ANNEX D TO
DGDP TENDER NO 215.237.23
DATED: 27 MARCH 2024

TECHNICAL SPECIFICATION OF DENSE WAVELENGTH DIVISION MULTIPLEXING (DWDM) EQUIPMENT (DP-5)

Ser	Nomenclature/Description	Technical Specifications	To be filled by the Principal/ Manufacturer
(a)	(b)	(d)	(e)
Part -1: General Specification. The network will be so designed that, it can transmit and receive any number of Alien Lambda to and from all nodes.			
1.	Name	Dense Wavelength Division Multiplexing (DWDM) Equipment	
2.	Make and Model	To be mentioned	
3.	Brand	To be mentioned	
4.	Country of Origin	Group A Countries	
5.	Country of Manufacture	Group B Countries	
6.	Country of Assembly	Group B Countries	
7.	Year of Production	Not before the signing of the contract year	
Part -2: Technical Specification.			
8.	**Establish of Network Management System (NMS).**		
	a. Location	NMS is to be established at Dhaka Cantonment (Station A)	
9.	**Installation of Hardware.**		
	Name of The Loc	**Description**	
	a. Station A	DWDM ROADM with 12 x 100 Gbps Add/ Drop are to be installed (Please follow Traffic Matrix)	
	b. Station D, Station F, Station C and Station G	DWDM ROADM with 2 x 100 Gbps Add/ Drop are to be installed (Please follow Traffic Matrix)	
	Station B and Station E	DWDM ROADM with 4 x 100 Gbps Add/ Drop are to be installed (Please follow Traffic Matrix)	
	c. ROADM 1, ROADM 2, ROADM 3, ROADM 4 and ROADM 5	05 x DWDM ROADM are to be installed in NTTN sites	
	d. OLA 1, OLA 2, OLA 3, OLA 4 and OLA 5	5 x OLA are to be installed in NTTN sites	
	e. NMS	To be located at Dhaka Cantonment	
10.	**Different Line and Client Interfaces.**		
	a. Wavelength Plan	Detailed wavelength plan for all the Line Och requirement is to be furnished	
	b. Detailed output	Detailed output from planning and design tools for each Line Och mentioned in Appendix 1, Appendix 2, Appendix 3 and Appendix 4 is to be furnished.	
	c. End Result	The results have to show the OSNR, optical receive power and distance traveled by each channel from source to destination considering at least 3dB margin of each fiber.	

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	d.CPE CONNECTIVITY	CPE connectivity Topology shown in Appendix 4.	
11.	**Power Supply Equipment.**		
	a. Power Supply Equipment	150-amp Rectifier + 200 AH Batteries at Dhaka and all 16 sites (Add/ Drop, ROADM and OLA sites).	
12.	**Equipment Overview.**		
	a. Wavelength	Optical Fiber Platform of Dense Wavelength Division Multiplexing (DWDM) technology (DWDM equipment) on single mode technology operating at discrete wavelengths in the C-band centered around 193.1 THz frequency as per ITU-T Rec. G.694.1 grid, at 50 GHz/100 GHz/Flexi Grid channel spacing	
	b. Transmission	Shall have 100 Gbps transmission on line side or higher bandwidth per channel in the C-band	
	c. Data Transmission Rate (Client side)	The 10GE and 10Gbps shall be supported simultaneously on the client SFP/XFP/Optical interface with no changes to the common equipment at the optical layer.	
	d. Data Transmission Rate (Line Side)	Minimum 100G	
	e. Mode of Optical Fibers	Single mode optical fibers conforming to ITU Rec. G. 652D.	
	f. Bandwidth transmission efficiency	(1) High-capacity transport.	
		(2) 10 Gbps / 10 GE / 100 GE Multiplexing and grooming capabilities.	
		(3) End to End Encryption (Line Side).	
		(4) Without requirement of any Regeneration (Anywhere in between the Main, Protection and restoration paths) of line signal (Minimum 100G per lambda) between Source and destination node.	
		(5) Without requirement of using any Dispersion Compensation module.	
		(6) Capable of implementing Protection and Restoration mechanism using Layer 0 (L0) – ASON/WSON/GMPLS/Optical ASON for increased service availability and decreased downtime.	
		(7) Having inbuilt OTDR functionality.	
		(8) Same Type/Unique type of 100G Line Card should be offered.	
		(9) Same Type/Unique type of 10G Client Card should be offered.	
		(10) Same Type/Unique type of WSS Card should be offered.	
		(11) Same Type/Unique type of OTDR Function Card should be offered.	
		(12) The offered Line card/Transponder should have adequate reach, Dispersion Tolerance, OSNR Tolerance to travel through the longest possible	

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		path/link so that no regeneration of line signal in between Source and destination node of traffic (Anywhere in between the Main, Protection and restoration paths) is required in all possible Restoration scenario and no dispersion compensation module is required.	
		(13) OLA Backplane/Shelf/Chassis should be same as ROADM Backplane/Shelf/ Chassis so that in future 100G Line Card or above, 100G Client Card, 10G Client Card, WSS Card, etc can be inserted. OTDR Function Card must be inserted in OLA system.	
		(14) The Client ports and Line (Transponder) ports may be in same or separate cards.	
13.	**DWDM System.**		
	a. Standard	Latest version of ITU-T and IEEE recommendations at date of contract signature.	
	b. Recommendations	(1) G.661'Definitions and test methods for the relevant generic parameters of optical amplifier devices and subsystems.	
		(2) G.662 'Generic characteristics of optical amplifier devices and subsystems.	
		(3) G.663 'Application related aspects of optical amplifier devices and subsystems.	
		(4) G.667 'Characteristics of adaptive chromatic dispersion compensators.	
		(5) G.671 'Transmission characteristics of optical components and subsystems.	
		(6) G.672 'Characteristics of multi-degree reconfigurable optical add/drop multiplexers.	
		(7) G.681 'Functional characteristics of interoffice and long-haul line systems using optical amplifiers, including optical multiplexing'.	
		(8) G.692 'Optical interfaces for multichannel systems with optical amplifiers.	
		(9) G.693 'Optical interfaces for intra-office systems.	
		(10) G.694.1 'Spectral grids for WDM applications: DWDM frequency grid'.	
		(11) G696.1 'Longitudinally compatible intra-domain DWDM applications.	
		(12) G.709 'Interfaces for the optical transport network'.	
		(13) G.798 'Characteristics of optical transport network hierarchy equipment functional blocks.	
		(14) G.806 'Characteristics of transport equipment – Description methodology and generic functionality'.	
		(15) G.8251 'The control of jitter and wander within the optical transport network.	
		(16) IEEE 802.3ba 'Media Access Control	

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		Parameters, Physical Layers and Management Parameters for 40 Gb/s and 100 Gb/s Operation'.	
		(17) G.8080/Y.1304 'Architecture for the automatically switched optical network'.	
14.	**Licensing.**		
	a. License Duration	All perpetual licenses for DWDM equipment, NMS, server and workstation must be provided.	
15.	**General Features of the DWDM System.**		
	a. Equipment Capacity	100GB/100GBE on line side and 100GBE and/or 10GB/10GBE on client side	
	b. Device Capability	Capable to configure any type of DWDM systems i.e. I, OADM, OLA etc. and associated with Network Management System (NMS)	
	c. Equipment support	Must support the WSS and implementation of GMPLS (RFC 3945) and/or ASON (ITU-T G.8080) for restoration requirement in the offered model and sub-rack. The GMPLS/ASON control plan is adopted in Optical Channel (Och) scenarios.	
	d. Equipment inter-working	The equipment shall have plan/concrete roadmap of inter-working with the IP/MPLS routers. The inter-working should base on ITU-T, IETF, and OIF standards.	
	e. Channel bandwidth capacity and node band Channel capacity	100 G Line per Channel with Flexigrid Och Add/Drop Mux with required No. of Ports according to Traffic Matrix at each node, expandable up to minimum 96 Channels per node	
	f. Non-blocking ROADM Architecture	Must be provided	
	g. Main and Protection Channel	Must be connected through minimum two distinct optical add-drop facility at each node i.e. One for Main and one for protection path.	
	h. Multiple protection architecture	Equipment should support multiple protection architecture based on OCH/OMS or OTS with optical protection switching (OPS) module or OTN switch, having protection switching achieved within 50ms (Excluding failure detection time).	
	j. Line side and Client-Side Protection	Line side protection will be implemented but both Line side and Client-side protection shall be possible.	
	k. Line Card (Transponder)	Must be able to sync fast enough so that effective switching time from main to protection path does not exceed 50ms (Excluding failure detection time).	
	l. Wavelength Grid and DWDM System Capacity	As defined in ITU-T recommendation G.694.1 Wavelength channel spacing, should be flexible (flexi grid supported).	
	m. OSC (optical supervisory channel) channel and service channel	Must be separated and OSC channel shall not be amplified.	

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	n. DWDM system modularity and scalability	System architecture for Point-to-Point, ring and mesh network application. From day one, Flexigrid add/drop MUX with required number of ports according to the traffic matrix of the node must be configured which is expandable up to minimum 96 channels per node.	
	p. Line Card (Transponder)	Must be software tunable type and can be tuned to any of the 96 channels on Standard and offset ITU-grid within the full C band spectrum. Must be flexi rate modules capable to support modulation with bandwidth of 100 Gbps or 200 Gbps or higher Gbps on line side and the transmission rate should be software configurable.	
	q. Supplier's solution	Shall support WSS/ROADM architectures for wavelength grooming with reference topology for 50 GHz / 100 GHz/ Flexigrid operation.	
	r. System Support	DWDM system shall support and provide all type and capacity of WSS (ROADM) to Re-Route any optical Channel from any path to any path among all paths connected to that node (For all possible restoration paths).	
		DWDM system shall support Remote NMS Reconfiguration of at least 96 Och reconfiguration with access to all channels and switching between common port and switched ports.	
		The DWDM system shall support a modular and flexible architecture, in order to allow scaling, the equipment in accordance to the network requirements	
	s. Optical Equipment	Should be able to cater the required link Budget (Total loss of cable at each span) along with 3 dB (On top of cable loss) margin for each span.	
	t. Equip the DWDM system	Possible to equip the system progressively, in accordance to the number of wavelengths transmitted, in order to allow real "pay as you grow" configurations.	
	u. System Up gradation	System must be capable of upgrading from one wavelength up to its maximum wavelength capacity.	
	v. Insertion of new channels or removal of channels	The proposed DWDM system should be able to ensure hitless in-service insertion of new channels or removal of channels, with ability to automatically adjust/tune.	
	w. Automatic Power Equalization (APE)	DWDM system shall support APE. The system shall be capable of automatically adjusting power per channel to its optimum value, if and when channels are added or removed without the need for manual adjustment.	
	x. Support of different Architecture by DWDM	Shall support all type of architecture i.e. Optical Terminal Multiplexers (OTM), Reconfigurable Optical Add and Drop Multiplexers (ROADM), sharing the common modules, in order to minimize the number of	

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		spares.	
	y. Protection and Subsequent Restoration	DWDM system must support Protection and subsequent restoration of traffic using Layer 0 (L0)-ASON/WSON/GMPLS/Optical ASON (i.e. 1+1+R) in all sites.	
	z. OTDR functionality	The DWDM system shall support OTDR functionality and able to measure without impacting traffic while DWDM system is in service.	
16.	**Online System Performance Monitoring.**		
	a. Online System Monitoring	(1) The DWDM equipment system shall have the capability to monitor system performance online without circuit interruption.	
		(2) The DWDM equipment system shall support monitoring and estimating OSNR or equivalent, measure optical power of each channel. Operator shall be able to view the related data in NMS.	
	b. OTDR Support	The DWDM system shall support OTDR functionality. Operator shall be able to view the related data in NMS.	
17.	**Requirements of the OTU.**		
	a. Access service	(1) 100GbE, 10 Gb (STM-64) and 10 GbE.	
		(2) 100GbE overhead processing shall conform to the IEEE802.3ba standard.	
	b. Optical interface	(1) Optical interface of OTU S/R side shall meet one or more optical interface standard defined in ITU-T G.691, ITU-T G.693, ITU-T G.959.1 and IEEE 802.3ba, 10 × 10 MSA technical specifications.	
		(2) 10xSTM-64 multiply to 100 Gb/s:Optical interface for client shall support the transparent transmission of 10 Gb/s. Optical interface shall possess the ability to intercommunicate with the optical interface using the same standard from other manufacturers.	
		(3) 10x10GbE multiply to 100 Gb/s	
	c. GFP mapping	(1) System shall comply GFP mapping according to ITU-T G.7041.	
		(2) Mapping of 10GE LAN PHY/10GE WAN PHY to ODU-2.	
		(3) The equipment shall support 10x STM-64 / 10GBE LAN PHY / 10GE WAN PHY signals mapped into ODU4.	
		(4) The supplier's solution shall support STM-64 / 10GE signals mapped into ODU4.	
18.	**Requirements of the OADM.**		
	a. Frequency	Supports add/drop of wavelength of 100Gb/s single channel rate.	
	b. Operation of drop wavelength	Shall not affect pass through /straightway wavelengths.	

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	c. In case of upstream optical fiber broken	It shall not affect the normal work of the downstream business;	
	d. New channel requirement	Addition of new channels is required in DWDM node; the addition should not influence/stop service, performance and function in existing channels.	
	e. Optical amplifiers	(1) Pre-amplifier, booster can be used, if necessary.	
		(2) Optical amplifier needs to compensate the loss of optical power according to type of use.	
		(3) All optical amplifiers must be Erbium Doped Fiber Amplifier (EDFA) type.	
	f. Transporting distance	The maximum transporting distance (reach of line card/transponder) needs to be sufficient to cover the Bangladesh Army's longest path requirement as per Appendix 1 of Annexure A.	
19.	**Safety Requirement.**		
	a. Personal Safety	Laser, optical fiber amplifier has the obvious safety signs to ensure personal safety. The system is certified as a Class 1M laser product with hazard level 1M according to the IEC 60825-1 and IEC 60825-2.	
	b. Restart Process	When the fiber is disconnected, according to the recommendations of the G.664 to support the APR function, and has automatic / manual restart process.	
20.	**Automatic Gain Equalization and Automatic Power Control Requirements.**		
	a. Gain equalization	Must have automatic gain equalization and automatic power control function.	
	b. Channel power dynamic control	The process of Channel power dynamic control does not affect the other channel which is adjusted and the work of online business service.	
	c. Line power dynamic adjustment	N x 100 Gb/s DWDM system can support the function of line power dynamic adjustment which does not influence the regular working service.	
	d. Increase/decrease the channel	Increase/decrease the channel without interrupting the business service.	
	e. Equalization function	Automatic equalization function can realize the dynamic adjustment.	
	f. Gain/tilt adjustment	The equipment shall support in-service gain/tilt adjustment without interruption of service.	
21.	**Protection Requirement.**		
	a. Optical Line Active/ Protection switching	The system must support Optical Line Active/Protection switching using Optical Protection switch (OPS) or OTN switch.	
	b. Switch time	In any case, the switch time of Optical Line Active/Protection switching should be no more than 50ms (Excluding the fault detection time).	
	c. System	It should be easily managed by same NMS system as	

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	Management	DWDM equipment and other optical card (amplifier card, MUX/DEMUX card etc.).	
	d. Traffic Management	Protection switch of all traffic shall be triggered on optical power monitoring and there shall be provision to set the LOS thresholds.	
	e. Automatic switching	Shall be triggered by line faults (LOS, LOF etc.), OCh layer faults.	
	f. Switching priority	Switching priority of Optical Line Active/Protection switching should support functions like Clear Switching, Forced Switching, and Automatic Switching.	
	g. Revertive operation	Must be provided.	
	h. Non-revertive operation	Must be provided.	
	j. Generic hold-off function	Provision able "generic hold-off function" must be provided.	
	k. Lockout	Lockout of protection and forced switch commands shall be supported.	
	l. Fault notification function	System should have the fault notification function in order to notify the external terminal equipment connecting to downstream system of fault occurred on the Network.	
22.	**Restoration Requirement.**		
	a. Re-Routing	For Restoration, all OADM sites must be able to Re-Route Optical Channels. Re-routing will be possible from any path to any path among all available/feasible paths connected to that node.	
	b. Restoration path	From source node to destination node must be created automatically.	
	c. Multiple fiber cut	The system must be able to create consecutive restoration paths one after another at multiple fiber cut scenario, as long as a single available/feasible path is available between the two nodes.	
	d. Availability of Path	The solution shall support and provide all type and capacity of WSS (ROADM) to Re-Route any optical Channel from any path to any path between all paths connected to that node.	
	e. WSS and GMPLS	The equipment must support the WSS and implementation of GMPLS (RFC 3945) and/or ASON (ITU-T G.8080) for restoration requirement in the offered model and sub-rack. The GMPLS/ASON control plan is adopted in Och scenarios.	
	f. Automatic discovery	The control plane should support automatic discovery of the network topology and network resources.	
	g. ASON/GMPLS	Should support the calculation of source node route.	
	h. Regeneration of line signal	Restoration will be possible without requirement of any regeneration of line signal in between Source and destination node through any available/feasible path.	
	j. Alarm/ Indication	The transmission system shall give alarm or indication	

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	System	to router/switch to stop transmission/ packet forwarding on 10GbE ports of transmission Ethernet card, if there is link down between transmission media due to fiber cut or some fault.	
23.	**OTDR Function Requirement.**		
	a. Operating Wavelength	Any or multiple wavelengths between 1500 nm to 1650 nm.	
	b. Resolution	±3 meter	
	c. Measurement	(1) Should measure at least 20 dB per direction.	
		(2) Measure from both sides into same fiber.	
		(3) OTDR measurements should be possible while DWDM system is in service.	
		(4) OTDR measurements should be done without impacting traffic while DWDM system is in service.	
	d. Additional optical fiber core	No extra optical fiber core will be required or allocated for OTDR function.	
	e. Availability	The system availability shall be higher than 0.99999.	
24.	**Hardware Resiliency.**		
	a. Architecture	The solution will be of modular chassis architectures.	
	b. Support Characteristics	The solution must support insertion, replacement and removal of modules whilst the equipment is powered up without affecting traffic and / or damaging any module.	
	c. Power Redundancy	Each shelf shall have power redundancy.	
	d. Shelf Controller Card	Each shelf shall have individual redundant shelf controller card.	
	e. Indication Facilities	The solution shall provide indications on each individual module to indicate a failure of the module.	
	f. Alarm Display	The equipment shall also have an alarm display showing at least major and minor summary alarms.	
25.	**Software Resiliency.**		
	a. Control and Forwarding Parts	The supplier shall indicate if control and forwarding parts are separated (autonomous) and if a control failure does affect (or not) the forwarding part.	
	b. SW Upgrade and SW Patches	The SW upgrade and SW patches can be performed without any service interruption and that its solution supports the upgrade of all operating software without any traffic interruption.	
	c. Backup and Restore Features	Regarding in-service configuration backup and restore features, the solution must have the capability to batch download software and firmware and switch in bulk.	
	d. Autonomous Operation	The solution should be capable of autonomous operation, without assistance from the Management System.	
26.	**Synchronization.**	The system must support clock recovery and stamping based on NTP.	

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27.	**Optical Supervisory Channel (OSC).**		
	a. Channel Facilities	Must have separate optical supervisory channel.	
	b. Wavelength	The wavelength of optical supervisory channel is 1510nm ± 10nm.	
	c. BER Performance	The BER performance of optical supervisory channel should be in the range of 1.0Exp (-3) to 1.0Exp (-12).	
	d. Failure and Replacement of Filters	The failure and replacement of filters units cannot affect the DCN communication via OSC.	
	e. Failure of OSC	The failure of an OSC unit must be non-traffic affecting.	
28.	**Satisfying Condition.**		
	Operating Temperature (DWDM equipment, Rectifier, Router and Battery)	0° to 50°c or better	
	Relative Humidity (DWDM equipment, Rectifier, Router and Battery)	Up to 85% or better	
29.	**Requirements of System Reliability.**		
	a. No. of Ports	Flexigrid Och Add/Drop Mux with at least No. of Ports according to Traffic Matrix at each node, expandable up to minimum 96 Channels.	
	b. Optical (Photonic) Part	WSS, Amplifier, OSC, OPS etc. must be equipped in optical sub-racks.	
	c. Cards and Switches	Line cards (Transponder), Client cards, OTN Switch (If used) can be equipped in separate sub racks from the optical sub-racks.	
	d. Ports	Line port and client port can be same or in separate cards.	
	e. Power Redundancy	All sub-Rack must have power redundancy.	
	f. Controller Redundancy	All Optical Sub-Rack must have controller redundancy.	
	g. Switch Redundancy	OTN switch (If used) must have redundancy.	
	h. Usability	All the ports in any type of card and or device be active or passive must be useable instantly when required without any further requirements of related software/ license.	
	j. Encryption Facility at Line Port	End to end encryption facilities of 100G Line port. Details of the encryption methodology is to be mentioned supported by relevant documentations.	
Network Management System (NMS).			
30.	**Management System**		
	a. The Network Management System (NMS)	NMS solution for the monitoring and management of the devices and network is required. The NMS shall be fully centralized for management of all network elements (NE), offering the possibility to perform	

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		network management tasks from single site or several sites. The NMS shall be of Server and clients-based architecture.	
	b. OS Platform	The NMS system shall be provided with user-friendly interfaces based on Unix and/or Linux and/or windows operating system. The NMS shall be able to provide an on-screen view of the managed network.	
	c. Accessibility	It shall be possible to access any managed NE from the whole network in the managed domain. The NMS shall be able to depict the failure state of each link and node in the displayed network.	
	d. Detail Status	Further, it shall be possible from the NMS system to get the details of status of an individual managed NE, such as equipment presence, settings, alarm status etc.	
	e. Additional Features	It shall be possible to add/ delete/ configure/ modify a NE by point & click feature.	
31.	**Management Facility.**		
	a. Fault Management.	Supported	
	b. Configuration Management	Supported	
	c. Inventory Management	Supported	
	d. Security Management	Supported	
	e. Alarm & Event Management	Supported	
	f. Performance Management	Supported	
	g. Software upload/ download capability	Supported	
	h. Backup and Restoration Management of all NE	Supported	
32.	**Visualization of Network Domain.**		
	a. End-to-End Visualization	NMS shall provide end-to-end visualization of wavelength paths.	
	b. End-to-End Display	NMS shall provide end-to-end display of optical power measurements.	
	c. End-to-End Wavelength	NMS shall provide for details for end-to-end wavelength channel provisioning and automated wavelength channel restoration.	
	d. Visualization of OTDR	NMS shall provide visualization of OTDR report of fiber spans.	
33.	**Features of Network Management System.**		
	a. OS Platform	The NMS shall run on Unix/Linux/Windows platform.	

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	b. Connectivity	NMS shall be connected to the proposed node equipment via IP interface.	
	c. Client Interface	NMS should provide web-based client interface which enables anywhere management.	
	d. E2E Service	NMS must support E2E service configuration, monitoring and performance checking.	
	e. GUI	NMS must support user-friendly GUI and easy point & click operations.	
	f. Common Facilities	(1) NMS should support quicker end-to-end provisioning of multi-service, including WDM circuit, SDH circuit, Ethernet circuit, and wavelength transport.	
		(2) NMS should provide Fault, Configuration, Performance & security features in their respective Window.	
		(3) The NMS shall provide management functionalities and web-based management.	
	g. Ethernet	NMS must support Ethernet OAM standards such as Y.1731.	
	h. Downloading	The NMS shall support remote downloading of all types of software and firmware required by WDM equipment.	
	j. Software Facilities	The system shall support up-gradation of the software version preloaded in the system without loss of traffic or configuration.	
		System shall allow revert back to the previous version of the software.	
	k. Download Failure	Download failure on the NE shall not affect other applications running on NMS.	
	l. Auto Discovery	The NMS should have the capability of auto discovery of new NE.	
	m. Inventory Details	NMS shall provide the inventory details of all systems in the network up to card and SFP/XFP level with simple operation.	
	n. Report Facilities	NMS shall have report generation capacity such as Number of configured WDM circuits, SDH circuits, Ethernet paths, used and unused capacity of each Network Element etc.	
	p. Mapping	NMS shall provide Comprehensive network map (geographic and synoptic) of all the managed elements with a sophisticated alarm and traffic status display, real time alarm and traffic monitoring and giving a full access to all NE technical management features through a user-friendly interface.	
	q. NMS Support	(1) Shall support SNMP, TMF CORBA OR REST NBIs.	
		(2) Shall support FCAPS via REST NBI.	
		(3) NMS shall have capability for interworking with 3rd Party SDN/Orchestration Solutions.	
		(4) NMS shall have capability for integration of 3rd	

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		Party NEs via SBI (Optional).	
		(5) NMS shall support Warm/Hot Standby Server Redundancy Solution (Max. 01 Min for Switching over between Main & Standby Servers).	
		(6) In Warm/Hot Standby concept, NMS shall support automatic switch-over between Main Server and Standby Server (without user-intervention).	
	r. Automatic Switching Over	In Warm/ Hot Standby concept, after switch-over to Standby server, all clients must be automatically switched-over to Standby Server (without user-intervention).	
34.	**NMS Hardware Requirements.**		
	a. Architecture	Server and clients-based	
	b. Local Craft Terminal	There will be provision to use Laptop/ Notebook as Local Craft terminal (LCT) with appropriate software to connect DWDM equipment directly so that configuration, monitoring can be done from the Laptop. The LCT shall be able to connect all network elements on the same network (autonomous system) from locally connected device.	
	c. Miscellaneous Product	Required HW resource for Server, Client workstations, Local Craft Terminal i.e. CPU (type and number of cores, speed), RAM (Capacity), Disk (Capacity + required partitioning), Number of network interfaces, Platform power consumption, Power protection and other HW requirements should be chosen for each management entity according to the total size of the network and no. of node / NE to be managed and monitored by the NMS.	
35.	**NMS Software Requirement.**		
	a. OS Platform	Unix and/or Linux and/or Windows based operating system	
	b. Capability	The NMS shall be a multi–task and multi-user system.	
	c. Future State	The offered software architecture shall be open and configurable to enable future extensions.	
	d. License	Perpetual license for Software to be provided.	
36.	**Fault and Alarm Management.**		
	a. Fault and Alarm	All fault and alarm events shall be reported.	
	b. Display And Logging	Adequate arrangement for display and logging shall be provided if there is any event received at the NMS.	
	c. Notification	All alarms received at the NMS shall cause a change of color/add object on the appropriate object on screen.	
	d. Indication on Screen	There shall be visible indication on screen that there is an alarm somewhere in the system. In addition to the displays, alarm details may be displayed in tabular format.	
	e. Surveillance	NMS should provide real time surveillance of network	

Ser	Nomenclature/Description	Technical Specifications	To be filled by the Principal/ Manufacturer
(a)	(b)	(d)	(e)
		faults from the various alarm captured from the network elements.	
	f. Alarms	(1) Alarms in any Node/NE shall be shown by the NMS.	
		(2) Fiber Link/Path (Fiber Cut / High Loss) alarm shall be shown by the NMS.	
		(3) The reported alarm shall have date and time stamped.	
		(4) Alarms shall be displayed on NMS screen in different color/object representing the severity (critical, major and minor) and the state of the alarm. The operator shall be able to acknowledge and investigate the cause of the alarm.	
		(5) Single alarm window for all NEs displaying network active alarms, cleared alarms, severity of alarms.	
		(6) Alarm list, threshold and severity should be customized.	
	g. Backup	System shall be capable to log performance parameters on 15 min/24 hours basis and made available whenever required through NMS beside current register counters, NMS shall be capable of storing history register counters for the last one months and if required can be exported to the external hard disk.	
	h. SMS or Mail	There should be a facility to send SMS and Mail for various alarms generated by any fault/loss (Hardware and Software). This should be configurable on basis of alarms and SMS and Mail list to be configurable.	
37.	**Configuration Management.**		
	a. E2E	E2E service provisioning	
	b. Port Settings	Enabled	
	c. Loopbacks	Supported	
	d. Configurable Parameters	All configurable parameters for the equipment shall be configured using the NMS.	
	e. Traffic Management	Should be possible to create, configure, provision and manage the traffic based on bandwidth and QoS requirements.	
38.	**Performance Management.**		
	a. System Capability	System has to be able to collect all standard quality parameters/indicators for WDM/SDH based part as well as for packed switch part in accordance with related standards. Data shall be available for online and offline data analyzes	
	b. Report Tools	System shall provide tools to analyze and report quality parameters/ indicators from network-on-network level (for each network service). System shall provide quality report not only on node/ element level but also on network service level.	

Ser	Nomenclature/Description	Technical Specifications	To be filled by the Principal/ Manufacturer
(a)	(b)	(d)	(e)
	c. Performance Report	All performance parameters to be monitored on 15 min, hour, day, month and weekly basis.	
	d. Receiving Level Monitoring	The receiving level monitoring to be provided on real time basis - both in table as well as graphical view with time stamp.	
	e. System Monitoring	The system should be able to monitor service quality parameters regarding availability on real time basis.	
	f. Packet Drop Monitoring	Monitor packet drops in case of Ethernet interface.	
	g. Ethernet Performance	Comprehensive Ethernet performance counters & utilization reports generation must be supported by NMS.	
	h. MIB Access	Support to MIB access must be available for integration / real time utilization monitoring by third party systems i.e. MRTG etc.	
	j. Backup	Facilities should be available to backup stored log data and other data.	
39.	**Security Management**. This functionality shall provide necessary security to the data as well as access to the network.	**Security Management**. The security and access management of the network will solely be controlled by Bangladesh Army.	
40.	**Access Security**.		
	a. Access Facility	(1) Only for authorized user.	
		(2) Comprehensive log-in operator identities and password facilities.	
		(3) Low level protection for read only access to faults and performance information.	
		(4) Medium level protection for access to configuration status and features.	
		(5) High-level protection for control of access to aforesaid clauses and to change in the configuration and control parameters.	
		(6) Log in and log out attempts shall be logged in the security Log File of the NMS system.	
		(7) System shall support following authentication and authorization mechanisms for security management on management system level as well as on element level.	
	b. Protocol	RADIUS or TACACS+ or Microsoft authentication protocol.	
41.	**Data Security**.		
	a. Data Protection	Adequate arrangement to protect data and to recover	

Ser	Nomenclature/Description	Technical Specifications	To be filled by the Principal/ Manufacturer
(a)	(b)	(d)	(e)
	and Data Recover	data lost due to stoppage or failure of the EMS hardware or communication system is to be provided.	
	b. Backup Facility	The NMS shall be able to back up and restore the data base to and from external storage media or internal storage media.	
42.	**Inventory Management.**		
	a. Scheduled automatic inventory data collecting and storing	Supported	
	b. Listing and filtering inventory data	Supported	
	c. Exporting inventory data	Supported	
43.	**Hardware Inventory.**		
	d. HW inventory data	Supported	
44.	**Service Inventory.**		
	e. Information Collection and Storing	System shall support collecting and storing information about configured network services in the network.	
45.	**Optical Distribution Frame (ODF).**		
	a. Country of Origin	Group A Countries	
	b. Country of Manufacture	Group A and B Countries	
	c. Country of Assembly	Group A and B Countries	
	d. General Features	The optical distribution/termination frame shall be Rack mount / Wall mount type. Rack mount ODF will be installed in standard 19 inch or ETSI rack. It may be mounted in the rack where equipment will be installed or in separate rack where necessary.	
	e. Optical connector	Optical connector (both side female) in the optical distribution/ termination frame shall be high grade SC/LC/FC type.	
	f. Maintenance Facility	Easy access and provision for maintenance facility.	
	g. ODF Facility	The capacity of the ODF shall be of at least 24/48/96 port.	
	h. ODF Equipment	The ODF will be equipped with 24/48/96 nos of Patch cord (10 Meter) equal to the number of ports of ODF.	
ROUTER, 16xE-1 OVER IP (OPTIONAL)			
46.	**General Description**		
	Name of The Loc	**Description**	
	a. Station A	ROUTER (ATLEAST 2x10GBPS LINEPORT+ 6 x10	

Ser	Nomenclature/Description	Technical Specifications	To be filled by the Principal/ Manufacturer
(a)	(b)	(d)	(e)
		GBPS CLIENT PORT+16 x 1 GBPS PORT)	
	b. Station D, Station F, Station C, Station G and Station B.	ROUTER (ATLEAST 1x10 GBPS LINEPORT+ 1x10 GBPS CLIENT PORT+8 x 1 GBPS PORT) are to be installed in each location	
	c. Station A	6 sets of 16xE-1 over IP (1GE PORT TO 16xE-1 PORT) Converter are to be installed (OPTIONAL)	
	d. Station D, Station F, Station C, Station G and Station B.	16xE-1 over IP (1GE PORT TO 16xE-1 PORT) Converter are to be installed in each location (OPTIONAL)	
47.	**Technical Specification of Router.**		
	a. Brand	To be mentioned	
	b. Model	To be mentioned	
	c. Country of Origin	Group A Countries	
	d. Country of Manufacture	Group A and B Countries	
	e. Country of Assembly	Group A and B Countries	
	f. General Features	(1) Shall have 19-inch Rack Mountable (2) Shall have separate Service Control Card and Route Processor Card. (3) Shall support 100G, 10G and 1 G port. (4) Shall be equipped with hot swappable redundant -AC power supply. (5) Router should be provided with 1+1 route processor/engine and 1+1 power supply redundancy. (6) Router should be provided with at least 1+1 switching/routing fabric redundancy. (7) All the fabrics should be functional as active/active and wireline / no blocking mode. (8) All interfaces on the routers shall provide wire-rate throughput. (9) All interfaces on the routers shall be supplied as integrated interfaces and no external convertors / adapters are acceptable. (10) The router shall support optics for 10GE/1GE interfaces with maximum distance of 10KM. (11) The operating system of the router shall have a kernel or modular OS based architecture. (12) The modular operating system shall run all critical functions like various routing protocol, forwarding plane and management functions in separate memory protected modules. Failure of one module shall not impact operations of rest of the OS. (13) Router should have in service bug patching feature available from day 1. (14) Router should support capability to scale more	

Ser	Nomenclature/Description	Technical Specifications	To be filled by the Principal/ Manufacturer
(a)	(b)	(d)	(e)
		Gigabit interfaces through extended line card with common control & management plane from parent chassis or distributed architecture using satellites. (15) Router should support capability to connect at least two routers in an active active fashion with single management and control plane. (16) The router along with respective line cards should be supplied with timing protocol support such as IEEE 1588-2008, Bidirectional time of day (ToD) with 10MHz, BITS and DTI timing reference mechanism. (17) Should be supplied with necessary power cards, data cables, connectors, CD's, manuals, bracket accessories, wire managers and other appropriate accessories.	
	g. Performance	(1) Bandwidth Capacity: Minimum 450 Gbps or higher for commonly used features.	
		(2) Port Capacity: Should be as such to be able to connect existing voice and data network of BD Army which should be finalized during survey.	
	h. Features of Route Processor	(1) Negotiating and maintaining IP Security (IPsec) authentication, encryption methods, and encryption keys (Internet Key Exchange [IKE])	
		(2) Building and distributing forwarding information to the Service Control Plane Processor (ESP)	
		(3) Load the operating system software images to all installed line cards upon powering up or through operator commands	
		(4) Perform high-availability failover for redundant solutions	
		(5) Track the status of various system components like the software, services processor, line cards, fan trays, PSU etc.& provide an out of band access method to the router in case of a software crash	
	j. Functions of Service Control Card	(1) MAC classification & Layer 2 and Layer 3 forwarding	
		(2) QoS classification, policing and shaping	
		(3) Firewalls 3& intrusion prevention with flexible pattern matching for deep-packet inspection.	
		(4) Network Based Application Recognition or similar technology	
		(5) LAN & MACSec support on all ports/ speed	
		(6) Minimum Forwarding information Base Scale	

Ser	Nomenclature/Description	Technical Specifications	To be filled by the Principal/ Manufacturer
(a)	(b)	(d)	(e)
		10M Ipv4 and 5M IPv6	
		(7) Route Processor shall have minimum 16GB of RAM/DRAM upgradable to 32GB.	
	k. Supported Protocol	(1) Shall have RIPv2, OSPF, IS-IS and BGP4 routing protocols, with support for all the features like OSPF on demand etc. & IP multicast routing protocols: PIM Version 2 (Sparse Mode & Dense Mode), IGMP v1,v2,v3	
		(2) Shall have MPLS feature MPLS Label Distribution Protocol, Tag Distribution Protocol, RSVP, BGP-MPLS, MPLS L3VPN for Multilink PPP, MP-iBGP to distribute IPv6 routes over the MPLS IPv4, MPLS IPv6 Switch, L2VPN Pseudo-wire, QoS Policy on L2VPN, QinQ, Multi-VRF, IPv6 VPN over MPLS, Multi-VRF Policy-Based Routing, MPLS over GRE , MPLS VPN Inter-AS, MPLS VPN eBGP Multipath, MPLS VPN Load Balancing, MPLS TE - DiffServ Aware	
		(3) Shall have MPLS high-availability features like RSVP, MPLS LDP Graceful Restart, MPLS TE-RSVP Graceful Restart, MPLS NSF/SSO, MPLS NSF/SSO over IPv6 LDP, L2VPN Pseudo-wire Redundancy, Fast Reroute with L2VPN	
		(4) Shall support IPSec Protocols: IPsec standards supported include Digital Encryption Standard (DES), Triple DES (3DES), and Advanced Encryption Standard (AES; 128, 192, and 256) for encryption; Shamir, Aldeman (RSA) algorithm signatures and Diffie Hellman for authentication; and Secure Hash Algorithm 1 (SHA-1) or Message Digest Algorithm 5 (MD5) hashing algorithms for data integrity with the cryptographic engine in the router	
		(5) The router should support congestion management techniques like RED and WRED or similar technology	
		(6) The router should support wide variety of queuing technologies like WRED, LLQ or similar technologies	
		(7) The router should support ingress and egress Committed Access Rate or similar technology features	
	l. QoS Features:	Shall support the following: Traffic Classification using various parameters like	

Ser	Nomenclature/Description	Technical Specifications	To be filled by the Principal/ Manufacturer
(a)	(b)	(d)	(e)
		source physical interfaces, source/ destination IP subnet, protocol types (IP/TCP/UDP), source/ destination ports, IP Precedence, 802.1p, MPLS EXP, DSCP and by some well-known application types through Application Recognition techniques. Shall support Strict Priority Queuing or Low Latency Queuing to support real time application like Voice and Video with minimum delay and jitter. Congestion Management: WRED, Priority queuing, Class based weighted fair queuing. Traffic Conditioning: Committed Access Rate/ Rate limiting. Platform must support hierarchical shaping, scheduling, and policing for the control upstream and downstream traffic. Shall support QoS based on differentiated service code point (DSCP), MPLS experimental bit (EXP) and 802.1p classification with marking, policing and scheduling, ingress and egress SLA enforcement is accomplished by enforcing the maximum service rates for residential and business subscribers. Shall support standards based RSVP for voice & video call admission control. Router should support video/ streaming traffic monitoring/ optimization or equivalent feature. Manufacturer/Principal can propose multiple appliance/additional hardware to meet the requirement. Router should have at least 4 level of scheduling for Hierarchical QOS or similar mechanism. Router should support at least 1 Million queues per line card. Support Per VLAN QoS, Time Based Shaping and Policing for QoS. Router should traffic priority marking for "interested/marked" traffic within the fabric. Shall support Priority propagation to ensure service integrity for voice and video throughout all hierarchy layers, even at peak hours with high traffic load. Platform must support nested hierarchical QOS policies. Should support hierarchical QoS for voice and video.	
	m. Manufacturer part number	Manufacturer/Principal should submit BOQ of proposed device including the details part numbers. Manufacturer/Principal should submit the required performance document for the proposed device.	
	n. Input voltage	AC: Rated voltage range: 100 V to 240 V A C, 50/60 Hz Maximum voltage range: 90 to 264 V AC, 47/63 Hz DC: Rated voltage range: –48 V to –60 V DC Maximum voltage range: –36 V to –72 V DC	
	p. Debug, Alarms	Support for monitoring of Traffic flows for Network	

Ser	Nomenclature/Description	Technical Specifications	To be filled by the Principal/ Manufacturer
(a)	(b)	(d)	(e)
	& Diagnostics:	planning and Security purposes Display of input and output error statistics on all interfaces Display of Input and Output data rate statistics on all interfaces. Display of Dynamic ARP table Telnet, Trace-route or equivalent, Ping and extended Ping Router shall support System & Event logging functions as well as forwarding of these logs onto a separate Server for log management. Router shall have Debugging features to display and analyze various types of packets.	
	q. Accounting:	The router should have following accounting features: Packet & Byte Counts Start Time Stamp & End Time Stamps. Network Time Protocol Input & Output interface ports. Type of service, TCP Flags & Protocol Source & Destination IP addresses Source & Destination TCP/UDP ports	
	r. Management	Shall support Secure Shell for secure connectivity. Embedded RMON support for four groups – history, statistics, alarms and events Should have to support Out of band management through Console / external modem for remote management. Event and System logging: Event and system history logging functions shall be available. The Router shall generate system alarms on events. Facility to put selective logging of events onto a separate hardware here the analysis of log shall be available. Shall support standard model driven telemetry system like Yang model (RUSD 6020) / JSON / XML /NETCONF for router management and programming shall support in line video monitoring features like real-time quality monitoring, error correction, fast channel change, VoD streaming and an optimized multicast architecture. The video monitoring function shall work on both IP and MPLS enabled interfaces and it should be able to measure quality metrics such as delay, jitter, MPEG MDI (RUSD 4445), Media Stop Event for uncompressed and compressed video formats (MPEG2/4, JPEG2K)	
	s. Security	Support Access Control List to filter traffic based on Source & Destination IP Subnet, Source & Destination	

Ser	Nomenclature/Description	Technical Specifications	To be filled by the Principal/ Manufacturer
(a)	(b)	(d)	(e)
		Port, Protocol Type (IP, UDP, TCP, ICMP etc) and Port Range etc. Time based & Dynamic ACLs for controlled forwarding based on time of day for offices. Support per-user Authentication, Authorization and Accounting through RADIUS. The routers shall provide hardware accelerated IETF Netflow-v9/J-Flow/equivalent feature. This feature shall be available for all interfaces provisioned on the router with hardware acceleration. MD-5 route authentication for RIP, OSPF and BGP Router should be ready for DDOS mitigation in future if required. URPF, DHCP snooping, control plane policing SNMPv3 authentication, SSHv2 IP Access list to limit Telnet and SNMP access to router Multiple privilege level authentications for console and telnet access through Local database or through an external AAA Server.	
	t. Protocol Support	Should have IPv4 Routing, Border Gateway Protocol, Intermediate System-to-Intermediate System [IS-IS], and Open Shortest Path First [OSPF]), Route Policy Language or Route Policy, Virtual Router Redundancy Protocol (VRRP), IPv6 Routing, and BGP Prefix Independent Convergence, GRE (Generic Routing Encapsulation) Tunneling Should have Multicast routing protocols IGMPv1, v2, v3, PIM-SM (RUSD2362) and PIM-SSM, MSDP, IGMP v2 snooping Should have DHCPv6 and OSPFv3 for IPv6, 6PE & 6VPE Router should have capability of mapping of address and port using encapsulation as well as translation mechanism for ipv4 to Ipv6 migration functionalities. Router should have NAT, MPLS Provider /Provider Edge functionality. MPLS VPN, Carrier Supporting Carrier (CsC), DiffServ Tunnel Modes, MPLS TE (Fast re-route), DiffServ-Aware TE, Inter-AS VPN, Resource Reservation Protocol (RSVP), VPLS, CESoPSN and SAToP as per RUSD 4553 from day one. BGP based Segment routing, BGP customer signalling Router should have automatic segment routing TE Tunnel generation using BGP communities. Router should have automatic manual imposition of Segment Routing Labels for selective Destinations Router should have flexibility in identifying the desired Egress peer and External links for efficient usage of external links	

Ser	Nomenclature/Description	Technical Specifications	To be filled by the Principal/ Manufacturer
(a)	(b)	(d)	(e)
		Router should support topology independent LFA for faster failure management Should support capability to isolate multicast traffic from impact of unicast traffic burst Router should have MPLS OAM, Ethernet OAM protocols - CFM (IEEE 802.1ag), Link OAM (IEEE 802.3ah) and ITU Y.1731. The router shall support Carrier Grade NAT Router shall preferably support PBB (Mac-in-Mac protocol) as per IEEE 802.1ah. Support feature capability to terminate PPPoE/IPoE (v4/v6/DS) sessions Support chassis-based redundancy for high SLA subscribers without L1/L2 connectivity between the gateway Support RUSD 7597 - Mapping of Address and Port with Encapsulation (MAP-E), RUSD 7599 - Mapping of Address and Port using Translation (MAP-T) Support Ethernet VPN (EVPN) VXLAN Transport and Ethernet VPN (EVPN) based Virtual Private Wire Service (VPWS) Support unequal cost link load sharing to better utilize the alternate paths Router should have both L2 and L3, MPLS and full routing services on all interfaces from day 1. The router should have Lawful intercept feature enabled from day 1. Configuration Roll Back to recover the mis-configured router to last good configuration	
	u. High Availability	Each Router must have primary and redundant routing engine/control engine from day 1. Shall support, On-line insertion and removal for cards, fast reboot for minimum network downtime, VRRP or equivalent Shall support Non-Stop forwarding for fast re-convergence of routing protocols (BGP, OSPF) Shall support multiple storage of multiple images and configurations Shall support link aggregation using LACP as per IEEE 802.3ad Boot options like booting from TFTP server, Network node & Flash Memory.	
	v. Manufacturer's warranty	Minimum 1 (one) year Manufacturer's warranty for OEM	
	w. License	Minimum 3 years	
48.	**16xE-1 over IP Converter (OPTIONAL ITEM)**		
	a. Name	To be mentioned	
	b. Make & Model	To be mentioned	
	c. Brand	To be mentioned	

Ser	Nomenclature/Description	Technical Specifications	To be filled by the Principal/ Manufacturer
(a)	(b)	(d)	(e)
	d. Country of Origin	Group A Countries	
	e. Country of Manufacture	Group A and B Countries	
	f. Country of Assembly	Group A and B Countries	
	g. Year of Production	Not before the signing of the contract year	
	h. Number	12 sets	
	j. General Features (Minimum requirement)	1 GE Port at least 16 E-1/ VC12) Ports	
DC Power System (Rectifier).			
49.	**General Requirements.**		
	a. General	(1) DC power plant (-48 Volt) equipment are required for the Optical Fiber Platform at different sites.	
		(2) The DC power plant will consist of the Rectifier, the Battery and the associated power distribution panels.	
		(3) DC wiring to be done from the assigned DC PDB to the DWDM/OLA equipment.	
		(4) Inverter is used for feeding uninterruptable power to the NMS of the optical transmission system.	
50.	**Rectifier Details.**		
	a. General	(1) Necessary rectifier (modular type) will be used as DC power source to run the system and to charge the back-up batteries.	
		(2) The charging current for the back-up batteries considered at 10 hours charging rate.	
	b. Rectifier Dimensioning Detail	To be mentioned.	
	c. Rectifier Rack	Size shall be such that there is enough gap between floor and the rectifier modules.	
	d. Control Function	The Rectifiers shall be electronic switch-mode type with automatic redundancy control and charging control functions.	
	e. Alarm System	The control panel shall provide visual and audible alarm facilities and required provision for alarm loops for connection to the remote monitoring system.	
	f. Display Facility	The display in the control panel shall have the facility to show all types of alarm and other necessary data such as input voltage and current of each phase, output voltage and current, battery current etc.	
	g. Additional Feature	There shall be provision for over voltage, under voltage, over current and over temperature protection.	
	h. Cut-off Mechanism	There shall be Low voltage cut-off mechanism to save the battery from deep discharge and the rectifier shall be equipped with necessary surge protector.	

Ser	Nomenclature/Description	Technical Specifications	To be filled by the Principal/ Manufacturer
(a)	(b)	(d)	(e)
	j. Circuit-Breakers	The rectifier shall be provided with circuit-breakers (both in AC & DC side) of adequate capacity and shall allow full isolation from the source and the load.	
	k. Rectifier Rack (or Frame)	Shall be provided with AC and DC power distribution panel with necessary circuit-breakers (both in AC & DC side) of adequate capacity and shall allow full isolation from the source and the load. If all of the rectifier modules are taken-out of service, provisions shall be there for automatic diversion of the load to the battery.	
	l. Rack Equipment	The rectifier rack shall contain one or more DC distribution panel consisting of circuit-breakers of 10A, 16A, 32A and 63A capacity (at least two numbers of each capacity).	
	m. Battery Connection	There shall be provision in the rectifier for connecting at least two sets of Battery. There shall be fuse of adequate capacity for each set of Battery and the fuse should be easily to disconnect (Knife type fuse is preferable).	
51.	**Technical Specifications of the Rectifier.**		
	a. Number	17 Sets	
	b. A/C input voltage	160 V ~ 260V	
	c. Frequency	45 Hz ~ 55 Hz	
	d. Efficiency	90% or more	
	e. Protection	Input Over Voltage, Input Under voltage, Output Over voltage, over load, short circuit, Over Temperature, Surge and transient	
	f. Output voltage	-48 Volt nominal (43 ~ 54 or better)	
	g. Output current/module	To be mentioned	
	h. Static voltage regulation	± 0.5%	
	j. Ripple and Noise	<300 mV p-p, <2 mV rms	
	k. Cooling	Forced cooling with internal fan	
52.	**Battery.**		
	a. Back-up DC Support	To be mentioned.	
	b. Number	17 Sets	
	c. Capacity of each set of Battery set at each site	200 AH	
	d. No. of Battery sets required at each site	1 set	
	e. Battery Volts	-48 Volts, 2 Volt each unit.	
	f. Battery Type	Maintenance Free (VRLA) Gel type. Li-ion battery is not accepted.	

Ser	Nomenclature/Description	Technical Specifications	To be filled by the Principal/ Manufacturer
(a)	(b)	(d)	(e)
	g. Life-cycle of the battery	3 (Three) years or at least 800 cycles of discharge at 80% discharge depth.	
	h. Battery Connection	Battery sets shall be connected to the rectifier through Fuses of adequate capacity which will allow complete disconnection of both of the battery sets during any required O&M function.	
	j. System Protection	In order to protect the exchange equipment and battery in case of dropping of the DC voltage below a certain level, the rectifier connection to the battery sets must be provided with a device for disconnecting the battery sets as soon as such levels arrive.	
	k. Protection on the Exposed Parts	All of the exposed parts of the terminals in each cell of the battery-sets will be provided with adequate oxidation-proof covers.	
	l. Charging-Current	The charging-current at 10hrs charging rate for the battery sets, as supplied shall be carried- over to calculation for rectifier requirement.	
53.	**Air Cooler/ Conditioner**		
	Name of The Loc	**Description**	
	a. Dhaka Cantonment	1+1 with automatic changeover facility (may be supplied from local source) Split Type 220V/230V AC 24000 BTU	
	b. 16 SITES	1+1 with automatic changeover facility (may be supplied from local source) Split Type 220V/230V AC 12000 BTU	
Others Requirement.			
54.	**Warranty.**		
	a. Warranty Period	(1) One Year (Twelve months) from the date of issuance of Inspection Note (I/Note) by IE&I. (2) PG will be released after warranty period.	
	b. Conditions	(1) Brand New, unused, of the most recent or current models and incorporate all recent improvements in design and materials unless provided otherwise in the Contract	
		(2) The Supplier must further warrant that the all Goods supplied under this Contract shall have no defect, arising from design, materials, or workmanship or from any act or omission of the Supplier that may develop under normal use of the supplied Goods in the conditions prevailing in Purchaser's country.	
	c. Defect Claim Period	Within 30 (Thirty) days. Upon receipt of such notice, the Supplier shall, with all reasonable speed, repair/replace and return the defective goods or parts in warranty	

Ser	Nomenclature/Description	Technical Specifications	To be filled by the Principal/ Manufacturer
(a)	(b)	(d)	(e)
		thereof, without any cost to the Purchaser.	
	d. Repair/replace and return the defective goods	Supplier shall Repair/replace and Return all replaceable parts/cards which become faulty during the warranty period. Purchaser shall apply and obtain all necessary permissions from concerned authority if needed. Upon receipt of notice/claim, the Supplier shall repair/replace and return the defective goods or parts in warranty thereof within 90 (Ninety) days of receipt.	
	e. Non-replaceable Equipment or Part of Equipment	If any non-replaceable Equipment or part of Equipment (Which fault cannot be removed using Spare cards) fails in this guarantee period, the Supplier shall repair and return this Equipment or it's concerned part.	
	f. Damage by Customer or Abnormal Condition	The Supplier Warranty does not extend to the Equipment/ Software, which has been modified, misused by the Customer or damaged by any abnormal conditions (water drain, water flow, fire etc.)	
	g. Flow of Spare Parts	The Supplier shall guarantee the flow and availability of all spare parts and units without major design change for at least 10 (ten) years after the expiry of warranty period and that, if there is any major design change or stoppage of production, the supplier shall arrange alternate solutions with the same price of original solution.	
55.	**Qualification Criterion (Experience)**		
	a. DWDM/ Telecom Equipment	Minimum of 3 (three) years of overall experience in the supply of DWDM/ telecom equipment and related services by manufacturer.	
		Specific experience of minimum 2 (two) projects completion satisfactorily with supply of similar goods within last 5 (five) years by Principal.	
	b. Principal Work Experience	(1) Certificate certifying that the Principal have completed 2 (Two) work of optical transmission equipment including 100G or higher DWDM Optical Transmission Equipment or a composite project which includes 100G or higher DWDM transmission equipment. One of them must be of Optical Transmission Equipment with Layer 0 (L0)-ASON/ WSON/ GMPLS/ Restoration/ Optical ASON. (2) If it is not clear from both the certificates that the projects include any 100G or higher DWDM optical transmission system and one of them is with Layer 0 (L0)-ASON/ WSON/ GMPLS/ Restoration/Optical ASON, the certificates will not be accepted. (3) However, in case of Principal/ local agent does not have the above experience, Principal must submit Manufacturer's certificate on original letterhead of	

Ser	Nomenclature/Description	Technical Specifications	To be filled by the Principal/ Manufacturer
(a)	(b)	(d)	(e)
		Manufacturer duly stamped and signed by Manufacturer: (a) Competency Certificate: (Principal/ local agent is capable of installation, operation, maintenance and after sales service). (b) Warranty/ Guarantee Certificate of the products. (4) Authorization certificate by the manufacturer to the Principal/local agent.	
	c. User's Certificate	(1) As Documentary evidence, the Manufacturer/ Principal will be required to submit following certificates issued by telecom operators/carriers/ NTTN Operators/ Govt. Organization/ Autonomous organization: (a) User's Certificates of satisfactory working record of manufacturer's offered model of DWDM Optical Transmission Equipment with Layer0(L0)-ASON/WSON/GMPLS/ Restoration/ Optical ASON for at least 1 (One) year in at least 2 (Two) operators, 1(One) of which must be outside the Country of origin of the equipment. (b) User's Certificates of satisfactory working record of manufacturer's offered model of DWDM 100 Gbps or higher per λ Optical Transmission Equipment for at least 1 (One) year in at least 2 (Two) operators, 1(One) of which must be outside the Country of origin of the equipment.	
56.	**Installation and Commissioning Services.**		
	a. Install and Commission	Principal/Local Agent shall be responsible to provide all services related to install and commission all equipment, related ancillary material, related auxiliary item and software covered by the purchase.	
	b. Quality and Workmanship	The quality and workmanship of the installation and Commissioning works must be of international standard.	
	c. Rejection Process	Any non-standard installation will be rejected by Bangladesh Army during implementation of the project or during PAT of the equipment.	
	d. Responsibility of Supplier	All manpower (including transportation), tools, instruments, equipment and consumable necessary for proper installation and Commissioning shall be arranged by the Supplier.	
	e. Content Matching	Actual content of each item should, however, be customized to match with the architecture and solutions offered by the Manufacturer/Principal.	

Ser	Nomenclature/Description	Technical Specifications	To be filled by the Principal/ Manufacturer
(a)	(b)	(d)	(e)
57.	**Requirement of Survey, Design, Engineering and Planning Services.**		
	a. Responsibility	The Principal/supplier shall be responsible to provide all services related to Survey, Design, Engineering and Planning Services for all equipment/system covered by this purchase.	
	b. Survey	After signing the contract, a survey shall be conducted jointly by the contractor and Bangladesh Army.	
	c. Contractor Responsibility	The contractor shall be responsible for Design, Engineering and planning based on the survey data.	
	d.	All manpower (including transport), tools, design from manufacturer etc. required for such service will be the responsibility of the supplier.	
	e. Design and Drawing	Before installation of the equipment the Supplier shall submit the design and drawing along with survey report to the project office for approval.	
	f. Installation Process	Installation shall be carried out as per the approved design and drawing.	
58.	**Requirement of Project Administration and Project Management Services.**		
	Local Agent Responsibility	(1) The Local agent shall be responsible to provide all services related to Project Administration and Project Management for smooth implementation of the project.	
		(2) All manpower (including transport), etc. required for such service will be the responsibility of the supplier.	
59.	Provisional Acceptance Certificate (PAC) and Final Acceptance Certificate (FAC)	a. After successful completion of JPSI, Provisional Acceptance Certificate will be issued by Board of Officers b. Final Acceptance Certificate will be issued after 3 months of satisfactory run of the system by Board of Officers	
60.		Detail Bill of Quantity/ Material (BOQ/BOM) of standard items to be provided as per FORM A.	
61.		Detail Bill of Quantity/ Material (BOQ/BOM) of Optional items to be provided as per FORM C.	
Part-3: Training Requirement			
62.	a. Training at the Manufacturer's Premises	As per Annexure D	
	b. Local Training at Dhaka		
Part-4: Repair and Maintenance Requirement			
63.	**Maintenance Support up to End of 1 (One) Year Warranty Period.**		
	a. Number of Engineers	The supplier, at his own cost, shall engage at least 2 (Two) Operation and Maintenance (O&M) Engineers.	

Ser	Nomenclature/Description	Technical Specifications	To be filled by the Principal/ Manufacturer
(a)	(b)	(d)	(e)
	b. Location of Engineers	The Engineers shall be stationed in Dhaka to provide full maintenance support for all equipment and sites covered by this purchase up to the end of the Warranty Period.	
	c. Language Capability	The support Engineer shall be fluent in English and shall have enough knowledge of the relevant system to effectively solve all O&M problems.	
	d. Expenditure	The supplier shall be responsible for all types of expenditure to be borne for the manpower, including all types of transportation.	
	e. Maintenance Support	Repair/replace and Return of all cards which become faulty during the period.	
		Supplier may use the buffer stock spares during the period but all faulty cards must be repaired/ replaced and returned to Bangladesh Army before the end of warranty period.	
	f. Return of Defective Goods	Repair/replace and return the defective goods or parts in warranty thereof within 90 (Ninety) days of receipt of such claim and necessary permissions.	
	g. Visit of NMS Site	Regular visits (at least twice a month) to NMS site and other sites (if required) to check and monitor different aspects of the working systems.	
	j. Support Timeline	To remain stand-by to respond in the shortest possible time (maximum 8 hours) during any call by purchaser.	
	k. Solving of Problem	Helping user's personnel to solve different software and hardware problems related to proper O&M of the equipment.	
	l. Bug Identification and Removal	Identify and remove different bugs in the system's operational software.	
	m. Support to Bangladesh Army	Helping Bangladesh Army personnel to properly maintain relevant databases related to O&M of the system.	
	n. Reports on O&M	Preparation and submission of reports to Bangladesh Army about different aspects of O&M of the system.	
	p. Training	Giving on-the-job training to Bangladesh Army personnel about different aspects of O&M.	
	q. Advise on O&M	Advising Bangladesh Army about different aspects of O&M, system dimensioning, expansion, etc.	
	r. Knowledge Transfer	Transfer of knowledge to purchaser's personnel.	
64.	Books and Manuals	To be provided free of cost.	
Part-5: List of Spares.			
65.	a. Spare equipment	Redundant Equipment (Spare) with such card/module for DWDM equipment and Rectifier	

Ser	Nomenclature/Description	Technical Specifications	To be filled by the Principal/ Manufacturer
(a)	(b)	(d)	(e)
		system (excluding Battery) for one station (Station C) need to be provided. Such equipment will be used as central buffer stock maintenance spare by purchaser.	
	b. List For Redundant DWDM Equipment	The list for such redundant DWDM equipment (Spare) must include at least one sub- rack and at least one unit of each replaceable item of each type of Card/Module of DWDM equipment (including OLA, ROADM & TRAFFIC ADD-DROP SITE).	
Part-5: Tool List for Different Level of Maintenance.			
66.	a. Testing, Analyzing, Fault Finding and Diagnostic Tool/ Equipment	List (without price) to be provided separately with technical offer. List (with price) to be quoted separately in financial offer.	
	b. SST and SSM		

FORM A

DETAILED BOQ FOR DWDM EQUIPMENT

(Detailed BoQ should be submitted in both Technical and Financial Offer but Price should be mentioned in FINANCIAL OFFER ONLY)

Sl No	Name of Item	Country of Origin	Country of Manufacture	Country of Assembly	Quantity	Model/Product Code/part No
A.	**DWDM Equipment and CPE** ROADM without traffic ADD/DROP 1. ROADM includes a. Backplane b. Power card (1+1) c. Controller Card (1+1) d. Monitoring Card (if required) e. WSS Card f. Optical Amplifier Card (as required by system) g. Filter Card h. Inbuilt OTDR Card j. Optical Protection module if required k. Any other module/ card required please mention				05 lots (As per site requirement)	
	2. ROADM with traffic ADD/DROP a. Backplane b. Power card (1+1) c. Controller Card (1+1) d. Monitoring Card (if required) e. WSS Card f. Optical Amplifier Card (as required by system) g. Filter Card h. Inbuilt OTDR Card j. line card (100G or higher) k. Client Card l. Optical Module for Line Card m. Optical Module for Client Card n. MUX/ DEMUX module p. Transponder system if required q. Optical Protection module r. Any other module/ card required please mention				07 lots (As per site requirement)	
	3. OLA a. Backplane b. Power card (1+1) c. Controller				05 lots (As per site requirement)	

Sl No	Name of Item	Country of Origin	Country of Manufacture	Country of Assembly	Quantity	Model/Product Code/part No
	Card(1+1) d. Monitoring Card (if required) e. Optical Amplifier Card f. Filter Card (if required) g. Inbuilt OTDR Card h. Any other module/ card required please mention					
	4. Router (optional)				06 lots (As per site requirement)	
	5. E1 Over IP (optional)				22 lots (As per site requirement)	
	6. License (Perpetual license for all equipment to be provided)				-	
B.	**Ancillary materials such as** 1. Rack				17 lots (As per site requirement)	
	2. ODF					
	3. DC System to Equipment cable, tray (if necessary), patch cord and other ancillaries					
	4. Other internal and external accessories				To be mentioned	
C.	**NMS Hardware** (The supplier shall show the detail BoQ of NMS hardware such as server, clients and other necessary hardware including the installation materials necessary for monitoring and controlling all the DWDM ROADM/ OLA Nodes under the project)				01 Lot	
D.	**NMS Software** (The supplier shall show the detail BoQ of NMS Software as per his choice and shall satisfy all requirements specified in this tender document.)				01 Lot	
E.	Portable Terminal for O&M of DWDM Equipment (LCT)				-	
	Portable Terminals (Laptop Computers) including all the required Hardware and Software					

Sl No	Name of Item	Country of Origin	Country of Manufacture	Country of Assembly	Quantity	Model/Product Code/part No
E.	**Rectifier materials**				17 lots (As per site requirement)	
F.	**Battery materials**				17 lots (As per site requirement)	
G.	**Documentation**					
	O&M Manual					
	As-built Drawing					
	Others					

Note:

1. Detail BOQ for each site/ location to be mentioned separately in details for assessment.
2. Another item/ module/ accessories/ service which is not mentioned in the BOQ but required for fulfilling the technical specification of the project must be provided.
3. However, during evaluation the evaluation committee of BD ARMY will check/examine actual necessity of the system/equipment/ goods/services quoted by the supplier in this form.
4. The supplier shall show the detail BoQ of hardware and software as per his choice and shall satisfy all requirements specified in this tender document.

FORM B

DETAIL BOQ OF SPARES

Sl No	Name of the Item	Model/ Product Code/ Part No	No/Qty
A.	**Spares of the DWDM equipment**		
	Supplier shall give detail break down as per his choice to fulfill the requirements of the tender document.		
B.	**Spares of the Rectifier**		
	Supplier shall give detail break down as per his choice to fulfill the requirements of the tender document.		
	Power system and Air Conditioner spares		
C.	Any other		

FORM C

OPTIONAL EQUIPMENT/ MATERIALS/ SERVICES

Sl. No.	Name of the Item	Quantity

Note: Suppliers may include any item in the list if they feel necessary.

FORM E

LIST OF ATTACHED CERTIFICATES

Ser	Terms & Conditions	To be filled by Manufacture/ Principal
1.	**Certificates**. Following original certificates must be submitted by the manufacturer: a. Country of Origin. b. Country of Manufacturer with year of production. c. Authorization certificate by the manufacturer to the Principal/Local Agent. d. A certificate to the effect that same/similar model of set/equipment will be available for Next 10 years. e. A certificate to the effect that spares will be available for next 10 years or as long as the set/ equipment remain in use. f. Competency Certificate: (Principal/Local Agent is capable of installation, operation, maintenance and after sales service). g. Warranty/ Guarantee Certificate of the products.	