REQUEST FOR OFFERS

FOR

SUPPLY OF SDH EQUIPMENT AND SPARES

FOR

FOCS PGCIL PROJECT

Ref. No. : TCIL/15/914/1/09-MM/41 E

Date : January 21, 2009

Issued by :

Material Management Division
Fourth Floor,
Fax : +91-11-26242266
Tel : +91-11-26202020
Email : mmdiv@tcil-india.com
visit us at : http://www.tcil-india.com

Telecommunications Consultants India Ltd.
(A Govt. of India Enterprise)
TCIL Bhawan, Greater Kailash-I
New Delhi – 110 048 (India)

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SECTION - 1

Reference No.: TCIL/15/914/1/09-MM/41 E **January 21, 2009**

REQUEST FOR OFFER

Sealed offers are invited from eligible Suppliers for the supply of **SDH Equipment and Spares** for FOCS PGCIL Project.

The :Request for Offer" documents are enclosed.

Complete documents are also available on TCIL's website address given below:

http://www.tcil-india.com

The documents downloaded by the parties from the website shall be valid for participation in the process.

ELIGIBILITY CRITERIA

(i) The vendor/supplier should be either an Original Equipment Manufacturer (OEM) of SDH Equipment or its authorized distributor/agent/dealer.

(ii) OEM should be ISO certified.

(iii) Average Annual Financial Turnover during the last 3 years ending March 2008 should be at least Rs. 73.26 lac (equivalent US$ 152,632).

(iv) Experience of having successfully supplied similar material during the last 2 years ending December 31, 2008 should be either of the following :

(a) Two similar supply orders each costing not less than Rs. 58.61 lac (equivalent US$ 122,106) in not more than 8 weeks time from the date of the client's order.

Or

(b) One similar supply order costing not less than Rs. 177.22 lac (equivalent US$244,210) in not more than 8 weeks time from the date of the client's order.

(v) The bidders shall submit assessment report in the format enclosed as Annexure-A.

(vi) The bidders shall submit the Data Requirement Sheet (DRS) which should be duly filled up by the bidders with signature and company seal. Format enclosed as Section-8 of the RFO.

Documentary evidence in support of the above eligibility criteria should be submitted.

Two stage bid system shall be adopted, i.e. Techno-commercial and Price offer.

The offer shall be submitted in the office of GGM (MM), TCIL, 4th Floor, TCIL Bhawan, Greater Kailash-I, New Delhi – 110048 **on or before 15:00 hrs., 12.02.2009.**

The techno-commercial offers shall be **opened at 1600 hrs. on 12.02.2009.**

TCIL reserves the right to accept or reject any or all the offers without assigning any reason.

(D. MANNA)
Group General Manager (MM)

Annexure-A

ASSESMENT REPORT

The following documents are required for this assessment report :

- **i) Registration/License/factory as evidence of being a manufacturer.**
- ii) Organization chart with name and qualification of key persons.
- **iii) List of plant and machinery.**
- **iv) List of testing equipment to carry out all the route tests in – house alongwith their calibration status.**
- v) List of raw material, bought out items with sourcing details.
- **vi) List of supplies made to other utilities in last three years.**
- vii) Third party approval, if any (viz. ISO, BIS).
- viii) Copy of quality manual (if ISO certified).
- ix) Pollution clearance wherever applicable.
- x) Sanctioned load and backup power/shed area/storage area.
- xi) Formats for RM, in process and acceptance testing.
- **xii) Type test approvals conducted in last 5 years, if applicable.**
- **xiii) Performance certificates from customers.**
- xiv) Company brochure/product catalogues.
- **xv) Photographs of factory, plant & machinery and testing facilities.**

Note : Requirements in bold are must requirements to be provided by the Bidder.

-END OF SECTION 1-

SECTION - 2

Reference No.: **TCIL/15/914/1/09-MM/41 E** **January 21, 2009**

INSTRUCTIONS TO BIDDERS

2.1 INTRODUCTION (DEFINITIONS)

2.1.1 "Purchaser" means Telecommunications Consultants India Ltd. (TCIL), its Head Quarter at New Delhi or any other project/branch offices within or outside India.

2.1.2 "Bidder" means the individual or firm or corporate body or consortium or association of persons who participates in the RFO and submits its bid.

2.1.3 ''Goods/Products" means all the hardware equipments, instruments, tools, machinery etc., and/or other materials like components/parts/spares including consumables which the supplier is required to supply to the Purchaser under the Purchase Order.

2.1.4 "Letter of Intent (LOI)" means the communication of the intention of the Purchaser to the Bidder to place the Purchaser Order for the former's offered goods/services.

2.1.5 "Purchase/Work Order (PO)" means the order placed by the Purchaser on the Supplier duly signed by the Purchaser's authorized representative to purchase certain goods & services from the vendor/contractor.

2.1.6 "Contract Price" means considerations payable to the supplier/contractor as stipulated in the Purchase or Work Order for performance of specified contractual obligations.

2.2 BIDDER TO BEAR COST OF PURCHASE OF TENDER

The Bidder shall bear all costs associated with the preparation and submission of the bid. The Purchaser in any case will not be responsible or liable for these costs regardless or the conduct of the bidding process.

2.3 BID DOCUMENTS

2.3.1 Bid Documents includes: -

Section 1	Request for Offers
Section 2	Instructions to Bidders
Section 3	General (Commercial) Conditions of the Contract
Section 4	Special Conditions of Contract
Section 5	Bill of Quantity and Price Bid Schedule
Section 6	Technical Specifications
Section 7	Performance Bank Guarantee (PBG) Format
Section 8	Data Requirement Sheet (DRS)

2.3.2 Any clarification or communications obtained from the Purchaser

2.4 AMENDMENT TO BID DOCUMENTS

2.4.1 At any time, prior to the date of submission of bids, the Purchaser may for any reason, whether at its own initiative or in response to a clarification requested by a prospective bidder, modify the bid documents by amendments.

2.4.2 The amendments will be notified in writing or by telex or fax to all prospective bidders who have received the bid documents and these amendments will be binding on them.

2.5 EXTENSION OF TIME

In order to give prospective bidders required time in which to take the amendments into action in preparing their bid, the Purchaser may at its discretion extend the deadline for submission of bid suitably.

2.6 BID PRICE

Unit prices/rates shall be quoted as given in Special Conditions of the tender in Section – 4.

2.7 BIDDERS ELIGIBILITY AND QUALIFICATIONS

Bidder shall furnish as a part of bid documents establishing the bidder's eligibility to supply the material. The bidder shall also submit documentary evidence in the form of literature, drawing, data on the goods offered.

2.8 BID SECURITY

No EMD/Bid Security need be submitted along with the offer.

2.9 VALIDITY PERIOD OF BID

Bid shall remain valid for 180 days after the date of bid opening. The bid valid for a shorter period shall be rejected by the Purchaser as non-responsive.

In exceptional circumstances, the purchaser may request the consent of the bidder for an extension to the period of bid validity. The bid security provided under clause 2.8.1 (a) shall also be suitably extended. A bidder accepting the request and granting extension will not be permitted to modify his bid.

2.10 FORMAT OF SIGNING OF THE BID

2.10.1 The bidder shall prepare two copies of the bid clearly marking as one copy as "Original Copy" and the other as "Copy" & also provide softcopy of technical bid on CD-ROM in MS-Word format.

2.10.2 In the event of any discrepancy between them, original shall prevail.

2.10.3 The original copy of the bid shall be typed and shall be signed by the bidder or a person duly authorized by the bidder. The Letter of Authorization shall be accompanied by a written Power of Attorney accompanying the bid.

2.10.4 All pages of the original bid except printed literature shall be initialed by the person signing the bid.

2.10.5 The bid shall contain no interlineations, erasures or overwriting except as necessary to correct errors made by the bidder in which case such corrections shall be initialed by the bidder signing the bid.

2.11 DEADLINE FOR SUBMISSION OF BID

Bid must be received by the Purchaser at the address specified and not later than the date and time specified in the NIT.

2.12 LATE BID

Any bid received late by the Purchaser after the deadline for submission of the bid shall be rejected and returned un-opened to the bidder.

2.13 MODIFICATION AND WITHDRAWAL OF BIDS

2.13.1 The bidder may modify or withdraw his bid provided that written notice of modification or withdrawal is received by the Purchaser prior to the deadline prescribed for submission of bids.

2.13.2 No bidder may modify or be allowed to withdraw bid subsequent to the deadline for submission of bids.

2.14 OPENING OF TECHNO-COMMERCIAL OFFER (PART-1)

2.14.1 The Purchaser shall open the Techno-Commercial Offer (Part-1) in the presence of authorized bidder's representatives who choose to attend at date and time specified in the RFO. The bidder's representative who are present shall sign the Attendance Register.

2.14.2 A maximum of two representatives for any bidder shall be permitted and authorized to attend the bid opening.

2.14.3 The date fixed for opening of bids, if subsequently declared as holiday by the TCIL, the revised date of schedule will be notified. However, in absence of such notification, the bids will be opened on next working day, time and venue remaining unaltered.

2.15 CLARIFICATION OF BIDS

2.15.1 To assist evaluation and comparison of the bids, the Purchaser may at its discretion may ask the bidder for clarification of the bid. The clarification and response from bidder shall be in writing.

2.15.2 The Purchaser does not bind himself to accept the lowest or any tender and reserves to himself the right to accept the whole or any part of the tender and altering the quantities offered and tenderer shall supply the same at the rate quoted.

2.16 EVALUATION OF RFO

2.16.1 The Purchaser shall evaluate the bids in respect to the substantive responsiveness of the bid or otherwise. The Purchaser shall carry out detailed evaluation of the substantially responsive bids. The Purchaser shall check the bid to determine whether they are complete, whether any computational errors have been made or required sureties have been furnished.

2.16.2 Arithmetical error shall be rectified on the following basis :-

a) If there is a discrepancy between the unit price and total price that is obtained multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected by the Purchaser.

b) In case of discrepancy between words and figures, the amount in words shall prevail.

2.16.3 A bid determined as substantially non-responsive shall be rejected by the Purchaser.

2.16.4 The Purchaser may waive any minor infirmity or non-conformity or irregularity in the bid which does not constitute a material deviation.

2.16.5 The Purchaser shall evaluate in detail and compare the bids which are substantially responsive.

2.16.6 The evaluation of the ranking shall be carried out on the landed price of goods offered inclusive of all taxes.

2.16.7 The distribution of required quantity amongst the technically and commercially complied bidders shall be based on merits of each case.

2.16.8 TCIL shall have the sole discretion in deciding the number of parties on whom the orders shall be finally placed.

2.17 PURCHASER'S RIGHT TO VARY QUANTITIES

2.17.1 The Purchaser reserves the right at the time of award of the contract to increase the quantity of the goods and services specified in the schedule of requirements without any change in unit price of the ordered quantity.

2.17.2 In case of division of order among number of parties. The distribution of quantity will be accordingly done by the Purchaser on an individual tender.

2.18 PURCHASER'S RIGHT TO ACCEPT ANY BID AND TO REJECT ANY OR ALL BIDS

The Purchaser does not bind himself to accept lowest or any other offer/bid and has the right to cancel the bidding process and reject all bids at any time prior to award of the contract without assigning any reasons whatsoever and without thereby incurring any liability to the affected bidder on the grounds for the Purchaser's action.

2.19 NOTIFICATION TO SUCCESSFUL BIDDER

2.19.1 Prior to the expiration of the bid period, the Purchaser will notify the successful bidder in writing by registered letter or fax, to be confirmed in writing by registered letter, that its bid has been accepted.

2.19.2 Upon successful bidder furnishing of Performance Guarantee, the Purchaser will notify each un-successful bidder and will discharge its bid bond.

2.20 ISSUE OF LETTER OF INTENT

2.20.1 The issue of Letter of Intent shall constitute the intention of the Purchaser to place the Purchase Order with the successful bidder.

2.20.2 The bidder shall within 10 days of issue of Letter of Intent give its acceptance along with Performance Guarantee in conformity with the bid documents.

2.21 CANCELLATION OF LETTER OF INTENT

Failure of the successful bidder to comply with the requirement of submission of Performance Guarantee in time shall constitute sufficient ground for the cancellation of the acceptance of bid and forfeiture of the bid bond, in which case Purchaser may make the offer to any other bidder at the discretion of the Purchaser or call for new bids.

2.22 POST BID CLARIFICATIONS

No post bid clarification at the initiative of the bidders shall be entertained and any effort by the bidders to influence the Purchaser in the Purchaser's bid evaluation, bid comparison or award of the contract shall result in rejection of the bid.

2.23 DELIVERY

Delivery of the goods shall be made by the supplier in accordance with the terms specified by the Purchaser in the Special condition of the contract and goods shall remain at the risk of the supplier until delivery have been completed in full. The Schedule of delivery shall be the essence of the contract.

2.24 SUBMISSION OF BID

Sealed offer shall be submitted in two separate envelops.

Envelope 1 superscribed as PART-1 (Techno-Commercial Offer) shall contain the following:

a) Documentary evidence in respect of the eligibility criteria mentioned in the R.F.O.

b) Technical Offer

c) A statement showing Clause-by-Clause compliance to all the Terms & Conditions of the RFO specified at Section 1, 2, 3, 4, 5, 6, 7 & 8.

Envelope 2 superscribed as PART-II (Price Offer) shall contain the Price Bid Schedule as per the format given in Section –5 of the Bid Document.

A single sealed envelope containing both the envelopes (i.e. Envelope 1 & Envelope 2 sealed separately) shall be addressed to the purchaser at the following address:

Group General Manager (MM)
Telecommunications Consultants India Limited,
MM Division,
TCIL Bhawan, Fourth Floor,
Greater Kailash – I, New Delhi – 110 048.
Tel: +91-11-26202020/Ext. 2406
Fax: +91-11-26242266/26241847

The envelopes should be superscribed "RFO No. TCIL/15/914/1/09-MM/41E dated January 21, 2009 for **"Supply of SDH Equipment and Spares for FOCS PGCIL Project"** and also **"Do not open before due date (date to be mentioned)"**.

The complete offer documents may be sent by the bidders by Courier/Speed-post, with the envelope marked as above. Alternatively, RFO's may also be deposited by the tenderers in the tender box kept in MM-Division at 4th floor at TCIL Bhawan.

The tender box shall be sealed at the stipulated deadline for submission.

The tender box shall be opened at the stipulated time of opening in the presence of intending bidders.

The names/designations of concerned officers who can be contacted are mentioned below:

Mr. J. K. Pandey	**Mr.Devki Nandan**
General Manager (MM)	Manager (MM)
Tele: 26202412	Tele: 26202424

(i) The inner and outer envelopes shall indicate the name and address of the bidders to identify the bid and to enable the bid to be returned unopened in case it is declared 'late' or 'rejected'.

(ii) VENUE OF RFO OPENING : Offers shall be opened in 4th floor TCIL Bhawan, New Delhi-110048 at the time on the due date mentioned in the N.I.T. If due to administrative reason the venue of Bid opening is changed it will be duly displayed at the Reception Hall of TCIL Bhawan.

(iii) Offer received through Fax/E-mail or through open letter shall be ignored.

-END OF SECTION 2-

SECTION - 3

Reference No.: **TCIL/15/914/1/09-MM/41 E** **January 21, 2009**

GENERAL (COMMERCIAL) CONDITIONS OF THE CONTRACT

3.1 PRICE APPLICABILITY

Prices in the Purchase Order shall remain valid for the period of delivery schedule or extended delivery schedule. In case of delayed supplies, after delivery period, the advantage of reduction of taxes/duties shall be passed onto the Purchaser and no benefit of increase will be permitted to the Supplier.

3.2 STANDARDS

The goods supplied under the contract shall conform to the standards mentioned in the Technical Specifications.

3.3 PATENT RIGHTS

The Supplier shall indemnify the Purchaser against all third party actions/claims of infringement of patent, trademark or industrial design rights arising from the use of goods or any part thereof.

3.4 PERFORMANCE SECURITY

3.4.1 Within 10 days of the Supplier's receipt of Letter of Intent (LOI)/P.O., the Supplier shall furnish a Performance Security for the amount of 10% of the contract/P.O value.

3.4.2 The proceeds of the Performance Security shall be payable to the Purchaser as compensation for any loss resulting from the Supplier's failure to complete its obligations under the contract.

3.4.3 The Performance Bond shall be in the form of Bank Guarantee issued by a Scheduled Bank situated in India and in the form provided by TCIL.

3.4.4 The Performance Bond will be discharged by the Purchaser after completion of the Supplier's obligations including any warranty obligations under the contract.

3.4.5 As regards validity of PBG, please refer to Special Conditions of the contract (Section-4).

3.5 INSPECTION AND TESTS

3.5.2 The Purchaser or its representatives or ultimate client shall have the right to inspect and test the goods for their conformity to the specifications. The Purchaser may also appoint an agency for this purpose. The technical specifications shall specify what inspection and tests the Purchaser requires and where they are to be conducted. Where the Purchaser decides to conduct such tests on the premises of the Supplier, all reasonable facilities and assistance like testing instruments and other test gadgets including access to the drawings and production data shall be furnished to the Inspector free of costs. In case the tested goods fail to conform to the specifications, the Inspector may reject them and the Supplier shall either replace the rejected goods or make alteration necessary to meet the specifications requirements free of cost to the Purchaser.

3.5.3 Notwithstanding the pre-supply tests and inspections, the material on receipt in the Purchaser's premises shall also be tested and if any material or part thereof is found defective, the same shall be replaced free of cost to the Purchaser.

If any material before it is taken over is found defective or fails to fulfill the requirements of the contract, the Inspector shall give the Supplier notice setting forth details of such defects or failures and the Supplier shall make the material good or alter the same to make it comply with the requirements of the contract and in any case within a period not exceeding 2 months of the initial report. These replacements shall be made by the Supplier, free of the all charges, at the site(s).

3.5.3 As regards Inspecting Authority and other details please refer to Special Condition of the Contract (Section-4).

3.6 TRAINING (WHERE REQUIRED)

3.6.1 The Bidder shall provide training for installation and maintenance staff of the Purchaser free of cost, where required.

3.6.2 The Bidder shall specify in his bid the number of trainees, quantum of proposed training, pre-training qualifications required of the trainees and the duration of the proposed training required.

3.6.3 The Bidder shall provide all training materials and documents and aids.

3.6.4 Conduct of training of the Purchaser's personnel shall be at the suppliers' plant and/ or on-site in assembly start-up operation, maintenance and/or repair of the supplied goods.

3.7 WARRANTY

3.7.1 The Supplier shall give warranty that goods to be supplied shall be new and free from all defects and faults in material, workmanship, and manufacture and shall be of the highest grade and consistent with the established and generally accepted standards for materials of the type ordered and shall perform in full conformity with the specifications and drawings. The Supplier shall be responsible for any defects that may develop under the conditions provided by the supplier and under proper use, arising from faulty materials, design or workmanship such as corrosion of the equipment, inadequate contact protection, deficiencies in circuit design and or otherwise and shall remedy such defects at his own cost when called upon to do so by the Purchaser who shall state in writing in what respect goods are faulty. This warranty shall survive inspection or payment for, and acceptance of goods, but shall expire except in respect of complaints notified prior to such date 12 months after the goods have been taken over.

However the warranty period specified, if any, in the Special Condition of Contract (Section – 4) the same shall rule.

3.7.2 If it becomes necessary for the supplier to replace or renew any defective portion/portions of the equipment under this clause, the provisions of the clause shall apply to the portion/portions of equipment's replaced or renewed or until the end of the above-mentioned period of twelve months, whichever may be later. If any defect is not remedied within a reasonable time, the Purchaser may proceed to get the work done at the Supplier's risk and expenses, but without prejudice to any other rights which the Purchaser may have against the Supplier in respect of such defects.

3.7.3 Replacement under warranty clause shall be made by the Supplier free of all charges at site including freight, insurance and other incidental charges.

3.8 CHANGE ORDERS

3.8.1 The Purchaser may at any time by written order given to the Supplier make changes within the general scope of the contract in any one or more of the following:-

a) Drawings, designs or specifications where goods to be furnished under the contract are to be specifically manufactured for the Purchaser.
b) Method of transportation or packing.
c) Place of delivery.
d) Services to be provided by the supplier.

3.8.2 If any such change causes an increase or decrease in the cost or the time required for the execution of the contractor, an equitable adjustment shall be made in the contract price or delivery schedule or both and the contract shall accordingly be amended.

3.9 SUB-LETTING

The Bidder cannot assign or transfer and sub-contract its interest/ obligations under the contract without prior written permission of the Purchaser.

3.10 LIQUIDATED DAMAGES

3.10.1 The date of the delivery of the goods stipulated in the acceptance of tender should be deemed to be the essence of the contract and the delivery must be completed not later than the dates specified therein. Extension in delivery period will not be given except in exceptional circumstances. Should, however, deliveries be made after expiry of the contract delivery period and accepted by the consignee, such deliveries will not deprive the Purchaser of the right to recover Liquidated Damages.

3.10.2 In case the Supplier fails to supply the material against the order, the material shall be procured from other suppliers at the cost and risk of the Supplier and the excess money will be recovered from any dues of the party.

3.10.3 For late supplies, as liquidated damages, a sum equal to 0.5% of the price of any goods not delivered or total order value in case where part delivery is of no use to a Purchaser, for a week or part of a week subject to maximum limit of 5% of the total order will be recovered from the Supplier. The Purchaser also reserves the right to cancel the order in such cases and forfeit the EMD/Performance Bank Guarantee and may also debar the Supplier for future purchases.

3.10.4 LD can be recovered from any dues of the Supplier.

3.11 ARBITRATION

In case of Foreign Bidders :

3.11.1 Any dispute or differences arising out of the contract which cannot be amicably settled between the supplier and the purchaser shall be decided as per arbitration rules of International Chamber of Commerce, Geneva. For arbitration, the venue shall be Geneva.

In case of indigenous Bidders:

3.11.2 In the event of any dispute arising between TCIL and the Supplier in any matter covered by this contract or arising directly or indirectly therefrom or connected or concerned with the said contract in any manner of the implementation of any terms and conditions of the said contract, the matter shall be referred to the Chairman & Managing Director, TCIL who may himself act as sole arbitrator or may name as sole arbitrator an officer of TCIL notwithstanding the fact that such officer has been directly or indirectly associated with this contract and the provisions of the Indian Arbitration Conciliation Act, 1996 shall apply to such arbitration. The supplier expressly agrees that the arbitration proceedings shall be held at New Delhi.

3.11.3 The proceedings of arbitration shall be in English language:

3.11.4 In case any supplier wants to take the dispute to a court of law after arbitration award as aforesaid, it is clearly understood that only courts in Delhi shall have the Jurisdiction.

3.11.5 In case of Public Sector Undertaking/Government Departments

In the event of any dispute or difference relating to the interpretation and application of the provisions of the contracts with any Public Sector Undertaking / Government Department, such dispute or difference shall be referred by either party for Arbitration to the sole Arbitrator in the Department of Public Enterprises to be nominated by the Secretary to the Government of India in-charge of the Department of Public Enterprises. The Arbitration and Conciliation Act, 1996 shall not be applicable to arbitration under this clause. The award of the Arbitrator shall be binding upon the parties to the dispute, provided, however, any party aggrieved by such award may make a further reference for setting aside or revision of the award to the Law Secretary, Department of Legal Affairs, Ministry of Law & Justice, Government of India. Upon such reference, the dispute shall be decided by the Law Secretary or the Special Secretary / Additional Secretary, when so authorized by the Law Secretary, whose decision shall bind the Parties finally and conclusively. The Parties to the dispute will share equally the cost of arbitration as intimated by the Arbitrator.

3.12 RISK PURCHASE

3.12.1 In the event of Supplier's failure to execute the contract to the satisfaction of the Purchaser, the Purchaser reserves the right :

(a) to reject any part of the Contract executed and withhold payment for such portion of the Contract till such time the defects are rectified to the satisfaction of the Purchaser.

(b) to terminate the Contract by giving 2 weeks notice in writing without assigning any reason and to get the Contract executed by other agency at the risk and cost of the Supplier.

3.13 APPLICABLE LAWS

This contract shall be interpreted, construed and governed by the laws of the Republic of India and the parties hereby submit to the exclusive jurisdiction of the Court and to all Courts having jurisdiction in appeal therefrom.

Any dispute in relation to the contract shall be submitted to the appropriate Court of the Republic of India for determination. The parties to the contract shall continue to fulfill their respective obligations under the contract during the currency of the contract pending the final decision of the Court.

3.14 GENERAL LIEN

Whenever under this contract any sum of money is recoverable from and payable by the Supplier, the Company shall be entitled to recover such sum by appropriating in part or in whole the security deposit of the Supplier, if a security is taken from the Supplier. In the event of the Security being insufficient or if no security has been taken from the Supplier, the balance or the total sum recoverable, as may be, shall be deducted from any sum due to the Supplier or which at any time thereafter may become due to the Supplier under this or any other contract with the Company. Should this sum be not sufficient to cover the full amount recoverable, the Supplier shall pay to the Company on demand the remaining balance due.

3.15 PACKING

The supplier shall ensure that the Goods/Equipment is securely and adequately packed to ensure safe arrival at the destination fully withstanding all hazards such as rough handling etc. during transit.

3.16 REPLACEMENT OF DEFECTIVE EQUIPMENT

3.16.1 If any equipment or any part thereof, is found defective or fails to meet the requirements of the contract before it is accepted TCIL shall give the Supplier a notice setting forth details of such defects or failures and the Supplier shall forthwith arrange to set right the defective equipment or replace the same by the good one to make it comply with the requirements of the contract. This in any case shall be completed within a period not exceeding one month from the date of the initial report pointing out the defects. The replacement or rectification shall be made at site by the Supplier free of cost. Should the Supplier fail to do the needful within this stipulated time frame, the purchaser reserves the right to reject the equipment in full or in part and get it replaced at the cost of the Supplier. The cost of any such replacement made by the Purchaser shall be deducted from the amount payable to the Supplier against this purchase order.

3.16.2 If any equipment or part thereof is lost or rendered defective during transit, pending settlement of the insurance claim, fresh order shall be placed on the Supplier for such loss or defective equipment and the Supplier shall arrange to supply the same within three months of such order at the same prices and on the same general terms and conditions as mentioned in this purchase order.

3.17 FORCE MAJEURE

If any time, during the continuance of this contract, the performance in whole or in part by either party under obligation as per this contract is prevented or delayed by reasons of any war or hostility, act of the public enemy, civil commotion, sabotage, fire, flood, explosion, epidemic, quarantine restrictions, strike, lockout or acts of God (hereinafter referred to "eventuality"), provided notice of happening of any such eventuality is given by either party to the other within 21 days of the date of occurrence thereof, neither party shall be reason of such an "eventuality" be entitled to terminate this contract nor shall either party have any claim or damages against the other in respect of such non-performance or delay in performance and deliveries under the contract. The contract shall be resumed as soon as practicable after such "eventuality" has come to an end or ceased to exist. In case of any dispute, the decision of CMD, TCIL, shall be final and conclusive, provided further that if the performance in whole or part of any obligation under this contract is prevented or delayed by reason of any such eventuality for a period exceeding 60 days, either party may at its option, terminate the contract. Provided also that if the contract is terminated under this clause the Purchaser shall be at liberty to take over from the Supplier at a price to be fixed by the Purchaser, which shall be final, all unused, undamaged and acceptable materials, bought out components and other stores in the course of manufacture which may be in the possession of the Supplier at the time of such termination, or such portion thereof as the Purchaser may deem fit except such material, as the Supplier may, with the concurrence of the Purchaser, elect to retain.

3.18 TERMINATION FOR DEFAULT

3.18.1 The Purchaser, may, without prejudice to any other remedy for breach of contract, by written notice of default, sent to the Supplier, terminate this contract in whole or in part.

a) if the supplier fails to deliver any or all the goods within the time period (s) specified in the contract, or any extension thereof granted by the Purchaser .
b) if the Supplier fails to perform any other obligation(s) under the contract; and
c) if the Supplier, in either of the above circumstances, does not remedy his failure within a period of 15 days (or such longer period as the Purchaser may authorize in writing) after receipt of the default notice from the Purchaser.
d) On a notice period of 30 days.

3.18.2 In the event the Purchaser terminates the contract in whole or in part pursuant to above para the Purchaser may procure, upon such terms and in such manner as it deems appropriate, goods similar to those undelivered and the Supplier shall be liable to the Purchaser for any excess cost for such similar goods. However, the Supplier shall continue the performance of the contract to the extent not terminated.

3.19 TERMINATION FOR INSOLVENCY

The Purchaser may at any time terminate the Contract by giving written notice to the Supplier, without compensation to the supplier if the supplier becomes bankrupt or otherwise insolvent as declared by the competent court provided that such termination will not prejudice or effect any right of action or remedy which has accrued or will accrue thereafter to the purchaser.

3.20 ADD-ON ORDER

TCIL reserves the right to place Add-on order for additional quantity upto 25% of the original quantity at the same rate and terms & conditions of the purchase order.

- END OF SECTION 3 -

SECTION - 4

Reference No.: **TCIL/15/914/1/09-MM/41 E** **January 21, 2009**

SPECIAL CONDITIONS OF THE CONTRACT

4.1 PRICE BASIS

4.2 PAYMENT TERMS

4.3 SALE IN TRANSIT

4.4 VALIDITY OF OFFER

4.5 PERFORMANCE BANK GUARANTEE (PBG)

4.6 PAYING AUTHORITY

4.7 CONSIGNEE

4.8 WARRANTY

4.9 DELIVERY PERIOD

4.10 LIQUIDATED DAMAGES (LD)

4.11 INSPECTION/TESTING OF RAW MATERIALS

4.12 QUANTITY VARIATION CLAUSE

4.1 PRICE BASIS

FOR Delhi/New Delhi/NCR site, inclusive of Excise Duty, Central Sales Tax, VAT/D-VAT, Freight, Octroi/Entry Tax and other levies including transit insurance. The break-up of these taxes and levies should also be provided. Prices to remain firm & fixed during the supply period.

4.2 PAYMENT TERMS

The payment terms shall be on back-to-back basis i.e., as per PGCIL payment terms to TCIL on submission of following documents :

(i) Supplier's Invoice
(ii) Manufacturer's Certificate of Quality
(iii) Insurance Policy / Certificate
(iv) Material Inspection Clearance Certificate (MICC) for dispatch issued by PGCIL.
(v) Test Certificates.

4.3. SALE IN TRANSIT

Form 'C' shall be issued by TCIL to the Supplier and the Supplier in-turn shall issue Form 'E-1' in case of supply under CST.

4.4 VALIDITY OF OFFER

The offer shall be valid for a period of 180 days from the date of opening of tender. Within that period, the bidder cannot withdraw his offer subject to the period being extended further, if required, by mutual agreement from time to time.

4.5. PERFORMANCE BANK GUARANTEE (PBG)

The supplier shall submit within 10 days from the date of Purchase Order a Performance Bank Guarantee for an amount equivalent to 10% of purchase order value, valid for 24 months from the date of receipt of supply at destination.

4.6 PAYING AUTHORITY

JGM (F&A), North
Telecommunications Consultants India Limited
TCIL Bhawan, Greater Kailash-I,
New Delhi 110048, India
Tel.: +91-11-26202701
Fax: +91-11-26242266

4.7 CONSIGNEE

PGCIL, New Delhi.
However, billing/tax invoice to be raised in favour of TCIL, New Delhi.

4.8 WARRANTY

Warrantee shall be 24 months from the date of supply/acceptance of the equipment/material.

4.9 DELIVERY PERIOD

To commence from February 2009 and be completed by April 2009.

4.10 LIQUIDATED DAMAGES

A sum equal to 0.5% of any goods not delivered or total order value in case where part delivery is of no use to the Purchaser, for a week or part of a week subject to maximum limit of 5% of the total order will be recovered from the Supplier.

4.11 INSPECTION/TESTING OF MATERIALS

By TCIL/PGCIL.

4.12 QUANTITY VARIATION CLAUSE

±30%.

- END OF SECTION 4 -

SECTION - 5

Reference No.: TCIL/15/914/1/09-MM/41 E **January 21, 2009**

TECHNICAL SPECIFICATIONS FOR SDH EQUIPMENT FOR FOCS PGCIL PROJECT

TECHNICAL REQUIREMENTS OF TERMINAL EQUIPMENT& NMS

This section describes the Fiber Optic communication network configuration and the equipment characteristics for communication system to be installed under the project. The subsystems addressed within this section are:

(1) Fibre Optic Transmission System (FOTS)
(2) Telecommunication Management Network (TMN)

The requirements described herein are applicable to the communication network depicted in Appendix- A and the Telecommunication Management Network (TMN) for monitoring and control of this communication network. TMN and NMS (Network Management System) have been interchangeably used in this specification.

2.1 General Network Characteristics

2.1.1 Description

(i) The proposed FO communication network for NDMC, New Delhi, India is depicted in Appendix-A. The offered communication System shall support the communication requirements of RTUs and the SCADA/DMS system described in point to multi point and/or multipoint to multipoint configurations using Ethernet over SDH. The RTUs located at various locations will report to Control Center over TCP/IP network using IEC 870-5-104 protocol. The Remote Consoles of SCADA/DMS system at various locations may also use the same communication network. The proposed network shall also be used for VoIP based voice connectivity and connectivity to various sites at E1 level. For Voice connectivity, all the locations (substations & control centres) shall be connected through VoIP system. VoIP gateways/EPABX along with DTMF telephone sets (for 20 subscribers) shall be provided at control centre location and at other locations (for 4 subscribers). The VoIP gateways to be provided at the control centers shall be interconnected with the suitable EPABX system. However the VoIP gateways to be provided at the other locations shall be directly connected through telephones.

The contractor shall develop numbering plan for the proposed voice communication system.

The communication links based on fibre optic network shall be based on the lowest bit rate of the Synchronous Digital Hierarchy (SDH) ie. STM-1. The Contractor, however can propose a system, if required, based on higher bit rate system so as to meet the link budget and upgradeability requirements. The detailed BoQ is described in Appendix-B.

There may be some RTU locations which are few hundred mtrs (approx 250 mtrs) apart. In such cases single SDH equipment shall be used. The Contractor shall be responsible for extending the voice & data of the RTU up the SDH node and shall

supply all necessary hardware & accessory such as media converter, cable, switch etc. for the same at no additional cost to the Employer.

2.1.2 General Systems Requirements

Under this section terminal equipment refers to SDH equipment of Fibre Optic Transmission System (FOTS) and its interfaces along with other items (routers/switch, interface converters etc. if provided external to SDH equipment to meet the specification). Required characteristics of fibre optic terminal equipment, NMS system, and associated equipment of communication system are specified herein at the system level, subsystem level, and equipment level in the following sections.

2.1.2.1 Nil

2.1.2.2 System Maintainability

To facilitate performance trending, efficient diagnosis and corrective resolution, the system shall permit in-service diagnostic testing to be executed both locally and from remote locations, manually and/or initiated under TMN control. Such testing shall not affect the functional operation of the system.

Preventive and problem oriented maintenance of the communications system shall be performed using diagnostics tools such as NMS and test equipment. They shall support complete maintenance of all system elements and shall permit the diagnosis of any fault without requiring additional test equipment. For all redundant systems, disconnection and repair of any failed device shall not interrupt the operation of the system.

2.1.2.3 System Upgradability and Expandability

Equipment supplied shall be sized (though not necessarily equipped) to support system/ subsystem expansion to full capacity as provided by specified aggregate transmission rates. Equipment units provisioned for unequipped subunit expansions, shall be terminated at appropriate patching facilities or termination blocks. Power supplies and NMS shall be sized for maximum equipped system capacity.

2.1.2.4 Equipment Availability

The calculated availability requirements are as follows:

(1) The availability of each fibre optic link (E1 to E1) shall be at least 99.999%.
(2) The availability of network end to end (E1 to E1) shall be at least 99.998%.
(3) The average per link subscriber to subscriber availability shall be at least 99.97%. The per link subscriber to subscriber availability is defined as the availability between any two data or voice subscribers at the two end of a wideband link.
(4) The network-wide subscriber to subscriber availability shall be atleast 99.8% .The network-wide subscriber to subscriber availability is defined as the availability between any two data or voice subscribers on the wideband network.

The calculated availability is defined as the theoretical availability determined by a statistical calculation based on the mean-time-between-failure (MTBF) and the mean-time-to-repair (MTTR) of the components and subsystems comprising the FOTS. The down time of the fibre optic cable shall not be considered in the aforesaid availability calculations.

In order to ensure that the equipment & configuration proposed by the bidders shall be capable of demonstrating the specified availability figures it is required that the Bidders shall include in their proposal a calculated availability analysis for the proposed equipment/ sub system. The calculated failure rates of the units and the calculated availabilities of the equipment being offered shall be provided in the proposal. The analysis shall be based on an availability block diagram and shall include the mean-time-between failure (MTBF) and mean-time-to-repair (MTTR) of all of the components on the link. The Contractor shall indicate in the analysis the MTBF and MTTR and the resulting availability of each point-to-point link. For this analysis, an MTTR of at least 4 hours, shall be assumed.

2.1.3 2.1.3General Equipment Characteristics

All Contractor supplied equipment shall be new and of the finest production quality. The Purchaser will not accept modules or printed-circuit boards that are modified by appending wires or components. Wired strapping options shall be incorporated in the board design to meet the above requirement.

All applicable requirements stated in this section shall equally apply to the NMS equipment

2.1.3.1 Revision Levels and Modifications

All hardware, firmware and software delivered as part of the communications network shall be field proven and at the most current revision level. All modifications and changes necessary to meet this requirement shall be completed prior to the start of the factory tests or under special circumstances, on written approval by owner, prior to the completion of SAT.

All field modifications of the hardware, firmware and software that is required to meet installation and/or performance specifications, shall be fully documented as part of the deliverables, both as a separate field modifications record and as corrected equipment/configuration documentation.

2.1.3.2 Equipment Capacities

Equipment supplied shall be sized and equipped with sufficient capacity to support the circuit, channelization and configuration requirements, including spares, as identified in the appendices.
Each subsystem supplied shall be sized (to be equipped as specified) to support full subsystem expansion.

Data communications channelization required to support the TMN subsystems specified in technical specifications are not identified in the appendices. Therefore, the Contractor is required to size and equip the system to include all channelization and channel cards required to support the TMN function

2.1.3.3 Redundancy Requirements and Protection Schemes

Equipment redundancy and Automatic Protection Schemes (APS) are specified in the Table 2-1a.

Table 2-1a
Equipment Redundancy Requirements Summary

Fiber Optic transmission System: SDH equipment (ADM and TM) Power Supply & Converters ----------	 1:1 APS or distributed power
Common Control* Cards ---------- Tributary Cards E1(ADM and TM)---------- * = Common control cards which are essentially required for operation of the equipment.	1:1 APS N:1 APS

The offered equipment shall support at least SNCP **as per standard ITU-T G.841**. In case the equipment offered by the Bidder does not support the above mentioned minimum protection methods, the bidder shall have to provide all additional equipment needed to provide same level of flexibility, redundancy and functionality at no additional cost to Employer. The bidders shall provide details of protection schemes supported in the Bid document.

The offered equipment shall support automatic switchover function between the redundant modules and all required modules and hardwares to support the automatic switch over shall be provided by the Contractor.

2.1.3.4 Lost Signal Recovery

At any digital signal level, reapplication of a lost signal shall result in automatic resynchronisation and full restoration to normal operation without manual intervention. All alarms incident to the signal failure, shall be automatically cleared at the equipment, rack and monitoring levels and normal operation indications restored and reported, if applicable.

2.1.3.5 Equipment Lifespan

All equipment supplied shall have a minimum expected life of fifteen (15) years from the date of operational acceptance.

2.1.4 Optical Fibre Characteristics

The characteristics of optical fibre to be installed under this package are detailed in section 03**.** Further, the characteristics of optical fibre(s) already installed/being installed separately shall conform to the ITU-T Recommendations G.652. However, the attenuation coefficient of the fiber shall be ≤ 0.35dB/km @ 1310nm and ≤0.21dB/km @ 1550nm.

2.2 Fibre Optic Transmission System

The FOTS shall be based on SDH technology. Minimum aggregate bit rate shall be STM-1 and equipped with minimum 4 E1 interfaces(G.703) & 4 Ethernet interfaces (IEEE 802.3/IEEE 802.3u) supporting layer 2 switching as tributaries. The Ethernet interfaces shall support VLAN (IEEE 802.1P/Q), spanning tree (IEEE 802.1D) quality of service. The Contractor may offer external Layer-2 switch to meet the functionality if Layer -2 switching is not supported within the offered SDH equipments.

The Contractor shall provide (supply and install) connectorised jumpers (patch cords) from FODP-to-equipment and equipment-to-equipment connection. Two number of spare jumpers shall be provided in each connection. Fiber jumpers shall be of sufficient lengths as to provide at least 0.5m of service loop when connected for their intended purpose.

2.2.1 SDH Equipment

2.2.1.1 Functional Requirement

The offered equipment shall be configurable either SDH Terminal Multiplexer (TM) or SDH Add/Drop Multiplexer (ADM) or Digital Cross Connect (DXC). For the purpose of the BoQ, the **SDH Equipment** is considered to be divided in three parts i.e. **Optical cards** (Line), **Tributary Cards** (Electrical Tributaries such as E1 & Ethernet 10/100 Mbps interface) and **Base Equipment** (Consisting of Common Cards, Power supply cards, power cabling, sub-rack, other hardware and accessories required for installation of equipment i.e. everything besides optical cards and tributary cards).

The offered equipment shall support at least four optical directions with STM 1 as aggregate interfaces, 4 Ethernet Interfaces & 4 E1 interfaces as tributaries. The SDH equipment shall be equipped with required aggregate and tributary interfaces based on the network topology as indicated in the BOQ. The offered equipment shall support the following network topologies:

a. TM (with protected/unprotected aggregates)
b. ADM (with protected/unprotected aggregates)
c. DXC (with protected/unprotected aggregates)

The ADM Equipment shall be capable of VC-12 level Cross Connection of up to 4 STM-1equivalent and support mapping of each Ethernet interface over any single or multiple VC-12s.The equipment shall support VC-12 cross connection in all the 4 directions. The equipment shall provide access to full STM1 Payload.

The SDH equipment should support four optical directions and it shall be possible to implement MSP & SNCP protection scheme.

2.2.1.2 Redundancy and Protection

The network connectivity is planned in rings with SNCP protection. On linear sections of the network, MSP protection using 4 fibres may be implemented. However, actual implementation of protection scheme (MSP or SNCP) shall be finalized during detailed engineering.

2.2.1.3 Service Channel

Service channels shall be provided as a function of the SDH equipment and shall be equipped with Service Channel Modems that shall provide at a minimum: One voice channel (order wire) with analog interface (0.3 to 3.4 kHz) and One data channel. Both omnibus and selective calling facilities shall be provided. There shall be a facility to extend the line system order-wire to any other system or exchange lines on 2W/4W basis.

2.2.1.4 Supervision and Alarms

ISM (In Service Monitoring) circuitry shall be provided as a function of the SDH equipment. Local visual alarm indicators shall be provided on the equipment, as a rack summary alarm panel. Alarms shall be as per ITU-T Standards G.774, G.783 and G.784. Additionally, F2 and Q2 interfaces for a local craftsperson terminal interface and remote equipment monitoring is required.

The Equipment shall support collection of at least four (4) external alarms for monitoring and control of station associated devices by the TMN. The Employer shall identify the alarm contact points during survey / detailed engineering and the wiring supply, installation and termination from these external points to the installed equipment shall be carried out by the Contractor.

2.2.1.5 Synchronisation Output

The equipment shall provide synchronisation as per table 2-2. One 2MHz synchronisation output from each equipment shall be provided.

2.2.1.6 Electrical and Optical I/O Characteristics and General Parameters

Table 2-2 provides the electrical and optical characteristics as well as other general parameters for SDH equipment.

Table 2-2

Electrical and Optical I/O Characteristics and General Parameters

Optical Wavelength NOTE (1)	1310/1550nm
Optical Source NOTE (2)	Laser
Optical Source Lifespan	Better than 5 X10^5 hours
Optical Fibre Type	G.652
Optical Connectors	Type FC-PC
Transmission Quality	Per ITU-T G.821, G.823, G.826
Source Primary Power	-48 Vdc
Equipment Specifications	Per ITU-T G.783

Tributary, Electrical Interface	Per ITU-T G.703, 75 Ω/ 120 Ω
Ethernet 10/100 Mbps interface	Per IEEE 802.3
SDH Bit Rates	Per ITU-T G.703
Optical Interfaces	Per ITU-T G.957, G.958
Frame and Multiplexing Structure for SDH	Per ITU-T G.707
Synchronisation	Per ITU-T G.813
Management Functions	Per ITU-T G.774, G.784
Protection Architectures	Per ITU-T G.841
Built In Testing and Alarms	Per ITU-T G.774, G.783, G.784

NOTE (1) Optical wavelength shall be selected considering the characteristics of the optical fibre and the link budget.

NOTE (2) **Eye Safety for Laser Equipment:** To avoid eye damage, when a receiver detects a line interruption, it is required that the optical power of the laser shall be reduced to safe limits on the transmitter in the opposite direction as per ITU-T G.958.

NOTE (3) In case other than FC-PC connector is provided in the equipment suitable patch cord with FC-PC connectors are to be provided to connect with FODP.

2.2.2 Optical Link Performance Requirements

The optical fibre link performance requirements are specified as follows.

2.2.2.1 Link Budget Calculations

The fibre optic link budget calculations shall be calculated based upon the following criteria:

(1) Fibre attenuation: The fibre attenuation shall be taken to be the guaranteed maximum fibre attenuation i.e. 0.21 dB/Km @1550nm and 0.35 dB/km @1310nm.

(2) Splice loss: Minimum 0.05 dB per splice. One splice shall be considered for every 2 kms.

(3) Connector losses: Losses due to connectors shall be considered to be minimum 1.0 dB per link.

(3) Equipment Parameters: The equipment parameters to be considered for link budget calculations shall be the guaranteed “End of Life (EOL)” parameters. In case, the End of Life parameters are not specified for the SDH equipment, an End of Life Margin of at least 2 dB shall be considered.

(4) Optical path Penalty: An optical path penalty of at least 1 dB shall be considered to account for total degradations due to reflections, inter symbol interference, mode partition noise and laser chirp.

(5) Maintenance Margin: A maintenance margin of at least 2.5 dB/100Km shall be kept towards cabling, repair splicing, cable ageing and temperature variations etc.

(6) Other losses: Other losses, if any required specifically for system to be supplied shall also be suitably considered.

(7) Dispersion: The fibre dispersion shall be taken to be the guaranteed maximum dispersion i.e 20 ps/nm.Km @1550 nm and 6 ps/nm Km @ 1310 for DWSM fibres.

(8) Bit Error Rate: The link budget calculations shall be done for a BER of 10^{-10}.

The bidders shall determine the total link loss based on the above criteria and shall submit the system design (including link budget calculation) and BoQ for SDH equipment.

For finalising the FOTS system design & BOQ, similar methodology shall be adopted taking into account fibre attenuation, dispersion and splice loss determined during the detailed engineering. Accordingly, additions and deletions from the contract shall be carried out based on unit rates indicated in the contract.

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2.2.2.2 Link Performance

The Link performance for ES, SES and BER for the fibre optic links shall correspond to National Network as defined in ITU-T G.826. Further, the packet loss shall not be more than one percent in any of the Ethernet circuits of the offered system.

2.2.2.3 FODP to SDH Equipment Connectivity

The Contractor shall be responsible for connectivity between the FODP and the SDH equipment. The Contractor shall provide FC-PC coupled patch cords of suitable length. The patch-cord length between the FODP & equipment rack shall be suitably protected from rodents, abrasion, crush or mechanical damage otherwise by flexible conduits.

The patch -cord return loss shall be equal to or better than 40 dB and insertion loss equal to or less than 0.5 dB.

2.3 TELECOMMUNICATION MANAGEMENT NETWORK

The Contractor shall provide a Telecommunication Management Network System (TMN) also referred as NMS to provide operational support for the FOTS and associated equipment. This TMN shall provide the capability to monitor, reconfigure, and control elements of the telecommunications network from a centralized location and at each node of the network where equipment is located. This TMN system shall assist Employer in the operations and maintenance of the wideband communication resources including detection of degraded equipment, system performance, the diagnosis of problems, the implementation of remedial actions and the allocation or reallocation of telecommunications resources and addition/deletion of network elements.

The bidder shall provide details of the offered TMN in the bid supporting all the features. The furniture for placement of the TMN hardware shall be provided by the Contractor.

2.3.1 Applicable Standards

The TMN design concept, functional and informational architecture and physical architecture, shall be in compliance with CCITT Recommendation M.3010.

TMN shall also include the monitoring of the Ethernet interfaces/Switching modules of SDH equipment (or external layer-2 switches) for configuration, alarm and performance monitoring as a minimum requirement.

2.3.2 NMS Architecture

The NMS shall provide

a. Collection of Management data from all Network Elements (NEs) supplied under this package.

b. Processing of above management data by using processor(s) located at control Centre.

c. Monitoring and control of the NEs as defined below:

   I) TMN system at Control Centre shall support management of all equipments supplied and monitoring of the complete network supplied under this package. At a minimum functions of Network Management Layer (NML) and Element Management Layer (EML) as defined in CCITT M.3010 shall be provided. The detailed functions are described below in this Section:
   II) Monitoring and control of NEs using Craft Terminals as defined in this section.

d. Supervisory monitoring and control of the following station associated devices:

   I) Intrusion Detection Alarms
   II) Power Failure
   III) Fire and Smoke Detection
   IV) Environmental Control (Temperature, Humidity etc.)

e. Communication channel support for TMN system

The supplied TMN system shall be capable of handling all management functions for at least 200 % of the supplied network elements. Further, the centralised TMN system shall have provision for addition of at least two remote operator consoles. The TMN hardware shall be so designed that failure of a single processor & component (router, switch, converter etc.) shall not inhibit any of the functionality of the TMN system.

The Contractor shall submit for Employer's approval the TMN architecture describing in detail the following subsystems/features:

a. Database used in TMN

b. Master Processor, server/workstation, LAN, Peripherals and hardware

c. Software and operating system

d. Local Consoles

e. Craft Terminals

f. Data communication between NEs, Local Consoles and TMN Processor(s)

g. Routers/Bridges

h. Expansion Capabilities

2.3.3 Management Functions

The TMN shall support following Management functions:

2.3.3.1 Configuration Management

Configuration management is concerned with management, display, and control of the network configuration. Minimum specific requirements that shall be satisfied include the following:

a. Provide tools to establish and maintain the backbone topology and configuration information and provide graphical maps depicting the configurations.

b. Gather descriptive information about the current configuration of the equipment, provide operator displays, and prepare reports.

c. Provide tools for planning, establishing, and changing the static equipment configuration. Provide for changes to the equipment configuration in response to equipment failures, planned upgrades, and operator requests to take equipment offline for testing.

d. Provide verification testing to support new equipment installation.

2.3.3.2 Fault Management

Fault management is concerned with detecting, diagnosing, bypassing, directing service restoral, and reporting on all the backbone network equipment, system and links, Minimum specific requirements that shall be satisfied include the following:

a. Display equipment status in a consistent fashion regardless of the source of the data on a graphical topological, map-type display. Status shall be displayed through the use of colours on links and nodes as well as through text.

b. Obtain status and detect faults through periodic polling, processing of unsolicited alarms and error events, and periodic testing for connectivity.

c. Maintain an alarm summary of unacknowledged alarm events on the management station display and maintain a log of all received alarms. The operator shall be able to acknowledge and clear alarms individually and as a group. The use of alarm correlation techniques is encouraged to minimize the proliferation of alarms caused by a single, common event. All alarms shall be configurable as critical alarms, major alarms and minor alarms with different colours like red, amber/orange, blue etc. The normal condition shall be green (preferably) in colour.

d. Provide the capability to diagnose and isolate failures through analysis of error and event reports and through the use of both on-line and off-line diagnostic tests and display of monitored data.

e. The criteria for failover shall be configurable as automatic failover to redundant equipment where possible and through operator-initiated actions where automatic failover is not possible. The status of fail over shall be reported to TMN.

e. Track network equipment failure history.

2.3.3.3 Performance Management

Performance management is concerned with evaluation of the use of network equipments and their capability to meet performance objectives. Minimum specific requirements that shall be satisfied include the following:

a. Provide support for an operator to initiate, collect, and terminate performance metrics under both normal and degraded conditions. For example, BER of each link together with other data measured at each node, shall be available on operator request.

b. Monitor point to point, end to end errors/signal quality and history. Provide operator controls to monitor performance of specified events, measures, and resources. Specifically provide displays to permit the operator to:

1. Select/deselect network equipments, events, and threshold parameters to monitor

2. Set monitoring start time and duration or end time

3. Set monitoring sampling frequency

4. Set/change threshold values on selected performance parameters

5. Generate alarm events when thresholds are exceeded.

6. Set multiple thresholds on certain performance parameters. Alarm categories include as a minimum a warning and a failure.

7. Calculate selected statistical data to measure performance on selected equipment based on both current and historical performance data maintained in performance logs. Performance data provided is limited to what is available from the equipment Contractors.

8. Provide graphical displays of NE current performance parameter values. Provide tabular displays of current, peak, and average values for performance parameters.

9. Generate reports based on system statistics such as daily, weekly, monthly yearly performance reports.

2.3.3.4 Security Management

The TMN shall be provided with security features to limit access to monitoring and control capabilities to only authorized personnel. One access level of System Administrator and at least two levels of operator access shall be provided - read only, and write. The system administrator shall be able to create, define and modify operators with different access levels, network domains and perform all kind of maintenance and up gradation of the TMN system. With "read only" access level, network parameters should only be viewed. Access to database maintenance, command control and test functions shall be available with "write" access level. Means shall be provided to ensure only one authorized user has write capability for a selected domain of the network. It shall be possible to define multiple domains for the purpose of monitoring and control.

Human error and conflict detection are also required. Such errors and access violations shall be reported to the offending user as error messages and warnings.

2.3.4 Communication Channel Requirements and Integration

Communication requirements for TMN system have not been considered in Appendices and the Contractor shall provide these as a part of TMN system. The Contractor shall provide all required interface cards / devices, LAN, routers/bridges, channel routing, cabling, wiring etc. and interfacing required for full TMN data transport.

The TMN data transport shall utilize the fibre optic communications transmission system service channel in the overhead whenever possible. This will provide inherent critical path protection.

In case supervisory channels are not available, the Contractor shall provide suitable interfaces in their supplied equipment for transport of TMN data. The Contractor shall also be responsible for providing suitable channels with appropriate interfaces to transport the TMN data.

The bidders shall describe in the proposal the TMN data transport proposed to be used by the bidder in detail including capacity requirements and various components/equipment proposed to be used.

2.3.5 Craft Terminal

Each SDH equipment on the telecom network shall include provision for connecting a portable personal computer (PC) to be known as craft terminal to support local commissioning and maintenance activities. It shall also be possible to remote login to other NE(s) through craft terminal. Through the use of this PC and local displays/controls, the operator shall be able to:

a. Change the configuration of the station & the connected NEs.

b. Perform tests

c. Get detailed fault information

2.3.6 Hardware Requirements

2.3.6.1 Master Processor, Server/Workstation and Craft Terminal

The server/workstation and craft terminal shall have Dual Core processor(s) which shall be sufficient to meet all the functional requirement and expansion capabilities stipulated in this specification. Only reputed make like Dell, IBM, HP make shall be supplied.

The server shall have minimum configuration of 3GHz for CISC based or 1.6GHz for RISC based processor, 2GB RAM, DVD-ROM drive, redundant 80 GB internal Hard Disk Drive, 101-Enhanced style keyboards, mouse, parallel, serial and USB(2.0) ports. VDUs shall be 17" TFT active matrix color LCD with a minimum resolution of 1024 X 768. Appropriate network drive card shall also be provided wherever required. However, the internal hard disk drive for the server shall be redundant and all the data shall be mirrored. Further, the TMN software shall support data mirroring on redundant disk drives.

The workstation shall have minimum configuration of 2.4Ghz for CISC or 1.4GHz for RISC based processor, 1GB RAM, DVD-RW drive, 160 GB Hard Disk Drive, 101-Enhanced style keyboards, mouse, parallel, serial and USB (2.0) ports. VDUs shall be 19" TFT active matrix color LCD with a minimum resolution of 1024 X 768. Appropriate network drive card shall also be provided wherever required.

CPU enclosures shall be desktop type and shall include available expansion slots except for the Craft Terminal which shall be a laptop. The craft terminal shall have minimum configuration of 1.83 GHz, 1GB RAM, 256 MB VRAM, DVD RW drive, 100 GB Hard Disk Drive, keyboard, mouse/trackball etc., LAN, serial/USB (2.0) ports to accommodate printers, and Internal/external Data/Fax modem and a battery back-up of at least 60 minutes. VDUs shall be 15" TFT active matrix color LCD with a minimum resolution of 1024 X 768.

2.3.6.2 Peripherals and hardware

TMN system shall be provided with laser printer. The laser printer shall have a minimum print speed 17 pages per minute and a minimum resolution of 600 dpi x 600 dpi. The laser printer shall have USB (2.0) & LAN port for connecting to TMN system.

The printer under this specification shall be colour & include print enhanced buffering to prevent loss of print data in the event of a print failure.

2.3.6.3 Local Operator Consoles

The Contractor shall provide operator consoles sized and equipped to support the offered subsystem(s) furnished and in compliance with the specification. The console shall provide hardware interfacing for the TMN users to the software operating support systems. At a minimum, a console shall include the hardware similar to a workstation.

2.3.7 General Software/Firmware Requirements

Due to various alternative design approaches, it is neither intended nor possible to specify all software and firmware characteristics. It is the intent herein to provide design boundaries and guidelines that help to ensure a demonstrated, integrated program package that is maintainable and meets both hardware systems requirements and the customer's operational requirements.

2.3.7.1 Software Utilities

A utility shall be provided to convert all reports into standard PC application formats i.e. dbase, dxf, excel, ASCII etc. as applicable.

2.3.7.2 Revisions, Upgrades, Maintainability

Software revisions, upgrades and maintainability are specified below:
All firmware and software delivered under this specification shall be the latest field proven version available at the time of approval. Installed demonstration for acceptance shall be required. All firmware provided shall support its fully equipped intended functional requirements without additional rewrite or programming.

All software shall be easily USER expandable to accommodate the anticipated system growth, as defined in this specification.

Software provided shall be compliant with national and international industry standards such as IEEE, ISO and OSF

2.3.7.3 Database(s)

The contractor shall develop all the databases for final communication network following the global acronyms for all stations. Database(s) to be provided shall contain all structure definitions and data for the integrated functional requirements of TMN system.

TMN operator Groups shall share the same virtual database. This means that they shall share the same database and database manager, whether or not physically separate databases are maintained.

2.3.7.4 Help

All applications shall be supported by USER accessible HELP commands that shall assist the USER in the performance of its tasks. HELP commands for an application shall be available to the USER from within the active application and shall not interfere with the activities of the application

2.4 DDF Patching Facilities

The Contractor shall supply and install all cabling, wiring, connectors, cross connects and Digital Distribution Frames (DDF) associated with the installation and interconnection of equipments procured under this package as follows:

(I) All the E1 ports shall be terminated on DDFs. DDF shall be provided for termination 16 E1 as minimum
(II) Cables (including connectors) for E1 level connections between DDF and telecom Equipment.
(III) Cables (including connectors) required for E-1 level connections of all other equipment to DDF and telecom Equipment.
(IV) All Ethernet ports shall be terminated with RJ-45 connector. Provision for 100% expansion with connector for terminating additional Ethernet ports shall be provided.
(V) Any other cables, connections etc required for a fully functional, integrated system.

2.5 Nil

2.6 Nil

2.7 ENVIRONMENT, EMI, POWER SUPPLY, CABLING AND EARTHING

The purpose of this section is to describe the minimum general equipment characteristics and specifications for environmental conditions, source power conditioning and backup, equipment construction, and installation. The section also highlights the Electro Magnetic Compatibility (EMC) guidelines for equipment that will be operated under the Electro Magnetic Interference (EMI) and Electro Static Discharge (ESD) conditions expected in an High Voltage (EHV) power system environment.

2.7.1 Environmental Requirements

Equipment and their components provided under this specification shall operate reliably under the following environmental conditions.

2.7.1.1 Temperature and Humidity

Most of the equipment will not be installed in environmentally controlled shelters. Therefore, equipment shall operate in accordance with the limits shown in Table 2-3.

Table 2-3
Environmental Operating Limits

Temperature Range: **To Specification** **Operation without damage** **Shipping/storage**	(Un Controlled Environment) 0 to +45 ^{o}C -10 to +55 ^{o}C -40 to +60 ^{o}C
Relative Humidity, non-condensing	Upto 90%
Elevation: **Operating** **Non-operating**	 to 3,500 m to 10,000 m

For each location, the Contractor is required to assess the environmental conditions for the equipment to be installed under this specification. The Contractor is responsible for all necessary enclosure, rack or equipment upgrades to ensure the proper operation of the installed equipment.

2.7.1.2 EMI and Electrostatic Interference

At each location, the Contractor shall assess the need for shielding against radiated emissions and shall provide recommended solutions for any EMI problem found at each location.

2.7.1.3 Tropicalization

Communications equipment will often be stored and operated in uncontrolled environment areas and will be subject to mould, growth of fungus, corrosion and oxidation. The equipment and components shall be suitably tropicalized during manufacture through commissioning, as necessary.

2.7.1.4 Contaminants

Communications equipment may be located in areas of poor air quality with the main contaminant being dust. Cabinets shall be tight fitting utilizing filtered ventilation openings only.

2.7.2 Primary Source AC/DC Power Requirements

Facility will be required to support both AC and DC power load requirements of telecommunication equipments as specified below:

2.7.2.1 AC Power Supply

It will be the Employer's responsibility to provide required Primary AC Power support for communications equipment installed under this specification. The Primary AC Power supplied will be 240 VAC ± 10%, 50Hz with a frequency variance between 46 and 55 Hz.

All equipment and components provided under this specification requiring Primary AC Power, shall be designed for normal operation under the above stated tolerances for 240 VAC supply.

2.7.2.2 -48V DC power Supply

Power supplies/converters for communications equipment (except computer system supplied as part of TMN which shall use 240 V AC) provided under this specification, shall use -48V DC uninterrupted primary source power. The contractor shall intimate the Employer the requirement of maximum projected load at -48 V DC for their equipment. The power supply may vary normally within the voltage range -42 to -58 V DC and the supplied equipment shall operate satisfactorily within this range.

2.7.2.3 Power Distribution and Protection

The Employer will furnish one source primary 240 VAC and/or -48 VDC power in each building. However, the equipment shall facilitate termination of two sources. It shall be the Contractor's responsibility for the connection and distribution of all Primary AC and -48V dc source power, in full compliance with all local and national electrical codes.

The Employer shall indicate during the survey by Contractor, on the primary source, the feeders/points that can be used by the Contractor. The Contractor shall provide required distribution panels, circuit breakers and appropriate Panel Disconnects. Distribution Panel feeders, Panel Disconnects, distribution panels and circuit breakers shall be sized and equipped to support at least 100% expanded load requirements.

The Contractor shall provide and install all required primary power distribution sourced from the distribution panels. The Contractor is responsible for all inter-rack (enclosure) and intra-rack (enclosure) power distribution required to support equipment supplied under this specification. The Contractor shall provide all cabling, fusing, switching and circuit breaker and surge protection required.

2.7.3 Signal Cabling

Connectorised signal cabling/wiring requires marking with a unique identifier at each connectorised end. The signal cable/wire identifier shall include a cable identifier and the location of both terminations. Signal cable/wiring installed on terminal blocks requires marking with the cable identifier and distant end location. The cable tag shall be clearly visible at the cable fan out point.

All signal cable, wiring and terminations shall be clearly labeled/tagged with identifiers consistent with Contractor supplied cable plant records. Marking techniques are subject to approval by the Employer.

2.7.4 Equipment Sub-Racks and Cabinets (Enclosures)

All equipment provided under this specification, shall be physically mounted in sub-racks and cabinets (enclosures). The Contractor shall determine and propose for the Employer approval, the type, size, weight and manner of installation for each location. All equipment racks, enclosures and equipment, including distribution frames, shall be clearly labeled with unique identifiers.

Selection of equipment sub-racks and cabinets (enclosures) shall meet the following requirements:

(A) Equipment Sub Rack Construction

Equipment Sub Racks provided for installation in environmentally controlled facilities, shall meet the following minimum requirements:

(1) Equipment Sub Racks shall be steel/aluminium fabricated and finished on all surfaces. All metal and welds shall be thoroughly cleaned and sanded to obtain a smooth finish. All surfaces shall be treated for rust and primed to form a bond between metal and the finish coats of paint.

(2) Equipment covers shall be provided for exposed components mounted in equipment sub Racks.

(3) Dust and moisture protection shall meet or exceed IP20 standards.

(B) Equipment Cabinet (Enclosure) Construction

(1) Equipment cabinets (enclosures) shall be steel/ steel & Aluminium extrusion fabricated and finished on all surfaces. All metal and welds shall be thoroughly cleaned and sanded to obtain a smooth finish. All surfaces shall be treated for rust and primed to form a bond between metal and the finish coats of paint.

(2) Equipment cabinets (enclosures) shall be designed free-standing but shall be mounted to the floor. Cabinets (enclosures) shall have secure fitting, lockable, full-length front doors for access to hardware and wiring. Equipment covers for exposed components mounted inside cabinets are not required unless specifically recommended.

(3) All doors and removable panels shall be fitted with long life rubber beading. All panels shall be fabricated from minimum 2.0mm thickness steel sheet. However, for racks with load bearing Aluminum extrusion frame, door panels and side panels may be fabricated from minimum 1.6mm thickness steel sheet and the top & bottom panels shall be fabricated from minimum 2.0mm thickness steel sheet.

(4) Equipment cabinets (enclosures) shall be dust and moisture-proof as per IP41 specification, or better.

2.7.5 Lightning and Transient Voltage Protection

The Contractor shall be required to provide protection from lightning and transient voltages for all telecommunications equipment, in accordance with the following:

(1) At the outside cable plant point-of-entry of all cabling penetrations for all cabling installed by the Contractor, the Contractor shall provide lightning and transient voltage isolation for the inside plant cabling, wiring, and all terminations and equipment.

(2) All equipment installed under this specification that requires 240VAC primary power, shall be surge protected.

2.7.6 Station Safety Earthing and Signal Grounding

For each facility, the Contractor is responsible for meeting the following station and equipment earthing requirements:

(1) All safety earthing and signal grounding shall be in full compliance with EMI/EMC requirements as per relevant international standards

(2) Each cabinet (enclosure) or cabinet (enclosure) group shall include suitable signal ground and safety earth networks. The signal ground network shall terminate at a separate signal ground stud connection isolated from safety earth.

(3) Each earth/ground network shall utilize copper bus bars, copper braids and/or 16 sqmm or bigger earth cable. All equipment earth/ground connections shall be made directly to the equipment chassis utilizing grounding lugs and secured metal-to-metal with star washers. Use of the enclosure frame, skin or chassis mounting hardware as part of the earthing/grounding networks, is not acceptable.

(4) The safety earth network shall be connected to "earth ground" at the safety earth stud. The earth stud connection shall be sized for an external earthing cable equipped with a 2/0 solid copper lug secured metal-to-metal with star washers. Primary AC feeds and distribution within enclosures, requires earthing wire connection to the safety earth stud.

(5) The safety earth and signal ground networks shall be inter-connected only at the safety earth stud and signal ground stud.

At each location, the owner shall extend the existing station earth to the equipment room. The Contractor shall be responsible for determining the suitability of existing station earth for the equipment to be supplied under this contract.

The Contractor is responsible for providing all required earthing/grounding cable and installation. Cabinet (Enclosure) and equipment safety earthing and signal grounding shall be subject to the Employer's approval.

The Contractor shall be responsible for providing earthing systems including earth pits, earthing studs and earthing net etc, as required, wherever the existing station earthing is found to be unsuitable for equipment being provided by the Contractor. In case new earthing studs are provided, the contractor shall be responsible for connection of new studs to the existing studs if any.

2.7.7 Interconnections

All power and signal cabling between component units of the communications systems shall be supplied and installed by the Contractor and shall be shown on contractor-supplied as-built drawings.

The Contractor shall supply and install all primary power cords, power strips, receptacles, circuit breakers, fuse panels, switches, earth fault detectors, surge protectors, distribution cabling, and power connectors required to support all equipment enclosures and system components furnished and installed under this specification, except as specifically excluded. Plug-type power connectors with captive fastening (such as "Twist-Lock") shall be used for interconnection of source power to the equipment enclosures or racks. Plug-type connectors with captive fasteners (i.e. DB-25, etc) shall be used for the interconnection of all inter and intra-enclosure signalling cable.

2.7.8 Locations for Supplied Equipment

All transmission equipment, the TMN and associated equipment shall generally be collocated in the communications room located in the Control Room Building whenever possible.

2.7.9 Cable Routing

In case TMN workstations are located remotely, the Contractor shall provide all cable, wiring, long haul landline interfacing and installation to facilitate communication channel requirements for the TMN.

2.8 Testing Requirement

The Type Testing and Factory Acceptance Test are to be carried out are as follows: General requirement of testing is given in Section-08.

2.8.1 Type Testing

The Contractor shall submit previously carried out type test for the SDH equipment. If the test reports are found satisfactory the Employer may waive off the requirement of the type testing. If the Contractor fails to submit the relevant type test report or if Employer recommends necessity of the type testing, the test specified below in this section shall be carried out by the Contractor. The Contractor shall demonstrate the performance of the offered equipment in conformance to the approved DRS. The functional tests shall be carried out on one sample before commencement of the type tests mentioned below and shall be repeated after the completion of these type tests. Further, the following functional checks shall be done during and after each type test in order to check the satisfactory performance of the equipment.

a) BER monitoring test and packet loss test for Ethernet Interface
b) Alarm status

2.8.2 List of Type Tests

The type testing requirement for communication equipment is defined in the section below:

2.8.2.1 Temperature and Humidity Tests

The tests listed below are defined in IEC Publication 68.

(a) Low Temperature Test: Operation to Specifications

Low temperature tests shall be conducted as defined in IEC Publication 68-2-1, test method and, with the following specifications:

(1) Test Duration: The equipment is started up as soon as thermal equilibrium has been reached and operated for sixteen (16) hours. Its performance is checked during the test.

(2) Degree of Severity: Test shall be done at 0 ^{o}C.

(3) Acceptance Criteria: No degradation of performance during and after the test.

(b) Low Temperature Test : Operation without Damage

Low temperature tests shall be conducted as defined in IEC Publication 68-2-1, test method Ad, with the following specifications:

(1) Test Duration: The equipment is started up as soon as thermal equilibrium has been reached and operated for 72 hours. Its performance is checked during the test and after the test as soon as the thermal equilibrium is reached at the room temperature (*Post-test*).

(2) Degree of Severity: Test shall be done at -10 ^{o}C.

(3) Acceptance Criteria: Degradation of performance is allowable during the test, however there shall be no degradation of performance in the *post-test*.

(c) Dry Heat Test : Operation to Specifications

Dry heat test shall be done as defined in IEC Publication 68-2-2, test method Bd, with the following specifications:

(1) Test Duration: The equipment is started up as soon as thermal equilibrium has been reached and operated for 96 hours. Its performance is checked during the test.

(2) Degree of Severity: 45 ^{o}C .

(3) Acceptance Criteria: No degradation of performance during and after the test.

(d) Dry Heat Test : Operation without Damage

Dry heat tests shall be done as defined in IEC Publication 68-2-2, test method , with the following specifications:

(1) Test Duration: The equipment is started up as soon as thermal equilibrium has been reached and operated for 96 hours. Its performance is checked during the test and after the test as soon as the thermal equilibrium is reached at the room temperature (*Post-test*).

(2) Degree of Severity: Test shall be done at 55^{o}C.

(3) Acceptance Criteria: Degradation of performance is allowable during the test, however there shall be no degradation of performance in the *post-test*.

(e) Damp Heat Test

Damp heat testing reveals aging with respect to the humidity level and applies basically to electronic equipment. This test shall be done as defined in IEC Publication 68-2-3 with the following specifications:

(1) Test Duration: The equipment is started up as soon as thermal equilibrium has been reached and operated for 10 days. Its performance is checked during the test.

(2) Acceptance Criteria: The equipment shall meet the specified requirement and there shall not be any degradation in BER.

(f) Temperature Variation Test

Temperature variation testing shall be as per IEC Publication 68-2-14 (Gradual Variations, Method Nb). The equipment shall be powered on and various parameters shall be monitored continuously during the test period.

(1) Number of cycles required is five (5)

(2) The degree of severity: temperature: TL:0°C , TH:45°C

(3) Cycle duration for each temperature is three (3) hours.

(4) Ramp : 1 ^{o}C/minute.

(5) Acceptance Criteria: The equipment shall meet the specified requirement and there shall not be any degradation in BER.

2.8.2.2 Power Supply and EMI/EMC tests

The test procedure and acceptance criteria shall be as defined in IEC 870-2-1.

(a) Immunity Tests

The list of Immunity tests are specified below in Table 2-4:

(b) Emission Tests

The list of Emission tests are specified below in Table 2-5

Table 2-4:
Recommended Immunity Tests

S. No.	Immunity Test IEC 1000-4-1	AC Power Supply	DC Power Supply	Control & Signal	Telecom Line	Parameters
1.1	Harmonics	Yes	N/A	N/A	N/A	Table 11 of IEC 870-2-1: 1995 - **Level : 1**
1.2	Interharmonics	Yes	N/A	N/A	**N/A**	
1.3	Signalling Voltage	Yes	N/A	N/A	N/A	
1.4	Voltage Fluctuations	Yes	Yes	N/A	N/A	
1.5	Voltage dips and Interruptions	Yes	Yes	N/A	N/A	
2.1	100/1300 µs surge	Yes	Yes	N/A	N/A	Table 12 of IEC 870-2-1: 1995 - **Level : 3**
2.2	1.2/50 - 8/20 µs surges	Yes	Yes	Yes	N/A	
2.3	Fast transient bursts	Yes	Yes	Yes	Yes	
2.5	Damped oscillatory waves	Yes	Yes	Yes	Yes	
2.8	10/700 µs surges	N/A	N/A	N/A	Yes	
3.1	Electrostatic discharge	Yes				Table 13 of IEC 870-2-1: 1995 - **Level : 3**
4.1	Power frequency magnetic field	Yes				Table 14 of IEC 870-2-1: 1995 - **Level : 3**
4.3	Damped oscillatory magnetic field	Yes				
5.1	Radiated electromagnetic field	Yes				Table 15 of IEC 870-2-1: 1995 - **Level : 3**
6.1	Power Frequency voltage on control and signal lines	N/A	N/A	Yes	Yes	
6.2	DC voltage on control and signal lines	N/A	N/A	Yes	N/A	
-End Of Table-						

Table 2-5:
Recommended Emission Tests

S.NO.	Emission test	AC Power Supply	DC Power Supply	Control & Signal	Telecom Line	Para-metres
1	Harmonics currents IEC 1000-3-2	Yes	N/A	N/A	N/A	Table 17 of IEC 870-2-1: 1995 - Class **: B**
2	Voltage fluctuations IEC 1000-3-3	Yes	N/A	N/A	N/A	
3	LF disturbance voltages CCITT recommendation P.53	N/A	Yes	N/A	N/A	
4	Transient disturbance voltages	Yes	Yes	N/A	N/A	
5	RF disturbance voltages CISPR 22	Yes	Yes	N/A	N/A	
6	RF disturbance currents CISPR 22	N/A	N/A	N/A	Yes	
7	RF radiated fields CISPR 22	Yes				
-End Of Table-						

(c) Insulation Withstand Voltages

As per section 6 of IEC 870-2-1. Recommended class : VW1 of Table 18.

2.8.2.3 Mechanical Tests

The following tests shall be performed with the equipment packed according to the Contractor's specifications to demonstrate safe transportation of the equipment:

(a) Mechanical Vibration Test

The procedure for this test is described in IEC Publication 68-2-6. The testing procedure shall be carried out in the sequence 8.1 + 8.2.1 + 8.1 as described in document 68-2-6.

For the vibration response investigation (clause 8.1 of 68-2-6), the test shall be carried out over a sweep cycle under the same conditions as for the endurance test (described later), but the vibration amplitude and the sweep rate may be decreased below these conditions so that the determination of the response characteristics can be obtained.

The endurance test conditions are selected according to the vibration withstand requirements.

(b) Shock Test

The procedure of this test is defined in IEC Publication 68-2-27 (each test) with a semi sinusoidal shape (clause 3.1.1.2).

The recommended severity shall be A = 294 m/s^2, D = 18 ms. Three shocks per axis per direction shall be applied to the equipment packed according to the Contractor's specifications.

Or Free Fall Test

This test could be performed as an alternative to the shock or Bump test. The procedure is defined in IEC publication 68-2-32. The equipment shall be packed according to the Contractor's specifications. The drop height shall be defined in accordance with IEC 68-2-32. The surface of the packing case which comes into contact with the ground is the surface on which the packing case normally rests; if the packing does not have any features (inscription, special shape, etc.) identifying this surface, the test is carried out successively on all the surfaces of the packing.

Or Bump Test

This test could be performed as an alternative to Shock test or Free Fall test. The procedure is defined in IEC 68-2-29.

2.8.3 Factory Acceptance Tests

The list factory acceptance tests for SDH equipment is provided in table 2-6 below. This list of factory acceptance tests shall be supplemented by the Contractor's standard FAT testing program.

Table 2-6:
Factory Acceptance Tests for SDH equipment

Item	Description:
1.	Physical inspection for conformance to DRS, BoQ, drawings and appearance of equipment
2.	Optical output power

3.	Transmitter light wave spectral analysis
4.	Low receive level threshold
5.	Generation of bit error rate curve
6.	Electrical interface tests which include: output and input jitter, bit error rate, pulse shape, and line rate tolerance, cable compensation
7.	Measurement of analog and digital service channel parameters/functionality
8.	Performance of supervision, alarm, diagnostics, loopbacks etc. through Craftsperson interface,
9.	Simulation of failure conditions and failover of each redundant unit.
10	At a minimum tests on Ethernet interface shall include demonstration of Ping test, Through put test, Latency test, Packet loss test as per RFC 2544
11	Test of spare card slots
12.	Checks of power supply/converter voltage margins
13.	Random inspections and any other additional tests to verify the accuracy of documentation
14	Test of spare parts/modules/cards as applicable tests.
	End of the Table

2.8.3.1 FAT of NMS

Physical inspection of TMN hardware for conformance to approved BoQ & drawing. Testing of TMN to demonstrate proper operation of all functions: Configuration Management, Performance Management, Fault Management and Security Management. All standard features and required customization of the TMN shall be demonstrated for proper functioning.

2.8.4 Site Acceptance Tests (SAT)

The SAT Shall be completed in following phases:

2.8.4.1 Installation Testing

The field installation test shall be performed for all equipment at each location. If any equipment has been damaged or for any reason does not comply with this Specification, the Contractor shall provide and install replacement parts at its own cost and expense.

In the installation test report, the Contractor shall include a list of all hardware or components replaced or changed between the completion of factory tests and the start of field tests and show that documentation and spare parts have been updated.

The minimal installation testing requirements for the fiber optic transmission subsystem are provided in Table 2-7

2.8.4.2 Link Commissioning Tests

The commissioning tests shall verify that communication can be performed over the fiber optic link under test. In addition, Bit Error measurements and service channel performance monitoring shall be made on the fibre optic links to verify compliance with designed link performance.

For Ethernet interface: At a minimum the following test requirements shall be demonstrated as per RFC 2544:

a) Ping Test
b) Through Put
c) Latency
d) Packet loss

10% of the total links (Chosen by the Employer, generally to cover links from all configurations used) shall be tested for a duration of 12 Hours. Rest of the links shall be tested for 1 Hour. In case a link does not meet the performance requirements during 1 hour, then the duration of the test shall be increased to 12 hours. In case any link does not meet the performance requirements during 12 hour, then the cause of failure shall be investigated and the test shall be repeated after rectifying the defects.

This phase of testing shall be conducted by the Contractor and witnessed by the Purchaser. Field adjustments shall be made to meet established standard, however if the field adjustments fail to correct the defects the equipments may be returned to the Contractor for replacement at his own expense. In case any adjustments are required to be made during the interval of the test then the test shall be repeated.

2.8.4.3 Integrated Testing

Prior to commencement of integrated testing the overall system shall be configured as required to provide all the data and voice channel required to interconnect various RTUs and Control centre.

Integrated testing shall include end to end testing of the entire communication system. The intent of integrated testing is to demonstrate that the equipment is operational end to end under actual conditions, that all variances identified during factory and field installation and communications testing have been corrected, and that the communication equipment is compatible with other equipment at all locations. The Integrated System Test shall include all fibre optic transmission equipment, the network management subsystem and other components, which were integrated to the communication system. The Integrated System Test shall include all fibre optic transmission equipment, PABX system, network management subsystem and other components.

At a minimum the following tests shall be included in the integrated testing:

(2) Installation testing for TMN as per tables 2-8 and equipment configuration shall be checked to establish that it supports the required channel routing plan.

(3) End to End testing of all channels provided for TMN systems to demonstrate proper operation.

(4) End to end testing of all individual voice circuits originating from VOIP/PABX or Phones and to establish proper interfacing with PABX/phones and to demonstrate proper operation of channels over wideband system. Operation shall be checked in terms of quality of voice, call initiation and call termination process.

(5) Data connectivity from SCADA/DMS control centre with remote location (RTU location) shall be verified. Operation shall be checked in terms of BER and packet loss for Ethernet interfaces

(4) Testing of TMN to demonstrate proper operation of all functions : Configuration Management, Performance Management, Fault Management and Security management. All the standard features and required customization of the TMN shall be demonstrated for proper functioning.

(5) Demonstration of Protection switching

Table 2-7
Fibre Optic Transmission system (SDH) Installation Testing

Item:	Description:
1.	Physical Inspection for conformance to drawings, rack elevations and appearance of equipment and cabling
2.	Station power supply input and equipment power supply (DC-DC converter) output voltage if access to o/p is available or external converters used measurements
3.	Terminal transceiver performance testing (Tx power, receive signal strength etc.)
4.	Service channel performance, EOW functionality in link test.
5.	Craftsperson interface, alarm and control functional performance
6.	Rack and local alarms: No unwanted alarms shall be present and all alarms shall be demonstrated to be functional
7.	Correct configuration, level setting & adjustments and termination of Input/ output interfaces
8.	Proper establishment of Safety and signalling earthing system and resistance to ground to be checked.
9.	Simulation of failure conditions and failover of protected components.

Table 2-8
TMN Installation Testing

Item:	Description:
1.	Physical inspection for conformance to drawings, rack elevations and appearance of equipment and cabling
2.	Workstation hardware inventory, configuration and characteristics
3.	Demonstration of proper operation of all hardware, including workstations peripherals

2.8.1 SDH Equipment

2.8.1.1 Functional Requirement

The offered equipment shall be configurable either SDH Terminal Multiplexer (TM) or SDH Add/Drop Multiplexer (ADM) or Digital Cross Connect (DXC). For the purpose of the BoQ, the **SDH Equipment** is considered to be divided in three parts i.e. **Optical cards** (Line), **Tributary Cards** (Electrical Tributaries such as E1 & Ethernet 10/100 Mbps interface) and **Base Equipment** (Consisting of Common Cards, Power supply cards, power cabling, sub-rack, other hardware and accessories required for installation of equipment i.e. everything besides optical cards and tributary cards).

The offered equipment shall support at least four optical directions with STM 1 as aggregate interfaces, 4 Ethernet Interfaces & 4 E1 interfaces as tributaries. The SDH equipment shall be equipped with required aggregate and tributary interfaces based on the network topology as indicated in the BOQ. The offered equipment shall support the following network topologies:

d. TM (with protected/unprotected aggregates)
e. ADM (with protected/unprotected aggregates)
f. DXC (with protected/unprotected aggregates)

The ADM Equipment shall be capable of VC-12 level Cross Connection of up to 4 STM-1equivalent and support mapping of each Ethernet interface over any single or multiple VC-12s.The equipment shall support VC-12 cross connection in all the 4 directions. The equipment shall provide access to full STM1 Payload.

The SDH equipment should support four optical directions and it shall be possible to implement MSP & SNCP protection scheme.

2.8.1.2 Redundancy and Protection

The network connectivity is planned in rings with SNCP protection. On linear sections of the network, MSP protection using 4 fibres may be implemented. However, actual implementation of protection scheme (MSP or SNCP) shall be finalized during detailed engineering.

2.8.1.3 Service Channel

Service channels shall be provided as a function of the SDH equipment and shall be equipped with Service Channel Modems that shall provide at a minimum: One voice channel (order wire) with analog interface (0.3 to 3.4 kHz) and One data channel. Both omnibus and selective calling facilities shall be provided. There shall be a facility to extend the line system order-wire to any other system or exchange lines on 2W/4W basis.

2.8.1.4 Supervision and Alarms

ISM (In Service Monitoring) circuitry shall be provided as a function of the SDH equipment. Local visual alarm indicators shall be provided on the equipment, as a rack summary alarm panel. Alarms shall be as per ITU-T Standards G.774, G.783 and G.784. Additionally, F2 and Q2 interfaces for a local craftsperson terminal interface and remote equipment monitoring is required.

The Equipment shall support collection of at least four (4) external alarms for monitoring and control of station associated devices by the TMN. The Employer shall identify the alarm contact points during survey / detailed engineering and the wiring supply, installation and termination from these external points to the installed equipment shall be carried out by the Contractor.

2.8.1.5 Synchronisation Output

The equipment shall provide synchronisation as per table 2-2. One 2MHz synchronisation output from each equipment shall be provided.

2.8.1.6 Electrical and Optical I/O Characteristics and General Parameters

Table 2-2 provides the electrical and optical characteristics as well as other general parameters for SDH equipment.

Table 2-2

Electrical and Optical I/O Characteristics and General Parameters

Optical Wavelength NOTE (1)	1310/1550nm
Optical Source NOTE (2)	Laser
Optical Source Lifespan	Better than 5 $X10^5$ hours
Optical Fibre Type	G.652
Optical Connectors	Type FC-PC
Transmission Quality	Per ITU-T G.821, G.823, G.826
Source Primary Power	-48 Vdc
Equipment Specifications	Per ITU-T G.783
Tributary, Electrical Interface	Per ITU-T G.703, 75 Ω/ 120 Ω
Ethernet 10/100 Mbps interface	Per IEEE 802.3

SDH Bit Rates	Per ITU-T G.703
Optical Interfaces	Per ITU-T G.957, G.958
Frame and Multiplexing Structure for SDH	Per ITU-T G.707
Synchronisation	Per ITU-T G.813
Management Functions	Per ITU-T G.774, G.784
Protection Architectures	Per ITU-T G.841
Built In Testing and Alarms	Per ITU-T G.774, G.783, G.784

NOTE (1) Optical wavelength shall be selected considering the characteristics of the optical fibre and the link budget.

NOTE (2) **Eye Safety for Laser Equipment:** To avoid eye damage, when a receiver detects a line interruption, it is required that the optical power of the laser shall be reduced to safe limits on the transmitter in the opposite direction as per ITU-T G.958.

NOTE (3) In case other than FC-PC connector is provided in the equipment suitable patch cord with FC-PC connectors are to be provided to connect with FODP.

2.8.2 Optical Link Performance Requirements

The optical fibre link performance requirements are specified as follows.

2.8.2.1 Link Budget Calculations

The fibre optic link budget calculations shall be calculated based upon the following criteria:

(1) Fibre attenuation: The fibre attenuation shall be taken to be the guaranteed maximum fibre attenuation i.e. 0.21 dB/Km @1550nm and 0.35 dB/km @1310nm.

(2) Splice loss: Minimum 0.05 dB per splice. One splice shall be considered for every 2 kms.

(3) Connector losses: Losses due to connectors shall be considered to be minimum 1.0 dB per link.

(4) Equipment Parameters: The equipment parameters to be considered for link budget calculations shall be the guaranteed "End of Life (EOL)" parameters. In case, the End of Life parameters are not specified for the SDH equipment, an End of Life Margin of at least 2 dB shall be considered.

(5) Optical path Penalty: An optical path penalty of at least 1 dB shall be considered to account for total degradations due to reflections, inter symbol interference, mode partition noise and laser chirp.

(6) Maintenance Margin: A maintenance margin of at least 2.5 dB/100Km shall be kept towards cabling, repair splicing, cable ageing and temperature variations etc.

(7) Other losses: Other losses, if any required specifically for system to be supplied shall also be suitably considered.

(8) Dispersion: The fibre dispersion shall be taken to be the guaranteed maximum dispersion i.e 20 ps/nm.Km @1550 nm and 6 ps/nm Km @ 1310 for DWSM fibres.

(9) Bit Error Rate: The link budget calculations shall be done for a BER of 10^{-10}.

The bidders shall determine the total link loss based on the above criteria and shall submit the system design (including link budget calculation) and BoQ for SDH equipment.

For finalising the FOTS system design & BOQ, similar methodology shall be adopted taking into account fibre attenuation, dispersion and splice loss determined during the detailed engineering. Accordingly, additions and deletions from the contract shall be carried out based on unit rates indicated in the contract.

2.8.2.2 Link Performance

The Link performance for ES, SES and BER for the fibre optic links shall correspond to National Network as defined in ITU-T G.826. Further, the packet loss shall not be more than one percent in any of the Ethernet circuits of the offered system.

2.8.2.3 FODP to SDH Equipment Connectivity

The Contractor shall be responsible for connectivity between the FODP and the SDH equipment. The Contractor shall provide FC-PC coupled patch cords of suitable length.

The patch-cord length between the FODP & equipment rack shall be suitably protected from rodents, abrasion, crush or mechanical damage otherwise by flexible conduits.

The patch -cord return loss shall be equal to or better than 40 dB and insertion loss equal to or less than 0.5 dB.

2.9 TELECOMMUNICATION MANAGEMENT NETWORK

The Contractor shall provide a Telecommunication Management Network System (TMN) also referred as NMS to provide operational support for the FOTS and associated equipment. This TMN shall provide the capability to monitor, reconfigure, and control elements of the telecommunications network from a centralized location and at each node of the network where equipment is located. This TMN system shall assist Employer in the operations and maintenance of the wideband communication resources including detection of degraded equipment, system performance, the diagnosis of problems, the implementation of remedial actions and the allocation or reallocation of telecommunications resources and addition/deletion of network elements.

The bidder shall provide details of the offered TMN in the bid supporting all the features. The furniture for placement of the TMN hardware shall be provided by the Contractor.

2.9.1 Applicable Standards

The TMN design concept, functional and informational architecture and physical architecture, shall be in compliance with CCITT Recommendation M.3010.

TMN shall also include the monitoring of the Ethernet interfaces/Switching modules of SDH equipment (or external layer-2 switches) for configuration, alarm and performance monitoring as a minimum requirement.

2.9.2 NMS Architecture

The NMS shall provide

a. Collection of Management data from all Network Elements (NEs) supplied under this package.

b. Processing of above management data by using processor(s) located at control Centre.

c. Monitoring and control of the NEs as defined below:

   I) TMN system at Control Centre shall support management of all equipments supplied and monitoring of the complete network supplied under this package. At a minimum functions of Network Management Layer (NML) and Element Management Layer (EML) as defined in CCITT M.3010 shall be provided. The detailed functions are described below in this Section:

   II) Monitoring and control of NEs using Craft Terminals as defined in this section.

d. Supervisory monitoring and control of the following station associated devices:

   I) Intrusion Detection Alarms
   II) Power Failure
   III) Fire and Smoke Detection
   IV) Environmental Control (Temperature, Humidity etc.)

e. Communication channel support for TMN system

The supplied TMN system shall be capable of handling all management functions for at least 200 % of the supplied network elements. Further, the centralised TMN system shall have provision for addition of at least two remote operator consoles. The TMN hardware shall be so designed that failure of a single processor & component (router, switch, converter etc.) shall not inhibit any of the functionality of the TMN system.

The Contractor shall submit for Employer's approval the TMN architecture describing in detail the following subsystems/features:

a. Database used in TMN
b. Master Processor, server/workstation, LAN, Peripherals and hardware
c. Software and operating system
d. Local Consoles
e. Craft Terminals
f. Data communication between NEs, Local Consoles and TMN Processor(s)
g. Routers/Bridges
h. Expansion Capabilities

2.9.3 Management Functions

The TMN shall support following Management functions:

2.9.3.1 Configuration Management

Configuration management is concerned with management, display, and control of the network configuration. Minimum specific requirements that shall be satisfied include the following:

a. Provide tools to establish and maintain the backbone topology and configuration information and provide graphical maps depicting the configurations.

b. Gather descriptive information about the current configuration of the equipment, provide operator displays, and prepare reports.

c. Provide tools for planning, establishing, and changing the static equipment configuration. Provide for changes to the equipment configuration in response to equipment failures, planned upgrades, and operator requests to take equipment offline for testing.

f. Provide verification testing to support new equipment installation.

2.9.3.2 Fault Management

Fault management is concerned with detecting, diagnosing, bypassing, directing service restoral, and reporting on all the backbone network equipment, system and links, Minimum specific requirements that shall be satisfied include the following:

a. Display equipment status in a consistent fashion regardless of the source of the data on a graphical topological, map-type display. Status shall be displayed through the use of colours on links and nodes as well as through text.

b. Obtain status and detect faults through periodic polling, processing of unsolicited alarms and error events, and periodic testing for connectivity.

c. Maintain an alarm summary of unacknowledged alarm events on the management station display and maintain a log of all received alarms. The operator shall be able to acknowledge and clear alarms individually and as a group. The use of alarm correlation techniques is encouraged to minimize the proliferation of alarms caused by a single, common event. All alarms shall be configurable as critical alarms, major alarms and minor alarms with different colours like red, amber/orange, blue etc. The normal condition shall be green (preferably) in colour.

d. Provide the capability to diagnose and isolate failures through analysis of error and event reports and through the use of both on-line and off-line diagnostic tests and display of monitored data.

e. The criteria for failover shall be configurable as automatic failover to redundant equipment where possible and through operator-initiated actions where automatic failover is not possible. The status of fail over shall be reported to TMN.

g. Track network equipment failure history.

2.9.3.3 Performance Management

Performance management is concerned with evaluation of the use of network equipments and their capability to meet performance objectives. Minimum specific requirements that shall be satisfied include the following:

a. Provide support for an operator to initiate, collect, and terminate performance metrics under both normal and degraded conditions. For example, BER of each link together with other data measured at each node, shall be available on operator request.
b. Monitor point to point, end to end errors/signal quality and history. Provide operator controls to monitor performance of specified events, measures, and resources. Specifically provide displays to permit the operator to:

1. Select/deselect network equipments, events, and threshold parameters to monitor

2. Set monitoring start time and duration or end time

3. Set monitoring sampling frequency

4. Set/change threshold values on selected performance parameters

5. Generate alarm events when thresholds are exceeded.

6. Set multiple thresholds on certain performance parameters. Alarm categories include as a minimum a warning and a failure.

7. Calculate selected statistical data to measure performance on selected equipment based on both current and historical performance data maintained in performance logs. Performance data provided is limited to what is available from the equipment Contractors.

8. Provide graphical displays of NE current performance parameter values. Provide tabular displays of current, peak, and average values for performance parameters.

10. Generate reports based on system statistics such as daily, weekly, monthly yearly performance reports.

2.9.3.4 Security Management

The TMN shall be provided with security features to limit access to monitoring and control capabilities to only authorized personnel. One access level of System Administrator and at least two levels of operator access shall be provided - read only, and write. The system administrator shall be able to create, define and modify operators with different access levels, network domains and perform all kind of maintenance and up gradation of the TMN system. With "read only" access level, network parameters should only be viewed. Access to database maintenance, command control and test functions shall be available with "write" access level. Means shall be provided to ensure only one authorized user has write capability for a selected domain of the network. It shall be possible to define multiple domains for the purpose of monitoring and control.

Human error and conflict detection are also required. Such errors and access violations shall be reported to the offending user as error messages and warnings.

2.9.4 Communication Channel Requirements and Integration

Communication requirements for TMN system have not been considered in Appendices and the Contractor shall provide these as a part of TMN system. The Contractor shall provide all required interface cards / devices, LAN, routers/bridges, channel routing, cabling, wiring etc. and interfacing required for full TMN data transport.

The TMN data transport shall utilize the fibre optic communications transmission system service channel in the overhead whenever possible. This will provide inherent critical path protection.

In case supervisory channels are not available, the Contractor shall provide suitable interfaces in their supplied equipment for transport of TMN data. The Contractor shall also be responsible for providing suitable channels with appropriate interfaces to transport the TMN data.

The bidders shall describe in the proposal the TMN data transport proposed to be used by the bidder in detail including capacity requirements and various components/equipment proposed to be used.

2.9.5 Craft Terminal

Each SDH equipment on the telecom network shall include provision for connecting a portable personal computer (PC) to be known as craft terminal to support local commissioning and maintenance activities. It shall also be possible to remote login to other NE(s) through craft terminal. Through the use of this PC and local displays/controls, the operator shall be able to:

a. Change the configuration of the station & the connected NEs.

b. Perform tests

c. Get detailed fault information

2.9.6 Hardware Requirements

2.9.6.1 Master Processor, Server/Workstation and Craft Terminal

The server/workstation and craft terminal shall have Dual Core processor(s) which shall be sufficient to meet all the functional requirement and expansion capabilities stipulated in this specification. Only reputed make like Dell, IBM, HP make shall be supplied.
The server shall have minimum configuration of 3GHz for CISC based or 1.6GHz for RISC based processor, 2GB RAM, DVD-ROM drive, redundant 80 GB internal Hard Disk Drive, 101-Enhanced style keyboards, mouse, parallel, serial and USB(2.0) ports. VDUs shall be 17" TFT active matrix color LCD with a minimum resolution of 1024 X 768. Appropriate network drive card shall also be provided wherever required. However, the internal hard disk drive for the server shall be redundant and all the data shall be mirrored. Further, the TMN software shall support data mirroring on redundant disk drives.

The workstation shall have minimum configuration of 2.4Ghz for CISC or 1.4GHz for RISC based processor, 1GB RAM, DVD-RW drive, 160 GB Hard Disk Drive, 101-Enhanced style keyboards, mouse, parallel, serial and USB (2.0) ports. VDUs shall be 19" TFT active matrix color LCD with a minimum resolution of 1024 X 768. Appropriate network drive card shall also be provided wherever required.

CPU enclosures shall be desktop type and shall include available expansion slots except for the Craft Terminal which shall be a laptop. The craft terminal shall have minimum configuration of 1.83 GHz, 1GB RAM, 256 MB VRAM, DVD RW drive, 100 GB Hard Disk Drive, keyboard, mouse/trackball etc., LAN, serial/USB (2.0) ports to accommodate printers, and Internal/external Data/Fax modem and a battery back-up of at least 60 minutes. VDUs shall be 15" TFT active matrix color LCD with a minimum resolution of 1024 X 768.

2.9.6.2 Peripherals and hardware

TMN system shall be provided with laser printer. The laser printer shall have a minimum print speed 17 pages per minute and a minimum resolution of 600 dpi x 600 dpi. The laser printer shall have USB (2.0) & LAN port for connecting to TMN system.

The printer under this specification shall be colour & include print enhanced buffering to prevent loss of print data in the event of a print failure.

2.9.6.3 Local Operator Consoles

The Contractor shall provide operator consoles sized and equipped to support the offered subsystem(s) furnished and in compliance with the specification. The console shall provide hardware interfacing for the TMN users to the software operating support systems. At a minimum, a console shall include the hardware similar to a workstation.

2.9.7 General Software/Firmware Requirements

Due to various alternative design approaches, it is neither intended nor possible to specify all software and firmware characteristics. It is the intent herein to provide design boundaries and guidelines that help to ensure a demonstrated, integrated program package that is maintainable and meets both hardware systems requirements and the customer's operational requirements.

2.9.7.1 Software Utilities

A utility shall be provided to convert all reports into standard PC application formats i.e. dbase, dxf, excel, ASCII etc. as applicable.

2.9.7.2 Revisions, Upgrades, Maintainability

Software revisions, upgrades and maintainability are specified below:
All firmware and software delivered under this specification shall be the latest field proven version available at the time of approval. Installed demonstration for acceptance shall be required. All firmware provided shall support its fully equipped intended functional requirements without additional rewrite or programming.

All software shall be easily USER expandable to accommodate the anticipated system growth, as defined in this specification.

Software provided shall be compliant with national and international industry standards such as IEEE, ISO and OSF

2.9.7.3 Database(s)

The contractor shall develop all the databases for final communication network following the global acronyms for all stations. Database(s) to be provided shall contain all structure definitions and data for the integrated functional requirements of TMN system.

TMN operator Groups shall share the same virtual database. This means that they shall share the same database and database manager, whether or not physically separate databases are maintained.

2.9.7.4 Help

All applications shall be supported by USER accessible HELP commands that shall assist the USER in the performance of its tasks. HELP commands for an application shall be available to the USER from within the active application and shall not interfere with the activities of the application

2.10 DDF Patching Facilities

The Contractor shall supply and install all cabling, wiring, connectors, cross connects and Digital Distribution Frames (DDF) associated with the installation and interconnection of equipments procured under this package as follows:

(I) All the E1 ports shall be terminated on DDFs. DDF shall be provided for termination 16 E1 as minimum
(II) Cables (including connectors) for E1 level connections between DDF and telecom Equipment.
(VI) Cables (including connectors) required for E-1 level connections of all other equipment to DDF and telecom Equipment.
(VII) All Ethernet ports shall be terminated with RJ-45 connector. Provision for 100% expansion with connector for terminating additional Ethernet ports shall be provided.
(VIII) Any other cables, connections etc required for a fully functional, integrated system.

- END OF SECTION 5 -

SECTION - 6

Reference No.: TCIL/15/914/1/09-MM/41 E **January 21, 2009**

BILL OF QUANTITY & PRICE BID SCHEDULE

Sl. No.	Item Description	Quantity	Ex- Factory Price in INR. (Basic Unit Price exclusive of all levies & charges)	Excise Duty		CST against Form 'C'/ VAT		Freight		Any other levy/charges/Packing, Forwarding & Transit Insurance charges	Discount	Unit Price inclusive of all levies & charges less discount [4+6+8+10+11-12]	Total Price inclusive of all levies & charges (3 x 13)	Excise/Custom Tariff Head
				%	Amount	%	Amount	%	Amount					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

LIST OF ITEMS DETAILS AT ANNEXURE-B ENCLOSED.

ANNEXURE-B

S.No.	ITEM DESCRIPTION	UNIT	QTY.
1.0	Transmission Equipment		
A	SDH Equipment (ADM)		
(I)	Base Equipment (Common cards, Power supply cards, power cabling, other hardware & accessories including sub-racks, patch cords, DDF etc. fully equipped excluding (II) and (III) below)	No.	26
(II)	Optical cards		
(a)	S1.1	No.	60
(III)	Tributary Cards		
(a)	E1 Interface card (Minimum 4 interfaces per card)@	No.	26
(b)	Ethernet interfaces 10/100 Mbps with Layer-2 switching (Minimum 4 interfaces per card.)	No.	27
2.0	Cabinet for SDH Equipment (including DDF patching facilities) & other accessories	No.	26
3.0	TMN		
(i)	Craft Terminal		
(a)	Hardware	Set	1
(b)	Software	Set	1
(ii)	Network Manager & Element Manager System		
(a)	Hardware	Set[1]	1
(b)	Software	Set[1]	1
II	**Mandatory Spares for Telecom Eqpt (NDMC works)**		
A	SDH Equipment		
(I)	Common cards, power supply cards, Power Cabling, hardware & accessories (each)	Set	3
(II)	Optical cards		
(a)	S1.1	No.	6
(III)	Tributary Cards		
(a)	E1 Interface card (Minimum 4 interfaces per card)	No.	3
(b)	Ethernet interfaces 10/100 Mbps with Layer-2 switching (Minimum 4 interfaces per card)	No.	3
(IV)	Pre-Connectorized Optical Fibre Patch cords (10 mtr length of each)	No.	18

- END OF SECTION 6 -

SECTION - 7

Reference No.: **TCIL/15/914/1/09-MM/41 E** **January 21, 2009**

PERFORMANCE BANK GUARANTEE FORMAT

M/s Telecommunications Consultants India Ltd.,
TCIL Bhawan, Greater Kailash-I
New Delhi – 110 048 (INDIA)

(With due stamp duty if applicable)

OUR LETTER OF GUARANTEE No. : _____

In consideration of TELECOMMUNICATIONS CONSULTANTS INDIA LIMITED, having its office at TCIL Bhawan, Greater Kailash-I, New Delhi – 110 048 (INDIA) (hereinafter referred to as "TCIL" which expression shall unless repugnant to the content or meaning thereof include all its successors, administrators and executors) and having entered into an agreement dated _____/issued Purchase Order No.TCIL/15/_____ dated _____ with/on M/s._____ (hereinafter referred to as "The Supplier" which expression unless repugnant to the content or meaning thereof, shall include all the successors, administrators, and executors).

WHEREAS the Supplier having unequivocably accepted to supply the materials as per terms and conditions given in the Agreement dated _____ /Purchase Order No. _____ dated _____ and TCIL having agreed that the Supplier shall furnish to TCIL a Performance Guarantee for the faithful performance of the entire contract, to the extent of 10% (ten percent) of the value of the Purchase Order i.e. for _____.

We, _____ ("The Bank") which shall include OUR successors, administrators and executors herewith establish an irrevocable Letter of Guarantee No. _____ in your favour for account of _____ (The Supplier) in cover of performance guarantee in accordance with the terms and conditions of the Agreement/Purchase Order.

Hereby, we undertake to pay up to but not exceeding _____ (say _____ only) upon receipt by us of your first written demand accompanied by your declaration stating that the amount claimed is due by reason of the Supplier having failed to perform the Agreement and despite any contestation on the part of above named Supplier.

This Letter of Guarantee will expire on _____ including 30 days of claim period and any claims made hereunder must be received by us on or before expiry date after which date this Letter of Guarantee will become of no effect whatsoever whether returned to us or not.

_____

Authorized Signature
Manager
Seal of Bank

- END OF SECTION 7 -

SECTION - 8

Reference No.: TCIL/15/914/1/09-MM/41 E **January 21, 2009**

DATA REQUIREMENT SHEET FOR SDH EQUIPMENT & SPARES

Manufacturer: _____
Model #: _____

GENERAL OLTE FEATURES

Seq	Parameter:	Unit:	Particulars:
1.	**SDH hierarchy level:** Capacity Aggregate Bit-rate: CEPT E-1 Ports:	STM Mbps n x E1	
2.	Whether ADM & TM are configurable? Both equipment use same type of Tributary card, PSU card?	Yes/No Yes/No	
3.	Protection OLTE = 1:1 APS? E-1 Ports = 1:N APS? STM-1 Ports = 1:1 APS? STM-4 Ports = 1:1 APS?	Yes/No	
4.	Unprotected system gain for BER 10^{-10}	dBm	
5.	1+1 APS system gain for BER 10^{-10}	dBm	
6.	MTBF Unprotected: 1+1 APS Protected:	Hours	
7.	Code Format:		
8.	List Optical Coupling options:		
9.	Remarks:		

DATA REQUIREMENTS SHEETS for
SDH EQUIPMENT

Seq	Parameter:	Unit:	Particulars:
OPTICAL TRANSMITTER (Fill for all Types)			
10.	Source (LED or Laser)?		
11.	Source wavelength:	nm	
12.	Source spectral width:	nm	
13.	Mean launched power Maximum: Nominal: End of Life:	dBm	
14.	Launch power during safety power-down due to fibre break:	dBm	
15.	Stability (nominal power variation due to temperature and/or biasing):	" %	
16.	Source rise time:		
17.	Source estimated life span:	hours	
18.	Source extinction ratio:		
19.	Low power alarm threshold: field adjustable?	dBm	
20.	Nominal receive signal strength: End of Life:	dBm	
21.	Receiver Threshold BER 10^{-10}:	dBm	
22.	Receiver overload limit:	dBm	
23.	Spectral Bandwidth (3 dB point):	nm	
24.	Digital Bandwidth:	Mbps	
25.	Signal-to-noise @ center wavelength: @ 3 dB points:		
SERVICE CHANNELS AND ORDERWIRE UNIT			
Engineering Orderwire (Fill for all type of Equipment)			

DATA REQUIREMENTS SHEETS for
SDH EQUIPMENT

Seq	Parameter:	Unit:	Particulars:
26.	Omnibus calling available? Describe:	Yes/No	
27.	Selected station calling available? Describe:	Yes/No	
28.	Signalling scheme Describe:		
29.	Tx/Rx level	dBm	
30.	Speech coding method & bit rate	Kbit/s	
31.	Distortion: Noise performance:	S/N_q	
32.	Are Service channel requirements specified in technical specs are met?	Yes/No	

DATA REQUIREMENTS SHEETS for
SDH EQUIPMENT

Seq	Parameter:	Unit:	Particulars:
Voice Channels (Fill for all type of Equipment)			
33.	Are Service channel requirements specified in technical specs are met?	Yes/No	
34.	No. of VF Channels:	ea	
35.	Pass band:	KHz	
36.	Subscriber side interface:		
37.	Input & output level	dBm	
38.	Idle channel noise	dBmOp	
39.	Distortion:		
Data and Supervisory Channels (Fill for all type of Equipment)			
40.	No of data channels:	ea	
41.	Interfaces/Connectors:		
42.	Data rates:	Kbps	
ELECTRICAL/ OPTICAL INPUT/OUTPUT INTERFACES (Fill for all type of Equipment)			
43.	List ITU-T Standards in compliance with:		
44.	Tributary bit rate (nominal):	Mbit/s	
(Fill for all type of Tributaries)			
45.	Tolerance in bit rate:	ppm	
46.	Line code:		
47.	No. of ports:		
48.	Impedance of coax cable used for electrical Input/Output port:	Ω	
49.	Type of connector		
50.	Spare cable pairs?		
51.	Input jitter acceptance **100 Hz to 10 KHz:** 10 KHz to 800 KHz:	UI (p-p)	
52.	Maximum output jitter in the absence of i/p jitter **100 Hz to 10 KHz:** 10 KHz to 800 KHz:	UI (p-p)	
53.	Jitter transfer characteristic:		

OUTPUT PORT (Fill for all type of Tributaries)			
54.	Line impedance balanced: unbalanced:	Ω	
55.	Test load impedance (Unbalanced):	Ω	
56.	Peak pulse amplitude (nominal " tolerance):	V dc	
57.	Pulse width (nominal " tolerance):	ns	
58.	Ratio of +ve & -ve pulses at the center of a pulse interval		
59.	Ratio of width of +ve & -ve pulses at nominal half amplitude		
60.	Maximum insertion loss	dB	
INPUT PORT (Fill for all type of Tributaries)			
61.	Attenuation Char. of inter-connecting cable for digital signal presented at input port		
62.	Return loss (at 1.024 MHz)	dB	
63.	Admissible i/p signal attenuation	dB	
64.	Cable loss Equalization Range	dB	
65.	Maximum insertion loss	dB	
Ethernet Interface Card			
66.	Number of port per card		
67.	Bit rate and applicable standards		
68.	Layer 2 functionality provided or external s/w or router offered? a) Vitual Concatination supported? b) Spanning Tree Supported? c) VLANs supported? d) Quality of service supported? Specify types of QoS supported. e) Any other features supported such as LCAS, rapid spanning tree etc. specify.		
PROTECTION SWITCHING			
69.	List the type of Protection Schemes supported by the Equipment		
70.	Discuss the proposed protection scheme and compare it with other schemes described in ITU-T G.841		
Fill for all supported Protection Schemes			
71.	Switching modes available		

	Auto? **Manual?** Remote/network management?	Yes/No	
72.	Switching priority:		
73.	Tx switchover & switchback criteria:		
74.	Rx switchover & switchback criteria:		
75.	Inbuilt Mux (if applicable) switchover & switchback criteria:		
76.	Switch option mode & status indicators:		
77.	Switching Time Nominal: Maximum:		
Alarms			
78.	List all alarms supported by Equipment:		
MECHANICAL AND ENVIRONMENTAL PARAMETERS			
79.	Number of Sub-Racks (including DC/DC converters, O/W muldem etc.) required for Unprotected Terminal: 1:1 Protected Terminal:	ea	
80.	Sub-Rack Dimensions (L*W*H):	cm	
81.	Sub-Rack Weight:	Kg	
82.	Sub-Rack mounting options:		
83.	Sub-Rack clearance requirements Top * Bottom * Sides: Front Access: Rear Access:	m	
84.	Sub-Rack colour and finish		
85.	Cabinet options available 19" ETSI? Slim rack? Others (specify)? Whether Truncated Cabinet Available?	 Yes/No Yes/No Yes/No Yes/No	
Fill for all Cabinet Types Proposed			
86.	Protection Class (IP Class):		
87.	Rack Colour and Finish:		

88.	Temperature range Guaranteed performance: Operation without damage: Storage/ transport:	EC	
89.	Relative humidity Minimum: Maximum:	%	
90.	Altitude Installed: Transport/storage:	m	
91.	Describe Ventilation requirements:		
92.	Describe dust proofing provisions:		
93.	Electromagnetic compatibility (List standards & severity levels)		

DATA REQUIREMENTS SHEETS for
SDH EQUIPMENT

POWER SUPPLY UNIT (DC/DC CONVERTER)

Manufacturer:_____

Model # :_____

Seq	Parameter:	Unit:	Particulars:
1.	Nominal supply voltage:	Vdc	
2.	Power supply variation Guaranteed performance: Operation without damage:	Vdc	
3.	Polarity:	"	
4.	Whether 220 Vac mains operation capability inbuilt		
5.	List derived DC voltages:	V dc	
6.	Total power consumption (Fully equipped incl. service channels) Unprotected terminal: 1+1 Protected terminal:	Watt	
7.	1+1 APS protection provided?	Yes/No	
8.	MTBF of power supply unit:	Hours	
9.	Ultimate power delivery capacity	Watt	
10.	Are the following protections provided? Overvoltage? Undervoltage? Overload? Reverse polarity? Other (specify)?	Yes/No	
11.	Whether proposed equipment has distributed Power Supply?	Yes/No	
12.	Provide AC & DC power supply requirement for each of the proposed equipment.	Watt	

DATA REQUIREMENTS SHEETS for
SDH EQUIPMENT

MISC

Manufacturer_____

Model #: _____

1.	Provide Procedure to convert Repeaters to Add Drop Multiplexer		
2.	Whether Equipment is Up gradable **From To** STM1 STM4 STM1 STM16	 Yes/no Yes/no	
3.	Expected life of Equipment	Years	
	Patch Cords		
4.	Length	m	
5.	Service Loop	m	
6.	Insertion Loss	dB	
7.	Return Loss	dB	
8.	Connector Type		

- END OF SECTION 8 -

INSPECTION, TESTING, TRAINING, SUPPORT SERVICES AND DOCUMENTATION

This Section describes the specific requirements for Inspection, Testing, Training, support services and documentation requirements of the Fibre Optic Communication System Package.

8.1 General

All materials furnished and all work performed under this Contract shall be inspected and tested. Deliverables shall not be shipped until all required inspections and tests have been completed, and all deficiencies have been corrected to comply with this Specification and approved for shipment by the Employer.

The entire cost of testing for factory & site acceptance, routine tests, production tests and other test during manufacture & site activities specified herein shall be treated as included in the quoted unit price of materials, except for the expenses of Inspector/Employer's representative.

Should any inspections or tests indicate that specific item does not meet Specification requirements, the appropriate items shall be replaced, upgraded, or added by the Contractor as necessary to correct the noted deficiencies at no cost to the Employer/Owner. After correction of a deficiency, all necessary retests shall be performed to verify the effectiveness of the corrective action.

The test shall be considered complete when (a) when all variances have been resolved (b) all the test records have been submitted (c) Employer acknowledges in writing the successful completion of the test.

8.2 Inspection

Access to the Contractor's facilities while manufacturing and testing are taking place, and to any facility where hardware/software is being produced for Employer shall be available to Employer/Owner representatives. The Contractor shall provide to Employer/Owner representatives sufficient facilities, equipment, and documentation necessary to complete all inspections and to verify that the equipment is being fabricated and maintained in accordance with the Specification. Inspection rights shall apply to the Contractor's facilities and to subcontractor facilities where equipment is being manufactured.

Inspections will be performed by Employer/Owner, which will include visual examination of hardware, enclosure cable dressings, and equipment and cable labeling. Contractor documentation will also be examined to verify that it adequately identifies and describes all wiring, hardware and spare parts. Access to inspect the Contractor's hardware quality assurance standards, procedures, and records that are applicable to the facilities shall be provided to Employer/Owner.

8.2.1 Inspection Certificate

The Contractor shall give the Employer two weeks in case of domestic supplies and six weeks in case of foreign supplies written notice of any material being ready for testing. Such tests shall be to the Contractor's account except for the expenses of the Inspector. The Employer, unless witnessing of the tests is waived, will attend such tests on the scheduled date for which Employer has been so notified or on a mutually agreed alternative date.

The Employer shall, within fourteen (14) days from the date of inspection as defined herein, give notice in writing to the Contractor of any objection to any drawings and all or any equipment and workmanship which in his opinion is not in accordance with the Contract. The Contractor shall give due consideration to such objections and shall make the modifications that may be necessary to meet said objections. When the factory tests have been completed successfully at the Contractor's or Sub-contractor's works, the Employer shall issue a certificate to this effect within fourteen (14) days after completion of tests but if the tests are not witnessed by the Employer, the certificate shall be issued within fourteen (14) days of receipt of the Contractor's Test Certificate by the Employer. The completion of these tests or the issue of the certificates shall not bind the Employer to accept the equipment should it, on further tests after erection, be found not to comply with the Contract.

In cases where the Contract provides for tests, whether at the premises or works of the Contractor or of any Sub-contractor, the Contractor except where otherwise specified shall provide free of charge items such as labour, materials, electricity, fuel, water stores, apparatus and instruments, as may be reasonably demanded by the Employer or his authorized representative to carry out effectively such tests of the equipment in accordance with the Contract and shall provide facilities to the Employer or his authorized representative to accomplish testing.

The inspection by Employer and issue of Inspection Certificate thereon, shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed Quality Assurance Program forming a part of the Contract.

The Contractor shall keep the Employer informed in advance of the time of starting of the progress of manufacture of material in its various stages so that arrangements can be made for inspection.

Record of routine test reports shall be maintained by the Contractor at his works for periodic inspection by the Employer's/Owner’s representative.

Certificates of manufacturing tests shall be maintained by the Contractor and produced for verification as and when desired by the Employer. No material shall be dispatched from its point of manufacture until it has been satisfactorily inspected and tested. Testing shall always be carried out while the inspection may be waived off by the Employer in writing only.

However, such inspection by the Employer's/Owner’s representative(s) shall not relieve the Contractor from the responsibility for furnishing material, software, and equipment to conform to the requirements of the Contract; nor invalidate any claim which the Employer may make because of defective or unsatisfactory material, software or equipment.

8.3 Test Plans and Procedures

Test plans for both factory and field tests shall be provided by the Contractor to ensure that each test is comprehensive and verifies all the features of the equipment are tested. The test plans for factory and field tests shall be submitted for Employer approval before the start of testing.

The contractor shall prepare detail testing procedure in line to specification and submit for employer's approval. The procedure shall be modular to the extent possible, which shall facilitate the completion of the testing in the least possible time.

8.3.1 Test Records

The complete record of all factory and field acceptance tests results shall be maintained by the Contractor. The records shall be maintained in a logical form and shall contain all the relevant information. The test reports shall be signed by the testing engineer and the engineer witnessing the tests.

8.3.2 Reporting of Variance

A variance report shall be prepared by either Employer or Contractor personnel each time a deviation from specification requirements is detected during inspection or testing. All such variances shall be closed in mutually agreed manner.

However, at any stage if employer feels that quality of variances calls for suspension of the testing the testing shall be halted till satisfactory resolution of variances, which may involve retesting also.

8.3.3 Test Periods Defined

The terminology used in bidding documents and their correlation with the tests requirements described within this section is as follows:

a. Pre-Commissioning & Commissioning Period - The Site Acceptance Test (SAT)

b. Operational Acceptance - Successful completion of SAT

The Site Acceptance Test (SAT) requirements are specified in the relevant sections. The successful completion of SAT will lead to Operational acceptance

8.4 Testing Requirements

Following are the requirements of testing for Fibre Optic Communication system:

1. Type Testing
2. Factory Acceptance Testing
3. Site Acceptance testing

8.5 Type Testing

"Type Tests" shall be defined as those tests which are to be carried out to prove the design, process of manufacture and general conformity of the materials to this Specification.

Type Testing shall comply with the following:

(a) The Contractor shall submit, within 30 days of Contract Award, copies of test reports for all of the Type Tests that are specified in the specifications and that have previously been performed. These reports may be accepted by the Employer only if they apply to materials and equipment that are essentially identical to those due to be delivered under the Contract and only if test procedures and parameter values are identical to those specified in this specifications carried out at accredited labs and witnessed by third party / customer's representatives

(b) Type Tests shall be performed for all equipment types for which report is not provided for the tests mentioned in the Technical Specification. In this case type testing shall be carried out by the Contractor and no payment shall be made.

(c) If the reports are submitted for the specified tests, however if it is determined by the Employer that the report provided is not acceptable, the same shall be carried out by the Contractor again. The bidder shall quote testing charges for each type test individually and payment shall be made for successful tests accordingly.

(d) Type Tests shall be certified or performed by reputed laboratories using material and equipment data sheets and test procedures that have been approved by the Employer. The test procedures shall be formatted as defined in the technical specifications and shall include a complete list of the applicable reference standards and submitted for Employer approval at least four (4) weeks before commencement of test(s). The Contractor shall provide the Employer at least 30 days written notice of the planned commencement of each type test.

(e) The Contractor shall provide a detailed schedule for performing all specified type tests. These tests shall be performed in the presence of a representative of the Employer.

(f) Testing charges for all the type tests listed in the specifications shall be indicated separately for each item (excluding expenses of Inspector/ Employer's representative) in the prescribed schedule of the bidding document. The total amount of these charges will be considered in the bid evaluation process.

(g) The Contractor shall ensure that all type tests can be completed within the time schedule offered in his Technical Proposal.

(h) In case of failure during any type test, the Supplier is either required to manufacture a fresh sample lot and repeat all type tests successfully or repeat that particular type tests at least three times successfully on the samples selected from the already manufactured lot at his own expenses. In case a fresh lot is manufactured for testing then the lot already manufactured shall be rejected.

8.5.1 **Type Test Samples**

The Contractor shall supply equipment/material for sample selection only after the Quality Assurance Plan has been approved by the Employer. The sample material shall be manufactured strictly in accordance with the approved Quality Assurance Plan. The Contractor shall submit for Employer approval, the type test sample selection procedure. The selection process for conducting the type tests shall ensure that samples are selected at random. For optical fibres/ Fibre Optic cables/PLB HDPE pipe, at least three reels/drums of each type of fibre/cable/PLB HDPE pipe proposed shall be offered for selection, samples shall be selected randomly from one or more of the reels/drums. For telecom equipment and Joint box at least three samples of each type proposed shall be offered for selection out of which one sample shall be selected. The type approval certificate shall clearly indicate the type/grade/source of HDPE raw material, and the construction of the pipe i.e. two layer or homogenous. Bulk manufacture and supply of the above materials shall start only after issue of type approval. List of tests and Procedures for type testing for specific items are described in relevant section of technical specifications.

8.6 Factory Acceptance Tests

Factory acceptance tests shall be conducted on randomly selected final assemblies of all equipment to be supplied. Visual inspection shall be carried out on 100% basis for all the equipment/items offered. Factory acceptance testing shall be carried out on SDH equipment, NMS, Underground fibre optic cable, Joint box, PLB HDPE pipe, FODP and all other items for which price has been identified separately in the Bid Price Schedule.

Equipment/Material shall not be dispatched to the Employer until required factory tests are completed satisfactorily, all variances are resolved, full test documentation has been delivered to the Employer, and the Employer has issued Material Inspection & Clearance Certificate (MICC). Successful completion of the factory tests and the Employer approval to dispatch shall in no way constitute final acceptance of the system or any portion thereof. These tests shall be carried out in the presence of the Employer's/Owner’s authorised representatives.

Factory acceptance tests shall not proceed without the prior delivery to and approval of all test documentation by the Employer.

The factory acceptance test shall demonstrate the technical characteristics of the fibre optic cable & equipment in relation to this specifications and approved drawings and documents. The factory acceptance tests for FODP and other items shall be proposed by the Contractor in accordance with technical specifications and Contractor's (including Sub-Contractor's /supplier's) standard FAT testing program. In general the FAT for other items shall include at least: Physical verification, demonstration of technical characteristics, various operational modes, functional interfaces, alarms and diagnostics etc.For Test equipment, FAT tests shall include supply of proper calibration certificates, demonstration of satisfactory performance, evidence of correct equipment configuration and manufacturer’s final inspection certificate/ report.

List of tests and Procedures for factory testing for specific items are described in relevant section of technical specifications.

8.6.1 Sampling for FAT

From each batch of equipment presented by the Contractor for Factory acceptance testing, the Employer shall select random sample(s) as described for specific items to be tested for acceptance in relevant sections of the technical specifications. Unless otherwise agreed, all required FAT tests in the approved FAT procedure shall be performed on all samples. The sampling rate for the Factory acceptance tests for telecom equipment shall be 10% of the batch size (minimum 1). The Sampling rate for the Factory acceptance tests shall be 10% of the batch size (minimum 2) for FO cable drums, FODPs, Joint box and other similar items. For PLB HDPE pipes, following sampling plan shall be followed.

E. Visual inspection and dimensional test shall be carried out on every length. All other test carried out as per sampling plan below:-

F.

No. of pipes in the lot	**H. Sample size I.**
Up to 150 **151 to 1200** **1201 and 3500** **3501 and above**	**O. 3** **P. 5** **Q. 8** **R. 12**

In case any of the selected samples fail, the failed sample is rejected and additional 20% samples shall be selected randomly and tested. In case any sample from the additional 20% also fails the entire batch may be rejected.

Since FAT testing provides a measure of assurance that the Quality Control objectives are being met during all phases of production, the Employer reserves the right to require the Contractor to investigate and report on the cause of FAT failures and to suspend further testing/ approvals until such a report is made and remedial actions taken, as applicable.

8.6.2 Production Testing

Production testing shall mean those tests which are to be carried out during the process of production by the Contractor to ensure the desired quality of end product to be supplied by him. The production tests to be carried out at each stage of production shall be based on the Contractor's standard quality assurance procedures. The production tests to be carried out shall be listed in the Manufacturing Quality Plan (MQP), along with information such as sampling frequency, applicable standards, acceptance criteria etc.

The production tests would normally not be witnessed by the Employer. However, the Employer reserves the right to do so or inspect the production testing records in accordance with Inspection rights specified for this contract.

8.7 Site Acceptance Tests

The Contractor shall be responsible for carrying out site tests and inspection for all equipment supplied in this contract as required by the Employer. All equipment shall be tested on site under the conditions in which it will normally operate. Site acceptance testing shall be carried out for underground fibre optic cable, joint box, PLB HDPE pipe, FODP, SDH equipment, TMN etc. The tests shall be exhaustive and

shall demonstrate that the overall performance of the contract works satisfies every requirement specified.

The minimum site acceptance testing requirements for SDH equipment, NMS Underground fibre optic cable, Joint box, PLB HDPE pipe, and FODP are described in relevant sections of the technical specifications. This testing shall be supplemented by the Contractor's standard installation testing program, which shall be in accordance with his quality plan(s). The Contractor shall be responsible for the submission of all equipment supplied in this contract for site tests and inspection as required by the Employer.

8.8 Support Services

The Contractor shall ensure the availability of the service, spares and expansion parts for the supplied equipments for a minimum period of 15 years from operational acceptance by the Employer or 7 years from the date of withdrawal from production whichever is earlier. However the termination of production shall not occur prior to Operational Acceptance of the system by the Employer.

8.9 Training Requirements

This section describes general requirements that apply to all training courses. Appendix-B provides the training requirements. The Contractor shall submit the training proposal along with the bid. The training content, schedule and location shall be finalised during project executive.

(a) Training will be conducted by Contractors personnel, who are experienced instructors and speak understandable English.
(b) All necessary training materials shall be provided by the Contractor. Each trainee shall receive individual copies of all technical manuals and all other documents used for training.
(c) Class materials, including the documents sent before the training courses as well as class handouts, shall become the property of Employer. Employer reserves the right to copy such materials, but for in-house training and use only.
(d) Hands-on training shall utilize equipment similar to that being supplied under the contract.
(e) For all training courses, the travel and per-diem expenses will be borne by the owner.
(f) The Contractor shall quote training prices individually for each of the courses indicated in appendices.
(g) Employer will have the option to cancel any or all training courses. In the case of cancellation, the rate quoted against the respective course will not be paid to the Contractor.

8.9.1 FO Communication System Training Course Requirements

(i) This training shall provide a functional description of the FO Cabling system, communication equipment, sub-systems and network, and a discussion of the fail over in the network. 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. 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.

(ii) The installation & maintenance trainings shall enable the Owner to be self-sufficient in preventive & restorative maintenance of the respective communications subsystems purchased by the Employer. 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.

The training shall focus on critical aspects associated with installation, testing & commissioning of fibre optic communication equipment. This shall include the state-of-the art techniques employed in laying, splicing & testing of fibre optic cable & terminal equipments etc. The owner's personnel shall be trained in such a way that the basic maintenance of terminal equipments & cable etc. can be carried out effectively.

(iii) The Network Management training shall familiarize the Owner maintenance personnel with the concepts and techniques for configuring, programming, maintaining, and troubleshooting the Contractor supplied TMN and its associated database. The Network Management training course shall provide the course participants with hands-on experience using the actual system being supplied.

(iv) 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.

8.10 Mandatory Spare Parts

Appendices provide the Mandatory Spare Parts Requirements to be provided for Employer/Owner.

8.11 Recommended Spare Parts

In addition to the Mandatory Spares the bidder shall provide a list of "Recommended Spare Parts", which may be required over and above the spares listed in Mandatory Spare parts list (Vol II, appendices), to support system availabilities specified in this section, during a one year period. This list of spares shall be called the "Recommended Spare Parts List". The Recommended spare parts list shall not be considered for evaluation and may be included in the final scope of supply.

The unit as well as set prices shall be provided for each subsystem set item of the spare parts list in the appropriate Bid Price Schedule.

8.12 Test Equipment

Appendices provide the Mandatory test equipment to be provided. The Contractor shall provide in their bid, additionally recommended test equipment list necessary to support system availability. 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 but may be included in the final scope of supply at the discretion of Employer

8.13 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.

8.14 System Maintenance

8.14.1 Defect Liability Period

The one year period commencing immediately after the operational acceptance is called the Defect liability Period. Operational Acceptance shall be given on successful completion of SAT. During this period, the Contractor shall replace or repair all defective parts and shall be responsible for maintaining an operational system to achieve the availability of 99.8% for subscriber to subscriber. The fibre optic cable outage (due to conditions not in control of the Contractor) shall not be considered in the availability calculations. The contractor maintenance engineer shall report to the site for restoration of the system within 6 hrs excluding travel time in case of complete break down of the link. Within four (4) months from Contract Award Date, the Contractor shall submit a comprehensive maintenance strategy for the maintenance of the system during the Defect Liability Period. For this period which commences immediately after operational acceptance, the actual outage frequency and the availability achieved during the period shall be calculated periodically, jointly by the Contractor and the Employer.

During the Defect Liability Period, the spare parts, test equipment and tools and tackles supplied by the Contractor to Employer under the present procurement including items in both the “Mandatory” and “Recommended” lists, shall be issued as required by the Contractor. Only these supplied items and no additional items, with the exception of general purpose toolkits, shall be used by the Contractor for all its testing and preventive & restorative maintenance activities.

If any additional test equipment or spare parts are required or found to be required, these additional items shall be provided by the Contractor, within a reasonable time, up to the expiry of the Defect liability Period, at no additional cost to Employer. Further, in such case the list of “recommended” spare parts and test equipment and tools & tackles shall be reviewed to identify further spares and test equipment requirement, which shall have to be provided by the Contractor at no additional cost to Employer. Since the spare parts shall be “issued for use”, by the end of the Defect Liability Period, the Contractor shall replenish the spare parts stock to the original level plus any additional spares required, found to be required or additionally identified as above.

All test equipment and tools & tackles issued to the Contractor shall be “issued for use” and shall be returned at the earliest in “as issued” condition.

8.14.2 Contractor’s Maintenance Responsibility for a period of five years after the Defect Liability Period

In addition to above, Owner/Employer may ask the Contractor to carry out “ Maintenance” of the system (excl. fibre optic cable) including supply of spares for a period of five years after Defect Liability Period for ensuring the successful operation

of the system. The Contractor shall be responsible for achieving the system availability and the response time mentioned above in clause 8.14.1. The bidder shall quote the Annual maintenance charges for five years after Defect Liability Period which shall be considered in the bid evaluation. Bidder shall submit the detailed procedure for achieving above in the bid.

8.15 Documentation

To ensure that the proposed systems conform to the specific provisions and general intent of the Specification, the Contractor shall submit documentation describing the systems to employer for review and approval. Further the Contractor shall also submit the drawings/documents for all the hardware & software required for site installation, testing and commissioning and thereafter operation of the system. The contractor shall obtain approval of Employer for the relevant document at each stage before proceeding for manufacturing, system development, factory testing, site testing, training etc. The schedule for submission/approval of each document shall be finalised during the discussions before placement of the contract, this schedule shall be in line to overall project schedule.

Each document shall be identified by a Contractor document number, the employer document number, and the employer purchase order number. Where a document is revised for any reason, each revision shall be indicated by a number, date, and description in a revision block along with an indication of official approval by the Contractor's project manager. Each revision of a document shall highlight all changes made since the previous revision.

The contractor shall submit two hard copies of each document/drawing for employer's review and approval along with soft copy with each submission. After approval two sets of all the documents shall be submitted as final documentation, however, for site specific documents two sets of documents shall be provided for each site. Any changes observed during field implementation shall be incorporated in the as-built drawing and required sets of the same shall be submitted to Employer. In addition to paper copies all the documents shall also be provided on electronic media in two copies. In case any documentation requirement is specified in the relevant section the same shall apply for the equipment /system defined in that section. The contractor shall also supply two sets of User manuals/guides/O&M manuals/manufacturer's catalogues for all the hardware & software supplied under the contract which shall be in addition to the one set each at all the locations where the System has been installed. The user manual shall at minimum include the principle of operation, block diagrams, troubleshooting and diagnostic and maintenance procedures. Considering all the components of the project briefly the following documents/drawings shall be required under the project. The user manual shall be oriented towards system user and system deployed under the Project.

1) Survey report
2) System Functional Description Document
3) Data Requirement Sheets (DRS) & Drawings
4) Link budget calculations
5) Manufacturing Quality Plan & Field Quality Plan
6) Bill of Quantities
7) Test schedule

8) Type test procedures (Type test, FAT & SAT)
9) Test reports (Type test, FAT & SAT)
10) Equipment Manuals & Standard Documents
11) Software Licences
12) Installation drawings
13) Schematic drawing
14) Numbering, Marking, labelling Document
15) Channel Routing
16) Synchronisation Plan
17) Configuration Diagrams
18) TMN Description Document
19) Installation & jointing procedure for FO cable
20) As built drawing for cable of installation
21) Site Drawings
22) Training documents
23) Maintenance Philosophy & Procedures

- END OF SECTION 9 -