routers at GP4	
7	Route Reflector as per specifications	
8	Expansion Module of Network ports - 2 X 10G for GP	
9	Expansion Module of 6 X 10 G Ports for Client ports of THQ (Including 10Kms SFP)	
10	Expansion Module of 10 X 1G Ports for Client ports of THQ (Including 10Kms SFP)	
11	SFP 1G (300m)	
12	SFP 1G (10Kms)	
13	SFP 1G (40Kms)	
14	SFP 10G (10Kms)	
15	SFP 10G (40Kms)	
16	SFP 10G (80Kms) - (This should include any DWDM/Amplifier/Optics requirements)	
17	SFP 100G (10Kms)	
18	SFP 100G (40Kms)	
19	SFP 100G (80Kms) (This should include any DWDM/Amplifier/Optics requirements)	
20	Remote Fibre Monitoring System (RFMS) at Taluka (as per specifications and design requirements)	
II)	Electronics of State NOC	
1	Element Management System (EMS)/ Network Management System (NMS) as per specifications	
2	Helpdesk	
3	Two L3 Router (same as GP Type-4 IP/MPLS Router)	

Sr. No.	Item Description as per technical specifications	Package A Complied (Yes/ No)
4	Access Switch (with 50Gbps switching capacity and 60x10/100/1000Mbps Ethernet Ports)	
5	IP PABX system for 150 subscribers	
6	Subscriber devices for IP PABX	
7	Workstations for all Sitting Locations with Windows OS and Microsoft Office	
8	One Video Wall of 24 DLP cubes of minimum 50" Screen with maximum Screen-to-Screen Gap of 0.2 mm	
9	Video end points for DHQ (26) + additional 14 units for Government offices	
10	Any other hardware/ software required to meet the RFP requirements	
II) Electronics of State NOC -DR		
1	Element Management System (EMS)/ Network Management System (NMS) as per specifications	
2	Helpdesk	
3	Two L3 Router (same as GP Type-4 IP/MPLS Router)	
4	Access Switch (with 50Gbps switching capacity and 60x10/100/1000Mbps Ethernet Ports)	
5	IP PABX system for 150 subscribers	
6	Subscriber devices for IP PABX	
7	Workstations for all Sitting Locations with Windows OS and Microsoft Office	
8	One Video Wall of 12 DLP cubes of minimum 50" Screen with maximum Screen-to-Screen Gap of 0.2 mm	
9	Any other hardware/ software required to meet the RFP requirements	
IV) Infrastructure of State NOC		
1	Comfort AC Cooling	
2	Power and LAN Connectivity	
3	Access Control Systems (as indicated in NOC Specification Section)	
4	Furniture infrastructure for 50 Operations staff and Furniture for Support area	
5	20KVA UPS	
6	DG Set	
7	Fire safety system	
8	Water leak detection system	
9	Building management system	
V) Infrastructure of State NOC -DR		
1	Comfort AC Cooling	
2	Power and LAN Connectivity	
3	Access Control Systems (as indicated in NOC Specification Section)	
4	Furniture infrastructure for 50 Operations staff and Furniture for Support area	
5	20KVA UPS	
6	DG Set	
7	Fire safety system	
8	Water leak detection system	
9	Building management system	
VI) NMS/OSS/BSS Software solution		

Sr. No.	Item Description as per technical specifications	Package A Complied (Yes/ No)
1	OSS/BSS as per specifications	
2	CRM	
3	Billing	
4	Service & Resource Assurance	
5	Web self-care	
6	MIS, reporting and analytics system	
7	Contact centre	
8	Remote Fibre Management System (FMS)	
9	Any other sub-system of NOC mentioned in RFP not mentioned above with breakup	
VII)	DC and DR hosting on Cloud	
1	Internet router (as per Bidder's solution)	
2	Server load balancer (as per Bidder's solution)	
3	Server/ Blades (as per Bidder's solution)	
4	SAN switch (as per Bidder's solution)	
5	Storage (as per Bidder's solution)	
6	TOR switch (as per Bidder's solution)	
7	Backup appliance (as per Bidder's solution)	
8	Backup software (as per Bidder's solution)	
9	Any other hardware/ software at DC/ DR required to meet the RFP requirements	
F	Security	
1	Next Generation Security solution for Taluka head-end	
2	Next Generation Security solution for NOC/NOC DR	
3	End Point Malware Protection for work-stations at NOC	
4	Software defined security solution	
G	Radio infrastructure	
1	Supply of RF link equipment as per specifications (Outdoor unit, Indoor unit, antenna, etc.) at GP / Taluka including all accessories i.e. mast, cabling, earthing, etc.	
H	Wi-Fi	
I)	Wi-Fi Access Point	
1	Wi-Fi access points at GP	
2	Supply of Mast/ pole and accessories for GP Wi-Fi	
3	Solar photovoltaic battery (60W), VRLA Maintenance Free battery (for 12Hrs backup), and charging unit for remote Wi-Fi access points at GPs	
II)	Wi-Fi Services Infrastructure (Wi-Fi Service Provider Scope)	
1	Wi-Fi Controller system	
2	Wi-Fi Broadband infrastructure (Telecom / Internet/ Wi-Fi Services provider Scope)	
3	Subscriber Authentication & Policy Management	
4	Lawful Intercept	
5	CGNAT IP Log Management System	

Sr. No.	Item Description as per technical specifications	Package A Complied (Yes/ No)
6	Wi-Fi NOC	
7	Any other sub-system for Wi-Fi Services as per specifications and regulation	
I	Spares (to manage the SLAs for period of Contract and to be transferred to MahalT post contract)	
J	Warehousing for storing Equipment during project phase	
Services as per Technical Specifications		
K	Composite Pricing for Underground OFC Laying activities	
1	Excavation of open trench (Depth 1.4 M). Horizontal Directional Drilling (HDD) for PLB pipe laying, in all types of soils/ strata, 40/33 mm PLB pipe laying, back-filling, compaction & levelling of trench / pit. Laying / blowing of 24/48/96F optical fibre cable inside laid PLB pipe, splicing and jointing of OFC, preparation of As-Built Diagram (ABD) of constructed OFC Route, acceptance testing, commissioning and makeover of the routes. The work also includes laying on road crossing, railway crossing, culverts wherever required, including fixing of route/ joint indicator. Termination at FTB and all the relevant accessories etc. and end to end testing of dark and lit fibre per GP (for underground laying) (As per the Engineering Instruction issued by BBNL)	
2	Laying of protection ON PLB pipe: As per the engineering instructions specified in the RFP, with the approval of the SIA (including the supply of protection material). Please also refer to page 20, Corrigendum 2, Annexure B: Engineering Instructions, Sub-section B-3: Penalty for deviation from standard engineering instructions for underground laying	
3	Laying optical fibre cables on bridges, culverts, road surface inside GI Pipe, concreting work on single PLB Pipe including supply of GI Pipe, cement, concrete and curing etc. (PCC 1:2:4 with weld mesh) for Bridges/Culverts or cables laid at lesser depth etc.	
4	Fixing and sign writing of Route /Joint Indicators.	
5	Supply of pre-cast RCC with bottom plant and top cove (preferably two halves). Joint Chambers of bricks/ pre-fabricated RCC chamber as per specification with handle and supply of stone slab for covering the Chamber and River sand for filling the chamber.	
6	At Taluka location installation of OF cable box, FDMS, leading-in arrangement, jointing of Pig-Tails, termination of OF cable at block, and all other related activities for commissioning of 48F/ 96F optical fibre cable connectivity from block PoP to GP. Acceptance testing of fibre network.	
7	At GP locations installation of FDMS, leading-in arrangement, jointing of Pig-Tails, termination of OF cable, and all other related activities for commissioning of 48/96F optical fibre cable for connectivity GP to Block. Acceptance testing of fibre network	
8	Physical survey of block to GP route, capturing the Latitude-Longitude of OF cable route, preparation of GIS survey report before execution of works	

Sr. No.	Item Description as per technical specifications	Package A Complied (Yes/ No)
9	Capturing the Latitude-Longitude of OF route & joint location after execution of works from block to GPs, capturing coordinates ,integration of GIS data with As-Built Diagrams of OF routes	
L	Composite Pricing for Underground OFC Laying activities for 2 Number of PLB Pipes and OFC Blowing in one of the PLB Pipe (30% of the routes will include Additional ducts for Monetization)	
1	Excavation of open trench (Depth1.4 M)/ Horizontal Directional Drilling (HDD) for PLB pipe laying, in all types of soils/strata, 2 Number of 40/33 mm PLB pipe laying, Backfilling, Compaction & levelling of trench / pit. Laying / blowing of 24/48/96F optical Fibre Cable inside one of the laid PLB pipe, splicing and jointing of Optical Fibre Cable preparation of As Built Diagram (ABD) of constructed OFC Route, acceptance testing, commissioning and makeover of the routes. The work also includes laying on road crossing, railway crossing, culverts wherever required, including fixing of route/ Joint indicator. Termination at FTB and all the relevant accessories etc. and end to end testing of dark and lit fibre per GP (For Underground laying) (As per the Engineering Instruction issued by BBNL)	
2	Laying of protection ON 2 number of PLB pipe: As per the engineering instructions specified in the RFP, with the approval of the SIA (including the supply of protection material). Please also refer to page 20, Corrigendum 2, Annexure B: Engineering Instructions, Sub-section B-3: Penalty for deviation from standard engineering instructions for underground laying	
3	Laying optical fibre cables on Bridges, culverts, road surface inside GI Pipe, Concreting work on 2 Number of PLB Pipe including supply of GI Pipe, cement, concrete and curing etc.(PCC 1:2:4) for bridges/ culverts or cables laid at lesser depth etc.	
4	Fixing and sign writing of Route/ Joint Indicators.	
5	Supply of Pre-cast RCC with bottom plant and Top Cove (preferably two halves) Joint Chambers of bricks/ pre-fabricated RCC chamber as per specification with handle and supply of stone slab for covering the chamber and river sand for filling the chamber.	
6	At Taluka location installation of OF cable box, FDMS, leading-in arrangement, jointing of Pig-Tails, termination of OF cable at block, and all other related activities for commissioning of 48/96F optical fibre cable connectivity from block PoP to GP. Acceptance testing of fibre network.	
7	At GP location installation of FDMS, leading-in arrangement, jointing of Pig-Tails, termination of OF cable, and all other related activities for commissioning of 48/96F optical fibre cable for connectivity GP to Block. Acceptance testing of fibre network	
8	Physical Survey of block to GP route, capturing the Latitude-Longitude of OF cable route, preparation of GIS survey report before execution of works	
9	Capturing the Latitude-Longitude of OF route & joint location after execution of works from block to GPs, capturing coordinates ,integration of GIS data with As-Built Diagram of OF routes	
M	Composite Pricing for Aerial OFC Laying activities	

Sr. No.	Item Description as per technical specifications	Package A Complied (Yes/ No)
1	Commissioning of 24/48/96 core optical fibre connectivity from the Taluka PoP to GP room and termination at GP Router. The cost shall include t laying, fittings, splicing, splitting, splice closure, Pole clamping installation, termination at FTB & all the relevant accessories etc. and end to end testing of dark and lit fibre per GP (For aerial laying) (As per the Engineering Instruction issued by BBNL)	
2	Formed OFC Dead-End & termination fittings @ 5 per Kms.	
3	OFC suspension fittings @ 15 per Kms.	
4	Demountable pulley @ one per 10 Kms.	
5	Adjustable Cable Storage Bracket and Joint closure (1 nos./ km)	
6	Installation and commissioning of Galvanized Steel Poles	
7	Installation and commissioning of stay arrangements on existing Galvanized Steel Poles	
N	Active infrastructure	
1	Installation, integration, testing and commissioning of Electronics at Taluka	
2	Installation, integration, testing and commissioning of Electronics including Wi-Fi at GP Level	
3	Installation, integration, testing and commissioning of RF Link equipment as per specifications (Outdoor and Indoor) at GP/Taluka including all accessories i.e. Mast, cabling, earthing, etc.	
O	Electronics of State NOC	
1	Building, installation, integration, testing and commissioning of NOC including OSS, BSS, NMS, Cyber Safety and other associated solution described in SOW and specifications as well as integration with Private Cloud Service Provider DC/DR Infrastructure	
2	Site preparation (Civil Works)	
P	Electronics of State NOC –DR	
1	Building, installation, integration, testing and commissioning of NOC including OSS, BSS, NMS, Cyber Safety and other associated solution described in SOW and specifications as well as integration with Private Cloud Service Provider DC/DR Infrastructure	
2	Site preparation (Civil works)	
Q	Site Preparation (Taluka)	
1	General site readiness like provisioning of proper earthing, racks installations, power infrastructure (as per specifications), etc. shall be carried out by the Bidder at no Extra cost. The Bidder shall provide suitable earthing arrangement as specified in TEC GR No. GR/SPV-03/02 JUN 2005, clause 2.5	
R	Site Preparation (GP)	
1	General site readiness like provisioning of proper earthing, racks installations, power infrastructure (as per specifications), etc. shall be carried out by the Bidder at no Extra cost. The Bidder shall provide suitable earthing arrangement as specified in TEC GR No. GR/SPV-03/02 JUN 2005, clause 2.5	
O&M as per requirements		
S	Gram Panchayat Infrastructure	
1	O&M of GP Active Electronics (Non Wi-Fi) equated quarterly for 5 years (Including warranty of one year)	

Sr. No.	Item Description as per technical specifications	Package A Complied (Yes/ No)
2	O&M of GP Wi-Fi Electronics equated quarterly for 5 years (Including warranty of one year)	
3	O&M of GP physical infrastructure equated quarterly for 5 years (Including warranty of one year)	
T	Taluka Infrastructure	
1	O&M of Taluka Active electronics equated quarterly for 5 years (Including warranty of one year)	
2	O&M of Taluka physical infrastructure equated quarterly for 5 years (Including warranty of one year)	
U	Central infrastructure	
1	O&M of NOC Active electronics and software solutions equated quarterly for 5 years (Including warranty of one year)	
2	O&M of NOC physical infrastructure equated quarterly for 5 years (Including warranty of one year)	
3	O&M of NOC-DR Active electronics and software solutions equated quarterly for 5 years (Including warranty of one year)	
4	O&M of NOC-DR physical infrastructure equated quarterly for 5 years (Including warranty of one year)	
5	O&M of NMS, OSS, BSS and other software sub-systems equated quarterly for 5 years (Including warranty of one year)	
6	O&M of Virtual Private Cloud Service Provider for DC-DR services equated quarterly for 5 years	
7	NOC management (L1/L2/L3), Managing OSS/BSS/NMS- To meet the SLAs as per contract	
V	Network Bandwidth (As per TRAI guidelines)	
1	Network bandwidth connectivity from Taluka to DC/DR	
2	Network bandwidth connectivity from Taluka to NOC/NOC DR	
3	Internet connectivity for other intra office infrastructure	
W	Warehousing for Storing Equipment during project phase and spares during O&M Phase	

ANNEXURE 4.1 – SCHEDULE OF REQUIREMENTS (SOR) FOR PACKAGE B

Sr. No.	Item Description as per technical specifications	Package B Complied (Yes/ No)
Supply of equipment, installation and commissioning		
Supply (Material)		
A Passive infrastructure (Underground Cable)		
1	96F Metal free Optical Fibre Cable Ribbon type with double HDPE Sheath (G.652DFibre): Specification as per "BSNL Tender No. : CA/MMT/NOFN/Selection of PIA/T-610/2017 Dated 29.12.2017	
2	48F Metal free Optical Fibre Cable Ribbon type with double HDPE Sheath (G.652DFibre): Specification as per "BSNL Tender No. : CA/MMT/NOFN/Selection of PIA/T-610/2017 Dated 29.12.2017	
3	24F Metal free Optical Fibre Cable Loose type with double HDPE Sheath (G.652DFibre): Specification shall comply as per TEC draft GR "TEC/GR/OFC-23/01/XXX-2011 (under finalisation in TEC)	
4	Supply of PLB HDPE Duct (40/33) and accessories as per specifications	
5	Supply of Cable locator as per specifications (per 150 km)	
6	Supply of Route Markers/ Joint Indicator as per specifications (6 nos./ km)	
7	Manhole/ Joint Chamber along with straight/ branching splice closure as per specifications (1 nos./ 2 kms)	
B Passive infrastructure (Aerial cable and Miscellaneous)		
1	Self-supporting Metal Free Aerial Optical Fibre Cable (24F ADSS): Specification shall comply as per TEC GR: TEC/GR/TX/OFC-022/02/MAR-17, Type II A with latest amendments if any.	
2	Self-supporting Metal Free Aerial Optical Fibre Cable (48F ADSS): Specification shall comply as per TEC GR: TEC/GR/TX/OFC-022/02/MAR-17, Type II A with latest amendments if any.	
3	Galvanized steel poles of tubular in design and swaged of the length 7 meters, with top cap welded and lightning spike and including muff (where pole erection is required estimated as 21 nos./ km)	
4	Galvanized steel poles of tubular in design and swaged of the length 8 meters, with top cap welded and lightning spike and including muff (where pole erection is required estimated as 4 nos./ km)	
5	Stay arrangement for 7 mtr / 8 mtr steel poles (where strengthening is required)	
C FDM and Other Passive Infrastructure		
1	FDMs Taluka including fibre patch cords, Pig-Tails with appropriate connectors	
2	FDMs GP including fibre patch cords, Pig-Tails with appropriate connectors	
3	Rack 42 U-floor mount with all accessories for Taluka	
4	Rack 6 U-floor mount with all accessories for GP	
5	Spare Cable Box	
D Power infrastructure		
1	Online UPS (6 KVA) at Taluka level as per specifications	
2	Offline UPS (600 VA) at GP as per specifications	
3	Solar Photo-Voltaic power supply system at the GP shall consist of following subsystems as per TE No. CA/MMT/NOFN/Selection of PIA/T-610/2017: 1. VRLA Maintenance Free battery (for 12Hrs Back-up) 2. Solar Panel: 12V/ 60W 3. SMPS: 12V/ 7A	

Sr. No.	Item Description as per technical specifications	Package B Complied (Yes/ No)
	4. Charge Controller: 120W	
E	Spares (to manage the SLAs for period of Contract and to be transferred to MahalT post contract)	
F	Warehousing for Storing Equipment during project phase	
G	Radio infrastructure	
1	Supply of RF link equipment as per specifications (Outdoor unit, Indoor unit, antenna, etc.) at GP / Taluka including all accessories i.e. mast, cabling, earthing, etc.	
Services as per Technical Specifications		
H	Composite Pricing for Underground OFC Laying activities	
1	Excavation of open trench (Depth 1.4 M). Horizontal Directional Drilling (HDD) for PLB pipe laying, in all types of soils/ strata, 40/33 mm PLB pipe laying, back-filling, compaction & levelling of trench / pit. Laying / blowing of 24/48/96F optical fibre cable inside laid PLB pipe, splicing and jointing of OFC, preparation of As-Built Diagram (ABD) of constructed OFC Route, acceptance testing, commissioning and makeover of the routes. The work also includes laying on road crossing, railway crossing, culverts wherever required, including fixing of route/ joint indicator. Termination at FTB and all the relevant accessories etc. and end to end testing of dark and lit fibre per GP (for underground laying) (As per the Engineering Instruction issued by BBNL)	
2	Laying of protection ON PLB pipe: As per the engineering instructions specified in the RFP, with the approval of the SIA (including the supply of protection material). Please also refer to page 20, Corrigendum 2, Annexure B: Engineering Instructions, Sub-section B-3: Penalty for deviation from standard engineering instructions for underground laying	
3	Laying optical fibre cables on bridges, culverts, road surface inside GI Pipe, concreting work on single PLB Pipe including supply of GI Pipe, cement, concrete and curing etc. (PCC 1:2:4 with weld mesh) for Bridges/Culverts or cables laid at lesser depth etc.	
4	Fixing and sign writing of Route /Joint Indicators.	
5	Supply of pre-cast RCC with bottom plant and top cove (preferably two halves). Joint Chambers of bricks/ pre-fabricated RCC chamber as per specification with handle and supply of stone slab for covering the Chamber and River sand for filling the chamber.	
6	At Taluka location installation of OF cable box, FDMS, leading-in arrangement, jointing of Pig-Tails, termination of OF cable at block, and all other related activities for commissioning of 48F/ 96F optical fibre cable connectivity from block PoP to GP. Acceptance testing of fibre network.	
7	At GP locations installation of FDMS, leading-in arrangement, jointing of Pig-Tails, termination of OF cable, and all other related activities for commissioning of 48/96F optical fibre cable for connectivity GP to Block. Acceptance testing of fibre network	

Sr. No.	Item Description as per technical specifications	Package B Complied (Yes/ No)
8	Physical survey of block to GP route, capturing the Latitude-Longitude of OF cable route, preparation of GIS survey report before execution of works	
9	Capturing the Latitude-Longitude of OF route & joint location after execution of works from block to GPs, capturing coordinates ,integration of GIS data with As-Built Diagrams of OF routes	
I	Composite Pricing for Underground OFC Laying activities for 2 Number of PLB Pipes and OFC Blowing in one of the PLB Pipe (30% of the routes will include Additional ducts for Monetization)	
1	Excavation of open trench (Depth1.4 M)/ Horizontal Directional Drilling (HDD) for PLB pipe laying, in all types of soils/strata, 2 Number of 40/33 mm PLB pipe laying, Backfilling, Compaction & levelling of trench / pit. Laying / blowing of 24/48/96F optical Fibre Cable inside one of the laid PLB pipe, splicing and jointing of Optical Fibre Cable preparation of As Built Diagram (ABD) of constructed OFC Route, acceptance testing, commissioning and makeover of the routes. The work also includes laying on road crossing, railway crossing, culverts wherever required, including fixing of route/ Joint indicator. Termination at FTB and all the relevant accessories etc. and end to end testing of dark and lit fibre per GP (For Underground laying) (As per the Engineering Instruction issued by BBNL)	
2	Laying of protection ON 2 number of PLB pipe: As per the engineering instructions specified in the RFP, with the approval of the SIA (including the supply of protection material). Please also refer to page 20, Corrigendum 2, Annexure B: Engineering Instructions, Sub-section B-3: Penalty for deviation from standard engineering instructions for underground laying	
3	Laying optical fibre cables on Bridges, culverts, road surface inside GI Pipe, Concreting work on 2 Number of PLB Pipe including supply of GI Pipe, cement, concrete and curing etc.(PCC 1:2:4) for bridges/ culverts or cables laid at lesser depth etc.	
4	Fixing and sign writing of Route/ Joint Indicators.	
5	Supply of Pre-cast RCC with bottom plant and Top Cove (preferably two halves) Joint Chambers of bricks/ pre-fabricated RCC chamber as per specification with handle and supply of stone slab for covering the chamber and river sand for filling the chamber.	
6	At Taluka location installation of OF cable box, FDMS, leading-in arrangement, jointing of Pig-Tails, termination of OF cable at block, and all other related activities for commissioning of 48/96F optical fibre cable connectivity from block PoP to GP. Acceptance testing of fibre network.	
7	At GP location installation of FDMS, leading-in arrangement, jointing of Pig-Tails, termination of OF cable, and all other related activities for commissioning of 48/96F optical fibre cable for connectivity GP to Block. Acceptance testing of fibre network	
8	Physical Survey of block to GP route, capturing the Latitude-Longitude of OF cable route, preparation of GIS survey report before execution of works	
9	Capturing the Latitude-Longitude of OF route & joint location after execution of works from block to GPs, capturing coordinates ,integration of GIS data with As-Built Diagram of OF routes	
J	Composite Pricing for Aerial OFC Laying activities	

Sr. No.	Item Description as per technical specifications	Package B Complied (Yes/ No)
1	Commissioning of 24/48/96 core optical fibre connectivity from the Taluka PoP to GP room and termination at GP Router. The cost shall include t laying, fittings, splicing, splitting, splice closure, Pole clamping installation, termination at FTB & all the relevant accessories etc. and end to end testing of dark and lit fibre per GP (For aerial laying) (As per the Engineering Instruction issued by BBNL)	
2	Formed OFC Dead-End & termination fittings @ 5 per Kms.	
3	OFC suspension fittings @ 15 per Kms.	
4	Demountable pulley @ one per 10 Kms.	
5	Adjustable Cable Storage Bracket and Joint closure (1 nos./ km)	
6	Installation and commissioning of Galvanized Steel Poles	
7	Installation and commissioning of stay arrangements on existing Galvanized Steel Poles	
K	Site Preparation (Taluka)	
1	General site readiness like provisioning of proper earthing, racks installations, power infrastructure (as per specifications), etc. shall be carried out by the Bidder at no Extra cost. The Bidder shall provide suitable earthing arrangement as specified in TEC GR No. GR/SPV-03/02 JUN 2005, clause 2.5	
L	Site Preparation (GP)	
1	General site readiness like provisioning of proper earthing, racks installations, power infrastructure (as per specifications), etc. shall be carried out by the Bidder at no Extra cost. The Bidder shall provide suitable earthing arrangement as specified in TEC GR No. GR/SPV-03/02 JUN 2005, clause 2.5	
O&M as per requirements		
M	Gram Panchayat Infrastructure	
1	O&M of GP physical infrastructure equated quarterly for 5 years (Including warranty of one year)	
N	Taluka Infrastructure	
1	O&M of Taluka physical infrastructure equated quarterly for 5 years (Including warranty of one year)	
O	Warehousing for Storing Equipment during project phase and spares during O&M Phase	

ANNEXURE 4.1 – SCHEDULE OF REQUIREMENTS (SOR) FOR PACKAGE C

Sr. No.	Item Description as per technical specifications	Package C Complied (Yes/ No)
Supply of equipment, installation and commissioning		
Supply (Material)		
A Passive infrastructure (Underground Cable)		
1	96F Metal free Optical Fibre Cable Ribbon type with double HDPE Sheath (G.652DFibre): Specification as per "BSNL Tender No. : CA/MMT/NOFN/Selection of PIA/T-610/2017 Dated 29.12.2017	
2	48F Metal free Optical Fibre Cable Ribbon type with double HDPE Sheath (G.652DFibre): Specification as per "BSNL Tender No. : CA/MMT/NOFN/Selection of PIA/T-610/2017 Dated 29.12.2017	
3	24F Metal free Optical Fibre Cable Loose type with double HDPE Sheath (G.652DFibre): Specification shall comply as per TEC draft GR "TEC/GR/OFC-23/01/XXX-2011 (under finalisation in TEC)	
4	Supply of PLB HDPE Duct (40/33) and accessories as per specifications	
5	Supply of Cable locator as per specifications (per 150 km)	
6	Supply of Route Markers/ Joint Indicator as per specifications (6 nos./ km)	
7	Manhole/ Joint Chamber along with straight/ branching splice closure as per specifications (1 nos./ 2 kms)	
B Passive infrastructure (Aerial cable and Miscellaneous)		
1	Self-supporting Metal Free Aerial Optical Fibre Cable (24F ADSS): Specification shall comply as per TEC GR: TEC/GR/TX/OFC-022/02/MAR-17, Type II A with latest amendments if any.	
2	Self-supporting Metal Free Aerial Optical Fibre Cable (48F ADSS): Specification shall comply as per TEC GR: TEC/GR/TX/OFC-022/02/MAR-17, Type II A with latest amendments if any.	
3	Galvanized steel poles of tubular in design and swaged of the length 7 meters, with top cap welded and lightning spike and including muff (where pole erection is required estimated as 21 nos./ km)	
4	Galvanized steel poles of tubular in design and swaged of the length 8 meters, with top cap welded and lightning spike and including muff (where pole erection is required estimated as 4 nos./ km)	
5	Stay arrangement for 7 mtr / 8 mtr steel poles (where strengthening is required)	
C FDM and Other Passive Infrastructure		
1	FDMs Taluka including fibre patch cords, Pig-Tails with appropriate connectors	
2	FDMs GP including fibre patch cords, Pig-Tails with appropriate connectors	
3	Rack 42 U-floor mount with all accessories for Taluka	
4	Rack 6 U-floor mount with all accessories for GP	
5	Spare Cable Box	
D Power infrastructure		
1	Online UPS (6 KVA) at Taluka level as per specifications	
2	Offline UPS (600 VA) at GP as per specifications	

Sr. No.	Item Description as per technical specifications	Package C Complied (Yes/ No)
3	Solar Photo-Voltaic power supply system at the GP shall consist of following subsystems as per TE No. CA/MMT/NOFN/Selection of PIAT-610/2017: 1. VRLA Maintenance Free battery (for 12Hrs Back-up) 2. Solar Panel: 12V/ 60W 3. SMPS: 12V/ 7A 4. Charge Controller: 120W	
E	Spares (to manage the SLAs for period of Contract and to be transferred to Mahait post contract)	
F	Warehousing for Storing Equipment during project phase	
G	Radio infrastructure	
1	Supply of RF link equipment as per specifications (Outdoor unit, Indoor unit, antenna, etc.) at GP / Taluka including all accessories i.e. mast, cabling, earthing, etc.	
Services as per Technical Specifications		
H	Composite Pricing for Underground OFC Laying activities	
1	Excavation of open trench (Depth 1.4 M). Horizontal Directional Drilling (HDD) for PLB pipe laying, in all types of soils/ strata, 40/33 mm PLB pipe laying, back-filling, compaction & levelling of trench / pit. Laying / blowing of 24/48/96F optical fibre cable inside laid PLB pipe, splicing and jointing of OFC, preparation of As-Built Diagram (ABD) of constructed OFC Route, acceptance testing, commissioning and makeover of the routes. The work also includes laying on road crossing, railway crossing, culverts wherever required, including fixing of route/ joint indicator. Termination at FTB and all the relevant accessories etc. and end to end testing of dark and lit fibre per GP (for underground laying) (As per the Engineering Instruction issued by BBNL)	
2	Laying of protection ON PLB pipe: As per the engineering instructions specified in the RFP, with the approval of the SIA (including the supply of protection material). Please also refer to page 20, Corrigendum 2, Annexure B: Engineering Instructions, Sub-section B-3: Penalty for deviation from standard engineering instructions for underground laying	
3	Laying optical fibre cables on bridges, culverts, road surface inside GI Pipe, concreting work on single PLB Pipe including supply of GI Pipe, cement, concrete and curing etc. (PCC 1:2:4 with weld mesh) for Bridges/Culverts or cables laid at lesser depth etc.	
4	Fixing and sign writing of Route /Joint Indicators.	
5	Supply of pre-cast RCC with bottom plant and top cove (preferably two halves). Joint Chambers of bricks/ pre-fabricated RCC chamber as per specification with handle and supply of stone slab for covering the Chamber and River sand for filling the chamber.	
6	At Taluka location installation of OF cable box, FDMS, leading-in arrangement, jointing of Pig-Tails, termination of OF cable at block, and all other related activities for commissioning of 48F/ 96F optical fibre cable connectivity from block PoP to GP. Acceptance testing of fibre network.	

Sr. No.	Item Description as per technical specifications	Package C Complied (Yes/ No)
7	At GP locations installation of FDMS, leading-in arrangement, jointing of Pig-Tails, termination of OF cable, and all other related activities for commissioning of 48/96F optical fibre cable for connectivity GP to Block. Acceptance testing of fibre network	
8	Physical survey of block to GP route, capturing the Latitude-Longitude of OF cable route, preparation of GIS survey report before execution of works	
9	Capturing the Latitude-Longitude of OF route & joint location after execution of works from block to GPs, capturing coordinates ,integration of GIS data with As-Built Diagrams of OF routes	
I	Composite Pricing for Underground OFC Laying activities for 2 Number of PLB Pipes and OFC Blowing in one of the PLB Pipe (30% of the routes will include Additional ducts for Monetization)	
1	Excavation of open trench (Depth1.4 M)/ Horizontal Directional Drilling (HDD) for PLB pipe laying, in all types of soils/strata, 2 Number of 40/33 mm PLB pipe laying, Backfilling, Compaction & levelling of trench / pit. Laying / blowing of 24/48/96F optical Fibre Cable inside one of the laid PLB pipe, splicing and jointing of Optical Fibre Cable preparation of As Built Diagram (ABD) of constructed OFC Route, acceptance testing, commissioning and makeover of the routes. The work also includes laying on road crossing, railway crossing, culverts wherever required, including fixing of route/ Joint indicator. Termination at FTB and all the relevant accessories etc. and end to end testing of dark and lit fibre per GP (For Underground laying) (As per the Engineering Instruction issued by BBNL)	
2	Laying of protection ON 2 number of PLB pipe: As per the engineering instructions specified in the RFP, with the approval of the SIA (including the supply of protection material). Please also refer to page 20, Corrigendum 2, Annexure B: Engineering Instructions, Sub-section B-3: Penalty for deviation from standard engineering instructions for underground laying	
3	Laying optical fibre cables on Bridges, culverts, road surface inside GI Pipe, Concreting work on 2 Number of PLB Pipe including supply of GI Pipe, cement, concrete and curing etc.(PCC 1:2:4) for bridges/ culverts or cables laid at lesser depth etc.	
4	Fixing and sign writing of Route/ Joint Indicators.	
5	Supply of Pre-cast RCC with bottom plant and Top Cove (preferably two halves) Joint Chambers of bricks/ pre-fabricated RCC chamber as per specification with handle and supply of stone slab for covering the chamber and river sand for filling the chamber.	
6	At Taluka location installation of OF cable box, FDMS, leading-in arrangement, jointing of Pig-Tails, termination of OF cable at block, and all other related activities for commissioning of 48/96F optical fibre cable connectivity from block PoP to GP. Acceptance testing of fibre network.	
7	At GP location installation of FDMS, leading-in arrangement, jointing of Pig-Tails, termination of OF cable, and all other related activities for commissioning of 48/96F optical fibre cable for connectivity GP to Block. Acceptance testing of fibre network	

Sr. No.	Item Description as per technical specifications	Package C Complied (Yes/ No)
8	Physical Survey of block to GP route, capturing the Latitude-Longitude of OF cable route, preparation of GIS survey report before execution of works	
9	Capturing the Latitude-Longitude of OF route & joint location after execution of works from block to GPs, capturing coordinates ,integration of GIS data with As-Built Diagram of OF routes	
J	Composite Pricing for Aerial OFC Laying activities	
1	Commissioning of 24/48/96 core optical fibre connectivity from the Taluka PoP to GP room and termination at GP Router. The cost shall include t laying, fittings, splicing, splitting, splice closure, Pole clamping installation, termination at FTB & all the relevant accessories etc. and end to end testing of dark and lit fibre per GP (For aerial laying) (As per the Engineering Instruction issued by BBNL)	
2	Formed OFC Dead-End & termination fittings @ 5 per Kms.	
3	OFC suspension fittings @ 15 per Kms.	
4	Demountable pulley @ one per 10 Kms.	
5	Adjustable Cable Storage Bracket and Joint closure (1 nos./ km)	
6	Installation and commissioning of Galvanized Steel Poles	
7	Installation and commissioning of stay arrangements on existing Galvanized Steel Poles	
K	Site Preparation (Taluka)	
1	General site readiness like provisioning of proper earthing, racks installations, power infrastructure (as per specifications), etc. shall be carried out by the Bidder at no Extra cost. The Bidder shall provide suitable earthing arrangement as specified in TEC GR No. GR/SPV-03/02 JUN 2005, clause 2.5	
L	Site Preparation (GP)	
1	General site readiness like provisioning of proper earthing, racks installations, power infrastructure (as per specifications), etc. shall be carried out by the Bidder at no Extra cost. The Bidder shall provide suitable earthing arrangement as specified in TEC GR No. GR/SPV-03/02 JUN 2005, clause 2.5	
O&M as per requirements		
M	Gram Panchayat Infrastructure	
1	O&M of GP physical infrastructure equated quarterly for 5 years (Including warranty of one year)	
N	Taluka Infrastructure	
1	O&M of Taluka physical infrastructure equated quarterly for 5 years (Including warranty of one year)	
O	Warehousing for Storing Equipment during project phase and spares during O&M Phase	

ANNEXURE 4.2 – Bidder's Profile**PIA Particulars for Mahait/CNI/001/01/2018 dated 31/01/2018**

S.No.	Area of the details to be provided	Responding Firm's/Company Details to be provided
1	Name of the PIA	
2	Address of the PIA	
3	Telephone number of the Firm/company	
4	PIAs' RFP number and date	
5	Name of the contact person to whom all references shall be made regarding this RFP	
6	Designation of the person to whom all references shall be made regarding this RFP	
7	Address of the person to whom all references shall be made regarding this RFP	
8	E-mail address of the Firm/company	
9	Fax number of the Firm/company	
10	Website address of the Firm/company	
11	Details of Registration	1. Registration Number of the Firm/company 2. Name of the place where the firm/company was registered 3. Date when the company was registered 4. Product /Service for which registered 5. Validity Period, if applicable
12	Goods and Service Tax Registration No. (GST No.)	
13	PAN No.	
14	Average Annual Turnover for the last three (3) audited financial Years (2014-15,2015-16 and 2016-17)	
15	Details of ownership of the firm (Name and Address of the Board of Directors, Partners etc.)	
16	Name of the authorized signatory who is authorized to quote in the RFP and enter into the Contract (Power of Attorney to be submitted)	
17	Name of the Bankers along with the branch (as appearing in MICR cheque) & Account #	
18	Status of Firm/company like Pvt. Ltd. etc.	
19	Locations and addresses of the offices.	1. Delhi or NCR region 2. The corporate address 3. The official address of the service delivery centre.

S.No.	Area of the details to be provided	Responding Firm's/Company Details to be provided
20	Name and contact details of the Project Manager	1. Name of the Project Manager assigned for 2. Contact details viz; telephone number, official address of the Project Manager assigned.

Witness:

Signature _____

Name _____

Address _____

Date _____

PIA:

Signature _____

Name _____

Designation _____

Company Seal _____

Date _____

ANNEXURE 4.3 – TECHNICAL BID LETTER

To

.....

Sir / Madam

Subject: “Selection of Project Implementing Agency (PIA) for MahaNet-I (BharatNet –II Maharashtra)”

Reference: NIT No Mahait/CNI/001/01/2018 Dated 31/01/2018

We, the undersigned PIA, having read and examined in detail all the RFP in respect of “Selection of Project Implementing Agency (PIA) for MahaNet-I (BharatNet –II), do hereby propose to provide the services as specified in the **RFP number Mahait/CNI/001/01/2018, Dated 31/01/2018** along with the following

1. EARNSET MONEY DEPOSIT (EMD)

We have enclosed an EMD in the form of a Bank Guarantee for the sum of **INR 10,00,00,000 (Rupees Ten Crore only)**. This EMD is liable to be forfeited in accordance with the provisions of the Section III - General Conditions of the Contract and Service Level Agreement

2. CONTRACT PERFORMANCE GUARANTEE BOND

We hereby declare that in case the contract is awarded to us, we shall submit the Bank Guarantee for contract performance in the form prescribed in Annexure 4.9 Pro forma and as specified under **Clause 6 of Section III - General Conditions of the Contract**

We hereby declare that our bid is made in good faith, without collusion or fraud and the information contained in the bid is true and correct to the best of our knowledge and belief. We understand that our bid is binding on us and that you are not bound to accept a bid you receive.

Thanking you,

(Signature of the PIA) Printed Name

Designation

Seal

Date: Place: Business Address:

Witness:

PIA:

Signature -----

Signature -----

Name -----

Name -----

Address -----

Designation -----

Company Seal -----

Date -----

Date -----

ANNEXURE 4.4 – DETAILS OF LITIGATION(S)

1. The PIA should provide the undertaking/details of litigations it is currently involved in, or has been involved in, for the last three years:

Details of Litigation (s)

Party in dispute with	
Year of initiation of dispute:	
Detailed description of dispute:	
Resolution / Arrangement arrived at (if concluded):	

ANNEXURE 4.5 – COMPLIANCE DOCUMENT

Following are the compliance and reference documents for “**Selection of Project Implementing Agency (PIA) for MahaNet-I (BharatNet –II Maharashtra)**”

S. No.	Eligibility Criteria	Documents Required	Reference (Page No. in Bid)	Compliance (Yes or No)
1	<p>e. The Sole Bidder or each of the Consortium members should be registered under Indian Companies Act 2013 as per section 2 (20) of the Indian Companies Act 2013 or Companies Act 1956 or as amended and should have at least 3 years of operations in India as on bid submission date.</p> <p>f. Sole bidder or lead bidder of a consortium, in the last three (3) audited financial years (2014-15, 2015-16 and 2016-17), should have an average annual turnover of at least:</p> <ul style="list-style-type: none"> • Rs. 650 crore for Package-A • Rs. 500 crore for Package-B • Rs. 500 crore for Package-C <p>g. The sole bidder or a Consortium can bid for maximum up to 2 packages and the turnover criteria shall be cumulative for the number of packages for which bid is submitted.</p> <p>h. For a bidder that intends to bid for package A, the following additional criteria will also be applicable.</p> <p>ii) The sole bidder or lead bidder of a consortium shall</p>	<p>The Sole Bidder or each of Consortium members:</p> <p>g) Copy of Certification of Incorporation / Registration Certificate</p> <p>h) PAN card</p> <p>i) GST Registration</p> <p>j) Audited financial statements for the last three financial years (2014-15, 2015-16 and 2016-17)</p> <p>k) Certificate from the Statutory Auditor/Company Secretary on turnover details for the last three (3) financial years (2014-15, 2015-16 and 2016-17).</p> <p>l) For Package A wrt Additional Criteria, Certified copy of the relevant work order(s) and certificate(s) (on the letterhead of the company issuing the certificate) with details from the client(s) stating that the work(s) has been completed or Certificate from Chartered Accountant/ Company Secretary to meet this financial criteria</p>		

	<p>have a cumulative turnover of at least Rs. 250 crore over the last three (3) financial years (2014-15, 2015-16 and 2016-17) from activities related to provision of IT Systems Integration services / IT services / Network services / Active Telecom equipment and services / NMS / OSS/ BSS services in India or abroad.</p> <p>Note: Turnover considered would be a consolidated turnover of the company i.e. a parent company can use the turnover of its child company (100% subsidiary of parent) but a child company cannot use parent company's turnover.</p>		
2	The Bidder / Consortium partner and its Parent Company shall not be a Licensed Telecom Service Provider to provide Basic Services/ Cellular Telephony Services/ Internet Services/ UASL/ NLD/ ILD Services, anywhere in India.	Self-Certificate by the bidder shall be submitted	
3	<p>The Sole Bidder or Lead bidder of consortium should have an experience as per the below mentioned scope of work in last 5 years as on bid submission date.</p> <p>“Experience of Laying, Installation, Testing and Commissioning of Optical Fibre Cable (Underground and Aerial), PLB Duct and accessories of at least 5,000 route km.</p>	<p>The Sole Bidder or any of Consortium members: Completion Certificate issued and signed by the competent authority of the client entity along with the supporting documents such as Work order/Purchase order OR Contract clearly highlighting the scope of work Bill of Material and value of the contract/ order.</p> <p>In case of ongoing project/s, then a certificate from the Client must be submitted stating the completion of the requisite eligibility criteria laid down in this Tender has been completed by the bidder in its ongoing project.</p>	

4	<p>Bidder should provide Solvency Certificate as per the last audited financial year and should be for at least</p> <ul style="list-style-type: none"> iv) INR 300 Crores for Package-A v) INR 200 Crores for Package-B vi) INR 200 Crores for Package-C <p>The sole bidder or a Consortium can bid for maximum up to 2 packages and the solvency criteria shall be cumulative for the number of packages for which bid is submitted</p>	Solvency certificate from Banker		
5	<p>Bidder should have minimum net worth equivalent to</p> <ul style="list-style-type: none"> i) INR 300 Crores for Package-A ii) INR 200 Crores for Package-B iii) INR 200 Crores for Package-C <p>as per the last audited (2016-17) financial figures.</p> <p>The sole bidder or a Consortium can bid for maximum up to 2 packages and the networth criteria shall be cumulative for the number of packages for which bid is submitted</p>	Certificate from statutory auditor/ Chartered Accountant		
6	The Sole Bidder or Lead Bidder, should have valid ISO 9001:2008/ ISO 9001:2015 for Quality Management System which should be valid as on bid submission date	The Sole Bidder or Lead Bidder: Copy of valid certificate		
7	The Sole Bidder or each of the Consortium members should not remain blacklisted/ debarred by any State/ Central Govt. department or any Govt. PSU for Telecom or OFC business in India as on bid submission date.	The Sole Bidder or each of the Consortium members: An undertaking signed by CEO/ Country Head/ Authorized Signatory of the company to be provided on Non – judicial stamp paper of INR 100/- or such equivalent amount and document duly attested by notary public.		

	<p>OEM shall ensure that all equipment / components / sub-components being supplied by them shall be supported for the entire contract period. If the same is de-supported by the OEM for any reason whatsoever, the bidder shall replace it with an equivalent or better substitute that is acceptable to Purchaser without any additional cost to the Purchaser and without impacting the performance of the solution in any manner whatsoever.</p> <p>For Package-A:</p> <ul style="list-style-type: none"> i) Lead Bidder can only bid with a single OEM for all IP/MPLS Routers for GP and Talukas. In case of Lead Bidder offering multiple OEM options for IP/MPLS routers, the bid of such Lead Bidder will be rejected. ii) Lead Bidder can only bid with a single OEM for Wi-Fi Access Points. In case of Lead Bidder offering multiple OEM options for IP/MPLS routers, the bid of such Lead Bidder will be rejected. iii) Lead Bidder can only bid with a single OEM for security. In case of Lead Bidder offering multiple OEM options for Security Solution, The bid of such Lead Bidder will be rejected. For the full scope of security solution, refer Annexure A 10. iv) For other electronics components (e.g.. NOC) multiple OEMs are allowed 	<p>Documentary evidences such as Authorization letters MAF (Manufacturers Authorization Form) from all OEM/Vendors whose products are being quoted by the Bidder need to be attached in the bid.</p>		
8				

9	The Sole Bidder or Lead Bidder should have a project office in the respective project area / zone. However, if the local presence is not there in the State, the selected bidder should give an undertaking for establishment of a project office, within one month of award of the contract.	Self-certification duly signed by authorized signatory on company letter head.		
10	The Sole Bidder or Lead Bidder shall be the single point of contact and shall be solely responsible for all the Terms and Conditions of the RFP	Self-certification duly signed by authorized signatory on company letter head.		
11	Product OEM qualification			
11 (a)	<p>IP-MPLS</p> <p>In case a bidder intends to bid for Package-A, the following incremental criteria will also be applicable.</p> <ul style="list-style-type: none"> iv) OEM should have deployed similar solutions in at least five Service Providers in India/Globally v) The OEM should have an aggregate installed base of at least 300 IP/MPLS edge/aggregation/core routers which should be working satisfactorily for over one year Of these, a minimum of 150 IP-MPLS edge/ aggregation/ core routers should be deployed in India in one single network. vi) The aggregate installed base of Access routers deployed in India/Globally by the OEM should be at least 7,500, which should be working satisfactorily for over two years 	<p>For Copy of PO/Contract/Agreement with the client along with certificate from client on their letterhead with details of quantity supplied or</p> <p>Self-certification duly signed by authorized signatory on company letter head</p>		

	OFC	Certificate from Authorized Signatory of the bidder mentioning the turnover in the last three financial years. For listed entities, in case the published audited annual reports contain the detailed breakup of financial as required, a copy of such annual reports certified by the authorized signatory may be provided.		
11 (b)	viii) The OFC manufacturer should have Infrastructure Assessment (IA) certificate issued by BSNL QA, Bangalore for manufacturing capacity of minimum 50,000 cable km per annum for minimum 48F type cables	CACT certificate to be submitted.		
	ix) The OFC manufacturer should use ITU-T grade G.652.D and G.657.A1 optical fibre, sourced from CACT approved indigenous sources.	Copy of PO/Contract/Agreement with the client along with certificate from client on their letterhead with details of quantity supplied.		
	x) The OFC Manufacturer should not be blacklisted for Telecom business by any Central/ State Government or Govt. PSU for Telecom or OFC business as on the date of bid submission	A certificate from the statutory auditor/ Chartered Accountant of the bidder regarding networth as on 31 st March 2017		
	xi) The OFC manufacturer should have valid ISO 9001 and TL9000 certification in its name with no prior history of withdrawal.			
	xii) The OFC manufacturer should have supplied a cumulative of at least 50,000 cable kms of minimum 24F and above OFC, to Telecom Companies (Private Telecom Operators, PSUs and Government Telecom Operators), including <ul style="list-style-type: none"> • Cumulative of at least 7,000 km of minimum of 48F and above Ribbon in India during the last three financial years (i.e., FY14-15, FY15-16, FY 16-17) 			

	<p>xiii) The OFC Manufacturer should have a sum total revenues of minimum INR 400 crore from the sale of OFC during the last three financial years (i.e., FY14-15, FY15-16, FY 16-17)</p> <p>xiv) The OFC Manufacturer should have a minimum networth of Rs 75 crore as on 31st March, 2017. A certificate from the statutory auditor/ Chartered Accountant of the bidder to this effect should be submitted.</p>		
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Witness:

Signature _____

Name _____

Address _____

Date _____

PIA:

Signature _____

Name _____

Designation _____

Company Seal _____

Date _____

ANNEXURE 4.6 – FINANCIAL BID LETTER

To

Dated:.....

.....

Sir/ Madam,

Subject: “Selection of Project Implementing Agency (PIA) for MahaNet-I (BharatNet –II for Maharashtra)”

Reference: NIT No: Mahait/CNI/001/01/2018 Dated 31/01/2018

We, the undersigned PIA, having read and examined in detail all the RFP in respect of “Selection of Project Implementing Agency (PIA) for MahaNet-I (BharatNet –II)” do hereby propose to provide services as specified in the NIT number **Mahait/CNI/001/01/2018 Dated 31/01/2018**

1. PRICE AND VALIDITY

- a. All the prices mentioned in our Bid are in accordance with the terms & conditions as specified in the RFP. The validity of bid is 180 days from the date of opening of the RFP.
- b. We are an Indian Firm and do hereby confirm that our prices excludes all taxes. However, all the taxes are quoted separately under relevant sections and shall be applicable as per actual
- 2. We have studied the clause relating to Indian Income Tax Department and hereby declare that if any income tax, surcharge on Income Tax, Professional and any other Corporate Tax in alteredcated under the law, we shall pay the same.

3. UNIT RATES

We have indicated in the relevant schedules enclosed, the unit rates for the purpose of on account of payment as well as for price adjustment in case of any increase to / decrease from the scope of work under the contract.

4. EARNEST MONEY DEPOSIT (EMD)

We have enclosed an EMD in the form of a Bank Guarantee for a sum of **Rs. 10,00,00,000** **(/Rupees Ten Crore only)**. This EMD is liable to be forfeited in accordance with the provisions of the **Section III - General Conditions of the Contract**.

5. TENDER PRICING

We further confirm that the prices stated in our bid are in accordance with your Instruction to Bidders included in RFP.

6. QUALIFYING DATA

We confirm having submitted the information as required by you in your Instruction to Bidders. In case you require any other further information/documentary proof in this regard before evaluation of our Bid, we agree to furnish the same in time to your satisfaction.

7. BID PRICE

We declare that our Bid Price is for the entire scope of the work as specified in the Schedule of Requirements. These prices are indicated in Annexure 4.11 of Section IV – Bid Submission Formats attached with our Financial Bid as part of the Bid Response.

8. CONTRACT PERFORMANCE GUARANTEE BOND

We hereby declare that in case the contract is awarded to us, we shall submit the Bank Guarantee for contract performance in the prescribed format given in Annexure 4.9 Pro forma.

We hereby declare that our Bidis made in good faith, without collusion or fraud and the information contained in the Bidis true and correct to the best of our knowledge and belief. We understand that our Bid is binding on us and that you are not bound to accept a Bid you receive.

We confirm that no Technical deviations are attached here with this financial offer.

Thanking you,

Yours faithfully,

(Signature of the PIA)

Printed Name

Designation Seal.

Date:

Place:

Business Address:

Witness:

Signature -----

PIA:

Signature -----

Name -----

Name -----

Address -----

Designation -----

Company Seal -----

Date -----

Date -----

ANNEXURE 4.7 – RFP ACKNOWLEDGEMENT LETTER

To,

 Dear Sir/Madam,

Dated.....

We hereby acknowledge receipt of a complete set of RFP consisting of 5 Sections (along with two Annexures) enclosed pertaining to "**Selection of Project Implementing Agency (PIA) MahaNet-I (BharatNet –II for Maharashtra)**" against Mahait/CNI/001/01/2018 Dated 31/01/2018

We have noted that the closing date of receipt of the bids is <DATE OF SUBMISSION OF BID> at <TIME OF SUBMISSION> hrs. We have also noted the important dates provided in Section I- Invitation for Bids.

1. We guarantee that the contents of the above said RFP are non-transferable and shall be kept confidential within our company and text of the said documents shall remain the property of MahalT and that the said documents are to be used only for the purpose intended by MahalT.

Our address for further correspondence on this RFP shall be as under:

Email Address:

Fax No. :

Telephone No (with STD code):

Personal attention of:

(If required)

Yours faithfully,

(PIA)

Note: A copy of this form should be returned along with the Bid duly signed

Witness:

PIA:

Signature -----

Signature -----

Name -----

Name -----

Address -----

Designation -----

Company Seal -----

Date -----

Date -----

ANNEXURE 4.8– DETAILS OF EXPERIENCE OF RESPONDING FIRM

In response experience for the last five (5) years

As per the format below the responding firm should provide information w.r.t. each project on the similar assignments required for evaluation of eligibility criteria.

S.No.	Items	Details
General Information		
1	Customer Name	
2	Name of the contact person and contact details for the client of the assignment	
Project Details		
1	Project Title	
2	Start Date/End Date	
3	Current Status (work in progress/completed)	
4	Number of staff deployed in the assignment	
Size of the project		
	Order Value of the project (INR)	
Enclosures Required		
Enclosure A: Narrative Description of the Project (attach separate sheet if required)		
Enclosure B: Completion Certificate issued & signed by the competent authority of the client entity along with the supporting documents such as Work order/Purchase order OR Contract clearly highlighting the scope of work Bill of Material and value of the contract/order		

Witness:

Signature -----

Name -----

Address -----

Date -----

PIA:

Signature -----

Name -----

Designation -----

Company Seal -----

Date -----

ANNEXURE 4.9 - BANK GUARANTEE FOR CONTRACT PERFORMANCE

(To be typed on non-judicial stamp paper)

1. In consideration of the having agreed to exempt _____ (hereinafter called 'the said PIA') from the demand under the terms &conditions of an agreement/ Advance Work Order No _____ dated _____ made between _____ and _____ for the "Selection of Project Implementing Agency for MahaNet-I (BharatNet –II)"(hereinafter called "the said Contract"), of security deposit for the due fulfilment by the said PIS of the terms &conditions contained in the said Contract, on production of the bank guarantee for _____ we, _____ (name of the bank) _____ (hereinafter refer to as "the bank") at the request of _____ (PIA) do hereby undertake to pay to the MahalT an amount not exceeding _____ against any loss or damage caused to or suffered or would be caused to or suffered by MahalT by reason of any breach by the said PIA of any of the terms &conditions contained in the said Contract.
2. We (name of the bank) _____ do hereby undertake to pay the amounts due and payable under this guarantee without any demur, merely on a demand from the MahalT by reason of breach by the said PIA' of any of the terms &conditions contained in the said Contract or by reason of the PIA' failure to perform the said Contract. Any such demand made on the bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee where the decision of MahalT in these counts shall be final and binding on the bank. However, our liability under this guarantee shall be restricted to an amount not exceeding _____.
3. We undertake to pay to the MahalT any money so demanded notwithstanding any dispute or disputes raised by the PIA in any suit or proceeding pending before any court or tribunal relating thereto our liability under this present being absolute and unequivocal. The payment so made by us under this bond shall be valid discharge of our liability for payment there under and the PIA shall have no claim against us for making such payment.
4. We (name of the bank) _____ further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Contract and that it shall continue to be enforceable till all the dues of the MahalT under or by virtue of the said Contract have been fully paid and its claims satisfied or discharged or till _____ (office/ Department) MahalT certifies that the terms &conditions of the said Contract have been fully or properly carried out by the said PIA and accordingly discharges this guarantee. Unless a demand or claim under this guarantee is made on us in writing on or before the expiry of TWO/ TWO AND HALF/ THREE YEARS (as specified in Work Order) from the date hereof, we shall be discharged from all liabilities under this guarantee thereafter.
5. We (name of the bank) _____ further agree with the MahalT that the MahalT shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms &conditions of the said Contractor to extend time of performance by the said PIA from time to time or to postpone for any time or from time to time any of the powers exercisable by the MahalT against the said PIA and to forbear or enforce any of the terms & conditions relating to the said Contract and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said PIA or for any forbearance, act or omission on the part of the MahalT or any indulgence by the MahalT to the said PIA or by any such matter or thing whatsoever which under the law relating to sureties would, but for this provision, have effect of so relieving us.
6. This guarantee shall not be discharged due to the change in the constitution of the Bank or the PIA.
7. We (name of the bank) _____ lastly undertake not to revoke this guarantee during its currency except with the previous consent of the MahalT in writing.

Place:

Date:

(Signature of the Bank Officer)

Rubber stamp of the bank:

Authorized Power of Attorney Number:

Name of the Bank officer:

Designation:

Complete Postal address of Bank:

Telephone Numbers

Fax numbers.....

(Bank's common seal)

ANNEXURE 4.10 - CONTRACT

THIS AGREEMENT made the _____ day of _____ 20XX

BETWEEN

The **MahalT** (hereinafter referred to as "the Purchaser") which expression shall unless repugnant to the context or meaning thereof mean and be deemed to include its authorized agents, representatives and permitted assigns of the First Part.

AND

The Party _____ (hereinafter referred to as "the PIA") which expression shall unless repugnant to the context or meaning thereof mean and be deemed to include their successors and permitted assigns having its registered office at _____ of the Second Part.

WHEREAS

- (a) The Purchaser had invited Bids vide their Tender _____ (hereinafter referred to as "RFP") for "Selection of Project Implementing Agency (PIA) for MahaNet-I (BharatNet-II)"
- (b) The PIA had submitted its proposal dated _____ (hereinafter referred to as the 'Bid') for the provision of such services in accordance with its proposal as set out in its Bid and in accordance with the terms & conditions of the RFP and this Contract.
- (c) The Purchaser has agreed to select the PIA for the provision of such services and the PIA has agreed to provide services as are represented in the RFP, including the terms & conditions of this Contract, the Schedules attached hereto and in accordance with the terms & conditions of the RFP and in terms of the discussions, negotiations and clarifications in relation to the implementation of the scope of work
- (d) In consideration of the foregoing and the mutual covenants and promises contained herein and other good and valuable consideration the receipt and adequacy of which is hereby acknowledged, the parties intending to be bound legally.

NOW THIS AGREEMENT WITNESSETH AS FOLLOWS:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the General Conditions of the Contract referred to.
2. The following documents shall be deemed to form and be read and construed as part of this Agreement viz:
 - a) the Scope of Work
 - b) the General Conditions of the Contract
 - c) the Service Level Agreement (SLA)
 - d) the Purchaser's Notification of Award.
3. In consideration of the payments to be made by the Purchaser to the PIA as hereinafter mentioned, the PIA hereby covenants with the Purchaser to provide the Services and to remedy defects therein in conformity in all respects with the provisions of the Contract.
4. The Purchaser hereby covenants to pay the PIA in consideration of the provision of the Services and the remedying of defects therein, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

IN WITNESS whereof the parties hereto have caused this Agreement to be executed in accordance with their respective laws the day and year first above written

Signed, Sealed and Delivered by the said _____ (For the Purchaser in the presence
of: _____ (WITNESS)

Signed, Sealed and Delivered by the said _____ (For the Bidder) in the presence
of: _____ (WITNESS)

ANNEXURE 4.11- FINANCIAL BID

The PIA is required to submit a Financial Bid in response to this RFP. This section provides the outline, content and the format that the PIA is required to follow in the preparation of their Bids.

Financial Bid has to be populated individually for each package for which the bidder is submitting the proposal.

ANNEXURE 4.11.A - FINANCIAL BID FOR PACKAGE A

Table A: Financial Bid

The financial bid for Package A (in INR) is

Grand Total (in words)

Grand Total (in figures).....

S.No.	Item	
1	Total of Table- B (Supply, installation and commissioning of equipment)	X1
2	Total of Table- C (Net Present Value of O&M Costs)	X2
	Grand Total	Z=X1+X2
	Grand Total (in words)	
	Grand Total (in figures)	

The Bidder who shall have the least/lowest value of “Z”

“**Z=X1+X2 (NPV)**” after calculating NPV value for O&M in Table-A shall be declared as “L1” and shall be awarded the project. States’/SIAs’ decision shall be final and binding.

Formula for calculating NPV is as follows:

$$X2 = NPV = R \times \frac{1 - (1 + i)^{-n}}{i}$$

R is the O&M cost for each period

i is the required rate of return per period

N are the No. of periods during for which O&M will be provided by the PIA.

Note 1: Prices in Financial Bid should be quoted in the provided format. All prices should be quoted in Indian Rupees and indicated both in figures and words. If there is a difference between the amounts mentioned in the above form, the lesser amount quoted would be considered as the final bid for the Package. Other values would be summarily discarded irrespective of the details mentioned in the Table B or Table C.

Instructions to fill the Financial Bid:

1. Bidder should provide all prices as per the prescribed format under this Annexure. Bidder should not leave any field blank.
2. All the prices are to be entered in Indian Rupees ONLY (%age values are not allowed)
3. Purchaser reserves the right to ask the Bidder to submit proof of payment against any of the taxes, duties, levies indicated.
4. Purchaser shall take into account that all Taxes, Duties & Levies shall be paid as per actual.
5. For the purpose of evaluation of Financial Bids the Purchaser shall make appropriate assumptions to arrive at a common bid price for all the Bidders. This however shall have no co-relation with the Contract value or actual payment to be made to the Bidder. The soft copy of the financial bid should be in excel format to be uploaded online.

6. The O&M value quoted should be minimum 5% of Sub total cost of Table-A value in column of O&M table per year. If quoted less than 5%, the financial bid of such bidder shall not be considered.

PIA:

Signature _____

Name _____

Designation _____

Company Seal _____

Table B: Supply, installation and commissioning of equipment

The details of Bill of Quantities is available in below table.

Sr. No.	Item Description as per technical specifications	Unit	Unit costs (exclusive of Tax)	Quantity - Package A	Total cost	*Rate of GST/Duty/ Tax/Govt. Levy etc. as applicable at the time of bid submission	Part Code	HSN Code
			A	B	C=A*B			
Supply of equipment, installation and commissioning								
Supply (Material)								
A Passive infrastructure (Underground Cable)								
1	96F Metal free Optical Fibre Cable Ribbon type with double HDPE Sheath (G.652DFibre): Specification as per "BSNL Tender No. : CA/MMT/NOFN/Selection of PIA/T-610/2017 Dated 29.12.2017	kms		7,848				
2	48F Metal free Optical Fibre Cable Ribbon type with double HDPE Sheath (G.652DFibre): Specification as per "BSNL Tender No. : CA/MMT/NOFN/Selection of PIA/T-610/2017 Dated 29.12.2017	kms		604				
3	24F Metal free Optical Fibre Cable Loose type with double HDPE Sheath (G.652DFibre): Specification shall comply as per TEC draft GR "TEC/GR/OFC-23/01/XXX-2011 (under finalisation in TEC)	kms		3,018				
4	Supply of PLB HDPE Duct (40/33) and accessories as per specifications	kms		11,520				
5	Supply of Cable locator as per specifications (per 150 km)	Nos.		74				
6	Supply of Route Markers/ Joint Indicator as per specifications (6 nos./ km)	Nos.		66,462				
7	Manhole/ Joint Chamber along with straight/ branching splice closure as per specifications (1 nos./ 2 kms)	Nos.		5,539				
B Passive infrastructure (Aerial cable and Miscellaneous)								
1	Self-supporting Metal Free Aerial Optical Fibre Cable (24F ADSS): Specification shall comply as per TEC GR TEC/GR/TX/OFC-022/02/MAR-17, Type II A	kms		604				

Sr. No.	Item Description as per technical specifications	Unit	Unit costs (exclusive of Tax)	Quantity - Package A	Total cost	*Rate of GST/Duty/ Tax/Govt. Levy etc. as applicable at the time of bid submission	Part Code	HSN Code
			A	B	C=A*B			
	(for Kohlapur, Nashik, Pune, Ratnagiri, Sangli, and Thane)" with latest amendments if any.							
2	Self-supporting Metal Free Aerial Optical Fibre Cable (24F ADSS): Specification shall comply as per TEC GR TEC/GR/TX/OFC-022/02/MAR-17, Type III A (for Palghar, Satara, and Sindhudurg districts) , with latest amendments if any.	kms		1,422				
3	Self-supporting Metal Free Aerial Optical Fibre Cable (48F ADSS): Specification shall comply as per TEC GR: TEC/GR/TX/OFC-022/02/MAR-17, Type III A (for Palghar, Satara, and Sindhudurg districts) , with latest amendments if any.	kms		4,266				
4	Galvanized steel poles of tubular in design and swaged of the length 7 meters, with top cap welded and lightning spike and including muff (where pole erection is required estimated as 21 nos./ km)	Nos.		53,330				
5	Galvanized steel poles of tubular in design and swaged of the length 8 meters, with top cap welded and lightning spike and including muff (where pole erection is required estimated as 4 nos./ km)	Nos.		10,158				
6	Stay arrangement for 7 mtr / 8 mtr steel poles (where strengthening is required)	Nos.		31,744				
C FDM and Other Passive Infrastructure								
1	FDMS Taluka including fibre patch cords, Pig-Tails with appropriate connectors	Nos.		51				
2	FDMS GP including fibre patch cords, Pig-Tails with appropriate connectors	Nos.		4,091				
3	Rack 42 U-floor mount with all accessories for NOC	Nos.		8				
4	Rack 42 U-floor mount with all accessories for Taluka	Nos.		51				
5	Rack 6 U-floor mount with all accessories for GP	Nos.		4,091				
6	Spare Cable Box	Nos.		4,142				

Sr. No.	Item Description as per technical specifications	Unit	Unit costs (exclusive of Tax)	Quantity - Package A	Total cost	*Rate of GST/Duty/ Tax/Govt. Levy etc. as applicable at the time of bid submission	Part Code	HSN Code
			A	B	C=A*B			
D Power infrastructure								
1	Online UPS (6 KVA) at Taluka level as per specifications	Nos.		51				
2	Offline UPS (600 VA) at GP as per specifications	Nos.		4,091				
3	Solar Photo-Voltaic power supply system at the GP shall consist of following subsystems as per TE No. CA/MMT/NOFN/Selection of PIA/T-610/2017: 1. VRLA Maintenance Free battery (for 12Hrs Back-up) 2. Solar Panel: 12V/ 60W 3. SMPS: 12V/ 7A 4. Charge Controller: 120W	Nos.		4,091				
E Active infrastructure								
I) IPMPLS								
1	Aggregation Routers at THQ-3/4	Nos.		52				
2	Aggregation Routers at THQ-1/2	Nos.		118				
3	Access Routers at GP1	Nos.		2,092				
4	Access Routers at GP2	Nos.		5,846				
5	Access Routers at GP3	Nos.		4,678				
6	Access Routers at GP4	Nos.		124				
7	Route Reflector as per specifications	Nos.		2				
8	Expansion Module of Network ports - 2 X 10G for GP	Nos.		1403				
9	Expansion Module of 6 X 10 G Ports for Client ports of THQ (Including 10Kms SFP)	Nos.		51				
10	Expansion Module of 10 X 1G Ports for Client ports of THQ (Including 10Kms SFP)	Nos.		51				
11	SFP 1G (300m)	Nos.		300				
12	SFP 1G (10Kms)	Nos.		500				
13	SFP 1G (40Kms)	Nos.		200				
14	SFP 10G (10Kms)	Nos.		300				
15	SFP 10G (40Kms)	Nos.		100				
16	SFP 10G (80Kms) - (This should include any DWDM/Amplifier/Optics requirements)	Nos.		30				
17	SFP 100G (10Kms)	Nos.		100				

Sr. No.	Item Description as per technical specifications	Unit	Unit costs (exclusive of Tax)	Quantity - Package A	Total cost	*Rate of GST/Duty/ Tax/Govt. Levy etc. as applicable at the time of bid submission	Part Code	HSN Code
			A	B	C=A*B			
18	SFP 100G (40Kms)	Nos.		50				
19	SFP 100G (80Kms) (This should include any DWDM/Amplifier/Optics requirements)	Nos.		50				
20	Remote Fibre Monitoring System (RFMS) at Taluka (as per specifications and design requirements)	Nos.		170				
II) Electronics of State NOC								
1	Element Management System (EMS)/ Network Management System (NMS) as per specifications	Set		As per Design				
2	Helpdesk	Set		As per Design				
3	Two L3 Router (same as GP Type-4 IP/MPLS Router)	Nos.		2				
4	Access Switch (with 50Gbps switching capacity and 60x10/100/1000Mbps Ethernet Ports)	Nos.		2				
5	IP PABX system for 150 subscribers	Nos.		1				
6	Subscriber devices for IP PABX	Nos.		150				
7	Workstations for all Sitting Locations with Windows OS and Microsoft Office	Nos.		50				
8	One Video Wall of 24 DLP cubes of minimum 50" Screen with maximum Screen-to-Screen Gap of 0.2 mm	Nos.		1				
9	Video end points for DHQ (26) + additional 14 units for Government offices	Nos.		40				
10	Any other hardware/software required to meet the RFP requirements	Set		As per Design				
II) Electronics of State NOC -DR								
1	Element Management System (EMS)/ Network Management System (NMS) as per specifications	Set		As per Design				
2	Helpdesk	Set		As per Design				
3	Two L3 Router (same as GP Type-4 IP/MPLS Router)	Nos.		2				
4	Access Switch (with 50Gbps switching capacity and	Nos.		2				

Sr. No.	Item Description as per technical specifications	Unit	Unit costs (exclusive of Tax)	Quantity - Package A	Total cost	*Rate of GST/Duty/ Tax/Govt. Levy etc. as applicable at the time of bid submission	Part Code	HSN Code
			A	B	C=A*B			
	60x10/100/1000Mbps Ethernet Ports)							
5	IP PABX system for 150 subscribers	Nos.		1				
6	Subscriber devices for IP PABX	Nos.		75				
7	Workstations for all Sitting Locations with Windows OS and Microsoft Office	Nos.		25				
8	One Video Wall of 12 DLP cubes of minimum 50" Screen with maximum Screen-to-Screen Gap of 0.2 mm	Nos.		1				
9	Any other hardware/software required to meet the RFP requirements	Set		As per Design				
IV) Infrastructure of State NOC								
1	Comfort AC Cooling,	Nos.		1				
2	Power and LAN Connectivity,	Nos.		1				
3	Access Control Systems (as indicated in NOC Specification Section)	Nos.		1				
4	Furniture infrastructure for 50 Operations staff and Furniture for Support area	Set		As per Design				
5	20KVA UPS	Nos.		2				
6	DG Set	Nos.		1				
7	Fire safety system	Set		As per Design				
8	Water leak detection system	Set		As per Design				
9	Building management system	Set		As per Design				
V) Infrastructure of State NOC -DR								
1	Comfort AC Cooling,	Nos.		1				
2	Power and LAN Connectivity,	Nos.		1				
3	Access Control Systems (as indicated in NOC Specification Section)	Nos.		1				
4	Furniture infrastructure for 50 Operations staff and Furniture for Support area	Set		As per Design				
5	20KVA UPS	Nos.		2				
6	DG Set	Nos.		1				
7	Fire safety system	Set		As per Design				

Sr. No.	Item Description as per technical specifications	Unit	Unit costs (exclusive of Tax)	Quantity - Package A	Total cost	*Rate of GST/Duty/ Tax/Govt. Levy etc. as applicable at the time of bid submission	Part Code	HSN Code
			A	B	C=A*B			
8	Water leak detection system	Set		As per Design				
9	Building management system	Set		As per Design				
VI) NMS/OSS/BSS Software solution								
1	OSS/BSS as per specifications	Set		As per Design				
2	CRM	Set		As per Design				
3	Billing	Set		As per Design				
4	Service & Resource Assurance	Set		As per Design				
5	Web self-care	Set		As per Design				
6	MIS, reporting and analytics system	Set		As per Design				
7	Contact centre	Set		As per Design				
8	Fibre Management System (FMS)	Set		As per Design				
9	Any other sub-system of NOC mentioned in RFP not mentioned above with breakup	Set		As per Design				
VII) DC and DR hosting on Cloud								
1	Internet router (as per Bidder's solution)	Set		As per Design				
2	Server load balancer (as per Bidder's solution)	Set		As per Design				
3	Server/ Blades (as per Bidder's solution)	Set		As per Design				
4	SAN switch (as per Bidder's solution)	Set		As per Design				
5	Storage (as per Bidder's solution)	Set		As per Design				
6	TOR switch (as per Bidder's solution)	Set		As per Design				
7	Backup appliance (as per Bidder's solution)	Set		As per Design				
8	Backup software (as per Bidder's solution)	Set		As per Design				
9	Any other hardware/software at DC/ DR required to meet the RFP requirements	Set		As per Design				
F	Security							

Sr. No.	Item Description as per technical specifications	Unit	Unit costs (exclusive of Tax)	Quantity - Package A	Total cost	*Rate of GST/Duty/ Tax/Govt. Levy etc. as applicable at the time of bid submission	Part Code	HSN Code
			A	B	C=A*B			
1	Next Generation Security solution for Taluka head-end	Nos.		52				
2	Next Generation Security solution for NOC/NOC DR	Set		As per Design				
3	End Point Malware Protection for work-stations at NOC	Nos.		75				
4	Software defined security solution	Nos.		As per Design				
G	Radio infrastructure							
1	Supply of RF link equipment as per specifications (Outdoor unit, Indoor unit, antenna, etc.) at GP / Taluka including all accessories i.e. mast, cabling, earthing, etc.	Nos.		200* *Quantity to be confirmed after site survey				
H	Wi-Fi							
I)	Wi-Fi Access Point							
1	Wi-Fi access points at GP	Nos.		25,480				
2	Supply of Mast/ pole and accessories for GP Wi-Fi	Nos.		25,480				
3	Solar photovoltaic battery (60W), VRLA Maintenance Free battery (for 12Hrs backup), and charging unit for remote Wi-Fi access points at GPs.	Nos.		12,740				
II)	Wi-Fi Services Infrastructure (Wi-Fi Service Provider Scope)							
1	Wi-Fi Controller system	Set		As per Design				
2	Wi-Fi Broadband infrastructure (Telecom / Internet/ Wi-Fi Services provider Scope)	Set		As per Design				
3	Subscriber Authentication & Policy Management	Set		As per Design				
4	Lawful Intercept	Set		As per Design				
5	CGNAT IP Log Management System	Set		As per Design				
6	Wi-Fi NOC	Set		As per Design				
7	Any other sub-system for Wi-Fi Services as per specifications and regulation	Set		As per Design				
I	Spares (to manage the SLAs for period of	Set		As per Design				

Sr. No.	Item Description as per technical specifications	Unit	Unit costs (exclusive of Tax)	Quantity - Package A	Total cost	*Rate of GST/Duty/ Tax/Govt. Levy etc. as applicable at the time of bid submission	Part Code	HSN Code
			A	B	C=A*B			
	Contract and to be transferred to MahalT post contract)							
J	Warehousing cost for Storing Equipment during project phase	Lump-Sum		As per Design				
Services as per Technical Specifications								
K	Composite Pricing for Underground OFC Laying activities							
1	Excavation of open trench (Depth 1.4 M). Horizontal Directional Drilling (HDD) for PLB pipe laying, in all types of soils/ strata, 40/33 mm PLB pipe laying, back-filling, compaction & levelling of trench / pit. Laying / blowing of 24/48/96F optical fibre cable inside laid PLB pipe, splicing and jointing of OFC, preparation of As-Built Diagram (ABD) of constructed OFC Route, acceptance testing, commissioning and makeover of the routes. The work also includes laying on road crossing, railway crossing, culverts wherever required, including fixing of route/joint indicator. Termination at FTB and all the relevant accessories etc. and end to end testing of dark and lit fibre per GP (for underground laying) (As per the Engineering Instruction issued by BBNL)	kms		7,754				
2	Laying of protection ON PLB pipe: As per the engineering instructions specified in the RFP, with the approval of the SIA (including the supply of protection material).							

Sr. No.	Item Description as per technical specifications	Unit	Unit costs (exclusive of Tax)	Quantity - Package A	Total cost	*Rate of GST/Duty/ Tax/Govt. Levy etc. as applicable at the time of bid submission	Part Code	HSN Code
			A	B	C=A*B			
	Please also refer to page 20, Corrigendum 2, Annexure B: Engineering Instructions, Sub-section B-3: Penalty for deviation from standard engineering instructions for underground laying							
3	Laying optical fibre cables on bridges, culverts, road surface inside GI Pipe, concreting work on single PLB Pipe including supply of GI Pipe, cement, concrete and curing etc. (PCC 1:2:4 with weld mesh) for Bridges/Culverts or cables laid at lesser depth etc.							
4	Fixing and sign writing of Route /Joint Indicators.							
5	Supply of pre-cast RCC with bottom plant and top cove (preferably two halves). Joint Chambers of bricks/ pre-fabricated RCC chamber as per specification with handle and supply of stone slab for covering the Chamber and River sand for filling the chamber.							
6	At Taluka location installation of OF cable box, FDMS, leading-in arrangement, jointing of Pig-Tails, termination of OF cable at block, and all other related activities for commissioning of 48F/ 96F optical fibre cable connectivity from block PoP to GP. Acceptance testing of fibre network.							
7	At GP locations installation of FDMS, leading-in arrangement, jointing of Pig-Tails, termination of OF cable, and all other related activities for commissioning of 48/96F optical fibre cable for connectivity GP to Block. Acceptance testing of fibre network							

Sr. No.	Item Description as per technical specifications	Unit	Unit costs (exclusive of Tax)	Quantity - Package A	Total cost	*Rate of GST/Duty/ Tax/Govt. Levy etc. as applicable at the time of bid submission	Part Code	HSN Code
			A	B	C=A*B			
8	Physical survey of block to GP route, capturing the Latitude-Longitude of OF cable route, preparation of GIS survey report before execution of works							
9	Capturing the Latitude-Longitude of OF route & joint location after execution of works from block to GPs, capturing coordinates ,integration of GIS data with As-Built Diagrams of OF routes							
L Composite Pricing for Underground OFC Laying activities for 2 Number of PLB Pipes and OFC Blowing in one of the PLB Pipe (30% of the routes will include Additional ducts for Monetization)								
1	Excavation of open trench (Depth1.4 M)/ Horizontal Directional Drilling (HDD) for PLB pipe laying, in all types of soils/strata, 2 Number of 40/33 mm PLB pipe laying, Backfilling, Compaction & levelling of trench / pit. Laying / blowing of 24/48/96F optical Fibre Cable inside one of the laid PLB pipe, splicing and jointing of Optical Fibre Cable preparation of As Built Diagram (ABD) of constructed OFC Route, acceptance testing, commissioning and makeover of the routes. The work also includes laying on road crossing, railway crossing, culverts wherever required, including fixing of route/ Joint indicator. Termination at FTB and all the relevant accessories etc. and end to end testing of dark and lit fibre per GP (For Underground laying) (As per the Engineering Instruction issued by BBNL)	kms		3,323				
2	Laying of protection ON 2 number of PLB pipe: As per the engineering instructions specified in the RFP, with the approval of the SIA (including the supply of protection material).							

Sr. No.	Item Description as per technical specifications	Unit	Unit costs (exclusive of Tax)	Quantity - Package A	Total cost	*Rate of GST/Duty/ Tax/Govt. Levy etc. as applicable at the time of bid submission	Part Code	HSN Code
			A	B	C=A*B			
	Please also refer to page 20, Corrigendum 2, Annexure B: Engineering Instructions, Sub-section B-3: Penalty for deviation from standard engineering instructions for underground laying							
3	Laying optical fibre cables on Bridges, culverts, road surface inside GI Pipe, Concreting work on 2 Number of PLB Pipe including supply of GI Pipe, cement, concrete and curing etc.(PCC 1:2:4) for bridges/ culverts or cables laid at lesser depth etc.							
4	Fixing and sign writing of Route/ Joint Indicators.							
5	Supply of Pre-cast RCC with bottom plant and Top Cove (preferably two halves) Joint Chambers of bricks/ pre-fabricated RCC chamber as per specification with handle and supply of stone slab for covering the chamber and river sand for filling the chamber.							
6	At Taluka location installation of OF cable box, FDMS, leading-in arrangement, jointing of Pig-Tails, termination of OF cable at block, and all other related activities for commissioning of 48/96F optical fibre cable connectivity from block PoP to GP. Acceptance testing of fibre network.							
7	At GP location installation of FDMS, leading-in arrangement, jointing of Pig-Tails, termination of OF cable, and all other related activities for commissioning of 48/96F optical fibre cable for connectivity GP to Block. Acceptance testing of fibre network							

Sr. No.	Item Description as per technical specifications	Unit	Unit costs (exclusive of Tax)	Quantity - Package A	Total cost	*Rate of GST/Duty/ Tax/Govt. Levy etc. as applicable at the time of bid submission	Part Code	HSN Code
			A	B	C=A*B			
8	Physical Survey of block to GP route, capturing the Latitude-Longitude of OF cable route, preparation of GIS survey report before execution of works							
9	Capturing the Latitude-Longitude of OF route & joint location after execution of works from block to GPs, capturing coordinates ,integration of GIS data with As-Built Diagram of OF routes							
M Composite Pricing for Aerial OFC Laying activities								
1	Commissioning of 24/48/96 core optical fibre connectivity from the Taluka PoP to GP room and termination at GP Router. The cost shall include t laying, fittings, splicing, splitting, splice closure, Pole clamping installation, termination at FTB & all the relevant accessories etc. and end to end testing of dark and lit fibre per GP (For aerial laying) (As per the Engineering Instruction issued by BBNL)	Kms		5,079				
2	Formed OFC Dead-End & termination fittings @ 5 per Kms.							
3	OFC suspension fittings @ 15 per Kms.							
4	Demountable pulley @ one per 10 Kms.							
5	Adjustable Cable Storage Bracket and Joint closure (1 nos./ km)							
6	Installation and commissioning of Galvanized Steel Poles	Nos.		63,488				
7	Installation and commissioning of stay arrangements on existing Galvanized Steel Poles	Nos.		31,744				
N Active infrastructure								
1	Installation, integration, testing and commissioning of Electronics at Taluka	Nos.		170				

Sr. No.	Item Description as per technical specifications	Unit	Unit costs (exclusive of Tax)	Quantity - Package A	Total cost	*Rate of GST/Duty/ Tax/Govt. Levy etc. as applicable at the time of bid submission	Part Code	HSN Code
			A	B	C=A*B			
2	Installation, integration, testing and commissioning of Electronics including Wi-Fi at GP Level	Nos.		12,740				
3	Installation, integration, testing and commissioning of RF Link equipment as per specifications (Outdoor and Indoor) at GP/Taluka including all accessories i.e. Mast, cabling, earthing, etc.	Nos.		702				
O Electronics of State NOC								
1	Building, installation, integration, testing and commissioning of NOC including OSS, BSS, NMS, Cyber Safety and other associated solution described in SOW and specifications as well as integration with Private Cloud Service Provider DC/DR Infrastructure	Lump-sum		1				
2	Site preparation cost (Civil Works)	Lump-sum		1				
P Electronics of State NOC –DR								
1	Building, installation, integration, testing and commissioning of NOC including OSS, BSS, NMS, Cyber Safety and other associated solution described in SOW and specifications as well as integration with Private Cloud Service Provider DC/DR Infrastructure	Lump-sum		1				
2	Site preparation cost (Civil works)	Lump-sum		1				
Q Site Preparation Cost (Taluka)								
1	General site readiness like provisioning of proper earthing, racks installations, power infrastructure (as per specifications), etc. shall be carried out by the Bidder at no Extra cost. The Bidder shall provide suitable earthing arrangement as specified in TEC GR No. GR/SPV-03/02 JUN 2005, clause 2.5	Nos		51				
R Site Preparation Cost (GP)								

Sr. No.	Item Description as per technical specifications	Unit	Unit costs (exclusive of Tax)	Quantity - Package A	Total cost	*Rate of GST/Duty/ Tax/Govt. Levy etc. as applicable at the time of bid submission	Part Code	HSN Code
			A	B	C=A*B			
1	General site readiness like provisioning of proper earthing, racks installations, power infrastructure (as per specifications), etc. shall be carried out by the Bidder at no Extra cost. The Bidder shall provide suitable earthing arrangement as specified in TEC GR No. GR/SPV-03/02 JUN 2005, clause 2.5	Nos		4,091				
	Sub Total Cost (X1)							

Table C: (Operations & Maintenance (O&M) Cost)

S.No.	Role	Unit	Total Cost (INR)	Quantity - Package A	Total Cost	GST Rate
		Q	A	B	T=A*B	
A	Gram Panchayat Infrastructure					
1	OPEX Cost of GP Active Electronics (Non Wi-Fi) equated quarterly for 5 years (Including warranty of one year)	Quarter		16		
2	OPEX Cost of GP Wi-Fi Electronics equated quarterly for 5 years (Including warranty of one year)	Quarter		16		
3	OPEX Cost of GP physical infrastructure equated quarterly for 5 years (Including warranty of one year)	Quarter		16		
B	Taluka Infrastructure					
1	OPEX Cost of Taluka Active electronics equated quarterly for 5 years (Including warranty of one year)	Quarter		16		
2	OPEX Cost of Taluka physical infrastructure equated quarterly for 5 years (Including warranty of one year)	Quarter		16		
C	Central infrastructure					
1	OPEX Cost of NOC Active electronics and software solutions equated quarterly for 5 years (Including warranty of one year)	Quarter		16		
2	OPEX Cost of NOC physical infrastructure equated quarterly for 5 years (Including warranty of one year)	Quarter		16		
3	OPEX Cost of NOC-DR Active electronics and software solutions equated quarterly for 5 years (Including warranty of one year)	Quarter		16		
4	OPEX Cost of NOC-DR physical infrastructure equated quarterly for 5 years (Including warranty of one year)	Quarter		16		
5	OPEX Cost of NMS, OSS, BSS and other software sub-systems equated quarterly for 5 years (Including warranty of one year)	Quarter		16		
6	OPEX Cost of Virtual Private Cloud Service Provider for DC-DR services equated quarterly for 5 years	Quarter		20		
7	NOC Man power (NOC management (L1/L2/L3), Managing OSS/BSS/NMS))- To meet the SLAs as per contract	Quarter		20		
D	Network Bandwidth costs (As per TRAI guidelines)					
1	Taluka to DC/DR	Quarter		20		
2	Taluka to NOC/NOC DR	Quarter		20		
3	Internet connectivity costs for other intra office infrastructure	Quarter		20		
E	Warehousing cost for Storing Equipment during project phase and spares during O&M Phase					
	Sub Total Cost (X2)					

ANNEXURE 4.11 - FINANCIAL BID FOR PACKAGE B

Table A: Financial Bid

The financial bid for Package B (in INR) is
 Grand Total (in words)
 Grand Total (in figures)

S.No.	Item
1	Total of Table- B (Supply, installation and commissioning of equipment)
2	Total of Table- C (Net Present Value of O&M Costs)
	Grand Total
	Grand Total (in words)
	Grand Total (in figures)

The Bidder who shall have the least/lowest value of "Z"

"**Z=X1+X2 (NPV)**" after calculating NPV value for O&M in Table-A shall be declared as "L1" and shall be awarded the project. States'/SIAs' decision shall be final and binding.

Formula for calculating NPV is as follows:

$$X2 = NPV = R \times \frac{1 - (1 + i)^{-n}}{i}$$

R is the O&M cost for each period

i is the required rate of return per period

N are the No. of periods during for which O&M will be provided by the PIA.

Note 1: Prices in Financial Bid should be quoted in the provided format. All prices should be quoted in Indian Rupees and indicated both in figures and words. If there is a difference between the amounts mentioned in the above form, the lesser amount quoted would be considered as the final bid for the Package. Other values would be summarily discarded irrespective of the details mentioned in the Table B or Table C.

Instructions to fill the Financial Bid:

1. Bidder should provide all prices as per the prescribed format under this Annexure. Bidder should not leave any field blank.
2. All the prices are to be entered in Indian Rupees ONLY (%age values are not allowed)
3. Purchaser reserves the right to ask the Bidder to submit proof of payment against any of the taxes, duties, levies indicated.
4. Purchaser shall take into account that all Taxes, Duties & Levies shall be paid as per actual.
5. For the purpose of evaluation of Financial Bids the Purchaser shall make appropriate assumptions to arrive at a common bid price for all the Bidders. This however shall have no co-relation with the Contract value or actual payment to be made to the Bidder. The soft copy of the financial bid should be in excel format to be uploaded online.
6. The O&M value quoted should be minimum 5% of Sub total cost of Table-A value in column of O&M table per year. If quoted less than 5%, the financial bid of such bidder shall not be considered.

PIA:

Signature

Name

Designation

Company Seal

Table B: Supply, installation and commissioning of equipment

The details of Bill of Quantities is available in below table.

Sr. No.	Item Description as per technical specifications	Unit	Unit costs (exclusive of Tax)	Quantity - Package B	Total cost	*Rate of GST/Duty/ Tax/Govt. Levy etc. as applicable at the time of bid submission	Part Code	HSN Code
			A	B	C=A*B			
Supply of equipment, installation and commissioning								
Supply (Material)								
A Passive infrastructure (Underground Cable)								
1	96F Metal free Optical Fibre Cable Ribbon type with double HDPE Sheath (G.652DFibre): Specification as per "BSNL Tender No. : CA/MMT/NOFN/Selection of PIA/T-610/2017 Dated 29.12.2017	kms		10,475				
2	48F Metal free Optical Fibre Cable Ribbon type with double HDPE Sheath (G.652DFibre): Specification as per "BSNL Tender No. : CA/MMT/NOFN/Selection of PIA/T-610/2017 Dated 29.12.2017	kms		748				
3	24F Metal free Optical Fibre Cable Loose type with double HDPE Sheath (G.652DFibre): Specification shall comply as per TEC draft GR "TEC/GR/OFC-23/01/XXX-2011 (under finalisation in TEC)	kms		3,741				
4	Supply of PLB HDPE Duct (40/33) and accessories as per specifications	kms		14,277				
5	Supply of Cable locator as per specifications (per 150 km)	Nos.		92				
6	Supply of Route Markers/ Joint Indicator as per specifications (6 nos./ km)	Nos.		82,368				
7	Manhole/ Joint Chamber along with straight/ branching splice closure as per specifications (1 nos./ 2 kms)	Nos.		6,864				
B Passive infrastructure (Aerial cable and Miscellaneous)								
1	Self-supporting Metal Free Aerial Optical Fibre Cable (24F ADSS): Specification shall comply as per TEC GR: TEC/GR/TX/OFC-022/02/MAR-17, Type II A	kms		629				

Sr. No.	Item Description as per technical specifications	Unit	Unit costs (exclusive of Tax)	Quantity - Package B	Total cost	*Rate of GST/Duty/ Tax/Govt. Levy etc. as applicable at the time of bid submission	Part Code	HSN Code
			A	B	C=A*B			
	with latest amendments if any.							
2	Self-supporting Metal Free Aerial Optical Fibre Cable (48F ADSS): Specification shall comply as per TEC GR: TEC/GR/TX/OFC-022/02/MAR-17, Type II A with latest amendments if any.	kms		1,887				
3	Galvanized steel poles of tubular in design and swaged of the length 7 meters, with top cap welded and lightning spike and including muff (where pole erection is required estimated as 21 nos./ km)	Nos.		23,594				
4	Galvanized steel poles of tubular in design and swaged of the length 8 meters, with top cap welded and lightning spike and including muff (where pole erection is required estimated as 4 nos./ km)	Nos.		4,494				
5	Stay arrangement for 7 mtr / 8 mtr steel poles (where strengthening is required)	Nos.		14,044				
C	FDM and Other Passive Infrastructure							
1	FDMS Taluka including fibre patch cords, Pig-Tails with appropriate connectors	Nos.		60				
2	FDMS GP including fibre patch cords, Pig-Tails with appropriate connectors	Nos.		4,045				
3	Rack 42 U-floor mount with all accessories for Taluka	Nos.		60				
4	Rack 6 U-floor mount with all accessories for GP	Nos.		4,045				
5	Spare Cable Box	Nos.		4,105				
D	Power infrastructure							
1	Online UPS (6 KVA) at Taluka level as per specifications	Nos.		60				
2	Offline UPS (600 VA) at GP as per specifications	Nos.		4,045				
3	Solar Photo-Voltaic power supply system at the GP shall consist of following subsystems as per TE No.	Nos.		4,045				

Sr. No.	Item Description as per technical specifications	Unit	Unit costs (exclusive of Tax)	Quantity - Package B	Total cost	*Rate of GST/Duty/ Tax/Govt. Levy etc. as applicable at the time of bid submission	Part Code	HSN Code
			A	B	C=A*B			
	CA/MMT/NOFN/Selection of PIA/T-610/2017: 1. VRLA Maintenance Free battery (for 12Hrs Back-up) 2. Solar Panel: 12V/ 60W 3. SMPS: 12V/ 7A 4. Charge Controller: 120W							
E	Spares (to manage the SLAs for period of Contract and to be transferred to MahalT post contract)	Set		As per Design				
F	Warehousing cost for Storing Equipment during project phase	Lump-Sum		As per Design				
Services as per Technical Specifications								
G	Composite Pricing for Underground OFC Laying activities							
1	Excavation of open trench (Depth 1.4 M). Horizontal Directional Drilling (HDD) for PLB pipe laying, in all types of soils/ strata, 40/33 mm PLB pipe laying, back-filling, compaction & levelling of trench / pit. Laying / blowing of 24/48/96F optical fibre cable inside laid PLB pipe, splicing and jointing of OFC, preparation of As-Built Diagram (ABD) of constructed OFC Route, acceptance testing, commissioning and makeover of the routes. The work also includes laying on road crossing, railway crossing, culverts wherever required, including fixing of route/ joint indicator. Termination at FTB and all the relevant accessories etc. and end to end testing of dark and lit fibre per GP (for underground laying) (As per the Engineering Instruction issued by BBNL)	kms		9,610				
2	Laying of protection ON PLB pipe: As per the engineering instructions specified in the RFP, with the approval of the SIA (including the supply of protection material). Please also refer to page 20, Corrigendum 2, Annexure B: Engineering Instructions, Sub-section B-							

Sr. No.	Item Description as per technical specifications	Unit	Unit costs (exclusive of Tax)	Quantity - Package B	Total cost	*Rate of GST/Duty/ Tax/Govt. Levy etc. as applicable at the time of bid submission	Part Code	HSN Code
			A	B	C=A*B			
	3: Penalty for deviation from standard engineering instructions for underground laying							
3	Laying optical fibre cables on bridges, culverts, road surface inside GI Pipe, concreting work on single PLB Pipe including supply of GI Pipe, cement, concrete and curing etc. (PCC 1:2:4 with weld mesh) for Bridges/Culverts or cables laid at lesser depth etc.							
4	Fixing and sign writing of Route /Joint Indicators.							
5	Supply of pre-cast RCC with bottom plant and top cove (preferably two halves). Joint Chambers of bricks/pre-fabricated RCC chamber as per specification with handle and supply of stone slab for covering the Chamber and River sand for filling the chamber.							
6	At Taluka location installation of OF cable box, FDMS, leading-in arrangement, jointing of Pig-Tails, termination of OF cable at block, and all other related activities for commissioning of 48F/ 96F optical fibre cable connectivity from block PoP to GP. Acceptance testing of fibre network.							
7	At GP locations installation of FDMS, leading-in arrangement, jointing of Pig-Tails, termination of OF cable, and all other related activities for commissioning of 48/96F optical fibre cable for connectivity GP to Block. Acceptance testing of fibre network							
8	Physical survey of block to GP route, capturing the Latitude-Longitude of OF cable route, preparation of GIS survey report before execution of works							

Sr. No.	Item Description as per technical specifications	Unit	Unit costs (exclusive of Tax)	Quantity - Package B	Total cost	*Rate of GST/Duty/ Tax/Govt. Levy etc. as applicable at the time of bid submission	Part Code	HSN Code
			A	B	C=A*B			
9	Capturing the Latitude-Longitude of OF route & joint location after execution of works from block to GPs, capturing coordinates ,integration of GIS data with As-Built Diagrams of OF routes							
H	Composite Pricing for Underground OFC Laying activities for 2 Number of PLB Pipes and OFC Blowing in one of the PLB Pipe (30% of the routes will include Additional ducts for Monetization)							
1	Excavation of open trench (Depth1.4 M)/ Horizontal Directional Drilling (HDD) for PLB pipe laying, in all types of soils/strata, 2 Number of 40/33 mm PLB pipe laying, Backfilling, Compaction & levelling of trench / pit. Laying / blowing of 24/48/96F optical Fibre Cable inside one of the laid PLB pipe, splicing and jointing of Optical Fibre Cable preparation of As Built Diagram (ABD) of constructed OFC Route, acceptance testing, commissioning and makeover of the routes. The work also includes laying on road crossing, railway crossing, culverts wherever required, including fixing of route/ Joint indicator. Termination at FTB and all the relevant accessories etc. and end to end testing of dark and lit fibre per GP (For Underground laying) (As per the Engineering Instruction issued by BBNL)	kms		4,118				
2	Laying of protection ON 2 number of PLB pipe: As per the engineering instructions specified in the RFP, with the approval of the SIA (including the supply of protection material). Please also refer to page 20, Corrigendum 2, Annexure B: Engineering Instructions, Sub-section B-3: Penalty for deviation from standard engineering instructions for underground laying							

Sr. No.	Item Description as per technical specifications	Unit	Unit costs (exclusive of Tax)	Quantity - Package B	Total cost	*Rate of GST/Duty/ Tax/Govt. Levy etc. as applicable at the time of bid submission	Part Code	HSN Code
			A	B	C=A*B			
3	Laying optical fibre cables on Bridges, culverts, road surface inside GI Pipe, Concreting work on 2 Number of PLB Pipe including supply of GI Pipe, cement, concrete and curing etc. (PCC 1:2:4) for bridges/ culverts or cables laid at lesser depth etc.							
4	Fixing and sign writing of Route/ Joint Indicators.							
5	Supply of Pre-cast RCC with bottom plant and Top Cove (preferably two halves) Joint Chambers of bricks/ pre-fabricated RCC chamber as per specification with handle and supply of stone slab for covering the chamber and river sand for filling the chamber.							
6	At Taluka location installation of OF cable box, FDMS, leading-in arrangement, jointing of Pig-Tails, termination of OF cable at block, and all other related activities for commissioning of 48/96F optical fibre cable connectivity from block PoP to GP. Acceptance testing of fibre network.							
7	At GP location installation of FDMS, leading-in arrangement, jointing of Pig-Tails, termination of OF cable, and all other related activities for commissioning of 48/96F optical fibre cable for connectivity GP to Block. Acceptance testing of fibre network							
8	Physical Survey of block to GP route, capturing the Latitude-Longitude of OF cable route, preparation of GIS survey report before execution of works							
9	Capturing the Latitude-Longitude of OF route & joint location after execution of works from block to GPs, capturing coordinates ,integration of GIS data with							

Sr. No.	Item Description as per technical specifications	Unit	Unit costs (exclusive of Tax)	Quantity - Package B	Total cost	*Rate of GST/Duty/ Tax/Govt. Levy etc. as applicable at the time of bid submission	Part Code	HSN Code
			A	B	C=A*B			
	As-Built Diagram of OF routes							
I	Composite Pricing for Aerial OFC Laying activities							
1	Commissioning of 24/48/96 core optical fibre connectivity from the Taluka PoP to GP room and termination at GP Router. The cost shall include t laying, fittings, splicing, splitting, splice closure, Pole clamping installation, termination at FTB & all the relevant accessories etc. and end to end testing of dark and lit fibre per GP (For aerial laying) (As per the Engineering Instruction issued by BBNL)	Kms		2,247				
2	Formed OFC Dead-End & termination fittings @ 5 per Kms.							
3	OFC suspension fittings @ 15 per Kms.							
4	Demountable pulley @ one per 10 Kms.							
5	Adjustable Cable Storage Bracket and Joint closure (1 nos./ km)							
6	Installation and commissioning of Galvanized Steel Poles	Nos.		28,088				
7	Installation and commissioning of stay arrangements on existing Galvanized Steel Poles	Nos.		14,044				
J	Radio infrastructure							
1	Supply of RF link equipment as per specifications (Outdoor unit, Indoor unit, antenna, etc.) at GP / Taluka including all accessories i.e. mast, cabling, earthing, etc.	Nos.		200* *Quantity to be confirmed after site survey				
K	Site Preparation Cost (Taluka)							
1	General site readiness like provisioning of proper earthing, racks installations, power infrastructure (as per specifications), etc. shall be carried out by the Bidder at	Nos		60				

Sr. No.	Item Description as per technical specifications	Unit	Unit costs (exclusive of Tax)	Quantity - Package B	Total cost	*Rate of GST/Duty/ Tax/Govt. Levy etc. as applicable at the time of bid submission	Part Code	HSN Code
			A	B	C=A*B			
	no Extra cost. The Bidder shall provide suitable earthing arrangement as specified in TEC GR No. GR/SPV-03/02 JUN 2005, clause 2.5							
L	Site Preparation Cost (GP)							
1	General site readiness like provisioning of proper earthing, racks installations, power infrastructure (as per specifications), etc. shall be carried out by the Bidder at no Extra cost. The Bidder shall provide suitable earthing arrangement as specified in TEC GR No. GR/SPV-03/02 JUN 2005, clause 2.5	Nos		4,045				
	Sub Total Cost (X1)							

Table C: (Operations & Maintenance (O&M) Cost)

S.No.	Role	Unit	Total Cost (INR)	Quantity - Package B	Total Cost	GST Rate
		Q	A	B	T=A*B	
A	Gram Panchayat Infrastructure					
1	OPEX Cost of GP physical infrastructure equated quarterly for 5 years (Including warranty of one year)	Quarter		16		
B	Taluka Infrastructure					
1	OPEX Cost of Taluka physical infrastructure equated quarterly for 5 years (Including warranty of one year)	Quarter		16		
C	Warehousing cost for Storing Equipment during project phase and spares during O&M Phase	Quarter		16		
Sub Total Cost (X2)						

ANNEXURE 4.11 - FINANCIAL BID FOR PACKAGE C

Table A: Financial Bid

The financial bid for Package C (in INR) is
 Grand Total (in words)
 Grand Total (in figures)

S.No.	Item	
1	Total of Table- B (Supply, installation and commissioning of equipment)	X1
2	Total of Table- C (Net Present Value of O&M Costs)	X2
	Grand Total	Z=X1+X2
	Grand Total (in words)	
	Grand Total (in figures)	

The Bidder who shall have the least/lowest value of “Z”

“**Z=X1+X2 (NPV)**” after calculating NPV value for O&M in Table-A shall be declared as “L1” and shall be awarded the project. States’/SIAs’ decision shall be final and binding.

Formula for calculating NPV is as follows:

$$X2 = NPV = R \times \frac{1 - (1 + i)^{-n}}{i}$$

R is the O&M cost for each period

i is the required rate of return per period

N are the No. of periods during for which O&M will be provided by the PIA.

Note 1: Prices in Financial Bid should be quoted in the provided format. All prices should be quoted in Indian Rupees and indicated both in figures and words. If there is a difference between the amounts mentioned in the above form, the lesser amount quoted would be considered as the final bid for the Package. Other values would be summarily discarded irrespective of the details mentioned in the Table B or Table C.

Instructions to fill the Financial Bid:

1. Bidder should provide all prices as per the prescribed format under this Annexure. Bidder should not leave any field blank.
2. All the prices are to be entered in Indian Rupees ONLY (%age values are not allowed)
3. Purchaser reserves the right to ask the Bidder to submit proof of payment against any of the taxes, duties, levies indicated.
4. Purchaser shall take into account that all Taxes, Duties & Levies shall be paid as per actual.
5. For the purpose of evaluation of Financial Bids the Purchaser shall make appropriate assumptions to arrive at a common bid price for all the Bidders. This however shall have no co-relation with the Contract value or actual payment to be made to the Bidder. The soft copy of the financial bid should be in excel format to be uploaded online.
6. The O&M value quoted should be minimum 5% of Sub total cost of Table-A value in column of O&M table per year. If quoted less than 5%, the financial bid of such bidder shall not be considered.

PIA:

Signature

Name

Designation

Company Seal

Table B: Supply, installation and commissioning of equipment

The details of Bill of Quantities is available in below table.

Sr. No.	Item Description as per technical specifications	Unit	Unit costs (exclusive of Tax)	Quantity - Package C	Total cost	*Rate of GST/Duty/ Tax/Govt. Levy etc. as applicable at the time of bid submission	Part Code	HSN Code
		A	B	C=A*B				
Supply of equipment, installation and commissioning								
Supply (Material)								
A Passive infrastructure (Underground Cable)								
1	96F Metal free Optical Fibre Cable Ribbon type with double HDPE Sheath (G.652DFibre): Specification as per "BSNL Tender No. : CA/MMT/NOFN/Selection of PIA/T-610/2017 Dated 29.12.2017	kms		8,337				
2	48F Metal free Optical Fibre Cable Ribbon type with double HDPE Sheath (G.652DFibre): Specification as per "BSNL Tender No. : CA/MMT/NOFN/Selection of PIA/T-610/2017 Dated 29.12.2017	kms		595				
3	24F Metal free Optical Fibre Cable Loose type with double HDPE Sheath (G.652DFibre): Specification shall comply as per TEC draft GR "TEC/GR/OFC-23/01/XXX-2011 (under finalisation in TEC)	kms		2,978				
4	Supply of PLB HDPE Duct (40/33) and accessories as per specifications	kms		11,364				
5	Supply of Cable locator as per specifications (per 150 km)	Nos.		73				
6	Supply of Route Markers/ Joint Indicator as per specifications (6 nos./ km)	Nos.		65,562				
7	Manhole/ Joint Chamber along with straight/ branching splice closure as per specifications (1 nos./ 2 kms)	Nos.		5,464				
B Passive infrastructure (Aerial cable and Miscellaneous)								
1	Self-supporting Metal Free Aerial Optical Fibre Cable (24F ADSS): Specification shall comply as per TEC GR: TEC/GR/TX/OFC-022/02/MAR-17, Type II A	kms		2,032				

Sr. No.	Item Description as per technical specifications	Unit	Unit costs (exclusive of Tax)	Quantity - Package C	Total cost	*Rate of GST/Duty/ Tax/Govt. Levy etc. as applicable at the time of bid submission	Part Code	HSN Code
			A	B	C=A*B			
	with latest amendments if any.							
2	Self-supporting Metal Free Aerial Optical Fibre Cable (48F ADSS): Specification shall comply as per TEC GR: TEC/GR/TX/OFC-022/02/MAR-17, Type II A with latest amendments if any.	kms		6,094				
3	Galvanized steel poles of tubular in design and swaged of the length 7 meters, with top cap welded and lightning spike and including muff (where pole erection is required estimated as 21 nos./ km)	Nos.		76,178				
4	Galvanized steel poles of tubular in design and swaged of the length 8 meters, with top cap welded and lightning spike and including muff (where pole erection is required estimated as 4 nos./ km)	Nos.		14,510				
5	Stay arrangement for 7 mtr / 8 mtr steel poles (where strengthening is required)	Nos.		45,344				
C	FDM and Other Passive Infrastructure							
1	FDMS Taluka including fibre patch cords, Pig-Tails with appropriate connectors	Nos.		59				
2	FDMS GP including fibre patch cords, Pig-Tails with appropriate connectors	Nos.		4,604				
3	Rack 42 U-floor mount with all accessories for Taluka	Nos.		59				
4	Rack 6 U-floor mount with all accessories for GP	Nos.		4,604				
5	Spare Cable Box	Nos.		4,663				
D	Power infrastructure							
1	Online UPS (6 KVA) at Taluka level as per specifications	Nos.		59				
2	Offline UPS (600 VA) at GP as per specifications	Nos.		4,604				
3	Solar Photo-Voltaic power supply system at the GP shall consist of following	Nos.		4,604				

Sr. No.	Item Description as per technical specifications	Unit	Unit costs (exclusive of Tax)	Quantity - Package C	Total cost	*Rate of GST/Duty/ Tax/Govt. Levy etc. as applicable at the time of bid submission	Part Code	HSN Code
			A	B	C=A*B			
	subsystems as per TE No. CA/MMT/NOFN/Selection of PIA/T-610/2017: 1. VRLA Maintenance Free battery (for 12Hrs Back-up) 2. Solar Panel: 12V/ 60W 3. SMPS: 12V/ 7A 4. Charge Controller: 120W							
E	Spares (to manage the SLAs for period of Contract and to be transferred to MahalT post contract)	Set		As per Design				
F	Warehousing cost for Storing Equipment during project phase	Lump-Sum		As per Design				
Services as per Technical Specifications								
G	Composite Pricing for Underground OFC Laying activities							
1	Excavation of open trench (Depth 1.4 M). Horizontal Directional Drilling (HDD) for PLB pipe laying, in all types of soils/ strata, 40/33 mm PLB pipe laying, back-filling, compaction & levelling of trench / pit. Laying / blowing of 24/48/96F optical fibre cable inside laid PLB pipe, splicing and jointing of OFC, preparation of As-Built Diagram (ABD) of constructed OFC Route, acceptance testing, commissioning and makeover of the routes. The work also includes laying on road crossing, railway crossing, culverts wherever required, including fixing of route/ joint indicator. Termination at FTB and all the relevant accessories etc. and end to end testing of dark and lit fibre per GP (for underground laying) (As per the Engineering Instruction issued by BBNL)	kms		7,649				
2	Laying of protection ON PLB pipe: As per the engineering instructions specified in the RFP, with the approval of the SIA (including the supply of protection material). Please also refer to page 20, Corrigendum 2, Annexure B: Engineering							

Sr. No.	Item Description as per technical specifications	Unit	Unit costs (exclusive of Tax)	Quantity - Package C	Total cost	*Rate of GST/Duty/ Tax/Govt. Levy etc. as applicable at the time of bid submission	Part Code	HSN Code
			A	B	C=A*B			
	Instructions, Sub-section B-3: Penalty for deviation from standard engineering instructions for underground laying							
3	Laying optical fibre cables on bridges, culverts, road surface inside GI Pipe, concreting work on single PLB Pipe including supply of GI Pipe, cement, concrete and curing etc. (PCC 1:2:4 with weld mesh) for Bridges/Culverts or cables laid at lesser depth etc.							
4	Fixing and sign writing of Route /Joint Indicators.							
5	Supply of pre-cast RCC with bottom plant and top cove (preferably two halves). Joint Chambers of bricks/ pre-fabricated RCC chamber as per specification with handle and supply of stone slab for covering the Chamber and River sand for filling the chamber.							
6	At Taluka location installation of OF cable box, FDMS, leading-in arrangement, jointing of Pig-Tails, termination of OF cable at block, and all other related activities for commissioning of 48F/ 96F optical fibre cable connectivity from block PoP to GP. Acceptance testing of fibre network.							
7	At GP locations installation of FDMS, leading-in arrangement, jointing of Pig-Tails, termination of OF cable, and all other related activities for commissioning of 48/96F optical fibre cable for connectivity GP to Block. Acceptance testing of fibre network							
8	Physical survey of block to GP route, capturing the Latitude-Longitude of OF cable route, preparation of GIS survey report before execution of works							

Sr. No.	Item Description as per technical specifications	Unit	Unit costs (exclusive of Tax)	Quantity - Package C	Total cost	*Rate of GST/Duty/ Tax/Govt. Levy etc. as applicable at the time of bid submission	Part Code	HSN Code
			A	B	C=A*B			
9	Capturing the Latitude-Longitude of OF route & joint location after execution of works from block to GPs, capturing coordinates ,integration of GIS data with As-Built Diagrams of OF routes							
H	Composite Pricing for Underground OFC Laying activities for 2 Number of PLB Pipes and OFC Blowing in one of the PLB Pipe (30% of the routes will include Additional ducts for Monetization)							
1	Excavation of open trench (Depth1.4 M)/ Horizontal Directional Drilling (HDD) for PLB pipe laying, in all types of soils/strata, 2 Number of 40/33 mm PLB pipe laying, Backfilling, Compaction & levelling of trench / pit. Laying / blowing of 24/48/96F optical Fibre Cable inside one of the laid PLB pipe, splicing and jointing of Optical Fibre Cable preparation of As Built Diagram (ABD) of constructed OFC Route, acceptance testing, commissioning and makeover of the routes. The work also includes laying on road crossing, railway crossing, culverts wherever required, including fixing of route/ Joint indicator. Termination at FTB and all the relevant accessories etc. and end to end testing of dark and lit fibre per GP (For Underground laying) (As per the Engineering Instruction issued by BBNL)	kms		3,278				
2	Laying of protection ON 2 number of PLB pipe: As per the engineering instructions specified in the RFP, with the approval of the SIA (including the supply of protection material). Please also refer to page 20, Corrigendum 2, Annexure B: Engineering Instructions, Sub-section B-3: Penalty for deviation from standard engineering instructions for underground laying							

Sr. No.	Item Description as per technical specifications	Unit	Unit costs (exclusive of Tax)	Quantity - Package C	Total cost	*Rate of GST/Duty/ Tax/Govt. Levy etc. as applicable at the time of bid submission	Part Code	HSN Code
			A	B	C=A*B			
3	Laying optical fibre cables on Bridges, culverts, road surface inside GI Pipe, Concreting work on 2 Number of PLB Pipe including supply of GI Pipe, cement, concrete and curing etc. (PCC 1:2:4) for bridges/ culverts or cables laid at lesser depth etc.							
4	Fixing and sign writing of Route/ Joint Indicators.							
5	Supply of Pre-cast RCC with bottom plant and Top Cove (preferably two halves) Joint Chambers of bricks/ pre-fabricated RCC chamber as per specification with handle and supply of stone slab for covering the chamber and river sand for filling the chamber.							
6	At Taluka location installation of OF cable box, FDMS, leading-in arrangement, jointing of Pig-Tails, termination of OF cable at block, and all other related activities for commissioning of 48/96F optical fibre cable connectivity from block PoP to GP. Acceptance testing of fibre network.							
7	At GP location installation of FDMS, leading-in arrangement, jointing of Pig-Tails, termination of OF cable, and all other related activities for commissioning of 48/96F optical fibre cable for connectivity GP to Block. Acceptance testing of fibre network							
8	Physical Survey of block to GP route, capturing the Latitude-Longitude of OF cable route, preparation of GIS survey report before execution of works							
9	Capturing the Latitude-Longitude of OF route & joint location after execution of works from block to GPs, capturing coordinates ,integration of GIS data with							

Sr. No.	Item Description as per technical specifications	Unit	Unit costs (exclusive of Tax)	Quantity - Package C	Total cost	*Rate of GST/Duty/ Tax/Govt. Levy etc. as applicable at the time of bid submission	Part Code	HSN Code
			A	B	C=A*B			
	As-Built Diagram of OF routes							
I	Composite Pricing for Aerial OFC Laying activities							
1	Commissioning of 24/48/96 core optical fibre connectivity from the Taluka PoP to GP room and termination at GP Router. The cost shall include t laying, fittings, splicing, splitting, splice closure, Pole clamping installation, termination at FTB & all the relevant accessories etc. and end to end testing of dark and lit fibre per GP (For aerial laying) (As per the Engineering Instruction issued by BBNL)	Kms		7,255				
2	Formed OFC Dead-End & termination fittings @ 5 per Kms.							
3	OFC suspension fittings @ 15 per Kms.							
4	Demountable pulley @ one per 10 Kms.							
5	Adjustable Cable Storage Bracket and Joint closure (1 nos./ km)							
6	Installation and commissioning of Galvanized Steel Poles	Nos.		90,688				
7	Installation and commissioning of stay arrangements on existing Galvanized Steel Poles	Nos.		45,344				
J	Radio infrastructure							
1	Supply of RF link equipment as per specifications (Outdoor unit, Indoor unit, antenna, etc.) at GP / Taluka including all accessories i.e. mast, cabling, earthing, etc.	Nos.		200* *Quantity to be confirmed after site survey				
J	Site Preparation Cost (Taluka)							
1	General site readiness like provisioning of proper earthing, racks installations, power infrastructure (as per specifications), etc. shall be carried out by the Bidder at no Extra cost. The Bidder	Nos		59				

Sr. No.	Item Description as per technical specifications	Unit	Unit costs (exclusive of Tax)	Quantity - Package C	Total cost	*Rate of GST/Duty/ Tax/Govt. Levy etc. as applicable at the time of bid submission	Part Code	HSN Code
			A	B	C=A*B			
	shall provide suitable earthing arrangement as specified in TEC GR No. GR/SPV-03/02 JUN 2005, clause 2.5							
K Site Preparation Cost (GP)								
1	General site readiness like provisioning of proper earthing, racks installations, power infrastructure (as per specifications), etc. shall be carried out by the Bidder at no Extra cost. The Bidder shall provide suitable earthing arrangement as specified in TEC GR No. GR/SPV-03/02 JUN 2005, clause 2.5	Nos		4,604				
Sub Total Cost (X1)								

Table C: (Operations & Maintenance (O&M) Cost)

S.No.	Role	Unit	Total Cost (INR)	Quantity - Package C	Total Cost	GST Rate
		Q	A	B	T=A*B	
A	Gram Panchayat Infrastructure					
1	OPEX Cost of GP physical infrastructure equated quarterly for 5 years (Including warranty of one year)	Quarter		16		
B	Taluka Infrastructure					
1	OPEX Cost of Taluka physical infrastructure equated quarterly for 5 years (Including warranty of one year)	Quarter		16		
C	Warehousing cost for Storing Equipment during project phase and spares during O&M Phase					
Sub Total Cost (X2)						

ANNEXURE 4.12: MAF Manufacturer's Authorization Format (MAF) FROM OEM

Ref: Date:

To

.....,
.....,
.....,
.....,

Subject: Manufacturer Authorization Letter for NIT No. Mahait/CNI/001/01/2018 Dated 31/01/2018

Sir,

We, **<OEM Name>** having our registered office at **<OEM address>**, hereinafter referred to as OEM are an established manufacturer of the following items quoted by **<Bidder Name>** having their registered office at **<Bidder address>**, hereinafter referred to as Bidder.

We **<OEM Name>** authorize **<Bidder's name>** to quote our product for above mentioned tender as our Authorized Indian Agent.

We confirm that we have understood the delivery & installation time lines defined in the tender. We confirm that we have worked out all necessary logistics and pricing agreement with **<PIA name>**, and there won't be any delay in delivery, installation and support due to any delay from our side. Our full support as per pre-purchased support contract is extended in all respects for supply, warranty and maintenance of our products. We also ensure to provide the required spares and service support as pre-purchased for the supplied equipment for a period of 5 years from date of supply of the equipment as per tender terms. In case of any difficulties in logging complaint at bidder end, user shall have option to log complaint at our call support centre.

We also undertake that in case of default in execution of this Contract by PIA, we shall provide necessary support in identifying another authorized partner with similar certifications/capabilities and extend support to the new partner in accordance with OEM's agreement with the new partner. In case PIA is unable to fulfil the obligations given under this Contract, OEM shall be responsible to replace the PIA with an alternate Indian Authorized agent to facilitate to get the requisite work done. OEM shall also ensure that the alternate Indian Authorized Agent in this case shall abide by all the terms & conditions laid down under the Contract and during the Award of Work to the PIA for the quoted OEM products.

If any product is declared end of sale, we shall proactively ensure that a suitable equivalent or higher roll over product is offered through the existing PIA to MahalT for due approval, contract and order executions thereafter.

We understand that any false information/commitment provided here may result in **<OEM's Name>** getting blacklisted/debarred from doing business with MahalT.

Thanking You

For **<OEM/ Manufacturer name>**

< (Authorized Signatory)>

Name:

Designation:

Contact Details:

Seal of the Company

NOTE:

1. The letter should be submitted on the letter head of the manufacturer / OEM and should be signed by the authorized signatory.
2. Any deviation would lead to summarily rejection of bids.
3. ***With reference to Corrigendum 6, the above clause has been changed for all active electronics components – “We also undertake that in case of default in execution of this Contract by PIA, we shall provide necessary support in identifying another authorized partner with similar certifications/ capabilities and extend support to the new partner in accordance with OEM's agreement with the new partner. If any product is declared end of sale, we (OEM) shall ensure***

that a suitable equivalent or higher version of product is offered through the existing PIA to MahaiT for due approval, contract and order executions thereafter at the same cost.”

- 4. For IP MPLS, OFC and Wi-Fi the Manufacturer Authorisation Form in Annexure 4.12 shall be applicable. For other OEMs (Security,OSS/BSS, NOC, CSP, etc.), the following clause shall be excluded from MAF form.**

“OEM shall be responsible to replace the PIA with an alternate Indian Authorized agent to facilitate to get the requisite work done. OEM shall also ensure that the alternate Indian Authorized Agent in this case shall abide by all the terms & conditions laid down under the Contract and during the Award of Work to the PIA for the quoted OEM products”

ANNEXURE 4.13 –DECLARATION PRO FORMA

(To be submitted on the Letterhead of the responding firm)

{Place}

{Date}

To,

.....
.....
.....
.....
.....

Ref: NIT No. Mahait/CNI/001/01/2018 Dated 31/01/2018**Subject: Declaration for not being under an ineligibility for corrupt or fraudulent practices or blacklisted/debarred with any of the Government or Public Sector Units**

Dear Sir/Madam,

We, the undersigned, hereby declare that we are not involved in any litigation with any client which would materially affect our ability to perform obligations as per the RFP and are not under a declaration of ineligibility for corrupt or fraudulent practices or blacklisted/debarred with any of the Government or Public Sector Units as on bid submission date.

For and on behalf of

Signature:

(Authorized Signatory)

Name of the person:

Designation:

Name of the Respondent:

Address of the Respondent:

Company seal:

ANNEXURE 4.14 - SELF CERTIFICATION ON PMA

Format for Affidavit of Self Certificate regarding Domestic Value Addition in quoted items on INR 100/- Stamp Paper.

Date: I _____ S/o, D/o, W/o _____ resident of _____ do hereby solemnly affirm and declare as under.

That I will agree to abide by the terms and conditions of the policy of the Government of India issued vide notification no. 8(78)/2012-IPHW dated 10/02/2012.

That the information furnished hereinafter correct to best of my knowledge and belief and I undertake to produce relevant records before the procuring agency or any authority so nominated by the Ministry of Electronics and Information Technology, Government of India for the purpose of assessing domestic value addition.

That the domestic value addition for all inputs which constitute the quoted item(s) has been verified by me and I am responsible for the correctness of the claims made therein.

That in event of the domestic value addition of the quoted product is found to be incorrect and not meeting the prescribed domestic value addition norms, based on assessment of an authority so nominated by the Department of Telecommunications, Government of India for the purpose of assessing domestic value addition. I will be disqualified from any Government Tender for period of 36 months. In addition, I will bear all costs of such an assessment.

That I have complied with all the conditions referred to in the notification no. 8(78)/2012-IPHW dated 10/02/2012, wherein preference to domestically manufactured electronic products in Government procurement is provided and that the procuring agency is hereby authorized to forfeit and adjust my EMD and other security amount toward such assessment cost and I undertake the balance, if any, forthwith. I agree to maintain the following information in the Company's record for a period of 8 years and shall make this available to any statutory authorities.

1. Name and details of domestic manufacture (Registered office, Manufacturing unit location, nature of legal entity)
2. Date on which this certificate issued
3. Electronic Product for which the certificate is produced
4. Procuring agency to whom the certificate is furnished Percentage of domestic value addition claimed
5. Name and contact details of the unit of the manufacturer
6. Sale price of the product
7. Ex-factory price of the product
8. Freight, insurance and handling
9. Total Bill of Material
10. List and total cost value of inputs used for manufacture of the domestic product
11. List and total cost value of inputs which are domestically sourced. Please attach the certificate from supplier, if the input is not in-house
12. List and total cost value of inputs imported, directly or indirectly.

For and on behalf of _____ (Name of firm/entity)

Authorized Signatory (To be duly authorized by Board of Directors) <Insert Name, Designation and Contact No.>

Note: The sole bidder or lead bidder through its partner, in case of consortium should comply with PMA guidelines notified by DoT and all its clarifications/amendments applicable on this tender excluding all active equipment(routers, switches, Wi-Fi, Radio, NOC, OSS/BSS, CSP, Security and any other software solutions)

ANNEXURE 4.15 - FORM OF POWER OF ATTORNEY FOR CONSORTIUM

(On Non –Judicial Stamp Paper of Appropriate value to be purchased in the Name of CONSORTIUM)

KNOW ALL MEN BY THESE PRESENTS THAT WE, the Members whose details are given hereunder..... Have formed a CONSORTIUM and having our Registered Office (s)/Head Office (s) at(hereinafter called the 'Consortium' which expression shall unless repugnant to the context or meaning thereof, include its successors, administrators and assigns) do hereby constitute, nominate and appoint M/s..... a company/Electrical Contractor incorporated under the laws ofand having its Registered/Head Office atas our duly constituted lawful Attorney (hereinafter called "Lead Member ") to exercise all or any of the powers for and on behalf of the CONSORTIUM in regard to bid document No..... For supply..... for which bids have been invited by the Owner namely (DISCOM), to undertake the following acts:

- (i) To submit proposal, participate and negotiate in respect of the aforesaid Bid – Specification of the Owner on behalf of the "Consortium".
- (ii) To negotiate with Owner the terms and conditions for award of the contract pursuant to the aforesaid Bid and to sign the contract with the Owner for and on behalf of the "Consortium".
- (iii) To do any other act or submit any document related to the above.
- (iv) To receive, accept and execute the contract for and on behalf of the "Consortium".
- (v) To submit the contract performance security in the form of an unconditional irrecoverable Bank guarantee in the prescribed format and as per terms of the contract. It is clearly understood that the Lead Member shall ensure performance of the contracts (s) and if one or more Member fail to perform their respective portion of the contracts (s), the same shall be deemed to be a default by all the Members. It is expressly understood that this power of Attorney shall remain valid binding and irrevocable till completion of the Defect or liability period in terms of the contract.

The CONSORTIUM hereby agrees and undertakes to ratify and confirm all the whatsoever the said Lead Member quotes in the bid, negotiates and signs the Contract with the Owner and / or proposes to act on behalf of the CONSORTIUM by virtue of this Power of Attorney and the same shall bind the CONSORTIUM as if done by itself.

IN WITNESS THEREOF the Members Constituting the CONSORTIUM as aforesaid have Executed these presents on this day of Under the Common Seal (s) of their Companies for and on behalf of the Members of CONSORTIUM

1.
2.
3.
4.

The Common Seal of the above Members of the CONSORTIUM:

The Common Seal has been affixed there unto in the presence of:

WITNESS

1. Signature
 - Name
 - Designation
 - Occupation
 2. Signature
 - Name
 - Designation
 - Occupation
- (Annexure-....)

Maintaining a minimum of 100 work fronts per package during non-monsoon months is a minimum requirement from the PIA selected for the package.

75 work fronts would pertain to underground cable laying comprising of 2 JCBs, 10 Breakers and minimum of 50 work force.

25 work fronts would pertain to Ariel fibre implementation comprising of 50 work force with pole mounting, staying of poles and stringing the cable teams.

Annexure 4.16- Format for Bank Guarantee for Earnest Money Deposit (EMD)

To,

<Name>

<Designation>

<Address>

<Phone Nos.>

<Fax Nos.>

<Email id>

Whereas <<Name of the bidder>> (hereinafter called 'the Bidder') has submitted the bid for Submission of RFP <<RFP Number>> dated <<Date>> for <<Name of the assignment>> (hereinafter called "the Bid") to <<Purchaser>>.

Know all Men by these presents that we <<...>> having our office at <<Address>> (hereinafter called "the Bank") are bound unto the << Purchaser >> (hereinafter called "the Purchaser") in the sum of Rs. <<Amount in figures>> (Rupees <<Amount in words>> only) for which payment well and truly to be made to the said Purchaser, the Bank binds itself, its successors and assigns by these presents. Sealed with the Common Seal of the said Bank this <<Date>>.

The conditions of this obligation are:

1. If the Bidder having its bid withdrawn during the period of bid validity specified by the Bidder on the Bid Form; or
2. If the Bidder, having been notified of the acceptance of its bid by the Purchaser during the period of validity of bid
 - (a) Withdraws his participation from the bid during the period of validity of bid document; or
 - (b) Fails or refuses to participate in the subsequent Tender process after having been short listed;
 - (c) Fails to submit the Performance Bank Guarantee as specified in the terms.

We undertake to pay to the Purchaser up to the above amount upon receipt of its first written demand, without the Purchaser having to substantiate its demand, provided that in its demand the Purchaser will note that the amount claimed by it is due to it owing to the occurrence of one or both of the two conditions, specifying the occurred condition or conditions.

This guarantee will remain in force up to <<insert date>> and including <<extra time over and above mandated in the RFP>> from the last date of submission and any demand in respect thereof should reach the Bank not later than the above date.

NOTWITHSTANDING ANYTHING CONTAINED HEREIN:

- I. Our liability under this Bank Guarantee shall not exceed Rs. <<Amount in figures>> (Rupees <<Amount in words>> only)
- II. This Bank Guarantee shall be valid up to <<insert date>>
- III. It is condition of our liability for payment of the guaranteed amount or any part thereof arising under this Bank Guarantee that we receive a valid written claim or demand for payment under this Bank

Guarantee on or before <<insert date>> failing which our liability under the guarantee will automatically cease.

(Authorized Signatory of the Bank)

Seal:

Date:

Section V

Scope of Work

Section V - Scope of Work

1. PROJECT BACKGROUND

BharatNet is a flagship project of Government of India (GoI) funded by Universal Service Obligation Fund, Department of Telecommunications, Ministry of Communication to provide broadband connectivity at all GPs. Such broadband connectivity under this RFP is proposed to be provided by laying underground and aerial OFC along with deployment of microwave radio (unlicensed band).

Government of Maharashtra (GoM) is committed to drive the economic growth of the State in an inclusive and all-encompassing manner and has decided to undertake implementation of **MahaNet – I** (under BharatNet – II) project under the State Led Implementation Model.

In accordance with the communication made by GoM to GoI, a State led SPV named Maharashtra Information Technology Corporation Limited (MahalIT) was incorporated under the Companies Act 2013 in the year 2016. Post selection of implementation partner through tenders, during the implementation phase, this State SPV (MahalIT) would be responsible for carrying out the review of detailed network design, infrastructure deployment, POP, infrastructure update, state level acceptance testing, managing the process of ROW provisioning and providing support during the central level acceptance tests. During the O&M Phase, the State SPV shall also be responsible for review of the infrastructure maintenance, infrastructure operations and driving the utilization of the network.

The project organization is as shown below:



For effective project implementation, 3-tier governance structure has been proposed and instituted. The 3-tiers include:

- Empowered Committee - Chaired by Secretary, DoT
- Project Steering Committee - Chaired by Administrator USOF with head of state implementation agencies as its members
- State Level Implementation Committee - Chaired by Chief Secretary of State with DoT/ USOF/ BBNL designated officials as its members

Periodic status reviews and health of the project would be monitored by the committees.

SIA would also deploy a **Project Management Consultants (PMC)** for overall assistance throughout the MahaNet-I project execution. During the project implementation, PMC roles and responsibilities would include the following:

(A) Planning:

- Assistance to SIA in defining and formalizing the project scope

- Developing the project plan in coordination with PIA and facilitating approval of the plan
- Develop the project schedule in coordination with PIA and facilitating approval of the schedule
- Develop governance, project monitoring and reporting processes to support the achievement of the project objectives

(B) Organizing:

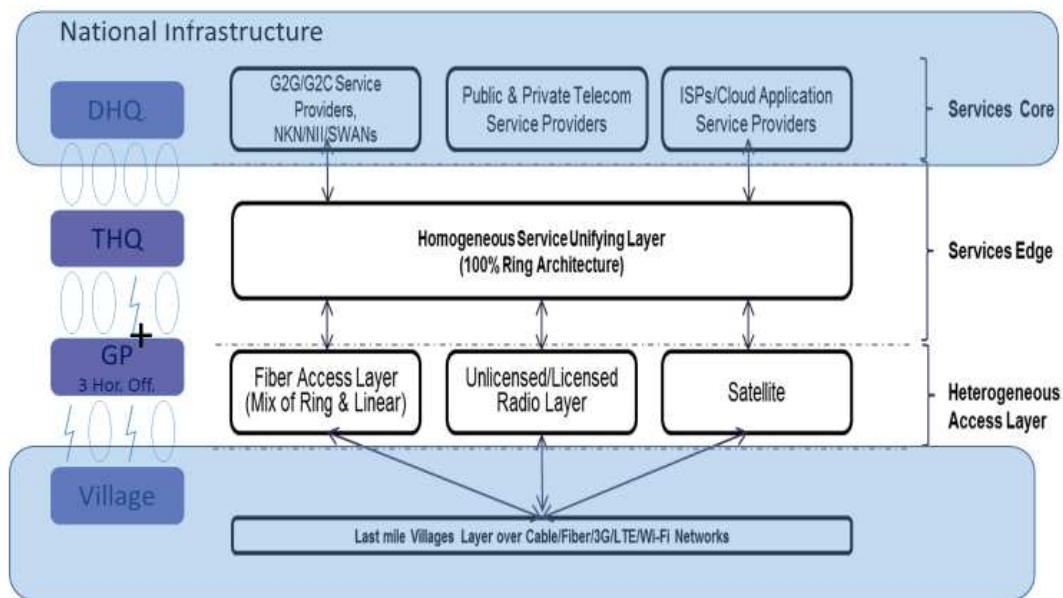
- Defining the key roles and responsibilities (RACIS) for the project stakeholders

(C) Monitoring and Reporting:

- Checking project progress toward meeting its objectives
- Determining the cause of deviations from the plan
- Reporting on the deviations
- Facilitating key decisions through providing insights to the SIA
- Facilitating implementation of the corrective action to address deviations

Indicative Responsibility Matrix clearly highlighting the role of each of the project stakeholder's activity-wise is indicated in Annexure – J

Through MahalT, the Government of Maharashtra intends to establish a futuristic, resilient and strong ICT backbone in the state to provide integrated services to its citizens and businesses. Further, it aims at rolling out of essential services like e-Health, e-Agriculture, e-Education etc. and satisfactorily maintaining these services along with their SLAs in a ring network architecture. The acceptability and sustainability of such infrastructure shall be critical with 24x7 assured availability of the last mile connectivity to the citizens, entrepreneurs, government agencies etc. for G2G, G2C, B2B, and B2B transactions.



2. SCOPE OF WORK

USOF (DoT)/State intends to create digital highway by deploying Optical Fibre Cable (UG/Aerial) or Radio Connectivity from Block to Gram Panchayat (GP), including supply of IP-MPLS routers, Solar Panel along with other passive infrastructure to enable the intended services such internet, telephone, e-services and value added services.

The Implementation of the project is to be done by MahalT through a PIA who would be responsible for "Survey, Planning, Procurement, Installation, End to End Integration, Testing and Commissioning for the following

- a. Underground optical fibre cable, PLB duct and accessories for construction of optical fibre cable

- b. Aerial OF Cable (AOFC), posts for erection / slinging of AOFC including all accessories, supply
- c. IP-MPLS Network
- d. Microwave radio (unlicensed band)
- e. Wi-Fi network across Gram Panchayat
- f. Network Operating Centre (NOC) and Disaster Recovery NOC for network monitoring and management.
- g. Data Centre (DC) on Virtual Private Cloud with key network elements such as NMS/EMS/BSS & Access Gateways, Storage/ servers, Network security and other applications

Through this RFP, the selected Project implementing agency (PIA) shall ensure to undertake the responsibility for facilitating service provisioning and Operations and Maintenance (O&M) for 5 years. (Refer to Section I - Invitation to Bid, for detailed scope to be covered across three packages)

The successful bidder shall also ensure to undertake the following work:

- 2.1. Provision of minimum 100 Mbps bandwidth scalable up to 1 Gbps in case of wired (OFC) and wireless media (Radio) at each GP
- 2.2. Medium of connectivity (to be done at the time of survey):
 - 2.2.1. Laying of fresh underground fibre from GP to GP (in ring type architecture), Taluka to GP and Taluka to Taluka (in ring type architecture) with type:
 - a. 96 core fibre
 - b. 48 core fibre
 - c. 24 core fibre
 - 2.2.2. Laying of 24 core and 48 core aerial fibre ADSS using electric pole, new pole/ nearest available pole (applicable only where underground connectivity is not feasible depending upon site survey)
 - 2.2.3. Laying of fresh 6 fibre ADSS for horizontal connectivity across Government buildings/ premises, school and colleges at Taluka and GP level using electric pole or nearest pole
 - 2.2.4. The type or specification of the optical fibre cable 'to be deployed' would be evaluated based on the commercial bid response obtained through this RFP
 - 2.2.5. *Certain GPs may be very remote and there may not be sufficient feasibility to lay underground or overhead optical fibre cable. Such GPs have been identified and will be connected through Radio separately.***

Fibre connectivity should be given priority and use of Radio should be minimized. The Radio requirements would be identified as part of site survey in each package by the PIA of the respective package. PIA of each package would be responsible for Supply, Design, Implementation and Operation of Radio network for their own package.
- 2.3. Provisioning of minimum 6 dark fibre to be made available at each GP from the Taluka level which can be used as spare for leasing
- 2.4. The provisioned bandwidth should have the capabilities to handle wide variety of e-services such as operational and social purposes, VPN networking, Internet (web browsing, e-mailing), VoIP, Video Store and forward high quality live video transmission, two-way video-conferencing, on board monitoring, and chart updates
- 2.5. An Indicative BoQ along with break up is provided in the RFP, however it may differ at the time of execution post the confirmation based on the site survey duly authenticated by Mahalt designated authorities
- 2.6. The period for completion of Implementation would be eleven (11) months from issue of work order. Mahalt will work with state agencies for eliminating the need of ROW permission and will issue necessary communication in this regard to smoothen the ROW process. After

commissioning one year warranty and Operations & Maintenance would be applicable for implemented network. After the completion of warranty period, O&M for the network for four years will have to be provided by the bidder. The O&M may further be extended thereafter on requirement basis, based on the satisfactory performance by the vendor and mutual consent

- 2.7. The PIA shall form a project monitoring team to provide daily progress reports of implementation and also record the progress on project monitoring tool mandated by State Government and Central Government
- 2.8. The PIA shall provide Monthly/Quarterly report to State / MahalT regarding uptime details of Network. The SLA of minimum 99.5% to be met for the network availability including public holidays (SLAs defined in **Section III – General Conditions of the Contract**)
- 2.9. PoP at Taluka shall be established at respective Taluka office or alternate locations for which power and other site requirements shall be provided by MahalT. It would be the responsibility of PIA to carry out site survey to understand the level of preparedness in all respect. Through this RFP, MahalT also plans to provide Solar Power (SPV) (based upon the power requirement of the technology deployed at the site) along with other communication and IT equipment to power electronic equipment supplied through this RFP. In cases, where the MPLS Router has to be installed, does not have appropriate plug points/ wiring, the PIA shall draw the electrical wiring from the nearest junction box to the MPLS router/ Rack (with requisite plug points etc.) at no extra cost to MahalT
- 2.10. PIA shall submit business plan for utilization and monetization of the entire network, created under MahaNet and shall strive to implement the same.

MahalT would like to reaffirm that time is of the essence for the execution of the project, and hence adherence to timelines is a key priority. In order to ensure timely delivery/commissioning of important milestones, it is expected that the selected PIA would continue to carry out work 24X7 including on all public holidays/weekends.

- 2.11. Besides the rural broadband infrastructure implemented for BharatNet Phase II – MahaNet Phase I as part of this RFP, PIA shall provide all necessary support and facilitation to the service provisioning agencies. This service shall be provided by PIAs' onsite O&M team as per the SLA defined in the Section III – General Conditions of Contracts
- 2.12. Integration of MahalT NOC and DR NOC with BBNL NOC shall be done within the scope of NOC Implementation
- 2.13. Project Implementing Agencies shall provide access to the USOF (DoT)/BBNL or its authorized representatives to MahalT assets as and when required for inspection and monitoring purpose
- 2.14. Project Implementing Agencies shall be bound to follow the advisory and other directions issued by USOF (DoT) during the implementation of the project

2.15. PLAN, DESIGN, IMPLEMENT AND COMMISSIONING PHASE

The scope of work shall broadly comprise of site survey; due diligence; supply of fibre, duct, electronics, Solar Panel, Radio equipment including all the accessories; trenching, laying, blowing, splicing of fibre, back filling; live line installation and commissioning of optical fibre cable on the existing power distribution poles and connectivity through Radio (wherever laying a cable not cost probative). If need arises for additional new poles/strengthening the pole to follow optimal path/route, such additional new poles shall be installed by the PIA. The fibre shall be terminated at FDF (Fibre Distribution Frame) supplied through this contract at respective Block /Gram Panchayat. The PIA shall be required to supply, install, commission and test the overall deployment at each site. This include successful testing of connectivity from FDF (Gram Panchayat) to FDF/ (Gram Panchayat), as well as testing of each core of fibre laid from the PoP/Block to Gram Panchayat.

The broad scope of work during this phase shall include the following, but is not limited to;

- 2.15.1. Site / Route Survey
- 2.15.2. Planning, Designing and Engineering of Fibre network

- 2.15.3. Project Planning and execution of project within stipulated timelines.
- 2.15.4. Installation and Commissioning Plan- IT and non IT components
- 2.15.5. Installation and Commissioning of Physical Infrastructure components such as Solar Power (SPV), MPLS Router, NOC and Data Centre equipment and network cabling etc. as per scope requirements .
- 2.15.6. Commissioning and Acceptance testing of the required components and making the network available to the GP level for service provisioning and/or utilization as per the framework specified by PIA. All documentation generated during planning, installation and commissioning phase shall always be made available to State /TPA
- 2.15.7. On the MPLS router PIA has to complete the installation, commission, pre - acceptance and offer to TPA for Node Acceptance, Link Acceptance, and Ring Acceptance from Taluka to GPs.

(Refer to Section I - Invitation to Bid, for detailed scope to be covered across three packages)

SITE SURVEY

- a. The PIA shall conduct exhaustive site survey based on optimal path for preparing the Bill of Quantity (BoQ) for each site. The site survey report for each planned location shall be progressively made available to designated authorities of MahalIT. On receipt of such survey reports, BoQ shall be finalized and award of work shall be issued to the Bidder for immediate execution / implementation of work for that specific location. It shall be clearly understood that the overall assigned work shall be completed within the stipulated period of 8 weeks from the date of issuance of Letter of Intent (LoI).
- b. PIA shall carry out the site survey by capturing the site coordinates at every 20-30 mtrs through GIS/Mobile application capturing the Offset side of indicating side of road, Road crossing, culvert bridges, road crossing /railway crossing together with inputs such as flow of water for the entire year, upstream /downstream of the river or river flow in a related.
- c. Data generated by site survey shall be shared with MahalIT and it shall be integrated with GIS application and with Project Management tool of MahalIT
- d. Designing, planning optical network, active network, NOC components, feasibility of MPLS Router and Data Centre – Virtual Private Cloud based solution as well as creation of database for utility infrastructure. The PIA shall prepare KMZ/KML file as per the data recorded during site survey from Block to GP and Block to nearest MPLS node using optimized routes.
- e. During the survey, the PIA shall take into account connectivity to GP based on optimal path for fibre layout covering maximum population en-route.
- f. A final exhaustive site survey report should be submitted covering detailed BoQ for each GPs and further consolidated at Block level, deviation from indicative BoQ (As per the financial bid format given in Section IV), risks involved in executing the work along with mitigation plan, resources required as well as a quality assurance plan indicating expected deviations along with the project execution strategy. A comprehensive documentation folder in soft copy (in Video format, KMZ format and MS Excel) to be submitted on the completion of the survey
- g. After completion of work PIA will submit the as built diagram in GIS format incorporating the fibre laid from blocks to GPs, joint / route indicators. Mobile app based online deployment monitoring tool shall be used for recording the parameters like sample pit depth, Geo-tagged picture and video of work execution and generation of GIS route map and KMZ files
- h. PIA can submit Block wise survey report with BOQ of that Block MahalIT shall approve Block wise survey report & shall not wait for entire completion of survey of all Blocks.
- i. MahalIT/TPA shall validate, vet and approve the site survey report and BoQ as prepared by the PIA

- j. In order to utilize the MPLS at the PoP effectively, should be indicated in As built document in Visio or Auto cad .Such document shall be available in the form of Hard copy and Softcopy in any of electronic Media.
- k. Active or Passive Equipment is to be supplied for this project shall be approved by TEC as Per GR attached in Annexure A
- l. Along with Supply of Material PIA has to produce Factory Acceptance certificate

In case there is a deviation between the BoQ prepared by the PIA after exhaustive site survey and indicative BoQ given in this RFP, the following terms shall prevail:

- a. If BoQ provided by the PIA is less than the indicative BoQ then BoQ provided by the PIA shall be approved by MahalIT
- b. If BoQ provided by the PIA is higher than the indicative BoQ, approval needs to be obtained from MahalIT, post recommendation from the PMC

Note: In any case site survey and BoQ provided by PIA shall be inspected and validated by TPA. Based on approved site survey firm work order shall be issued to PIA

2.16. FIBRE IMPLEMENTATION

- 2.16.1. Based on the approved site survey report, the PIA shall be required to initiate fibre implementation
- 2.16.2. Supply, delivery to site, unloading, storing, warehousing and handling of Optical Fibre cable equipment along with fittings and associated items as required, including the HDPE PLB duct, Splice Chamber, Manhole and FDMS etc. as per the approved survey /Router report.
- 2.16.3. PAI has to apply of the RoW approval at least 7 days before the start of the work.
- 2.16.4. Obtain the ROW approval before trenching.
- 2.16.5. The selected PIA is expected to work on at least the following (as per Annexure H) number of work-fronts in parallel.
- 2.16.6. It is expected that the selected PIA would continue to carry out work 24X7 including on all public holidays/weekends.
- 2.16.7. Live line installation and commissioning of optical fibre cable on the existing power distribution poles - If need arises for additional new poles to follow optimal path/route, such additional new poles shall be installed by the vendor and Supply and Installation cost of pole as per design will be signed-off in APO stage.
- 2.16.8. Trenching, Laying, Backfilling, Blowing, Splicing, Terminating, Installation and Commissioning of underground fibre from Block to GP 96 core as per Annexure B – Engineering Instructions. (For underground fibre)
- 2.16.9. PIA would be responsible for erection and strengthening of poles where required to facilitate fibre deployment. Stringing activity would only be carried out after the poles are strengthened to support fibre stringing. (For aerial)
- 2.16.10. For Subnormal trenching PIA has to follow the protection mechanism provided as per the guidelines (Annexure B)
- 2.16.11. Installation of OF cable box, FDMS, leading-in arrangement, jointing of Pig Tails, termination of OF cable at block/GP locations, and all other related activities for commissioning of 48/96 optical fibre cable connectivity from block PoP to GP,GP to GP Fixing, painting and sign writing of Route /Joint Indicators.
- 2.16.12. Live line Installation and Commissioning of Optical Fibre Cable on the existing power distribution poles from the nearest Block PoP to Gram Panchayat using appropriate pole clamping and accessories 48 core as per Annexure B – Engineering Instructions. (For Aerial fibre)

2.16.13. Laying / blowing of 48/96F optical Fibre Cable inside laid PLB pipe, splicing and jointing of Optical Fibre Cable preparation of As Built Diagram (ABD) of constructed OFC Route, Acceptance Testing, commissioning and makeover of the routes. Testing of each core of the fibre

2.16.14. End-to-End testing of the connectivity thus laid from FDF at GP till Block FDF

The PIA shall complete all the implementation of the sites in the allocated district/block within the stipulated time

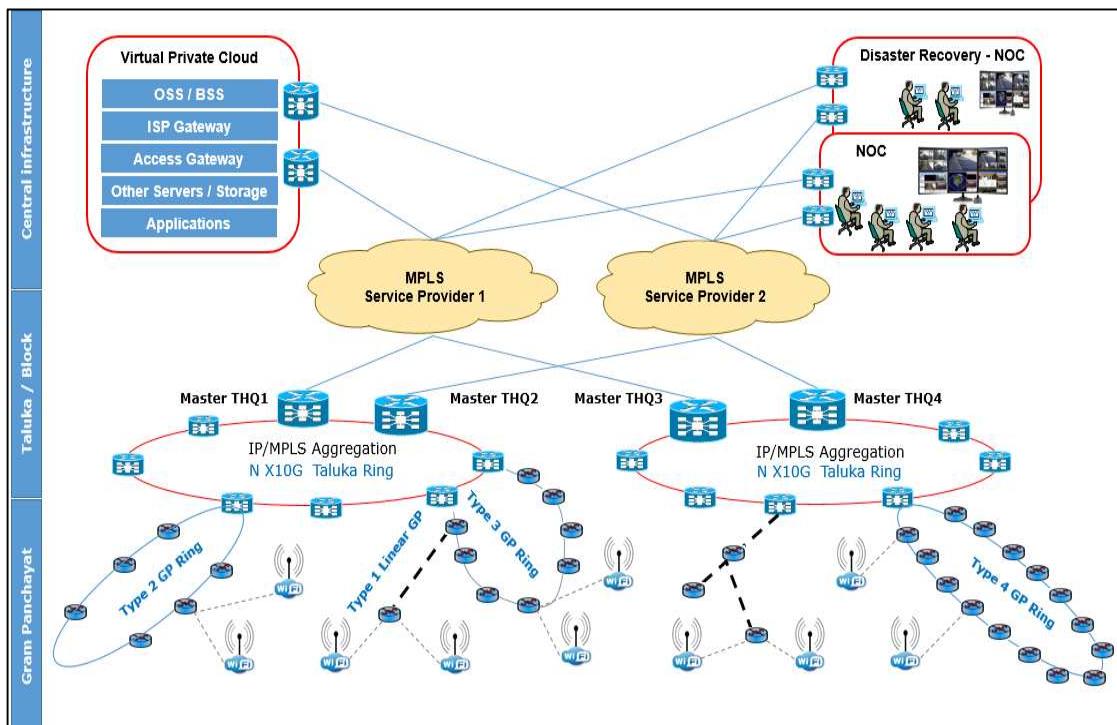


Figure 1: Network Design Architecture

2.17. ELECTRONICS IMPLEMENTATION AT TALUKA AND GP LEVEL

The electronics implementation will be a part of 'Package – A' as mentioned in Section I – Invitation to Bid. The State Broadband Network will be using Multiprotocol Label Switching (IP-MPLS) to construct a packet-switched transport networks. This will provide a common set of functions to support the operational models and capabilities required for such critical networks. IP-MPLS will provide connection-oriented paths, protection and restoration mechanisms, comprehensive operations, administration, and Maintenance (OAM) functions for seamless network operation using dynamic control plane.

It has been envisaged that as a part of the project implementation, Point of Presence (PoP) would be created at the Taluka, and GP level with an objective to enable the customers to have easy access to the network.

The transport network will have distributed architecture and will have three layers:

- 2.17.1. Master Aggregation Layer (Master Taluka)
- 2.17.2. Aggregation Layer (Taluka)
- 2.17.3. Pre – Aggregation Layer (Gram Panchayat)

The proposed network will support MPLS based Ring topology (Single Homed /Dual Homed/Spur) to provide following:

- Redundancy of nodes and Links

- Better Link utilization
- Dedicated and predefined path for critical application
- Easy Insertion of new Node.
- QOS for Video and critical data
- Segregation of critical and non-critical traffic

2.17.1. Master Aggregation Layer (Master Taluka)

This layer will deploy high end scalable Routers and will be running IP-MPLS protocols. The capacity will be multiple of 100G which can be further scaled as the traffic grows. Core Layer will hand over traffic to Data Centre (cloud) and will connect with Network Operating Centre (NOC) / DR NOC through IP-MPLS cloud network available with other Telecom service providers. In each of the Taluka ring, two of the Taluka routers which has better presence of Telecom service providers for internet traffic egress will be configured as Master aggregation routers (Master Taluka) and will be connected through dual 100 G capacity.

The exit connectivity from MahalT network beyond Taluka head end/Master Taluka is responsibility of PIA. Bandwidth/Connectivity cost for management/DCN traffic of network shall be reimbursed through OPEX costs to PIA. Taluka location may not be same as BSNL/BBNL location and Master Taluka/Head end Taluka within Taluka ring will be selected where more than one ISP may be available and PIA may select any ISP for exit connectivity.

PIA needs to consider MPLS link with required bandwidth from telecom service provider between each Master Taluka to Data Centre (cloud). This is meant for management traffic of all the elements proposed as part of tender.

2.17.2. Aggregation Layer (Taluka)

This layer will deploy High end scalable Routers and should act as service edge layer for insertion of any kind of services (native L2, L3, MPLS VPN, Multicast etc.). The capacity of Taluka ring which shall connect Talukas in one districts shall be 100G. Aggregation Layer will be connected to Master Taluka Router.

This layer of the network will connect all Talukas in a District together in ring topology. This will aggregate the traffic at Master Talukas connected in a ring topology. As stated earlier to have better manageability and reliability, Taluka rings shall be designed with the optimum number of talukas (~ approx. 6) in each, balancing the total distance and population covered by each ring on the one hand, with the carrying capacity electronics provided for the ring

S.No.	Appliance Category	Traffic Handling Capacity
1	Type – 1 (THQ 1-2)	100 Gbps
2	Type – 2 THQ (3/4)	200 Gbps

Table 1: Sizing of active Network Appliances at Taluka

2.17.3. Pre – Aggregation Layer (Gram Panchayat)

This layer will deploy High end scalable Routers and should act as service edge layer for insertion of any kind of services (native L2, L3, MPLS VPN, Multicast etc.). The capacity will be multiple of 1G which can be further scaled as the traffic grows.

This layer of the network will be used to connect users at GPs. Based on current Bandwidth estimation the access network at GP is planned to carry average 150 Mbps traffic from each Gram Panchayat.

The actual Capacity of access rings will depend on the number of GPs in a ring and the population in the hinterland served by the GP Ring. All the network devices are therefore to be sized based on the capacity handling required. Hence, these appliances are categorized in various categories as detailed below

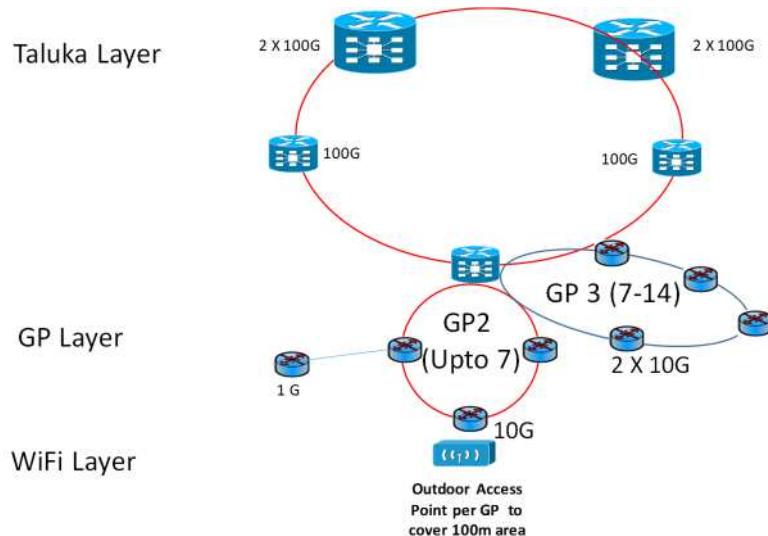
S.No.	Appliance Category	Traffic Handling Capacity	Usage Guidelines
1	Type - 1	1Gbps	For GP connected in Spurs/Linear mode
2	Type - 2	10 Gbps	To be used in GPs rings connecting up to 7 GPs
3	Type - 3	10 Gbps	To be used in GPs rings connecting up to 7-14 GPs
4	Type - 4	20 Gbps	To be used in GPs rings connecting >14 GPs

Table 2: Sizing of active Network Appliances at GP

The technical specification for the IP-MPLS router is provided in Annexure A

The following should be considered at the time of **IP-MPLS router installation** at PoP location:

- a. Based on the approved site survey report, the PIA shall install the MPLS Router.
- b. Supply, delivery to site, unloading, storing, warehousing and handling of Router equipment along with fittings and associated items as required as per the approved survey report.
- c. End-to-End installation of the equipment along with the civil work that needs to be carried out for installation of Router connectivity according to State plan
- d. End-to-End testing of the Router link from GP to GP, GP to THQ and further integration, offer to PIA with Pre Nodal AT, Link AT and Ring AT
- e. MPLS Router to be connected to DCN for EMS/NMS visibility further to State NOC and Delhi/Bangalore NOC of BBNL
- f. Earthing of Rack and equipment
- g. The number of patch cords to be supplied with the MPLS router shall be four more than the number of ports for each type of MPLS (i.e. 8, 12, 20 respectively). The patch cords specification shall be as per TEC GR. Design and specification of accessories at GP Sites.
- h. Testing of traffic from the MPLS at Gram Panchayat to the Block MPLS and further to State NOC



2.18. INFRASTRUCTURE – NETWORK POP MPLEMENTATION

Network Point of Presence (PoP) for MahaNet are planned to ensure the smooth operations and service integration with other service providers/Clients (**Clients mean State Wide Area Network and National Knowledge Network**).

Key design considerations for Network PoPs and three different hierarchical level of network are detailed below:

2.18.1. Master Aggregation Layer (Master Taluka)

The PoPs will have DG backup power supply and AC cooling to ensure higher uptime of network infrastructure. It should also have fire extinguisher and centralized fire alarm monitoring system

2.18.2. Aggregation Layer (Taluka)

The PoPs will have DG backup power supply and AC cooling to ensure higher uptime of network infrastructure. It should also have fire extinguisher and centralized fire alarm monitoring system

2.18.3. Pre – Aggregation Layer (Gram Panchayat)

The PoPs are proposed to have solar power and battery backup to ensure higher uptime of network infrastructure. It should also have fire extinguisher and centralized fire alarm monitoring system.

The technical specification for the network infrastructure is provided in Annexure A

The following should be considered at the time of **setup network infrastructure** at PoP locations:

- PIA shall supply all the accessories required like lugs, fuses (at the power plant end), cable tray, support iron structure, Power Cable, Earthing Cable, and Attenuators etc. Length of Power & Earthing Cable, Number of Attenuators are site specific and PIA needs to supply as per site survey.
- Installation of MPLS at the Block and Gram Panchayat respectively in coordination with State /MahalT. Installation of FDMS and Rack (wherever applicable)
- General site readiness like provisioning of proper earthing, racks installations etc. shall be carried out by the PIA at no extra cost to MahalT
- Additionally, in case the Gram Panchayat end point where the MPLS router has to be installed, does not have appropriate plug points/ wiring, the PIA shall draw the electrical wiring from the nearest junction box to the MPLS Equipment (with requisite plug points etc.) at no extra cost to MahalT.

2.19. RADIO IMPLEMENTATION

Based on the approved site survey report, the PIA shall install the radio link and undertake the following work

- 2.20.1. Supply, delivery to site, unloading, storing, warehousing and handling of radio equipment along with fittings and associated items as required as per the approved survey report
- 2.20.2. End-to-End installation of the pole, radio equipment along with the civil work that needs to be carried out for installation of radio connectivity according to State plan
- 2.20.3. End-to-End testing of the Radio link from GP to tower and further integration with MahalIT NOC
- 2.20.4. Earthing of Pole and equipment

The technical specifications for the same is provided in Annexure A

2.20. Wi-Fi IMPLEMENTATION

Infrastructure is to be deployed for creating Wi-Fi hotspots or any other suitable broadband technology and provisioning of Wi-Fi or Broadband Services at every Gram Panchayat as per the functional and technical specifications as provided in Annexure A of this RFP, that must include:

- 2.20.1. Deployment of two Wi-Fi access point to cover the area around GP PoP and institution such as School, Primary Health Centre or Police Station is proposed.
- 2.20.2. Erection of towers/ masts/poles for installing Wi-Fi Access Points or any other suitable broadband technology
- 2.20.3. Provisioning of network equipment (such as access points, controllers, access gateways etc.), antennae for providing Wi-Fi Services or any other suitable broadband technology including procurement, supply, delivery, design, planning, installation and commissioning of all required equipment
- 2.20.4. Easy accessibility through Wi-Fi enabled user devices (i.e. Laptop, Tablet, Smart phone etc),
- 2.20.5. Easy accessibility through non-Wi-Fi enabled devices (Personal Computer etc.) also by using a cost effective Wi-Fi access point.
- 2.20.6. Centralized user authentication and control and free spectrum band to be used for Wi-Fi services
- 2.20.7. Provisioning of free Wi-Fi services for one hour in a day and implementation of tariff based plan

2.21. CENTRAL INFRASTRUCTURE IMPLEMENTATION

In order to manage and monitor the optical fibre network of MahalIT it is cardinal to have a Central IT infrastructure. This will be comprised of the following

- 2.21.1. Network Operation Centre (NOC) and Disaster Recovery NOC
- 2.21.2. Virtual Private Cloud (Data Centre)

The functional and technical specifications is provided in Annexure A

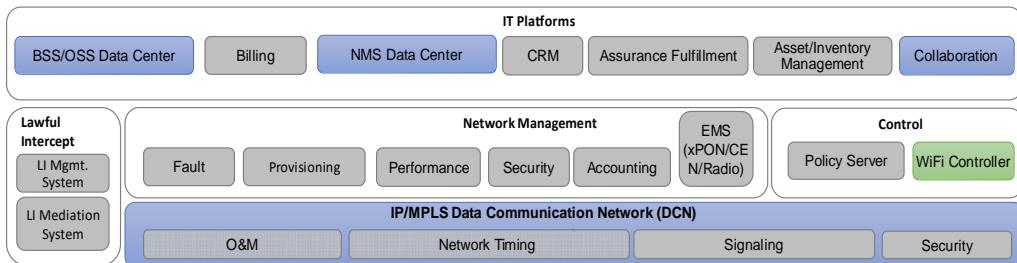
2.21.1. Network Operation Centre (NOC) and Disaster Recovery (DR) NOC

Network Operations Centre (NOC) will be the central location from where network administrators supervises, monitors, controls and maintains the telecommunication/data network, which in our case is MahaNet Optical Fibre Network.

It will be the focal point for activities such as network monitoring, network incident resolution, software distribution and its updates, router and switch configuration, wireless controller management, applications monitoring, network performance monitoring and coordination with affiliated networks. It should also have the capability of analysing problems, performing troubleshooting, communicating with site technicians and tracking problems until they are resolved.

DR NOC will provide an end-to-end disaster recovery solution that ensures the recovery of failed business processes to support restoration of production services and existing application functionality.

2.21.2. Virtual Private Cloud (Data Centre)



The core applications including OSS and BSS will be hosted in the Public Cloud and a full proof arrangement should be done to prevent service disruption due to disaster like situation by ensuring the high availability and redundant storage so that there is minimum loss of data.

The following are the key high-level service objectives Client expects to achieve through outsourced cloud IaaS services in this SOW:

- Meet business needs for available, reliable, scalable and secure services.
- Maintain compliance with industry standards and government regulations (for example, ITIL, ISO27k, and Six Sigma).
- Acquire services with availability guarantees backed by service levels (SLs) and associated penalties in the form of fee reductions with full earn-back opportunities.
- Acquire services that can leverage operational scale and best practices to achieve optimum commercial price performance.
- Acquire ongoing feedback mechanisms to ensure performance meets expectations

2.22. ACCEPTANCE TESTING (COMMISSIONING)

2.22.1. Online measurement books and visual records (pictures and videos) will be considered as documents for Acceptance Testing (AT). All daily progress and visual records will be stored in central server. For Civil AT, following shall be applicable:

Normally depth of the trench should 1.4 m in normal and mix soil and 1.2m in hard soil. Deviations due to field conditions will be required to have necessary protections in case of less depth. The cases and solutions are as following;

- Minimum depth of burial in general shall be 1.4m
- In rocky area (including Murru & soil mixed with stone or soft rock) depth of burial shall be 1.2m at the minimum.
- In case of utility where depth is 90 to 120 cm then DWC protection is to be used in normal/mix soil case.
- In some areas where the depth is 60cm, in those cases reinforced concrete casing of 4"(Four inch) round should be provided.
- For hard strata/rock soil layer for 60 to 90 cm cases DWC with wire mesh and PCC is to be used. However, for depth relaxation photograph (with GPS) proof and justification is required.
- Above ground installation of ducts shall be limited to culvert and bridge crossings only. At such locations, ducts shall be installed inside GI pipe or HDPE DWC pipes with metal

sheet protection (GI sheet wrapping) of appropriate size (4" to 6") suitable for number of ducts to be installed

- g. The relaxation by the competent authority prescribed below shall be obtained giving reasons for not achieving standard depth;
- h. The bidders shall quote composite rates for all kind of soil strata including any mechanical protection used for depth deviation. There will be no variations allowed on account soil strata

2.22.2. Final AT will be done by Maha IT or agency authorized by MahalT. AT of optical Fibre Cable, entire IP-MPLS equipment, Wi-Fi and all associated equipment at GP, Block, NOC, DR-NOC and Virtual Private Cloud shall be done by MahalT. AT schedule will be finalized by MahalT in consultation with vendor as per scope and specification of tender. Final AT shall cover 100% testing of the network connectivity of all Gram Panchayat Router at Block level & DCN connectivity from Block to NOC and DC/DR.

2.22.3. After completion of work PIA will submit the as built diagram in GIS format incorporating the fibre laid from blocks to GPs, joint / route indicators. Mobile app based online deployment monitoring tool shall be used for recording the parameters like sample pit depth, Geo-tagged picture and video of work execution and generation of GIS route map and KMZ files

2.22.4. Commissioning of GP:

- a. If the IP-MPLS router at GP is visible in NOC, then same GPs will be treated as commissioned subject to local AT of GP equipment and Block equipment.
 - b. If any GP is not connected due to any reason beyond the control of PIA or site hindrance or Row permission, Managing Director, MahalT can grant relaxation for excluding that GPs from commissioning target
- 2.22.5. Central electronic infrastructure, e.g. NOC, DR-NOC, Virtual Private Cloud, OSS/BSS, etc. will be treated as commissioned subject to AT of all the solution components as per specifications.**
- 2.22.6. Warranty and O&M of network will be declared Block wise by MahalT. At the end of completion of entire project and warranty period, O&M handover will be declared by MahalT in consultation with PIA for smooth operation & maintenance of network.**

2.23. GO-LIVE FOR THE NETWORK

- 2.23.1. The Go-live for the connectivity from Gram Panchayat at Block level shall be considered when 100% implementation and commissioning for the defined locations along with Acceptance testing as envisaged has been completed
- 2.23.2. The PIA would submit a Go-Live report to MahalT in this regard detailing the completeness of the activities for the connectivity of GP at Block level. The Go-Live report shall be vetted MahalT in order to prove that the traffic is flowing through IP-MPLS Routers from the respective Gram Panchayat and Taluka
- 2.23.3. The connectivity for GP at Block level could be declared Go-Live once IP-MPLS routers of GP and Taluka is accessible from MahalT NOC, DR NOC and central BBNL NOC with the report regarding the same being submitted and accepted by MahalT

Note:

- a. In case any associated component is required not covered in the BoM, MahalT may ask the PIA to procure the associated component so required. The price shall be determined by MahalT and upon approval, the PIA shall install the associated equipment. This shall be dealt on case to case basis.
- b. The PIA shall be required to follow the Technical Specification & Testing Parameters as mentioned in Annexure A, Engineering Instructions (EI) (Annexure B) for implementation of the project.
- c. In case there are any changes in the standard engineering instructions PIA may be asked to execute the work as per the latest engineering instructions.

- d. PIA shall obtain necessary Right of Way (RoW) from State/Central agencies whichever applicable. MahalT shall facilitate the PIA in obtaining the same.
- e. Support for obtaining RoW permission will be provided by MahalT. Any delay on account ROW permission will be excluded from overall deployment schedule for concerned GP and block completion

2.24. QUALITY ASSURANCE AND TESTING

- 2.24.1. The QA test schedule shall be issued by MahalT.
- 2.24.2. The supply shall be accepted only after Quality Assurance tests are carried out by appropriate Quality Testing Agencies within 7 days of intimation on sample basis as identified by MahalT.
- 2.24.3. Only for the completed supplies, as per work order issued during delivery period shall be considered to have been supplied within the scheduled delivery period.
- 2.24.4. In case of any Quality issue, the manufacturers shall be required to replace the defective/inferior material, in full, by good material duly passed by QA.
- 2.24.5. The QA units of MahalT/TPA, as specified by MahalT in the purchase order, while clearing the equipment/ stores shall be strictly adhere to the package discipline for all item in the Bill of Material mentioned in the purchase order. Supplies made in full, "as per the work order", during delivery period only shall be deemed to have been supplied within the schedule delivery period.
- 2.24.6. The consignees shall be MahalT, as specified by MahalT in the Purchase Order. Supplies shall be all over the country at District HQ level or any other location(s) as specified.
- 2.24.7. All measurements shall be recorded through the digital platform with Geo-tagged and Time-stamped images and videos during the implementation stage. The summary of the measurement book for every activity shall be used for billing, invoicing and reconciliation process. The parameters that shall be recorded will be mutually decided with the successful bidder. The digital platform shall have the capability to load and integrate the optical test results in addition to the civil works.
- 2.24.8. Civil AT and depth measurement will be done by representative of PIA through the digital platform. Video recording of trench and depth measurement using measuring tape should be recorded while conducting Civil AT. Sample video recording of sections with depth deviation/protection should be done in such a way that it clearly displays the protection provided as per engineering guideline.
- 2.24.9. Optical AT will also be done by representatives of PIA. Video recording of OTDR test and upload of the same should be done by PIA during this AT process.
- 2.24.10. All video recording should be submitted for verification to MahalT designated representatives. Post satisfactory validation of video recording and sample tests submitted for any section, Optical and Civil AT certificate will be issued within 7 days of offer

2.25. OPERATION AND MAINTENANACE PHASE

After commissioning, the maintenance of the network as per the Service Level Agreement (SLA) shall be carried out for a period of five (5) years from the date of commissioning of the site.

2.25.1. WARRANTY PHASE

- a. During warranty period, the vendor will have to provide O&M of the complete network i.e. OFC Network, MPLS Network at Taluka level, MPLS network at Gram Panchayat level, Data Centre & NOC and DR- NOC setup.
- b. During the warranty period, the maintenance of complete network (OFC links, MPLS nodes, Data Centre & NOC) will be carried out by vendor at his own cost, this includes repair / replacement of damaged OFC. If major damage to network has happened due to road widening, water and sewage work or other civil work, then cost of material and services for restoration will be borne by MahalT, subject to approval from competent MahalT authority.
- c. Warranty period of one year, the bidder should maintained same SLA as for maintenance period at his cost. First year of maintenance should be inclusive in the unit rate quoted by the Bidder as part of the Financial Bid. The maintenance cost quoted as part of Operations & Maintenance shall be only for four (4) years. The maintenance phase shall commence after completion of one year warranty
- d. *The warranty of all products and services implemented at GPs will start after all products and services for 25% of the GPs (25% GPs commissioned) have been commissioned and Acceptance Testing Certificate (ATC) has been issued. Next date of start of warranty will be after all products and services for 50% of GPs (50% GPs commissioned) have been commissioned and ATC issued. The subsequent date of start of warranty will be when 75% of GPs (75% GPs commissioned) have been commissioned. For remaining GPs, the date of start of warranty will be from the date of issue of ATC for products and services commissioned at the last GP (100% GPs have been commissioned) in respective block.*

Therefore each block will have four effective dates of start of warranty:

- I. When 25% of GP have been commissioned
- II. When 50 % of GP have been commissioned
- III. When 75% of GP have been commissioned
- IV. When 100% GPs have been commissioned

During the warranty period, the maintenance of network will be carried out by the PIA at their own cost. The commissioning date of products and services implemented at individual GPs will not be taken into account for the purpose of start of warranty or start of O&M.

The date when 25% of GPs in a block is commissioned, the warranty of that block for these 25% GPs will start. The O&M of these 25% GPs will start one year after the date of start of warranty. Similarly for the GPs commissioned at the milestones of 50%, 75% and 100%; the O&M shall begin after one year from the start of warranty.

The payment will be made for the O&M period proportionate to the GPs covered as part of the milestones in each of the blocks. For the first year, the O&M of GPs commissioned at 25%, 50%, 75% and 100% milestones will be separate which will be combined in the second year. For unifying date of start of O&M for all the GPs in a block, date of completion of first year of O&M for GPs commissioned at 100% milestone, will be date of start of O&M for second year for entire block covering 100% GPs.

The proportionate payment towards O&M charges for 25%, 50%, and 75% GPs commissioned for the intervening period will be paid separately.

2.25.2. MAINTENANCE PHASE

- a. The skilled manpower, testing instruments and equipment & material required for proper maintenance and meeting the SLA obligation shall be the sole responsibility of the successful bidder

- b. The bidder should have proper legal agreement with the OEM to guarantee quality, timely supply, performance, warranty and O&M during the full life-cycle of the contract.
- c. The PIA shall carry out periodical maintenance of the network commissioned and shall submit the report on quarterly basis during this phase.
- d. If any issue is reported by the end user (GP, Block) with regards to the services, then the issue shall be reported to centralized help desk of NOC, and if there is any issue in the network connectivity, the issue shall be forwarded to the respective bidder. These issues shall be rectified so as to restore the services as per the SLA. Issues pertaining to the MPLS nodes/FDMS/OFC other active or passive equipment (installed by the PIA except OFC/PLBE) shall be handled by the PIA. However, if there are issues with MahalIT, it shall be reported to respective stakeholders and shall be excluded from SLA calculations.
- e. In case of theft/physically damaged (Repair not possible (RNP), the equipment shall be replaced on MahalIT cost after due recommendation of designated representative of MahalIT and lodging of FIR by the MahalIT/Gram Panchayat or by PIA staff. In such cases, MahalIT will pay for both, material as well as service charges. In issues pertaining to OFC/PLBE Cable due to poor workmanship and other technical reason the fault has to be rectified or cable/PLBE pipe has to be replaced by PIA. In case of cable cut due to any reason the fault to be rectified by the PIA and services to be restored as per SLA. All the store required for such restoration to be borne by PIA except in cases of the following condition after supervision report of designated representative of MahalIT
- f. In issues pertaining to OFC/PLBE Cable due to poor workmanship and other technical reason the fault has to be rectified or cable/PLBE pipe has to be replaced by PIA. In case of cable cut due to any reason the fault to be rectified by the PIA and services to be restored as per SLA. All the store required for such restoration to be borne by PIA except in cases of the following condition after designated personnel of MahalIT
- g. If the OFC cable cut is such that the cable has been damaged for distance more than 10 meter by any external agency then MahalIT shall bear cost of cable/PLBE. But the PIA shall bear the cost of workmanship and other store like splicing, jointing kits etc.
- h. If the pole has fallen down or replaced by electricity department/external agency and cable has been damaged such that it cannot be used further, then MahalIT shall bear cost of cable, Pole (if required) other pole kits. But the PIA shall bear the cost of workmanship and other store like jointing kits etc.
- i. Due to various cut (more than 8 cuts in one km) due to wear and tear and external agency, OFC cable shall be replaced and MahalIT shall bear the cost of restoration (material and services)
- j. Any downtime due to issues with third party backhaul link shall not be counted for SLA purpose
- k. SLA for restoration in such cases where initial information is available only with MahalIT, the SLA will start when TT has been handed over to vendor staff.
- l. The cost of pre-notified planned shifting of network / OFC route due to other reasons like widening of road, construction of bridges or asked by central / state authorities (PWD/NHAI/Railway etc.) or force majeure reasons will be paid by MahalIT. The same condition will be applicable during O&M period

2.25.3. MAINTENANCE – MPLS AND OTHER SUPPORTING POWER INFRASTRUCTURE

- a. Operation and Maintenance Contract (O&M) shall be for four (4) years after one years of warranty and including routine maintenance/ first line maintenance which in turn includes diagnosis & rectification of faults in EMS, MPLS nodes, solar power system etc. for 5 (1 year warranty + 4 year O&M). The skilled manpower, testing instruments along with equipment and material required for proper maintenance and meeting the SLA obligation shall be the sole responsibility of the successful bidder.

- b. The cost quoted shall include deployment of skilled & trained person on active equipment & other equipment supplied under this RFP, in each Block for performing various maintenance activities and fault diagnosis of all active and passive nodes installed at the GPs and Taluka areas along with maintenance of equipment installed as a part of Central Infrastructure (NOC, DR-NOC and Data Centre – Virtual Private Cloud)
- c. Maintenance responsibility of successful bidder shall start from the date of commissioning of Sites after successful Acceptance Testing.
- d. The bidder should have proper legal agreement with the OEM to guarantee quality, timely supply, performance, warranty and O&M during the full life-cycle of the contract.
- e. As a part of First Line Maintenance (routine maintenance), the bidders' personnel will make at least one visit to each GP location in 2 week for carrying out routine maintenance and upkeep activities. However, detailed set of maintenance procedures, periodic test/maintenance schedules, traffic report generation & analysis and remedial measures to be taken in each occasion shall be finalized and approved by MahalT in consultation with successful bidders within a month of award of work. The detailed Terms and Conditions of the Routine Maintenance Agreement shall accordingly be mutually decided and signed with successful bidders
- f. Failure of bidder to perform maintenance activities as stipulated in Maintenance agreement, shall invite penalty as mentioned in this RFP
- g. The bidder shall maintain an up-to-date inventory of all FRU's (Field Replaceable unit) required for the integrated solution. The same shall be liable for inspection by MahalT team. The bidder has to submit complete address details of nodal/repair centers.
- h. The bidder shall equip maintenance personal with minimum necessary testing equipment and spares required for the maintenance. The same shall be liable for inspection by MahalT team.
- i. In case any MPLS node is down, either reported by MahalT officer or monitored through EMS/NMS, he will attend the fault and rectify the same and/or report for 2nd Line maintenance to O&M vendor/personal, as the case may be.
- j. The common control modules/ cards provided in critical parts of network site's equipment like MPLS etc shall be maintained in hot standby mode. The system availability shall be at least 99.5% measured over a period of one quarter.
- k. Maintenance of battery sets provided with the SPV systems shall be done as part of preventive maintenance
- l. The charge-discharge cycle testing of the batteries shall be done at an interval of every six months.
- m. Suitable corrective action shall be taken for repair/ replacement in cases of any deficiency in the performance parameters.
- n. The bidder shall provide suitable earthing arrangements for all equipment and measure the earth resistance value once every year during warranty and O&M period.

2.25.4. MAINTENANCE – OPTICAL FIBRE CABLE

- a. Routine inspection, viz, patrolling on the routes, to identify area where OFC / Duct is exposed due to natural wear and tear etc.
- b. Faulty rectification of OFC cuts along routes.
- c. Replacement of OFC routes due to non-viability of transmission link.
- d. Ensure availability of OFC route marker along the route at regular intervals.
- e. Maintain proper condition of joint closure.
- f. Prevent third party damages viz, theft, damage by other U/G utility bidder etc.

- g. Maintain condition of OFC with casing or with special arrangements near critical areas viz, major bridges, railway crossing, pipe line crossing etc.
- h. Visual inspection of joint closure to check ingress of water, foreign particles etc.
- i. Preventive and regular checks of power plant battery, generator, ac & remote alarm units.
- j. Periodic measurement of the link attenuation loss to ensure that the link is free from any splice loss or point loss defects etc.
- k. Maintenance and update of as-built drawing, information along the OFC route.
- l. Maintaining history of events, analysis and reporting, public liaisoning with concerned authorities.

2.25.5. MAINTENANCE – FAULT RESTORATION SERVICES

- a. The bidder shall deploy Maintenance Teams at the designated locations to ensure SLA adherence. The Maintenance teams shall comprise of manpower, logistics, required tools/tackles/machinery & equipment etc. The exact locations for placement of maintenance teams will be intimated after award of contract before the links are commissioned.
- b. The Bidder shall provide OFC maintenance service on round the clock basis for attending & rectifying the OFC fault in minimum downtime (including travel time) from the time of lodging the complaint to the representative of Bidder at their designated office. The maintenance bidder shall provide all assistance including providing manpower, transportation of men and materials etc. if required in the event of link failure due to any other reason.
- c. The Bidder shall provide conveyance facilities for maintenance, for transporting the manpower, tools/tackles, test/ measuring equipment and consumables like: OFC cable, Joint Closures, Jointing Pit, duct, couplers, etc. Suitable vehicle shall be available round the clock with each of the maintenance team. Vehicle should be in good working condition and shall not be more than five years old.
- d. The Bidder shall provide communication facilities to the maintenance teams. This shall include landline phone at office location and mobile phone to members of the maintenance teams for the purpose of contacting on an urgent need basis. The team-in-charge should have mobile phone of mobile operator whose coverage is available in the desired section and it should be always be on.
- e. The bidder will be required to carry out maintenance activities which include identification of OFC fault/cut on ground, obtaining permission from local authorities if required, excavation of earth to expose cable, laying of required length of OFC with protection wherever required, splicing of OFC, installation of Jointing pit & back filling of pit with sand, supply and installation of cable Route Markers and Joint Markers as per specification, testing of OFC and updating of OFC as-built drawings etc.
- f. The bidder shall arrange for logistics to provide facilities such as AC/DC power source, lighting arrangement, dewatering facility, DG sets etc, which may be required during the execution of maintenance job at site.
- g. Optimum functionality of maintenance teams is a prime necessity to carry out day to day maintenance of OFC links. OFC and accessories spares to cater for repair of at least 10 fibre cuts shall be maintained with each of these teams at all times.
- h. Bidder shall take insurance for all the workmen engaged under this contract and as per labour laws applicable from time to time.

2.25.6. MAINTENANCE – Methodology for Fault Restoration/ Fibre Cuts

Under OFC link cut condition, the following minimum activities shall have to be taken up by the bidder for its restoration for the end-to-end restoration of the network traffic/service:

- a. On receipt of information of fault in OFC the team stationed at the Communication Node shall move immediately for locating and rectifying fault as per the response time given below. The working fibres shall be restored first. Sufficient labour shall be engaged for speedy restoration. Adequate care shall be taken not to damage any other cable if laid in the same trench.
- b. For the identification of exact fault location on immediate basis, the OTDR measurement of spare fibre shall be made from the nearest telecom station/Node. For better clarity, the OTDR measurement on spare fibre shall be taken at Nodes / nearest OFC joints situated at both ends of cut and using dummy fibre spool of 1km, in case required.
- c. After the OTDR measurement, the as-built drawing shall be referred and the physical site of fault on ground shall be located. It may be possible that data in as-built document may not be correct for the accuracy purpose. As-built drawing shall be taken as reference only. No claim of bidder will be entertained on account of this. Accordingly, locating the OFC fault, the job of excavation in all types of soil, identification of OFC, blowing of cable, construction of jointing pits, splicing of OFC, back filling of trench & jointing-pit shall be taken up as per the standard procedure. This should be incorporated in the cable route plan also. The splicing of fibres is to be carried out in line with the installed fibre and measurements are to be taken on spare fibres. In case the active fibres are to be used, precautions are to be taken with regard to the power launched on to the fibre. Restoration of site shall be done to the entire satisfaction of designated Mahait personnel.
- d. In case of OFC cut where it is not possible to pull the cable from either end, the bidder has to make two pits/ splicing joints between the required lengths of new OFC to be laid between the two joints. The spacing of joints/ pits shall be depending up on situation at site and shall be as decided by Site Engineer. Remaining OFC has to be coiled in both the pits. Wherever new joint is provided or existing joint is attended for rectification during the maintenance period joint shall be buried to the depth of 1.2 Mtr. from the ground level in joint chamber
- e. After the completion of site activities, the bidder shall ensure the restoration of the traffic from Mahait NOC and thereafter, fresh OTDR measurement & traces (for 1310nm, 1550nm) shall be taken for all fibres & submitted to Mahait representative
- f. After the completion of site activities and hop test, the As-built drawing shall be updated by incorporating the new details like OFC loop used, Joint-pit location, etc. The length of loop in joint pit after fault restoration shall be incorporated in as built drawings
- g. After attending the fault & permanent restoration a Fault-Rectification report, jointly signed by Mahait & bidder, shall be generated for the closure of the complaint
- h. Any other job required for the restoration of the OFC fault/cut in totality is to be taken up by the bidder. In case the site condition is not favorable for the immediate restoration of the fault, the temporary restoration of the service fibres shall be taken up immediately with the approval of authorized representative of Mahait. Permanent restoration work will not be considered in breakdown time unless there is again link break during restoration job. Permanent restoration of joint pits is to be carried out by bidder within reasonable time of fault / OFC cut. In case the site is not conducive for permanent restoration some arrangement of manpower has to be done by bidder for safeguarding exposed OFC till permanent restoration. No extra payment shall be given to bidder on account of deployment of additional manpower In such case, further cut in that stretch will not be counted in SLA measurements as this is non attributable to PIA/ vendor.
- i. It is mandatory for the bidders to install the jointing chambers after permanent restoration is done.
- j. In case of any breakdown in the OFC network, bidder shall be responsible for obtaining approval from statutory authorities like Municipal Corporation, Development Authorities, Electricity Department PWD, NHAI and any other concerned authority as

- required for carrying out the repair. MahalIT can assist in getting permission for repair in few cases where there is urgency
- k. Drains, pipes, cables, overhead wires and similar services encountered in the course of the works shall be guarded by the bidder at his own cost, so that they may continue in full and uninterrupted use to the satisfaction of the Owners thereof.
 - l. Should any damage be done by the bidder to any AC power mains, utility pipelines cables or lines (whether above or below ground etc) whether or not shown on the drawings, the bidder must make good or bear the cost of making good the same without delay to the satisfaction of the Engineer-in-Charge
 - m. Bidder shall observe all national and local laws, ordinances, rules and regulations and requirements pertaining to the work and shall be responsible for extra costs arising from violations of the same
 - n. Bidder shall have at all times during the performance of the work, a competent supervisor at district level. Any instruction given to such supervisor shall be considered as having been given to the bidder
 - o. The Bidder shall employ as many personnel as required to comply with the local rules and administrative orders governing the Working Hours of Employment. The bidder shall be responsible for compliance with all statutory requirements including personnel related matters.
 - p. The minimum down time shall include time taken in restoration of fault/ cut caused by any means like miscreant activity at day or night, due to work done by any other organization, due to development of high losses/ break at existing joints, fault caused due to rodent, ant etc.
 - q. In case of partial damage of the cable or development of high loss in the working and spare fibre or cable cut at any time (day/night) by miscreants or by any agency, the responsibility of repairing the defective fibre lies with the bidder.
 - r. In case bidder fails to completely restore (as per original condition) or submit OTDR test (power level in live equipment) records to establish completion of work a penalty shall be levied for the work involved at site.
 - s. Examination of Finished Work. When finished work is taken down for the purpose of inspection for any reason, the bidder shall bear the entire expenses incidental thereto in the event that the said work is found to be defective. This situation may be applicable to both planned work as also to emergency restoration.
 - t. During the maintenance or fault rectification work, should any damage occur to the other cables, bidder is liable to pay compensation as demanded by the respective

2.26. SERVICE LEVEL AGREEMENT AND TARGETS

Details regardint the service levels and target have been detailed in Section

2.22. AUDIT AND SECURITY SERVICES

- 2.22.1. The PIA shall be required to provide comprehensive support to MahalIT during the Third Party Audit and Security Audit etc. The PIA shall be responsible in getting the required readiness built in the network during audit for security solutions.
- 2.22.2. MahalIT reserves the right to inspect, monitor and assess the progress and performance of the project either itself or through another designated agency as it may deem fit, throughout the course of the Contract. MahalIT may demand and upon such a demand being made, MahalIT shall be provided with any document, data material or any other information which it may require, to enable it to assess the progress of the project.
- 2.22.3. State/MAHAIT shall also have the right to conduct, either itself or through another agency as it may deem fit, an audit to monitor the performance of the PIA of its obligations/ functions in accordance with the standards committed to or required by MahalIT and the PIA undertakes to cooperate with and provide to MahalIT or any other agency appointed by USOF (DoT)/MahalIT, all documents and other details as may be required by them for this purpose

2.23. MIS REPORTS

The vendor/PIA shall submit the periodical reports on a regular basis in a mutually decided format. The following is an indicative list of MIS reports that may be submitted to MahalT.

2.28.1. Daily Reports

- a. Summary of issues/ complaints
- b. Summary of resolved/ unresolved and escalated issues/ complaints
- c. Summary of resolved/ unresolved and escalated issues/ complaints to vendors
- d. Summary fault/complain reported and pending at MahalT end

2.28.2. Weekly Reports

- a. Component wise IT infrastructure availability and resource utilization
- b. Summary of component wise network uptime
- c. Summary of changes in network
- d. Consolidated SLA/ (non) conformance report
- e. Summary fault/complain reported and pending at MahalT end.

2.28.3. Monthly Reports

- a. Consolidated SLA/ (non) conformance report
- b. Component wise IT infrastructure availability and resource utilization
- c. Summary of component wise network uptime
- d. Summary of changes in network
- e. Summary fault/complain reported and pending at MahalT end

2.28.4. Quarterly Reports

- a. Consolidated SLA/ (non) conformance report
- b. Component wise IT infrastructure availability and resource utilization
- c. Summary of component wise network uptime
- d. Summary of changes in network
- e. Summary fault/complain reported and pending at MahalT end

2.24. THIRD PARTY AGENCY FOR THE ACCEPTANCE TESTING CERTIFICATION

The Acceptance Testing (AT) for the GPs: MahalT shall have the right to appoint a TPA or its nominated agency or agency nominated by MahalT to carry out the inspection of work & integration of the GPs with NOC. TPA/ nominated agency shall submit the Acceptance Testing Report and Certificate to MahalT. Bidder will be provide all details / drawings / reports to TPA of AT agency of MahalT for testing & certification of network.

2.25. CRITICAL DATE FOR START OF WARRANTY AND O&M

The date of commissioning of equipment at GPs shall be reckoned for the start of Warranty of the said Block. In case some equipment at these locations are not commissioned due to reasons beyond control of bidder than site engineer / MahalT will decide date of start of warranty of all commissioned GPs. If less than 90% GPs are commissioned then decision for start of warranty of block will be decided by Managing Director, MahalT. If MahalT decides if some GPs are non-feasible or to be commissioned on alternate media then those will be excluded from purchase order. After expiry of one year of warranty, O&M shall start for that block. The vendor has to provide maintenance support, mentioned in the RFP document, after commissioning but before start of warranty, during warranty and during O&M as per provisions stipulated in the RFP.

2.26. MATERIAL RECONCILIATION

As per actual consumption, the material reconciliation, as mentioned above, will be done in stages. Wastages of 4% for Ducts and 1.5 % of OF Cable shall be allowed to take care of site level

contingency and non-usuable cut lengths. The final reconciliation shall therefore be required to be done for all the blocks and also for the entire package on commissioning of all GPs in the package. At the end of project block wise reconciliation will be before final payment of block or MahalT management may decide based on around realties.

2.27. GOVERNANCE MECHANISM

- 2.27.1. In order to ensure effective governance during execution of entire project, MahalT will clearly define roles and responsibilities amongst PMC, MahalT, Govt. agencies in APO with successful bidder.
- 2.27.2. Similarly MahalT will define work certification process with clear roles and responsibilities in the APO to minimize touch points for work & bills certification to enable payments within 7 days of submissions.
- 2.27.3. Periodic Review by the concerned Collector & District Magistrate to address any issues related to execution.
- 2.27.4. During periodic governance meeting, the project management consultant/ designated authorities shall define TAT and owners for all issues raised by partner for support & resolution. ***In case of delays for activities which have inter-linkages across packages/PIAs, project management consultant/ designated authorities would perform root cause analysis to assess which partner/ PIA delay is attributable to and concerned PIA would be penalized for the delay in milestone.***
- 2.27.5. Delays attributable to on-ground ROW challenges during execution & buyer related issues impacting project schedule shall be excluded from the project timeline.
- 2.27.6. MahalT shall define the SPOC for issue resolution and support through a single window clearance mechanism at the time of issue of APO.
- 2.27.7. ***Appropriate issue resolution procedures would be adequately defined as part of the project governance for tracking, root cause analysis, ownership, monitoring and resolution of all issues which arise during implementation. Appropriate logs (e.g. Hindrance Register) would be maintained by the designated stakeholders. The logs could be online (PM Tool)/ offline based on project operational requirements. Separate instructions would be issued to the bidders before the LOI.***

Annexure-A

Technical Specifications

Annexure A**Technical specifications**

Sub-section	Description
A – 1	Technical specifications for Optical Fibre, FDMS and accessories
A – 2	Technical specifications for Electronics equipment
A – 3	Technical specifications for Wi – Fi Access Points and Link Controller
A – 4	Technical specifications for Radio Implementation
A – 5	Technical specifications for VSAT
A – 6	Technical specifications for Cloud Infrastructure
A – 7	Technical specifications for Network Operation Centre (NOC) and DR NOC
A – 8	Technical specifications for B2B Business Support System (BSS)
A – 9	Technical specifications for Passive Infrastructure
A – 10	Technical specifications for Security

Annexure A: Technical Specifications

Sub-Section A – 1: Technical Specification for Optical Fibre, FDMS & Accessories

1. Generic requirement for 48F/96F metal free ribbon type optical fibre cable with double HDPE sheath (G.652.D Fibre), 24F/48F metal free optical fibre cable, 24F/48F core ADSS optical fibre cable, accessories and FDMS.

S.No	Item	Standards / TEC GR No.
1	24F/48F OF Cable	TEC/GR/OFC-23/01/XXX-2011 (under finalisation in TEC)
2	Aerial OF 48F/24F ADSS	TEC/GR/TX/OFC-022/02/MAR-17 with latest ammendments if any
3	Specification for Raw Material used in manufacturing of optical fibre cables.	GR No. TEC/GR/TX/ORM-01/04 SEP.09
4	96F/48F OF Cable Ribbon Type	TEC GR No. GR/OFC-05/02 MAR 2006 (96F/48F)
5	Tools for installation & Operating the OFC & for assembly of the OF Splice Closures.	GR No. GR/OFT-01/03. APR2006
6	Drum specifications for Cable ends.	GR No. G/CBD-01/02. NOV 94
7	Specifications for Splice Closure for Optical Fibre Cable	GR No. TEC/GR/TX/OJC-002/03/APR-2010
8	OTHER STANDARDS (EIA/IEC/Bell Core/CISPR/ISO etc.)	
9.1	Generic Requirement for Optical Fibre Cable (Bell Core)	GR-20-CORE Issue4, 2013
9.2	ITU-T Recommendations	ITU-T G.652D
9.3	Test Methods for Optical Fibres	IEC 811-5-1, IEC 794-1-2-E1 IEC 794-1-2-E2, IEC 794-1-2-E3 IEC 794-1-2-E4, IEC 794-1-2-E7 IEC 794-1-2-E10, IEC 794-1-E11 IEC 794-1-2-F1, IEC 794-1-2-F3 IEC 794-1-2-F5, IEC 60793-1-30 IEC 60793-1-31, IEC 60793-1-32 IEC 60793-1-33, IEC 60793-1-34 IEC 60793-1-47, IEC 60793-1-51 IEC 60793-1-52, IEC-60793-1-53 IEC -60793-2-50
9.4	Colour Standard	EIA 598-C
9.5	Test Method for Optical Fibre	EIA 455-104, EIA/TIA-455-73 EIA/TIA-455-181

S.No	Item	Standards / TEC GR No.
9.6	ISO 9001-2000 Test Methods for Optical Fibres International Quality Management System	ISO 175
9.7	Test Methods	FOTP-89, FOTP-181 ASTM D-566 ASTM D-790 ASTM D-1248 ASTM D-4565
10	Patch Cord Optical Fibre Jumpers	TEC GR No TEC/GR/TX/OFJ-01/05. NOV 2009
11	Fibre Termination Box	TEC GR No. GR/TX/FTB-02/02 APR-2010
12	HDPE material	GR no. TEC/GR/TX/ORM-01/04/SEP-09
13	PLB HDPE Duct	TEC GR No. TEC/GR/TX/CDS-008/03/MAR-11 with latest Amendments
14	PLB HDPE Duct Accessories Push fit Coupler	TEC GR no TEC/GR/TX/CDS-008/03/Mar11 with latest amendments.
15	End Cap	TEC GR No. TEC/GR/TX/CDS-008/03/MAR-11 with latest amendments.
16	Raw material used in the cable	GR No. TEC/GR/TX/ORM-01/04 SEP-09
17	Tension pole / Suspension pole assembly set (Tubular) / (Rail)	TEC GR No. TEC/GR/TX/OAF-001/03 Mar 2017
18	FDMS (Indoor) Type 1, Type 3B	As per TEC GR No. GR/FDM-01/02. APR 2007 with Amendment Dated 02.05.2012, with latest amendments if any.
19	FDMS (Outdoor)	GR No. TEC/GR/TX/FDM-003/01 MAR 2012
20	Electronic Route marker	TEC GR No.TEC/GR/TX/TIE-007/02.MAR-14 Construction: Ball type, with RFID Installation Fixable with Cable Tie on FDMS Outdoor, using a supplied Stainless Steel Cable Tie. Frequency/colour: 104.4 KHz, orange colour for Telecommunication cable

Note:

1. **For Package B and Package C - Self-supporting Metal Free Aerial Optical Fibre Cable (24F/ 48F ADSS):** Specification shall comply as per TEC GR "TEC/GR/TX/OFC-022/02/MAR-17, Type II A. Additionally, Anti-track PE material to be used for this product shall comply as per TEC GR No: TEC/GR/TX/ORM-01/04/SEP-09 with amendment issued on 28.03.2013. In case of OFC, OFC manufacturer who has valid TSEC / QF103 for any size of Aerial/ADSS cable & any design of Aerial/ADSS cable is eligible and can issue MAF to Bidders. But for supply purposes, OFC manufacturer shall obtain valid TSEC for all sizes/designs as specified by June 10, 2018.
2. **For Package A - Self-supporting Metal Free Aerial Optical Fibre Cable (24F ADSS):** Specification shall comply as per TEC GR "TEC/GR/TX/OFC-022/02/MAR-17, Type III A (for Palghar, Satara, and Sindhudurg districts), and TEC/GR/TX/OFC-022/02/MAR-17 Type II A (for Kolhapur, Nashik, Pune, Ratnagiri, Sangli, and Thane)". Additionally, Anti-track PE material to be used for this product shall comply as per TEC GR No: TEC/GR/TX/ORM-01/04/SEP-09 with amendment issued on 28.03.2013. In case of OFC, OFC manufacturer who has valid TSEC / QF103 for any size of Aerial/ADSS cable & any design of Aerial/ADSS cable is eligible and can issue MAF to Bidders. But for supply purposes, OFC manufacturer shall obtain valid TSEC for all sizes/designs as specified by June 10, 2018.

Self-supporting Metal Free Aerial Optical Fibre Cable (48F ADSS): Specification shall comply as per TEC GR "TEC/GR/TX/OFC-022/02/MAR-17, Type III A (for Palghar, Satara, and Sindhudurg districts). Additionally, Anti-track PE material to be used for this product shall comply as per TEC GR No: TEC/GR/TX/ORM-01/04/SEP-09 with amendment issued on 28.03.2013. In case of OFC, OFC manufacturer who has valid TSEC / QF103 for any size of Aerial/ADSS cable & any design of Aerial/ADSS cable is eligible and can issue MAF to Bidders. But for supply purposes, OFC manufacturer shall obtain valid TSEC for all sizes/designs as specified by June 10, 2018.

Sub-Section A - 1.1: Detailed technical specifications for 96F / 48F / 24F metal free ribbon and 24F / 48F metal free optical fibre cable with double sheath (G.652.D)

Introduction

This section describes the generic requirements of Metal free Ribbon Optical fibre cable (Non-Nylon Ribbon type) for underground installation in ducts. The cable shall have double HDPE jacketing anti-termite & anti-ratent (Optional) with glass yarn in between as reinforcement. The optical fibre cable shall be suitably protected for the ingress of moisture by WS yarn and WS tape. The raw material used in the cable shall meet the requirements of the GR for raw materials (GR No. TEC/GR/TX/ORM-01/04 SEP-09).

1. Technical specifications of underground optical fibre cable and related accessories

S.No	Item	Detail specifications / TEC GR
1	PLB Pipe (40/33 mm)	TEC/GR/TX/ CDS-008/03 March, 2011
2	Double Walled Corrugated (DWC) HDPE Duct(63mm(OD) / 51mm (ID)) (DWC) HDPE Duct(63mm(OD) / 51mm	GR/DWC-34/01-Sept.2007
3	Laying practice for underground optical fibre cable including Trenching, PLB pipe laying, splicing and other related works	As per Annexure B
4	Fibre Distribution Frame (FDF)	TEC/GR/TX/FDF-01/02/MAY-2010
5	OF Splice Protection Sleeve for optical fibre ribbon	TEC/GR/TX/PTS-02/03 JAN 2011
6	For Cable Locator	Supply of integrated Cable Route Locator and Marker locator of reputed make suitable to detect buried electronic RFID markers and have the ability to read, write on the Electronic RFID markers and also be able to detect the underground armored cables, live power cables.
7	For RFID Ball Markers	Supply of RFID based electronic marker of reputed make. The Rfid electronic marker's should have self-leveling design that ensures the marker is always in an accurate, horizontal position regardless of how it is placed into the ground and along with inbuilt programmable memory for saving the user specific data inside the RFID Marker Memory , later readable by marker locator during locating of the RFID marker.

Note:

1. **OFC manufacturer who has valid TSEC / QF103 for any size of ribbon cable is eligible and can issue MAF to bidders for all sizes / designs of ribbon cable subject submitting valid TSEC certificates before commencement of supplies.**
2. **For all passive items (Splitters, Radio equipment, Solar Panel, Batteries, and Charging Control Unit etc.) in case TSEC is not available, QF-103 obtained by the OEMs of bidders for the various tenders floated by BBNL/ BSNL in the last two years can be accepted for the items which are part of this RFP, provided that the technical specification remains unchanged. For items for which QF103 was submitted, TSEC certification would be submitted before commencement of supplies.**
3. **Inspection & QA Circle shall accept application for TSEC testing on the basis of documentary proof / undertaking submitted by the perspective bidders. Submission of Cable drums or test reports is not mandatory at the time of registration for TSEC.**

2. Functional Requirement:

- a. The design and construction of Optical fibre cable shall be inherently robust and rigid under all conditions of installation, operation, adjustment, replacement, storage and transport.
- b. The Ribbon Optical fibre cable shall be able to work in a saline atmosphere in coastal areas and should be protected against corrosion.
- c. Life of cable shall be at least 25 years. Necessary statistical calculations shall be submitted by the manufacturer, based upon life of the fibre and other component parts of the cable. The cable shall meet the cable aging test requirement.
- d. It shall be possible to operate and handle the Ribbon Optical fibre cable with tools as per GR No. GR/OFT-01/03 APR 2006 and subsequent amendment, if any. If any special tool is required for operating and handling the optical fibre cable the same shall be provided along with the cable.
- e. The Optical fibre cable supplied shall be suitable and compatible to match with the dimensions, fixing, terminating & splicing arrangement of the splice closure. The cable supplied shall also meet other requirement of splice closure (GR No.TEC/GR/TX/OJC-002/03/APR2010) and subsequent amendments, if any.
- f. The manufacturer shall submit an undertaking that the optical and mechanical fibre characteristics shall not change during the lifetime of the cable against the manufacturing defects.
- g. It is mandatory that the Optical fibre cable supplied in a particular route is manufactured from a single source of optical fibres.
- h. The Optical fibre cable shall be manufactured so as to protect the cable from rodent and termite.

3. Technical Requirements of Optical Fibres:

Single Mode Optical Fibre used in manufacturing optical fibre cables shall be as per ITU-T Rec.G.652.D. The specifications of optical fibres are mentioned below

3.1 Type of fibre

Single mode (Section -I of the GR No.TEC/GR/TX/ORM 01/04/SEP-09 and subsequent amendments, if any) (Wavelength band optimized nominal 1310 nm)

3.2 Geometrical Characteristics:

S.No.	Characteristics	Values
1	MFD	8.8-9.8 μm
2	Cladding Diameter	$125 \mu\text{m} \pm 1.0 \mu\text{m}$
3	Cladding Non-circularity	< 1%
4	Core Clad concentricity error	$\leq 0.6 \mu\text{m}$

5	Diameter over primary coated with double UV cured acrylate. (Shall be measured on uncoloured fibre)	$245 \mu\text{m} \pm 10 \mu\text{m}$
6	Coating / Cladding Concentricity	$\leq 12 \mu\text{m}$

Note: The thickness of colour coating may be over and above the values specified above, if the manufacturer adopts separate UV cured colouring process (to colour the un coloured fibres) other than the on line integrated colouring process (of secondary layer of primary coating) of the fibres, during fibre manufacturing.

3.3 Transmission Characteristics

3.3.1 Attenuation

a. Fibre attenuation before cabling

S.No.	Wavelength	Power
1	At 1310 nm	$\leq 0.34 \text{ dB/Km}$
2	Between 1285 to 1380 nm	$\leq 0.37 \text{ dB/Km}$
3	Between 1390 to 1525 nm	$\leq \text{Value at } 1310\text{nm}$
4	At 1550 nm	$\leq 0.21 \text{ dB/Km}$
5	Between 1525 to 1625 nm	$\leq 0.24 \text{ dB/Km}$

b. Water Peak Attenuation before cabling

S.No.	Wavelength	Power
1	Between 1380-1390nm	$\leq \text{Value at } 1310\text{nm}$

Note:

- Attenuation in the band 1380-1390nm shall be checked at every 2nm after Hydrogen ageing as per IEC 60793-2-50. Hydrogen ageing test is to be carried out by CACT, Bangalore or any other recognized laboratory for type test.
- Sudden irregularity in attenuation shall be less than 0.1 dB
- The spectral attenuation shall be measured on un-cabled fibre.
- The Spectral attenuation in the 1250 nm–1625 nm band shall be measured at an interval of 10nm and the test results shall be submitted.

c. Fibre attenuation after cabling

S.No.	Wavelength	Power
1	At 1310 nm	$\leq 0.36 \text{ dB/km}$
2	At 1550 nm	$\leq 0.23 \text{ dB/Km}$
3	At 1625 nm	$\leq 0.26 \text{ dB/Km}$

3.3.2 Dispersion:

a. Total Dispersion

S.No.	Wavelength	Dispersion
1	In 1285-1330 nm band	$\leq 3.5 \text{ ps/nm.km}$

2	In 1270-1340 nm band	$\leq 5.3 \text{ ps/nm. km}$
3	At 1550 nm	$\leq 18.0 \text{ ps/nm.km}$
4	At 1625 nm	$\leq 22.0 \text{ ps/nm.km}$

Note: The dispersion in the 1250 nm–1625 nm band shall be measured on un-cabled fibre at an interval of 10nm and the test results shall be submitted.

b. Polarization mode dispersion at 1310 & 1550 nm.

S.No.	Fibre Type	Dispersion
1	Fibre	$\leq 0.2 \text{ ps}/\sqrt{\text{km}}$
2	Cabled Fibre	$\leq 0.3 \text{ ps}/\sqrt{\text{km}}$

Note: Measurement on un-cabled fibre may be used to generate cabled fibre statistics and correlation established.

c. Zero Dispersion Slope: $\leq 0.092 \text{ ps}/(\text{nm}^2 \text{ Km})$.

d. Zero dispersion wave length range: 1300 -1324 nm.

3.3.3 Cut off wavelength for fibres used in cables: 1320 nm Max.

Note: The above cut off wavelength is w.r.t. 2M sample length of fibre.

3.3.4 Cable cut off wavelength: 1260nm Max.

3.4 Mechanical Characteristics:

S.No.	Characteristics	Value
1	Proof test for minimum strain level	1% (Test method IEC–60793-1–30)
2	Peak Strip ability force to remove primary: coating of the fibre. (Test method IEC–60793-1-32)	$1.3 \leq F \leq 8.9 \text{ N}$
3	Dynamic Tensile Strength (Test method IEC–60793-1-31)	a) Un-aged : $\geq 550 \text{ KPSI (3.80 Gpa)}$ b) Aged : $\geq 440 \text{ KPSI (3.00 GPa)}$
4	Dynamic Fatigue (Test method IEC- 60793 - 1-33)	≥ 20
5	Static Fatigue (Test method IEC-60793 - 1-33)	≥ 20
6	Fibre Macro bend (Test method FOTP– 62/ IEC- 60793-1-47)	a) Change in attenuation when fibre is coiled with : $\leq 0.05 \text{ dB}$ at 1550nm 100 turns on $30 \pm 1.0 \text{ mm}$ radius mandrel : $\leq 0.5 \text{ dB}$ at 1625nm b) Change in attenuation when fibre is coiled with : $\leq 0.5 \text{ dB}$ at 1550nm 1 turn around $32 \pm 0.5 \text{ mm}$ diameter mandrel : $\leq 1.0 \text{ dB}$ at 1625nm
7	Fibre Curl: meters radius of curvature (Test method as per IEC 60793-1-34	≥ 4

3.5 Material properties

3.5.1 Materials:

- a. The substance of which the fibres are made: To be indicated by the manufacturer.
- b. Protective material requirement:
- The physical and chemical properties: It shall meet requirement of fibre of the material used for fibre primary coating.
- The best way of removing protective: To be indicated by the manufacturer.
- coating material
- Group refractive index of fibre: To be indicated by the manufacturer.

3.6 Environmental Characteristic of Fibre (Type test):

3.6.1 Operating Temperature

(Test Method IEC – 60793 – 1-52)

Temperature Dependence of Attenuation :	- 60°C to +85°C
Induced Attenuation at 1550 nm at -60°C to +85°C :	≤ 0.05 dB/km

3.6.2 Temperature – Humidity Cycling

(Test method /EIA/TIA-455-73)

Induced Attenuation at 1550 nm at -10°C to +85°C :	≤ 0.05 dB/km
And 95% relative humidity.	

3.6.3 Water Immersion 23°C

(Test method IEC- 60793 – 1 -53)

Induced Attenuation at 1550 nm due to water Immersion at 23 ± 2°C : ≤ 0.05 dB/km

3.6.4 Accelerated Aging (Temperature) 85°C

(Test method IEC- 60793 – 1 - 51)

Induced Attenuation at 1550 nm due to Temperature Aging at 85 ± 2°C:	≤ 0.05 dB/km
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3.6.5 Retention of Coating Colour

(Test method IEC- 60793 – 1 - 51)

Coated Fibre shall show no discernible change in colour, when aged for relative and then 20 days in 85°C dry heat.
humidity.

3.7 Colour Qualification and Primary coating Test:

3.7.1 Colour Qualification Test:

- **MEK Rub Test (Methyle Ethyl Ketone Test)**

To be tested by using soaked (Solvent) tissue paper for ten strokes unidirectional on 10 cm length of fibre. No colour traces shall be observed on the tissue paper after testing.

- **Water immersion Test (Type Test)**

To be tested for coloured fibre for 30 days. After the test Colour qualification, Attenuation measurement & Strip ability test are to be taken.

3.7.2 Primary coating Test:

- Fourier Transform Infrared Spectroscopy (FTIR) Test**

To be tested to check the curing level of coating on the surface of natural fibre. The curing level shall be better than 90%.

- Adhesion Test**

To be tested by using soaked (Solvent) tissue paper for ten strokes unidirectional on 10 cm length of fibre. No coating shall be observed on the tissue paper after testing.

3.8 Ribbon Structure:

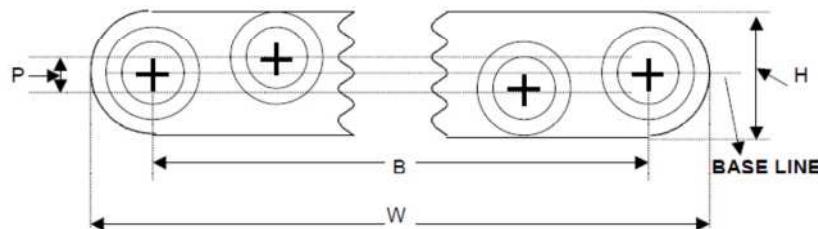
3.8.1 A group of primary coated fibres shall be arranged in ribbon structure. The fibres in the structure shall be parallel and shall not cross over each other along the entire length of the ribbon. The dimensions of 6 fibres ribbon shall be as per the Bell Core document no. GR-20-Core issue 4, 2013 with latest version and as given below:

3.8.2 Ribbon Dimensions

The maximum dimensions of fibre ribbon shall be as follows and the cross section geometry of the fibre ribbon shall be as shown in the following figure:

Table - Maximum Ribbon Dimensions

Number of Fibers per Ribbon	Ribbon Width w (μm)	Ribbon Height h (μm)	Fiber Alignment	
			Extreme Fibers b (μm)	Planarity p (μm)
6	1648	360	1310	50



Cross section of Fibre Ribbon

3.8.3 Ribbon Material

The ribbon shall be manufactured using single mode optical fibres coloured with UV cured resin and the ribbon shall be encapsulated with a further layer of UV cured acrylate. The fibres and the ribbons shall confirm to the colour requirement as per clause no. 4.4 of this GR.

3.8.4 Ribbon mechanical properties

a. **Ribbon Macro-bend**

Change in attenuation when wrapped on a 60 mm diameter mandrel for 100 turns at 1310 & 1550 nm : $\leq 0.05\text{dB}$

- b. Ribbon Compression Resistance
Change in attenuation when subjected to a compressive load of 500 N at 1310nm & at 1550nm: ≤ 0.05 dB
- c. Ribbon Torsion Resistance
Change in attenuation (At 1310 nm & 1550 nm): ≤ 0.05 dB

3.9 Ribbon Optical Fibre Cable Construction Specifications for Dry core which will be procured through this tender:

General: The Metal Free optical fibre cable shall be designed to the parameters mentioned in Sub-Section A-1.3. The manufacturer shall submit designed calculations and the same shall be studied and checked.

TYPICAL STRUCTURAL DRAWING FOR 48 FIBRE OF DRY CORE CABLE



TYPICAL STRUCTURAL DRAWING FOR 96 FIBRE OF DRY CORE CABLE



3.9.1 Secondary protection:

The primary coated Ribbon fibres may be protected by loose packaging within tube, which shall be filled with thixotropic jelly. The dimensions of tube shall be as per **Sub-Section A-1.3**.

3.9.2 No. of fibres in cable: 48 & 96.

- a) Numbers of pair per ribbon: Six (6) fibres.
- b) The number of ribbons per loose tube in ribbon optical fibre cable shall be as follows:

S.No.	No. of fibres	Multi Loose type
1	48	4 tubes and 1 Filler 2 ribbon per tube
2	96	4 tubes and 1 Filler 4 ribbon per tube

3.9.3 Strength Member:

- a) Solid FRP non - metallic strength member shall be used in the centre of the cable core. The strength member in the cable shall be for strength and flexibility of the cable and shall have anti-buckling properties. The FRP shall keep the fibre strain within permissible values. The size of FRP shall be as per Sub-section A – 1.3
- b) Impregnated Glass Fibre Reinforcement are used to achieve the required tensile strength of the optic fibre cables over the cable inner sheath to provide peripheral reinforcement along with Solid Rigid FRP Rod in the centre at cable core. These flexible strength members shall be Nonwater blocking type. The use of Solid Rigid FRP Rod(s) is mandatory in Optical Fibre cable design. Impregnated Glass Fibre Reinforcement used shall be equally distributed over the periphery of the cable inner sheath. It shall be applied helically and shall provide full coverage to inner sheath to provide rodent protection. The quantity of the Impregnated Glass fibre Reinforcement used per km length of the cable along with its dimensions shall be as per Sub-section A – 1.3.. The specification of the glass roving shall be as per Section XII of GR No. TEC/GR/TX/ORM-01/04 SEP.09 and as per other details given in the Sub-section A – 1.3.

3.9.4 Cable Core Assembly

Primary coated fibres in loose tubes stranded together around a central strength member using helical or reverse lay techniques shall form the cable core. The dimensions of FRP and stranding pitch shall be as per Sub-section A – 1.3.

3.9.5 Core Wrapping

The main cable core containing Ribbon fibres shall be wrapped by a layer / layers of Water Swellable tape. The nylon/polyester binder tape/thread/PP tape shall be used to hold the tape, if required. The core wrapping shall not adhere to the secondary fibre coating and shall not leave any kink marks over the loose tube.

3.9.6 Moisture barrier (protection)

The main cable core (containing loose tubes stranded around central strength member) shall be protected by water swellable yarns over FRP (central strength member) and by a layer of water swellable tape.

3.9.7 Filling compound

The filling compound used in the loose tube shall be compatible to fibre, secondary protection of fibre, core wrapping and other component part of the cable. The drip point shall not be lower than +70°C. The fibre movement shall not be constrained by stickiness & shall be removable easily for splicing. Reference test method to measure drop point shall be as per ASTM D 566. The thixotropic filling compound (jelly) shall be as per the GR No. TEC/GR/TX/ORM-01/04/SEP-09 and subsequent amendment issued, if any.

3.9.8 Inner Sheath:

A non-metallic moisture barrier sheath may be applied over and above the cable core. The core shall be covered with tough weather resistant High Density Polyethylene (HDPE) sheath, black in colour (UV Stabilized) and colour shall confirm to Munsell colour standards. Thickness of the sheath shall be uniform & shall not be less than 0.9 mm. The sheath shall be circular, smooth, and free from pin holes, joints, mended pieces and other defects. Reference test method to measure thickness shall be as per IEC 189 para 2.2.1 and para 2.2.2.

Note: HDPE material, black in colour, from the finished cable shall be subjected to following tests (on sample basis) and shall confirm to the requirement of the material as per GR No. TEC/GR/TX/ORM-01/04 SEP.09.

- Density
- Melt flow index
- Oxidative Induction time
- Carbon black content
- Carbon black dispersion
- ESCR
- Moisture content
- Tensile strength and elongation at break

3.9.9 Glass Reinforcement

Impregnated Glass Fibre Reinforcement are used to achieve the required tensile strength of the optic fibre cables over the cable inner sheath to provide peripheral reinforcement along with Solid Rigid FRP Rod in the centre at cable core. These flexible strength members shall be Non-water blocking type. The use of Solid Rigid FRP Rod(s) is mandatory in Optical Fibre cable design. Impregnated Colour Coated Glass Fibre Reinforcement used shall be equally distributed over the periphery of the cable inner sheath. It shall be applied helically and shall provide full coverage to inner sheath to provide rodent protection. The quantity of the Impregnated Glass fibre Reinforcement used per km length of the cable along with its dimensions shall be as per Sub-section A – 1.3. The specification of the glass roving shall be as per Section XII of GR No. TEC/GR/TX/ORM-01/04 SEP.09 and as per other details given in the Subsection E.

3.9.10 Outer Sheath:

A non-metallic moisture barrier sheath (black in colour) shall be applied over the inner sheath, which shall consist of tough weather resistant made High Density Polyethylene compound (HDPE) which is Anti-termite. The outer sheath shall be UV stabilized and the colour shall confirm to Munsell colour standards. The thickness of the outer sheath shall not be less than 1.5 mm .The outer sheath shall be uniform, circular, smooth, free from pin holes, joints mended pieces and other defects The reference test method to measure thickness shall be as per IEC 811-5-1.

Note: HDPE material from finished product shall be subjected to following tests (on sample basis) and shall confirm to the requirement of the material as per the GR no. TEC/GR/TX/ORM-01/04/SEP-09 (Section-III):

- Density
- Melt flow index
- Oxidative Induction time
- Carbon black content
- Carbon black dispersion
- ESCR
- Moisture content
- Tensile strength and elongation at break

Note: The outer jacket of HDPE shall be able to protect the cable from attack by termites. Manufacturer shall provide the details of doping material used and same shall be verified during bulk testing. The outer sheath shall be termite protected. The surface of the sheath shall be smooth and free of defects such as cracks, blisters, etc. The cable shall be rodent protected. As specified in various clauses of the Technical specifications of the OF cable, it is to be clarified that the HDPE Outer Jacket shall be anti-termite with/without dopants. Addition of dopants for anti-rodent property is optional. The tests as per clause 4.28 shall be carried out as applicable.

3.9.11 **Cable diameter**

The finished cable diameter shall be as per Sub-section A – 1

3.9.12 **Cable Weight**

The nominal cable weight shall be as per Sub-section A – 1.3

3.9.13 **RIP Cord:**

Four suitable ripcords shall be provided in the cable, which shall be used to open the both HDPE sheath of the cable. Two ripcords shall be placed diametrically opposite to the each other at below the outer Jacket & two ripcords shall be placed at below inner sheath. It shall be capable of consistently slitting the sheath without breaking for a length of 1meter at the installation temperature. The ripcords (3ply & twisted for outer sheath and suitable ripcord for inner sheath) shall be properly waxed to avoid wicking action and shall not work as water carrier.

The ripcords used in the cable shall be readily distinguishable from any other components utilized in the cable construction.

4. Mechanical characteristics and Tests on optical fibre cable:

Note: All observations are to be taken at 1550nm wavelengths. Change in attenuation value at 1550nm to be taken after conducting all mechanical tests.)

4.1. **Tensile strength Test:**

Objective : This measuring method applies to optical fibre cables which are tested at a particular tensile strength in order to examine the behaviour of the attenuation as a function of the load on a cable which may occur during installation.

Method : IEC 60794-1-2-E1.

Test Specs. : The cable shall have sufficient strength to withstand a load of value T(N) = 3000 Newton . The load shall be sustained for 10 minutes and the strain of the fibre monitored.

Requirement : The load shall not produce a strain exceeding 0.25% in the fibre and shall not cause any permanent physical and optical damage to any component of the cable. The attenuation shall be noted before strain and after the release of strain. The change in attenuation of each fibre after the test shall be ≤ 0.05 dB both for 1310 nm and 1550 nm wavelength.

4.2. **Abrasion Test:**

Objective : To test the abrasion resistance of the sheath and the marking printed on the surface of the cable.

Method : IEC-60794-1-2-E2 or by any other international test method

Test Specs : The cable surface shall be abraded with needle (wt. 150 gm) having diameter of 1 mm with 500 grams weight (Total weight more than equal 650 gms.) No. of cycles: 100 Duration: One minute (Nominal)

Requirement : There shall be no perforation & loss of eligibility of the marking on the sheath.

4.3. **Crush Test (Compressive Test):**

Objective	: The purpose of this test is to determine the ability of an optical fibre cable to withstand crushing.
Method	: IEC 60794-1-2-E3.
Test Specs	: The fibres and component parts of the cable shall not suffer permanent damage when subjected to a compressive load of 2000 Newton applied between the plates of dimension 100 x 100 mm. The load shall be applied for 60 Secs. The attenuation shall be noted before and after the completion of the test.
Requirement	: The change in attenuation of the fibre after the test shall be ≤ 0.05 dB both for 1310 nm and 1550 nm wavelength.

4.4. Impact Test:

Objective	: The purpose of this test is to determine the ability of an optical fibre cable to withstand impact.
Method	: IEC 60794-1-2-E4.
Test Specs	: The cable shall have sufficient strength to withstand an impact caused by a mass weight of 50 Newton, when falls freely from a height of 0.5 meters. The radius R of the surface causing impact shall be 300 mm. 10 such impacts shall be applied at the same place. The attenuation shall be noted before and after the completion of the test.
Requirement	: The change in attenuation of the fibre after the test shall be ≤ 0.05dB both for 1310 nm and 1550 nm wavelength.

4.5. Repeated Bending:

Objective	: The purpose of this test is to determine the ability of an optical fibre cable to withstand repeated bending.
Method	: EIA-455-104.
Test Specs.	: The cable sample shall be of sufficient length (5 m minimum) to permit radiant power measurements as required by this test. Longer lengths may be used if required.
Parameters	:
Weight	: 5 Kg
Minimum distance from Pulley centre to holding device	: 216mm
Minimum distance from Wt. to Pulley centre	: 457mm
Pulley Diameter	: 20 D (D - cable diameter)
Angle of Turning	: 90o
No. of cycles	: 30
Time required for 30 cycles	: 2 min
Requirement	: During the test no fibre shall break and the attenuation shall be noted before and after the completion of the test. The change in attenuation of the fibre after the test shall be ≤ 0.05 dB both for 1310 nm and 1550 nm wavelength.

4.6. Torsion Test:

Objective	: The purpose of this test is to determine the ability of an optical fibre cable to withstand torsion.
Method	: IEC 60794-1-2-E7.
Test Specs.	: The length of the specimen under rest shall be 2 meters and the load shall be 100 N. The sample shall be mounted in the test apparatus with cable clamped in the fixed clamp sufficiently tight to prevent the movement of cable sheath during the test. One end of the cable shall be fixed to the rotating clamp which shall be rotated in a clock wise direction for one turn. The sample shall then be returned to the starting position and then rotated in an anti-clock wise direction for one turn and returned

to the starting position. This complete movement constitutes one cycle. The cable shall withstand 10 such complete cycles. The attenuation shall be noted before and after the completion of the test.

Requirement : The cable shall be examined physically for any cracks tearing on the outer sheath and for the damage to other component parts of the cable. The twist mark shall not be taken as damage. The change in attenuation of the fibre after the test shall be ≤ 0.05 dB both for 1310 nm and 1550 nm wavelength.

4.7. Kink Test:

Objective : The purpose of this test is to verify whether kinking of an optical fibre cable results in breakage of any fibre, when a loop is formed of dimension small enough to induce a kink on the sheath.

Method : IEC 60794-1-2-E10.

Test Specs. : The sample length shall be 10 times the minimum bending radius of the cable. The sample is held in both hands, a loop is made of a bigger diameter and by stretching both the ends of the cable in opposite direction, the loop is made to the minimum bend radius so that no kink shall form. After the cable comes in normal condition, the attenuation reading is taken.

Requirement : The kink should disappear after the cable comes in normal condition. The change in attenuation of the fibre after test shall be ≤ 0.05 dB both for 1310 nm & 1550 nm wavelength.

4.8. Cable Bend Test:

Objective : The purpose of this test is to determine the ability of an optical fibre cable to withstand repeated flexing. The procedure is designed to measure optical transmittance changes and requires an assessment of any damage occurring to other cable components.

Method : IEC 60794-1-2-E11 (Procedure-I).

Test Specs. : The fibre and the component parts of the cable shall not suffer permanent damage when the cable is repeatedly wrapped and unwrapped 4 complete turns of 10 complete cycles around a mandrel of 20 D, where D is the diameter of the cable. The attenuation shall be noted before and after the completion of the test.

Requirement : The change in attenuation of the fibre after the test shall be ≤ 0.05 dB both for 1310 nm and 1550 nm wavelength. Sheath shall not show any cracks visible to the naked eye when examined whilst still wrapped on the mandrel.

4.9. Temperature Cycling (Type Test):

Objective : To determine the stability behaviour of the attenuation of a cable subjected to temperature changes which may occur during storage, transportation and usage.

Method : IEC 60794-1-2-F1 (To be tested on Standard cable length & drum i.e 2Km. $\pm 10\%$)

Test Specs. : The permissible temperature range for storage and operation will be from -20°C to +70°C. The rate of change of temperature during the test shall be 10°C per minute approx. The cable shall be subjected to temperature cycling for 12 Hrs. at each temperature as given below:

TA2 temp. : -20°C TAt temp. : -10°C. TB1 temp. : + 60°C. T B2 temp. : + 70°C. The test shall be conducted for 2 cycles at the above temperatures.

Requirement : The change in attenuation of the fibre under test shall be ≤ 0.05 dB for 1310 nm and 1550 nm wave length respectively for the entire range of temperature.

4.10. Cable aging Test (Type Test):

Objective	: To check the cable material change dimensionally as the cable ages.
Method	: At the completion of temperature cycle test, the test cable shall be exposed to 85 ± 2 degree C for 168 hours. The attenuation measurement at 1310 & 1550 nm wave length to be made after stabilization of the test cable at ambient temperature for 24 hours.
Requirement	: The increase in attenuation allowed: ≤ 0.05 dB at 1310 and 1550 nm.

Note: The attenuation changes are to be calculated with respect to the base line attenuation values measured at room temperature before temperature cycling

4.11. Water Penetration Test (Type Test):

Objective	: The aim of this test is to determine the ability of a cable to block water migration along a specified length.
Method	: IEC 60794-1-2-F5
Test Specs	: A circumferential portion of the inner HDPE cable end shall face the water head. The water tight sleeve shall be applied over the cable. The cable shall be supported horizontally and one meter head of water, containing a sufficient quantity of water soluble fluorescent dye for the detection of seepage, shall be applied on the inner HDPE sheath for a period of 7 days at ambient temperature. No other coloured dye is permitted. Note: For bulk testing, 24 hours as duration of test shall be considered.
Requirement	: No dye shall be detected when the end of the 3m length of the cable is examined with ultraviolet light detector. The cable sample under test shall be ripped open after the test and then it shall be examined for seepage of water into the cable and the distance to be noted.

4.12. Test of Figure of 8 (Eight) on the cable (Type Test):

Objective	: Check of easiness in formation of figure of 8 of the cable during installation in the field.
Test Method	: 1000 meter of the cable shall be uncoiled from the cable reel and shall be arranged in figure of 8 (eight) shape. The diameter of each loop of the figure of 8 shall be maximum 2 meters.
Requirement	: It shall be possible to make figure of 8 of minimum 1000 meters of the cable uncoiled from the cable reel without any difficulty. No visible damage shall occur.

4.13. Flexural Rigidity Test on the optical fibre cable (Type Test):

Objective	: To check the Flexural Rigidity of the metal free optical fibre cable.
Method	: To be tested as per ASTM D –790
Test Specs	: The fibre and the component parts of the cable shall not suffer permanent damage in the cable subjected to Flexural Rigidity Test as per the above method. The attenuation shall be noted after and before the completion of the test.
Requirement	: The change in attenuation of the fibre after the test shall be < 0.05 dB at 1310nm and 1550nm wavelengths. The sheath shall not show any cracks visible to the naked eye.

4.14. Static Bend test (Type Test):

Objective	: To check the Cable under Static Bend.
Method	: As per the clause no 4.8 of the GR alternatively as per ASTM D790.

Test Specs : The cable shall be subjected to static bend test. The optical fibre cable shall be bend on a mandrel having a Diameter of 10 D (D is diameter of the cable).

Requirement : The change in attenuation of the fibre after the test shall be ≤ 0.05 dB for 1310 nm and 1550 nm wavelengths. Sheath shall not show any cracks visible to the naked eye when examined whilst still wrapped on the mandrel.

4.15. Cable Jacket Yield Strength and Ultimate Elongation:

Objective : To determine the yield strength and elongation of the polyethylene (HDPE) cable sheath (jacket).

Test Method : FOTP-89 or ASTM 1248 Type III class

Test Condition : 1. Sample shall be taken from a completed cable. The aged sample shall be conditioned at $100 \pm 2^\circ\text{C}$ for 120 hours before testing. 2. The cross-head speed shall be 50 mm per minute.

Requirement:

Jacket material	Minimum yield strength		Minimum Elongation (%)
	(Mpa)	(psi)	
HDPE-unaged	16.5	2400	400
HDPE aged	12.4	1800	375

4.16. To Check of the quality of the loose tube (containing ribbon optical fibre) (Type Test):

a. Embrittlement Test

This test method is based on bending by compression and reflects embrittlement much better than the other tensile tests. This test is independent of wall thickness of the loose tube.

Sample: The minimum length of the test sample depends on the outside diameter of the loose tube and should be 85 mm for tubes up to 2.5 mm outside dia. The length of the bigger tubes should be calculated by using the following equation:

$$Lo > 100 \times \frac{[(D^2 + d^2)]^{1/2}}{4} \text{ where}$$

Lo = Length of tube under test.

D = Outside dia of loose tube.

d = Inside dia of loose tube.

Procedure : Both the ends of a buffer tube test sample may be mounted in a tool, which is clamped in jaws of a tensile machine which exerts a constant rate of movement. The movable jaw may move at a rate of 50 mm per minute toward the fixed jaw. Under load, the tube will bend so that it is subjected to tensile and compressive stresses. The fixture for holding the tube should be designed in a manner that the tube might bend in all directions without further loading.

Requirement : The tube should not get embrittled. No kink should appear on the tube up to the safe bend diameter of tube (15 D), where D is the outside diameter of the loose tube. There should also not be any physical damage or mark on the tube surface.

b. Kink Resistance Test on the Loose Tube

Objective : To safeguard the delicate optical fibres, the quality of the loose tube material should be such that no kink or damage to the tube occur while it is being handled during installation and in splicing operations.

Procedure : To check the kink resistance of the loose tube, a longer length of the loose tube is taken (with fibre and gel), a loop is made and loop is reduced to the minimum bend radius of loose tube i.e. 15 D (where D is the outside diameter of the loose tube). This test is to be repeated 4 times on the same sample length of the loose tube.

Requirement : No damage or kink should appear on the surface of the tube.

4.17. Ribbon Dimension Measurements test (Type Test):

Objective : To check the fibres in ribbon structure, fibres cross over and fibre identity to ensure the transmission performance and mechanical service life of the fibre in the ribbon structure.

Test method : FOTP-123 (Video Gray Scale Analysis (VGSA) or Microscopic method).
Requirement : It shall meet the dimensional requirements given in clause no.3.8.2 of this GR. The fibres in the entire length of the ribbon shall not cross over at any point.

4.18. Ribbon Resistance to Twist (Robustness) test (Type Test):

Objective : To check the robustness of the fibre ribbons to withstand the twist during installation conditions and to check the structural integrity of the ribbon over the deployed length for mid-span entry, maintenance purposes, consideration in rearrangements and housekeeping.

Test method : FOTP-141.
Requirement : The un-aged and aged (at $85 \pm 2^\circ\text{C}$ with uncontrolled humidity for a period of 30 days) completed ribbon shall not show any separation of individual fibres from the ribbon structure after completion of the twist test when observed under 5X magnification.

4.19. Ribbon Residual Twist (Flatness) Test (Type Test):

Objective : To check the dimensional integrity of the ribbon without twisting to allow rearrangements and to limit the potential attenuation increases due to a macro-bending caused by twisting of the fibre ribbon.

Test Method : FOTP-131.
Requirement : The aged (at $85 \pm 2^\circ\text{C}$ with uncontrolled humidity for a period of 30 days) ribbon residual twist (if any) shall have a pitch : > 400 mm.

4.20. Ribbon Separation Test (Type Test):

Objective:

- To check the separation of individual fibres, separation of sub-unit of fibres and mid span separation from a fibre ribbon.
- To check the retention of sufficient colorant for identification for any 2.5 cm length of fibre after separation for individual and sub-unit of fibres.

Test to be conducted for:

- Separation of any single fibre or a multi-fibre subgroup by a tool or by hand from a ribbon for a length of 1 meter. Midspan separation from a 2 meter sample, separated close to middle for at least 0.5 meter (both single fibre and the three fibre sub – units) for un-aged ribbon.

Requirement: The un-aged ribbon of minimum length of a 0.3 meter (1.0foot) of an individual fibre and a sub group of three fibres shall be separated from the ribbon without breaking the fibres or damaging the fibre coating. The force required to perform separation shall not exceed 4.4 N. The area at the separation shall not show any damage to the fibre coating when examined under 5X magnification.

- Retention of the Colour and Fibre Identification after separation.
- Requirement: Individual fibre colour identification shall be maintained after the separation test. It shall retain sufficient colorant that any 2.5 cm length is readily identifiable.
- Removal of Ribbon matrix material to access individual fibres.
Requirement: No damage shall occur either to fibre coating or the fibres. The coating shall not sustain any swelling self-stripping, cracking or splitting when examined under 5X magnification.

Note: The manufacturer shall recommend the procedure for the removal of ribbon matrix.

4.21. Ribbon Stripability Test (Type Test):

Objective	: Check of removal of the matrix material and the fibres protective coating mechanically with commercial stripping tools from unaged and aged ribbons.
Test Method Pre Conditioning	: GR-20-CORE issue 4, 2013 : 1) Aged samples: The humidity of aged ribbons shall be soaked at 85 ± 2 °C and a non-condensing humidity of 85 ± 5 % for a period of 30days. 2) Water aged samples: The water aged ribbons shall be soaked in deionizador distilled water at a temperature of 23 ± 5 °C for a period of 14 days. The fibre ribbon strip-ability testing shall be conducted at standard atmospheric conditions. The un-aged, humidity – aged, and water aged ribbons shall be tested within eight hours after aging.
Requirement	: There shall be no fibre breakage and any coating residue shall be removable with a single isopropyl alcohol wipe when at least 25 mm of the matrix material and the fibre Protective coating is mechanically removed with commercial stripling tools from un-aged and aged ribbons.

4.22. Ribbon Macro-bend Performance

Objective	: To check the macro-bend performance of a ribbon.
Method	: One hundred turns of ribbon are wound around a 60 mm diameter ribbon and the loss increase at 1310 nm & 1550 nm shall be measured.
Requirement	: The change in attenuation of the fibre shall be ≤ 0.05 dB, for 1310 nm and 1550 nm wavelengths.

4.23. Torsion Resistance of the ribbon Test (Type Test):

Objective	: To check the torsion resistance of the ribbon.
Method	: One meter length of ribbon is twisted to through five revolutions of 360° and measurement is taken.
Requirement	: The change in attenuation of the fibre shall be ≤ 0.05 dB, for 1310 nm and 1550 nm wavelengths.

4.24. Crush Resistance of Ribbon (Type Test):

Objective	: To check the crush resistance of the ribbon.
Method	: A 50 mm^2 sample is subjected to a load of 500 N and the attenuation measurement taken for both 1310 nm & 1550 nm wavelengths.
Requirement	: The change in attenuation of the fibre shall be ≤ 0.05 dB, for 1310 nm and 1550 nm wavelengths.

4.25. Drainage Test for Loose Tube and Drip test on the cable (Type Test):

a. Drainage Test for loose Tube

Sample Size: 30 cm tube length.

Test procedure:

1. Cut the tube length to 40 cm.
2. Fill the tube with the tube filling gel ensuring that there are no air bubbles and the tube is completely full.
3. Place the filled tube in a horizontal position on a clean worktop and cut 5 cm from either end so that the finished length of the sample is 30 cm.
4. Leave the filled tube in a horizontal position at an ambient temperature for 24 hrs. (This is necessary because the gel has been sheared and the viscosity has been reduced during the filling process).
5. The sample tube is then suspended vertically in an environment heat oven over a weighed beaker. It is left in the oven at a temperature of 70°C for a period of 24 Hrs. At the end of the 24 hrs period the beaker is checked and weighed to see if there is any gel in the beaker.

Results:

1. If there is no gel or oil in the beaker the tube has PASSED the drainage test.
2. If there is gel or oil in the beaker the tube has FAILED the drainage test.

b. Drip test on the cable

Objective	: The purpose of this test is to determine the ability of jelly in the O.F. cable to withstand a temperature of 70 degree C.
Method	: Take a sample of 30 cm. length of the cable with one end sealed by end cap. Remove outer black sheath, binder tapes for 5 cm from open end of the sample. Clean the jelly. Then the sample is kept vertically with open end downwards in the oven for 24 hours at 70o C with a paper under the sample.
Test Specs	: Examine the paper placed below the cable inside the oven for dripping of the jelly after 24 hours. There should be no jelly drip or oily impression on the paper.

4.26. Check of easy removal of sheath:

Objective	: Check of the easy removal of sheath of the fibre optic cable by using normal sheath removal tool.
Procedure	: To check easy removal, the sheath shall be cut in circular way and the about 300 mm length of the sheath should be removed in one operation. It should be observed during sheath removal process that no undue extra force is applied and no component part of the cable is damaged. One should be able to remove the sheath easily.

4.27. Check of the effect of aggressive media on the cable (Acidic and Alkaline Behaviour) (Type Test):

Procedure	: To check the effect of aggressive media, solution of PH4 and PH10 shall be made. The two test samples of the finished cable, each of 600 mm in length, are taken and the ends of the samples are sealed. These test samples are put in the PH4 and PH10 solutions separately. After 30 days these samples are taken out from the solutions and examined for any corrosion etc on the sheath and other markings of the cables. (Test method no. ISO175).
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Requirement : The sample should not show any effect of these solutions on the sheath and other marking of the cable.

4.28. Termite & Rodent Test (Type Test):

The Anti-rodent (Optional) test shall be checking the uniformity of application of glass rowing yarns around the periphery of inner sheath. The test shall be carried out by MahalT QA during type testing or can be carried out at any recognized lab on finished cable and in addition, manufacturer shall also give an undertaking in this respect.

The reports shall be submitted by the manufacturers. Termite resistance shall be provided with an additive/without additive in outer sheath and rodent protection shall be provided with Glass roving yarns around the periphery of inner sheath and these yarns should be spread uniformly around the periphery of inner sheath.

The following minimum parametric tests on Anti termite / Anti rodent dopants shall be carried out during the TSEC testing

- Non-toxicity
- Thermal Stability
- Long life Span / half-life
- Compatibility
- Efficacy

The thermal stability of the dopant should not deteriorate during cable execution process. The life of the dopant should be equal or better than the life of the cable specified in the technical specification herein. Appropriate certificate in this regard from any neutral lab accredited with NABL / Government BBNL Tender Laboratory / Institute should be produced. Similarly other parameters such as non-toxicity, efficacy and compatibility shall be certified in any neutral lab accredited with NABL / Government Laboratory / Institute and test report is to be submitted during TSEC testing.

5. Engineering Requirements:

5.1. Cable Marking

- 5.1.1 A long lasting suitable marking shall be applied in order to identify this cable from other cables. The cable marking shall be imprinted (indented). The marking on the cable shall be indelible of durable quality and at regular intervals of one meter length. The accuracy of the sequential marking must be within -0.25% to +0.5% of the actual measured length. The sequential length markings must not rub off during normal installation and in life time of optical fibre cable. The total length of the cable supplied shall not be in negative tolerance.
- 5.1.2 The marking shall be in contrast colour over the black HDPE Sheath (jacket) and shall be one by hot foil indentation method. The colour used must withstand the environmental influences experienced in the field.
- 5.1.3. The type of legend marking on O.F. cable shall be as follows: a) Company Legend b) Legend containing telephone mark & international acceptable Laser symbol c) Type of Fibre– G.652.D d) Number of Fibres e) Type of cable f) Year of manufacture g) Sequential length marking h) User's Identification i) Cable ID

5.2. Cable Ends

- 5.2.1. Both cable ends (the beginning end and end of the cable reel) shall be sealed and readily accessible. Minimum 5 meter of the cable of the beginning end of the reel shall be accessible for testing. Both ends of the cable shall be kept inside the drums and shall be located so as to be easily accessible for the test. The drum (confirming to GR No. G/CBD-O1/02 Nov. 94 and subsequent amendment) should be marked to identify the direction of rotation of the drum. Both ends of cable shall be provided with cable pulling (grip) stocking and the anti-twist device (free head hook). The wooden drums shall be

properly treated against termites and other insects during transportation and storage. The manufacturer shall submit the methodology used for the same

- 5.2.2. An anti-twist device (Free head hook) shall be provided, attached to the both the ends of the cable pulling arrangement. The arrangement of the pulling eye and its coupling system along with the anti-twist system shall withstand the prescribed tensile load applicable to the cable.

5.3. The nominal drum length

- 5.3.1 Length of optical fibre cable in each drum shall be 2 Km ± 10% / 4Km ± 10% / 8Km ± 10% / 10Km ± 10% and shall be supplied as per the order. The variation in length of optical fibre cable, as specified above (in each drum), shall be acceptable. 5.3.2 The fibres in cable length shall not have any joint.

- 5.3.2 The drum shall be marked with arrows to indicate the direction of rotation.

- 5.3.3 Packing list supplied with each drum shall have at least the following information:

- Drum No.
- Type of cables
- Physical Cable length
- No. of fibres
- Length of each fibre as measured by OTDR
- The Cable factor - ratio of fibre/cable length
- Attenuation per Km. of each fibre at 1310 & 1550 nm
- Users / Consignee's Name
- Manufacturers Name, Month, Year and Batch No
- Group refractive index of fibre.
- Purchase Order No.
- Cable ID

5.4 Colour coding in O.F. Cables

- 5.4.1 The colorant applied to individual fibres shall be readily identifiable throughout the lifetime of the cable and shall match and conform to the Munsell Colour Standards (EIA-598-C).

- 5.4.2 Colour Coding Scheme: When the loose tubes are placed in circular format, the marking to indicate the loose tube no. "1" shall be in blue colour followed by loose tube no.2 of orange and so on for other tubes as per the colour scheme given below and complete the circular format by placing the dummy /fillers at the end.

Depending upon the number of fibres in a Ribbon (which depends on the cable capacity), the colour of fibres are serially chosen from the column no. II of the following table-1.

No of Fibre/ Buffer tube	Fibre identification in Ribbon II	Loose tube identification III
1	Blue	Blue
2	Orange	Orange
3	Green	Green
4	Brown	Brown
5	Slate	Slate
6	White	White

Table -1: Colour Coding scheme of the Optical Fibre & Loose tube

- 5.4.3 Identification of Ribbon:

No of Fibre in cable	No of Tubes	No of Ribbon per tube	Fibre per Ribbon	Marking on Ribbon
48	4 Tube 1 Filler	2	6	Individual Ribbon shall be printed with respective number as 1, 2.
96	4 Tube 1 Filler	4	6	Individual Ribbon shall be printed with respective number as 1, 2, 3, 4.

Note: The individual number marking shall be at regular interval of every 300 mm or lesser on natural colour ribbon and shall be legible. The printing on the ribbon shall also be of durable quality and shall be compatible with coating of the ribbon and Thixotropic Jelly (filled in the loose tube of the cable).

6. Quality Requirements

- 6.1 The cable shall be manufactured in accordance with the international quality standards ISO 9001-2008 (latest issue) for which the manufacturer should be duly accredited. The Quality Manual shall be submitted by the manufacturer.
- 6.2. **Raw Material**
 - 6.2.1 The cable shall use the raw materials approved against the GR No. TEC/GR/TX/ORM-01/04 SEP.09 and the subsequent amendment issued, if any.
 - 6.2.2 Any other material used shall be clearly indicated by the manufacturer. The detailed technical specifications of such raw materials used shall be furnished by the manufacturer at the time of evaluation/testing.
 - 6.2.3 The raw materials used from multiple sources is permitted and the source / sources of raw materials (Type and grade) from where these have been procured shall be submitted by the manufacturer.
 - 6.2.4 The manufacturer can change the raw material from one approved source to other approved source with the approval of QA wing of purchaser. In case of change of source/grade of SM Optical Fibre, the call for fresh evaluation/testing shall be decided by QA wing of purchaser.
 - 6.2.5 The raw material used (HDPE black in colour) for outer sheath shall protect the cable from attack by termite & rodent. The manufacturer shall specify anti-termite and anti-rodent (optional) additives and submit the detail characteristics of the material and additives used to make it termite & rodent (optional) proof. The additives shall also be non-toxic. The cable shall be tested for the presence of Anti termites & Anti rodent (optional) additives by recognized laboratory or institute. The cable shall also be tested for its termite & rodent (optional) proven-ness by NABL accredited Lab / Govt laboratory or institute.
 - 6.2.6 The HDPE black in colour used for sheath shall be UV stabilised.
Note: A test certificate from a recognised laboratory or institute may be acceptable for the UV stability of the HDPE sheath material
 - 6.2.7 The material used in optical fibre cable must not evolve hydrogen that will affect the characteristics of optical fibres.
Note: A test certificate from a recognised laboratory or institute may be acceptable.
 - 6.2.8 **Cable Material Compatibility:** Optical fibre, buffers/core tubes, and other core components shall meet the requirements of the compatibility with buffer/core tube filling material(s) and/or water-blocking materials that are in direct contact with identified components within the cable structure (This shall be tested as per clause no. 6.3.3 of Telecordia document GR-20-CORE issue 4, 2013).

Note: The tests may be conducted in house (if facility exist) or may be conducted at CACT or any other recognized laboratory. The test certificate may be accepted and the tests may not be repeated subsequently, in next type approvals, if the raw material used is of same make and grade.

7. Documentation:

- 7.1 Complete technical literature in English with detailed cable construction diagram of various sub-components with dimensions, weight & test data and other details of the cable shall be provided.
- 7.2 All aspects of installation, operation, maintenance and fibre splicing shall also be covered in the handbook. The pictorial diagrams of the accessories (with model no. and manufacturer name) supplied along with the cable as package shall be also be submitted. A hard as well as soft copy of the manuals shall be provided.

8. Safety

- 8.1 The material used in the manufacturing of the Optical fibre cables shall be non-toxic and dermatologically safe in its life time and shall not be hazardous to health. The manufacturer shall submit MSDS (Material safety Data Sheet) for all the material used in manufacturing of optical fibre cable to substantiate the statement

Sub-Section A - 1.2: Technical specifications of 24F ADSS aerial optical fibre

S. No.	Description
1	Fibre used should be complying as per ITU-T G.652 D.
2	Fibre Geometrical Parameters
2 (a)	MFD at 1310 nm – 9.2 +/- 0.4 µm
2 (b)	MFD at 1550 nm – 10.4 +/- 0.5 µm
2 l	Core Diameter (Typical) - 8.6 µm
2 (d)	Cladding Diameter - 125 +/- 1.0 µm
2 l	Cladding Non-Circularity - 1 %
2 (f)	Core Clad concentricity error – 0.6 µm
2 (g)	Diameter over primary coated with double UV cured acrylate – 245 µm ± 10 µm
2 (h)	Coating / Cladding Concentricity ≤ 12
3	Fibre Optical/Transmission Properties
3 (a)	Maximum Attenuation (Fibre) at 1310 nm ≤ 0.34 dB/Km
3 (b)	Maximum Attenuation (Fibre) at 1490 nm ≤ 0.24 dB/Km
3 l	Maximum Attenuation (Fibre) at 1550 nm ≤ 0.21 dB/Km
3 (d)	Maximum Attenuation (Fibre) at 1625 nm ≤ 0.24 dB/Km
3 l	Maximum Attenuation (Fibre) between 1380-1390 nm ≤ Attenuation at 1310 nm (After Hydrogen Ageing)
3 (f)	Maximum Attenuation (Cabled Fibre) at 1310 nm ≤ 0.36 dB/Km
3 (g)	Maximum Attenuation (Cabled Fibre) at 1490 nm ≤ 0.26 dB/Km
3 (f)	Maximum Attenuation (Cabled Fibre) at 1550 nm ≤ 0.23 dB/Km
3 (g)	Maximum Attenuation (Cabled Fibre) at 1625 nm ≤ 0.26 dB/Km
3 (h)	Chromatic Dispersion (1285-1330)nm ≤ 3.5
3 (i)	Chromatic Dispersion (1270-1340)nm ≤ 5.3
3 (j)	Chromatic Dispersion at 1550nm ≤ 17.5
3(k)	Chromatic Dispersion at 1625nm ≤ 22
3 (l)	PMD (1310 nm & 1550 nm) ≤ 0.3 ps/√Km
3 (m)	LDV (1310 nm & 1550 nm) ≤ 0.2 ps/√Km

3 (n)	Zero Dispersion Slope	\leq	0.092 ps/(nm.sq.km)
3 (o)	Zero dispersion wave length range	-	1300 – 1324 nm
3 (p)	Cable cut off	-	1260 nm Maximum

S. No.	Description
4	Fibre Reliability Parameters
4 (a)	Proof test strain level - 1% Test method – IEC-60793-1-30
4 (b)	Dynamic Tensile strength (Un-aged) - > 3.8 Gpa Test method – IEC-60793-1-31
4 l	Dynamic Tensile strength – (Aged) - > 3.0 Gpa Test method – IEC-60793-1-31
4 (d)	Stripability Force to remove primary coating – $1.3 \leq F \leq 8.9$ N Test method – IEC-60793-1-32
4 l	Dynamic Fatigue ≥ 20 Test method – IEC-60793-1-33
4 (f)	Static Fatigue ≥ 20 Test method – IEC-60793-1-33
4 (g)	Fibre Curl ≥ 4.0 metres Test method – IEC-60793-1-34
4 (h)	Macro bend Test method – IEC-60793-1-47 / FOTP – 62
4 (h)(i)	Change in Attenuation when fibre is coiled with 100 turns on 30 ± 0.1 mm radius mandrel. ≤ 0.05 dB/km at 1550 nm ≤ 0.5 dB/km at 1625 nm
4 (h)(ii)	Change in Attenuation when fibre is coiled with 1 turn on 32 ± 0.5 mm diameter mandrel. ≤ 0.5 dB/km at 1550 nm ≤ 1.0 dB/km at 1625 nm
5	OFC CONSTRUCTION

5 (a)	<p>Cross sectional view:</p> <p>The diagram illustrates the cross-section of a cable. It shows a central yellow 'CENTRAL STRENGTH MEMBER' surrounded by four 'LOOSE TUBES WITH FIBERS & GEL'. These are wrapped with 'BINDER OR PP TAPE WITH WATER SWELLABLE TAPE'. The next layer consists of 'WATER SWELLABLE YARNS'. The outermost layer is the 'UV PROOF BLACK HDPE OUTER SHEATH'. Two 'ARAMID YARNS' are shown extending from the outer sheath into the cable core. A 'RIPCORD (s)' is also indicated.</p>
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S. No.	Description
5 (b)	<p>Buffer tube: Four numbers of primary coated coloured fibres shall be protected by loose packaging within a tube which shall be filled with thixotropic jelly. Colour sequence of fibres inside tubes should be Blue, Orange, and Green& Brown.</p>
5 l	<p>Central Strength Member: Solid FRP non – metallic strength member in the centre of the cable core shall be provided.</p>
5 (d)	<p>Cable Core: Primary coated fibres in loose tubes, stranded together around a central strength member (using reverse lay techniques), shall form the cable core. Colour sequence of loose tubes around FRP should be Blue, Orange, Green, Brown, Slate & White.</p>
5 l	<p>The main cable core containing fibres shall be wrapped by a layer of water swellable tape. Aramid yarn reinforcement shall be done over water swell-able tape to provide sufficient tensile strength.</p>
5 (f)	<p>A circular and uniform tough weather resistant polyethylene compound HDPE/MDPE material sheath/Jacket, black in colour, (UV Stabilized) shall be provided over and above the reinforcement of Aramid Yarn. Thickness of outer sheath should be minimum 1.5 mm.</p>
5 (g)	<p>Two ripcords shall be placed diagonally opposite to each other below the outer jacket to strip the HDPE outer jacket.</p>
6	<p>OFC MECHANICAL PARAMETERS</p>
6 (a)	<p>Tensile Strength - 3000 N at maximum allowable 0.25 % Fibre strain Test Method – IEC 60794-1-2-E1</p>
6 (b)	<p>Crush resistance - 2500 N/100 MM X 100 MM Test Method – IEC 60794-1-2-E3</p>

S. No.	Description
6 l	Impact Resistance – 50 N from 0.5 M Test Method – IEC 60794-1-2-E4
6 (d)	Torsion - +/- 180 Test Method – IEC 60794-1-2-E7
6 l	Cable Bending Test – 20 D, 4 Turns, 10 cycles Test Method – IEC 60794-1-2 E11
6 (f)	Abrasion resistance - Needle – 150 gm, Dia – 1 mm, Weight – 500 gm No of cycles – 100, Duration 1 minute Test Method – IEC-60794-1-2-E2
6 (g)	Repeated Bending - 20D, 35 Cycles IEC 60794-1-2 E6
6 (h)	Drip Test – 30 cm, 70°C, 24hr IEC 60794-1-2-E14
6 (i)	Water Penetration test - 1m head, 3m samples, 24 hrs IEC 60794-1-2 F5
7	OFC Environmental Parameters
7 (a)	Installation - -10°C to + 60°C
7 (b)	Operation - - 20°C to + 70°C
7 l	Storage & Transport - -20°to + 70°C
8	Optical Fibre Cable Loading Conditions
8 (a)	Maximum Span length - 65 Meters
8 (b)	Installation Sag - 1.0 %
8 l	Operational Sag - 1.5 %
8 (d)	Wind Speed - 100 Km/hour or 150 km/hour
8 l	Ice loading - Nil
9	Optical Fibre Physical Parameters
9 (a)	Cable Diameter - 10.4 +/- 0.5 mm
9 (b)	Cable Weight - 77 +/- 10% kg/km

S. No.	Description
9(c)	Printing details : NAME OF MANUFACTURER SM G652 D 24 F ADSS Laser symbol Year of manufacturer length code Meter Marking (White Hot Foil Embossing)
9 (d)	Optical Fibre 2F / Buffer tube Colour - Blue, Orange, Green, Brown
9(e)	Loose tube Number – 6 Colour Sequence – Blue, Orange, Green, Brown, Slate, White
9 (f)	Outer Sheath colour - Black
10	Optical Fibre Cable packing details
10 (a)	Cable length in a drum – 2/4 +/- 5 % km
10 (b)	Short length - MAX 5 %
10 (c)	Order Tolerance - +/- 5 %

Aerial fibre Pros/Cons

Pros

1. Faster deployment (20-30% faster than UG)
2. Marginally lower cost

Cons:

1. Low availability ~ 85-90% (compared to UG of 95%), particularly for ring architecture as it is prone to disruption during the cyclonic storms, heavy winds. Constant squalls, bird/squirrel chipping
2. Fresh alignment required to be erected
3. Requires specialized skills for stringing arrangement
4. Life is reduced (<10 yrs vs 25 yrs for UG) and attenuation is higher
5. Road expansion would require shifting of poles
6. Constant patrolling is required

Considering the above Aerial is best for 1) Hilly Terrains as UG trenching is difficult and route lengths is more 2) Forest areas

Key features for our RFP

Considering the above, our Annexure has the following points as regards Annexure H- Workfront calculation as well as Section -- Scope of Work

Considering that time is of essence (project completion is March 2019) and that 33% of route km is

1. At least 25 Aerial workfronts should be executed by PIA in parallel per package to achieve
2. During the monsoon period, emphasis should be on doing Aerial work and alignments as it could be done faster than Underground
3. Prioritize on Aerial first to cover route km as much as possible

Aerial km is advised for spurs, hilly and forest areas. For rings that have a mix of UG and aerial, PIA should focus on deploying Aerial first to at least get the linear connectivity and then focus on closing the ring through underground

Sub-section A – 1.3: Parameters of the component part of the fibre cable

The following parameters of the component parts of the cable are to be taken in to account while designing and manufacturing the optical fibre cables of the required fibre count. These parameters shall be checked during evaluation of the OF cables.

S.No.	Parameter	Unit	48F Ribbon Fibre cable	96F Ribbon Fibre cable
1	FRP Road EAA Coated	Mm	2.5 +0.1/-0.0	3.0 + 0.1/-0.0
2	FRP Up-coating thickness	Mm	0	0
3	Tue (ID) (min)	Mm	2.6	3
4	Tube OD	Mm	3.4+0.2	4.0+0.2
5	No of fibre / ribbon	No	6	6
6	No of Ribbon in a tube	No	2	4
7	Colour of fibre per ribbon		BL,OR,GR,BR, SL,WH	BL,OR,GR,BR,SL ,WH
8	No of loose tubes	No	4 with 2 Ribbons	4 with 4 Ribbons
9	Colour of loose tubes		BL,OR,GR,BR	BL,OR,GR,BR
10	No of dummy cord	No	1	1
11	Tube stranding lay over length	Mm	>200	>400
12	Inner stealth thickness (min)	Mm	0.9	0.9
13	Qty. of Impregnated Glass roving (min.)	Kg	27	27
14	Outer sheath thickness (min)	Mm	1.5	1.5
15	Cable diameter	Mm	16+1.0	17.8+1.0
16	Cable weight	Kg/km	185+8%	230+8%
17	Cable to be designed to Fibre strain value of.	%	0.1	0.1
18	Cable to be tested at defined load for fibre strain value of	%	0.25	0.25

Note: The manufacturer shall submit the design calculations which shall be cross checked.

Annexure A – Sub-section A – 1.4: Technical specification of Fibre distribution management system (Exchange) Type-1

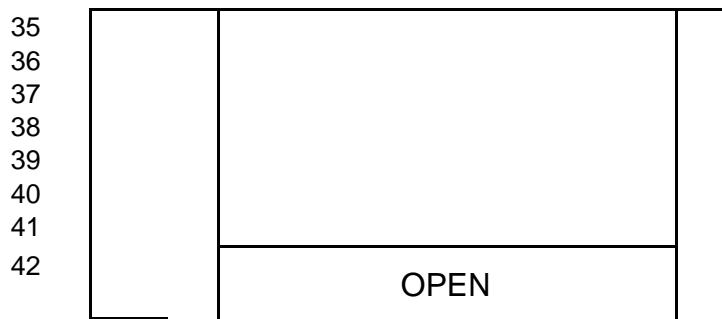
(A) Fibre Distribution Management System (Exchange) Type – I

1. TEC GR Reference - GR/FDM-01/02 APR 2007. Design and additional specification of FDMS Type-I (at Exchange). Wherever specifications under this section shall contradict with TEC GR, then specifications under this section shall prevail.
2. Items under this section shall be installed by the bidder at site.
3. Schematic Diagram and Tray Termination Capacity

High

(U)

1	OPEN
2	48F S&P Module 1
3	48F S&P Module 2
4	48F S&P Module 3
5	48F S&P Module 4
6	48F S&P Module 5
7	48F S&P Module 6
8	H P M S
9	24F S&P Module 1
10	24F S&P Module 2
11	24F S&P Module 3
12	24F S&P Module 4
13	192F Splicing Module 1
14	OPEN
15	Splitter Box
16	Fibre Monitoring System
17	
18	
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4. Specifications

4.1	FDMS Outer Dimensions	As per GRwith depth 400mm
4.2	48F S & P Module (6 Nos.)	19 inch Rack Mountable, 2U high, with 4 nos. of 2x6FRibbon Splicing & Patching Trays, each preloaded with 2Nos. 6F SC-APC type Ribbon Fan-out & 12 Nos. ofSCAPC Adaptors.
4.3	24F S & P Module (4 Nos.)	<i>19 inch Rack Mountable,1U high, with 2 nos. of 12F splicing & Patching Trays, each preloaded with 12 nos. single fibre pigtailed of 0.9mm SCAPC connectorized and 1.5 meters in length & 12 nos. of SCAPC adaptors. The pigtails shall be colour coded for easy identification</i>
4.4	FDMS Exchange Type - I capacity	Total 384F (6 Nos. Modules of 48F and 4 Nos. Modules of 24F)
4.5	Splicing Module (1 No.)	19 inch Rack Mountable, 3U high(16 Splice Trays of 12F) = 192 F.
4.6	Constructed from	Powder-Coated CRCA Steel Sheet (min.1.6mm thick)
4.7	Mounting Method	Floor Mounting using Levelling Screws (4 Nos.)
4.8	Ventilation Method	'Perforated Rear and Side Walls for efficient heat management of OLTE/PSU
4.9	Type of Ribbon	6F as per Bellcore document GR-20 Issue-4 2013
4.10	Type of Adaptor, (CACT Approved)	SC-APC as per TEC GR TX/OFJ-01/05 NOV 2009
4.11	Ribbon Fan-out Connector	SC-APC as per TEC GR TX/OFJ-01/05 NOV 2009 (CACT Approved source)

4.12	Type of Ribbon Fan-out	6F Ribbon, G-652D, Ribbon Length 1.5m, Fan out Length - 0.5m with 6 Nos. of SC-APC Connectors.
4.13	Patch Cords Supplied	SC-APC Patch Cord (3 Meter length) 8 Nos.(for Testing/S & P Modules to Splitter/OLTE Connectivity)
4.14	OFC Entry Ports (Top)	4 Nos. for Ribbon OFC Diameter 15-22mm, 6 Nos. for 24F OFC Diameter 10-14mm
4.15	Patch Cord Ports (Top)	12 Nos. for 24 x 3mm SC-APC Patch Cords
4.16	Provisions for (on Top)	8 Nos. for Entry of Power Cable/ Data Cable to MCBs
4.17	Site Installation	Bidder to undertake Installation of FDMS Type – I
4.18.	Test Procedure	As per TEC GR referred.

(B) Spare Cable Box, Runway segments for exchange sites

1. Design and additional specification of Spare Cable Box, Runway segments for exchange sites)
- 2. Bidder is required to submit MAF certificates from OEM for spare cable box.**
3. Specification of Spare Cable Box Type-A for exchange location

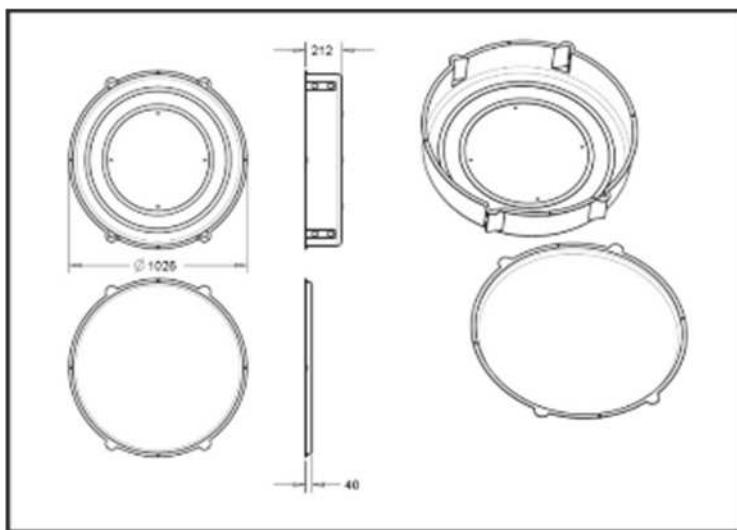
Spare Cable Box Type-A	
Dimensions	Diameter 1.20 meter x Height 0.25 meter (Body + Cover)
Material	3mm Thick Fibre Glass Reinforced Polyester (FRP), 8 Kgs. Weight approx.
Wall Mounting	Embedded Galvanised MS C Channel 40 x 8 x 1.6mm (4 Nos.) With Slotted Holes for Wall mounting using M8 Expansion Bolts (4 Sets supplied with each Box)
Capacity	To Store minimum 15 Meters each of 3 Nos. of 96F/48F Ribbon Cables (Dia 18mm).
Design Feature	Provided with provision for maintaining minimum Cable Bending Diameter of 720mm for 96F/48F O F Cable.

Separators	Provided with suitable built-in separators between cables, for easy operation.
Cable Entry/Exit	3 Nos. of 96F/48F Ribbon Cables.
Installation	To be installed by PIA / Vendor, along with FDMS – Type – I

4. Runway segments for exchange sites:

Dimensions	Slotted Channel of Size 150mm x 50mm x 1.6mm, Powder-coated
Quantity	Supplied in length of 2 meters x 2 nos., with Hardware as required for mounting above FDMS Rack, for safe Entry of OFC & Other Cables, with mounting hardware suitable for Top mounting.
Installation	To be installed by PIA / Vendor, along with FDMS – Type – I

5. Schematic Diagram for Spare Cable Box Body & Cover Type- 1(for Exchange Location)



6. Parameters

- I. Material – Glass Reinforced Polyester/Plastic, 3mm minimum thickness
- II. Size – Diameter 1.02 meter x Height 0.25 meter.
- III. Cover – Assembly with 4 Nos. Retainer Screws
- IV. Installation – Wall Mount using M8 Expansion Bolts
- V. Cable Entry/Exit – 4 Nos. + 4 Nos. Cable Diameter 15-22

Sub-section A – 1.5: Technical specification of Fibre distribution management system outdoor

Fibre Distribution Management System Outdoor

1. **TEC GR Reference - TEC/GR/TX/FDM-003/01 MAR 2012.** Additional specification of FDMS Outdoor. Wherever Specifications under this section shall contradict with TEC GR, then specifications under this section shall prevail.
2. **Fibre Distribution Management System (Outdoor) Schematic Diagram and specifications**
(GR No. TEC/GR/TX/FDM-003/01 MAR 2012)



3. Specification details:

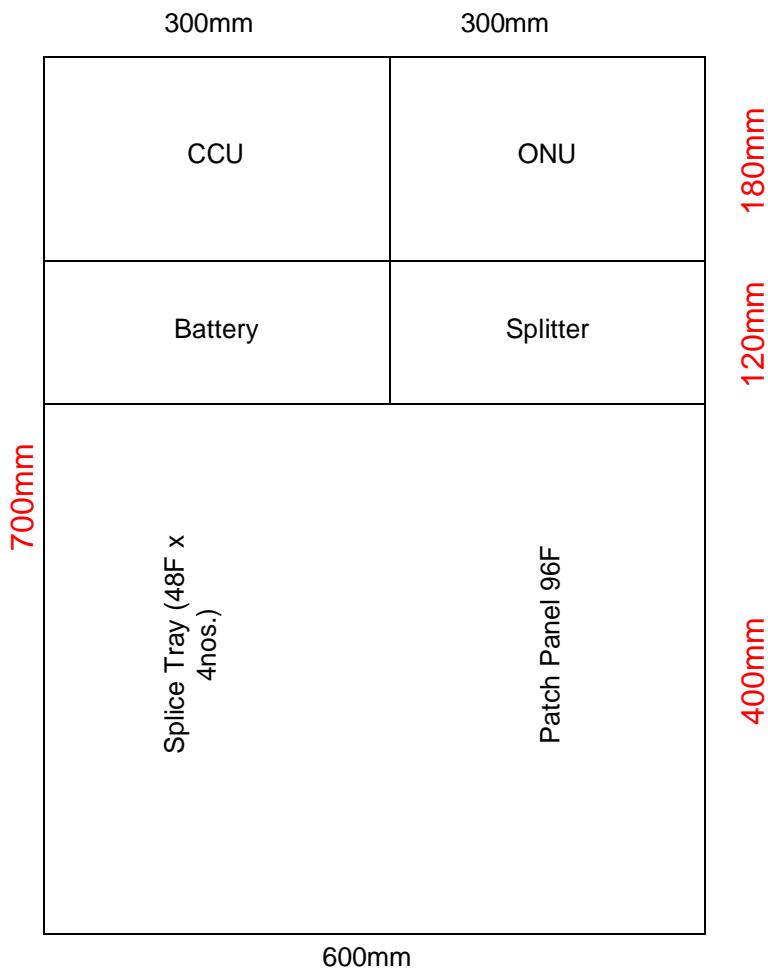
OFC entry ports	4 Nos. Round Port, suitable for Ribbon O F Cable of Diameter 14-22mm; 1 No. Oval Port (100mm x 40mm) suitable for Ribbon O F Cable of Diameter 14-24mm
Splicing Tray Capacity	14 Nos. Splice Trays of 4 x 6F Ribbon each = 336 Fibres
Type of Ribbon	6F as per Bellcore document GR-20 Issue 4, 2013
Cable Entry Port Sealing	Supplied with 4 Sets suitable for Ribbon O F Cable of Diameter 14-22mm and 1 Set suitable for Ribbon O F Cable of Diameter 14-24mm

Splice Protection Sleeves	As per GR TEC/GR/TX/PTS-02/03. JAN-2011 - 56 nos. + 25% extra
Test Procedure	As per TEC GR referred.

Sub-section A – 1.6: Technical specification of Fibre distribution management system Type-III (Indoor for GP)

Fibre Distribution Management System Type – III-B (Indoor- for GP) TEC GR Reference - GR/FDM-01/02 APR 2007. Design and additional specification of FDMS Type-III-B (Indoor for GP). Wherever Specifications under this section shall contradict with TEC GR, then specifications under this section shall prevail.

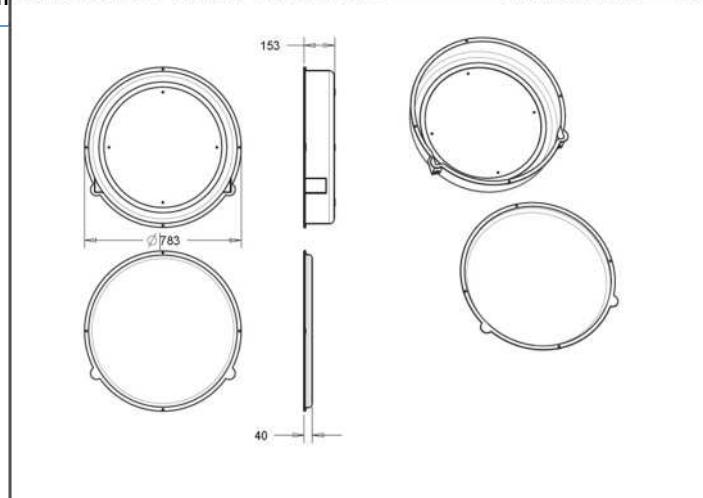
1. Schematic Diagram



2. Specification Parameters:

Specification	Description
Outer Dimensions	Height 700mm, Width 600mm, Depth 225mm, +/- 5%
Splicing & Patching Capacity	96 Nos. (16 x 6F Ribbon Fibre)
Provision for	Mounting of Battery, CCU, Splitter Box & ONT. Sliding Tray for Battery/CCU for easy Cabling etc.
PLC Splitter	No requirement for provisioning of PLC splitter.
Constructed from	Powder-Coated CRCA Steel Sheet (minimum 1.6mm thick)
Mounting Method	Wall Mounting using M8 Expansion Bolts (4 Nos.)
Type of Ribbon	6F as per Bellcore document GR-20 Issue-4 2013
Type of Adaptor	Pre-installed with 96 Nos. of SC-APC as per TEC GR TX/OFJ-01/05 NOV 2009 (CACT Approved)
Ribbon Fan-out Connector	SC-APC as per TEC GR TX/OFJ-01/05 NOV 2009 (CACT Appd source)
Type of Ribbon Fan-out	Pre-installed with 16 Nos. of 6F Ribbon Fan-out G-652D, Ribbon Length 1.5m, Fan out Length - 0.5m
Supplied with	SC-APC Patch Cord (2 Meter length) 4 Nos., (for Testing/Patch Panel to Splitter/ONT Connectivity).
OFC Entry Ports (Bottom)	2 Nos. for Ribbon OFC Diameter 15-22mm, 2 Nos. for 24F OFC Diameter 10-14mm
Test Procedure	As per TEC GR referred.
Patch Cord Ports (Bottom)	4 Nos. for 24 x 3mm SC-APC Patch Cords
Provisions for (on Top)	4 Nos. for Entry of Power Cable/ Data Cable to FMS

3. Schematic diagram for Spare Cable Box Type 2 (Gram Panchayat)

**4. Fibre Distribution Management System Type – III-B (Indoor- for GP)**

- Material – Glass Reinforced Polyester/Plastic, 3mm minimum thickness
- Size – Diameter 0.78 meter x Height 0.19 meter
- Cover – Assembly with 4 Nos. Retainer Screws
- Cable Entry/Exit – 2nos. cable diameter 15-22m
- Installation – Wall Mount using M8 Expansion Bolts

Sub-section A – 2: Technical Specification for Electronics Equipment

1. Access Electronics

Following are the components required to support the proposed network architecture highlighted in Scope of work section of the RFP

1.1. Gram Panchayat Router – Type 1

S. No.	Specifications
1	Proposed router should support the following environmental condition : Operating Temperature: -5 to 65 degrees celcius Relative humidity: 5 to 85% non condensing
2	Proposed routers should support redundant power inputs. Power input redundancy using redundant power supplies in the proposed router is desirable
3	The proposed router should support AC and DC power AC Voltage range: 200-240V AC, 50-60 Hz DC Voltage range: -39 to -72V
4	The power supply of proposed router should have protection against under-voltage and reverse polarity conditions <i>in compliance to IEC/ EN standards</i>
5	The proposed router should support the following ports: a. 2 Network ports: 1Gbps SFP b. 10 Access ports: min. 6 SFP based ports of 1Gbps, 4ports of 10/100/1000Mbps BASE-T
6	All SFP and SFP+ modules should be IEEE 802.3 and MSA compliant
7	The design of the system shall not allow plugging of an SFP module in the wrong slot or upside down.
8	The SFP modules shall be hot swappable and live insertion shall be possible to ensure maximum network availability and easy maintainability.
9	Proposed router should support non-blocking capacity of 12 Gbps
10	All ports in the proposed proposed router should support line-rate forwarding at 64B frame-size. Total forwarding performance should be min. 17.8 MPPS.
11	The proposed router should support synchronization using IEEE 1588v2 and ITU-T G.8261/8262/ 8264 Sync E Internal oscillator in the proposed router should provide a clock of atleast Stratum 3 quality and internal hold-over of 30 minutes
12	Shall support Frame sizes from 64 bytes to 1518; Proposed router should support jumbo frames of 9000 or above bytes on all ports
13	The proposed router should support atleast the following: a. 16K MAC Addresses b. 8K IPv4 unicast routes c. 2K IPv6 routes d. 900 multicast routes e. 900 MPLS labels f. 3 labels in label stack
14	a. Routing Protocols: Static, RIP, OSPF, ISIS and BGP. VRRP should also be supported b. MPLS: MPLS LDP, IP FRR (LFA and Remote LFA), BGP Labelled Unicast, BGP PIC (Edge and Core) c. VPNs: 6PE/6VPE, L3 VPN, PWE3, EoMPLS, VPLS / EVPN/H-VPLS. Min. 128 MPLS VPN instances, 1000 EoMPLS tunnels/VPLS instances should be

S. No.	Specifications
	supported d. Multicast: uRPF, PIM-SM, PIM-SSM/ M-VPN e. Segment Routing (SR), SR-TE, TI-LFA/seamless MPLS. Roadmap for SR with IPv6 should be provided
15	The Proposed router should support Point to Point and Point to Multipoint LSP for Unicast and Multicast traffic.
16	The router should support BFD in hardware with min interval of 10 ms. Protection against link / node failure in rings should be <50ms using TE-FRR/IP-FRR
17	The proposed router should support 4000 VLANs per port. The router should also support Q-in-Q or Stacked VLANs
18	The proposed router should support ITU-T G.8032 based Ethernet Ring Protection with <50ms convergence.
19	The proposed router should support 802.1ag (Ethernet OAM) and Y.1731 or equivalent based performance management
20	Proposed router should support QoS mechanism for end-to-end bandwidth and atleast 3 level HQOS/ 8 hardware queues should be supported.
21	Proposed router should also support Policy for control plane protection
22	The Proposed router should support multilevel priority scheduling for voice and video applications with minimal jitter, latency and packet loss.
23	Proposed router should support Quality of service for marking/policing traffic, Prioritising and assuring bandwidth Guarantees. Classification should be done based on DSCP, IP TOS (Type of Service), MPLS EXP and 802.1p.
24	Proposed router should support Eight No of hardware queues that are required for per port for flow treatment of traffic, Policy Based QOS,WRED,WFQ,
25	The proposed router should support Zero touch provisioning for ease of management
26	The software shall have all the features to administer, manage, maintain and troubleshoot the network through the CLI/ HTTP/HTTPS Web Access or GUI
27	It shall be possible to verify the software and firmware version check, file-size and check-sums
28	The software shall support audit logs for all activities carried out on the system like user logins, failed access attempts with source IP address.
29	The system Command line interface (CLI) shall have commands for fault management, configuration management, performance management, security management and administration/EMS
30	Remote software and configuration download, backup of configuration without interruption of functioning of the system via management system shall preferably be possible including means of identification of software module versions./EMS
31	The proposed routers shall support the following, as per IETF/ IEEE standards - Network Time Protocol (NTP) - TELNET - SSH - FTP/ SFTP - TFTP - Syslog - DHCP, DHCP client and relay agent functionality - RADIUS, TACACS and TACACS+ for AAA

S. No.	Specifications
32	The system should support Programmable APIs or Netconf/Yang/SNMP for configuration management, fault management, security management and administration
33	Compatibility of the existing hardware with future software versions shall be maintained.
34	It shall not be required to reboot the system to make the configuration changes effective.
35	The Power failure should not result in lost configuration and recover to the original / current configuration
36	The proposed router shall provide SNMP based Traps and Alarms to the configured EMS/NMS. SNMP v1, v2 and v3 should be supported
37	The proposed router shall support SNMP community attributes.
38	The vendor shall provide Standards MIBS
39	The proposed router shall support saving system messages and software crash files on local media (like flash card).
40	The Router should send the status and monitoring attributes to EMS/ NMS
41	The proposed router shall be able to provide performance attributes per service/ RPM - real time performance monitoring
42	The proposed router shall provide appropriate service measurement parameters to the EMS/NMS using IP-SLA or equivalent, Y.1731
43	The Router should support Storm Control
44	Access Control List violations shall generate alarms to EMS/NMS and logs of the same shall be generated.
45	"Security Standards" means all the relevant contemporary standards associated with national and international security standard related to Telecom equipment hardware and software and those related to information & communication security, including but without limitation to ISO 27000 series
46	The system shall have the standard rack mountable capacity of 19" / 21" (ETSI compliant),
47	The router has to support standard as per IEC / EN 61000-4-2
48	The router has to support standard as per IEC / EN 61000-4-3
49	The router has to support standard as per IEC / EN 61000-4-4
50	Surge Protection: The system shall withstand the surges applied to all electrical inputs and outputs, excluding internal connections via the backplane, as specified in the following standards. - IEC / EN 61000-4-5. - IEC / EN 61000-4-11.
51	The proposed routers should be supplied with the most recent H/w and Software Version at the time of supply. During the contract period, bidder will have to provide the product with the equivalent or better specifications at same price.
52	OEM must undertake to provide support for 7 years from the date of acceptance or 8 years from the date of delivery.

1.2. Gram Panchayat Router – Type 2

S. No.	Specifications
1	Proposed router should support the following environmental condition : Operating Temperature: -5 to 65 degrees celcius Relative humidity: 5 to 85% non condensing
2	Proposed routers should support redundant power inputs. Power input redundancy using redundant power supplies in the proposed router is desirable

S. No.	Specifications
3	The proposed router should support AC and DC power AC Voltage range: 200-240V AC, 50-60 Hz DC Voltage range: -39 to -72V
4	The power supply of proposed router should have protection against under-voltage and reverse polarity conditions <i>in compliance to IEC/ EN standards.</i>
5	The proposed router should support the following ports: a. 2 Network ports: 10 Gbps SFP+/ XFP b. 10 Access ports: min. 6 SFP based ports of 1Gbps, 4ports of 10/100/1000Mbps BASE-T
6	All SFP and SFP+ modules should be IEEE 802.3 and MSA compliant
7	The design of the system shall not allow plugging of an SFP module in the wrong slot or upside down.
8	The SFP modules shall be hot swappable and live insertion shall be possible to ensure maximum network availability and easy maintainability.
9	Proposed router should support non-blocking capacity of 30 Gbps
10	The performance of the router should be line rate on WAN interfaces supporting Min 30 Mpps
11	The proposed router should support synchronization using IEEE 1588v2 and ITU-T G.8261/8262/ 8264 Sync E Internal oscillator in the proposed router should provide a clock of atleast Stratum 3 quality and internal hold-over of 30 minutes
12	Shall support Frame sizes from 64 bytes to 1518; Proposed router should support jumbo frames of 9000 or above bytes on all ports
13	The proposed router should support atleast the following: a. 16K MAC Addresses b. 8K IPv4 unicast routes c. 2K IPv6 routes d. 900 multicast routes e. 900 MPLS labels f. 3 labels in label stack
14	a. Routing Protocols: Static, RIP, OSPF, ISIS and BGP. VRRP should also be supported b. MPLS: MPLS LDP, IP FRR (LFA and Remote LFA), BGP Labelled Unicast, BGP PIC (Edge and Core) c. VPNs: 6PE/6VPE, L3 VPN, PWE3, EoMPLS, VPLS / EVPN/H-VPLS. Min. 128 MPLS VPN instances, 1000 EoMPLS tunnels/VPLS instances should be supported d. Multicast: uRPF, PIM-SM, PIM-SSM/ M-VPN e. Segment Routing (SR), SR-TE, TI-LFA/seamless MPLS. Roadmap for SR with IPv6 should be provided
15	The Proposed router should support Point to Point and Point to Multipoint LSP for Unicast and Multicast traffic.
16	The router should support BFD in hardware with min interval of 10 ms. Protection against link / node failure in rings should be <50ms using TE-FRR/IP-FRR
17	The proposed router should support 4000 VLANs per port. The router should also support Q-in-Q or Stacked VLANs
18	The proposed router should support ITU-T G.8032 based Ethernet Ring Protection with <50ms convergence.
19	The proposed router should support 802.1ag (Ethernet OAM) and Y.1731 or equivalent based performance management

S. No.	Specifications
20	OEM is allowed to offer CE 2.0 complaint products subject to OEM submitting CE 2.0 certificate before commencement of shipment
21	Proposed router should support QoS mechanism for end-to-end bandwidth and atleast 3 level HQOS/ 8 hardware queues should be supported.
22	Proposed router should also support Policy for control plane protection
23	The Proposed router should support multilevel priority scheduling/Strict priority queuing with COS for voice and video applications .
24	Proposed router should support Quality of service for marking/policing traffic, Prioritising and assuring bandwidth Guarantees. Classification should be done based on DSCP, IP TOS (Type of Service), MPLS EXP and 802.1p.
25	Proposed router should support Eight No of hardware queues that are required for per port for flow treatment of traffic,Policy Based QOS,WRED,WFQ,
26	The proposed router should support Zero touch provisioning for ease of management
27	The software shall have all the features to administer, manage, maintain and troubleshoot the network through the CLI/ HTTP/HTTPS Web Access or GUI
28	It shall be possible to verify the software and firmware version check, file-size and check-sums
29	The software shall support audit logs for all activities carried out on the system like user logins, failed access attempts with source IP address.
30	The system Command line interface (CLI) shall have commands for fault management, configuration management, performance management, security management and administration/EMS
31	Remote software and configuration download, backup of configuration without interruption of functioning of the system via management system shall preferably be possible including means of identification of software module versions./EMS
32	The proposed routers shall support the following, as per IETF/ IEEE standards - Network Time Protocol (NTP) - TELNET - SSH - FTP/ SFTP - TFTP - Syslog - DHCP, DHCP client and relay agent functionality - RADIUS, TACACS and TACACS+ for AAA
33	The system should support Programmable APIs or Netconf/Yang/SNMP for configuration management, fault management, security management and administration
34	Compatibility of the existing hardware with future software versions shall be maintained.
35	It shall not be required to reboot the system to make the configuration changes effective.
36	The Power failure should not result in lost configuration and recover to the original / current configuration
37	The proposed router shall provide SNMP based Traps and Alarms to the configured EMS/NMS. SNMP v1, v2 and v3 should be supported
38	The proposed router shall support SNMP community attributes.
39	The vendor shall provide Standards MIBS
40	The proposed router shall support saving system messages and software crash files on local media (like flash card).
41	The Router should send the status and monitoring attributes to EMS/ NMS

S. No.	Specifications
42	The proposed router shall be able to provide performance attributes per service/ RPM - real time performance monitoring
43	The proposed router shall provide appropriate service measurement parameters to the EMS/NMS using IP-SLA or equivalent, Y.1731
44	The Router should support Storm Control
45	Access Control List violations shall generate alarms toEMS/NMS and logs of the same shall be generated.
46	"Security Standards" means all the relevant contemporary standards associated with national and international security standard related to Telecom equipment hardware and software and those related to information & communication security, including but without limitation to ISO 27000 series
47	The system shall have the standard rack mountable capacity of 19" / 21" (ETSI compliant),
48	The router has to support standard as per IEC / EN 61000-4-2
49	The router has to support standard as per IEC / EN 61000-4-3
50	The router has to support standard as per IEC / EN 61000-4-4
51	Surge Protection: The system shall withstand the surges applied to all electrical inputs and outputs, excluding internal connections via the backplane, as specified in the following standards. · IEC / EN 61000-4-5. · IEC / EN 61000-4-11.
52	The proposed routers should be supplied with the most recent H/w and Software Version at the time of supply. During the contract period, bidder will have to provide the product with the equivalent or better specifications at same price.
53	OEM must undertake to provide support for 7 years from the date of acceptance or 8 years from the date of delivery.

1.3. Gram Panchayat Router – Type 3

S. No.	Specifications
1	Proposed router should support the following environmental condition : Operating Temperature: -5 to 65 degrees celcius Relative humidity: 5 to 85% non condensing
2	Proposed routers should support redundant power inputs. Power input redundancy using redundant power supplies in the proposed router is desirable
3	The proposed router should support AC and DC power AC Voltage range: 200-240V AC, 50-60 Hz DC Voltage range: -39 to -72V
4	The power supply of proposed router should have protection against under-voltage and reverse polarity conditions in compliance to IEC/ EN standards.
5	The proposed router should support the following ports: a. 2 Network ports: 10 Gbps SFP+/ XFP (Upgradable to 4 X 10Gbps SFP+/ XFP) b. 10 Access ports: min. 6 SFP based ports of 1Gbps, 4 ports of 10/100/1000Mbps BASE-T
6	All SFP and SFP+ modules should be IEEE 802.3 and MSA compliant
7	The design of the system shall not allow plugging of an SFP module in the wrong slot or upside down.
8	The SFP modules shall be hot swappable and live insertion shall be possible to ensure maximum network availability and easy maintainability.
9	Proposed router should support non-blocking capacity of 50 Gbps

S. No.	Specifications
10	The performance of the router should be line rate on WAN interfaces supporting Min 60 Mpps
11	The proposed router should support synchronization using IEEE 1588v2 and ITU-T G.8261/8262/ 8264 Sync E Internal oscillator in the proposed router should provide a clock of atleast Stratum 3 quality and internal hold-over of 30 minutes
12	Shall support Frame sizes from 64 bytes to 1518; Proposed router should support jumbo frames of 9000 or above bytes on all ports
13	The proposed router should support atleast the following: a. 16K MAC Addresses b. 20K IPv4 unicast routes c. 4K IPv6 routes d. 900 multicast routes e. 1,000 MPLS labels f. 3 labels in label stack
14	a. Routing Protocols: Static, RIP, OSPF, ISIS and BGP. VRRP should also be supported b. MPLS: MPLS LDP, IP FRR (LFA and Remote LFA), BGP Labelled Unicast, BGP PIC (Edge and Core) c. VPNs: 6PE/6VPE, L3 VPN, PWE3, EoMPLS, VPLS / EVPN/H-VPLS. Min. 128 MPLS VPN instances, 1000 EoMPLS tunnels/VPLS instances should be supported d. Multicast: uRPF, PIM-SM, PIM-SSM/ M-VPN using either mGRE or mLDP e. Segment Routing (SR), SR-TE, TI-LFA. Roadmap for SR with IPv6 should be provided
15	The Proposed router should support Point to Point and Point to Multipoint LSP for Unicast and Multicast traffic.
16	The router should support BFD in hardware with min interval of 10 ms. Protection against link / node failure in rings should be <50ms using TE-FRR/IP-FRR
17	The proposed router should support 4000 VLANs per port. The router should also support Q-in-Q or Stacked VLANs
18	The proposed router should support ITU-T G.8032 based Ethernet Ring Protection with <50ms convergence.
19	The proposed router should support 802.1ag (Ethernet OAM) and Y.1731 or equivalent based performance management
20	OEM is allowed to offer CE 2.0 complaint products subject to OEM submitting CE 2.0 certificate before commencement of shipment
21	Proposed router should support QoS mechanism for end-to-end bandwidth and atleast 3 level HQOS/ 8 hardware queues should be supported.
22	Proposed router should also support Policy for control plane protection
23	The Proposed router should support multilevel priority scheduling/Strict priority queuing with COS for voice and video applications .
24	Proposed router should support Quality of service for marking/policing traffic, Prioritising and assuring bandwidth Gurantees. Classification should be done based on DSCP, IP TOS (Type of Service), MPLS EXP and 802.1p.
25	Proposed router should support Eight No of hardware queues that are required for per port for flow treatment of traffic, Policy Based QOS,WRED,WFQ,
26	The proposed router should support Zero touch provisioning for ease of management
27	The software shall have all the features to administer, manage, maintain and troubleshoot the network through the CLI/ HTTP/HTTPS Web Access or GUI

S. No.	Specifications
28	It shall be possible to verify the software and firmware version check, file-size and check-sums
29	The software shall support audit logs for all activities carried out on the system like user logins, failed access attempts with source IP address.
30	The system Command line interface (CLI) shall have commands for fault management, configuration management, performance management, security management and administration/EMS
31	Remote software and configuration download, backup of configuration without interruption of functioning of the system via management system shall preferably be possible including means of identification of software module versions./EMS
32	The proposed routers shall support the following, as per IETF/ IEEE standards - Network Time Protocol (NTP) - TELNET - SSH - FTP/ SFTP - TFTP - Syslog - DHCP, DHCP client and relay agent functionality - RADIUS, TACACS and TACACS+ for AAA
33	The system should support Programmable APIs or Netconf/Yang/SNMP for configuration management, fault management, security management and administration
34	Compatibility of the existing hardware with future software versions shall be maintained.
35	It shall not be required to reboot the system to make the configuration changes effective.
36	The Power failure should not result in lost configuration and recover to the original / current configuration
37	The proposed router shall provide SNMP based Traps and Alarms to the configured EMS/NMS. SNMP v1, v2 and v3 should be supported
38	The proposed router shall support SNMP community attributes.
39	The vendor shall provide Standards MIBS
40	The proposed router shall support saving system messages and software crash files on local media (like flash card).
41	The Router should send the status and monitoring attributes to EMS/ NMS
42	The proposed router shall be able to provide performance attributes per service/ RPM - real time performance monitoring
43	The proposed router shall provide appropriate service measurement parameters to the EMS/NMS using IP-SLA or equivalent, Y.1731
44	The Router should support Storm Control
45	Access Control List violations shall generate alarms to EMS/NMS and logs of the same shall be generated.
46	"Security Standards" means all the relevant contemporary standards associated with national and international security standard related to Telecom equipment hardware and software and those related to information & communication security, including but without limitation to ISO 27000 series
47	The system shall have the standard rack mountable capacity of 19" / 21" (ETSI compliant),
48	The router has to support standard as per IEC / EN 61000-4-2
49	The router has to support standard as per IEC / EN 61000-4-3
50	The router has to support standard as per IEC / EN 61000-4-4

S. No.	Specifications
51	Surge Protection: The system shall withstand the surges applied to all electrical inputs and outputs, excluding internal connections via the backplane, as specified in the following standards. · IEC / EN 61000-4-5. · IEC / EN 61000-4-11.
52	The proposed routers should be supplied with the most recent H/w and Software Version at the time of supply. During the contract period, bidder will have to provide the product with the equivalent or better specifications at same price.
53	OEM must undertake to provide support for 7 years from the date of acceptance or 8 years from the date of delivery.

1.4. Gram Panchayat Router – Type 4

S. No.	Specifications
1	Proposed router should support the following environmental condition : Operating Temperature: -5 to 65 degrees celcius Relative humidity: 5 to 85% non condensing
2	Proposed routers should support redundant power inputs. Power input redundancy using redundant power supplies in the proposed router is desirable
3	The proposed router should support AC and DC power AC Voltage range: 200-240V AC, 50-60 Hz DC Voltage range: -39 to -72V
4	The power supply of proposed router should have protection against under-voltage and reverse polarity conditions <i>in compliance to IEC/ EN standards.</i>
5	The proposed router should support the following ports: a. 4 Network ports: 10 Gbps SFP+/XFP b. 10 Access ports: min. 6 SFP based ports of 1Gbps, 4ports of 10/100/1000Mbps BASE-T
6	All SFP and SFP+ modules should be IEEE 802.3 and MSA compliant
7	The design of the system shall not allow plugging of an SFP module in the wrong slot or upside down.
8	The SFP modules shall be hot swappable and live insertion shall be possible to ensure maximum network availability and easy maintainability.
9	Proposed router should support non-blocking capacity of 50 Gbps
10	The performance of the router should be line rate on WAN interfaces supporting Min 60 Mpps
11	The proposed router should support synchronization using IEEE 1588v2 and ITU-T G.8261/8262/ 8264 Sync E Internal oscillator in the proposed router should provide a clock of atleast Stratum 3 quality and internal hold-over of 30 minutes
12	Shall support Frame sizes from 64 bytes to 1518; Proposed router should support jumbo frames of 9000 or above bytes on all ports

S. No.	Specifications
13	The proposed router should support atleast the following: a. 16K MAC Addresses b. 20K IPv4 unicast routes c. 4K IPv6 routes d. 900 multicast routes e. 1,000 MPLS labels f. 3 labels in label stack
14	a. Routing Protocols: Static, RIP, OSPF, ISIS and BGP. VRRP should also be supported b. MPLS: MPLS LDP, IP FRR (LFA and Remote LFA), BGP Labelled Unicast, BGP PIC (Edge and Core) c. VPNs: 6PE/6VPE, L3 VPN, PWE3, EoMPLS, VPLS / EVPN/H-VPLS. Min. 128 MPLS VPN instances, 1000 EoMPLS tunnels/VPLS instances should be supported d. Multicast: uRPF, PIM-SM, PIM-SSM/ M-VPN using either mGRE or mLDP e. Segment Routing (SR), SR-TE, TI-LFA. Roadmap for SR with IPv6 should be provided
15	The Proposed router should support Point to Point and Point to Multipoint LSP for Unicast and Multicast traffic.
16	The router should support BFD in hardware with min interval of 10 ms. Protection against link / node failure in rings should be <50ms using TE-FRR/IP-FRR
17	The proposed router should support 4000 VLANs per port. The router should also support Q-in-Q or Stacked VLANs
18	The proposed router should support ITU-T G.8032 based Ethernet Ring Protection with <50ms convergence.
19	The proposed router should support 802.1ag (Ethernet OAM) and Y.1731 or equivalent based performance management
20	<i>OEM is allowed to offer CE 2.0 complaint products subject to OEM submitting CE 2.0 certificate before commencement of shipment</i>
21	Proposed router should support QoS mechanism for end-to-end bandwidth and atleast 3 level HQOS/ 8 hardware queues should be supported.
22	Proposed router should also support Policy for control plane protection
23	The Proposed router should support multilevel priority scheduling/Strict priority queuing with COS for voice and video applications .
24	Proposed router should support Quality of service for marking/policing traffic, Prioritising and assuring bandwidth Guarantees. Classification should be done based on DSCP, IP TOS (Type of Service), MPLS EXP and 802.1p.
25	Proposed router should support Eight No of hardware queues that are required for per port for flow treatment of traffic, Policy Based QOS,WRED,WFQ,
26	The proposed router should support Zero touch provisioning for ease of management
27	The software shall have all the features to administer, manage, maintain and troubleshoot the network through the CLI/ HTTP/HTTPS Web Access or GUI
28	It shall be possible to verify the software and firmware version check, file-size and check-sums
29	The software shall support audit logs for all activities carried out on the system like user logins, failed access attempts with source IP address.
30	The system Command line interface (CLI) shall have commands for fault management, configuration management, performance management, security management and administration/EMS

S. No.	Specifications
31	Remote software and configuration download, backup of configuration without interruption of functioning of the system via management system shall preferably be possible including means of identification of software module versions./EMS
32	The proposed routers shall support the following, as per IETF/ IEEE standards - Network Time Protocol (NTP) - TELNET - SSH - FTP/ SFTP - TFTP - Syslog - DHCP, DHCP client and relay agent functionality - RADIUS, TACACS and TACACS+ for AAA
33	The system should support Programmable APIs or Netconf/Yang/SNMP for configuration management, fault management, security management and administration
34	Compatibility of the existing hardware with future software versions shall be maintained.
35	It shall not be required to reboot the system to make the configuration changes effective.
36	The Power failure should not result in lost configuration and recover to the original / current configuration
37	The proposed router shall provide SNMP based Traps and Alarms to the configured EMS/NMS. SNMP v1, v2 and v3 should be supported
38	The proposed router shall support SNMP community attributes.
39	The vendor shall provide Standards MIBS
40	The proposed router shall support saving system messages and software crash files on local media (like flash card).
41	The Router should send the status and monitoring attributes to EMS/ NMS
42	The proposed router shall be able to provide performance attributes per service/ RPM - real time performance monitoring
43	The proposed router shall provide appropriate service measurement parameters to the EMS/NMS using IP-SLA or equivalent, Y.1731
44	The Router should support Storm Control
45	Access Control List violations shall generate alarms to EMS/NMS and logs of the same shall be generated.
46	“Security Standards” means all the relevant contemporary standards associated with national and international security standard related to Telecom equipment hardware and software and those related to information & communication security, including but without limitation to ISO 27000 series
47	The system shall have the standard rack mountable capacity of 19" / 21" (ETSI compliant),
48	The router has to support standard as per IEC / EN 61000-4-2
49	The router has to support standard as per IEC / EN 61000-4-3
50	The router has to support standard as per IEC / EN 61000-4-4
51	Surge Protection: The system shall withstand the surges applied to all electrical inputs and outputs, excluding internal connections via the backplane, as specified in the following standards. · IEC / EN 61000-4-5. · IEC / EN 61000-4-11.

S. No.	Specifications
52	The proposed routers should be supplied with the most recent H/w and Software Version at the time of supply. During the contract period, bidder will have to provide the product with the equivalent or better specifications at same price.
53	OEM must undertake to provide support for 7 years from the date of acceptance or 8 years from the date of delivery.

1.5. Taluka Router – Type 1 & 2	
No.	Specifications
1	Proposed router should support the following environmental condition : Temperature: '0°C to 40°C operating temperature while operating in an indoor air-conditioned controlled environment Relative humidity: 5 to 85% non condensing
2	The proposed router should be of modular design with: - redundant control and data plane - power supplies in 1+1 or N+1 redundancy - fan trays in 1+1 or N+1 redundancy - modular line card slots All modules should support online insertion or removal without impacting traffic/performance of other modules/cards
3	Router should have redundant control and data plane
4	The proposed router should support ISSU (In Service Software Upgrade)
5	The proposed router should support AC and DC power AC Voltage range: 200-240V AC, 50-60 Hz (16A current maximum) DC Voltage range: -39 to -72V (60A current maximum)
6	The power supply of proposed router should have protection against under-voltage and reverse polarity conditions in compliance to IEC/ EN standards.
7	Routers should have following interfaces from day one Client Side- 12x10G and 20 x1G for client side, All client ports to be loaded with SFPs supporting 10KM, No of Client ports should be 50% scalable (18 X 10G and 30 X 1G) in future Network Ports- i) 2x100G for Uplink (CFP2 or QSFP28). Supporting 40km ii) Additional Solution for supporting up to 80 km to be quoted on the network ports in 20% of the THQ-THQ link. All 100G/10G (Network and client side) ports shall be distributed among different slots to avoid single point of failure and Network isolation.
8	All SFP and SFP+ modules should be IEEE 802.3 and MSA compliant
9	The design of the system shall not allow plugging of an SFP module in the wrong slot or upside down.
10	The SFP modules shall be hot swappable and live insertion shall be possible to ensure maximum network availability and easy maintainability.
11	Proposed router should support non-blocking capacity of 400 Gbps upgradable to 600 Gbps. Failure of 1 switch fabric/controller card should not impact / degrade the performance/capacity of the router
12	All ports in the proposed router should support line-rate forwarding at 64B frame-size. Total forwarding performance should be min. 600 MPPS upgradable to 900MPPS.
13	Router shall support aggregation of links(LAG) as per IEEE 802.3ad. Minimum 8 link should be supported as part of single link aggregation group
14	The proposed router should support synchronization using IEEE 1588v2 and ITU-T G.8261/8262/ 8264 Sync E Internal oscillator in the proposed router should provide a clock of atleast Stratum 3 quality and internal hold-over of 30 minutes
15	Shall support Frame sizes from 64 bytes to 1518; Proposed router should support jumbo frames of 9000 or above bytes on all ports

16	The proposed router should support atleast the following: a. 200,000 MAC Addresses b. 128k IPv4 unicast routes c. 64k IPv6 routes d. 4k multicast routes e. 4 labels in label stack
17	a. Routing Protocols: Static, RIP, OSPF, ISIS and BGP. VRRP should also be supported b. MPLS: MPLS LDP, IP FRR (LFA and Remote LFA), BGP Labelled Unicast, BGP PIC (Edge and Core) c. VPNs: 6PE/6VPE, L3 VPN, PWE3, EoMPLS, VPLS / EVPN/H-VPLS. Min. 128 MPLS VPN instances, 1000 EoMPLS tunnels/VPLS instances should be supported d. Multicast: uRPF, PIM-SM, PIM-SSM/ M-VPN using either mGRE or mLDP e. Segment Routing (SR), SR-TE, TI-LFA. Roadmap for SR with IPv6 should be provided
18	The Proposed router should support Point to Point and Point to Multipoint LSP for Unicast and Multicast traffic.
19	The router should support BFD in hardware with min interval of 10 ms. Protection against link / node failure in rings should be <50ms using TE-FRR/IP-FRR
20	The proposed router should support 4000 VLANs per port. The router should also support Q-in-Q or Stacked VLANs
21	The proposed router should support ITU-T G.8032 based Ethernet Ring Protection with <50ms convergence.
22	The proposed router should support 802.1ag (Ethernet OAM) and Y.1731 or equivalent based performance management
23	<i>OEM is allowed to offer CE 2.0 complaint products subject to OEM submitting CE 2.0 certificate before commencement of shipment</i>
24	Proposed router should support QoS mechanism for end-to-end bandwidth and atleast 3 level HQOS/ 8 hardware queues should be supported.
25	Proposed router should also support Policy for control plane protection
26	The Proposed router should support multilevel priority scheduling/Strict priority queuing with COS for voice and video applications .
27	Proposed router should support Quality of service for marking/policing traffic, hierarchical QoS, Prioritising and assuring bandwidth Gurantees. Classification should be done based on DSCP, IP TOS (Type of Service), MPLS EXP and 802.1p.
28	Proposed router should support Eight No of hardware queues that are required for per port for flow treatment of traffic,Policy Based QOS,WRED,WFQ,HQOS,
29	The proposed router should support Zero touch provisioning for ease of management
30	The software shall have all the features to administer, manage, maintain and troubleshoot the network through the CLI and HTTP/HTTPS Web Access or GUI
31	It shall be possible to verify the software and firmware version check, file-size and check-sums
32	The software shall support audit logs for all activities carried out on the system like user logins, failed access attempts with source IP address.
33	The system Command line interface (CLI) shall have commands for fault management, configuration management, performance management, security management and administration/EMS
34	Remote software and configuration download, backup of configuration without interruption of functioning of the system via management system shall preferably be possible including means of identification of software module versions/EMS

35	The proposed routers shall support the following as per IETF/ IEEE standards - Network Time Protocol (NTP) - TELNET - SSH - FTP/ SFTP - TFTP - Syslog - DHCP, DHCP client and relay agent functionality - RADIUS, TACACS and TACACS+ for AAA
36	The system should support Programmable APIs or Netconf/Yang for configuration management, fault management, security management and administration
37	Compatibility of the existing hardware with future software versions shall be maintained.
38	It shall not be required to reboot the system to make the configuration changes effective.
39	The Power failure should not result in lost configuration and recover to the original / current configuration
40	In case of failure of any single route processor or fabric cards, none of the line card traffic should be impacted
41	In event of a hardware failure and replacement, the proposed Router shall support sync any configurations from previous modules to new modules
42	The proposed router shall provide SNMP based Traps and Alarms to the configured EMS/NMS. SNMP v1, v2 and v3 should be supported
43	The proposed router shall support SNMP community attributes.
44	The vendor shall provide Standards MIBS
45	The proposed router shall support saving system messages and software crash files on local media (like flash card).
46	The Router should send the status and monitoring attributes to EMS/ NMS
47	The proposed router shall be able to provide performance attributes per service / RPM-real time performance monitoring
48	The proposed router shall provide appropriate service measurement parameters to the EMS/NMS using IP-SLA or equivalent, Y.1731
49	The Router should support Storm Control
50	Access Control List violations shall generate alarms to EMS/NMS and logs of the same shall be generated.
51	“Security Standards” means all the relevant contemporary standards associated with national and international security standard related to Telecom equipment hardware and software and those related to information & communication security, including but without limitation to ISO 27000 series
52	The system shall have the standard rack mountable capacity of 19" / 21" (ETSI compliant),
53	The router has to support standard as per IEC / EN 61000-4-2
54	The router has to support standard as per IEC / EN 61000-4-3
55	The router has to support standard as per IEC / EN 61000-4-4
56	Surge Protection: The system shall withstand the surges applied to all electrical inputs and outputs, excluding internal connections via the backplane, as specified in the following standards. · IEC / EN 61000-4-5. · IEC / EN 61000-4-11.

57	The proposed routers should be supplied with the most recent H/w and Software Version at the time of supply. During the contract period, bidder will have to provide the product with the equivalent or better specifications at same price.
58	OEM must undertake to provide support for 7 years from the date of acceptance or 8 years from the date of delivery.

1.6. Taluka Router – Type 3 & 4	
S. No.	Specifications
1	Proposed router should support the following environmental condition : Temperature: 0°C to 40°C operating temperature while operating in an indoor air-conditioned controlled environment Relative humidity: 5 to 85% non condensing
2	The proposed router should be of modular design with: - redundant control and data plane - power supplies in 1+1 or N+1 redundancy - fan trays in 1+1 or N+1 redundancy - modular line card slots All modules should support online insertion or removal without impacting traffic/performance of other modules/cards
3	Router should have redundant control and data plane
4	The proposed router should support ISSU (In Service Software Upgrade)
5	The proposed router should support AC and DC power AC Voltage range: 200-240V AC, 50-60 Hz (16A current maximum) DC Voltage range: -39 to -72V (60A current maximum)
6	The power supply of proposed router should have protection against under-voltage and reverse polarity conditions in compliance to IEC/EN standards .
7	Routers should have following interfaces from day one Client Side- 12x10G and 20 x1G for client side, All client ports to be loaded with SFPs supporting 10KM, No of Client ports should be 50% scalable (18 X 10G and 30 X 1G) in future Network Ports- i) 4x100G for Uplink (CFP2 or QSFP28) supporting 40km ii) Additional Solution for supporting up to 80 km to be quoted on the network ports in 20% of the THQ-THQ link All 100G/10G (Network and client side) ports shall be distributed among different slots to avoid single point of failure and Network isolation.
8	All SFP and SFP+ modules should be IEEE 802.3 and MSA compliant
9	The design of the system shall not allow plugging of an SFP module in the wrong slot or upside down.
10	The SFP modules shall be hot swappable and live insertion shall be possible to ensure maximum network availability and easy maintainability.
11	Proposed router should support non-blocking capacity of 600 Gbps upgradable to 800Gps. Failure of 1 switch fabric/controller card should not impact / degrade the performance/capacity of the router
12	All ports in the proposed router should support line-rate forwarding at 64B frame-size. Total forwarding performance should be min. 900 MPPS upgradable to 1.2BPPS.
13	Router shall support aggregation of links(LAG) as per IEEE 802.3ad. Minimum 8 link should be supported as part of single link aggregation group
14	The proposed router should support synchronization using IEEE 1588v2 and ITU-T G.8261/8262/ 8264 Sync E Internal oscillator in the proposed router should provide a clock of atleast Stratum 3 quality and internal hold-over of 30 minutes
15	Shall support Frame sizes from 64 bytes to 1518; Proposed router should support jumbo frames of 9000 or above bytes on all ports

16	The proposed router should support atleast the following: a. 512,000 MAC Addresses b. 2,000,000 IPv4 unicast routes c. 1,000,000 IPv6 routes d. 32,000 multicast routes e. 4 labels in label stack
17	a. Routing Protocols: Static, RIP, OSPF, ISIS and BGP. VRRP should also be supported b. MPLS: MPLS LDP, IP FRR (LFA and Remote LFA), BGP Labelled Unicast, BGP PIC (Edge and Core) c. VPNs: 6PE/6VPE, L3 VPN, PWE3, EoMPLS, VPLS / EVPN/H-VPLS. Min. 128 MPLS VPN instances, 1000 EoMPLS tunnels/VPLS instances should be supported d. Multicast: uRPF, PIM-SM, PIM-SSM/ M-VPN using either mGRE or mLDP e. Segment Routing (SR), SR-TE, TI-LFA. Roadmap for SR with IPv6 should be provided
18	The Proposed router should support Point to Point and Point to Multipoint LSP for Unicast and Multicast traffic.
19	The router should support BFD in hardware with min interval of 10 ms. Protection against link / node failure in rings should be <50ms using TE-FRR/IP-FRR
20	The proposed router should support 4000 VLANs per port. The router should also support Q-in-Q or Stacked VLANs
21	The proposed router should support ITU-T G.8032 based Ethernet Ring Protection with <50ms convergence.
22	The proposed router should support 802.1ag (Ethernet OAM) and Y.1731 or equivalent based performance management
23	<i>OEM is allowed to offer CE 2.0 complaint products subject to OEM submitting CE 2.0 certificate before commencement of shipment</i>
24	Proposed router should support QoS mechanism for end-to-end bandwidth and atleast 3 level HQOS/ 8 hardware queues should be supported.
25	Proposed router should also support Policy for control plane protection
26	The Proposed router should support multilevel priority scheduling/Strict priority queuing with COS for voice and video applications .
27	Proposed router should support Quality of service for marking/policing traffic, hierarchical QoS, Prioritising and assuring bandwidth Gurantees. Classification should be done based on DSCP, IP TOS (Type of Service), MPLS EXP and 802.1p.
28	Proposed router should support Eight No of hardware queues that are required for per port for flow treatment of traffic,Policy Based QOS,WRED,WFQ,HQOS,
29	The proposed router should support Zero touch provisioning for ease of management
30	The software shall have all the features to administer, manage, maintain and troubleshoot the network through the CLI/ HTTP/HTTPS Web Access or GUI
31	It shall be possible to verify the software and firmware version check, file-size and check-sums
32	The software shall support audit logs for all activities carried out on the system like user logins, failed access attempts with source IP address.
33	The system Command line interface (CLI) shall have commands for fault management, configuration management, performance management, security management and administration/EMS
34	Remote software and configuration download, backup of configuration without interruption of functioning of the system via management system shall preferably be possible including means of identification of software module versions/EMS

35	The proposed routers shall support the following as per IETF/ IEEE standards - Network Time Protocol (NTP) - TELNET - SSH - FTP/ SFTP - TFTP - Syslog - DHCP, DHCP client and relay agent functionality - RADIUS, TACACS and TACACS+ for AAA
36	The system should support Programmable APIs or Netconf/Yang for configuration management, fault management, security management and administration
37	Compatibility of the existing hardware with future software versions shall be maintained.
38	It shall not be required to reboot the system to make the configuration changes effective.
39	The Power failure should not result in lost configuration and recover to the original / current configuration
40	In case of failure of any single route processor or fabric cards, none of the line card traffic should be impacted
41	In event of a hardware failure and replacement, the proposed Router shall support sync any configurations from previous modules to new modules
42	The proposed router shall provide SNMP based Traps and Alarms to the configured EMS/NMS. SNMP v1, v2 and v3 should be supported
43	The proposed router shall support SNMP community attributes.
44	The vendor shall provide Standards MIBS
45	The proposed router shall support saving system messages and software crash files on local media (like flash card).
46	The Router should send the status and monitoring attributes to EMS/ NMS
47	The proposed router shall be able to provide performance attributes per service / RPM-real time performance monitoring
48	The proposed router shall provide appropriate service measurement parameters to the EMS/NMS using IP-SLA or equivalent, Y.1731
49	The Router should support Storm Control
50	Access Control List violations shall generate alarms to EMS/NMS and logs of the same shall be generated.
51	"Security Standards" means all the relevant contemporary standards associated with national and international security standard related to Telecom equipment hardware and software and those related to information & communication security, including but without limitation to ISO 27000 series
52	The system shall have the standard rack mountable capacity of 19" / 21" (ETSI compliant),
53	The router has to support standard as per IEC / EN 61000-4-2
54	The router has to support standard as per IEC / EN 61000-4-3
55	The router has to support standard as per IEC / EN 61000-4-4
56	Surge Protection: The system shall withstand the surges applied to all electrical inputs and outputs, excluding internal connections via the backplane, as specified in the following standards. · IEC / EN 61000-4-5. · IEC / EN 61000-4-11.

57	The proposed routers should be supplied with the most recent H/w and Software Version at the time of supply. During the contract period, bidder will have to provide the product with the equivalent or better specifications at same price.
58	OEM must undertake to provide support for 7 years from the date of acceptance or 8 years from the date of delivery.
59	Proposed router should support the following environmental condition : Temperature: '0°C to 40°C operating temperature while operating in an indoor air-conditioned controlled environment Relative humidity: 5 to 85% non condensing

Note:

- i. All throughput mentioned in specifications for IP-MPLS routers is full duplex.
- ii. The capacity upgrades from 400Gbps to 600Gbps (Taluka Router Type 1 & 2) and 600 Gbps to 800 Gbps (Taluka Router Type 3 & 4) shall be made available by the bidder without any additional cost.
- iii. All the expansion modules required for Taluka routers (6X10G, 10 X 1G) for future expansions (as per requirements mentioned) shall be pre-loaded with SFPs.
- iv. All GP routers for network port will be equipped with 10KM SFPs and client ports will be Short range (300m); All Taluka routers network port shall be equipped for 40KM and client ports will be for 10KM; Price schedule shall also include options for SFPs for different distances to meet the network requirements

1.7. Route Reflector

S. No.	Specifications
1	Proposed router should support the following environmental condition : Temperature: '0°C to 40°C operating temperature while operating in an indoor air-conditioned controlled environment Relative humidity: 5 to 85% non condensing
2	The proposed router should be of modular design with: <ul style="list-style-type: none"> - redundant control and data plane - power supplies in 1+1 or N+1 redundancy - fan trays in 1+1 or N+1 redundancy - modular line card slots All modules should support online insertion or removal without impacting traffic/performance of other modules/cards
3	Router should have redundant control and data plane
4	The proposed router should support ISSU (In Service Software Upgrade)
5	The proposed router should support AC and DC power AC Voltage range: 200-240V AC, 50-60 Hz (16A current maximum) DC Voltage range: -39 to -72V (60A current maximum)
6	The power supply of proposed router should have protection against under-voltage and reverse polarity conditions. Lightning protection for LINE-to-LINE and LINE-to-GND should be as per the following specifications: Lightning protection <ul style="list-style-type: none"> • DC: LINE-to-LINE: 1KV LINE-to-GND: 2KV (IEC61000-4-5) • AC: LINE-to-LINE: 6KV LINE-to-GND: 6KV (IEC61000-4-5)

7	The proposed router should support Min. 4 x 10G SFP+/ XFP and 10 x 1G From day 1. There should be atleast 1 free slot in the router for future expansion after populating the aforementioned interfaces.
8	All SFP and SFP+ modules should be IEEE 802.3 and MSA compliant
9	The design of the system shall not allow plugging of an SFP module in the wrong slot or upside down.
10	The SFP modules shall be hot swappable and live insertion shall be possible to ensure maximum network availability and easy maintainability.
11	Proposed router should support non-blocking capacity of 300 Gbps. Failure of 1 switch fabric/controller card should not impact / degrade the performance/capacity of the router
12	All ports in the proposed proposed router should support line-rate forwarding at 64B frame-size. Total forwarding performance should be min. 450 MPPS.
13	Router shall support aggregation of links(LAG) as per IEEE 802.3ad. Minimum 4 links should be supported as part of single link aggregation group
14	Shall support Frame sizes from 64 bytes to 1518; Proposed router should support jumbo frames of 9000 or above bytes on all ports
15	The proposed router should support atleast the following: a. 256,000 MAC Addresses b. 4,000,000 IPv4 unicast routes c. 2,000,000 IPv6 routes
16	a. Routing Protocols: Static, RIP, OSPF, ISIS and BGP. VRRP should also be supported b. MPLS: MPLS LDP, IP FRR (LFA and Remote LFA), BGP Labelled Unicast, BGP PIC (Edge and Core) c. VPNs: 6PE/6VPE, L3 VPN, PWE3, EoMPLS, VPLS / EVPN/H-VPLS. Min. 128 MPLS VPN instances, 1000 EoMPLS tunnels/VPLS instances should be supported d. Multicast: uRPF, PIM-SM, PIM-SSM, M-VPN using either mGRE or mLDP e. Segment Routing (SR), SR-TE, TI-LFA/seamless MPLS. Roadmap for SR with IPv6 should be provided
17	The Proposed router should support Point to Point and Point to Multipoint LSP for Unicast and Multicast traffic.
18	The router should support BFD in hardware with min interval of 10 ms. Protection against link / node failure in rings should be <50ms using TE-FRR/IP-FRR
19	The proposed router should support 4000 VLANs per port. The router should also support Q-in-Q or Stacked VLANs
20	Proposed router should support QoS mechanism for end-to-end bandwidth and atleast 3 level HQOS/ 8 hardware queues should be supported.
21	Proposed router should also support Policy for control plane protection
22	The Proposed router should support multilevel priority scheduling/Strict priority queuing with COS for voice and video applications .
23	Proposed router should support Quality of service for marking/policing traffic, hierarchical QoS, Prioritising and assuring bandwidth Guarantees. Classification should be done based on DSCP, IP TOS (Type of Service), MPLS EXP and 802.1p.
24	Proposed router should support Eight No of hardware queues that are required for per port for flow treatment of traffic,Policy Based QOS,WRED,WFQ,HQOS,
25	The proposed router should support Zero touch provisioning for ease of management
26	The software shall have all the features to administer, manage, maintain and troubleshoot the network through the CLI/ HTTP/HTTPS Web Access or GUI

27	It shall be possible to verify the software and firmware version check, file-size and check-sums
28	The software shall support audit logs for all activities carried out on the system like user logins, failed access attempts with source IP address.
29	The system Command line interface (CLI) shall have commands for fault management, configuration management, performance management, security management and administration/EMS
30	Remote software and configuration download, backup of configuration without interruption of functioning of the system via management system shall preferably be possible including means of identification of software module versions/EMS
31	The proposed routers shall support the following as per IETF/ IEEE standards - Network Time Protocol (NTP) - TELNET - SSH - FTP/ SFTP - TFTP - Syslog - DHCP, DHCP client and relay agent functionality - RADIUS, TACACS and TACACS+ for AAA
32	The system should support Programmable APIs or Netconf/Yang for configuration management, fault management, security management and administration
33	Compatibility of the existing hardware with future software versions shall be maintained.
34	It shall not be required to reboot the system to make the configuration changes effective.
35	The Power failure should not result in lost configuration and recover to the original / current configuration
36	In case of failure of any single route processor or fabric cards, none of the line card traffic should be impacted
37	In event of a hardware failure and replacement, the proposed Router shall support sync any configurations from previous modules to new modules
38	The proposed router shall provide SNMP based Traps and Alarms to the configured EMS/NMS. SNMP v1, v2 and v3 should be supported
39	The proposed router shall support SNMP community attributes.
40	The vendor shall provide Standards MIBS
41	The proposed router shall support saving system messages and software crash files on local media (like flash card).
42	The Router should send the status and monitoring attributes to EMS/ NMS
43	The proposed router shall be able to provide performance attributes per service.
44	The proposed router shall provide appropriate service measurement parameters to the EMS/NMS
45	The Router should support Storm Control
46	Access Control List violations shall generate alarms to EMS/NMS and logs of the same shall be generated.
47	The proposed proposed router should be CCC certified-OEM undertaking to be provided
48	The system shall have the standard rack mountable capacity of 19" / 21" (ETSI compliant)
49	The router has to support standard as per IEC / EN 61000-4-2
50	The router has to support standard as per IEC / EN 61000-4-3
51	The router has to support standard as per IEC / EN 61000-4-4

52	Surge Protection: The system shall withstand the surges applied to all electrical inputs and outputs, excluding internal connections via the backplane, as specified in the following standards. - IEC / EN 61000-4-5. - IEC / EN 61000-4-11.
53	The router has to support standard based certification as per ETSI / EN
54	The router has to support standard based certification as per GR-63-CORE: NEBS, Physical Protection GR-1089-CORE:EMC and Electrical Safety for Network Telecommunications Equipment
55	The router has to support standard based certification as per ETSI / EN
56	The proposed routers should be supplied with the most recent H/w and Software Version at the time of supply. During the contract period, bidder will have to provide the product with the equivalent or better specifications at same price.
57	OEM must undertake to provide support for 7 years from the date of acceptance or 8 years from the date of delivery.

1.8. Network Management System / Element Management System

S.No.	NMS Requirement
1	The Element Management System must manage all the devices in the network
2	In case more than one instance of EMS is required to manage the device in scope, then a manager of manager should also be provided for a consolidated view for administration and operation of the network
S.No.	Network Topology Requirements
1	There should be one web portal with single view of the complete network
2	There should be a portal web page that presents all the devices in network with cross-launch capability to the corresponding NMS instance managing the selected device.
3	For any selected device, the complete topology of its connected devices (Layer2 and Layer3) should be displayed.
4	For a selected device, topology of one Layer above and one Layer below should be presented.
5	Topology view should also list the current status of node and list the present alarms generated by the component.
8	Either of a redundant pair going down at the Network level should be indicated with a color change for the device in the Topology Map
9	The Device color should be amber when one of its RSP is down
10	In the Topology map, Links must be color coded based on the Alarm severity (For example, Node down in Red, Link Flapping in Yellow, Optical threshold in Mustard etc.)
11	In the Topology maps there should be a view with color-coding of links based on link utilization/status.
12	In the Topology map, for a given bundle interface, all its member links must be displayed
13	Capacity and Utilization of the WAN links should be shown in the topology.
14	In the topology map, all individual links connecting a pair of devices should be displayed as separate links.

15	It should be possible to view BGP peers in the topology view
16	It should be possible to search for a device using HOSTNAME/IP Name in topology maps
17	From the Topology map, it should be possible to perform Source based ping to service node .
18	It should be possible to correlate the Alarms based on topology knowledge and classify them as Root-cause and Symptom Alarms. Parent Child correlation should be supported, i.e. if Parent node down, all the entire children should be down & cause should be Parent alarms.
19	Portal /dash board for device, network, service availability and performance KPIs
S.No.	Inventory Management Requirements
1	NMS should collect the complete Physical and Logical Inventory for all the devices in the network.
2	Physical Inventory must include the attributes of entities such as Chassis, Card/Module, Port, Fan, Power supply etc.
3	Logical Inventory must include logical attributes such as Interface configuration details, status, Routing Protocol details etc.
4	NMS should be configured to collect the device inventory for all the Managed Network Elements daily at a specific time of the day.
5	Please refer to the network Element Matrix for the device families and count of devices in scope.
6	Inventory Audit & Comparison – System should perform audit and comparison for inventory components. All physical and logical changes history report should be available in NMS as a report.
7	Custom polling configuration – NMS should support Custom Polling, for example, specific OIDs for set of equipment.
9	FAN, Fabric card and Power Supply, which are inserted on rear side of chassis, must be visible in the Chassis View.
10	NMS should display the rear side of the Chassis (360 degree view).
11	NMS should poll for Device Reachability/Availability every 5 minutes
12	Preferential Polling: Operator must be able to order the sequence of devices to be polled for Device Reachability.
13	NMS should not only display the list of unreachable devices, but it should also display the time from which each of them is unreachable.
14	Device Down and Interface Down status must be determined via polling and not just based on SNMP Traps. This helps in determining the status of the devices more reliably in case SNMP Traps fail to reach the NMS server.
15	Except Node down, all other parameters including interface should be trap based to avoid delay due to polling interval.
16	It should be possible to move Devices to Maintenance Mode in NMS to facilitate alarm suppression during the maintenance of those Devices.
17	It should also be possible to move certain Interfaces to Maintenance Mode (to facilitate alarm suppression during maintenance of those interfaces for example, while the fibre is under maintenance.)

18	It should be possible to schedule the devices to move to maintenance state using a spreadsheet/CSV import.
19	Device should be moved back to the Management state automatically at the end of the duration
20	Image details should be collected and displayed in the Device Inventory view.
21	NMS must display the speed related statistics in Mbps or Gbps instead of bps
22	It should be possible to export Inventory details such as list of modules and interfaces for a given device in CSV format.
23	There must be a facility to display the total backplane utilization of a given device
24	RRG (Router Redundancy Group) monitoring – System should support HSRP / VRRP based redundancy groups discovery & monitoring
25	NMS should be able to generate a single consolidated inventory report for across Maharashtra.
26	NMS should be able to generate a single report Device not reachable across Maharashtra.
27	NMS should be able to generate a single report for Devices in Maintenance mode
28	NMS should be able to generate a single Report on ICMP reachable but SNMP Not reachable nodes.
29	NMS should be able to generate a single report on Trap destination IP set on the Devices (to check whether Node is sending traps to multiple destinations)
30	<p>Live status of Device Inventory like</p> <ul style="list-style-type: none"> · Routing Engine (RE) Status (Active or Standby) · RE Version · RE Physical CPU /Memory. · RE Power status. · Device Power Supply Status and counts. · Devices FAN status and Counts. · No of line cards.
31	No of Ports per line cards and its status (Admin up /down)
S.No.	Fault Management Requirements
1	NMS Server instances should be configured to receive SNMP v2c Traps and no syslogs from Network Elements
2	Trap configuration - NMS should support a feature to Enable & disable traps. NMS shall have feature of Blocking of Traps, filtering of traps also
3	NMS should be able to correlate alarms at the Network Element Level.
4	NMS should be able to correlate alarms at the Network Element Level as well as at Topology level.
5	Message correlation – NMS should support Dampening / Duplicate correlation / suppression / pair wise correlation of alarms/events
6	If any alarm is received multiple times, recurrence count must also be displayed for the last 24 hours.
7	NMS should collect interface, Equipment, Hardware alarm, degraded alarms and syslog event from monitored devices.

8	Standard features of alarm management system should be supported by NMS. For example alarm filtering, alarm copy, alarm export and history view
9	NMS should be able to differentiate between polling based alarms and Trap based alarms for Device Reachability
10	On a device if 4 Interfaces are down then we will receive 4 alarms, and then after some time we receive node down alarm for the same node , then all the individual interface down alarms should be cleared.
11	NMS Should support Alarm Sync capability in both SBI and NBI
12	NMS should support SNMP get support for Alarms resynchronization with North Bound Central Fault Management System in NMS
13	NMS should be able to generate Device-wise and Device Group-wise report for the alarms of severities “Critical” and “Major”.
14	Top N devices with most number of alarms should show hostname, Sap-ID & CI name along with IP address
15	In NMS, Alarm Category Dashboard should have drill downs for each section of the pie chart.
S.No.	Performance Management Requirements
1	NMS System should poll for CPU utilization, Memory pool utilization, environment temperature, and device availability.
2	NMS System should poll for Interface Health Metrics such as Interface status, utilization, discards, errors, etc.
3	Monitoring settings configuration - Profiling of monitored entities. It should support to set device priority for higher level of monitoring.
4	The polling interval of performance data should be 5 minutes. (In NMS, the present interval is configured to be 15 minutes)
5	Performance Trend Reports for interface, memory and CPU utilization should support duration based filtering where raw data (not the aggregated data) must be available for reporting for a minimum of 07 days
6	Performance Monitoring: System should support to provide Quality assurance (latency and jitter packet loss)
7	Performance management -- System should support to provide Traffic monitoring (highly used source / destination / application / protocol / etc.)
8	Performance metrics reports- NMS should support performance metrics report in form of Tabular / charts / Top N / dashboard / etc.
9	Health of BGP, IS-IS, LDP in the network should be monitored and displayed (Similar functionality as BGPMon)
12	Performance Dashboard should display QoS Drops, per Class per Queue and per Policy
13	Link utilization: - It should be possible to display the 95percentile utilization details in addition to Max & Average Values (by removing the peaks)
14	It should be possible to export the Performance graph data into CSV format
15	Link utilization Dashboard should display both A and Z end device and interface details

16	It should be possible to generate a report of all the devices with interfaces above a specific percentage utilization such as above 70% bandwidth utilization, above 90% bandwidth utilization etc.
17	Fibre performance alerting: SFP Threshold Crossing Alarm should be raised.
18	It should result in links being displayed in a different color in topology view.
19	As it gets addressed in the field, the alarm should get cleared in the next polling cycle.
20	NMS System should support to provide component health metrics
21	NMS should be able to generate single report on Node availability
22	Need the following to be reported by the NMS: · Interface Utilization · CPU utilization · Memory Utilization · Temperature
23	For each of the above, the reports should also present each occurrence of the Threshold crossing and the duration it stayed above the threshold value.
24	In NMS, There should be reports to show: · Device Group-wise Interface Availability · Individual Interface Availability and · Device Availability
25	Performance Graph: in NMS, a single graph should display CPU/Memory utilizations for multiple devices and should have an option to choose the CPU.
26	Live graphs should be made available for all KPIs
27	Specific URLs should be publishable to the end users for all / any specific KPIs.
28	NMS should have a mechanism to provide CRC / Power loss report.
S.No.	Configuration and Image Management Requirements
1	<i>Device configuration Backup should be done on daily basis and backups of one months should be retained.</i>
2	Configuration Archive should retain versions based on a specified duration such as 30 days, 365 days etc.
3	Compliance Audit: It should be possible to check for the presence of a particular set of commands in the latest archived configurations of all/selected devices.
4	It should be possible to schedule an Image upgrade job for the selected target device list which can be imported from a CSV file to avoid manual errors
5	As this is a vendor provided NMS, it should have the facilities to perform all the operations using the NMS itself with no necessity to launch tools such SSH console. Even if such a console is launched, it must be possible to log all the operations performed via such a tool.
S.No.	User Management Requirements
1	<i>Element Management System should be configured to perform Authentication and Authorization using the RADIUS/TACACS</i>

2	User groups should include the following: TAC users, IP Access Group users, Surveillance users, NBI read only users etc.
3	Each NMS server instance should support 40 users in total and 10 concurrent user sessions.
4	Each NMS server instance should support 3 NBI users
5	It should be possible to export the UserID list from the NMS
6	Details of UserIDs such as when they were created/ their privileges were modified/ they were deleted/ last login time should be maintained in the NMS
7	NMS should support password expiry policy, max retries followed by locking policy, etc.
8	Single report on users existing in NMS along with creation/deletion date, last modification date, last login date & user expiry date if applicable.
9	Single user creation/modification/deletion in all NMSs with one command should be supported.
10	Bulk user creation/deletion in all/selective NMSs should be supported.
11	Password Management: NMS should support Multisession capability for a single user
12	NMS should support integration with SYSLOG
13	NMS should support provisioning of Time-based user access management
14	NMS should support Configurable role-based user access management
15	NMS should provide user-friendly bulk user management capability from CLI / GUI
16	It should be possible to dump users in text /csv formats.
S.No.	North Bound Integration Requirements
1	NMS should support to integrate with industry standard alarm management tools. Feature to integrate with North bound unified OSS. System should be able to forward interface, Equipment, Hardware alarm, degraded alarms and syslog alarms. NMS shall provide synchronization feature with OSS for all alarm types
2	NMS server instances should support APIs for integration with North Bound Performance Management System.
3	NMS should support to integrate with industry standard performance monitoring tool
4	Discovery - NMS should support to integrate with industry standard inventory Discovery and Reconciliation application
5	NMS should have the capability to support config backup / restore functionality
S.No.	System Management Requirements
1	System/ application monitoring dashboards should be visible (read-only) to non-admin users. (For example, System Memory and CPU Utilization dashlet in NMS)
3	NMS should be able to take initial Full Application Backup and later it should only take Application Backup delta that has changed over the last backup interval
4	The Authentication logs/System logs/Audit logs/Operations should be available in text format on the server which can be pulled by Log Management System on a specified interval (Example: Daily, Weekly, etc.)

1.9. NTP server

NTP (Network Time Protocol) Server	
S.No.	Description
1	Shall support clients to synchronize clocks with server
2	Shall support all type of computer, Servers and network equipment.
3	The network clocks shall be designed for easy, cost effective, and reliable installation and use standard 10/100/1000 MB or more connectivity.
4	NTP Server(s) shall be accurate to the UTC time reference when synchronized.
5	It shall utilize DHCP, by default, as a means of automating the configuration of all required network settings utilizing the optional settings area of a DHCP server. All DHCP network and optional NTP settings shall allow for enabling or disabling at each clock, in order to use static IP address mode network and NTP settings.
6	shall be able to offset to any international time zone offset and provide automatic Daylight Saving Time (DST) adjustment
7	Best-in-class security, reliability, and ease of management
8	Multiple 1GbE ports and options for 10 GbE and 40 GbE
9	Accurate timing across your network
10	Shall support UDP protocol
11	Shall complied with RFC 1305/RFC 1769
12	The NTP provider follows the standards specified by NTP version 3 for a client and server, and can interact with SNTP clients and servers for backward compatibility with other SNTP clients

Sub-Section A – 3: Technical Specification for Wi-Fi

Please refer Annexure – I for Wi-Fi technical specification.

Sub-section A – 4: Technical Specification for Radio Implementation

Specific Requirements for Radio Link:

Radio Modem:

Reference: TEC/GR/R/ISM-MOD-001/04.MAR2016

SIA intends to purchase Radio Equipment for point to point installation as per Generic Requirements as mentioned in TEC/GR/R/ISMMOD-001/04.MAR2016 for point to point deployment along with following additional requirement of Mahanet. Requirement of radio infrastructure of Mahanet is for establishing point-to point link between BSNL tower and Gram Panchayat. The system should work in Point to Point mode of operation.

The system will employ modulation techniques like FHSS (Frequency Hopping Spread Spectrum), DSSS (Direct Sequence Spread Spectrum), OFDM (Orthogonal Frequency Division Multiplexing) etc. and will work in TDD (Time Division Duplex) or FDD (Frequency Division Duplex) with channel bandwidths of 20MHz and 40MHz in addition to 50MHz (optional, if available). Bidders offering 50 MHz/40 MHz should have fall back option to operate in lower channel bandwidths in case of RF interference, low signal or installation inaccuracies etc. At the same time, it should not interfere with adjacent bands.

1. Systems based on IEEE Standard 802.11 ac are also allowed.
2. The system should support Point-to-Point architecture.
3. The frequency range of the system shall lie within 5825 - 5875 MHz. However, it should be configurable in complete ISM Band (5 GHz) as per NFAP present provisions or any future changes.
4. The modem shall support pure IP traffic (Type B). However installer will have to deploy appropriate converter where ever support for backend connectivity from E1 port is required to be extended. (To be added in Price schedule)
5. The system should support the minimum data rates as per the table below (with maximum two spatial streams):

Modulation and FEC	Physical data Rate in Mbps(20 MHz)	Data Rate (throughput) in Mbps* (20 MHz)	Physical data Rate in Mbps (40 MHz)	Data Rate throughput) in Mbps* (40 MHz)	Data Rate throughput) in Mbps* (50 MHz)
BPSK-1/2	13	6.5	27	13.5	18
QPSK-1/2	26	13.0	54	27.0	37
QPSK-3/4	39	19.5	81	40.5	55
16QAM-1/2	52	26.0	108	54.0	73
16QAM-3/4	78	39.0	162	81.0	110
64QAM-2/3	104	52.0	216	108.0	146
64QAM-3/4	117	58.0	243	121.0	165
64QAM-5/6	130	65.0	270	135.0	183

*Minimum unidirectional throughput (in Mbps) for different channel widths.

Note: 1. for 802.11ac testing will be done at GI=800ns.

1. It is mandatory for the system to operate with at least 64 QAM modulation scheme and should have adaptive coding & modulation which enables dynamically altering of modulation scheme to maintain link quality and optimize the throughput in case of RF interference, low signal or installation inaccuracies etc.
2. Bidders may also offer 256 QAM in which case it should have adaptive coding and modulation which enables dynamically altering of modulation scheme to maintain link quality and optimize the throughput in case of RF interference, low signal or installation inaccuracies etc.
3. Channelling Plan / Configurable Channel Bandwidth: The system should be configurable to 20/40/50(optional) MHz channel bandwidths. This flexibility shall allow BBNL to use different channel bandwidths in different installations depending on throughput requirements.
4. The status of Alarms and Diagnostics should be displayed on the front panel of the equipment (LED/LCD display) and should be extendable to EMS/State/BBNL NMS.
5. There should be a provision of extending at least Four External Alarms such as SPV health indicating Alarms (4Nos.) to be extended to the EMS/NMS.
6. There shall be indication on front panel on LED/LCD display/GUI and EMS/BBNL NMS for the following alarms.
 - a. Power failure
 - b. Receive power below threshold
 - c. Radio sync loss
 - d. Dying Gasp (message to EMS/NMS)
7. The equipment shall have (1+1) hot standby configuration for point to point deployment scenarios.
8. Nominal power supply available at telephone exchange or tower site is -48 volts DC, with a variation over the range -44V to -57V. The equipment should operate over this range without any degradation in performance by using suitable convertor.

DC to DC Convertor

S. No.	Specification parameter	Parameter value
1	Operating temperature range	-10°C to 60°C
2	Protections	Short circuit, Overload, Ovvervoltage

Provision for 1000 Mbps PoE (Power over Ethernet) may also be supported wherever required.

For the equipment to be installed in snowbound areas, it should be IP-67 compliant. For other regions it should be IP-65.

Synchronization: As per TEC GR. Frequency, Phase and Time/ it will ensure successful transmission of packet of sync without fail---

Tower/Pole Specification 9 m pole and 15 m tower antenna Characteristics shall be as follows:

S. No.	Specification parameter	Parameter value
1	Minimum Load Capacity	50 kg (This includes antenna, solar panel and 3 access points etc.)
2	Maximum survival wind speed upto	196 km/h
3	Lightning arrestor	Yes
4	Galvanisation	All steel parts - IS: 4759 Bolts and nuts - IS- 1367 part VIII

1. Electrical Parameters

Frequency	4900-5900 MHz
Gain (dBi) (Minimum)	H=23.5 +/- 0.5 V=23.5 +/- 0.5
VSWR (Max)	1.5:1
E Plane BW (deg)	7 +/- 0.5
H plane BW (deg)	7 +/- 0.5
Polarization	Dual (Linear H & V)
Port to port isolation (dB)	25
Max power input (watts)	50
Impedance	50 Ohm
Front to back ratio (dB)	> 26
Cross polarization (dB)	> 28

2. Mechanical Parameters

Radome	UV Stabilized ABS/UV Protected Polycarbonate
Mounting hardware	MS galvanized powder coated
Mounting style	Tower, Pole and Wall
Mounting adjustment	H Plane +/- 180degree V Plane +/- 180degree

3. Environmental Parameters

Temperature Range (deg C)	-10 to +65 (Snow bound areas - -40 to 65)
Max Wind Speed survivability (Km/hr)	196
Humidity	95% No condensation
Shock	QM333, Category D
Vibration	QM333, Category D
Water Protection	IP65*
Environmental protection	QM333, category D
RoHS/WEEE comply	Complied

Sub-section A – 5: Technical Specification for VSAT

1. Technical specifications for Hub

S. No.	Item Description	Specification
1	9.0 m C Band Antenna	<p>1. C-band 2 port, Linear Polarized Feed, TX/RX * TX (5.85 - 6.425 GHz)* RX (3.625 - 4.2 GHz) * Feed Polarization Positioning ($\pm 50^\circ$) * Kingpost Pedestal - Galvanized* Jackscrews in Azimuth (120°) and Elevation (0°-90°) * Reflector - white diffusive painted Aluminum panels * Lightning arresting rods * Foundation hardware kit</p> <p>2. TX Axis Crossover Waveguide for 9.0M C Band - LINEAR * Single TX Run from Az Axis to Feed Flange * Up to 5 KW Power Capability (as per specification)</p> <p>3. Servo Interface Kit for 9.0 M * Drive Motors for AZ, EL and Pol* Limit Switches * Brackets for Mounting Limit Switches and Transducers * Conduits and Cables</p>
2	Antenna Control System	Antenna Control System with Control Cable
3	Beacon Tracking Receiver	<p>Input Frequency - 930 to 2300 MHz Frequency Selection - 10 kHz steps Digital level reference setting, -40 to -100 dBm on 0.5 dB steps Ethernet connectivity with M&C control interface NEW Version 2.0 M&C control interface allows for remote monitoring from one or multiple locations RS-232/422/485 and Ethernet All Standard Dimensions ... 1 RU, 19" x 16" x 1.75" Temperature stabilization compensation.</p>
4	Dehydrator	<p>Provides dry pressurized air to ensure signal quality of antenna waveguide and dielectric coaxial cable Highly configurable to meet the needs of wide ranging applications Programmable operating pressure range: 0.10 psig - 7.50 psig (7mbar - 517mbar) Brushless compressor for long life Future-proof software based features allow updates and upgrades while in service Remote monitoring and control with web interface or SNMP Configurable Master/Slave operation Ethernet, RS-422/485, RS-232 and alarm relay outputs for compatibility with nearly any system Optional front panel with display allows for IP configuration and status monitoring when no network is available Simple power connections between 100 and 240 VAC, inclusive, or ± 20-75 VDC</p>

		Small, lightweight chassis with multiple mounting options makes installation easy Low energy use minimizes operational costs Quiet operation
5	Lightning Arrester System	As per international Standards
6	Aircraft Warning Light	As per international Standards
7	Ladder and platform	As per OEM recommended specifications
8	Antenna foundation	As per OEM recommended specifications
9	Bird Deterrent	As per OEM recommended specifications
10	750 W TWTA / SSPA	<ul style="list-style-type: none"> ▪ RF Amplifier system consisting of : Type : TWTA / SSPA ; including integral linearisers; and BUCs; ▪ 1:1 dual redundant switch Power dummy load ▪ All necessary coaxial and waveguide interconnections Forward and reverse couplers etc ▪ Mounting kit as per OEM standards.
11	C- Band PLL LNB	<ul style="list-style-type: none"> ▪ PLL LNB for C-Band ▪ Input frequency (GHz) 3.40 to 4.20 ▪ L.O. frequency (GHz) 5.15 ▪ Output frequency (MHz) 950 to 1750 ▪ Weight 500 g / 17.6 oz ▪ Temperature Range -40°C to +60°C ▪ Relative Humidity 0 - 100% condensing ▪ Dimensions 144 (L) x 70 (W) x 98 (H) mm (5.7 x 2.8 x 3.9 in)
12	Baseband Modem	<ul style="list-style-type: none"> ▪ Interface: Ethernet ▪ DVB-S2 ACM QPSK, 8PSK, Adaptive Modulation 256, 512, 1024, 2048 kbps Channel rate 1/2, 2/3, 4/5 Channel coding ▪ BER 10^-10 or better (Rx) ▪ BER 10^-10 or better (Tx)
13	TCP Accelerator	<ul style="list-style-type: none"> ▪ Acceleration of all TCP applications. ▪ Consolidation of IT infrastructure ▪ Reduced bandwidth utilization. ▪ Accelerated, simplified backup and replication ▪ Data Streamlining – Bandwidth utilization reduced by 60 to 95% ▪ Transport Streamlining – Overcomes TCP limitations; ▪ Provides virtual window expansion; Enables High-speed TCP ▪ Application Streamlining – Overcomes application protocol limitations for CIFS, MAPI, HTTP, and SQL; Enables disconnected operations; Provides transparent pre-population ▪ SNMP – SNMPv2 support ▪ Configuration – Web UI, command line interface High Availability and Security
14	IP Gateway / Satellite Gateway Modulator	<p>Configurations:</p> <ul style="list-style-type: none"> - 3 x DVB-S2X carrier demodulator - Modem with one or two demodulators with optional ASI interfaces

		<ul style="list-style-type: none"> • Minimum symbol rate: 256 kBaud • Maximum symbol rate: 133 MBaud • Data rates up to 425 Mbit/s • IF (70/140) and L-Band (950-2150) high power outputs • Demodulators with dual L-band input • Highest system reliability and service uptime through robust design and industry leading redundancy solutions
15	Hub with NMS	OEM standard
16	Network Switch	24 Port network switch in redundancy
17	Installation material for Hub RF infrastructure, Cables, Connectors etc.	Racks, Waveguide, RF cables and connectors.

2. Technical specifications for Spoke (at GP)

S. No.	Item Description	Specification
1	3.8 m C Band Antenna	<p>Earth Station Antenna, C-band (Rx: 3,625-4,200GHz, Tx: 5,850-6,425GHz), precision aluminium reflector assembly, self aligning, easy-to-install antenna features high durability, with manual Pedestal mount and AZ/EL manually adjustable struts,</p> <ul style="list-style-type: none"> • Glass Fibre Reinforced Polyester SMC • Linear or Circular Cross-Polarization • Mount Type: Elevation over Azimuth
2	Antenna Control System	Antenna Control System with Control Cable
3	Beacon Tracking Receiver	<ul style="list-style-type: none"> ▪ Input Frequency - 930 to 2300 MHz ▪ Frequency Selection - 10 kHz steps ▪ Digital level reference setting, -40 to -100 dBm on 0.5 dB steps ▪ Ethernet connectivity with M&C control interface ▪ NEW Version 2.0 M&C control interface allows for remote monitoring from one or multiple location ▪ RS-232/422/485 and Ethernet All Standard ▪ Dimensions ... 1 RU, 19" x 16" x 1.75" ▪ Temperature stabilization compensation.
4	Lightning Arrester System	As per international Standards
5	Aircraft Warning Light	As per international Standards
6	Antenna foundation	As per OEM recommended specifications
7	Bird Deterrent	As per OEM recommended specifications
8	80 W TWTA / SSPA	<ul style="list-style-type: none"> ▪ Converts L-Band to C Band ▪ Integrated amplifier with output power of 80W to 200W ▪ Phase-locked oscillator to external 10MHz reference ▪ High linearity (low intermodulation products) ▪ Remote Monitor & Control ▪ RMS power detector

S. No.	Item Description	Specification
		<ul style="list-style-type: none"> ▪ Protection against thermal runaway and out-of-lock conditions ▪ Output sample monitoring port ▪ Built-in power supply ▪ Integral Harmonic Filter ▪ Light weight ▪ Compact Weatherproof packaging ▪ CE Marking
9	C- Band PLL LNB	<ul style="list-style-type: none"> ▪ PLL LNB for C-Band ▪ Input frequency (GHz) 3.40 to 4.20 ▪ L.O. frequency (GHz) 5.15 ▪ Output frequency (MHz) 950 to 1750 ▪ Weight 500 g / 17.6 oz ▪ Temperature Range -40°C to +60°C ▪ Relative Humidity 0 - 100% condensing ▪ Dimensions 144 (L) x 70 (W) x 98 (H) mm (5.7 x 2.8 x 3.9 in)
10	Baseband Modem	<ul style="list-style-type: none"> ▪ Interface: Ethernet DVB-S2 ACM, QPSK, 8PSK, Adaptive Modulation 256, 512, 1024, 2048 kbps Channel rate 1/2, 2/3, 4/5 Channel coding ▪ BER 10^-10 or better (Rx) ▪ BER 10^-10 or better (Tx)
11	TCP Accelerator	<ul style="list-style-type: none"> ▪ Acceleration of all TCP applications. ▪ Consolidation of IT infrastructure ▪ Reduced bandwidth utilization. ▪ Accelerated, simplified backup and replication ▪ Data Streamlining – Bandwidth utilization reduced by 60 to 95% ▪ Transport Streamlining – Overcomes TCP limitations ▪ Provides virtual window expansion; Enables High-speed TCP ▪ Application Streamlining – Overcomes application protocol limitations for CIFS, MAPI, HTTP, and SQL; Enables disconnected operations; Provides transparent pre-population ▪ SNMP – SNMPv2 support ▪ Configuration – Web UI, command line interface ▪ High Availability and Security
12	IP Gateway / Satellite Gateway Modulator	<ul style="list-style-type: none"> ▪ Configurations: <ul style="list-style-type: none"> - 3 x DVB-S2X carrier demodulator - Modem with one or two demodulators with optional ▪ ASI interfaces ▪ Minimum symbol rate: 256 kBaud ▪ Maximum symbol rate: 133 MBaud ▪ Data rates up to 425 Mbit/s ▪ IF (70/140) and L-Band (950-2150) high power outputs ▪ Demodulators with dual L-band input ▪ Highest system reliability and service uptime through robust design and industry leading redundancy solutions
13	Network Switch 24 Port	24 Port network switch in redundancy

S. No.	Item Description	Specification
14	Installation material for Hub RF infrastructure, Cables, Connectors etc.	Racks, Waveguide, RF cables and connectors.

Sub section A- 6: Cloud Infrastructure

Cloud Service Provider is required to have following Capabilities:

- Geographical Location of the Disaster Recovery Environment in different seismic zone from the production environment or the DR location should be on a different fault line than that of the production site and at a minimum distance of 150 kms **or DC-DR to be in different physical locations, providing active – active architecture**
- ISO 27001 - Data Center and the cloud services should be certified for the latest version of the standards
- The NOC and SOC facility must be within India for the cloud environment and the managed service quality should be certified for ISO 20000:1
- Storage Space: Online, on-demand virtual storage supporting a single storage sizes in multiples of 1 GB
- PCI DSS - compliant technology infrastructure for storing, processing, and transmitting credit card information in the cloud
- Data Transfer Bandwidth: Bandwidth utilized to transfer files/objects in/out of the providers infrastructure supporting a minimum of 100GB of data transferred (in and out) within 1 hour via the network
- ITIL Framework for service delivery
- Cloud Service Provider (CSP) should be empaneled by GI Cloud– Cloud Computing Initiative of MeitY and should have completed the STQC Audit
- RTO - 2 Hours
- RPO – 15 Minutes

1. Scope of Work for CSP

1.1. Service Provisioning:

The CSP should offer cloud service provisioning portal for MahalT in order to provision cloud services either via portal, mobile app or automated using API.

- Cloud service provider should enable MahalT to provision cloud resources through self service provisioning portal.
- CSP should enable MahalT to provision cloud resources from application programming interface (API).
- The user admin portal should be accessible via secure method using SSL certificate.
- MahalT should be able to create, delete, shutdown, reboot virtual machines from provisioning portal.
- MahalT should be able to provision additional resources from provisioning portal as and when require.
- MahalT should be able to take snapshot of virtual machines from provisioning portal.
- MahalT should be able to size virtual machine and select require operating system when provisioning any virtual machines.
- MahalT should be able to predict his billing of resources before provisioning any cloud resources.

- MahalIT should be able to set threshold of cloud resources of all types of scalability.
- MahalIT should be able to provision all additional storages require for cloud services.
- MahalIT should be able to provision any kind of resources either static or elastic resources.
- MahalIT should be able to take console of cloud virtual machines from portal to perform any operations.
- MahalIT should get list of all cloud resources from provisioning portal.
- MahalIT should be able to set the scaling parameters like in case of horizontal scaling,
 - MahalIT should be able to set percentage / quantity of RAM consumption to trigger new virtual machines.
 - MahalIT should be able to set percentage / quantity of CPU consumption to trigger new virtual machines.
 - MahalIT should be able to set percentage / quantity of network bandwidth to trigger new virtual machines.
- MahalIT should be able to set port on which horizontal scaling will work.
- MahalIT should be able to set minimum and maximum number of virtual machines which will be automatically provisioned as part of horizontal scaling to handle spike in load.
- The cloud virtual machine created by portal should be have at-least two virtual NIC cards. One NIC card should be used for internet traffic while other should be used for internal service traffic.

1.2. Operational Management

- CSP should provide access of cloud virtual machines either by SSH in case of Linux and RDP in case of Windows servers.
- CSP should enable MahalIT to get console access of cloud virtual machine from portal and perform operations.
- CSP should upgrade its hardware time to time to recent configuration to delivery expected performance for MahalIT. Investigate outages, perform appropriate corrective action to restore the hardware, operating system, and related tools.
- CSP should manage their cloud infrastructure as per standard ITIL framework in order to delivery right services to MahalIT.
- The CSP should allow different users with different level of access on CSP portal. For example billing user should not be able to provision resources or delete any resources
- The CSP should allow quota management for each department/ISV/Group. The resources to specific department/group/ISV should be as per allocated quota only. If there is any request for more than quota request then it should be sent as request to admin.

1.3. Data Management

- CSP should provide access of cloud virtual machines either by SSH in case of Linux and RDP in case of Windows servers.
- CSP should enable MahalIT to get console access of cloud virtual machine from portal and perform operations.

1.4. Compatibility Requirements

- CSP must ensure that the virtual machine format is compatible with other cloud provider.
- MahalIT should be able to export the virtual machine from CSP cloud and use that anywhere.
- CSP should give provision to import cloud VM template from other cloud providers.
- CSP should ensure connectivity to and from cloud resources of MahalIT is allowed to/from other cloud service providers if require.

1.5. Cloud Network Requirement

- CSP must ensure that cloud virtual machine of MahalT is into separate network tenant and virtual LAN.
- CSP must ensure that cloud virtual machines are having private IP network assigned to cloud VM.
- CSP must ensure that all the cloud VMs are in same network segment (VLAN) even if they are spread across multi datacenters of CSP.
- CSP should ensure that cloud VMs are having Internet and Service Network (internal) vNIC cards.
- CSP should ensure that Internet vNIC card is having minimum 1 Gbps network connectivity and service vNIC card is on 10 Gbps for better internal communication.
- In case of scalability like horizontal scalability, the CSP should ensure that additional require network is provisioned automatically of same network segment.
- CSP must ensure that MahalT gets ability to map private IP address of cloud VM to public IP address as require by MahalT from portal of CSP.
- CSP must ensure that public IP address of cloud VMs remains same even if cloud VM gets migrated to another datacenter due to any incident.
- CSP must ensure that public IP address of cloud VMs remains same even if cloud VM network is being served from multiple CSP datacenters.
- CSP must ensure that the public network provisioned for cloud VMs is redundant at every points.
- CSP must ensure that cloud VMs are accessible from MahalT private network if private links P2P/MPLS is used by MahalT.
- CSP must ensure that there is access to cloud VMs if MahalT require to access it using IPSEC/SSL or any other type of VPN.
- CSP should ensure that cloud VM network is IPV6 compatible.
- CSP should have provision of dedicated virtual links for data replication between their multiple datacenter in order to provide secure data replication for DR services.
- CSP should ensure use of appropriate load balancers for network request distribution across multiple cloud VMs.

1.6. Cloud datacenter specifications

- The datacenter of CSP must be within India only.
- All the physical servers, storage and other IT hardware from where cloud resources are provisioned for MahalT must be within Indian datacenters only.
- The datacenters of CSP should be spread across different geolocation in different seismic zones ***or DC-DR to be in a different physical locations, providing active – active architecture.***
- The CSP datacenters should have adequate physical security in place.
- The CSP datacenters should comply/certified Tier III datacenter norms,
Or,
- The Data Center should conform to at least Tier III standard (preferably certified under TIA 942 or Uptime Institute certifications by a 3rd party) and implement tool-based processes based on ITIL standards.

1.7. Cloud Storage Service Requirements

- CSP should provide scalable, dynamic and redundant storage.
- CSP should offer provision from self-provisioning portal to add more storage as and when require by MahalT.

- CSP should clearly differentiate its storage offering based on IOPS. There should be standards IOPS offering per GB and high performance disk offering for OLTP kind of workload. CSP should deliver minimum 8000 IOPS per TB for OLTP load. The IOPS for NON OLTP load should be minimum 3000 per TB.
- CSP should have block disk offering as well as file/object disk offering to address different kind of MahalIT needs.
- CSP should allow minimum block of 5 GB to be provisioned by MahalIT from self-service provisioning portal.
- CSP must give provision to attach new disk block to any cloud VM MahalIT needs from self-service portal.

1.8. Cloud Security Requirements

- CSP should ensure there is multi-tenant environment and cloud virtual resources of MahalIT are logically separated from others.
- CSP should ensure that any OS provisioned as part of cloud virtual machine should be patched with latest security patch.
- In case, the CSP provides some of the System Software as a Service for the project, CSP is responsible for securing, monitoring, and maintaining the System and any supporting software.
- CSP should implement industry standard storage strategies and controls for securing data in the Storage Area Network so that Maha ITs are restricted to their allocated storage
- CSP should deploy public facing services in a zone (DMZ) different from the application services. The Database nodes (RDBMS) should be in a separate zone with higher security layer.
- CSP should give ability to create non-production environments and segregate (in a different VLAN) non-production environments from the production environment such that the users of the environments are in separate networks.
- CSP should have built-in user-level controls and administrator logs for transparency and audit control.
- CSP cloud platform should be protected by fully-managed Intrusion detection system using signature, protocol, and anomaly based inspection thus providing network intrusion detection monitoring.

1.9. Virtual Machine specifications

- The Cloud virtual machine provided by CSP should be provisioned on redundant physical infrastructure.
- ***The cloud virtual machines should be vertically or horizontally auto-scalable.***
- MahalIT should be able to provision cloud virtual machine of any operating system like Linux and Windows.
- CSP should clearly define policies to handle data in transit and at rest.
- CSP should not delete any data at the end of agreement without consent from MahalIT.
- CSP should provide facility to make template from virtual machines.
- CSP should enable MahalIT to select configuration of cloud virtual machine like custom RAM, CPU and disk.
- CSP should enable MahalIT to add either block storage volume or file level storage block to cloud VM from provisioning portal.
- CSP should enable MahalIT to select even 512 MB RAM configuration of cloud virtual machines.
- CSP should give provision to make clone of cloud virtual machine of MahalIT from provisioning portal.

- CSP should make provision so that MahalIT can add any virtual machine as part of scalable infrastructure.
- CSP should have provision to live migration of virtual machine to another physical servers in case of any failure.
- CSP should provide facility to use different types of disk like SAS, SSD based on type of application.

1.10. Data Management

- CSP should always ensure that data is destroyed whenever any cloud virtual machine is recycled or deleted. The data destruction policy of CSP should be shared with MahalIT before.
- CSP should clearly define policies to handle data in transit and at rest.
- CSP should not delete any data at the end of agreement without consent from MahalIT.
- In case of scalability like horizontal scalability, the CSP should ensure that additional generated data is modified/deleted with proper consent from MahalIT.

1.11. Disaster Recovery Management if services obtained

- CSP is responsible for Disaster Recovery Services so as to ensure continuity of operations in the event of failure of primary data center and meet the RPO and RTO requirements.
- RPO should be less than or equal to 15 Minutes and RTO shall be less than or equal to 2 hours
- The key transaction data shall have RPO of 15 minutes. However, during the change from Primary DC to DRC or vice-versa (regular planned changes), there should not be any data loss.
- There shall be asynchronous replication of data between Primary DC and DRDC and the CSP will be responsible for sizing and providing the DC-DR replication link so as to meet the RTO and the RPO requirements.
- During normal operations, the Primary Data Center will serve the requests. The Disaster Recovery Site will not be performing any work but will remain on standby. During this period, the compute environment for the application in DR shall be available but with minimum possible compute resources required for a functional DR as per the solution offered. The application environment shall be installed and ready for use. DR Database Storage shall be replicated on an ongoing basis and shall be available in full (100% of the PDC) as per designed RTO/RPO and replication strategy. The storage should be 100% of the capacity of the Primary Data Center site.
- In the event of a site failover or switchover, DR site will take over the active role, and all requests should be routed through that site. The pre-requisite to route request to DR should be articulated properly and shared by CSP.
- Whenever there is failover from primary to secondary, compute environment for the application at DR site shall be equivalent to DC
- The installed application instance and the database shall be usable and the same SLAs as DC shall be provided.
- The bandwidth at the DR shall be scaled to the level of Data center when DR is activated.
- The CSP shall conduct DR drill for two days at the interval of every six months of operation wherein the Primary DC has to be deactivated and complete operations shall be carried out from the DR Site. However, during the change from DC to DRC or vice-versa (regular planned changes), there should not be any data loss. The pre-requisite of DR drill should be carried out by CSP and MahalIT jointly.
- The CSP shall clearly define the procedure for announcing DR based on the proposed DR solution. The CSP shall also clearly specify the situations in which disaster shall be announced along with the implications of disaster and the time frame required for migrating to DR. The CSP shall plan all

the activities to be carried out during the Disaster Drill and issue a notice to the Department at least two weeks before such drill.

- The CSP should offer dashboard to monitor RPO and RTO of each application and database.
- Any lag in data replication should be clearly visible in dashboard and alerts of same should be sent to respective authorities.

1.12. Cloud resource and Network monitoring

- CSP should give provision to monitor the network traffic of cloud virtual machine.
- CSP should offer provision to analyze of amount of data transferred of each cloud virtual machine.
- CSP should provide network information of cloud virtual resources.
- CSP should offer provision to monitor latency to cloud virtual devices from its datacenter or Mahait should be able to set monitoring of latency to cloud VMs from outside world.
- CSP must offer provision to monitor network uptime of each cloud virtual machine.
- CSP must make provision of resource utilization i.e. CPU graphs of each cloud virtual machine.
- CSP must make provision of resource utilization graph i.e. RAM of each cloud virtual machine. There should be provision to set alerts based on defined thresholds. There should be provision to configure different email addresses where alerts can be sent.
- CSP must make provision of resource utilization graph i.e. RAM of each cloud virtual machine.
- CSP must make provision of resource utilization graph i.e. disk of each cloud virtual machine. There should be graphs of each disk partition and emails should be sent if any threshold of disk partition utilization is reached.
- CSP should give provision to monitor the uptime of cloud resources. The report should be in exportable form.
- CSP must give provision to monitor the load of Linux/Windows servers and set threshold for alerts.
- CSP should make provision to monitor the running process of Linux/Windows servers. This will help Mahait to take the snapshot of processes consuming resources.
- CSP must ensure that there should be historical data of minimum 6 months for resource utilization in order to resolve any billing disputes if any.
- CSP must ensure that audit logs of scalability i.e. horizontal and vertical is maintained so that billing disputes can be addressed.
- CSP must ensure that log of reaching thresholds used to trigger additional resources in auto provisioning are maintained.
- CSP must ensure that there are sufficient graphical reports of cloud resource utilization and available capacity.

1.13. Managed Services

- a) Network and Security Management:
 - Monitoring & management of network link proposed as part of this solution.
 - Bandwidth utilization, latency, packet loss etc.
 - Call logging and co-ordination with vendors for restoration of links, if need arises.
 - Redesigning of network architecture as and when required by Mahait
 - Addressing the ongoing needs of security management including, but not limited to, monitoring of various devices / tools such as firewall, intrusion protection, content filtering and blocking, virus protection, and vulnerability protection through implementation of proper patches and rules.
 - Ensuring that patches / workarounds for identified vulnerabilities are patched / blocked immediately
 - Ensure a well-designed access management process, ensuring security of physical and digital assets, data and network security, backup and recovery etc.

- Adding/ Changing network address translation rules of existing security policies on the firewall
 - Diagnosis and resolving problems related to firewall, IDS /IPS.
 - Managing configuration and security of Demilitarized Zone (DMZ) Alert / advise Mahait about any possible attack / hacking of services, unauthorized access / attempt by internal or external persons etc
- b) Server Administration and Management:
- Administrative support for user registration, User ID creation, maintaining user profiles, granting user access, authorization, user password support, and administrative support for print, file, and directory services.
 - Setting up and configuring servers and applications as per configuration documents/ guidelines provided by Mahait
 - Installation/ re-installation of the server operating systems and operating system utilities
 - OS Administration including troubleshooting, hardening, patch/ upgrades deployment, BIOS & firmware upgrade as and when required/ necessary for Windows, Linux or any other O.S proposed as part of this solution whether mentioned in the RFP or any new deployment in future.
 - Ensure proper configuration of server parameters, operating systems administration, hardening and tuning
 - Regular backup of servers as per the backup & restoration policies stated by Mahait from time to time
 - Managing uptime of servers as per SLAs.
 - Preparation/ updation of the new and existing Standard Operating Procedure (SOP) documents on servers & applications deployment and hardening

1.14. Backup Services

- CSP must provide backup of cloud resources. The backup tool should be accessible
- To perform backup and restore management in coordination with Mahait's policy & procedures for backup and restore, including performance of daily, weekly, monthly, quarterly and annual backup functions (full volume and incremental) for data and software maintained on the servers and storage systems using Enterprise Backup Solution.
- Backup and restoration of Operating System, application, databases and file system etc. in accordance with defined process / procedure / policy.
- Monitoring and enhancement of the performance of scheduled backups, schedule regular testing of backups and ensure adherence to related retention policies
- Ensuring prompt execution of on-demand backups & restoration of volumes, files and database applications whenever required.
- Real-time monitoring, log maintenance and reporting of backup status on a regular basis. Prompt problem resolution in case of failures in the backup processes.
- Media management including, but not limited to, tagging, cross-referencing, storing (both on-site and off-site), logging, testing, and vaulting in fire proof cabinets if applicable.
- Generating and sharing backup reports periodically
- Coordinating to retrieve off-site media in the event of any disaster recovery
- Periodic Restoration Testing of the Backup
- Maintenance log of backup/ restoration
- CSP should provide network information of cloud virtual resources.
- CSP should offer provision to monitor latency to cloud virtual devices from its datacenter or Mahait should be able to set monitoring of latency to cloud VMs from outside world.

- CSP must offer provision to monitor network uptime of each cloud virtual machine.

1.15. Web Application Firewall as Service

- Cloud platform should provide Web Application Filter for OWASP Top 10 protection
- CSP WAF should be able to support multiple website security.
- CSP WAF should be able to perform packet inspection on every request covering all 7 layers.
- CSP WAF should be able to block invalidated requests.
- CSP WAF should be able to block attacks before it is posted to website.
- CSP WAF should have manual control over IP/Subnet. i.e., Allow or Deny IP/Subnet from accessing website.
- The attackers should receive custom response once they are blocked.
- CSP must offer provision to customize response of vulnerable requests.
- CSP WAF should be able to monitor attack incidents and simultaneously control the attacker IP.
- CSP WAF should be able to Grey list or Backlist IP/Subnet.
- CSP WAF should be able to set a limit to maximum number of simultaneous requests to the web server & should drop requests if the number of requests exceed the threshold limit.
- The WAF should be able to set a limit to maximum number of simultaneous connections per IP. And should BAN the IP if the threshold is violated.
- Should be able to set a limit to maximum length of path to URL.
- Should be able to limit maximum size of request to Kilobytes.
- CSP WAF should be able to limit maximum time in seconds for a Maha IT to send its HTTP request.
- Should be able to BAN an IP for a customizable specified amount of time if the HTTP request is too large.
- Should be able to limit maximum size of PUT request entity in MB
- The WAF should be able to close all the sessions of an IP if it is ban.
- Should be able to Ban IP on every sort of attack detected and the time span for ban should be customizable. There should be a custom response for Ban IP.
- The Dashboard should show a graphical representation of
 - a) Top 5 Attacked Websites.
 - b) Top 5 Attacking IP.
 - c) Top 5 Attack types.
 - d) Top 5 Attacked URLs.
- For analysis purpose the Dashboard should contain following information:
 - a) Number of requests to web server.
 - b) Number of attacks.
 - c) Number of Attackers.
 - d) Types of error messages and on. Of error messages sent to the users.
 - e) Total Bytes sent during transaction

1.16. Helpdesk Support from CSP

- CSP should provide flexibility of logging incident manually via windows GUI and web interface.
- The web interface console of the incident tracking system would allow viewing, updating and closing of incident tickets
- Allow categorization on the type of incident being logged

- Provide classification to differentiate the criticality of the incident via the priority levels, severity levels and impact levels
- Provide audit logs and reports to track the updating of each incident ticket
- It should be able to log and escalate user based requests.
- CSP should allow ticket logging by email, chat or telephone.

1.17. Database support service

- Installation, configuration, maintenance of the database (Cluster & Standalone).
- Regular health checkup of databases.
- Regular monitoring of CPU & Memory utilization of database server, Alert log monitoring & configuration of the alerts for errors.
- Space monitoring for database table space, Index fragmentation monitoring and rebuilding.
- Performance tuning of Databases.
- Partition creation & management of database objects, Archiving of database objects on need basis.
- Patching, upgrade & backup activity and restoring the database backup as per defined interval.
- Schedule/review the various backup and alert jobs.
- Configuration, installation and maintenance of Automatic Storage Management (ASM), capacity planning/sizing estimation of the Database setup have to be taken care by the vendor.
- Setup, maintain and monitor the 'Database replication' / Physical standby and Asses IT infrastructure up-gradation on need basis pertaining to databases.

1.18. Performance Metrics

1.18.1. Provisioning

Description:

Shall mean facility to provision or deliver new cloud resources as and when require by the cloud customers. Cloud service providers shall have online secured provisioning system so that customer can itself provision any type of cloud resources.

Performance Attributes:

<u>Attribute</u>	<u>Description</u>
Provisioning Portal	Shall refer to provisioning portal made available by CSP for its customers so that as and when require, they can provision new resources.
Secure access to Portal	Portal should be have complete secure access running on HTTPS protocol along with SSL certificate
Access Method	VPN shall be preferred access method of any provisioning
Authentication	Provisioning portal should have secure authentication system. Preferred is dual authentication system.
API	Cloud service provider should make API available with secure authentication of customers to provision resources.
Provisioning options	Cloud service providers should make all of his cloud service and infrastructure to customer to provision from portal. Such services may include virtual machines, storage, network, firewall, backup servers and so on.

1.18.2. Accessibility

Description:

Shall mean the facility to access cloud resources by customer and their end users. Whenever any cloud service is provisioned its accessibility should be made available to customer can his allocated infrastructure like virtual machines, storage, network, backup etc. as and when required and from any location.

Performance Attributes:

Attribute	Description
Resources	Cloud service providers should make all types of resources accessible to customer which may include allocated virtual machines, network, backup, security solution, monitoring system, reports, helpdesk tickets, invoices etc.
Location	Cloud service providers should make resources accessible from anywhere with secure access.
Method	Cloud service providers shall make resources available to customer by using all standard communication protocols like HTTP, HTTPS, FTP, SSH, RDP and so on.
Time	Cloud service providers should make resources accessible 24*7 hours.

1.18.3. Availability

Description:

Shall mean the availability of cloud services to customer upon demand by authorized person.

Performance Attributes:

Attribute	Description
Available Time	Cloud service providers should make system available as per mutually agreed time i.e. 99.9 % of the service contract time. This available time should be between two billing cycles. For example if billing cycle is quarterly, then the available time for a quarter should be considered against SLA so that service credit against downtime can be settled in next billing cycle.
Scheduled downtime	Any scheduled downtime which is mutually agreed between parties should be excluded from overall service availability time.
Quantity of resources	Shall mean that overall resources required to run customer service from cloud should be available during availability period. For example if to deliver email service, virtual machine, network, storage, security are required then during availability period, everything should be available.
Time	The metering unit of available time should be minutes.

1.18.4. Storage Performance

Description:

Shall mean performance of cloud storage for read and write operations. Storage performance is key factor for any application accessibility. The performance of storage should meet standard requirements of OLTP load.

Performance Attributes:

<u>Attribute</u>	<u>Description</u>
IOPS (Input Output Operations per second)	Cloud provider should ensure that the storage offered for OLTP load would deliver minimum 8000 IOPS per TB. While storage for OLAP load and other VMS must deliver minimum 5000 IOPS per TB
Storage throughput	The capability of a storage system to transfer a fixed amount of data in a measured time is known as throughput, or bandwidth. Cloud service provider must ensure that virtual machine get minimum 1Gbps.
Latency	Latency or response time describes the time taken to complete a single I/O (input output) operation and is essentially a measure of how fast a storage system responds to read and write requests. Cloud service provider must ensure that response time is below 5 ms.

1.18.5. Network Latency

Description:

Shall mean the time to access cloud resources between customer end and cloud infrastructure. As communication protocol, the minimum time to access the resources is recommended for faster access of application and better customer experience.

Performance Attributes:

<u>Attribute</u>	<u>Description</u>
Domestic Latency	Domestic latency means the time require to access cloud services from any Indian location. The latency generally should not exceed 100 ms.
International latency	International latency means the time require to access cloud resources from anywhere in the world. The time to access cloud services may vary depending country location. However in general case, it should not exceed 350 ms.
Packet Loss	During the communication or accessing the cloud services hosted in cloud service providers' datacenter, there should not be any packet loss ideally. As part of SLA it should not exceed more than 1% of overall packet loss.
Bandwidth	While accessing any cloud service, customer can opt any bandwidth he requires starting from 10Mbps upto 10Gbps. Cloud service provider should make require bandwidth available to customer agreed as per SLA.

1.18.6. Scalability

Description:

Shall mean the expansion of virtual resources like virtual machine, storage, network bandwidth, backup capacity, firewall throughput, load balancer capacity and so on either on demand or

automatically, as and when require by customers, after mutually agreeing payment terms of additional resources.

Performance Attributes:

<u>Attribute</u>	<u>Description</u>
Scalability Limit	Cloud service provider should make at-least 60% resources available for customer, at any point of time, so that by using defined “method”, customer can scale resources.
Time to scale	Cloud service providers should make resources available to customer within 2 hours of time of “Scalability Limit” resources to scale, any point of time.
Reports	Cloud service providers should make all reports of additional resources requested and provisioned by CSP. The report should include details of resources including time, person and line itNMS of service.
Methods	CSP should make additional resources available by using vertical scalability or horizontal scalability either automatically or manually.
Additional Invoice	Additional invoice of scaled up/down resources should be generated or should be clearly mentioned in the invoice.

1.18.7. Capacity

Description:

Shall mean overall capacity of cloud computing infrastructure which includes compute, storage, network, manpower and financial capacity of cloud service provider in order to deliver cloud services.

Performance Attributes:

<u>Attribute</u>	<u>Description</u>
Compute Capacity	Cloud service provider should always have 60% expandable capacity over and above of overall agreements. This capacity includes total cloud RAM, CPU spread across different availability zones.
Storage Capacity	Cloud service provider should always have 60% expandable capacity over and above of overall agreements. This capacity includes total cloud storage, can be any type like FC, iSCSI, block, NFS, file etc., spread across different availability zones.
Network Capacity	Cloud service provider should always have 60% expandable capacity over and above of overall agreements. This capacity includes total cloud internet bandwidth, spread across different availability zones.
Expansion	CSP should make additional resources available by using vertical scalability or horizontal scalability either automatically or manually.
Manpower	Cloud service provider should have sufficient skilled manpower in order provide required technical support for cloud services. Skilled manpower includes system administrators, network administrators, cloud evangelist, backup engineers and so on.

1.18.8. Service Monitoring

Description:

Shall mean monitoring facility to monitor usage, status of different cloud components like RAM, CPU, disk, and bandwidth, service alerts.

Performance Attributes:

Attribute	Description
Basic monitoring	Cloud service provider should provide provision of monitoring basic components of cloud resources like RAM, CPU, disk and bandwidth as part of default service.
Alerts	CSP should provide provision to configure email address of customer where emails of alerts can be sent.
Reports	CSP should provide provision to generate reports of cloud resource performance like RAM, CPU, and disk usage and internet bandwidth/data volume.
Historical Data	CSP should have historical data of reports of minimum six months and should be downloadable in PDF format.

1.18.9. Support

Description:

Shall mean interface made available by the cloud service provider to handle issues and queries raised by the cloud service customer.

Performance Attributes:

Attribute	Description
Support Hours	Shall refer to the time between which customer support service is available for customer for any type of customer query/complain
Response time	Shall refer to the maximum time the cloud service provider should take to acknowledge a cloud service customer inquiry or request. There can be different response time based on severity of technical issue.
Resolution time	Shall refer to the target resolution time for customer requests. In other words, the time taken to complete any necessary actions as a result of the request. There can be different resolution time based on severity of technical issue.
Escalation Matrix	Shall refer to the technical support hierarch at CSP to provide technical support services. Based on severity of customer query/complain and delay time, the escalation matrix should be defined.
Root cause analysis	In case of major problems, RCA needs to be performed and corrective action taken to prevent repeat of the same incident
Topology map	Updated map should be maintained at all times to visualize the dependencies at all times to minimize time for resolution

1.18.10. Data availability

Description:

Shall refer to the availability of customer data in cloud service providers storage, may be spread across different availability zones.

Performance Attributes:

<u>Attribute</u>	<u>Description</u>
Volume of data	Shall refer to overall volume of customer data which may be in MB, GB, TB or PB.
Type of data	Shall refer type of data which can be files, block, audio formats, video formats or any other types of data storing customer information.
Retention	Shall refer to the period for which data should be retain by cloud service provider. The time can be in days, months or years.
Accessibility	Shall refer to the time within which data is made available to cloud customer on his request. The access method should be defined clearly.

1.18.11.Data Security

Description:

Shall refer to customer data privacy and security hosted at CSP, prevention of data being breached. Multiple measures should be taken to implement data security.

Performance Attributes:

<u>Attribute</u>	<u>Description</u>
Access Permission	Shall refer to access permission of cloud customer data/system by cloud service provider's engineers. Limited permission or pre-authorization should be in place
Firewall / UTM	Shall refer to system implemented in order to block access of system from unauthorized external world.
Data Leakage Protection	Shall refer to system put in place to avoid any data leakage issues.

1.18.12.Incidents

Description:

Shall refer single or series of events that may cause service interruption.

Performance Attributes:

<u>Attribute</u>	<u>Description</u>
Incident Type	Shall refer to type of incident. Incident types can be classified based on its impact on service.
Notification Method	Shall refer to method of notification to cloud customer, this may be by email, phone, forums, social network and so on.
Incident Report Time	Shall refer to time within which incident is reported to cloud customer. incident type can be classified based on impact of service.

1.18.13.Virtual Machine Portability

Description:

Shall refer to capability where customer can use existing virtual machine image at other cloud service provider when his contract is terminated. This should require for interoperability of cloud virtual machines across multiple cloud providers.

Performance Attributes:

Attribute	Description
Virtual machine format	Shall refer to format of virtual machine format in which virtual machine should be stored. Every cloud should
Change request time	Shall refer to time within which service change request is successfully processed. Time can be set based on types of service.
Change Type	Should refer to different types of service change request based on impact on service.
Change request notification	Shall refer to notification system by which customer should be updated about request, status, and closure of service request.

1.18.14.Incident response and Support Methodology

Incidents- Any event which may disrupt service shall be refer to as incident. Such incident can be classified into different categories based on their service impact. Classification of incident should be as following.

<u>Incident Impact Type</u>	<u>Severity</u>	<u>Incident Description</u>
Low	Severity3	Any incident which causes limited inconvenience or operational difficulties to the Maha IT but with 100% application functioning with minor performance issues shall be refer to as Severity 3 type of incident.
Medium	Severity2	Any incident type which causes inconvenience or operational difficulties to the users for partial functioning which leads to business impact shall be refer as Severity 2 type of incident.
Critical	Severity1	Any incident which causes business to stop operations, completely non-operation of business leading to business loss shall refer to as Severity 1 type of incident.

As incidents types are classified, the priority and time to respond different types of incidents should also be defined. Standard time to respond shall be as below.

<u>Incident Impact Type</u>	<u>Severity</u>	<u>Time to respond</u>
Low	Severity3	Since this type of incidents are not business impacting, time to respond such type of incident shall be within business 8 hours.
Medium	Severity2	Since this type of incidents are partially impacting business operations, time to respond such type of incident shall be within 1 hours.

Critical	Severity1	Since this type of incidents are completely impacting business operations, time to respond such type of incident shall be within 15 hours.
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1.18.15. Technical Support

Technical support services for cloud customers should be available from multiple communication channels. These channels can as below.

- a. Web Portal to log complaints
- b. Email communication to raise issues by sending emails.
- c. Phone support. Phone support can help to understand issue easily and perfectly.

Language of technical support should be English along with regional language if any applicable.

Technical support shall be provided 24*7.

Technical support performance metric should be based on following deliverables.

<u>Issue Priority</u>	<u>Time to Respond</u>	<u>Time to Resolve</u>	<u>Update time</u>
Low	Shall refer to the time respond to customer once issue is logged. Shall be within 2 hours	Shall refer to the time resolve issue starting from time issue is logged. Shall be within 12 hours	Shall refer to the time interval at which customer is updated about issue. Customer shall be notified every two hour.
Medium	Shall refer to the time respond to customer once issue is logged. Shall be within 1 hours	Shall refer to the time resolve issue starting from time issue is logged. Shall be within 6 hours	Shall refer to the time interval at which customer is updated about issue. Customer shall be notified every an hour.
Critical	Shall refer to the time respond to customer once issue is logged. Shall be within 15 minutes	Shall refer to the time resolve issue starting from time issue is logged. Shall be within 2 hours	Shall refer to the time interval at which customer is updated about issue. Customer shall be notified every 30 minutes.

Sub-section A – 7: Technical Specification for Network Operation Centre (NOC) and DR NOC

GENERAL REQUIREMENTS FOR DATA CENTER AND NOC

The minimum requirements/ specifications for the Virtual Private Cloud DC (DC/DR) and Network operation Center (NOC) Operations area are detailed in the following sub-sections. While it is mandatory for the Bidder to meet these minimum requirements, if the Bidder estimates that a particular requirement would need a higher category of equipment, the Bidder should provision for the same in his bid. The Bidder should however provide basis for arriving at the solution being proposed as part of his bid.

The overall Scope of Work (SOW) for the Bidder includes the following.

- Design of the proposed Virtual Private Cloud DC
- Bidder may suggest innovative interior design layout for the NOC Operations area, and prepare working drawings / shop drawings good for execution of interior fit out works for the layout and BOM for design in consultation and approval of consultant / purchaser.
- Design layout of the NOC operations area in accordance with the team segregation & NOC resource requirements. Bidder should take consultation and approval of consultant / purchaser, for the interior layout and material to be procured for the operations area.
- NOC area consists of the network operation center (NOC) room, helpdesk, reception area, meeting room, manager cabin, Electrical room and Conferences room.
- Design, Supply, installation and setting up of the necessary basic Infrastructure Civil interior work, electrical, air-conditioning system, fire prevention detection and suppression System, Rodent replant system, water leak detection system etc.
- Design, Supply, installation and setting up of the multi-layer Physical Security infrastructure like bio-metric based access-control system, CCTV/ surveillance systems.
- Design, Supply, installation of operation Area at NOC.
- ***Taluka to NOC/NOC DR and DC/DR connectivity is for the purpose of Network management/OSS/BSS requirements (Only management layer). The NMS/OSS/BSS solution is to be designed by the bidder and hence the bandwidth requirement also has to be assessed by the bidder during the contract period.***



NOC OPERATION CENTER

As part of this RFP, it is proposed that a Network Operations Center (hereinafter referred to as "NOC") shall be established for monitoring the network infrastructure laid as part of Mahanet Network Backbone across all locations as proposed in this RFP. The minimum requirements/ specifications for the NOC area are detailed in the following sub-sections. While it is mandatory for the Bidder to meet these minimum requirements, if the Bidder estimates that a particular requirement would need a higher category of equipment, the Bidder shall provision for the same in the bid response. The Bidder shall however provide basis for arriving at the solution being proposed as part of his bid.

The NOC shall analyse network problems, perform troubleshooting, communicate with various NMC officials / technicians and track problems through resolution. The key objective of the NOC is to ensure the health and availability of components. When necessary, NOC shall escalate problems to the appropriate stakeholders. The Bidder shall develop service catalogue for NOC and get a sign off on the same from purchaser / authorized entity.

Features of NOC

- Incident Management based on incident Category
- Remote Infrastructure Management for Configuration, fault diagnosis, preventive maintenance
- Tracking and reporting of all contractual SLAs in an automated way.
- Update knowledge base for technical analysis and further help end-users to search solutions for previously solved issues.
- The NOC shall escalate issues in a hierarchical manner, so if an issue is not resolved in a specific time frame, the next level is informed to speed up problem remediation.
- The Services Catalogue for the NOC has to be prepared by the Bidder and get a sign off from Purchaser. Indicative list of services that have to be provided through the NOC are mentioned below:-

> Connectivity (Transport Bandwidth Sale)
> L2 & L3 VPN Services
> Unicast and Multicast Services
> Fibre Segment Leasing
> Hosting Services (At State POP/DC)

Core Infrastructure Requirements

- Access Switches
- Video Wall & Video Conferencing solution
- Sitting Infrastructure
- Cooling
- Power and LAN Connectivity

NOC Requirements

- NOC to be established at Navi Mumbai in a space provided by the Authority complying the best-in-class standards
- NOC will act as centralized management on full-network resource inventory to improve utilization of in-service resources
- Provide key correlation analysis for network fault processing to improve network fault processing efficiency
- Provide the function of automatic service design and resource distribution
- Provide performance & trend development analysis of network equipment and impact range of network fault and supply end-to-end service quality management & control, which control network & service quality continuously and enhance customer satisfaction
- Provide FOA (Field Operation Assistance) for field engineers
- Contractor needs to survey the site; design the layout of the site including all the standard furnishings etc. to make the NOC operations. The complete BOQ of the work to be done at NOC needs to be submitted along with the design and approval to be taken from the Authority before start of the work
- Integration with National NOC – NOC will integrate with a National NOC which is being set-up at the National Capital Region (New Delhi). This integration will include:
- Integration of state NMS with national NMS for monitoring of the state network status at the national NOC
- In case of different technologies deployed at the state and the centre, the technologies for monitoring will also be different probably. The bidder selected for the MahaNet project (Bidder) will have to develop the required connectors wherever needed (to tackle the integration between open as well as proprietary network interfaces) to realize this integration, and also have to understand other systems and integrate it with the monitoring solution of NOC. In short, whatever additional development will be required for this implementation, will be part of the bidder's (Bidder's) responsibility. This also means that the national NOC (NNOC) shall be provided a view into the Maharashtra NMS by

providing them with user credentials that would enable them to have read-only access into the state NMS, and if required NNOC shall be provided with single consolidated view of certain features of state NOC, mutually agreed upon

- Integration of state BSS with national BSS

Primary responsibilities of NOC personnel shall include but not limited to:

- Network Supervision and Monitoring
 - Monitor the complete network 24/7, to keep network and systems functioning in a stable operation mode
- Configuration Management
 - Ensure the proper configuration of network, systems and applications for the provision of reliable and high quality end-user services
- Change Management, Network Extension
 - Ensure efficient day-to-day management of short-term network changes and optimization, including their implementation. This activity shall be synchronized with the maintenance scheduled activities
- Performance Management
 - Provide efficient performance management procedures ensuring a reliable, high-quality network performance and service
- Service and Network Provisioning
 - Define all necessary actions to be performed when a request for a new customer service is issued, and control the actions performed at NOC level or field level until completion
- Scheduled Activities Planning
 - Provide regular plans for all scheduled activities, including preventive maintenance. Respect a schedule, and achievement of the plan. This is linked to the change management function which ensures overall synchronization of all network activities
- IT and DB Management
 - Day-to-day management of all OSS systems, IT systems and databases (administration, backups)
- Security Management
 - Define and implement security policies, guidelines, and best practices, and check for compliance with security regulations
- Quality Management
 - Define quality management policies, and ensure implementation and usage for competitive quality of service
- Workforce Management
 - Manage field personnel to ensure timely interventions and respect of the preventive maintenance plan
- Network Inventory Management
 - Ensure consistent management of network equipment, and accurate, up-to-date documentation of it
- Spare Parts Management
 - Manage spare part handling and logistics to minimize repair/swap turn-around times for defective items, and keep low CAPEX for spare parts and consumables
- Asset Inventory Management
 - Ensure consistent inventory management for all assets including infrastructure, buildings, tools, spares, and equipment
- Repair and Return
 - Receive and repair defective boards, return repaired or replacement boards.
- The contractor shall be responsible for maintaining an operational system to achieve the availability of minimum 99% uptime of NOC and related software applications and a 98% uptime per PoP (to be monitored on monthly basis)

- During O&M period, the contractor shall also manage the NOC and other software deployed at NOC. The scope shall also include creation of various application instances of BSS solutions for ISP's, LCO's, MSO's etc. and provide them with web based access including training the requisite assistance for the use of software
- The bidder is responsible for supply, installation and operations of entire network, accessories, network equipment including those related specifically to NOC



Video Wall Requirement

Maharashtra NOC will have large display screens on which various network parameters will be displayed. Video Wall system will consist of three major components which are:

- Video Wall screen consisting of multiple LCD/LED HD panels tiled together to form a single screen
- Video Wall controller used to split single image into parts to be displayed on video wall screen
- Video Wall management software used for managing and monitoring of the input sources, displays and scaling, multi-view support and health of the video wall system

For NOC, it is envisaged to have:

- 3 Video Walls of 24 LCD/LED/DLP cubes of minimum 65" screen
- Display should typically be a LED backlit model
- Display should typically have an aspect ratio of 16:9
- Display should typically support true resolution of 1920x1080 pixels
- Display should typically have a minimum contrast ratio of 1600:1
- Display should typically have a minimum life-span of 50,000 hours
- The video controller should typically have (but not limited to) 6 output (1920x1080), 4 physical input and dual LAN
- The video controller should typically have (but not limited to) a Xeon processor, 6 GB RAM and 500 GB storage
- The video controller should be supplied with wall management software to control the video wall for showing any input in the wall
- The video controller should have a feature to split the wall into multi-window
- The video controller should be 24x7 operational with proper cooling system

Video Conferencing Requirement

- Typically, video conferencing will include Tele-Presence equipment, End-points, Multi-conferencing unit and VC management software.
- Tele Presence equipments
 - Cameras
 - Microphone arrays (used for creating life-like immersive tele-presence experiences)
 - End-Point devices
 - HD Camera(s) (min 720p)
 - Microphone(s)
 - Speaker(s)
 - Screen(s)
 - Controller (handheld remote or desktop touch panel)
 - Signal processing resources (to establish and then code and decode audio and video)
 - Multi-Conferencing units
 - Any standard video conference system should be able to connect to the MCU on any of the following: H.320 (ISDN), H.323 (IP), BidderP (Video Phones), HD (High Definition video)
 - MCU should support transcoding (i.e. various video conferencing systems connecting with the MCU can have different data rates, different audio or video algorithms, different standards, different frame rates etc. and the MCU can still negotiate the best possible connectivity with each of the end-points)
 - VC Management software
 - Provide directory, scheduling and reporting services
 - Monitors, manages and provisions multiple video devices like tablets and smartphones, desktop systems, conference room systems, and immersive tele-presence theatres

DATA CENTER APPLICATIONS

All Application/Databases deployment in private virtual cloud data center would be hosted with architecture to ensure 99.999% availability. Application High Availability and Business Resiliency would be maintained through following philosophy

1. Application High Availability

- a. All Database Instances would be deployed in 1+1 or (N+N) cluster of Server or Virtual Machines
- b. All Application Server Instances would be deployed in N+m cluster of Server or Virtual Machines where N is number of Nodes designed with capacity to handle complete Load for next 10 years of Operation. Value of m would be N/4 (rounded up).
- c. All Web Server Instances would be deployed in N+1 cluster.
- d. All database instances would be deployed on external storage system. Exception on case to case basis would be given for only those case where database is tightly integrated with Application and only manage application specific data.

2. Site Level Redundancy

- a. One Main Data Center with One Disaster Recovery Data Center with Data **RTO = 8Hrs, RPO=30Mins;**
Connectivity from Taluka to DC/DR, NOC to be provided by the bidder. Refer to OpeX items in SOR & BOQ (Network Bandwidth costs)
- b. Data on storage system would be replicated to DR site through replication
- c. Data on Local Disks would be replicated to DR by database based replication tool. Bidder should provide all required tools.

Proposed Private Virtual Cloud Data Center should be able to provision following as per IT HW sizing

- Load Balancer
- Pool of Virtualized Servers (No. of VM, Cores, RAM, Local Disk, SAN Storage etc)

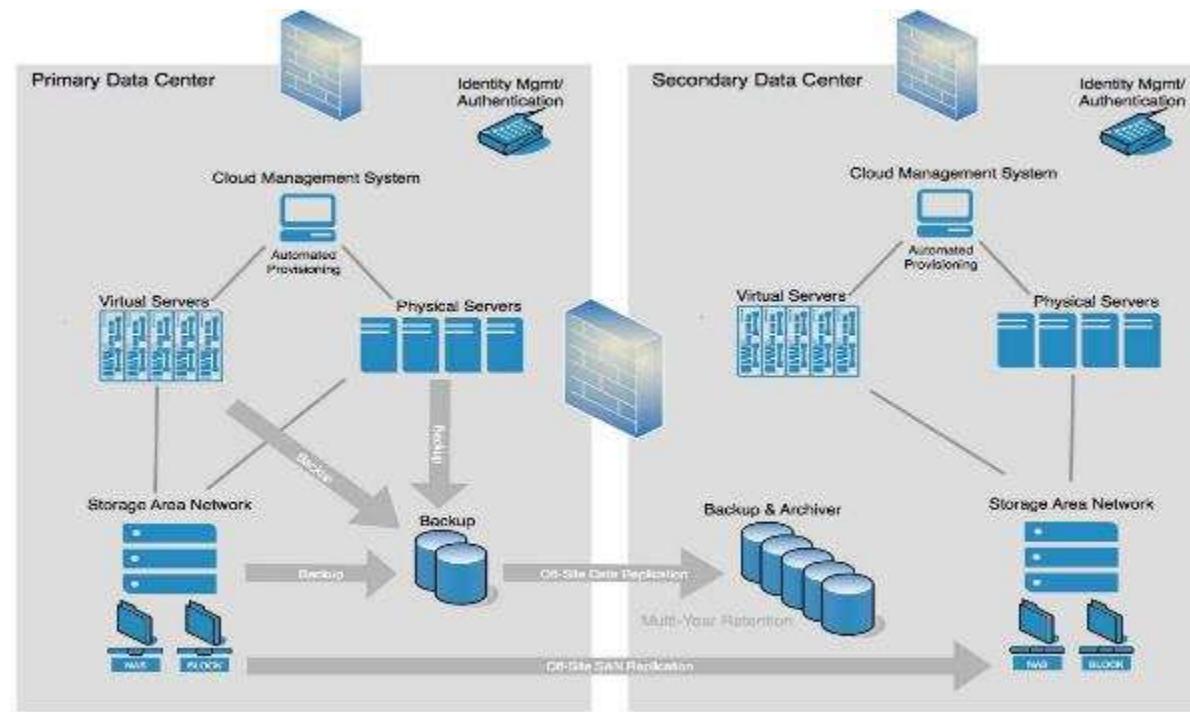
- 80TB RAW Storage (80% Disk as SAS and 20% as SSD)
- 80TB Disk based Virtual Tape Library
- All Server/VM with End-point Security
- Virtualization
- Databases
- Operating systems
- Backup

Bidder would deploy these applications at cloud data center.

- Remote Access Server
- Email solution
- SMS gateway
- Data Center Applications

NOC Room will have following components

- Workstations
- Laptops
- Desktop/Laptop Antivirus
- Printers
- IP phone



ELEMENT MANAGEMENT SYSTEM

- EMS must comply with Telecom Management Forum (TMF) guidelines and relevant ITU standards. Element Management System is first management layer above NEL (Network Element Layer) as per TMN reference model.
- Virtual Private Cloud DC will have element management system of ISP network technology deployed in High availability configuration mode (Active Hot Standby)
- The EMSs shall have an Open & modular Architecture and shall integrate with the Single Unified Mediation Layer.

- The EMSs shall support following interfaces:-
 - CORBA, SOAP/XML
 - Flat File (ASCII).
 - TMF 814 Interfaces.
 - Telnet, SSH
 - CLI, Custom, etc.
- EMS shall have Non-proprietary North bound interfaces including IP support for simplified and streamlined management functionality.
- EMS should support Network Elements Software download, centralized remote debugging functions.
- It shall be possible to configure and manage the equipment remotely.
- EMS must also be capable of generating user-defined reports on the performance of the network.
- EMS shall be intuitive, GUI based, intuitive even for traffic engineering, engineering fast reroutes, performance monitoring and reporting, flow control, performance, quality of service, traffic analysis and statistics, storage of data etc. shall be supported.
- The respective EMS shall provide complete FCAPS functions
 - Fault Management and Diagnostics. The system shall be able to detect, log, notify users, automatically fix (to the extent possible) network problems so as to keep the network running effectively.
 - Configuration Management. It is required to enable gross control of Network resources and topologies to the extent that each network device is configurable.
 - Accounting (Inventory) Management. The Inventory Management system should manage and track the end-to-end Services, logical and physical information which will enable knowledgeable decisions in capacity planning and building by providing precise figures on utilization, faults which will impact the network services.
 - Performance Management. The System shall provide end-to-end visibility of network operations in order to have SLA monitoring as well as Performance Reporting.
 - EMS Application Security Management with User Identity Management, Access Control and Access Audit features.
- EMS shall provide
 - Node wise, class of service and bandwidth wise resource utilization, Resource availability
 - Report of congestion.
 - Error, events and alarm logging with time stamp and storage up to 4 months online and its consequent backup for another 6 months.
 - Customizable daily, weekly and monthly report. Customizable yearly report on data stored.
 - Node wise Inventory shall be generated from the Central/Zonal NMS automatically from the cards reported in the EMS.
 - Traffic Analysis. Special drill down to undelivered and unsuccessful traffic including trace back.
 - Event logging of all user activities with time stamp.
- Hierarchical architecture shall have following two layers:-
 - Zonal (for a group of NEs).
 - Central (for the entire network).
- Seamlessly integrate with the existing Umbrella Network Management System.
- Remote Configuration back up shall be possible.
- Call and Traffic Data Recording shall be possible.
- It shall be possible to generate a configuration file for a remote station from Central Location (CZC/ZC)-and load the same onto the equipment so that installation of equipment at remote site does not require expert technical resource.

NETWORK MANAGEMENT SYSTEM

- NMS should be integrated to ems of Routing/Switching network for FCAPS functions.
 - Fault Management
 - Configuration/Provisioning Management
 - Accounting (Inventory) Management.
 - Performance Management
 - Security Management with Network User Identity Management, Access Control and Access Audit features.
 - Planning and Engineering
- NMS should integrate with Network Elements of any OEM either directly or through respective ems.
- NMS should have open/standard interfaces to EMS to ensure support on standard plug-ins and other proprietary plug-ins of EMS
- The NMS modules/application should collect, poll and store data on optimal basis:
- Modules/application to integrate the data collected among them without replication and repeat invoke of request to NE/EMS.
- Records in tables/DB are not duplicated across the modules.
- NMS including its OS and applications modules are to support IPv6 with backward compatibility to IPv4.
- NMS should run on cluster with feature of auto-recovery and rollback. Any single point of failure in NMS including its dependent hardware and software should not affect/deteriorate the performance of NMS.
- NMS and its components should seamlessly integrate amongst themselves for all data needs without necessity of manual or external intervention and it shall be integrated as follow only indicative and not limited to :
 - Fault Management module should be integrated with Trouble ticketing and Performance management module.
 - Provisioning system shall be integrated with Performance module, fault monitoring module and SLA /QM module. (Once the link is created via provisioning module, the system should generate performance, SLA reports and customer shall be able to book trouble ticket for any fault on the link. Necessary integration of the modules needs to be done.)
 - Provisioning system should be integrated with inventory management module.
 - Inventory module should be integrated with fault module
 - SLA module shall be integrated with fault management, performance, provisioning.
- Dimensioning of NMS hardware specifications of its resources should be in such a way that the applications during the life cycle will not undergo under performance / slowdown / hanging due to lack of resources.
- NMS shall automatically discover TCP/IP networks within given IP range, display and build network topologies as soon as it is installed. Also shall correlate and manage events and SNMP traps, monitor network health and gather performance data.
- In addition to real time monitoring of the network, NMS should have the capability for trend analysis and predictive mechanism using dynamic base thresholds and user configurable thresholds to prevent any outage or performance degradation even before they occur.

FAULT MANAGEMENT

- Fault management monitoring module shall receive all the events received from the various event sources, unifies them into a common alarm format, correlates them and provide a common graphical user interface for alarm analysis and acknowledgement. The fault management module should consolidate the management of networks elements and multiple element management systems and tools under a single view.
- Fault management system is responsible for detection, isolation and recovery of failures in the network. Fault management shall provide at least the following functions:
 - Real time event monitoring and event collection

- Event/Alarm correlation (root cause analysis)
- Severity mapping using different color codes
- Representation of alarm on graphical network map
 - Alarm storage
 - Alarm reporting
 - Alarm filtering
 - Alarm distribution
 - Alarm acknowledgement and alarm clear
 - Alarm archiving and exporting
 - Trend analysis
- Same alarm raised for various events shall be shown with distinguished colours (eg., Node isolation to due interface failure, NE failure, SNMP agent failure shall be shown in different colours)
- Fault monitoring module shall be able to process all fault and event related information in memory and in real time. It shall be capable of processing in excess of 5000 events per second and support up to 10000 events per second during an event storm allowing visibility of all alarms.
- It should also support an interface to an external database for event/alarm data storage.
- Fault management module shall support multi-vendor devices in a heterogeneous network environment.
- Fault monitoring module shall consolidate and de-duplicate repeated alarms collected from throughout the network and provide a clear, coherent and noise-free list of fault messages.
- The management agents should be able to collect events from SNMP and non-SNMP management data sources, API's, databases, network devices, log files and other utilities. The fault management agents/probes should allow definition of custom rules for parsing / text manipulation, etc.(Required only for monitoring applications, API and database and other components of NMS.)
- Fault monitoring module shall be able to filter off repeated alarms of the same device. The start-time, end-time, and number of repetition of the alarm shall be indicated.
- Fault monitoring module should have the capability to detect event rate anomaly – it should detect when it is receiving an unusually low or unusually high rate of events. The event rate should be compared to normal or baseline – and generate a new event to describe the condition.
- The fault monitoring module shall have multiple alarm-display domains. Bidder should describe in their responses any restrictions that exist on the number of alarm-display domains that may be currently active in their NMS.
- It shall be possible to apply filters to each alarm-display domain so a given domain shows only a selected subset of the total list of outstanding alarms (for example, a backbone management group may only want to see equipment alarms from the core network, a service assurance team may only want to see circuit state change alarms, and so on).
- Fault monitoring module should have the capability to detect when there is an event storm based on dynamic base thresholds in case there is no user configured threshold, it should have the capability to take remedial actions such as discarding events of low severity or diverting events based on user configured actions.
- Fault monitoring module should have out-of-box capability to perform predictive analysis and generate events that represent predictions for systems that are in danger of an impending threshold violation, and which require attention.
- All alarm messages shall be automatically recorded to a database in a form that enables easy and efficient future retrieval, query and analysis.
- All alarm/event messages shall be automatically time and date-stamped by the fault monitoring module.
- All alarm/event messages shall have the following information:
 - Event/Alarm origination unit
 - Event/Alarm parent unit

- Event origination units hierarchy (eg., if the event is from a port then Port->slot(card)->frame->main rack)
- Event/alarm start date and time
- Event/alarm acknowledgement date and time
- Event/alarm end date and time
- Event/Alarm Type
- Event/Alarm Severity
- Probable cause
- List of events which were correlated for correlated alarms.
- The fault management should provide root cause analysis and correlate the physical failures with all of the (but not limited to the) following Physical network infrastructure:
 - Logical network infrastructure
 - Routing protocol alarms
 - Customer profile (This is for alarm correlation. When there is a physical alarm - correlating to the customer data from CRM to verify which customer(s) / links are affected. The link may be L3/L2 etc.,)
 - Customer Services
 - Access Infrastructure like MLLN, FTTH, and GSM etc.
- All alarm related data as mentioned above shall be logged in an easily retrievable and query able format
- Fault monitoring module shall have a flexible and scalable platform that offers an integrated and open architecture for the network management applications required in this tender. It shall have the capability to support the addition of new network elements with all standard plug-ins and all existing proprietary plug-ins
- Fault monitoring module shall be able to collect alarm events from all the managed NEs via their respective EMS or directly if EMS is not available for that equipment type.
- Fault monitoring module shall be able to present alarm history of selected NE for a specific period upon request.
- Fault monitoring module shall be able to display alarm and events specified by the following criteria and their combination thereof:
 - Alarm types
 - Time interval
 - Vendor / Network element
 - Technology
 - Customer
 - Service
 - Location (State/Location/Node)
 - Alarm severity
- Fault monitoring module shall be able to display and print of detailed alarm logs with location, time and date of occurrence, duration of the faults, correction actions taken and event history information
- Fault monitoring module should help to prioritize responses to alerts, manage escalation procedures and automate response policies.
- Fault monitoring module should enable operators to define policies for handling incoming events through a graphical user interface.
- Fault monitoring module should be able to monitor all segments of L2 VPN, detecting failures in any one segment and notifying the user.
- Fault monitoring module shall support
 - Service centric Layer 2 VPN maps for VPWS (Virtual Private Wire Service)
 - Service centric Layer 2 VPN maps for VPLS (Virtual Private LAN Service)
 - Service oriented launch of LSP (Label Switch Path) for L3 VPN & L2 VPN
 - LSP Reroute Alerts for any change in the path of LSP
 - LSP Down Alerts correlated under service impact incidents of either L3 or L2 VPN
- Fault monitoring module should have correlation methods to automatically clear events, translate one event into another, and deduce set of events into one alarm

- Fault monitoring should integrate with other EMS for correlation of events to isolate root cause.
- Fault monitoring module should be able to filter out events from device / infrastructure marked under maintenance. It should have a GUI to define maintenance schedule
- Fault monitoring module shall provide a complete view of the health of the entire distributed environment from a centralized NMS console. It shall be able to provide decentralized management through multiple consoles with centralized escalation, reporting and control if required.
- Fault monitoring module shall capture all the events that are generated across the multi-vendor network infrastructure, correlate them and automate suitable actions as defined.
- Fault monitoring module should be able to capture events/alarms of managed switches where the MPLS links are aggregated
- Fault monitoring module should receive all events and traps from Network elements or filter and receive the events from the EMS integrated irrespective of vendor, model and location.
- Fault monitoring module shall have easy-to-use graphical rules builder to help build and adapt business rules and automations quickly and easily. Rules shall be created using a GUI, which shall also provide a convenient environment for testing rules before they are put into production.
- Fault monitoring module shall be able to set rules for alarm filtering and correlation. It shall be possible to sort, filter, select and group. Select the alarms in both the current alarm list and the alarm history, based on at least the following categories. (Filtering on multiple categories should be possible)
 - Severity
 - type
 - Equipment type
 - Network type
 - Alarm identifier
 - Alarm description
 - Alarm data and time
 - Acknowledge alarms
 - Cleared alarms
- Fault monitoring module shall be able to act on events using either automatic or operator-initiated responses through predefined message-actions definable in event management.
- Fault monitoring module shall classify the events/alarms into following types:
 - Communications alarm type: An alarm of this type is principally associated with the procedures and/or processes required to convey information from one point to another;
 - Quality of service alarm type: An alarm of this type is principally associated with a degradation in the quality of a service;
 - Processing error alarm type: An alarm of this type is principally associated with a software or processing fault (if the device/application generates this error, should be categorised as processing error.);
 - Equipment alarm type: An alarm of this type is principally associated with an equipment fault;
 - Environmental alarm type: An alarm of this type is principally associated with a condition relating to an enclosure in which the equipment resides.
 - Security Alarm: where there is breach in security (NMS should be capable of checking unauthorised attempt to login. Port scans)
- Fault monitoring module shall have the ability to define at least the following five severity levels for the events received from the different sources.
 - Critical
 - Major
 - Minor
 - Warning
 - Informational
 - And any other User defined

- Fault monitoring module shall trigger automated actions based on incoming events / traps through predefined message-actions definable in event management.
- The NMS shall enable operators to append one or more notes to a selected alarm or group of alarms. If a group of alarms is selected, the note shall be appended to each of the selected alarms. (Instead of typing the same comment on all the alarms due to the same cause (say a cable cut), should be able to update the status on one go.)
- Operator notes should be able to be long enough to contain substantial amounts of information that may be passed between groups during fault resolution. Bidder should describe in their responses the operator notes facilities available in their NMS.
- Fault monitoring module shall be suppress events for key network elements that are down for routine maintenance, to assist in root cause determination and help prevent flooding of non-relevant console messages using appropriate rules. Event correlation shall be rules-based and work in conjunction with event management.
- Fault monitoring module shall have the ability to store alarms locally in the event of network failure between the collection mechanism and the NMS server. Upon the network connection being restored all stored alarms should then be forwarded to the NMS server.
- Monitoring module must provide capability to notify critical alerts with priority overriding other alerts in queue
- Fault monitoring module must support auto-forwarding of alerts to service desk which qualify as actionable alerts either via user or automated scripts
- Should be integrated with trouble ticketing application for booking of core/customer links. Time taken to book should not be more than 5 minutes. Type of fault (Link down / Link fluctuating etc.,), probable cause also to be sent to trouble ticketing system. It should be possible to filter alarms sent to trouble ticketing module such that only select customer links are booked automatically.
- The fault management module shall have inbuilt failover/redundancy mechanism right from the processing engine down to collection probes/agents.
- Fault Management should coherently correlate the faults in a hierarchy of Network elements and links and consolidate into least definable fault matrix.
- Syslog servers shall be provided which shall get the data from all NE irrespective of vendors/model/location

PERFORMANCE MANAGEMENT

- The Performance monitoring module must support a distributed polling and data gathering architecture in order to achieve optimal performance and scalability.
- The Performance monitoring module should be capable of supporting High Availability on data collection, storage and reporting.
- The Performance monitoring module should enable service oriented KPI modelling of logical resources for the purpose of reporting on logical entities or end-to-end service paths. The feature should enable the creation of a more service-oriented model of network resources with an upper layer of logical resources mapping to a lower layer of physical resources such as network elements and interfaces.
- The Performance monitoring module must support the ability to poll and pull data from element management systems and network elements utilizing a variety of methods including automated scheduled file polling, manual and scheduled FTP transfer of files, SNMP get, etc.
- The frequency to collect data from NEs or EMSs shall be flexible. It must provide the capability to specify the polling frequency from minutes down to every five second for data collection and also be able to poll only the required data from the MIB or device. The polling frequency shall be 5 seconds and multiples thereof for real time performance viewing by the NOC users. Regular polling for all interfaces physical/virtual historical data shall be minimum polling frequency of one minute and multiple of minutes.
- Maximum of 1000 concurrent NOC Users having real time observations shall be possible.
- Performance management module should provide inter provider MPLS-VPN performance data

- Performance monitoring module shall support multi-vendor devices in a heterogeneous network environment.
- The Performance monitoring module should be capable of importing data into the single database. The single database should provide a single integrated performance management method to monitor the complete network.
- The Performance Management component shall provide a web browser-based GUI to allow users to monitor network performance and generate performance reports.
- Performance management module should be able to provide in single view for all the MPLS links spread across different types of access systems for a customer and should be able to get across.
- The performance management system must be able to generate service performance reports for every customer and provide customized services tailored to each customer. The customized parameters include: logo, name and title. In addition, the user report should be viewed with the Web browser. The performance management system should support flexible report formats, and the formula to analyse collected data must customizable
- The performance management system should also be able to:
 - Group links belonging to different access networks of the customer into one group
 - The combined grouping thus done shall further be sub divided into smaller groups and access limitations be given to the sub-groups which will be useful for a enterprise customer who needs zonal level monitoring
- The Performance Management component shall allow users to view near real-time and historical network statistics and trends
- The Performance Management component shall present all collected performance data in both tabular and graphical format, including capability of exporting any report in CSV format.
- The Performance Management module shall have the capability aggregate data per group of resources. (per site, per customer, per service)
- The Performance Management component must be able to calculate capacity requirements and generate capacity reports.
- The performance module should be capable of generating trend analysis reports.
- The performance module should have the capability of generating baseline reports – This will allow the operator to compare current traffic volume to the average traffic volume for prior days.
- The Performance Management component must support the ability to set thresholds on the collected performance statistics. When a threshold is crossed, the system must generate a threshold-crossing alert with customizable color coding. The performance module shall be able to send selective threshold crossing alert notifications to a fault monitoring module.
- The system should support three types of thresholds: burst threshold (a threshold is exceeded X times within a measurement period), periodical threshold (alarms are generated when the threshold is about to be over) and dynamic threshold (higher or lower than a certain proportion of a specific baseline).
- The Performance Management component must have the capability to retain statistics for a specified timeframe defined by the administrator.
- The Performance management module should have the capability to export data to another application via SQL.
- Performance Management component must make historical data available for inclusion in performance displays and reports requested by users
- Performance Management shall include SLA manager to calculate the performance as specified in the SLA through various KPIs and should be able to proactively alert based on the threshold conditions through SMS / Email to the corresponding persons as configured well before the performance degrades to the penalty conditions
- Performance Management / SLA manager should be able of inform / alert all the related customers in advance for any planned activity on Network Link / Element and shall not include the down time of such duration in the SLA calculation (SLA with the customers).
- The reports must provide global view on the network showing aggregated values per groups of network resources, resources in exception

- The user must have the capability to drill-down from the global overview to more detailed views by simple click.
- The performance management system shall be able to collect and report the following data:
 - Packet delay and packet loss
 - CPU usage rate
 - Input/output traffic through physical ports
 - Input/output traffic through logical ports
 - Class based QOS with support for nested policies and hierarchical policies
- The performance management system shall have the ability to provide SLA reports on the following (but not limited to) metrics:
 - Availability
 - BW utilization
 - Resource utilization (in WAN / LAN)
 - Response Time (for monitoring the performance of NMS itself)
 - Throughput
 - Latency
 - Jitter
 - Loss ratio
 - Downtime
 - Round Trip Time delay
 - Failure Frequency
 - Mean time to repair
 - Mean time between failures
 - Uptime
 - Error statistics
- The Performance Management shall have a set of reports including:
 - Group Summary Reports: Reports displaying per group of resources the group aggregations for a set of metrics (for example, per customer, the maximum traffic or the total traffic).
 - Grouping of reports should be possible across various EMS's integrated
 - Resource Summary Reports: Reports displaying for a set of resources the period aggregations for the same set of metrics (for example, per interface, the maximum traffic over the day).
 - Detail chart Reports: Reports displaying for one resource and the same set of metrics the values over the period (for example, the raw collected values for the day).
 - Resource Threshold Reports: Reports displaying the resources for which a threshold was violated
 - Should be able to group links as incoming and outgoing for a NE and provide traffic report on outgoing and incoming as a group for that particular NE
- Shall provide graphical view of performance reports and shall be customizable to i)select the metrics ii) group links together to view on a single screen
- Threshold reports for instances where the customer link has (say cross 95percentile) of its total bandwidth

NETWORK DISCOVERY AND INVENTORY

- Network monitoring module shall support multi-vendor devices in a heterogeneous network environment.
- The Network monitoring tool should be designed to provide network discovery, topology visualization, and root cause analysis for Layer 2 and Layer 3 networks, including IP, Ethernet services, and Multi-protocol label switching (MPLS) and IPv6.
- The Network monitoring tool should support topology-based event correlation and root-cause analytics in turn, to help network operator's work more efficiently by focusing time and attention on root cause events, and by helping to identify symptom events that can be filtered into a separate view.

- The Network monitoring tool should possess network discovery and modeling capability that can provide enterprises with more accurate, visibility of the network infrastructure to help:
 - Reduce operational expenditures and future capital expenditure
 - Maximize network performance
 - Automated network discovery and modeling shall have the following features:
 - The Network manager tool should be designed to provide the user with the capability to automatically discover network devices and their connectivity.
 - It should provide periodic rediscovery (including event driven partial-rediscovery). Also support plug and play agent-based discovery which will allow new technologies to be added quickly to help adapt to evolving networks.
 - It should support to discover almost all layer 2 and 3 network devices, interfaces, and layer 2 and 3 connectivity
- The Network Monitoring tool should support discovery and modelling of VLANs. It should be able to partition discovered topologies based on VLAN membership.
- The Network monitoring tool should support topology-based event correlation policies that map network events onto its topology model and help identify events as root causes. Some default features should include the following:
 - Isolated and downstream suppression: For example, correlating a device failure event to all the resulting ping failure downstream and surrounding events.
 - Event correlation in redundant meshed networks: For example, correlating a catastrophic failure of multiple redundant links at the provider-edge to the resultant flood of ping failure events from downstream devices.
 - The network monitoring tool should support actively polling of network devices to help proactively identify problems in the network.
 - It should allow the operator to alter the Monitoring policies that can be fine tuned for a group of devices (each policy identifies the attributes of the device to poll to better understand the health of a device).
 - In addition, it should allow altering the poll intervals that can be customized to cater to site-specific requirements.
 - The tool should include the following default pollers out-of-the-box:
 - Ping polling: used to ensure that a device is still present, live and contactable in the network
 - SNMP polling: used to acquire MIB-related information from particular network devices.
- The Network Monitoring tool should include Web-based network topology visualization tool. The network visualization GUI should use the network topology and event information from the tool (and, if applicable, your event management tool) to generate graphical maps of the network topology around particular devices and send these maps to Web clients on demand.
- The alarm state of each device should be displayed in all network views. This alarm state is retrieved from the event management tool and represents the highest severity alarm state on the device.
- Network operators should be able to drill down on specific problems in the event list to locate the alarmed device in the network topology view, or show a list of all outstanding alarms on a selected device in the network topology view.
- Inventory management module should have latest inventory available of all network elements (viz., all routers, switches and servers of all makes)
- Reports of availability, Spare (slots / ports), Fault, % utilisation should be available and should be customizable – for providing the same it should be integrated with fault management module, performance module, provisioning module
- Any inventory change in the network should create an alert to the network administrator with a facility to approve the inventory change. Alert/alarm should come to network administrator for all unplanned inventory change(i.e., the inventory should be first removed from the inventory management module before it is actually removed physically)
- Inventory management module shall support multi-vendor devices in a heterogeneous network environment.

- Should be able to take the backup of inventory status and later compare two different backups of the changes happened on inventory.
- Should have a track of all inventory changes in the network
- Shall be IPv6 Compliant

PROVISIONING SYSTEM

- The Provisioning system should support all type of services. The PMS should be integrated with all other modules supplied so as to data integrity is maintained and flow of data between modules is automated.
- Provisioning Management system shall be in two modules, one to input the data on Web Based GUI (Front end server) and another as backend server to process the request.
- Remote and distributed users (node in-charges) shall input the required fields for processing of the request. The operation request shall appear to the NOC executives for validation, which when validated shall be executed on the NE by the provisioning system back end module
- There shall be a feature to auto validate the operation requests from node in-charges by the NOC executives, such that all requests from remote, distributed users are processed without manual intervention of NOC executives. During such period, only failed requests shall be handled by the NOC executives.
- Should allow users to Provision on the same NE simultaneously but shall limit on provisioning on same resource of the NE
- The bidder should provide a carrier class Service Provisioning system that can provision any of the services envisaged over the network. The PMS systems shall be located at the two NOC locations with one of them acting as Primary & the other as Backup acting as a disaster recovery site.
- Provisioning procedures shall be vendor independent: As a provisioning system module user will not be using different procedures for different make of the network element to do the same operation
- The PMS should provide a common single GUI for provisioning across devices from multiple vendors.
- The PMS should provide provisioning of both L3 and L2 VPN Services. The PMS should provide GUI based creation of LSPs.
- The PMS shall provide a user-friendly Template-based provisioning capability to quickly create a new & consistent configuration, or clone and modify an existing configuration, which can then be pushed to the devices (Network Elements).
- The PMS shall support multi-layer password protection and shall be user customizable as per the requirement of the user. It shall be possible to assign combination of function to the users of the PMS.
- The PMS shall support:
 - Journaling,
 - Multi-thread programming,
 - Quality of Service provisioning,
 - Rate limiting on edge devices
 - Traffic shaping capability
- Shall have provisioning procedures incorporated into it so that any new user will be able to use it with minimum training
- Shall have facility to channelize individually or in bulk the interfaces.
- The PMS shall provide the ability to rollback provisioning transactions in the event of failure (restoring the network element to known state)
- The PMS must be capable of generating a variety of notifications during provisioning. Typical events to be generated would include startup, completion, failure, rollback etc
- The PMS shall support the provisioning of IPsec VPNs in addition to MPLS VPNs.
- The PMS shall support step-by-step information-assisted population of templates.
- Operators should be able to add, delete, or modify customer VPNs.
- Operators shall be able to add, delete, or modify customer VPNs in bulk

- The VPN Provisioning activity can be scheduled or executed on real-time basis.
- Options for dynamic scheduling and periodic scheduling of provisioning activities for providing customers with variable bandwidth / QoS during peak and off peak hours
- The PMS must offer comprehensive connection management capabilities to downstream NE's. This includes ability to schedule connections (work around blackout periods for NE's), create additional connection under high load conditions and to tear down connections when not needed.
- The PMS must have the capability to re-transmit all service commands executed on a particular NE again, in exactly the same order. This allows certain NE's that may lose their configuration due to outage to be reconfigured/ restored back to original state.
- The PMS shall support service changes in the network through reliable delivery of templates/commands to the appropriate network elements.
- The PMS shall support display of VPN topology with the following requirements to ensure correct activation of a new VPN site to an existing VPN Client configuration:
 - Hierarchical Layout to organize the topology into distinct levels.
 - Facility to expand and collapse views.
 - Should provide discrete configuration of the QoS parameters on the Network Elements through the Topology Map.
- The PMS should provide feedback of the successful or unsuccessful execution of a command to the management server.
- The PMS should rollback the transactions in case of unsuccessful command activation.
- The PMS should provide service activation templates, which shall choose a network path, corresponding network elements, the interface, the layer specific, and service specific information to be applied on devices.
- The PMS should discover on demand of existing MPLS services, L2, L3 VPNs of a NE or a group of NE within the given IP range. After discovery the user should be able to modify the VPNs as required.
- The PMS should permit Viewing of records of application activity.
- The PMS should perform Archiving the templates and configuration file of each network element. Maintaining a history of configuration file changes on each network element. This archive shall be maintained in an embedded Object Oriented Database.
- The PMS should allow Creation and management of permission groups for defining access rights for users in a group.
- The PMS should provide Management of individual users.
- A co-relation mechanism shall exist by virtue of which the Network ID's should be correlated to VPN ID's and service parameters.
- The PMS should provide analysis of state of device resources against service implementations
- The PMS should provide analysis of service request history
- The PMS shall allow for generation of a report based on the current status of the service deployment.
- The PMS shall allow for updation of the status of service requests.
- The PMS shall have the capability to verify the correctness of Virtual Router Forwarding (VRF) tables.
- The PMS shall allow for Scheduling of Audits
- The PMS shall be capable of displaying topology maps with the following functionality:
 - Mapping of objects to topology maps
 - The inventory shall be in sync with all objects defined in the superset of all maps.
- The PMS shall support Management for Network-Elements forming part of the IP Network.
- The PMS shall support Template based provisioning and configuration.
- The PMS shall support Creation and management of permission groups for defining access rights for users in a group.
- Should manage all link characteristics while creation /modification via the GUI interface totally thereby not requiring any CLI mode creation /modification in the router

- Maintain a history of all operations done and reporting in terms for customer/Links/Operator/router/Interface/Period and the combination of above.
- Bulk shifting of links shall be possible from one router/interface to another router/interface
- Web based GUI to be provided for field units to create work orders for Customer link management (creation, modification and deletion) and shall support 500 simultaneous users
- Web Information Portal/Customer information portal shall be integrated with provisioning system to enable to customer to view the status of the work order (Pending in Field/ Pending in NOC/In-progress/Created/Commissioned)
- Customer data/Link data shall be stored in OODBMS for efficient data retrieval and operation
- The jobs submitted by the operator should not take more than 2 Second for execution

NETWORK SERVICE ANALYTICS

- System shall provide real time accurate discovery of routed networks
- Should provide real time layer 3 topology of the IP network with detail data of route availability, link status
- Should support all routing protocols RIP, IS-IS.EIGRP, OSPF, BGP, EBGP, MBGP with IPv4 and IPv6 versions
- Should maintain accurate routing map for the network across AS, areas, multiple protocols and MPLS VPNs
- The module should not cause any performance degradation to the router
- Should detect routing events and failures
- Should provide network simulation(what-if analysis) and history data should be available for what-if analysis with play back feature
- Should be integrated with other modules so that any route flap should be reflected in this module
- Historical data should be available for analysis.
- The Module should be non-intrusive listening to routing announcements:
 - Should be passive in the network
 - Display the running network for design verification"
 - Provide alerts on route changes and its implications
 - Track and display various paths between sources and destinations
 - Stores historical data of layer 3 topology and activity for analyzing intermittent problems
- The system shall support creation of custom groups for tracking traffic network-wide, including source IP, destination IP, protocol, source port, destination port, and DiffServ value (quality of service). The system shall have capability to support:
 - Network-wide traffic monitoring and analysis
 - Traffic congestion detection and diagnosis
 - Network planning and optimization
 - Peering/transit analysis and planning
- The system shall support Alerts, for real-time awareness of potential problems Real-time alerting links to network operations by allowing users to configure alerts that signal routing events—as they happen.
- The System shall provide global traffic distribution reports:
 - Major Traffic Events Report with correlated routing events for at a glance, anomaly monitoring and faster root cause analysis.
 - IGP Links by Utilization for monitoring congestion hot spots and traffic changes.
 - BGP Traffic Reports for Peering and Transit Analysis:
- Distribution by Destination AS
- Distribution by Exit Router
- Distribution by Neighbor AS
- Distribution by Transit AS
- Distribution by Community
- Distribution by Exporting Router Interface

- The NMS/Analytics solution shall support the traffic analytics and performance analytics features
 - Statistics/Network Performance statistics from a router or set of few routers configured in different groups for troubleshooting & monitoring
 - Service Performance Statistics
 - Interface & LSP label status collection.
 - Real-Time & Historical graphing support for statistics.
 - Operational Support through Dashboard, reports
 - Portal for customers for latency to various destinations which is required for latency related SLA fulfilment as well as for internal monitoring also.
 - Matrixes like event-counting, time-based measurements (e.g., round-trip time, unidirectional delay) should be monitored.
 - Monitor overall network key performance indicators.
 - IPv6 Transition Dashboard: Investigate the ongoing adoption of IPv6 on network with, gaining insight into the applications and devices driving the trends
 - Traffic Management Dashboard: To plan congestion management policies based on the granular insight provided by the Traffic Management Dashboard, then view the positive impact.
 - Usage Management Dashboard: Provide segmentation to identify opportunities to plan new services.
 - Capacity Planning Dashboard: Gain insight into your Traffic Management deployment to manage congested resources and measure overall business benefit with the Capacity Planning Dashboard
- Speed troubleshooting, increase service levels, and reduce downtime with multi-vendor network monitoring
- Advanced network troubleshooting for on-premises, hybrid, and cloud services with critical path hop-by-hop analysis
- Traffic optimization SOP

SERVICE DESK

- Should have a GUI for service desk which facilitates the integration of business processes into the service management infrastructure and should be a single point of contact for communication needs of both subscribers and employees
- The service desk tool should provide, out-of-the-box, a rules-based workflow engine that spans all modules
- The Service desk tool should expose its applications and data as Web Services by dynamically generating Web Service Description Language (WSDL) upon request. A Web Service enables one application to access the functionality of another application using SOAP operations (XML-based transactions), regardless of differences in their operating system platform, application language, or tool set.
- The Service Desk should provide the service agent's tools to document capture and update information about a customer's reported issue and leverage knowledge management tools to maximize first-call resolution.
- The CMDB should provide a clear model of Configuration Items (CI), their relationships, dependencies and associated SLAs.
 - The CMDB should provide visualization (graphical view).
 - The CMDB should support integration and federation with third-party tools / databases to leverage existing information and investments.
 - It should also provide information about people / organizations associated with the assets. Details could include name & contact details, IP addresses, etc.
- The Incident Management module should provide out-of-the-box categorization, as well as routing and escalation workflows that can be triggered based on criteria such as SLA, impact, urgency, CI, location or customer.

- Upon resolution of an incident, the Incident Management module should provide an automated feedback loop to validate the solution and capture it for future use.
- It should be possible to generate alerts when SLAs or business rules are violated.
- The system shall support problem management module track trends to help identify consistent problem areas and potential long-term resolutions.
- Must automatically determine severity and priority, based on the specific failed component, with the ability for the operator to override when necessary.
- Must keep track of the total time the Incident was open. This total time should not include suspended or frozen state time. The time should be broken down by individual
- Any proposed Incident management solution should be fully integrated with change, inventory, service level, and problem management solutions.
- Must allow users to create a work queue, and access other queues defined by system administrators
- Must be able to relate and link problems to specific incidents.
- Solution should capture problems, known errors, workarounds and solutions separately.
- Must provide a secured historical audit log of all updates to problem records.
- Ability to relate problems to configuration records.
- Problem Management solution should be separate process rather than a subset of Incident Management processes.
- Known Errors should be tracked as separate records.
- Problem Management Process should manage multiple phases.
- Each Problem must assign and track multiple tasks and multiple parties.(A problem may be broken into multiple tasks)
- Solution shall provide a graphical workflow interface to ease E2E change processes visualization and monitoring.
- Solution shall provide a graphical interface that exposes every element of a change process (people, assets, timeframes, tasks, phases, etc.) thus turning the complexity of tracking changes, approvals, task assignments and planning into easily understandable processes.
- Solution shall provide a live dashboard showing the current status of Change Requests along with their states.
- The authorized change manager of the Contractor shall approve or reject any change request to meet the time frame as defined in Service Level Agreement (SLA) with employer.
- Solution shall manage different approval paths. Different change types can follow different paths. Pre-approved changes for standard requests can be facilitated while other changes can follow a more complex approval process.
- Implementation of any approved change request should be governed within the time frame as defined in SLA Solution shall create and monitor change calendars.
- Solution shall coordinate change activities across parties involved with the change process.
- Solution shall create, modify and reuse change processes.
- Solution shall create standardized and repeatable change workflows (for reducing risk and improving the benefits associated with changes).
- Solution shall detect potential conflict/collision of every change request. Conflict/collision can be based on infrastructure and application relationships but they can also reflect timing conflict from change calendars.
- Solution shall analyze the impact on the business of every change request. Impact can be based on infrastructure and application relationships but it can also reflect timing conflict from change calendars.
- Solution shall handle exceptions (outage period, business event, etc.) preventing change requests to be executed even if initially scheduled on a change calendar.
- Solution shall support the ability to make configuration changes against sets of devices, user selected group of devices, or group of devices based on a user defined search.
- Solution shall record the success or failure of a configuration change against each individual device in a group, and the group as a whole.

- The architecture and design of the self care system shall ensure the complete security of the personal and corporate information extended through the web.
- In order to enforce security at the system, database and application levels, the system will be designed to interface with a number of firewall schemes so that interfacing with third parties is a secure process.
- The system shall contain a security and user database tool, which ensures security risk management of threats, such as Unauthorised disclosure, Impersonation, “En route” customer request modifications, System exposure to expel unwelcome users, Denial of service to authorised users by malicious interference, etc.
- The system shall adopt various inherent security mechanisms, such as Data encryption, Authentication, Authorisation, Account access management, Logging and monitoring all system access, Resource allocation management, User access privileges management, Carefully-designed system architecture, Secured code development methodologies, etc.
- The application shall not have to depend on a particular type of user credential, such as a user name and password. The system shall be able to use authentication methods based on user credentials such as X.509 certificates or user-defined credential types. It shall be possible to add new credential types to the system without code modification.
- System shall use a standard Directory Server and LDAP protocol for maintenance, authentication and authorisation of users.
- In actual implementation web self care can have its own authentication and authorization module implemented over an RDBMS in place of the Directory Server.
- Shall offers ability to perform self-service by the customer over the web
- Shall provide ability to book ticket
- Shall provide ability to view ticket status and updates
- Shall provide ability to close existing ticket
- Shall provide the ability to suggest solutions for incidents raised by the customer
- It shall be able to generate Docket Number for giving reference to customer
- The system should have the ability to record complaints with customer information (like Name, number, Address, Contact no. for this particular case, Call Back time/Date, Complaint/issue/request type etc Plus some additional details required based on type of Complaint)
- It should be possible to prioritize requests based on the importance of the Customer and severity
- It should be possible to prioritize requests based on the importance of the Customer and severity
- The provision should be there to resubmit the Complaint/docket to same department and section or to the other department and section if the customer is not satisfied with proper comments
- Categorization of all iterations being held with the customer in Main and Sub Categories should be possible. All kinds of requests, Informational, Commercial, and Complaints should be captured in the system
- All Interactions held with the customer should be captured and available.
- The system needs to be able to route the docket /case to different Depts based on the type/subtype of request/complaint
- The system should be able to automatically alert managers if there are a large number of occurrences of a particular complaint/fault report across the branches in a user defined period
- The system shall allow the registration of tickets/dockets for recording and tracking the resolution of problems, complaints or queries raised by customers
- It shall be possible to determine the list of available ticket reasons.
- It shall be possible for administrator to set the list of available ticket subjects
- The system shall allow attachment of an unlimited number of text messages or notes to any tickets to describe the gist of the problem or the steps for solving it etc
- The names of the employees who entered each text message as well as the date and time corresponding to the message shall be recorded in the system
- It shall be possible to search for tickets by the words contained in the message texts

- The ticket status shall show the current stage of handling this ticket for example, the status Open or Running or Closed.
- The processing of the request should be based on the Category / Sub Category under which the request falls
- It shall be possible to store the history for each ticket, which shall contain all changes of ticket status, priority, categories, any change in the employee responsible for this ticket etc. The date and time of each change shall also be logged.
- The system shall allow automatic notification of system users when actions assigned to tickets become overdue
- The staff should be able to receive guidelines for addressing a particular kind of request based on request category / subcategory
- The staff should be able to search the database for informational requests based on key words, links or any other means
- A request will involve multiple entities for completing all the steps outlined. It should be possible to assign these tasks to more than one person or a group of people for parallel or sequential completion of activities.
- Ems/NMS should be sized for following baseline

Number of Chassis based Routers	
Number of 1U/2U Routers	
Number of Concurrent Users	500
Total of ems/NMS Users	1000
Number of B2B External Users	5000
Number of B2B Concurrent External Users	500

EMS (ENTERPRISE MANAGEMENT SYSTEM)

- Enterprise Management System (EMS) is primarily for management of Servers, Storage, Load balancers, Firewall, Networking equipment, **Applications, Database** etc as part of Wi-Fi Offload & SMP platform. The Element Management System shall monitor following parameters:
 - Shall monitor all Application, Network Elements, Security Elements, OS, Database Instances, Servers, Storage at Main and DR sites.
 - The proposed system shall be able to monitor various operating system parameters such as processors, memory, files, processes, file systems, etc. where applicable, using agents on the servers to be monitored.
 - It shall be possible to configure the operating system monitoring agents to monitor based on user-defined thresholds for warning/critical states and escalate events to event console of enterprise management system.
 - It shall also be able to monitor various operating system parameters depending on the operating system being monitored yet offer a similar interface for viewing the agents and setting thresholds.
 - Monitoring of interconnecting links and all its interfaces.
 - The management system shall alarm critical, major and minor events.
 - The Management System shall display alarms based on violation of traffic thresholds of each of the interfaces, interconnection links with other nodes and system performance indicators (KPI). It shall be possible to customize these KPIs. Display alarms based on thresholds violation system parameters such as: size of file systems, processor load, memory utilization, etc.
 - All kind of reporting about system's capacity & licensing utilization. Reporting about connected/concurrent users; Reporting about connected users & their status with time duration. Statistics about traffic usage & utilization per user/AP/Venue/Location/Controller & overall system.

- Monitor performance and faults. Support for event notifications. Support of SNMP protocol standard. Support for NTP Integration.
- Support full backup and restoration of the system configuration, system database, reports, configuration profiles, views, maps, etc. Concurrent number of transactions/second.
- Login and session details, browsing history and audit trails. The solution shall provide at least the following statistics. Number of login attempts; Number of successful sessions; Number of failed sessions;

Network & IT Asset Management

- Ability to capture and provide physical inventory of Network and DC IT infrastructure of Router, Switches, Server, Storage, other Hardware and software applications
- Bidder should main physical location of all inventory along with Inventory Configuration. Bidder can use equipment Configuration date from Network Discovery module of NMS /ems. Asset should capture following but not least (Equipment Model, Number of Slots, Equipped/Not Equipped, Type of Cards, Model of Cards, OEM Name, OS Version, Date purchased, Warranty/AMC status/contract no., End of OEM Support date etc)
- Bidder should implement logic synchronize asset details in system with respect to details found in discovery through Automation and on weekly basis
- System should support change management for migration, removing, replacement, repair of equipment or part thereof.
- Ability to have reporting capabilities; provide predefined reports and ability to create customized reports on data in the inventory database.
- Ability to support grouping of enabling assets to be grouped dynamically based on some pre-defined criteria
- Ability to use the query tool to identify specific instances of concern like policy violation (presence of prohibited programs / games and old versions, etc.), inventory changes
- Facility to track changes by maintaining history of an asset
- Ability to have web based console

Looking Glass Services

The portal with looking glass services like ping, traceroute, advertised bgp routes, received bgp routes etc. from remote locations/PoP of **MahalIT**. The intended portal should have following capabilities:

- a) To ping & traceroute from remote PoP
- b) To view advertised & received bgp routes.
- c) To select source and destination location or IPv4 & IPv6 address
- d) To select ipv4 or ipv6 protocol version
- e) To view BGP summary
- f) Randomly generated security code which is required to be entered for processing of queries
- g) Login based access to users



Below is Looking Glass Sample Image.

Portal for Speed Test

The speed test meter shall be web based & provide on demand speed test results to **Mahait** customers for links from 64Kbps up to 10Gbps. The intended portal should have following capabilities:

- To log old records
- To display measure both upload and download link speed
- To measure and display speed from different locations
- Randomly generated security code which is required to be entered for processing of queries
- Login based access to users

The contractor shall document the procedure for testing of internet and MPLS VPN links for link handover through proposed network using speed test meter or any other required tool (e.g., IPERF etc.). There should also be capability of unidirectional ping test.



Below is Speed Test Sample Image

IP address Management System:

IP Address Management system is also required to ensure proper IP address management and no duplication of IP addresses happens inside the ISP network. The below mentioned specifications are the minimum requirements that must be met by this system.

- Solution must provide integrated support for high availability configurations without the requirement for licensing of additional third party software components.
- Solution should support monitoring using SNMPv2 and/or SNMPv3
- Solution must fully support IPv4 and IPv6 for operation and services
- Solution should integrate with multiple pass-through authentication options including RADIUS, LDAP, Active Directory, and TACACS/TACACS+
- Communication between the various system components should be encrypted using a secure method of communication
- Encryption should support the use of industry standard Certificate Authorities (CAs) for the management web interface.
- IPAM user interface must be web-based without specific browser vendor requirements

- IPAM system should support High Availability failover
- IPAM system should support 500,000 defined objects. (Specify any license pricing for growth.)
- IPAM system should support at minimum 50 concurrent administration sessions (Web GUI).
- IPAM system should provide support for user level authentication
- IPAM system should provide import/export to flat files
- IPAM system should support granular rights administration limiting the function and rights to user and record level
- Solution should provide the ability to display, and search objects based on user-created custom fields
- IPAM system should support VLSM (Variable Length Subnet Masks)
- IPAM system should support CIDR (Classless Inter-domain routing)
- IPAM appliance should provide the ability to backup and restore the appliance configuration
- IPAM solution should be able to export reports in PDF format and raw data in flat file text format (i.e. plain text, CSV or delimited ASCII)
- Solution should have support for workflow process for various administrator roles and should include a change approval oversight capability.
- IPAM system should keep track of any and all changes to the system, including record changes.
- The audit records should contain a timestamp, username and record modified.
- Reporting engine should include audit reports.
- Access to audit records should be a configurable administrative role.
- Audit reports should support customizable parameters such as time range, object, subnet, administrator or administrative group.
- Solution should provide API access to the database for customs scripting and manipulation of data.
- Solution must support automated IP tracking and allocation with full network IP discovery and IP reconciliation, helping to eliminate IP conflicts.
- Must support Intuitive GUI for real-time visibility and detailed IP audit reporting and diagnostics
- IPAM must be able to manage IP blocks for both IPv4 and IPv6 addressing.

NETWORK ACCESS SECURITY

The ems/security solution shall be provided with security functions to define and control authorized access to ems, equipment for monitoring and control capabilities to only authorized personnel. System Login of ems system should be mapped to Operational users based on Access profile defining role, access to defined equipment.

- Solution should allow single sign-on window login to all equipment. Direct access to all equipment would be restricted.
- Solution shall provide portal to manage Operation User life cycle management. Operation User could be from BSNL, from O&M Vendors or from OEM.
- User name and password access control – the access to system shall be available through a common username and password. The system shall support complex password mechanisms with combinations of alphanumeric and special characters.
- Solution shall provide security management mechanism and functions, such as reasonable definition of user security levels and meticulous rights assignment with strict login/logout authentication, operation/access control and operation logs storage for 11 months to ensure the auditable security management of the system.
- One access level of System Administrator and at least three levels of operator access shall be provided - none, read only, and write. The system administrator shall be able to create, define and modify operators with different access levels, network domain of the ems system. With “read only” access level, network parameters shall only be viewed.

- Solution shall allow auditable remote access service for maintenance purpose from outside NOC IP subnet domain as per employer's prevailing remote access policy being modified time to time.
- The solution should allow defining roles or groups for user management. Roles should be customizable and pre-defined in system.
- Access to database maintenance, command control and test functions shall be available with "write" access level. Means shall be provided to ensure only one authorized user has write capability for a selected domain of the network.
- It shall be possible to define multiple domains for purposes of monitoring and control. It should be possible control access of Users to each equipment or set of equipment based on authorization.
- The solution should provide secure administrator control, monitor and record privileged sessions including RDP, SSH, Telnet, HTTP/HTTPS, in single module.
- It should keep & show the records (screen capture & key stroke) executed command logs along with date, time, user, source IP etc. Also the remote access should follow the DoT guidelines from time to time.
- The solution should be able to support text searching for SSH session logs and records.
- The solution should provide the capability to manage application credential together with access control, SSH key and password management all within a single hardened platform.
- User profile should be stored in LDAP and the solution shall integrate with LDAP solution for authentication and authorisation.
- The solution should provide the following features:
 - Password Vault
 - Access Management
 - Continuous Session Recording
 - Ideal session time out
 - Prevent leap frog attempts
 - Application to Application (allows dynamic password access from applications), etc.
- Solution should be Common Criteria certified with a NIAP approved Enterprise Security Management Protection Profile.
- Solution should provide in-line command filtering using white lists/black lists for SSH, network devices and Mainframe command line operations. No endpoint agent needed and should detect when violations of the white list/black list rules occur and can automate action as a result including warning the user, logging off the session, or disabling the user's account within the product as well as alerting when the event occurs.

User Management

- The User Management System shall provide features primarily that consist of the following services towards Network Operations & Management:
 - Administration
 - Authentication & Authorization
 - Audit
- The System shall provide a Super User who shall administrate the system User Groups and its privileges. Super User shall be the system Security Administrator (System Admin). All actions of this user shall be logged and this user shall not be allowed to tamper logs.
- The system shall have role based access.
- The System Admin shall create User Groups as per the profiles with pre-defined privileges.
- The System Admin shall be able to administer user / password of users across all groups and privileges across all user groups.
- The System Admin shall have the rights to create users and administer username/password of User Group / Users. Users created shall derive its default privileges as per the User Group created by System Admin.
- The System shall support users belonging to multiple groups.

- The System shall be customizable towards multitenant architecture that allows distributing the secured user administration to select group(s) to administer users within their organization. The System shall support auto generation of password.
- The System shall be customizable towards Two Factor Authentication with OTP (One Time Password) support.
- The System shall send mail notification on key admin transactions like account creation along with first time password
- The System shall provide User account expiry date. It shall be set/modified to the required number of days, once the number of days set for the user account exceeds, the user will not be allowed to log in to system as the user status will be changed as "userExpired". Configuration for the userExpiry shall be enabled or disabled accordingly.
- The System shall provide Password expiry date and can also be set/modified as number of days after which the user status will be changed as "PasswordExpired". By default the password expiry is enabled and set for 45 days. Thus when the user tries to log in, then the message "Password Expired" will be displayed and user is allowed to configure a new password.
- The System shall allow User login to be enabled /disabled.

User Authorization:

- The System Authorization level shall be extensible towards a fine gained security wherein the users shall perform the operations based on the data like location or department.
- Customizable "request workflows" for credential access approval including dual controls, integration with helpdesk ticketing systems and multiple additional parameters
- Segregation of duties to ensure that privileged credentials can only be accessed by authorized users for approved business reasons
- The System shall provide a mechanism in which continuously failed login attempts will be detected and controlled. Number of failed login attempts shall be configurable and will default to 5. The failure attempts shall be logged in the user audit records.
- The System Admin with sufficient privileges shall only restore the user access further to failed attempts, and shall not automatically allow access. It shall be logged and shall be work flow based.
- The System Authorization service shall control the access limits of the respective logged in users. Authorization shall validate an authenticated user's request and grant/deny him permission to perform a requested operation.
- The System shall provide an option for the newly logged in user to change his password and the user shall be forced to change the password first time. It shall also provide option to authenticated user to change password.
- Passwords shall be encrypted and stored in database and will not be stored in clear text.
- Strong Password techniques shall be employed as powerful password login mechanism.
- All the NOC components including Servers, OS users , Application users and Network devices users shall be authenticated through LDAP (to be supplied).

User Audit:

- The System shall provide facility to audit the authentication and authorization related information and stored in.
- Auditing shall monitor the selected operations performed by the user.
- The User Audit trails shall be logged and viewed by authorized security admin, it includes views of the current users logged in and past users logged in/out and the operations performed.
- All authorized operations that are performed are audited and logged in the audit tables.
- Any erroneous and suspicious activities like login attempt failures shall be logged and viewed as part of audit.
- The system shall provide audit reports on the performed operations with its user information and time stamps.
- Remote Support:

- The Remote Access (RA) to network would be provided only to approved locations abroad through approved location(s) in India. The approval for location(s) would be given by the DoT after satisfying itself about the appropriateness.
- The necessary logging provisions for remote access for TAC support shall be deployed and provision for storage of such logs/audit trail shall be kept at least for 1(One) year. The necessary hardware, software & license for at least 3(three) users shall be supplied without any additional price implication to **MahaIT**. Remote logging shall include following but not limited to below:
 - Record of key stroke during remote access period
 - Record of screen display for remote access period
 - Record of user access and activity logs.
- In case, the contractor is upgrading the existing Remote Access Server Solution to address the current requirement, the same shall be integrated suitably covering all equipments/ EMS/NMS supplied under this project.
- Tamper-proof storage for credentials, log files and recordings ensures sensitive information is protected from unauthorized access and misuse.
- High availability and disaster recovery modules include built-in fail-safe measures, secure backup and simple recovery to meet disaster recovery requirements.
- Support for strong authentication including multi-factor solutions enables companies to leverage existing authentication solutions for privileged accounts.
- FIPS 140-2 validated cryptography addresses compliance and security requirements.
- Real-time behavioural analytics to detect and disrupt in-progress attacks

SECURITY INCIDENT EVENT MANAGEMENT (SIEM)

- The Proposed solution should be an appliance based solution. The solution should consist of complete hardware, OS, Database and storage any other license to support the SIEM solution including scalability with no additional cost to be borne by the customer.
- The SIEM platform should be based on a Hardened Operating System Based solution with a clear physical separation of the collection engine, the logging engine and the co-relation engine. The solution should have a scalable architecture, catering multi-tier support and distributed deployments.
- The proposed SIEM solution should be deployed to collect and correlate data from multiple locations spread across locations.
- The SIEM Correlation solution should be able to handle a minimum of 15,000 Sustained EPS and should be scalable up to 20,000 Sustained EPS over a period of 5 years. The proposed solution should take into account upgrades of hardware, software, licenses as applicable over the 5 Years at no additional cost.
- The SIEM solution licensing should be by the number of events per second and not based on number of assets/devices forwarding the logs to the SIEM Solution.
- For assets not natively supported, the SIEM solution should provide the collection of events through customization of connectors or similar integration; Must support event collection using at least the following industry standards: syslog, OPSEC, WMI, ODBC, FTP, SCP, HTTP, text file, CSV, XML file, etc.
- The SIEM receiver or log collection component must store the data locally if communication with centralized correlators is unavailable.
- Receiver appliance should have the capability to collect flows. If receiver/collector does not have the capability to collect flows, third party product can be utilized
- Receiver appliances /Log collector should be able to work in high availability without the need for any third party solution for High Availability.
- The proposed SIEM solution should integrate bi directionally with the proposed Advanced Endpoint Protection solution such that the proposed SIEM solution should be able to change policies through integration on the proposed endpoint security such as in case

there is a virus outbreak, SIEM solution should be able to lock down a system by changing the policy on endpoint solution.

- The proposed SIEM solution should be able to ingest Indicators of Compromise information thus enabling the SIEM to know when files in the bad list are executed and their associated IP within the environment.

Log Collection & Management

- The proposed solution should provide a minimum log compression of 14:1 for ensuring log compression to reduce overall log storage space for the raw log format.
- The solution should be able to collect data from new devices added into the environment, without any disruption to the ongoing data collection.

Reporting

- The solution should use an adaptable and intuitive rules based interface for correlation
- The solution should provide pre-defined report templates. The reports should also provide at least the following reports out of the box or customized for: ISO 27001-2, PCI DSS, Basel II. Etc. without any additional license from the OEM.

Basic Correlation

- The SIEM solution should provide content aware correlation both rule based and rule less correlation against data collected from multiple devices across the network.
- The SIEM Solution should provide real time threat intelligence from Own or other third party trusted feed vendors.

Advance Correlation

- The SIEM solution should provide a formula of threat which should be customized to allow increasing or decreasing the level of risk with at least the following types of correlation:
 - Geo Location Based correlation
 - Historical Based Correlation
 - Vulnerability Based Correlation
- The solution should be able to decode an entire application session up to Layer 7, providing a full analysis of everything from the underlying protocols and session integrity all the way up to the contents of the application (such as the text of an email or its attachments) at the central site only.
- The solution should include pre-built detection rules for regulated and sensitive data.

Remote Fibre Monitoring System (RFMS)

Telecom Operators had lost more than 40% of underground fibre asset due to absence of monitoring and control on Dark Fibres.

Fibre Asset digitalization is key for maintaining, monetizing and keeping it ready for services. Monitoring, traceability and continuity of the buried / underground fibre asset is very important in consideration of increasing bandwidth demand and subsequently fibre media network.

Reconciliation of resources and continuous health review of fibre asset has become feasible with deployment of this remote fibre monitoring system.

It gives information about exact cut location remotely, in fault scenario, which helps reduce overall MTTR (Min Time To Restore).

It helps in better SLA (Service Level Agreement) adherence also avoid manual efforts & errors in testing of fibres.

It should also have the capability to integrate with Geographical Information System.

Please refer TEC GR no “TEC/GR/TX/RFM-001/02/MAR-15” for specifications

NOC INFRASTRUCTURE SPECIFICATIONS

Bidder needs do its due diligence and finalize Bill of Material (BoM) at the time of implementation. This finalized BoM should be submitted by Bidder for approval. This approved BoM will become the base document. Bidder will be required to submit design documents (as defined in earlier sections of the RFP) to State SPV for approval based on the approved BoM.

Further detailing of some of the technical and functional specifications are provided below.

1.1. Workstations (Desktop Computer)

S.No.	Parameter	Minimum Specifications
1.	Processor	Latest generation 64bit X86 Quad core processor(3Ghz) or better
2.	Chipset	Latest series 64bit Chipset
3.	Motherboard	OEM Motherboard
4.	RAM	Minimum 8 GB DDR3 Memory @ 1600 Mhz. Slots should be free for future upgrade
5.	Graphics card	Minimum Graphics card with 2 GB video memory (non-shared)
6.	HDD	2 TB SATA-3 Hard drive @7200 rpm
7.	Media Drive	NO CD / DVD Drive
8.	Network interface	10/100/1000 Mbps autosensing on board integrated RJ-45 Ethernet port.
9.	Audio	Line/Mic IN, Line-out/Spr Out (3.5 mm)
10.	Ports	Minimum 6 USB ports (out of that 2 in front)
11.	Keyboard	104 keys minimum OEM keyboard
12.	Mouse	2 button optical scroll mouse (USB)
13.	Monitor	Min. 22" (<u>or 21.5"</u>) TFT LED monitor, Minimum 1920 x1080 resolution, 5 ms or better response time, TCO 05 (or higher) certified For Command Control Centers : 2 LED Monitors <u>attached to the same workstation (multi monitor)</u>
14.	Certification	Energy star 5.0/BEE star certified
15.	Operating System	64 bit pre-loaded OS with recovery disc
16.	Security	BIOS controlled electro-mechanical internal chassis lock for the system.
17.	Antivirus feature	Advanced antivirus, antispyware, desktop firewall, intrusion prevention (comprising of a single, deployable agent) which can be managed by a central server. (Support, updates, patches and errata for the entire contract/ project period)

18.	Power supply	SMPS:- Power supply should be 90% efficient with EPEAT Gold certification for the system.
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1.2. IP PABX System

S.No.	Description	Parameter
1.	Technology	PCM-TDM , IP, Non-blocking
2.	Interface	Should support all telecom interfaces in Indian Telecom Service provider offerings
3.	Type of Interface	ISDN interface for digital, basic interface for Analog lines
4.	No. of lines - ,ISDN PRI lines & Analog / Digital Extensions	1 PRI from BSNL, 32 Extensions (IP / Analog / Digital)
5.	Type of Extension Support	Analog , Digital and IP
6.	Expansion of Extensions	Multiples of 8 / 16
7.	Run Distance	Not less than 800 mtrs. on 0.5mm dia. Cable
8.	Max. Loop resistance for analog trunk lines Extensions	2500 ohms including telephone
9.	Requirement at the time of supply	01 ISDN PRI, 24 Analog Ports & 8 Digital extension ports.. Expected to handle at least 30 external lines.
10.	Contact center Expansion available (Max. capacity)	It must support at least 16 Call center Agents
11.	Max. loop resistance for analog trunk lines	1200 ohms at -48 Volts DC
12.	Other	<ul style="list-style-type: none"> • ISDN supplementary services for Digital phone • Support for digital trunk lines • Working on 230v AC mains and DC voltage • Support for ACD call center with CTI and advanced call routing
13.	Design of EPABX System	Modular with universal slots, wall mountable
14.	Conferencing	5 party conferencing to be provided (to be configurable dynamically)

15.	Digital / IP Extension telephone instrument with programmable one touch keys	
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1.3. Online Uninterrupted Power Supply (UPS) System

Supply, install, test and commissioning of two numbers of true online, double conversion, high efficiency, and high power factor Uninterruptible Power Systems (UPS) rated at 2 x 20 KVA with battery backup support for 60 minutes on full load. The backup batteries should be supplied with the necessary arrangements to mount externally. The UPS shall be connected in LBS (Load bus Synchronization Mode) and should have the capability to add 20KVA Modules which can go up to 80Kva on each side i.e. 4X 20KVA and 4X20 KVA in LBS Mode. Every 2Modules of 20KVA can have a Common Battery Bank. Load to get power feed from two independent 2 x 20 KVA UPS systems to ensure redundancy. For single Power Source ACOS to be considered. Each UPS Input Shall have TVSS (Transient Voltage Surge Suppressor) as per the rating desired for each Location. TVSS and UPS shall be from same OEM.

Specification / features of the each UPS system are as follows :

- Widest input range. -
- Double conversion and IGBT technology. -
- Full IGBT Rectifier / Battery charger -
- IGBT based Inverter -
- Batteries to support 60minutes combined full load backup.
- Facility for remote viewing
- Easy to expand in a cost effective way
- **Surge Protection**

20 KVA UPS other Technical Specification:

OUTPUT PARAMETERS	
Capacity	20kVA/18kW (0-30deg C) / 16.2kW (30-35 deg C) / 14.4kW (35-40 deg C)
Power Factor	0.9 at 30Deg C
Configuration	3- ph, 3-wire,N +PE / 1 phase, L-N +PE
Voltage Regulation	(+/- 1%)
Voltage THD	<=2% - Linear load <=5% - Nonlinear load
Frequency	50/ 60Hz
Frequency Regulation (synchronized with bypass)	(+/- 2 Hz)
Slew Rate	0.2Hz/s

Crest Factor	3:1 max.
Recovery time	60 millisecond
Over load capacity	< 105% - continuous; 105-125% - < 5 min; 125-150%-<1min >150% - < 200ms(after overload shifted to bypass)
AC-AC Efficiency	>93% up to 94%
Transfer time - Mains to battery	0 millisecond
Transfer time - Inverter to bypass - Synchronization mode	1 millisecond
Parallel Redundancy	N+N
INPUT PARAMETERS	
Configuration	3- ph, 3-wire,N +PE
Nominal Voltage	380/400/415V
Input Voltage range	3 Phase 228Vac-478Vac
Frequency	50/60 Hz
Frequency range- Hz	40 to 70 Hz at full load
Power Factor	>0.99 at full load
BYPASS	
Voltage Range	+15% -20%
Frequency	50/ 60Hz
Frequency Range	+/-20%
BATTERY PARAMETERS	
Type	SMF

1.4. Civil Work, Safety Instrumentation and Furniture

The entire control room environment has to be designed as per ISO 11064 (International Norms to Design the Control Center). It should be state-of-art and the design should conform to provisions under ISO 14001 and OHSAS 18001, HFE and ISO 9241, covering various aspects of Command Center (wall paneling/partition & ceiling).

SAFETY: It must be safe and the designing components should not PROVOKE FIRE. So, ASTM E84 (Standard Test Method for Surface Burning Characteristics of Building Materials) certified materials to be used for wall cladding, flooring, paneling, partitions and ceilings. Safety of User & control room equipment safety is a high concern area therefore ceiling, paneling, partition and desk must be seismically tested and qualified. The test must be carried out by authorized government agency.

The test must be carried out by authorized government agency and certificate to be submitted along with the bid.

False Ceiling

"The ceiling used must be ASTM E84 class A certified for surface spread of flame and smoke generation and ROHS certified (Restriction of Hazardous Substance like Nickle, Cadmium etc.). Zero / minimum maintenance is the basic requirement, thus wood, painted Gypsum, Fabric etc. are not acceptable. Designer Acoustic Metal False Ceiling: Factory made acoustic modular metal false ceiling of powder coated panels. Panels shall be designed to achieve shape and design as per the design consultant. The ceiling shall be designed to enhance visual feel, with provision for easy installation and maintenance, integrated lighting and scope for integration of building services like HVAC and fire detection/ fighting system.

Design

- The ceiling panels shall be made up of powder coated metal panels to achieve strength. These planks shall be bend through CNC & laser Cut to achieve perfect accuracy.
- Structure shall be made from heavy duty powder coated modular steel frame (minimum sheet thickness 1 to 1.6mm). It shall be securely grouted from roof with help of anchor fastener and GI self-threaded rods. It shall be formed with the help of slotted rolled sections (stiffener) with help of M6 cage nut and bolts.
- Light fitting & AC Diffuser can be defined as per the LUX requirement.
- Surface Finish:
 - For Panels: Powder coated GI sheet. (sheet thickness: 0.6mm with powder coating:)
 - For Structure: Powder coated sheet. (sheet thickness: 1.0mm to 1.6mm with powder coating)
- The metal sheet shall have possibility of being formed mechanically per the specific needs of the project. The powder coating shall be able to undergo stretching up to 100% and therefor follow (adhere to) bend with the steel in all its deformation.
- In some parts of the control room; fire rated acoustical fleece to be pasted on the perforated metal ceiling planks to achieve better acoustic levels. Metal modular false ceiling is having Sound absorption coefficient (NRC) value 0.30 per IS:8225-1987, ISO: 354-1985 and ASTM 423-90.

Material Testing/Certification:

- Powder coating
 - Adhesion test: EN ISO 2409 (2 mm)
 - Impact resistance test: ASTM D 2794 (5/9' ball)
 - flexibility test: EN ISO 1519
 - Salt spray test: 600 hrs.
 - Resistance to humid atmosphere test: DIN 50017.

ILLUMINATION

- A detailed Lux level report to be submitted considering ISO 11064:6 (norms for Environmental requirements for control centers).
- Design factors must consider influences such as comfort, health, safety, efficiency and effectiveness of all people through architectural design, control room lighting and lighting therapy.

- Illumination levels on the work surface where paperwork is undertaken should be maintained at a level of 200lx to 750 lx with an upper limit of 500lx where VDUs are used; this can be a combination of ambient and task lighting.
- Diming should be provided with a lower limit of maintained 200lx on the work surface at all times.
- For working areas where mainly paperwork is undertaken an illumination level of 500 lx should be maintained.

1.5. Furniture and Fixture

- Physical structure:
 - Ergonomically designed desk to ensure 24x7 desking solution with sufficient knee space (min 450mm) and foot space (min 600 mm).
- Working surface
 - The Console Top / working surface should be made of minimum 25 mm thick MDF with High Pressure Laminate finish. The laminate shall be fire retardant, Insulated, Water Proof, Scratch resistant and high hardness. The Table Top should be able to mount three 27 Inches Display monitors for each work station.
 - Working surfaces must be NEMA LD3 Norms with moulded ergonomic Urethane waterfall edge with minimum 50-60mm thickness for operator's wrist comfort.
- Console design
 - Consoles must be of modular design, facilitating future equipment retrofits and full reconfigurations without requiring any major modification to the structure or exterior elements
- Equipment mounting
 - The workstation shall be able to house computer equipment's, Ethernet Points, Power Distribution Unit.
- Frame material
 - Made of heavy duty Aluminum. The Extrusions shall be duly powder coated with 40+ micron over all surfaces. Console should be Seismic Zone- 4 tested.
- Certificates & submittals
 - BIFMA X5.5, FSC Certified manufacturer, OHSAS 18001, RoHS on console (from UL/Intertek), Greenguard Certified.
 - Consoles to be qualified for Seismic Zone 4 (or better).
 - Test certification for ASTM E84 from UL; for the surface burning characteristics of products and materials. Test must refer the actual assembled components for wood-core panels including core, laminates, edging.
 - Raw-material supplier data alone is not acceptable.
- Proven track record
 - The desk manufacturer or supplier Should have supplied Minimum One desk with BIFMA X5.5 (all parameters) certified desk having scratch resistant table top with Moulded PU nosing to any one Government/PSU (through system integrator or end user) in past three years.
 - For desk, agency to produce minimum one installation with similar specifications.
 - Desk Manufacturer must be FSC certified from last 1 year.

1.6. Partitions (wherever required as per approved drawing)

- Partitions must be modular in nature.
 - Straight Metal Partition–
- All the properties and material of construction shall be like straight Metal paneling but the partition shall have metal tiles on either side of the frame.
 - Curvilinear Metal Partition:-
- All the properties and material of construction shall be like Metal paneling/partition but the front tiles shall be having perfect curve to meet the aesthetical requirement of the Control room and shall allow easy installation of the LVS/Screens on it.
- SAFETY
 - From fire and safety point of view; the metal partitions must be ASTM E84 class A certified for surface spread of flame and smoke generation and ROHS Certified (Restriction of Hazardous Substance like Nickle, Cadmium etc.)
- GLASS PARTITION
 - Full glass wall partitions will be made of 12mm Toughened laminated glass with frame-less structure. The glass partition shall be supported by 200-600mm high Modular metal partition (having the same finish as that of wall cladding) from the floor. Proper structure shall be made to ensure the fixing of glass from RCC slab above false ceiling and flooring.
 - Straight and vertical structural members shall not be visible. Safety film shall be applied on the glass to avoid shattering. Glass shall be fitted on anodized extrusion with tool less technology and having a provision for replacing glass with perforated sheet/acoustic tile by removing the glass.
- NOTE: - The nature of installation should be replaceable, expandable and flexible to cater the future expansion/technical up-gradation.
- Air Flow
 - Design to ensure proper flow and throw of air in the control room. This requirement is mandatory to create perfect temperature and enough air movement to stay awake and comfortable. Design must comply ISO 11064:6.
- All desired certificates to be obtained from UL or Intertek or any Indian Government owned Research / Testing Institute

1.7. Painting

- WALL PANELING
 - Panel should comprise of hexagonal perforations for making the cladding and partitions acoustically sound. Min 20% panels shall be perforated or as required in the control room to achieve the desired acoustic levels. .
 - Materials having adverse impact on the environment and nature shall not be accepted. Zero / minimum maintenance is the basic requirement, thus wood, painted Gypsum, etc are not acceptable.
- Material Specification for Paneling
 - Factory made removable type self inter lockable metal panels of Preformed textured Hot dip galvanized strips and sheets of low carbon steel coated on one side with rigid polyvinylchloride (PVC) film and on the other side a coating based

on cross linkable polyester resins (sheet thickness 0.6mm & PVC Coating 0.15mm). Make shall comprise of specially designed combination of perforated and non-perforated panels through CNC laser Cutting, bending & punching. Panel shall be of 0.75mm thick galvanized metal of approved color. Panels shall be designed to achieve shape and design as per the design consultant. Panels shall be fixed using hook fitting on structure. Overall system thickness for paneling shall be 70mm to 85mm and for partition shall be 85mm to 110mm.

- As per design panel shall comprise of hexagonal perforation for making paneling and partitions acoustically sound. Acoustic grade fire retardant fabric (min 1.5mm thick) will be fixed at some parts of the control room.
- Panel shall be design in such a manner that it takes care of undulation of civil walls and gives perfect flat surface finish and compile easy service & maintenance procedure.
- The cladding panels shall be made up of combination of two sheets locked and riveted together and polystyrene shall be used as infill to achieve strength and acoustics. The front tile (PVC pre-coated metal sheet) shall be perforated/ non-perforated as per the design requirement and the back tile (Powder coated 0.6mm GI sheet) shall be designed in such a manner that it fits on the back portion of the front tile. Once the tiles are fitted together then these will be manually riveted. These tiles shall be bend through CNC, machine punched & laser Cut to achieve perfect accuracy.
- Structure Shall be made from heavy duty powder coated modular steel frame (minimum sheet thickness 1 to 1.6mm) and shall allow uninterrupted flow of wires/cable/tubes of max. dia. 25mm.
- Structure Shall be securely grouted from wall, roof and floor. It shall be made up of 1-1.6mm thick vertical Slotted rolled C sections (Upright) and horizontal rolled 'C' connectors. Grid of desired dimension shall be formed by Vertical and horizontal sections having 50mm pitch.
- Surface Finish:
 - For Panels:
 - Front Panel: PVC pre-coated GI sheet (sheet thickness: 0.6mm and PVC coating: 0.15mm)
 - Back Cover: Powder coated GI sheet. (sheet thickness: 0.6mm with powder coating:)
 - For Structure:
 - Powder coated sheet. (sheet thickness: 1.0mm to 1.6mm with powder coating)
- The metal sheet shall have possibility of being formed mechanically per the specific needs of the project.
- Panel shall provide better thermal, electrical insulation as compared to normal GI panels. It shall be non-reflective/glare free and be eligible for food contact.
- Material Selection:
 - Available Width- 300mm to 1200mm (in multiples of 150mm).
 - Available Height- 150mm to 750mm (in multiples of 150mm).
 - Thickness- 10mm to 15mm for perforated tiles with acoustic fleece without back cover
 - 25mm to 30mm for non-perforated tiles with back covers
 - PVC pre-coated sheet:

- Fire rating and Low flame spread: EN ISO 11925-2, EN 13823 and ASTM E-84
- Food grade: EU10/2011
- Core material (compressed polystyrene): Acoustic test: 9301/ ISO: 140/ASTM 413, ASTM C 578.
- Powder coating
 - Adhesion test: EN ISO 2409 (2 mm)
 - Impact resistance test: ASTM D 2794 (5/9' ball)
 - Flexibility test: EN ISO 1519
 - Salt spray test: 600 hrs.
 - Resistance to humid atmosphere test: DIN 50017.

1.8. Acoustics

- The ambient noise level in the control room must not exceed 45 dB(A) during the length of the working day also it should not be less than 30dB.
- The auditory alarms Alarm signals should be at least 10 dB(A) over the background noise of the control room in order to be audible; and less than 15 dB higher than the background to avoid startling staff and affecting speech communication (ISO 7731:1986).
- Sound transmission class (STC) value of 35dB for Wall Paneling & Partition (according to IS: 9901 (Part III) – 1981, DIN 52210 Part IV- 1984, ISO:140(Part III) -1995.
- Metal modular perforated plank false ceiling have Sound absorption coefficient (NRC) value 0.60 per IS:8225-1987.
- Acoustic flooring (shall reduce impact sound by 14dB (ISO 717-2)). It shall be twinlayer linoleum built up from 2 mm acoustic and a 2 mm Corkment backing. Flooring shall be decorative type of approved shade, pattern, texture and design and of approved manufacturer. Dimensions shall be as per the final approved design and site requirement.
- EXECUTION
 - ACP, wood & laminate, gypsum, fabric shall be deemed unacceptable for vertical cladding and ceiling surfaces.
 - Vendor to demonstrate one portion at wall paneling& ceiling at their premises before dismantling & shipping to site. In short, a FAT (Factory acceptance test) to be carried out at vendors works for ceiling & paneling.
 - At site, any type of cutting, chipping, Gluing, screwing etc. shall not be acceptable.
 - All desired certificates to be obtained from UL or Intertek or any Indian Government owned Research / Testing Institute
- General Requirement for Command Center Manufacturer
 - Certificate for ISO 9001-2015 quality certification and proof of quality system implementation in Manufacturing processes for at least 5 years.
 - To prove supplier's seriousness in the business; Printed Catalogues to be furnished.
 - Ergonomic compliance report for Command and control room layout as per international ISO ergonomic norms to be submitted along with the bid.
 - The bidder to produce following documents from the Command and control room interior Manufacturer or supplier along with the bid: -
 - Minimum 10 installation of Command control rooms/ NOC areas with appreciation letters for the turnkey scope including but not limited to ceiling, flooring, illumination and wall cladding from reputed companies to be submitted along with the bid. These packages should have been executed on or before Bid release date.

- Copy of Test certification for ASTM E84 (from UL) for the surface burning characteristics of wall paneling tiles and ceiling tiles to be submitted along with the bid. This is mandatory requirement from Fire safety point of view.
- Raw-material supplier data alone is not acceptable."

1.9. Steel Conduit

- All sections of conduit and relevant boxes shall be properly cleaned and glued using appropriate epoxy resin glue and the proper connecting pieces, like conduit fittings such as Mild Steel and should be so installed that they can remain accessible for existing cable or the installing of the additional cables.
- No conduit less than 20mm external diameter shall be used. Conduit runs shall be so arranged that the cables connected to separate main circuits shall be enclosed in separate conduits, and that all lead and return wire of each circuit shall be run to the same circuit.
- All conduits shall be smooth in bore, true in size and all ends where conduits are cut shall be carefully made true and all sharp edges trimmed. All joints between lengths of conduit or between conduit and fittings boxes shall be pushed firmly together and glued properly.
- All electrical wiring should be done as per CPWD specifications.
- The chase in the wall required in the recessed conduit system shall be neatly made and shall be of angle dimensions to permit the conduit to be fixed in the manner desired. Conduit in chase shall be held by steel hooks of approved design of 60cm center the chases shall be filled up neatly after erection of conduit and brought to the original finish of the wall with cement concrete mixture 1:3:6 using 6mm thick stone aggregate and coarse sand.

1.10. Wiring

- PVC insulated copper conductor cable shall be used for sub circuit runs from the distribution boards to the points and shall be pulled into conduits. They shall be stranded copper conductors with thermoplastic insulation of 650 / 1100 volts grade. Color code for wiring shall be followed.
- Looping system of wiring shall be used, wires shall not be jointed. No reduction of strands is permitted at terminations.
- Wherever wiring is run through trunking or raceways, the wires emerging from individual distributions shall be bunched together with cable straps at required regular intervals. Identification ferrules indicating the circuit and D.B. number shall be used for sub main, sub circuit wiring the ferrules shall be provided at both end of each sub main and sub-circuit.
- Where, single phase circuits are supplied from a three phase and a neutral distribution board, no conduit shall contain wiring fed from more than one phase in any one room in the premises, where all or part of the electrical load consists of lights, fans and/or other single phase current consuming devices, all shall be connected to the same phase of the supply.
- Circuits fed from distinct sources of supply or from different distribution boards or M.C.B.s shall not be bunched in one conduit. In large areas and other situations where the load is divided between two or three phases, no two single-phase switches connected to difference phase shall be mounted within two meters of each other.
- All splicing shall be done by means of terminal blocks or connectors and no twisting connection between conductors shall be allowed.
- Metal clad sockets shall be of die cast non-corroding zinc alloy and deeply recessed contact tubes. Visible scraping type earth terminal shall be provided. Socket shall have push on protective cap.

- All power sockets shall be piano type with associate's switch of same capacity. Switch and socket shall be enclosed in a M. S. sheet steel enclosure with the operating knob projecting. Entire assembly shall be suitable for wall mounting with Bakelite be connected on the live wire and neutrals of each circuit shall be continuous everywhere having no fuse or switch installed in the line excepting at the main panels and boards. Each power plug shall be connected to each separate and individual circuit unless specified otherwise. The power wiring shall be kept separate and distinct from lighting and fan wiring. Switch and socket for light and power shall be separate units and not combined one.
- Balancing of circuits in three phases installed shall be arranged before installation is taken up. Unless otherwise specified not more than ten light points shall be grouped on one circuit and the load per circuit shall not exceed 1000 watts.

1.11. Earthing

- All electrical components are to be earthen by connecting two earth tapes from the frame of the component ring and will be connected via several earth electrodes. The cable arm will be earthen through the cable glands. Earthling shall be in conformity with provision of rules 32, 61, 62, 67 & 68 of Indian Electricity rules 1956 and as per IS-3043. The entire applicable IT infrastructure in the Control Rooms shall be earthed.
- Earthing should be done for the entire power system and provisioning should be there to earth UPS systems, Power distribution units, and AC units etc. so as to avoid a ground differential. State shall provide the necessary space required to prepare the earthing pits.
- All metallic objects on the premises that are likely to be energized by electric currents should be effectively grounded.
- The connection to the earth or the electrode system should have sufficient low resistance in the range of 0 to 25 ohm to ensure prompt operation of respective protective devices in event of a ground fault, to provide the required safety from an electric shock to personnel & protect the equipment from voltage gradients which are likely to damage the equipment.
- Recommended levels for equipment grounding conductors should have very low impedance level less than 0.25 ohm.
- In case of a UPS and Transformer equipment, the Earth resistance shall be automatically measured on an online basis at a pre-configured interval and corrective action should be initiated based on the observation. The automatic Earthing measurements should be available on the UPS panel itself
- There should be enough space between data and power cabling and there should not be any cross wiring of the two, in order to avoid any interference, or corruption of data.
- The earth connections shall be properly made.
- A complete copper mesh earthing grid needs to be installed for the server farm area, every rack need to be connected to this earthing grid. A separate earthing pit needs to be in place for this copper mesh.
- Provide separate earthing pits for servers, UPS & generators as per the standards.
- Expectation is to have maintenance free chemical earthing.

1.12. Cable Work

- Cable ducts should be of such dimension that the cables laid in it do not touch one another. If found necessary the cable shall be fixed with clamps on the walls of the duct. Cables shall be laid on the walls/on the trays as required using suitable clamping/ fixing

arrangement as required. Cables shall be neatly arranged on the trays in such manner that a criss-crossing is avoided and final take off to switch gear is easily facilitated.

- All cables will be identified close to their termination point by cable number as per circuit schedule. Cable numbers will be punched on 2mm thick aluminum strips and securely fastened to the. In case of control cables all covers shall be identified by their wire numbers by means of PVC ferrules. For trip circuit identification additional red ferrules are to be used only in the switch gear / control panels, cables shall be supported so as to prevent appreciable sagging. In general distance between supports shall not be greater than 600mm for horizontal run and 750mm for vertical run.
- Each section of the rising mains shall be provided with suitable wall straps so that same can be mounted on the wall.
- Whenever the rising mains pass through the floor they shall be provided with a built-in fire proof barrier so that this barrier restricts the spread of fire through the rising mains from one section to the other adjacent section.
- Neoprene rubber gaskets shall be provided between the covers and channel to satisfy the operating conditions imposed by temperature weathering, durability etc.
- Necessary earthing arrangement shall be made alongside the rising mains enclosure by Mean of a GI strip of adequate size bolted to each section and shall be earthed at both ends. The rising mains enclosure shall be bolted type.
- The space between data and power cabling should be as per standards and there should not be any criss-cross wiring of the two, in order to avoid any interference, or corruption of data.

1.13. Fire Detection and alarm System

- Fire can have disastrous consequences and affect operations of a Control Room. It is required that there is early-detection of fire for effective functioning of the Control Room.

i. System Description

- The Fire alarm system shall be an automatic 1 ton (e.g. 8) zone single loop addressable fire detection and alarm system, utilizing conventional detection and alarm sounders.
- Detection shall be by means of automatic heat and smoke detectors located throughout the Control Room (ceiling, false floor and other appropriate areas where fire can take place) with break glass units on escape routes and exits.

ii. Control and Indicating Component

- The control panel shall be a microprocessor based single loop addressable unit, designed and manufactured to the requirements of EN54 Part 2 for the control and indicating component and EN54 Part 4 for the internal power supply.
- All controls of the system shall be via the control panel only.
- The system status shall be made available via panel mounted LEDs and a backlit 8 line x 40-character alphanumeric liquid crystal display.
- All system controls and programming will be accessed via an alphanumeric keypad. The control panel will incorporate form fill menu driven fields for data entry and retrieval.
- The system will include a detection verification feature. The user shall have the option to action a time response to a fire condition. This time shall be programmable up to

10 minutes to allow for investigation of the fire condition before activating alarm outputs. The operation of a manual call point shall override any verify command.

iii. Manual Controls

- o Start sounders
- o Silence sounders
- o Reset system
- o Cancel fault buzzer
- o Display test
- o Delay sounder operation
- o Verify fire condition
- o Disable loop

iv. Smoke detectors:

Smoke detectors shall be of the optical or ionisation type. Devices shall be compatible with the CIE conforming to the requirements of EN54 Part 7 and be LPCB approved. The detectors shall have twin LEDs to indicate the device has operated and shall fit a common addressable base.

v. Heat detectors

- o Heat detectors shall be of the fixed temperature (58°C) or rate of temperature rise type with a fixed temperature operating point.
- o Devices shall be compatible with the CIE conforming to the requirements of EN54 Part 5 and be LPCB approved.
- o The detectors shall have a single LED to indicate the device has operated and shall fit a common addressable base.

vi. Addressable detector bases

- o All bases shall be compatible with the type of detector heads fitted and the control system component used. Each base shall comprise all necessary electronics including a short circuit isolator.
- o The device shall be automatically addressed by the CIE on power up of the loop without the need of the insertion of a pre-programmed EPROM or setting of DIL switches.
- o Detector bases shall fit onto an industry standard conduit box

vii. Audible Alarms

- o Electronic sounders shall be coloured red with adjustable sound outputs and at least 3 sound signals. The sounders should be suitable for operation with a 24V DC supply providing a sound output of at least 100dBA at 1 meter and 75 dBA min, for a bed head or sounder base type device. The sounder frequency shall be in the range of 500Hz to 1000Hz.

viii. Commissioning

- o The fire detection and alarm system will be programmable and configurable via an alpha numeric keypad on the control panel.

ix. High Sensitivity Smoke Detection System

- General – The HSSD system shall provide an early warning of fire in its incipient stage, analyse the risk and provide alarm and actions appropriate to the risk. The system shall include, but not be limited to, a Display Control Panel, Detector Assembly and the properly designed sampling pipe network. The system component shall be supplied by the manufacturer or by its authorized distributor.

x. Regulatory Requirements

- National Electrical Code (NEC)
- Factory Mutual
- Local Authority having Jurisdiction

1.14. Water leak detection System

- Water leak detection System should be designed to protect the Air-conditioned premises and to alert the personnel about the leak in the AC systems. The system should be capable of interfacing to Water leak detection sensors, condensation sensors & I/O modules.
- Events should be clearly reported on LCD/LED display with full English language description of the nature of the fault in the panel. The successful bidder should make detailed working drawings and coordinate them with other agencies at site. Water Leak Detection systems should be integrated with BAS.

i. EQUIPMENT

The Water leak detection system should comprise of Tape Sensors, Water Leak detection modules, Condensation detectors, I/O modules and sounders all connected to a Control Panel.

ii. CONTROL PANEL

- The control panel should be computerized 4/8/12 zone multiplex controller with a facility to add on dialer and speech processor. The system should be programmed, armed or disarmed through a control key pad. The control key pad should have a 16 character LCD display for viewing various events. The code to arm or disarm the system should be changed only by entering a master code.
- The system should have 4/8/12 zones and all the detectors should be connected through a 2 core cable. Each area of the premises should be divided into specific zones such that any zone should be isolated by the user if required.
- The entire system should be backed up by a maintenance free rechargeable battery to take care of system's power requirements whenever power fails.
- The system should be totally tamper proof and should activate an alarm if the control panel is opened, the sensors tampered with or if the system cables are cut even in the disarmed state.
- The system should log 500 events and optionally printer should be connected for generating reports.
- The Detectors, I/O Modules, Remote Keypads and other Devices should be connected to a system on a single 2/4/6 Core Cable Bus to avoid individual cabling of zones.
- The system should have a Buffer memory of minimum 250 events and log each event with exact date and time.
- The controller should have a Serial Port for connecting to a computer.

- The controller should work on 220/240V AC power supply and it should also have a built in battery backup.
- The memory inside the controller should be backed up by a lithium battery. The controller should work effectively over a temperature range of -10 Deg. C to + 55 Deg. C. and 0 to 90% of Humidity.

1.15. WATER LEAK DETECTION SENSOR

Water Leak Detection sensors should be able to mount in DIN rails, inside AHU's, power distribution units or other equipment where localized leak detection is required. The detectors should be resistant to oxidation and erosion. The detector should have relay output for connection to the controller. LED alarm indication should also be provided. The detectors should operate in AC or DC supply.

1.16. TAPE SENSORS

Tape sensors are used to detect water leaks usually under floors. Tape sensors for use with water leak detectors should be covered with plastic netting to prevent short circuits when used in metal trays or conduits, and enables the tape to be folded at right angles to allow easy routing.

1.17. HOOTER / SOUNDER

The hooter / sounder should give audible alarm when any sensor operates. It should be complete with electronic oscillations, magnetic coil (sound coil) and accessories ready for mounting (fixing). The sound output from the Hooter should not be less than 85 decibels at the source point.

1.18. Access Control System

The Access Control System shall be deployed with the objective of allowing entry and exit to and from the premises to authorized personnel only. The system deployed shall be based on Biometric Technology. An access control system consisting of a central PC, intelligent controllers, power supplies and all associated accessories is required to make a fully operational on line access control system. Access control shall be provided for doors. These doors shall be provided with electric locks, and shall operate on fail-safe principle. The lock shall remain unlocked in the event of a fire alarm or in the event of a power failure. The fire alarm supplier shall make potential free contacts available for releasing the locks in a fire condition especially for staircase and main doors. Entry to the restricted area shall be by showing a proximity card near the reader and exit shall be using a push button installed in the secure area. The system shall monitor the status of the doors through magnetic reed contacts. The system should be designed and implemented to provide following functionality:

- Controlled Entries to defined access points
- Controlled exits from defined access points
- Controlled entries and exits for visitors
- Configurable system for user defined access policy for each access point
- Record, report and archive each and every activity (permission granted and / or rejected) for each access point.
- User defined reporting and log formats
- Fail safe operation in case of no-power condition and abnormal condition such as fire, theft, intrusion, loss of access control, etc.
- Day, Date, Time and duration based access rights should be user configurable for each access point and for each user.

- One user can have different policy / access rights for different access points.

1.19. Rodent Repellent system:

The entry of Rodents and other unwanted pests shall be controlled using non-chemical, non-toxic devices. Ultrasonic pest repellents shall be provided in the false flooring and ceiling to repel the pests without killing them. However periodic pest control using Chemical spray can be done once in 3 months as a contingency measure to effectively fight the pest menace.

o Configuration	:	Master console with necessary transducer
o Operating Frequency	:	Above 20 KHz (Variable)
o Sound Output	:	50 dB to 110 dB (at 1 meter)
o Power output	:	800 mW per transducer
o Power consumption	:	15 W approximately
o Power Supply	:	230 V AC 50 Hz
o Mounting	:	Wall / Table Mounting

1.20. Instruction about Civil Work

- a. Building design must be in accordance with international standards.
- b. Bidder has to provide the Building Design Parameters which are essential for building State of the Art Building of NOC
 - i. Layout Design
 - ii. Cabling
- c. Layout
 - i. Type of cable (Fire resistant etc.)
- d. Ducting
- e. Bidder should define the standard of on building construction.
- f. It is expected that design of CCC building is demonstrated through 3D video.
- g. Bidder should recommend the international standards and suggest what specific requirement of building design are required for building a state of the art Integrated Command and Control Center.
- h. Building design must be futuristic, using 3D modelling, which can be refined and revise the final view of the actual NOC.
- i. The NOC physical building design should also be modular and able to accommodate other Municipal Corporations systems within NOC premises.
- j. Bidder will be required to get approval on engineering drawings of NOC from TUFIDCO.
- k. During the review of design documents, TUFIDCO may suggest some changes or provide feedback on design parameters. Bidder will be required to incorporate such inputs.
- l. TUFIDCO may authorize any third party do to review of design documents.
- m. After final approval of TUFIDCO on design documents, building work will be initiated by TUFIDCO.

1.21. DG Set Specifications

S.No.	Item	Minimum Specifications
1	General Specifications	<ul style="list-style-type: none"> Auto Starting DG Set mounted on a common base frame with AVM (Anti-Vibration) pads, residential silencer with exhaust piping, complete conforming to ISO 8528 specifications and CPCB certified for emissions. KVA rating as per the requirement to provide the supply for NOC
2	Engine	Radiator cooled, multi cylinder, 1500 RPM diesel engine, with electronic/manual governor and electrical starting arrangement complete with battery, conforming to BS 5514/ ISO 3046/ IS 10002
3	Fuel	High Speed Diesel (HSD)
5	Alternator	Self-exciting, self-regulating type alternator rated at 0.8 PF or better, 415 Volts, 3 Phase, 4 wires, 50 cycles/sec, 1500 RPM, conforming to IS 4722/ BS 5000, Windings of 100% Copper, class H insulation, Protection as per IP 23.
6	AMF (Auto Main Failure) Panel	<p>AMF Panel fitted inside the enclosure, with the following:</p> <p>It should have the following meters/indicators</p> <ul style="list-style-type: none"> • Incoming and outgoing voltage • Current in all phases • Frequency • KVA and power factor • Time indication for hours/minutes of operation • Fuel Level in fuel tank, low fuel indication • Emergency Stop button • Auto/Manual/Test selector switch • MCCB/Circuit breaker for short-circuit and overload protection • Control Fuses • Earth Terminal • Any other switch, instrument, relay etc. essential for Automatic functioning of DG set with AMF panel
7	Acoustic Enclosure	<ul style="list-style-type: none"> The DG set shall be provided with acoustic enclosure / canopy to reduce the sound level and to house the entire DG set (Engine & Alternator set) assembly outside (open-air). The enclosure must be weather resistant powder coated, with insulation designed to meet latest

S.No.	Item	Minimum Specifications
		MOEF/CPCB norms for DG sets, capable to withstand climate. The enclosure must have ventilation system, doors for easy access for maintenance, secure locking arrangement
8	Fuel Tank Capacity	It should be sufficient and suitable for containing fuel for minimum 12 hours continuous operation, Complete with level indicator, fuel inlet and outlet, air vent, drain plug, inlet arrangement for direct filling and set of fuel hoses for inlet and return.

1.22. Comfort Air-conditioning System

Comfort air conditioning (CAC), which shall be connected through Duct AC system using industrial grade machines. Comfort air conditioning (CAC) shall be used in the all NOC area. Cooling machines in this area shall be provided with N+1 configuration. No window air-conditioner or split air-conditioner shall be used for comfort air conditioning system.

The Duct AC has to be installed in the NOC. The indoor unit will be installed on the ceiling void.

The piping will be taken through the wall and along with the wall outside.

(i) Technical Specification:

- The Duct AC to be air cooled type.
- Compressor to be scroll type.
- The Duct AC to have refrigerant diaphragm valve, Filter dryer.
- Fins to have aluminum construction.
- The Unit to run on 3phase power 415 +/- 10 %, 50 cycles,
- Unit shall be complete with thermostat, internal wiring and starter panels for each compressor
- Refrigerant type will be R407C/R410A
- Operating range upto 35 deg C
- Noise level to be 65 db max
- The AC to have energy saving mode and it must take no power on idle conditions
- The duct sheet metal to be properly insulated with nitrile rubber.
- Size of the main duct to be as per the requirement of the CFM required for the rooms
- Thickness of the duct sheet metal to be 0.8mm min.
- Diffusors to be required on the room and it will be square type to be used on ceiling only.
- Diffusor to be made out of powder coated Aluminum metal with volume control damper.
- The COP and EER have to be as per BEE standard star 5 rated.

1.23. Integrated Building management system

S.No.	Description
1.	<p>A. The Bidder shall supply, install and commission BAS, Access control and Physical security system for NOC Building Office. Bidder has to also provide all necessary hardware and all operating and applications software necessary to perform the control sequences of operation as called for in this specification</p> <p>B. The Bidder shall Supply, install and commission a complete Building Automation System (BAS) including all necessary hardware and all operating and applications software necessary to perform the control sequences of operation as called for in this specification. All components of the system –, application controllers, unitary controllers, etc. shall communicate using the BACnet protocol, as defined by ASHRAE Standard 135-2007, or EIA standard 709.1, the LonTalk™ protocol, or Modbus protocol. At a minimum, provide controls for the following:</p> <ol style="list-style-type: none"> 1. Air handling units 2. Return air fans 3. Exhaust and supply fans 4. Chilled water system including pumps, chillers, and cooling towers 5. Boilers including hot water pumps 6. Computer room air handling units 7. Refrigerant leak detection system 8. Smoke evacuation sequence of AHUs and return fans including smoke control dampers and fire command override panel. 9. Finned tube radiation control 10. Variable volume and constant volume box control including interlocks with finned tube radiation. 11. Cabinet unit heater controls 12. Monitoring points for packaged equipment such as emergency generators, 13. Power wiring to DDC devices, smoke control dampers and BAS panels except as otherwise specified.

1.24. Access Control System

- Access Controller Ethernet Based
 - The Access Controller's should be designed for both critical government & private sector security applications.
 - Below input & output modules should be onboard with the Controllers.
 - Universal Inputs : 12
 - Reader Inputs : 8
 - Tamper Input : 1
 - Digital Lock Output : 4
 - The Access Controller's should be designed to support both entry & egress readers while supplying +5 or +12 VDC to each reader.
 - The controller should support the data transfer rates upto 100 Mbps and should have IPSec/IKE encryption and authentication. Encryption (up to 192-bit) and authentication may be enabled for communication to and from workstations and controllers. Controller

- should utilizes Internet Protocol Security (IPSec) and Internet Key Exchange (IKE) for its encryption to assure tamperproof communications over the Ethernet.
- The Controller should be perfect for large systems. A controller servicing up to 8 areas can hold 480,000 personnel records. With such a large local storage capacity, access decisions can be made swiftly without waiting for validation by a remote server.
- Controller should have inbuilt 32 MB of flash memory and 128 MB of DDR SDRAM. The flash memory is used to preserve 12 MB of application and run-time data. The dynamic RAM is partitioned for dedicated functions: a full 12 MB for applications, 48 MB for personnel records and 8 MB for the operating system. The unused memory should be available for future enhancements. Personnel record data should be preserved using onboard batteries that can hold the data for at least 7 days without the use of an external UPS. If the controller has its application stored in flash and power loss lasts longer than what the battery can supply for RAM, the controller will send a message to Cyber Station and request that the personnel records automatically be reloaded when the power returns.
- The reader inputs should be powered by a dedicated processor allowing the controllers to support current and future devices for advanced applications. The hardware should be ready to support 260-bit encrypted data messages from the reader.
- It is important for controller to be able to contain potential threats when they are detected. The Controller should respond to Area Lockdown commands set from Access control software providing a quick method of sealing off areas. A simple click of a graphic or an automatic program response is all that is needed to disable card readers and exit requests in any given area. First responder personnel can still gain access to the area if their record is marked with “executive privilege”.
- The Controller should be able to adapt access rights to a change in condition or “threat” levels. Each personnel record should be assigned a clearance level for each area to which they have access. When the condition is more severe than the person’s clearance level then access is automatically denied. The Condition Level may be set manually through workstation or automatically through a program. A program can even be used to monitor national threat levels and adjust Condition Levels accordingly.
- Each controller should support the use of two expansion modules plus an Display unit. The expansion module is used for expanding the controller for special or access to doors. Modules can also be used to provide a cost effective entry reader only solution.
- The Access controller should support up to 32 Infinet nodes. The RS-485 programmable port can be set to support a wired or wireless Infinet field bus.
- The Controllers should be ready to support a wide range of card formats. Ideal for retrofits, The Controller lets you preserve existing cards by accepting standard formats (Weigand, ABA, HID Corporate-1000, CardKey) as well as custom formats (Custom Weigand, Custom ABA). The Controller should support formats up to 260-bits making the controllers ready for government installations that must meet HSPD-12 and FIPS 201 standards.
- SNMP (Simple Network Messaging Protocol) messages may be sent to network monitoring software to inform IT managers as to the health and presence of the access controller on the corporate network. The Access Controller should also support the SNMP alarming option.

Parameters	Specifications
Controller	Microprocessor Based with 8 Readers 12 Inputs, 4 DO , 10/100 bT

Parameters	Specifications
Memory	DDR SDRAM: 128 MB Flash: 32 MB
Power	24 VAC , 50/60 Hz 12-28 VDC auto-sensing , 50/60 Hz
Power Consumption	90 VA (AC) 50 W (DC)
Real time Clock	Battery backed by an Internal Battery
Operation Environment	0-50 * C 10-90% RH (Non-Condensing)
Enclosure	UL open class, flammability rating of UL94-5V, IP 10
Mounting	Wall mount using fasteners.
Internal Battery	NiMH , 3.6 VDC, 800 mAh
Battery Backup	Minimum 7 days DDR SDRAM and real-time clock
Ethernet LAN Interface	10/100 Ethernet; ethernet cable with RJ-45 connector.
Serial Comm. Interface	One RS-485 programmable port, software configurable for Infineon, wireless adapter, RoamIO2 or third-party system.
Input Voltage Range	0-5.115 volts DC
Input Impedance	10K ohm to 5.120V or 5M ohm with pull-up resistor disabled
Input Resolution	5.0 mV
Input Accuracy	±15mV (±0.56°C from -23°C to +66°C or ±1°F from -10 °F to +150°F)
Alarm Inputs	12
Card Reader/Keypad Inputs	8, Each input can be connected to a card reader, dedicated keypad, or reader/keypad combination.
Card Reader Type	Wiegand, ABA, or CardKey (jumper selectable)
Max Number of Bits/Card	Up to 260 bits/card
Card Reader Power	+5 VDC @ 120 mA or +12 VDC @ 180 mA (jumper selectable)
Door Outputs	4 Nos. Form C relays with a manual override switch
Output Rating	24 VAC/30 VDC @ 3 A
Overrides	3-position manual override switch on each output for manual control of relay. LED override status indicator.
Status Indicator LEDs	CPU Active, Transmit & Receive Data , Status of Ethernet activity & link etc.
Dip Switches	Universal inputs, 10 K ohm pull-up disable/enable
Listing & Certifications	FCC , ICES, CE, C-Tick, WEEE, UL/CUL , UL.

i. Input/output Expansion Module:

Up to two I/O modules and an xP-Display may be connected to a controller.

Parameters	Specifications
Operating Environment	32°-120°F (0-49°C), 10-95% RH (non-condensing)
Communications Interface	Through built-in Expansion Port on controller
Status Indicator LEDs	CPU Module is Active

Switches	RESET
Listing	CE,UL & FCC

ii. Smart card/Biometric fingerprint reader

Parameters	Specifications
Read Range	Card Up to 4" (10.2 cm) Key/Tag Up to 1.25" (3.2 cm)
Mounting	Mounting plate attaches to US/EU/ Asian back box, 52-60 mm Screw hole spacing (vertical or horizontal). LCD/Keypad reader Housing latches onto mounting plate; fingerprint module secured to reader with a screw.
Power Supply	9-12 VDC, Linear supply
Operating Temperature	32° F to 113° F (0° C to 45° C)
Operating Humidity	5% to 95% relative humidity non-condensing
Transmit Frequency	13.56 Mhz
Cable Distance	Wiegand/Clock-and-Data Interface: 500 ft (150 m) (22AWG), RS232: 50 ft (15 m), RS485: 4000 ft (1220 m), USB: 16 ft (4 m), UART: 1 ft (0.30 m).
Card Compatibility	iCLASS 15693 & 14443B - read-only on 16k bit (2k Byte), 32k bit (4k Byte); HID Application iCLASS 15693 & 14443B - read/write (RWKL575 only) on 16k bit (2k Byte), 32k bit (4k Byte); Application Space
Certifications	UL,CE,FCC, C-Tick.
Housing Material	UL94 Polycarbonate
Resolution	500 dpi, 256-bit gray scale, 18 x 22 mm sensor area
Timing	Card read < 0.5 sec Fingerprint capture < 2 sec, typical 1 sec Verification of captured finger < 1 sec
False Accept/Reject Rate	FAR < 0.01%, FRR < 0.01%

iii. Electromagnetic Lock (LED with Lamp Indicator)

Parameters	Specifications
Magnet Size	250 x 42 x 26 mm
Armature Size	180 x 38 x 11 mm
Holding Force	Up to 600 lbs
Current Drain	480 mA+/- 10% / 12 VDC
Temperature	(-10 to 55) * C (14 to 131) * F
Weight	2.0 Kg

iv. Fixed Dome Cameras for Indoor Surveillance

S.No.	Parameter	Minimum Specifications
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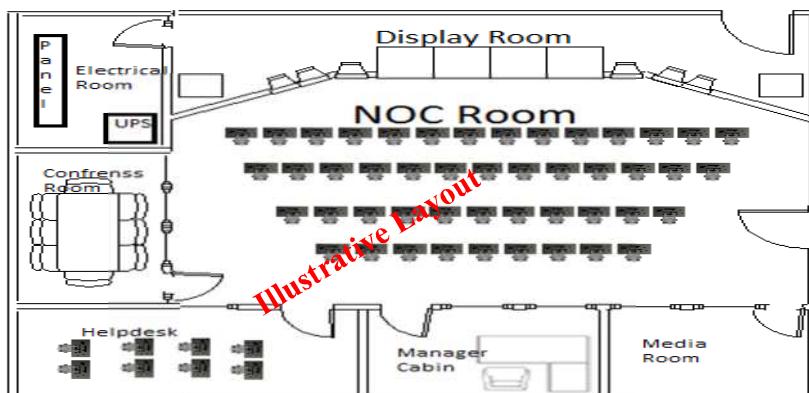
1.	Video Compression	H.264
2.	Video Resolution	1920x1080
3.	Frame rate	25 fps in all resolutions
4.	Image Sensor	1/4" / 1/3" Progressive Scan CMOS
5.	Lens Type	Varifocal, C/CS Mount, IR Correction
6.	Lens	Fixed IRIS 2.8-10mm, F1.7, 10x digital zoom
7.	Minimum Illumination	0.9 lux
8.	Image settings	Compression, colour, brightness, sharpness, contrast, white balance, exposure control, backlight compensation, rotation
9.	Protocol	HTTP, HTTPS, FTP, SMTP, RTSP, RTP, TCP, UDP, RTCP, DHCP, UPnP, QoS, IPV4, IPV6
10.	Security	Password Protection, IP Address filtering, User Access Log
11.	Operating conditions	0 to 50°C
12.	Casing	Tamper Resistant casing for Indoor Environment

NOC area and layout

Bidder is required to design and submit NOC layout as per the requirements and considering the optimal utilisation of space. The tentative area detail of the NOC is given below:

S. No.	Zone	Description	Area (Sq. ft.) Approx.
I	A- Operation Centre	NOC Room, display room	3500
II	B- Support Area	Helpdesk room, Manager cabin, conference room, Electrical room, media room, rest rooms & others if any as actual site requirement.	1500
Total Operation Centre Area (Sq. ft.) – Approx.			5000

The Bidder is required to design the Data Centre and provide the exact allotment of total available area as per the above identified divisions. Tentative layout of the Operation centre area is given below for only the reference purpose and bidder needs to prepare the design/ layout for the data centre as per the location identified by the purchaser



Illustrative Layout

DR-NOC area and layout

Bidder is required to design and submit DR-NOC layout as per the requirements and considering the optimal utilisation of space. The tentative area detail of the DR -NOC at Nagpur is given below:

S. No.	Zone	Description	Area (Sq. ft.) Approx.
1	A- Operation Centre	NOC Room, display room	1500
2	B- Support Area	Helpdesk room, Manager cabin, conference room, Electrical room, media room, rest rooms & others if any as actual site requirement.	1000
Total Operation Centre Area (Sq. ft.) – Approx.			2500

- DC & DR Setup in CSP location will form same LAN and share same VLAN.
- NOC location at Navi Mumbai and Nagpur will form same LAN and would be connected through L2/L3 VPN.
- NOC resource would acquire login access to IT infrastructure in DC/DR Cloud setup only through Remote Access Server & Privileged Identity Management Server Combine.

NOC at Navi Mumbai will have

- Two L3 Router (same as GP Type-4 IP/MPLS Router)
- Two Access Switch (with 50Gbps switching capacity and 60x10/100/1000Mbps Ethernet Ports)
- Security solutions as per the document (Sub-Section A – 10: Technical Specification for Security)
- Sitting infrastructure for 100 people
- Two 20KVA UPS
- One DG Set
- One IP PABX system for 150 subscribers
- Workstations for all Sitting Locations with Windows OS and Microsoft Office
- One Video wall of 24 DLP cubes of minimum 50" screen with maximum screen to screen gap of 0.2mm
- Videoconferencing system
 - Shall support multi-party conferencing across all the units
 - Video end points for DHQ (26) + additional 14 units for Government offices required is 40
- Comfort AC Cooling,
- Power and LAN Connectivity,
- Access Control Systems (as indicated in NOC Specification Section)
- End-point protection for Workstations for duration of contract

NOC at Nagpur will have

- One L3 Router (same as GP Type-4 IP/MPLS Router)
- One Access Switch (with 50Gbps switching capacity and 60x10/100/1000Mbps Ethernet Ports)
- One UTM device with Firewall, IPS and Web Filtering Capability (10Gbps throughput, 10K Concurrent Active Sessions)

- **Sitting infrastructure for 50 people**
- **One 20KVA UPS**
- **One DG Set**
- **One IP PABX system for 100 subscribers**
- **Workstations for all Sitting Locations with Windows OS and Microsoft Office**
- **One Video wall of 12 DLP cubes of minimum 50" screen with maximum screen to screen gap of 0.2mm**
- **One Video Conferencing Unit (shall connect minimum 5 party simultaneously from State Govt. offices)**
- **Comfort AC Cooling,**
- **Power and LAN Connectivity,**
- **Access Control Systems (as indicated in NOC Specification Section)**
- **End-point protection for Workstations**

CONTACT CENTER

- **Solution should be web based. The solution should be processor based only. The software should be from indigenous or globally known OEM. No open source or Asterisk based solution is allowed. With minimum 8GB RAM with Quad core processor and HD of 500 GB (mirrored) per Box. Minimum 2 Ports (RJ45) of 1/10G per box.**
- **Proposed solution should be configured in HA Mode (A/P).The proposed solution should be able to support 15 registered agent and proposed single appliance should be Scalable up to 100 Agent users. The proposed appliance should be equipped with minimum 2 PRI ports from day1.**
- **Provides reports for calls based on records, calls on a user basis, calls through gateways etc. The system should have built-in Unified communication features like Click to call, web Real Time Communication (Web RTC) ,MS Outlook integration ,chat , presence etc.**
- **Protocol to be supported: SIP, MGCP, H.323, and Coder-decoder (codec) support for automated bandwidth selection: G.711 mu-law, a-law, G.729.**
- **General specs for Contact Centre: Recording, System should support skill based routing. Disposition status of calls should be customizable as per the business needs. Live Dash board, reports in PDF, CSV and excel format, Call Barge and Monitoring. Multi-level IVR Tree should be possible with Multi language support.**
- **Provided platform should support FTP to archive historical CDR and Recording files Interactive Voice blaster, Time Zone Administration, Logical Partitioning, SMS Integration, Email integration, Multi Digit IVR support**

Certifications

- **OEM / product should be ISO 27001, 14001 certified Company should be listed in Gartner, any equivalent.**
- **The offered solution/product should not end of life before at least 5 years**
- **Warranty - Must be quoted with the three years comprehensive replacement and direct OEM 8 x 5 NBD Support pack.**
- **All Licenses, Software and upgrade (Application, Database), security patches etc. should be part of solution**

1. Video Endpoint

S.No.	Parameter	General requirements
1	Video Standards	H.263, H.264

S.No.	Parameter	General requirements
2	Video Features	Ability to send and receive two live simultaneous video sources in a single call, so that the image from the main camera and PC or document camera can be seen simultaneously Should support H.239 and BFCP protocols with 1080p resolution
3	Video Output	Should have at least 2 HDMI / DVI (High Definition Multimedia Interface) output to connect Full High Definition display devices such as LCD / LED and projectors for both Video and Content. (Dual Monitor Support)
4	Video Input	Should have at least one HD video Input to connect HD camera with full functionalities as mentioned in the camera specifications
5	Audio standards	G.711, G.722, G.722.1, 64 kbps MPEG-4 AAC-LD or equivalent standards must be supported.
6	Audio Inputs	Should support minimum 2 Microphone inputs. 1 needs to be supplied from day one.
7		1 LAN / Ethernet - 10/100/1000 Mbps
8	Camera	Minimum of 12X Optical zoom 1920 x 1080 pixels progressive @ 30fps Should have at least 70 degrees field of view (horizontal)
9	The Camera and codec should be from the same manufacturer	

2. IP Phone

S.No.	Parameter	General requirements
1	Display	2 line or more, Monochrome display for viewing features like messages, directory
2	Integral switch	10/100 mbps for a direct connection to a 10/100BASE-T Ethernet network through an RJ-45 interface
3	Speaker Phone	Yes
4	Headset	Wired, Cushion Padded Dual Ear-Speaker, Noise Cancelling headset with mouthpiece microphone, port compatibility with IP Phone
5	VoIP Protocol	SIP
6	POE	IEEE 802.3af or better and AC Power Adapter (Option)
7	Codecs	G.711, G.722, G.729 including handset and speakerphone
8	Speaker Phone	Full duplex speaker phone with echo cancellation, Speaker on/off button, microphone mute
9	Volume control	Easy decibel level adjustment for speaker phone, handset and ringer

10	Call Logs	Access to missed, received, and placed calls. (Minimum 20 overall)
11	Clock	Time and Date on display
12	QoS	QoS mechanism through 802.1p/q

3. L2 POE at NOC/ DR-NOC

S.No.	Parameter	General requirements
1	Interfaces	19" Rack Mountable stackable switch with min 24 Nos. 10/100/1000 copper input POE (15.4W) ports and additional support of 4x1G SFP, support for external/internal redundant power supply.
2	Throughput	Switch should support for minimum 96 Gbps of forwarding throughput & minimum 70 mpps forwarding rate
3	Stacking Bandwidth	The switch should support dedicated stacking port separate from uplink ports with 80 Gbps of stacking bandwidth to put minimum 8 switches into a single stack group
4	Link Aggregation	Switch shall have IEEE 802.3ad Link Aggregation Control Protocol (LACP) with up to 8 links (ports) per trunk.
5	Power Supply	Should have Power supply 230 Volt 50Hz input
6	QoS	Switch should support automated image installation, configuration & automatic configuration of per port QoS to reduce switch provisioning time & effort.
7	IPv6	The switch should be IPv6 ready

4. Core Switch

S.No	Parameter
1	Ports
	24 or 48 (as per density required) 1G/ 10G Ethernet ports (as per internal connection requirements) and extra 2 numbers of Uplink ports (40GE)
	All ports can auto-negotiate between all allowable speeds, halfduplex or full duplex and flow control for half-duplex ports.
2	Switch type
	Layer 3
3	MAC
	Support 32K MAC address.
4	Backplane

	Capable of providing wire-speed switching
5	Throughput
	500 Mpps or better
6	Port Features
	Must support Port Mirroring, Port Trunking and 802.3ad LACP Link
	Aggregation port trunks
7	Flow Control
	Support IEEE 802.3x flow control for full-duplex mode ports.
8	Protocols
	<ul style="list-style-type: none"> • IPV4, IPV6 • Support 802.1D, 802.1S, 802.1w, Rate limiting • Support 802.1X Security standards • Support 802.1Q VLAN encapsulation, IGMP v1, v2 and v3 snooping • 802.1p Priority Queues, port mirroring, DiffServ • DHCP support • Support up to 1024 VLANs • Support IGMP Snooping and IGMP Querying • Support Multicasting • Should support Loop protection and Loop detection,
9	Access Control
	<ul style="list-style-type: none"> • Support port security • Support 802.1x (Port based network access control). • Support for MAC filtering. • Should support TACACS+ and RADIUS authentication
10	VLAN
	<ul style="list-style-type: none"> • Support 802.1Q Tagged VLAN and port based VLANs and Private VLAN • The switch must support dynamic VLAN Registration or equivalent • Dynamic Trunking protocol or equivalent
11	Protocol and Traffic
	<ul style="list-style-type: none"> • Network Time Protocol or equivalent Simple Network Time Protocol support • Switch should support traffic segmentation • Traffic classification should be based on user-definable application types: TOS, DSCP, Port based, TCP/UDP port number

S.No	Parameter
12	Management
	<ul style="list-style-type: none"> • Switch needs to have a console port for management via console term or PC • Must have support SNMP v1,v2 and v3 • Should support 4 groups of RMON • Should have accessibility using Telnet, SSH, Console access, easier software upgrade through network using TFTP etc. Configuration management through CLI, OR GUI based software utility.
13	Resiliency
	<ul style="list-style-type: none"> • Dual load sharing power supplies • Redundant variable-speed fans

Sub-Section A – 8: Technical Specification for B2B Business Support System (BSS)

The following requirements outline the B2B BSS system required for the MahaNet project. These requirements are keeping in mind the advanced design of the MahaNet OFN and requirements of the consumers as envisioned in the MahaNet project.

These requirements also include features required for system SLAs and operational SLAs.

5. Components of BSS

1	CRM	Customer Management Customer Management Order Management (Capture, Validation, Submission Order Orchestration, Fulfilment and Closure) Integration with MIS, Reporting and Analytics System Trouble Tickets – Case management
2	Billing	Data Mediation Invoicing Partner Management Payments Payment Gateway
3	Web Self Care	Web Self Care
4	MIS, Reporting and Analytics System	Operational Reports, Analytics Reconciliation, Auditing
5	Contact Centre	Contact Centre Operations

All the subsystems for Wi-Fi services including Wi-Fi NMS and NOC need to be designed as per Annexure – I (Wi-Fi services)

6. BSS Applications and Software

BSS Software consists of applications with broad functional capabilities proposed to be supplied and integrated under this project, which are as given below:

- CRM (Customer Management, Order Entry, Trouble Tickets etc.)
- Billing (Invoicing, Partner Management etc.)
- Payment Gateway
- Service and Resource Assurance
- Web Self Care
- MIS, Reporting and Analytics System (MRAS)
- Contact Centre

Description of Application Modules

1.1 Customer Relationship Management (CRM)

CRM is set of features and processes that include best practices helpful to learn more about customers' needs and behaviours in order to develop stronger relationships with them. CRM analysts study stored information related to customers' habits and behaviours to create methods that increase prospects for sale, productivity, profit and popularity of services. It involves using technology to organize, automate and synchronize sales, marketing, customer service and technical support.

1.1.1 General Requirements

S.No	General requirements
1	CRM solution shall provide a single customer information repository and as such must have access to information in all other proposed applications and modules.
2	CRM system needs to be accessed through call centre and web self-care system.
3	It shall provide capability for multiple user sessions to synchronize subsets of user's application business data.
4	It shall support LDAP authentication capability.
5	The solution shall interface seamlessly with the web self-care, Billing, NMS (NMS includes provisioning / activation), Order management, etc.
6	The system shall have the capabilities to track and present all the necessary information like customer details, product details, Contract / SLA details etc.
7	The CRM system should provide user-interface (UI) to apply for various B2C services through web.

S.No	General requirements
8	CRM System should enable acquisition of the customer online by filling the forms electronically by the customers using appropriate authentication methods.
9	CRM shall maintain flexible parent child hierarchy of customers at multiple levels (configurable) at three levels (Ex. Unit level, Zonal level, Circle level / Corporate level etc). Accordingly it shall be possible to present both a consolidated bill as well as breakup bill for various itNMS, which needs to be configured in CRM. The solution should support defining child accounts as paying or non-paying entities.
10	MahaNet should be able to configure the marketing advertisements to be displayed on the bills. The display can be depending on the category of the customer. It shall also be configured for a specific customer. These marketing messages can also appear in the online bill report.
11	The system should have the capability to display the Call Centre Executive (CCE) Screen in NOC Call centre giving both Customer service-related & Infrastructure-related view with correlation i.e. the system should be able to present the information to the CCE in case there is fault in any network element the system should be able to present the information for the customers affected due to this element.
12	Integration Capabilities - The system shall provide Integration tools, including adaptors and object interfaces. a. Service Assurance (Provisioning, etc) b. Web Self care c. Billing system (Order Management) d. Payment Gateway e. MRAS (MIS, Reports & Analytics System) f. Industry standard GIS applications g. Other systems such as MS applications -Word, Excel, Outlook, Exchange, Scheduler, etc.; SMTP, POP3; Workforce Management tools etc
13	The system shall allow a single sign-on with transparent logon to the Billing system, meaning that the agent shall have a consolidated desktop application. There shall be no need to launch the Billing application from the CRM system
14	The system shall allow access of billing information within the CRM GUI.
15	The system should be capable to handle number of concurrent CRM users for each role including number of concurrent CRM web-self-care users(Concurrent CRM Users = 100; Concurrent Self Care Users = 500).
16	The system shall support various activities regarding Billing and adjustments through the CRM GUI such as:

S.No	General requirements
17	Display of customer current billing information and services a. Display of customer current billing information and services b. Customer Hierarchy and relevant billing information c. Manage bill adjustments d. View bill images – from a Billing archive system e. View billed charges and usage f. Request bill reprint/resend g. Request statements h. Bill Disputes i. Post a payment j. Display of Payment History etc.
18	CRM solution shall provide a single customer information repository and as such must have access to information in all other proposed applications and modules.
19	CRM system needs to be accessed through call centre and web self-care system.
20	It shall provide capability for multiple user sessions to synchronize subsets of user's application business data.
21	It shall support LDAP authentication capability.
22	The solution shall interface seamlessly with the web self-care, Billing, NMS (NMS includes provisioning / activation), Order management, etc.
23	The system shall have the capabilities to track and present all the necessary information like customer details, product details, Contract / SLA details etc.
24	The CRM system should provide user-interface (UI) to apply for various B2C services through web.
25	CRM System should enable acquisition of the customer online by filling the forms electronically by the customers using appropriate authentication methods.
26	CRM shall maintain flexible parent child hierarchy of customers at multiple levels (configurable) at three levels (Ex. Unit level, Zonal level, Circle level / Corporate level etc). Accordingly it shall be possible to present both a consolidated bill as well as breakup bill for various itNMS, which needs to be configured in CRM. The solution should support defining child accounts as paying or non-paying entities.
27	MahaNet should be able to configure the marketing advertisements to be displayed on the bills. The display can be depending on the category of the customer. It shall also be configured for a specific customer. These marketing messages can also appear in the online bill report.

S.No	General requirements
28	The system should have the capability to display the Call Centre Executive (CCE) Screen in NOC Call centre giving both Customer service-related & Infrastructure-related view with correlation i.e. the system should able to present the information to the CCE in case there is fault in any network element the system should be able to present the information for the customers affected due to this element.
29	Integration Capabilities - The system shall provide Integration tools, including adaptors and object interfaces. <ul style="list-style-type: none"> • Service Assurance (Provisioning, etc) • Web Self care • Billing system (Order Management) • Payment Gateway • MRAS (MIS, Reports & Analytics System) • Industry standard GIS applications • Other systems such as MS applications -Word, Excel, Outlook, Exchange, Scheduler, etc.; SMTP, POP3; Workforce Management tools etc
30	The system shall allow a single sign-on with transparent logon to the Billing system, meaning that the agent shall have a consolidated desktop application. There shall be no need to launch the Billing application from the CRM system
31	The system shall allow access of billing information within the CRM GUI.
32	The system should be capable to handle number of concurrent CRM users for each role including number of concurrent CRM web-self-care users
33	The system shall support various activities regarding Billing and adjustments through the CRM GUI such as: <ul style="list-style-type: none"> • Display of customer current billing information and services • Customer Hierarchy and relevant billing information • Manage bill adjustments • View bill images – from a Billing archive system • View billed charges and usage • Request bill reprint/resend • Request statements • Bill Disputes • Post a payment • Display of Payment History etc.

1.1.2 Product Management

S.No.	Functions
1	Product Catalogue Management
2	<p>The Product Catalogue displays a list of all possible products that MahaNet provides which should contain:</p> <ul style="list-style-type: none"> a. Product types b. Categories c. Class of Services d. Price, Adds / modifies tariff / products e. Time period based offers
3	CRM Administrator defines / update product catalogue, based on the network capability to offer various services and business viability of those services. Tariffs and offers in product catalogue are to be defined by Billing System
4	<p>Following products/services as an example can be maintained as product catalogue</p> <p>Bandwidth: Access-Seeker will seek bandwidth between IP/MPLS backbone and WiFi for end premises at Gram Panchayat level for service offerings</p>
5	Product Life-cycle Management
6	The product life cycle management involves all activities from creation of product till its withdrawal from field.
7	Capability to define products
8	Capability to define pricing rules
9	Ability to relate products
10	Ability to define product life period
11	Capability to maintain customer-product association
12	Capability to view all upgrades done on existing field products
13	Capability to view product support expiry date
14	Capability to manage upgrade on existing product with all product information
15	Capability to notify customers regarding product withdrawal

1.1.3 Product(s) Selection

S.No.	Functions
1	CRM should expose Product catalogue to customer, provide product offers and take product(s) order from customer. Customer has to choose product/products from this catalogue. CRM product catalogue will contain all product details, requirements, configurable attributes, tariff details etc.
2	It should provide product Offer and credit details (generic/customer specific), tariff details etc. Product offers can be various types like offers on all products, offers on selected product, region specific offers and also offers based on customer types.

S.No.	Functions
3	When customer has chosen the product(s), information on applicable locality or area for each product will be captured

1.1.4 Product Feasibility Checking

Product feasibility checking should be done at CRM before placing the actual order of customer to assure that service(s) can actually be provided to the customer

S.No.	Functions
1	CRM should decompose the product to corresponding services as per product to service mappings maintained by CRM.
2	It checks availability of resources from Resource Inventory module at NMS system.
3	As per availability status replied by NMS System, CRM notifies customer regarding product order feasibility status.

1.1.5 Customer Information Management

Customer Information Management should ensure management and synchronization of customer information and reconcile customer data inconsistencies. It should provide accurate and complete customers' information. Functional requirements are:

S.No.	Functions
1	Simple and Effective customer acquisition is key for customer satisfaction. The CRM system should provide interface to apply for MahaNet services from comfort of the prospective customer's office. Since MahaNet's prospective customers are expected to be enterprise customers, CRM system should have the option to accept all digitally signed electronic applications and push to order management system. CRM System should be able to acquire the customer online by filling the forms electronically by the customers, which may use the digital signature or other authentication methods.
2	Create/Modify Access-seeker Details: It should enable access-seekers to provide/update their details like Customer Name (organization name), Address details (Billing, service address etc.), contact numbers (FAX, phone), customer types such as Government or private, paying or non-paying etc., billing point required for Billing System etc.
3	Create/Modify Customer Hierarchy: It should be able to associate/dissociate customers in parent child relationship where parent account can be associated with many child accounts. For example, parent-child relationships can be defined at unit level, block level, district level, head-quarters level, state level, etc. for MahaNet customers.
4	Generate Customer Report: It should manage and provide all customer reports e.g. subscribed services, product details, status reports, Billing history, complaint history, payment details, eligible offers and credit reports etc.

S.No.	Functions
5	Customer Life Cycle management: The CRM system should be able to maintain the complete history of the customer from acquisition to removal. It should maintain the complete details such as type of services subscribed, associated products / tariff plan, Network element (s) used etc.
6	Maintain Customer Details: It should maintain scanned copies of Customer Acquisition Forms along with supporting documents like Identity, Address Proof, Company MOU, Authorized Signatory Letter etc. It should ensure management of scanned signatures.

1.1.6 Customer Document Management

The system should be able to capture, manage and deliver all transaction documents and templates from/to different CRM modules. The functional requirements are:

S.No.	Functions
1	Capture all the documents like CAF (Customer Acquisition Form), ID / Address proof, SLA etc.
2	Manage all customer transaction documents.
3	Provide Templates for various functions like order /quote capture, order issue, SLA template, customer data / detail capture etc.
4	Archiving documents (<i>Customer documents should be kept archived in online secondary storage for complete duration of contract. The duration could be modified by SIA at a later date</i>)
5	Deliver documents on request in various format like text, spreadsheets etc

1.1.7 Order Management (OM)

Order Management System in MahaNet BSS suite of application shall manage and orchestrate different type of order/request related to other systems namely CRM, Billing, NMS etc. The OM system shall enable the complete business flow for order entry / replacement and fulfilment:

S.No.	Functions
1	The system shall include an integrated order entry process for various types of products, places of installation, geographic area and clients, temporary product. CRM should ensure all necessary information about the Customer Order (for example, type of product, address, payment information, special requirements etc.) is available. It will issue correct and complete customer orders (product/service order/requests) to NMS System for provisioning.
2	This functional area must be able to receive service requests from the Order Entry system. This process behaves as an entry point for service requests into the application and notifies the Order Management functional area of new or changed service requests. Order Entry shall be able to receive different types of orders e.g. installation, fault, maintenance etc.

S.No.	Functions
3	Complex Product Configuration - the system shall provide a sophisticated product configuration tool with the rule-based capabilities including applying restrictions by customer type.
4	Multi-channel - The Order Entry process shall be prepared to receive order feeds from a number of different channels, such as Customer Care applications, back-end offices, POS, third party dealers, Internet, extranet, intranet, IVR- etc.
5	The Order Entry process shall be integrated with the CRM, billing, NMS etc.
6	Order priority - Ability for the service representative to assign and display a priority level, indicating the level of care that needs to be given to the order
7	Multiple addresses for one order - Ability to capture multiple addresses for an order (e.g., installation address, billing address etc.)
8	Billing accounts information - Ability to capture billing account and billing information required to bill the product or service.
9	Order identification - The system shall generate a unique internal order ID. It shall also be able to reference an internal order ID with several external order IDs.
10	Order search criteria - Ability to search and retrieve orders by multiple criteria (e.g., order reference number, project reference number, name).
11	Data access for products and services - Ability to access the Product Catalogue.
12	Provide information with order status - Provide CSRs or other entities with information regarding the order status
13	Order tracking - Ability to track all information within an order at all task levels; Ability to monitor orders by different types of information, which may be geographical information, order type, resources allocated, etc.
14	View orders/requests rejected by downstream systems - Ability to view order status based on rejections by downstream systems (e.g. NMS).
15	Managing multiple order amendment - Ability to recycle in batch multiple orders after correction for a particular rejection; with this functionality, OM is able to correct all the orders for which the same rejection occurred (e.g., product-related rejections).
16	Internal product catalogue – OM shall include an internal Product Catalogue, flexible enough to define products and services with their hierarchy of associated options, dependencies and particular features.

S.No.	Functions
17	Software must have capability to integrate with external product catalogues – The system must access information online and in batch mode. Order Management – Workflow & Service Creation / Fulfilment
18	Capability to define business rules to handle and route orders to the appropriate destinations within / outside OM, and set the appropriate status for orders when rejections and manual handling are required
19	The system must enable quick definition of changes and creation of new states and stages. This must be done through parameters without any hard-coded information.
20	Generation of routing steps - Ability to generate routing steps based on business rules containing appropriate locations, timing and information requirements for routing.
21	Work force management - The system ability to route orders to Work Force Management systems - Ability to route a service order to a Work Force Management system to plan, schedule and form the most appropriate team for installation of the customer's request. The Work Force Management system shall notify OM when the work order is complete. The system should have the capability to manage resource assignment and scheduling for service requests that requires the intervention of internal or outsourced resources.
22	Interface with provisioning platforms Workflow engine shall have to interface with the provisioning platforms following the order, thus installing the necessary features and line classes, modifying them or taking them away. Also, it shall be possible to interface both online and through batch processes
23	Routing of orders to fulfilment - The OM shall send the necessary information for fulfilment to the order fulfilment component.
24	Ability to route to a fault management system - All information on installed services and products is sent to the fault management system.
25	Ability to interface with a commissioning / payment systems - Normally performed once the order is closed following the installation of the requested product/service.
26	Re-routing of orders - Ability to re-route the order or create an alternative workflow based on information of up- and downstream systems.
27	Routing to external vendors - Ability to route orders to external vendors who provide products or services in an automated manner
28	Escalation of orders - Mechanism based on a set of business rules to escalate orders in terms of workgroups, priority, etc
29	Support of order life-cycle in differing transition states - Ability to flag the order to the appropriate office for manual intervention (e.g., incomplete information).

S.No.	Functions
30	The system should have the ability to define the type of fulfilment required for a particular order. These types of fulfilment shall be determined according to business rules which include all the functionality associated with service provisioning, inventory management and work force management, necessary to complete the order.
31	The system should have the capability to break down an order into different parts and fulfil the parts separately at different times. This can be linked to the provisioning timing or to the customer's demands.
32	Order bulk fulfilment - Ability to specify a single destination for order bulk fulfilment.
33	The system should have the capability to automatically recognize that the entire work has been done and that the order can be closed and moved to order history.
34	It should have the ability to set time intervals for certain sub-processes and notify the responsible team of a breach when necessary. Time intervals must not be hard-coded.
35	The system should notify customer and CSR if service provisioning problems occur even if provisioning is temporarily technically impossible or if the requested service is not available.
36	The system should able to manage complex provisioning rules such as pre-requisites, dependencies, sequential or parallel fulfilment tasks etc. that may pertain to a single order line (e.g. availability check before scheduling a customer site visit for the services) or multiple order lines.
37	The OM has the capability to interface with the NMS / provisioning platform when the order fulfilment implies the provision of a service. It should have the ability to receive a return status from the NMS / provisioning platform that the provision has been successfully completed.
38	The system should have the capability to export order and pricing information to billing and accounting systems after closing or cancelling an order.
39	It should allow amending the Customer's ordered /product(s) list. Customer may require adding / removing product to/from order list. If a product is not feasible to be provisioned by NMS System then customer may opt for other product(s), in this case customer may remove that unavailable product from order list and may add others product(s)
40	It should allow cancellation of customer order. Order cancellation request may come from Billing System / Customer. Penalty for cancellation will be as per pre-configured rules. CRM should inform customer regarding cancellation penalty (if applicable). In case the Customer is a defaulter (who have defaulted payment), Billing System notifies CRM to add the customer in Defaulters List.
41	It ensures that every order placed, is tracked all the way to closure / cancellation.

S.No.	Functions
42	Any SLA violation should be informed by NMS System. CRM tracks the service quality by analyzing the SLA reports. Accordingly it should inform the customer and notify Billing System.
43	Reports – The system should be able to generate various management and analysis reports such as: a. Total number of orders b. Number of orders per input source, per entity and per user c. Number of pending orders, classified according to their reason d. Number of orders per order type e. Number of completed orders f. Number of rejections and type of rejection code per order type g. Orders by status type h. Content and level of detail - Ability to present different content with different levels of detail i. Export reporting information - Exporting reports to various types of support and format

1.1.8 SLA Management System

System includes the required functionality to assure that SLA agreements made between MahaNet and access-seeker/customers are met. This includes taking appropriate actions when the specified agreements are not met. The functional requirements of SLA management system are:

S.No.	Functions
1	The system shall be able to capture and control different types of Contract / Service Level Agreements (SLAs)
2	Service Level Agreement control types - SLAs apply to service installation, service maintenance and service repair
3	Service Level Agreements at different levels - SLAs may be at the client level, the product/service level or the contract level. SLA repository - SLA information may reside in OM or in an external system
4	Segmentation of Service Level Agreements - Ability to view, choose from an inventory list, introduce and/or apply a standard or customized product Service Level Agreement (SLA), based on segments and customer type
5	Allow multiple service levels to be defined for help desk, change tickets or user-developed applications
6	Provide response, resolution service level tracking at customer SLA and/or internal operation SLA level

7	It should have the capability to produce service level agreements specifications to have network independent parameters like: a. Average call response time b. Average time to resolve case (trouble ticket) c. Mean time to provide service etc.
8	The system should have the necessary functionality to analyze performance with respect to the established Service Level Agreement. It translates Contract (SLA) performance data received into a form suitable for Contract (SLA) analysis
9	Customer Contract (SLA) Violation: It provides the necessary functionality to manage Contract (SLA) violations and the activities necessary to resolve the apparent breaches
10	The system should have the capabilities for CRM to produce periodic reports say on daily/weekly/monthly/ yearly basis. The reports can be as below: a. Count / number of total complaints (breaches) for each stage at periodic intervals b. Count / number and percentage of complaints (breaches) that exceeded “n” number of days etc.

1.1.9 Contract Approval

S.No.	Functions
1	Review and approve generic and product specific terms and conditions (contracts rules). Terms and condition may consist of a number of parameters like Average call response time, Average time to resolve case (trouble ticket), Mean time to provide service etc.
2	Provide digital signature to approve the order placement (if done online).

1.1.10 Trouble Tickets (Case Management)

Case Management applications manage the end-to-end life cycle of a case. The system will provide the necessary functionality to define different types of cases, along with the states for each case type and associated configurations and work flow. Following types as an example can be configured: General Queries, Service related complaints, billing related etc.

S.No.	Functions
1	Cases and Case Management could apply to any area of assurance, Billing, or fulfilment, but presumably in the customer layer.
2	System should be capable to generate unique Complaint Number / Docket Number / Inquiry Number
3	It should be capable to create case specific to various categories.
4	Make available all Trouble Management functionality across all products, with full history permanently retained by the customer record.
5	Allow the definition of standard problem codes and the required response time.

S.No.	Functions
6	Automatically send complaints to the appropriate person/group that deals with particular issues according to the standard problem code.
7	Automatically generate notifications based on user-defined business rules, for example, automatically sending an email /SMS to the customer when a trouble ticket is closed.
8	Describe the system's support for Service Level Agreements (SLAs) and escalations. Capability to escalate case based on configurable level and delay with respect to case categories. Create escalation actions triggered after a period of inactivity, i.e., a case has not been closed within a certain timeframe.
9	Support parent/child correlation between related trouble tickets and tasks e.g. allow the status of child trouble tickets to be automatically updated when the parent trouble ticket is updated or allow the child trouble tickets to be automatically closed when the parent trouble ticket is closed.
10	Include central problem or knowledge management that allows call centre agents and customers (over the Web) to search inquiries / advance search. This shall include user-definable queries, search by key words and phrases.
11	Allow several employees to work collaboratively to resolve a customer problem (dividing the trouble ticket into sub-tickets that can be separately handled).
12	Be able to automatically create sub-tickets based on predefined templates.
13	Describe the process and time frame for capturing complaints in the system. (The time frame for inputting complaints into the system must be very short of the tune of say 60 seconds.)
14	Capability to attach notes and attachments with case
15	Provide Call Centre and outlet staff with a guide to potential resolutions for different types of complaints, including a troubleshooting guide to provide immediate answers to various complaints. This may also be based on resolutions other sites have found particularly successful for certain types of complaints.
16	Provide a history of a customer's previous complaints so that CSRs are aware if a certain resolution has already been tried and have a greater understanding of the customer's individual situation.
17	Allow for each team member to see the complaints assigned to them and to record their actions and the status of the complaint.
18	Monitor/track progress of complaint solving and workflow for trouble ticketing such as activities with time flags and reminders.
19	Display all complaints and their resolution status on a single screen (with drilldown for further information if necessary).

S.No.	Functions
20	Automatically alert managers if there are a large number of occurrences of a particular complaint/fault report across the sites in a user-definable period.
21	Alert and print reports for section managers regarding all pending trouble tickets (complaints and faults) that have been waiting for resolution for a user-definable period (to ensure escalation of problem).
22	Track progress of fault report and resolution.
23	Link high-value customers to enhanced levels of service, i.e., priority call routing.
24	Handle inbound and outbound contact via Telephone, Email, SMS, Fax, Web self-care etc.
25	Support automatic screen population via CTI and/or IVR.
26	Enable the CSR to hot-key between screens.
27	Enable customers to use an SMS service to receive requested details of current balance, credit limit, etc.
28	Shall present all user-specified customer details on an initial customer overview screen
29	Enable the CSR to amend customer details within user-defined criteria and authorization level.
30	Shall have an alert/flash for the CSR regarding significant customer data, e.g., birthday etc.
31	Shall select main topics via menus/tabs on a customer overview screen with the ability to drill down to more detailed information, such as status of order, status of repair, etc.
32	Shall show both inbound and outbound contact by any channel in sequence in the customer history screen available to the CSR
33	Create, read, and edit information on date of next communication or follow-up, following the voluntary termination of service.
34	Make available the same screens and system function shall be available to CSRs, Sales representatives, Staff in retail outlets, etc.
35	Allow agents to quickly mail, email or fax literature requests to prospects, and track inventory as it is used.
36	The system shall have the ability to support the various CSR related activities e.g. to display the required information, tariff plans, discounting plans, SLA details, fault / complaint details etc. to serve the customers
37	The system shall enable an administrator to set up a general fault alert message for distribution to all system users (including Web-based users).
38	The system shall be able to manage Field Operations such as Dispatching Field Engineers to customer sites, track field schedules, log parts used, log time and expenses, and more.

S.No.	Functions
39	The system shall be able to provide a solutions database. User shall be able to create a solution database containing information that other support users and end users can access for potential solutions to their problems or questions. It shall be possible to propose new solution and to include the same after approval
40	It shall be possible to track duplicate cases. It shall be possible for the user to associate multiple instances to a single problem and tie the resolution of multiple cases to the resolution of one case.
41	The system will check for tickets status and perform escalation and notify the management or next level of support staff based on predefined Service Level Agreement (SLA) which will include (but not limited to) criteria like service application, severity and customer
42	System shall support bulletin board functionality that allows support technicians and managers to post and review messages about critical issues

1.1.11 Knowledge-base for complaints resolution

S.No.	Functions
1	CRM enables to create articles on any subject such as case resolutions and FAQs for CRM users as well as CRM web self-care portal users. It can embed the contents of a file into an article, or attach the file to the article. All articles are stored in the CRM. Articles can be of two types: Internal: These articles are only available to CRM users. External: These articles are available to CRM users as well as CRM web self-care portal users/Customers.
2	The system shall provide facility to generate Standard reports divided according to functional areas as described in this document
3	The system should have reporting tools like Dashboards, Matrix Reports, Scheduled Reports, Custom Reports, Pipeline reports etc. at various stages to give customers integrated/unified view of overall system.
4	The system shall also provide a mechanism for making modifications to pre-defined standard reports as well as facilitate generation of on-demand reports beyond the above pre-defined standard reports.
5	Segregation of Real time reports Vs scheduled reports should be made available through the reporting system.
6	It should provide all reports as per the requirements of TRAI, DoT, and any other regulatory / administrative body.
7	To provide a consolidated view of reports it should be integrated with NMS reporting system.
8	Error Handling and Management

S.No.	Functions
9	System should handle all exception while integrating with NMS. Common error and its exception handling should be seamless from operations prospective.
10	Queue management should be handled in an effective and efficient manner, so that CRM system is not overloaded.

1.2 Billing System

MahaNet services are proposed to be wholesale billing in nature i.e. MahaNet proposes to provide the services to the ISPs/TSPs/Enterprise customers/OSPs. It is proposed to support direct billing retail services thus Usage-based /CDR based retail billing.

1.2.1 Billing & Accounting Management System

- Accounting / journals, Billing
- Credit Limit Manager
- Collections
- Bill Formatting Pricing / Invoice Management
- Rebates / Adjustments Management
- Billing Account management
- Bill enquiry & Dispute Settlements

1.2.2 General Requirement

S.No.	General Requirement
1	Billing Solution should support billing for multiple services.
2	The system should be capable of configuring different billing cycles which may be weekly / fortnightly/ monthly / bimonthly / quarterly / yearly etc. as per requirement of MahaNet.
3	It should be able to bill charges in advance or in arrears or mix of both.
4	The Billing system shall interface seamlessly with the web self-care, CRM, Assurance etc. Which shall be provisioning the components (bandwidth, Fibre etc.) of the MahaNet network for the service availed by the customer.
5	The system shall have the capabilities to track and present all the necessary billing information like bill date, bill period, pay by date, total current bill amount, previous bill amount, amount that has been paid against previous bill, outstanding amounts against previous bill, type of bill, any type of adjustment (credit or debit), rebates with corresponding remarks etc.

S.No.	General Requirement
6	CRM/Billing shall maintain flexible parent child hierarchy at multiple level (configurable) may be at three level, say Unit level, zonal level, Circle level / corporate office level etc. and accordingly it shall be possible to present both a consolidated bill as well as breakup bill. It shall be configured in CRM where consolidated or breakup bill is required. The Solution should support defining child accounts as paying or non-paying entities. (Segregate billing data will be available for all entities, but invoice shall be generated either for Parent or child node as has been configured in the CRM for that particular customer, while defining the customer.)
7	MahaNet should be able to configure the marketing advertisements to be displayed. The display can be depending on the category of the customer. It shall also be configured for a specific customer. These marketing messages can also appear in the online bill report.
8	Transfer GL data to Financial system
9	The system should Interface with a. Payment Gateway b. CRM c. Assurance Systems d. Web self-care
10	Billing Scenarios: MahaNet systems to maintain inventory and fulfil, assure, bill, payment, accounting services will be designed to be wholesale / enterprise in nature, and will also support direct retail of services.
11	Bill generation for the business parties / Enterprise services who have done SLA with MahaNet for availing the MahaNet network. The billing may be based Class of Service (COS), Quality of Services (QoS), and SLA based. The system should have the capabilities to recognize the SLA based events which have been generated and make available through NMS Interface to the billing system, calculate the charges based on SLA configured (SLA is envisaged to be configured in CRM system), and present the bill in the desire format for the customers.
12	Types of Products & Services a. Services provided to the CABLE MSO providers b. Broad Band ISP Services c. Telco Services d. Corporate V-LAN services e. Data Center (Cloud services) f. Co-Location (Content Servers, Application Servers, etc.) g. Tariff shall include leasing partners agreement, but not limited to i. Unit (monthly, quarterly, yearly). ii. Fixed charges. iii. iii. Maintenance charges. iv. Bandwidth offered (as per the Contract with the Fibre Leasing Agency) v. Length of Fibre. vi. SLA based events. vii. Quality of Service based. viii. Class of Service based.

1.2.3 Functional Requirement

a. Billing

S.No.	General Requirement
1	Parent-child hierarchy is proposed to be defined in the CRM system along with all the attributes. The billing solution will need to support a flexible customer hierarchy with definition of child accounts under the parent account. The Solution should support defining child accounts as paying or non-paying entities. Customer Hierarchy will enable flexibility for Service Seekers to segregate billing data. This will further allow products to be grouped into a number of different billable accounts and in order separate invoices can be generated for each.
2	The solution should also allow a billing account to have one or more products attached to it.
3	The Solution should support customer segmentation. Further, the Solution should also support defining rules based on customer segments. i.e. defining Late payment fees or payment incentives based on customer segment. The solution should not pose restriction on account belonging to more than one customer segment.
4	The Solution should support changes in customer hierarchy after creation of account. These changes should include a. Changing the status of an account (Changing from non-paying bill entity to a paying bill entity and vice versa). b. Change of Billing address c. Change of contact information, payment type and customer category d. Addition or cancellation of services
5	The Solution should provide the flexibility for the Customer Management screens.
6	The Solution should support backdating of customer actions like: a. Backdate Account creation b. Backdate product/ deal/ discount purchase/ cancellation c. Backdate account/ service status change. d. Backdate product or discount purchase, cycle start and end date

b. Tariff and Billing Cycle Creation

S.No.	Requirement
1	Normally product catalogue is maintained as a part of CRM solution, where creation and deletion of product and package is being carried out. The billing system should not pose any restriction in adding or removing products and/or services in packages and define tariff plans for the same.
2	Modified SLA / tariff shall be applicable from the next billing cycle or as per billing cycle configured in the system.
3	Tariff creation should have a date of effect of tariff plan. It shall be current/future date and not any previous date.
4	Tariff creation should have a date range for limited period charges.

S.No.	Requirement
5	Tariff and products shall take effect as per billing cycle boundary defined for the customer.
6	Billing Cycle boundary shall be definable. It may be weekly / fortnightly / monthly / bimonthly / quarterly / yearly.
7	The solution must include a default rate plan for every Product.
8	The system shall have the ability to rate based on customer specific data i.e. customer type within customer information.
9	Solution should allow definition of the different charge types such as arrear, advance and mixed (split, recurring charges and non-recurring or one-time purchase).
10	Solution must be capable to support tiered, geographic based rate plans.
11	The Solution should support charging based on the Service level agreements committed to the customer (Silver, Gold plan etc.). SLA Management Solution will also pass information, or billing events, to the billing solution for SLA based rebates.
12	The Solution should support loading of pre-rated events/charges from the external Solutions with the following add-on options: a. Percentage increases the passed-in price by a percentage that you enter. b. Add-on Value increases the passed-in price by a fixed amount that you enter. c. New Value replaces the passed-in price with an amount you enter.
13	The solution should support export and importing of the pricing data as XML files.
14	The solution should support customization of product rates and charges at the time of plan purchase. This could be done for any specific customer. The customization should be in terms of overriding the existing one-time and recurring fees, providing a fixed-amount or percentage discounts on onetime/recurring fees, usage rates/charges. The Solution should support customization in the following ways: a. Override the price for purchase and cycle events. b. Provide a fixed-amount or percentage discount that applies to the product as a whole c. Modify rates or price models in the product by specifying positive or negative changes to resource balance impacts
15	The solution should support charging a cancellation fee in case the product is cancelled before a minimum configurable period.
16	The solution should support rollover of un-used resources from one billing cycle to another.
17	The solution should provide functionality for grouping of pricing components.
18	Flexible rounding rules in tariffs are required. The method of rounding should be capable of rounding up or down. The value that triggers the rounding should be definable as well as the digit that is rounded
19	It should be possible to define Pay-by-Date for various Billing cycles and late payment fee method (slab based, percentage based, fixed amount).

c. **Discounts and Adjustments**

S.No.	Requirement
1	Discount and adjustment shall be offered, based on the value defined for SLA threshold violations during customer creation and applied automatically at the time of bill generation.
2	Any fixed discount /adjustment configured during customer registration shall be applied.
3	Option for offering discount or adjustment in case the bill amount is more than a certain amount
4	Option to offer discounts and adjustment to the customers with pending bills with amount beyond a defined threshold value shall be available in the system.
5	The discount and adjustment functionality should have the flexibility of separate discounts in the parent child hierarchy defined.
6	It should also be possible to change customer discounts and adjustment
7	Discount and adjustment based on Customer Type can be offered.
8	Promotional Discount: All discounts should have an associated date range to indicate that the discount is only available for a set period of time.
9	Cross product discounting should be available where discount can be applied to one product based on another product's criteria. The discount should be available in the form of percentage or fixed price.
10	The discount model should support definition of formulae for discounting, including basic mathematical expressions.
11	System should be able to do adjustment based on region /tariff change and able to calculate and apply accordingly.

d. **Billing Calculation**

S.No.	Requirement
1	The solution should support multiple billing cycles i.e. Weekly, Monthly, Bimonthly, Quarterly, half yearly or annually.
2	The solution should support billing based on the occurrence of events like, <ul style="list-style-type: none"> a. Purchasing a product b. Changing account status eg. active, de-active c. Cancelling a product
3	The Solution should support generation of separate bills for different services under the same subscriber account or grouping of bills for different services. There should be an option to have different frequency of billing cycles for the 2 services and different billing dates for the generation of the 2 bills.
4	Solution should calculate pro-rata in arrears, pro-rata rebates or adjustment of fees paid and early termination fees that may apply to a Product at the time of billing

S.No.	Requirement
5	For the purpose of creation of the trial invoices, the solution should provide an option of trial billing before the actual bill run. Based on the results of the trial billing, the solution should support making changes before the final billing is done.
6	To load balance, the billing operations, the solution should provide an option of segment wise billing to support load balancing of the billing operations.
7	Based on the business requirements, the solution should provide an option of configuring bill due dates in the solution. The solution should support defining payment terms for example, a. 21 days after the billing cycle end date b. 15 business days after the billing cycle end date c. 2nd Tuesday of the month .etc
8	The solution should provide an option of suppressing bills on request. Suppression of bills should be based on the different criteria.
9	The solution should provide an option of configuring GL codes. The solution should also support export of GL data to external financial Solutions
10	The solution should support both open item accounting and balance forward accounting.
11	The solution should support running the billing function for specified accounts.
12	Solution should provide capability to define credit limits for each account and separately for each service within the account.
13	The solution should support re-billing and generation of corrective invoices or correction letters for customers. Further, the Solution should support rebilling for subscribers individually or in a batch.
14	Fixed rates offered can vary for different type of customers like different fixed rates could be defined for government agency and for commercial agency (CRM to take care of customers' types, while creating the customer).
15	Facility for the customer to view report for bills with various tariff plan to help him in choosing the appropriate tariff plan
16	It shall be possible to define the various TAX types along with the value. The solution should support configuration of taxes. It should be possible to support taxes based on the tax amount as well as on the amount calculated after inclusion of taxes.
17	Create recurring charges for the invoice in advance.
18	Consolidation of charges for an invoice against each customer

e. **Bill/Invoice Generation**

S.No.	Requirement
1	GUI shall be provided for generation of Invoices.
2	Formatting an invoice

S.No.	Requirement
3	The solution should support sending of invoices to external applications for printing, fax, E mail or FTP.
4	At the time of account creation, the Solution should provide an option of associating each subscriber bill with an invoice template.
5	The solution should support digital signatures on subscriber invoices.
6	It shall be possible to apply any charge which is not applied automatically independent of bill generation.
7	Based on the parent child hierarchy defined in CRM, a consolidated bill, as well as per child-wise bill shall be generated taking into account the level of hierarchies i.e. based on the hierarchy defined for customer during provisioning by NMS for the customer for offering services in different zones / blocks / districts, it shall be possible to generate bill.
8	Facility shall exist for the inclusion of messages for the subscribers in the bills generated locally (either common messages, or subscriber wise messages).
9	The billing system should have the capability to distribute invoices via e-mail.
10	There should be a provision to give discount or apply interest at the time of bill generation.
11	Late payment reminder message on the invoice
12	Generation of “Revised BILL” shall be available in the system
13	Invoice reminders based on generic message framework (i.e. thru mail/SMS)

f. **Billing Enquiry and Dispute Resolution**

S.No.	Requirement
1	System must allow to process disputes and settlements which may vary slightly from level to level such as a. Bill Level b. Item Level c. Event Level
2	System must support passing adjustments at different levels a. Individual account level b. Subscription service level c. Bill level d. Item level e. Event level
3	System support passing of reason codes at the time of passing adjustments, disputes and settlements

S.No.	Requirement
4	System should support bulk adjustments.
5	There shall be presentation of consolidated information like QOS report, SLA parameters, invoices etc. for the ease of verification, in case of any dispute.

g. **Bill Formatting**

S.No.	Requirement
1	It shall be possible to define different Invoice formats. The solution should support generation of invoice in different formats such as PDF, RTF and HTML format etc.
2	It shall be possible to choose from system defined format for each customer. The solution should support customization of invoice and bill numbers. It shall support logo, multiple formats for invoice, dynamic messages while formatting the bill.

h. **Collection Management**

S.No.	Requirement
1	The solution must provide a mechanism for identifying Invoices which are overdue for payment.
2	The solution must provide an aged debt reporting.
3	Solution must support configurable workflow for collecting overdue receivables such as, <ul style="list-style-type: none"> a. User-defined ageing buckets b. Unlimited collections scenarios c. Customer profiling to qualify accounts for specific collections scenarios d. Configurable entry and exit criteria
4	Solution should provide defining manual and custom actions for collections management like, <ul style="list-style-type: none"> a. Style sheet-based, multilingual dunning letters b. Late fees and percent-based finance charges c. Invoice reminders based on a generic message framework

i. **Account Receivables**

S.No.	Requirement
1	The solution should support the cash and cheques / DD based payments directly into the systems. Split payments should be possible i.e. part of the payments may be cash and part of the payment through cheques / DD.
2	Solution should support payment reversals and payments suspension/ disputed payments.
3	Solution should support refunds.
4	Solution support writing-off of customer bad debt.

S.No.	Requirement
5	Solution should provide APIs to integrate with 3rd Party Payment Gateways for Credit card / debit card based payments.
6	The solution must provide Product revenue reporting.
7	The solution must create financial transactions for GL postings at bill time.
8	The solution must create financial transactions for GL postings when a payment is received or adjustment is made.

j. **Integration of Customer Web portal for billing (refer Web self-care Module)**

k. **Reports**

S.No.	Requirement
1	It shall be possible to generate Histograms, Bar Charts, etc. of different statistical information stored over a period of time from the earlier billing cycles.
2	Report of Defaulters of billing shall be generated by the system.
3	The solutions should able to generate the reports as per the requirements of TRAI, DOT and any other government / regulatory bodies.
4	Any other reports as per the requirements of the managements / users / Business partners

l. **Payments/Accounting Interface (refer Payments Gateway)**

S.No.	Requirement
1	Billing system shall pass all invoice information to the financial system based on standard APIs, which are to be made available by financial system. All payments shall be recorded by financial system and to be informed to billing system via standard API.
2	User shall be given an interface in billing system to provide adjustments, whenever needed, which shall be reflected in next billing cycle invoice. The adjustments shall be done.

m. **Payment Gateway**

S.No.	Requirement
1	A Secure PCI certified payment gateway which guarantees secure processing
2	Hosted Payment pages with 2048 bit encrypted SSL secure Transmission of card data
3	Single interface to deal with for all payment solutions (Internet, POS/EDC ,mobile, IVR)
4	International processing with worldwide network

S.No.	Requirement
5	State of the art configurable fraud management
6	Do business worldwide by choosing the local currency globally and settled globally
7	Manage your customers and subscriptions easily with one click upsell
8	Industry specific solutions that makes payment collection very easy
9	Unified payment platform that offers mobile/IVR/Email billing with No technology investment on your end
10	Unified payment engine which integrates with your billing/invoicing system to track and reconcile your payment receipts in real time
11	Ability to set automated Receipts for Both Mobile and Internet for your customers
12	Ability to expand to your Kiosk/payment collection network over Internet and Mobile platforms
13	Customized scalable solutions that can work for your business globally to reduce payment collection costs
14	Customized reporting and integration development on a project basis

1.3 Web Self Care Module

Web self-care module shall be able to provide a one-stop facility to the corporate customers (enterprise wide access – corporate self-care) with secure access to their information including but not limited to Bill viewing, Bill payment, complaint booking & monitoring, purchasing products & services online, updating personal information, general enquiry etc. using a standard Internet browser.

1. The main components of the Web Self Care Portal Framework which are available on 365x24 basis

Components	Description
Delivery Channels	Corporate Customers (enterprise wide access – corporate self-care), customers / dealers, Field Users, Regional Users Citizens and other Agencies. System shall support all types of customers / dealers including corporate customers.
Presentation Services	Application Services, Marketing Requirements Notification Services, Searching and Personalization, Online help
Business Support Services	Custom Applications, Electronic Bill presentment and payment, Processing Services and Reporting / Report Generation
Identity and Integration Services	Account and Service Management Features, Identity Management, Authentication and Authorization, System Messaging, Trouble Ticketing

Components	Description
Infrastructure Services	System Maintenance, System Management Integration web self-care module with the CRM, Billing, ERP Solutions, etc and other third party system (e.g. MahaNet NMS, GIS etc). The portal framework supports content delivery to a number of different devices.
Web Portal	The web portal would provide information as well as links to delivery services for the main actors in the system.
Payment Gateway Integration	The solution would support Payment Gateway and also support the integration with the MahaNet and all System Users through the web portal.
SMS Gateway Integration	The solution would support SMS based services and also support the integration with the MahaNet and all System Users through the web portal.
Email Integration	The solution would support email based services and also support the integration with the MahaNet and all System Users

1.4 MRAS (MIS, Reports and Analytics System)

1. MahaNet will have multiple applications in their IT environment, applications such as Customer relationship management (CRM), Billing System, Order management and provisioning application, etc.
2. The centralized enterprise reporting system shall have visibility and access capability to take data from all the mentioned applications and will create reports and analytics to be used for various reporting purposes by MahaNet.
3. MRAS should have the capabilities to present reports in a dash-board like environment for the top management so as to help them make intelligent decisions based on factual data.
4. MRAS should have capability to use Data Centre (DC) environment by using production/archived data for report generation. The reporting requirement is primarily two types:
 - Mandatory Reports (Standard): Needed by MahaNet Management, TRAI, CCI, DOT and other government agencies.)
 - Customised Reports: Needed by MahaNet on Daily, Weekly, Quarterly and Yearly Basis for various Activities:
 - CRM
 - Billing
 - Payments
 - Service Activation and Assurance
 - Trouble Tickets
 - Contact Centre Activities
5. Batch Mode replication of Data

6. The MRAS should take care of the enterprise wide reporting need for MahaNet and should have the components for creating comprehensive reports.
7. SI must have capability to support additional Reporting and Analytics requirements during implementation and contract period as per MahaNet business needs.
8. The specifications listed below layout requirements of a platform required for reporting needs of MahaNet middle level & top management for this project.
The users shall be able to login and access the reporting platform based on their privileges.
 - o MRAS must have web based interfaces
 - o Able to pull and analyze data from multiple data sources in Data Center.
 - o Ability to drill, slice, dice. The level of drill, etc. shall be finalized in the SRS Phase.
 - o Ability to create graphs, charts on parameters mentioned in Reports
 - o Ability to download reports for MahaNet Management users depending on access privileges
 - o Must provide online Help and Tutorial feature to get the desired outputs
 - o MRAS Management of Users, Folders, Servers, Objects, User Groups, Server Groups, Authorization and Setting
9. Each user shall be able to get scheduled reports on his/her chosen e-mail ID. e.g: Various report type
 - o Ad Hoc Reports
 - o Object and Folder level Security
 - o Multiple Export format support including PDF, MS XL, MS Word, RTF and HTML Objective model programmable administrative control mechanism Parameterized reporting and sorting
 - o Cross Platform Deployment
10. The report design software shall have following features:
 - o Multiple report types including Mailing Labels, Cross Tabs, Conditional and other reports
 - o Local printing and exporting capability
 - o Formula expert, customs functions and display string formatting
 - o Unlimited SQL commands
11. Capability error-check queries in the reporting software. Policies in this regard shall be user configurable by the administrator.

1.5 Contact Centre Operations

Standard Contact centre operations to support end user base of 10 lacs/as the number may be and several hundred MSOs, ISPs in the first year. The call centers shall be established by the MSOs, ISPs etc, but the application should proposed by the bidder should support the same.

1.6 Other Requirements

- EMS and NMS must expose a REST API interface to provide both bandwidth consumption history and provisioning history for both the MAC and IP address.
- The EMS, NMS, OSS combined must provide accurate accounting of bandwidth consumption delayed by at most 4 hours, at least on a rolling 4 hour basis. Consumption accounting data must be accurate to within 5% and must be split into intra-MahaNet (MahaNet grid) consumption, out of grid - in India consumption and international bandwidth consumption. This data must be made available by Mac and by static IP address on a defined, authenticated REST API for use by BSS

1.7 Consumer, ISP and Cable operator Features and Flows that need to be provided in the EMS/NMS/BSS

The MahaNet shall support a fixed set of broadband products in V1 and allow ISPs to define their own products in V2. The V2 product should allow for any valid combination of the following variables:

- Periodicity (monthly, weekly, one-time)
- Start/ Stop Times
- [Bandwidth (Mbps), Usage (GB), QoS; excess usage Bandwidth + QoS] tuples, upto 3 tuples with design room for more
- In V1, the consumer products must at least include (more may be added in consultation with ISPs and Cable operators), but not limited to:
 - 10/5 Mbps, 25 GB, 5 GB international plan including basic cable
 - 10/10 Mbps, 35 GB, 10 GB international, high QoS business plan including basic cable
 - Both of the above without basic cable
 - 100/50 Mbps, 50 GB, 10 GB international plan
 - 100/100 Mbps, 100 GB, 20 GB international plan
 - All of the above have option of consumer switching to low bandwidth after consumption is done or to pay for consumption bandwidth including international per GB at published rates
 - 1/ 0.5 Gbps, 1000 GB, international as consumed
- Consumer operations: Express interest capture, Enroll, activate product, change product, payment (to ISP or State to be decided)
- Prepaid including monthly pre-paid must be supported in V1, post-paid must be supported in V2

- ISP operations: Enroll, ISP parameters like area, payment (to State or reverse), add product V2, deprecate product V2; including structured metadata for ISP verification, start date, end date, target connections promised
- Web interfaces, reports, alerts the consumer, the ISP, the state will need to operationalize the requirements including SLAs and ensure quality service, assist in financial integrity
- Ability to generate unified billing spanning cable + ISP + telephone using cable and phone bill summaries delivered to BSS via batch imports using authenticated interfaces by authorized ISP personnel or alternately sent over secure authenticated API interfaces, which is must have in V2
- Manual enablement and data entry, bill computation and reporting of Telecom circuits for 2G, 3G, 4G
- Provide phone lines over IP, v1 single provider, v2 multiple. In v1 its safe to accept provider billing but have all the logs in structured, quality checked data and quarterly run reports to verify accuracy of reporting and billing within 6% in V1 and 3% in V2
- Trouble, non-activation and outage reporting APIs along with resolution APIs and interfaces
- Follow system and database design principles like 3 normal form, simplicity of consumer experience, consumer delight, simplicity of operations

1.8 Additional Technical Requirements

- All interfaces must be specified and available as REST APIs following the Open API protocols.
- All user features, service staff interfaces including complete enrolment, provisioning, trouble ticket management + acceptance must be available on mobile via Android Apps. All service provider, ISP, OSS/ BSS management interfaces must have a single sign-on using Aadhar.
- Bidder must specify for all major consumer facing data and reports such as uptime, provisioning, usage, 90-9599% bandwidth, billing amount, latency (across node), jitter (across node), specify: coverage, accuracy, timeliness SLA as well as bug fix SLAs at the time of the specification signoff.
- All changes to a consumer network or provisioning shall generate an alert informing them of the change with a link to a full report.

1.9 Additional Features required in OSS

- Provision, disconnect consumer, telecom based on BSS API command, provisioning includes modifying IP/MPLS-VPN tables
- Sanity and integrity runs to find gaps between BSS provisioning records, OSS state and when possible and legitimate modify OSS provisioning as per BSS
- Configure all intra state broadband traffic to go direct between the relevant ports to the extent possible, most do for 90% of intra-state usage by V2

2. Testing and acceptance criteria relating to BSS

- These features and requirements must be sufficiently detailed by the contractor in the forms of requirement specification in consultation with the authority and tabled within 4 weeks of project award, to be signed off within 6 weeks of project award. A user interface review shall be conducted within 12 weeks. These timelines can be subject to changes also as per the MahaNet's decision
- The contractor shall within 8 weeks of detailed requirement sign off, define use cases, test descriptions for major use case along with test data suites as time series via API calls if needed. This timeline can be subject to change also as per MahaNet's decision
- All test results and reports must be submitted in an agreed on format via a REST API for every release starting with the first release. All regressions or lowering in performance must be explained in notes and significant degradation in any of these must be sent in the progress reports along with explanation

3. Specification for Centralized Reports Solution

- Reports solution shall be software based installable on any carrier grade hardware which shall be hardened from operating system point of view.
- Reports solution shall support full text search for all collected logs
- Reports solution shall support customized reports as per requirement which can apart from standard reports.
- Reports solution shall use a Unix / Linux -Like Operating System.
- Reporting solution shall have Access Control List as a product feature.
- Reports should be smarter and based on Public IP solution shall identify Circle and search in that circle.
- Long duration search 24 hours and 7 days search should be supported
- Reports shall be DoT compliant.

Sub-section A – 9: Technical Specification for Passive Infrastructure**1. Air Conditioning (2 ton split)**

EER (w/w)	2.7
Min Star Rating	3 Star & Above
Power V/Hx/Ph	220 – 240V / 50Hz 1Ph
Ton	2
Capacity (BTU/hr)	24000
Refrigerant	R22
Air Flow Volume (m ³ /h)	1100
Power Consumption	2340 W
Operation Current	10.8 A
Capacity	24000 BTU
Noise Level (Indoor) should be better than High	Noise Level (Indoor) should be better than 48 dB (A)
Mid	45 dB (A)
Low	42 dB (A)
Outdoor	59 dB (A)
Compressor	High quality famous brand rotary type compressor
Elegant panel design, with LED/LCD central Display	
Galvanized outdoor unit or plastic outdoor unit for anti-corrosion	

2. Diesel Generator (15 KVA silent DG)

S.No.	Description
1.	Engine type: Multi cylinder, in accordance with IS 10002-1981 with latest amendments
2.	Method of starting: Electric start 12 V DC
3.	Type of fuel: High speed diesel
4.	Rating Continuous: 20 BHP
5.	Output: Minimum 18 BHP under NTP conditions
6.	Rated Speed: 1500 RPM
	Output: 15 KVA

S.No.	Description
7.	
8.	P.F: 0.8 lag
9.	Voltage: 220 V, 1 Phase, AC
10.	Type: Continuous running duty type
11.	Frequency: 50 Hz
12.	Phase: 3-Phase

3. 6 KVA, 12 Hours backup Online UPS specifications

S.No.	Parameter	Minimum Specifications
1.	Capacity	Adequate capacity to cover all above IT Components at respective location
2.	Output Wave Form	Pure Sine wave
3.	Input Power Factor at Full Load	>0.90
4.	Input	Three Phase 3 Wire for over 6 KVA
5.	Input Voltage Range	305-475VAC at Full Load
6.	Input Frequency	50Hz +/- 3 Hz
7.	Output Voltage	400V AC, Three Phase for over 6 KVA UPS
8.	Output Frequency	50Hz +/- 0.5% (Free running); +/- 3% (Sync. Mode)
9.	Inverter efficiency	>90%
10.	Over All AC-AC Efficiency	>85%
11.	UPS shutdown	UPS should shutdown with an alarm and indication on following conditions 1)Output over voltage 2)Output under voltage 3)Battery low 4)Inverter overload 5)Over temperature 6)Output short
12.	Battery Backup	12 Hrs on full load
13.	Battery	VRLA (Valve Regulated Lead Acid) SMF (Sealed Maintenance Free) Battery

14.	Indicators & Metering	Indicators for AC Mains, Load on Battery, Fault, Load Level, Battery Low Warning, Inverter On, UPS on Bypass, Overload, etc. Metering for Input Voltage, Output Voltage and frequency, battery voltage, output current etc.
15.	Audio Alarm	Battery low, Mains Failure, Over temperature, Inverter overload, Fault etc.
16.	Cabinet	Rack / Tower type
17.	Operating Temp	0 to 40 degrees centigrade

Notes:

- 1) Offered UPS should be BIS certified **or equivalent**
- 2) Offered UPS should be CE certified
- 3) Offered UPS should be ERTL (Third Party Test Lab) certified
- 4) **OEM should be listed by Frost and Sullivan for the last year.**

4. Server/Networking racks

S. No.	Parameter	Minimum Specifications
1	Type	19" 42U racks mounted on the floor.
		Floor Standing Server Rack - 42U with Heavy Duty Extruded Aluminium Frame for rigidity. Top cover with FHU provision. Top & Bottom cover with cable entry gland plates. Heavy Duty Top and Bottom frame of MS. Two pairs of 19" mounting angles with 'U' marking. Depth support channels - 3 pairs with an overall weight carrying Capacity of 500Kgs.
		All racks should have mounting hardware 2 Packs, Blanking Panel
		Stationery Shelf (2 sets per Rack)
		All racks must be lockable on all sides with unique key for each rack
		Racks should have Rear Cable Management channels, Roof and base cable access
2	Wire managers	Two vertical and four horizontal
3	Power Distribution Units	2 per rack
		Power Distribution Unit - Vertically Mounted, 32AMPs with 25 Power Outputs. (20 Power outs of IEC 320 C13 Sockets & 5 Power outs of 5/15 Amp Sockets), Electronically controlled circuits for Surge & Spike protection, LED readout for the total current being drawn from the channel, 32AMPS MCB, 5 KV AC isolated input to Ground & Output to Ground
4	Doors	The racks must have steel (solid / grill / mesh) front / rear doors and side panels. Racks should NOT have glass doors / panels.
		Front and Back doors should be perforated with at least 63% or higher perforations.

S. No.	Parameter	Minimum Specifications
		Both the front and rear doors should be designed with quick release hinges allowing for quick and easy detachment without the use of tools
5	Fans and Fan Tray	Fan 90CFM 230V AC, 4" dia (4 Nos. per Rack) Fan Housing Unit 4 Fan Position (Top Mounted) (1 no. per Rack) - Monitored - Thermostat based - The Fans should switch on based on the Temperature within the rack. The temperature setting should be factory settable. This unit should also include - humidity & temperature sensor
6	Metal	Aluminium extruded profile
7	Side Panel	Detachable side panels (set of 2 per Rack)

5. Specifications for Earthing

S. No.	Description
1	Earthing should be done for the entire power system and provisioning should be there to earth UPS systems, Power distribution units, and AC units etc. so as to avoid a ground differential. State shall provide the necessary space required to prepare the earthing pits.
2	All metallic objects on the premises that are likely to be energized by electric currents should be effectively grounded.
3	The connection to the earth or the electrode system should have sufficient low resistance in the range of 0 to 25 ohm to ensure prompt operation of respective protective devices in event of a ground fault, to provide the required safety from an electric shock to personnel & protect the equipment from voltage gradients which are likely to damage the equipment.
4	Recommended levels for equipment grounding conductors should have very low impedance level less than 0.25 ohm.
5	In case of a UPS and Transformer equipment, the Earth resistance shall be automatically measured on an online basis at a pre- configured interval and corrective action should be initiated based on the observation. The automatic Earthing measurements should be available on the UPS panel itself
6	There should be enough space between data and power cabling and there should not be any cross wiring of the two, in order to avoid any interference, or corruption of data.
7	The earth connections shall be properly made.
8	A complete copper mesh earthing grid needs to be installed for the server farm area, every rack need to be connected to this earthing grid. A separate earthing pit needs to be in place for this copper mesh.
9	Provide separate earthing pits for servers, UPS & generators as per the standards.

6. Specifications for cables

S. No.	Parameter	Minimum Specifications
1	Standards	ANSI TIA 568 C for all structured cabling components
2	OEM Warranty	OEM Certification and Warranty of 15-20 years as per OEM standards
Electrical cabling component		

S. No.	Parameter	Minimum Specifications
1	Standards	All electrical components shall be design manufactured and tested in accordance with relevant Indian standards IEC's

7. Specifications for 42 U Rack for NOC

S.No.	Parameter	Minimum Requirement Description
1	Form Factor / Dimension	42U (800x1000)
2	Material	Aluminium
3	Cooling	Provision for heat dissipation for side-to-side and Front-to-Back units
4	Cable Entry	Top and Bottom gland cable Entry trays with brush
5	Side Panels	Full Side Panels for both sides
6	Front Door	Front door with latch and ventilation holes.
7	Back Door	Back door with latch and ventilation holes.
8	PDU	2* Dual 32 A PDU
9	Power Outlets	2* 16 receptacle Power Connectors each connected to separate PDUs
10	Extra Units	Keyboard Drawer, 2x fixed tray
11	Mounting Accessories	Nuts and washers for mounting equipment and slides.
12	Cable Managers	Adequate cable managers for units.
13	Depth Support	4 * Depth Support channels
14	Support	The rack should not be an end of life / end of service product.

8. Specifications for 42 U Rack THQ-3,4

S.No.	Parameter	Minimum Requirement Description
1	Form Factor / Dimension	42U (600x1000)
2	Material	Aluminium
3	Cooling	Provision for heat dissipation for side-to-side and Front-to-Back units
4	Cable Entry	Top and Bottom gland cable Entry trays with brush
5	Side Panels	Full Side Panels for both sides
6	Front Door	Front door with latch and ventilation holes.
7	Back Door	Back door with latch and ventilation holes.
8	PDU	2* Dual 32 A PDU
9	Power Outlets	2* 16 receptacle Power Connectors each connected to separate PDUs
10	Extra Units	Keyboard Drawer, 2x fixed tray
11	Mounting Accessories	Nuts and washers for mounting equipment and slides.
12	Cable Managers	Adequate cable managers for units.
13	Depth Support	4 * Depth Support channels
14	Support	The rack should not be an end of life / end of service product.

9. Specifications for 27 U Rack for THQ -1,2

S.No.	Parameter	Minimum Requirement Description
1	Form Factor / Dimension	27U (600x1000)
2	Material	Aluminium
3	Cooling	Provision for heat dissipation for side-to-side and Front-to-Back units
4	Cable Entry	Top and Bottom gland cable Entry trays with brush
5	Side Panels	Full Side Panels for both sides
6	Front Door	Front door with latch and ventilation holes.
7	Back Door	Back door with latch and ventilation holes.
8	PDU	2* Dual 32 A PDU
9	Power Outlets	2* 16 receptacle Power Connectors each connected to separate PDUs
10	Extra Units	Keyboard Drawer, 2x fixed tray
11	Mounting Accessories	Nuts and washers for mounting equipment and slides.
12	Cable Managers	Adequate cable manager for units.

S.No.	Parameter	Minimum Requirement Description
13	Depth Support	4 * Depth Support channels
14	Support	The rack should not be an end of life / end of service product.

10. Specifications for 12 U Rack for GP

S.No.	Parameter	Minimum Requirement Description
1	Form Factor / Dimension	12U (600x1000)
2	Material	Aluminium
3	Cooling	Provision for heat dissipation for side-to-side and Front-to-Back units
4	Cable Entry	Top and Bottom gland cable Entry trays with brush
5	Side Panels	Full Side Panels for both sides
6	Front Door	Front door with latch and ventilation holes.
7	Back Door	Back door with latch and ventilation holes.
8	PDU	2* Dual 32 A PDU
9	Power Outlets	2* 16 receptacle Power Connectors each connected to separate PDUs
10	Extra Units	Keyboard Drawer, 2x fixed tray
11	Mounting Accessories	Nuts and washers for mounting equipment and slides.
12	Cable Managers	Adequate cable manager for units.
13	Depth Support	4 * Depth Support channels
14	Support	The rack should not be an end of life / end of service product.

Sub-Section A – 10: Technical Specification for Security**Cyber Security Solution**

- The purpose of the MahaNet is to provide secure connectivity to the end users at all levels. To provide secure services the proposed security systems should be innovative layer-7 classification engine, it should provide granular traffic visibility to ICS protocols, applications, and users and as the enforcing device allows users to segment their network using intuitive organization policies that reduce the attack footprint. It should further secure the allowed traffic by natively blocking known threats such as ICS software and protocol exploits, viruses and spyware and by sandboxing unknown threats which are quickly analyzed and stopped with automatically generated protections. Security should also be extended to virtual and mobile environments which are increasingly being deployed in control systems to improve efficiencies.
- The Security solution should create defense at the Master Taluka as well as at the DC, DR and NoC level to achieve the complete network security. These layers should ideally talk to each other and integrate to common source of updates.
- DC And DR are proposed to be hosted in the cloud and one level of prevention is envisaged to be provided using software level of layer 7 application based security platform in the cloud. All the traffic coming and going out of cloud should pass through this layer of prevention.

The solution should also address: K

- Zero Trust approach.
- Automatically control and block unwanted applications and activity everywhere on the network.
- Protect and defend systems at all places in the network, across all network traffic on GP, Talukas in data centers and at major Internet gateways.
- Automatically transform threats into actionable controls that prevent future attacks and should simplify workflows to create and enforce new controls, from fully automated to user directed to the asked security platform at the external gateway
- Solution should have capabilities to analyze and correlate threat intelligence. For identified high-priority attacks, solution should enable Department to find related indicators of compromise.
- Tool which can provide the intelligence, analytics, and context required to understand which attacks require immediate response, as well as the ability to make indicators actionable and prevent future attacks.
- Prevent new attacks and automatically block follow-on attacks at the DC level.

- Immediate and automatic sharing and distribution of intelligence signatures.

All the GP traffic get accumulated at the exit master taluka level. Each Master Taluka will act as an exit point for traffic and should be equipped with Security platform to cater for taluka as well as traffic coming from GP ring and taluka.

1. Detailed Functional Requirements

Next Generation Security Solution for Taluka Head End:

S. No.	Specification
1.	The proposed solution must allow single policy rule creation for application control, user based control, host profile, threat prevention, Anti-virus, file filtering, content filtering, QoS and scheduling at single place within a single rule and not at multiple locations. There must not be different places and options to define policy rules based on these parameters.
2.	The Solution must support identification and control of all types of applications (Business, Social, Encrypted and Custom) within the Network environment without requiring any license/subscription/blade. It should provide detailed analysis on sessions consumed, data transferred and threats involved through the applications.
3.	The proposed solution must allow free custom application signatures for Homegrown and custom applications (both current and future) that are running in the network.
4.	The solution must provide real time traffic logs based on applications irrespective of ports. While monitoring real time traffic logs, solution must provide detailed view of defence (attack identified), Services , application and Users, not just ports and IP addresses. E.g. the solution must distinguish between telnet on port 80 and http traffic between same pair of source and destinations.
5.	Solution must not have Application specific chips like ASICs that doesn't allow future firmware and feature expansions on the same hardware. Solution must be based on parallel processing architecture and must not use proprietary ASIC

S. No.	Specification
	chips.
6.	Solution must support Full tunnel, split tunnel and application specific tunnel for client to site VPNs. Solution must allow custom policies to control VPN traffic based on users, applications. It must allow different policies for different users groups for threat (Viruses, vulnerabilities, malware) within VPN traffic.
7.	The Firewall must support application identification natively, without requiring any license/subscription/blade. There should not be any need to buy any license for application visibility and the must operate at Layer 7 natively.
8.	The solution must support Firewall, Application visibility and control, IPS, Anti-virus, Anti-malware, Anti-bot from day one and support for URL Filtering.
9.	The solution should support language like Hindi, Urdu and Tamil for URL and IP database to fulfill web security needs
10.	The solution must have always on access to the firewall. The Firewall should have dedicated inbuilt hardware resources for firewall access and management at all times, and must be available irrespective of load.
11.	The administrator must be able to view report on the CPU usage for management activities and CPU usage for other activities.
12.	The Solution must have dedicated Data Plane and Management Plane.
13.	The proposed solution must support Policy Based forwarding based on: <ul style="list-style-type: none"> - Zone - Source or Destination Address - Source or destination port - Application (not port based) - AD/LDAP user or User Group - Services or ports
14.	Firewall solution should be offered in HA and should support Active/Active and Active/Passive HA and must support synchronization of the following for HA:

S. No.	Specification
	<ul style="list-style-type: none"> -All sessions -Decryption Certificates -All VPN Security Associations -All IPS and AV sessions -All threat and application signatures -FIB Tables
15.	The proposed solution must support different Custom IPS and Application policies for different users and groups.
16.	The proposed solution must support Customized DoS protection rules.
17.	Solution should support Session based load sharing (not packet based) over multiple equal cost paths. It should work with both static and dynamic routing.
18.	The device should be capable to identify and prevent in-progress phishing attacks by controlling sites to which users can submit corporate credentials based on the site's URL category thus blocking users from submitting credentials to untrusted sites while allowing users to continue to submit credentials to corporate and sanctioned sites.
19.	The proposed solution must support different actions in the policy such as deny, drop, reset client, reset server, reset both client and server.
20.	Solution should support Session based (not packet based) differentiated services code point (DSCP) classification.
21.	Solution must support end-to-end (firewall-to-client) priority policing and C2S & S2C direction enforcement.
22.	Solution must support Link Layer discovery protocol (LLDP) for simplified network management
23.	Solution must support IPv6 based site-to-site VPN tunnels
24.	Solution must support SNMP counters for logical interfaces e.g. L2/L3 sub

S. No.	Specification
	interfaces, tunnel interfaces, LAG (802.3ad), Loopback.
25.	Solution must have at least 10 virtual systems. Every Virtual system must support individual separate configuration for separate DNS entries and other service routes for access to NTP, Syslog, SNMP, Proxy etc. Every virtual system must support individual routes through virtual system specific interfaces to access all these services.
26.	Solution should correlate and detect hosts that have received malware, and have also exhibited command-and-control (C2) network behavior corresponding to the detected malware.
27.	Solution should correlate and detect hosts that have exhibited command-and-control (C2) network behavior corresponding to malware elsewhere on the network.
28.	Solution should correlate and detect a host involved in a sequence of activity indicating remote compromise, starting with scanning or probing activity, progressing to exploitation, and concluding with network contact to a known malicious domain.
29.	Solution should detect probable exploit kit activity targeted at a host on the network. Exploit kits should be identified by a vulnerability exploit or exploit kit landing page signature, combined with either a malware download signature or a known command-and-control signature.
30.	Solution should correlate and detect likely compromised hosts based on activity that resembles command-and-control (C2) beaconing, such as repeated visits to dynamic DNS domains, repeated file downloads from the same location, generation of unknown traffic, etc.
31.	Solution must provide change control and baseline deviation mechanisms. It must provide visibility in traffic pattern changes in last one hour, one day and compare this with last one day, one week and one month traffic patterns.

S. No.	Specification
32.	The proposed solution shall support sandbox behavior based inspection and protection of unknown viruses and zero-day malware for any application and protocol (not limited to HTTP, SMTP, FTP) in future and the solution shall be able to provide automated signature generation for discovered zero-day malware and the solution should ensure the delivery of the signature in 5 mins from the time of detection as required in Future. The environment should support both cloud based and on premise architecture.
33.	The proposed solution shall support DNS-based signatures to detect specific DNS lookups for hostnames that have been associated with malware
34.	The solution must support minimum four level of decompression/decoding for any combination of decoding: ZIP, gzip, base64, chunked, encode.
35.	The solution must provide the ability to block files with multi-level-encoding with 5 or more level of compression e.g office file in 5 levels of zip.
36.	The proposed solution be able to support simultaneous deployment with interfaces servicing Layer 3, Layer 2, Transparent and Tap modes
37.	The proposed solution must support the ability to lock configuration while modifying it, avoiding administrator collision when there are multiple people configuring the appliance
38.	The proposed solution must support validation of policy for shadowed rules before rule application
39.	The proposed solution must support on appliance Per policy SSL and SSH decryption for both inbound and outbound traffic.
40.	The proposed must support on appliance SSL decryption policy based on IP, User, web category.
41.	The proposed solution shall support block and continue (i.e. allowing a user to access a web-site which potentially violates policy by presenting them a block page with a warning with a continue option allowing them to proceed for a certain

S. No.	Specification
	time)
42.	The proposed solution should support the ability to create QoS policy on a per rule basis: -by source address -by destination address -by application (such as Skype, BitTorrent, YouTube, azureus) -by static or dynamic application groups (such as Instant Messaging or P2P groups) -by port and services
43.	The proposed solution shall support packet captures based on: -Applications -Unknown Applications -any threat -data-filters
44.	The solution should provide Data Loss Prevention - to protect any credit card and other information leaking out of the network. DLP licenses to be included from day-1
45.	Solution must not require cloud connectivity to detect and control any application
46.	Solution should allow file blocking across all protocols not limited to http, smtp, imap, Pop3.
47.	Should be capable to checks SSL/TLS certificates before ingesting dynamic lists for preventing an attacker performing a MITM attack on threat intel lists to hide their IPs or poison the lists with bogus data.
48.	Should support Authentication Policy and Multi-Factor Authentication to enforce 2FA on any application or site in an organization, regardless of whether an application natively supports 2FA.

S. No.	Specification
49.	Should support admin level commit and revert so that config changes can be grouped per Admin context and changes can be pushed by a Admin without including other Admin changes.
50.	Should support Global and Zone Protection for Multi-path TCP Evasions
51.	The solution must provide a Single View on Known Threats, Hosts/Users visiting malicious URLs, Hosts/Users resolving malicious domains, applications involved in attacks, applications using non-standard ports, and detailed view on security policies allowing applications on non-standard ports.
52.	The solution must provide detailed Change monitor or baseline deviations applications, source and destinations. The change monitor dashboard must compare changes in applications, source and destinations in terms of percentage increase/decrease for last 15 mins/ 30 mins/ one hour/ one day against historical time period of 24 hours/ 7 days/ one month etc.
53.	The solution must provide detailed view on User Activity (along with source and destination IP) with granular view on Data transferred (bytes/sessions), threats associated with a user, Content and URLs accessed by User. This information must be available in Graphical as well as tabular format.
54.	OEM must provide performance, throughput and features evidence through public domains- Websites and data sheets. We reserves the right for asking the bidder to do a PoC that validates all technical compliance as submitted in the tender document.
	Performance Requirement
1.	The proposed solution will be a Next Generation Firewall with a capability of supporting at least 30 Gbps of Application Identification Enabled Firewall throughput using 64 KB transaction size using HTTP. The OEM must publish performance claims on public domain like websites, datasheets. In case if any parameter is not specified, it must be declared on the Company Letter Head signed by Global Head of Engineering.

S. No.	Specification
2.	The proposed solution should support at least 20 Gbps of performance with Firewall, application control, IPS, Anti-Virus, Anti-malware and Anti-bot enabled. The OEM must publish performance claims on public domain like websites, datasheets. Letter head performance claims will not be entertained.
3.	The proposed solution should support at least 20 Gbps of performance with stream based (not proxy based) Anti-Virus Prevention. The OEM must publish performance claims on public domain like websites, datasheets. Letter head performance claims will not be entertained.
4.	The performance must be measured using Data Center Environment with all Traffic enabled (not just internet traffic). The OEM must furnish details of the testing methodology.
5.	The proposed solution must support at least 8,000,000 concurrent sessions. The session count must be active TCP connections. The concurrent sessions must not drop while enabling all requested features.
6.	The proposed solution must support at least 300,000 new session per second
7.	The solution must provide 4 no 100/1000/10G interfaces, 12 gigabit SFP/SFP+ populated with 2 SX and 4 SR, 4 nos 100 Gig QSFP28 ports and 1 out of band management interface.
8.	The proposed solution must have 10 Gbps of IPSEC VPN throughput and should support at least 2,000 IPsec VPN tunnels and 10,000 SSL VPN Users from Day one without requiring any license.
9.	<i>The proposed solution must be in Leader's quadrant as per Gartner's Publication 'Magic Quadrant for Enterprise Network Firewall' for 2017.</i>
10.	OEM must be EAL4/ ICSA/ FIPS 4.0 certified
11.	OEM must support UL, CUL, CB Safety Certifications, FCC Class A, CE Class A, VCCI Class A, TUV EMI Certifications for the proposed solution.

2. Next Generation Security Solution for NOC

S. No	Specification
1.	The proposed solution must allow single policy rule creation for application control, user based control, host profile, threat prevention, Anti-virus, file filtering, content filtering, QoS and scheduling at single place within a single rule and not at multiple locations. There must not be different places and options to define policy rules based on these parameters.
2.	The Solution must support identification and control of all types of applications (Business, Social, Encrypted and Custom) within the Network environment without requiring any license/subscription/blade. It should provide detailed analysis on sessions consumed, data transferred and threats involved through the applications.
3.	The proposed solution must allow free custom application signatures for Homegrown and custom applications (both current and future) that are running in the network.
4.	The solution must provide real time traffic logs based on applications irrespective of ports. While monitoring real time traffic logs, solution must provide detailed view of defence (attack identified), Services , application and Users, not just ports and IP addresses. E.g. the solution must distinguish between telnet on port 80 and http traffic between same pair of source and destinations.
5.	Solution must not have Application specific chips like ASICs that doesn't allow future firmware and feature expansions on the same hardware. Solution must be based on parallel processing architecture and must not use proprietary ASIC chips.
6.	Solution must support Full tunnel, split tunnel and application specific tunnel for client to site VPNs. Solution must allow custom policies to control VPN traffic based on users, applications. It must allow different policies for different users groups for threat (Viruses, vulnerabilities, malware) within VPN traffic.
7.	The Firewall must support application identification natively, without requiring

S. No	Specification
	any license/subscription/blade. There should not be any need to buy any license for application visibility and the must operate at Layer 7 natively.
8.	The solution must support Firewall, Application visibility and control, IPS, Anti-virus, Anti-malware, Anti-bot from day one and support for URL Filtering.
9.	The solution should support language like hindi, Urdu and Tamil for URL and IP database to fulfill web security needs
10.	The solution must have always on access to the firewall. The Firewall should have dedicated inbuilt hardware resources for firewall access and management at all times, and must be available irrespective of load.
11.	The administrator must be able to view report on the CPU usage for management activities and CPU usage for other activities.
12.	The Solution must have dedicated Data Plane and Management Plane.
13.	The proposed solution must support Policy Based forwarding based on: <ul style="list-style-type: none"> - Zone - Source or Destination Address - Source or destination port - Application (not port based) - AD/LDAP user or User Group - Services or ports
14.	Firewall solution should be offered in HA and should support Active/Active and Active/Passive HA and must support synchronization of the following for HA: <ul style="list-style-type: none"> -All sessions -Decryption Certificates -All VPN Security Associations -All IPS and AV sessions -All threat and application signatures -FIB Tables

S. No	Specification
15.	The proposed solution must support different Custom IPS and Application policies for different users and groups.
16.	The proposed solution must support Customized DoS protection rules.
17.	Solution should support Session based load sharing (not packet based) over multiple equal cost paths. It should work with both static and dynamic routing.
18.	The device should be capable to identify and prevent in-progress phishing attacks by controlling sites to which users can submit corporate credentials based on the site's URL category thus blocking users from submitting credentials to untrusted sites while allowing users to continue to submit credentials to corporate and sanctioned sites.
19.	The proposed solution must support different actions in the policy such as deny, drop, reset client, reset server, reset both client and server.
20.	Solution should support Session based (not packet based) differentiated services code point (DSCP) classification.
21.	Solution must support end-to-end (firewall-to-client) priority policing and C2S & S2C direction enforcement.
22.	Solution must support Link Layer discovery protocol (LLDP) for simplified network management
23.	Solution must support IPv6 based site-to-site VPN tunnels
24.	Solution must support SNMP counters for logical interfaces e.g. L2/L3 sub interfaces, tunnel interfaces, LAG (802.3ad), Loopback.
25.	Solution must have at least 10 virtual systems. Every Virtual system must support individual separate configuration for separate DNS entries and other service routes for access to NTP, Syslog, SNMP, Proxy etc. Every virtual system must support individual routes through virtual system specific interfaces to access all these services.

S. No	Specification
26.	Solution should correlate and detect hosts that have received malware, and have also exhibited command-and-control (C2) network behavior corresponding to the detected malware.
27.	Solution should correlate and detect hosts that have exhibited command-and-control (C2) network behavior corresponding to malware elsewhere on the network.
28.	Solution should correlate and detect a host involved in a sequence of activity indicating remote compromise, starting with scanning or probing activity, progressing to exploitation, and concluding with network contact to a known malicious domain.
29.	Solution should detect probable exploit kit activity targeted at a host on the network. Exploit kits should be identified by a vulnerability exploit or exploit kit landing page signature, combined with either a malware download signature or a known command-and-control signature.
30.	Solution should correlate and detect likely compromised hosts based on activity that resembles command-and-control (C2) beaconing, such as repeated visits to dynamic DNS domains, repeated file downloads from the same location, generation of unknown traffic, etc.
31.	Solution must provide change control and baseline deviation mechanisms. It must provide visibility in traffic pattern changes in last one hour, one day and compare this with last one day, one week and one month traffic patterns.
32.	The proposed solution shall provide sandbox behavior based inspection and protection of unknown viruses and zero-day malware for any application and protocol (not limited to HTTP, SMTP, FTP) from day one and the solution shall be able to provide automated signature generation for discovered zero-day malware and the solution should ensure the delivery of the signature in 5 mins from the time of detection. The environment should support both cloud based and on premise architecture. Separate on premise device with support for 36 VM

S. No	Specification
	and clustering support of upto 20 devices has to be provided at NoC
33.	The proposed solution shall support DNS-based signatures to detect specific DNS lookups for hostnames that have been associated with malware
34.	The solution must support minimum four level of decompression/decoding for any combination of decoding: ZIP, gzip, base64, chunked, encode.
35.	The solution must provide the ability to block files with multi-level-encoding with 5 or more level of compression e.g office file in 5 levels of zip.
36.	The proposed solution be able to support simultaneous deployment with interfaces servicing Layer 3, Layer 2, Transparent and Tap modes
37.	The proposed solution must support the ability to lock configuration while modifying it, avoiding administrator collision when there are multiple people configuring the appliance
38.	The proposed solution must support validation of policy for shadowed rules before rule application
39.	The proposed solution must support on appliance Per policy SSL and SSH decryption for both inbound and outbound traffic.
40.	The proposed must support on appliance SSL decryption policy based on IP, User, web category.
41.	The proposed solution shall support block and continue (i.e. allowing a user to access a web-site which potentially violates policy by presenting them a block page with a warning with a continue option allowing them to proceed for a certain time)
42.	The proposed solution should support the ability to create QoS policy on a per rule basis: -by source address -by destination address -by application (such as Skype, BitTorrent, YouTube, azureus)

S. No	Specification
	<ul style="list-style-type: none"> -by static or dynamic application groups (such as Instant Messaging or P2P groups) -by port and services
43.	<p>The proposed solution shall support packet captures based on:</p> <ul style="list-style-type: none"> -Applications -Unknown Applications -any threat -data-filters
44.	The solution should provide Data Loss Prevention - to protect any credit card and other information leaking out of the network. DLP licenses to be included from day-1
45.	Solution must not require cloud connectivity to detect and control any application
46.	Solution should allow file blocking across all protocols not limited to http, smtp, imap, Pop3.
47.	Should be capable to checks SSL/TLS certificates before ingesting dynamic lists for preventing an attacker performing a MITM attack on threat intel lists to hide their IPs or poison the lists with bogus data.
48.	Should support Authentication Policy and Multi-Factor Authentication to enforce 2FA on any application or site in an organization, regardless of whether an application natively supports 2FA.
49.	Should support admin level commit and revert so that config changes can be grouped per Admin context and changes can be pushed by a Admin without including other Admin changes.
50.	Should support Global and Zone Protection for Multi-path TCP Evasions
51.	The solution must provide a Single View on Known Threats, Hosts/Users visiting malicious URLs, Hosts/Users resolving malicious domains, applications involved

S. No	Specification
	in attacks, applications using non-standard ports, and detailed view on security policies allowing applications on non-standard ports.
52.	The solution must provide detailed Change monitor or baseline deviations applications, source and destinations. The change monitor dashboard must compare changes in applications, source and destinations in terms of percentage increase/decrease for last 15 mins/ 30 mins/ one hour/ one day against historical time period of 24 hours/ 7 days/ one month etc.
53.	The solution must provide detailed view on User Activity (along with source and destination IP) with granular view on Data transferred (bytes/sessions), threats associated with a user, Content and URLs accessed by User. This information must be available in Graphical as well as tabular format.
54.	OEM must provide performance, throughput and features evidence through public domains- Websites and data sheets. We reserves the right for asking the bidder to do a PoC that validates all technical compliance as submitted in the tender document.
	Performance Requirement for NoC
1.	The proposed solution will be a Next Generation Firewall with a capability of supporting at least 16 Gbps of Application Identification Enabled Firewall throughput using 64 KB transaction size using HTTP. The OEM must publish performance claims on public domain like websites, datasheets. In case if any parameter is not specified, it must be declared on the Company Letter Head signed by Global Head of Engineering.
2.	The proposed solution should support at least 8 Gbps of performance with Firewall, application control, IPS, Anti-Virus, Anti-malware and Anti-bot enabled. The OEM must publish performance claims on public domain like websites, datasheets. Letter head performance claims will not be entertained.
3.	The proposed solution should support at least 8 Gbps of performance with stream based (not proxy based) Anti-Virus Prevention. The OEM must publish

S. No	Specification
	performance claims on public domain like websites, datasheets. Letter head performance claims will not be entertained.
4.	The performance must be measured using Data Center Environment with all Traffic enabled (not just internet traffic). The OEM must furnish details of the testing methodology.
5.	The proposed solution must support at least 4,000,000 concurrent sessions. The session count must be active TCP connections. The concurrent sessions must not drop while enabling all requested features.
6.	The proposed solution must support at least 120,000 new session per second
7.	The solution must provide 4 no 100/1000/10G interfaces, 12 gigabit SFP/SFP+ populated with 2 SX and 2 SR, 4x QSFP ports and 1 out of band management interface.
8.	The proposed solution must have 10 Gbps of IPSEC VPN throughput and should support at least 2,000 IPsec VPN tunnels and 10,000 SSL VPN Users from Day one without requiring any license.
9.	<i>The proposed solution must be in Leader's quadrant as per Gartner's Publication 'Magic Quadrant for Enterprise Network Firewall' for 2017.</i>
10.	OEM must be EAL4/ ICSA/ FIPS 4.0 certified
11.	OEM must support UL, CUL, CB Safety Certifications, FCC Class A, CE Class A, VCCI Class A, TUV EMI Certifications for the proposed solution.

3. End Point Malware Protection for Workstations at NOC

S. No	Specification
1.	The solution should be advanced endpoint protection offering that has multi-method prevention including a proprietary combination of malware and exploit prevention methods that pre-emptively blocking both known and unknown

S. No	Specification
	threats.
2.	The security solution should support prevention of cyber breaches by preemptively blocking known and unknown malware, exploits and zero-day threats
3.	The security solution should support protection and enables users to conduct their daily activities and use web-based technologies without concern for known or unknown cyber threats.
4.	Should automate prevention by autonomously reprogramming itself using threat intelligence
5.	The proposed solution must prevent exploitation of unpatched OS like Windows XP vulnerabilities
6.	Should support protection against legacy systems with a lightweight agent that does not rely on signatures or scanning.
7.	Should support Windows Vista, Windows 7, Windows 8, Mac endpoints running OS X 10.10, OS X 10.11, 10.12, Windows server 3, windows server 8 and windows server 12 operating systems.
8.	Should support static analysis via machine learning for an instantaneous verdict for any unknown executable file before it is allowed to run. It should examine hundreds of the file's characteristics in a fraction of a second, without reliance on signatures, scanning or behavioral analysis.
9.	Should support inspection and analysis to rapidly detect unknown malware and automatically reprogram to prevent known malware by transforming it into known in about 5-10 minutes.
10.	Should support trusted publisher execution restrictions to identify executable files that are among the “unknown good” because they are published and digitally signed by trusted publishers
11.	Should support Exploit Kit Fingerprinting Protection to protect Windows endpoints from fingerprinting, a common technique used by exploit kits.

S. No	Specification
12.	Should support Child Process Protection for Windows endpoints for prevention against script-based attacks used to deliver malware such as ransomware.
13.	Should block malicious macros from running when launched from a Microsoft office process on Windows endpoints for the file formats: Microsoft Office 2003 to Office 2007—doc, xls Microsoft Office 2010 and later releases—docm, docx, xlsm, xlsx
14.	Should support protection of Mac endpoints from dylib hijacking attack.
15.	Should support Policy-Based Execution Restrictions to restrict specific execution scenarios, thereby reducing the attack surface of any environment.
16.	Should support admin override policies to define policies, based on the hash of an executable file, to control what is allowed to run in any environment and what is not. This fine-grained whitelisting (or blacklisting) capability controls the execution of any file, based on user-defined conditions that tie into any object that can be defined with Active Directory.
17.	Both the External security platform and End Point Malware Protection for Servers and Workstations solution should be from same OEM for the purpose of integration and effective protection at both the level.
18.	Should support Memory Corruption Prevention to prevent the exploitation techniques that manipulate the operating system's normal memory management mechanisms for the application that opens the weaponized data file containing the exploit.
19.	Should support Logic Flaw Prevention that recognizes and blocks the exploitation techniques that allow an exploit to manipulate the operating system's normal application process and execution mechanisms.
20.	Should prevent execution of attacker's commands that are embedded in the exploit file to recognize the exploitation techniques that allow the attacker's malicious code to execute and blocks them before they succeed.

S. No	Specification
21.	The solution should be from the same OEM as external threat Prevention solution and should support upto thousands of users and servers to address the requirements of future requirements.
22.	Same On-Premise appliance should be used by the Perimeter proposed security device and the end-point security device.
23.	It should prevent attempts by exploit kits before they begin, by blocking their initial vulnerability profiling actions.
24.	The Solution should draw intelligence from multiple resources, analyzes the collected intelligence and delivers prevent on controls to the end point solution. This integration should be automatic thus enabling department to block malware that has first been seen elsewhere by other.
25.	The Management software should be provided with the solution to manage the advance endpoint solution.

4. Software Defined Security Solution at DC and DR

S. No	Specification
1.	The proposed Firewall should be in Software Form factor and can be either present in the Virtualization/ Hypervisor layer or as a Virtual Machine and the proposed solution must allow single policy rule creation for application control, user based control, host profile, threat prevention, Anti-virus, file filtering, content filtering, QoS and scheduling at single place within a single rule and not at multiple locations. There must not be different places and options to define policy rules based on these parameters.
2.	The Solution must support identification and control of all types of applications (Business, Social, Encrypted and Custom) within the Network environment without requiring any license/subscription/blade. It should provide detailed analysis on sessions consumed, data transferred and threats involved through the applications.
3.	The proposed solution must allow free custom application signatures for Homegrown and custom applications (both current and future) that are running in the network.

S. No	Specification
4.	The solution must provide real time traffic logs based on applications irrespective of ports. While monitoring real time traffic logs, solution must provide detailed view of defence (attack identified) , Services , application and Users, not just ports and ip addresses. E.g. the solution must distinguish between telnet on port 80 and http traffic between same pair of source and destinations.
5.	The firewall should support following hypervisor and orchestration environments VMware NSX, ESXi vCloud Air Microsoft Azure Hyper-V Citrix NetScaler SDX Amazon Web Services KVM with optional support for the OpenStack plugin
6.	The Firewall must support application identification natively, without requiring any license/subscription/blade. There should not be any need to buy any license for application visibility and the must operate at Layer 7 natively.
7.	The solution must support Firewall, Application visibility and control, IPS, Anti-virus, Anti-malware from day one.
8.	The proposed solution must support Policy Based forwarding based on: - Zone - Source or Destination Address - Source or destination port - Application (not port based) - AD/LDAP user or User Group - Services or ports
9.	The solution should secure within virtual network, cyberthreats moving laterally from VM to VM in an east-west manner.
10.	The proposed solution must support different Custom IPS and Application policies for different users and groups.
11.	The proposed solution must support Customized DoS protection rules.
12.	Solution should support Session based load sharing (not packet based) over multiple equal cost paths. It should work with both static and dynamic routing.
13.	The device should be capable to identify and prevent in-progress phishing attacks by controlling sites to which users can submit corporate credentials based on the site's URL category thus blocking users from submitting credentials to untrusted sites while allowing users to continue to submit credentials to corporate and sanctioned sites.

S. No	Specification
14.	The proposed solution must support different actions in the policy such as deny, drop, reset client, reset server, reset both client and server.
15.	Solution should support Session based (not packet based) differentiated services code point (DSCP) classification.
16.	Solution must support end-to-end (firewall-to-client) priority policing and C2S & S2C direction enforcement.
17.	Solution must support Link Layer discovery protocol (LLDP) for simplified network management
18.	Solution must support IPv6 based site-to-site VPN tunnels
19.	Solution should correlate and detect hosts that have received malware, and have also exhibited command-and-control (C2) network behavior corresponding to the detected malware.
20.	Solution should correlate and detect hosts that have exhibited command-and-control (C2) network behavior corresponding to malware elsewhere on the network.
21.	Solution should detect probable exploit kit activity targeted at a host on the network. Exploit kits should be identified by a vulnerability exploit or exploit kit landing page signature, combined with either a malware download signature or a known command-and-control signature.
22.	Solution should correlate and detect likely compromised hosts based on activity that resembles command-and-control (C2) beaconing, such as repeated visits to dynamic DNS domains, repeated file downloads from the same location, generation of unknown traffic, etc.
23.	Solution must provide change control and baseline deviation mechanisms. It must provide visibility in traffic pattern changes in last one hour, one day and compare this with last one day, one week and one month traffic patterns.
24.	The proposed solution shall provide sandbox behavior based inspection and protection of unknown viruses and zero-day malware for any application and protocol (not limited to HTTP, SMTP, FTP) in future and the solution shall be able to provide automated signature generation for discovered zero-day malware and the solution should ensure the delivery of the signature in 5 mins from the time of detection. The analysis has to be done on premise and data should not go to cloud for analysis.
25.	The proposed solution shall support DNS-based signatures to detect specific DNS lookups for hostnames that have been associated with malware
26.	The solution must support minimum four level of decompression/decoding for any combination of decoding: ZIP, gzip, base64, chunked, encode.
27.	The solution must provide the ability to block files with multi-level-encoding with 5 or more level of compression e.g office file in 5 levels of zip.

S. No	Specification
28.	The proposed solution must support the ability to lock configuration while modifying it, avoiding administrator collision when there are multiple people configuring the appliance
29.	The proposed solution must support validation of policy for shadowed rules before rule application
30.	The proposed solution must support on appliance Per policy SSL and SSH decryption for both inbound and outbound traffic.
31.	The proposed must support on appliance SSL decryption policy based on IP, User, web category.
32.	The proposed solution shall support block and continue (i.e. allowing a user to access a web-site which potentially violates policy by presenting them a block page with a warning with a continue option allowing them to proceed for a certain time)
33.	The proposed solution should support the ability to create QoS policy on a per rule basis: -by source address -by destination address -by application (such as Skype, BitTorrent, YouTube, azureus) -by static or dynamic application groups (such as Instant Messaging or P2P groups) -by port and services
34.	The proposed solution shall support packet captures based on: -Applications -Unknown Applications -any threat -data-filters
35.	Solution should allow file blocking across all protocols not limited to http, smtp, imap, Pop3.
36.	The solution must provide a Single View on Known Threats, Hosts/Users visiting malicious URLs, Hosts/Users resolving malicious domains, applications involved in attacks, applications using non-standard ports, and detailed view on security policies allowing applications on non-standard ports.
37.	The solution must provide detailed Change monitor or baseline deviations applications, source and destinations. The change monitor dashboard must compare changes in applications, source and destinations in terms of percentage increase/decrease for last 15 mins/ 30 mins/ one hour/ one day against historical time period of 24 hours/ 7 days/ one month etc.
38.	The solution must provide detailed view on User Activity (along with source and destination IP) with granular view on Data transferred (bytes/sessions), threats associated with a user, Content and URLs accessed by User. This information must be available in Graphical as well as tabular format.
39.	OEM must provide performance, throughput and features evidence through public domains- Websites and data sheets. We reserve the right for asking the

S. No	Specification
	bidder to do a PoC that validates all technical compliance as submitted in the tender document.
	Performance Requirement
1.	The proposed Firewall should be in Software Form factor and can be either present in the Virtualization/ Hypervisor layer or as a Virtual Machine. It should offer preferably throughput of over 16 Gbps Per Physical Host/Server/Blade.
2.	The proposed solution should support at least 8 Gbps of performance with Firewall, application control, IPS, Anti-Virus, Anti-malware and Anti-bot enabled from day-1. The OEM must publish performance claims on public domain like websites, datasheets. Letter head performance claims will not be entertained.
3.	The proposed solution must support at least 10,00,000 concurrent sessions. The session count must be active TCP connections. The concurrent sessions must not drop while enabling all requested features.
4.	The proposed solution must support at least 100,000 new session per second.
5.	<i>The proposed solution must be in Leader's quadrant as per Gartner's Publication 'Magic Quadrant for Enterprise Network Firewall' for 2017.</i>

Annexure B

Engineering Instructions

Sub-section	Description
B-1	Engineering instructions for underground optical fibre cable laying works
B-2	Engineering instructions for installation of aerial optical fibre
B-3	Penalty for deviation from standard engineering instructions

ANNEXURE B**Sub-section B-1****Engineering instructions for underground optical fibre cable laying works****1. SCOPE**

- 1.1. The Engineering Instructions spelt out in this document deal with the methods to be adopted for underground Optical Fibre Cable laying in PLB HDPE ducts and termination of OF Cables at Gram Panchayats(GPs) for MahaNet-I (BharatNet-II)

2. OF CABLE LAYING APPROACH

- 2.1. On the basis of the survey reports done by PIA and further approved by MahalT, routes for OF cable laying shall be finalized. Road Cutting Permission shall be obtained from road and rail authorities for laying the Optical Fibre Cable along the finalized roads and at rail / road crossing along the route. Generally, OF Cable may preferably be laid straight as far as possible along the road near the boundaries, away from the burrow pits. When the OF Cable is laid along the National Highways, Cable should run along the road land boundary or at a minimum distance of 15 meters from the centre line of the road where the road land is wider as the OFC carries high capacity traffic and is planned for about 25 to 30 years of life. It is essential that the cable is laid after obtaining due permission from all the concerned authorities to avoid any damage (which may result in disruption of services / revenue loss) and shifting in near future due to their planned road widening works. For obtaining RoW MahalT will facilitate the PIA.
- 2.2. In special cases where it may be necessary to avoid burrow pits or low lying areas, the Cable may be laid underneath the shoulders at a distance of 0.6 meter from the outer edge of the road embankment provided the same is located at least 4.5 meters away from center line of road.

3. GENERAL**3.1. Soil Classification**

Soil shall be classified under two broad categories Rocky and Non Rocky, The soil is categorized as rocky if the cable trench cannot be dug without blasting and / or chiseling. All other types of soils shall be categorized as Non Rocky including Murrum & soil mixed with stone or soft rock.

3.1.1. Rocky soil.

The terrain which consists of hard rocks or boulders where blasting/ chiseling is required for trenching such as quartzite, granite, basalt in hilly areas and RCC (reinforcement to be cut through but not separated) and the like.

3.1.2. Non Rocky soils

This will include all types of soil- soft soil/hard soil/Murrum i.e. any strata, such as sand, gravel, loam, clay, mud, black cotton murrum, shingle, river or nullah bed boulders, soling of roads, paths etc. (All such soils shall be sub-classified as kachcha soil) and hard core, macadam surface of any description (water bound, grouted tarmac etc.), CC roads and pavements, bituminous roads, bridges, culverts (All such soils shall be classified as Pucca soils)

4. The Optical Fibre Cable shall be laid through PLB HDPE Ducts buried at a nominal depth of 165cm. The steps involved in OF Cable laying are as under

- 4.1. Excavation of trench up to a nominal depth of 165 cm in non-Rocky soil, according to construction specifications along National/State Highways/other roads and in built up /rural areas. Under exceptional conditions/ genuine circumstances due to site constraints/ soil conditions, relaxation can be granted by the competent authority for excavation of trench to a depth lesser than 165cm. Such relaxation shall be given as per the laid down norms/ procedures being set by MahalT and with the

approval of the competent authority. The payment in such cases shall be made on pro-rata basis as per the laid down norms adopted by the concerned MahalT.

- 4.2. Laying of PLB HDPE Ducts/coils coupled by sockets in excavated trenches, on bridges and culverts, as per construction specification and sealing of PLB HDPE Ducts pipe ends at every manhole by end-plugs of appropriate size.
- 4.3. Providing additional protection by R.C.C. Pipes/GI pipes and/or concreting/chambering, wherever required according to construction specification.
- 4.4. Fixing of GI pipes/troughs with clamps on culverts/bridges and/or chambering or concreting of G.I. Pipes/troughs, wherever necessary. Normally, RCC/DWC pipes shall be used and use of GI pipes shall be avoided. However, in case it is felt that GI pipe is unavoidable in certain circumstances this should be done with the prior approval of competent authority within the concerned MahalT. This shall be recorded appropriately.
- 4.5. Laying Protection Pipes on Bridges and Culverts. In case trenching and pipe laying is not possible on the culverts, the pipes shall be laid on the surface of the culverts/bridges after due permission from the competent authority as per construction specification
- 4.6. Back filling and Dressing of the Trench according to construction specifications.
- 4.7. Making manhole of size (2.0 m length x 1.0 m width x 1.4 m Depth) at every Cable pulling location for housing the OF Cable loop & Pulling Optical Fibre Cable using proper tools and accessories. Sealing of both ends of the PLB HDPE pipe in manhole by hard rubber bush of suitable size to avoid entry of rodents into the PLB HDPE Ducts, putting split PLB HDPE Ducts and split RCC pipes with proper fixtures over cable in the manhole to protect the bare cable.
- 4.8. Digging of pit of size 2 meter x 2 meter x 1.8 meter (depth) for fixing of Jointing chambered cast RCC cover or stone of suitable size on jointing chamber to protect the Joint and backfilling of jointing chamber with excavated soil.
- 4.9. Digging of pits 500 cm to 1000 cm towards jungle side at every manhole and jointing chamber along the route to a depth of 75cm fixing of route Indicator/joint indicator, concreting and backfilling of pits. Painting of route indicators with Blue colour and joint Indicator by Grey colour and sign writing denoting route/joint indicator number and Marking as per instruction of MahalT.

5. Specifications of Materials to be used

5.1 PLB HDPE Duct

Optical Fibre Cables should be pulled through Permanently Lubricated HDPE Duct of 40mm/33 mm size conforming to the specifications as per TEC GR No. TEC/GR/TX/CDS-008/03/MAR11 with latest Amendments. The Ducts shall be blue in colour and have the identification markings as per TEC GR wherein - logo specified by MahalT shall be marked as purchaser's name.

5.2 PLB HDPE Duct Accessories

5.2.1 Push fit Coupler

Push Fit couplers shall be used for coupling PLB HDPE ducts/coils. The specifications of the couplers shall be as per TECGR no TEC/GR/TX/CDS-008/03/Mar11 with latest amendments.

5.2.2 PP Rope

Should confirm to TEC GR No.TEC/GR/TX/CDS-008/03/MAR-11 with latest Amendments. However, this is optional and CPSUs may use the same on need basis. The PP rope can be ordered along with the PLB duct as required. In this case PP ropes drawn through the HDPE/PLB pipes/coils and safely tied to the end caps at either ends with hooks to facilitate pulling of the OF cables at a later stage. The rope used is 3 strands Polypropylene Para Pro rope having yellow

colour and size of 6 mm diameter. It should have a minimum breaking strength of 550 kgs. The length of each coil of rope should be 5 meter more than the standard length of duct(or as ordered) and it should conform to (i) BS 4928 Part-II of 1974 (ii) IS 5175 of 1982. It should be of special grade and should have ISI certificate mark. It should be manufactured out of industrial quality Polypropylene.

5.2.3 End cap

End Cap shall be used for sealing the ends of the empty ducts, prior to installation of the OF Cable and shall be fitted immediately after laying the duct to prevent the entry of any dirt, water, moisture, insects/rodents etc. It should conform to TEC GR No. TEC/GR/TX/CDS-008/03/MAR11with latest amendments. The ends of the PLB HDPE ducts/coils laid in the manholes should be closed with End Caps. The End Caps used should be suitable for closing40mm/33mm PLB HDPE ducts/coils. A suitable arrangement should be provided in the End Cap to tie PP Rope. (See figure-1 for details)

5.2.4 Cable sealing Plug

This shall be used to seal the end of the ducts perfectly, after the OF cable is pulled in the duct. For pulling the cable through the ducts, it is necessary to provide manholes at that location and also at bends and corners wherever required. The ends of the PLB HDPE ducts/coils are closed with Cable sealing Plugs. The End Plugs used should be suitable for closing40mm/33mm PLB HDPE ducts/coils. The Cable sealing plug shall confirm to TEC GR No. TEC/GR/TX/CDS008/03/MAR-11 with latest amendments.(Wherever blowing technique is used for laying OF Cable, at the discretion of the CPSUs concerned, the hand holes/manholes required for accessing the cable during cable laying can be at longer distances depending upon requirement.)

6. Material for Providing Additional Protection

- 6.1. RCC Full Round Pipes: Reinforced cement concrete pipes (spun type) coupled with RCC collars sealed with cement mortar used to provide additional protection to PLB HDPE Ducts/coils at lesser depths should be of full round, NP-2 class and size 100 mm (internal diameter), conforming to IS standard 458-1988 with latest amendments. The pipes should have a nominal length of 2 meters.
- 6.2. The RCC collars should be properly sealed using cement mortar 1:3 (1:53 grade cement of reputed brand, 3: fine sand without Impurities). If case of long spans, every third joint will be embedded in a concrete block of size 60 cm (L) x 40cm (W) x 25 cm (H) of 1:2:4 cement concrete mix (1: cement, 2: coarse sand, 4: stone aggregate of 20 mm nominal size) so that the alignment of RCC pipes remain firm and intact. Also, both ends of RCC pipes spans will be sealed by providing concrete block of size 40 cm (L) x 40 cm (W) x 25 cm (H) of 1:2:4 cement concrete mix to avoid entry of rodents.
- 6.3. RCC Split Pipes: The split Reinforced cement concrete pipes (spun type) with in-built collars are used to provide additional protection to PLB HDPE Ducts/coils should be of 100mm internal dia.(Spotted), Class--NP-3, Thickness: 25mm, Length: 2 Meters with inbuilt collar one end, Conforming to ISI Specification IS: 458, 1988 with latest amendment
- 6.4. G.I. Pipes: G.I. pipes should be of medium duty class having inner diameter of 50mm and should conform to specifications as per IS 554/1985 (revised up to date) IS 1989 (Part-I), 1900 Sockets (revised up to date) & IS 1239 (Part-II) 1992 (revised up to date).
- 6.5. DWC Pipes: Use of normal duty DWC (Double walled corrugated) HDPE pipe – confirming to TEC GR no.GR/DWC-34/01 Sep.2007 with latest amendments shall be preferably utilized as first choice for protection of Optical Fibre Cable instead of GI pipes. The DWC pipes used shall be of size 75/61mm as per table 2 of the said TEC GR.
- 6.6. M.S. Weld Mesh: The PLB HDPE Ducts can also be protected by embedding it in concrete of size of 25 cm x25 cm reinforced with MS weld mesh. The MS weld mesh used should be of 50 mm x 100mm size, 12 SWG, 120 cm in width in rolls of 50m each. One meter of MS weld mesh caters to approx. 3 meters of concreting. (See figure '2' for details). The strength of RCC/CC is dependent on proper curing, therefore, it is imperative that water content of CC/RCC mix does not drain out into the surrounding soil. In order to ensure this, the RCC/CC work should be carried out by covering all the

sides by yellow PVC sheets of weight not less than 1 kg per 8 sqm to avoid seepage of water into the soil.

- 6.7. Joint Chamber: The Joint chamber shall be provided at every joint location to keep the OF cable joint well protected and also to house extra length of cable which may be required in the event of faults at a later date. The Joint chamber shall be of pre-cast RCC type as per construction specification. Brick chamber can also be made with prior permission of MahalT.
- 6.8. Rubber Bush: To prevent entry of rodents into PLB HDPE DUCTS, the ends of PLB HDPE DUCTS are sealed at every manhole and joint using rodent resistant hard rubber bush (cap) after optical Fibre cable is pulled. The rubber bush should be manufactured from hard rubber with grooves and holes to fit into 40 mm PLB HDPE DUCTS pipe, so that it should be able to prevent the entry of insects, rodents, mud, and rainwater into the PLB HDPE DUCTS pipe. It should conform to TEC GR with latest amendments. (See Figure-3)

- 6.9. Route/Joint Indicator: The Route/Joint indicators are co-located with each manhole/joint chamber. In addition Route indicators are also to be placed where route changes direction like road crossings etc. Either RCC/Pre-cast or Stone based route indicators can be used. The detailed specification and design of the same shall be as per construction specification. Generally, Stone Route indicators shall be used for the MahaNet-I (BharatNet-II) project

7. EXACAVATION OF TRENCHES

7.1 Trenching

- 7.1.1 Location and Alignment of the Trench: In built up areas, the trench will normally follow the foot-path of the road except where it may have to come to the edge of the carriage way cutting across road with specific permissions from the concerned authorities maintaining the road (such permissions shall be obtained by the department as per MOU signed with respective State Govt.). Outside the built up limits the trench will normally follow the boundary of the roadside land. However, where the road side land is full of burrow pits or afforestation or when the cable has to cross culverts/ bridges or streams, the trench may come closer to the road edge or in some cases, over the embankment or shoulder of the Road (permissions for such deviations for cutting the embankment as well as shoulder of the road shall be obtained). The alignment of the trench will be decided by a responsible official of the MahalT

Once the alignment is marked, no deviation from the alignment is permissible except with the approval of MahalT. While marking the alignment only the centre line will be marked and the PIA shall set out all other work to ensure that, the excavated trench is as straight as possible. The PIA shall provide all necessary assistance and labour, at his own cost for marking the alignment. PIA shall remove all bushes, undergrowth, stumps, rocks and other obstacles to facilitate marking the centre line without any extra charges. It is to be ensured that minimum amount of bushes and shrubs shall be removed to clear the way and the PIA shall give all, consideration to the preservation of the trees.

The line-up of the trench must be such that PLB pipe(s) shall be laid in a straight line, both laterally as well as vertically except at locations where it has to necessarily take a bend because of change in the alignment or gradient of the trench, subject to the restrictions mentioned elsewhere.

- 7.1.2 Line-Up: The line-up of the trench must be such that PLB HDPE Ducts shall be laid in a straight line except at locations where it has to necessarily take a bend because of change in the alignment or gradient of the trench, subject to the restrictions mentioned elsewhere.

7.2 Method of Excavation

- 7.3 In built up areas, the PIA shall resort to use of manual labour / HDD only to ensure no damage is caused to any underground or surface installations belonging to other public utility services and/or private parties.
- 7.4 However, along the Highways and cross country there shall be no objection to the PIA resorting to mechanical means of excavation, provided that no underground installations existing the path of excavation, if any, are damaged.

- 7.5 There shall be no objection to resort to horizontal boring to bore a hole of required size and to push through G.I. Pipe (50 mm ID) through horizontal bore at road crossing or rail crossing or small hillocks etc.
- 7.6 All excavation operations shall include excavation and ‘getting out’. ‘Getting out’ shall include throwing the excavated materials at a distance of at least one meter or half the depth of excavation, whichever is more, clear off the edge of excavation. In all other cases ‘getting out’ shall include depositing the excavated materials as specified.
- 7.7 In Rocky strata excavation shall be carried out by use of electro mechanical means like breakers/ jack hammers or by blasting wherever permissible with express permission from the competent authority. If blasting operations are prohibited or not practicable, excavation in hard rock shall be done by chiselling/ jack hammers.
- 7.8 Trenching shall as far as possible be kept ahead of the laying of pipes. PIA shall exercise due care that the soil from trenching intended to be loose for back filling is not mixed with loose debris. While trenching, the PIA should not cause damage to any underground installations belonging to other agencies and any damage caused should be made good at his own cost and expense.
- 7.9 Necessary barricades, night lamps, warning board and required watchman shall be provided by the PIA to prevent any accident to pedestrians or vehicles. While carrying out the blasting operations, the PIA shall ensure adequate safety by cautioning the vehicular and other traffic. The PIA shall employ sufficient man-power for this with caution boards, flags, sign writings etc.
- 7.10 The PIA should provide sufficient width at the trench at all such places, where it is likely to cave in due to soil conditions without any extra payment. A minimum free clearance of 15 cm should be maintained above or below any existing underground installation. No extra payment will be made towards this. In order to prevent damage to PLB HDPE DUCTS over a period of time, due to the growth of trees, roots, bushes, etc., the PIA shall cut them when encountered in the path of alignment of trench without any additional charges.
- 7.11 In large burrow pits, excavation may be required to be carried out for more than 165 cm in-depth to keep gradient of bed less than 15 degrees with horizontal. If not possible as stated above, alignment of trench shall be changed to avoid burrow pit completely.

7.12 Depth and Size of the Trench

The depth of the trench from top of the surface shall not be less than 165 cm unless otherwise relaxation is granted by MahalIT under genuine circumstances.

In rocky terrain, less depth shall be allowed only in exceptional circumstances with additional protection where it is not possible to achieve the normal depth due to harsh terrain/ adverse site conditions encountered. This shall be done only with the approval of the MahalIT. This shall be properly documented. In all cases, the slope of the trench shall not be less than 15 degrees with the horizontal surface. The width of the trench shall normally be 45 cm at the top & 30 cm at the bottom.

In case, additional pipes (HDPE/GI/RCC Pipes) are to be laid in some stretches, the same shall be accommodated in this normal size trench.

When trenches are excavated in slopes, uneven ground and inclined portion, the lower edge shall be treated as top surface of land and depth of trench will be measured accordingly. In certain locations, such as uneven ground, hilly areas and all other Places, due to any reason whatsoever it can be ordered to excavate beyond standard depth of 165 cm to keep the bed of the trench as smooth as possible. Near the culverts, both ends of the culverts shall be excavated more than 165 cm to keep the gradient less than 15 degree with horizontal. For additional depth in excess of 165 cm, no additional payment shall be applicable.

If excavation is not possible to the minimum depth of 165 cm, as detailed above, full facts shall be brought to the notice of the MahalIT in writing giving details of location and reason for not being able to excavate that particular portion to the minimum depth.

Approval shall be granted by the MahalIT in writing under genuine circumstances. The decision of the MahalIT shall be final and binding on the PIA. All the relaxations granted as specified above shall be dealt with as per the laid down norms and procedure of MahalIT.

7.3.1. Dewatering:

The PIA shall be responsible for all necessary arrangements to remove or pump out water from trench. The PIA should survey the soil conditions encountered in the section and make his own

assessment about dewatering arrangement that may be necessary. No extra payment shall be admissible for this.

7.3.2. Wetting

Wherever the soil is hard due to dry weather conditions, if watering is to be done for wetting the soil to make it loose, the same shall be done by the PIA. No extra payment shall be admissible for this.

7.3.3. Blasting:

For excavation in hard rock, where blasting operations are considered necessary, the PIA shall obtain approval of the MahalT in writing for resorting to blasting operation. The PIA shall obtain license from the MahalT for undertaking blasting work as well as for obtaining and storing the explosive as per the Explosive Act, 1884 as amended up to date and the explosive Rules, 1983. The PIA shall purchase the explosives fuses, detonators, etc. only from a licensed dealer. Transportation and storage of explosive at site shall conform to the aforesaid Explosive Act and Explosive Rules. The PIA shall be responsible for the safe custody and proper accounting of the explosive materials. Fuses and detonators shall be stored separately and away from the explosives. The MahalT or his authorized representative shall have the right to check the PIA's store and account of explosives. The PIA shall provide necessary facilities for this. The PIA shall be responsible for any damage arising out of accident to workmen, public or property due to storage, transportation and use of explosive during blasting operation. Blasting operations shall be carried out under the supervision of a responsible authorized agent of the PIA (referred subsequently as agent only), during specified hours as approved in writing by the MahalT. The agent shall be conversant with the rules of blasting. All procedures and safety precautions for the use of explosives drilling and loading of explosives before and after shot firing and disposal of explosives shall be taken by the PIA as detailed in IS: 4081 safety code for blasting and related drilling operation.

7.3.4. Trenching Near Culverts/ Bridges:

The PLB HDPE Ducts shall be laid in the bed of culvert at the depth not less than 165 cm protected by RCC pipes as decided by MahalT. Both ends of culverts shall be excavated more than 165 cm in depth to keep the gradient of not less than 15 degree with horizontal. The bed of trench should be as smooth as possible.

7.3.5. While carrying out the work on bridges and culverts, adequate arrangement for cautioning the traffic by way of caution boards during day time and danger lights at night shall be provided .In case of small bridges and culverts, where there is a likelihood of their subsequent expansion and remodelling, the cable should be laid with some curve on both sides of the culvert or the bridge to make some extra length available for readjustment of the cable at the time of reconstruction of culvert or the bridge.

8. Laying OF PLB HDPE Ducts

After the trench is excavated to the specified depth, the bottom of the trench has to be cleared of all stones or pieces of rock and levelled up properly. A layer of soft soil/or sand (in case the excavated material contains sharp pieces of rock/stones) of not less than 5 cm is required for levelling the trench to ensure that the cable when laid will follow a straight alignment. Adequate care shall be exercised while laying so that the OF cables are not put to undue tension/pressure after being laid as this may adversely affect the optical characteristics of cables with passage of time.

The PIA shall ensure that trenching and pipe laying activities are continuous, without leaving patches or portions incomplete in between. In case intermediate patches are left, measurement of the completed portions will be taken only after work in such left over patches are also completed in all respects.

Preparatory to aligning the pipe for jointing, each length of the PLB HDPE Ducts shall be thoroughly cleaned to remove all sand, dust or any other debris that may clog, disturb or damage the optical Fibre cable when it is pulled at a later stage. The ends of each pipe and inside of each Socket shall be thoroughly cleaned of any dirt or other foreign materials.

After the trench is cleaned the PLB HDPE Ducts/Coil shall be laid in the cleaned trench, jointed with Sockets. Drawing up of PP rope is optional as per TEC GR. In case of use of PP Rope, at every manhole approximately at every 200m or at bends or turns the PP rope will be tied to the HDPE end caps used for sealing the PLB HDPE Ducts, to avoid entry of rodents/mud etc.

At the end of each day work, the open ends of the pipes sections shall be tightly closed with endcaps to prevent the entry of dirt/mud, water or any foreign matter into PLB HDPE Ducts until the work is resumed. In built up area falling within Municipal/Corporation limits, the PLB HDPE Ducts shall be laid with protection using RCC Pipes/ Concreting reinforced with weld mesh (only in exceptional cases).

For lesser depths requiring additional protection in built up areas, towns and cities falling within the municipal limits, suitable protection shall be provided to PLB HDPE pipes/coils using RCC/DWC full round/split pipes or GI pipes or cement concreting reinforced with MS weld mesh or a combination of any of these as per the site requirement. This shall be done only with the prior instructions/approval of the MahalT. The specifications for providing each of these protections are given later in this document.

Moreover, in cross country routes, if depth is less than 1.2 meters, protection by using RCC/DWC Pipe shall be provided. MahalT shall decide about such stretches and type of protection to be provided in view of the site requirements. Normally 100 mm RCC /DWC Pipes shall be used for protecting PLB HDPE Ducts but if more than one PLB pipe is to be laid and protected, RCC/DWC Pipe of suitable size to accommodate the required number of PLB Pipes shall be used.

The PLB HDPE Ducts shall be laid in RCC Full Round spun Pipes/GI Pipes as required at Road crossings. The RCC pipes/GI pipes shall extend at least 3 meters on either side of the road at Road crossings. At Road crossings, extra GI/PLB HDPE Ducts may be laid as per the direction of the MahalT. On Rail bridges and crossings, the PLB HDPE Ducts shall be encased in suitable cast iron as prescribed by the Railway Authorities.

Wherever RCC pipes are used for protection, the gaps between the RCC collars and the RCC pipes shall be sealed using cement mortar 1:3 (1:53 grade cement of reputed brand, 3: fine sand without impurities) to bar entry of rodents. Every third collar of RCC pipes (normally of 2 meters length) and also both ends of RCC Pipes will be embedded in a concrete block of size 40 cm (L)x 40 cm(W) x 25 cm (H) of 1:2:4 cement concrete mix (1:53 grade cement of reputed brand, 2: coarse sand, 3: stone aggregate of nominal size of 20 mm) so that the alignment of RCC pipes remain firm and intact and to avoid entry of rodents.

Wherever GI pipes are used, special care should be taken to ensure that G.I. Pipes are coupled properly with the sockets so as to avoid damage to PLB pipe and eventually the OF Cable in the event of pressure coming on the joint and G.I. Pipe joint giving its way. Rubber bushes shall be used at either ends of the GI pipes to protect PLB pipe. Both the ends of G.I. Pipe will be embedded in a concrete block of size 40 cm (L) x 40 cm ((W) x 25 cm (H) of 1:2:4 cement concrete mix (1:53 grade cement of reputed brand, 2: coarse sand, 3: stone aggregate of nominal size of 20 mm) so that the alignment of G.I. Pipes remain firm and intact and to avoid entry of rodents.

In case of protection by concreting at site, the nominal dimension of concreting shall be 250 mm x250 mm section. Cement Concrete Mixture used shall be of 1:2:4 composition i.e. 1:53 grade Cement of a reputed company, 2: Coarse Sand, 4: Graded Coarse Stone aggregate of 20 mm nominal size, reinforced with MS weld mesh. As the RCC is cast at site, it is imperative to ensure that special care is taken to see that proper curing arrangements are made with adequate supply of water. The PIA shall invariably use mechanical mixer at site for providing RCC protection, to ensure consistency of the mix.

For carrying out concreting work in trenches, yellow PVC sheets of width not less than 1.0 M and of weight not less than 1 kg. Per 8 sq. meters shall be spread and nailed on sides of the trench to form trapezoidal section for concreting in the cleaned trench, to avoid seepage of water into the soil.

A bed of cement concrete mixture of appropriate width and 75 mm thickness shall be laid on the PVC sheet, before laying PLB HDPE ducts. The PLB HDPE Ducts shall then be laid above this bed of concrete. After laying the PLB HDPE Ducts, MS weld mesh is wrapped around and tied and concrete mix is poured to form the cross sectional dimensions as instructed by the MahalT.

The strength of RCC is dependent on proper curing therefore, it is imperative that water content of RCC mix does not drain out into the surrounding soil. Portions where cement concreting has been carried out shall be cured with sufficient amount of water for reasonable time to harden the surface. After curing, refilling of the balance depth of the trench has to be carried out with excavated soil.

The PLB HDPE Ducts/RCC/GI Pipes shall be laid only in trenches accepted by MahalT or his representative. The PIA shall exercise due care to ensure that the PLB HDPE Ducts are not subjected to any damage or strain.

Water present in the trench at the time of laying the PLB HDPE Ducts shall be pumped out by the PIA before laying the pipes in the trench to ensure that no mud or water gets into the pipes, thus choking it.

In case of nallahs, which are dry for nine months in a year, the PLB HDPE Ducts shall be laid inside the RCC Pipes laid at a minimum depth of 165 cm, as instructed by the MahalT. The mechanical protection shall extend at least 5 meters beyond the bed of nallah on either side.

Notwithstanding anything contained in clauses referred above, the MahalT may order, based on special site requirements, that the PLB HDPE Ducts may be encased in reinforced cement concrete, as detailed, ibid. While laying the pipes, a gap of 2 M is kept at convenient locations approx. 200 m apart and at the bends and turns, which will be used as manholes during OF cable pulling. Ends of the PLB HDPE Ducts at the manholes shall be sealed using end caps after tying the PP rope to the end caps to avoid choking of the pipes. In a similar manner, manholes shall be kept while approaching bridges, road crossings etc., as instructed by the MahalT. The location of the manholes will be decided by the MahalT

8.1. Laying Protection Pipes on Bridges and Culverts:

In case trenching and pipe laying is not possible on the culverts, the pipes shall be laid on the surface of the culverts/bridges after due permission from the MahalT. Of late the bridge construction authorities are providing channel ducts on the footpaths on the bridges for various services. The RCC/DWC/ G.I. Pipes can be laid in these ducts for pulling cables. However, for laying cables on existing bridges, where duct arrangement does not exist, one of the following methods may be adopted.

8.1.1. In case of the Bridges/Culverts, where there are no ducts and where the cushion on the top of the Arch is 50 cm to 100 cm or more, G.I. Pipe (Carrying PLB HDPE pipe and cable) may be buried on the top of the Arch adjoining the parapet wall, by digging close to the wheel guards. Every precaution shall be taken to see that no damage occurs to the arch of the culvert. After burying the GI pipe, the excavated surface on the arch shall be restored.

8.1.2. Where the thickness of the Arch is less than 50 cm, the pipe must be buried under the wheel guard masonry and the wheel guard rebuilt.

8.1.3. If neither of the two methods is possible, the G.I. Pipes/GI Troughs must be clamped on the parapet wall with the clamps. If necessary, the pipes may be taken through the parapet wall at the ends where the wall diverges away from the road.

Methods cited in above clauses should be carried out under close supervision of Road authorities.

The surface to be concreted should be thoroughly cleaned and levelled before concreting. At both ends of the Bridges/Culverts, where the GI Pipes /GI Troughs slope down and get buried, the concreting should be extended sufficiently to ensure that no portion of the GI Pipes/GI Troughs is exposed as approved by the MahalT to protect the pipe/trough from any possible externally caused damage.

Where white wash/colour wash is existing on the Bridges/ Culverts, the same should also be carried out on the concreted portion to ensure uniformity.

9. Back Filling and Dressing of the Trench

Provided that the PLB HDPE pipes have been properly laid in the trench at the specified depth, the back filling operation shall follow as early as practicable. The earth used for filling shall be free from all roots, Grass, shrubs, vegetation, trees, saplings and any other kind of garbage or pebbles. The back filling operation shall be performed in such a manner so as to provide firm support under and above the pipes and to avoid bend or deformation of the PLB HDPE pipes when the pipes get loaded with the back filled earth.

At locations where the back filled materials contains stones/sharp objects which may cause injury to the PLB HDPE pipes and where the excavated or rock fragments are intended to refill the trench in whole or in part, the trench should be initially filled, with a layer of ordinary soil or loose earth (free from any stones/pebbles) not less than 10 cm thick over the pipes.

Back filling on public, roads, railway crossings, footpaths in city areas shall be performed immediately after laying the HDPE pipes. Back filling at such locations shall be thoroughly rammed, so as to ensure original condition so that it is safe for the road traffic. All excess soil/ material left on road/ footpath/railway crossing shall be removed by PIA. However, along the highways and in country side, the excess dug up material left over after refilling should be kept in a heap above over the trench. In city limits, at any given time not more than 50 Meters length of trench should be kept open and in all places where excavation has been done, no part of the trench should be kept open over night to avoid occurrence of any mishap or accident in darkness.

10. Restoration of Road Surface

Road restoration work to be made with bituminous macadam for semi grouting 50 mm thick and premix carpet surfacing 25 mm thick over the grouted surface (total up to 75 mm thick) including supply of asphalt etc. to evenly match the road, including consolidation and rolling as per standard specification of DSR 1997

Road restoration work with cement concrete 1:4:8 mix for thickness varying from 150 mm to 225 mm, including supply of concrete to be made to evenly match the road.

11. CABLE PULLING AND JOINING/SPLICING

11.1. CABLE PULLING

Manholes marked during PLB HDPE Ducts pipe laying of approx. size of 2.0 m length x 1.0 m width x 1.4 m depth shall be excavated for pulling the cables. There may be situations where addition manholes are required to be excavated, for some reasons, to facilitate smooth pulling of cable. Excavation of addition manholes will be carried out, without any extra cost. De-watering of the manhole, if required, will be carried out without any extra costs. Dewatering/ Degasification of the Ducts, if required, will be carried out without any extra costs.

The Optical Fibre cables are available in drums in lengths of approx. 2 km. The cables shall be blown / manually pulled (in exceptional cases) through already laid PLB HDPE DUCTS. This work is to be carried out under the strict supervision of site in-charge. It shall be ensured that during the blowing / pulling of Cable the tension is minimum and there is no damage to the Cable/Optical Fibres.

After pulling of the drum is completed, both ends of the PLB HDPE DUCTS pipe in each Manhole should be sealed by hard rodent resistant rubber bush, to avoid entry of rodents/mud into PLBHDPE Ducts.

The Manholes are prepared by providing 40 mm split PLB HDPE DUCTS pipe of 2.5 to 3m length and closing the split PLB HDPE Ducts by providing necessary clamps/ adhesive tape as per the directions of Mahait. Afterwards, the split/cut PLB HDPE DUCTS pipe are covered with 100 mm split RCC pipe of 2m length and sealing the ends of RCC pipe with lean cement solution for protecting bare cable in the manhole . After fixing of RCC Split Pipes necessary back filling/reinstatement and dressing of manholes should be carried out as referred under trenching. The location of the pulling manhole should be recorded for preparation of documentation.

11.2. Jointing/ Splicing

Optical Fibre Cable Joints will be at varying distances depending upon the incremental Fibre to be laid for connecting Panchayats. The 48 Fibres are to be spliced at every Joint & at both ends (Terminations) in the equipment room as directed by the Mahait. The Infrastructure required for cable splicing i.e.

- Splicing machine
- OTDR
- Optical talk set
- Toolkit etc

Will be arranged by the PIA and also any additional accessories. e. g. Engine etc. required at site for splicing will also be arranged by the PIA.

The Optical Fibre Cable thus jointed end-to-end will be tested by the MahalT/TPA officer of Acceptance Testing unit of the concerned MahalT for splice losses and transmission parameters as specified by MahalT and prevalent at that time. The through Optical Fibre should meet all the technical parameters, specified and no relaxation will be granted.

12. Construction of Jointing Chamber:

The joint chambers are provided at every joint to keep the OFC. joint well protected and also to keep extra length of cable, which may be, required to attend the faults at a later date. Jointing chambers are to be prepared at the Fibre Point of Interconnect (FPIO) or normally at distance of every 2 km. Actual location of jointing chamber depends on length of cable drum and appropriateness of location for carrying out jointing work. The location is finalized by MahalT.

The jointing chambers are constructed by way of fixing pre-cast RCC chambers/Brick Chambers and covers as per the instructions from MahalT.

12.1 Pre cast RCC chamber

For fixing pre cast RCC chamber, first a pit of size 2 m x 2 m x 1.8 m depth shall be required to be dug. Pre cast RCC chamber shall consist of three parts (i) round base plate of 140 cm diameter and 5 cm thickness in two halves (ii) full round RCC joint chamber with diameter of 120 cm and height of 100 cm and thickness of 5 cm (iii) round top cover will be in two halves with diameter of 140 cm and thickness of 5 cm having one handle for each half in centre and word 'MahalT OFC' engraved on it. (See figure '4'). After, fixing the pre cast RCC joint chamber, the joint chamber is filled with clean sand before closing. Back filling of joint chamber pit with excavated soil shall be carried out in the end.

12.2 Brick Chamber

For constructing brick chamber, first a pit of size 2m x2 mx1.8 m depth is shall be required to be dug, then, base of the chamber shall be made using concrete mix of 1:5:10 (1 cement, 5 coarse sand, 10 graded stone aggregate of 40mm nominal size) of size of 1.7m x 1.7 m and 0.15 m thickness. Wall of brick chamber should be constructed on this base having wall thickness of 9" using cement mortar mix of 1:5 (1: cement, 5: fine sand). The chamber should have internal dimensions of 1.2 m x 1.2 m and 1 m height. The bricks to be used for this purpose should be of size 9" x 4.5" x 3", best quality available and should have smooth rectangular shape with sharp corners and shall be uniform in colour and emit clear ringing sound when struck.

The joint chamber should be so constructed that PLB pipe ends remain protruding minimum 5 cm inside the chamber on completion of plastering. The PLB pipes should be embedded in wall in such a way that, the bottom brick should support the pipe and upper brick should be provided in a manner that PLB HDPE pipe remains free from the weight of the construction. The joint chamber should be plastered on all internal surfaces and top edges with cement mortar of 1:3 (1: cement, 3: coarse sand), 12 mm thick finished with a floating coat of complete cement as per standard. Pre-cast RCC slab with two handles to facilitate easy lifting, of size 0.7 m x 1.4 m and of thickness of 5 cm having one handle for each half in centre and word "OFC" engraved on it are to be used to cover the joint chamber. Two numbers of such slabs are required for one joint chamber. This pre-cast slab should be made of cement concrete mix of 1:2:4 (1: cement, 2: coarse sand, 4: stone aggregate 6 mm nominal size) reinforced with steel wire fabric 75 x 25 mm mesh of weight not less than 7.75 Kg per sq. Meter. The joint chamber is filled with clean sand before closing. Back filling of joint chamber pit with excavated soil shall be carried out in the end .

12.3 Fixing of Route Indicators / Joint Indicators

Pits shall be dug 500 cm to 1000 cm towards jungle side at every Manhole and Jointing chamber for fixing of Route/Joint Indicator. In addition, Route Indicators are also required to be placed where OF Cable changes directions like road crossing etc.

The pits for fixing the indicator shall be dug for a size of 60 cm x 60 cm and 75 cm (depth).

The indicator shall be secured in upright position by ramming with stone and murrum up to a depth of 60 cm and concreting in the ratio of 1:2:4 (1: cement, 2: coarse sand, 4 stone aggregate 20 mm nominal size) for the remaining portion of 15 cm. Necessary curing shall be carried out for the concreted structure with sufficient amount of water for reasonable time to harden the structure.

12.3.1. RCC/Pre cast Route Indicators

The route /joint indicator made of pre-cast RCC should have the following dimensions

Base - 250 mm x 150 mm Top - 200 mm x 75 mm Height - 1250 mm (See Figure '5')

12.3.2 Stone based Route Indicators

The route /joint indicators made of Sand/lime Stone Should have the following dimension. The word 'MahALT OFC' should be engraved on the Route/Joint indicators.

- Stone to be used (Sand/lime Stone)
- Indicator Top surface to be rounded Base 155 mm x 100 mm Upper 500 mm length to be Tapered width wise as shown in the drawing and homogeneously finished.
- Height 650mm (Straight) + 400 mm (Tapered)
- The route indicators should be engraved with word 'OFC' of size 80mm length & 50mm, width.
- Length 3.5 Ft., top 4"x4" dressed 1Ft. from top & tapered.

The Route indicators shall painted Blue and placed at 500 to 1000 cm away from the centre of the trench towards jungle side. The Joint indicators are placed at OFC joints and placed 500 to 1000 cm away from wall of the joint chamber facing jungle side and are painted Grey. The engraved word "MahALT OFC" should be painted in white, on route as well as joint indicators. Numbering of route indicators/joint indicators should also be done in white paint. The numbering scheme for route indicators will be Joint No./Route Indicator No. for that joint. For example, 2/6 marking on a route indicator means 6th route indicator after 2nd joint. Additional joints on account of faults at a later date should be given number of preceding joint with suffix A, B, C, and D. For example sign writing 2A on a joint indicator means, additional joint between joint No. 2 and 3. The numbering of existing route/joint indicator should not be disturbed on account of additional joints. Enamel paints of reputed brand should be used for painting and sign writing of route as well joint indicators.

The route and joint indicator shall be painted with primer before painting with oil paint. The material used should bear ISI mark. The size of each written letter should be at least 3.5 cm. The colours of painting and sign writing is as under:

- For Joint Indicator: Grey colour
- For Route Indicator: Blue colour
- For OFC & Nos: White colour.

13. Documentation

The documentation, consisting of the following shall be prepared for each Block and the Panchayats connected to the Block. 4 sets of documentation shall be provided both in Electronic format on CD as well as Hard binded copy.

13.1. Route Index Diagrams –

General: This diagram shall consist of Cable Route Details on Geographical Map drawn to scale with prominent land marks and alignment of cable with reference to road. This shall be prepared on A-3 sheets of 80 GSM.

13.2. Route Index Diagrams –Profile

These diagrams will contain

- Make and size of the cable.
- Offset of cable from centre of the road at every 10 meters
- Depth profile of Cable at every 10 meter;
- Details of protection with type of protection depicted on it;
- Location of culvert and bridges with their lengths and scheme of laying of PLB HDPE Ducts pipe thereon.
- Important landmarks to facilitate locating the cable in future; Location of Joints and pulling manholes.

These diagrams shall be prepared on A-4 sheets of 80 GSM. On one sheet profile of maximum 400 meters shall be given to ensure clarity.

13.3. Joint Location Diagram

This diagram will show

- Geographical location of all the joints.
- Depth of Joint Chamber covers from ground level
- Type of chamber (Brick/Pre-cast)
- Length of OF Cable kept inside the joint chamber from either direction. This shall be prepared on A-4 sheets of 80 GSM.

All the diagrams (1), (2) & (3) shall bear the signatures of the PIA, the MahalIT as a proof of accuracy of the details. The diagrams shall be bound in A-4 size book with cover.

The cover sheets shall be of 110 GSM and laminated. The front cover shall have the following details.

- I. Name of the State/District/Block
- II. Name of the Panchayats connected
- III. Name of the MahalIT with logo
- IV. Name of the PIA
- V. Date of commencement of work XVI. Date of completion of work

For each Block 1 sets of above mentioned document shall be submitted to MahalIT.

14. SAFETY PRECAUTIONS

14.1. Safety Precautions when excavating or working in excavations close to electric cables :

The Officer in charge (MahalIT) of the work should get full information from Electricity undertaking regarding any electric cables, which are known or suspected to exist near the proposed excavation and unless this is done, excavation should not be carried out in the section concerned. The electricity undertaking should be asked to send a representative and work should be preceded with close consultation with them.

Only wooden handled hand tools should be used until the electric cables have been completely exposed. Power Cables, not laid in conduits, are usually protected from above by a cover slab of concrete, brick or stone. They may or may not be protected on the sides. It is safer, therefore, always to drive the point of the pick axe downwards then uncovering a cable, so that there is less chance of missing such warning slabs. No workman should be permitted to work alone where there are electric cables involved. At least one more man should be working nearby so that help can be given quickly in case of an accident. If disconnection of power could be arranged in that section it will be better. No electric cables shall be moved or altered without the consent of the Electric Authority and they should be contacted to do the needful. If an electric cable is damaged even slightly, it should be reported to the Electric Authority and any warning bricks disturbed during excavation should be replaced while back filling the trench. Before driving a spike into the ground, the presence of other underground properties should be checked. Information on plans regarding the location of power cables need not to be assumed as wholly accurate. Full precautions should be taken in the vicinity until the power cable is uncovered. All electric cables should be regarded

as being live and consequently dangerous. Any power is generally dangerous, even low voltage proving fatal in several cases.

14.1. Electric shock-Action and treatment :

Free the victim from the contact as quickly as possible. He should be jerked away from the live conductors by dry timber, dry rope or dry clothing. Care should be taken not to touch with bare hands as his body may be energized while in contact. Artificial respiration should begin immediately to restore breathing even if life appears to be extinct. Every moment of delay is serious, so, in the meanwhile, a doctor should be called for.

14.2. Safety Precautions while working in public street and along railway lines :

Where a road or footpath is to be opened up in the course of work, special care should be taken to see that proper protection is provided to prevent any accidents from occurring. Excavation work should be done in such a manner that it will not unduly cause inconvenience to pedestrians or occupants of buildings or obstruct road traffic. Suitable bridges over open trenches should be so planned that these are required for the minimum possible time. Where bridges are constructed to accommodate vehicular traffic and is done near or on railway property, it should be with the full consent and knowledge of the competent railway authorities.

14.3. Danger from falling material

Care should be taken to see that apparatus, tools or other excavating implements or excavated materials are not left in a dangerous or insecure position so as to fall or be knocked into the trench thereby injuring any workman who may be working inside the trench.

14.4. Care when working in Excavations

Jumping into a trench is dangerous. If it is deep, workmen should be encouraged to lower themselves. Workers should work at safe distance so as to avoid striking each other accidentally with tools. If the walls of the trench contain glass bits, corroded wire or sharp objects they should be removed carefully. If an obstruction is encountered, it should be carefully uncovered and protected if necessary. If an obstruction is encountered, it should be carefully uncovered and protected if necessary. Care must be taken to see that excavated material is not left in such a position that it is likely to cause any accident or obstruction to a roadway or waterway. If possible the excavated material should be put between the workmen and the traffic without encroaching too much on the road.

14.5. Danger of cave in

When working in deep trenches in loose soil, timbering up/shoring the sides will prevent soil subsidence. The excavated material should be kept at sufficient distance from the edge of the trencher pit. Vehicles or heavy equipment must not be permitted to approach too close to the excavation.

When making tunnelled opening, it should be ensured that the soil is compact enough to prevent cave in even under adverse conditions of traffic. Extra care should be taken while excavating near the foundations of buildings or retaining walls. In such cases, excavation should be done gradually and as far as possible in the presence of the owners of the property.

14.6. Protection of Excavations

Excavations in populated areas, which are not likely to be filled up on the same day should be protected by barriers or other effective means of preventing accidents and the location of all such openings must in any event be indicated by red flags or other suitable warning signs. During the hours from dusk to dawn, adequate number of red warning lamps should be displayed.

Supervisory officers should ensure that all excavations are adequately protected in this manner as serious risk and responsibility is involved. Notwithstanding adoption of the above mentioned precautions, works involving excavations should be so arranged as to keep the extent of opened ground and the time to open it to a minimum.

14.7. Precautions while working on roads

The period between half an hour after sun-set and half an hour before sunrise, and any period of fog or abnormal darkness may also be considered as night for the purpose of these instructions, for the purpose of providing the warning signs.

Excavation liable to cause danger to vehicles or the public must at all times be protected with fencing of rope tied to strong uprights or bamboo poles at suitable height or by some other effective means. Any such temporary erection which is likely to cause obstructions and which is not readily visible should be marked by posts carrying red flags or boards with a red background by day and by continuously lighted lamps at night.

The flags and the lamps should be placed in conspicuous positions so as to indicate the pedestrians and drivers of vehicles the full expanse i.e. both width and length of the obstruction. The distance between lamps or between floors should not generally exceed 1.25 m along the width and 6m along length of the obstruction in non-congested areas, but 4 meters along the length in congested areas.

If the excavation is extensive, sufficient notice to give adequate warning of the danger, should be displayed consciously not less than 1.25 m above the ground and close to the excavation. Where any excavation is not clearly visible for a distance of 25m to traffic approaching from any direction or any part of the carriage way of the road in which the excavation exists, a warning notice should be placed on the kerb or edge of all such roads from which the excavation or as near the distance as is practicable but not less than 10 m from the junction of an entering or intersecting road in which the excavation exists. All warnings, in these should have a red background and should be clearly visible and legible. All warning lamps should exhibit a red light, but white lights may be used in addition to facilitate working at night. Wherever required a passage for pedestrians with footbridge should be provided. At excavations, cable drums, tools and all materials likely to offer obstructions should be properly folded round and protected. This applies to jointer's tents as well. Leads, hoses etc. stretched and across the carriageway should be guarded adequately for their own protection and also that of the public.

14.8. Traffic Control

The police authorities are normally responsible for the control of traffic and may require the setting up of traffic controls to reduce the inconvenience occasioned by establishment of a single line of traffic due to restriction in road width or any other form of obstruction caused by the work. As far as possible, such arrangements should be settled in advance. If there are any specific regulations imposed by the local authorities, these should be followed.

14.9. Work along Railway Lines

Normally all works at Railway crossing is to be done under supervision of the railway authorities concerned, but it is to be borne in mind that use of white, red or green flags by the Departmental staff is positively forbidden to be used when working along a railway line as this practice may cause an accident through engine drivers mistaking them for railway signals. When working along double line of railway, the men should be warned to keep a sharp look on both the "UP" and "DOWN" lines to avoid the possibility of any accident when trains pass or happen to cross one another near the work spot.

14.10. Procedure and Safety Precautions for use of explosives during blasting for trenching

In areas where the cable trench cannot be done manually on account of boulders and rocks, it is necessary to blast the rocks by using suitable explosives. The quality of explosive to be used depends on the nature of the rocks and the kind of boulders. A few types of explosive fuses and detonators normally used for making trenches for cable works are detailed below:

- Gun powder
- Nitrate Mixture III.
- Gelatine
- Safety fuse
- Electric Detonator
- Ordinary Detonator

14.10.1. Procedure

A detailed survey of the route is to be done to assess the length of the section where trenching is to be done with the help of blasting. A route diagram of the rocky section may be prepared indicating the length of the route where the explosives are to be used. For the purpose of obtaining license, a longer length of route should be given in the application as in many cases, after digging, rocks appear which was not initially anticipated.

Next a license will have to be obtained for use and storing of explosive in that section. If the area falls under a police commissioner, the authority for granting such license is the police commissioner of the concerned area. When the route does not fall in the jurisdiction of a police commissioner, the authority for issuing license is the District Magistrate.

The concerned MahalT authority should be applied in prescribed form with a route map. The concerned authority will make an enquiry and issue license for using/storing explosives for cables trenching work. Such license will be valid for 15 days only. The license should be got renewed if the blasting operation needs to be extended. Once the license is granted, it is the responsibility of the holders of the license for the proper use of explosives, its transportation and storing.

14.10.2. Method of using

The safest explosive is the Gelatin and electric detonator. Gelatin is in the form of a stick. Electric detonator is a type of fuse used for firing the explosive electrically. Holes are made at suitable intervals on rocky terrain or boulders either by air compressor or by manual chipping. The depth of the holes should be 2 to 3 ft. Fill up the holes with small quantity of sand for about 6". First the electric detonator is to be inserted into the Gelatin and the Gelatin is to be inserted into the holes keeping the + ve and - ve wirings of electric detonators outside the holes. Again refill the holes with sand. These +ve and -ve insulated wires of detonator are then extended and finally connected to an EXPLoder kept at a distance of not less than 100 m.

Now the explosive is ready for blasting. But, before connecting wires to exploder for blasting, all necessary precautions for stopping the traffic, use of red flags, exchange of caution signals, etc. should be completed and only then Exploder should be connected and operated.

14.10.3. Operation of exploder (IDL schaffler type 350 type exploder)

The type 350 blasting machine consists of a bearing block with blasting machine system and the explosion proof light-alloy injection moulded housing. The exploder is held with the left hand. The twist handle is applied to the drive pin, clapped with the right hand turned in the clock wise direction in continuous measurements at the highest speed from the initial position until it reached to a stop. At this stage an indication lamp will glow. When the indication lamp glows, "press button switch" should be pressed. This will extend the electric current to detonator and Gelatin will be detonated. The rock will be blasted out of the trench. Number of holes can be blasted in a single stroke by connecting all such detonators in series connection and finally to the exploder. After blasting, again mazdoors are engaged on the work to clear the debris. If the result of the first blasting is not satisfactory, it should be repeated again on the same place.

14.10.4. Warning

There may be two reasons for unsatisfactory results of the blasting

- a) Misfire of Gelatin due to leakage of current from detonator.
- b) Over loading because of overburdens.
- c) Never pull the broken wire pieces from the holes in such cases. Attempt should not be made to reblast the misfired Gelatin. The safest way is to make a fresh hole by its side and put fresh Gelatin in that hole and blast it.

14.11. Precautions

The abstract of Explosives Rules 1983 which are relevant to our work is given below:

14.11.1. Restriction of delivery and dispatch of explosives

No person shall deliver or dispatch any explosives to anyone other than a person who is the holder of a license to possess the explosives or the agent of a holder of such a license duly authorized by him in writing on his behalf?

OR

Is entitled under these rules to possess the explosives without a license.

The explosives so delivered or dispatched shall in no case exceed the quantity, which the person to whom they are delivered or dispatched is authorized to possess with or without a license under these rules.

No person shall receive explosives from any person other than the holder of a license granted under these rules. No person shall receive from or transfer explosives to any person for a temporary storage or safe custody in a licensed premise unless prior approval is obtained from the Chief Controller.

A person holding license for possession of explosives granted under these rules shall store the explosives only in premises specified in the license.

14.11.2. Protection from Lightning During Storing

Every magazine shall have attached there to one or more efficient lightning conductors designed and erected in accordance with the specification laid down in Indian Standard Specifications No.2309 as amended from time to time. The connections to various parts of earth resistance of the lightning conductor terminal on the building to the earth shall be tested at least once in every year by a qualified electrical engineer or any other competent person holding a certificate of competency in this behalf from the State Electricity Department. A certificate showing the results of such tests and the date of the last test shall be hung up in conspicuous place in the building.

14.11.3. Precautions during thunder-storm

When a thunder- storm appears to be imminent in the vicinity of a magazine or store house every person engaged in or around such magazine and store house shall be withdrawn to a safe distance from such magazine or store house and the magazine and store house shall be kept closed and locked until the thunder storm has ceased or the threat of it has passed.

14.11.4. Maintenance of records

Every person holding a license granted under these rules for possession, sale or use of explosives shall maintain records in the prescribed form and shall produce such record on demand to an Inspection Officer.

14.11.5. Explosives not to be kept in damaged boxes

The licensee of every magazine or store house shall ensure that, the explosives are always kept in their original outer package. In case, the outer package gets damaged so that the explosive contained therein cannot be stored or transported, such explosives shall be repacked only after the same are examined by controller of explosives.

14.11.6. Storage of explosives in excess of the licensed quantity

The quantity of any kind of explosives kept in any licensed magazine or store house shall not exceed the quantity entered in the license against such kind of explosives. No explosives in excess of the licensed quantity shall be stored in the magazine or store house unless a permit in this behalf is obtained from the licensing authority by a letter or telegram.

14.11.7. Precautions to be observed at Site

The electric power at the blasting site shall be discontinued as far as practicable before charging the explosives. No work other than that associated with the charging operations shall be carried

out within 10 meters of the holes unless otherwise specified to the contrary by the licensing authority.

When charging is completed, any surplus explosive detonators and fuses shall be removed from the vicinity of the hole and stored at a distance which should prevent accidental detonation in the event of a charge detonating prematurely in any hole. The holes which have been charged with explosive shall not be left unattended till the blasting is completed. Care shall be taken to ensure that fuse or wires connected to the detonation are not damaged during the placing of stemming materials and tamping.

14.11.8. Suitable warning procedure to be maintained

The licensee or a person appointed by the licensee to be in charge of the use of explosives at the site shall lay down a clear warning procedure consisting of warning signs and suitable signals and all persons employed in the area shall be made fully conversant with such signs and signals.

14.11.9. Precautions to be observed while firing

The end of the safety fuse (if used in place of a detonator should be freshly cut before being lighted. The exploders shall be regularly tested and maintained in a fit condition for use in firing. An exploder shall not be used for firing a circuit above its rated capacity. The electric circuits shall be tested for continuity before firing. All persons other than the shot-firer and his assistant, if any, shall be withdrawn from the site before testing the continuity.

For the purpose of jointing, the ends of all wires and cables should have the insulation removed for a maximum length of 5 cm. and should, then be made clear and bright for a minimum length of 2.5 cm. and the ends to be joined should be twisted together so as to have a positive metal contact.

Then these should be taped with insulation to avoid leakage when in contact with earth. In case of blasting with dynamite or any other high explosive, the position of all the bore holes to be drilled shall be marked in circles with white paint. These shall be inspected by the PIA's agent. Bore holes shall be of a size that the cartridge can easily pass down. After the drilling operation, the agent shall inspect the holes to ensure that drilling has been done only at the marked locations and no extra hole has been drilled. The agent shall then prepare the necessary charge separately for each bore hole. The bore holes shall be thoroughly cleaned before a cartridge is inserted. Only cylindrical wooden tamping rods shall be used for tamping. Metal rods or rods having pointed end shall never be used for tamping. One cartridge shall be placed in the bore hole and gently pressed but not rammed down. Other cartridges shall then be added as may be required to make up the necessary charge for the bore hole. The top most cartridge shall be connected to the detonator which shall in turn be connected to the safety fuses of required length. All fuses shall be cut to the length required before being inserted into the holes. Joints in fuses shall be avoided.

Where joints are unavoidable, a semi-circular niche shall be cut in one piece inserted into the niche. The two pieces shall then be wrapped together with string. All joints exposed to dampness shall be wrapped with rubber tape.

The maximum of eight bore holes shall be loaded and fired at one occasion. The charges shall be fired successively and not simultaneously. Immediately before firing, warning shall be given and the agent shall see that all persons have retired to a place of safety. The fuses of the charged holes shall be ignited in the presence of the agent, who shall see that all the fuses are properly ignited.

Careful count shall be kept by the agent and other of each blast as it explodes. In case all the charged bore holes have exploded, the agent shall inspect the site soon after the blast but in case of misfire the agent shall inspect the site after half an hour and mark red crosses (X) over the holes which have not exploded. During this interval of half an hour, nobody shall approach the misfired holes. No driller shall work near such bore until either of the following operations has been done by the agent for the misfired boreholes.

The PIA's agent shall very carefully (when the tamping is a damp clay) extract the tamping with a wooden scraper and withdraw the primer and detonator.

The holes shall be cleaned for 30 cm of tamping and its direction ascertained by placing a stick in the hole. Another hole shall then be drilled 15 cm away and parallel to it. This hole shall be charged and fired. The misfired holes shall also explode along with the new one.

Before leaving the site of work, the agent of one shift shall inform the agent relieving him for the next shift, of any case of misfire and each such location shall be jointly inspected and the action to be taken in the matter shall be explained to the relieving agent. The Mahait shall also be informed by the agent of all cases of misfire, their cause and steps taken in that connection.

14.11.10. General Precautions

For the safety of persons red flags shall be prominently displayed around the area where blasting operations are to be carried out. All the workers at site, except those who actually ignite the fuse, shall withdraw to a safe distance of at least 200 metre from the blasting site. Audio warning by blowing whistle shall be given before igniting the fuse.

Blasting work shall be done under careful supervision and trained personnel shall be employed. Blasting shall not be done within 200 meters of an existing structure, unless specifically permitted by the Mahait in writing.

14.11.11. Precautions against misfire

The safety fuse shall be cut in an oblique direction with a knife. All saw dust shall be cleared form inside of the detonator. This can be done by blowing down the detonator and tapping the open end. No tools shall be inserted into the detonator for this purpose. If there is water present or if the borehole is damp, the junction of the fuse and detonator shall be made water tight by means of tough grease or any other suitable material. The detonator shall be inserted into the cartridge so that about one-third of the copper tube is left exposed outside the explosive. The safety fuse just above the detonator shall be securely tied in position in the cartridge. Waster proof fuse only shall be used in the damp borehole or when water is present in the borehole. If a misfire has been found to be due to defective fuse, detonator or dynamite, the entire consignment from which the fuse, detonator or dynamite was taken shall be got inspected by the Mahait or his authorized representative before resuming the blasting or returning the consignment.

14.11.12. Precaution against stray currents

Where electrically operated equipment is used in locations having conductive ground or continuous metal objects, tests shall be made for stray current to ensure that electrical firing can proceed safely.

15. ALLIED ACTIVITIES

- 15.1. Storing/Warehousing of Materials: PIA will be responsible for storing and warehousing of all the material and accessories, but not limited to, supplied by him at his own cost. No storing/warehouse shall be provided by Mahait.
- 15.2. Transportation of Materials: The PIA shall be responsible for transporting the materials, to be supplied by the Mahait or otherwise to execute the work under the contract, to site at his/ their own cost. The costs of transportation are subsumed in the standard quoted Rates and therefore no separate charges are payable on this account.
- 15.3. Disposal of Empty Cable Drums: The PIA shall be responsible to dispose of the empty cable drums after laying of the cables. The cost of various sizes of empty cable drums recoverable from the PIA will be fixed taking into account the prevailing market rates.
- 15.3.1. It shall be obligatory on part of the PIA to dispose of the empty cable drums at his/their level and the amount fixed for various empty cable drums shall be recovered from the bill for the

work for which the drum (s) was/were issued or from any other amount due to the PIA or the Security Deposit.

- 15.3.2. The PIA shall not be allowed to dump the empty cable drums in Govt. /Public place which may cause inconvenience to the MahalT / public. If the PIA does not dispose of the empty cable drums within 3 days of becoming it empty, the MahalT shall be at liberty to dispose off the drums in any manner deemed fit and also recover the amount fixed in this contract from the bill/security deposit/ any other amount due to the PIA.
- 15.4. Supply of Materials: There are some materials (Accessories) other than as mention in BoQ required to be supplied by the PIA for execution of work under this contract like Bricks, Cement, Wire Mesh and Steel for protection, etc., besides using other consumables which do/don't become the part of the asset. The PIA shall ensure that the materials supplied are of best quality and workmanship and shall be strictly in an accordance with the specifications.
- 15.5. Social auditing: While carrying out the execution work of cable/Eqpt. ,videography may be carried out on sample basis for duration of 15 to 30 minutes per Gram Panchayat which may also involve the local people of the Gram Panchayats and villages including the Gram Panchayat Pradhan (If possible) and same may be submitted in a form of CD along with the documentation sets for information.

Note: All the materials as above have to be TSEC/Type approved by BSNL QA/TEC against mentioned TEC GR or as per the approval procedure of MahalT for which TEC GR not there.

Figure 1
HDPE END CAPS

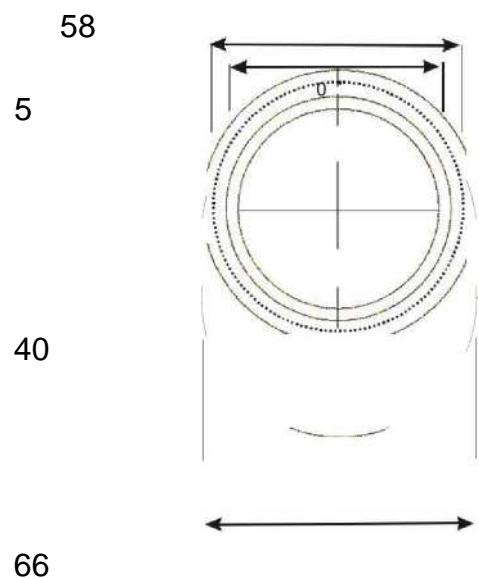
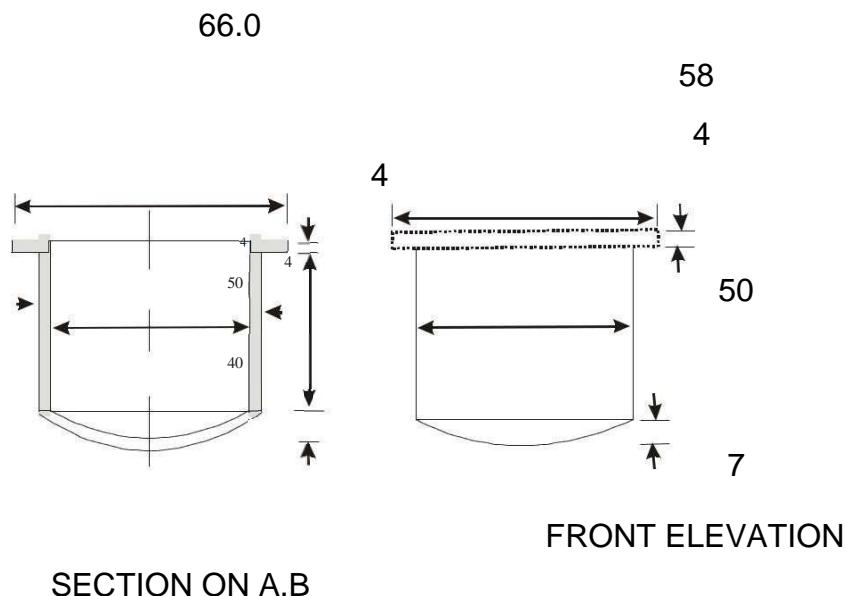
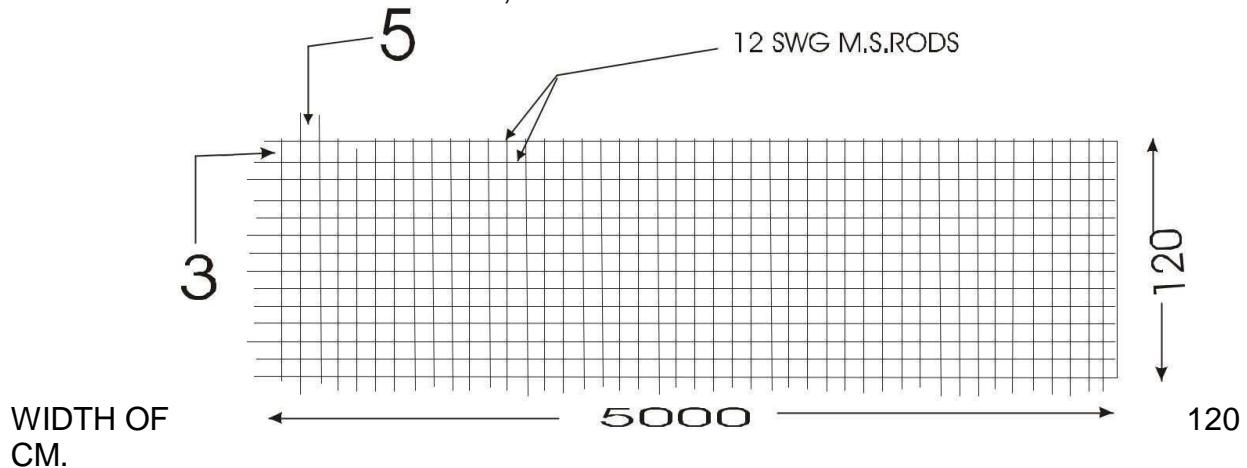


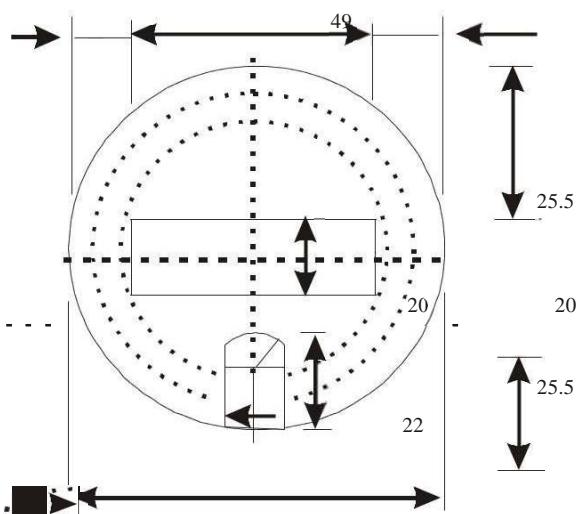
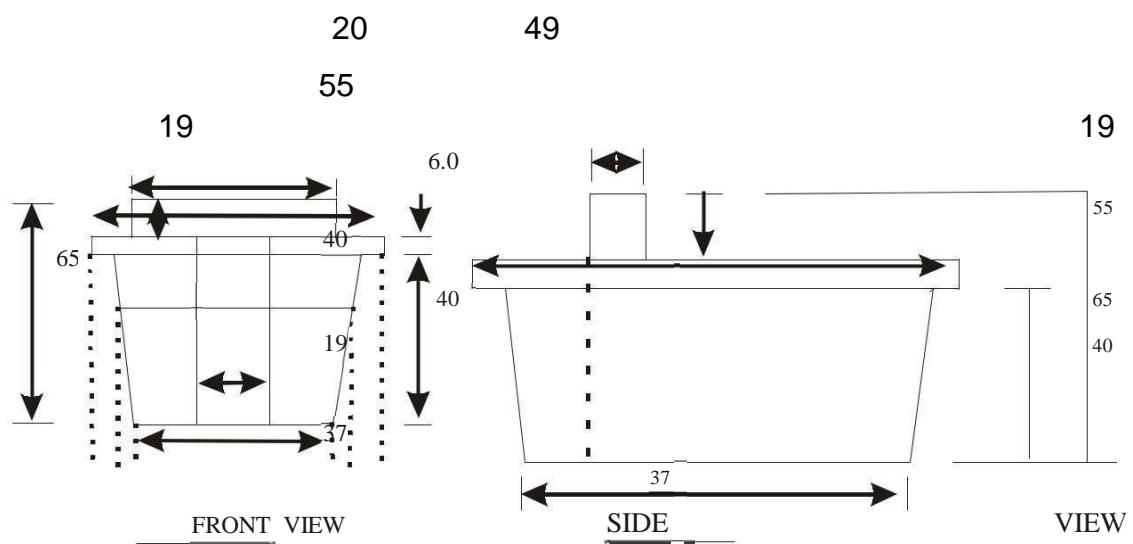
Figure2
M.S. WELDMESH

DETAILS OF 100 MM X 50 MM, 12 SWG MILD STEEL WELD MESH HAVING



Note: All measurements are in centimetres.

Figure 3
Rubber Cork

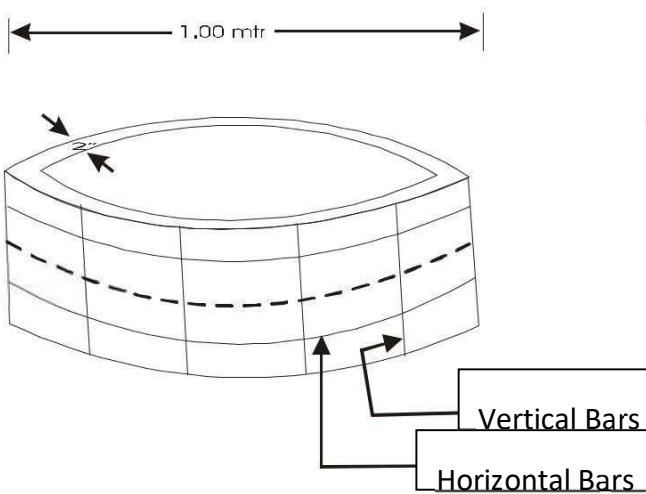


55

TOP VIEW

NOTE:

1. ALL DIMENSIONS ARE IN MM.
2. DIMENSIONS ARE ONLY FOR GUIDANCE. TAPPER SHOULD BE SUCH THAT IT SHOULD TIGHTLY FIX. INTO TYPE A & TYPE B HOPE 50 mm OO PIPES.

Figure 4**SPECIFICATION AND REINFORCEMENT DETAILS OF R.C.C. JOINT PROTECTION CHAMBERS****R.C.C. COLLAR**

Concrete 'Mix. 1:2:3
Cement : 2 Sand : 3
graded Stone aggregate 20 mm nominal size.
b) Finishing : Smooth

Specifications:

1. Diameter: 1.0 Mtr (Inner)
2. Thickness: 25 cm
3. Height : 50 cm.
4. 6 mm Horizontal Iron round rings 4 Nos
5. 6 mm vertical bars Iron 12 mm Nos
6. 12 gauge GI wire mesh to be wrapped before reinforcing the concrete.

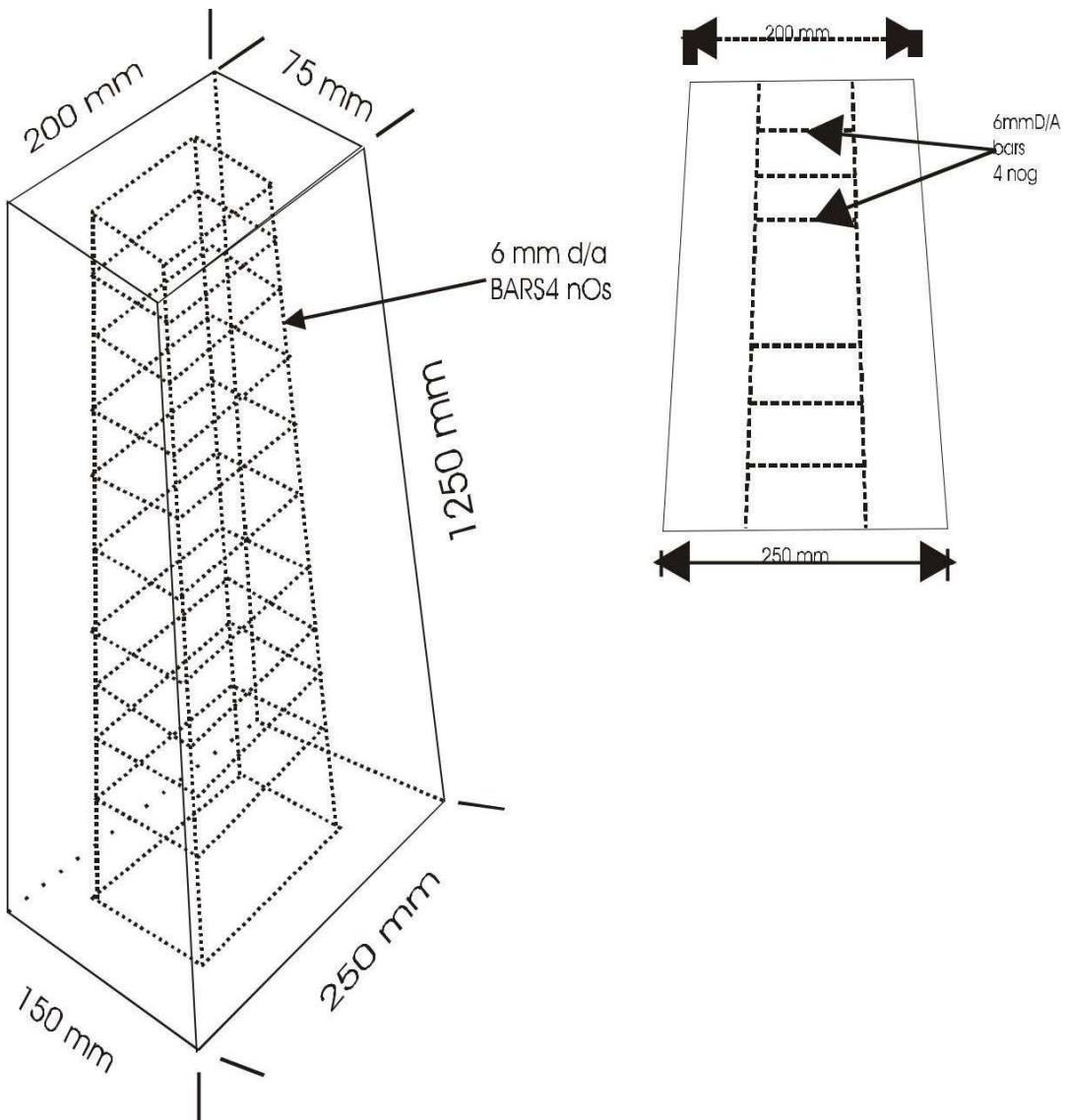
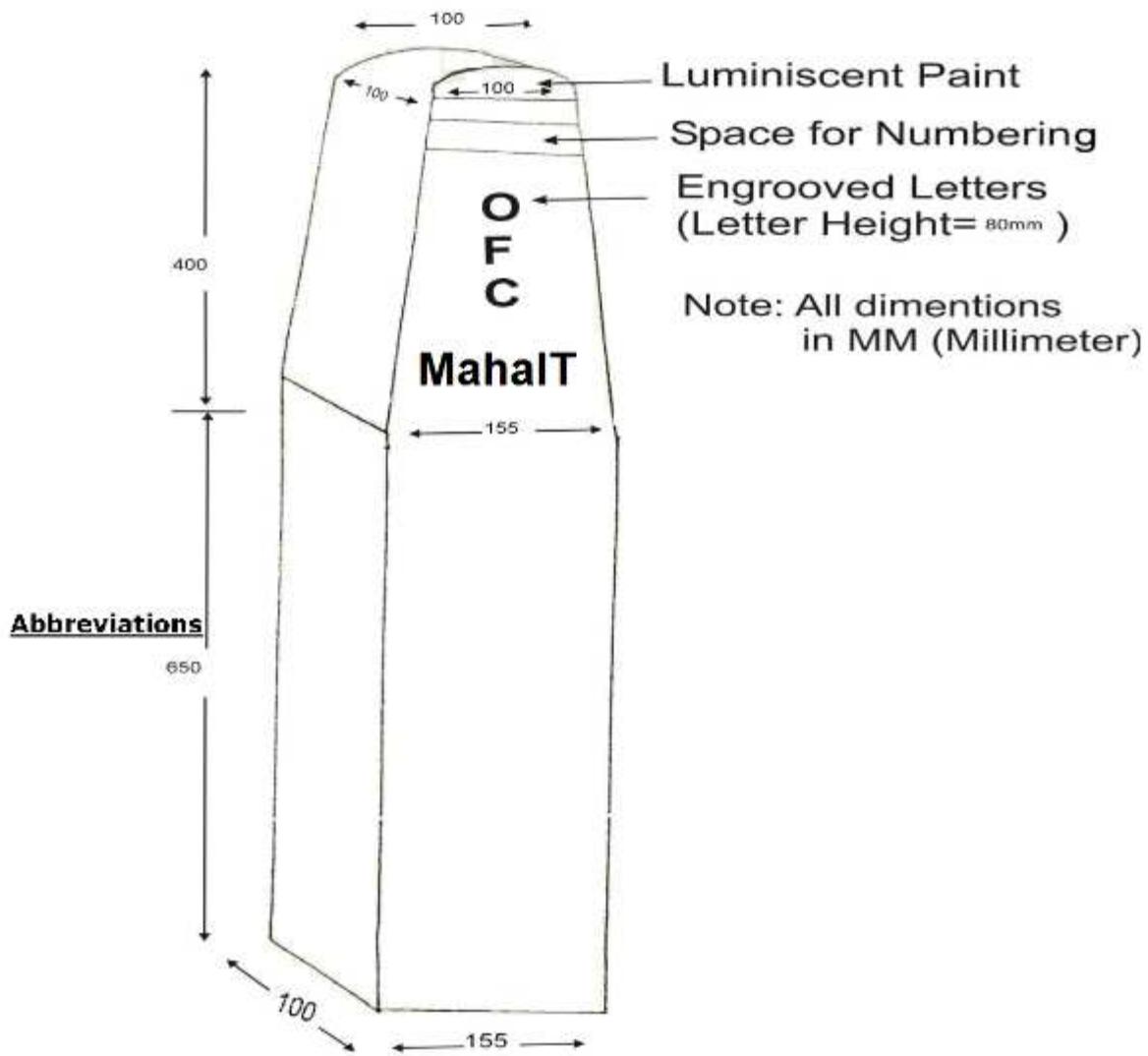
Figure 5**RCC Route Indicator**

Figure 6**1. Stone OFC Route Indicator**

Sub-section B-2**Engineering instructions for installation of Aerial optical fibre cable****INSTALLATION PRACTICE OF SELF SUPPORTING METAL FREE AERIAL OPTICAL FIBRE CABLE****1. SCOPE:**

This Engineering Instruction (EI) deals with the guidelines and the installation practice for installing self-supporting metal free aerial optical Fibre cable.

2. GENERAL:

Department Of Telecommunication has already introduced self-supporting metal free aerial optical Fibre cable for local junctions and short haul trunk working. This is particularly useful in situations where underground cable laying is not possible. It is also recommended for short term working.

3. ROUTE SURVEY:

The route should be inspected before the actual installation of optical Fibre cables. Survey of the aerial route should be carried out pole by pole.

4. OVER HEAD ALIGNMENT:

The existing route alignment wherever available should be used. On new routes, alignment should be erected. The span length must not exceed above 90 metres.

5. LINE DIAGRAM:

A line diagram should be prepared to mark the poles & the actual distance between the poles in a splice section (Normally 15 poles per km are recommended). Additional poles should be erected if required to keep the span length within the specified limits. Care should be taken that the alignment is easily accessible from the road. It is necessary to keep a clear head way (Ground clearance) of 12 to 15 feet in a section. A complete line diagram should be prepared i.e. from station A to station B. The number of road crossings, canals or nallahs, electric lines should be clearly marked in the route diagram.

6. HILLY REGIONS:

Line erection rules must be strictly followed. Additional poles may be erected for better support to optical Fibre cable & to avoid sharp curves & bends. Span lengths should be reduced to avoid sags in case of steep slopes.

7. TENSION POLES:

Tension poles are dead end or termination poles. The tension poles shall have dead end fittings. The Dead end fittings offer a continuous run of the aerial optical Fibre cable. These fittings relieve the optical Fibre cable of its compressive, bending & clamping stresses. The performed dead end fittings are suitably gritted for excellent tensile holding strength.

8. SELECTION OF TENSION POLES;

Selection of tension poles depends upon the actual site location of the route. Every fifth pole should be a tension pole in straight alignment. Splicing location poles should be tension poles or wherever alignment takes a sharp turn (more than 15 degrees) should also be a tension pole.

9. SUSPENSION POLES:

The suspension pole assembly is designed to offer cushion to aerial optical Fibre cable against the dynamic stress of Aeolian vibration at the suspension point. They also reduce static stresses at the Support point.

10. SELECTION POLES:

- a) Selection of suspension poles also depends upon actual site location of route.
- b) All the intermediate poles between two tension poles will be suspension poles.

11. SELECTION OF SPLICE LOCATION:

The splice box of the aerial optical cable should be buried underground. Therefore it is necessary to fix & determine the splicing location as per the designated cable drum length.

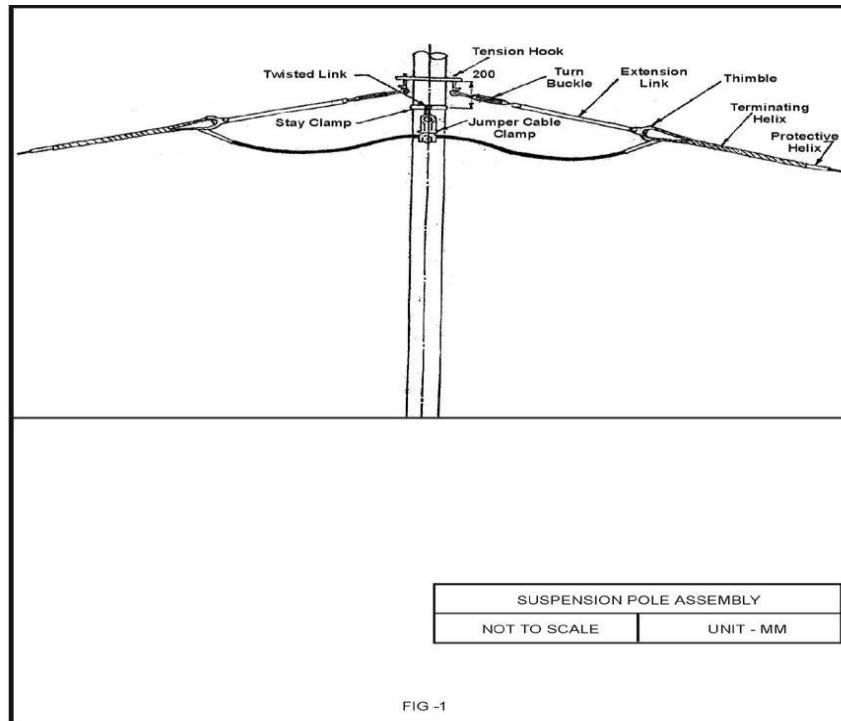
12. AERIAL OPTICAL FIBRE CABLE SPECIFICATIONS:

1	Maximum span length	100 metres
2	Maximum ice loading	0 Kg per meter
3	Maximum Operational wind velocity	100 Kms per hour(depending on geographical location)
4	Maximum sag allowed (Without excess load)	2% of span length
5	Maximum sag allowed (With excess load)	3% of span length
6	Temperature range	
	Operation and Storage	-30 to +70 degree C
	Installation	-15 to +50 degree C
7	Minimum bend radius	2D (D- Dia of cable)
8	Tensile force	
	During installation	$9.81 \times 1.3 \times w$
	Permanent with ice & wind load:	$9.81 \times 3 \times w$
	(Where w is the mass of 1 km length of cable, in kg)	

13. TYPES OF ACCESSORIES AND FIXTURES:

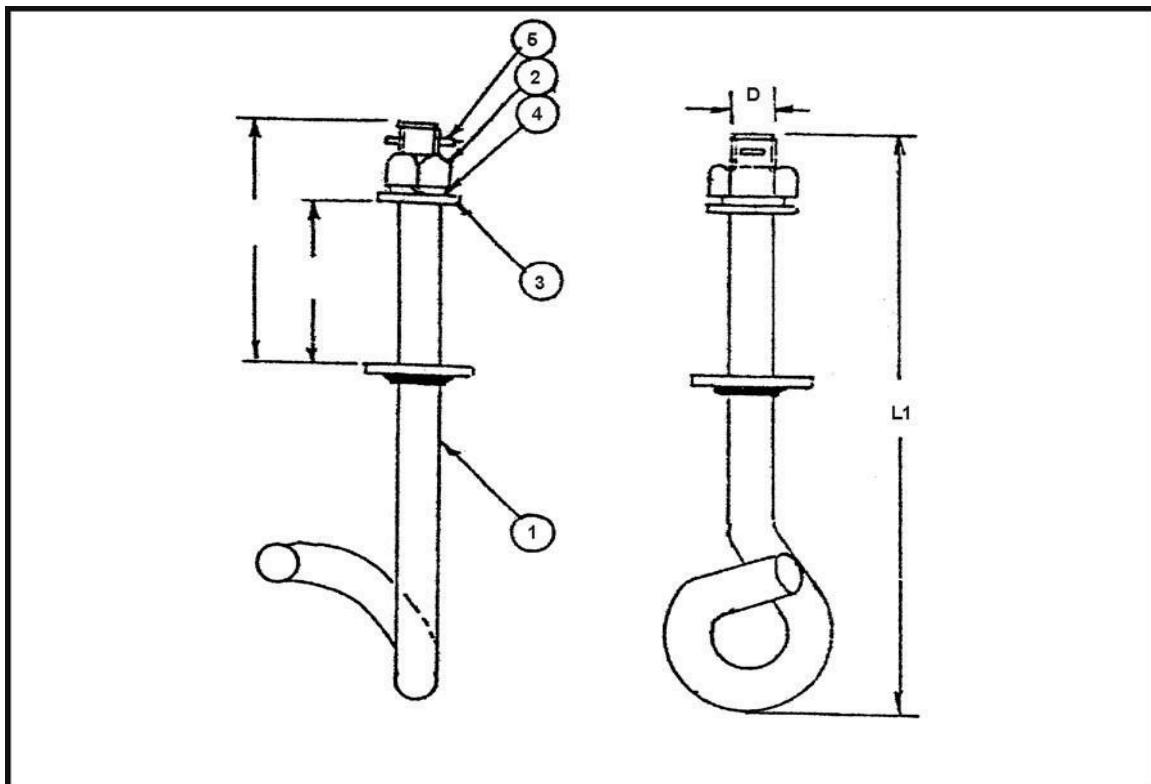
13.1 FORMED OFC DEAD END AND TERMINATION FITTINGS:

These fittings are used at tension/termination poles (dead end poles), or poles where splices are located and the poles where the overhead alignment takes a turn, (angle exceeding more than 15 degrees) as shown in below fig. 1.



13.2 J-SHAPED TENSION HOOK:

J - Shaped tension hook is for the installation on cross arm channel C (C-Bracket) of the poles as shown in fig. 6.



DIMENSIONS IN MM :

L1	L2	L3	D
177	75	50	12

NOTE :- TOLERANCE SHALL BE AS PER IS : 2102
(DETAIL AS PER GR, UNLESS UNTILL SPECIFIED)

TO BE USED HERE C-BRACKET IS AVAILABLE ON POLE FOR FITMENT OF TENSION HOOK
HOT DIP GALVANISED AS PER IS : 2629

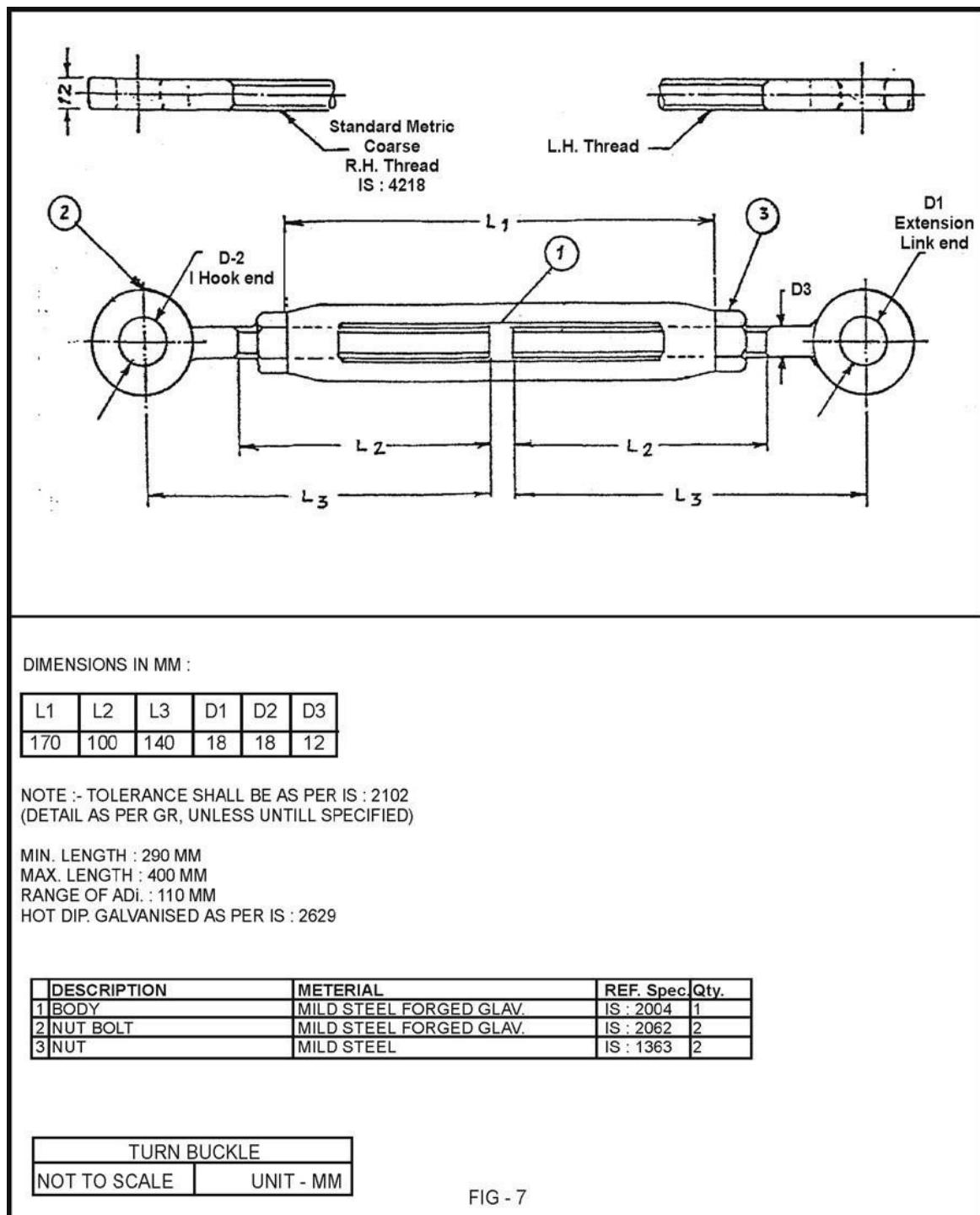
DESCRIPTION	MATERIAL	REF. Spec.	Qty.
1 BODY	ALLOY STEEL GALVANISED	IS : 2004	1
2 NUT	MILD STEEL GALVANISED	IS : 1363	1
3 PLAIN WASHER	MILD STEEL GALVANISED	IS : 2016	1
4 SPRING WASHER	SPRING STEEL GALVANISED	IS : 3063	1
5 SPILT PIN	STAINLESS STEEL	IS : 549	1

TENSION HOOK	
NOT TO SCALE	UNIT - MM

FIG - 6

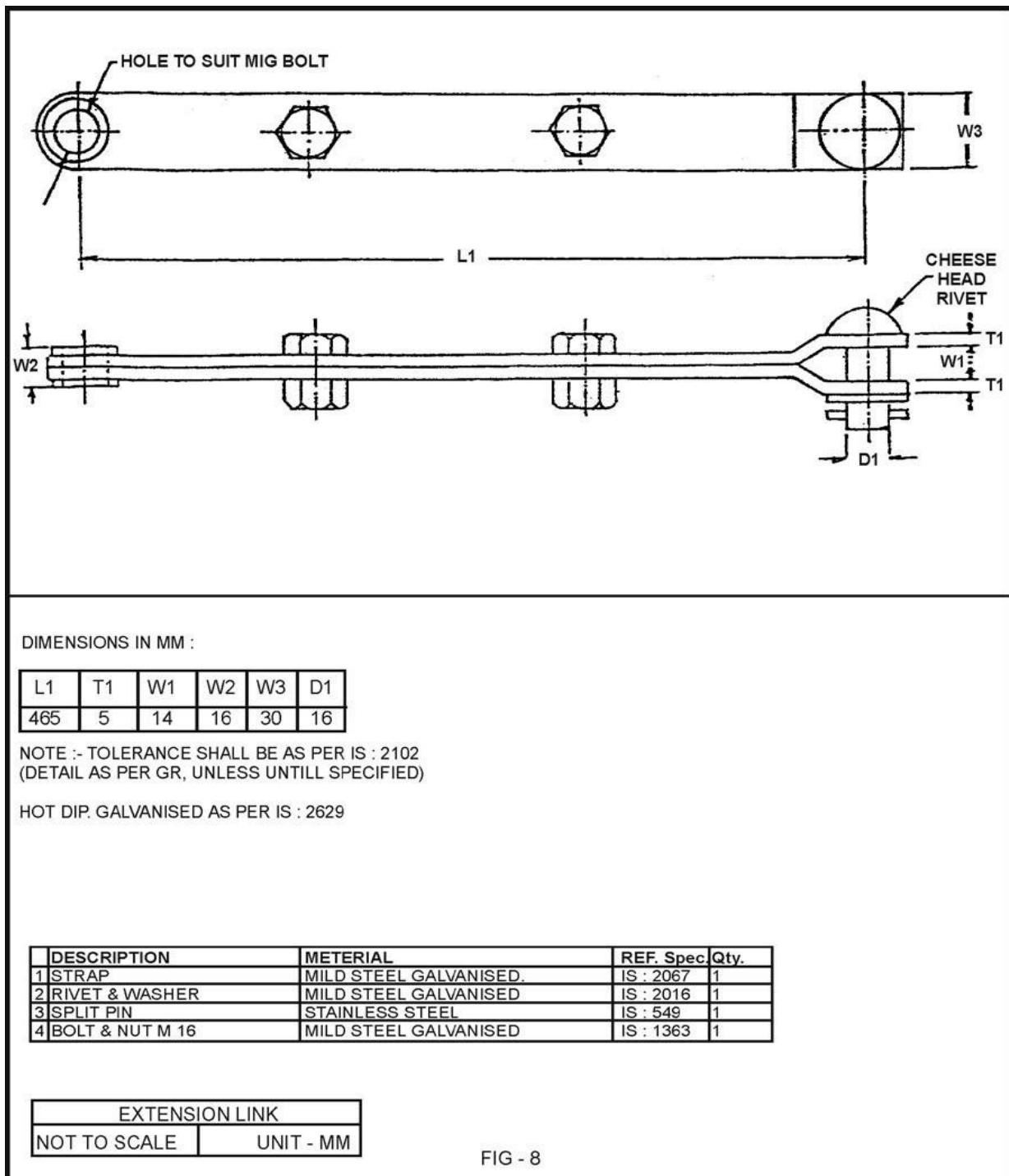
13.3 TURN BUCKLE:

Galvanized forged steel turn - buckle is used at the dead end and at tension positions (for adjusting the sag & tension) as shown in fig. 7.



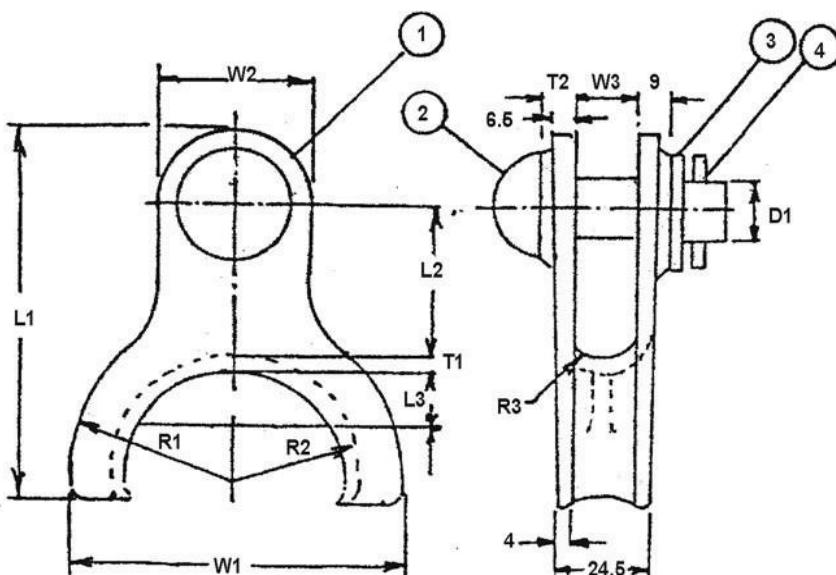
13.4 EXTENSION LINK:

Galvanized steel extension link is used along with turn buckle as shown in fig. 8.



13.5 CLEVIS THIMBLE:

Aluminium alloy die cast thimble is used to attach the extension link and for accommodating the loop of the helically formed terminating helix at the other end and its smooth internal contour as shown in fig.9.



DIMENSIONS IN MM :

L1	L2	L3	T1	T2	R1	R2	R3	W1	W2	W3	D1
102	42	15	4	9	23	15	8	92	40	18	16

NOTE :- TOLERANCE SHALL BE AS PER IS : 2102
(DETAIL AS PER GR, UNLESS UNTIL SPECIFIED)

FEROUS PARTS ARE HOR DIP GALVANISED
AS PER IS : 2629

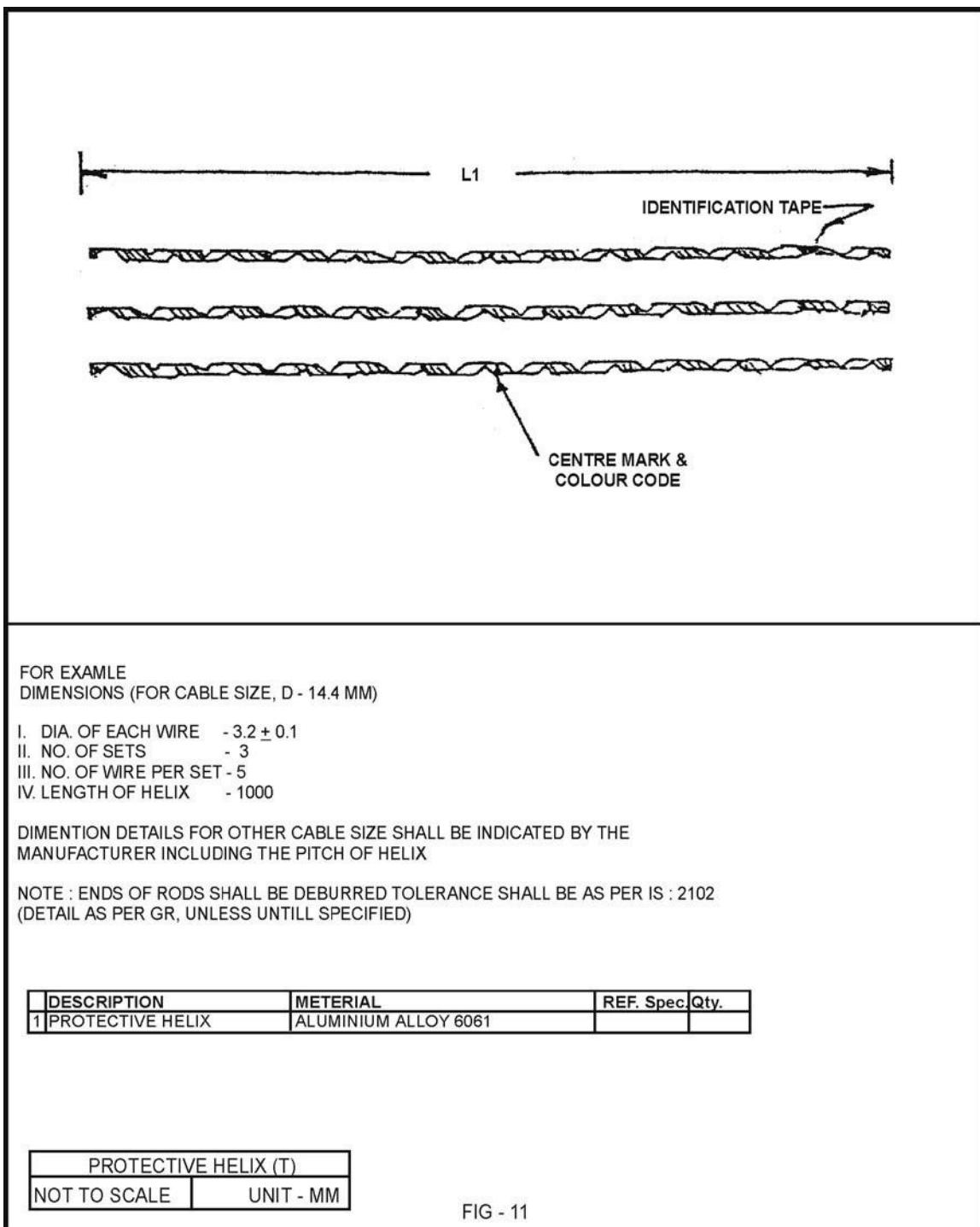
DESCRIPTION	MATERIAL	REF. Spec	Qty.
1 CLAMP	ALUMINIUM ALLOY GDC.	IS : 617	1
2 RIVET M16 x 45	GALV. STEEL	IS : 2016	1
3 WASHER	GALV. STEEL	IS : 2016	1
4 SPLIT PIN	STAINLESS STEEL	IS : 549	1

CLEVIS THIMBLE	
NOT TO SCALE	UNIT - MM

FIG - 9

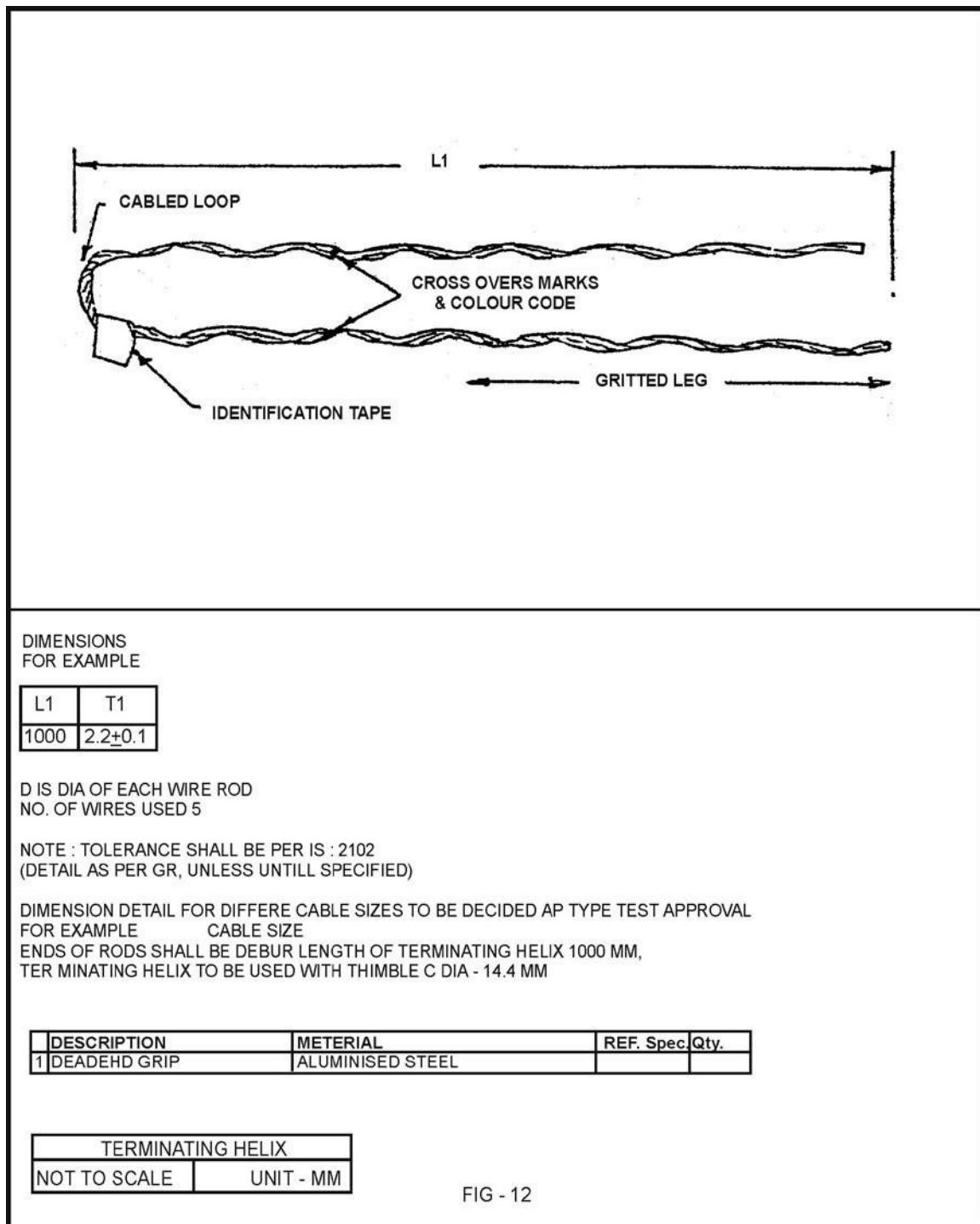
13.6 PROTECTIVE HELIX (T):

Set of aluminium alloy helically formed protective helix having predetermined spiral shape is used & making them conveniently applied on the optical Fibre cable without excessive clamping pressure at any point. See fig. 11.



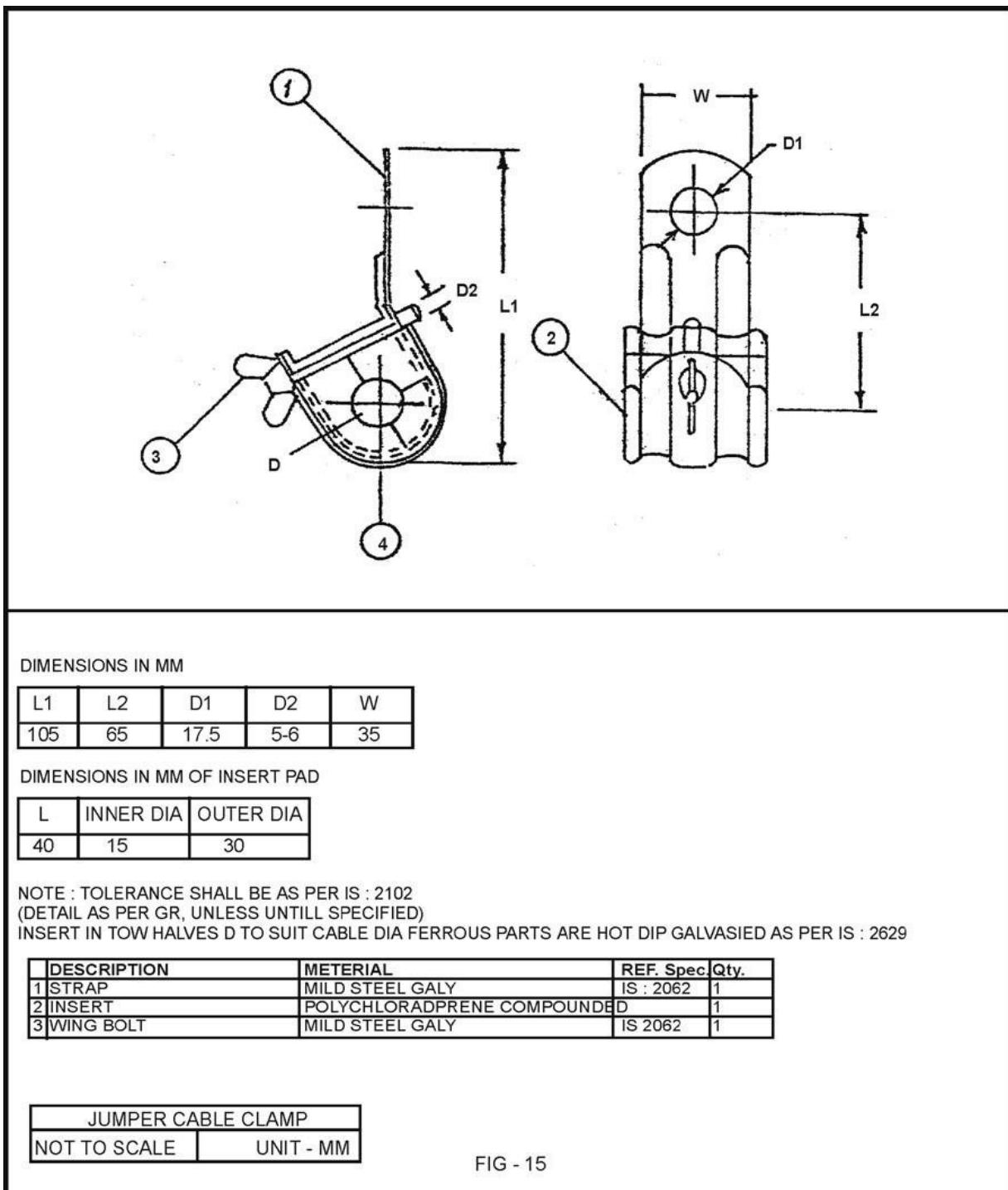
13.7 TERMINATING HELIX:

Helically formed terminating helix of Aluminized steel having a prefabricated loop shall be to fit into the grooved contour of the thimble and for fixing over protective helix over the optical Fibre cable. See fig.12.



13.8 JUMPER CABLE CLAMP:

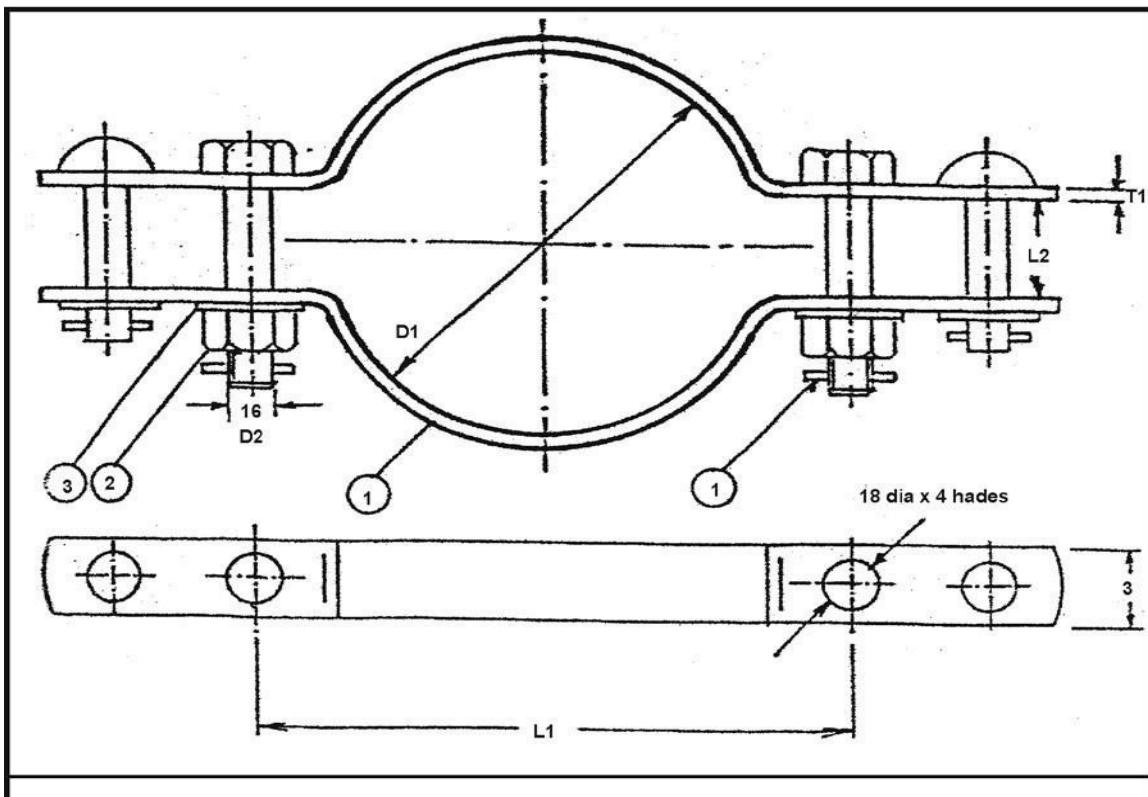
Galvanized steel jumper cable clamp is used to support the through length of optical Fibre cable at the intermediate tension poles as shown in fig. 15.



13.9 POLE MOUNTED STAY CLAMP (RAIL) OR POLE MOUNTED STAY CLAMP (TUBULAR)

Galvanized mild steel pole mounted stay clamp should be used at the pole for the fixing with a twisted eye & turn buckle; see figs.4 & 5. The selection of the type of stay clamp will depend upon the type of poles.

POLE MOUNTED STAY CLAMP (RAIL)



POLE MOUTED STAY CLAMP (RAIL)

L1	L2	L3	L4	L5	L6	L7	L8	T1	T2	D1	W1
270	170	251	151	20	32	50	120	5	20	16	60

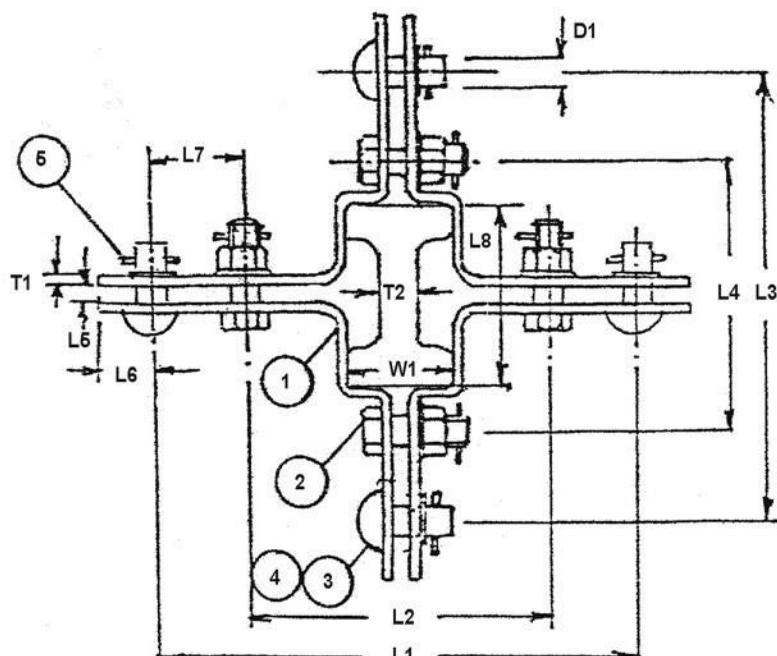
NOTE :- TOLERANCE SHALL BE AS PER IS : 2102
(DETAIL AS PER GR UNLESS UNTILL SPECIFIED)
HOT dIP Galvainised as per is : 2629

DESCRIPTION	METERIAL	REF. Spec.	Qty.
1 CLAMP	MILD STEEL GALVANISED	IS : 2062	1 SET
2 BOLT & NUT M 16	MILD STEEL GALVANISED	IS : 1363	2
3 RIVET 16	MILD STEEL GALVANISED	IS : 2016	2
4 WASHER	MILD STEEL GALVANISED	IS : 2016	4
5 SPILT PIN	STAINLESS STEEL	IS : 549	4

POLE COLLAR CLAMP	
NOT TO SCALE	UNIT - MM

FIG - 4

13.10 POLE MOUNTED STAY CLAMP (TUBULAR)



DIMENSIONS IN MM :
POLE MOUTED STAY CLAMP TUBULAR

L1	L2	D1	D2	T1	W
210	20	150	16	5	30

NOTE :- TOLERANCE SHALL BE AS PER IS : 2102
(DETAIL AS PER GR UNLESS UNTILL SPECIFIED)
HOT DIP GALVANISED AS PER IS : 2629

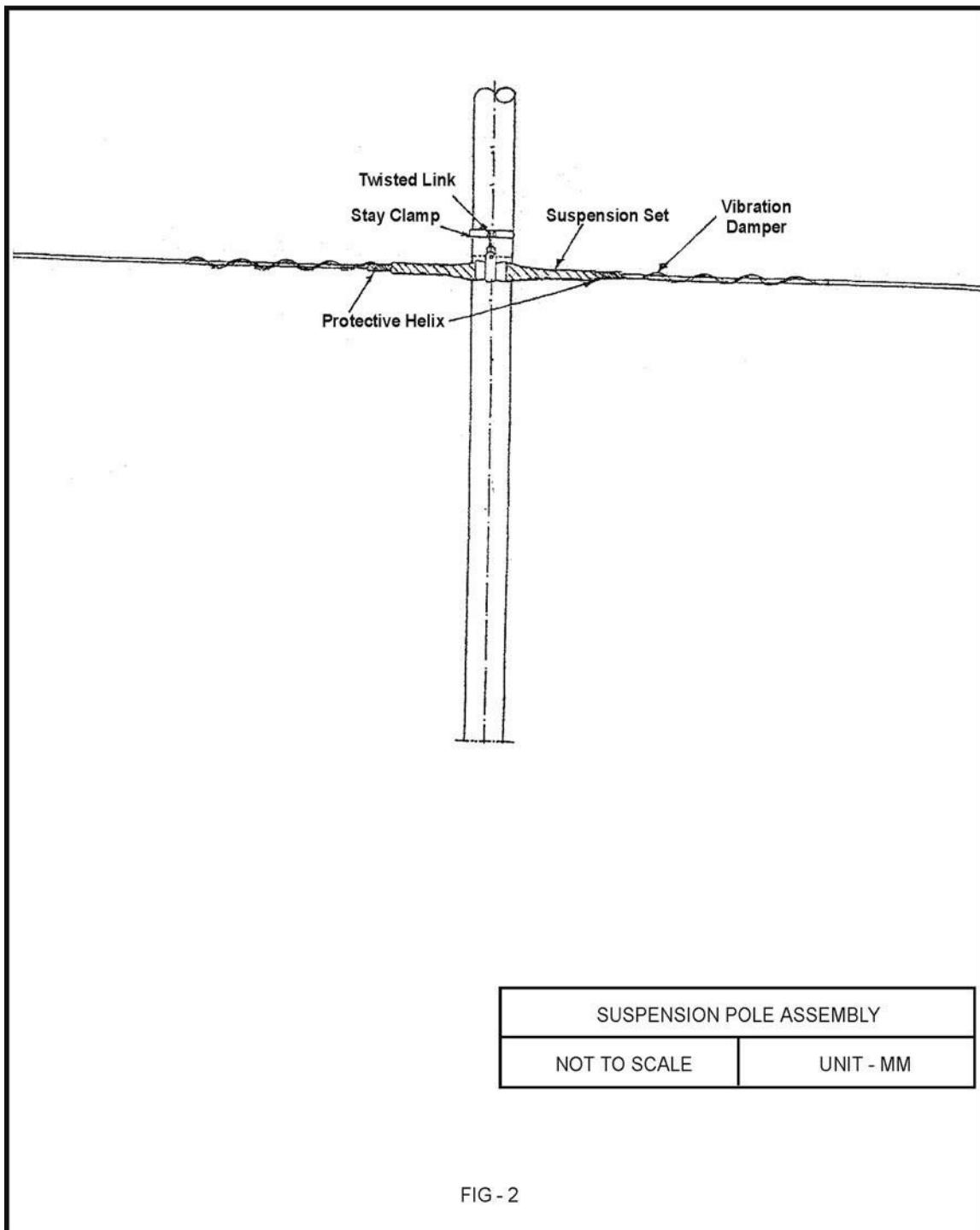
DESCRIPTION	MATERIAL	REF. Spec	Qty.
1 CLAMP	MILD STEEL GALVANISED	IS : 2062	1 SET
2 BOLT & NUT M 16	MILD STEEL GALVANISED	IS : 1363	4
3 RIVET 16	MILD STEEL GALVANISED	IS : 2016	4
4 WASHER	MILD STEEL GALVANISED	IS : 2016	8
5 SPILT PIN	STAINLESS STEEL	IS : 549	8 SET

POLE COLLAR CLAMP (R)	
NOT TO SCALE	UNIT - MM

FIG - 5

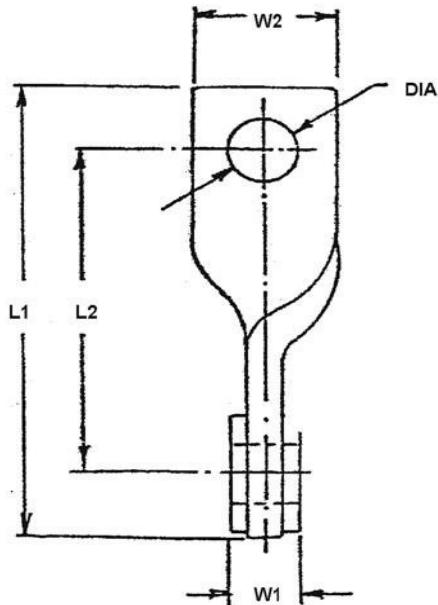
13.11 OFC SUSPENSION FITTINGS:

Helically formed suspension fittings along with the elastomeric pads inserts strapped by a galvanized steel eye-band is used to hang from the twisted eye-link connected to a pole mounted stay clamp or on the tension hook (J-shaped) installed on the C bracket at the intermediate poles as shown in fig. 2.



13.12 TWISTED EYE LINK:

The twisted eye link is used for installing suspension fitting on stay clamp or on tension hook as shown in fig. 14.



DIMENSIONS IN MM

L1	L2	W1	W2	DIA
138	100	27	38	18

NOTE : TOLERANCE SHALL BE AS PER IS : 2102
 (DETAIL AS PER GR, UNLESS UNTILL SPECIFIED)
 HOT DIP GAVANISED AS PER IS : 2629

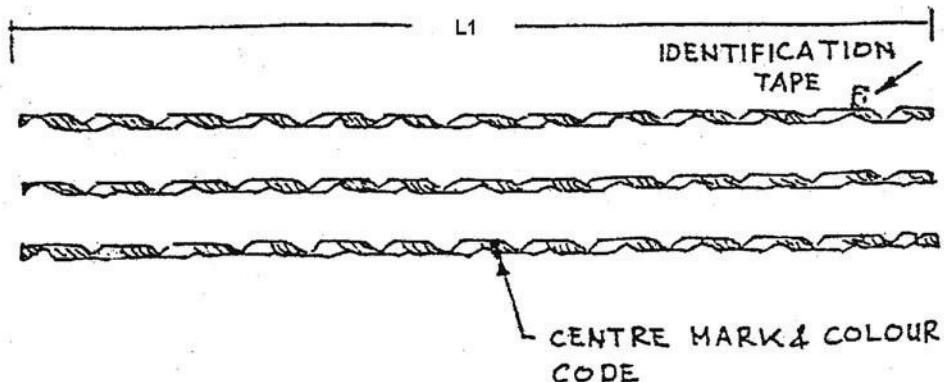
DESCRIPTION	MATERIAL	REF. Spec	Qty.
1 LINK	MILD STEEL	IS : 2062	1

TWISTED EYE LINK	
NOT TO SCALE	UNIT - MM

FIG - 14

13.13 PROTECTIVE HELIX (S)

Set of aluminium alloy helically formed protective helix having predetermined spiral shape is used & making them conveniently applied on the optical Fibre cable without excessive clamping pressure at any point. See fig. 10.



FOR EXAMLE
DIMENSIONS (FOR CABLE SIZE, D - 14.4 MM)

- I. DIA OF EACH WIRE - 3.2 ± 0.1
- II. NO. OF SETS - 3
- III. NO. OF WIRE PER SET - 5
- IV. LENGTH OF HELIX - 1400

DIMENTION DETAILS FOR OTHER CABLE SIZE SHALL BE INDICATED BY THE MANUFACTURER INCLUDING THE PITCH OF HELIX

NOTE : ENDS OF RODS SHALL BE DEBURRED TOLERANCE SHALL BE AS PER IS : 2102 (DETAIL AS PER GR, UNLESS UNTILL SPECIFIED)

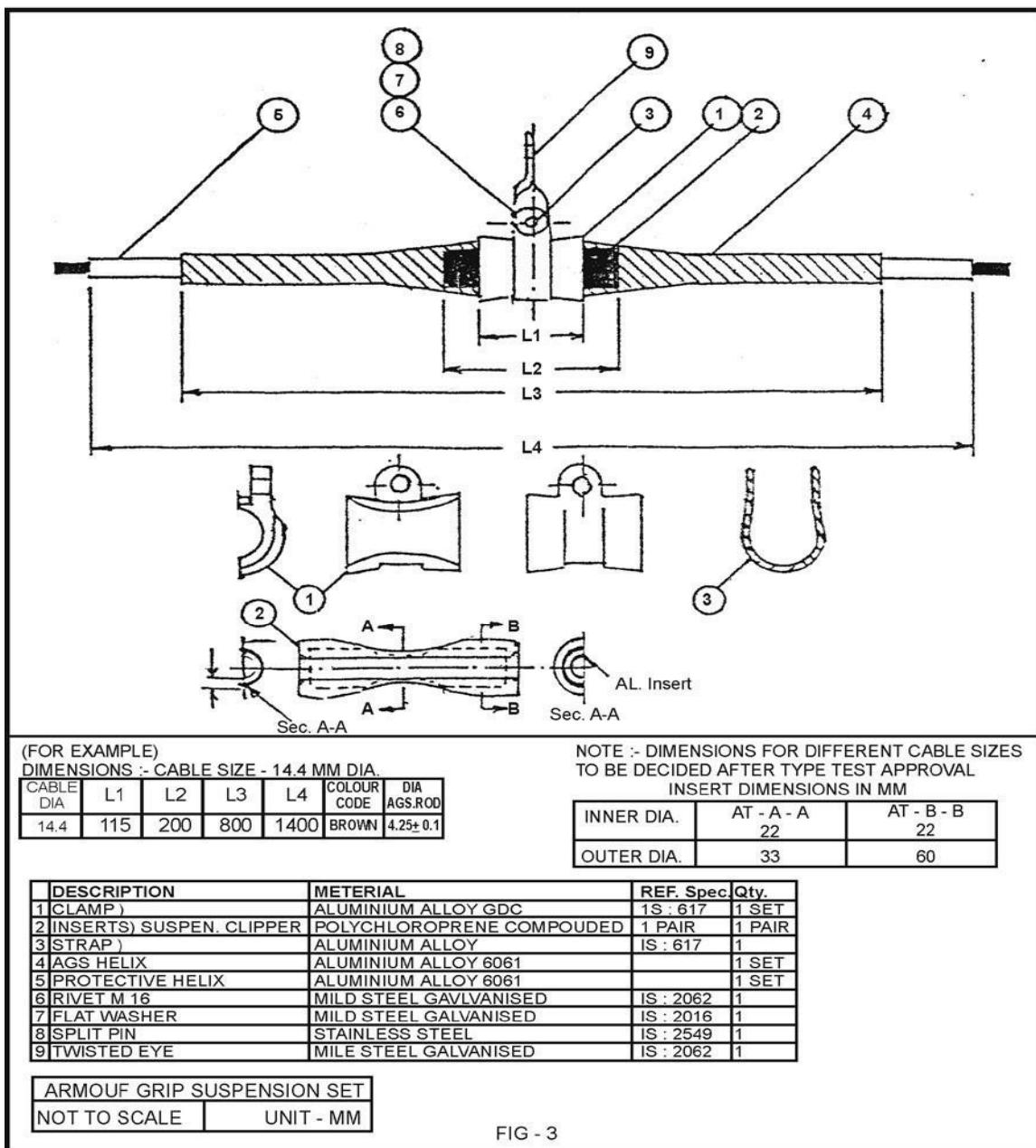
DESCRIPTION	METERIAL	REF. Spec	Qty.
1 PROTECTIVE HELIX	ALUMINIUM ALLOY 6061		

PROTECTIVE HELIX (S)	
NOT TO SCALE	UNIT - MM

FIG - 10

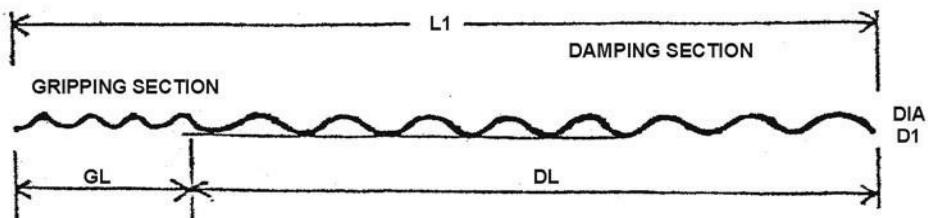
13.14 ARMOUR GRIP HELIX:

Set of aluminium alloy armour grip helix is used or fixing on the profile shaped elastomer pad for proper strut action, grip & bird caging as shown in fig. 3.



13.15 SPIRAL VIBRATION DAMPER (SVD)

Helically formed spiral vibration dampers are used on both sides of suspension fittings as shown in fig. 13.



DIMENSIONS IN MM

L1	GL	DL	D1
1346	446	900	12+1

NOTE : TOLERANCE SHALL BE AS PER IS : 2102
(DETAIL AS PER GR, UNLESS UNTIL SPECIFIED)

DESCRIPTION	MATERIAL	REF. Spec.	Qty.
1 SPIRAL VIBRATION DAMPER	POLYVINYL COMPOUNDED		

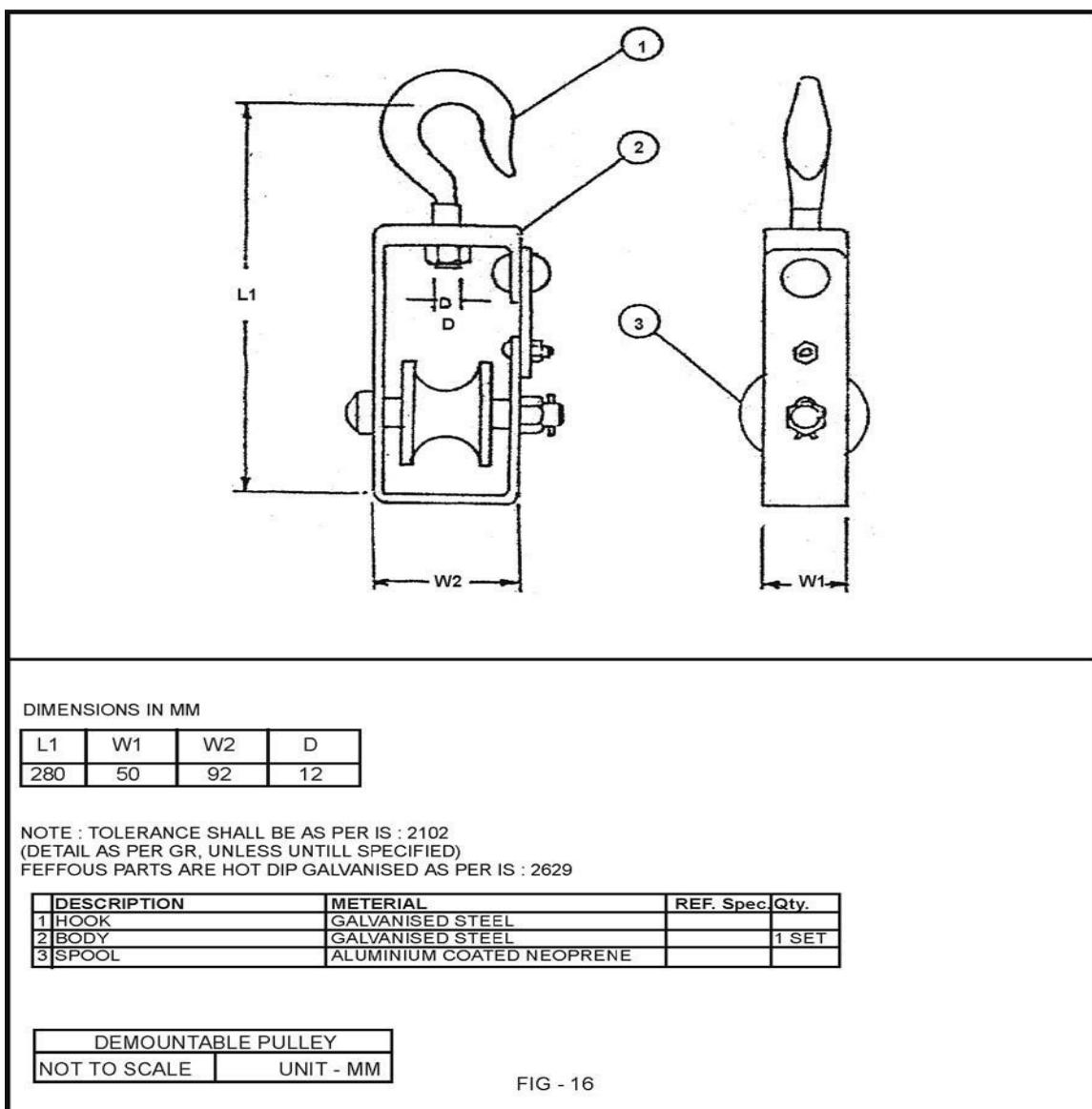
SPIRAL VIBRATION DAMPER	
NOT TO SCALE	UNIT - MM

FIG - 13

13.16 DEMOUNTABLE PULLEY:

Demountable pulleys are used during the installation of aerial optical Fibre cables see fig.16.

These are made from mild steel & the contour of the wheel is coated with rubber or any other suitable material for free movement of cable.



14. Joint Enclosure and Splicing:

The ADSS cables would be required to be spliced at every joint, normally at a distance of every 2 kilometre. Splicing can be placed overhead or underground. The choice of placement of joint as overhead or underground buried would depend upon the field conditions & the decision of the executing agency based on the suitability as indicated below.

14.1 Overhead placement of joint:

14.1.1 The placement of joint overhead on the poles may be preferred choice of splicing in cases where power utilities are carrying out the work as most Power distribution companies may be more comfortable with aerial joint placement as compared to underground.

14.1.2 The overhead joints shall be placed with proper mounting arrangements on the poles.

14.1.3 Proper tool/arrangement should be made available during maintenance for overhead joints.

14.2 Underground buried joint:

14.2.1 Underground buried joint is an established and field proven practice and is being used by BSNL since very long.

14.2.2 This would be safer and better suited methodology in cases where the workmanship of overhead joints may not be of desired quality and that chances of damage due to this may be higher.

14.2.3 During maintenance, the handling of underground joints would be easier as compared to Aerial placement of joints.

Features

- Standard Fibre count 24 F
- Universal type i.e. suitable for all type of cable (ADSS OFC, Armoured and metal free cable)
- Provide scope for straight / branch joints
- Resistant to chemicals and corrosive atmosphere.
- Easy re-entry and closing with mechanical plastic clamp.
- Shall be water and air proof.
- Ribs on the body for extra strength
- 6 Cable entry port & 1 oval port
- Suitable for cable size upto-30mm
- Mounting Bracket for erecting on pole vertically straight.
- Dome type



Dimensions

- Length-395mm ±5%
- Outer diameter-273mm ±5%

15. MATERIAL REQUIREMENT OF INSTALLATION ACCESSORIES AND FIXTURES:

15.1 FOR DOUBLE TENSION POLES:

S.No.	Description	Quantity
1	J-shaped tension hook (For C-bracket)	2
2	Turn buckle	2
3	Extension link	2
4	Clevis thimble	2
5	Protective helix (T)	
6	Terminating helix	2 sets
7	Jumper cable clamp	2 sets
8	8. a) Pole mounted stay clamp (Tubular) b) Pole mounted stay clamp (Tubular) OR a) Pole mounted stay clamp (Rail) b) Pole mounted stay clamp (Rail)	1 (Pole having C-bracket) 2 (Pole without C-bracket) 1 (Pole having C-bracket) 2 (pole having C-bracket)

15.2 FOR SUSPENSION (INTERMEDIATE POLES)

S. No.	Description	Quantity
1	a) Pole mounted stay clamp (Tubular) b) Pole mounted stay clamp (Tubular) OR c) Pole mounted stay clamp (Rail) d) Pole mounted stay clamp (Rail)	
2	Twisted eye link	
3	Suspension clamp consisting of the following:	
4	Protective Helix (S)	1 set
5	Armour grip helix	1 set
6	Suspension clipper with Elastomer pad etc	1 set
7	Spiral vibration damper	2
8	J-shaped tension hook	1 (Pole with C-bracket)
9	Demountable pulley	One per pole in the splice section

16. Entry of the optical fibre cable in the building.

Normal methods for leading in and precautions recommended for leading-in of the optical Fibre cable should be followed. A conduit pipe should be laid for leading-in the OF cable.

Inside the building; the cable may also be taken directly from the nearby overhead pole to inside of the building for termination.

17. PREPARATION:

- i. Before the installation the OF cable should be tested.
- ii. As per requirement install the additional new poles.
- iii. Each pole should be checked for its strength. Provide extra stays if more strength is required.

- iv. The Aerial OF Cable is recommended to be installed on the outermost hole of bracket towards road on the existing bracket/new bracket on the poles.
- v. Replace weak and other poles for clear ground clearance and strength as per the field conditions.
- vi. Provide ground clearance of 12 feet in non-obstructing areas.
- vii. Raise the height to minimum 16 feet at all the road crossings.
- viii. Maintain the alignment as straight as possible.
- ix. Construct splice chambers.

18. SPLICE LOCATIONS:

For the cases, where field splices are to be buried underground, the cable should be brought down through a 40mm diameter GI pipe clamped on the pole. Proper bends (120-135 degree) are recommended for negotiating the bend. Wooden/hard rubber bushes shall be used at the entry and exit points of the GI pipe to avoid damage to the cable. A splice chamber as per the standard practice shall be made.

The selection of the splice point shall depend upon the availability of space and the cable length.

19. CALCULATION OF SECTION LENGTH:

Aerial OF cable is supplied as per TEC GR in a length of 2 Kms \pm 10%.

To arrive at the section length and allocating a particular reel of the cable to a particular section following consideration are required.

SECTION LENGTH:

- 1) Actual section length measured.
- 2) Allowance for sag 2% for each span length.
- 3) Cable at each through tension pole (4 meters).
- 4) Drop length.
- 5) Extra spare cable for coiling at the splice location (10 meters).

20. INSTALLATION MATERIAL REQUIRED DURING INSTALLATION:

S.No.	Material	Quantity
1	Demountable pulleys	1 each for each pole in the installation section
2	Jack for cable drum	1 set
3	Ladders	For each pole
4	Tools	Screw drivers C&T pliers spanner set & hammer etc.
5	Manila rope 12mm diameter	250 meters
6	Cable pulling winch machine with tension monitoring device	1
7	Anti-twist device	1
8	Cable pole fork	10

9	Flat twin open type cable grip	2
10	Communication link to connect feeding, pulling and intermediate points.	
11	40 mm 61 pipe, bends, bushes & clamps for fixing the pipe at the splice location	
12	First aid box.	

21. INSTALLATION OF AERIAL OPTICAL FIBRE CABLE:

The following steps are recommended:

1. Install the accessories and fixtures as per the requirement of the individual poles it tension and suspension fittings.
2. Install the demountable pulley on all the poles in the section before pulling the cable.
3. Keep the cable drum over the jack near the 1st pole at the beginning of the section.
4. Attach anti-twist device and the shackle hook along with the rope to the front and of the cable on pulling eye or on the cable grip. Carry the attached rope over the demountable pulleys for pulling the cable.
5. Depute one person at each pole to monitor and in case it is required to guide the cable over the demountable pulley during pulling operation.
6. The cable should be pulled till the cable reaches the last pole of the section.
7. Wherever in the pulling section; through pulling is difficult; half section or one fourth, action pulling method may be adopted by using figure of a techniques.
8. The feeding and pulling of the cable should be synchronized by using communication link. Care is required to be taken so that the cable is not accumulated at any one point during pulling operation and sharp bends are avoided.
9. Once the cable reaches the other end actual tensioning of the cable and fixing the installation of the accessories and fixtures shall be taken up with the help of cable pulling winch. The pulling tension must be monitored during tensioning.
10. Install the tension fittings and accessories at the 1st pole.
11. Fix a flat twin open type cable grip on the cable after tension pole for tensioning the cable in the preceding tension section.
12. The cable shall be tensioned to a tension of 1-3 to 1-6 times of the cable weight. The Sag shall be Monitored and kept between 0.25 to 0.5% of the span length.
13. The cable should be lifted between two poles by using cable pole fork during tensioning and fixing of the cable.
14. During the fixing operation the cable shall remain under required tension for minimizing the sag in the splice section.
15. Now install tension fitting and accessories at the all tensioned pole at the end of the tension section.
16. Install the suspension fitting and accessories on the intermediate poles in the tensioned section.
17. Similarly installation should be carried out in each tension pole in the entire section and the tension and suspension fittings are installed.
18. At the Through tension poles the cable shall be kept loose and shall be supported by cable jumper clamp.

19. At the end pole where the cable reel is kept; the cable to be taken through GI pipe (fixed to the pole) to the splice location in case of underground splicing. Extra care for the aerial OF Cable may be taken at the bends and at entry and at the exit of the pipe. About 10 meters of cable shall be kept at the splice location for coiling (spare cable) and jointing requirement.
20. Test the installed OF Cable.
21. Coil the OF Cable and keep it safe in the splice location for splicing.

22. PRECAUTIONS:

- a) Provide display boards.
- b) Provide sufficient number of road sign and traffic cones.
- c) Avoid sharp bending of the OF cable during installation.
- d) The OF cable should not be given extra tension than the permissible tension limits.
- e) While crossing the overhead electric installations, safety measures should be taken. Also provide guard wire.
- f) To avoid man made damages, safety measures should be taken for each pole.

23. REFERENCE:

- TEC GR on Planning Guidelines and the Installation Practices for the installation of self-supporting metal-free Aerial optical Fibre cable.

24. GUIDELINE FOR INSTALLATION OF ADSS AERIAL OPTICAL FIBRE CABLE

1) Scope

This document is intended to provide guidelines for selection of appropriate methodology for aerial installation of ADSS optical Fibre Cable on Existing Electrical Poles of 440/220/132/33/11 KV Lines and LT lines as per the route map and network design.

2) Installation Techniques

The techniques used in installation of Aerial ADSS Optical Fibre Cables are described here. With the proper installation hardware and skilled resource, any of these methods can be used to install ADSS cable. Many a times, it will become necessary to use a combination of these methods to achieve full installation.

Selection of the specific technique (i.e. Moving Drum method, Stationary Drum method or Manual Installation method), or a combination thereof, shall largely depend on the actual site conditions. The PIA shall select the most appropriate installation technique suitable to the site conditions.

3) Moving Drum method

In this method the cable is pulled directly from the cable drum mounted on a moving vehicle as it drives along the pole line. The cable drum must be mounted on a proper support to allow easy cable pay off. At the dead-end point, the cable is terminated using Termination Assembly sets and tensioned using turnbuckles to maintain cable sag within permissible value.

To start installation, park the vehicle with the cable drum approximately 15 - 20 meters away from the pole facing away from it down the pole line. The cable must pay off from top of the drum towards the rear of the vehicle.

Install the termination supports and temporary hooks on the poles at the starting point and subsequent poles. Pull off the necessary amount of slack, lift the dead-end to the top of the pole and mount on the termination assembly.

Once the cable is fixed at both ends with at the terminating assemblies, carry out tensioning. After the cable section is properly tensioned and secured at both ends lift the cable out of the hooks at each of the intermediate pole and support it with the suspension set assemblies.

4) **Stationary Drum Method**

In this method of aerial cable installation, the cable is pulled along the cable route through temporary support hardware. Stationery drum installation method requires installation of temporary support hardware such as pulley blocks.

A rope wound on the tension limiting winch is passed through the pulleys and connected to the cable on the drum installed on a stand which allows free rotation of the drum. The pulling load should normally not exceed 60% of the maximum permissible cable tension recommended by cable supplier.

The cable drum and winch locations must have vehicular access. The cable drum should always be placed on levelled ground so that its flanges are vertical thus avoiding rubbing of cable against flanges. The orientation should be such that the cable pay-off is directly in the direction of pull. Always pay-out the cable from top of the drum and not from bottom. The drum should have provision to allow controlled pay-out of cable. Cable pay-out needs to be controlled to prevent free running or jerking.

Once the cable is completely pulled end to end, it is then ready for installation of permanent supporting system of terminating and suspension set assemblies at required locations and tensioning for sag control.

5) **Manual Installation method**

Manual installation method technique is similar to stationary drum method, except that in this case the cable is uncoiled from the drum and placed on the ground in the shape of 8.

The pulling operation is same as in stationary drum method. The hardware requirement and pulling equipment also remains same.

For pulling in both directions, two loops of shape of 8 can be made and each can be pulled in separate directions. Loops of size 4 to 5m x 1.5m should be sufficient in most cases.

6) **Installation of Accessories**

6.1 **Pole Clamp**

Prior to fixing any temporary supports / stringing blocks or permanent cable suspension / termination assemblies, it is necessary to fix pole clamps. Appropriate type of pole clamps will be required depending on the shape of the pole. The two halves shall be opened and fixed at the specified height using tightening bolts.

6.2 **Terminating (or dead End) Assembly**

Termination assemblies are required at dead ends locations where:

- Cable needs to be terminated at the end facility
- loops are to be kept for future maintenance activities
- For double sided termination assembly 2 sets would be required.
- To fix a termination Assembly following accessories are required:

- Protective Helix on the cable,
- Terminating Helix with a thimble,
- Clevis Thimble,
- Spiral Vibration Damper

6.3 Suspension Assembly

ADSS optical Fibre cable shall be supported on all intermediate poles between two terminating poles using the pole clamp and a suspension assembly set.

To fix a suspension Assembly following accessories are required:

- i. Protective Helix on the cable,
- ii. Suspension Helix,
- iii. Clevis Thimble,
- iv. Spiral Vibration Dampers

6.4 Installation Cable Loop / storage / Joint Closure

Cable loops are to be provided for future maintenance purposes at regular spacing. A fixture is required to be installed. Excess cable is then wound & kept on support. The fixture provides a means to ensure Proper bend radius is maintained. Separate clamp is required for installation of Joint Closures.

6.5 Supporting Jumper Cable Clamp

Jumper cable hanging between a pair of Termination Assemblies installed at locations where there is sharp change in direction need to be supported with a special twisted link. To support jumper cable, use already installed clamp.

6.6 Cable Tensioning

After the required Length of cable has been placed, the cable shall be properly tensioned before it is permanently secured into suspension assemblies.

The temporary dead end should be installed 4 to 5 m from the pole so that after complete tension is applied, appropriate permanent termination assembly set can be installed while the cable is in tension. The chain hoist will also need to be tied to the pole directly using a sling and on to pole clamp.

Once the cable sanction are under the required tension and the sag is within limits (i.e. less than 1% of span), the “free” end of the cable used for tensioning is fitted with termination assembly set and terminated. Once the load is transferred on to permanent termination end, the temporary arrangement shall be removed.

6.7 Machinery / Equipment / Tools

- Ropes and Light weight ladder for installation of termination / suspension assemblies, clamps etc. ii. Temporary supports, dynamometer, chain hoists, temporary dead ends steel cables, etc. required during cable laying and / or cable pulling and cable preparation kits, etc. as applicable will have to be arranged by the PIA.
- Van with portable splicing machines and OTDR, power meter, cable preparation kits, etc. for splicing and testing of installed ADSS Optical Fibre Cable.
- Other tools and tackles shall include wrenches, spanners, screwdrivers, hummer, ropes etc.
- All safety equipment such as safety belts, insulating and cotton gloves and hard hats, fluorescent vests etc. as required.

Sub-section B-3: Penalty for deviation from standard engineering instructions

1. UNDERGROUND LAYING

Depth of the trench shall be 1.4 meters and can be relaxed to 1.2 meters in case of hard soil. However deviations due to field conditions will be required to have necessary protections in case of depth less than 1.2 meters. SIA shall decide about such stretches and type of protection to be provided in view of the site requirements. The relevant authority matrix to seek necessary approvals for depth relaxation for sub-normal trenching is provided below.

1. **If depth is less than 1.2 meters but better than 0.9 meters, protection by using precast 100 mm NP-3 RCC/ DWC pipe shall be provided.**
2. **If depth is less than 0.9 meters but better than 0.6 meters, protection by using pre-cast RCC pipes NP-3 shall be provided. 100 mm RCC/ DWC pipes shall be used for protecting PLB HDPE ducts.**
3. **The choice between RCC/ DWC would basis the soil and operating conditions. In urban and rodent infested areas, use of RCC might be mandated by the site in-charge based on site survey results.**
4. **If more than one PLB HDPE pipe is to be laid and protected, RCC/ DWC pipe of suitable size to accommodate the required number of PLB HDPE pipes shall be used.**
5. **Wherever RCC pipes are used for protection, the gaps between the RCC collars and the RCC pipes shall be sealed using cement mortar 1:3 (1:53 grade cement of reputed brand, 3:fine sand without impurities) to bar entry of rodents.**
6. **If depth is less than 0.6 meters, concreting surrounding the pipes with a cover of 11 cms on all the sides with weld mesh shall be provided. Cement Concrete Mixture used shall be of 1:2:4 composition, i.e. 1:53 Grade Cement, 2: Coarse Sand, 4: Graded Coarse Stone aggregate of 20 mm nominal size, reinforced with mild steel weld mesh.**
7. **Laying OF cables at trench depth less than 0.5 m will not be permitted.**

Authority matrix for depth relaxation (sub-normal trenching):

Size/ Type of Cable	Standard depth cms.	Minimum acceptable depth in cms. (without protection)	Powers delegated for depth relaxation, for depth in cms. up to	
			Designated SIA Officer – 1	Designated SIA Officer - 2
OFC	140	>=120	<120 & >90	<90 & >=50

In case, the PIA does not adhere to the mentioned Engineering Instructions (Annexure B) and does not provide requisite protection, then the Bidder is liable to penalty as per below;

Depth between	Reduction in rates	Rate Payable
<140cm. to > 120cm.	5 % of approved rates	95% of the approved rates for the achieved depth

For sub-normal trenching for laying ducts at less than 1.2mts, protection as specified above is required to be provided without exception.

If at any time during the acceptance and warranty period, any omission regarding non-provision of protection as mentioned in engineering instructions for sub-normal trenching is identified,

- i. This would invite a penalty of 10% of approved composite services (e.g., excavation, trenching, laying of ducts, OF cable pulling/ blowing) cost for a total length of 1km (i.e. preceding and succeeding the location, where the deficiency was noticed.)
- ii. PIA will be required to provide protection by way of cement concrete mixture of 1:2:4 composition, i.e. 1:53 Grade Cement, 2: Coarse Sand, 4: Graded Coarse Stone aggregate of 20 mm nominal size, reinforced with mild steel weld mesh, with a cover of 10cm surrounding the pipe on all sides for the length of 1km on either side (of location where the deficiency is noticed) excepting for portions where protection is already available.

2. AERIAL LAYING

The pole installation and alignments will be recorded as per the Engineering Instruction. The Successful Bidders shall be required to provide all articles used for Aerial OFC laying. In case the Successful Bidder does not use any mandatory article, he shall be required to implement the articles mentioned in EI (as per Annexure B) and the payment will be not processed until the proper rectification has been completed.

ANNEXURE C

Format of Integrity Pact

ANNEXURE C
Format of Integrity Pact

Maharashtra Information Technology Corporation (MahalIT), a 100% state owned, autonomous corporation hereinafter referred to as "The Principal".

And

..... (Hereinafter referred to as "The Bidder/ Contractor")

PREAMBLE

The Principal intends to award, under laid down organizational procedures, contract/s for Selection of Project Implementing Agency (PIA) for MahaNet-I (BharatNet-II) Project in Maharashtra. The Principal values full compliance with all relevant laws of the land, rules and regulations, economic use of resources, and of fairness/ transparency in its relations with its Bidder(s) and/or Contractor(s).

In order to achieve these goals, the Principal will appoint an Independent External Monitor (IEM) who will monitor the Tender process and the execution of the contract for compliance with the principles mentioned above.

Section 1 – Commitments of the Principal

1. The Principal commits itself to take all measures necessary to prevent corruption and to observe the following principles:-
 - No employee of the Principal, personally or through family members, will in connection with the Tender for, or the execution of a contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.
 - The Principal will, during the Tender process treat all Bidder(s) with equity and reason. The Principal will in particular, before and during the Tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential/additional information through which the Bidder(s) could obtain an advantage in relation to the process or the contract execution.
 - The Principal will exclude from the process all known prejudiced persons.
2. If the Principal obtains information on the conduct of any of its employees which is a criminal offence under the IPC / PC Act, or if there be a substantive suspicion in this regard, the Principal will inform the chief Vigilance Officer and in addition can initiate disciplinary actions.

Section 2 – Commitments of the Bidder(s) / Contractor(s)

1. The Bidder(s)/ Contractor(s) commit himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the Tender process and during the contract execution.
 - The Bidder(s) / Contractor(s) will not, directly or through any other persons or firm, offer promise or give to any of the Principal's employees involved in the tender process or the execution of the contract or to any third person any material or other benefit which he/she is not legally entitled to, in order to obtain in exchange any advantage during the process or during the execution of the contract.
 - The Bidder(s) / Contractor(s) will not enter with other Bidder(s) into any undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.
 - The Bidder(s) / Contractor(s) will not commit any offence under the relevant IPC / PC Act; further the Bidder(s) / Contractor(s) will not use improperly, for purposes of competition or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

- The Bidder(s) / Contractor(s) of foreign origin shall disclose the name and address of the Agents/representatives in India, if any. Similarly, the Bidder(s)/Contractor(s) of Indian Nationality shall furnish the name and address of the foreign principals, if any. Further details as mentioned in the “Guidelines of Indian Agents of Foreign Suppliers” shall be disclosed by the Bidder(s) / Contractor(s). Further, as mentioned in the Guidelines all the payments made to the Indian agent/representative have to be in Indian Rupees only. Copy of the “Guidelines on Indian Agents of Foreign Suppliers” is annexed and marked as Annexure.
 - The Bidder(s) / Contractor(s) will, when presenting his Bid, disclose any and all payments he has made, is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the Contract.
2. The Bidder(s) / Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

Section 3 – Disqualification from Tender process and exclusion from future Contracts

If the Bidder(s) / Contractor(s) before award of the Contract or during execution of the Contract has committed a transgression through a violation of Section 2, above or in any other form such as to put his reliability or credibility in question, the Principal is entitled to disqualify the Bidder(s) / Contractor(s) from the tender process or take action as per the procedure mentioned in the “Guidelines on banning of business dealings”. Copy of the “Guidelines on banning of business dealings” is annexed and marked as Annex-“B”.

Section 4 – Compensation for Damages

1. If the Principal has disqualified the Bidder(s) from the Tender process prior to the award, according to Section 3, the Principal is entitled to demand and recover the damages equivalent to Earnest Money Deposit/Bid Security.
2. If the Principal has terminated the Contract according to Section 3, or if the Principal is entitled to terminate the Contract according to Section 3, the Principal shall be entitled to demand and recover from the Contractor liquidated damages of the contract value or the amount equivalent to Performance Bank Guarantee.

Section 5 – Previous transgression

1. The Bidder declares that no previous transgression occurred in the last three years with any other Company in any country conforming to the anti-corruption approach or with any other public sector enterprise in India that could justify his exclusion from the Tender process.
2. If the Bidder makes any incorrect statement on this subject, he can be disqualified from the Tender process or action can be taken as per the procedure mentioned in “Guidelines on Banning of Business dealings”.

Section 6 – Equal treatment of all Bidders / Contractors / Subcontractors

1. The Bidder(s) / Contractor(s) undertake(s) to demand from all subcontractors a commitment in conformity with this Integrity Pact, and to submit it to the Principal before contract signing.
2. The Principal will enter into agreements with identical conditions as this one with all Bidders, contractors and subcontractors.
3. The Principal will disqualify from the Tender process all bidders who do not sign this Integrity Pact Agreement or violate its provisions.

Section 7 – Criminal charges against violating Bidder(s) / Contractor(s) / Subcontractor(s)

If the Principal obtains knowledge of conduct of a Bidder, or Contractor, or Subcontractor or of an employee or a representative or an associate of a Bidder, or Contractor, or Subcontractor, which

constitutes corruption, or if the Principal has substantive suspicion in this regard, the Principal will inform to the Chief Vigilance Officer.

Section 8 – Independent External Monitor(s)

1. The Principal appoints competent and credible independent external Monitor for this Pact. The task of the Independent External Monitor is to review independently and objectively, whether and to what extent the Parties comply with the obligations under this Agreement.
2. The Independent External Monitor is not subject to instructions by the representatives of the Parties and performs his functions neutrally and independently. He reports to the Managing Director of the MahalT.
3. The Bidder(s) / Contractor(s) accepts that the Independent External Monitor has the right to access without restriction to all project documentation of the Principal including that provided by its contractor. The Contractor will also grant the Independent External Monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his project documentation. The same is applicable to the subcontractors. The Independent External Monitor is under contractual obligation to treat the information and documents of the Bidder(s) / Subcontractor(s) with confidentiality.
4. The Principal will provide to the Independent External Monitor sufficient information about all meetings among the Parties related to the project provided such meetings could have an impact on the contractual relations between the Principal and the Bidder. The Parties offer to the Independent External Monitor the option to participate in such meetings.
5. As soon as the Independent External Monitor notices, or believes to notice, a violation of this Integrity Pact Agreement, he will so inform the management of the Principal and request the management to discontinue or take corrective action, or to take other relevant action. The Independent External Monitor can in this regard submit non-binding recommendations. Beyond this, the Independent External Monitor has no right to demand from the Parties that they act in a specific manner, refrain from action or tolerate action.
6. The Independent External Monitor will submit a written report to the Managing Director, MahalT within 8 to 10 weeks from the date of reference or intimation to him by the 'Principal' and, should the occasion arise, submit proposals for correcting problematic situations.
7. Monitor shall be entitled to compensation on the same terms as being extended to / provided to Independent Directors on the MahalT Board.
8. If the Independent External Monitor has reported to the Managing Director, MahalT, a substantiated suspicion of an offence under IPC / PC Act, and the Managing Director, MahalT has not, within reasonable time, taken visible action to proceed against such offence or reported it to the Chief Vigilance Office, the Independent External Monitor may also transmit this information directly to the Central Vigilance Commissioner, Government of India.
9. The word Independent External 'Monitor' would include both singular and plural.

Section 9 – Pact Duration

1. This Pact begins when both parties have legally signed it. It expires for the Contractor 10 months after the last payment under the contract, and for all other Bidders, 6 months after the Contract has been awarded.
2. If any claim is made / lodged during this time, the same shall be binding and continue to be valid despite the lapse of this Pact as specified above, unless it is discharged / determined by Managing Director, MahalT.

Section 10 – Other provisions

1. This Integrity Pact Agreement is subject to Indian laws. The place of performance and jurisdiction is the registered office of the Principal, i.e. Mumbai.
2. Changes and supplements as well as termination notices need to be made in writing. Side Agreements have not been made.
3. If the contractor is a partnership or a consortium, this agreement must be signed by all partners or consortium members.
4. Should one or several provisions of this Integrity Pact Agreement turn out to be invalid, the remainder of this Integrity Pact Agreement remains valid. In this case, the parties will strive to come to an agreement to their original intention.

For & on behalf of the Principal

(Office Seal)

For & on behalf of Bidder/Contractor

(Office Seal)

Place.....

Date

Witness 1 :

(Name & Address)
.....
.....

Witness 2 :

(Name & Address)
.....
.....

Annexure D

Special Instructions to Bidders

ANNEXURE D – SPECIAL INSTRUCTION TO BIDDERS FOR e-TENDERING

The special instructions (for e-tendering) supplement 'general instructions to bidders', as given in the tender document. Submission of online bids is mandatory for this tender.

E-tendering is a new methodology for conducting public procurement in a transparent and secured manner. Now, the government of India has made e-tendering mandatory. Suppliers/vendors will be the biggest beneficiaries of this new system of procurement. For conducting electronic tendering, MahalT Corporation has decided to use the portal

<http://www.mahatenders.gov.in>. This portal is based on the 'secure' and 'user friendly' software from electronic tender and is referred as the portal in this document. A portal built using electronic tender's software is also referred to as electronic tender system (ETS).

1. For participating in this tender online, the following instructions are to be read carefully. These instructions are supplemented with more detailed guidelines on the relevant screens of the portal.
2. **Registration:** To use the portal <http://www.mahatenders.gov.in> and to participate in the bidding process, bidders must register on the portal. Registration of each organization is to be done by one of its senior persons who will be the main person coordinating for the e-tendering activities. In ETS terminology, this person will be referred to as the super user (SU) of that organization. For further details, please visit the website/ portal, and click on the 'supplier organization' link under 'registration' (on the home page), and follow further instructions as given on the site. Pay annual registration fee as applicable.
3. **Digital certificates:** To participate in online bidding process, bidders must procure a Digital Signature Certificate (Class - II) as per Information Technology Act - 2000 using which they can digitally sign and encrypt their electronic bids. The bidders can procure the same from any CCA approved certifying agency, i.e. TCS, Safecrypt, Ncode, etc. The bidders who already have a valid Digital Signature Certificate (DSC) need not procure a new DSC.
4. The complete bidding document has been published on <https://www.mahatenders.gov.in> for the purpose of downloading. The downloaded bid document shall be considered valid for participation in the electronic bidding process (e-Tendering) subject to the submission of required tender/ bidding document fee and EMD.
5. A two envelope selection procedure shall be adopted.
6. The bidders (authorized signatory) shall submit their offer online in electronic formats for preliminary qualification, technical and financial proposal. The tender document fees, and Earnest Money Deposit (EMD) should be submitted online as per the details provided in the bid document.
7. Purchaser will not be responsible for delay in online submission due to any reason. For this, bidders are requested to upload the complete bid proposal well in advance so as to avoid issues like slow speed, choking of web site due to heavy load or any other unforeseen problems. For queries related to bid submission, the bidders may contact the helpdesk given on the e-Tendering website.
8. The bidders are also advised to refer "Bidders Manual Kit" available on the website for further details regarding the e-tendering process.
9. The entire bid-submission would be online on the portal (unless specified for offline submissions).

Annexure E

Districts, Talukas and Gram Panchayats (GPs) in MahaNet-I (BharatNet-II) scope

Annexure E – Districts, Talukas and Gram Panchayats (GPs) in MahaNet-I (BharatNet-II) scope

Annexure 6 (E) provides the Districts, Talukas and Gram Panchayats in scope as per the scope indicated in the proposal submitted for approval to Telecom Commission. (Details are provided in the Annexure file. The proposal was considered and approved on 08 September 2017 as per the letter dated 25 September 2017.

Note: The total GPs in scope has been revised to 12,740 across **172** blocks as notified by key BBNL stakeholders. The information will be provided as part of the corrigendum to the RFP.

E. 1. District wise count of Talukas and GPs

District	No. of Talukas	No. of GPs
AHMEDNAGAR	13	1,085
AKOLA	5	395
AMRAVATI	7	403
AURANGABAD	4	492
BEED	3	13
BULDHANA	10	588
CHANDRAPUR	9	513
GADCHIROLI	6	225
HINGOLI	5	540
JALGAON	9	521
KOLHAPUR	6	391
LATUR	3	268
NANDED	11	964
NASHIK	10	772
PALGHAR	5	237
PARBHANI	6	428
PUNE	6	547
RATNAGIRI	6	467
SANGLI	2	172
SATARA	8	980
SINDHUDURG	2	69
SOLAPUR	6	669
THANE	6	456
WARDHA	6	223
WASHIM	5	346
YAVATMAL	13	976
Total	172	12,740

List of Talukas and GPs will be provided as soft copy.

Annexure F

GIS Survey Data

ANNEXURE- F GIS SURVEY DATA

KMZ files for 78 Talukas for which indicative/initial route optimization has been done are available in annexure. The remaining files would be provided to the Bidders over the next few days before the Bid Submission Date.

Annexure G

Soil Strata Analysis

ANNEXURE- G SOIL STRATA ANALYSIS

Annexure G provides the estimated KMs of soil type based on BBNL survey performed in 2013 as part of BharatNet Phase I. The survey spanned 24 Districts, 147 Talukas and 12,471 GPs (Details are available in annexure files).

Note: The survey provided is indicative for the purpose of estimation by the bidders. MahalT does not take any responsibility for the accuracy and completeness of the data. The bidders would need to rely on the site survey conducted by them as part of the project implementation.

Indicative per cent of Kms based on soil type:

District	No. of Blocks	No. of GPs	Kachha (in KMs)	Pucca (in KMs)	Rocky (in KMs)	Total (in KMs)
Ahmednagar	11	1,086	552	727	1,017	2,296
AKOLA	5	395	1,003	237	7	1,247
Amravati	7	403	853	197	79	1,130
Aurangabad	4	492	461	378	303	1,142
Buldhana	9	588	1,291	543	62	1,896
Chandrapur	9	513	1,027	459	102	1,588
Gadchiroli	6	225	917	180	41	1,138
Hingoli	4	453	240	385	342	967
Jalgaon	7	492	641	100	206	947
Kolhapur	3	313	272	124	291	687
Latur	4	355	276	270	163	709
Nanded	11	964	1,076	724	608	2,408
Nasik	8	770	551	565	1,002	2,119
Parbhani	4	418	495	336	297	1,128
Pune	5	546	377	603	336	1,316
Ratnagiri	5	465	204	279	635	1,118
Sangli	2	172	88	88	138	314
Satara	6	876	463	1,094	171	1,727
Sindhudurg	2	69	78	76	35	188
Solapur	6	668	484	398	521	1,402
Thane	10	692	248	773	518	1,539
Wardha	3	206	481	245	37	764
Washim	4	338	271	347	236	854
Yavatmal	12	972	488	2,591	49	3,128
Grand Total	147	12,471	12,835	11,717	7,198	31,749
% based on Soil Type			40%	37%	23%	
% KMs based on soil type categorized into Rocky/ Non-Rocky soil types						
Soil categorization					Estimate	Estimate (rounded)
Rocky					77%	~75%
Non-Rocky					23%	~25%

Annexure H

Work-front Estimation

ANNEXURE- H: Work-front Related Guidance (Estimation)

Annexure - H provides an estimate of the number of work-fronts required to complete the digging, trenching and fibre laying for underground route KMs to be completed for implementation of the MahaNet – I scope. Timely implementation of MahaNet – 1 is of utmost importance and the work-front calculations are intended to emphasize on the need for robust planning considering 4 months of the 12 months timeline would be hampered by monsoon.

Project Implementation Agency (PIA) is expected to take into consideration the impact of monsoon and plan the work-fronts such that the reduced work during monsoon does not impact overall project delivery timelines.

Note: The estimations provided are indicative and PIA is expected to perform their own route survey as part of the project and plan the number of work fronts to complete the defined scope within the defined timelines.

Estimated Total KM of OFC to be laid		50,314	
	Package A	Package B	Package C
Underground (km)	11,078	13,728	10,927
Aerial (km)	5,079	2,247	7,255

No. of work-fronts required have been calculated based on following assumptions:

1. Each work front for underground fibre laying will comprise of 2 earth excavators along with rock breaker attachment, 10 breakers and work force of 60.

Work front indicative staffing: 2 JCB (earth excavators along with rock breaker attachment), 10 Breakers and 60 resources	
Average length that can be covered in a day (KM)	1.2
Working days in a month (days)	20
Estimated distance covered in one month (KM) - Non-monsoon	24

2. Each work front for aerial fibre stringing would comprise of workforce of 60 resources with teams for pole mounting, pole strengthening and stringing.

Work front indicative staffing: Work force of 60 resources with teams for pole mounting, pole strengthening, stringing	
Average length that can be covered in a day (KM)	2
Working days in a month (days)	20
Estimated distance covered in one month (KM) - Non-monsoon	40

3. Each work front for underground fibre laying would cover 1.2 kms per day. Assuming 20 working days in a month, the work front would cover 24 kms in the month.
4. Each work front for aerial fibre laying would cover 2 kms per day. Assuming 20 working days in a month, the work front would cover 40 kms in the month.
5. It is expected that the selected PIA would continue to carry out work 24X7 including on all public holidays/weekends.
6. It is assumed that PIA would perform site survey in the month of April.
7. Months of June – September are assumed to be monsoon months. Cumulative route kms to be covered during monsoon is assumed to be 10% of the total route kms in the package.
8. Working months for fibre laying would be May, October, November, December and January (months of February and March would be utilized for cable blowing).
9. The selected PIA is expected to work on at least the following (refer table below) number of work-fronts in parallel.

Package	Workfront (Underground/ Aerial)	Total	Work to be performed in monsoon	Apr-18	May- 18	Jun- 18	Jul- 18	Aug- 18	Sep- 18	Oct- 18	Nov- 18	Dec- 18	Jan- 19	Feb- 19	Mar- 19
Package A	UG - Route- KMs	11,078	10% of the route KMs		2,040		1,200			2,040	2,040	2,040	1,718		
	No. of work fronts	85	N/A		85			Minimal no. of work fronts not defined for monsoons		85	85	85	85		
	Aerial - Route- KMs	5,079	10% of the route KMs		1,000		600			1,000	1,000	1,000	479		
	No. of work fronts	25	N/A		25			Minimal no. of work fronts not defined for monsoons		25	25	25	25		
Package B	UG - Route- KMs	13,728	10% of the route KMs		2,520		1,400			2,520	2,520	2,520	2,248		
	No. of work fronts	105	N/A		105			Minimal no. of work fronts not defined for monsoons		105	105	105	105		
	Aerial - Route- KMs	2,247	10% of the route KMs		400		300			400	400	400	347		
	No. of work fronts	10	N/A		10			Minimal no. of work fronts not defined for monsoons		10	10	10	10		
Package C	UG - Route- KMs	10,927	10% of the route KMs		2,040		1,100			2,040	2,040	2,040	1,667		
	No. of work fronts	85	N/A		85			Minimal no. of work fronts not defined for monsoons		85	85	85	85		
	Aerial - Route- KMs	7,255	10% of the route KMs		1,400		800			1,400	1,400	1,400	855		
	No. of work fronts	35	N/A		35			Minimal no. of work fronts not defined for monsoons		35	35	35	35		

Note: Minimum number of work fronts are not defined for monsoon. Only completion target is defined for the monsoon months.

Annexure I

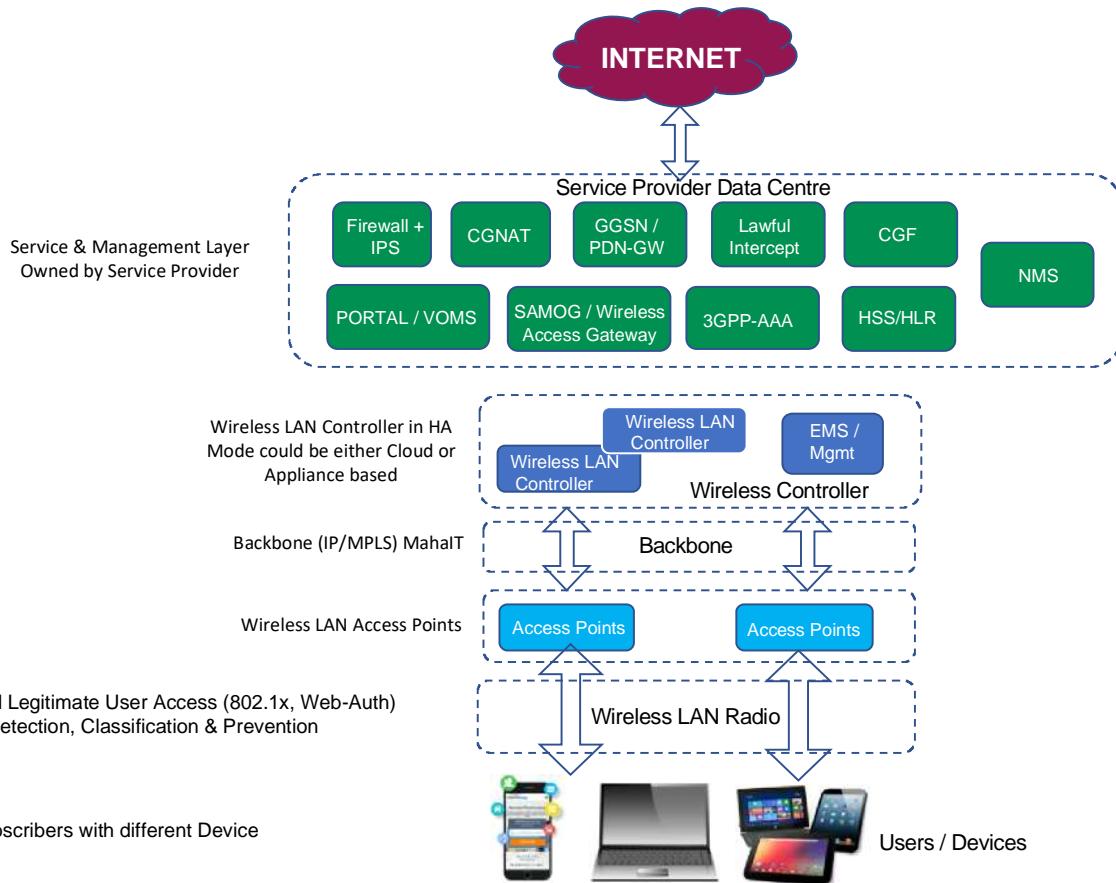
MahaNet Wi-Fi Solution

Annexure I – MahaNet Wi-Fi Solution

MahaIT Wi-Fi Architecture

Government of Maharashtra is envisaging to deploy MahaNet-I (BharatNet II) project to create a broadband highway to provide the digital connectivity to the Rural Areas. With the same vision, the state is deploying fibre network coupled with IP/MPLS technology to deliver various types of services. To connect the rural users to the MahaNet-I network, Wi-Fi will be deployed as last mile technology using dual band Wi-Fi access points. This Wireless Access will be connected to the backbone network provided by MahaIT IP/MPLS Network. Since this Wireless network will provide the digital connectivity to the rural users, hence, considering the State-wide Impact of the network, the overall architecture should be Centralized, Reliable, Robust, Secure and Scalable to meet the current and future requirements efficiently.

Below is the proposed architecture for the Wi-Fi with the key pillars as Wi-Fi access, Backbone Network and Management Layer:-



Carrier Wi-Fi can be deployed by a mobile operator to provide Wi-Fi access to its subscribers or partners' roaming subscribers. There could be a requirement to deploy Venue Wi-Fi for a commercial retailer or enterprise to provide Wi-Fi access to its customers and employees.

1. Scope of Engagement

The high level of scope of supply / deployment responsibility is depicted below in the figure.

MahaIT PIA Scope of Supply: PIA would be responsible for supply of Access Layer components that includes

- a. WLAN AP(s) along with PoE injectors**

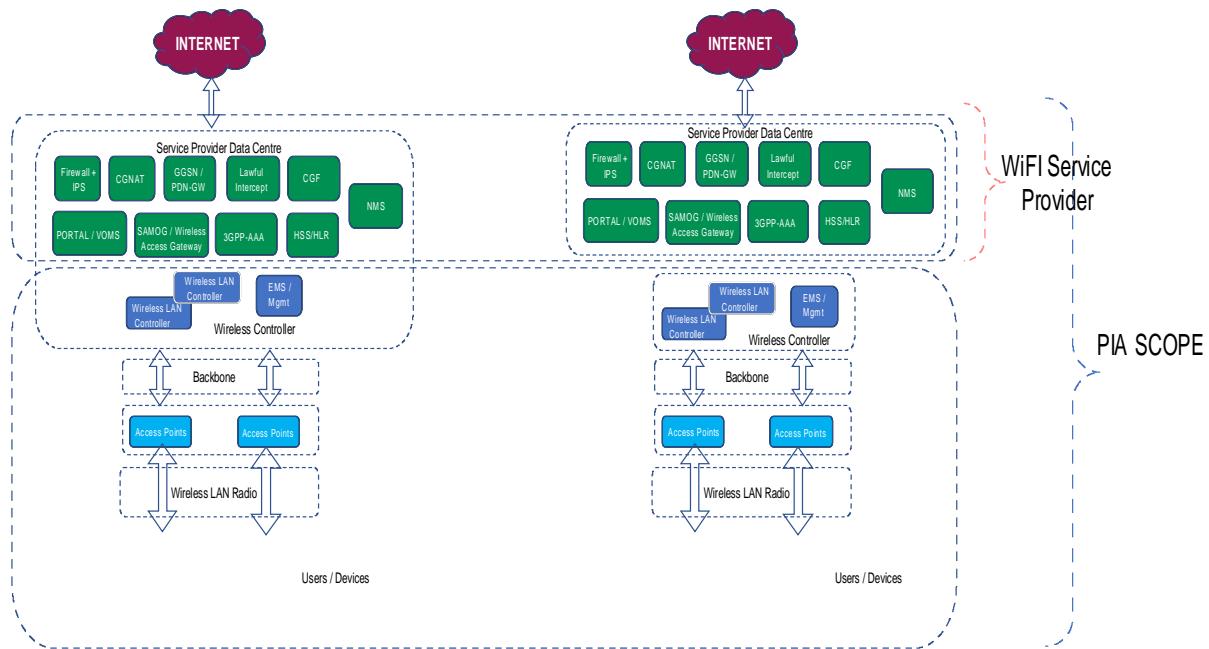
- b. WLAN Controller (irrespective of Cloud or Appliance, if appliance HA Mode)
- c. EMS (Element Management System for Wireless Access)

MahaIT PIA Scope of Implementation:

PIA would be responsible for deployment of all components that are deployed in the field at GP/Talukas etc. as per the RFP document. PIA would work with an established Wi-Fi Service Provider and define the scope to avoid any ambiguity in ownership to provide best in class Wi-Fi services at GPs.

The Wi-Fi Service Provider may use their existing Service Management layer or deploy in their premises to support the Wi-Fi Core requirement as given in the architecture in accordance to 3GPP / IETF / WBA Standard based approach.

The PIA will be responsible for overall scope through the contract period in partnership with Wi-Fi Service provider. At the end of contract, the PIA scope of supply components shall be transferred back to MahaIT by the PIA and will PIA will ensure smooth transition of services to the agency who is selected by MahaIT (in case the new selected Wi-Fi service provider is different than existing).



1.1. Ownership of the Infrastructure / Wireless

The ownership of Wireless Access Points, Wireless LAN controller and NMS to manage the wireless infrastructure will be with PIA. The management layer components like WAG, CGNAT, Firewall, Captive portal, OSS/BSS etc. will be arranged by the service provider and service provider can use its existing infrastructure/ management layer components. PIA shall integrate the WLC, Access Points & NMS and will partner with the service provider to deliver the internet services. The integration of wireless infrastructure with service provider management components will be done by the service provider. The operations and management responsibilities of the wireless infrastructure and services shall be shared between the PIA and the service provider for their respective components however PIA will contractually own the complete responsibility to MahaIT for Wi-Fi services.

1.2. Subscribers / Users

The wireless access network should be placed at appropriate locations such that the subscriber's coverage can be maximized. It should be ensured that India regulation and policy will be adhered to for subscriber on-boarding and service delivery.

1.3. Subscriber Management

These users will connect to the wireless network through captive portal or 802.1x authentication. The users shall be provided with the credentials through coupons which they can use to authenticate to the wireless network. These coupons can have different plans which can be duration based or data usage based. The centralized AAA server at service provider NOC will authenticate the user credentials and appropriately instruct the wireless infrastructure to apply policies for the user based on the user data plan. Once users are connected to the network, the wireless network should keep record of user browsing data / natting data for records and compliances through lawful intercept server / syslog server at the service provider data centre.

1.4. Subscription Management

The Wireless infrastructure should periodically report the AAA system at the service provider NOC through accounting updates about the usage details of the subscribers. These accounting updates will be used by the service provider billing system to realize the exhaustion of data plan for respective users and appropriately instruct wireless network to change policies (disconnect user, change the plans – reducing the bandwidth etc.)

2. Design

2.1. User Equipment - Device Eco-System

Devices need to be able to support and utilize the features present in a WLAN network to provide customers with the full benefits of WLANs deployed by operators. In addition to one operator Mobile Subscribers, it is expected to have some retail Walk-in subscriber who may not have any existing service relationship but want to use the Wi-Fi Service by buying physical Vouchers / Coupons or via online payment. The access approach is completely Client-Less Architecture, which ways out the dependency for Client Installation on the device and other coupled challenges.

Access - Two SSID architecture- The WLAN access point supports up to 8 SSIDs and the same can be used for additional services in the future

2.2. Authentication

To control subscriber access to Wi-Fi networks, multiple authentication methods can be used. The choice of method is crucial to the usability of the network. The more transparent the authentication method is for the subscriber, the likelier the subscriber will connect to the network.

The authentication method also determines the subscriber and device types that can be addressed in a particular network (subscribers with or without SIM cards, the operator's subscribers, visiting subscribers, etc.).

In a typical modern Wi-Fi network, two types of authentication are available to address all possible subscribers and at the same time provide convenient access to the network for frequent Wi-Fi users. The First method, EAP authentication provides transparent and easy access for the operator's own subscribers with SIM cards or certificates. The alternatively method, portal-based authentication, targets customers without a permanent contract with the operator (vouchers, time-limited access, SMS payments, etc.). It can also be used for operator's customers that do not use SIM-based device and use username/password credentials assigned by the operator instead of SIM.

2.3. Transmission / Backhaul Network

Transmission network or the backhaul network provides logical connectivity for wireless access network to core. The backhaul network between AP at GPs till Head end Taluka

shall be provided through MahalT / IP-MPLS transmission network till Master Taluka/Headend Taluka.

Wi-Fi service provider shall be responsible for the Internet/MPLS connectivity beyond Headend Taluka through existing Service provider's network available at the respective Head end taluka location.

2.4. Wi-Fi Access Point placement options

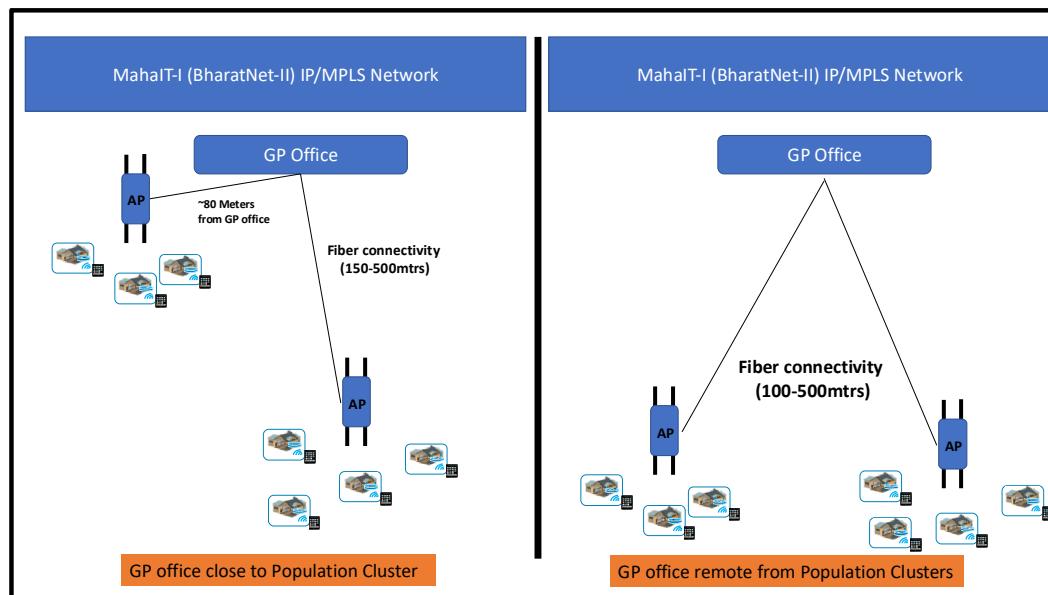
Wi-Fi AP may be placed at various locations to address coverage and capacity needs. Depending on the location of the Gram Panchayat Office and the population clusters (Market, school, PHC etc.), When selecting the appropriate locations, the following considerations should also be taken into account:

1. Power source availability
2. Backhaul connectivity options
3. Special environmental conditions
4. Local zoning requirements

The access points can be deployed in Rural locations in below scenarios:-

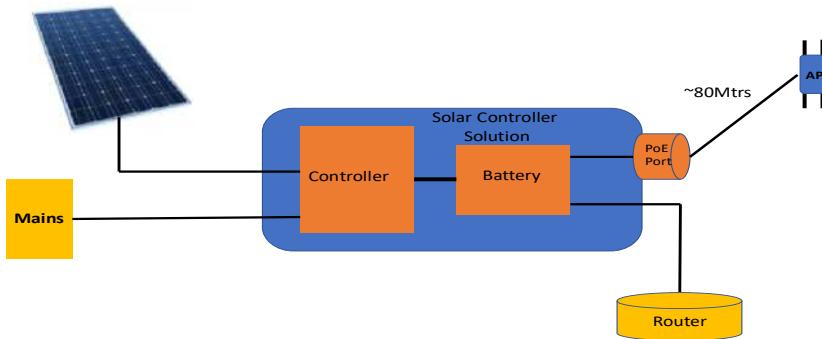
GP office close to Population clusters – In this case one AP will be ~ 80 meters distance from the GP router. Second AP will be 150-500 Meters distance from the GP router connected on fibre port.

GP office remote from population clusters – In this case the GP router will be at a distance away from population clusters and both the APs will be 100 - 500 Meters away from the GP router both connected on fibre port



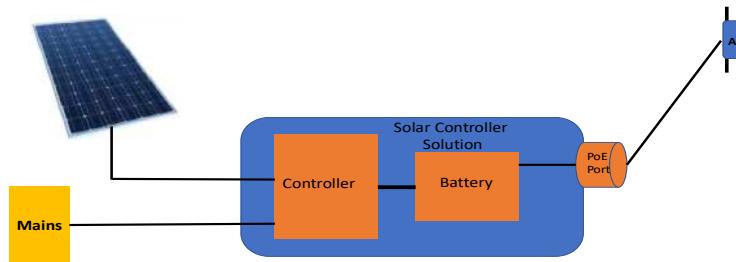
2.5. Power solution at GP office

GP office will be deployed with the solar solution. The controller of solar solution will take two inputs i.e. mains and Solar panel. The controller will take input supply from both these sources and select primary source based on the quality and priority of the source. Finally, the power will be supplied to the Router. Also, in case the AP is also deployed close to GP office then the same solar solution will provide the power to the access points through PoE / PoE+.



2.6. Power solution at Remote AP location

Remote AP location will be deployed with the solar solution to power up the AP. The controller of solar solution will take two inputs i.e. mains and Solar panel. The controller will take input supply from both these sources and select primary source based on the quality and priority of the source. Finally, the power the power to the access points will be provided through PoE / PoE+.



2.7. Physical security

Wi-Fi Access Points that are installed outdoors, in open public areas, must ensure the physical security of the small cell is maintained.

Depending on the installation location, there may be a need for security screws or bolts for mounting hardware, to prevent theft or vandalism. An option to lock the Wi-Fi AP to prevent tampering and theft should be provided. Tamper resistant screws may be used to prevent opening or breaking of the device. In outdoor installations, equipment may also need to be placed at a height to prevent injury to general public, or damage due to vandalism (for example, placement at 3m or more off the ground).

3. Management Layer

PIA shall partner with Wi-Fi Services Provider who shall be responsible to provide below mentioned Management Layer to bidder so that Wi-Fi Services can be provided to GP level under this tender. Management layer will be responsible for the below functions:-

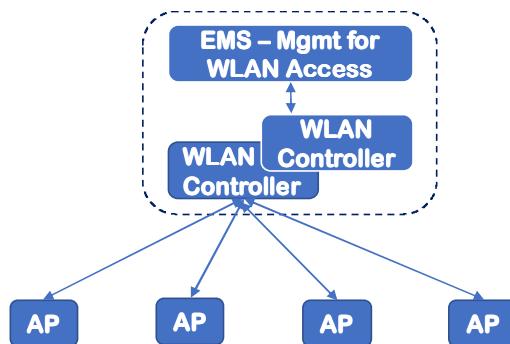
1. **Centralized Management and Monitoring of Wi-Fi network**
2. **Centralized Management of Users through Wi-Fi-SMP (Service Management Platform).**
3. **Perform the reporting functions required for records and compliances. Deploy CGNAT IP Log Management System to keep records and correlate them as and when needed to perform LI for Wi-Fi network.**

4. Enforcing the user policies across the Wi-Fi network by enforcing user policies on the GW/WAG from the Policy Management Platform.
5. Secure the network and users from Internet, Intranet and external networks by means of Firewall/IPS
6. The proposed solution should manage user sessions based on defined policies and also maintain session information for records and compliances

Below are the key components required to achieve the above functionalities: -

3.1. Wireless LAN Controller

Wireless LAN controllers are responsible for the centralized system-wide WLAN functions, such as security policies, intrusion prevention, RF management, quality of service (QoS), and mobility. They work in conjunction with Access points to support wireless applications. Wireless Lan Controller (WLC) is the key element of the entire wireless network and the AP performance depends upon it. The WLC functionality should not be loaded on APs and separate WLC to be provisioned in HA mode.



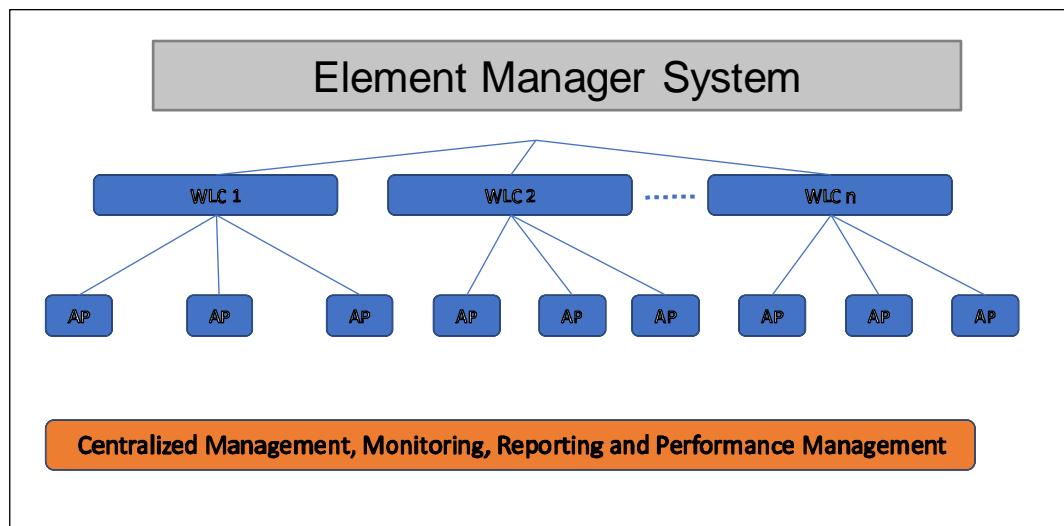
3.2. Wi-Fi Service Management Platform (SMP):

The overall solution consists of various software modules each of which are described below. This platform is responsible for management of Wi-Fi subscribers and their service packages along with their login credentials and policies.

- a) Captive Portal:
- b) AAA Server:
- c) Policy Manager:
- d) Monetization Platform:
- e) Voucher Management System:
- f) Web Self Care Portal:
- g) Mobile APP:
- h) DHCP
- i) Wi-Fi Access Gateway (WAG)

3.3. ELEMENT MANAGER SYSTEM

EMS provides the FCAPS functionality of management, monitoring, troubleshooting and Reporting for records and compliance of wireless networks. It offers Day 0 and 1 provisioning, as well as Day N assurance from the access to the Management layer.



Below are the key functionalities provided by the EMS: -

- 1) **Fault Management**—Detect, isolate, notify, and correct faults encountered in the network.
- 2) **Configuration Management**—Configuration aspects of network devices such as configuration file management, inventory management, and software management.
- 3) **Performance Management**—Monitor and measure various aspects of performance so that overall performance can be maintained at an acceptable level.
- 4) **Security Management**—Provide access to network devices and corporate resources to authorized individuals.
- 5) **Accounting Management**—Usage information of network resources
- 6) **Reporting the performance, users and network**
- 7) **Provide APIs for any central NMS/Application integration**
- 8) **Generate alerts and show them on single pane dashboard and through email**

4. Scope of Work

The scope of work in each of the packages is broadly divided into two phases –

- i. Implementation Phase
- ii. Operations and Maintenance Phase

Scope of work during each phase is detailed below, which needs to be fulfilled by the Bidder.

4.1 Scope of Work during Implementation Period

- 4.1.1 Deployment of infrastructure for creating Wi-Fi hotspots and provisioning of Wi-Fi at every Gram Panchayat as per the functional and technical specifications provided in this RFP, respectively, that must include:
 - i. Provisioning of backhaul bandwidth using the MahaNet network at all GPs
 - ii. Erection of towers/ masts/poles for installing Wi-Fi Access Points or any other suitable broadband technology
 - iii. Provisioning for space and electrical power
 - iv. Provisioning of network equipment, antennae for providing Wi-Fi Services or including procurement, supply, delivery, design, planning, installation and commissioning of all required equipment

- v. Custody of all equipment installed and commissioned for providing Wi-Fi Services.
- 4.1.2 Operations and maintenance of all hardware, software and other equipment required
- 4.1.3 The Bidder must define and implement its overall solution as per the Functional Specifications and Technical Specifications defined in RFP.
- 4.1.4 Maha IT Corporation shall share block wise segregation of GPs.
- 4.1.5 Bidder must strive to install the Wi-Fi Access Points or at a location within the Gram Panchayat area with most optimal coverage to fulfill the minimum requirement of active users as per Annexure A of this RFP.
- 4.1.6 Commissioning of each Wi-Fi hotspot or within the Gram Panchayat area with EMS/NMS at the Network Operations Centre (“Bidder’s WiFi NOC”). Bidder must provide a remote view (over a secured network) of all the software tools used for monitoring of Wi-Fi to the central network operations control of Maha IT Corporation (“Maha IT Corporation NOC”). Bidder shall facilitate access of the tools and dashboards deployed for provisioning of Wi-Fi to Maha IT Corporation NOC for monitoring of services as per SLA parameters at the Gram Panchayats commissioned by the Bidder.
- 4.1.7 Bidder shall submit the installation details of all Wi-Fi Access Points or within the Project Area which shall necessarily include
 - a. Manufacturers serial numbers of all Wi-Fi Access Points equipment
 - b. Details (make, model and serial number) of other equipment installed at the Gram Panchayat locations like UPS, solar panels, PoE switches, etc.
 - c. Geo-location (coordinates) and post-installation photographs (geo-tagged) of all Wi-Fi Access Points equipment
- 4.1.8 Setting up of an automated Authentication, Authorization and Accounting (AAA) mechanism as per DoT guidelines and in compliance with all legal guidelines, procedures and statutes as applicable in India for keeping records of each Wi-Fi Services user at the Gram Panchayat level

4.2 Scope of work during Operations and Maintenance Period

- 4.2.1 Providing Wi-Fi Services and to operate and maintain the entire infrastructure.
- 4.2.2 Keeping user authentication and verification records as per DoT guidelines for all users accessing the Wi-Fi Services on a non-SIM based device. However, OTP (One Time Password) authentication on the registered mobile number of the end user should be mandatory for registering non-SIM based devices into the Wi-Fi / network.
- 4.2.3 The Bidder must ensure that records of end users are captured on the Customer Acquisition Forms (CAF) as per Government of India guidelines. In addition, end users may also be registered through OTP authentication through their existing and verified mobile number which is linked to a SIM activated through a valid CAF. This is required to ensure users don't need to register to the network for every session separately and also to ensure that they can latch onto any of the Wi-Fi access points / equipment

commissioned within the Project Area under the Program without the need for an additional registration process.

- 4.2.4 The Bidder must provision for local coordinators who would be responsible to assist users in case of any difficulties in accessing the internet through the Wi-Fi Services provisioned. These coordinators shall also be responsible for first level troubleshooting in the event of disruption of services for any reason.
- 4.2.5 Facilitate sale of coupons (either physical or e-coupons) for internet usage through the Wi-Fi / or infrastructure thus created.
- 4.2.6 Ensure network uptime as per the SLA provided in RFP. The Bidder must ensure availability, as maybe necessary to maintain the SLAs and accordingly provision for spare equipment to be used as replacements, as and when required.
- 4.2.7 At least 2% of the overall equipment installed for Wi-Fi Services must be kept as spares throughout the Program duration in a central location at each District. For this, Bidder may provision for a store at each of the Districts within each of the work packages.
- 4.2.8 Undertake operations and maintenance of the equipment to adhere to the SLA commitments as detailed in this RFP including firmware/ software updates, fault resolution, etc.
- 4.2.9 Create an active user base using the Wi Fi Services and undertake effective measures to add on new users.
- 4.2.10 Generation and submission of the following reports on a monthly basis (latest by the 7th day of the subsequent month) through the EMS/NMS at the Bidder's WiFi NOC (and made available to the Maha IT Corporation NOC) :
 - 4.2.11 Bandwidth configured and utilization report at each Wi-Fi access points/ equipment
 - 4.2.12 Equipment uptime at each Wi-Fi hotspot/ equipment and its access points/ equipment
 - 4.2.13 List of registered and active user base along with their average bandwidth consumption and with GP wise and District wise summary reports
 - 4.2.14 Total aggregate bandwidth consumed per month per Gram Panchayat and per District
 - 4.2.15 Sale of coupons per month along with coupon value, user details, data usage validity, date of purchase and coupon expiry date
 - 4.2.16 Incidence report by end consumers due to non-availability of internet through the Wi-Fi infrastructure thus created
 - 4.2.17 Customizable MIS reports on the above for on demand access by Maha IT Corporation officials or any other personnel thus appointed by Maha IT Corporation
 - 4.2.18 AAA Performance Report
 - 4.2.19 Provide assistance to the local population for using the Wi-Fi or any other broadband Services.
 - 4.2.20 Bidder may use the services of Common Services Centres (CSC), a special purpose vehicle under Ministry of Electronics and Information Technology (MEITY), Government of India for providing services on need basis as defined in this RFP. The Bidder may use the services of CSC for effective delivery of Wi-Fi / Services at the Gram Panchayat level. However, it should be noted that this is an option and not an obligation for the

Bidder. Maha IT Corporation shall not be a party to any such association or involvement between the Bidder and CSC.

Periodic Audits of tools at Bidder's Wi-Fi NOC

Maha IT Corporation shall have the right to audit any or all tools installed at the Network Operations Centre ("Bidder's WiFi NOC") of the Bidder for provisioning of Wi-Fi Services. These shall include all tools which are used to generate user reports and user details as specified in this RFP, calculation of network uptime, etc. The audit shall be conducted by an independent third party as and when required by Maha IT Corporation. Such audits shall be limited to the software tools used for execution of Work and delivery of Wi-Fi / Services.

Maha IT Corporation shall also have the right to verify that the Bidder's Wi-Fi NOC and the solution deployed by the Bidder for completion of Work complies with all requirements as per the Functional and Technical Specifications, as defined in this RFP.

Bidder shall facilitate any such audit and provide all required support to Maha IT Corporation and its appointed agency during the audit process. The audit process may also include the auditing of the security and anti-intrusion measures implemented by the Bidder to check for conformity with the specifications detailed in this RFP.

If any deviations are observed during the audit process, Bidder shall undertake to rectify those in a maximum of 30 (thirty) days from the date of communication of such deviations by Maha IT Corporation. Maha IT Corporation may repeat the audit process to verify the rectification of such deviations.

5. Functional Specifications

The Bidder must ensure the following while providing Wi-Fi / Services at each Gram Panchayat area in the Project Area:

- 5.1 Provisioning of Wi-Fi services at the Gram Panchayat area at a location covering a sizeable portion of the local village population, with at least the minimum number of Wi-Fi Access Points or any other broadband technology Nodes specified in Annexure A of this RFP for a particular Gram Panchayat area, and must comply with the minimum technical specification provided in this RFP.
- 5.2 The radio equipment for setting up Wi-Fi Services should have the capability to propagate frequencies of both 2.4 GHz and 5 GHz to ensure it can be accessed by a wide variety of devices with different hardware specifications
- 5.3 The system must be both IPv4 and IPv6 compliant.
- 5.4 The methodology employed by the Bidder for installation of equipment for Wi-Fi Services shall ensure that the devices are able to withstand high speed winds/ thunderstorms

- 5.5 The Wi Fi network should have minimum bandwidth as per Annexure A of this RFP as per the local population of a particular Gram Panchayat (averaged out at the District level) at 1:1. Bandwidth requirement will be exempted only for sites where Maha IT Corporation's bandwidth would be through VSAT.
- 5.6 Each Wi-Fi Access Point(s) access node shall have a capacity to support 50 (Fifty) concurrent users. The Bidder must ensure that the Wireless Lan Controller (WLC) installed for controlling the Wi-Fi Access Points nodes must have the capacity to support such number of concurrent users across all Wi-Fi Access Points Nodes commissioned by the Bidder under the Program
- 5.7 The Bidder must be able to control bandwidth at user level to prevent users from creating bandwidth monopoly (for example, by downloading large sized files or videos) by adopting required Fair Usage Policy ("FUP").
- 5.8 The radio equipment used for Wi-Fi any other Services shall be capable of operating on dual power sources – solar or other renewable power source and UPS power.
- 5.9 Bidder must provision for at least 8 (Eight) hours of power backup to each Wi-Fi Access Point/ Node installed at the Gram Panchayat areas
- 5.10 All equipment installed by the Bidder for provisioning of Wi-Fi Broadband Services shall have proper earthing and lightning protection and the Bidder shall ensure provisioning of required earthing if not available
- 5.11 The Bidder shall provide and manage its own IP schema as per DoT/ TRAI guidelines for provisioning of Wi-Fi / Broadeband Services
- 5.12 The users must be required to register themselves through a web portal or through a mobile based application along with OTP based authentication. The web portal should be customized for error free access via both desktops/ laptops and mobile devices (including mobile handsets, tablets, etc.)
- 5.13 The web portal must have a landing/home page which should prominently display the links to the available tariff plans
- 5.14 Bidder must also provide a mobile based self-help application to help users of the Wi-Fi / Services to check their usage, compare available tariff plans and also for the purchase of coupons
 - 5.15 The Bidder must provision for a SMS gateway/ Email gateway) on its own for sending messages (**Maximum 5000 per day for Service orders/ tasks/ intimation etc.**) and emails for user registration, password change, One Time Password (OTP) generation and for sending other such communication which may be required during the normal course of operations.
- 5.16 The Bidder must ensure that users of Wi-Fi / Services are able to connect to the internet, using their existing user id and password, through any of the Wi-Fi Access Points Nodes deployed under the Work Order within the Project Area, without the need to re-register into the network.

- 5.17 The Bidder shall provision to store user specific log trails and must keep backup of all such logs for at least one year. Whenever requested by Maha IT Corporation or any statutory body, Bidder must be able to provide the logs within 24 hours of such request.
- 5.18 Wi-Fi Services should have capability to support voice over Wi-Fi (VoWiFi) services to provide quality voice service to the Gram Panchayat location.
- 5.19 Wi-Fi access / equipment and services shall remain functional in the event the link is lost between Wi-Fi Access Points equipment and the wireless management system or if the wireless management system fails
- 5.20 All Wi-Fi Access Points nodes commissioned by the Bidder under the Work Order shall have the ability to be managed remotely, including for firmware and software updates
- 5.21 The Wi-Fi Access Points or associated wireless management system shall have the ability to block traffic based on IP address, port, URL, or host name and should have the ability to block or manage traffic based on QoS
- 5.22 ***Wi-Fi controller solution can be cloud based or appliance based solution depending on the architecture proposed. Wi-Fi access points will be managed by Wi-Fi service provider through their NMS and hence has to be hosted/ managed by Wi-Fi service provider domain. In case it is appliance based, the same may be physically located at other locations in the network however will again be managed by the Wi-Fi service provider. The Wi-Fi controller shall be integrated to the Wi-Fi service provider NMS for managing the APs and provision of Wi-Fi services including all the functions (Authentication, LI, Customer billing and management, Advertisement etc.). At the end of contract, the Wi-Fi controller solution shall be handed over back to MahalT by the bidder. The bidder is responsible for overall scope through the contract period in partnership with Wi-Fi Service provider.***

6. Technical Specifications

Minimum Technical specifications for Wi-Fi Access Point (Outdoor) equipment:

The Wi-Fi Access Points (or “AP”) to be used for this Program shall conform to the following technical specifications:

Sr. No.	Minimum Requirement Description
1	Access Points proposed must be 802.11ac, Wave 2 compliant, include radios for both 2.4 GHz and 5 GHz.
2	<i>Must support a variety of antenna options. (Omni and directional)/ integrated antenna.</i>
3	Must have -90 dB or better Receiver Sensitivity.
4	<i>Must support minimum 2X2 multiple-input multiple-output (MIMO) with two spatial streams, The AP should support working in 2.4G & 5G mode</i>
5	Must support 802.11ac, Wave 2 and backward compatible with 802.11n standards
6	<i>Must support data rates up to 1 Gbps rate</i>

Sr. No.	Minimum Requirement Description
7	Must support 80 MHz wide channels in 5 GHz.
8	Must support WAP enforced load-balance between 2.4Ghz and 5Ghz band.
9	<i>The access point must support 32 dBm EIRP or higher transmit power. Field deployment shall be with EIRP as per regulatory guidelines (ETA and WPC to be enclosed at the time of bid submission)</i>
10	Support Encrypted and authenticated connectivity between all backhaul components
11	<i>Access point should have one 10/100/1000BASE-T Ethernet autosensing (RJ-45) with Additional SFP/SFP+ fibre port for direct fibre termination for long distance wired connections(Every Access Point has to include power injector solution of the required capacity as an accessory to be supplied).</i>
12	Preferred to have built in Bluetooth
13	Should have mechanism for surge protection preferred to have in built solution
14	Should have dedicated console port (RJ-45) for local troubleshooting
15	Wireless AP should support beam forming technology
16	Wireless AP Should able to detect and classify non-Wi-Fi wireless transmissions.
17	Must incorporate radio resource management for power, channel, coverage hole detection and performance optimization
18	Access point shall support powering from any of the POE/PoE+/uPoE source as per Device requirement
19	Access point shall support pole, wall and Cable strand mounting options.
20	The equipment shall support up to 100 MPH sustained winds &160 MPH wind gusts.
21	The Access point shall be IP67
22	The Access point shall support operating temperature of -40 to 65°C
23	Wi-Fi Alliance Certification for WMM and WMM power save
24	Must support QoS and Video Call Admission Control/Equivalent capabilities.
25	Must support 16 WLANs per AP for BSSID deployment flexibility.
26	Must support telnet and SSH login to APs directly for troubleshooting flexibility.

NOTE: Bidder must provide valid ETA and WPC Certificate for the Access Points at the time of bid submission.

7. Minimum Technical specifications for Wireless Equipment:

The equipment offered by the bidder will be tested for the standard protocols as above during technical validation and QA stage

The Wireless technology offered by the bidder should meet the criterion of availability of suitable access devices such as hand held devices/ mobile phones/ tablets/ laptops etc. and should be supporting the community service in terms of multiple concurrent users

8. Technical specification for Security of the System

- I. Security enforcement for wireless users through the use of a role-based, stateful firewall that can be directly integrated with the roles defined within existing authentication servers
- II. Capability to ensure privacy protection by preventing firewall and IP spoofing attacks.
- III. System should provide the capability to capture the data and syslog for audit and analysis.

- IV. Rules for access rights based on any combination of role identity, and device identity.
- V. The firewall must be able to take action including allowing the traffic, denying the traffic, rejecting the traffic and routing the traffic
- VI. Network monitoring through centralized NOC
- VII. Fault management and performance management (FCAPS)
- VIII. Comply with other applicable norms/ standards/ guidelines of the Government of India/ DoT/ TRAI.

Technical specifications for Intrusion Detection and Prevention for the System

- I. Wireless Intrusion Detection Solution (WIDS)
- II. Ability for the system to provide visibility into Channels including the detection of rogue devices / RF activity occurring between channels.
- III. Should be able to classify real rogues (on network) versus interfering neighbour networks, irrespective of whether rogues have encryption or not, and without client software or upgrades to current network.
- IV. The system must support Pairwise Master Key (PMK) caching.

NOTE:

1. The Bidder shall be required to provide Wi-Fi Access Points outdoor broadband equipment (Outdoor type) within the area covered by an individual Gram Panchayat. However, the Bidder shall be required to install, commission and maintain Wireless LAN Controllers, Wi-Fi Element Management System, Network Switches, Security and Intrusion detection and prevention systems, power banks/ UPS and other associated equipment required for fulfilling its obligations as per the Scope of Work defined in this RFP. The Bidder shall ensure adequate security and anti- intrusion mechanism for all such equipment installed to ensure the Wi-Fi network thus created by the Bidder is safe and secure at all times.
2. Specifications in this RFP shall be included as part of the overall Wi-Fi system thus created and does not necessarily need to be entirely managed at the Wi-Fi Access Points nodes deployed at Site. Bidder can provide these features at upstream levels like the Wireless Controller (WLC), Firewall, NMS or as part of the overall solution deployed at the Bidder's NOC. However, Bidder must be able to demonstrate these features as part of the Acceptance Testing as provided in this RFP.

10. Utilization and Marketing of Services

As part of the Program design, Maha IT Corporation encourages the Bidder to partner with Service providers/ Agencies who can help monetize the infrastructure created through implementation of the Program.

The Bidder may, within the applicable laws and other guidelines issued by DoT and the Government of India, to monetize the created infrastructure through any or all of the following:

1. Subscription charges from users for the usage of Wi-Fi Services
2. Advertising on the web portal (only on the home page and without push messages during internet browsing by a paying user)
3. Free Wi-Fi usage to users in lieu of viewing of advertisements
4. Any other revenue generation model which the Bidder wishes to employ within the realms of existing laws, rules and regulations of Government of India, TRAI and DoT

The above services for monetization of the Wi-Fi or infrastructure thus created should be co-branded with Maha IT Corporation by the Bidder. Bidder must use industrial grade sticker (for outdoor use) stating “Powered by MahaNet” and display it prominently on all Wi-Fi Access Points Nodes deployed/ installed under Works. Similarly, display boards shall also state “Powered by MahaNet” at all points-of-sale of Wi-Fi coupons.

Bidder shall be free to offer tariff plans considered appropriate by the Bidder to ensure more active users are on boarded for using the Wi-Fi Services.

The Bidder is expected to carry out the operations and maintenance as per the defined SLA parameters in Section VII of this RFP and may support it with the revenue thus generated by it.

The Bidder shall have the right to retain 50% of the proceeds from such revenue generated throughout the Operations and Maintenance phase and for any period for which the operations and maintenance is extended thereof, as provided in Section V B of this RFP. The Bidder will be required to share 50% of the revenue thus generated throughout the Operations and Maintenance phase with Maha IT Corporation.

In the event of any interruptions in Wi-Fi Services, Bidder must provide additional hours of usage to the affected users, without any additional cost to the end user and as per the plan opted by the user, for a proportionate amount of time for which the Wi-Fi Services were either unavailable or disrupted.

11. Proposed services from Common Services Centres

Common Services Centres (or “CSC”) is a special purpose vehicle under Ministry of Electronics and Information Technology (MEITY), Government of India. It is one of the pillars of the Digital India mission. It has a strong village level presence across India, leveraging its network of Village Level Entrepreneurs (VLEs) for delivery of basic services like banking, Aadhaar registration, insurance etc. to the village population.

Given the nature of services under this RFP, the Bidder will require strong local representation at the Gram Panchayat level to manage its day to day operations and also to engage the local population to create a robust user base.

Bidder may use the existing network of VLEs across the Gram Panchayats for effective delivery of services as required under this RFP. If the Bidder wishes to collaborate with CSC, Maha IT Corporation may facilitate such an agreement. However, for the sake of clarity, Maha IT Corporation shall not be a party to any such agreement itself but may only facilitate the agreement between the two parties (i.e. the Bidder and CSC).

Bidder may also seek the assistance of the VLEs to help them identify and hire space for installation of the Wi-Fi Access Points equipment and other related equipment (like towers, power banks, etc.) at the Gram Panchayat level. VLEs may also help the Bidder for provisioning of grid power for the Wi-Fi equipment or to be installed at site. However, Bidder may approach the VLEs for provisioning of such power and space requirements at its own discretion at a rate agreed between the Bidder and CSC or the VLEs.

It is the responsibility of the Bidder and CSC to negotiate the terms of such association. It must also be noted that it is an option and not an obligation on the Bidder to leverage the services of CSC or its VLEs. The following may however be considered as a guiding principle for arriving at such an agreement.

Annexure J

Responsibility Matrix

Annexure J: (Indicative) Responsibility Matrix

The (Indicative) responsibility matrix (RACIS) will be finalized/modified through discussion with the bidders selected through LOI (Letter of Intent) where need be.

Where RASCI stands for the following:

R (responsibility: Those who do the work to achieve the task),

A (accountability: The one ultimately answerable for the correct and thorough completion of the deliverable or task, and the one who delegates the work to those responsible),

C (Consulted: Those whose opinions are sought, typically subject matter experts; and with whom there is two-way communication),

I (Informed: Those who are kept up-to-date on progress, often only on completion of the task or deliverable; and with whom there is just one-way communication) and

S (Support: Resources allocated to responsible).

Interlinkages between Package A as well as B/C (Indicative)

S.No.	Interworking between Pack-A & Pack-B &C	PIA Package-A	PIA Package - B/C	SIA	PMC	TPA
1	ROW requests (notification of routes planned at least 1 week prior to commence)		R		S	
2	ROW approvals		S	A	C,S	
3	Trenching/ ducting for underground OFC		R,A		S	
4	Preparation of splice chambers having regards to cable drum lengths and coils to be placed in the chamber		R,A	I	S	I
5	Planting of OFC route and joint indicators		R,A	I	S	I
6	Measurement & re-coding of trench depth in measurement book		R,A		S	
7	Auditing & acceptance of trenching depth		S,A	I	C,S	R
8	Back filling & dressing of the trenches		A	I	S	R
9	Auditing & acceptance of splice chambers, route and joint indicators		A	I	C,S	R
10	Blowing/ cable pulling of OF cable		R,A	I	S	I
11	OFC splicing & splice-loss measurement		R	I	A,S	A

S.No.	Interworking between Pack-A & Pack-B &C	PIA Package-A	PIA Package - B/C	SIA	PMC	TPA
12	Termination of OFC at FDF (Fibre Distribution Frame)		R,A	I	S	
13	Acceptance of GP rings and measurement to assess compliance for thresholds as per specifications for: - Splice losses - cable loss		A	I	C,S	R
14	As built drawings encompassing trench, duct, splice chambers, route & joint indicators , OF cable, route index diagrams, make & size of cable, off-set from centre of road, type of protection, depth and size of		R	I	C,S	A
15	Intimation to Pack-A PIA for Active	I	A,R	I	C	I
16	Delivery of equipments to GP	R,A	I	I	S	I
17	Site Infra Readiness	I	A,R	S	S	I
18	Fibre termination at GP	I	A, R	I	S	I
19	Fibre testing (OTDR report)- upload in portal	I	A, R	I	S	R
20	Intimation to PackageA-PIA for active components with (4 weeks time window to complete MPLS)	I	A	I	R	I
21	Installation of MPLS routers at GP Level (within 4 weeks from intimation date)	A, R	S	S	S	I
22	If Package A-PIA raises any issue within 4 weeks, Package B-SIA resolves any issues with respect to site readiness or fibre testing (within 4 weeks from intimation)	A, R	A, R	S	S	I
23	Commissioning of MPLS routers at GP level with visibility at NOC (within 4 weeks from intimation date)	A, R	S	S	S	I
24	Commissioning of GP milestone (for both Package A-SIA and Package B/C-SIA)	A, R	I	I	S	R
25	If Package A-PIA team does not respond within 4 weeks from intimation date, Package B/C-SIA claims GP commissioning	I	A, R	S	S	I

S.No.	Interworking between Pack-A & Pack-B &C	PIA Package-A	PIA Package - B/C	SIA	PMC	TPA
Note:	In S.No. 8, both Package A-PIA and Package B/C-PIA will be responsible as well as accountable because in case of any issue, Package A-PIA will be held responsible and accountable for intimating Package B/C-PIA. And on the other hand, Package B/C-PIA will be held responsible and accountable for rectifying the issue.					

Responsibility Matrix - Package A (Indicative)

S.No.	Action Items	PIA	SIA	TPA	PMC
1	RFP Release	I	A		R
2	Bid Evaluation	I	A		C
3	Bid Finalisation	I	A		C
4	Issue of LOI	I	A		R

Project Phase

A	Planning	PIA	SIA	TPA	PMC
1	Closure of contracts/ sign-off with PIAs and release of purchase orders	S	A		R
2	Project governance model (processes and organization) design	S	A	I	R
3	Develop detailed project plan	S	A	I	R
4	Publishing procedures, guidelines, checklists and report formats	S	C	I	A,R
5	Resource planning	A,R	C	I	C
6	Approval of resource plan	I	A	I	R
7	Approval of detailed project plan	I	A	I	R
8	Engineering documentation	R	C	I	A
9	Approval of engineering documentation	I	A	C	R
10	EHS compliance	R	I	A	C
11	Commissioning of Project Management Tool	I	R	C	A
12	Training on usage of project management tool	S	A	I	R

13	Finalization,distribution and maintenance of: - project deliverables - documentation - documentation control	S	C	I	A,R
14	Dispute resolution	S	A	I	R
15	Escalation handling	S	A	I	R
16	Risk analysis and mitigation	S	A	I	R
17	Project tracking / reporting (weekly / monthly / quarterly reports)	S	C	I	A,R
18	Process for handling Change requests and approvals	S	C	I	A,R
19	Governance process for Review meetings with PIA,MahaIT,BBNL,SLIC etc.	S	C	I	A,R
B	Site Survey	PIA	SIA	TPA	PMC
1	Site / route survey format template	R	I	C	A
2	Conducting site survey	A,R	I		S
3	Population of site/ route survey template Inputs regarding the following to be provided as part of the site survey: - Any road expansions planned/ water pipe line/ drainage activities planned - En-route culverts and bridges,water flow of the river or stream (indicating the duration of months water is flowing) - Side of the road from where the proposed cable is to be laid - Road crossing (road and railway lines) - existing fibre routes if any - existing power cable routes and overhead power cables alignments - diverse route availability w.r.t to formation of taluka and GP rings (avoidance of flat rings to avoid single point of failure) - proposed alignment from the centre of the road/ nearest carriage way, GIS parameters (Longitude ,Latitude and altitude (HASL)). - availability of electric poles for stringing ADSS cables with headway of 12 - 15ft - Strengthening of poles	A,R	I	I	C
4	Entry of detailed survey data in Project management tool	A,R	I	I	C
5	Submission of route survey for approval	R	I	I	A
6	Approval of survey document	S	A	I	R
7	Site survey action item w.r.t to Maha IT / BBNL	S	A	C	R
C	Planning and Engineering				
C 1	OFC	PIA	SIA	TPA	PMC
1	Details of Taluka and GP rings,existing and planned	A,R	I		C
2	Proposal for Taluka and GP rings based on survey data	A,R	I		C

3	Finalisation of distance between rings and ring formation	A,R	I	I	S
4	Avoidance of flat rings by trenching on both sides of the roads	A,R	I	I	C
5	Enhancement of scope for PIA in case of flat rings (trenching to be done on both side of road)	S	A	I	R
6	Design acceptance of GP and Taluka rings	S	I	A,R	C
7	Assessment of existing poles and stregthening where ever required	A,R	I	I	C
8	Approval for placement of additional poles	S	A	I	R
9	Planning for necessary safety arrangements while working in close range of electric lines	A,R	C	S	C
10	Guidelines for safety arrangements for stringing ADSS cable working at heightened posts and road sides	A,R	C	S	C
11	Survey of the proposed TalukA,GPs locations for civil,electric infrastructure availability	A,R	I	I	C
12	Plan for Civil and Electrical upgradation of Talukas and GPs	A,R	I	I	C
C 2	MPLS Network	PIA	SIA	TPA	PMC
1	Information request e.g. bandwidth,capacity etc. for connecting Taluka rings to district/ national rings	A,R	I	C	S
2	High level network planning design document	A,R	I	I	C
3	Area wise planning document	A,R	I	I	C
4	Final detailed design	A,R	I	I	C
5	Design approval	S	C	A,R	C
6	Low level design document	A,R	I	I	C
7	Low level design approval	S	C	A,R	C
8	Bill of Material (BoM) (electronic and installation related material)	A,R	I	I	C
9	Bill of Material (BoM) approval (electronic and installation related material)	S	C	A,R	C
C 3	DCN	PIA	SIA	TPA	PMC
1	Identification of the network elements that need to be managed	A,R	I	I	C,S
2	Leasing of bandwidth from service providers for connecting the network elements to NOC /DR	A,R	I	I	C
3	DCN design and BOM approval	S	C	A,R	C
C 4	NOC and NOC – DR	PIA	SIA	TPA	PMC
1	Specification details of Maha-NOC	A,R	I	I	C
2	Design finalisation of NOC including space/ manpower etc.	A,R	I	I	C
3	Integration requirements for BSS-OSS	A,R	I	I	C
4	Detailed BoM including video wall,servers,desktops,security and surveillance,video conferencing systems etc.	A	I	R	S

5	Design and BoM approval	S	C	A,R	C
D	Implementation				
D 1	Civil and electrical Infrastructure (Parallel activity with OFC)	PIA	SIA	TPA	PMC
1	Installation of FDMS and termination of the cable	A,R	I	I	C
2	Delivery of DG sets,ACs,UPSs,battries,solar panels and racks at proposed Taluka locations	A,R	I	I	C
3	Installation and commissioning of DG Sets,UPs,ACs etc./	A,R	I	I	C
4	Provisioning of earth for equipment,mast and solar panel	A,R	I	I	C
5	Infrastructure acceptance of the Taluka locations/Gram panchayat	S	C	A,R	C
D 2	UPS/ Solar (Parallel activity with OFC)	PIA	SIA	TPA	PMC
1	Delivery of solar panels,on-line UPS and batteries	A,R	I	I	C
2	Installation and commissioning of solar panels,UPS and Batteries at the proposed locations	R,A	I	I	C
3	Acceptance for UPS system and solar panels	S	C	A,R	C
D 3	Underground OFC	PIA	SIA	TPA	PMC
1	ROW requests (notification of routes planned at least 1 week prior to commence of work)	A,R	I	I	S
2	ROW approvals	S	A,R		C
3	EHS compliance audit	S	C	A,R	C
4	Procurement of material for ducting,Fiber etc	A,R	I		C
5	Verification of the materials	S	I	A,R	C
6	Compliance testing with tender specifications for the material procured by PIA for MahaNet (GR/TEC/ etc.)	R,S	I	A	C
7	Barricading for trenching	A,R	I	I	C
8	Trenching/ ducting for underground OFC	A,R	I	I	C
9	Updation of project plan in tool for periodic monitoring	S	I	I	A,R
10	Request for sub-normal trenching and protection requirement in the portal	A,R	I	I	C
11	Approval for sub-normal trenching and protection requirement within 7 days on the portal (otherwise deemed approved)	S	I	A,R	C
12	Preparation of splice chambers with regards to cable drum lengths and coils to be placed in the chamber	A,R	I	I	C
13	Placement of OFC route Electronic indicator	A,R	I	I	C
14	Measurement and recoding of trench depth in measurement book	A,R	I	I	I
15	Auditing and acceptance of trenching depth	S	I	A,R	C
16	Back filling and dressing of the trenches	A,R	I	I	C

17	Auditing and acceptance of splice chambers,electronic indicators(Route and joints)	S	I	A,R	C
18	Notification to field electronics team for deployment of electronics for sections where fibre ducting/stringing is complete	A,R	I	I	S
19	Blowing/pulling of OF cable	A,R	I	I	C
20	Inputs/updates regarding progress on fibre blowing	C	I	I	A,R
21	Notify PIA electronics for implementation status	A,R	I	I	S
22	OFC splicing and splice-loss measurement with OTDR	A,R	I	I	C
23	Termination of OFC at FDF (Fibre Distribution Frame) and LSPM	A,R	I		S
24	Acceptance of GP rings and measurement to assess compliance for thresholds as per specifications for: - Splice losses - cable loss - end-to-end ring connectivity	S	I	A,R	C
25	Acceptance of Taluka rings and measurement to assess compliance for thresholds as per specifications for: - Splice losses - cable loss - end to end ring connectivity	S	I	A,R	C
26	Acceptance of interconnect rings and measurement to assess compliance for thresholds as per specifications for: - Splice losses - cable loss - end to end ring connectivity	S	I	A,R	C
27	As built drawings encompassing trench,duct,splice chambers,route and joint indicators ,OF cable,route index diagrams,make and size of cable,off-set from centre of road,type of protection,depth and size of chambers amongst others and GIS data	A,R	I	I	C
28	Stage wise material (pipe,OFC,accessories,etc.) reconciliation Taluka/ GP wise	S	I	S	A,R
29	Issuing notices to PIA for non-performance,if any	I	A	R	C
30	Invoice pre-verification based on the milestones and recommendation for the payments	I,S	C	A, R	C
31	Final verification of Invoice based on the milestones and recommendation for the payments	I	A	R	C
D 4	Aerial OFC	PIA	SIA	TPA	PMC
1	Request of placement of ADSS cable using existing electric poles	A,R	I	I	C
2	Joint box fixing and stringing OF cable	A,R	I	I	C
3	Notify the progress on completion of fibre Stringing of ADSS cable	C	I	I	A,R

4	Notify PIA Electronics for deployment of electronics for sections where stringing of ADSS cables are complete	A,R	I	I	S
5	OFC splicing, provisioning spare cable of Coil length and splice-loss measurement with OTDR	A,R	I	C	C
6	Termination of OFC at FDF (Fibre Distribution Frame)	A,R	I		S
7	Acceptance of GP rings and measurement to assess compliance for thresholds as per specifications for: Splice losses Cable link loss end to end ring connectivity	S	I	A,R	C
8	Acceptance of Taluka rings and measurement to assess compliance for thresholds as per specifications for: Splice losses Cable link loss end to end ring connectivity	S	I	A,R	C
9	Acceptance of interconnect rings and measurement to assess compliance for thresholds as per specifications for: Splice losses Cable link loss end to end ring connectivity	S	I	A,R	C
10	As built drawings capturing ADSS alignment with offset from the road center,type of posts used,staying arrangement made,span length between poles,type of ADSS cable and count of fiber,splice closure placement,longitude and latitude of poles/alignment,distance between high tension lines and ADSS,windload that the cable can withstand	A,R	I	I	C
11	Stage wise material (ADSS OFC,accessories,etc.) reconciliation Taluka/ GP wise,poles erected,strengthened etc	A	I	R	S
4 E	Electronics (MPLS Network)	PIA	SIA	TPA	PMC
1	Delivery of equipments to Taluka/ GP as per the installation plan	A,R	I	I	C
2	Verification of the Active/ passive materials as per design	A	I	R	S
3	Fixing and grounding of racks	A,R	I	I	C
4	Installation of DCDB	A,R	I	I	C
5	Fixing the fibre trays for connectivity with equipments	A,R	I	I	C
6	Fixing of patch cords and organising the ODFs at designated place	A,R	I	I	C
7	Laying the power cable from DCDB to racks	A,R	I	I	C
8	Labelling of complete equipments,accessories,patched cords,power cables,electronic devices etc.	A,R	I	I	C
9	Installation of MPLS routers at Taluka and GP	A,R	I	I	C
10	Testing and Commissioning of MPLS routers at Taluka and GP Level	A,R	I	I	C
11	Nodal acceptance of Taluka and GP	S	I	A,R	C,S
12	Integration of Taluka and GP rings	A,R	I	I	C

13	DCN service readiness and node visibility at NOC (EMS/NMS)	A,R	I	I	C
14	Pre-link/ ring acceptance	S	I	A,R	C,S
15	Notification on completion of installation of Taluka and GP ring for acceptance	A	I	I	R
16	Acceptance testing of Taluka and GP Rings with NOC visibility of GP	A	I	R	C,S
17	Notification regarding completion of 25%,50% and 75% of GPs in a package and incremental of 5%	A,R	I	I	C,S
18	As-built drawings of Taluka and GP rings	A	I	R	C,S
19	Material reconciliation Taluka/ GP wise	A	I	R	C,S
20	Handover the completed GPs to O&M PIA on integration of DFMS with NOC	A,R	I	I	C
4 F	DCN	PIA	SIA	TPA	PMC
1	Delivery of the devices as per the approved design/ BOM	A,R	I	I	C
2	Verification of the DCN equipments	A	I	R	S
3	Installation of the DCN network connecting all the elements	R,A	I	I	S
4	DCN engineering which includes assessment of bandwidth requirement of OAMP functionality.	A,R	I	C	S
5	Approval of DCN bandwidth	A	A	S	R
6	Feasibility of bandwidth requirement with service providers and testing the bandwidth before handover	A	I	R	S
7	Testing of end to end connectivity with NOC	A	I	R	S
8	DCN acceptance testing	A	I	R	S
4 G	NOC	PIA	SIA	TPA	PMC
1	Delivery of the equipments as per the approved design/ BOM	R,A	I	I	S
2	Verification of all active BOM	A	I	R	S
3	Completion of civil,electrical and other infrastructure work etc.	A	R	I	S
4	Installation of video wall,servers,desktops,security and surveillance,video conferencing systems etc.	A,R	I	I	S
5	Installation of NOC	A,R	I	I	S
6	Commissioning of NOC (including BSS)	R,A	I	I	S
7	Testing of OSS	A	I	R	S
8	Testing of BSS	A	I	R	S
9	Formalization of all NOC processes	R,A	I	R	S
10	Approval of all NOC processes	A	I	S	R
11	Acceptance testing of OSS	A	I	R	S
12	Acceptance testing of BSS	A	I	R	S
13	Integration of MahaNet NOC	R,A	I	S	S

14	Testing of MahaNet NOC	A	I	R	S
15	Integration of MahaNet NOC with NNOC Delhi	A	I	R	S
16	Testing of MahaNet NOC with NNOC Delhi	S,R	I	R	C,S
17	Material reconciliation	A	I	R	S
18	Acceptance of NOC (functionality,intergration etc.)	A	I	R	S
4 H	Network integration and testing	PIA	SIA	TPA	PMC
1	Leasing of bandwidth from service providers for data bearer traffic	R	A	I	S
2	Testing of the leased bandwidth	A,R	I	S	S
3	Integrating leased bandwidth to MTHQ and taking traffic tests	A,R	I	S	S
4	NOC testing - creation of LSP (Label Switched Path),monitoring of alarms	A,R	I	S	S
5	End-to-End testing and traffic trials	A,R	I	S	S
E	Project state: Maintenance	PIA	SIA	TPA	PMC
1	Commissioning of NMS - Formation of FRT (Fault Repairing Team) - Route patrolling teams for OF cable routes for every 300Km - Weekly/Monthly measurement of optical power budget parameters - Sparing strategy for OF cable and jointing accessories in maintenance locations - OTDR traces after restoration of the fault - Capturing additions,deletions of OF cable in the As-Built diagrams - Provisioning of additional electronic joint indicators in new jointing locations that are introduced - Shifting of OF cable wherever found necessary - Centralized monitoring through NOC / NMS	A,R	I	I	C
2	Preparation of Standard Operating Procedure (SOP) based on SLA criteria (e.g. network availability,GP ring- 99.9%,Spur- 99.5%),MTTR,Preventive maintenance)	A,R	I	I	C
3	Approval of the SOPs	S	A	S	R
4	Provisioning of bandwidth at GPs based on the approved requirements	A,R	I	I	C
5	Provisioning of 6 dark fibres at GP	A,R	I	I	S
6	Deployment of O and M team	A,R	I	I	C
7	Conducting Preventive Maintenance (PM) activity and submitting periodic reports	A,R	I	I	I
8	MIS report- related to issues/ resolved/ unresolved etc.	S	I	I	A,R
9	Escalation matrix	S	I	I	A,R
10	Root-cause analysis	S	I	I	A,R
11	Review meetings (weekly/ bi-weekly/ monthly)	S	I	I	A,R
12	Submission of performance matrix at defined periodic intervals	S	I	I	A,R

13	Governance set up and management reporting	S	I	I	A,R
14	Trouble ticketing	A,R	I	I	S
15	Alarm collection across different service providers	A,R	I	I	S
16	Publishing operational reports (SLA,Availability report,Dashboards,Compliance reports)	S	I	I	A,R
17	Competence training/ floor mentoring	A,R	I	I	S
18	Monitoring of uptime based on agreed SLA	A,R	I	I	S

Responsibility Matrix - Package B (Indicative)

S.No.	Action Items	PIA	SIA	TPA	PMC
1	RFP Release	I	A		R
2	Bid Evaluation	I	A		C
3	Bid Finalisation	I	A		C
4	Issue of LOI	I	A	I	R

Project Phase

A	Planning	PIA	SIA	TPA	PMC
1	Closure of contracts/ sign-off with PIAs and release of purchase orders	S	A		R
2	Project governance model (processes and organization) design	S	A	I	R
3	Develop detailed project plan	S	A	I	R
4	Publishing procedures,guidelines,checklists and report formats	S	C	I	A,R
5	Resource planning	A,R	C	I	C
6	Approval of resource plan	I	A	I	R
7	Approval of detailed project plan	I	A	I	R
8	Engineering documentation	R	C	I	A
9	Approval of engineering documentation	I	A	C	R
10	EHS compliance	R	I	A	C
11	Commissioning of Project Management Tool	I	R	C	A
12	Training on usage of project management tool	S	A	I	R
13	Finalization,distribution and maintenance of: - project deliverables - documentation - documentation control	S	C	I	A,R
14	Dispute resolution	S	A	I	R
15	Escalation handling	S	A	I	R
16	Risk analysis and mitigation	S	A	I	R

17	Project tracking / reporting (weekly / monthly / quarterly reports)	S	C	I	A,R	
18	Process for handling Change requests and approvals	S	C	I	A,R	
19	Governance process for Review meetings with PIA,MahalIT,BBNL,SLIC etc.	S	C	I	A,R	
B	Site Survey		PIA	SIA	TPA	PMC
1	Site / route survey format template	R	I	C	A	
2	Conducting site survey	A,R	I		S	
3	Population of site/ route survey template Inputs regarding the following to be provided as part of the site survey: - Any road expansions planned/ water pipe line/ drainage activities planned - En-route culverts and bridges,water flow of the river or stream (indicating the duration of months water is flowing) - Side of the road from where the proposed cable is to be laid - Road crossing (road and railway lines) - existing fibre routes if any - existing power cable routes and overhead power cables alignments - diverse route availability w.r.t to formation of taluka and GP rings (avoidance of flat rings to avoid single point of failure) - proposed alignment from the centre of the road/ nearest carriage way, GIS parameters (Longitude ,Latitude and altitude (HASL)). - availability of electric poles for stringing ADSS cables with headway of 12 - 15ft - Strengthening of poles	A,R	I	I	C	
4	Entry of detailed survey data in Project management tool	A,R	I	I	C	
5	Submission of route survey for approval	R	I	I	A	
6	Approval of survey document	S	A	I	R	
7	Site survey action item w.r.t to Maha IT / BBNL	S	A	C	R	
C	Planning and Engineering					
C 1	OFC		PIA	SIA	TPA	PMC
1	Details of Taluka and GP rings,existing and planned	A,R	I		C	
2	Proposal for Taluka and GP rings based on survey data	A,R	I		C	
3	Finalisation of distance between rings and ring formation	A,R	I	I	S	
4	Avoidance of flat rings by trenching on both sides of the roads	A,R	I	I	C	
5	Enhancement of scope for PIA in case of flat rings (trenching to be done on both side of road)	S	A	I	R	
6	Design acceptance of GP and Taluka rings	S	I	A,R	C	

7	Assessment of existing poles and strengthening where ever required	A,R	I	I	C
8	Approval for placement of additional poles	S	A	I	R
9	Planning for necessary safety arrangements while working in close range of electric lines	A,R	C	S	C
10	Guidelines for safety arrangements for stringing ADSS cable working at heightened posts and road sides	A,R	C	S	C
11	Survey of the proposed TalukA,GPs locations for civil,electric infrastructure availability	A,R	I	I	C
12	Plan for Civil and Electrical upgradation of Talukas and GPs	A,R	I	I	C
D	Implementation				
D 1	Civil and electrical Infrastructure (Parallel activity with OFC)	PIA	SIA	TPA	PMC
1	Installation of FDMS and termination of the cable	A,R	I	I	C
2	Delivery of DG sets,ACs,UPSs,battries,solar panels and racks at proposed Taluka locations	A,R	I	I	C
3	Installation and commissioning of DG Sets,UPs,ACs etc./	A,R	I	I	C
4	Provisioning of earth for equipment,mast and solar panel	A,R	I	I	C
5	Infrastructure acceptance of the Taluka locations/Gram panchayat	S	C	A,R	C
D 2	UPS/ Solar (Parallel activity with OFC)	PIA	SIA	TPA	PMC
1	Delivery of solar panels,on-line UPS and batteries	A,R	I	I	C
2	Installation and commissioning of solar panels,UPS and Batteries at the proposed locations	R,A	I	I	C
3	Acceptance for UPS system and solar panels	S	C	A,R	C
D 3	Underground OFC	PIA	SIA	TPA	PMC
1	ROW requests (notification of routes planned at least 1 week prior to commence of work)	A,R	I	I	S
2	ROW approvals	S	A,R		C
3	EHS compliance audit	S	C	A,R	C
4	Procurement of material for ducting,Fiber etc	A,R	I		C
5	Verification of the materials	S	I	A,R	C
6	Compliance testing with tender specifications for the material procured by PIA for MahaNet (GR/TEC/ etc.)	R,S	I	A	C
7	Barricading for trenching	A,R	I	I	C
8	Trenching/ ducting for underground OFC	A,R	I	I	C
9	Updation of project plan in tool for periodic monitoring	S	I	I	A,R
10	Request for sub-normal trenching and protection requirement in the portal	A,R	I	I	C

11	Approval for sub-normal trenching and protection requirement within 7 days on the portal (otherwise deemed approved)	S	I	A,R	C
12	Preparation of splice chambers with regards to cable drum lengths and coils to be placed in the chamber	A,R	I	I	C
13	Placement of OFC route Electronic indicator	A,R	I	I	C
14	Measurement and recoding of trench depth in measurement book	A,R	I	I	I
15	Auditing and acceptance of trenching depth	S	I	A,R	C
16	Back filling and dressing of the trenches	A,R	I	I	C
17	Auditing and acceptance of splice chambers,electronic indicators(Route and joints)	S	I	A,R	C
18	Notification to field electronics team for deployment of electronics for sections where fibre ducting/stringing is complete	A,R	I	I	S
19	Blowing/pulling of OF cable	A,R	I	I	C
20	Inputs/updates regarding progress on fibre blowing	C	I	I	A,R
21	Notify PIA electronics for implementation status	A,R	I	I	S
22	OFC splicing and splice-loss measurement with OTDR	A,R	I	I	C
23	Termination of OFC at FDF (Fibre Distribution Frame) and LSPM	A,R	I		S
24	Acceptance of GP rings and measurement to assess compliance for thresholds as per specifications for: - Splice losses - cable loss - end-to-end ring connectivity	S	I	A,R	C
25	Acceptance of Taluka rings and measurement to assess compliance for thresholds as per specifications for: - Splice losses - cable loss - end to end ring connectivity	S	I	A,R	C
26	Acceptance of interconnect rings and measurement to assess compliance for thresholds as per specifications for: - Splice losses - cable loss - end to end ring connectivity	S	I	A,R	C
27	As built drawings encompassing trench,duct,splice chambers,route and joint indicators ,OF cable,route index diagrams,make and size of cable,off-set from centre of road,type of protection,depth and size of chambers amongst others and GIS data	A,R	I	I	C
28	Stage wise material (pipe,OFC,accessories,etc.) reconciliation Taluka/ GP wise	S	I	S	A,R
29	Issuing notices to PIA for non-performance,if any	I	A	R	C
30	Invoice pre-verification based on the milestones and recommendation for the payments	I,S	C	A, R	C

31	Final verification of Invoice based on the milestones and recommendation for the payments	I	A	R	C
D 4	Aerial OFC	PIA	SIA	TPA	PMC
1	Request of placement of ADSS cable using existing electric poles	A,R	I	I	C
2	Joint box fixing and stringing OF cable	A,R	I	I	C
3	Notify the progress on completion of fibre Stringing of ADSS cable	C	I	I	A,R
4	Notify PIA Electronics for deployment of electronics for sections where stringing of ADSS cables are complete	A,R	I	I	S
5	OFC splicing,provisioing spare cable of Coil length and splice-loss measurement with OTDR	A,R	I	C	C
6	Termination of OFC at FDF (Fibre Distribution Frame)	A,R	I		S
7	Acceptance of GP rings and measurement to assess compliance for thresholds as per specifications for: Splice losses Cable link loss end to end ring connectivity	S	I	A,R	C
8	Acceptance of Taluka rings and measurement to assess compliance for thresholds as per specifications for: Splice losses Cable link loss end to end ring connectivity	S	I	A,R	C
9	Acceptance of interconnect rings and measurement to assess compliance for thresholds as per specifications for: Splice losses Cable link loss end to end ring connectivity	S	I	A,R	C
10	As built drawings capturing ADSS alignment with offset from the road center,type of posts used,staying arrangement made,span length between poles,type of ADSS cable and count of fiber,splice closure placement,longitude and latitude of poles/alignment,distance between high tension lines and ADSS,windload that the cable can withstand	A,R	I	I	C
11	Stage wise material (ADSS OFC,accessories,etc.) reconciliation Taluka/ GP wise,poles erected,streghtened etc	A	I	R	S
E	Project state: Maintenance	PIA	SIA	TPA	PMC

	Commissioning of NMS - Formation of FRT (Fault Repairing Team) - Route patrolling teams for OF cable routes for every 300Km - Weekly/Monthly measurement of optical power budget parameters - Sparing strategy for OF cable and jointing accessories in maintenance locations - OTDR traces after restoration of the fault - Capturing additions,deletions of OF cable in the As-Built diagrams - Provisioning of additional electronic joint indicators in new jointing locations that are introduced - Shifting of OF cable wherever found necessary - Centralized monitoring through NOC / NMS	A,R	I	I	C
1	Preparation of Standard Operating Procedure (SOP) based on SLA criteria (e.g. network availability,GP ring- 99.9%,Spur- 99.5%),MTTR,Preventive maintenance)	A,R	I	I	C
2	Approval of the SOPs	S	A	S	R
3	Provisioning of bandwidth at GPs based on the approved requirements	A,R	I	I	C
4	Provisioning of 6 dark fibres at GP	A,R	I	I	S
5	Deployment of O and M team	A,R	I	I	C
6	Conducting Preventive Maintenance (PM) activity and submitting periodic reports	A,R	I	I	I
7	MIS report- related to issues/ resolved/ unresolved etc.	S	I	I	A,R
8	Escalation matrix	S	I	I	A,R
9	Root-cause analysis	S	I	I	A,R
10	Review meetings (weekly/ bi-weekly/ monthly)	S	I	I	A,R
11	Submission of performance matrix at defined periodic intervals	S	I	I	A,R
12	Governance set up and management reporting	S	I	I	A,R
13	Trouble ticketing	A,R	I	I	S
14	Alarm collection across different service providers	A,R	I	I	S
15	Publishing operational reports (SLA,Availability report,Dashboards,Compliance reports)	S	I	I	A,R
16	Competence training/ floor mentoring	A,R	I	I	S
17	Monitoring of uptime based on agreed SLA	A,R	I	I	S

Responsibility Matrix - Package C (Indicative)

S.No.	Action Items	PIA	SIA	TPA	PMC
1	RFP Release	I	A		R
2	Bid Evaluation	I	A		C
3	Contract Finalisation	I	A		C
4	Issue of LOI	I	A	I	R

Project Phase

A	Planning	PIA	SIA	TPA	PMC
1	Closure of contracts/ sign-off with PIAs and release of purchase orders	S	A		R
2	Project governance model (processes and organization) design	S	A	I	R
3	Develop detailed project plan	S	A	I	R
4	Publishing procedures, guidelines, checklists and report formats	S	C	I	A,R
5	Resource planning	A,R	C	I	C
6	Approval of resource plan	I	A	I	R
7	Approval of detailed project plan	I	A	I	R
8	Engineering documentation	R	C	I	A
9	Approval of engineering documentation	I	A	C	R
10	EHS compliance	R	I	A	C
11	Commissioning of Project Management Tool	I	R	C	A
12	Training on usage of project management tool	S	A	I	R
13	Finalization, distribution and maintenance of: - project deliverables - documentation - documentation control	S	C	I	A,R
14	Dispute resolution	S	A	I	R
15	Escalation handling	S	A	I	R
16	Risk analysis and mitigation	S	A	I	R
17	Project tracking / reporting (weekly / monthly / quarterly reports)	S	C	I	A,R
18	Process for handling Change requests and approvals	S	C	I	A,R
19	Governance process for Review meetings with PIA, Mahait, BBNL, SLIC etc.	S	C	I	A,R
B	Site Survey	PIA	SIA	TPA	PMC
1	Site / route survey format template	R	I	C	A
2	Conducting site survey	A,R	I		S

	Population of site/ route survey template Inputs regarding the following to be provided as part of the site survey: - Any road expansions planned/ water pipe line/ drainage activities planned - En-route culverts and bridges,water flow of the river or stream (indicating the duration of months water is flowing) - Side of the road from where the proposed cable is to be laid - Road crossing (road and railway lines) - existing fibre routes if any - existing power cable routes and overhead power cables alignments - diverse route availability w.r.t to formation of taluka and GP rings (avoidance of flat rings to avoid single point of failure) - proposed alignment from the centre of the road/ nearest carriage way, GIS parameters (Longitude ,Latitude and altitude (HASL)). - availability of electric poles for stringing ADSS cables with headway of 12 - 15ft - Strengthening of poles	A,R	I	I	C
3	Entry of detailed survey data in Project management tool	A,R	I	I	C
4	Submission of route survey for approval	R	I	I	A
5	Approval of survey document	S	A	I	R
6	Site survey action item w.r.t to Maha IT / BBNL	S	A	C	R
C	Planning and Engineering				
C 1	OFC	PIA	SIA	TPA	PMC
1	Details of Taluka and GP rings,existing and planned	A,R	I		C
2	Proposal for Taluka and GP rings based on survey data	A,R	I		C
3	Finalisation of distance between rings and ring formation	A,R	I	I	S
4	Avoidance of flat rings by trenching on both sides of the roads	A,R	I	I	C
5	Enhancement of scope for PIA in case of flat rings (trenching to be done on both side of road)	S	A	I	R
6	Design acceptance of GP and Taluka rings	S	I	A,R	C
7	Assessment of existing poles and stregthening where ever required	A,R	I	I	C
8	Approval for placement of additional poles	S	A	I	R
9	Planning for necessary safety arrangements while working in close range of electric lines	A,R	C	S	C
10	Guidelines for safety arrangments for stringing ADSS cable working at heightened posts and road sides	A,R	C	S	C
11	Survey of the proposed TalukA,GP locations for civil,electric infrastructure availability	A,R	I	I	C

12	Plan for Civil and Electrical upgradation of Talukas and GPs	A,R	I	I	C
D	Implementation				
D 1	Civil and electrical Infrastructure (Parallel activity with OFC)	PIA	SIA	TPA	PMC
1	Installation of FDMS and termination of the cable	A,R	I	I	C
2	Delivery of DG sets,ACs,UPSs,battries,solar panels and racks at proposed Taluka locations	A,R	I	I	C
3	Installation and commissioning of DG Sets,UPs,ACs etc./	A,R	I	I	C
4	Provisioning of earth for equipment,mast and solar panel	A,R	I	I	C
5	Infrastructure acceptance of the Taluka locations/Gram panchayat	S	C	A,R	C
D 2	UPS/ Solar (Parallel activity with OFC)	PIA	SIA	TPA	PMC
1	Delivery of solar panels,on-line UPS and batteries	A,R	I	I	C
2	Installation and commissioning of solar panels,UPS and Batteries at the proposed locations	R,A	I	I	C
3	Acceptance for UPS system and solar panels	S	C	A,R	C
D 3	Underground OFC	PIA	SIA	TPA	PMC
1	ROW requests (notification of routes planned at least 1 week prior to commence of work)	A,R	I	I	S
2	ROW approvals	S	A,R		C
3	EHS compliance audit	S	C	A,R	C
4	Procurement of material for ducting,Fiber etc	A,R	I		C
5	Verification of the materials	S	I	A,R	C
6	Compliance testing with tender specifications for the material procured by PIA for MahaNet (GR/TEC/ etc.)	R,S	I	A	C
7	Barricading for trenching	A,R	I	I	C
8	Trenching/ ducting for underground OFC	A,R	I	I	C
9	Updation of project plan in tool for periodic monitoring	S	I	I	A,R
10	Request for sub-normal trenching and protection requirement in the portal	A,R	I	I	C
11	Approval for sub-normal trenching and protection requirement within 7 days on the portal (otherwise deemed approved)	S	I	A,R	C
12	Preparation of splice chambers with regards to cable drum lengths and coils to be placed in the chamber	A,R	I	I	C
13	Placement of OFC route Electronic indicator	A,R	I	I	C
14	Measurement and recoding of trench depth in measurement book	A,R	I	I	I
15	Auditing and acceptance of trenching depth	S	I	A,R	C
16	Back filling and dressing of the trenches	A,R	I	I	C

17	Auditing and acceptance of splice chambers,electronic indicators(Route and joints)	S	I	A,R	C
18	Notification to field electronics team for deployment of electronics for sections where fibre ducting/stringing is complete	A,R	I	I	S
19	Blowing/pulling of OF cable	A,R	I	I	C
20	Inputs/updates regarding progress on fibre blowing	C	I	I	A,R
21	Notify PIA electronics for implementation status	A,R	I	I	S
22	OFC splicing and splice-loss measurement with OTDR	A,R	I	I	C
23	Termination of OFC at FDF (Fibre Distribution Frame) and LSPM	A,R	I		S
24	Acceptance of GP rings and measurement to assess compliance for thresholds as per specifications for: - Splice losses - cable loss - end-to-end ring connectivity	S	I	A,R	C
25	Acceptance of Taluka rings and measurement to assess compliance for thresholds as per specifications for: - Splice losses - cable loss - end to end ring connectivity	S	I	A,R	C
26	Acceptance of interconnect rings and measurement to assess compliance for thresholds as per specifications for: - Splice losses - cable loss - end to end ring connectivity	S	I	A,R	C
27	As built drawings encompassing trench,duct,splice chambers,route and joint indicators ,OF cable,route index diagrams,make and size of cable,off-set from centre of road,type of protection,depth and size of chambers amongst others and GIS data	A,R	I	I	C
28	Stage wise material (pipe,OFC,accessories,etc.) reconciliation Taluka/ GP wise	S	I	S	A,R
29	Issuing notices to PIA for non-performance,if any	I	A	R	C
30	Invoice pre-verification based on the milestones and recommendation for the payments	I,S	C	A, R	C
31	Final verification of Invoice based on the milestones and recommendation for the payments	I	A	R	C
D 4	Aerial OFC	PIA	SIA	TPA	PMC
1	Request of placement of ADSS cable using existing electric poles	A,R	I	I	C
2	Joint box fixing and stringing OF cable	A,R	I	I	C
3	Notify the progress on completion of fibre Stringing of ADSS cable	C	I	I	A,R

4	Notify PIA Electronics for deployment of electronics for sections where stringing of ADSS cables are complete	A,R	I	I	S
5	OFC splicing,provisioing spare cable of Coil length and splice-loss measurement with OTDR	A,R	I	C	C
6	Termination of OFC at FDF (Fibre Distribution Frame)	A,R	I		S
7	Acceptance of GP rings and measurement to assess compliance for thresholds as per specifications for: Splice losses Cable link loss end to end ring connectivity	S	I	A,R	C
8	Acceptance of Taluka rings and measurement to assess compliance for thresholds as per specifications for: Splice losses Cable link loss end to end ring connectivity	S	I	A,R	C
9	Acceptance of interconnect rings and measurement to assess compliance for thresholds as per specifications for: Splice losses Cable link loss end to end ring connectivity	S	I	A,R	C
10	As built drawings capturing ADSS alignment with offset from the road center,type of posts used,staying arrangement made,span length between poles,type of ADSS cable and count of fiber,splice closure placement,longitude and latitude of poles/alignment,distance between high tension lines and ADSS,windload that the cable can withstand	A,R	I	I	C
11	Stage wise material (ADSS OFC,accessories,etc.) reconciliation Taluka/ GP wise,poles erected,streghtened etc	A	I	R	S
E	Project state: Maintenance	PIA	SIA	TPA	PMC
1	Commissioning of NMS - Formation of FRT (Fault Repairing Team) - Route patrolling teams for OF cable routes for every 300Km - Weekly/Monthly measurement of optical power budget parameters - Sparing strategy for OF cable and jointing accessories in maintenance locations - OTDR traces after restoration of the fault - Capturing additions,deletions of OF cable in the As-Built diagrams - Provisioning of additional electronic joint indicators in new jointing locations that are introduced - Shifting of OF cable wherever found necessary - Centralized monitoring through NOC / NMS	A,R	I	I	C
2	Preparation of Standard Operating Procedure (SOP) based on SLA criteria (e.g. network availability,GP ring- 99.9%,Spur- 99.5%),MTTR,Preventive maintenance)	A,R	I	I	C

		S	A	S	R
3	Approval of the SOPs	S		S	R
4	Provisioning of bandwidth at GPs based on the approved requirements	A,R	I	I	C
5	Provisioning of 6 dark fibres at GP	A,R	I	I	S
6	Deployment of O and M team	A,R	I	I	C
7	Conducting Preventive Maintenance (PM) activity and submitting periodic reports	A,R	I	I	I
8	MIS report- related to issues/ resolved/ unresolved etc.	S	I	I	A,R
9	Escalation matrix	S	I	I	A,R
10	Root-cause analysis	S	I	I	A,R
11	Review meetings (weekly/ bi-weekly/ monthly)	S	I	I	A,R
12	Submission of performance matrix at defined periodic intervals	S	I	I	A,R
13	Governance set up and management reporting	S	I	I	A,R
14	Trouble ticketing	A,R	I	I	S
15	Alarm collection across different service providers	A,R	I	I	S
16	Publishing operational reports (SLA, Availability report, Dashboards, Compliance reports)	S	I	I	A,R
17	Competence training/ floor mentoring	A,R	I	I	S
18	Monitoring of uptime based on agreed SLA	A,R	I	I	S

Annexure K Rewards and Penalties

1. For Fibre Optics

S. No.	Deliverable	Timeline for completion	% of total GPs to be completed** (Milestone)	Penalties	Incentives	Remarks
1	Issuance of APO/ Work Order	T0	NA	NA	NA	On selection of PIA, award of contract and Work Order is issued
2	Site Survey and OFC laying where survey is completed	<i>3 months from the date of issuance of Award of Work</i>	2%	If the bidder fails to complete 2% of total GPs within stipulated time schedule, then a penalty as computed below shall be deducted	NA	Copy of Duly Signed and Stamped Installation, Commissioning and testing report approved by Maha IT, OTDR link test reports, AsBuilt Diagram (ABD report) and Monthly Progress Report
3	GPs to be RFI (Ready For Installation) for active network elements	<i>4 months from the date of issuance of Award of Work</i>	10%	If the bidder fails to complete 10% of total GPs within stipulated time schedule, then a penalty as computed below shall be deducted	NA	Copy of Duly Signed and Stamped Installation, Commissioning and testing report approved by Maha IT, OTDR link test reports, AsBuilt Diagram (ABD report) and Monthly Progress Report
4	GPs to be RFI (Ready For Installation) for active network elements	<i>8 months from the date of issuance of Award of Work</i>	30%	If the bidder fails to complete 30% of total GPs within stipulated time schedule, then a penalty as computed	1) If the bidder completes additional no. of GPs as given in milestone within the stipulated time schedule, then an incentive of 2% of total cost of Project (excluding O&M cost) of additional	Copy of Duly Signed and Stamped Installation, Commissioning and testing report approved by Maha IT, OTDR link test reports, AsBuilt Diagram (ABD report) and Monthly Progress

S. No.	Deliverable	Timeline for completion	% of total GPs to be completed** (Milestone)	Penalties	Incentives	Remarks
				below shall be deducted	completed GPs shall be given to the 2) Additional 1% Incentive shall be provided subject to all the GPs completing RFI in 8th month achieve GP commissioning in the 9th month.	Report
5	GPs to be RFI (Ready For Installation) for active network elements	<i>9 months from the date of issuance of Award of Work</i>	50%	If the bidder fails to complete 50% of total GPs within stipulated time schedule, then a penalty as computed below shall be deducted	NA	Copy of Duly Signed and Stamped Installation, Commissioning and testing report approved by Maha IT, OTDR link test reports, AsBuilt Diagram (ABD report) and Monthly Progress Report
6	GPs to be RFI (Ready For Installation) for active network elements	<i>10 months from the date of issuance of Award of Work</i>	75%	If the bidder fails to complete 75% of total GPs within stipulated time schedule, then a penalty as computed below shall be deducted	1) If the bidder completes additional no. of GPs as given in milestone within the stipulated time schedule, then an incentive of 2% of total cost of Project (excluding O&M cost) of additional completed GPs shall be given to the bidder 2) Additional 1% Incentive shall be provided	Copy of Duly Signed and Stamped Installation, Commissioning and testing report approved by Maha IT, OTDR link test reports, AsBuilt Diagram (ABD report) and Monthly Progress Report

S. No.	Deliverable	Timeline for completion	% of total GPs to be completed** (Milestone)	Penalties	Incentives	Remarks
				subject to all the GPs completing RFI in 10th month achieve GP commissioning in the 11th month.		
7	GPs to be RFI (Ready For Installation) for active network elements	<i>11 months from the date of issuance of Award of Work</i>	100%	If the bidder fails to complete 100% of total GPs within stipulated time schedule, then a penalty as computed below shall be deducted	NA	Copy of Duly Signed and Stamped Installation, Commissioning and testing report approved by Maha IT, OTDR link test reports, AsBuilt Diagram (ABD report) and Monthly Progress Report

Penalty will be deducted as % of total cost of Project (excluding O&M cost) of incomplete GPs as below for respective milestone

- 0.25%/ week - Achievement is > 90%
- 0.5 %/ week - Achievement is >75% and <90%
- 1.0 %/ week - Achievement is >50% and <75%
- 2.5 %/ week - Achievement is < 50%

Method of computation:

1. Total cost of project is per package excluding O&M (For OFC and Active electronics separately)
2. Net per GP cost will be calculated dividing the Total cost of project/No of GPs in respective package and the same will be used for computation of incentives and penalties

3. Incentive and penalty will be computed for number of additional and pending GPs, with reference to the milestone

2. For Electronics

S. No.	Deliverable	Timeline for completion	% of total GPs to be completed** (Milestone)	Penalties	Incentives	Remarks
1	Issuance of APO/ Work Order	T0	NA	NA	NA	On selection of PIA, award of contract and Work Order is issued
2	Site Survey and OFC laying where survey is completed	<i>4 months from the date of issuance of Award of Work</i>	2%	If the bidder fails to complete 2% of total GPs within stipulated time schedule, then a penalty as computed below shall be deducted	NA	Copy of GP Commissioning report approved by Maha IT, AsBuilt Diagram (ABD report) and Monthly Progress Report
3	Commissioning of GP for active network elements	<i>5 months from the date of issuance of Award of Work</i>	10%	If the bidder fails to complete 10% of total GPs within stipulated time schedule, then a penalty as computed below shall be deducted	NA	Copy of GP Commissioning report approved by Maha IT, AsBuilt Diagram (ABD report) and Monthly Progress Report

S. No.	Deliverable	Timeline for completion	% of total GPs to be completed** (Milestone)	Penalties	Incentives	Remarks
4	Commissioning of GP for active network elements	<i>9 months from the date of issuance of Award of Work</i>	30%	If the bidder fails to complete 30% of total GPs within stipulated time schedule, then a penalty as computed below shall be deducted	NA	Copy of GP Commissioning report approved by Maha IT, AsBuilt Diagram (ABD report) and Monthly Progress Report
5	Commissioning of GP for active network elements	<i>10 months from the date of issuance of Award of Work</i>	50%	If the bidder fails to complete 50% of total GPs within stipulated time schedule, then a penalty as computed below shall be deducted	NA	Copy of GP Commissioning report approved by Maha IT, AsBuilt Diagram (ABD report) and Monthly Progress Report
6	Commissioning of GP for active network elements	<i>11 months from the date of issuance of Award of Work</i>	75%	If the bidder fails to complete 75% of total GPs within stipulated time schedule, then a penalty as computed below shall be deducted	NA	Copy of GP Commissioning report approved by Maha IT, AsBuilt Diagram (ABD report) and Monthly Progress Report

S. No.	Deliverable	Timeline for completion	% of total GPs to be completed** (Milestone)	Penalties	Incentives	Remarks
7	Commissioning of GP for active network elements	12 months from the date of issuance of Award of Work	100%	If the bidder fails to complete 100% of total GPs within stipulated time schedule, then a penalty as computed below shall be deducted	NA	Copy of GP Commissioning report approved by Maha IT, AsBuilt Diagram (ABD report) and Monthly Progress Report

** The milestone is for material planning of active electronics, however, the actual benchmark will be the cumulative GPs RFI provided by all 3 packages in the previous month

Method of computation of LD at the end of execution period (T0+11 Months):

1) MahalT will compute the bills payable against milestones, rewards and penalties at the end of each intermediate milestone / period ('Timeline for Completion', as outlined in the Annexure K Corrigendum 2 Rewards and Penalties. Penalties would be computed as % of total cost of project implementation (excluding O&M cost) of incomplete GPs, as below for respective milestone:

- a. 0.25%/ week - Achievement is >=90% and <100% of the milestone defined
- b. 0.5 %/ week - Achievement is >=75% and <90% of the milestone defined
- c. 1.0 %/ week - Achievement is >=50% and <75% of the milestone defined
- d. 2.5 %/ week - Achievement is < 50% of the milestone defined

2) On a quarterly basis, MahalT would compute, recover and adjust the consolidated rewards and penalties from the bills payable at the end of every quarter based on the progress achieved on the milestones outlined in Annexure K, Rewards and Penalties. If the PIA is able to re-align progress to meet or exceed the milestone defined in the subsequent quarter/s, MahalT will release the sum equivalent to the penalty charged in the previous quarters.

3) At the end of the project, SIA shall assess liquidated damages for breach of contract. Final reconciliation, settlement and recovery would be done at the end of the project execution phase as per the milestones outlined in Payment Schedule.

4) LD shall be capped to maximum of 12% of total cost of Project (excluding O&M cost and Taxes)

5) In extraneous circumstances, if the work is not completed due to reasons beyond control of PIA, or any other unforeseen reasons, MahalT may extend the timelines (without LD) till such time as deemed fit for completion of project

6) During execution period if MahaiT has withheld more amount than the actual LD calculated at the end of project, MahaiT will release the balance amount after recovering the LD amount from withhold payments on account of LD.

Annexure L
Strategy for NOC Integration

Strategy for integration of “State” NOC/NMS with BBNL NOC/NMS

Purpose of this concept paper is to capture the basics requirements for Integration of State’s NOC/NMS with centralized Network Operating Centre (NOC)/NMS of BBNL

Introduction: BharatNet is mandated to provide broadband connectivity covering all the 2.5 lakh Gram Panchayats (GPs) in the country. Though execution of project to set up such a wide spread network in rural areas is a challenge, O&M of BharatNet will be a much bigger challenge and complex. This challenge can only be met with effective & innovative utilization of available IT tools and technology underphase-1 BharatNet to minimize MTTR (mean time to repair) and achieve desired service levels.

The Central BharatNet Network Management System (NMS-OSS) is one of the key technology tools available which is successfully implemented for phase-1 BharatNet. This can enable “State” to effectively manage the phase-2 BharatNet broadband network with optimum number of resources. Present deployed NMS is a versatile, open and in-house developed tool under “make -in-India” initiative and having capability to integrate with the upper layer i.e. Business Support System (BSS) as well as below EMS layer.

BBNL-NMS provides end-to-end network management capabilities by seamlessly integrating the capabilities of underlying EMS(s). It enables single point of Management capabilities for Configuration, Provisioning, and Monitoring in Multi-vendor/Multi-partner/multi-technology. BBNL’s NMS-OSS has been developed based on industry standard e-TOM framework which defines standard interfaces through which multiple technology EMS/NMS can be integrated to an umbrella BBNL -NMS. Though the current NMS-OSS is customized for GPON technology, it can cater to other technologies after required customization as it is C-DOT’s in-house development.

The following broad functionalities of State’s EMS/NOC shall be integrated with BBNL-NOC/NMS to achieve the true pan india visibility of network.

a) Network Management System:

Since the BharatNet network is a pan-India network, it is imperative to have an umbrella NMS (BBNL-NMS) for end-to-end view of network health, performance and circuit provisioning. In multi NMS/EMS scenario, the QoS and Service levels need to be defined & enforced uniformly across multiple networks through respective State NOC/NMS which can be integrated with umbrella NMS. Therefore, State’s NMS/EMS should be implemented under pre-defined framework for seamless integration preferably with unified Trouble Ticketing system. BBNL- NMS has capability to provide pan-India, Zonal, State or district view of network as per requirement. C-DOT has designed the application which is scalable to cater network elements required for 2.5lakh GPs and can be further integrate with others NOC/NMS under BharatNet project.

b) Network Operations Centre (NOC): The NOC is hub for monitoring & management of network operations which can be implemented in distributed manner. As proposed above, BBNL NOC will have pan-India view of network operations through umbrella NMS. The present BharatNet -NOC is also designed to support distributed NOC operations. State NOC shall be implemented in such a manner that both umbrella NOC and State’s NOC will have common data base and efforts shall be compliment to each other. Creation, editing and viewing rights of NMS shall be assigned to the different stakeholders as per the policy decided by State govt.

BBNL has installed its main DC NOC at Shastri Park, New Delhi and DR – DC NOC at Doorvani Nagar, Bengaluru. Both main DC and DR – DC are in working condition and being used for BharatNet Phase I.

c) Operations Support System (OSS):

In most of the cases, the delivery of services (like e-health, e-education, e-Gov, banking etc.) on BharatNet network is expected on regional or pan-India basis, therefore seamless provisioning/modification/deletion services shall be possible from State's NOC as well as from BBNL-NOC. Therefore, State's OSS shall be closely integrated with BBNL's OSS to achieve these functionalities or seamless integration of State level EMS / NMS / OSS with BBNL's domain specific BBNL NMS, the State's EMS / NMS / OSS shall support e-ToM based external interfaces in each functionality. The following external interface mechanism is expected from State's OSS.

- i) APIs using RESTful web services
- ii) Notifications using JMS services to Apache Active MQ middleware

Both the above interfaces shall contain XML Objects using JAVA

d) Security aspect:

The security features which include Role Based Access Control- RBAC, restrictions on direct Data base access, event logging and audit trails which can further be followed with periodic third-party audit of NOC/NMS shall be adopted while implementing the network. Further, the setup of Security Operations Centre (SOC) shall also be considered and integrated with BBNL-NOC for making the network more secure and enforcing the security directives issued by GOI/regulator.

e) Other Key Features

- **Location ID & IP Address Management:** BharatNet network is primarily based on IP technology. For avoiding any kind of IP conflict and manage it with flawless, State IP schema shall be different from BBNL IP schema.
- **(LMS) Location Management System or LMS data needs to be common for both BBNL and respective state's network for seamless operations.**
- **GIS Integration & Fibre network topology Management:** for committing the SLA to Telecom Service Provider, both BBNL and State govt shall have the complete end-to-end network's fibre visibility used for the customer. Integration of fibre network topology and GIS will facilitate to address the fibre related issues and serve the customers in better way.

Annexure M
Solvency Certificate

SOLVENCY CERTIFICATE FROM BANK

This is to certify that Shri. M/s. has / have

been maintaining an S.B. / current account with us since last years.

From his / her dealing with us we have found him as follows: To the best of our knowledge and information belief he is / they are solvent to the extent of Rs.

.....

Rs. (.....)

This certificate is issued without any responsibility on the part of the bank of any of its officers.

Seal of the Bank :

Date : (Signature)

Place : Branch Manager

