

## Section-8 Training and Support Services Index

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## **Section-8 Training and Support Services**

This section describes the requirements for Contractor-supplied training, support services, and maintenance of the Fiber Optic Cabling System, FOTS, Terminations equipments sub-systems, Network Management System, DCPS System etc. The intent of the training and support program is to ensure a smooth transfer of systems and technologies from the Contractor to the Employer/Owner, and to ensure that Employer/Owner staff are fully trained to operate, maintain and expand the integrated telecommunication network.

### **8.1 Training**

The Contractor shall provide a comprehensive training program that prepares the Employer/Owner's personnel for on-site installation support, operation, and maintenance of the telecommunication network.

Training may be conducted by the Contractor, the Contractor's subcontractors, and/or original equipment manufacturers (OEMs). The training requirements of this Specification shall apply to all such courses.

Training courses shall be conducted by personnel who speak understandable English and who are experienced in instruction. All necessary training material shall be provided by the Contractor. The training charges quoted by the Contractor shall include training materials and all associated expenses. However, for all training courses in India or abroad, the travel (e.g., airfare) and per diem expenses of the participants will be borne by the respective Employer/Owner. For courses conducted abroad, however, the Contractor shall extend all necessary assistance for making appropriate lodging arrangement.

Hands-on training shall be provided with equipment identical to that being supplied to the Employer/Owner.

The schedule, location and detailed training contents shall be submitted by the Contractor to the Employer/Owner for approval.

#### **8.1.1 System Design & Overview Training**

This training shall provide a functional description of the telecommunication subsystems for both Fiber optic transmission system and Termination equipment system and a discussion of the failover and alternate routing schemes inherent in the configuration. The training shall include an overview of the network configuration and indicate the functional responsibilities of all major subsystems including the network monitoring system hardware and software. The training shall highlight all significant methodologies or concepts utilized by the hardware and software to

perform the required functions. High-level hardware configuration block diagrams and network/sub-network block/flow diagrams shall be included to enhance the understanding of the overall capability incorporated into all network and sub-network equipment.

The training shall be oriented to a user's point of view. The Employer/Owner users will include managers, design & planning personnel, communication support staff and maintenance personnel. As part of the proposal, the Contractor shall identify the number of days deemed appropriate for this training.

In addition, the contractor shall also provide the training on the DCPS & Battery for the supplied system. The training shall cover aspects covering installation, testing & commissioning of DCPS & Battery. Proper emphasis of the training shall be for effective operation & maintenance of DCPS & Battery on routine & emergency basis by the Employer's personnel.

The overview training shall be customized for the specific functions, features, and equipment purchased by the Employer/Owner; it shall not be a general presentation of the Contractor's standard equipment repertoire. Personnel assigned by the Contractor to implement the Employer's system shall conduct this overview training. The Employer shall review and approve the contents of the overview training at least four (4) weeks prior to the course.

### **8.1.2 Supervision, Maintenance and Installation Crew Training at Site**

The Installation, Supervision & Maintenance training course shall enable the trainees to effectively supervise the Fiber optic cable installation work from an Employer perspective, particularly with respect to installation quality checks and safety procedures. The training shall cover FO cable handling techniques, stringing and installation, jointing & splicing, OTDR use and OTDR trace analysis, operation, preventive maintenance, troubleshooting procedures, corrective maintenance, and expansion procedures.

It shall also cover an appreciation of restorative procedures required after any likely cable failure such as cable breaks due to storms or falling trees, installation hardware failures or misalignments.

Installation crew training shall be predominantly hands-on training courses provided for a group of persons. The intent of this training is to enable Employer to undertake maintenance & restoration work in case of cable breaks or other such failures.

The Contractor shall submit for approval a detailed proposal for this training as per the agreed documentation schedule. The proposal shall include information such as proposed number of trainees, trainee profile, course duration, training facilities and methodology to be used etc. The training charges for this training course shall be separately identified in the Bid Price Schedules.

### **8.1.3 Fiber Optic cable Installation and Maintenance Training**

There shall be installation & maintenance training for Fiber Optic cable & associated items. The installation & maintenance trainings shall enable the Employer to be self-sufficient in preventive & restorative maintenance of the Fiber Optic cable & associated items purchased by the Employer. The training courses shall cover Fiber Optic cable & associated items installation, testing & commissioning, preventive maintenance, diagnostic tools and troubleshooting procedures, corrective maintenance for Fiber Optic cable. The courses shall provide theoretical background and extensive hands on experience.

#### **8.1.4 Installation & Maintenance Training of Communication Equipment & DCPS System**

There shall be separate modules of the installation & maintenance training for the following systems:

- (1) FO Transmission System Training
- (2) Termination Equipment System Training
- (3) DCPS System

The installation & maintenance trainings shall enable the Employer/Owner to be self-sufficient in preventive & restorative maintenance of the respective communications subsystems purchased by the Employer/Owner. The training courses shall cover equipment installation, testing & commissioning, operation, interfaces and cabling between equipment, preventive maintenance, diagnostic tools and troubleshooting procedures, corrective maintenance, and expansion procedures for all equipment. The courses shall provide theoretical background and extensive hands on experience.

Courses shall include equipment adjustments, board-level troubleshooting and repair and, where appropriate, component-level troubleshooting and repair. Course participants shall operate actual equipment and diagnose and repair simulated failures.

### **8.1.5 Network Management Training**

The Network Management training shall familiarize the Employer/Owner's telecommunication personnel with the concepts and techniques for configuring, programming, maintaining, and troubleshooting the Contractor supplied NMS and its associated database. The training course shall provide a thorough understanding of the general design concepts, features, and user interface requirements for local and remote monitoring of the equipment, as well as procedures for restoring service after equipment and power failures.

The Network Management training course shall provide the course participants with

hands-on experience using the actual system being supplied. Table 8-1 summarizes the minimal Network Management training requirements.

**Table 8-1:  
Network Management System  
Training**

<b>Item:</b>	<b>Description:</b>
<b>1.</b>	Features of the software being supplied
<b>2.</b>	System generation and configuration procedures, including memory allocation, operating system parameterization, and buffer sizes
<b>3.</b>	Operating system concepts, including resource allocation, priority level processing, performance monitoring, diagnostic messages, and restoration procedures.
<b>4.</b>	Concepts and techniques for generating, modifying, and saving database, CRT displays, and reports
<b>5.</b>	Utilities, techniques, and equipment used for editing, debugging, testing, integrating, expanding and documenting new programs and subsequent implementation in software and/or firmware.

Training aids for each course shall include the Operator's User Manual for each type of equipment. Operator training that is a standard part of the maintenance training will be applicable.

#### **8.1.6 Training Course Requirements**

This section describes general requirements that apply to all training courses.

##### **8.1.6.1 Class Size**

The Employer/Owner plans to send a number of participants to the training courses for a specified duration as described in Appendices.

##### **8.1.6.2 Training Schedule**

The Contractor shall provide training in a timely manner that is appropriate to the overall project schedule. All training courses shall be available to the Employer/Owner for a minimum of five years after final acceptance of the communication system.

The training courses shall be offered in one cycle, such that none of the courses within the cycle overlap.

The Contractor shall take the above requirements into account in developing the preliminary training schedule. Contractor shall develop a final training schedule in consultation with the Employer/Owner after contract award.

### **8.1.6.3 Manuals and Equipment**

The Contractor, subcontractor, or OEM shall prepare training manuals and submit them to the Employer for review at least one month prior to the start of classroom instruction. The training manuals shall be prepared specifically for use as training aids; reference manuals, maintenance manuals, and user's manuals may be used as supplementary training material. Principal documents used for training shall be tailored to reflect all the Employer requirements specified.

Each course participant shall receive individual copies of training manuals and other pertinent material at least two weeks prior to the start of each course. The Employer/Owner shall retain the master and two additional copies of all training manuals and materials as reference documentation. A complete set of instructor's manuals and training aids shall also be provided.

Upon completion of each course, instructor's manuals, training manuals, and training aids shall become the property of the Employer. As part of the delivered system documentation and the final documentation, the Contractor shall supply the Employer with all changes and revisions to the training manuals and other training documentation. The Employer reserves the right to copy all training manuals and aids for use in the Employer-conducted training courses.

The Contractor shall furnish for use during training courses all special tools, equipment, training aids, and any other materials required to train course participants.

## **8.2 Support Services**

Throughout design, implementation, factory testing, and field installation and testing, the Contractor shall supply consulting assistance, as required by the Employer for site preparation, field installation, and other areas where technical support may be required.

The Contractor shall be responsible for minor facility renovation, and maintenance of the supplied system up to and including successful completion of the Site Acceptance Test.

After final acceptance of the communications equipment, the Contractor shall offer continuing technical support and spare parts for the communications equipment for a minimum period of 15 years from operational acceptance by the Employer or 7 years after the declaration of withdrawal of equipment from production whichever is earlier. However, the termination of production shall not occur prior to Operational Acceptance of the system by the Employer.



### **8.2.1 Technical Support**

Consultation with Contractor's technical support personnel and trained field service personnel shall be readily available on a short-term/long-term basis to assist the Employer personnel in maintaining, expanding, and enhancing the telecommunication network upon expiration of the warranty period. The Contractor shall include in their offer(s), a proposal for ensuring continued technical support as stated above.

### **8.2.2 Contractor's Future Hardware/Software Changes**

The Employer shall be informed of all alterations or improvements to the hardware supplied under this Specification. The Employer shall be placed on the Contractor's mailing list to receive announcements of the discovery, documentation, and solution of hardware/software problems as well as other improvements that could be made to supply equipment. The service shall begin at the time of contract award, and shall continue for a minimum period of 15 years from operational acceptance by the Employer or 7 years after the declaration of withdrawal of equipment from production whichever is earlier. The Contractor shall also include a subscription to the hardware subcontractors' change notification service from the time of contract award through the warranty period, with a Employer renewable option for extended periods.

## **8.3 Spare Parts and Test Equipment**

The spare parts and test equipment shall be provided for each subsystem as described below.

### **8.3.1 Mandatory Spare Parts**

BoQ provides the Mandatory Spare Parts Requirements described in subsystem sets. The mandatory spare parts table represents the minimum spares the Contractor shall be required to supply. The subsystem set of spare parts is defined to include all equipment modules, subunits and parts required to effect replacement, repair and restoration to full operational status of a defined unit of a subsystem.

### **8.3.2 Test Equipment**

BoQ provides mandatory test equipment requirements, to be provided. The parameters / features of the mandatory equipments are enumerated in Table 8.3.2 below:



Table 8.3.2		
S.No	Test equipment	Parameter
<b>A.</b>	<b>Test Equipments for OPGW cable</b>	
1	OTDR (Optical Time Domain Reflectometer) for 1310/1550 nm with laser source.	Equivalent to Anritsu MW9076B1 or better.
2	Optical Attenuators (variable 1310/1550nm).	Equivalent to JDSU OLA55 or better.
3	Optical Power meter (1310/1550nm) incl laser source	Equivalent to JDSU OLP55 or better
4	Laser Light Source (1310/1550nm)	Equivalent to EXFO FLS300-23BL or better.
5	Optical Fiber Fusion Splicer incl. Fiber cleaver	Equivalent to Sumitomo T-39-SE or better.
6	Splice kit	FIS – FI-0053-FF or equivalent
7	Optical test accessory kit including all necessary connectors, adaptors, cables, terminations and other items required for testing	FIS – FI-0053-TS-ST or equivalent

In case the offered make/model of test equipment has multiple options for the parameters, the option of higher range shall be acceptable. The supplied test equipment shall be suitable for use in the high EMI/EMC environment. The Contractor shall submit performance certificate for offered test equipment from at least one customer. The Contractor shall offer only reputed make test equipment such as Acterna (JDSU)/ Anritsu/Sumitomo/Agilent/EXFO etc.

The Contractor shall provide in their bid, additionally recommended test equipment list necessary to support specified system outage requirements. These lists shall include all relevant technical descriptions and recommended minimum quantities based upon the guidelines consistent with the telecommunications resource management hierarchy and continuing maintenance concept. The recommended test equipment shall not be considered for evaluation and may be included in the final scope of supply.

## 8.4 System Maintenance

As per DoT guidelines, operation and maintenance of the network shall be entirely by Indian engineers and dependence on foreign engineers shall be minimal within a period of two years from date of LoA. The contractor shall be responsible to maintain the confidentiality of the Employer's System Information that Employer shares with the contractor for maintenance period.

### 8.4.1 Warranty Period

The twenty-four (24) months commencing immediately after the operational acceptance is called the Warranty Period/Defect liability Period. In addition to the responsibilities covered under Vol- I Condition of Contracts during Defect Liability Period, the Contractor shall also be responsible for maintenance of the

Fiber Optic Cabling System, Fiber Optic Transmission System, Termination Equipment, NMS & DCPS System supplied under this Package. The specification for the maintenance of the system after Operational Acceptance is enclosed at Annexure-I.

#### **8.4.2 Contractor's Maintenance Responsibility**

The Contractor shall be responsible for carrying out "Comprehensive Maintenance" of the Communication System (excluding OPGW Cable) for a period of six years after warranty period for ensuring the successful operation of the system. The Contractor shall be responsible for achieving the system availability and the response time mentioned in technical specifications. The bidder shall quote the Annual Maintenance Charges for six years after Warranty Period which shall be considered in the bid evaluation. Bidder shall submit the detailed procedure for achieving above in the bid. The specification for the maintenance of the system is enclosed at Annexure-I. Upon expiry of the six years AMC period Employer may, at its discretion, extend this Maintenance for additional one year at the same price & terms and conditions.

#### **8.5 Miscellaneous Supplies**

The Contractor shall provide all required consumable and non-consumable supplies necessary to support all installation and test activities through final operational acceptance. However, if there are any problems in the SAT and additional consumables are required, the same shall also be supplied by the Contractor at no additional cost.

## **Annexure-I**

### **Technical Specifications for Maintenance after operational acceptance during maintenance period (i.e., Warranty/defect liability period & AMC Period)**

#### **A -1.0 GENERAL**

The Contractor shall be responsible for comprehensive maintenance of the Fiber Optic communication equipment including NMS & DCPS system supplied & installed under this Contract. The maintenance contract shall commence after completion of the project

i.e. after Operational Acceptance. Communication network & BOQ as given in Appendices. There may be some variation during detailed engineering. Contractor shall meet system availability of 99.9% for Fiber optic system. Contractor will have to make their own assessment of the network and deploy manpower accordingly. However, it is to be ensured that specified manpower of requisite qualification are deployed.

Contractor's maintenance engineer/service engineer shall have minimum qualification of graduate in Computer or IT or Electronics & Telecommunication with minimum one year experience or Diploma with three years maintenance/testing & commissioning experience on the equipment proposed to be supplied & installed. The Degree/Diploma must be recognised Indian professional qualification. This staff shall be supported by head office technical staff for restorative problem or other assistance as may be required. Maintenance engineer shall have technical background and trained in first & second level maintenance on the supplied Fiber Optic communication system, DCPS & Battery and NMS system of their own without technical assistance from Head Office.

Contractor will arrange for adequate transportation for their staff as per the work demand. Contractor's staff (at all locations) should be equipped with necessary tool kits, mobile phones, vehicle etc.

The Maintenance of the system supplied & installed by the Contractor shall be comprehensive and all the spares required during maintenance period shall be provided by the Contractor at no additional cost to the Employer.

#### **A - 1.1 RESOURCE DEPLOYMENT**

In order to cover the entire network, it is imperative that Contractor's maintenance engineers are strategically located so as to reach the site within shortest possible time frame. Thus a minimum of two (2) engineers will be

deployed at two (2) locations, this however, does not relieve contractor from its obligation to maintain required system availability of 99.9% for Fiber Optic System. Accordingly, Contractor shall assess the actual manpower requirement and place them suitably at locations, if required. The exact location for deploying engineer shall be finalised during detailed engineering. The central control and monitoring of communication system will be performed from centralized location by means of the centralized NMS. The other locations will work under the control/instruction of the Co-ordinator located at Centralized NMS system.

## A 1.2 MONITORING

Network will be monitored through centralized NMS. Network Monitoring Team (NMT), whenever, notices any fault/abnormality in the system (including the third party optical interfaces/SFPs supplied & commissioned under a subsequent different package in the Communication equipment commissioned by the bidder under the current package) shall notify to the Contractor's maintenance Co-ordinator at NMS location, over phone with an event no. An event report shall be generated as per the enclosed formats. On issuance of Event report by NMT, corrective action(s) shall be carried out by Contractor's maintenance personnel for rectification. Contractor's representative must report within four (4) hours at locations where Contractor's engineers are stationed and within reasonable time at all other location which shall in no case exceed more than 12 hours (including travel time). Time mentioned here is irrespective of normal working hours or holidays. The NMT shall co-ordinate and control any site visits to ensure that communication network is operating with a minimum of disruption during these visits. The NMT will inform to facilitate the access to the site/equipment where fault is suspected.

The main responsibilities of the Employer's Network Monitoring Team are:

- a) Communication Network monitoring through Network Management System (NMS)
- b) Detect faults, prioritizing them and notifying to the Contractor for immediate corrective actions.
- c) Follow up on corrective actions to verify that the agreed time frames are met.
- d) Record all faults in the fault record sheet and summary of action taken for fault rectifications.
- e) Co-ordinate all planned / breakdown site visits to minimize disturbance of service.
- f) Update status information of operated network to users communication network.

### A 1.3 MAINTENANCE

Maintenance activities are either Event Based (Fault/breakdown maintenance,) or planned site visits (Semi annual site visit, testing of channel/s, augmentation and modification in the network if end equipment for data/speech does not communicate with corresponding equipment as and when required. Planned visits shall mainly carried out during working days.

Event based work is to be carried out round the clock seven days a week, A start status shall be jointly filled by Employee & Contractors representative at 10.00 Hrs of commencement date of maintenance contract.

Planned site visits shall be carried out twice in a year (semi-annually) at all the sites in the network or time to time if speech/data is affected at a particular site. Thus, in a year, not less than two planned site visits to all locations will be undertaken.

Contractor will maintain record of events during the maintenance services ; simultaneously Employer shall also record the events in the LOG BOOK available in the NMS control room.

The tasks during the planned site visits for the system include but are not limited to following:

- Visual inspection of equipment
- Alarm measurement verification
- Status report of site
- Updating of log records
- Cleaning the equipment
- Tightening of connectors
- Sealing of cabinets to arrest entry of rodents etc.
- Measurement of earth resistance
- Checking of Joint box for water penetration & sealing of entries (To be done Anually)
- Fiber loss measurement

Work to be taken up during semi-annual site visits is given in enclosed Format.

Fault/Breakdown maintenance is a process of fault correction / trouble shooting/interfacing with other contractor (for data & Speech connectivity of existing RTUs & EPABXs etc.) as per the fault reported by NMT. Contractor will maintain a log of activities carried out at all locations and necessary History will include site name, visit date, actions taken and site condition. Detailed report in this respect shall be submitted by the contractor in the monthly meeting. Whenever fault is reported in the third party interfaces/SFPs

supplied & commissioned under a subsequent different package in the Communication Equipment commissioned by the bidder under the current package, the same shall be reported to the optical interface/SFP supplier by the Contractor's maintenance personnel for necessary resolution/corrective measure.

The PrKTCL representatives will associate in trouble shooting, change of unit as per programme notified/intimated by the contractor however, due to any reason if PrKTCL can not depute their representative, contractor will proceed for the work so as to attend the breakdown/testing as per their programme.

The scope of corrective maintenance is as follows:

- Troubleshooting on a network element and its interfaces as and when required and directed by NMT, engineer/coordinator of PrKTCL.
- Diagnostics on interfaces to locate problems in network elements. If required, the contractor shall depute maintenance engineer for joint inspection with other vendors for pin-pointing the fault.
- Identification of the faulty hardware unit, replacing it.
- Performance of function verification in co-ordination with the NMT operators
- Handing over of faulty unit to PrKTCL at site or Control Centre.

## **MAINTENANCE OF DC POWER SUPPLY SYSTEM**

(DCPS includes charger, Batteries, DCDB and other associated cables/connectors, Meters, relays, switches, surge protection devices etc.)

The Contractor shall carry out both preventive and break down maintenance of the supplied DCPS & Battery System.

### **Preventive Maintenance (PM)**

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 etc. It will be carried out quarterly at mutually agreed dates.

### **Break Down Maintenance**

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

Immediately on noticing the fault, the fault will be reported by the PrKTCL on

phone to the contractor. The fault reporting time on phone shall be taken as reference time for the purpose of RT and TAT.

(RT is Response Time when contractor's person report at site after reporting of fault in system. TAT is Turn-Around-Time when system is brought back in service after necessary rectification/replacement works.)

#### **A 1.4 HARDWARE SERVICES**

In case any failure or malfunction is discovered, the maintenance team shall identify the problem, organise to promptly attend the fault, replace the faulty equipment/card/module or any other hardware component with a spare unit and ship the faulty unit to specified location. Each faulty unit shall be accompanied with correctly filled-out Event Report. Contractor shall ensure maximum utilisation of the channel capacity, hence healthy channel/s will be put in use and hardwired to respective DDF/MDF point, in coordination with PrKTCL, without disturbing end user (PABX, PLCC, RTU ) connection so that outright replacement of card is avoided. Card shall be replaced when all the healthy channels are faulty. Necessary modification (temporary) in drawing/s in site copy and at NMS location will have to be done without changing original document.

The Contractor shall be responsible for providing all the spares (cards/modules/accessories etc.) for supplied & installed equipment such as SDH, MUX, NMS etc. The spares shall be provided/arranged by the contractor at no extra cost to Employer. For early restoration during the emergency condition, if spares are made available by Employer, the same shall have to be replenished by the Contractor within thirty (30) days.

Contractor's hardware services shall also cover support for the NMS hardware & Software supplied to Employer as part of the Contract. Contractor shall be responsible for providing spares for the supplied NMS system, if required, during maintenance period at no additional cost to the Employer.

Contractor will carry out the following tasks for hardware services:

- a) Handover the faulty unit/s to Employer
- b) Replace faulty units from their own spares stock.
- c) Send faulty units to Original equipment supplier's representative in India on Employer behalf with the correctly completed Failure Report with site information and symptoms of failure.
- d) Test the repaired unit for their healthiness after the same is rectified by the original manufacturer.

#### **A 1.5 MAINTENANCE SERVICES SUMMARY**



The Maintenance Services are summarised below:

<b>ON SITE SUPPORT / MAINTENANCE</b>	
Scope	To maintain required system availability of 99.9% for Fiber Optic System and specified response time.
Availability	On all working days of week except on Sundays & holidays during office hours. After office hours / Holidays, duty phone to be contacted (with co-ordinator)
Task	Troubleshooting & Fault rectification
<b>MAINTENANCE FAULT/BREAKDOWN</b>	
Equipment Scope	As per approved BoQ
Scope	Rectification / Corrective maintenance
Availability	On call basis as mentioned above in TS
<b>PLANNED SITE VISIT</b>	
Equipment Scope	As per approved BoQ
Scope	Visual inspection of equipment, alarms measurement verifications, status report of site, updating of log record, cleaning the equipment, modification & augmentation
Availability	Semi-annual / planned visits

#### **A 1.6 OUTAGE TIME DEFINITION:**

An outage time refers to period in which loss of communication is detected on any part of the telecommunication network / equipment and continues until the fault is cleared by taking into account conditions listed below.

- Time of unavailability excludes running with faulty equipment on specific instruction from PrKTCL (not affecting communication or monitoring of other units other than faulty unit).
- The time of unavailability excludes the transportation time to a faulty site average of twelve (12) hours and time to get authorization for access to the telecommunication room and to the equipment.
- An event would not be considered as failure when the system features allow to continue the data/voice transmission utilizing redundancies available in the subsystem/equipment.
- In case of failure of any E1, no consequential lower level channel failure shall be accounted for.
- In case a loss of communication is detected in system of third party (PLCC/PABX equipment, RTU/SCADA, existing SDH/PDH equipment procured under separate contract) and no corresponding alarm is detected in

NMS the event will be jointly studied with the parties and plan/schedule of fault finding will be made. However, under such conditions of fault attribution to the third party, it would be contractor's responsibility to logically establish such attribution.

- f) If it is needed to identify the fault, it is allowed to disconnect/loop circuits for trouble shootings. This testing time shall not be counted in the outage time calculations. However, interruption time for healthy channel should not exceed 10 minutes. Proper planning and coordination with all concerned may be required while carrying out this activity so as to minimize outage time.
- g) Outage due to force majeure conditions (Not attending fault due to war, curfew, earthquake at the location of fault, serious accident during traveling for attending fault) or outage due to failure in power system equipment (or AC/DC).
- h) Outages which are not attributable to equipment faults such as fault in Fiber optic cable will not be considered for calculation in system availability.

## **A 1.7 DOCUMENTATION DURING MAINTENANCE PERIOD**

Events shall be recorded by using of event form. The forms shall be filled in duly dated, timed and signed by representatives of both the parties. Absence of one or the other party's representative shall not render the record invalid but assumes only that such representative signs the record at his earliest convenience.

The initial condition of the system shall be recorded on the start status form to constitute or reference for later events. All the events recorded in the start status form shall have to be rectified within 15 days. Faults not attended within 15 days will be considered as outage. Any and all events such as incoming and existing alarms, fault occurrence, action taken for remedies etc. shall be recorded in the event report forms. If a unit is replaced or repaired both the new and the replaced or repaired unit is to be recorded in the event report form. Contractor shall submit the detailed report for fault occurrence after the cards/equipment is rectified at the works of supplier.

## **A 1.8 CALCULATION OF NETWORK AVAILABILITY**

The system availability shall be calculated as per following formula during the Maintenance period.

### Availability Calculation Formula.

$$\text{System Availability} = \frac{T_t * Ch_t - \sum Ch_n * T_n}{T_t * Ch_t} \times 100\% \quad (n=1 \text{ to } Ch_t)$$

Where

SA = System Availability (%)

T<sub>t</sub> = Total test time (24\* days in a month)  
Ch<sub>t</sub> = Total number of channel

Ch<sub>n</sub> = Number of channels affected by event

En T<sub>n</sub> = Outage time of event En

The NMS availability for both PDH/SDH shall be calculated as follows:

$$\text{Availability of NMS}(A_v) = \frac{T_t * NE_t - \sum NE_n * T_n}{T_t * NE_t} \times 100\%$$

Where

A<sub>v</sub> = NMS Availability(%)

T<sub>t</sub> = Total test time(24 \* days in a month)  
NE<sub>t</sub> = Total number of network

Element NE<sub>n</sub> = Number of NE affected by an event  
T<sub>n</sub> = Outage time of NE

### A 1.9 AVAILABILITY REQUIREMENT

The availability of wideband communication equipment shall be measured in categories as below:

- Channel (Voice, Asynchronous & Synchronous data circuits and management data channels)
- E-1 / Ethernet channels
- Availability of NMS system

The availability requirement for type of channels for wideband communication equipment and NMS systems shall be 99.9%.

However notwithstanding the commutation of availability of the communication system as specified above, the prompt restoration of the faulty equipment/part of the network is also of equal importance and any delay in restoration of the faulty system shall be governed as per terms & condition of the contract.

### A 1.10 SCOPE OF WORK DURING MAINTENANCE PERIOD

Sl.no.	Description	Detailed Scope
1	<i>Overall Infrastructure</i>	Infrastructure includes the building, air conditioners, AC/DC system, UPS, cable trenches, Earthing etc provided by Employer. They will be maintained by Employer.
1.1	<i>Equipment site</i>	
1.1.1	General conditions	General checking during semi annual / troubleshooting site visits and advise
1.1.2	Cleanliness of the room	General checking during semi annual / troubleshooting site visits and advise.
1.1.3	Earthing interconnections	Checking, connector cleaning, redoing the connection during semi annual / troubleshooting site visits (limited to the earthing of equipment under scope of maintenance) and as required specifically. Earthing interconnection will be checked upto earthing star point). Earthing interconnection shall also be checked and corrected during troubleshooting site visits if it is considered the probable cause of fault. Measurement of earth resistance during semi-annual site visit
1.1.4	Air conditioning	General checking during semi annual / troubleshooting site visits and advise
1.1.5	Cable route	General checking during semi annual / troubleshooting site visits and advise
1.1.6	EMI issues	Contractor 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.
1.2	Interfacing with others	Checking interfacing with other equipment and take corrective actions on its MDFs if required. The scope will be limited to the MDFs where the cables of wideband communication system have been terminated. Report and advise on others' if it is the probable cause of fault.
1.3	Indoor cabling	Checking terminations, re-kroneing, if necessary, during semi-annual/troubleshooting site visits. It shall also be checked during troubleshooting site visits if it is the

		probable cause of faults.
1.4	Out-door cabling	Checking terminations, re-kroning, if necessary, during semi-annual/troubleshooting site visits. It shall also be checked during troubleshooting site visits if it is the probable cause of faults.
1.8	Fiber Optic Cable	Checking with OTDR. Rectification if fault is found to be in the OPGW Cable, approach cable, patch cord etc. up to DDF. Splicing of Fibers due to excessive loss or breakage due to any reason.
<b>2</b>	<b>Main Equipment</b>	
2.1	PDH MUX & Digital Cross Connect	Faulty equipment to be replaced at site as per conditions of Maintenance Plan.
2.2	Fiber Optic terminal SDH	Faulty equipment to be replaced at site as per conditions of Maintenance Plan.
2.3	GPS Clock	Faulty equipment to be replaced at site as per conditions of Maintenance Plan. Contractor shall be responsible for providing hardware, if required, during maintenance without any additional cost implication to Employer.
<b>2.4</b>	<b>NMS of SDH</b>	
2.4.1	Computer hardware and Routers	Faulty equipment to be replaced at site as per conditions of Maintenance Plan. Comprehensive maintenance with hardware suppliers to be tied up by the Contractor. Contractor shall be responsible for providing all hardware & software required during maintenance without any additional cost implication to Employer.
2.4.2	Alarm handling, Backups etc. - software part	Alarm deletions, Backups as per maintenance plan. Consumables to be provided by Employer. Software corruption to be corrected as per actual requirement.
<b>2.5</b>	<b>NMS of PDH(D/I Mux&amp; DACS)</b>	
2.5.1	Computer hardware	Faulty equipment to be replaced at site as per conditions of Maintenance Plan. Comprehensive maintenance with hardware supplier to be tied up by the Contractor. Contractor shall be responsible for providing all hardware & software required during maintenance without any additional cost implication to Employer
2.5.2	Alarm handling Backups etc. software part	Alarm deletions, Backups as per agreed back up plan. Consumables to be provided by Employer. Software corruption to be corrected as per actual requirement.
2.5.3	Monitoring and	Regular monitoring of the communication link

	general operation of communication link	operations through NMS in association with the Employer's staff. Investigations for abnormal behaviour and take corrective actions.
2.5.4	Provisioning/ Re-provisioning of channels	As per requirement.
2.6	Repeater Shelter & it's associated subsystem	Regular monitoring of the Repeater Shelter & it's associated subsystem in association with the Employer's staff. Investigations for abnormal behaviour and take corrective actions.
3	<b>Contractor's set-up</b>	Generally in consonance with the set-up mentioned in the maintenance plan.
<b>4 MAINTENANCE OF DC POWER SUPPLY SYSTEM</b> (DCPS includes charger, Batteries, DCDB and other associated cables/connectors, Meters, relays, switches, surge protection devices etc.)		
Details of Job to be carried out during Preventive Maintenance <ol style="list-style-type: none"> <li>1 Physical inspection of DCPS at all specified locations</li> <li>2 Cleaning of System</li> <li>3 Tightening of all the power and control connections including checking the input power cable terminations at both ends.</li> <li>4 Checking of DC Voltage</li> <li>5 Checking for AC Voltage L-L, L-N</li> <li>6 Checking AC Current</li> <li>7 Checking for ripple Voltage</li> <li>8 Functional checking Of DC System For Normal Operation including battery charging</li> <li>9 Checking for Normal operation of each Module</li> <li>10 Checking of earthing of the system by measurement of earth to neutral potential.</li> <li>11 Checking of charging condition of the batteries</li> <li>12 Checking of the physical conditions of the batteries</li> <li>13 Checking of each battery voltage during quarterly visits &amp; battery impedance/resistance measurement twice during the contract during 2nd &amp; 4th quarterly visit.</li> <li>13 Three discharge tests per year at normal load for three hours during 1st, 2nd and 4th quarterly visit.</li> <li>14 Checking of present load on charger.</li> <li>15. Matching of DCPS parameters with SCADA system</li> <li>16. Proper guidance to the operation staff for satisfactory working of the equipment and its proper upkeep.</li> <li>17. Checking of battery terminals for corrosion and cleaning thereof, torquing and greasing.</li> <li>18. C-3 discharge test on batteries once a year during 3rd quarterly visit.</li> </ol>		

Above observations shall be recorded as per enclosed format and duly signed at site by Employer Engineer.

**Details of Job to be carried during Break Down Maintenance**

- 1 Repair and replacement of Faulty Module
- 2 Repairing and replacement of faulty components in the system
- 3 Analysis report of the fault
- 4 Plan for preventive measure to arrest recurrence of such faults

## **A 2.0 Cyber Security Audit**

Cyber Security Audit for the network shall be conducted through a CERT-In empaneled auditor once in every year till the end of maintenance service contract. Network forensics, Network hardening, Vulnerability Assessment, Network penetration test, Risk assessment, Actions to fix problems and to prevent such problems from reoccurring etc. shall be covered under network audit.

The contractor upon any incidence of Cyber Security Breach shall carry out cyber security tests at any lab designated for cyber testing by Ministry of Power. These tests shall be similar to Pre-Commissioning Security Test and those essential for carrying out Post Incident Forensics Analysis.

All critical and high vulnerabilities shall be closed within a period of one (1) month and medium as well as low non-conformity before the next audit. Root cause analysis for all reportable events shall be carried out and corrective action taken, so as to ensure that any re-occurrence of such event can be managed with ease.

## **A 3.0 PENALTY FOR DEFAULT IN SERVICES**

- (a) Contractor will maintain an adequate level of qualified staff for carrying out this maintenance contract, failing which Rs 50,000/- per month will be deducted by Employer from the amount due to contractor under this contract. In addition 5% of the total payable amount shall be deducted for every fall of 1% or part thereof in the specified availability.
- (b) In addition to above, a penalty of Rs 1000/- per day shall be imposed for not attending the fault in specified period for all non-communication equipment. For non-communication equipment maximum allowable restoration time shall be 48 Hrs.
- (c) Employer shall have the right to terminate the contract after giving notice of two month if the availability of the system is not attained as per specification consecutively for two months.



## **A 4.0 CO-ORDINATION**

### **REQUIREMENTS A 4.1 MEETING**

#### **PRACTICE**

Regular meeting between Employer and the Contractor is vital for communication and information flow between these two organisations. The purpose of the meeting is to tackle the essential issues concerning the services and network performance. The suggested schedule for meeting is once in every month. The meeting agenda shall be decided between Employer and Contractor and could for example consist of the following issues:

- Services and network performance according to the report during last month
- Review of emergency situation
- Status of spare
- Action plan
- Next Meeting
- Alarms/events unattended till the date of

meeting The following participants should be present in this meeting:

- Co-ordinator (Contractor)
- Members of the Contractor team as needed
- Co-ordinator Employer representative
- Operation and maintenance staff as designated to attend (Employer)

### **A 4.2 EMERGENCY MEETING**

Whenever a major outage occurs in any part of the network, an emergency meeting may be called if desired by Employer. In the meeting, the outage will be discussed in the context of cause, correction and prevention.

### **A 4.3 REPORTING PROCEDURE**

The purpose of report is to summarize the activities performed during the reporting period. The report provides the information on the performance of the services and describes the current status of the network. The report is a monthly report from Contractor to Employer which shows the trends in the network and services provided by the Contractor. By analysing the report data, management and expert of Employer and contractor are able to focus attention on the areas where further improvement is needed.

Emergency Reports: Contractor reports to Employer every time the emergencies call up and call out service is invoked. In these cases, on termination of the

emergency all details of the fault and clearance information are submitted within five working days.

#### **A 4.4 INTERFACE BETWEEN EMPLOYER AND CONTRACTOR**

##### **Contractor Interfaces**

Contractor shall submit detail of personnel deployed in the enclosed format through which all problems identified by PRKTCL are to be reported to contractor via duty phone

Description			
Name			
Telephone			
Fax			
Email			

Co-ordinator :

Telephone no :

Mobile no:

FAX No :

E-mail

address: (Details to be provided later)

**Contacts in Employer**

Name	Responsibility	Phone number (Residence) (mobile)	Phone number office	Fax number, E-mail address

**Form-I**  
**EVENT REPORT**  
**FORM**

Event Report No \_\_\_\_\_ Date: \_\_\_\_\_

Station: \_\_\_\_\_ Constituent: \_\_\_\_\_

Affected Path:

\_\_\_\_\_

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

\_\_\_\_\_

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

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

**REPORT**

i) Failure within contractor system

Yes \_\_\_\_\_ No \_\_\_\_\_ ( If No then date \_\_\_\_\_ time \_\_\_\_\_)

ii) Entrance to site and room for rectification date \_\_\_\_\_ time \_\_\_\_\_

iii) Rectification start time by Contractor date \_\_\_\_\_ time \_\_\_\_\_

iv) Fault fixed date \_\_\_\_\_ time \_\_\_\_\_

b

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

Comments:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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

New Unit Sl. No.: \_\_\_\_\_

Date:

PrKTCL \_\_\_\_\_ Contractor \_\_\_\_\_

**Form-II****START STATUS FORM**

Page: (1)

Report no:

**Start:** Date : \_\_\_\_\_**Time :** 10.00 Hrs:

	Station	Description
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____
6	_____	_____
7	_____	_____
8	_____	_____
9	_____	_____
10	_____	_____

Special test conditions or action:

Attachments:

Initials:

PrKTCL \_\_\_\_\_

Contractor \_\_\_\_\_

## **FORMAT TO BE FILLED DURING SEMI ANNUAL SITE VISIT**

### **1. SITE INFORMATION:**

Site name :-----

Address :-----

Contact Person :-----

Telephone & Fax :-----

### **2. 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
- Action Required by PRKTCL-----

Communication room cleanliness

- Check if communication room is in good condition (Over all)

- Check if regular cleaning of telecom room done.

- Check if room is manned.

- Check if AC/DC sully has been tapped for other uses.

- Is the room having any damp wall.

- Action required by Employer.

Contractor's representative

PrKTCL representative

**Form-III contd/-****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 with vacuum cleaner.                      Cleaned

Actions required by Employer: \_\_\_\_\_

Action required by Contractor: \_\_\_\_\_

**3.0 TEMPERATURE MEASUREMENT:**

Room temperature

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

Action Required by Employer: \_\_\_\_\_

**4.0 POWER SUPPLY MEASUREMENT**

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

Actions required by Employer                      \_\_\_\_\_

\_\_\_\_\_



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#### 4.0 MULTIPLEXER & SDH EQUIPMENT ALARM CHECK

Visual check for the alarm on Mux & SDH equipment, in case of any alarm present further investigation and corrective action.

**Healthiness of spare Fiber**

Fiber

no:

Colour :

**Form-III contd/-**

From :

To :

Condition :

Equipment used :

Action required by Contractor: \_\_\_\_\_

**5.0 CABLE CHECK**

- Check the cable terminations at all MDFs visually. Recrone if any loose wires.
- Check cable route for any abnormality.
- Are cable trenches covered properly?

**6.0 DOCUMENTS AND TEST INSTRUMENTS**

- Check the documents at site. Available Not available
- Check the availability of test instrument/tool kit at site.(Multimeter,Screw driver,plier etc.) \_\_\_\_\_available

**7.0 EARTHING CHECK**

- All the cables are connected properly with the ground point.
- Clean the end points 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: \_\_\_\_\_Ω

Contractor's representative

PrKTCL's representative

**Form- IV****DC POWER SUPPLY EQUIPMENT MAINTENANCE FORMAT TO BE FILLED AT SITE****SITE INFORMATION****SITE NAME** : \_\_\_\_\_**ADDRESS** : \_\_\_\_\_

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**TELEPHONE AND FAX NO** -----

	DESCRIPTION	VALUE,IF ANY	REMARKS
1	Cleaning done		
2	Power connections checked for tightening & over heating		
3	Control Connections are all tight		
4	All indications/meters/display on the panel are working		
5	Input frequency		
6	Rectifier LEDs		
7	Normal Operation on each module		
8	Float voltage		
9	Checking for ripple Voltage		
10	Checking for AC Voltage L-L, L-N		
a	R - Y		
b	Y - B		
c	R - B		
11	Checking AC Current		
12	Checking of DC Voltage		
13	Checking of earthing		
14	Battery voltage/resistance measurement done & enclosed		
15	Load test done on batteries as enclosed		
16	Check functioning of hooter/Buzzer (Alarm Annunciation)		
17	Parameters checked in SCADA system		
18	Proper guidance given for normal day to day operation.		

Suggestions from Contractor :

Remarks from Customer :

**PrKTCL representative**

**Form -V****CONTRACT NO./DATE :****DESCRIPTION OF JOB :****CONTRACTOR :****BIO-DATA OF CONTRACTOR'S EMPLOYEES****NAME :****AGE :****TRADE :****RESIDENTIAL ADDRESS :****TEMPORARY :****PERMANENT :****LANGUAGES KNOWN :****SPEAK :****READ :****WRITE :****QUALIFICATION :****TRAINING IN SAFETY :****/ HEALTH / ENVIRONMENT****QUALITY/TRADE :****JOB EXPERIENCE :****PHOTO****DATE:****SIGNATURE:**

-----End of this Section-----  
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