

**CENTRAL ELECTRICITY REGULATORY COMMISSION  
NEW DELHI**

**No.- L-1/210/2016/CERC**

**CORAM:**

**Shri Jishnu Barua, Chairperson  
Shri I. S. Jha, Member  
Shri Arun Goyal, Member  
Shri P. K. Singh, Member**

**Date of Order: 19<sup>th</sup> January, 2024**

**In the matter of:**

Approval of Procedure on “Procedure on Maintenance and testing of Communication System” under the Central Electricity Regulatory Commission (Communication System for inter-State transmission of electricity) Regulations, 2017.

**Order**

The Central Electricity Regulatory Commission (Communication System for inter-State transmission of electricity) Regulations, 2017 (hereinafter referred to as the ‘Communication Regulations’) were published on 29.05.2017 in the Gazette of India Extraordinary (Part-III, Section-4, No. 218).

2. Regulation 9 of the Communication Regulations requires CTU to prepare a Procedure on “Maintenance and testing of Communication System” in consultation with the stakeholders and submit the same for approval of the Commission.

3. Accordingly, CTU, vide its letters dated 1.9.2017, 28.10.2021 and 18.5.2023, submitted the Procedure on “Maintenance and testing of Communication System” after stakeholder consultation for approval of the Commission.

4. The Commission has examined the Procedure submitted by CTU, and after incorporating suitable changes, the Commission hereby approves the Procedure on “Maintenance and testing of Communication System” which is enclosed as an Annexure to this Order.

<b>Sd/-</b>	<b>Sd/-</b>	<b>Sd/-</b>	<b>Sd/-</b>
<b>(P. K. Singh)</b>	<b>(Arun Goyal)</b>	<b>(I. S. Jha)</b>	<b>(Jishnu Barua)</b>
<b>Member</b>	<b>Member</b>	<b>Member</b>	<b>Chairperson</b>

**PROCEDURE FOR**  
**MAINTENANCE AND TESTING**  
**OF**  
**COMMUNICATION SYSTEM**

*Prepared in Compliance*

*To*

*Central Electricity Regulatory Commission*

*(Communication System for inter-State transmission of electricity)*

*Regulations, 2017*

January, 2024

## ABBREVIATIONS

ADSS	All Dielectric Self Supporting
BLVD.	Battery Low Voltage Disconnect
BER	Bit Error Ratio
DCPS	DC Power Supply
DCN	Data Communication Network
DDF	Digital Distribution Frame
DCDB	DC Distribution Board
FODP	Fibre Optic Distribution Panel
GI	Galvanized Iron
HDPE	High Density Poly Ethylene
IPMS	Integrated Power Management System
LLVD	Load Low Voltage Disconnect
MDF	Main Distribution Frame
MSDS	Material Safety Data Sheet
NMS	Network Management System
OPGW	Optical Power Ground Wire
OTDR	Optical Time Domain Reflectometer
OEM	Original Equipment Manufacturer
PPE	Personal Protective Equipment
POP	Point of Presence
PVC	Polyvinyl chloride
PDH	Plesiochronous Digital Hierarchy
SDH	Synchronous Digital Hierarchy
TMN	Telecommunication Management Network
UG FO	Under Ground Fibre Optic
CNMS	Centralized Network Management System
VSAT	Very Small Aperture Terminal

## **1. Introduction**

The Communication System Infrastructure of Inter-State transmission system and Intra-State transmission system being used for communication purpose for Power System Operation at National, Regional, Inter-State & Intra State level needs to be tested and maintained. Owner/ User of this Communication system shall carry out maintenance of their system for twenty-four hours on continuous basis to ensure reliability and availability of their respective system.

The Procedure for Maintenance & Testing of Communication System is being issued in compliance to the Regulation 9 of the Central Electricity Regulatory Commission (Communication System for inter-State transmission of electricity) Regulations, 2017 (hereinafter referred to as “the Communication Regulations”).

## **2. Applicability**

2.1 This Procedure shall be applicable to the following:

(i) The Communication System Infrastructure of Inter-State transmission system and Intra-State transmission system, till appropriate regulation on Communication is framed by the respective State Electricity Regulatory Commission, being used for communication purpose for Power System Operation at National, Regional, Inter-State & Intra State level.

(ii) All Users as defined under Regulation 2(i)(aa) of the Communication Regulations 2017 (such as generating company including captive generating plants, RE generator, Transmission Licensee, Distribution Licensee, Bulk consumer whose electrical system is connected to the ISTS or Intra-State Transmission system, SLDCs, RLDCs, NLDC, CTUIL, STUs, RPCs, REMC, FSP and Power Exchanges shall abide by the principles and procedure as applicable to them in accordance with this procedure.

2.2. Till the time the Centralized Supervision System is not in place, the present maintenance and practices shall be carried out as per the existing Procedure enclosed as Appendix-I and all the users/ owners shall facilitate CTU/STU to

coordinate for the same with all requisite details on periodic manner as brought out in this procedure, as applicable.

### **3. Components/ Sub System of Communication System**

This document contains elaborate maintenance and testing procedure of following components / Sub system of communication system.

#### a) Communication Media

- OPGW
- UG FO
- ADSS
- Associated hardware fittings
- Others (VSAT, leased line)

#### b) Communication Equipment with Cabling

- SDH
- PDH
- e Cabling
- Network Management System
- VSAT IDU/ODU

#### c) Auxiliary Power Supply

- DCPS
- Battery Bank
- Sub Station Power Supply

#### d) Associated Auxiliary Infrastructure

- Repeater Shelter
- Air Conditioner
- DG Set

### **4. Responsibility & Resources for Maintenance & Testing**

All ISTS communication System Owners/ Users, ISTS, ISGS, IPPs, RLDCs, SLDCs shall coordinate with NMTs (Network Monitoring Teams for CNMS) deployed by CTU for maintenance & testing activity for updating the CNMS as applicable. NMT of CTU shall discharge all functions in coordination with ISTS

Owners/ Users, IPPs, ISGS, RLDCs, SLDCs for Maintenance & Testing of the communication system.

The Centralized Supervision and Monitoring System (CSMS) shall be in main and back-up control centre architecture at Regional and National level with centralized database and twenty-four hours operations & maintenance on all days.

#### **4.1 Owner/ User's Responsibility:**

4.1.1 Communication system owner/user shall identify Nodal officer (s) who shall be responsible for maintenance of the communication system in their respective area/ system. The Nodal officer shall be single point coordinator, responsible for maintenance of communication system and co-ordination with national/ regional NMT team of CTU. Details of Nodal Officer (name, designation, company name, address, contact details email, mobile no.) to be given to NMT team of CTU.

Nodal officer shall be responsible and initiate advance action for following to ensure timely commencement of maintenance activity as per guidelines/ periodicity brought out in this procedure:

- 1) Coordinate and allocate maintenance team for maintenance activity.
- 2) Shutdown/Permit to Work/Right of Work (ROW) and Security Pass for access to site location for maintenance work.
- 3) Timely issue of Tools and Plant (T&P), spares and test equipment's to maintenance team.
- 4) Entire coordination right from the time of reporting of fault till restoration shall be done by nodal officer and escalate the same, as per escalation matrix mentioned at **Annexure-I**, if required.
- 5) Coordinate and allocate maintenance team in case of planned expansion (e.g. LILO of line), upgradation at rated voltage level, reconductoring of line, alteration or relocation when informed by concerned line incharge/substation in-charge of utility.
- 6) Ensuring availability of Safety Procedure to maintenance team in Hindi/English/Local (Regional) Language.

- 7) Ensure adequately trained operator/ engineer placed at Repeater/ Point of Presence (POP)/ Sub Station should be deployed for day-to-day operation and maintenance work of Communication System.

#### **4.2 Resources for Maintenance & Testing:**

The maintenance shall be part of AMC contract placed for all components/ subsystem of users/owner's communication system in order to meet the availability guidelines mentioned in the document. Nodal officer and maintenance team shall coordinate for working out detailed plan for maintenance and to assess the requirement & procurement of resources such as spares, T&P, Test Equipment, Transportation, mobile sets or other electronic communication devices etc. Based on the assessment during Preventive, Predictive and Breakdown Maintenance, mobilization of maintenance teams shall be coordinated by Nodal Officer along with required resources.

The resources for maintenance and testing are classified into three main categories:

- 1) Maintenance Team
- 2) T&P, Spares and Test Equipment
- 3) Documents to be available with Maintenance Team

##### **1) Maintenance Team**

- Availability of trained Maintenance Team for OPGW/ UG FO/ ADSS cables stringing/laying, splicing, DCPS, Battery Bank, DG Set, AC, Repeater Shelter and Network elements along with associated auxiliaries. The maintenance teams should be deployed in shifts & can be placed at central locations considering the geographical spread of the communication network so as to mobilize the team at the fault location for faster restoration for communication to meet the availability requirement as per CERC Communication Regulations and round the clock maintenance requirement as per CEA Technical Standards.

- Maintenance Team shall comprise skilled personnel having technical background and trained in maintenance and testing of the users' communication system. The teams should be supported with transportation/



logistics arrangement and equipped with necessary test equipment, tool kits, personal safety tools, Rapid restoration kit & live line installation tools, laptop, mobile phones. Periodic training to be provided to maintenance team to keep abreast of technological advancement.

- Skilled/ Trained Personal should have minimum 15 days on the site/ field training or experienced professionals from the related field.

**2) T&P, Spares Inventory and Test Equipment**

- Availability of Tools and Plant (T&P), spares and test equipment and its locations, to be identified for various links to cater to maintenance requirement. The T&P, spares and test equipment should be kept at multiple locations within the owner's area so as to mobilize them at the fault location quickly for faster restoration. (Typical list of T&P and Test Equipment attached at **Annexure-II**)

**3) Documents to be available with maintenance team (while carrying out maintenance/ testing activity).**

- Details of transmission lines having UG/OH OFC in the area of concerned.
- Typical format for Communication Link details is attached as **Annexure-III**.
- Design Documents of OPGW used in lines including special OPGW design considered for longer span, Approved Tower Schedule of Lines.
- Mandatory spares/ quantity of UG/OH OFC available.
- Drum Schedule of OPGW laid and as built drawing of UG OFC.
- Maintenance register comprising various milestones i.e. Date of commissioning, routine (i.e. Preventive & Predictive) maintenance done, Breakdown maintenance done, if any, and consumption of mandatory spares etc with regular updates of the same.
- Relevant Design Documents/ Manuals for communication equipment and associated auxiliaries for maintenance and testing.

## **5. Maintenance and Testing Activity**

### **5.1. Maintenance & Testing of Communication Media**

#### **5.1.1 OPGW**

The most important thing that must be taken care for OPGW is the fibre and other link losses that may be kept within the limits of design document as per International Standards IEC 60793, 60794, ITU G.652.

In case of OPGW, first of all, the attenuation of fibres is checked followed by implementing preventive measures so as to protect the cable from bending or sagging due to the wind or other environmental factors. Fibre loss can also occur due to the excess tightening of the clamps and the mis-alignment of the hardware accessories which need to be checked.

Secondly, there are possibilities of occurrence of loose kinks on the clamped ends resulting into bending (macro/micro) of the fibres inside the cable. Loose kinks may occur due to extra tension applied for tightening of the earthing clamps to the OPGW or an impulse occurring due to some external force on the cable. Loose kinks may be identified using an Optical Time Domain Reflectometer (OTDR); the exact location of the kinks can also be located from the loss versus distance curve that is generated by the OTDR. Loose kinks may be repaired by tightening clamp / straightening the portion of the cable where the kink has occurred.

Thirdly, the sag of the OPGW cable should be maintained as per the sag tension specifications. Deviations of tension from the specified value might change the alignment of the OPGW and there may be possibilities of OPGW being affected by extreme wind conditions.

The down lead clamping of the OPGW at the splicing locations are to be checked regularly in order to assure the proper routing of the cable. Improper attachments of the down lead clamps might result in bending or kinks in the cable.

The deformation of the surface of OPGW shall be monitored closely during maintenance and in case found damaged, the OPGW in the span shall be spliced/ replaced (as applicable) by the Owner.

### **5.1.2 Approach Cable**

In case of approach cable, the fibre and other link losses have to be kept within the limits of design document.

Regular inspection shall be carried out to check clamping inside the trench and cable raceways specially during the monsoon season. Similarly, the GI (Galvanized Iron) pipes and the HDPE (High Density Poly Ethylene) pipes through which the approach cable is taken shall be checked regularly for any deformities or damages. The cable should also be checked regularly for rodent attacks.

### **5.1.3 ADSS**

All-dielectric self-supporting (ADSS) cable is a type of optical fibre cable that is strong enough to support itself between structures without using conductive metal elements. It is used by utilities as a communication medium, installed along existing overhead transmission lines and sharing the similar type of support structures as the electrical conductors.

The fibre and other link losses and associated preventive and maintenance activities in terms of ADSS shall be similar to OPGW mentioned under clause 5.1.1 of this procedure.

### **5.1.4 UG OFC**

Underground Optic Fibre Cable (UG OFC) is suitably placed into ducts (PLB HDPE/ PVC/ HUME pipes), which is being laid below the ground surface. In underground installation, the conduit provides protection from both physical and environmental abuse. The conduit protects cable from shifting rocks, aggressive rodents, and/ or damage from hand shovels. There may be breakage/ attenuation in the OFC, due to problems like temperature variation, Fire/ Rodent cuts/ water seepage/ re-digging etc.

UG OFC is prone to cut due to digging done by multiple service providers/ utilities. Accordingly, maintenance team of the communication system owner

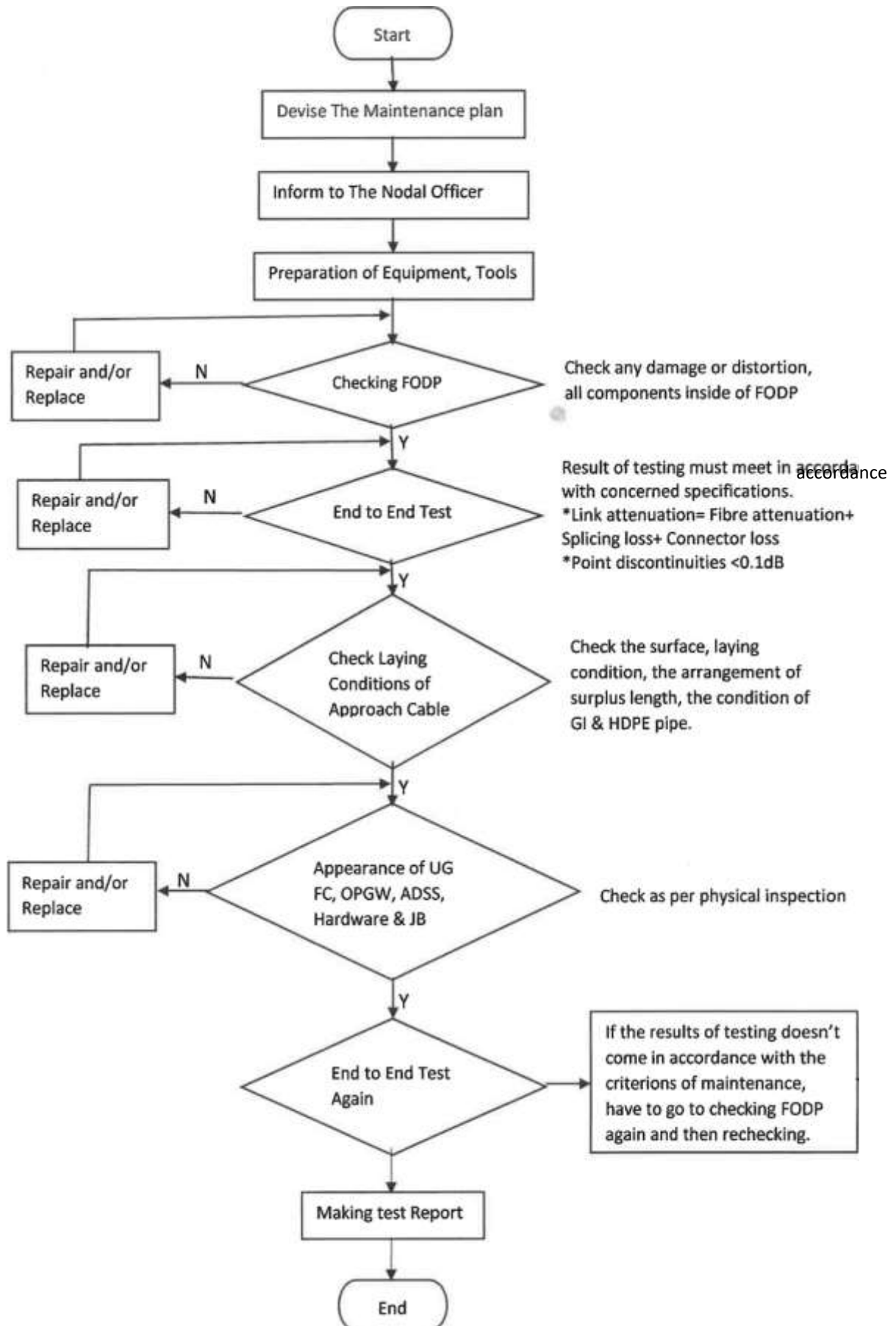
shall be equipped with requisite T&P (enclosed as **Annexure-II**) and spares to attend the UG OFC cut on daily basis.

UG OFC laid in cable trenches may be cut by rodents, armoured or unarmoured cable with suitable protection (GI pipe) in addition to ducts (PLB HDPE/ PVC/ HUME pipes), may be used, to ensure protections against rodent cuts.

Water seepage in joint boxes may result in increased fibre attenuation. Cable entry points in joint boxes/ FODP shall be sealed properly to avoid water leakage/ rodent/ insect entry.

Garbage stored/ weeds growth in cable trenches may cause fire to damage UG OFC. So UG OFC route shall be checked for garbage collection/ weeds growth on regular basis. GI/ RCC clamps shall be checked for proper fitting at Nala/ River crossing. Missing/ improper clamps may result in UG OFC cable bending causing increased fibre attenuation.

Typical Flow chart for performing maintenance activity on individual links is as a



ails of Communication Media may be noted in the following format during maintenance.

s. No	Details of Owner	Link Detail A to B	Location of Maintenance (A/B)	OPGW/ADSS/UGOFC/Approach Cable Type (24/48 F)/Dia	No of Live Fibers	Year of Commissioning	Under AMC (Y/N)	Contact Details of AMC Agency/Person	Date of last Maintenance	Maintenance done as per procedure (Y/N)	Date of maintenance	Remarks
1												
2												
3												

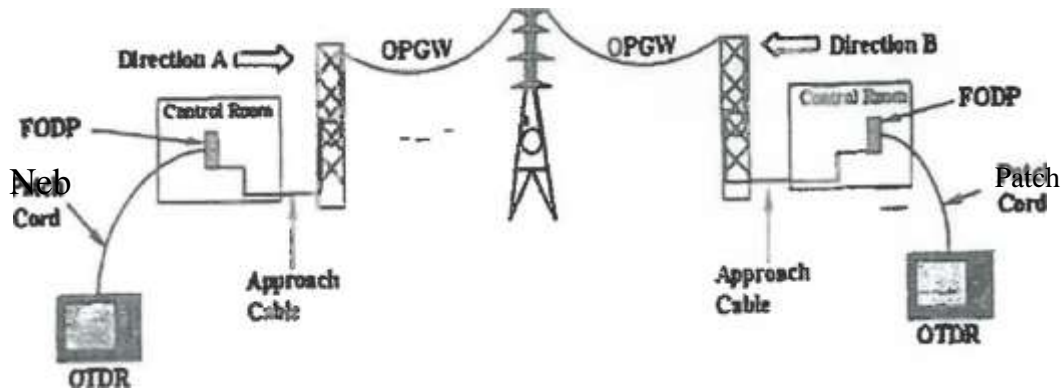
Prepared by:

Approved by:

The maintenance periodicity of the communication media may be carried out as under:

Maintenance Activity	Items	Checking Period	Remarks
Physical Inspection	<ul style="list-style-type: none"> <li>● OPGW</li> <li>● UG FO</li> <li>● ADSS</li> <li>● Approach Cable</li> <li>● Associated Hardware &amp; Fittings</li> <li>● Splicing Enclosure</li> <li>● FODP</li> </ul>	Half Yearly	each link
	<ul style="list-style-type: none"> <li>● Surroundings Condition</li> </ul>	Quarterly	
Measurement of optical properties of spare/dark fibers	<ol style="list-style-type: none"> <li>1. Transmission Loss by power meter &amp; laser source (1310 nm &amp; 1550nm)</li> <li>2. Splicing Loss by OTDR (1310nm &amp; 1550nm)</li> <li>3. Discontinuities of Optical Fibers (1310 nm &amp; 1550nm)</li> </ol>	Half Yearly	each link

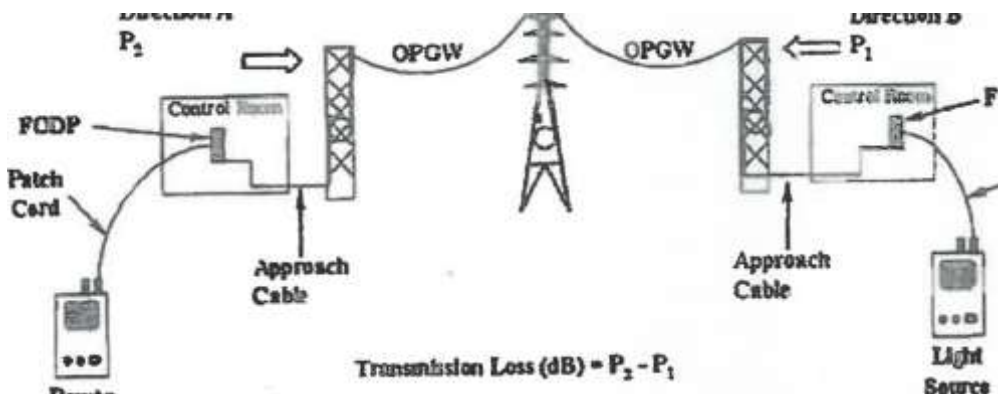
5.1.6. Test Set Up for Measurement of optical properties of spare/dark fibres. The path attenuation shall be measured at both ends of link by OTDR & Power meter and the average value of these two measurements shall be calculated.



Measurement using OTDR

$$\text{Loss A-B} = \dots \text{ dB}$$

$$\text{Loss B-A} = \dots \text{ dB}$$



Measurement using Power Meter

5.1.6.1 The path attenuation shall be less than the calculated value as below:

- Max Attenuation @ 1550nm: 0.21dB/km+0.05dB/splice+0.5dB/connector
- Max Attenuation @ 1310 nm: 0.35dB/km+0.05dB/splice+0.5dB/connector

5.1.6.2 There shall be no point discontinuities in excess of 0.1 dB

### 5.1.7. Preventive/ Predictive Maintenance:

Preventive maintenance is to be done to prevent the system from unnecessary hazards and to ensure smooth functioning of the system. Maintenance schedule may be prepared specially for preventive maintenance for entire UG/OH OFC network considering resources identified.

There are three major components of Preventive Maintenance of communication media:

- a) Patrolling
- b) Maintenance based on inputs from patrolling team
- c) Scheduled maintenance

- **Patrolling:** The Maintenance team shall deploy patrollers for patrolling the entire route length of UG/OH OFC. Transmission Line patrolling staff can also take care of OPGW aspects while patrolling the transmission line. Transmission line engineer concerned shall inform Communication Nodal officer about upcoming Transmission line (having OPGW) maintenance outage.

The patrolling team shall report all issues on route to the concerned Nodal Officer.

The physical inspection (associated with necessary photographs/ GPS details) carried out by the patrolling team shall include the following activities as mentioned in the table below:

<b>Patrolling Items</b>	<b>Periodicity</b>	<b>Method</b>	<b>Observation</b>
Clamp	Half Yearly	Visual inspection with binocular	<ul style="list-style-type: none"><li>● If there is any remarkable bent in OPGW</li><li>● If OPGW is vibrating</li><li>● If the rust gathered on bolts.</li><li>● If there is any unusual abrasion</li></ul>



Jumper			<p>on the moving part of hanging clamp.</p> <ul style="list-style-type: none"> <li>● How is the status of OPGW in regard to corrosion</li> <li>● If OPGW secures the allowable bending radius</li> <li>● Measurement of tightening torque with a torque wrench for all clamp bolt</li> </ul>
Cleats & downlead clamps	Half Yearly	Same as above	<ul style="list-style-type: none"> <li>● If all downlead clamps are in position</li> <li>● If OPGW is hanging away from tower.</li> <li>● If OPGW is slipping at clamp portion</li> </ul>
Inserting region of fibre optic joint box			
Span region	Half Yearly	Same as above	<ul style="list-style-type: none"> <li>● If there is any strand broken in OPGW surface</li> <li>● If sag of OPGW is normal</li> <li>● If OPGW is vibrating</li> <li>● If all dampers and twist prevention weights are in position</li> <li>● If there are arc marks on the OPGW surface</li> <li>● How is the state of corrosion on the OPGW surface</li> </ul>

Fiber Optic Joint Box	Half Yearly	<p>Visual inspection of external appearance using binocular</p> <p>Internal Visual inspection whenever the Joint Box is opened.</p>	<ul style="list-style-type: none"> <li>● If there is any bolt look loose or missing.</li> <li>● If rust or corrosion is observable.</li> <li>● Any abnormality in the arrangement of housing tray and optical fibre installation into it.</li> <li>● If moisture penetration or dew condensation is observable</li> </ul>
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FODP	Half Yearly	Visual inspection	<ul style="list-style-type: none"> <li>● Appearance: check any damages or distortions</li> <li>● Check the conditions of pig tails and connectors</li> <li>● Check presence of any hole/space for rodent entry</li> </ul>
Approach Cable UG OFC ADSS	Half Yearly	Visual inspection with binocular	<ul style="list-style-type: none"> <li>● Appearance: check the surface of approach cable/ ADSS cable.</li> <li>● Check laying conditions between terminal tower at switch yard and FODP at control room.</li> <li>● Check the arrangement of surplus length of approach cable.</li> <li>● Check the conditions of installed GI and HDPE pipe/ duct.</li> <li>● Check the presence of garbage/ foreign materials/ weeds on the route.</li> <li>● Check the presence of space/ hole for entry of rodent or any damage caused by rodents.</li> </ul>
Environments for OH and UG Optical Cables	Quarterly	Visual inspection with the naked eye /binocular	<ul style="list-style-type: none"> <li>● On the ROW and surrounding areas, check the excavation work and construction works under progress for any abnormality.</li> <li>● Check the growth of vegetation in surroundings.</li> <li>● Garbage collection/ weeds growth in cable trenches and manholes.</li> </ul>

○ **Maintenance based on inputs from Patrolling team:**

Patrolling Item	Observation	Action to be taken
Clamp & Damper	<ul style="list-style-type: none"> <li>● If there is any remarkable bent in OPGW</li> <li>● If OPGW is vibrating</li> <li>● If all dampers and twist prevention weights are in position</li> <li>● If the rust gathered on bolts, etc.</li> <li>● If there is any unusual</li> </ul>	Replacement and tightening of Clamps/ jumper/ damper and other associated fittings.

Jumper	<p>abrasion on the moving part of hanging clamp.</p> <ul style="list-style-type: none"> <li>• How is the status of OPGW in regard to corrosion</li> <li>• If OPGW secures the allowable bending radius, Measurement of tightening torque with a torque wrench for all clam bolt</li> </ul>	
Cleats & downlead clamps	<ul style="list-style-type: none"> <li>• If all downlead clamps are in position</li> <li>• If OPGW is hanging away from tower.</li> <li>• If OPGW is slipping at clamp portion</li> </ul>	<ul style="list-style-type: none"> <li>• Replacement and tightening of Downlead clamps.</li> <li>• Extra Downlead clamps may be placed.</li> </ul>
Span region	If a sag of OPGW is deviated from design value.	Tightening of clamps on both sides to maintain the requisite sag.
	<ul style="list-style-type: none"> <li>• If there is any strand broken in OPGW</li> <li>• If there are arc marks on the OPGW</li> <li>• How is the state of corrosion on the OPGW</li> </ul>	Respective span/ section of OPGW may be replaced

Patrolling Item	Observation	Action to be taken
fibre Optic Joint Box	<ul style="list-style-type: none"> <li>• If moisture penetration or dew condensation is observable</li> <li>• If rust or corrosion is observable</li> </ul>	Replace the joint box in case of moisture penetration and corrosion.
	<ul style="list-style-type: none"> <li>• Any abnormality in the arrangement of housing tray and optical fibre installation into it</li> </ul>	Splice tray/ Joint Box to be replaced and splicing to be done.
	If there is any bolt looks loose or missing	Loose bolts/clamp to be tightened and missing bolts should be replaced.
	Service Loop are opened/ loosened.	Service loops are to be properly clamped.
	Cable insertion point of joint box not sealed	Proper sealing of cable insertion point.

FODP	<ul style="list-style-type: none"> <li>● Appearance: check any damages or distortions</li> <li>● Check the conditions of pig tails and connectors.</li> <li>● Check presence of any hole/space for rodent entry.</li> </ul>	<ul style="list-style-type: none"> <li>● Replace damaged tray/ rack of FODP.</li> <li>● Replace the damaged pigtails &amp; connectors.</li> <li>● Proper sealing of any hole/ space to avoid rodent entry in FODP Panel.</li> </ul>
Approach Cable/ UG OFC/ ADSS	<ul style="list-style-type: none"> <li>● Appearance: check the surface of fiber optic cables for any damage or abnormality.</li> <li>● Check the following laying conditions of FO cables: <ul style="list-style-type: none"> <li>○ the service loop conditions at tower and control room.</li> <li>○ the conditions of installed GI and HDPE pipe/ duct.</li> <li>○ the presence of garbage/ foreign materials/ weeds on the route.</li> <li>○ the presence of space/ hole for entry of rodent or any damage caused by rodents.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>● Replace the damaged section of the cable.</li> <li>● Service loops are to be properly clamped.</li> <li>● Replace/rectify damaged portion of GI/HDPE pipe.</li> <li>● Cleaning/ removal of garbage/ foreign materials/ weeds.</li> <li>● Proper sealing of any hole/ space to avoid rodent entry.</li> </ul>
Environments	<ul style="list-style-type: none"> <li>● On the ROW and surrounding areas, check the excavation work and construction works under progress for any abnormality.</li> <li>● Check the growth of vegetation in surroundings</li> <li>● Garbage collection/ weeds growth in cable trenches and manholes.</li> </ul>	<ul style="list-style-type: none"> <li>● Requisite measures to be taken in coordination with local authorities for safety/ route diversion of FO cable.</li> <li>● Clearance of hindrance/ minimization of risk (removal of vegetation etc.)</li> <li>● Coordinate with local authorities for clearance and accessibility to manholes</li> </ul>

- **Scheduled Maintenance:** Following test shall be performed during Scheduled Maintenance

Maintenance Activity	Periodicity	Testing Observations	Action to be taken
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Healthiness of Fibre Optic	Half Yearly	1. Transmission Loss by power meter & laser source(1310nm &1550nm)	The results will be compared with previous data and standard data.
		2. Discontinuities of Optical Fibres by OTDR (1310 nm & 1550nm)	In case of abnormalities, losses/ discontinuities shall be rectified by replacement of the respective section with healthy fibre optic cable.
		3. Fibre Attenuation/ Splicing Loss by OTDR (1310m & 1550mn)	Re-splicing of fibres at high loss points.

### 5.1.8 Breakdown Maintenance:

Breakdown maintenance includes the maintenance of the facilities, during the sudden failure of the communication system. On occurrence of any breakdown noted in NMS/CNMS, Nodal Officer/NMT through Nodal Officer of User/Owner shall instruct the maintenance team to take up steps mentioned as under:

- Visit the terminal station of affected link and test the fibre by OTDR to identify the exact location of the fault using Drum Schedule details/ ABD (As Built Drawing).
- Access the fault/damage location of UG/OH OFC.
- Carry out rectification work such as replacement of UG/OH OFC /splicing in Joint Box in minimum time.
- Temporarily lay OFC (Optical Fibre Cable) over temporary structure/tower/ground in the section for restoration of link, in case of fault in link/damage to UG/OH OFC requiring long restoration time viz in case of collapse of tower.
- Carry out testing of UG/OH OFC after rectification/re-stringing to ensure fibre loss within limit and UG/OH OFC ready to take back in service.
- Maintenance Team shall get the confirmation of link restoration from NMS and further CNMS.
- Submit the plan for permanent restoration of temporarily restored section and schedule the permanent restoration activity in consultation with Nodal Officer & NMT of CNMS centre.

### **5.1.9. Post restoration Activities**

- Ensure removal of man and material so that system can be put back in service.
- Submit detailed report on maintenance work carried out including intimation of fault, response time and rectification time, rectification work carried out, consumption of spares, Splicing Test Reports, end-to-end test reports. Typical format for Functional test of OFC is attached as **Annexure-IV**.
- Update History Register incorporating maintenance works carried out by maintenance team.
- After completion of maintenance activity, Maintenance team shall intimate Nodal officer about the same who will coordinate for return of Shutdown/ Pennit to Work and restoration of system.

### **5.1.10. VSAT**

A very-small-aperture terminal (VSAT) is a two-way satellite ground station with a dish antenna. It mainly consists of 3 parts:

1. Antenna
2. VSAT Outdoor Unit: The outdoor unit (ODU) consists of the following devices:
  - Low Noise Block (LNB) which is a down converter and receiver.
  - Block Up Converter (BUC) which is up converter and transmitter.
  - Ortho-Mode Transducer (OMT) which is Tx and Rx waveguide joint.
  - Microwave filters which protect the LNB from the Tx signals.
3. VSAT Indoor Unit: The indoor unit (IDU) usually consists of a single box (normally referred to as a Modem) which should be located in a dry, cool and clean place.

#### **5.1.10.1 Preventive/ Predictive Maintenance Activities**

This consists of necessary measures to maintain the VSAT in the proper operating condition and to keep the link functioning. Preventive maintenance includes antenna inspection, functional checking, cleaning and necessary repair/replacement/adjustments. It will be carried out half yearly.

SI No.	Description	Observation	Action To be taken
<b>1</b>	<b>Antenna</b>		
	Antenna Mechanical Part	<ul style="list-style-type: none"> <li>● Check for Dust, Corrosion on the antenna surface, platform and feed cabinet.</li> </ul>	<ul style="list-style-type: none"> <li>● Clean the antenna outdoor platform and feed cabinet.</li> <li>● Fill grease to each lubricating point when needed.</li> </ul>

		<ul style="list-style-type: none"> <li>● Check condition of greasing on mechanical parts at lubricating points.</li> <li>● Check the surface of antenna for De-ice system.</li> <li>● check the outdoor waveguide, various cable connecting and outside surface</li> <li>● Check for the beacon light.</li> </ul>	<ul style="list-style-type: none"> <li>● Weatherproofing, surface without damage.</li> <li>● Tighten the waveguide and cable connecting normally.</li> <li>● Beacon light working normally</li> </ul>
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	Antenna Tracking and Servo System	<ul style="list-style-type: none"> <li>● Check surface of each equipment and system.</li> <li>● Tracking system and mechanical servo system checking.</li> <li>● Different modes and function transition of ACU (Antenna Control Unit) checking.</li> </ul>	<ul style="list-style-type: none"> <li>● Surface of each equipment and system is dust free and works normally.</li> <li>● Tracking system and mechanical servo system (Azimuth &amp; Elevation Actuator Boot, gear box, motor) repair and replace.</li> <li>● Perform Antenna Control Unit Troubleshooting.</li> <li>● Replace or repair any other faulty parts.</li> </ul>
	Antenna Electrical Part	<ul style="list-style-type: none"> <li>● Check the various RF and AC Power cable connections.</li> <li>● Check the earthing connections.</li> <li>● Check Lightning protection system.</li> </ul>	<ul style="list-style-type: none"> <li>● Tighten the loose RF and AC Power cable connections and replace the damaged cables.</li> <li>● Inform Nodal Officer if problem is in Earthing connections.</li> <li>● Lightning protection system shall be corrected.</li> </ul>
2	Outdoor Unit	<ul style="list-style-type: none"> <li>● Check for Dust, Corrosion on the ODU surface.</li> <li>● Check the RF and AC Power cable connections.</li> <li>● Check the functioning of various electronics module.</li> </ul>	<ul style="list-style-type: none"> <li>● Clean the surface.</li> <li>● Tighten the loose RF and AC Power cable connections.</li> <li>● Replace/ repair the faulty module.</li> </ul>
3	Indoor Unit	<ul style="list-style-type: none"> <li>● Check for dust, corrosion on the IDU surface</li> <li>● Check the cooling fans working.</li> <li>● Check the cable connections.</li> <li>● Check the functioning of various electronics module.</li> </ul>	<ul style="list-style-type: none"> <li>● Tighten the loose cable connections.</li> <li>● Replace/ repair the faulty card/module.</li> </ul>
4	Environment	Check the growth of vegetation in surroundings for block in LOS	Removal of vegetation for clearing LOS.

### 5.1.10.2 Breakdown Maintenance

Details of activities to be carried during Break Down Maintenance of VSAT:



- Repair and replacement of Faulty Module.
- Arranging & commissioning of spare VSAT unit for ensuring link connectivity, in case of fault in VSAT requires longer restoration time. Later same shall be replenished by the vendor.
- Analysis report of the fault.
- Plan for preventive measure to arrest recurrence of such faults.

## 5.2. Maintenance of Communication Equipment

The details of Communication Equipment shall be noted in the following format during maintenance.

No	Detail of Owner	Detail A-B, A-C, A-D	Location of Equipment	Type of Equipment (PDH/ SDH- STM1/ 4/ 16/ 64	Make of Equipment/ Serial No.	Year of Commissioning	Under AMC (Y/N)	Contact Details of AMC Agency/ Person	Date of last Maintenance	Maintenance done as per procedure Y/N	Date of maintenance	Remarks
1												
2												
3												

Preventative/Predictive maintenance shall be carried out half yearly at all the sites in the network.

### 5.2.1. Preventive/ Predictive Maintenance Activities

- Maintenance team shall be equipped with necessary test equipment like BER (Bit Error Rate) meter, SDH Analyzer, Ethernet Tester, Multi-meter, attenuators, optical jumpers or equivalent test equipment with composite functionalities.
- The planned site visits shall consist of necessary measures to maintain the equipment in proper operating conditions. This shall include visual inspection of the equipment, functional checking, cleaning and necessary repair/replacement/adjustments.

Work to be taken up during half yearly preventive maintenance site visits shall include but not limited to the following:

Sl.no.	Description	Observation	Action To be taken
1	Overall Infrastructure	Overall Infrastructure and environmental requirements (building/ air conditioners), AC/DC system, battery, cabling connectivity and earthing of communication equipment.	

<b>1.1</b>	<b>Equipment site</b>		
1.1.1	General conditions	General checking during half yearly /troubleshooting site visits and advise	
a	Dust Proofing	If equipment room is clean, dust free, rodent free.	Proper care shall be taken to make the room dust/ rodent free.
b	Earthing	Check for separate or combined earthing for communication and substation equipment.	Noting of earthing details. Nodal Officer may be informed regarding

		<p>Checking earthing of communication equipment:</p> <ul style="list-style-type: none"> <li>● In Kiosks in switchyard.</li> <li>● In control room.</li> </ul> <p>Measurement of earth resistance. Check the equipment Earthing interconnection up to earthing start point. Checking connector cleaning</p>	<ul style="list-style-type: none"> <li>● any maintenance activity for the connection of equipment earthing.</li> <li>● Earthing interconnection shall be corrected if it is the probable cause of fault during troubleshooting.</li> </ul> <p>Clean the Connector.</p>
c	Air conditioning	General checking of installed AC in line with equipment operating condition (temp.) requirement	Ambient temperature of the equipment room to be noted and inform if AC is not working properly as per equipment operating conditions requirement or is not adequate.
d	Power Cable route	General checking of power cables routing up to the communication equipment.	Advice action if any fault found in power cables.
e	Communication cabling	Check terminations, patch cord, if necessary, based on probable cause of faults.	take corrective action if indoor cabling, patch cord is probable cause of fault.
1.2	EMI issues	Maintenance team shall study in special case of repeated faults if the probable cause is earthing interconnection at the station or possibility of spurious signals through various cable connections to the wideband equipment and advise.	The observations and analysis shall be brought into the notice of Nodal Officer for resolution of the problem.

1.3	Interfacing of MDF/ DDF with other equipment	Check interfacing with other equipment and take corrective actions on its MDFs/ DDFs if required as per cable routing diagram.	Routing/ tracing as per labelling of connected equipment upto MDF/ DDF and ensure proper connection with MDF/ DDF.
<b>2</b>	<b>Main Equipment</b>		
2.1	PDH MUX & Digital Cross Connect	<p>Check:</p> <p>Physical Inspection of the equipment</p> <ul style="list-style-type: none"> <li>● Cleaning</li> <li>● Interconnections</li> <li>● Sealing of cabinets</li> </ul>	<ul style="list-style-type: none"> <li>● Clean the equipment/ equipment filter</li> <li>● Tighten the connectors</li> <li>● Seal of cabinets to arrest entry of rodents etc.</li> </ul>

		Functional testing of equipment	<ul style="list-style-type: none"> <li>● Replace the faulty equipment/ module/ Fan module.</li> </ul>
2.2	Fibre Optic terminal SDH	<p>Check:</p> <p>Physical Inspection of the equipment</p> <ul style="list-style-type: none"> <li>● Cleaning</li> <li>● Interconnections</li> <li>● Sealing of cabinets</li> </ul> <p>Functional testing of equipment</p> <p>Perform Jitter &amp; wander test on long distance links.</p> <p>Equipment Parameters like laser bias current measurement, equipment/unit temp measurement. .</p>	<ul style="list-style-type: none"> <li>● Clean the equipment/ equipment filter</li> <li>● Tighten the connectors</li> <li>● Seal of cabinets to arrest entry of rodents etc.</li> <li>● Replace the faulty equipment/ module/ Fan module.</li> </ul>
2.3	End user Equipment	Check functioning of all the end user equipment along with associated hardware e.g. IP gateway, Phone.	Replace/ maintenance of end user equipment and their connectivity.
2.4	GPS Clock	Check for the Fault/ signal strength of GPS clock.	Replace the faulty hardware or adjust antenna.
<b>2.5</b>	<b>NMS of SDH</b>		

2.5.1	Computer hardware and Software	<p>Check healthiness of the NMS system e.g. Functionality, data backup, storage.</p> <p>Check for the loading of latest patches/upgrades of the NMS software including security and configuration of the running system.</p>	<p>Replace/ upgrade the faulty hardware/ firmware.</p> <p>Ensure for compliance of the non-conformity, if any, regarding software patches/ upgrade.</p> <p>Data Backups to be ensured as per maintenance plan.</p>
<b>2.6</b>	<b>NMS of PDH (D/I Mux&amp; DACS)</b>		
2.6.1	Computer hardware and Software	<p>Check healthiness of the NMS system eg. Functionality, data back up, storage.</p> <p>Check for the loading of latest patches/upgrades of the NMS software including security and configuration of the running system.</p>	<p>Replace/ upgrade the faulty hardware.</p> <p>Ensure for compliance of the non-conformity if any regarding software patches/ upgrade.</p> <p>Data Backups to be ensured as per maintenance plan.</p>

Sl. no.	Description	Observation	Action To be taken
2.6.2	Functional Checking	Verify that the configured channel should be in line with approved channel.	

### 5.2.2 Preventive/ Predictive maintenance of NMS

Communication System Owners have to install Network Management System (NMS) through their OEM for the centralized supervision of communication equipment installed at all ISTS nodes including different POP/Repeaters.

Preventive and predictive maintenance of NMS shall cover the activities (but not limited to) as tabulated below. The report of following activities shall be submitted to respective Network Control Centre:

Sl. No.	Activity	Description	Frequency	Action To be taken
1	Network Monitoring	To check upcoming network problems	Daily	Fault Rectification
2	Site Visit	To attend fault/ other operations	Case to case basis	Depute maintenance team as required.

3	Link Loss Measurement	Measurement of losses in Optical Links.	Quarterly	Inform the Nodal Officer for corrective measures through respective maintenance team.
4	Traffic Matrix Check	Verify that the configured channels, should be in line with approved channel.	Half Yearly	Take corrective measures in coordination with Nodal Officer
5	TMN System Data Back Up/ Data Back	Back up shall be taken	Daily	Backup to be taken as per setting Auto/Manual.
6	Traffic Grooming	Optimisation of communication channels	Half Yearly	Reconfiguration/ rerouting of channels.
7	Network Utilization/ Congestion Report/ availability of spare ports		Half Yearly	Inform the Nodal Officer for upgradation of equipment/ rerouting of traffic
8	Network Check wrt approved document (services/connectivity/ Bandwidth/performance parameter)	Network Check shall include but not limited to <ul style="list-style-type: none"> <li>● Performance Check</li> <li>● Bandwidth Check</li> <li>● Route allocation of links</li> </ul>	Yearly	Inform the Nodal Officer for corrective measures
9	TMN Remote Check	At Main NMS Centre	Yearly	Take corrective measures in coordination with Nodal Officer
10	Remote Access Channel Check (DCN Check)	For remote access of nodes for diagnostics and troubleshooting	Yearly	Take corrective measures in coordination with Nodal Officer

### 5.2.3. Breakdown Maintenance

Break down maintenance includes the maintenance of the facilities, during the sudden failure of the communication system. On occurrence of any breakdown noted in NMS, Nodal Officer will instruct the maintenance team to take up following steps mentioned as under:

- Visit the terminal station of affected link and test the communication equipment.

- Carry out rectification work such as replacement of module/patch cord/ hard reset in coordination with NMS team/ Nodal Officer.
- Maintenance Team shall get the confirmation of link restoration from NMS Team/ Nodal Officer.
- In case the fault results in long duration breakdown of the link, Temporary path reconfiguration shall be provided through NMS in coordination with the Nodal Officer and he shall ensure the permanent restoration of temporarily restored links.

#### 5.2.4. Post restoration Activities

- Ensure removal of man and material so that system can be put back in service.
- Submit detailed report on maintenance work carried out including intimation of fault, response time and rectification time, rectification work carried out, consumption of spares, all software in Network, their version, date of previous update, Plan of next update, Major changes after update.

Typical format for Fault intimation/ status report is attached as **Annexure-V**.

- Update History Register incorporating maintenance works carried out by the maintenance team.
- After completion of maintenance activity, Maintenance team shall return the faulty module to Nodal officer who will further send to OEM for repairing.

#### 5.3. Maintenance of Auxiliary Power Supply

DCPS includes charger, Batteries, DCDB and other associated cables/connectors, Meters, relays, switches, surge protection devices. The Maintenance Team shall carry out both preventive and break down maintenance of the supplied DCPS & Battery System.

The details of DCPS and Battery shall be noted in the following format during maintenance.

S. No	Detail of Owner	DCPS/ Battery Bank No. 1/2/3	Location of DCPS/ Battery	Type of DCPS/ Battery	Make of DCPS/ Battery / Serial No.	Year of Commissioning	AMC (Y/N)	Contact Details of AMC Agency/ Person	Date of last Maintenance	Maintenance done as per procedure	Date of maintenance	Remarks
1												
2												
3												

#### 5.3.1 Preventive/ Predictive Maintenance Activities

This consists of necessary measures to maintain the equipment in the proper operating condition. Preventive maintenance includes functional checking, cleaning and necessary repair/replacement/adjustments. It will be carried out Quarterly.

Details of activities to be carried out during Preventive Maintenance as follows:

Sl. no.	Description	Observation	Action To be taken
<b>1</b>	<b>DCPS</b>		
1.1	General conditions	Check: <ul style="list-style-type: none"> <li>● Cleaning</li> <li>● Connections</li> </ul>	<ul style="list-style-type: none"> <li>● Cleaning of System</li> <li>● Tightening of all the power and control connection, MCB, wiring, LED, terminations including checking the input power cable terminations at both ends.</li> </ul>
1.2	Functional Checking	<ul style="list-style-type: none"> <li>● Functional checking Of DC System for Normal</li> <li>● Operation including battery charging.</li> <li>● Checking for Normal operation of each Module. Checking of present load on charger.</li> <li>● Matching of DCPS parameters with Centralized system.</li> </ul>	<ul style="list-style-type: none"> <li>● Check the Controller Display working status and it should be showing reading of AC voltage, DC voltage, load current, alarm.</li> <li>● Faulty Module shall be replaced/ repaired.</li> </ul>
1.3	Testing	Following measurements shall be done with multi meter and compare the same with standard value of approved document	Make necessary adjustments/ corrections to match values with standard value of approved document.

		<p>a. Checking of DC Voltage</p> <p>b. Checking for AC Voltage L-L, L-N</p> <p>c. Checking AC Current</p> <p>d. Checking for ripple Voltage</p> <ul style="list-style-type: none"> <li>● Reading of the displayed value in the controller and measured through the multimeter should be within the range of <math>\pm 1</math> % difference.</li> <li>● Check Load Low Voltage Disconnect (LLVD) and Battery Low Voltage Disconnect (BLVD) setting.</li> </ul>	Faulty parts/ modules shall be replaced/ repaired.
<b>2</b>	<b>Battery (VRLA / Lithium Ion)</b>		
2.1	General conditions	<p>Checking of the physical conditions of the batteries Connections, marking, wiring, protection cover</p> <p>Checking of battery terminals for corrosion and cleaning thereof, torqueing and greasing.</p> <p>connectivity of battery at battery fuse of DCPS/IPMS.</p>	<p>Cleaning</p> <p>Tightening of all the battery connections.</p> <p>Make necessary adjustments/ corrections.</p>
2.2	Testing	<p>battery parameters setting like charging current @ C-10, Boost voltage and Float voltage in the controller.</p> <p>Checking of each battery voltage &amp; battery impedance/resistance measurement</p> <p>C-3, Three discharge tests per year at normal load for three hours during 1<sup>st</sup>, 2<sup>nd</sup> and 4<sup>th</sup> quarterly visit.</p> <p>C-10 discharge test on batteries once a year on 3<sup>rd</sup> quarterly visit.</p>	Faulty Cells/ Battery Bank to be replaced.



3	Earthing Measurement	Checking of earthing of the system by measurement of earth to neutral potential <ul style="list-style-type: none"> <li>● For DCPS</li> <li>● For Battery</li> </ul>	Tighten the connectors. Inform the Nodal Officer.
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Based on observation noted w.r.t. above mentioned parameters/ aspects, report shall be made for further maintenance/ actions to be taken.

### 5.3.2. Breakdown Maintenance

Breakdown Maintenance is to be carried out in the event of malfunctioning of DCPS equipment, which blocks the normal operation of the DCPS. Breakdown maintenance includes fault finding, repair or replacement of defective parts and functional checking.

Details of activities to be carried during Breakdown Maintenance:

1. Repair and replacement of Faulty Module/components.
- 2.
3. Arranging & commissioning of spare DCPS unit for ensuring the supply, in case fault in DCPS requires longer restoration time. Later the same shall be replenished by the vendor.
4. Analysis report of the fault.
5. Plan for preventive measures to arrest recurrence of such faults.

## 5.4 Maintenance of Associated Auxiliary Infrastructure

### 5.4.1 DG Set

#### 5.4.1.1 Predictive/ Preventive Maintenance

The Maintenance Team shall carry out both preventive and break down maintenance of the supplied DG Set. Preventive maintenance includes functional checking, cleaning and necessary repair/replacement/adjustments. It will be carried out as per approved design document. The details of DG Set shall be noted in the following format during maintenance.

S. No	Detail of Owner	DG Set	Location of DG Set	Type of DG Set	Make of DGSet/ Serial No.	Year of Commissioning	Under AMC (Y/N)	Contact Details of AMC Agency/ Person	Date of last Maintenance	Maintenance done as per procedure Y/N	Date of maintenance	Remarks
1												
2												
3												

Details of activities to be carried out to examine following parameters during Preventive Maintenance:

Sl. no.	Description	Observation	Action To be taken (In case of abnormality)
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1	Fan assembly	<p>Check:</p> <ul style="list-style-type: none"> <li>● Radiator fan alignment</li> <li>● Fan drive bracket bolt tightness</li> <li>● Fan Belt Condition</li> <li>● Fan Belt Tension</li> <li>● Fan clutch resistance or operation hot air circulation from fan shroud area</li> </ul>	Faulty parts shall be replaced/ repaired.
		<ul style="list-style-type: none"> <li>● Water Pump Belt Tension</li> <li>● Water Pump Belt Condition</li> </ul>	Faulty parts shall be replaced/ repaired.
		<ul style="list-style-type: none"> <li>● Oil leakage from front oil seal</li> <li>● Oil, Coolant leakage from header assembly</li> <li>● Fuel Leakage</li> <li>● Condition of Fuel Hoses</li> <li>● Supporting of fuel hoses, check for fouling, condition of bradding</li> <li>● Oil leakage at Actuator</li> <li>● Oil leakage from rocker cover or cylinder head</li> </ul>	Faulty parts shall be replaced/ repaired.

	Cooling & Exhaust System	<ul style="list-style-type: none"> <li>● Coolant Hose and Clamp condition and tightness</li> <li>● Coolant level inside reservoir tank</li> <li>● Coolant Pump belt condition</li> <li>● Coolant pump belt tension</li> <li>● Air filter element condition, outer element cleaning if required</li> <li>● Breather hose, clamp, air filter bracket bolt tightness</li> <li>● Exhaust gas leakage</li> <li>● for exhaust manifold and diffuser and shield nuts, if loose, tighten</li> <li>● Walk around and inspect for coolant and oil leakage during test run</li> </ul>	Faulty parts shall be replaced/ repaired.
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		<ul style="list-style-type: none"> <li>● Engine mount bolt tightness</li> <li>● Alternator bolt tightness</li> <li>● Electrical connection check tightness if required at panel and end terminal</li> <li>● Oil level in Engine sump</li> <li>● Static battery charger connection and operation</li> <li>● battery electrolyte level and terminal condition</li> <li>● connectors of sensors and actuator</li> <li>● Condition of centrifuge filter and clean it if required</li> <li>● Inspection of Power cables, termination, condition of lugs inside Alternator extension box</li> <li>● Automatic Voltage Regulator (AVR) connection</li> <li>● Charge Air Cooling (CAC) hose connection, condition of hose and clamps</li> <li>● Battery Charger Available for Coastal area -space heater used for High Moisture area -space heater used</li> </ul>	<ul style="list-style-type: none"> <li>● Make necessary adjustments for rectification.</li> <li>● Faulty parts shall be replaced/ repaired.</li> </ul>
	Functional Test	<ul style="list-style-type: none"> <li>● Testing for Auto Mode Start.</li> <li>● Take the reading of Output Voltage/ Current with Multi</li> </ul>	Reading to be Noted and abnormalities to be rectified.

		<p>Meter and compare with Controller Panel Display.</p> <ul style="list-style-type: none"> <li>● Reading from hour meter to be noted for Servicing/ major overhauling as per approved design document (Quarterly)</li> </ul>	
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#### 5.4.1.2 Breakdown Maintenance

Details of activities to be carried during Break Down Maintenance of DG Set:

1. Repair and replacement of Faulty Module.
2. Repairing and replacement of faulty components in the system.
3. Arranging & commissioning of spare DG Set unit for ensuring the supply, in case of fault in DG Set requires longer restoration time. Later same shall be replenished by the vendor.
4. Analysis report of the fault.
5. Plan for preventive measure to arrest recurrence of such faults.

#### 5.4.2 Maintenance of Repeater Shelter

Repeater Shelter hosts multiple (Electrical/ Communication) devices/ systems of different vendors and this is under the ownership of the communication system owner/ user. Annual visit for maintenance / upkeep of this infrastructure shall be made by the concerned Maintenance In charge/ Nodal Officer. Repeater Shelter shall be inspected for following check list.

Sl. no.	Description	Observation	Action To be taken (In case of abnormality)
<b>Repeater Premises</b>			
1	Availability of SOP of Repeater/point of presence (POP) Station in Hindi/English/Local Language.	OK/ Not OK	Nodal Officer to ensure the availability of SOP.
2	Availability & Condition of Repeater/ POP Station fencing & its Earthing (as applicable).	OK/ Not OK	Inform to respective maintenance team for the rectification.
3	Illumination level Condition inside/outside Repeater/ POP station.	OK/ Not OK	Inform to respective maintenance team for the rectification.

4	Availability of Canopy/rain shade for SEB Power meter & Status of SEB Power meter (Installed for Communication Equipment)	OK/ Not OK	Inform to respective maintenance team for the rectification.
5	Battery Bank healthiness/Cleanliness inside the shelter	OK/ Not OK	Inform to respective maintenance team for the rectification.
6.	Material safety Data (MSDS) of Battery/ Diesel storage displayed.	OK/ Not OK	Inform to respective maintenance team for the rectification.
7	Working Status of Air Conditioner in the Shelter Hut.	OK/ Not OK	Inform to respective maintenance team for the rectification.
8	Repeater/ POP Station Housekeeping/Weed Control Status.	OK/ Not OK	Inform to respective maintenance team for the rectification.
9	Smoke Detector Check Inspection records & of Healthiness.	OK/ Not OK	Inform to respective maintenance team for the rectification.

11	Availability of First-Aid Box & register as per norms.	OK/ Not OK	Inform to respective maintenance team for the rectification.
12	Availability of Emergency Light in Shelter Hut.	OK/ Not OK	Inform to respective maintenance team for the rectification.
13	Emergency Contact details Displayed.	OK/ Not OK	Inform to respective maintenance team for the rectification.
14	Entry & Exit details of Workmen/Visitors/vehicles entry logs record in register	OK/ Not OK	Inform to respective maintenance team for the rectification.
15	Availability of Fire Extinguisher as per latest norms (eg. minimum one foam & one CO2 type).	OK/ Not OK	Inform to respective maintenance team for the rectification.
16	Fire Extinguishers maintenance/inspection, Annual inspection records as per IS.	OK/ Not OK	Inform to respective maintenance team for the rectification.
17	Provision of locking arrangement at main gate & shelter.	OK/ Not OK	Inform to respective maintenance team for the rectification.
18	Routing of electrical supply through Residual Current Circuit Breaker (RCCB) with sensitivity 30mA.	OK/ Not OK	Inform to respective maintenance team for the rectification.

19	Availability of Danger boards/notices/posters.	OK/ Not OK	Inform to respective maintenance team for the rectification.
20	Compliance of Covid-19 protocol	OK/ Not OK	Inform to respective maintenance team for the rectification.
<b>Diesel Generator</b>			
1	Annual Maintenance report/record of DG set.	OK/ Not OK	Inform to respective maintenance team for the rectification.
2	Status of Battery Set of DG Set/last replacement date	OK/ Not OK	Inform to respective maintenance team for the rectification.
3	Oil Leakage observed (if Any)	OK/ Not OK	Inform to respective maintenance team for the rectification.

4	Availability of Tank Capacity specified on DG Set diesel storage tank	OK/ Not OK	Inform to respective maintenance team for the rectification.
5	DG should be on auto mode as applicable except during maintenance.	OK/ Not OK	Inform to respective maintenance team for the rectification.
<b>EARTHING</b>			
1	Earth Pit Visual Inspection (rusting, tightness & cleanness) status & record.	OK/ Not OK	Inform to respective maintenance team for the rectification.
2	Record of date of Testing, Earth resistance value and pit number.	OK/ Not OK	Inform to respective maintenance team for the rectification.
3	Whether earth strip is visible and connected to earth rod or not?	OK/ Not OK	Inform to respective maintenance team for the rectification.
4	Availability of body earthing & separate Neutral Earthing of DG set and connected with two earth Pit.	OK/ Not OK	Inform to respective maintenance team for the rectification.
5	Shelter hut structure is earthed from two sides.	OK/ Not OK	Inform to respective maintenance team for the rectification.

6	DCPS panel & Shelter equipment are connected with earthing as per norms.	OK/ Not OK	Inform to respective maintenance team for the rectification.
7	Check earthing of all electrical panel inside the shelter as per norms.	OK/ Not OK	Inform to respective maintenance team for the rectification.
8	All marshalling box/doors/main gate/fence were linked to earth with flexible connection.	OK/ Not OK	Inform to respective maintenance team for the rectification.
<b>Personal Protective Equipment (PPE) &amp; T&amp;Ps</b>			
1	Availability of healthy T&P/PPE for Shelter O&M and stored/placed properly.	OK/ Not OK	Inform to respective maintenance team for the rectification.
2	Periodical inspection PPE & of Shelter (Once in a Year)	OK/ Not OK	Inform to respective maintenance team for the rectification.
3	Industrial Safety Helmets Confirming as per IS	OK/ Not OK	Inform to respective maintenance team for the rectification.

4	Electrical Hand gloves confirming as per IS	OK/ Not OK	Inform to respective maintenance team for the rectification.
5	Safety Shoes confirming as per IS	OK/ Not OK	Inform to respective maintenance team for the rectification.
6	Others (If Any)	OK/ Not OK	Inform to respective maintenance team for the rectification.

### **5.5 Testing of Communication Channel Redundancy for Data Reporting By NLDC/ RLDC/ SLDC:**

NLDC/RLDC/SLDC have to test the alternate / redundant channels quarterly for data reporting in coordination with the concerned owner. The non-configuration [unavailability of redundant channel] shall be intimated to the users for corrective measures for ensuring reliability/ availability of the communication network in line with CERC Communication Regulations 2017.

### **5.6 Cyber Security**

Inter-State Communication system user/ provider shall ensure that the communication equipment have got tested as per relevant contemporary Indian or International Security Standards e.g. IT, OT and IT related elements against ISO/IEC 15408 standards, for Information Security Management System against ISO 27000 series Standards, in line with cyber security guidelines of Central Govt.

### **5.7. Documentation & Reporting Procedure**

All the Maintenance & Testing activity conducted by communication system owner shall be recorded/ logged along with necessary evidences including photographs/ GPS details and report shall be generated.

Communication System Owner/ User shall maintain the retention data as per CEA (Technical Standards for Communication System in Power System Operations) Regulations, 2020.

- (1) User shall keep evidence of compliance on availability for the previous two calendar years plus the current year for all the interfaces which are in operation.
- (2) Historical data of ninety days shall be kept.

The purpose of reporting is to summarize the activities performed during the reporting period. The reports shall include all the completed, ongoing and scheduled activities and transmittals issued and received for the month. Typically following report shall be generated (but not limited to):

I. **Reports generated at Remote End:**

The maintenance engineer shall also maintain a log of events and preventive maintenance carried out on the communication system at various sites. All the exceptional events shall be recorded. The initial condition of the system shall be recorded on the start status to constitute or reference for later events. All events such as incoming and existing alarms, fault occurrence, action taken for remedies shall be recorded. If a unit is replaced or repaired both the new and the replaced or repaired unit details are to be recorded.

II. **Reports generated at NMS Control Centre of Owner/User:**

- Daily/ Monthly/ Annually etc Report shall be generated/prepared at various NMS of communication system owner in coordination with maintenance team and shall be shared with NMT of Regional CNMS centre, A typical format of report is attached as **Annexure-VI**.
- Based on these reports, monthly report (MIS) which shall have details of availability, downtime, performance, trends etc of the network, has to be generated. The monthly report should provide the information on the performance of the services and describe the current status of the network. By analysing the report data, management and expert of concerned utility should be able to focus attention on the areas, where further improvement is needed.

Proper record should be maintained of all the events, activity and store transactions for reference. All the documents/ reports generated at remote



end and control centre shall be stored in physical form (hard copy/ logbook/ register) as well as in electronic form in respective Database, as applicable.

Emergency reports: Maintenance team shall submit reports every time the emergencies call up or call out service is invoked. In these cases, on termination of the emergency all details of the fault and clearance information may be submitted within 5 working days.

## **6. Safety Procedure**

Communication System Owner shall ensure that all safety procedure as applicable, as per prevailing CEA Safety Regulations 2010 and amendments thereof on “Measures relating to Safety and Electric Supply” shall be followed during maintenance and testing activities.

## **7. Disaster Management**

Communication Network along with Transmission lines are prone to damage due to earthquake, cyclone, flood etc. Communication Network plays a very crucial role for efficient & secure Power System Operation and quick restoration of the same needs to be dealt with utmost importance in case of disaster. Disaster management of communication system shall be dealt in line with the latest and related guidelines on “CRISIS AND DISASTER MANAGEMENT PLAN FOR POWER SECTOR” issued by CEA.

In case of failure of communication system due to disaster/ crisis, priority shall be the restoration of critical communication channels of communication system on alternate paths, as a measure/ part of Disaster Management Plan (DMP), and this shall be coordinated by NMT team of CTU with POSOCO/ SLDC/ Other Control Centre and Communication system Owners/ Users (For the same sufficient redundancy shall be planned in our communication system).

## **8. Maintenance & Testing Meetings**

In line with Centralized Supervision for Quick Fault Detection and Restoration of Communication System, NMT of CTU shall coordinate among the communication system users/owners for supervision, quick fault detection and restoration of communication system in respect of Inter-State communication system. For ensuring the desired availability as per the CERC Communication Regulations 2017, it is important that proper monitoring and maintenance of redundant path shall also be done along with the main path and quick restoration of main/ redundant path shall be ensured in case of failure of any path.

In order to address the Maintenance and Testing issues of communication system and to review the same for necessary measures (system improvement plan for recurring and critical issues/ upgradation/ replacement), meeting on quarterly basis may be planned by CTU in coordination with NLDC/RLDC/SLDC along with the concerned stakeholders.

Scheduled maintenance/ Outage Planning in line with RPC approved procedure shall be informed by ISTS system users/owners to NMT of CTU for finalizing the monthly outage planning of ISTS communication system in coordination with RLDC/SLDC and the same shall be updated in CNMS system for further coordination and optimal resource allocation.

This meeting shall be coordinated and held quarterly by CTU as nodal agency with NMT of CTU, Communication System Owners and Users, NLDC/RLDC/SLDC for communication and information flow between parties to tackle the essential issues concerning the services and network performance. Officers shall be designated from all communication system owners/ users, NLDC/RLDCs/SLDCs/REMCs to participate in the said meeting.

Following issues, but not limited to, may be addressed or deliberated in the meeting:

- Services and network performance review based on the Availability Reports (data, main/ protection/ redundant paths)/ DER/ MIS.
- Issues related to unattended faults/problems
- Operational issues
- Operational feedback
- Status of spares/ T&P
- Network/ software upgradation issues
- Review of emergence situation
- System Improvement Plan
- Action plan
- CNMS system generated reports (e.g. Maintenance, Testing, Outage, Redundant path Reports etc.
- Any other issues

### **Emergency meeting**

An emergency meeting may be called by CTU in coordination with the concerned stakeholders, in case of occurrence of any major breakdown in the network. In the meeting, the breakdown shall be discussed in the context of

cause, correction and immediate remedial measures to be taken so as to avoid such breakdown in future.

## **9. Revision of Procedure**

As and when required, the procedure shall be reviewed and revised by CTU with the approval of the Commission.

Typical Escalation Matrix

Technical Support Desk User/ Owner Name:

Email:

TEL:

Complaint /Trouble Ticket send email: [abc@xyz.com](mailto:abc@xyz.com)

Escalation Level	Personnel Detail	Remarks
Level A	<b><u>XEN/SE</u></b> <b><u>Alternate Executive</u></b> <b>ABC</b> Office: Contact: Email:	To open trouble ticket send email to: <a href="mailto:abc@xyz.com">abc@xyz.com</a>
Level B	<b><u>SE</u></b> <b>Xxxxxxxx</b> Office: Contact: Email:	
Level C	<b><u>CE</u></b> <b>Xxxxxxxx</b> Office: Contact: Email:	
Level D	<b><u>Director/MD</u></b> <b>Xxxxxxxx</b> Office: Contact: Email:	

**Escalation Procedure**

The escalation level shall be guided based on the severity level (I, II, III, IV) and specified timeline with respect to initial call as specified in the prevailing AMC contract.

**List of T&P and Test Equipment (Typical)**

1. Wire/sisal/Manila rope.
2. Rope pulley single/Double Four/Six sheave.
3. Derrick pole.
4. D-Shackle of various sizes
5. Slings.
6. Hammer.
7. Spanner/wrenches.
8. Chain pulley block.
9. Heavy duty Tripole
10. Snatch pulley block.
11. Drum lifting jack
12. Pilot wire.
13. Turntable.
14. Rollers.
15. Ground rollers
16. Pull lift Ratchet.
17. Turfer.
18. Steel measuring tape.
19. Thermometer.
20. Hydraulic compressor (100 M.T.)
21. Dies for Compression Joints.
22. Safety belt.
23. Sag Board.
24. Earthing Chain.
25. Bulldog clamps.
26. Crobar.
27. Come along with clamps.
28. Wrench Machine.
29. Binoculars.
30. Conductor cutter.
31. Cutting plier-
32. Hacksaw frame & blade.
33. Chisel.
34. Punching tool.
35. Anvil.
36. Torch/Petromax.
37. Tent.
38. Tractor.
39. Truck.
40. Wire bench.
41. Articulate joints.
42. Equalizer pulley.
43. Socks for moose conductors.
44. Torque wrench
45. Arial Trolley

46. Sliding Ladder
47. Pengo/ Tensioner.
48. OTDR
49. Protection gears (i.e. Electrical insulation gloves, safety helmet, safety harness, safety shoes etc.)
50. Splicing Machine
51. Fiber spool
52. Power meter
53. Cleaver & Stripper
54. Laser source
55. Digital camera
56. Mobile Phone Duct Tracer

**T&P for VSAT**

1. Compass
2. Inclinator
3. Spectrum Analyser
4. RF cables
5. Spare

**T&P for Equipment**

1. BER Tester
2. El Tester
3. Power Meter
4. Multimeter
5. Patch cord
6. El cable
7. Pigtail
8. Spare

**T&P for DG Set**

1. Multimeter
2. Power Meter
3. Power Cable

**T&P for Battery & DCPS**

1. Torque wrench.
2. Tool for opening /closing of pressure regulation valve of battery
3. Power Cable
4. Spare

**Typical Format for OPGW/ ADSS/ UG OFC Link Details (Under Maintenance)**

Owner's Name:

Link Details

The Links for the Line..... are classified as below:

**1. InterState/ IntraState Links**

a) Station A ..... - Station B.....

U/G section in km=.....; Overhead section in km= .....

b) Station C..... - Station D.....

U/G section in km=.....; Overhead section in km=.....

c) Schematic map of above Links under maintenance.



**Typical Format for OFC Functional Test;  
Eg. Splice Testing & Fiber Attenuation**

**Table - A****Fibre Optic Cable Splice Testing**

<b>Item</b>	<b>Description</b>	<b>Acceptance Criteria</b>
1	Physical inspection of Joint Box for proper fiber routing techniques	As per technical specifications/ Relevant standards/ ITU-T
2	Physical inspection of sealing & weatherproofing etc.	As per technical specifications/ Relevant standards/ ITU-T

**Table - B****Fibre Attenuation Testing**

<b>Item</b>	<b>Description</b>	<b>Acceptance Criteria (as per Standard/ Practicing Norms for ISTS)</b>
1	Fibre continuity and link attenuation (bidirectional) of newly laid OFC for each fibre at 1310nm OR at 1550nm by OTDR and Power Meter & Laser Source wherever feasible .	<p align="center">Attenuation 0.35 dB per KM at 1310m &lt; 0.21 dB per KM at 1550nm</p> <p align="center">(The measured attenuation for the links shall be submitted to the Owner.)</p>
2	Fibre continuity and link attenuation (bi- directional) OFC (including newly laid & existing fibre i.e. from POP Location to Customer Location or Customer Location to Customer Location) for each fibre at 131() nm OR at 1550nm by OTDR and Power Meter & Laser Source (wherever feasible	

**Typical- FAULT RECTIFICATION/ STATUS REPORT**  
**(for OPGW/ Communication Equipment)**

**Name of the Maintenance Personal/Splicer..... Base Location.....**

Sl.No.	Name of the Link	Fault Location	Fault Occurrence/ Ticket Opening Time	Fault Restoration/ Ticket Closing time	Action taken	Material Consumed	Cause of Fault
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

For  
AMC Contractor



**Present Maintenance Practices with Existing NMS**  
**&**  
**The manually generated reports**  
**for Communication System/ Link/ Channel availability calculation**

**Network Management System:**

A network management system (NMS) is an application or set of applications that lets network engineers manage a network's independent components in the supplied system having the limited number of NEs/ FOTE, inside a bigger network management framework and performs functions with limitations of computational efficiency of the existing NMS computer. Manual/Hand-made report/log generation is being followed as present practice for calculating system availability & its performance.

The primary purpose of network management is to deliver a secure, reliable, and high-performing network to end-users. Network management covers the procedures, methods, and tools need to effectively operate, administrate, and maintain networks. As a practice area, it's primarily focused on maintaining reliability, efficiency, and overall performance of data transfer channels. The main functions of network management include remote configuration (of equipment and connections in the network), performance monitoring, and fault management. In addition, security and accounting are also management functions. Monitoring an active communications network to diagnose problems and gather statistics for administration and fine tuning.

Link Downtimes/ Logs are noted manually from these multiple NMS (Proprietary in nature) computers for the faults/ its restorations of the managed nodes (NEs/ FOTE etc) and are summated manually to calculate & derive the Communication system performance & availability; i.e. Link/ Channel Availability & the Downtime. These manually generated signed reports are submitted by the owners (communication system owners of ISTS/ states/ utilities) to the respective RPC/forums for assessing ISTS Communication System Availability & Performance.

Typical maintenance & fault reports to be filled and signed by the vendor/ owner is hereby enclosed.

**The Five Functional Areas of Network Management:**

1. **Fault Management:** Fault management is the process to identify and fix any errors in the system. There is provision of many alarms that can be distinguished based on faults. Alarms can be classified as Critical, Major & Minor.
2. **Configuration Management:** This is the process to monitor and maintain devices and network configurations. NMT (Network Monitoring Team) can create new channels as per requirement. Addition of New NE (Network Equipment), deletion of NE, Basic configuration to advance level configuration can be done with NMS.
3. **Performance Management:** In this process various data channel (E1, Ethernet, 64 Kbps) performance is measured with defined parameters.
4. **Security Management:** A user can access NMS only if he/she is having user id & password. Administrator has privilege to give certain permissions to any users.
5. **Accounting Management:** Administrator can create multiples user accounts based on requirement. Administrator has privilege to add/delete accounts.

**Role of NMS:** In general practice NMT Engineer collects various data for maintaining network availability.

1. **Network fault management:** NMT engineer can have a designated network fault management to anticipate, detect, and resolve network faults to minimize downtime. In addition to fault resolution, this function is responsible for logging fault information, maintaining records, conducting analysis, and aiding in regular audits.
2. **Configuration data:** There is provision to create new (E1/ ETHERNET/ 64 KBPS) channels as required. These channels can be created within fraction of time. Network fault management, the network configuration management team must also keep detailed records of all changes, their outcomes, and issues, if any. NMS can generate data like configuration of NE's and Inventory of components used in NE.
3. **Performance Data:** An NMT can also measure performance of these new channels or existing channels within the standard parameters available in NMS. These data can be retrieved from NMS. Network performance management involves various tasks that help boost network uptime and service availability.

Network management is the backbone of any system. It determines the uptime and performance of applications running on network.

**Periodic monitoring, testing and maintenance of the communication system installed at Substations.**

**A) List of Inventory**

A list of inventory available at substation shall be maintained at each substation in following format

S. No.	Item	Make & Model	Serial No.	Date of Comm.	Remarks
1.	SDH				
2.	PDH				
3.	DCPS				
4.	Battery				
5.	Craft Terminal				
6.	Spares available				

**B) Type of Maintenance.**

Maintenance can be broadly classified into two categories

- 1) Preventive maintenance
- 2) Breakdown Maintenance

**C) Preventive Maintenance**

Following shall be included in preventive maintenance:

**1. Communication Equipment (SDH and PDH)**

<b>SDH/PDH</b>			
<b>Make and Model</b>			
<b>S.No.</b>		<b>Date:</b>	
<b>S.No.</b>	<b>Activity</b>	<b>Frequency</b>	<b>Remarks (OK/NOT OK)</b>
1.	Visual Inspection of the equipment	Monthly	
2.	General cleaning of the equipment	Monthly	
3.	Alarm measurement verification.	Weekly	
4.	Tightening of connectors	Quarterly	
5.	Sealing of cabinets to arrest entry of rodents etc.	Monthly	
6.	Checking termination, re-kroning of Indoor cable, outdoor cable, Fibre Optic cable (Patch cord) etc.	Quarterly	
7.	Functional checking of Air-Conditioning	Quarterly	
8.	Measurement of earth resistance	Half-Yearly	
9.	Status report of site.	Monthly	
10.	Updating of log records	Monthly	
11.	Proper Labelling of Patch Cord.	Quarterly	

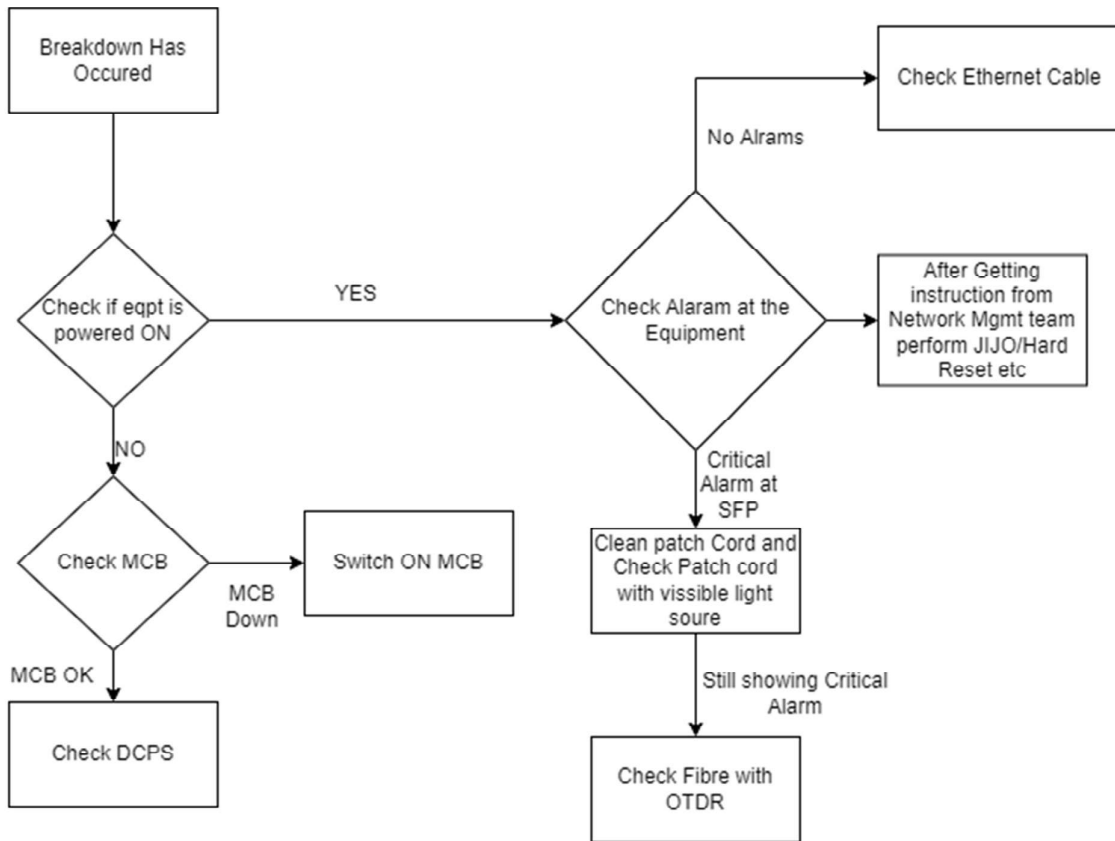
**2. DCPS**

<b>DCPS and Battery</b>			
<b>Make and Model</b>			
<b>S.No.</b>		<b>Date:</b>	
<b>S.No.</b>	<b>Activity</b>	<b>Frequency</b>	<b>Remarks (OK/NOT OK)</b>
1.	Physical inspection of DCPS	Monthly	
2.	Cleaning of System	Monthly	
3.	Tightening of all the power and control connections including checking the input power cable terminations at both ends	Quarterly	
4.	Checking of DC Voltage	Monthly	
5.	Checking for AC Voltage L-L, L-N	Monthly	

6.	Checking AC Current	Monthly	
7.	Functional checking Of DC System For Normal Operation including battery charging	Monthly	
8.	Checking for Normal operation of each Module	Monthly	
9.	Checking of earthing of the system by measurement of earth to neutral potential	Quarterly	
10.	Checking of charging condition of the batteries	Monthly	
11.	Checking of the physical conditions of the batteries	Monthly	
12.	Checking of each battery voltage & battery impedance/resistance measurement	Quarterly	
13.	Checking of present load on charger	Monthly	
14.	Checking of battery terminals for corrosion and cleaning thereof, torqueing and greasing	Quarterly	
15.	C-3 discharge test on batteries	Yearly	

**D) Breakdown Maintenance :**

In case of fault, breakdown maintenance has to be taken up following steps should be followed:



**E) Breakdown maintenance Report Format**

Date: \_\_\_\_\_

Affected Path: \_\_\_\_\_

Fault Description: \_\_\_\_\_

A. Event start time (as per NMS)                      date \_\_\_\_\_                      time \_\_\_\_\_

B. Reporting time by NMT                                      date \_\_\_\_\_                      time \_\_\_\_\_

C. Alarms (As per NMS)                                      \_\_\_\_\_

D. DC Supply Status    \_\_\_\_\_

E. Physical Alarms on Cards                                      \_\_\_\_\_

F. Patch cord's Status    \_\_\_\_\_

**REPORT**

Rectification start time                                      date \_\_\_\_\_                      time \_\_\_\_\_

Fault fixed    date \_\_\_\_\_                      time \_\_\_\_\_



**Total Outage time** \_\_\_\_\_

Remarks:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Faulty unit Sl. No: \_\_\_\_\_

**Signature**  
\_\_\_\_\_

**F) Preventive Maintenance Report Format:**

**1. General Cleanliness**

Communication room air conditioner

- Is air conditioner on? Yes/No
- Are filters clean? Yes/No
- Is air conditioner cooling O.K? OK/NOT OK

Communication room cleanliness

- Check if communication room is in good condition (Over all)  
-----
- Check if regular cleaning of telecom room done.  
-----
- Check if AC/DC sully has been tapped for other uses.  
-----
- Is the room having any damp wall.  
-----

Equipment Rack Cleanliness:

- Check if cabinets are closed and key available with room in charge.  
Key: available/Not Available                      Cabinet Closed/Open
- Clean the equipment                                      Cleaned/Not cleaned

**2. Temperature Measurement:**

Room temperature

- Check the room temperature (25°C is recommended) \_\_\_\_\_
- Temperature very near equipment cabinet \_\_\_\_\_
- Temperature inside the telecom equipment rack \_\_\_\_\_

### 3. Power Supply Measurement

- Input DC Voltage at MCB \_\_\_\_\_
- Input DC Voltage at Cabinet TB \_\_\_\_\_
- AC Voltage at the time maintenance (Primary source): \_\_\_\_\_
- Availability of AC Supply in 24 hours \_\_\_\_\_
- Charger Voltage \_\_\_\_\_
- Battery Voltage (Charger AC Supply off) \_\_\_\_\_

### 4. SDH & PDH Equipment Alarm Check

Visual check for the alarm on SDH & PDH equipment, in case of any alarm present further coordination to be done with regional NMS team and corrective action to be taken.

### 5. Cable Check

- (a) Check the cable terminations at all MDFs visually. Re-krone if any loose wires.
- (b) Check cable route for any abnormality.
- (c) Are cable trenches covered properly?

### 6. Earthing Check

- All the cables are connected properly with the ground point.
- Clean the ends, if required. While removing the earth cable first put temporary earth cable. After correction place the original cable and remove loop cable.
- Clean star point with sand paper and put petroleum jelly.
- Measurement of earth resistance: \_\_\_\_\_  $\Omega$