ISRAEL ELECTRIC CORPORATION
INFORMATION SYSTEMS & COMMUNICATIONS DIVISION
COMMUNICATIONS & ELECTRONICS DEPARTMENT

Technical Specification

For

Metro/Access Packet Optical Transport System

Specification 200-15

<table>
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<th>FUNCTION</th>
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<tr>
<td>Written by:</td>
<td>Moshe Avi Meshulam Hagai Koritny Mark Attas Michael</td>
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<td>Checked by:</td>
<td>Libsi Dessie</td>
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<td>Approved by:</td>
<td>Honovich Tamir</td>
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## Changes History

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<thead>
<tr>
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<tr>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
0 (I) ADMINISTRATION.................................................................................................................. 7
  0.1 GENERAL................................................................................................................................. 7
  0.2 DEFINITIONS .......................................................................................................................... 7
  0.3 ADMINISTRATION OF TENDER PROCESS ........................................................................ 7
  0.4 THE SPECIFICATION ............................................................................................................ 9
  0.5 CLASSIFICATION OF THE TECHNICAL SPECIFICATIONS .............................................. 10
  0.6 STRUCTURE OF THE PROPOSAL ......................................................................................... 11
  0.7 LANGUAGE ........................................................................................................................... 11

1 (I) OBJECTIVES.................................................................................................................................. 12
  1.1 GENERAL.................................................................................................................................. 12
  1.2 TRANSMISSION NETWORK CUSTOMERS............................................................................. 12
  1.3 OBJECTIVES AND GOALS....................................................................................................... 12
  1.4 ORGANIZATION GOALS WITH THE RELATIONSHIP TO BUSINESS.............................. 13
  1.5 FEASIBILITY AND COST/ BENEFITS...................................................................................... 13
  1.6 DECLARER................................................................................................................................ 13

2 (S) APPLICATION - THE ESSENCE OF THE SYSTEM .................................................................... 15
  2.1 (I) GENERAL CHARACTERISTICS ....................................................................................... 15
  2.2 (I) NETWORK ARCHITECTURE ............................................................................................. 17
  2.3 (S) PHOTONIC LAYER ............................................................................................................ 17
  2.4 (S) OTN CROSS CONNECT .................................................................................................... 19
  2.5 (S) CONTROL PLANE PHOTONIC AND OTN ...................................................................... 20
  2.6 (S) 10G SOLUTION ................................................................................................................ 22
  2.7 (S) 100G COHERENT SOLUTION .......................................................................................... 23
  2.8 (S) 200G SOLUTION ............................................................................................................. 24
  2.9 (S) ETHERNET REQUIREMENTS ........................................................................................ 25
  2.10 (G) PLATFORM SCALABILITY ............................................................................................. 27
  2.11 (S) ENCRYPTION ................................................................................................................ 27
  2.12 (S) NETWORK MANAGEMENT SYSTEM ............................................................................ 28
  2.13 (S) FAULT MANAGEMENT .................................................................................................. 30
  2.14 (S) CONFIGURATION MANAGEMENT ................................................................................ 31
  2.15 (S) PERFORMANCE MANAGEMENT .................................................................................. 32
  2.16 N/A........................................................................................................................................ 33
  2.17 (G) RELIABILITY ................................................................................................................ 33
  2.18 (M) SECURITY REQUIREMENTS FOR COMPUTERIZED SYSTEM - APPENDIX A-1 ........ 34
  2.19 (M) PROJECT SYSTEM SECURITY STANDARD SPECIFICATION - APPENDIX A-2 ........ 34
  2.20 (I) DATA COMMUNICATION NETWORK (DCN) ............................................................... 34
  2.21 (S) REQUIREMENTS FOR INTEGRATION WITH IEC OSS .................................................. 34
  2.22 (I) INFRASTRUCTURE ......................................................................................................... 34
  2.23 (S) NETWORK PLANNING & ANALYSIS TOOL ................................................................. 34
  2.24 (I) SYSTEM MAINTENANCE FEATURES .......................................................................... 35
  2.25 (I) POWER SUPPLY INTERFACE ....................................................................................... 35
  2.26 (I) ENVIRONMENTAL CONDITIONS ................................................................................... 36

3 (S) TECHNOLOGY AND INFRASTRUCTURE................................................................................. 38
  3.1 (I) ARCHITECTURE AND GENERAL APPROACH .............................................................. 38
  3.2 (L) TYPICAL SITE CONFIGURATION...................................................................................... 38
  3.3 (S) CLIENT & LINE INTERFACES ......................................................................................... 39
  3.4 (I) GENERAL REQUIREMENTS ............................................................................................ 40
  3.5 (I) DELIVERABLES .............................................................................................................. 41

4 (I) IMPLEMENTATION.................................................................................................................... 43
4.1 GENERAL.................................................................................................................................43
4.2 EXPERIENCE AND OFFEROR DETAILS..................................................................................43
4.3 (I) SERVICE AND MAINTENANCE .........................................................................................45
4.4 (G) TRAINING ...........................................................................................................................47
4.5 (I) INSTALLATION & TESTING ...............................................................................................48
4.6 (I) PROOF OF CONCEPT ........................................................................................................49
4.7 (I) DOCUMENTATION..............................................................................................................49
4.8 (I) PURCHASER’S REQUIREMENTS FOR PACKING...............................................................50
### List of Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AES</td>
<td>Advanced Encryption Standard</td>
</tr>
<tr>
<td>AES256</td>
<td>AES code with key length 256 bit</td>
</tr>
<tr>
<td>ASON</td>
<td>Automatically Switched Optical Network</td>
</tr>
<tr>
<td>BB</td>
<td>Backbone</td>
</tr>
<tr>
<td>BBE</td>
<td>Background Blocks Errors</td>
</tr>
<tr>
<td>BFD</td>
<td>Bidirectional Forwarding Detection</td>
</tr>
<tr>
<td>BOM</td>
<td>Bill of Material</td>
</tr>
<tr>
<td>BPSK</td>
<td>Binary Phase Shift Keying</td>
</tr>
<tr>
<td>CD</td>
<td>Chromatic Dispersion</td>
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<tr>
<td>CDC</td>
<td>Colorless, Directionless and Contentionless</td>
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<tr>
<td>CFP</td>
<td>C form-factor SFP</td>
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<tr>
<td>CIR</td>
<td>Committed Information Rate</td>
</tr>
<tr>
<td>CLI</td>
<td>Command Line Interface</td>
</tr>
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<td>CMF</td>
<td>Client Management Frame</td>
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<tr>
<td>CP</td>
<td>Control Plane</td>
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<tr>
<td>CWDM</td>
<td>Coarse Wavelength Division Multiplexing</td>
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<tr>
<td>DB</td>
<td>Database</td>
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<tr>
<td>DCC</td>
<td>Data Communication Channel</td>
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<tr>
<td>DCF</td>
<td>Dispersion Compensating Fiber</td>
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<td>Data Communication Network</td>
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<td>DGD</td>
<td>Differential Group Delay</td>
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<td>DRP</td>
<td>Disaster Recovery Protection</td>
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<td>DSCP</td>
<td>Differentiated Services Code Point</td>
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<tr>
<td>DWDM</td>
<td>Dense Wavelength Division Multiplexing</td>
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<tr>
<td>DXC</td>
<td>Digital Cross Connect</td>
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<td>EDFA</td>
<td>Erbium Doped Fibre Amplifier</td>
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<td>EFEC</td>
<td>Enhanced Forward Error Correction</td>
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<td>EIR</td>
<td>Excess Information Rate</td>
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<td>E-LAN</td>
<td>Ethernet Local Area Network</td>
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<td>EMC</td>
<td>US Corporation (data storage, information security)</td>
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<td>EML</td>
<td>Element Management Layer</td>
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<tr>
<td>EMS</td>
<td>Element Management System</td>
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<td>EPL</td>
<td>Ethernet Private Line</td>
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<td>ES</td>
<td>Error Seconds</td>
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<td>ETSI</td>
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<td>EVPL</td>
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<td>FC</td>
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<td>FIPS</td>
<td>Federal Information Processing Standards</td>
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<td>FLEX</td>
<td>SAN switch manufactured by IBM</td>
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<td>FTP</td>
<td>File Transfer Protocol</td>
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<td>GGC</td>
<td>General Communications Channel</td>
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<td>GE</td>
<td>Gigabit Ethernet</td>
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<td>GFP</td>
<td>Generic Framing Procedure</td>
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<td>GMPLS</td>
<td>Generalized Multi-Protocol Label Switching</td>
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<tr>
<td>GUI</td>
<td>Graphical User Interface</td>
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<td>HO</td>
<td>High Order</td>
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<td>IBM</td>
<td>International Business Machines Corporation</td>
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<td>IEC</td>
<td>Israel Electric Corporation</td>
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<tr>
<td>IEEE</td>
<td>Institute of Electrical and Electronics Engineers</td>
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<td>IGMP</td>
<td>Internet Group Management Protocol</td>
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<td>IP</td>
<td>Internet Protocol</td>
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<td>ISC</td>
<td>InterSystem Coupling</td>
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<td>ISO</td>
<td>International Organization for Standardization</td>
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<td>ITU</td>
<td>International Telecommunication Union</td>
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<td>ITU standards for Telecommunication</td>
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<td>Java Message Service</td>
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<td>Local Area Network</td>
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<td>Managed Extensibility Framework</td>
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<td>Muxponder –Transponder</td>
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<td>NBI</td>
<td>Northbound Interface</td>
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<td>Network Management System</td>
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<td>Abbreviation</td>
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<td>NoC</td>
<td>Network Operations Center</td>
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<td>NTP</td>
<td>Network Time Protocol</td>
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<td>OAM</td>
<td>Operations, administration and management</td>
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<td>OC</td>
<td>Optical Carrier</td>
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<td>OCH</td>
<td>Optical Channel</td>
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<tr>
<td>OCS</td>
<td>Optical Supervisory Channel</td>
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<td>ODU</td>
<td>Optical Channel Data Unit</td>
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<td>ODUflex</td>
<td>Optical Channel Transport Data Unit flexible</td>
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<td>ODUk</td>
<td>Optical Channel Data Unit-k (k=1/2/3/3e2/4)</td>
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<td>OMS</td>
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<td>OOB</td>
<td>Out-Of-Band</td>
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<td>OSC</td>
<td>Optical Supervisory Channel</td>
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<td>OSNR</td>
<td>Optical Signal-to-Noise Ratio</td>
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<td>OSS</td>
<td>Operations Support System</td>
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<td>OTM</td>
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<td>Optical Transport Network</td>
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<td>Optical Channel Transport Unit</td>
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<td>P2MP</td>
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<td>P2P</td>
<td>Point to Point</td>
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<td>PM</td>
<td>Performance Monitoring, Path Monitoring</td>
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<td>PMD</td>
<td>Polarization Mode Dispersion</td>
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<td>PoP</td>
<td>Point of Presence</td>
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<td>POTS</td>
<td>Packet Optical Transport System</td>
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<td>QAM</td>
<td>Quadrature Amplitude Modulation</td>
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<td>QPSK</td>
<td>Quadrature Phase Shift Keying</td>
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<td>RFP</td>
<td>Request for Proposal</td>
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<td>ROADM</td>
<td>Reconfigurable Optical Add-Drop Multiplexer</td>
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<td>RPBS</td>
<td>Pseudo-Random Bit Sequence</td>
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<td>RS</td>
<td>Regenerator section</td>
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<td>RSTP</td>
<td>Rapid Spanning Tree Protocol</td>
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<td>SAN</td>
<td>Storage Area Network</td>
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<td>SDH</td>
<td>Synchronous Digital Hierarchy</td>
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<td>SDN</td>
<td>Software-Defined Networking</td>
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<td>SES</td>
<td>Severely Error Seconds</td>
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<td>SFD</td>
<td>Start Frame Delimiter</td>
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<td>SFP</td>
<td>Small Form-factor Pluggable transceiver</td>
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<td>SLA</td>
<td>Service Level Agreement</td>
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<td>SML</td>
<td>Service Management Layer</td>
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<td>SNCP</td>
<td>Sub-Network Connection Protection</td>
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<td>SNMP</td>
<td>Simple Network Management Protocol</td>
</tr>
<tr>
<td>SOAP</td>
<td>Simple Object Access Protocol</td>
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<td>SONET</td>
<td>Synchronous Optical Networking</td>
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<td>SP</td>
<td>Shelf Processor</td>
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<td>SQL</td>
<td>Structured Query Language</td>
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<td>SRLG</td>
<td>Shared Risk Link Group</td>
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<tr>
<td>STM</td>
<td>Synchronous Transfer Mode, SDH transmission rates</td>
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<td>SW</td>
<td>Software</td>
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<td>TCM</td>
<td>Tandem Connection Monitoring</td>
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<td>TCP</td>
<td>Transmission Control Protocol</td>
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<td>Time Division Multiplexing</td>
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<td>TED</td>
<td>Traffic Engineering Database</td>
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<td>TMF</td>
<td>TeleManagement Forum</td>
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<td>Telecommunications Management Network</td>
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<td>UAS</td>
<td>Unavailable Seconds</td>
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<td>UDP</td>
<td>User Datagram Protocol</td>
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<td>UME</td>
<td>Un-Managed Element</td>
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<td>VC</td>
<td>Virtual Container</td>
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<td>Virtual Local Area Network</td>
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<td>WAN</td>
<td>Wide Area Network</td>
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<td>WDM</td>
<td>Wavelength Division Multiplexing</td>
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<td>WSON</td>
<td>Wavelength Switched Optical Network</td>
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<tr>
<td>WSS</td>
<td>Wavelength Selective Switching</td>
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<tr>
<td>XC</td>
<td>Cross Connect</td>
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<tr>
<td>XFP</td>
<td>10 Gb Small Form Factor Pluggable transceiver</td>
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</table>
0 (I) Administration

0.1 General

The Israel Electric Corporation Ltd. (hereinafter: "IEC"), a government corporation, is an electricity utility company.
IEC is hereby publicly tendering for a new ROADM based Optical Transport with ODU XC to interconnect the sites with 10G and coherent 100G optical transport (the "Transmission Network"). In this context further optimizations of the network will be established as well.
To support this objective, Offerors to this Tender will be required to submit proposals that include compliance table, design of the architecture & BOM according to IEC network requirements.
The winning supplier will also provide a solution and tools, characterize and shape the required solutions, will set up the system, guide and provide support and maintenance services as described in detail in this document and its appendixes.

0.2 Definitions

a) "IEC" or "The Company" or "The Electric Company" - The Israel Electric Corporation.
b) "Offeror" - The Offeror who presents a proposal in response to this request for proposals.
c) "Supplier" - The Supplier or Manufacturer whose proposal was awarded the Tender.
d) "Manufacturer "- The company that developing and manufactures the proposed equipment and technology, H/W and S/W wise.
e) "Offer" or "Proposal" or "Bid" - The Offeror's response to the tender.

0.3 Administration of Tender Process

0.3.1 The Tender will be conducted in two stages as detailed below:
First Stage –
Pre-qualification stage - at this stage, proposals must be submitted in accordance with all requirements without quotes.
For this stage the proposals will be compliance examined with all the prerequisites.
Proposals which will not meet the prerequisites will be disqualified.
At this point the compliance with the conditions defined in Chapter 0 General (Administration) will be checked, together with all the technical elements, chapters 1-4 and appendixes.
All various components and grades will be according to the criteria specified in the Proposal Evaluation Methodology (PEM) appendix E.
IEC shall be entitled to apply for price proposals to bidders that their proposal has received the minimum passing grade defined and met the requirements of the tender.

Second Stage –
At this stage, a final comparison is made on the basis of technical test score of first stage along with the Offeror quotation.

The Company undertakes no obligation to contact all those who submitted a technical proposal for a quotation in the second stage.

Results scoring of the two phases (technical and commercial) will form the basis for rating the proposals.

IEC reserves the right to update the tender documents, the tender amount and terms at each stage of the tender.

0.3.2 Contact Details
a) IEC Contact details
   Technical issues regarding this tender will be addressed to:
   Michael Attas
   Phone #: 04-8182221, Fax #: 04-8182469
   e-Mail: michael.attas@iec.co.il
   Address: The new office building Netive haoor 1, Haifa.

b) (G) The Offeror’s contact person
   The Offeror will provide the details of the Offeror's contact, including name and surname, function, address, telephone, fax number and eMail address.
   Any document, including clarification and / or updating delivered to the address and / or fax number / above e-mail address, will be considered as delivered to their destination.
   The Offeror undertakes to inform IEC in the event that the Offeror's contact changes, and to provide details of the substitute contact.
   Offeror undertakes to inform the IEC in case of any updates/changes of the contact details.

0.3.3 Questions and Clarifications - Procedure and Response (procedure for IEC receiving Offeror’s questions and IEC providing answers):

a) Offeror’s questions will be presented in writing by mail to the Offeror’s contact to IEC contact at the above address.

b) Offeror s are requested to submit questions and clarifications no later than 14 days before the proposal submission date.
0.3.4 Offerors conference

Offerors/ Suppliers/Manufacturers Pre-Bid Conference will be take place at 07.07.16, 10:00 A.M. on Mahar building, Haifa. Participation in the Pre-Bid Conference shall be at the Offeror’s expense.

0.3.5 Method of delivering messages to the Offerors on updates and changes.

During the bid process there may be updates and changes in the tender documents (including appendixes) and conditions contained in them.

It is clarified that IEC reserves the right to change the tender documents, the tender amount and terms of the tender at each stage of the tender.

Offerors are required to constantly monitor updates on the website of the company with regard to the provisions of the tender conditions and management, prior to the deadline for submission of bids.

As stated above track updates and announcements at the website, shall be the responsibility of the Offerors.

Even if tender updates will be sent directly to the Offerors, it is does not remove the Offeror’s responsibility to continue to monitor updates about the tender at the company's website until the deadline for submission of proposals.

Changes and updates after the deadline will be delivered in writing to the Offerors.

0.4 The Specification

0.4.1 Application for proposals (the "specification" or "Tender Documents") contains:

a) Administrative part - also called the "administration chapter", and marked as Chapter 0.

b) Technical part - including the characterization of the system / services / SW, and marked as Chapters 1-4 (including appendixes), appears separately and attached to this request to bid.

Appendixes as follows: A – Security, B – OSS, C- POC procedure, D- Threshold Requirements, E - Proposal Evaluation Methodology (PEM), F – Exercise Content Table and G – Offeror's Declaration.

0.4.2 The tender chapters marked as follows:

Chapter 0: Administration - sections of this document
Chapter 1: Objective
Chapter 2: Application - The Essence of the System
Chapter 3: Technology and Infrastructure
Chapter 4: Implementation

0.4.3 Offerors will have no rights in the tender documents, they will not be eligible to be transferred to, or make any use of them, except for the purposes of preparing full proposals and submission, unless they obtain written approval for this from IEC.
0.4.4 In the event that it is unable by the Offeror to participate in the tender (after the paid tender fee), a message will be submitted the company that indicates the reason for non-participation in the tender.

0.4.5 Prior to the dealing with the other parts of the specification, the Offeror should read carefully administration chapter, which defines exactly how to meet the specification requirements.

0.4.6 Appendixes:

0.4.6.1 All appendixes must be accurately and fully completed. Each appendix will be presented separately.

0.5 Classification of the Technical Specifications

0.5.1 The method

0.5.1.1 The Technical Specifications classify paragraphs/provisions according to the following letters:

I (Information)
A paragraph intended for information purposes only and which does not require an answer. No reply will be understood as "I have read and understood and accepted" and will bind the Offeror. If Offerors have any comments - please note them.

G (General)
A paragraph requiring a general answer.

S (Specific)
A paragraph requiring a detailed and accurate reply, in the exact format required in the RFP (eg. filling-in a table, or enclosing a document/approval/ CV or enclosing an undertaking for the fulfillment of a requirement, etc.), or description of a required action (for example, demonstrations.

M (Mandatory)
Mandatory or threshold paragraph ("Go/No-Go"), also called “obligatory paragraph”. The Offeror’s reply will be in full and of one of the followings formats, according to the requirements of the paragraph: “I have read and understood and accept”, "Yes/No" with a full explanation, fulfilling a requirement (for example, providing an authorization)’ undertaking to fulfill a requirement – all according to the requirements of the paragraph. Lack of an answer or an answer which does not meet the requirement, or does not refer to a requirement or is unclear or inconclusive will automatically disqualify the proposal.

L (Least)
A Go / No Go component having a "Pass" level which must be met or exceeded. A detailed answer per the requirement of an "S" component is required. Answers which do not comply with the requirements of the L type component will not be considered.

N (Non-relevant) A special marking for paragraphs omitted from the specification as being "not applicable", and are not to be answered. The purpose of this marking is to indicate to the Offeror that this is not a mistake, but rather an intentional omission.

0.5.1.2 Classified sections (S) and (L) are sections that receive a score. Bid will be weighted and evaluated by these sections. Weights sections are part of an internal document review.

0.5.1.3 Classification of a main paragraph is valid for its sub-paragraphs, unless indicated differently in the sub-paragraph. For a paragraph that does not have a classification, the main paragraph classification will be used.

0.5.1.4 In addition to the classification, notice must be taken of the instructions in the paragraph itself and of the requirements formulated therein.

0.6 Structure of the Proposal

0.6.1 General Structure of the Proposal
The numbering and division of the proposal – all items where a response has been submitted to the RFP will be corresponding with the original Chapters and numbers of the RFP (including appendixes). For example: paragraph 2.1 in the proposal will contain a reply or comment to item 2.1 of the RFP, paragraph 2.2 will include the reply or comment to item 2.2, etc. Where items contained in the RFP do not require any response or comment, the proposal shall reflect a response of “No reply”, and the next item will maintain its original number in the RFP.

The Offeror will reply to all the paragraphs according to the structure and contents of every paragraph in the RFP.

0.7 Language
The technical proposal will be submitted in English.

Note: In case of incompatibility between the tender documents and paragraph 0 (administration) in spec. 200-15, the determine version will be the tender docs.
1 (I) Objectives

1.1 General

Because of the steadily increasing demand of bandwidth, the capacity of IEC’s transmission network has to be expanded. For this reason it is planned by IEC to introduce a new ROADM based Optical Transport Network with ODU XC to interconnect the sites with 10G and coherent 100G services (the “Transmission Network”).

1.1.1 The Suppliers will provide a solution and tools, characterize and shape the possible solutions, be part of the implementation phase, supply training sessions and will provide support and maintenance services.

1.1.2 (M) Manufacturer’s market share in optical (DWDM) and OTN switching solutions shall be at least 5% of global market share, in at least one of the years 2014 or 2015.

The Offeror will provide an analyst report from one of the following official analysis group: Ovum, Dell’Oro or Infonetics, proving the Manufacturer’s global market share proportion of at least one year during the last 2 years 2014 and 2015. The Offeror will attach the report to the proposal.

1.2 Transmission network customers

IEC Transmission network provides range of Telecommunications services, operational and administrative for IEC internal customers.

1.3 Objectives and Goals

1.3.1 Objectives
a. A scalable Transmission Network with an ability to deliver a wide bandwidth, using the latest and advanced technology supporting reliability and availability of 99.999%.

b. Secure and encrypted management channels.

1.3.2 Practical Goals
a. Establishment of a new Transmission Network consisting of an OTN XC and ROADM (WSS) nodes supporting at least 88 DWDM channels at rates of 10G, 100G and 200G.

b. Establishment of secure operation and network management system which will manage the full set of converged NEs by providing integrated, coherent and homogeneous NE supervision and administration capabilities.

The new Network Management System (the “NMS”) will be activated from two different NOC sites (Active – Active, Active – Hot Standby) in two different locations.

c. Allow controlled changes without affecting the network services.
d. Ability to provide bandwidth as required.
e. 4 types of platforms layers: Core, Distribution, Metro-Access & Access and support a variety of services and protocols.
f. Provision of special services such as in-house AES256 level encryption capabilities over 10G and 100G.
g. Provision of FC 2/4/8/10 including EMC and IBM certification.
h. An alien wavelength support.
i. Integration with the existing IEC OSS system.

1.3.3 Future goals
a. The ability to extend the network features, bandwidth and services to 400G and 1T as an evolution growing path.
b. Enabling Network migration from Packet-Optical to SDN.

1.4 Organization goals with the Relationship to business
a. Providing communication services for all IEC units, allowing high reliability and availability performance on the product delivering.
b. Constantly supply of 10G & 100G wavelength as per internal customers requirements.
c. Services and bandwidth with a low investment budget.

1.5 Feasibility and Cost/ Benefits
a. Optimal and efficient working planning for the transmission network.
b. Raising the reliability and availability of services in business and operating income.
c. Efficient customer SLA by measuring the level of service provided to the customer.

1.6 Declaimer

Abbreviations and terms used in this specification defined and will be concordant with the following standards and documents:

e. 10Gb and 100Gb data technology – related groups of IEEE standards 802.3ax and 802.3bx, where x=a, b, c,...., etc.
g. MPLS technologies – associated groups of IETF Request of Comments documents and drafts (the lasts only for reference) for Generalized, Transport and IP MPLS.

h. Control Plane – generally collected in ASTN/ASON ITU-T standards G.807, G.8080 and linked child standards (G.7712 to G.7715, G.7718), GMPLS architecture per RFC Publication 3945 and linked Publications (3473, 3741, 4202, 4206, 4258, etc.).

i. The abbreviations M, G, T used for designation of data bit rate in Mega bit per second, Gigabit per second and Terabit per second.
2 (S) Application - The essence of the system

2.1 (I) General Characteristics

2.1.1 IEC required for a solution to support WDM-OTN transport and switching, including wavelength switching via multi-ways ROADM and electrical sub-lambda switching of ODU containers.

IEC transport network shall provide any mix of TDM and broadband data services and give to the operator the necessary tools for high scalability and flexibility in the design of the different parts of its transport network. It shall be possible to scale in the network capacity to accommodate requirements ranging from High-End Customer Premises to the Access and Metro networks.

The network shall be designed in accordance with telecommunication industry standards and provide the necessary carrier-class performance features required in the network.

The network will be supported by a state-of-the-art management solution ensuring cost-efficient network operation and rapid introduction and provisioning of new services.

2.1.2 (S) Main Features and Technical Requirements

IEC concept emerge from the recognition that telecommunication networks are evolving to become more data-centric, and they require equipment capable of efficient supporting current and new data services with the reliability, robustness and security that are needed for real carrier-class applications.

2.1.2.1 (M) The whole solution and all products in the proposed solution and equipment (DWDM, OTN switching, Muxponder, metro carrier Ethernet, line amplification, 10G and 100G encryption, FC services and ROADM and any functions) must be from the same proposed Manufacturer and managed by the same proposed NMS. The Offeror shall sign the attached declaration, appendix G spec. 200-15.

2.1.2.2 (I) All products in the network shall be Carrier Class products that support multiple protection schemes with fast fault recovery of less than 50 milliseconds, making it suitable for delivering services with an availability of 99.999%.

2.1.2.3 (I) One Network management system shall manage all layers and provisioning of all services.
2.1.2.4 (I) All NEs shall be managed by the NMS (top to bottom).

2.1.2.5 (I) The OTN switching shall be done via a central fabric.

2.1.2.6 (I) The OTN system shall support the following granularity: ODU0, ODU1, ODU3, ODU4 and ODUflex.

2.1.2.7 Network Element upgrades process shall be non-traffic affecting with full responsibility of the Supplier for the process.

2.1.2.8 The upgrade process shall be simple, enabling the operator to perform Network Element upgrades without Supplier assistance.

2.1.2.9 (I) NMS upgrades shall be performed with full responsibility of the Manufacturer.

2.1.2.10 (G) The Offeror shall describe in details the upgrade process procedure.

2.1.2.11 The upgrade process should include application allowing simultaneous upgrade in groups of numbers of NEs, at least 10 NEs at a time.

2.1.2.12 (I) The DWDM functionality shall include Multi Degree directionless ROADM, amplifiers and passive cards.

2.1.2.13 (I) The DWDM system shall be able to support colorless and directionless in the initial phase of the implementation.

2.1.2.14 (I) The system shall support coherent technology in rates of 100G & 200G.

2.1.2.15 (I) The system shall support coherent technology in rate of 400G.

2.1.2.16 Wavelengths ("alien wavelength") offered in the tender shall be integrated within the existing IEC network, according to ITU-T G.872.

2.1.2.17 The DWDM system features shall support the alien wavelength of the IEC existing Manufacturer.

2.1.2.18 (I) The proposed solution shall include:
   a. Planning tool.
   b. (M) The proposed cards supporting FC client services (as per par. 3.3.5.c in spec 200-15) must be supported in the same proposed platform and must have an official documented IBM and EMC certification credential effective date prior to the
tender publication date, and must have at least one operational field experience with the proposed card in the past 2 years prior to the RFP issue date which required this certification. The Offeror will attach the certification and information regarding implementation to the proposal. The Offeror shall fill the table apply in spec. 200-15 paragraph 4.2.5.6.

c. Encryption Services (AES256 level encryption) Certification of FIPS security for 10G and 100G lines.

2.1.2.19 (I) The proposed management system must have the capability of integration with the OSS solution deployed at IEC (discussed in details in Appendix B).

2.1.2.20 (M) The proposed management system must have proven experience in at least 3 different OSS projects, prior to the tender publication date, based on Fault Management and Inventory Management integration. The Offeror shall fill the table apply in spec. 200-15 paragraph 4.2.5.6.

2.2 (I) Network architecture

2.2.1 IEC Transport Network shall be defined as an OTN layer and photonic layer consist of ROADM Multi Degree includes data recovery capabilities of alternative routes for cost-efficient network operation defined as the optic layer.

2.2.2 (G) The Offeror shall specify the system shelf size and type offered. All the shelves type will use the same software load and can reuse service and line interfaces.

2.3 (S) Photonic Layer

2.3.1 (I) The system shall support both passive filters as well as ROADM-based connectivity with WSS.

2.3.2 The system must have the capability to support both 50GHz-spaced, 100GHz-spaced and upgrade to flexible grid ROADM architectures.

2.3.3 (G) The Offeror shall describe in details the upgrade process procedure to flexible grid ROADM architectures.

2.3.4 (L) The system must support at least 88 channels in the C-band according to ITU-T G.694.1.
2.3.5 The system needs to be able to perform automatic per-channel power control and optimization via software.

2.3.6 (L) The DWDM system must support ROADM multi degree directionless which will be able to switch wavelengths between the directions of granularity of single wavelength, at least.

2.3.7 The Multi degree directionless ROADM shall support geo-distribution – ROADM implementation in different sites.

2.3.8 (I) The system should support auto-discovery in layer 0.

2.3.9 The proposed ROADM should allow IEC to implement the ROADM solution CD (Colorless & Directionless). Operator should be able to upgrade existing (previous installed) ROADM nodes to CDC configurations.

2.3.10 CDC system (HW & SW) should be able to automatically ensure that all cables are connected to the right ports, as per provisioning information entered.

2.3.11 CDC system (HW & SW) should be able to identify fiber degradation in its internal architecture.

2.3.12 CDC system (HW & SW) should be able to display results of the photonic connection validation (in its internal architecture) to the operator.

2.3.13 CDC system (HW & SW) should support a manually initiated “Transmitter loopback test” that tests the complete path from the Transmitter to the channel mux/demux and looped back at the WSS in its internal architecture.

2.3.14 (G) The Offeror shall provide details, including diagrams, concerning how the channel bands are designed for the proposed system. The diagrams and information shall show how the respective lambdas pass through the filters and are multiplexed onto a single pair of fibers for a fully populated DWDM system.

2.3.15 (G) The Offeror shall describe in details the OSC implementation in the network.

2.3.16 The optical network structure shall allow an incremental traffic growth. The Offeror shall provide a wide set of passive filters which can be selected according to traffic needs and network segments (4 channels filter, 8 channels filter, ..., 48 channels filter).

2.3.17 The proposed System shall have an integrated OTDR.
2.4  (S) OTN Cross Connect

2.4.1  (I) The equipment shall be OTN based and fully support G.709 standards.

2.4.2  The ODU-XC shall support full WDM functionality installed on the same cage.

2.4.3  The system shall support ODUk cross-connect and also ODU-flex.

2.4.4  (I) The system should be able to support OTN switching and groom lower speed ODU0, ODU1, ODU2e, ODU2, ODU3 signals onto a 100G wavelength.

2.4.5  (G) The Offeror shall list all fabric cards (and the relevant shelves), that the system currently supports and it's roadmap.

2.4.6  The OTN fabric shall be hybrid OTN/Packet fabric type and be capable of supporting any mix of OTN/Packet.

2.4.7  The hybrid OTN/Packet fabric should support any mix of OTN XC and Packet over the full scale of the hybrid fabric XC capabilities without restrictions.

2.4.8  (I) The proposed platform shall have the ability to support shelf processor (SP) redundancy in shelves that can support DXC.

2.4.9  (I) Each port should be software provisioned to either client or line interface.

2.4.10 (I) Each OTUk should be provisioned to at least EFEC; the Offeror shall list other proprietary FECs and the specified FEC performance that the system supports.

2.4.11 The system shall support at least B&W SFP/SFP+/XFP and tunable XFP.

2.4.12 The system shall support 40G OTU-3 and 100G OTU-4 service interfaces.

2.4.13 The system shall support at least 100G line interfaces.

2.4.14 (I) The OTU-2/3/4 interface could de-multiplex to tributary ODUk signals (software provisionable) via the matrix.

2.4.15 (I) The system should support loopback function on each port by the management system.
2.4.16 (I) The OTN-XC shall have independent and redundant synchronization matrix.

2.4.17 (I) OTN-XC shall be able to perform mapping and multiplexing of a non-OTN client signals into higher order ODUk signals.

2.4.18 1+1 trail protection shall be provided by the OTN cross-connect.

2.4.19 (I) The system shall support In-service switch capacity upgrade capability.

2.4.20 The OTN equipment shall allow to support traffic protection mechanisms:
   a. ODUk Sub-Network Connection Protection (SNCP) and N:1 protection.
   b. ODUk Sub-Network Connection restoration with ODU0 granularity.
   c. Restoration based on GMPLS/ASON on HW&SW(NEs) managed by the NMS.

2.4.21 (I) The OTN switch shall be able to aggregate and switch 10G OTN client ports mapped into ODU-2 (such as OC-192, STM-64, 10GbE, ODU2).

2.4.22 (I) The OTN switch shall be able to switch 100G OTN client ports mapped into ODU-4 (that supports 100GbE, ODU4).

2.4.23 (G) The Offeror shall state how many client services can be aggregated to a single ODUk port using ODUflex.

2.5 (S) Control Plane Photonic and OTN

2.5.1 (I) The Control Plane shall be implemented in the proposed system and will be based on normative standards GMPLS/ASON/WSON. The Offeror will describe the overall Control Plane architecture, possibly by means of a block diagram, highlighting the interfaces to other modules (agents, control plane elements located outside the device, overlay) and to the management system.

2.5.2 Control plane shall support service routing defining as well as blocked service routing defining.

2.5.3 Control plane shall support automatic reversion.

2.5.4 Control plane shall support optional automatic reversion based on Wait-to-Restore time.

2.5.5 Control plane shall support the ability to enter admin weights to each link.
2.5.6 Control plane shall allow user to specify at least 4 levels of restoration priority per connection.

2.5.7 Priority classes shall be capable to manage service restoration according to available resources.

2.5.8 Control plane shall support bandwidth lockout, the ability to lock bandwidth on a link for maintenance activities.

2.5.9 Control plane should be able to make use of available bandwidth per link.

2.5.10 Control plane shall allow the user to specify preferred paths as well as to be able to exclude paths.

2.5.11 Control plane shall allow the ability to block a node and a link from accepting any new connections or participating in restoration and capable of accepting special services routing which are not under the control plan definitions.

2.5.12 Control plane shall support provisioning of mesh restorable connections.

2.5.13 Operator shall be able to retain home path and maintain home path bandwidth resources, even if service connection is switched off the home path.

2.5.14 Control plane shall support the ability to select protection path based on admin weight or latency.

2.5.15 OTN control plane should support the ability to setup a new connection path prior to tearing down the existing path, reducing traffic disruption to less than 50ms.

2.5.16 OTN control plane should be able to display the transmit delay associated with each link.

2.5.17 OTN control plane should capable of changing connections from permanent connections to mesh restorable connections.

2.5.18 Control plane should ensure that the working service connections and the protected service connections in multi restoration service connections take divers rout.

2.5.19 (G) The Offeror shall state the maximum number of nodes managed by the control plane.

2.5.20 (G) The Offeror shall state the maximum number of restored ODU-k connections at the same time for the whole network.
2.5.21 (G) The Offeror shall describe the implemented routing architecture (distributed/centralized, hierarchical …).

2.5.22 The system shall provide the following functionalities:
   a. Constraint routing.
   b. Exclude/include node.
   c. Exclude/include link.
   d. Exclude/include SRLG.

2.5.23 The Control Plane shall be able to create/delete/manage Permanent Connections.

2.5.24 (G) The Offeror shall describe which communication channels are used by the Control Plane for signaling purposes (e.g. Optical Supervisory Channel, General Communication Channels …).

2.5.25 (L) The System must support at least services protection, restoration and other combination options (SNCP 1+1, 1+N …).

2.5.26 (L) OTN Control Plane must provide protection and restoration function that allows automatic multi-fault recovered by SNCP 1+1 in 50 ms at most.

2.6 (S) 10G Solution

2.6.1 (G) The Offeror shall describe the proposed 10G multi-protocol transponder and I/O cards.

2.6.2 (L) 10G TR shall support at least 10.7G OTU2 or 11.09G OTU2e line interfaces.

2.6.3 10G solution shall support FEC methods. The Offeror shall explain in details which types of FEC are implemented in the proposed system.

2.6.4 10G solution shall support loopback on the line side.

2.6.5 10G solution should support loopback on the client side.

2.6.6 (G) The Offeror shall specify the 10G TR lowest latency figure.

2.6.7 (L) 10G TR shall support at least the following client protocols: STM-64 (9.53Gb/s), 10GbE (10.3125Gb/s), OTU2 (10.709 Gbit/s), OTU2e (11.09 Gbit/s), 4GFC (4.25Gb/s) and 8GFC (8.5 Gbit/s) rates.

2.6.8 (I) 10G solution shall support 5G PSIFB (5Gb/s), ISC3 Peer Mode (2.125Gb/s).
2.6.9 10G solution shall support 1+1 card protection.

2.6.10 The 10G solution shall be able to be deployed on B&W, XFP fixed and tunable colored line systems.

2.6.11 (G) The Offeror shall describe the port density and capabilities in the 10G card and the additional features of the TR card(s).

2.7 (S) 100G Coherent Solution

2.7.1 (G) The Offeror shall describe the 100G solution compensation for PMD.

2.7.2 (G) The Offeror shall describe the 100G solution compensation for chromatic dispersion.

2.7.3 (G) The Offeror shall describe 100G solution FEC coding gain at 10^{-15} BER.

2.7.4 The 100G solution shall be coherent and able to be deployed on tunable colored line systems and support OTN Control Plane connections.

2.7.5 The 100G solution shall be capable to be deployed in any of the following applications: metro, regional and long haul.

2.7.6 100G TR solution shall support 1+1 card protection.

2.7.7 The 100G solution should be capable to support flexible modulation (for 50G and 100G) and being remotely provisioned by the user.

2.7.8 100G solution shall support either 100GbE or OTU4 with a single client interface.

2.7.9 100G TR solution should support embedded PRBS test set capability.

2.7.10 100G solution shall support loopbacks.

2.7.11 100GbE shall support multiple types of CFP pluggable, including 100m, 2km, and 10km variants.

2.7.12 100G Muxponder and Transponder solution shall support 10G multiprotocol solution.
2.7.13 The multiprotocol solution shall support OC-192/STM-64/10G, 10GbE (10.3125Gb/s), OTU2 (10.709 Gbit/s), OTU1e (11.05 Gbit/s), OTU2e (11.09 Gbit/s) and 8GFC (8.5 Gbit/s) rates.

2.7.14 (I) 100G Muxponder and Transponder solution shall support G.7041 compliant Client Management Frames (CMF) and Ordered Set Transparency.

2.7.15 100G Muxponder and Transponder solution should support integrated 10G PRBS test set capability, with one integrated 10G test set per port (enabling independent integrated 10G test set per port).

2.7.16 (G) The Offeror shall describes 100G product line, type of cards and services.

2.7.17 (G) The Offeror shall state and explain the PMD, CD and OSNR limitation and the way it is handle on old (10-15 years) G.652 fibers.

2.7.18 The system shall be able to cope with changing CD and PMD during automatic wavelengths restoration.

2.7.19 The system shall enable 100G coherent wavelengths with 10G wavelengths over 50Ghz spacing (without guard bandwidth between 100G and 10G wavelengths).

2.7.20 (G) The Offeror shall describe the port density and capabilities in the 100G card and the additional features of the TR card(s).

2.8 (S) 200G Solution

2.8.1 The Offeror shall be able to provide proven 200G@50Ghz wavelengths interface uplink over the offered network.

2.8.2 (G) The Offeror shall specify operational 200G deployment.

2.8.3 (G) The Offeror shall state 200G line interface maximum of latency through the line module.

2.8.4 (I) The 200G TR shall support flexible mix of services – STM-n, FC, OTU2/3/4, 10GE, 100GE.

2.8.5 The 200G TR shall support different line rate - 100G and 200G.

2.8.6 The 200G solution shall be coherent and able to be deployed on tunable colored line systems.

2.8.7 (G) The Offeror shall describe the port density and capabilities in the 200G card and the additional features of the TR card(s).
2.8.8 (G) The Offeror shall provide platform Roadmap beyond 200G, i.e. 400G.

2.9 (S) Ethernet Requirements

2.9.1 The Offeror shall propose at least L1, L2 and MPLS TP packet switching capabilities. The proposed solutions shall be described in details.

2.9.2 (G) The Offeror shall indicate which services the system support including Ethernet Private Line (EPL), Ethernet Virtual Private Line (EVPL), Ethernet Local Area Network (E-LAN), and various others. The requirement for sub 50 millisecond service restoration shall apply to all services types described below.

2.9.3 The platform shall support at least 100G packet switching capacity on its blade-based Ethernet-switch modules.

2.9.4 The platform shall support fabric-based packet switching of 1GE, 10GE and 100GE over 10G/100G DWDM.

2.9.5 The platform shall support packet switching onto ODUFlex containers.

2.9.6 The platform shall support PtoP and MPtoMP services.

2.9.7 The platform shall support SyncE protocols.

2.9.8 The platform shall support packet fabric and OTN switching simultaneously.

2.9.9 (G) The Offeror shall indicate and explain the capability of the platform for supporting the following standards/protocols (client or line): G.8032 Ethernet Ring Protection, IEEE 802.3ad Link Aggregation, IEEE 802.1D MAC Bridges, IEEE 802.1Q Virtual LANs, IEEE 802.1 ad Q-in-Q.

2.9.10 The equipment shall support Layer 2 protection mechanisms:
   a. Ethernet Ring Protection.
   b. MPLS-TP mode.

2.9.11 (G) The Offeror shall provide and describe a solution that shall be capable of being provisioned to multiple classes of service. The solution shall provide the ability to provision Committed Information Rate (CIR), Excess Information Rate (EIR), and Peak Information Rate (PIR) parameters in increments of 10 Mbps.
2.9.12 (G) The Offeror shall describe all classes of service that may be provisioned on the proposed system. In addition, the Offeror shall indicate the information fields (e.g. VLAN ID, Interface, DSCP values, etc.) that can be utilized to identify and classify traffic into various queues and indicate which information fields can be utilized to perform rate limiting.

2.9.13 (G) The Offeror shall indicate the minimum increments of bandwidth that can be provisioned for each class of service.

2.9.14 (G) The Offeror shall detail the support for multicast/drop and continue solutions.

2.9.15 (I) Traffic management shall be based on the following mechanisms:
   a. Ingress (and optionally egress) policing at UNI and E NNI ports based on VLAN tagging (C VLAN, S VLAN, untagged), 802.1p, and DSCP.
   b. Forwarding is based on VLAN, MPLS label stack, and/or destination MAC address.
   c. Egress scheduling combining strict priority with weighted round robin (WRR).
   d. Weighted random early drop (WRED).
   e. Dedicated queues defined per outgoing LSP/CoS.

2.9.16 Sub 50 msec protection is supported with MPLS TP linear protection for bidirectional LSPs.

2.9.17 (I) The L2 card shall support:
   a. Configurable data switching modes: Ethernet PB (QinQ) switch, based on 802.1d/q/ad (default).
   b. MPLS TP Layer 2 switch.
   c. Interoperability with third party datacom equipment.
   d. Ethernet services, including: E-LINE Point to Point (P2P), E-LAN Multipoint to Multipoint (MP2MP), E-Tree Point to Multipoint (P2MP).
   e. Packet applications are augmented by OTN wrapping of 10GE ports into OTU2e, with the ability to tune the port lasers, eliminating the need for transponders between the 10GE ports and the OTN/photonic equipment.

2.9.18 (I) OAM support:
   a. Performance Monitoring (PM) enabling efficient tracking, storage, and analysis of the potentially huge amounts of historical PM data produced by large numbers of data objects, a valuable capability for network operators monitoring heavy traffic. This data can be accessed through PMH in Management system.
   b. Ethernet link OAM, (IEEE 802.3 05, formerly 802.3ah).
   c. MPLS TP tunnel OAM, (RFC5586, RFC5860).
d. MPLS TP fault management (FM), (RFC6427, RFC6428).
e. Ethernet Service Connectivity Fault Management (CFM), enabling E2E network OAM for Ethernet networks.
f. Ethernet Service PM, (Y.1731).
g. Port mirroring.
h. Traffic management, including classifications and mapping, scheduling, and policing.

2.9.19 L2 Card shall support MEF-based Services.

2.10 (G) Platform Scalability

2.10.1 The hardware shall be expandable. The Offeror shall describe the expansion capabilities.

2.10.2 The Offeror shall describe how the platform is expanded to supply additional channel capacity. The expansion should be non-service affecting.

2.11 (S) Encryption

2.11.1 (M) The proposed system must support TR or I/O card encryption for 10G encrypted uplink on the proposed platform based on AES256. The proposed 10G encryption must have official documented FIPS 140-2 encryption certification effective date prior to the tender publication date. The Offeror will attach the certification to the proposal. The proposed TR or I/O card encryption for 10G encrypted uplink, must have an operational field experience, in active and operational networks in at least two customers, for the past two years prior to the tender publication date. The Offeror shall fill the table apply in spec. 200-15 paragraph 4.2.5.6.

2.11.2 (M) The proposed system must support TR or I/O card encryption for 100G encrypted uplink (supporting 100G client) on the proposed platform based on AES256. The proposed 100G encryption must have official documented FIPS 140-2 encryption certification or be in FIPS 140-2 Certification Process effective date prior to the tender publication date. The Offeror will attach to the proposal, FIPS 140-2 certification or approved in Process List of the Cryptographic Module Validation Program FIPS 140-2.

2.11.3 The system shall support TR or I/O card encryption based on AES256 on the proposed platform supporting FIPS 140-2 encryption for 200G encrypted uplink.

2.11.4 The system shall support any mix of traffic over the 100G encryption wavelength.
2.11.5 (I) The platform shall support protocol agnostic encrypted 10G and 100G solution, with support for any of 10GE, 10G OTN, 10G SONET/SDH or 8G/10G Fiber Channel, ODU-1/2/3/4 protocols.

2.11.6 The encryption shall support ECC (Elliptic Curve Cryptography) for key exchange and certificate based authentication on the lines. The Offeror will attach the certification to the proposal.

2.11.7 The platform’s encryption solution shall support X.509 authentication.

2.11.8 The platform’s encryption solution shall offer separate keys for authentication and encryption functions.

2.11.9 (I) The Offeror shall provide a separate key generator Server.

2.11.10 (G) The Offeror shall indicate the authentication interval.

2.11.11 (G) The Offeror shall indicate the hitless key rotation interval.

2.12 (S) Network Management System

2.12.1 (L) NMS minimal configuration:

2.12.1.1 The offered management system shall include a single unified NMS (HW and SW) for different product lines and/or scalability purposes for all network layers (layer 1, layer 2 and DWDM).

2.12.1.2 The NMS shall support two NOCs geographically separated, without any distance limitation.

2.12.1.3 The NMS shall support High Availability configuration, both servers shall be up and available continuously (configured as active-hot standby or active-active), using automatic switching between the two servers, enabling the continued management of the network, for maintenance or during an active site failure.

2.12.1.4 Both NOCs servers shall be synchronized with each other (both servers always up to date with the network's real time status). The Offeror will describe in details the synchronization process, backup and recovery, Automatic and Manual.

2.12.1.5 (S) NMS supporting active-active High Availability, enabling immediate management continuity, will be considered as an advantage.
2.12.1.6 (I) The NMS (HW and SW) will be available 24/7, 365 days a year.

2.12.1.7 (G) The Offeror shall describe the data recovery process in crisis.

2.12.2 All data and optical trails as well as maintenance actions should be managed by the NMS (top to bottom).

2.12.3 (I) The NMS shall support Optical impairment awareness of the user during trail creation and beyond. This means the user can see actual measurements from the network and can judge whether the optical trail's parameters meets the required levels.

2.12.4 The NMS shall support multiple physical and logical layers in graphical views.

2.12.5 The NMS shall support graphical network usage chart, show used/free resources over the whole network or drill-down into a link (lambda and sub-lambda levels).

2.12.6 The NMS shall support multi-route trails (protection/restoration).

2.12.7 The NMS shall have a rich Graphical User Interface (GUI). It is required that it will be possible to perform any Network Management operation via GUI without the need for the user to perform CLI (Command Line Interface) commands.

2.12.8 The management system shall provide the maximal flexibility in implementation of combined protection and restoration and pre-planned path calculation using the OTN & Photonic control plan capabilities.

2.12.9 (I) The NMS architecture shall be based on client-server relationships using standard technologies.

2.12.10 (G) The Offeror shall list and describe the device management capabilities (number of Users and NEs).

2.12.11 The management system should support display of:
   a. Optical logical layer showing Logical Elements (Optical cards/ports) and logical optical topology.
   b. OCH logical layer showing logical OCH topology.
   c. Graphical lambda availability chart.

2.12.12 The NMS shall allow the provisioning, monitoring, operation and troubleshooting of the entire network from the two NOCs. The Offeror shall describe this facility, addressing amongst others, the ISO conceptual model of all key functional areas (fault management,
configuration management, accounting, performance management, and security management) of the NMS.

2.12.13 (I) It should be possible to present 3rd party equipment as topology links and trails.

2.12.14 (I) The NMS shall support alien lambda services, representing other Manufacturers or foreign channels integrated into the DWDM system.

2.12.15 The management system shall be capable to produce a network inventory reports.

2.12.16 (G) The Offeror shall explain in details the future migration to SDN.

2.13 (S) Fault management

2.13.1 The NMS shall perform alarm surveillance on the managed networks.

2.13.2 The alarm severity shall be ranking at least four categories: warning, minor, major, critical.

2.13.3 The highest severity alarm state in network element shall be displayed by means of different icon colors on the topological map.

2.13.4 Links that are affected by an alarm shall be displayed by means of different link color on the topological map, according to the highest severity alarm affecting the link.

2.13.5 All alarms shall be displayed in graphical way.

2.13.6 The NMS shall display counters for the following:
   a. Total active alarms.
   b. Severity (critical, major, minor, warning) of each alarm.
   c. Unacknowledged alarms for each severity.

2.13.7 It will be possible to filter the Alarms List according to following entities:
   a. Alarming entity (alarm and network element name).
   b. Alarm state.
   c. Alarm time stamp.
   d. Severity.
   e. Acknowledgement.

2.13.8 All historical alarms shall be stored in the database. The historical alarms report shall be managed by filters based on the following fields:
   a. Event name.
   b. Equipment type.
c. Severity.
d. Date and time.

2.13.9 The NMS shall enable the user to view lists of trails/tunnels/services which affected by an alarm.

2.13.10 The NMS shall enable the user to view a list of all current alarms for a specific NE or trail or tunnel or service.

2.13.11 (I) It shall be possible for users to attach user notes to each alarm.

2.13.12 (I) Proposed corrective actions for each alarm shall be displayed by the NMS.

2.13.13 (I) The NMS shall support site level alarm correlation and network level alarm correlation to reduce the number of alarms reported at each site to a minimum.

2.13.14 (I) The management system shall support “Crossed fibers suspected” alarm.

2.13.15 (I) The management system shall detect and alarm insufficient loss in a span between photonic nodes.

2.13.16 The management system shall be able to detect sudden unexpected optical power changes.

2.13.17 The management system shall support Automatic Power reduction on all EDFA-based and Raman amplifiers.

2.13.18 The management system shall support Automatic Line Shutoff with power levels at or above eye safe levels.

2.14 (S) Configuration management

2.14.1 (I) The NMS shall monitor network and system configuration information so that the effects on network operation of various hardware and software elements can be tracked and managed.

2.14.2 The NMS shall support graphical point-and click service provisioning of all network layers.

2.14.3 The NMS shall support automatic selection of the optimal path and resources for the trail on point-and click provisioning of trails.

2.14.4 The automatic path selection shall support at least the following criteria:
   • Minimum hops
• Minimum distance
• Minimum cost
• Maximum quality

2.14.5 (I) The NMS shall support service configuration tools: policer profiles and service templates.

2.14.6 The NMS shall support an automatic Shared Risk Link Group (SRLG).

2.14.7 The NMS shall fully support editing any parameter of an existing service, including adding/removing endpoints and changing any service or service endpoint parameter.

2.14.8 The NMS shall support a graphical availability chart showing link utilization.

2.14.9 The NMS shall support an inconsistency detection and correction tool for inconsistencies between the NMS DB and the EMS/network configuration. These tools shall be supported for trails, tunnels and services.

2.14.10 The NMS shall support inserting or remove NE to the network. When inserting or removing NE, the NMS shall automatically update/configure services so they continue to operate correctly in the new network topology.

2.14.11 For Ethernet services the NMS shall perform loop detection to prevent users from creating loops in the network due to misconfiguration.

2.15 (S) Performance management

2.15.1 (I) Different performance of the interface, device, and protocol levels shall be collected on a regular basis. The polling engine in the network management system will be utilized for data collection purposes. The network management systems shall be capable of collecting, storing, and presenting polled data.

2.15.2 The following network performances shall be available:
• Error Seconds (ES)
• Severely Error Seconds (SES)
• Unavailable Seconds (UAS)

2.15.3 The NMS shall show all current values of performance monitoring counters in time intervals up to 24H.
2.15.4 Historical Performance data shall be stored into the database. All the performance data stored into the database shall be presented to the user through a proper report. The performance report shall be managed by filters based on the following fields:
- Network element
- Measurement type
- Equipment type

2.15.5 (I) The results of the query shall be displayed in a table and graph format.

2.15.6 (I) Different performance at the interface, device, and protocol levels shall be collected on a regular basis (including physical performance diagnostics as channel power, Dispersion, PMD, etc).

2.16 N/A.

2.17 (G) Reliability

2.17.1 The Offeror shall explain all the protection options (traffic and hardware) and how the protection mechanism works in each one of them.

2.17.2 The proposed equipment should be without single point of failure that could potentially cause a traffic outage. The Offeror shall describe in detail the service protection and hardware redundancy available for the proposed equipment (Client and Line interfaces).

2.17.3 The proposed system should support “hitless” upgrades when a new software upgrade is applied to the proposed system. If the system does not support hitless upgrades, the Offeror shall detail the expected outage time for the upgrade. The Offeror shall detail Roll Back process (to the previous load).

2.17.4 The proposed system architecture should achieve at least a level of “five nines” reliability (99.999%). The Offeror shall state the level of reliability and provide details on the methodology used to achieve the stated level of reliability.

2.17.5 (I) The system shall support card replacement during system run time (hot swappable).
2.18 (M) Security requirements for computerized system - Appendix A-1

The proposed system must comply with the requirements described in Appendix A-1. Appendix A-1 will be submitted to the Offerors in the 2nd part of the technical session, the POC session, (Only to Offerors who managed to pass the first part of the technical session).


The proposed system must comply with the requirements described in Appendix A-2. The Offeror shall fill the table apply with the Appendix A-2.

2.20 (I) Data Communication Network (DCN)

2.20.1 The equipment shall be provided with an external DCN Ethernet interface (RJ45) for out-of-band management.

2.20.2 The physical interface for management port shall be a 10/100Base-T which supports fixed speed/duplex configurations or auto-negotiation.

2.20.3 (G) The Offeror shall state the max bandwidth required for DCN.

2.20.4 The DCN implementation is compliant to specs ITU-T G.7712.

2.20.5 It shall be possible to designate more than one NE Gateway for a management domain.

2.21 (S) Requirements for integration with IEC OSS

See Appendix B for detailed requirements.

2.22 (I) Infrastructure

A DRP (disaster recovery protection) scheme shall be available for the NMS-EMS system. The system will support DB replication and archiving.

2.23 (S) Network Planning & Analysis Tool

2.23.1 (I) The Offeror shall provide to IEC a network planning tool that enables a range of capabilities for optical switching network and DWDM network design.

2.23.2 The proposed planning tool shall have the following capabilities:
a. Network optimization & growth projections
b. An optimized planning that meets the design requirements (services routing wise).
c. What-if scenarios which can be modeled without impacting a live network.
d. Routing Simulation.

2.23.3 (L) The proposed planning tool will be capable of at least extracting data from the network and allows designing all network configurations.

2.24 (I) System Maintenance features

2.24.1 Full equipment Self-test shall be supported.

2.24.2 SW tests (Health Monitoring Tests) shall be supported.

2.24.3 External loops shall be supported.

2.24.4 Internal loops shall be supported.

2.24.5 Software restart shall be supported.

2.24.6 Module shut-down shall be supported.

2.24.7 Two banks of memory shall be supported for software upgrade.

2.24.8 It shall be possible to activate the active software banks from the LCT/NMS.

2.24.9 The installed SW version can be read from LCT/NMS.

2.25 (I) Power Supply Interface

2.25.1 Input voltage ranges shall be 48 Vdc nominal per ETSI EN 300 132-2. The equipment shall operate with positive terminal connected to ground.

2.25.2 Availability for 190 to 265 Vdc (220VDCnominal) power supply voltage range shall be considered as an advantage.

2.25.3 The power supply module(s) shall be tolerant to reverse polarity supply and power supply voltage disturbance caused by dips, interruptions and voltage skips on grounding – no interruption in normal operation shall be produced. The Offeror shall describe in detail the utilized preventing methods.
2.25.4 Double power feeders with automatic back-up switching shall be provided.

2.25.5 The equipment shall have redundant power supply by means of independent modules.

2.25.6 (G) The Offeror shall define power consumption for each module. Heat dissipation (in BTU/h and Watts) shall be provided for typical configurations.

2.26 (I) Environmental Conditions

The Offeror shall make reference to the fact that the equipment shall be installed in the vicinity of 400 kV or 161 kV lines and therefore shall be susceptible to induction and to line switching effects.

The Offeror shall state the environmental conditions which are met by his proposed equipment. The Offeror must state those cases in which the proposed equipment performance is degraded due to certain simultaneous values of two (or more) environmental parameters.

2.26.1 The Ambient Environment

2.26.1.1 The minimal Purchaser's requirement for operation, storage and transportation shall be in accordance with ETSI EN 300 019 as follows:

a. Transportation shall be provided as “Very careful” as defined in part 1-2, Class 2.1 of the standard.

b. Packing of equipment for storage shall satisfy conditions for partially temperature controlled locations’ as per Class 1.1, part 1-1.

c. Operation environment shall be per Class 3.1, part 1-3, except of the low air temperature and low relative humidity for access class equipment that shall satisfy Class 3.3.

2.26.1.2 Withstand of the surpassed of maximal environmental conditions (particular as temperature leaps up to +55 ºC and high relative humidity accompanied with high temperature) above Class 3.1 of the ETSI EN 300 019-1-3 shall be considered as an advantage.

2.26.2 Electromagnetic Compatibility (EMC) shall be in accordance with ETSI EN 300 386 (2012-04). Withstand the electromagnetic environment harsher than defined in the standard shall be considered as an advantage.

2.26.3 The target insulation, voltage withstand, EMC and standards preferred by the Purchaser are collected in the following table:
## Insulation and Electromagnetic Compatibility (EMC)

<table>
<thead>
<tr>
<th>Test description</th>
<th>Test reference</th>
<th>Requirements</th>
<th>Ports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulation withstand voltages</td>
<td>IEC 60870-2-1</td>
<td>Table 18, Class VW1</td>
<td>A, B, C, D</td>
</tr>
<tr>
<td>Insulation resistance after insulation withstand test</td>
<td>IEC 60060-1</td>
<td>Higher than 100MOhm at 500 Vdc</td>
<td>A, B, C, D</td>
</tr>
<tr>
<td>Damped oscillatory waves</td>
<td>IEC 60870-2-1; IEC 61000-4-1, A.2.5</td>
<td>Table 12, Level 1, 0.5 kVpeak</td>
<td>A, B, C, D</td>
</tr>
<tr>
<td>Fast transient bursts</td>
<td>IEC 60870-2-1; IEC 61000-4-1, A.2.3</td>
<td>Table 12, Level 1, 0.5 kVpeak</td>
<td>A, B, C, D</td>
</tr>
<tr>
<td>Electrostatic discharge</td>
<td>IEC 60870-2-1; IEC 61000-4-1, A.3.1</td>
<td>Table 13, Level 1, Contact discharge 2 kVpeak</td>
<td>A, B, C, D</td>
</tr>
<tr>
<td>Radiated electromagnetic field</td>
<td>IEC 60870-2-1; IEC 61000-4-1, A.3.1</td>
<td>Table 15, Level 2 3 V/m</td>
<td>D</td>
</tr>
<tr>
<td>RF disturbance emission</td>
<td>IEC 60870-2-1; EN 55022 (CISPR 22) Clause 10</td>
<td>Table 17, Class A</td>
<td>D</td>
</tr>
<tr>
<td>Power supply variations, dips and interruptions</td>
<td>IEC 60870-2-1; IEC 61000-4-1, A.1.5</td>
<td>Table 11, Level 1 DC3 class, ripple VR3 class, dips 100% at 10 ms; interruptions 10 ms, random sequence, over 20 s period</td>
<td>A</td>
</tr>
</tbody>
</table>

Where interface points are: A – power supply, B – communications (low voltage), C – alarms (rated equal or less than 60 V dc) and D – housing/shelf.

2.26.4 In case the proposed equipment conforms to recommendations, standards and/or specifications other than those herein, the Offeror shall define these recommendations, standards and/or specifications and shall attach compliance (comparison) tables for each such case. Non-compliant points shall be highlighted. Copies of each such recommendation, standard and/or specification shall be submitted as it applicable to this Specification.
3 (S) Technology and Infrastructure

The overall system will be based on standard shelf components. All equipment proposed by the Offeror will be from one manufacturer except servers manufacture (hardware / operating system) and will be managed by a central management system NMS.

3.1 (I) Architecture and General Approach

a. (G) The Offeror will submit a detailed scheme of the system architecture including hardware and software components required, considering High Availability of 24 hours a day, 7 days a week and Survivability based on two IEC NOC sites.

b. Software upgrades (major & minor) will not affect system availability.

c. Systems interfaces are required in accordance with paragraph 3.3.

d. Requires compliance with product security as it appears in paragraphs 2.18 and 2.19.

3.2 (L) Typical Site Configuration

a. **Core Site** ("C-type") - will be carrier grade include ROADM and provide OTN switching. The ROADM will be a multi-degree ROADM enable to scale up to 9 degree (without traffic effecting) and support 50 GHz spacing at least. The topology of the required network will be according to paragraph 3.5.9.

   Sites C1 and C2 will be CD (Colorless & Directionless) ROADM type. Sites C3, C4, C5 and C6 will be multi-degree ROADM type.

   The Core OTN switching matrices (including redundant OTN switching) will be 3T capacity at least on one platform.

   The platform shall provide capabilities for extension of Client interface quantity.

b. **Distribution site 1** ("D1-type") - will be carrier grade include ROADM and provide OTN switching. The ROADM will be a multi-degree ROADM enable to scale up to 9 degree (without traffic effecting) and support 50 GHz spacing at least. The topology of the required network will be according to paragraph 3.5.9.

   The D1-type OTN switching matrices (including redundant OTN switching) will be 1T capacity at least on one platform.
The platform shall provide capabilities for extension of Client interface quantity.

c. **Distribution** site 2 ("D2-type") - will be carrier grade provide OTN switching with matrices (including redundant OTN switching) of 1T capacity at least on one platform. The topology of the required network will be according to paragraph 3.5.9.

The platform shall provide capabilities for extension of Client interface quantity.

d. **Metro Access site** ("Access 1-type") - will be carrier grade provide OTN switching (including redundant OTN switching) with matrices of 500G capacity at least on one platform. The topology of the required network will be according to paragraph 3.5.9.

The platform shall provide capabilities for extension of Client interface quantity.

e. **Access site** ("Access 2-type") – will be a platform capable to carry 3 or more transponders cards of 10G or 100G at least, exercised by fixed OADM with at least 4 W/L or similar solution. The line connections will be provided with Transponder cards.

3.3 (S) Client & Line Interfaces

The H/W platform that be capable to adopt any type of Client & Line modules with Interfaces according to paragraph 3.3 shall be considered as an advantage.

3.3.1 Ethernet Interfaces for 1G and 10G, 40G and 100G, at least:

   a. 1G, copper, as per IEEE 802.3ab, 1000BASE-T.
   b. 1G, optical, as per IEEE 802.3z, 1000BASE-X, where X refers as SX, LX and ZX for different target distances.
   c. 10G, copper, as per 802.3an-2006, 10GBASE-T.
   d. 10G, optical, as per 802.3ae-2002, 10GBASE-X, where X refers as SR, LR, ER, ZR and LX4 for different target distances.
   e. 40G, optical, as per IEEE 802.3ba-2010, 40GBASE-X, where X refers as SR4 for short reach distance and LR4 – for long reach distance.
   f. 100G, optical, short reach distance 100GBASE-SR4 per 802.3bm and 100GBASE-SR100 per IEEE 802.3ba.
   g. 100G, optical, long reach distance 100GBASE-LR4 and 100GBASE-ER4, both interfaces per 802.3ba.
   h. Availability of non-IEEE multi- vendor 100G interfaces 100GBASE-CWDM4, 100GBASE-PCM4 and long reach distance interface 100GBASE-ZR should be considered as an advantage.
   i. Availability of 100G copper interfaces 100GBASE-CR4 per IEEE 802.3bj and 100GBASE-CR10 per IEEE 802.3a along with
corresponding physical connectors should considered as an advantage.

3.3.1.1 The physical layer of the Ethernet interfaces shall be SFP+ and XFP modules. For 100G interfaces acceptable MPO and CFP modules. Availability of CFP2 and CFP4 modules for 100G interfaces should be considered as an advantage.

3.3.2 Synchronous Digital Hierarchy (SDH) interfaces, at least:

a. STM-1/STM-4/STM-16/STM-64, optical, as per ITU-T G.957, indexes I, S and L for different target distances and as per ITU-T G.691, indexes I, S and L for different target distances.

b. The physical layer of the interfaces shall be SFP, SFP+ XFP and QSFP modules.

3.3.3 Interfaces for OTN:

ODU0 (1G), OTU1/ODU1 (2.5G), OTU2/ODU2 (10G), OTU2e/ODU2e (Transports a 10 Gigabit Ethernet), OTU-2f (Transports a 10 Fiber Channel), OTU3/ODU3 (40G), ODU3ef/OTU3e2 (Transports up to four OTU2e signals), OTU4/ODU4 (100G).

3.3.4 Fiber Channel interfaces:

a. 1GFC, 2GFC, 4GFC, 8GFC, 16GFC, optical, as per T11 Technical Committee Standards, where T11 is part of INCITS (International Committee for Information Technology Standards).

b. 10GFC, 10GFCoE, optical, as per T11 INCISTS Standards.

3.3.5 (L) The following client interfaces (which should be taken into consideration for techno-economical evaluation) shall be at least:

a. 1000BASE-T, 1000BASE-SX/LX, 10GBASE-SR/LR, 100GBASE-SR10 - for Ethernet.

b. STM-1/STM-4/STM-16/STM-64, distance grade – for SDH.

c. 4GFC and 8GFC for storage.

3.4 (I) General Requirements

3.4.1 (G) The Offeror will detail all space and power consumption (AC and DC) limits of the solution.

3.4.2 The platform shall support 100G per slot capacity for the larger shelf form factors.
3.4.3 The proposed platform should be able to be installed as follows:

a. C-type equipment shall be installed in closed 19" cabinet with height no more than 2.2 meters and depth 0.6 meters or in ETSI frames with height 2.2/2.6 meters.

b. D-type and A-type equipment shall be installed in 19" closed cabinet with height no more than 2.2 meters and depth 0.6 meters.

3.4.4 (G) The Offeror shall detail the proposed solution for out-door installation in uncontrolled environment conditions.

3.4.5 (G) The Offeror shall detail the installation option taking consideration: air flow, cable management, shelf layout, rack installation, front or rear access and connector types (fiber and electrical). Please attach system specification.

3.4.6 (G) The Offeror shall provide the detailed description of the product family multiple shelf sizes and configurations to meet the needs for a variety of different solution types (e.g. small, medium, large hub sites and customer premises).

3.4.7 The proposed system shall be provided with high port density, minimal height and footprint.

3.5 (I) Deliverables

3.5.1 (G) The Offeror shall establish and submit with the proposal a detailed Bill of Material and Services (BOM).

3.5.2 The BOM shall include all the items to be delivered under the Order.

3.5.3 The Offeror shall define all the H/W items: chassis, assemblies, modules, connectors, adapters, patch panels, power boxes, cables, mechanical hardware and accessories, special test equipment and tools, other hardware and materials required for installation and operation.

3.5.4 The Offeror shall define all the S/W items: license, user and S/W modules.

3.5.5 (M) During the period of the contract/ agreement and option the price of every item within the context of the agreement/contract will include all the required components to operate the equipment, including software and hardware licenses, and will not incur any additional costs due to any licenses whatsoever.
3.5.6 For each item in the BOM must be listed the item denomination, product name, Manufacturer's part number and version number (if exists).

3.5.7 The updated, upgraded items or new items that substitute the End-of-Life items or replace the same functionality obsolete items shall be delivered only after written Purchaser's approval.

3.5.8 Offeror’s detailed BOM will be based on the following (according to Figure 1):

a. Network design using the Offeror’s planning tool (the report will be attach to the BOM).
b. Network capabilities to support at least 88 channels of 100G coherent.
c. Network capability to transport service from any site to any site in the longest rout on the required topology.
d. Exercise content table - Appendix F.
e. Sites topology and connections according to Figure 1.
f. Sites type according to par. 3.2.

3.5.9 Network topology – Figure 1
4 (I) Implementation

4.1 General

IEC intends to install Packet Optical Transport System (the System) to support all of the IEC's requirements in the following years.

The Manufacturer shall manufacture, assemble, test, preserve and ship the equipment, associated Hardware and Software, provide all the required documentation and services as defined here-in.

The Supplier shall be responsible for the satisfactory operation of the System and for performing the Work ("the program"), in accordance with all the requirements.

4.2 Experience and Offeror details

4.2.1 (M) The Offeror of the proposed System must be the Manufacturer or the Supplier authorized by the Manufacturer of at least one year in optical transmission network prior to the tender publication date. The Offeror must present with the proposal written authorization certification from the Manufacturer.

4.2.2 (M) The Offeror must have a representative entity in Israel for the lifetime of the contract, authorized by the Manufacturer to provide technical and logistic support to IEC. The Offeror must present with the proposal written authorization certification from the Manufacturer.

4.2.3 (G) Organization Structure, describing the support personnel, relevant technical skills and the experience of the Offeror and Local Agent, shall be provided.

4.2.4 The Supplier shall appoint a Program Manager in Israel. The Program Manager shall serve as Supplier's focal point for the Purchaser and shall have the authority to commit Supplier's resources in order to perform the Program. The designation, signed by an authorized person, shall be provided. Replacement of the Program Manager shall be upon mutual agreement.

4.2.5 (M) Experience

4.2.5.1 (I) The proposed System shall be state-of-art platform, be the modern design and the flagship line in the Manufacturer's portfolio.

4.2.5.2 The Manufacturer's proposed system must have proven operational field experience (installed and successfully operated)
in at least two different current working projects (in at least two different customers) prior to the tender publication date, in scale of the current IEC’s RFP. The proven operational network must include; Control plan, OTN switching core networks, 100G coherent core networks and ROADM core networks. The Offeror shall fill the table apply in spec. 200-15 paragraph 4.2.5.6.

4.2.5.3 The Manufacturer of the proposed system must have proven technology experience of at least 3 years prior to the tender publication date of all the following technologies: control plan deployment, OTN switching core networks deployment, 100G coherent core networks deployment and ROADMs core network deployment in scale of the current IEC’s RFP. The Offeror shall fill the table apply in spec. 200-15 paragraph 4.2.5.6.

4.2.5.4 The Manufacturer of the proposed system must have proven operational field experience (installed and successfully operated) in ISRAEL in at least one network in leading Israeli Communication Operator or Israeli Infrastructure Operator or Governmental offices or IDF prior to the tender publication date. The proven operational experience must include the following: core network(s) in scale of 4 ROADM sites (with minimum 2 WSS per site) and another core network(s) with at least 3 100G coherent links (with at least one link of 50KM) or 4 ROADM sites (with minimum 2 WSS per site) and at least 3 100G coherent links (with at least one link of 50KM) in the same core network(s). The Offeror shall fill the table apply in spec. 200-15 paragraph 4.2.5.6.

4.2.5.5 The proposed 200G solution must have operational field experience in at least 3 different current working networks and a proven experience of 200G links deployment of at least 6 months prior to the tender publication date in various customers. The Offeror shall fill the table apply in spec. 200-15 paragraph 4.2.5.6.

4.2.5.6 The Offeror shall provide all the data requested in paragraphs 4.2.5.2 – 4.2.5.5 in the following table:

<table>
<thead>
<tr>
<th>Customer Details</th>
<th>Year of implementation</th>
<th>Brief description of the project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Position</td>
<td>eMail</td>
</tr>
<tr>
<td></td>
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44
4.3 (I) Service and Maintenance

4.3.1 Technical Support Requirements

4.3.1.1 (M) The Supplier shall provide technical support for network design and planning, implementation of new components and services, site configuration documentation, installation supervision and commissioning of the system at IEC's facilities.

4.3.1.2 (M) The Offeror's technical support team shall comprise of 5 engineers/technicians, minimum. The engineers/technicians must be local employees with at least one year experience in optical transmission network and certified by the manufacture on the proposed system prior to the tender publication date. The Offeror must attach to the proposal the Engineers/technicians Manufacturer's certifications.

4.3.1.3 (M) The Offeror shall commit the compliance of Paragraphs 4.3.1.1 and 4.3.1.2 for the lifetime of the proposed System or the duration of the contract, which comes later.

4.3.2 (M) Warranty

4.3.2.1 The Warranty shall run for a period of 24 months starting:

a. For the first batch: upon successful completion of the System test.

b. For the following batches: upon acceptance at IEC Warehouse.

4.3.2.2 The warranty services will consist of:

a. Telephone/written consultation. A “hot-line” shall be available for support 24/7, that meaning support 24 hours a day, seven days a week. Once a problem is demonstrated, qualified service personnel will be immediate dedicated full-time to resolving the problem.

b. Following table:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Working hours: Sunday till Thursday 08:00 – 18:00</th>
<th>After working hours: Sunday till Thursday 18:00 – 08:00, Holydays &amp; Weekends</th>
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<tr>
<td></td>
<td>(1) Critical problems (2) Major problems</td>
<td>(1) Critical problems (2) Major problems</td>
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<tr>
<td>Technical support</td>
<td>Within 30 minutes from problem</td>
<td>Within the same working day</td>
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<td>statement</td>
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<tr>
<td>Professional support</td>
<td>Within one hour of case handling by Technical support</td>
<td>Within the next working day for problems that cannot be resolved by Technical support</td>
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<td>Within one hour of case handling by Technical support</td>
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<td>Within the next working day for problems that cannot be resolved by Technical support</td>
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<tr>
<td>Equipment replacement</td>
<td>(3) Fast Exchange (within one hour)</td>
<td>(4) Fast Exchange (within one hour)</td>
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<td>(4) Within the same working day</td>
<td>(4) Within the same working day</td>
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<tr>
<td>(1) Critical problems consider as traffic outage or management (NMs and NEs) outage.</td>
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<td>(2) Major problems consider as other problems.</td>
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<tr>
<td>(3) Fast exchange for replacement parts within one hour from problem statement (excluding traveling time) to IEC NOC sites (North and South).</td>
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<td></td>
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<tr>
<td>(4) Fast exchange for replacement parts within the same working day from problem statement (excluding traveling time) to IEC NOC sites (North and South).</td>
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<tr>
<td>c. For critical problems that cannot be resolved by remote diagnosis, an on-site support (at Purchaser’s facilities) will be required within the same working day after problem statement. The required on-site support will be on the Supplier expenses.</td>
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<tr>
<td>d. Supply of software updates and versions for the proposed NEs and NMS.</td>
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<td>e. On-site support for SW Upgrades.</td>
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<td>f. Activities in paragraphs d and e will be coordinate in advance with IEC.</td>
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<td>g. A report defining the failure and corrective action of failed equipment, its subassemblies, modules and cards shall be submitted to the Purchaser.</td>
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<tr>
<td>h. Automatic submissions of updates and corrections to manuals, drawings, catalogs, specifications, reliability data and all other supplied documentation.</td>
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4.3.2.3 The Supplier shall warrant that the design of the hardware and software are free of systematic failures and design defects, as defined hereinafter.
a. A design defect is a defect in the system, which results from inadequate design.

b. A systematic failure is a failure, which occurs three times or more within a period of 6 months.

Systematic failures, design defects and latent defects, will be repaired by the Supplier on his own expenses.

4.3.3 The FOS (Follow On Support), post warranty maintenance, will be at exactly the same level and extent as would have been provided during the warranty. The Purchaser shall have the right to exercise an option for FOS services for a period of another eight years, one year at the time.

4.3.4 (I) R&D product visibility

4.3.4.1 All products, offered in the tender, shall have life expectancy for at least the duration of the contract (5 + 5 years).

4.3.4.2 End of Life (EOL) declaration by the Manufacturer shall be delivered to IEC at least 12 months in advance.

4.3.4.3 The EOL product will be fully supported at least 6 years from the date of EOL declaration.

4.3.4.4 In case of EOL declaration for any item, the Supplier shall provide, under IEC approval, a substitute solution with at least the same functionalities in the same price of the declared EOL item.

4.4 (G) Training

4.4.1 The Offeror shall define training principles such that Purchaser's personnel shall become proficient in installation, commissioning, operation and maintenance of the equipment with associated management system, test equipment and tools. Syllabus of the courses shall be attached to proposal. "Hands-on" training or "On the Job" training (OJT) shall be emphasized.

4.4.2 The Offeror shall list all facilities, equipment and accessories which proposed for the proper conduct of the training courses.

4.4.3 The Offeror shall elaborate the duration and the adequate location for conducting the training courses in Israel.
4.4.4 The Offeror shall propose training for technicians at his facilities in Israel. The number of trainees shall be 20, up to 10 per each session. The Supplier shall provide the trainees with all required knowledge for successful installation, commissioning, operation and maintenance of the equipment with associated management system, test equipment and tools.

4.4.5 (I) Training shall be conducted in Hebrew (preferred) or in English.

4.5 (I) Installation & Testing

4.5.1 This section details the structure and extent of the testing program required to be completed in order to achieve a system working as specified. Under this paragraph, the Offeror shall define Installation, Inspection and Test Plan that shall cover all verification items according to the following stages:

a. Manufacturing inspection and testing process of System hardware and software.
b. Factory Acceptance Testing (FAT), providing full performance verification. The Purchaser reserves the right to have his representatives present at any phase of the FAT.
c. Installation for the first phase of the project.
d. Site Acceptance Testing (SAT) - after installation of defined sites.
e. Link Acceptance Testing (LAT) - after installation of defined links.
f. System Acceptance Testing (SYAT) - after LAT and commissioning of the Management System.

4.5.2 SAT and LAT of the network in its initial configuration and the SYAT (for at least 2 NEs for each type of installation and testing) shall be performed by the Purchaser under the supervision and responsibility of the Supplier.

4.5.3 The Test Procedures shall state the activities for executing the testing items mentioned in paragraphs above, covering the following issues as a minimum:

a. Each specific test shall be identified and proper measurement equipment selected.
b. Acceptance/rejection criteria and associated operating conditions shall be defined for each data item and for each function. Retest guidelines/procedures shall be defined as well.
4.5.4 The Supplier shall prepare and submit for Purchaser’s approval an Acceptance Test Procedure (ATP) for each one of the Acceptance Tests as defined in paragraphs above.

4.5.5 Acceptance Tests shall be performed according to the approved procedures.

4.5.6 Successful completion of Acceptance Testing shall be prerequisite to Acceptance. If the equipment fails to meet the Acceptance Tests, it shall be rejected. The equipment may be reworked or have parts replaced to correct the cause of rejection.

4.5.7 The Testing plan shall include the security issues.

4.6 (I) Proof of Concept

4.6.1 (M) As part of the evaluation process, the Offeror must provide the proposed system and associated management system for Proof of Concept (POC) session, according to appendix C. The POC will be conducted in the Offeror/Supplier/Manufacturer facilities (in Israel or abroad).

4.6.2 The POC shall be conducted by the Offeror at Offeror’s premises, up to 5 working days, at his own expense and under his responsibility.

4.6.3 The POC sessions shall start 6 weeks after the completion of the first stage of the technical session (part A of the technical evaluation). The exact date of demonstration and POC test procedure will be coordinated with the Offeror.

4.6.4 (S) POC results as per appendix C will be graded by IEC.

4.7 (I) Documentation

4.7.1 The documentation to be provided with proposal shall conform in coverage and in detail to the levels of maintenance, training, installation and testing that are defined in the Specification.

4.7.2 All dimensions and quantities throughout the above drawings and documents shall be in the M.K.S (Meter, Kilogram, Second) measurement units.

4.7.3 All documentation shall be in English or Hebrew, clear, legible, of suitable quality for storage for the life of the equipment.
4.7.4 In addition all documentation shall be available in soft copy on CD/DVD media.

4.8 (I) Purchaser’s requirements for packing

4.8.1 The Supplier shall provide with every shipment of Equipment list of all deliverables including the part numbers and serial numbers of each item, card or sub module.

4.8.2 Each and every item that shall be delivered must have at least the following marking data:
   a. Order No.
   b. Supplier’s name.
   c. Equipment identification (type and catalog No.).
   d. Purchaser’s name.
   e. Purchaser’s catalog No.